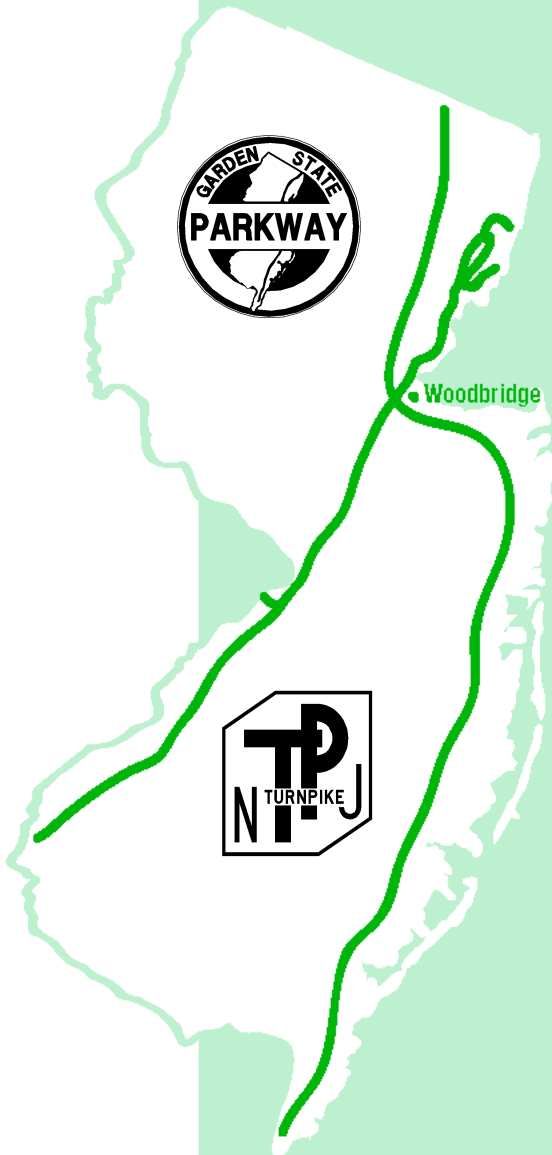


NEW JERSEY TURNPIKE AUTHORITY

GARDEN STATE PARKWAY

NEW JERSEY TURNPIKE



**CONSTRUCTION
MANUAL**

SECTION 0
INTRODUCTION

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INTRODUCTION

This Manual is a guide for the Authority and Consultant inspection staff to be used in the performance of administration and inspection work on New Jersey Turnpike Authority construction contracts. It establishes a minimum standard of performance expected of Consultants. In addition, it serves as a baseline reference for consistency in decision-making, documentation, and communication among all project participants. This Manual is intended to maintain a procedural standard to be utilized uniformly for all Authority construction contracts and describes expected engineering practices, references acceptable established standards of performance, and identifies desired results. These practices and standards are intended to promote quality, safety, schedule adherence, cost control, and regulatory compliance throughout the life of the project. Consultants are expected to integrate these requirements and practices into their scopes of work for Authority construction contracts. Such integration shall be reflected in staffing plans, quality management procedures, inspection protocols, reporting practices, and coordination efforts with the Authority and other stakeholders. **Please be aware that this Manual is not intended as a set of specifications.** It was compiled to clarify the Standard Specifications and to suggest uniform procedures in heavy highway/facility construction. Accordingly, the Manual should be used as a guidance and reference document to support proper interpretation and application of the Contract Documents. It is to work in conjunction with the Procedures Manual, current edition. Consultants are responsible for ensuring that the most current editions of all referenced manuals are utilized.

The Standard Specifications, Supplementary Specifications, Standard Drawings, Contract Drawings, and Manual for Traffic Control in Work Zones (collectively the Contract Documents) are all binding parts of the Contract. Nothing in this Manual changes the Contract, nor is any part of this Manual to be used in conflict with the Contract Documents. In the event of a discrepancy or perceived inconsistency, the Contract Documents shall govern, and the issue shall be promptly brought to the attention of the Authority for resolution.

Each project is unique and has particular needs and requirements. This Manual does not attempt to encompass the total scope of important, published information and literature relative to the performance of all construction administration and supervision. Professional judgment and experience remain essential elements in the effective application of the guidance provided herein. The information set forth in the Manual is meant to complement the Construction Manager's experience in dealing with the specific Contract Documents and providing a quality product to the Authority. The Construction Manager is expected to exercise due diligence and proactive oversight when applying this guidance to project-specific conditions. The Construction Management Team is required to meet the qualifications, and have the certification and licensing, required by the Contract Documents and established standards. Verification and maintenance of required qualifications and certifications throughout the duration of the Contract is the responsibility of the Consultant.

The Manual focuses on project administration tasks and select construction activities; and provides significant guidance on facility construction (as discussed in [Section 7](#)). It is written for an audience that has experience in heavy highway construction work. As such, the Manual assumes familiarity with standard industry terminology, construction methods, and inspection practices. Example reports, meeting agenda and minutes, check lists, change orders, and utility orders are provided as Exhibits. These examples are intended to serve as templates and may be adapted to meet project-specific needs, subject to Authority review and acceptance.

This Manual is intended to assist the Construction Management Team (Project Managers, Resident Engineers, Inspectors, Schedulers, Surveyors, Testing Laboratory, CADD Technicians, Community Outreach, Environmental, etc.) both on-site and off-site with appropriate techniques and procedures to be used in association with heavy highway/facility construction. Effective coordination among these disciplines is essential to achieving project objectives and ensuring timely and accurate communication with the Authority.

The word “Authority” as it appears in this Manual is intended to be the New Jersey Turnpike Authority, with its principal office in Woodbridge, New Jersey, or its duly authorized representative in cases of projects entrusted to the Authority’s General Consultant or Program Manager, acting on behalf of the Authority and should be given the requisite respect and deference. All directives, interpretations, and approvals issued by the Authority or its authorized representatives shall be complied with in accordance with the Contract Documents.

This Manual is posted on the Authority’s website, <https://www.njta.gov/business-hub/professional-services/engineering-manuals/>

Suggestions for future updates or clarifications are encouraged and may be submitted to your Authority Liaison Engineer. Consultants are encouraged to identify lessons learned, best practices, and areas requiring clarification based on field experience. Updates and revisions to this Manual may occur and will be posted on the Authority’s website <https://www.njta.gov/business-hub/professional-services/document-change-announcements/> Consultants are responsible for monitoring posted updates and implementing revisions as applicable to their Contracts.

SECTION 1
DEFINITIONS AND ACRONYMS

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Section 1 - DEFINITIONS AND ACRONYMS

1.1. DEFINITIONS

The definitions provided herein are for terms that may be encountered during the execution of Authority construction contracts. Several of the terms listed below are also listed and defined similarly in the Standard Specifications.

ACCEPTANCE: Formal written acknowledgement by the Authority that all Work, or specific portion thereof, under Contract has been satisfactorily completed.

ACCEPTANCE TESTING: Testing conducted by the Engineer to measure the degree of compliance to the Contract Documents.

ADDENDA: Written interpretations or revisions of any of the Contract Documents transmitted to bidders via the Authority's Electronic Bidding website in advance of the opening of bids in the manner required by law.

ADVERTISEMENT FOR PROPOSALS: The public announcement, as required by law, inviting bids for Work to be performed or materials to be furnished. Such announcement will indicate the location of the Project, character and estimated quantity of materials required, prequalification requirements, time and place of the opening of Proposals, and other relevant information to prospective bidders.

AGREEMENT: A legal instrument executed between the Authority and a secondary party for specific services to be provided.

ALLOWABLE VARIATION: The permissible deviation from specified dimensions, quantities, or properties of materials or Work as defined in the Contract Documents or applicable standards.

APPROVAL IN PRINCIPLE (AIP): Preliminary acceptance by the Authority or Engineer indicating that a submittal generally conforms to the intent of the Contract Documents, subject to final review and compliance.

ARCHITECT: An architectural firm engaged by Agreement to perform professional services on Authority owned or designated facilities.

AS-BUILTS (AS-BUILT DRAWINGS): Conformed record set of plans for work performed within the Authority Right Of Way.

ASPHALT CONCRETE (AC): A composite material consisting of asphalt binder and aggregate, used for pavement surfaces and structural layers in roadway construction.

AUTHORITY: The New Jersey Turnpike Authority (NJTA), with its principal office in Woodbridge, New Jersey, or its duly authorized representative in cases of projects entrusted to the Authority's General Consulting Engineer or Program Manager, acting on behalf of the Authority.

AUTHORITY LABORATORY: The testing laboratory (or laboratories) or testing engineers that may be designated by the Authority.

AUTHORITY LIAISON ENGINEER: The Authority employee of the Engineering or Maintenance Department who is responsible for the administration and management of the construction contract.

AUTHORIZATION TO PROCEED (ATP): Written and signed document to proceed with Work prior to the processing of the corresponding Change Order.

AWARD: The decision of the Authority to accept the Proposal of the lowest responsible Bidder, subject to the Governor's veto period, and the execution and approval of a Contract, and receipt by the Authority of the Contract Bond, in accordance with the Specifications, and as may be required by law.

BACKFILL: Material placed and compacted in excavations around structures, utilities, or foundations in accordance with the Contract requirements.

BASE BID / BASE PRICE: The sum of the individual amounts for all Scheduled Items of Work listed in the Bidder's Proposal.

BASE COURSE: One or more layers of specified material placed on a subgrade to support a pavement structure.

BIDDER: An individual, firm, partnership, corporation, or joint venture, acting directly or through a duly authorized representative submitting a Proposal.

BUSINESS DAY: A calendar day between the hours of 9:00 A.M. and 5:00 P.M., exclusive of Saturdays, Sundays or as declared by the Authority.

BY OTHERS: The term "by others" refers to a person, firm or corporation, other than the Contractor or its surety or persons, firms or corporations in a contractual relationship with the Contractor of the surety, such as a subcontractor, supplier, fabricator or consultant at any tier. "By others" shall include the Authority or other public body.

CALENDAR DAY OR DAY: Every day shown on the calendar.

CAPEX MANAGER: The Authority's Construction Services stand-alone software application allowing the Construction Manager to create inspectors' daily reports, initiate pay estimates, document control, Change Orders (CO), and other additional administrative and management tasks. Regarding pay estimates, after a review process initiated by the Construction Manager, the Authority's Liaison Engineer, Contractor, and the Construction Manager come to agreement and payments can be made.

CERTIFICATE OF OCCUPANCY (CO) / CERTIFICATE OF APPROVAL: Formal authorization issued by the New Jersey Department of Community Affairs allowing a facility or structure to be occupied or placed into service.

CERTIFIED PAYROLL: Payroll documentation submitted by the Contractor or Subcontractor verifying compliance with prevailing wage requirements.

CHANGE ORDER (CO): A written order to the Contractor, signed by the Chief Engineer, ordering a change in the work from that shown by the original Plans and Specifications.

CHANGE OF PLAN (COP): Amended contract drawings or specifications that becomes incorporated into the Contract Documents.

CHECKLIST: Documented lists used to verify essential items of the Work as to meet contractual requirements.

CHECKLIST, CONSTRUCTION INSPECTOR'S: Lists derived from the Supplementary Specifications used to verify essential items of the Work meet contractual requirements. The checklists are in no way intended to serve as a substitute or waiver of any provisions of the Contract. They may be modified by the Construction Manager to meet project specific requirements.

CHECKLISTS, CQP: Contractor or Consultant Quality Program guidelines used to determine if the Contractor or Consultant is fulfilling the requirements of the Capital Program Plan, procedures and their approved CQP plans.

CHIEF ENGINEER: The Chief Engineer of the New Jersey Turnpike Authority whom oversees all design and construction contracts.

CLAIM: A petition for reconsideration of a Contractor's request for additional compensation previously rejected by the Engineer and following certain formalized procedures.

COMPLETION DATE: The date upon which all the following shall occur: (1) the Work has been satisfactorily completed in all respects in accordance with the Contract Documents; (2) the Project is ready for use by the Authority to the degree by the terms of the Contract; (3) the Contractor has satisfactorily executed and delivered to the Chief Engineer all documents, certificates, and proofs of compliance required by the Contract Documents, it being understood that the satisfactory execution and delivery said documents, certificates and proofs of compliance is a requirement of the Contract.

COMPLETION DATE, FINAL: The date all Construction Contract items, including punch list, have been completed, all final quantities have been determined, and all Contractor submittals, including Final Shop Drawings, warranties, and manuals have been received.

COMPLETION DATE, INTERIM: The dates established in the Contract Documents, designating the completion of certain Job Progress Milestones.

CONDITIONAL AWARD: Award of the Contract subject to Veto of the Governor as required by the law.

CONSTRUCTION INCIDENT COMMUNICATIONS PLAN (CICP): The emergency communications protocol established for field operations. Each contract is required to create and publish a CICP immediately following the Pre-Construction Conference. The CICP includes the names of supervisory type personnel for the Contractor, Construction Manager, and the Authority. Depending on the complexity and location of the contract, additional parties may need to be included.

CONSTRUCTION MANAGER (CM): Party authorized by the Authority to handle the administrative and management tasks associated with construction contracts as depicted in the Order for Professional Services.

CONSTRUCTION OPERATIONS: Construction operations shall include site clearing, demolition, movement of utilities or other facilities and actual construction of any of the temporary or permanent structures, roadways or public improvements required by the Contract. The term shall not include mobilization, procurement and storage of materials and plant, providing engineering services, Performance Bond and Payment Bond, surveys, working drawings, field offices, or other schedules, certificates, forms, or documents necessary prior to the performance of Work on Pay Items.

CONSTRUCTABILITY REVIEW: A formal review process evaluating the Contract Documents for clarity, feasibility, sequencing, safety, cost efficiency, and coordination prior to or during construction.

CONSTRUCTION SAFETY MANUAL: A Contract Document governing the Contractor, the Contractor's employees, subcontractors and suppliers with respect to compliance with safety standards and procedures on the job site.

CONSTRUCTION SCHEDULE: The Contractor's detailed plan showing the sequence, duration, and interrelation of construction activities necessary to complete the Work.

CONSULTANT QUALITY PROGRAM – CONSTRUCTION MANAGER (CQP-CM): The Construction Manager's approved internal quality program that addresses the quality of the Construction Manager services, assuring they are provided in a professional correct and adequate manner and meet the Authority's needs. The CQP-CM does not address QC of the construction Contractor's work.

CONSULTING ENGINEER: The Engineer or Firm of Engineers retained by the Authority for the purpose of carrying out the duties imposed pursuant to the terms and conditions of the OPS.

CONTRACT: The Agreement between the Authority and the Contractor for the performance of a specific project, in accordance with the requirements and provisions of the Contract Documents, which include, without limitation, the Proposal, Proposal Guaranty, Contract Agreement, Contract Bond, Standard Specifications, Supplementary Specifications, Traffic Permit, Construction Safety Manual, Power of Execution, Standard Drawings, Contract Plans, Addenda (if any) and Change Orders (if any), all of which are to be treated as one instrument, as if set forth at length in the Contract.

CONTRACT BOND: The approved form of security furnished by the Contractor guaranteeing the faithful performance of the Contract by the Contractor.

CONTRACT DOCUMENTS: The term "Contract Documents" includes, without limitation, Advertisement for Proposal, Proposal Guaranty, Contract Agreement, Contract Bond, Power of Execution, Standard Specification, Supplementary Specifications, Standard Drawings, Contract Plans, Addenda, or other information mailed or otherwise transmitted to the prospective bidders prior to the receipt of bids, Change Orders, Field Orders, and Supplementary Agreements, all of which are to be treated as one instrument whether or not set forth at length in the written Contract Agreement.

CONTRACT PLANS: The standard drawings, the official approved drawings specially prepared for the Project, profiles, cross-sections, and any supplemental drawings, or exact reproductions thereof, and that are current on the date the bids are received, and were furnished by the Authority, that indicate the location, character, dimensions, and details of the Work to be done.

CONTRACT PRICE: The amount of the successful bidder's Proposal, accepted by the Authority at the time of the award.

CONTRACT TIME: The number of Working Days or Calendar Days specified in the Contract for completion of the Work.

CONTRACTOR: Party to the Contract who is solely liable for the acceptable performance of the Project and for the payment of all debts pertaining to the Project, except those specifically assumed by others.

CONTRACTOR'S DESIGNER: The professional engineering entity that is responsible to the Contractor for the scope of design defined in the Construction Contract for Performance Based design work.

CONTRACTOR'S QUALITY PROGRAM (CQP): The Contractor's approved program that details the method of inspection and documentation procedures that will be taken to assure that all of the Work included under the project conform to the Contract requirements, whether constructed and/or processed by the Contractor, or procured from Subcontractors or vendors.

CORRECTIVE ACTION: Measures taken to remedy non-conforming Work or practices to achieve compliance with Contract requirements.

CURRENT CONTROLLING OPERATION OR OPERATIONS: Any feature of Work, which, if delayed at the time in question, will delay the overall time of completion of Contract.

DAYS: Calendar days, unless otherwise designated.

DCA: The New Jersey Department of Community Affairs who is the Authority Having Jurisdiction for all construction phase permit filings, inspection coordination, and applications for Temporary Certificates of Approval/Occupancy and/or Certificates of Approval/Occupancy.

DCA LIAISON: Construction Manager, or Authority assigned "Owner's Designated Agent" to serve as liaison between the Contractor and the New Jersey Department of Community Affairs for all construction phase permit filings, inspection coordination, and applications for Temporary Certificates of Approval/Occupancy and/or Certificates of Approval/Occupancy.

DEFECTIVE WORK: Work that does not conform to the Contract Documents, is damaged, or is otherwise unacceptable to the Engineer.

DESIGN ENGINEER: The Design Engineer is an authorized representative of the Engineer of Record, with at least 10 years of direct highway or bridge structural engineering design experience and who is licensed to practice in New Jersey. Design Engineers shall have practical experience with all the design and construction issues required for the project including, but not limited to, steel fabrication including welding and field erection, basic metallurgical understanding of common construction materials, basic concrete mix design and chemistry, and an understanding of current trends in construction methods and materials related to heavy highway & bridge work. The Design Engineer may or may not be the Engineer of Record. However, the Design Engineer's initials shall always be the Supervisor in the "supervised box" lower left hand corner of the Plans related to the structural design aspects of the Project.

DESIGN PROFESSIONAL: Architects, engineers (civil, structural, mechanical, electrical, plumbing, heating/ventilating/air conditioning, etc.), interior designers, landscape architects, and others whose services are considered "professional" activities, require licensing or registration by the State, or otherwise require the knowledge and application of design principles appropriate to the issue.

DESIGNER: The person (or consultant team) responsible for performing a design task for an Authority project. Although this is typically the Design Engineer (DE), it can also include a person (or consultant team) hired by a Contractor to perform design for falsework or a proprietary based design. This document will use the term "Designer" which covers anyone performing design and will only use the term "Design Engineer" when discussing tasks specific to the Authority's consultant team.

DESIGNER OF RECORD (DOR): The engineering firm that takes responsibility for the bid set of Contract Documents. The Engineer of Record (EOR) is the firm's professional engineer (PE) or structural engineer (SE) licensed to practice in New Jersey who stamps the drawings. The EOR is employed by the DOR.

DISABLED VETERAN OWNED BUSINESS (DVOB): VOB or veteran-owned business is a business that has its principal place of business in the State, is independently owned and operated, and at least 51% of the business is owned and controlled by persons who are veterans. DVOB is a disabled veteran-owned business. These certifications require different applications and offer different opportunities.

EMERGENCY WORK: Unplanned Work required to address an immediate threat to public safety, property, or critical infrastructure.

ENGINEER: The Chief Engineer of the Authority, or the Chief Engineer's duly authorized representative acting within the scope of the particular authority vested in him.

ENGINEER OF RECORD (EOR): Professional Engineer licensed to practice in New Jersey, responsible for the preparation of the Contract Documents. All communications with the Authority shall be through the EOR.

EQUAL EMPLOYMENT OPPORTUNITY (EEO): The process, mandated by the Federal Government, of providing equal access to the marketplace for Women and Minorities. The U.S. Department of Labor has created standards related to the total number of hours worked by women and minority tradespersons.

EEO CERTIFICATE OF PARTICIPATION: A form used by the Authority to track and determine Equal Employment Opportunity.

EQUIPMENT: All machinery, equipment, tools and apparatus, together with the necessary supplies for upkeep and maintenance, necessary for the proper construction and acceptable completion of the Work.

FALSEWORK: Temporary structures or framework used in construction work to support materials, equipment or any assembly. Falsework includes the use of steel tubes, adjustable steel props, proprietary frames, or any other means to support a permanent structure during its erection and until it becomes self-supporting.

FINAL CERTIFICATE OF PAYMENT: The last Pay Certificate prepared on a Contract and constituting the completion of the Contract.

FINAL INSPECTION: A formal inspection conducted by the Authority and Construction Manager to determine readiness for Final Acceptance.

FIELD ORDER: A written order signed by the Construction Manager, requiring specified performance by the Contractor. Such written order shall be in the sole judgment of the Resident Engineer, and is not subject to negotiation.

FORCE ACCOUNT: A method of payment for Work performed on a cost-plus basis when unit prices or lump sum prices are not applicable.

GENERAL CONSULTING ENGINEER (GCE): The Engineer or engineering firm or corporation retained by the Authority for the purpose to perform the acts and carry out the duties pursuant to the terms and conditions of the Turnpike Revenue Bond Resolution and any additional requirements, entered into, by, or on behalf of the Authority.

GENERAL CONTRACTOR (GC): Party to the Contract who is solely liable for the acceptable performance of the Project and for the payment of all debts pertaining to the Project, except those specifically assumed by others.

GEOTECHNICAL ENGINEER (GE): The Geotechnical Engineer is an authorized representative of the Engineer of Record with at least 10 years of geotechnical engineering experience and at least 5 years working as a geotechnical engineer in New Jersey who is licensed to practice in New Jersey. The Geotechnical Engineer shall have practical experience with all the exploration, design and construction issues required for the project.

GEOTECHNICAL FIELD REPRESENTATIVE (GFR): Authorized representative of the GE, assigned to monitor the Subsurface Exploration. The purpose of the GFR is to monitor conformance of the Contractor's work with Plans and Specifications, and to collect relevant data as directed by the GE.

HEALTH AND SAFETY PLAN (HASP): A written plan specific to the project governing the Contractor, the Contractor's employees, subcontractors, fabricators, and suppliers with respect to compliance with safety standards and procedures on the job site. The HASP is assembled to meet the requirements of State, Federal, and local regulators, with specific ties to the hazards of the construction workplace covering company safety

policies, procedures, protective gear, hazard assessment, safety committees, etc. In addition, the HASP shall be submitted to the Authority and the Construction Manager for their review and comments prior to work commencing. Guidelines and minimum requirements for the development and implementation of the Contractor's Health and Safety Plan are available on the Authority's website.

HIGH PERFORMANCE CONCRETE (HPC): Concrete blended with various components such as silica fume, micro silica, fly ash, slag, as well as admixtures to meet specific parameters requested by the Designer.

HIGHWAY, STREET OR ROAD: A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

INDEPENDENT ASSURANCE (IA): Testing and inspection activities performed to verify the reliability of Quality Control and Quality Assurance procedures.

INSPECTION: The art and technology of ascertaining and reporting that the work by a Contractor, subcontractor, or supplier is consistent with the Contract.

INSPECTOR: Authorized representative of the Engineer assigned to the inspection of work and materials.

INVITATION FOR BIDS: The Advertisement for Proposals for all work or materials on which bids are required.

JOB SITE: The total environs of a Project.

LIQUIDATED DAMAGES (LDs): The cost per calendar day set forth in the Contract Documents, which represents damage to the Authority as a result of delays to the completion of any specified milestone for the project.

LABORATORY: A firm or individual designated by the Chief Engineer for the inspection and testing of the materials to be used or integrated into the Project.

LANE: Area of roadway utilized for either permanent or temporary single line of vehicular traffic.

LANE OCCUPANCY CHARGE: The charge for a delay in the reopening of the lane closing(s), premised upon road user costs and costs incurred by the Authority for engineering, inspection, and administration (including overhead).

LETTER OF AUTHORIZATION: A letter issued by the Authority to prospective bidders, containing instructions for access to, and inspection of, work sites.

LETTER OF SURETY: The Proposal Guaranty submitted by the Bidder on the Authority issued form.

LUMP SUM: When used for a Scheduled Item of Work, means complete payment for that Scheduled Item of Work described in the Contract.

MAJOR ITEM: Any Scheduled item of Work whose price, based on the Proposal quantity multiplied by the Contract unit price bid, amounts to more than 15-percent of the Total Price bid for the Contract or as directed by the Chief Engineer.

MANUFACTURER: Any corporation, partnership, firm, or individual who manufactures goods, materials, or equipment.

MATERIALS: All raw or prepared materials and manufactured or fabricated products utilized in the Project.

MATERIAL HANDLING PLAN (MHP): A plan developed and implemented by the Contractor for dealing with materials and potentially regulated materials encountered during work activities. The MHP shall set forth requirements for the excavation, stockpiling, sampling and analysis, measurement, transportation and disposal/recycling of regulated materials in accordance with all applicable Federal, State and/or local regulations. In addition, the MHP shall be done so as to protect site workers, visitors and the general public from uncontrolled exposure to regulated materials (if encountered), and to prevent uncontrolled releases of regulated materials to the environment. The Contractor submits the MHP to the Construction Manager for review and acceptance.

MEASUREMENT AND PAYMENT: The process by which quantities of Work are measured and compensation is determined in accordance with the Contract.

MEDIAN: That portion of a divided highway separating the paved sections, said paved sections including both the shoulders and the traveled way.

METHOD OF MATERIAL ACCEPTANCE: Means of determining whether material supplied is in conformance with specifications.

MILESTONE: A significant event or point in time that marks the completion of a major phase or deliverable within the project. Milestones are used to: track progress, facilitate coordination, and support decision-making events.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES): A provision of the Clean Water Act that prohibits discharge of pollutants into the waters of the United States unless a special permit is issued by the Environmental Protection Agency (EPA), a state or other designated regulatory agency.

NJDOT: The New Jersey Department of Transportation of the State of New Jersey, as created by law.

NJTA: The New Jersey Turnpike Authority.

NON-COMPLIANCE: Failure to comply with written Contract Documents, directives, standard requirements or government rules and regulations.

NON-CONFORMANCE REPORT (NCR): Written notice developed in web-based project management (WBPM) system documenting non-conforming actions, non-conforming Work, and acceptable corrective action.

NON-PAY ITEM: Work required by the Contract for which no separate payment is made and is included in the price of other Pay Items.

NOTICE OF AWARD (NOA): The written notice from the Authority to a successful Bidder advising of the Award of the Contract.

NOTICE TO PROCEED (NTP): Written notice to the Contractor advising the Contractor to begin work on the Project. The date of the Notice to Proceed is the beginning of the Contract Time.

OPERATOR: User Group that operates a leased facility, building, or land from the New Jersey Turnpike Authority (NJTA).

ORDER FOR PROFESSIONAL SERVICES (OPS): The agreement executed between the Authority and an engineering consultant for engineering or architectural services. This agreement includes the Consultants Proposal and the signed Contract.

OWNER: The New Jersey Turnpike Authority (NJTA), with its principal office in Woodbridge, New Jersey.

PAY CERTIFICATE: A statement issued by the Construction Manager notifying the Owner of the amount due to the Contractor for Work completed and/or the delivery or storage of materials.

PAY ESTIMATE: See **Pay Certificate**.

PAY ITEM: A specifically described item of Work for which the Bidder provides price in the Proposal based on the unit of measure.

POTENTIAL CHANGE ORDER (PCO): Possible modification to the Work which would result in increases or decreases in the quantity of or cancellations of any one or more of the unit price or lump sum items. The PCO alerts the Authority to potential changes to the Contract budget. The Construction Manager uploads PCO Logs weekly into WBPM. A PCO may become a CO.

PRE-CONSTRUCTION CONFERENCE: The initial project meeting conducted by the Construction Manager, and attended by the Contractor. A separate utility pre-construction conference may be scheduled.

PRELIMINARY ACCEPTANCE: Conditional acceptance of the Work prior to Final Acceptance, typically associated with Substantial Completion.

PRIVATE LABORATORY: Any construction material testing or design facility not operated by the Authority. This requirement includes Contractor, producer, Consultant, or Local Agency testing facilities performing Quality Control, Quality Assurance, acceptance, independent assurance, or any other required or contracted testing on an Authority project.

PROGRAM MANAGER (PM): The Engineer or firm of Engineers retained by the Authority for the purposes of carrying out the duties imposed on the Program Manager, pursuant to the terms and conditions of the Order for Professional Services.

PROJECT: The entire Work to be performed under the Contract, including the furnishing and doing of all things necessary or proper therefor or incidental thereto for completion of the Work.

PROJECT CHANGE REQUEST (PCR): The instrument used to request and approve changes to project scope and budget of construction projects.

PROJECT CLOSEOUT: The administrative and technical process of completing all Contract requirements, including documentation, final payments, and acceptance.

PROJECT MANAGER: A licensed Professional Engineer employed by the Construction Manager to oversee the administrative and management tasks, supervise the project staff and assume responsibility for the Work depicted in the Order for Professional Services.

PROPOSAL: The Authority issued form, which has been completed, executed, and submitted by the Bidder as a bid for the performance of the Project.

PROPOSAL BOND: The Proposal Guaranty submitted by the Bidder on the Authority issued form.

PROPOSAL GUARANTY: Security in the form of a Proposal Bond or Letter of Surety, accompanying a Proposal, guaranteeing that Bidder will execute the Contract and furnish the required Contract Bond, if Bidder's Proposal is accepted.

PUBLIC FACILITY ORDER (PFO): A Public Facility Order is the formal document through which the Authority and a non-regulated utility owner agree to the terms under which utility relocations, ordering of materials and/or inspection are to be performed. This document consists of the order proper and associated schedules and exhibits which are appended to the Public Facility Order.

PUNCH LIST: A document prepared near the end of a project that identifies work that does not conform to contract specifications and needs to be completed, corrected, or repaired before final acceptance. Key characteristics of a punch list include: created during final walkthroughs, lists deficiencies, used for closeout, and may affect payment.

QUALIFIED PRODUCTS LIST (QPL): A list of products prequalified as meeting the Contract requirements for specified materials to be incorporated into the Work. The list is maintained and updated periodically and will be available at the Authority's website.

QUALITY ASSURANCE (QA): The independent inspection, sampling and testing programs performed by the Construction Manager and/or the Authority to verify and validate the results of the Contractor's Quality Control Program (CQP) to assure general conformance with the Contract requirements. In the CQP-CM, QA is performed by the Consultant's Quality Representative (QR) as an internal audit of the Construction Manager staff's tasks.

QUALITY CONTROL (QC): The process and activities put forth by the Contractor to ensure conformance with the specification requirements. This is the responsibility of the Contractor. The Construction Manager shall refer to the Authority's Contractor's Quality Program (CQP) and CQP Manual and Capital Program Procedures.

QUALITY REPRESENTATIVE (QR): The Consultant Construction Manager's assigned individual responsible for implementing and administering the CQP-CM with the authority to act in all quality matters, remaining at all times independent of those having direct responsibility for the Work being performed and not responsible for cost, construction, schedule, or production of Work. The Contractor has a person designated as a QR to administer their CQP.

RECORD DOCUMENTS: Final documentation reflecting the actual constructed conditions, including approved As-Built drawings and related records.

REFERENCE DRAWING: Any Plan sheet from a previous contract, a concurrent contract, or a future contract, included with the Contract Documents which will aid the Contractor in performing the work of the Project. Absolutely no changes are to be made to any Reference Drawings from previous contracts. Changes that affect concurrent or future contracts shall be coordinated through the Authority Liaison.

RENTAL RATE BLUE BOOK (BLUE BOOK): Document designed for use in determining equipment costs for cost-plus/time and material activities for the Authority.

REQUEST FOR INFORMATION (RFI): A formal written request from the Contractor to the Construction Manager seeking clarification of a specific element of the Contract. The Construction Manager can also forward it to the Design Engineer for response or respond directly to the RFI.

RESIDENT ENGINEER (RE): The field representative of the Engineer, having direct supervision of the administration of the Contract.

RETAINAGE: See **Retained Percentage**.

RETAINED PERCENTAGE: Money withheld on a Pay Certificate in accordance with the Contract Documents.

SAFETY DEFICIENCY: A condition or practice identified during construction that presents an unacceptable risk to workers, the public, or property.

SBE CERTIFICATE OF PARTICIPATION: A form issued by the Authority to indicate Small Business Enterprise involvement. See **Small Business Enterprise (SBE)**.

SCHEDULED ITEM OF WORK: A specifically described unit of Work for which a price is provided in the Contract.

SEQUENCE OF CONSTRUCTION: The planned order in which construction activities are performed, as submitted by the Contractor and accepted by the Engineer.

SHOP (WORKING) DRAWINGS: Stress sheets, working drawings, diagrams, illustrations, schedules, performance charts, brochures, erection plans, falsework plans,

framework plans, cofferdam plans, bending diagrams for reinforcing steel, reproductions of manufacturer's pre-printed information (catalog cuts), and any other supplementary plans or similar data that is prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor, and that the Contractor is required to submit to the Engineer for approval.

SMALL BUSINESS ENTERPRISE (SBE): Small Business Enterprise refers to the company level of diversity. Eligibility for certification as a Small Business Enterprise varies depending on the issuer; requirements may relate to number of employees, length of time the company has been in business and the net worth of the company's owner.

SOIL EROSION AND SEDIMENT CONTROL PLAN (SESCP): A document that is part of the Storm Water Pollution Prevention Plan (SWPPP) that defines how the project site will be protected from soil erosion and sediment damage by use of temporary erosion control measures.

SOILS ENGINEER: An employee of the Engineer who tests, analyzes, and reports on the materials to be included in the Project.

SPECIAL FINAL PAY ESTIMATE: Pay Certificate used in the event a claim is filed against the Authority. Prepared on Final Certificate form and normally releases all monies due the Contractor, except amounts in dispute.

SPECIALTY ITEMS: Such items that require highly specialized knowledge, craftsmanship or equipment not normally available among contractors qualified to bid on the Contract as a whole, and which are designated as "specialty items" in the Contract Documents.

SPECIFICATIONS: The Standard Specifications, the Supplementary Specifications and Addenda, if issued, pertaining to the method or manner of performing the Project and to the qualities of the materials to be furnished for the Project.

STANDARD SPECIFICATIONS: The edition of the Authority's Standard Specifications as given in the Contract.

STAGING: The planned division and arrangement of construction activities to maintain traffic flow, safety, and access during construction.

STATE: The State of New Jersey.

STORM WATER POLLUTION PREVENTION PLAN (SWPPP): Document required by the Authority to meet EPA and other regulatory and national resource requirements to impose erosion and sediment control, spill prevention and spill control measures on the project site.

SUBCONTRACTOR: Any corporation, partnership, firm or individual who contracts with the Contractor to perform Work at or about the construction site, for or on behalf of the Contractor.

SUBSTANTIAL COMPLETION: The point in time that the Chief Engineer determines the performance of the Work or portion thereof under the Contract is 98% complete, except final clean-up and repair of Work performed not acceptable to the Engineer, has been

completed; provided however, that the Chief Engineer has determined, in the Chief Engineer's sole discretion, that (1) the project is safe and convenient for use by the public and Authority employees and visitors; and (2) failure to complete the Work and repairs excepted above will not result in deterioration of the other completed Work.

SUPERINTENDENT: The Contractor's authorized representative in charge of the Work, who shall be authorized to receive all communications from the Authority.

SUPPLEMENTARY SPECIFICATIONS: Additions to or amendments of the Standard Specifications pertaining to the Project.

SUPPLIER: Any corporation, partnership, firm or individual who contracts with the Contractor to supply or sell goods, materials, or equipment for the Project for or on behalf of the Contractor.

SURETY: A company licensed to do business in the State of New Jersey, and authorized to issue bonds in accordance with N.J.S.A. 2A:44-143.

SURVEY: Work performed by the Engineer to layout, measure, or verify dimensions of Work within the terms of the agreement.

TESTING AGENCY: A privately owned facility capable of testing and evaluating component parts, or the whole, for certification of the composition or construction of the material or product.

FINAL CONTRACT PRICE: The total Contract price as adjusted through the issuance of Change Orders and Field Orders and the calculation of as-built quantities.

TEMPORARY FACILITIES: Facilities constructed for use during the execution of the Work and removed upon completion, including offices, access roads, and utilities.

TIME AND MATERIALS (T&M): A payment method based on actual labor, equipment, and material costs plus applicable markups.

TOTAL PRICE: The sum of the individual amounts for all Scheduled Items of Work listed in the Bidder's Proposal including Change Orders and Field Orders.

TRAFFIC PERMIT: An approved form, also referred to as a construction permit, issued to the Contractor by the Operations Department of the Authority through the Engineer. No operations will be performed by the Contractor or subcontractor, which requires occupation of or entry upon any Authority-owned facility, until a Traffic Permit has been issued. The Permit does not alter the provisions of the Contract as may be amended by Change Order. The Traffic Permit is considered a part of the Contract Documents, and it shall be adhered to in all circumstances. In addition, if the completion date is extended, the Contractor shall submit a request for an extension of the Traffic Permit.

UNIFORM CONSTRUCTION CODE: The State of New Jersey laws and regulations governing the construction of buildings and other specific facilities. This Code is administered by the Department of Community Affairs.

UTILITY: A public, privately or cooperatively owned authority, agency or agencies operated by one or more persons or corporations for public service. For purposes of this Contract, railroads shall be considered utilities as well as all Authority owned services. Utilities include, but are not limited to, electric, telephone, communications, traffic surveillance, sewer, water, gas and similar services.

UTILITY ORDER (UO): A Utility Order is the formal document through which the Authority and a utility owner (as described in N.J.S.A. 27:23-6) agree to the terms under which utility relocations, ordering of materials and/or inspection are to be performed. This document consists of the order proper and associated schedules and exhibits which are appended to the Utility Order.

VALUE ENGINEERING (VE): A systematic evaluation of alternatives intended to improve value, performance, or constructability without reducing quality or safety.

VISUAL EXAMINATION: Assessment of any item's markings, physical dimensions, obvious defects or damage for acceptance or rejection and/or close conformity with Contract Document requirements.

WAGE ACT: The New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et seq. as amended and supplemented.

WEB-BASED PROJECT MANAGEMENT (WBPM): Software database tool used to reduce coordination errors and improve productivity through automation of previously paper-based processes. The database is administered via a website on the Internet, allowing controlled access to the documentation processes. WBPM is utilized as a communication, collaboration, and coordination tool, as well as a document management solution, for various project activities during planning, design, and construction phases. WBPM allows the Authority's authorized users with various roles to collaborate on various types of projects.

WEEKDAY: A calendar day exclusive of Saturdays, Sundays, Authority recognized holidays and other holidays as declared by the Authority.

WEEKEND: Saturdays and Sundays, exclusive of the Authority recognized holidays, and other holidays, as declared by the Authority.

WORDS OF LIKE IMPORT: When referring to the Project or its performance, "directed", "required", "permitted", "ordered", "designated", "prescribed", and words of like import, shall imply the direction, requirement, permission, order, designation or prescription of the Engineer; and "approved", "acceptable", "satisfactory", and words of like import, shall mean approved by or acceptable or satisfactory to the Engineer; and "necessary", "reasonable", "proper", "correct", or words of like import, shall mean necessary, reasonable, proper or correct in the judgment of the Engineer.

WORK: The term "Work" means the furnishing of all labor, services, materials, equipment, tools, transportation, supplies, and other incidentals necessary or convenient for the successful completion by the Contractor of the construction described in the Contract Documents, and the carrying out of all duties and obligations imposed by the Contract Documents on the Contractor.

WORKING DAY: Any calendar day, exclusive of: 1) Saturdays, Sundays and holidays, 2) days on which the Contractor is specifically required by the Supplementary Specifications to suspend construction operations, and 3) days on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom adverse to the current controlling operation or operations, as determined by the Engineer, from proceeding with at least 75-percent of the normal labor and equipment force engaged on such operation or operations for at least 60-percent of the total daily time being currently spent on the controlling operation or operations.

Should the Contractor prepare to begin Work at the regular starting time in the morning of any day on which inclement weather, or the conditions resulting from the weather, prevent the Work from beginning at the usual starting time, and the crew is dismissed as a result thereof, and the Contractor does not proceed with at least 75-percent of the normal labor and equipment force engaged in the current controlling operation or operations for at least 60-percent of the total daily time being currently spent on the controlling operation or operations, the Contractor will not be charged for a working day whether or not conditions should change thereafter during said day and the major portion of the day could be considered to be suitable for such construction operations.

WORK ORDER DIRECTIVE (WOD) / PTAT SYSTEM LEASE AGREEMENT: The Authority owns and maintains various facilities along both roadways. For impacts to Authority owned facilities, either a Work Order Directive (WOD) or specific terms of the PTAT System Lease Agreement will apply.

WORK ZONE: The area of a roadway or facility where construction, maintenance, or utility operations are taking place, including traffic control devices.

1.2. ACRONYMS

The acronyms provided here are those which may be encountered at some point during the execution of Authority Contracts. Several of the acronyms listed below are also listed and described similarly in the Standard Specifications.

AAMA	American Architectural Manufacturers Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACI-MCP	American Concrete Institute – Masonry Certification Program (certification program for masonry construction personnel)
ADA	Americans with Disabilities Act (Federal law governing accessibility requirements for facilities and public rights-of-way)
A/E	Architect/Engineer
AGC	Associated General Contractors of America
Agg	Aggregates
AHJ	Authority Having Jurisdiction
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMRL	AASHTO Materials Reference Laboratory
ANLA	American Nursery and Landscape Association
ANSI	American National Standards Institute
API	American Pipe Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASLA	American Society of Landscape Architects

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATP	Authorization to Proceed
ATSSA	American Traffic Safety Services Association
AUP	Agreed to Unit Price
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
ERB	EquipmentWatch Rental Rate Blue Book
BMP	Best Management Practice (methods or measures used to control erosion, sedimentation, and pollution)
BOCA	Building Officials and Code Administrators
BOD	Board of Directors (governing body of the Authority)
CADD / CAD	Computer-Aided Design and Drafting (electronic preparation of drawings and plans)
Capture	EEO Reporting Application
CCRL	Cement and Concrete Reference Library (Division of ASTM International)
CFR	Combined Field Report (monthly RE report entered into Capex per pay period)
CIP	Capital Improvement Program (Authority's planned program of capital construction projects)
CM	Construction Manager
CMR	Construction Manager's Report (formal project reporting document)
CO	Change Order
CPM	Critical Path Method (scheduling technique used to determine controlling activities and project duration)
CQP	Contractor's Quality Program

CQP-CM	Consultant Quality Program – Construction Manager
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DBA	Doing Business As (legal designation for business trade names)
DE	Design Engineer (engineering professional responsible for design elements of the Contract)
DOR	Designer of Record
DSE	Design Section Engineer
DVOB	Disabled Veteran Owned Business
EEI	Edison Electrical Institute
EEO	Equal Employment Opportunity
EIR	Environmental Impact Report (documentation evaluating environmental effects of a project.
EIS	Environmental Impact Statement (formal environmental document prepared under NEPA)
EOR	Engineer of Record; professional engineer responsible for stamped Contract Documents (often referenced separately from Designer of Record).
EPA	Environmental Protection Agency of the United States Government
ERP	Environmental Resource Permit (regulatory approval for environmentally sensitive work)
ESBE	Emerging Small Business Enterprise
FA	Force Account (Work performed on a cost-plus basis)
FAA	Federal Aviation Agency
FDR	Full Depth Reclamation (pavement rehabilitation technique)
FHWA	Federal Highway Administration
FHWA-FPD	Federal Highway Administration – Federal-aid Project Division (oversight entity for federally funded projects)

FSS	Federal Specifications and Standards, General Services
GCE	General Consulting Engineer
GMP	Guaranteed Maximum Price (contract pricing structure limiting total cost)
HASP	Health and Safety Plan
HDS	High Density Settlement (ground improvement condition requiring monitoring)
HIC	Hazard Identification Card (safety reporting tool)
HICC	High-Intensity Construction Cycle (non-standard lane closures for an extended period of time)
HPC	High Performance Concrete
HMA	Hot Mix Asphalt
IAS	International Accreditation Service
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IDR	Independent Dispute Resolution (formal process for resolving Contract disputes)
IEEE	Institute of Electrical and Electronic Engineers
IFR	Inspector Field Report (daily inspector report entered into Capex)
IMSA	International Municipal Signal Association
ION	Incidence of Non-Compliance
IPCEA	Insulated Power Cable Engineers Associations
ISA	International Society of Arboriculture
ISEA	International Safety Equipment Association
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems (electronic traffic and roadway monitoring systems)

LOI	Letter of Intent (preliminary commitment issued prior to Contract execution)
MAC	Material Acceptance Certificate (documentation confirming material compliance)
MARTCP	Mid-Atlantic Region Technician Certification Program
MBE	Minority Business Enterprise
MBMA	Metal Building Manufacturers Association
MOA / MOU	Memorandum of Agreement / Memorandum of Understanding (inter-agency or inter-party agreement)
MPT	Maintenance and Protection of Traffic
MSDS / SDS	Material Safety Data Sheet / Safety Data Sheet (documentation of hazardous material properties and handling)
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NCR	Non-Conformance Report
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act (Federal environmental review law)
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJ-MIRS	NJ Materials Inspection and Reporting System
NJSA	New Jersey Statutes Annotated
NJSAT	New Jersey Society of Asphalt Technologists
NJSHPO	New Jersey State Historic Preservation Office

NJSP	New Jersey State Police
NJTA	New Jersey Turnpike Authority
NOI	Notice of Intent
NOT	Notice of Termination
NPCA	National Precast Concrete Association
NPDES	National Pollutant Discharge Elimination System
NRCA	National Roofing Contractors Association
NTP	Notice to Proceed
OE	Office Engineer (administrative support role to the Resident Engineer)
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCC	Portland Cement Concrete
PCI	Prestressed Concrete Institute
PCMS	Project Construction Management System (electronic project management platform (sometimes used interchangeably with WBPM in legacy documents)
PCO	Potential Change Order
PCR	Project Change Request
PE	Professional Engineer
PM	Program Manager
PMB	Pre-engineered Metal Building
PS&E	Plans, Specifications, and Estimate (complete bid document package)
QA	Quality Assurance
QA / QC	Quality Assurance / Quality Control (combined reference to quality management systems)
QC	Quality Control

QR	Quality Representative
RCP	Reinforced Concrete Pipe (commonly used drainage material)
RCSC	Research Council on Structural Connections
RE / OE	Resident Engineer / Office Engineer (project administration roles)
RFP	Request for Proposals (solicitation for professional services)
RFI	Request for Information
RFQ	Request for Qualifications (procurement document)
ROW	Right-of-Way
SAE	Society of Automotive Engineers
SBE	Small Business Enterprise
SCD	Soil Conservation District
SDI	Steel Deck Institute
SE	Structural Engineer (licensed engineer specializing in structural design)
SEOR	Structural Engineer of Record (engineer responsible for structural components)
SESCP	Soil Erosion and Sediment Control Plan
SJI	Steel Joist Institute
SOV	Schedule of Values (breakdown of Contract Price for payment purposes)
SPN	Standard Plant Names adopted by the American Joint Commission on Horticulture Nomenclature
SR	Safety Representative
SSPC	Steel Structures Painting Council
SSWP	Site Specific Work Plan
SWPPP	Storm Water Pollution Prevention Plan
T&M	Time and Materials (payment method for certain Work)

TCC	Traffic Control Coordinator
TCP	Traffic Control Plan (plan governing traffic operations during construction)
UCC	Uniform Construction Code
UL	Underwriter's Laboratories
USCG	United States Coast Guard
VE	Value Engineering (process for evaluating cost-effective alternatives)
WBE	Women's Business Enterprise
WBPM	Web-Based Project Management
WBS	Work Breakdown Structure (project organization framework used in scheduling)
WZTC	Work Zone Traffic Control (traffic operations within construction zones)

SECTION 2

RESPONSIBILITIES AND AUTHORITY

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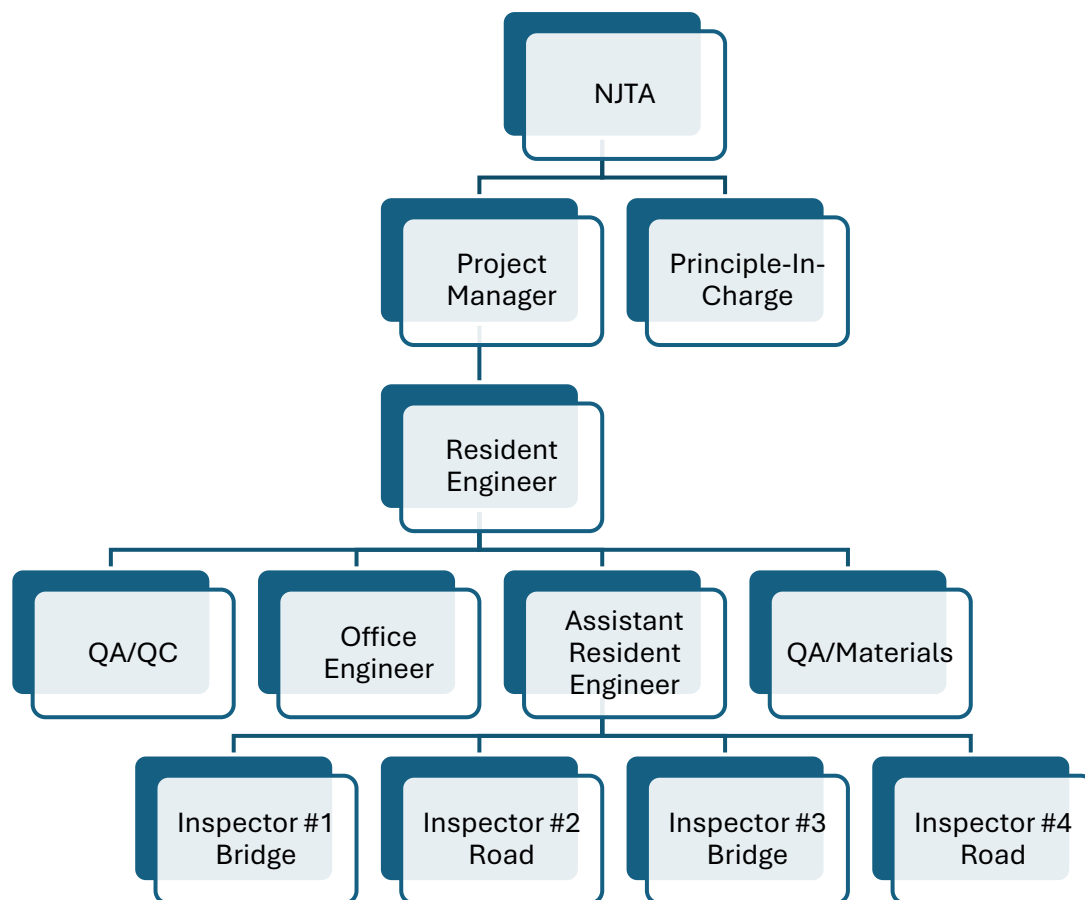
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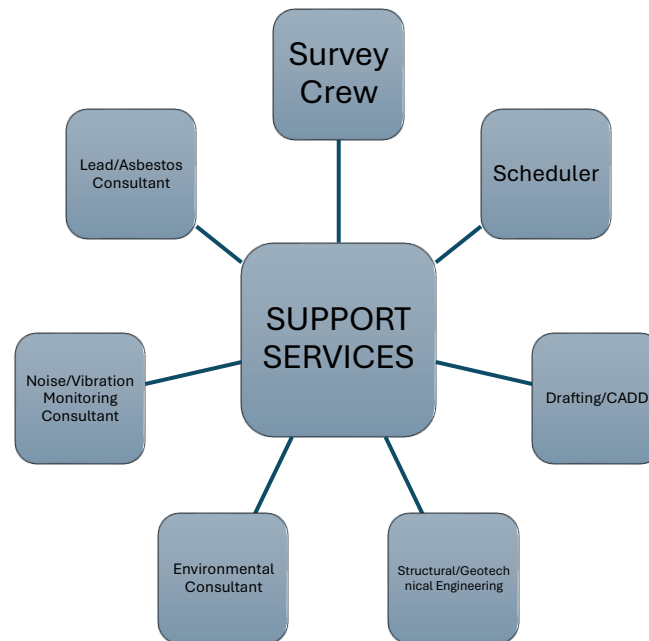
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2.1. CONSTRUCTION MANAGEMENT ORGANIZATION CHART

The following organization chart depicts the levels of authority and relationships of the construction management team.

EXHIBIT 2 - 1 CONSTRUCTION MANAGEMENT ORGANIZATION CHART





2.2. AUTHORITY'S RESPONSIBILITIES

For any given construction project, from advertisement to acceptance, the Authority has the following specific responsibilities. (Specifications Subsection or Paragraph reference)

1. Ensure that Bidders of Proposals for Work in excess of \$50,000 are prequalified. (Subsection 102.01)

This responsibility includes establishing and maintaining qualification criteria, reviewing bidder submissions for compliance, and ensuring that only qualified entities are permitted to submit Proposals in accordance with Authority requirements.

2. Disqualify Bidders for various reasons. (Subsection 102.02)

Such reasons may include failure to meet qualification standards, submission of incomplete or inaccurate information, lack of responsibility, or noncompliance with applicable laws, regulations, or Authority policies.

3. Solicit bids for work to be performed or materials to be furnished. (Subsection 102.03)

This includes advertising Proposals, issuing Contract Documents, responding to inquiries, issuing addenda when required, and conducting the procurement process in a fair and transparent manner.

4. Reject Proposals for various reasons. (Subsection 102.11)

Reasons may include irregularities, non-responsiveness, lack of bidder responsibility, or determination that rejection is in the best interest of the Authority.

5. Award Contract or reject all Proposals within 60-days from date of receipt of Proposals unless timeframe is extended by mutual agreement. (Subsection 103.01)

The Authority retains discretion to extend the award period when necessary to complete evaluations, resolve issues, or obtain required approvals.

6. Supply Owner's representation from the Chief Engineer through a Liaison Engineer. (Subsections 104.02 and 104.05)

Such representation establishes the Authority's chain of command and provides oversight, direction, and coordination throughout the duration of the Project.

7. Approve/Authorize/Issue Change of Plans, Pay Estimates, and Change Orders. (Subsection 104.04)

All changes affecting scope, cost, or time shall be reviewed, authorized, and documented in accordance with the Contract Documents and Authority procedures.

8. Approve/Reject use of a particular subcontractor or supplier for various reasons. (Subsection 103.04)

This includes review of qualifications, compliance with contract requirements, and consideration of performance, responsibility, and eligibility.

9. Provide direction regarding an issue in the event of differing opinions between the Construction Manager and the Contractor. (Subsection 104.02)

The Authority's determination shall be final and shall govern the resolution of such issues.

10. Make changes in the Contract Plans or Specifications by issuance of a Change Order or Change of Plan. (Subsection 104.04)

Such changes may be required to address field conditions, design revisions, safety concerns, or operational requirements.

11. Furnish all traverse points and benchmarks as shown on the Plans. (Subsection 104.09)

The Authority/Engineer is responsible for providing the reference control necessary for layout and verification of the Work.

12. Acquire and make available to the Contractor the right to take materials from sources designated on the Plans and described in the Supplementary Specifications. (Subsection 105.02)

This includes securing rights, permits, or agreements required for use of such sources when specified by the Contract.

13. Furnish material to be incorporated into a Project. (Subsection 105.10)

Materials furnished by the Authority shall meet the requirements of the Contract Documents.

14. Annul the Contract for various reasons. (Subsection 106.03)

Such action may be taken in accordance with the Contract Documents when circumstances warrant annulment.

15. May perform the Work with its own employees, have work performed by other Contractors, and permit Public Utility Companies' and others to perform work during progress of the Project. (Subsection 104.07)

Such work shall be coordinated to minimize interference with the Contractor's operations.

16. Rule on Contractor claims for additional compensation or extensions of time. (Subsections 105.15 and 107.06)

The Authority shall evaluate claims based on Contract provisions, documentation, and project records.

17. Order completed or partially completed sections of a Project to be opened to traffic prior to Acceptance. (Subsection 106.09)

Such openings may be ordered when deemed safe and in the public interest.

18. Provide for SBE Contractor/Supplier opportunities. (Subsection 106.24)

This includes implementing and administering applicable participation requirements in accordance with Authority policy.

19. Execute the Contract and provide Notice to Proceed to allow the Contractor to begin Work. (Subsection 107.03)

The Notice to Proceed establishes the official start date for Contract Time.

20. May revise construction staging and maintenance of traffic due to unforeseen circumstances which may arise during construction. (Paragraphs 107.04(A) and 107.04(B))

Such revisions shall be made to address safety, operational needs, or changing field conditions.

21. Require the Contractor to increase effort (work overtime, add shifts, etc.) whenever the Contractor falls behind schedule. (Paragraph 107.04(D))

This authority may be exercised to mitigate delays and maintain the approved project schedule.

22. Suspend Work. (Subsection 107.08)

Suspension may be ordered for safety, operational, contractual, or other reasons as permitted by the Contract Documents.

23. Terminate the Contract for various reasons. (Subsection 107.09)

Termination shall be carried out in accordance with the Contract Documents and applicable provisions.

2.3. CONSTRUCTION MANAGER'S RESPONSIBILITIES

The following list of responsibilities for the Construction Manager during the pre-construction, construction, and post-construction phases is not intended to be all inclusive. Specific responsibilities will be provided in the Order for Professional Services (OPS) Agreement Scope of Services for any and all specific activities.

The Construction Manager shall perform all assigned responsibilities in accordance with the Contract Documents, Authority standards, applicable laws and regulations, and established professional practices.

2.3.1. Pre-Construction Phase

1. The Construction Managers shall employ personnel that have thorough knowledge of, and are fully experienced with, a wide array of construction techniques and methods. Personnel should be familiar with Authority Standards and procedures.

Personnel assignments shall be commensurate with the complexity, scope, and risk of the Project, and staffing levels shall be adjusted as necessary to ensure effective oversight and timely performance of assigned duties.

2. All personnel will be familiar with Authority maintenance and protection of traffic procedures and requirements.

Such familiarity shall include the ability to review, interpret, and enforce Maintenance and Protection of Traffic (MPT) plans and to identify unsafe or noncompliant traffic control conditions.

3. All personnel will understand how to apply the Specifications to achieve a high-quality finished product.

This includes interpreting Specification requirements, verifying compliance during construction operations, and identifying deficiencies requiring corrective action.

4. The Construction Manager must obtain a Traffic Permit before they will be allowed to enter the Authority's right of way to perform work.

The Construction Manager shall ensure that all permit requirements, restrictions, and conditions are fully understood and complied with throughout the duration of the Project.

5. On certain projects, the Construction Manager will be expected to interact and coordinate with State, County, Municipal, Institutional, Business and Residential entities as circumstance may require. This may also include verifying that the contractor has attained required local traffic permits based on the project needs.

Such coordination shall be documented and performed in a manner that minimizes disruption, resolves conflicts, and supports timely progression of the Work.

6. The Construction Manager may be required to develop and implement a vibration monitoring program which will be performed at the pre-construction and post-construction inspections of structures, residences and businesses within a given distance of vibration causing activities not limited to pile driving, and sheet pile driving, as well as heavy compaction operations. However, in some cases the Contractor may be responsible for the vibration monitoring with the Construction Manager performing oversight. The Contract Documents will specify which method to be utilized.

The Construction Manager shall ensure that baseline data is properly established, monitoring activities are conducted in accordance with the Contract Documents, and any exceedances or complaints are promptly investigated and reported.

7. Conduct a pre-construction conference, attend all meetings called by the Authority and convene job meetings with the Contractor, as required.

The Construction Manager shall prepare agendas, document meeting minutes, track action items, and distribute records to all required parties in a timely manner.

8. Establish procedures to monitor the expending review and processing of shop drawings, submittals, and RFIs.

Such procedures shall ensure timely review, coordination among reviewers, proper documentation, and adherence to Contract-required review timeframes.

9. The Construction Manager will implement a Quality Assurance Program for each specific project and demonstrate how it follows its firm's Quality Assurance Policy.

The Quality Assurance Program shall include defined inspection procedures, documentation requirements, verification processes, and corrective action protocols.

10. Create and publish a complete Construction Incident Communication Plan (CICP) with all required contacts and established protocol for any type of emergency event or significant issue.

The plan shall be distributed to all relevant parties prior to the start of construction and updated as necessary to reflect changes in personnel, responsibilities, or procedures.

2.3.2. Construction Phase

1. CapEx will be the web based software system utilized by the Authority for all of their projects.

The Construction Manager shall utilize CapEx for project documentation, correspondence, submittals, RFIs, change management, pay estimates, reporting, and record retention in accordance with Authority requirements.

2. The Construction Manager shall coordinate its activities with Authority personnel throughout the course of the project. The Authority shall be informed of all meetings with other agencies, government officials and/or groups so that Authority personnel can attend if necessary.

Such coordination shall include advance notification, distribution of agendas, and documentation of discussions, decisions, and action items.

3. The Construction Manager shall have available daily inspection reports accessible by the Authority at all time.

Inspection reports shall be accurate, complete, timely, and maintained in an organized manner to support project oversight, payment verification, and dispute resolution.

4. The Construction Manager shall conduct a detailed review of the Contractor's computer generated CPM progress schedules, including analysis of the logic associated with these schedules. Upon discovery of schedule or cost variance from the Contractor's plans, the Construction Manager shall recommend remedial action to the Contractor and/or the Authority.

Schedule reviews shall include evaluation of critical path activities, sequencing, resource loading, and recovery plans when delays or impacts are identified.

5. The Construction Manager shall staff the Field Office at all times when the Contractor is working and until 5:00 PM each weekday to receive mail and telephone messages.

Field Office staffing shall ensure continuous communication, responsiveness to issues, and proper handling of project correspondence.

6. The Construction Manager shall assume responsibility for the full time inspection of construction, and assign sufficient experienced personnel to staff the project

acceptably. The qualifications of the field inspection provided shall ensure proper control and shall meet with the approval of the Authority.

Inspection staffing levels shall be adjusted as necessary to address changes in construction activity, complexity, risk, or schedule.

7. Ensure that the Contractor complies with all local, state, and federal laws, ordinances, rules, regulations or orders, as provided by the Contract. Review the Contract Documents and become familiar with, and verify in the field, all utilities, including Gas, Electric, Communications, Water, Sewer, in particular the Electronic Toll Collection (ETC) facilities, and any relocation and/or protection requirements identified in the Contract Documents.

Utility coordination activities shall be documented and monitored to prevent conflicts, service disruptions, or damage to existing facilities.

8. Ensure the Contractor does not proceed with any ground intrusive activities until satisfactorily completing the State's One Call System and complying with the State's Underground Facility Protection Act. Ensure the Contractor submits the New Jersey One Call System confirmation number or a copy of the New Jersey One Call System markout ticket and subsequent updates.

The Construction Manager shall verify markouts in the field and ensure required renewals are obtained as necessary.

9. Depending on the specific project requirements, Construction Manager may be required to provide staffing on weeknights, weekends and weekend nights. The potential for two shift field supervisors may also be necessary.

Staffing plans shall be coordinated with the Authority and adjusted to maintain adequate coverage during all construction operations.

10. The Construction Manager shall prepare and submit two separate monthly progress reports to the Authority within 20 calendar days of the end of each billing period. One of the reports will indicate weighted percent complete per task, and the other one will indicate percent complete based on hours spent per task. Both of the reports will correspond to invoices. The Construction Manager shall monitor the percent fee expended compared to the project percent complete. If at any time the percent fee exceeds the project percent complete, the Construction Manager shall implement the necessary adjustments and/or make recommendations on how to alleviate this condition.

Progress reports shall be accurate, supported by documentation, and reflect current project status.

11. Contractor requests for supplementary traffic patrols and slowdowns shall be reviewed by the Construction Manager for compliance with the warrants outlined in the Specifications.

Recommendations shall be documented and submitted to the Authority for review and approval as required.

12. If applicable, the Construction Manager shall coordinate Project activities with those of neighboring agencies, local communities, and utility company's whose Contractors are working concurrently in the same or adjacent work zones.

Coordination efforts shall focus on minimizing conflicts, maintaining safety, and ensuring efficient progression of work.

13. The Construction Manager shall document with photographs any unusual incidents, conditions, or construction methods encountered; and obtain progress photographs meeting the requirements of Specifications Section 107.10.

Photographs shall be properly labeled, dated, and archived for future reference.

14. Prepare and recommend for approval Change Orders as required. Prepare independent cost estimates and negotiate prices with the Contractor for supplemental and/or extra work resulting from proposed design changes or Field Orders.

Cost evaluations shall be based on Contract provisions, documented quantities, and reasonable pricing.

15. The Construction Manager shall notify the Authority of structural asset removals and openings in accordance with the "Guidelines for Structural Asset Changes". Procedures Manual.

Notifications shall be timely and include all required documentation to support asset tracking and record updates.

2.3.3. Post-Construction Phase

1. The Construction Manager shall participate in the final inspection of the completed work, prepare a "punch list" resulting from such inspections, measure all pay items of work and make certifications that the Work has been completed in accordance with the Contract Documents, and prepare the Final Certificate of Payment.

The Construction Manager shall coordinate final inspections with the Authority and Contractor, track completion of punch list items, verify final quantities, and ensure all required documentation is complete prior to recommending final payment.

2. The Construction Manager shall provide services which will include, but are not limited to, inspecting all work to ensure that it is done in conformance with the Contract Plans and SpecificationsContract Documents, inspecting all construction materials to be used and incorporated on the Project to ensure compliance with the Contract requirements, obtaining certifications of all materials, maintaining as-built information and the preparation of "as-built" plans, and all such other services as may be required to furnish a complete engineering service of high quality. The

as-built information should be completed within the allotted time period specified by the Authority.

As-built documentation shall accurately reflect field conditions, approved changes, and final configurations, and shall be reviewed for completeness and accuracy prior to submission to the Authority.

3. The Construction Manager shall review all Contractor Claims and Requests for additional Compensation.

Reviews shall include evaluation of Contract provisions, supporting documentation, schedules, and cost records, and recommendations shall be submitted to the Authority for determination.

4. The Construction Manager shall conduct a post-construction conference(s) with the Design Engineer and Contractor to review the Project in its entirety for the purpose of identifying areas for improvement and areas of excellence from the perspective of each project participant. The Construction Manager shall develop the meeting agenda with input and approval from the Authority's Liaison Engineer. The purpose of the meeting is to provide an open forum to discuss and review measurable and actionable recommendations for future projects. The participants shall include key project personnel, principals and decision makers from each firm. The Construction Manager shall summarize the meeting findings and recommendations in a "Best Practices" document which shall detail items for further consideration and evaluation by the Authority. The document shall be in a format approved by the Authority's Liaison Engineer, and delivered to the Authority following the conclusion of construction during the Contract closeout.

The Construction Manager shall document attendance, discussions, and outcomes of the conference(s) and ensure that recommendations are clearly defined, actionable, and supported by project experience.

2.4. CONSTRUCTION MANAGER'S MATERIAL TESTING LABORATORY

The Construction Manager shall hire, coordinate, instruct and pay all testing laboratories for specialized testing services. The Authority shall approve the AASHTO accredited testing laboratory proposed by the Construction Manager. It shall be the Construction Manager's responsibility to confirm that the testing/laboratory of their choice have current up to date accreditations for testing services to be provided. These accreditations/requirements will include AASHTO, AMRL and CCRL.

The Construction Manager shall maintain documentation of all laboratory accreditations and submit such documentation to the Authority upon request. Any lapse, suspension, or revocation of accreditation shall be reported immediately to the Authority and corrective action taken as directed.

Materials will be tested in accordance with the procedures set forth in Specifications Section 105.03 (Inspections, Tests, and Samples) and as further defined in the Specifications applicable to the particular material or pay item.

Testing frequencies, methods, and acceptance criteria shall conform strictly to Contract requirements, and all test results shall be properly documented and retained as part of the project records.

Off-site laboratory testing by an independent testing laboratory is intended for the purpose of providing all off-site testing and inspection of shop fabrication of bearings, structural steel, precast concrete deck panels, joint extrusion, high performance concrete mixes, asphalt, substructure concrete mixes, precast concrete products and other similar materials that require off-site testing.

The Construction Manager shall coordinate off-site inspections with fabricators and suppliers and ensure that the Authority is notified of scheduled inspections when attendance is required.

The testing laboratory retained by the Construction Manager shall also perform testing of asphalt and concrete in place properties, embankment densities and soil/aggregate testing. The Construction Manager will be responsible for on-site sampling of concrete material and all on-site visual inspections. Materials will be tested in accordance with the current methods of AASHTO, ASTM, ANSI, FSS or as otherwise specified or applicable in accordance with Specifications Section 105.03.

Sampling and testing activities shall be performed by qualified personnel using calibrated equipment, and any nonconforming results shall be promptly reported to the Construction Manager and the Authority.

The approved testing laboratory must have current AASHTO accreditation for the AASHTO testing procedures (or ASTM equivalents) required for each individual test.

Laboratories shall be approved only for those tests for which they are specifically accredited, and substitution of testing procedures or personnel shall not be permitted without Authority approval.

In addition, testing personnel must be current in accreditation of the appropriate certifying entity, a partial list of certification titles is provided herein:

All certifications shall be valid at the time of testing and maintained throughout the duration of the Work.

- ACI Level I Field Technician

Personnel holding this certification shall perform field testing of fresh concrete in accordance with applicable standards.

- ACI Concrete Strength Testing Technician

Certified personnel shall be responsible for preparation, curing, and testing of concrete strength specimens.

- PCI Level I, II and III Technician

Certified technicians shall perform inspection and testing of precast concrete products as required by the Contract Documents.

- AWS Certified Welding Inspector

Certified inspectors shall oversee welding operations and inspections in accordance with applicable codes and specifications.

- NJSAT Asphalt Plant Technologist I and II

Certified personnel shall perform asphalt plant inspection and testing in accordance with Authority and NJSAT requirements.

- NJSAT Asphalt Paving Construction Technologist

Certified personnel shall perform asphalt paving inspection and testing operations in the field.

- Nuclear Density Gauge Certified Technician

Certified technicians shall perform in-place density testing in compliance with applicable safety and regulatory requirements.

2.4.1. Procedures for Control of Materials

An adequate and effective system for control of the materials used in Authority construction is absolutely essential to be certain that the materials furnished and incorporated in the work are in compliance with the requirements of the Contract Plans and Specifications. It is the Construction Manager's responsibility to monitor this control and to implement a system of tests and records to account for all aspects of quality control. Such a system should be organized in a straightforward manner to facilitate review by representatives of the Authority.

The Construction Manager shall ensure that material control procedures are consistently applied throughout the Project and that all personnel involved in inspection, sampling, and testing understand their responsibilities and reporting requirements.

A Contract Specific Materials Acceptance Criteria Matrix prepared by the Project's Designer will be provided by the Authority to the Construction Manager. See Exhibit 3 - 9 of the Authority's Procedures Manual for an example Matrix.

The Construction Manager shall review the Matrix upon receipt, incorporate its requirements into project inspection and testing plans, and verify compliance throughout the duration of the Work.

As a means to expedite material acceptance, the Authority has recently created a Qualified Products List (QPL), where the list of material products prequalified as meeting the Authority's requirements is located. The list is maintained and updated periodically by the Authority and is available on the Authority's website at the following link: Quarterly QPL Report. This document is also accessible within the CAPEX Software.

The Construction Manager shall verify that materials proposed for incorporation into the Work are included on the current QPL when applicable and shall document such verification in the project records.

It is extremely important that a complete set of records, including test and inspection reports, be maintained in the Construction Manager's files for a construction contract. In case of failure to meet specified requirements, the materials control data will constitute the basis for rejection of the work deemed unfit for acceptance, or it may be the basis for its acceptance upon appropriate credit considerations where this is in the best interest of the Authority.

Records shall be maintained in an organized, traceable, and retrievable manner to support acceptance decisions, audits, claims resolution, and final project closeout.

Specifications shall define the minimum requirements for materials to be used for a specific purpose. Tests generally must be made for all materials and compared against the contract requirements to determine acceptability. All sampling and testing of materials shall be performed under the direct control of the Construction Manager. Although independent testing laboratories may be arranged directly by the Authority to perform certain testing services, the laboratory will report test results to the Construction Manager with a specified number of copies to the Authority. All decisions to accept or reject materials rest with the Construction Manager.

The Construction Manager shall ensure that sampling and testing frequencies, methods, and documentation conform to the Contract Documents and that any nonconforming materials are promptly identified, documented, and addressed in accordance with Authority procedures.

2.4.2. Material Suppliers

Materials Suppliers shall be approved by the Construction Manager prior to the commencement of Contract Work. The Contractor is required to submit a list of all materials producers and vendors to include all sources of supply setting forth the company name, address, brand name and the approximate quantities of materials to be purchased. The Construction Manager may require additional information prior to accepting a particular producer/vendor; this information that could be required from the Contractor may include a list of similar projects serviced by the proposed source. This list should include the name and location of the project, the project owner, the name of an owner's representative familiar with the project and the date that the proposed source supplied the project.

The Construction Manager shall review submitted information to verify that proposed material suppliers are capable of providing materials that comply with the Contract Documents, Authority standards, and applicable specifications. Approval of a supplier shall be based on demonstrated performance history, product quality, capacity to meet project schedule requirements, and compliance with applicable certification and qualification requirements. The Construction Manager shall document all approvals, rejections, and conditions of acceptance, and shall monitor approved suppliers throughout the duration of the Project to ensure continued compliance.

2.4.3. Testing Materials

In general, on-site inspection, off-site inspection, and certification are the three ways in which materials are tested for acceptance on Authority construction contracts, which are described herein:

The Construction Manager shall ensure that the appropriate method of material acceptance is applied based on the Contract Documents, material type, and Authority requirements.

1. On-Site Inspection

On-site inspection includes all testing normally performed for the project. Such testing is done by both the Construction Manager and testing laboratory. The Construction Manager shall obtain the appropriate size and number of samples from the Contractor consistent with the requirements of Specifications Section 105.12 (Material and Product Samples) and shall ensure they are delivered to the testing laboratory for testing. Materials arriving on the job site should be accompanied by Quality Control (QC) test results from the Contractor. Once received, the testing laboratory then performs Quality Assurance (QA) testing to confirm the Contractor's QC results.

The Construction Manager shall verify that sampling, handling, and delivery of samples are performed in accordance with applicable standards and that all test results are properly documented and reviewed for compliance.

On-site inspection by the Construction Manager/Test Lab will cover such items as:

- Gradation of embankment
- Compaction of embankments
- Subbase
- Porous backfill
- Stone base
- Lumber formwork
- Untreated timber piles
- Fertilizer
- Pre-molded joint filler
- Granite curb
- Lighting fixtures
- Topsoil
- Mulch
- Concrete slump
- Concrete air voids
- Concrete cylinder creation
- HMA compaction
- Field weld testing

Testing and inspection activities shall be performed by qualified personnel using calibrated equipment and in accordance with applicable testing standards.

The list above is provided as a guide for typical inspection duties and is not intended to be all inclusive.

Additional inspections or tests may be required as dictated by the Contract Documents, material performance, or Authority direction.

2. Off-Site Inspection

Off-site inspection, or plant inspection, of such products as Portland cement concrete, asphalt concrete and structural steel fabrication is done by an independent testing laboratories working under the specific direction of the Construction Manager.

The Construction Manager shall coordinate off-site inspections, establish inspection schedules, and ensure that testing laboratories are authorized and properly accredited.

The testing laboratory will generally conduct off-site inspection on the following items:

- Asphalt concrete
- Metal castings
- Portland cement concrete
- High performance concrete
- Concrete cylinders
- Pre-cast concrete products
- Structural steel fabrication
- Overhead sign structure fabrication
- Paint and Coatings
- Bearing fabrication

Off-site inspection reports shall be reviewed by the Construction Manager and maintained as part of the permanent project records.

The list above is provided as a guide for typical testing laboratory duties and is not intended to be all inclusive.

Additional off-site inspections may be required based on fabrication complexity, quality concerns, or Authority requirements.

3. Certification

Some products such as guide rail, H-piles, cement, sign panels and similar materials require certifications. The manufacturer may maintain excellent quality control procedures and testing results at their plant. In these cases, the Construction Manager may accept the testing performed by the producer's quality control personnel and accept materials represented by such tests provided it

meets Specifications. However, in all such cases, the Construction Manager shall require valid certifications of compliance along with the test results.

Certifications shall be reviewed for completeness, validity, and conformance with Contract requirements prior to acceptance of materials.

It is always recommended to obtain samples of materials for possible testing wherever there is a question of compliance. The following items will most often be approved by certification of compliance together with test reports from the manufacturer:

- Structural steel (except for fabrication)
- Steel piles and sheeting
- Steel casings for drilled shafts, micropiles
- Portland cement
- Reinforcement steel
- Corrugated metal pipe
- Light standards
- Fence
- Epoxy
- Admixtures
- Concrete liquid curing compounds
- Asphalt cement
- Electrical wire

Acceptance by certification does not relieve the Construction Manager of the responsibility to reject materials that do not conform to Specifications or exhibit deficiencies.

The lists above are not meant to be all inclusive but will serve as a guide for establishing materials approval procedures.

The Construction Manager shall exercise professional judgment in determining appropriate acceptance methods.

The Construction Manager shall inform the testing laboratory of all requirements for sampling and testing materials. The tests required and sampling frequency are listed in the Contract Documents and is to be followed unless otherwise directed by the Authority.

Any deviations from specified testing requirements shall require prior approval from the Authority.

It will be the responsibility of the Construction Manager to establish a report procedure from the testing laboratory to and from the Construction Manager to the Contractor. Under no circumstances should the testing laboratory be authorized to report directly to the Contractor or supplier. It is a primary responsibility for Construction Management staff to scrutinize and inspect all delivery tickets, shipping tags, seals and the like to establish that all products and raw materials

have been properly inspected by the authorized testing laboratory and procured from an approved source.

The Construction Manager shall ensure that communication protocols are strictly enforced and that all documentation supports traceability and acceptance of materials.

2.5. GENERAL CONTRACTOR'S RESPONSIBILITIES

The General Contractor has the following specific responsibilities. (Specifications Division or Subsection reference)

1. Pay prevailing wage. (Subsection 102.13)

The Contractor shall comply with all applicable prevailing wage laws and requirements and maintain certified payroll records for review by the Authority.

2. Be a Registered Public Works Contractor. (Subsection 102.15)

Registration shall remain current and valid for the duration of the Contract.

3. Have a valid Business Registration Certificate. (Subsection 102.16)

The Business Registration Certificate shall be maintained in good standing and made available upon request.

4. Perform ≥ 50 -percent of the contract work, exclusive of Specialty Items and be responsible for Subcontractors. (Subsection 103.04)

The Contractor shall coordinate, supervise, and be fully responsible for the actions, performance, and compliance of all Subcontractors.

5. Always have an English speaking superintendent on site and employ sufficient personnel and equipment to complete work on time. (Subsection 104.06)

The superintendent shall have authority to act on behalf of the Contractor and ensure continuous coordination with the Construction Manager.

6. Cooperate with Utilities and other 3rd party entities. (Subsection 104.07)

Such cooperation shall include coordination of schedules, protection of facilities, and timely communication to minimize conflicts and delays.

7. Submit accurate and properly detailed shop/working drawings and, upon completion of the project, deliver to the Authority one complete set of approved shop/working drawings. (Subsection 104.08)

Shop drawings shall conform to Contract requirements and be submitted in accordance with established review procedures.

8. Perform all Work required in connection with the layout for construction of the Project using the traverse control points furnished by the Authority. (Subsection 104.09)

The Contractor shall verify control points prior to use and be responsible for accuracy of layout.

9. Conduct all operations during the performance of the Work to provide protection for the general public, and those within the construction site, from the harmful and disturbing effects of excessive noise and dust. (Subsections 104.11 and 104.12)

Mitigation measures shall be implemented as required by the Contract Documents and applicable regulations.

10. Comply with State and Federal laws, rules and regulations concerning construction safety and health standards. (Subsections 104.13, 104.14 and 104.15)

Compliance shall include implementation of safety programs, training, and enforcement of safe work practices.

11. Observe all laws and local ordinances that affect those engaged or employed on the Project, the materials or equipment used, or the conduct of the work; Federal OSHA provisions, NJ Right-To-Know and High Voltage Proximity Act. (Subsection 106.02)

The Contractor shall be responsible for ensuring all personnel are informed of and comply with these requirements.

12. Notify the Chief Engineer, in writing, within 10-days of an event that the Contractor deems is the basis for additional compensation or an extension of time. (Subsection 106.07)

Failure to provide timely notice may result in waiver of entitlement as provided by the Contract Documents.

13. Assumes full responsibility of the Work until Acceptance. The Chief Engineer reserves the right to open completed sections of roadway prior to Acceptance. If damage to the roadway occurs, through no fault of the Contractor, then all costs associated with repair of this damage will be paid for by the Authority. (Subsection 106.09)

The Contractor shall continue to protect completed work until final Acceptance.

14. Procure all permits and licenses, pay all charges, fees and taxes, and give proper notices necessary and incidental to the lawful prosecution of the Work. (Subsection 106.10)

All permits and licenses shall be obtained prior to performing the associated work activities

15. Provide for public convenience and safety. (Subsection 106.12 and Division 800)

The Contractor shall implement and maintain traffic control, access, and safety measures as required.

16. Preserve all public and private property markers. (Subsection 106.14)

Any disturbed or damaged markers shall be restored in accordance with applicable requirements.

17. Provide the Construction Manager with NJ One Call confirmation number prior starting ground intrusive activities. Provide advance notification to utility owners of intentions. Exercise extreme care in working around Authority owned utilities. (Subsection 106.18)

The Contractor shall comply fully with the Underground Facility Protection Act and verify all markouts prior to excavation.

18. Procure and maintain insurance as required by the Contract until Project Acceptance. Typically, these involve; General Liability, Auto Liability, Worker's Comp, Pollution Liability, Umbrella Liability, Owner's Protective Liability. (Subsection 106.20)

Certificates of insurance shall be submitted to the Authority and maintained without lapse.

19. Employ workers with sufficient skill and experience to perform properly the work assigned to them. Ill-tempered or disorderly persons will be removed from the Project. (Subsection 106.22)

The Contractor shall ensure personnel conduct themselves in a professional manner at all times.

20. Submit, for approval, within 10-days after the Contract is executed by the Authority, a preliminary progress schedule detailing the Work for the first 60-days. Submit, for approval, within 30-days after the Contract is executed by the Authority, a complete and comprehensive progress schedule. (Subsection 107.04)

Schedules shall be maintained and updated to accurately reflect progress and planned operations.

- a. Schedule the Work using such procedures and staging as may be specified in the Contract Documents.
- b. Provide sufficient labor, materials and equipment to guarantee the completion of the Project in accordance with the Contract Documents and within the time set forth in the Contract Agreement.
- c. Determine the most feasible order of Work commensurate to the best of the Contractor's abilities and the Contract Documents.

21. If the contractor falls 15-days behind schedule, a revised recovery schedule shall be submitted. (Subsection 107.04)

The recovery schedule shall identify corrective actions and measures to regain compliance with the approved schedule.

22. Prior to commencement of construction operations, take and provide color photographs in a number that is sufficient to depict the existing condition of the construction site. (Subsection 107.10)

Photographs shall be dated, labeled, and submitted in accordance with Contract requirements.

23. Perform final clean up and restoration of property. (Subsection 109.01)

Final cleanup shall restore the site to conditions acceptable to the Authority.

24. Prior to receiving final payment, furnish a Surety Bond to the Authority in a sum equal to 5-percent of the Total Contract Price. The Bond shall remain in full force and effect for a period of 1-year from the date of final acceptance by the Authority. (Subsection 109.03)

The bond shall cover defects and obligations as specified in the Contract Documents.

The lists above are not meant to be all inclusive but will serve as a guide for establishing General Contractor Responsibilities.

The Contractor remains fully responsible for all obligations imposed by the Contract Documents.

SECTION 3

ADMINISTRATIVE

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Section 3 - ADMINISTRATIVE

3.1. PROJECT ADMINISTRATION

3.1.1. Design to Construction Hand-Off

The first meeting to be held with the Construction Manager will be the Design to Construction handoff meeting. This meeting will be at the request of the Authority, and will involve the Design Engineer, the Construction Manager, and members of the Authority that will or have been involved in the administration of the Contract. This meeting serves as the formal transition between the design and construction phases and establishes the initial framework for communication, coordination, documentation, and issue resolution for the duration of the Project.

The purpose of the meeting will be to bring both of the professional service groups together to discuss any potential problems or concerns regarding the Project. It also becomes the first “meet and greet” meeting whereby the notable members from each discipline have the opportunity to get acquainted and become part of a “team” structure selected by the Authority to complete the Project from the design phase through construction and close-out phases. In addition, it allows for specific discussion regarding the protocol and timing for shop drawings, permits, RFI’s, change of plans, materials, etc. During this meeting the Design Team shall also provide the Construction Team a list of major items that were discussed during the design of the project that may or may not have been incorporated into the design. The Design Team shall also identify any design assumptions, constraints, staging limitations, right-of-way limitations, environmental commitments, unresolved design considerations, known constructability concerns, and third-party coordination issues that may affect construction sequencing, safety, schedule, or cost. If available, the Design Team should provide a summary of design-phase utility coordination, permit status, and agency coordination items that require continued follow-up during construction.

A list of the Local Agencies and points of contacts should be provided to the Construction Manager based on coordination efforts performed during the design phase. The list should include municipalities, counties, emergency responders, railroads, utility owners, permit agencies, and any other stakeholders with jurisdiction or oversight responsibilities related to the Project. Where applicable, the list should include after-hours contact information and escalation procedures.

This meeting is typically held a week or so prior to the pre-construction conference, and does not involve the Contractor. Meeting minutes shall be prepared by the Construction Manager documenting key discussions, action items, responsibilities, and due dates, and shall be distributed to all attendees.

3.1.2. Pre-Construction Conference

The pre-construction conference is the Authority’s meeting that is conducted by the Construction Manager. The meeting is held prior to the start of Work and it provides an opportunity for the Owner to present, to all involved parties, the scope of the Work and instructions relating to the execution of the contract. These instructions include; limit of authority, lines of communication, contract time and limitations, contract payments, project safety, traffic control, permits, quality control, character of workmanship, wages and EEO (Equal Employment Opportunity), and DBE (Disadvantage Business Enterprise) / SBE

(Small Business Enterprise) involvement. The pre-construction conference also establishes project expectations, required submittals, documentation standards, reporting protocols, and compliance requirements to be followed throughout construction and close-out.

The pre-construction conference will commence with the Authority's Liaison Engineer opening remarks followed by introductions around the room by all attendees. A sign-in sheet will be passed around and the meeting will be handed off to the Construction Manager who will then facilitate the meeting utilizing the agenda described below:

Attendance by key Contractor supervisory staff, including the Contractor's Project Manager and Superintendent, is required. As applicable, key subcontractors and suppliers may be requested to attend based on the scope of Work and anticipated early-start activities.

1. Contract Execution

This discussion will revolve around when it is anticipated that the contract be executed. The contract is considered executed only after it has been endorsed by the Authority. This should be discussed with the Contractor with the reminder that the Contractor follows the instructions given in the Letter Of Award. The Contractor shall be advised that no Work, including mobilization activities within the Authority's right of way, may commence prior to receipt of a Notice To Proceed from the Authority.

2. Contract Bond

Four copies of the Contract Bond will be required to be submitted along with the Contract. The Construction Manager shall verify that all bond documents conform to Contract requirements prior to Contract execution.

3. EEO Requirements

Requirements are in accordance with the Contract Documents. Historically they have been identified in the Supplementary Specifications. Typically, the Authority's EEO representative will be in attendance and will address the specified requirements. The Contractor shall be advised of required reporting, documentation, and compliance monitoring procedures, including any applicable submission timelines.

4. Insurance

Insurance certificates are required as described in Section 106 of the Specifications. The Contract provisions should be reviewed including a discussion of the insurance types and minimum policy amounts that will be required. Advise the Contractor that once the insurance has been determined to meet the Contract requirements, and all other prerequisite information is in order, the Contractor will receive a Notice To Proceed letter from the Authority stating that operations may commence. Any changes to insurance coverage during the life of the Project shall be submitted to the Authority for review prior to implementation.

5. Safety

The Contractor shall be required to ensure that all employees, subcontractors and their suppliers, while on the job site and in conduct of the Authority's contracts report any injuries within 24-hours of said injury. The Contractor shall also be required to ensure that all employees, subcontractors and their suppliers, while within the Authority ROW wear safety vests meeting the most recent ANSI/ISEA - American National Standard for High Visibility Public Safety Vest - Class 3 requirements, hardhats, and eye protection. Additional personal protective equipment (PPE) may be required based on the specific task a worker is performing. The Contractor shall be required to maintain and enforce jobsite safety practices and shall immediately correct unsafe conditions. The Construction Manager shall monitor compliance with safety requirements and may direct the Contractor to stop Work for unsafe conditions in accordance with the Contract Documents.

The Contractor will not be permitted to perform work within Authority ROW until the "Lane Closure and Construction Safety" presentation has been viewed and acknowledged by all personnel, which shall be documented with an attendance sheet. Any Subcontractors or other personnel who will be working within the Authority ROW will also have to view the presentation and sign the attendance sheet. The Contractor shall maintain the attendance documentation on-site and make it available upon request.

Failure to comply with training and documentation requirements shall result in denial of access to the Authority ROW and may require removal of non-compliant personnel from the Project.

Nothing contained herein shall be construed to limit the Authority's right to enforce safety requirements, require corrective actions, suspend Work, or remove personnel for safety violations. Such actions shall not constitute extra work, delay, or grounds for additional compensation.

6. The Contractor shall prepare and implement a Health and Safety Plan (HASP) that encompasses the following:

- Protect the lives and health of all persons.
- Prevent damage to the property of others.
- Prevent damage to the environment.

The Contractor shall be solely responsible for the development, implementation, and enforcement of the HASP, and Authority review or acceptance shall not relieve the Contractor of responsibility or transfer liability to the Authority.

Guidelines and minimum requirements for the development and implementation of the Contractor's Health and Safety Plan for the Authority's HASP requirements are available on the Authority's Web Site at the following link: <http://www.njta.com/doing-business/construction-and-maintenance-contracts> under the Policies & Procedures section of the page. Follow the link

titled "Health and Safety Plan Manual". Failure to comply with HASP requirements may result in corrective action, including suspension of Work, with no entitlement to additional time or compensation.

In addition to the Health and Safety Plan, the Contractor shall prepare and implement a Safe Work Plan (SWP) for Contract items of work applicable and depicted in the Contract's Supplementary Specifications. These plans shall address task-specific hazards, protective measures, and regulatory compliance, and shall be enforced at all times during the Work.

The Contractor shall prepare a Material Handling Plan for dealing with materials and potentially regulated materials encountered during Work activities if applicable and depicted in the Contract's Supplementary Specifications. The HASP, SWP, and Material Handling Plan, when required, shall be submitted for review and accepted by the Construction Manager prior to commencement of applicable Work activities.

The Authority reserves the right to require revisions, enforce compliance, suspend the Work, or remove personnel for failure to comply with approved safety or environmental plans, and such actions shall not constitute extra work, delay, or grounds for additional compensation.

7. Subcontractors

The Contractor must perform Work amounting to at least 50% of the Contract value, exclusive of specialty items (Facility and Building Projects; based on the prevalence of specialty work items, typically have a requirement of less than 50% unless otherwise specified). A specific listing of specialty items is listed in the Supplementary Specifications.

Discuss the SBE Forms as required in the Supplementary Specifications. The Contractor agrees to make a good faith effort to award at least 25% of this contract to subcontractors registered as an SBE, unless otherwise specified.

Discuss how the Contractor needs to complete the Notification of Intent to Subcontract forms. Be advised a valid copy of the Subcontractor's "Public Works Registration Act" certificate and Business Registration is required as part of the submittal. The Construction Manager shall track subcontractor utilization, approvals, and compliance throughout the duration of the Project.

8. Plans and Specifications

The Contractor must maintain a complete set of Contract Documents at the job site at all times. The Contractor shall ensure that field personnel are working from the latest issued and approved Contract Documents, including all addenda, revisions, approved RFIs, and approved changes.

The Contract Plans and Supplementary Specifications are available on the Authority's BidX web site in PDF format. A link and directions on registering in BidX are provided at: <http://www.njta.com/doing-business/construction-and-maintenance-contracts>.

The Authority's Standard Drawings and Standard Specifications are available on the Authority's website at the following link: <https://www.njta.com/doing-business/professional-services/manuals-tab> under the Announcements & General Information section of the page. Follow the link titled "Drawings" or "Standard Specifications".

The Contractor should be asked how many additional copies of the Contract Documents will be required, including full-size plans and half-size plans. Efforts shall be made to secure them after the meeting by the Construction Manager staff and Authority's Liaison Engineer.

Upon the Contractor's request and approval by the Authority, the Contract Plan sheets may be provided electronically in CADD format. The Contractor will be required to fill out a CADD release letter and return it to the Authority prior to the release of the CADD documents.

9. Contractor's Organization

The Contractor is required to submit an Organizational Chart of the responsible people involved in the Project with the role descriptions and contact information. Emergency 24-hour contacts will also be required to be listed. Any changes to key personnel shall be communicated to the Construction Manager and may require prior written approval by the Authority as required by the Contract Documents.

The Contractor's superintendent should be present at the meeting, and should be reminded of the need to submit a weekly memorandum detailing the numbers and classifications of the workers and equipment used on the Project each day, including those of the subcontractors.

Certified payrolls are required on a weekly basis for all personnel, including subcontractors.

Photo identification is required for the entire workforce and is to be made available by all personnel at all times while on-site. Photo identification shall have the individual's name, company name, and company telephone number. The Contractor shall be responsible for ensuring that site access is limited to authorized personnel.

10. Contractor's Field Office

Agreement should be reached as to the location of the Contractor's Field Office.

There should be a discussion regarding the need for pre-construction photos of any staging/storage yards on the Authority's right of way, including the need for the Contractor to submit the Staging Inventory/Inspection Form for all staging areas and to update the form every 6-months. Field offices, staging areas, and storage yards shall be maintained in a neat, orderly, and secure

condition, and shall be restored in accordance with Contract requirements at the completion of Work.

11. Construction Incident Communications Plan

A Construction Incident Communication Plan (CICP) will be implemented to quickly and thoroughly communicate a significant issue or any potential impact to traffic due to a construction related incident by following a "Construction Communication Chain".

Construction-related incidents, with the potential to impact traffic, include any possible delay in the opening of closed lanes such as equipment breakdowns, construction workers being injured, etc. Furthermore, any incident in a work zone requires notification using the established protocol. The protocol includes notice of all work related injuries, no matter how minor, in the work zone. These are to be communicated to the Construction Manager, who then follows the construction incident communications chain until all parties have been notified. The Construction Manager shall review the CICP with the Contractor at the pre-construction conference, and the CICP shall be updated as necessary throughout the Project.

12. Materials Approval

The Contractor should be prepared to provide a list of proposed suppliers at the meeting. The Contractor shall identify any anticipated long lead procurement items and any materials requiring pre-approval, prequalification, or special testing.

All materials to be used forming a permanent part of the Project shall be new.

The Authority has recently added a Qualified Products List (QPL) for all material products meeting the Contract requirements. The list is maintained and updated periodically and is available on the Authority's website at the following link: [Quarterly QPL Report](#). Materials proposed for incorporation into the Work shall conform to the Contract Documents and, where applicable, shall be selected from the QPL.

Additional time may be required for asphalt and concrete mix designs as well as specified embankment materials. It is anticipated that updates be submitted periodically. The Construction Manager shall maintain a log of material submittals, approvals, conditional approvals, and re-submittals to support schedule tracking and compliance.

13. Shop Drawings

Prior to the pre-construction conference, it is advisable that the Construction Manager discuss with the Design Engineer the list of anticipated shop drawings required. Once determined, the list should be forwarded to the Contractor. The Construction Manager should also discuss anticipated review durations, sequencing, and any items requiring multiple iterations or specialized review.

This list is not to be considered all inclusive, but rather a guide for the Contractor in determining those items that will be requiring shop drawings. During the pre-construction conference, the shop drawing list and corresponding procedures for submittal and approval will be acknowledged. The Contractor shall be advised that fabrication and installation shall not proceed prior to receipt of the required approvals as indicated in the Contract Documents.

Work performed without required approvals shall be at the Contractor's risk and may be subject to rejection, removal, or replacement with no entitlement to additional time or compensation.

Incomplete, inaccurate, or non-compliant submittals may be rejected and shall not constitute grounds for delay, additional time, or compensation.

Be specific with the name and address of the Design Engineer responsible for reviewing the shop drawings, the number of copies to be submitted, and those items that will require as-built/mylar type sheets (size 22" x 36") once final approval has been received. Structural steel components are typically those requiring as-built mylars prior to the close-out of the Project. Where applicable, clarify electronic submittal requirements, file naming conventions, and the distribution protocol for approved submittals.

The following procedure applies to final shop drawings and submittals:

- Once a shop drawing and/or submittal receives a No Exceptions Taken (NET) (by the Construction Manager or Design Engineer) and is sent back to the Contractor electronically, the Contractor will print three hard copies and return them to the Construction Manager for distribution. Shop drawing will be 22" x 36" and catalog cuts or similar documents will be 8 ½" x 11".
- The three hard copies will be distributed as follows: One copy to the Construction Manager, one copy to the EOR and one copy to the Authority at the time of project closeout.
- The Contractor must provide the Construction Manager with one set of CD's for all the submittals, which will be turned over to the Authority as part of project closeout. Electronic tracking of shop drawings and submittals shall be maintained by the Construction Manager to monitor review durations, approval status, and compliance with Contract requirements.

Review or approval of shop drawings shall not relieve the Contractor of responsibility for errors, omissions, deviations, or compliance with the Contract Documents. No changes to the Work shall be made unless authorized in writing in accordance with the Contract.

14. Testing Procedures

Discuss with the Contractor the protocol associated with testing responsibilities. The Contractor is responsible for the quality control, and the Construction Manager will be responsible for the quality assurance. The Construction Manager will also select a testing laboratory as part of their team for each project unless otherwise directed. The responsibility of cylinder delivery to the testing lab should also be discussed so that all parties know each other's responsibilities. It would also be advisable to discuss the frequency of any type of testing that may be outside the norm. The testing plan shall include procedures for documenting results, addressing failures, implementing corrective actions, and performing re-testing as required.

Also discuss that any materials delivered to the job site must have a "manufacturer's certificate" with it, particularly if it will be used in the finished product. Certificates shall be maintained with project records and made available upon request.

15. Progress Schedule

The type of progress schedule the Contractor is responsible to submit is identified in the Supplementary Specifications.

The Contractor should have already been advised, by the Construction Manager, that a 60-day interim schedule should be brought to the pre-construction conference for further discussion. The need for a full schedule should be emphasized and is required within 30-days of the execution of the Contract.

No progress payments will be processed until the baseline schedule has been approved.

Also discuss the need for monthly updates and the reports/narratives that should accompany the monthly updates. In the event the Contractor falls 15-days or greater behind the baseline schedule, a recovery schedule will have to be submitted indicating clearly how the Contractor will get the project back on schedule.

No progress payments will be processed until monthly schedule updates have been approved.

Be prepared to discuss any long lead items that have the potential to disrupt the progress of the Contract. These items should be disclosed at the meeting and dealt with in the appropriate fashion. The Contractor shall identify long lead items, procurement milestones, and anticipated submittal dates to support schedule realism and proactive management.

The liquidated damages associated with the Contract should be discussed, as well as any Contract specific constraints. The Construction Manager shall review the baseline schedule and updates for logic, sequencing, constraints, and conformance with Contract requirements.

16. Right of Way

Any parcels that have yet to be received should be discussed at the meeting as well as the potential impact on the progress schedule. Discuss construction easements, keeping in mind that most easements have a timetable associated with them and if the Contract proceeds in a different fashion than originally intended, the consequences of those easement timetables should be discussed further. Also, if parcels have yet to be acquired, discuss the schedule in which they may become available. The Contractor shall not enter property outside of Authority control without proper authorization and documented Right of Entry.

17. Permits

A listing of all permits for which the Authority has applied and for which the Contractor is responsible to follow can be found in Section 106 of the Specifications.

It is advisable to list those permits in the agenda, particularly if there are notification time frames and timing restrictions associated with them. Permit compliance requirements, including monitoring, documentation, and reporting obligations, shall be reviewed and enforced throughout the Project duration.

18. Utilities

An up-to-date status report should be discussed by the Construction Manager regarding the procurement of any Utility Orders or agreements. All utilities require advance knowledge of the time table for which the Work will proceed and any advance notification time will be listed in the Supplementary Specifications. Be prepared to discuss the materials and labor being supplied by the utility companies through the Utility Order and those being supplied by the Contractor through the Contract Documents. Before beginning any ground intrusive activities, the Contractor shall provide the Construction Manager with the NJ One Call System confirmation number or a copy of the mark-out ticket. The Contractor shall coordinate utility work and notifications in accordance with the Contract Documents and shall protect existing utilities during all operations.

An additional responsibility of the Construction Manager is to sign off on the Fiber Optic document acknowledging that the Construction Manager is aware of the Authority fiber optic line, and will take the appropriate precautions when working around the existing fiber optic line. Advance notification is required to the Authority whenever work is in close proximity of the fiber optic line. The Contractor shall comply with all fiber optic protection requirements and shall coordinate with the Authority as required prior to and during Work in close proximity to fiber optic facilities.

19. Pay Certificates

Discuss with the Contractor that only the person signing the Contract agreement is authorized to sign the pay certificates or Change Orders. If it is their intent to allow others to sign the pay certificates, a Power of Execution should be completed with the signing of the Contract agreement or immediately

thereafter. The Contractor shall be advised that incomplete, inaccurate, or non-compliant pay submissions may be returned for correction and may delay processing.

Semi-monthly payments may be obtained in accordance with the Contract requirements listed in Section 108.03 of the Specifications. In an effort to avoid all pay certificates being submitted at the same time, the Authority uses the last digit designation in determining the closing dates for the pay certificates. Please refer to Exhibit 3 - 1 for the chart establishing those dates.

20. Traffic Protection

Maintenance and protection of traffic for all sites shall be in accordance with the Contract Plans and Specifications and the Authority's Manual for Traffic Control in Work Zones. Traffic control setups shall be inspected routinely by the Construction Manager to verify conformance with approved plans, permits, and safety requirements.

The Contractor is required to prepare and submit an Application for Traffic Permit form to the Authority at least 10 working days prior to the time the Contractor intends to start any operations at the project site.

Discuss the allowable lane closing hours in the Contract's work zone, ingress and egress, traffic direction, traffic control devices required, layouts and any special Contract provisions.

All equipment escort and slowdown requests require at least 24-hour notice.

The Contractor must furnish the names of two responsible supervisory employees that may be reached at any time. These employees shall also be listed on the Construction Incident Communication Plan.

Discuss the electronic submission of lane closing requests, slowdowns, escorts, use of lane closing tables, and roadway closure processes if allowed by the Contract.

The contractor should be reminded that a brief safety meeting must be held in the field with NJTA Operations and NJ State Police. The Contractor shall maintain compliance with all permit conditions and shall promptly correct any deficiencies identified in traffic control operations.

21. Construction Layout

Discuss the responsibility for setting control within the work zone. For most Contracts, the Design Engineer uses software combined with the aerial plotting to determine the embankment quantities. Good practice dictates that prior to any embankment work being performed, pre-strip and post strip elevations be taken. Elevations should be agreed upon by both survey teams (Contractor and Construction Manager). Final elevations (post-embankment) should be taken so as to eliminate any arguments regarding quantities. Monuments called out to be installed shall be punched by a land surveyor licensed in the

State of New Jersey. Any discrepancies identified during construction layouts shall be immediately brought to the attention of the Construction Manager for review and resolution. Survey disputes or discrepancies shall be documented and resolved prior to proceeding with affected Work.

22. Buildings

Building Contractors should be informed that the requirements expected of the highway Contractors apply to them as well. Coordination at a building site is extremely important and that all trades involved with the building should have a set of coordinated working drawings so that each trade is aware of the other trades infrastructure, where it is located and what are the guidelines and applicable codes. The Department of Community Affairs (DCA) is the state agency that has control over the Authority buildings when it involves the health and safety of the public and the Authority's employees, and as such they will be involved in the construction process beginning with the original plan review and followed by inspections completed by their staff. The DCA has separate permits and inspections for civil, electrical, mechanical, structural, fire, and demolition operations, and will require coordination with the Construction Manager or Architect and Contractor.

The Construction Manager or Architect involved should place emphasis on supplying temporary power, heat, and water, in particular, when the building starts to receive finish treatments. It is important that the building environment be stable so that these finish treatments are not damaged due to excessive heat, humidity, or cold. This is in the Contractors best interest as they may be responsible for repair of damage prior to final acceptance.

Typically, buildings are bid on a lump sum basis, and as such, the Contractor is required to submit an itemized breakdown or "Schedule of Values". This breakdown once agreed to by the Construction Manager or Architect and approved by the Authority, will facilitate preparation of monthly pay estimates as well as any weekly or monthly progress reports submitted by the Construction Manager.

The Construction Manager or Architect should also stress the importance and responsibility of maintaining a clean facility. A final inspection will not be conducted nor will a Contract be accepted if the building site is not clean and ready for occupancy.

One of the final requirements for most buildings will be the training of the operational systems and all of the accompanying manuals shall be supplied. This should be discussed with the Contractor & Architect. Commissioning may also be necessary for the Building Management System, and should be discussed in detail prior to any commissioning operations taking place. Commissioning procedures, training requirements, and documentation deliverables shall be coordinated with the Authority and tracked through to completion prior to final acceptance.

Guarantees and warranties should also be discussed as depicted in the General Provisions of the Supplementary Specifications.

It is recommended that a night watchman be provided whenever the building is in a stage that is susceptible to vandalism, and this should be discussed either at the pre-construction conference or follow up bi-weekly meetings.

23. Progress Photos

Discuss with the Contractor the requirement for progress photos, the number of views and frequency required. It is good practice to have each inspector on the jobsite taking daily photos of operations in addition to the actual project photos. These inspector photos go a long way in assisting with document control and overall quality. Photos should be cataloged in a consistent manner and maintained as part of the project record for reference and documentation purposes.

The Contractor is responsible to provide monthly progress photos in accordance with Section 107 of the Specifications. An average of 10 progress photographs per month shall be provided, with the actual number and views determined by the Construction Manager. Additionally, the Contractor and Construction Manager shall conduct a Pre-Construction photographic survey of the site in order to document the existing condition of the site.

24. Surety Bond

As a guarantee against defective Work, the Contractor must furnish a Surety Bond in the sum equal to 5-percent of the final Contract value prior to final payment. This bond will remain in full force and effect for a period of 1-year from the date of final acceptance of the Contract by the Authority unless otherwise specified.

25. Questions

Provide an opportunity for the Contractor to ask questions regarding the Contract Plans, Specifications, or methods of construction.

Samples of pre-construction conference agenda and sign-in sheet are attached as Exhibit 3 - 4 and Exhibit 3 - 5 for reference.

3.1.3. Progress Meetings

The Construction Manager conducts periodic meetings with the Authority and Contractor as well as all other parties involved in the Project. These meetings are usually held on a bi-weekly basis, but may be increased or reduced depending on the complexity of the Project. The topics discussed at the meeting include safety, past performance and project issues, proposed construction operations, RFI's, submittals and shop drawings, old business and new business, project payment, change orders, and utility coordination. The project schedule and status of updates will also be discussed. At the conclusion of the meeting, an action plan will be prepared with responsibilities being assigned for outstanding issues. Action items should identify responsible parties and target dates for completion to support timely resolution and accountability.

Progress meeting attendees will be required to sign-in. Samples of progress meeting minutes and sign-in sheet are attached as Exhibit 3 - 6 and Exhibit 3 - 7 for reference.

3.1.4. **Construction Schedule**

The Contractor prepares the schedule of operations needed to complete the Project within the time limits of the Contract. The Critical Path Method (CPM) is used to develop the schedule which shows in detail: work to be accomplished, a logic diagram showing project milestones, and the critical path to project completion. The schedule shall be prepared in accordance with the Contract requirements and shall be used as a management tool to plan, monitor, and control the Work.

In some cases, the schedule will require cost and resource loading as required in the Specifications. The Contractor will be responsible to add labor, equipment, and material resources needed to complete the tasks. As is the case with most schedules, special attention is to be given to delivery of materials and completion of utility relocations and their impact on the schedule. Where required, resources shall be adequate, realistic, and consistent with the proposed sequence of operations.

To maintain flow, the Contractor should include a material submission schedule and a working drawing/shop drawing submission schedule so the Design Engineer and Construction Manager are not inundated with submittals at any one time. This sequencing should consider review durations, fabrication timelines, and procurement milestones to minimize the risk of delay.

Long lead items are activities that require special attention. Items such as HPC concrete mixes typically call out for verification testing and that time period can be as long as 4 to 6 months. This type of mix design needs to take priority in the submission process, and if not started promptly, could derail the Project or at the very least be problematic. Items such as structural steel components and specialty type items will not follow the typical 14-day review time period, and several iterations may be required before reaching acceptable fabrication status. The Contractor shall identify long lead items early and incorporate procurement and approval durations into the baseline schedule.

Another structural steel element that requires extensive shop drawing/fabrication and testing time are the beam bearings. Some bearings require destructive testing to be complete prior to approval. These activities, if not monitored properly, can cause schedule slippage that may not be easily recoverable. The Contractor and Construction Manager shall closely monitor these activities and address any emerging risks promptly.

To maintain its usefulness, the schedule must be updated on a regular basis, typically on a monthly basis, and it becomes advantageous to update the schedule just before the monthly estimate is processed. The schedule and narrative is to be transmitted as a hard copy and electronically to the Construction Manager, in an agreed upon format, so that progress can be monitored both by the schedule and by project costs. Using this data, capital expenditures may be tracked and projected. Schedule narratives should clearly describe progress, critical path activities, constraints, delays, recovery measures, and changes in sequencing, and should identify variances from the baseline schedule.

In addition to the network diagram schedule, the Contractor is to provide to the Construction Manager a weekly schedule of upcoming planned Work, including labor,

equipment and material commitments. A three week look-ahead schedule will also be provided to the Construction Manager. Look-ahead schedules should identify access requirements, anticipated lane closures, utility coordination, material deliveries, and required inspections to support efficient daily operations.

The project schedule will be discussed at the progress meetings as will the status of any updates. In the event the Contractor falls behind the baseline schedule by 15-days, a recovery schedule will be required for submittal. The recovery schedule shall include labor, equipment, and materials needed and a commitment from the Contractor to see that the resources are provided to implement the plan and bring the Project back on schedule. Recovery schedules shall be reviewed for feasibility and shall be monitored until the Project returns to an acceptable status.

Any revisions to the Contract Staging Plans or sequence of operations proposed by the Contractor shall have a fatal flaw analysis performed so that the Work does not get impeded at some point due to the revised sequence. This review should be performed by the Design Engineer and the Construction Manager. The fatal flaw analysis should also consider impacts to traffic control, safety, constructability, utilities, permits, and overall Contract time constraints.

The Construction Manager shall not process a certificate of payment to the Contractor until the progress schedule submission has been approved. Schedule reviews, comments, and approvals shall be documented and maintained with the project records.

For additional and up-to-date information regarding the prosecution of the Work, refer to the Authority's Standard Specifications Section 107, Progress Schedule as well as any Supplementary Specifications or other provisions stated in the Contract Documents that may be specific to the Contract.

3.1.5. Construction Incident Communication

Incidents on construction sites are disruptive, can cause injuries and create property damage. To minimize these impacts, it is imperative to maintain good traffic control, enforce the laws, and promote safety on the jobsite. However, in the event of an incident, it is extremely important that the communications chain not be broken. The Authority addresses incident communications by implementing a Construction Incident Communication Plan (CICP). The purpose of this plan is to provide direction to project personnel to assure that construction-related incidents, that affect personnel or have the potential to impact traffic or Authority facilities, are communicated quickly and thoroughly in accordance with the "Construction Notification Chain". Construction-related incidents with the potential to impact traffic include, but are not limited to any possible delay or occurrence with the potential to result in the delayed opening of closed lanes, ramps, and/or roadways. The Construction Notification process starts with Contractor and the Construction Manager. A Sample Construction Incident Communication Plan is attached as Exhibit 3 - 8. The CICP shall be treated as an active working document and shall be updated when personnel or contact information changes.

The Construction Manager will also be responsible to investigate all accidents and incidents occurring on the jobsite to identify the causes and prevent their recurrence. Law enforcement shall investigate traffic accidents, and a copy of the accident report shall be obtained. If the accident involves hazardous materials, personal safety is the first concern.

The Contract Environmental Health and Safety Plan (HASP) will be consulted in dealing with any environmental incidents, and in the event of injury, immediate medical attention will be requested. The Construction Manager shall document the incident timeline, notifications, corrective actions, and follow-up measures as part of the project record.

When accidents or injuries involve the Contractor's operations, the Authority will be notified immediately. In addition, the Contractor and Construction Manager will retain copies of the accident report and create factual correspondence of the incident timeline and how the events unfolded. The Contractor will be directed to repair any unsafe job conditions, as well as implement procedures to avoid any future recurrences. Corrective actions shall be tracked to completion.

The Contractor shall immediately notify the Construction Manager when any accident or incident occurs, that results in property damage, injury, or death, to any employee or to the public. The Contractor shall complete an Accident Investigation Report and shall provide the report to the Construction Manager within 24-hours of each incident. The Construction Manager shall review the report for completeness and coordinate any additional reporting requirements with the Authority as applicable.

In the event of an accident on the project site, the Construction Management staff duties and communication shall include the following:

- Check the scene to identify potentially dangerous conditions
- Check for the number of injured persons and type of injuries
- Call 911 in case of serious emergencies or injuries
- Call and/or text informing the Construction Manager of the accident or incident
- Remain at the scene, in a safe location, in order to provide updates
- Begin collecting information for the Accident Investigation Report and document the names of involved parties, location, time, weather, lane closure status, and any immediate actions taken.

The Construction Manager's duties and communication shall include the following:

- Notify the Authority's Engineering Department and Liaison Engineer and provide information on the accident or incident
- Notify emergency responders if that was not done by the reporting party
- Notify the Contractor of the accident or incident
- Notify the Traffic Management and Technology Center (TMTC)
- Call the Authority Operations Department and inform them of the event.
 - 1-800-352-4848
 - Parkway roadway: 732-376-5678
 - Turnpike roadway: 732-376-5673
- Confirm the location of all of the Construction Management staff assigned to the Project
- Obtain update status reports from the accident scene
- Begin collecting information for the Accident Investigation Report

- Notify the Authority's Operations Department and provide information on the accident or incident
- Work with the Contractor and Authority's Engineering and Operations Departments to determine a course of action to prevent the recurrence of the accident and coordinate additional notifications as required by the Contract Documents and applicable procedures.

All members of the Construction Management staff involved with the accident shall take notes of all communications, discussions, and responses. A sample of an Accident Investigation Report form can be found in the Authority's Health and Safety Plan on the website at: NJTA Health and Safety Plan (HASP) Manual. All incident records, reports, and correspondence shall be retained in accordance with Authority recordkeeping requirements.

3.1.6. **Right of Way**

Right of way and easements required for the construction of the Project typically are acquired before the bidding process begins. Before construction begins, the Contractor and the Construction Management team will become familiar with the limits of construction and with the types and limitations of the right of way. This will include obtaining information on all agreements reached for the acquisition of the right of way. The Contractor will stake the limits of the right of way and place construction fencing where necessary, to control the work area. Special attention will be made to protecting and maintaining all property monuments and resetting of monuments will be performed by licensed land surveyors. The Contractor shall protect all right of way features and shall prevent unauthorized access or encroachment beyond approved limits.

Construction easements with time limitations will be noted and special attention will be made to assure that the schedule accounts for the time limitations. Signed "Right of Entry" documents will be in hand prior to entering on property not under Authority control. The Contractor shall comply with all easement requirements and restrictions and shall coordinate access needs in advance.

In the event property has not yet been acquired by the Authority, a discussion regarding any right of way issues will take place to determine the effect of not having the right of way, and ultimately when the right of way will become available either through either acquisition or condemnation. Access to restricted areas shall not be permitted until proper authorization is received.

All applicable permits should be obtained and in hand prior to the Contractor performing any Work associated with those permits. Access to and from the work zone will only be allowed through access points that have received approval from the Authority. The Contractor shall maintain compliance with all access requirements and shall not create unauthorized access points.

ROW fence shall remain contiguous. Any breaks in the ROW fence by whatever cause will be repaired immediately so as to maintain a complete closure of the Authority's property throughout the Project's duration. The Contractor shall routinely inspect fencing and barriers and shall immediately address any deficiencies.

The Contractor shall adhere to all Authority Rules and Regulations as documented on the Authority's website at:

<http://www.njta.com/about/regulations-and-policies>.

The Contractor shall be responsible for ensuring that all subcontractors and suppliers comply with these requirements.

3.1.7. Request for Information

The Contractor shall utilize the Request for Information (RFI) process to obtain written assistance from the Construction Manager, Design Engineer, and the Authority. This formal process allows the Contractor to request the following:

- Clarification of a particular portion of the Contract Documents.
- Direction on how to accommodate a specific existing physical feature (such as a utility) in the contract.
- Directions on how to deal with third party activities occurring on the project site.
- Directions for resolving Contract Document discrepancies, omissions, or flaws, and similar inquiries.

The Contractor may utilize the RFI process to obtain an agreement for accepting a variance to the Contract Documents. Caution in dealing with these types of requests needs to be taken by the Construction Manager based on the scope of the requested change. RFIs shall not be used as a substitute for change order requests, claims, or contractual notice requirements.

Based on the nature of the request, the Construction Manager may need to forward the request to the Design Engineer. The Design Engineer shall respond directly back to the Construction Manager and responses developed by the Design Engineer shall be reviewed by the Construction Manager with care to determine if conditions in the field may impact the validity of the response. Only the Construction Manager shall respond to the Contractor. The Construction Manager shall use care in composing or clarifying all RFI responses, and diligently pursue a resolution of each issue raised without unnecessary delay. RFI responses shall be clear, complete, and consistent with the Contract Documents, and shall identify any required follow-up actions.

RFI responses shall not change, modify, or waive Contract requirements unless confirmed by written directive issued in accordance with the Contract Documents.

The Construction Manager may also utilize the RFI process when they have a need for additional information from the Design Engineer. When so doing, the prefix to the RFI number should be either CM or RE.

All requests from subcontractors, fabricators, and suppliers are to go through the Contractor, who in turn will submit the RFI to the Construction Manager.

The Contractor shall indicate if the RFI has the potential to impact the project schedule and/or impact cost. An electronic log of the RFI submittals is kept with the project documentation. The Construction Manager ensures that the RFI submittal is dated, logged

in, and distributed to the appropriate reviewer. The review/response process of RFI submittals is time sensitive. The Construction Manager monitors the review process to ensure the Contractor receives a response in a timely manner. It is the Construction Manager's responsibility to follow up on review deadlines. Status of RFI's should be reviewed at the progress meetings. The RFI log should track dates submitted, dates forwarded, dates responded, current status, and any schedule/cost impacts identified. The Contractor shall proceed with unaffected Work and shall not delay the Work pending an RFI response unless directed in writing.

A sample RFI form and log is attached as Exhibit 3 - 9.

3.1.8. Specialty Construction Meetings

Specialty construction meetings are held by the Construction Manager in advance of beginning complex, critical, or difficult construction activities. The meeting is to be facilitated by the Construction Manager and will involve representatives from the Authority's various departments, Contractor personnel, as well as State Police and local authorities as determined by the type of construction activity required. The purpose of the meeting is to present and familiarize those involved with the plan of construction operations, time limitations, traffic control plan, and health/safety concerns. Traffic permits and routes may be discussed as needed for oversized material and equipment transport. Project and testing requirements may be discussed, along with the materials and equipment to be used. All required material submittals and special construction plans and permits are to have been approved prior to the meeting. Necessary changes to the operation and traffic control will be discussed and approval will be required prior to their implementation. These meetings are in addition to jobsite operations and safety meetings that the Construction Manager and Contractor hold with their respective workforces. All specialty construction meetings will require an agenda and subsequent minutes to be distributed to all invited parties thereafter. Attendance by all affected parties is required for applicable specialty operations. Specialty meeting minutes shall document decisions, responsibilities, and required follow-up actions.

Examples of the types of activities that may require specialty construction meetings are as follows:

Erection of structures, drilled shaft installation, micropile installation, driving piles, asphalt paving, HPC deck placement, slipforming, directional drilling, pipe jacking, major traffic shifts, detours, and any other activities that require significant advanced planning. Additional activities may include major concrete pours, demolition operations, setting of major components, and work in close proximity to sensitive facilities or active traffic.

3.1.9. Demolition of Existing Structures

The Contractor shall submit a project Demolition Plan to the Construction Manager for review. The Contractor will retain all liability resulting from the demolition actions and plan. In addition to the general project Demolition Plan, the Contractor will submit Demolition Plans for major demolition work, such as bridge removal over the Authority's ROW, railroads, local roads, or over waterways. Similarly, for any building demolition, a plan is required. The Demolition Plan will address traffic control, public safety, jobsite safety, demolition process, debris disposal, noise ordinances/mitigation, demolition schedule,

and clean up. The Demolition Plan submitted by the contractor shall be signed and sealed by a Professional Engineer licensed in the State of New Jersey. The transport of any oversized equipment and/or materials shall address traffic permits and routing. Once the Demolition Plan has been submitted, a meeting will be scheduled and the procedures followed as in Section 3.1.8 of this Manual. The Demolition Plan shall also address any required notifications, utility shutdowns, protection of existing facilities, environmental controls, and emergency response procedures as applicable to the Work.

The Construction Manager shall notify the Authority of structural asset removal(s) in accordance with the "Guidelines for Structural Asset Changes". The Construction Manager shall ensure that demolition documentation, approvals, and notifications are maintained as part of the project records.

These guidelines are available on the Authority's website at the following link: <https://www.njta.com/doing-business/professional-services/manuals->

3.1.10. Documentation

The Construction Manager is responsible for developing and maintaining an organized system of project documentation throughout the execution of the Project. Such system shall be structured to support auditability, traceability, and defensible project records, including clear linkage between field records, correspondence, approvals, and payments. Such documentation provides accurate and complete records of the Work. Basic criteria for a good document filing system would include ease of set up, ease of use, and the capability to retrieve any specific document in a timely manner. The Construction Manager should implement standardized naming conventions, version control, and status identification (Draft/Final/Superseded) across all folders and records. Prior to the commencement of Work, a filing system index will be developed and submitted for review and acceptance by the Authority's Liaison Engineer. The filing index should identify both storage locations, naming standards, and responsible roles for maintenance and periodic review. Documentation can be of electronic or paper media, or a combination thereof. Where a combination is used, the Construction Manager shall ensure consistency between formats so that records are complete and non-conflicting. The implementation of an electronic documentation system must provide the Construction Manager and the Liaison Engineer with ease of access to the system. Access shall be controlled by user roles to protect sensitive information while ensuring timely availability for project administration. If ease of access is not possible then the project files must mirror the electronic filing system in its entirety. Mirroring shall include identical folder structure, file naming, indexing, and document status tracking to prevent gaps between the two systems.

All meetings, regardless of type, shall have minutes published and/or filed. Meeting minutes should clearly document date/time/location, attendees, decisions, action items, responsible parties, and due dates, and should be issued promptly after each meeting. Where applicable, meeting minutes should reference related RFIs, submittals, schedule activities, change items, and CapEx entries to maintain full traceability.

The following is a sample of an acceptable documentation filing index; additional levels of detail shall be built upon the basic outline. All General Correspondence (or specific to the list below) should have the Contract Number and Description as it appears on executed Contract.

Specific folders:

- Certificates for Payments and Change Orders (changes/additions to contract) (including supporting backup, approvals, independent estimates, and schedule impact documentation where applicable)
- DCA Correspondence (including the applicable DCA identifier, effective date, and documentation of implementation actions taken)
- Environmental (including permits, agency correspondence, inspection logs, non-compliance tracking, corrective actions, and closeout documentation)
- Meeting Minutes (including progress meetings, utility/railroad/agency coordination meetings, partnering meetings, and safety meetings)
- Payroll Data (including prevailing wage documentation and required certified payroll submissions as applicable)
- Progress/Construction Photos (Negatives/CD's) (including photo logs identifying date, location, direction, subject, and related contract item/activity)
- Progress Reports (including weekly and monthly reporting, narrative summaries, and key issues/risks tracking)
- Right of Way (including access coordination, property owner communications where applicable, and related agreements/permits)
- Scheduling (including baseline, updates, narratives, recovery schedules, and correspondence related to schedule impacts)
- Shop Drawings and Transmittals (including submittal logs, reviewer assignments, review deadlines, status tracking, and resubmissions)
- Subcontractors (including approvals, compliance documentation, and scope/coordination correspondence)
- Testing (asphalt, concrete, etc.) (including sampling records, test results, certifications, non-conformance reports, and corrective actions)
- Utilities (General) (including coordination logs, contact lists, and meeting minutes)
- Utility Orders/Work Orders (including executed orders, supplemental orders, invoices, and approvals)

The Construction Manager will record all project data on appropriate forms and in field books. Field documentation shall be legible, dated, attributable to the preparer, and maintained as part of the permanent project record. This shall be done in a manner meeting the approval of the Authority. Various forms and reports are presented as exhibits at the end of this Section. The information from these forms and reports provide the essential information to report in the project tracking software. The Construction Manager should implement routine reconciliation between field books/forms and entries made in project tracking systems to confirm consistency and completeness.

The implementation of a Web-Based Project Management system (WBPM) is encouraged. If utilized, the WBPM system should support workflow tracking, document routing, automated notifications to improve timeliness and accountability. The Construction Manager may choose to utilize a collaborative based software package such as Microsoft SharePoint Site or Primavera Contract Manager. Such web-based software

packages allow the Construction Manager, Contractor, Design Engineer, and Authority to provide, access, and process electronic documents with ease. Such systems should include required several fields (e.g., Contract number, discipline, status, and due dates) to improve searchability and reporting. Varying levels of access shall be granted to the parties mentioned above based on their level of responsibility. Access privileges should be documented, reviewed periodically, and updated as staffing changes occur. Prior to the implementation of such system, the Construction Manager shall provide an outline detailing the access rights each party and user shall be granted. The outline should also define document ownership, and the process for archiving and closing out the system at project completion. Final comments will be requested from the Authority's Liaison Engineer before the system is activated.

Upon completion of all Work, all relevant field office files will be kept by the Construction Manager for the period designated in the Order for Professional Services. The Construction Manager should ensure that retention requirements include backups and that records remain accessible and readable for the full retention period. The Authority may request copies of any and all files, hard copy, electronic, or both. Electronic files should be provided in a mutually agreed format and organized consistent with the approved filing index to facilitate Authority review. The Authority's Liaison Engineer will provide directions as to where the files are to be delivered and stored. The Construction Manager should document the transfer, including an inventory of records delivered and confirmation of receipt.

3.1.11. **CapEx Manager**

CapEx Manager is the web-based software used by the Authority to manage all of their construction projects. The Construction Manager shall ensure all required project entries are made accurately and in a timely manner to maintain real-time project control and reporting integrity. A project is set up in CapEx Manager by the Design Resident Engineer, who will identify and enter unit codes for each item of construction work. All construction project tracking can be accomplished using CapEx Manager, with the Contractor having access to the software for entering submittals, schedules, RFI's and other project correspondence and information. The Construction Manager should verify that the Contractor's submissions are properly categorized, complete, and routed to the appropriate reviewers. A user's manual is available to assist both the Contractor and the Construction Manager. The Construction Manager will record the daily inspection reports and quantities constructed by the Contractor in CapEx Manager. Daily entries should be supported by field measurements, inspection documentation, and quantity calculation records maintained in the project files. The information will be used to track the Contractor's progress and project costs. Pay estimates, change orders and extra work will be developed and tracked within CapEx Manager. The Construction Manager should routinely reconcile pay estimates, change orders, and extra work records with supporting backup to ensure accuracy and prevent duplication or omission. Through the use of CapEx Manager, all parties with access to the software will have real time access to the project information. The Construction Manager should coordinate with the Authority to confirm that user permissions remain current and consistent with assigned roles and responsibilities.

Further instructions and recent software updates are available on the Authority's website at the following link: <http://www.njta.com/doing-business/professional-services>

<https://www.njta.com/doing-business/construction-and-maintenance-contracts> under the Consultant Resources section of the page. Follow the link titled “CapEx Manager”.

3.1.12. Coordination with Public Agencies/Local Entities

The Construction Manager should be provided a list of Public Agencies or Localities, by the Design Engineer, which may be affected by the Project or project related activities. The Construction Manager shall formally document receipt and review of such list and maintain an updated coordination log identifying each agency, primary contact, and scope of potential impact. The Construction Manager will also identify any additional Public Agencies or Localities that may be affected by the Project or project related activities. Any additional entities identified shall be promptly communicated to the Authority’s Liaison Engineer in writing. For each such entity, typically a single point of contact should be established for ongoing and future coordination. The single point of contact will be the first point of contact for matters pertaining to that entity; while reviewing the list it is important that the Construction Manager note they are the initial point of contact for any coordination regarding the Project. The Construction Manager shall clearly communicate this responsibility in writing to avoid duplication or conflicting direction.

The Construction Manager will answer questions and explain, in detail, project related inquiries that the Public Agencies or Localities may have. All responses affecting scope, cost, schedule, or operational commitments shall be coordinated with the Authority’s Liaison Engineer prior to issuance. The Construction Manager will refer the Public Agencies to a higher authority when questions or inquiries cannot be answered at the field level. The Construction Manager may invite representatives from the Public Agencies or Localities to project coordination meetings when issues dealing within their domain are to be discussed. Meeting minutes shall document all commitments made and any required follow-up actions.

Attention is made to Sections 104.07, 106.02, 106.12 and Section 803 of the Specifications, and the compliance with these as well as any Supplementary Specifications, DCAs, or other provisions stated in the Contract Documents that may be specific to the contract. The Construction Manager shall verify that all coordination activities remain consistent with these referenced sections.

Prior to holding a coordination meeting with local agencies, the Construction Manager must be aware of any agreements established between the Authority and any local agency. The Construction Manager cannot alter the commitments to the local agencies without the expressed approval of the Authority. Any perceived conflicts between field conditions and existing agreements shall be documented and elevated to the Authority for direction.

Prior to holding a coordination meeting, the Construction Manager should consider and discuss with the Contractor how the Project and the various agencies will interact. To best understand the impact on the agencies the Construction Manager should have an approved progress schedule. Schedule impacts to affected agencies shall be clearly identified, particularly where work affects access, utilities, drainage, emergency response routes, or public services. The coordination with the affected local agencies should occur as soon as possible after the Construction Manager and Contractor have discussed and considered the effects on the various agencies so as to establish a good working relationship with those agencies.

It may be necessary to hold separate meetings if there are several agencies affected by the contract. The local agencies should be kept apprised of progress and changes to the contract which may affect them. Periodic updates should be documented in writing when significant changes occur.

Detours are normally established during the Contract's design phase but it is not uncommon for those detours to be modified during the construction phase. Approval of any modifications must be granted by the agency holding jurisdiction. Written confirmation of such approval shall be retained in the project files prior to implementation. Local police and fire departments, first aid squads, and schools must be made aware of the detours, the anticipated duration and any subsequent changes to the detours. Emergency service notification shall be documented to demonstrate compliance.

Depending on the project, the Construction Manager may anticipate dealing with State, County, and Municipal agencies.; in addition, it is common for the Construction Manager to have to coordinate with police, fire and first aid. The Construction Manager should also inquire with the local agency if there are other entities which may be affected.

Although it is the Contractor's obligation to learn and follow all local ordinances, the Construction Manager should discuss noise ordinances and make certain all parties are aware of any restrictions. Compliance with local ordinances shall be monitored during inspections and documented in daily reports when applicable.

The Construction Manager may be required to work with other agencies, including: United States Coast Guard; Army Corps of Engineers; New Jersey Department of Labor and Industries; New Jersey Department of Transportation; Underwriters; Laboratories; Department of Environmental Protection (Federal and State); New Jersey Department of Community Affairs; Occupational Safety and Health Administration; County Soil Conservation District. Coordination with regulatory agencies shall be proactive and documented to minimize delays or enforcement actions.

3.1.13. Coordination with Railroads

When working on or adjacent to Railroad right of way, close coordination with the Railroad is vital to ensure public safety, and maintain a safe work zone and uninterrupted operation of the Railroad. Safety of railroad operations and public protection shall be the primary consideration in all coordination efforts. The Construction Manager will invite the Railroad representatives to a coordination meeting and to any subsequent meetings when Railroad issues are to be discussed. The Contractor will obtain the required Railroad safety training and permitting for all staff involved in the work. Documentation of such training and permitting shall be maintained in the project files. The Construction Manager will publish and maintain a project contact list of key personnel involved in coordinating construction on or near the Railroad right of way. The Contractor will obtain right of entry before working inside or encroaching Railroad property. Attention is made to the Section 106.16 of the Standard Specifications, and the need for compliance as well as any Supplementary Specifications or other provisions stated in the Contract Documents that may be specific to the contract. The Construction Manager shall verify that all required railroad agreements, insurance certificates, and flagging arrangements are in place prior to work commencement.

Prior to holding a coordination meeting with the Railroad, the Construction Manager must be aware of any agreements established between the Authority and the Railroad. The Construction Manager cannot alter the commitments to the Railroad without the expressed approval of the Authority.

Prior to holding a coordination meeting, the Construction Manager is to consider and discuss with the Contractor how the Project will affect the Railroad. To best understand the impact on the Railroad the Construction Manager should have an approved progress schedule. Critical path activities affecting railroad operations shall be clearly identified. The coordination meeting with the affected Railroad should occur as soon as possible after the Construction Manager and Contractor have discussed and considered the effects on the Railroad so as to establish a good working relationship with Railroad representatives.

The Railroad should be kept apprised of progress and changes to the contract which may affect them. All correspondence shall be documented in the project records.

A single point of contact should be established between the Railroad and the Construction Manager. The Construction Manager should clearly communicate that the single point of contact, established at the coordination meeting, should also be the first point of contact. All communication should be made to the Construction Manager.

Site Specific Work Plans (SSWP) are required any time that construction operations have the potential for “fouling” the tracks. The word “fouling” is used anytime construction activities are within 15’ of the centerline of the active track or if at any time the proposed construction equipment, materials, manpower or falsework has the capability of entering the space designated as the fouling area. A SSWP is required to be submitted in advance with approval received from the railroad prior to implementing the Work. No work shall commence within the fouling zone without documented railroad approval. The railroad may also request a specialty construction meeting before allowing access on or near their property. This may be separate from the Coordination Meeting or in conjunction with it.

3.1.14. Coordination with Utility Companies

The Construction Manager and Contractor will develop working relationships with representatives of utility companies whose facilities are located within the Work and will be affected by the Project. A utility coordination log shall be maintained identifying contacts, commitments, relocation status, and schedule milestones. The Construction Manager will invite these representatives to a project pre-construction conference and to project progress meetings when issues dealing with these utilities are to be discussed. Since the timely completion of utility work is critical to the overall schedule of the Project, these strong relationships with the utility/public facilities will hopefully facilitate the removal, relocation and protection of existing utilities in an expeditious manner.

Attention is made to Section 106.18 of the Standard Specifications, and the need for compliance with any Supplementary Specifications or other provisions stated in the Contract Documents that may be specific to the contract.

The relocation of Utilities is a critical aspect of the overall schedule of the Project, as such careful coordination and monitoring of that work is essential. Utility relocation activities

shall be evaluated against the approved project schedule and identified if on the critical path.

A Utility/Public Facility Order is required for the relocation or modification of an existing utility and is generally prepared by the Design Engineer during the design phase along with a schedule for that work. During the hand-off meeting the Construction Manager should obtain copies of all the executed Utility and Public Facility Orders. The Construction Manager shall verify scope, funding limits, and reimbursement procedures defined in each order.

Coordination of the Contractor's Work and that of the Utility/Public Facilities is vital. It is most helpful for the Construction Manager and Contractor to come to an agreement with the Utility/Public Facilities on a Progress Schedule. To that end it is essential to have an approved progress schedule from the Contractor in hand.

An application by the Utility or Public Facility for a traffic permit must be submitted to the Authority 10-days prior to the commencement of work and must be kept in good standing for the duration of the work. The traffic permit is issued by the Operations Department of the Authority. The Construction Manager is responsible to make sure this is completed. Verification of permit issuance shall be documented prior to work authorization.

The Contractor is to be reminded of the proper written advanced notification to the Utility and/or Public Facility; this is to be noted at the Contractor's pre-construction conference. Such notification shall comply with the timeframes and documentation requirements specified in the Contract Documents and the applicable Utility/Public Facility Order. The Construction Manager shall verify that proof of notification is documented in the project files.

The Construction Manager will schedule a coordination meeting to be attended by the Utility and/or Public Facility representatives, the Contractor and affected subcontractors. This meeting will address advance notice requirements and the progress schedule. It will establish the chain of communication required for the success of this effort. This meeting will establish whether regularly scheduled or on an as-needed basis meetings are required. Right of way and traffic control issues should be resolved at this meeting. Meeting minutes shall be prepared and distributed documenting agreements reached, action items, responsible parties, and required follow-up dates. Any commitments affecting schedule or cost shall be incorporated into the project schedule and tracked accordingly.

The Utility/Public Facility must be kept apprised of any changes to the progress schedule. The Construction Manager shall ensure that all schedule updates affecting utility or public facility work are formally transmitted and acknowledged, and that impacts are evaluated for potential cost or time implications.

The reimbursement process should be defined by the Utility/Public Facility Order, and may include that the Authority reimburses each on a direct cost basis. Therefore, it is necessary for the Construction Manager to monitor labor, equipment and materials on a daily basis. Work performed by the Utility or Public Facility should be covered under the same inspection procedures as required for the regular contract work. Daily inspection reports for all utility or public facility work performed shall be prepared by the Construction Manager. The Construction Manager will monitor and report on the effort as defined by the Utility/Public Facility order. All monitored costs shall be supported by detailed records,

including force account documentation where applicable, and shall be reconciled against the authorized work order limits on a regular basis.

Utility/Public Facility invoice payment shall be made in accordance with the approved work orders. It is often the case that the Utility/Public Facility shall submit an invoice for payment to the Construction Manager who in turn will verify the invoice for work accomplished, labor, equipment and materials expended. The Construction Manager shall indicate approval for payment on the face of the invoice and forward the entire billing together with all attachments to the Authority for final approval. All billing must be completed within 90-days of completion of the Work so that the Authority may promptly reimburse the Utility/Public Facility. The Construction Manager shall confirm that all invoices are mathematically accurate, properly supported, and consistent with inspection reports and approved work order quantities prior to recommending payment.

Under no circumstances will payments chargeable to a specific Utility/Public Facility order exceed the authorized amount. If for any reason during construction it is determined that the cost of the Work, as part of the authorized work order, exceeds the estimated amount, then a supplemental Utility/Public Facility order must be processed prior to the actual expenditure of these additional funds. The Construction Manager shall keep a current running estimate of the monies expended for each utility order. By closely monitoring the invoices and the Work being performed, the Construction Manager can anticipate if the authorized amount of the Utility/Public Facility order is likely to be exceeded. Such monitoring shall include periodic cost forecasting and comparison against remaining authorized balances to ensure early identification of potential overruns.

The form of the Supplemental Utility/Public Facility Order is identical to the initial Work Order and must be accompanied by a letter from the Construction Manager explaining the anticipated increase or decrease in the costs. A sample Supplemental Utility Order Work Form is attached as Exhibit 3 - 10. The explanatory letter shall include justification, supporting cost breakdowns, schedule impacts if any, and confirmation that no additional funds will be expended until formal approval is received from the Authority.

3.1.15. Construction Layout/Survey

The Construction Manager and the Construction Manager's staff are responsible for performing quality assurance of the Contractor's activities. Surveying checks are necessary to ensure that all elements of the Project are constructed in accordance with the approved plans and to the necessary tolerances as required by the Specifications. Independent verification of critical control points shall be performed and documented, particularly for structural foundations, roadway alignments, drainage invert elevations, utility tie-ins, and property limits. The person in responsible charge of the surveyors shall be a licensed land surveyor registered in the State of New Jersey. The Construction Manager shall maintain documentation verifying current licensure and qualifications of the responsible survey professional.

Project survey control is provided by the Contract Documents. Horizontal control shall reference the New Jersey State Plane Coordinate System referenced to the North American Datum of 1983 (NAD83) plus the Adjustment Date Tag (1996) (NAD83/96) and vertical control shall reference the North American Vertical Datum of 1988 (NAVD 88). The Construction Manager shall verify that the Contractor's survey equipment and control

methods are consistent with these datum requirements prior to commencement of layout activities.

Working stakes for layout of the Project are the responsibility of the Contractor and are to be set by the Contractor's forces based on contract furnished control. The Construction Manager shall verify the Contractor's baseline monuments and perform spot checks of layout staking prior to critical construction operations.

The Construction Manager surveyor will be responsible for verifying the Contractor's stakeout and baseline monuments. Additionally, the surveyor may be required to perform the following:

- Locate existing features prior to construction e.g. Bridge centerlines, piers, abutments, retaining walls, foundations, bearings, building corners and other features as designated by the Construction Manager.
- Documentation of existing conditions shall be retained as part of the permanent record.
- Check Contractor's layout of formwork and anchor bolts prior to placing concrete. Verification shall be documented before concrete placement authorization.
- Provide grades pre, during and post construction. Grade verification shall be cross-referenced with inspection reports and quantity calculations where applicable.
- Verify as-built structures, drainage, roadways, striping and other features as requested by the Construction Manager. As-built data shall be incorporated into final record drawings.
- Check construction layout and dimensions as may be necessary. Any discrepancies shall be immediately documented and communicated to the Contractor and Authority.

3.1.16. Working Drawings and Shop Drawings

Attention is made to the Section 104.08 of the Standard Specifications. The Construction Manager is to be familiar with what types of shop drawing, work plans and catalog cuts are required based on the items of work in the Contract. The Construction Manager shall maintain a comprehensive submittal log tracking submission dates, review deadlines, reviewer assignments, status, and resubmission cycles. The Construction Manager shall have an understanding of the full scope of work to be performed to ensure that the entirety of the shops drawings pertaining to said Work have met the Engineer's final approval via the shop drawing review process. No work requiring a submittal shall proceed without documented approval unless otherwise authorized in writing by the Authority. The Supplementary Specifications Section 104.08 will outline required submittals based on the principal items of work in the contract; this list is not exhaustive and the Construction Manager should review the list and require any additional submittals which are warranted by the Contract. The Construction Manager shall verify completeness of each submission prior to forwarding to the Design Engineer.

The Construction Manager must utilize a system that processes the shop drawing review in a well-organized and expeditious manner. It is suggested that shop drawings be cataloged, exchanged, and processed electronically. The Construction Manager must

maintain real time knowledge of the status of all shop drawing submittals with the ability to follow up on review deadlines that are outside the Construction Manager's immediate team. Delays in review shall be tracked and escalated as necessary to avoid schedule impacts. Status of Shop Drawing Nos. is an important agenda item at the project progress meetings. An example of a typical shop drawing log utilizing "Ball in Court" tracking is attached as Exhibit 3 - 11.

As a means to enhance the submission process, the Construction Manager should perform a go/no-go check of the shop drawing package prior to sending it out to the Design Engineer. One of the primary responsibilities should be to make certain that the shop drawing submission is sufficiently complete to warrant submission to the Design Engineer. Incomplete or non-compliant submittals shall be returned to the Contractor without formal review.

The Construction Manager should obtain a material submission schedule from the Contractor and review the schedule to ensure submittals are made in a timely and logical progression. The submission schedule must provide adequate review time for each submittal and should be shared with the Design Engineer to help provide a streamlined review process. The Construction Manager shall verify that long-lead materials are identified and monitored against the approved project schedule.

The Construction Manager should reference the Material Acceptance Criteria Matrix (Authority's Procedure Manual, Exhibit 3 - 59) to determine the appropriate reviewer for each submittal.

Please note that submittals reviewed by the Construction Manager shall be stamped in conformance with the Authority's Procedures Manual, Exhibit 3 - 4 Stamp A. Stamping shall clearly indicate review status and date to maintain accountability.

3.1.17. Constructability Review

The Construction Manager will ensure that proper constructability reviews are performed, as requested by the Authority. The constructability review draws upon the construction experience and knowledge of the Construction Manager with the intent to promote a set of Contract Documents that are biddable and buildable. A quality constructability review also reduces costs associated with corrective work and change orders due to plan errors.

One of the tasks for the Construction Manager may be to perform constructability reviews for all contracts involved in their project/program that are under design. In some cases, the Authority may request or put out an RFP during the design phase for constructability review(s) of the design Phase B (70-percent), C (95-percent), and D (100-percent) submittals. Reviews shall evaluate staging, maintenance of traffic, access constraints, environmental impacts, safety risks, utility conflicts, drainage continuity, structural sequencing, and constructability of details.

It is anticipated that the Construction Manager will have knowledge of the region, type of work, and apply known "Best Practices" to assist the Design Engineer with producing quality documents that are biddable and constructable. Findings and recommendations shall be documented in writing and submitted to the Authority for review.

3.1.18. Pay Estimates

The Contractor will be paid for Work done (and, in some cases, materials supplied) during the preceding month by means of a Certificate of Payment. This certificate is to be made up by the Construction Manager utilizing CapEx Manager, at monthly intervals on a closing date established at the pre-construction conference. Payments are generally processed at monthly intervals, however semi-monthly when Work accomplished in a two-week period exceeds the thresholds as outlined in Section 108.03 of the Specifications. The Construction Manager shall verify eligibility for semi-monthly payment processing in accordance with the Specification thresholds.

The inclusive interim dates for any one contract are established at the pre-construction conference using the table below:

EXHIBIT 3 - 1 MONTHLY CLOSING DATES AND INTERIM PERIODS

Contract Ending In:	Nos.	Closing Monthly Date for Estimates:	Period Covered by Interim Estimates:
0		1 st	1 st to 15 th
1		4 th	4 th to 19 th
2		7 th	7 th to 22 nd
3		10 th	10 th to 25 th
4		13 th	13 th to 28 th
A or 5		16 th	16 th or 30 th or 31 st
B or 6		19 th	19 th to 4 th
C or 7		22 nd	22 nd to 7 th
D or 8		25 th	25 th to 10 th
E or 9		28 th	28 th to 13 th

The Contractor is responsible for submitting a Payment Application for review by the Construction Manager. Upon agreement of the quantities, the Construction Manager, shall develop the pay certificate in CapEx and submit it to the Contractor, for approval, via CapEx Manager. Following the Contractor's approval is submission of the following forms:

- Certification of Subcontractor/Supplier Payment by Prime Contractor
- SBE Certification of Participation

The pay certificate will require approvals from the Authority's Liaison Engineer followed by the Supervising Engineer of Construction and by the Deputy Chief Engineer of Construction before payment can be made. The Construction Manager shall ensure that all supporting documentation is complete prior to routing for approval.

The value of permanent materials and equipment furnished, but not incorporated in the Work, shall be determined in accordance with Section 105.15 of the Specifications. Verification of stored materials shall include inspection, inventory documentation, proof of ownership, and appropriate insurance coverage.

Off-site partial material payments as depicted above will apply to Contract items which are considered unique to the particular Contract. For example; guiderail and epoxy coated

reinforcement will not be considered by the Authority. Items such as standard sound barrier panels and standard MSE Wall panels might be considered. Eligibility for off-site payment shall be confirmed with the Authority prior to processing.

3.1.19. Quantity Calculations

Attention is made to Sections 108.01 and 108.06 of the Specifications.

All contract items must be tabulated daily, computed weekly and reported monthly. Daily tabulations shall be based on field measurements and documented inspection reports. The Construction Manager should keep a complete file of calculation books showing, in detail, the precise computations for establishing the final pay quantity for each contract item. The method of measurement and computations, to be used in determination of quantities of material furnished and of Work performed under the Contract, will be those methods as specified in the Contract Documents and conforming to good engineering practice.

The quantity calculations performed by the Construction Manager provide the quantities of Work done for use in preparation of monthly estimates.

The Contractor and Construction Manager should be in agreement for the work performed within the monthly estimate at the time of submission. The Contractor should assist the Construction Manager in preparation of quantities for monthly estimates and as-builts.

The Construction Manager should routinely compare the estimated as-built quantities to the plan quantities and any noted discrepancies should be thoroughly vetted to ensure accuracy. Significant discrepancies shall be documented and communicated to the Authority's Liaison Engineer.

In the event plan quantities vary significantly from as-built quantities, the Construction Manager will back check all calculations to ensure accuracy. If plan quantities are believed to be in error, the Construction Manager will document, in detail, the noted error and the matter will be forwarded to the Design Engineer for verification. Supporting documentation shall be maintained in the project file.

3.1.20. Change Orders

Change Orders may be required to help complete or modify the original concept of a project. Change Orders must be approved by the Authority before the Change Order task is performed. No additional work shall proceed without written authorization unless required to address an immediate safety concern. Work performed without written authorization shall be at the Contractor's risk and shall not be eligible for additional time or compensation. Change Order documentation must include clear and concise reasons for the change, quantity of change and the associated cost, proper calculations, sketches and pictures where applicable. Documentation shall also include schedule impact analysis and independent cost evaluation where appropriate. Incomplete or unsupported Change Order documentation may be rejected and shall not justify delay, additional time, compensation, or claims.

The Chief Engineer may make changes in the Contract Plans and Specifications within the general scope thereof at any time by a written order referred to as a Change Order. Such Change Orders then become part of the Contract. The Change Order is always prepared by the Construction Manager. The amount paid to the Contractor for performing the Work or furnishing the materials covered by a Change Order may be a lump sum, unit price or measured on a cost-plus basis. No Change Order, extra work, or cost-plus work shall be eligible for payment unless authorized in writing in accordance with the Contract Documents.

Change Orders show in detail the kind and quantity of Work to be performed or omitted, or materials to be furnished or omitted, and the number of days, if any, that will be added to, or deducted from, the time for completion on account of the added or decreased Work. Change Orders are also used to increase or decrease estimated quantities in order to equal the final as-built quantities. Another function of a Change Order is to extend the scheduled completion date of a contract when, after concurrence among the Construction Manager, the General Consulting Engineer, and the Chief Engineer, it is deemed advisable to revise a completion date. No adjustment to Contract time shall be granted without proper justification, supporting documentation, and written approval in accordance with the Contract Documents.

If during the course of construction, the Construction Manager notes in the Contract Documents any concern which may result in a Change Order, then the Construction Manager should proactively summarize the condition and engage the Authority's Liaison Engineer and/or the Design Engineer to determine if a Change Order is warranted. Early identification and documentation of potential change conditions shall minimize disputes and delays. Failure to provide timely notice, documentation, or required supporting information shall constitute waiver of the request and no entitlement shall arise. Changes that alter MPT may require further review and approvals by the Design Engineer, Authority Operations, and any local authority which may delay Change Order review and approval.

Change orders may be used to increase, decrease, add, or remove Contract items. Additional information can be referenced in Section 104.04 of the Specifications.

Nothing herein shall be construed as authorization to perform extra or changed Work without written approval by the Authority.

The Authority recognizes three different types of Change Orders.

1. Type 1 Change Orders

A Type 1 Change Order adjusts the quantities of Contract items at their bid unit prices.

A Type 1 Change Order may adjust the quantity of a previously created "X" (extra work) item but does not add any new "X" items.

2. Type 2 Change Orders

A Type 2 Change Order creates new "X" (extra work) items due to unanticipated conditions and/or provides for time extensions to Contract milestone completion dates and/or the overall Contract completion date.

A Type 2 Change Order may also include adjustments to Contract items at their bid unit prices in addition to the aforementioned items.

3. Type 3 Change Orders

A Type 3 Change Order is required for changes of scope to the Contract.

A Type 3 Change Order requires approval by the Authority's Commission.

In addition to the Change Order, explanation and justifications, and any back-up information shall be provided. Examples of all three Change Order types, including the Explanation and Justifications section and Back up Information for each, are attached as Exhibit 3 - 12, Exhibit 3 - 13, and Exhibit 3 - 14. A Change Order Log Summary is attached as Exhibit 3 - 15. Failure to comply with Change Order documentation and authorization requirements shall result in no entitlement to additional time or compensation.

3.1.21. **Requests for Additional Compensation**

When a Contractor deems that additional compensation is due for Work or materials which were not required by the Contract and which have not been covered by a Change Order, the Contractor will notify the Chief Engineer in writing through the Construction Manager of the intention to file a claim for additional compensation before beginning the Work or furnishing the material in question. The Construction Manager shall document the date of receipt of such notice and confirm whether timely notification requirements of the Specifications have been met. Failure to provide timely written notice in accordance with the Contract shall constitute waiver of the claim and no entitlement shall arise.

In general, a claim is a petition for reconsideration of a Contractor's invoice that has previously been rejected by the Construction Manager. Once the Contractor's request for additional compensation has exhausted all efforts for reconciliation at the Construction Manager's level, it may be at the Contractor's option to be submitted to the Authority as a claim. Also, an item of extra cost which had been recommended by Change Order from the Construction Manager and subsequently rejected by the Authority may be resubmitted as a claim. All reconciliation discussions shall be documented in writing and retained in the project files. Submission of a claim shall not constitute entitlement to additional time or compensation unless approved in accordance with the Contract Documents.

In cases where work has to proceed in order to maintain the project schedule and before the Construction Manager and the Contractor reach an agreement on the extra work compensation, the Construction Manager will keep an accurate account of labor, materials, and equipment used during the execution of the extra work. Daily force account records shall be verified and signed by both parties when applicable.

Attention is made to Section 106 of the Specifications, Claims for Additional Compensation or Extension of Time, and the compliance with that section as well as any Supplementary Specifications that may be specific to the Contract.

Formal procedures governing the presentation of a claim have been established by the Authority and set forth in the section of the Standard Specifications noted above. This section of the Manual defines a contract claim and explains the policy for guidance for

Construction Managers and Architects. Failure to comply with established claim procedures shall result in rejection of the claim with no entitlement.

The review shall be made in detail for compliance with all elements of Section 106.07 of the Specifications; the review shall include a check of all calculations, a comparison of all supporting documents with the Construction Manager's records and a commentary on the Contractor's argument. The Construction Manager's review shall be objective, evidence-based, and supported by documentation. The Construction Manager is free to meet with the Contractor and request information and documentation, but is not authorized to offer any compromise or settlement whatsoever, and should not discuss their recommendation or opinion.

Upon completion of the Construction Manager's review of the Contractor's claim, the Construction Manager is to send two bound copies of the review along with a working copy of the Contractor's claim to the Authority. The review should include all elements outlined in the Section 106 of the Specifications along with supporting documentation such as progress schedules, correspondence, inspector's reports, etc. The Construction Manager is to include a presentation of any and all credits and counter claims. All supporting documentation shall be clearly indexed and tabbed to facilitate Authority review. Incomplete or unsupported claim submissions may be rejected and shall not constitute grounds for delay, additional time, or compensation.

The Construction Manager may be asked to submit an estimated time schedule to review immediately after receiving the claim. If, in the opinion of the Construction Manager, the cost to review the claim is beyond the scope of the engineering agreement, then this should be so stated along with an estimate of the cost to review for which reimbursement will be sought. Such notice shall be provided promptly and in writing in accordance with the applicable agreement.

After the Authority has concluded its review of a claim any consideration which may be due the Contractor is handled by Change Order and Pay Certificate. In addition to the usual line item entry on the Change Order, a special release is to be included. The form of the release shall be obtained from the Authority. These forms change periodically and it is the Construction Manager's obligation to obtain the acceptable language used in the release statement. The Construction Manager shall verify use of the most current release language prior to issuance.

3.1.22. Requests for Time Extension

Attention is made to Sections 106 and 107 of the Specifications.

Change Orders requesting that time extensions be granted the Contractor may be prepared and submitted for approval; however certain stringent conditions apply before such a change order is considered. The Construction Manager should be fully aware of the conditions set forth by the Authority as outlined in the Specifications noted above. A detailed schedule analysis demonstrating impact to the critical path shall accompany any recommendation for time extension.

When a Contractor deems that an extension of time is necessary for Work to be performed or materials to be furnished, which is not required by the contract, the Contractor must notify the Chief Engineer in writing through the Construction Manager of the intention to

file a claim for a time extension before beginning the Work or furnishing the material in question. If this notification is not given and the Chief Engineer is not afforded an opportunity to keep account of the work or materials, then the Contractor shall agree and does agree to waive the claim for an extension of time. The Construction Manager shall document compliance with notification requirements and maintain associated correspondence.

3.1.23. Dispute Resolution

In the event the Contractor disagrees with the Construction Manager's position regarding an additional compensation or extension of time request; the Authority's dispute resolution procedure is to be implemented. The Authority's dispute resolution begins with the Liaison Engineer at the project level and works its way through the senior management positions of the Engineering Department, prior to being submitted as a formal claim to the Chief Engineer. All dispute resolution steps shall be documented in writing and tracked in a dispute log. If the Contractor does not agree with the decision rendered by the Liaison Engineer, the Contractor is to present their request for additional compensation to the Supervising Engineer. If, however the Contractor is not satisfied by the Authority's position following the Supervising Engineer's review, the Contractor is to present the request for additional compensation to the Deputy Chief Engineer, Construction. If the Contractor is not satisfied by the Authority's position following the Deputy Chief Engineer's review, the Contractor shall present the request for additional compensation to the Chief Engineer as a formal claim as shown in Section 106 of the Specifications.

3.1.24. Changes of Plan

The Authority can make changes to the Contract Plans and Specifications at any time during the Contract via written Change Order. The Construction Manager is expected to notify the Contractor of the change and implement the changes in an expedited manner via the Change Order Process. Notification to the Contractor shall be documented in writing and tracked in a change log.

The Construction Manager must forward the change of plan to the Contractor immediately upon receipt from the Authority via a letter. The cover letter for the change of plan shall briefly detail the following changes:

- Detailed list of revised or added plan sheet(s) with summary of changes per plan sheet.
- Description to revisions to Supplementary Specifications.
- Detailed list of item quantity revisions; summarized by Item with adjusted quantities.
- Detailed list of new items with quantities.

The letter shall direct the Contractor to review the change of plans documents and submit a detailed cost breakdown for each new Contract item listed and document any changes to the approved project schedule resulting from the implementation of the change of plan. Schedule impact analysis shall be required where applicable.

In most cases the Design Engineer will have the responsibility of performing the Engineer's Estimate for all of the pay items associated with the change of plan. However,

in some cases the Construction Manager, having the local knowledge, could be requested by the Authority to assist the Design Engineer in preparing an independent Engineer's Estimate. The Engineer's Estimate must be prepared prior to receiving the Contractor's detailed cost breakdown. The Construction Manager shall maintain confidentiality of the Engineer's Estimate during negotiations.

The Construction Manager will ensure that the construction field office's plans are updated and the inspection team receives updated plan sheets and summary of changes in a timely manner. Superseded plans shall be clearly marked and removed from active use to prevent errors.

The Construction Manager will maintain a log and description of all change of plans as well as any Contractor generated change requests. The document will be incorporated into the as-built plans. The log shall include status, approval dates, and associated Change Order numbers.

3.1.25. Cost-Plus Work

Attention is made to Section 108.04 of the Specifications. All Cost-Plus Work shall be performed in strict accordance with the requirements of Section 108.04 and any applicable Supplementary Specifications.

Cost-Plus Work contracting method, also known as Force Account contracting, is used when the Contractor and the Construction Manager cannot negotiate an agreement for extra work, or for work designated for Force Account elsewhere in the Contract Documents. Cost-Plus Work shall not be performed without prior written authorization from the Authority, except as otherwise permitted under the Contract for emergency or safety conditions. Work performed without proper authorization shall not be eligible for payment.

When such work is accomplished on a cost-plus basis, accurate daily records of the performance must be kept both by the Contractor and the Construction Manager utilizing Schedule F, Inspector Report, which is to be signed daily by the inspector and the Contractor's representative at the job site. Schedule F, Inspector Report, is provided in Appendix Z of the Supplementary Specifications. The Contractor's final cost plus work reports shall be signed by the Contractor and submitted daily for the Construction Manager's review and approval utilizing the Authority's Standardized Schedules for Cost-Plus Work Forms found in Appendix Z of the Supplementary Specifications. All labor classifications, equipment rates, and material invoices shall comply strictly with the Specifications. Failure to maintain complete, accurate, and signed daily records shall result in no entitlement to payment for the affected Work.

The Construction Manager is responsible to review and approve the amounts on the Cost-Plus Work Forms and ensure proper supporting documents are provided prior to submission to the Authority's Liaison Engineer. Incomplete documentation shall not be approved. Only properly documented, verified, and authorized Cost-Plus Work shall be considered for payment. Unsupported, unverifiable, or non-compliant costs shall be rejected.

3.1.26. Visitors

Outside visitors to the project site, both for their safety and in the client's best interests, shall follow the procedure outlined below. This procedure should also be shared with the inspection staff. Visitor activity shall be documented in a visitor log maintained in the field office.

- Written Construction Manager approval must be obtained prior to any visitors being escorted onto the project site.
- On the day of the visit, all visitors must sign the Indemnification and Waiver of Claims form prior to entering the project site. The Waiver Form is attached in Exhibit 3 – 16.
- The original signed Waiver will be retained in the Construction Manager's files.
- All visitors must sign in at the Construction Managers Field office and wear the required PPE. The Construction Field Office shall have an adequate supply of PPE for visitors.

In the event an inspector from a regulatory agency visits the job site, (EPA/DEP/OSHA):

- First and foremost, be courteous;
- Immediately advise the Authority's Liaison Engineer;
- Politely request the nature of their visit and document all associated information;
- Summon personnel with the appropriate expertise to meet with the visiting inspector, i.e. the Contractor's designated Safety Representative for an OSHA site visit;
- Draft minutes of their discussion and/or concerns;
- Document any directives, notices of violation, or corrective actions issued and forward to the Authority promptly.

3.1.27. Document Change Announcements

Document Change Announcements (DCAs) can be released for a number of the Authority's standard documents. Document Change Announcements for specific documents are available on the Authority's website at the following link: <https://www.njta.com/doing-business/professional-services/document-change-announcements> under the Document Library section of the page. The links to the various documents also include a "Summary of Revisions" that lists the changes associated with each document.

During the administration of Authority contracts, there may be Document Change Announcements issued by the Authority which could affect the performance of the Contract. Direction to implement a Document Change Announcement released during construction will be provided by the Authority's Liaison Engineer. The Construction Manager shall review each DCA for applicability and document implementation actions taken.

3.1.28. Final Closeout

Final Acceptance is the final step in the project closeout process. It is the formal action by the Authority accepting the Work, following written notice from the Construction Manager that the Work has been completed and is acceptable subject to the provisions of the Contract regarding acceptance. Prior to requesting Final Acceptance, the Construction Manager shall verify completion of all punch list items, submission of as-built drawings, warranties, certifications, releases, and regulatory approvals. Final Acceptance shall not be granted until all Contract requirements, documentation, and closeout deliverables have been fully satisfied and verified.

When all Work included in the Contract has received final acceptance by the Authority and outside agencies having jurisdiction (i.e. DCA or SCD) the Project shall be considered as completed, and the Contractor shall be released from all further obligations and requirements except as set forth and provided in Sections 109.02 and 109.03 of the Specifications and in the Contract Documents. Final Acceptance shall not relieve the Contractor of responsibility for latent defects, warranty obligations, or any provisions of the Contract that survive completion. A comprehensive closeout checklist shall be completed and retained in the project files. Incomplete or missing closeout documentation may delay Final Acceptance and shall not constitute grounds for additional time, compensation, or claim.

3.1.29. Record Drawings

The Construction Manager will maintain a set of updated Record Drawings indicating all changes from the original plan set. This set of documents commonly referred to as the “redline” set of drawings will be updated routinely throughout the construction phase. Updates shall be made with field modifications to ensure accuracy, completeness, and traceability. All changes that are part of the permanent Work should be documented in the redline drawings. No permanent field change shall remain undocumented. Changes such as drainage pipe and inlet locations and inverts are an example of what should be as-built and noted in the Contract Documents. Structural changes of any type require redline documentation. Final grades for roadway embankments are also required. Building components that were revised should be documented. All revisions shall clearly reference applicable RFIs, Change Orders, Field Orders, or approved shop drawings for audit defensibility.

The Construction Manager will confirm that all project changes and updates are included in the Record Drawings. This confirmation shall include a formal reconciliation of field records, approved changes, and payment quantities prior to submission. All structural steel shop drawings will be submitted to the Construction Manager electronically before the final pay estimate is processed. Electronic submissions shall be provided in a format compatible with Authority archival requirements.

It is imperative that the Construction Manager review and conform to the submittal requirements in the Authority’s Procedures Manual located on the Authority’s web site prior to commencing the Record Drawing work. Failure to comply with established submittal procedures may result in rejection and delay of final payment processing.

3.1.30. Global Position System (GPS) As-Built of Project

New Jersey State Plane coordinates (2011, feet) is the control criteria for digital as-built CAD delivery. All as-built CAD drawings, and the components found therein, will adhere

to the aforementioned coordinate system. No alternate coordinate system shall be utilized without prior written approval from the Authority. These components may include, but are not limited to: roadway pavement limits and elevations; bridges; drainage structures; manholes; signs; light poles; guiderail; noise barrier; retaining walls; and traffic control devices. The level of accuracy and limits of the survey will also be specified in the Contract Documents. Survey control, tolerances, and documentation shall be clearly identified within the digital deliverables.

3.1.31. **Best Practices Report**

One of the critical components of the administration of a contract during the close-out process, is the development of a “best practices” or “lessons learned” report. This report is an opportunity to reflect on design elements, construction methods, and management practices that can be improved on future projects. The intent is to capture institutional knowledge and promote continuous improvement across future Authority programs.

During the monthly project progress meetings, the Construction Manager will develop a “best practices” questionnaire that will be distributed to meeting participants. This questionnaire may also be shared with representatives from the Authority, Contractor(s), Design Engineer(s), Consultant inspection staff, and others that are not present at the monthly meetings as necessary. The comments received will be summarized and compiled into a 6-month summary report that will serve as a running report of all “best practices” and “lessons learned”. The interim reports shall be maintained as a living document throughout the duration of the Project. At the completion of the project, a post-construction conference will be held with the participants to develop a consensus on issues which will then be compiled into a final written report that is submitted to the Authority. It is the intent of these reports (interim and final) to act as an education program and guide to future programs, projects, and contracts moving forward. The final report shall clearly distinguish between design-related, construction-related, and administrative recommendations.

The following item is an example taken from a Best Practices Report developed on an actual infrastructure reconstruction project:

Best Practices (Crossover Paving)

On highway rehabilitation projects temporary pavement crossovers are often required at the project limits or in areas of entrance and exit ramps. In these cases, the Design Engineer must give thought to how the new paving will tie to the existing paving. It has been observed, in some cases, that the staging and plans simply show the location of the crossovers. This is done sometimes without thought of how the Contractor is to accomplish the grade difference between the new and existing pavement. Should the temporary crossover be in the area of a super elevation buildup, the difference may be 12” or more. This is sometimes not clearly foreseeable by the bidders, and often, bid items are not provided for the variable depth of buildup required for temporary paving. Other considerations for crossover paving that may be overlooked by design are impacts to drainage and asphalt placement requirements for pavement buildup.

3.2. **SAFETY AND TRAFFIC CONTROL**

3.2.1. **HASP Manual**

3.2.1.1. **Responsibility of the Contractor**

The New Jersey Turnpike Authority has online an NJTA Health and Safety Plan (HASP) Manual; this manual provides the minimum guidelines for Contractor HASP. The Contractor is responsible for developing a project specific Health and Safety Plan (HASP) that meets these minimum requirements, applicable OSHA regulations, and their own company Safety Manual. The Authority's guidelines should be considered as only the minimum requirements and the Contractor will tailor the project specific HASP to address all known and possible jobsite hazards. The HASP shall include hazard identification, risk assessment, and control measures specific to each phase of work.

The Contractor's HASP will be submitted to the Construction Manager for review. The Construction Manager's review will focus on compliance with the Contract Documents and conformance with the NJTA HASP Manual requirements. A copy of the Contractor's HASP will be forwarded to the Authority, along with the Construction Manager's review comments. No work will be allowed to begin on the Project until the Contractor's HASP has been submitted and accepted. Acceptance shall be documented in writing.

The HASP is a working document that is to be used as a plan to protect the workers and the public from unsafe or unhealthy conditions, and to protect the environment and property from damage. All project subcontractors will conduct their work in conformance with the project HASP. Should conditions on the Project require it; a revised HASP will be prepared and submitted for acceptance by the Construction Manager and the Authority. Revisions shall be clearly dated and version-controlled.

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs for their employees in connection with the Project. Furthermore, the Contractor is responsible to provide a safe work site for employees and consultants of the Authority. The Contractor shall have a designated Safety Representative (SR) on the Project. The SR shall have authority to enforce safety compliance and stop unsafe operations.

If a Safety Representative is required, the Contract will designate whether a full time or a part time Safety Representative is required. The Safety Representative will be an integral part of the Contractor's efforts towards maintaining a safe working environment, by implementing the HASP, conducting safety meetings and training, conducting safety inspections, documenting meetings, inspections, and incidents, and making changes to prevent future incidents from occurring.

The Safety Representative will have a minimum of 5-years of heavy construction experience in the type governed by the Contract. A minimum of 2-years of that experience will have been served in a supervisory role. The Safety Representative will have completed a 30-hour OSHA Construction Safety and Health course. The Contractor's Safety Representative is subject to approval by the Construction Manager and by the Authority. The Safety Representative will be available 24-hours a day, if needed. On projects where a full time Safety Representative is

required by the contract, the Contractor will provide an approved alternate Safety Representative, in order to adequately cover all operations.

The Contractor will conduct weekly safety meetings with all the project workers. These meetings will be documented and a sign-in sheet will be used to document attendance by the employees. Employees will be given an opportunity to provide input on perceived unsafe conditions or practices and will be allowed to provide input on how the safety of an operation might be improved. Safety briefings will be held at the beginning of each shift and at the beginning of a new operation. Documentation of these meetings shall be maintained in the project safety files and made available upon request.

Each project operation will be addressed in detail in a Safe Work Plan (SWP). Each SWP will address the scope of the Work, the methods to be used to complete the Work, a description of possible hazards, and the methods which will be employed to control the hazards and to prevent accidents. The SWP shall include responsible personnel, required PPE, emergency procedures, and verification of training where applicable.

Each potential hazard will be addressed with specific actions to be taken, that will eliminate or reduce the hazard. Safe Work Plan actions shall be governed by the appropriate OSHA or other acceptable standards. The SWP for upcoming Work will be reviewed at the progress meeting and the SWP will be used by the Contractor as a basis for safety meetings and tool box talk sessions.

Each lifting operation will have its own SWP and the Plan will address the following safety concerns:

- Limit all lifting activity in close proximity to the roadway as much as possible.
- When absolutely necessary all lifting activity adjacent to the roadway must utilize adequately restrictive tie-back techniques which will prevent any encroachment onto the active roadway. Caution must be exercised here to ensure that other hazards are not created by using these secondary tie-backs.
- Review every lift adjacent to the highway as a critical lift and create a written lift plan. The written lift plan should be reviewed with the Construction Manager and include a sign-off from the Contractor's site supervisor responsible for the lift.
- Ensure that the appropriate crane is properly located to complete the task being undertaken safely in accordance with the lifting plan.
- Ensure without exception adequate ground preparation for the placement of any crane next to the roadway.
- Ensure that no structures or underground utilities shall be impacted by placement of crane weight or outrigger placement.
- Conduct a tool box talk session with the entire crew involved with any such lift at the start of each shift
- Lane closures or slow-downs will only be considered when it is unavoidable and necessary to completely separate lifting activities from the travelling

public. These MPT activities will have to be examined very carefully so as not to create an even greater traffic hazard.

- Document pre-lift inspections of rigging, equipment certification, and operator qualifications.

The Contractor is responsible for complying with all OSHA and NJTA-HASP safety requirements. Any non-compliance shall be treated the same as non-compliance with the requirements of a Contract item. Repeated safety violations may result in suspension of work as determined by the Authority.

3.2.1.2. Responsibility of the Construction Manager and the Authority

The Construction Manager and the Authority will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with Contractor's work.

The Authority is committed to safety and expects the Construction Manager to maintain close scrutiny of the Contractor's methods of construction to maintain the Authority's excellent construction safety record. Authority Contract Documents specify that precautions be exercised at all times for the protection of persons and property. The Construction Manager's oversight shall be limited to monitoring compliance with Contract requirements and observing unsafe conditions, without assuming control over the Contractor's operations.

Job safety is the sole responsibility of the Contractor. The Construction Manager should remind the Contractor whenever it appears that safety has been overlooked. However, it is not intended to shift that responsibility to the Construction Manager at any time. Any safety-related observations or notifications made by the Construction Manager shall not relieve the Contractor of its contractual obligations.

The safety provisions governing Authority, State, and local laws are incorporated by reference into the Specifications. The Occupational Safety and Health Administration (OSHA) publishes extensive and detailed criteria on maintaining a safe and healthy workplace. Federal and State requirements are wide ranging and well detailed, and not all parts governing safety provisions are emphasized in this Manual. Compliance with all applicable laws and regulations is mandatory regardless of whether specifically referenced herein.

On construction projects involving inspection personnel, safety provisions of the law are the responsibility of the Contractor. The responsibility of the Authority and its Construction Manager, to their inspection personnel, is in their employer-employee relationship. Their responsibility is in providing protective clothing, safety equipment, and educating their employees. Safety training seminars, periodic safety meetings, and safety training videotapes are intended to inform employees to recognize hazardous conditions. The Authority and Construction Manager shall ensure their personnel are properly trained for hazard recognition and safe work practices applicable to their assigned duties.

Each employee, working within the Authority ROW, will have and is responsible for using the following minimum personal safety equipment:

- Safety vest meeting the most recent ANSI/ISEA – American National Standards for High Visibility Public Safety Vest – Class 3 requirements
- Safety toe boots
- Gloves
- Hearing protection
- Safety glasses or goggles
- Hard hat

Additional PPE may be required depending on site conditions, specific operations, or regulatory requirements. Employees are responsible for inspecting their PPE prior to use and replacing defective equipment immediately.

In addition, each employee on the Project should be equipped with the following, to allow documenting safety concerns and for reporting accidents and injuries:

- Telephone
- Emergency and contact phone list
- Incident Communications Plan
- Directions to nearest hospital
- Pen, pencil, or marker
- Clipboard and notepad
- Camera
- Watch
- Measuring devices

These items shall be readily accessible during field operations to ensure timely documentation and response to incidents.

The Construction Manager will assure that the Construction Manager's staff is in compliance with all applicable OSHA regulations, with the Authority-HASP safety requirements, and with their own Safety Manual. The staff will hold weekly safety meetings and will attend the Contractor's specialty construction and safety meetings. All safety meetings will be documented and sign-in sheets will be used to document attendance. Documentation shall be maintained in the project files and made available for review upon request.

The Construction Manager is responsible for providing safety leadership at all times and safety enforcement, when necessary. The Construction Manager shall give the inspection staff thorough instructions on the safe use of tools, materials, equipment, and the safe prosecution of the Work. The Construction Manager shall see that all inspection staff and Authority employees, on the Project, wear appropriate protective equipment when in construction and/or hazardous areas in accordance with the New Jersey Department of Health and OSHA standards. Failure of personnel to comply with PPE requirements shall be addressed promptly and documented.

Safety is everybody's business. The primary responsibility of safety lies with the individual. Accidents may result in loss of life, permanent disability, pain and suffering, economic loss to the individual and employer, and rising insurance rates. Accordingly, proactive hazard identification and risk mitigation are essential components of project execution.

Cooperation in safety programs is the mutual obligation of every employee. In view of this, each employee should endeavor to:

- Work safely on or off the job.
- Realize individual actions may cause accidents or injuries.
- Have regard at all times for the safety of others.
- Use knowledge and influence to prevent accidents.
- Contribute ideas and suggestions for improvement of safety.

The Construction Manager and the inspection staff should be alert to any unsafe working conditions that might develop on the Project. The Contractor is responsible for compliance with applicable safety standards, but if in the judgment of the Construction Manager, a serious hazard exists that presents imminent danger to the Contractor's employees, to the Authority's project staff, or to the public, the Construction Manager may exercise the authority to direct the Contractor to stop working on the affected part of the Work until corrective measures are taken to eliminate the hazard. Such direction shall be issued formally, documented in the project records, and communicated immediately to the Authority.

The Construction Manager shall notify the Authority of any loss of life or serious injury that require hospitalization to any employee that occurred during activities related to the Project. Fatalities or multiple hospitalizations of employees also require OSHA notification. All serious accidents, whether involving the Contractor's employees or those of the Construction Manager or Authority, will be investigated by the Construction Manager, the Contractor's SR, and the Authority's Safety Coordinator. They will meet to determine the probable cause of the accident and to formulate actions to prevent recurrence of such an accident. If necessary, the HASP will be immediately revised and submitted to the Construction Manager and the Safety Coordinator. A written incident investigation report identifying root cause, corrective measures, and responsible parties shall be prepared and retained in the project records.

The Contractor and the Construction Manager will each have a written Construction Incident Communication Plan (CICP), which shall be distributed to all their employees. See Section 3.1.5 for further clarification. The CICP shall clearly define notification timelines, reporting hierarchy, designated contacts, and escalation procedures.

3.2.2. Construction Manager Safety Manual

The Construction Manager will have a written Safety Manual, which outlines their company's policies, guidelines, and resources available to promote a safe working environment and to prevent work-related accidents. The Manual will meet the requirements of the NJTA Health and Safety Plan (HASP) Manual requirements at a

minimum. Substance abuse and the company response to violations of their Safety Manual and policies will be covered in the written Safety Manual. The Safety Manual shall be reviewed periodically and updated as necessary to reflect changes in regulations or company policy.

The Safety Manual will support the key elements of accident prevention, which include:

1. Management commitment
2. Hazard assessment and control
3. Safety planning, rules and work procedures
4. Safety responsibilities, accountabilities and competencies
5. Accident reporting and investigation
6. Employee involvement and communications
7. Safety training
8. Safety inspections

These elements shall be implemented through documented procedures and measurable safety performance objectives.

All of the Construction Manager's employees shall have access to the Safety Manual and will be required to be familiar with and comply with the contents of the manual. Personal Protective Equipment (PPE) and its uses will be outlined in the Safety Manual and all employees will be required to comply with the requirements of the manual. Acknowledgment of receipt and understanding of the Safety Manual shall be documented.

Each Authority project involving a Construction Manager shall have a Site Specific Safety Plan developed. An Emergency Action Plan (EAP) shall be included as a part of the Site Specific Safety Plan. The Project shall have a designated safety officer that is responsible for safety meetings, site hazard assessments, and record keeping. The Site Specific Safety Plan shall address project-specific risks, emergency procedures, and coordination with local emergency responders.

Emergency evacuation routes, emergency contacts, and hazard assessments shall be posted along with these safety posters:

- "Job Safety and Health: "It's the Law" (Federal OSHA 3165) and the NJTA-HASP posters
- "Log and Summary of Occupational Injury and Illnesses" Poster (OSHA Form 200)

All postings shall be maintained in a visible and accessible location at the project site in accordance with regulatory requirements.

3.2.3. Manual for Traffic Control in Work Zones

The high volume of public travel on the Authority roadways combined with difficult construction near highly populated areas makes it imperative that project personnel be concerned with not only maintaining construction standards and schedules, but also with the safe and smooth operation of traffic in and around construction areas. Accordingly, traffic safety and mobility shall be treated as critical project objectives and shall be continuously prioritized throughout construction activities. Intensive supervision by the Contractor and inspection by field personnel is necessary to obtain guidance and

protection of traffic through work areas on the Project. Such supervision and inspection shall be performed routinely and with sufficient frequency to verify ongoing compliance and effectiveness of the implemented traffic control.

The Contractor is responsible for complying with all Authority regulations when working on roadways owned and operated by the Authority. The Manual for Traffic Control in Work Zones provides guidelines for temporary traffic control in and through work zones by Authority personnel and by all other entities performing survey, construction or maintenance work on Authority roadways. The traffic control shall be laid out in accordance with the Contract Documents and the Authority's Standard Drawings. The Contractor must immediately notify the Construction Manager of any conflict between the Contract Documents and the Standard Drawings. The Construction Manager will resolve any conflicts that exist between the drawings. No field changes to traffic control layouts shall be implemented until conflicts are resolved and direction is provided by the Construction Manager and/or the Authority, as applicable.

The referenced document can be found at the following link:

<https://www.nita.com/doing-business/professional-services/publications/manuals/traffic-control>.

The Manual on Uniform Traffic Control Devices (MUTCD) requires "devices used are clearly visible, clean, and in good repair." This requirement is further defined by the American Traffic Safety Services Association (ATSSA) "Quality Standards for Work Zone Traffic Control Devices", which is intended to be used by field personnel to help them inspect the work zones. The guide is a national industry standard to determine an acceptable quality level for a typical work zone traffic control device. The guide includes examples of acceptable, marginal, and unacceptable work zone traffic control devices. The Contractor's Traffic Control Coordinator (TCC) and the traffic control inspector should both use the ATSSA guidelines when assessing the effectiveness of individual traffic control devices. Any device determined to be marginal or unacceptable shall be corrected, cleaned, repaired, re-positioned, or replaced immediately to restore compliance and maintain safe operations.

The Contractor shall construct the Project in a manner that protects persons and property, both the driving public and the adjacent property and persons. The Contractor is responsible for implementing and maintaining the project traffic control and shall assign a certified supervisory individual as the Traffic Control Coordinator as describe in Section 801.03 of the Specifications. The Contractor's TCC is responsible for all installation, operation, and maintenance of the traffic control system. It is important that the Construction Manager and the Construction Manager's staff regularly inspect and document the Contractor's traffic control and evaluate its effectiveness. The Contractor will remove or cover traffic control signs and devices, when they are no longer needed.

Vehicles in use on the Project shall have the company's name on the side and they shall be equipped with a flashing beacon, first aid kit, and fire extinguisher. The vehicle shall have the headlights on and the flashing amber warning lights activated and shall be equipped with a sign displaying "Construction Vehicle Do Not Follow". When in use on the Project, vehicles shall be operated in a safe and courteous manner. When the vehicles are not in use they shall be parked away from the traveling public and out of the way of construction activities. All vehicles shall operate in the direction of travel to the adjacent

roadway. Vehicles shall not be staged, parked, or maneuvered in a manner that creates an unexpected hazard or reduces sight distance for the traveling public.

Construction Manager staff, who are involved in the inspection and documentation of the project traffic control shall be equipped with the minimum items:

EXHIBIT 3 - 2 CONSTRUCTION MANAGER'S PROJECT TOOLS

Approved Job Information	Daily Essentials
Project Plans with Revisions	Safety Vest
Standard Specifications	Hard Hat
Supplementary Specifications	Boots
Traffic Permit	Ear/Eye Protection
MUTCD Manual	Pen/Pencil/Marker
ATSSA Manual	Scale
	Measuring Tape
Blank Forms	Watch
Personal Diary	Camera
Traffic Control Device Checklist	Clip Board
	Telephone
Contact Information	Lights (night work)
Incident Communication Plan	Project Specific PPE
Map of Nearest Hospitals	360-degree amber vehicle light

The Construction Manager shall ensure that these tools are available, functional, and used consistently to support standardized inspections and documentation.

Copies of the "Quality Standards for Work Zone Traffic Control Devices," may be obtained by contacting the American Traffic Safety Services Association at (800) 272-8772. The most current ATSSA edition shall be used unless the Contract Documents require otherwise.

3.2.4. Coordination with Operations and State Police

Any proposed modifications to the traffic control plans must be implemented in accordance with Manual for Traffic Control in Work Zones. All proposed modifications shall be reviewed for conformance with the approved plans, lane closure tables, and permit conditions prior to implementation. No modification shall be implemented without required approvals, and unauthorized changes shall be subject to immediate correction with no entitlement to additional time or compensation.

The New Jersey State Police may assist with the implementation of the traffic control during lane and shoulder closures. Directives and approvals by the Operations Department and assistance by the State Police does not relieve the Contractor of responsibility for the traffic control and for maintaining a safe work zone. The State Police enforces the laws and regulations relating to the control and movement of traffic and has the authority to control work forces when they are on Authority property. Traffic slowdowns and heavy vehicle escorts will be performed with the assistance of the State Police after the procedure is approved by the Operations Department. The Contractor shall coordinate

with the Construction Manager to ensure that all State Police-supported operations are scheduled, permitted, and executed in accordance with Authority requirements. All costs, coordination, and compliance associated with traffic control shall remain the responsibility of the Contractor unless otherwise provided in the Contract.

The Contractor will complete the application for and receive a traffic permit before beginning any Work on Authority roadways in accordance with the requirements of the Manual for Traffic Control in Work Zones. Work shall not begin until the permit is issued, active, and applicable to the planned operation. Work performed without a valid permit shall be subject to suspension and may constitute a Contract violation with no entitlement to additional time or compensation.

The Construction Manager and the inspection staff are also required to attend a training class conducted by the State Police. Attendance records shall be maintained and made available to the Authority upon request. Personnel who have not completed required training may be restricted from performing duties affecting traffic control.

The Contractor will be required to fill out their traffic requests on the web based lane closure request system. The Contractor is required to populate the traffic form with the lane closure requests complete with location, direction, times, and any State Police assistance that may be required (slowdowns/escorts/sub-patrol). Once submitted, the status is identified as "Pending". Submissions shall be made sufficiently in advance to meet required lead times and to avoid schedule impacts. Failure to submit requests within required timeframes shall not constitute grounds for delay, additional time, or compensation.

The Construction Manager will then review the Contractor's request and determine if the requests conform to the approved traffic control plans and the established timelines in the lane closing tables. Once verified, the status is changed to "Pre-Approved" or "Cancelled" based on the Construction Manager's assessment. The Construction Manager's review shall include verification of limits, durations, required devices, and requested support services. Non-conforming requests shall be rejected and shall not justify delay, additional time, or compensation.

If "Pre-Approved" the Authority reviews and marks "Approved" or "Denied" based on the Authority's assessment. The link to the lane closing requests can be found at: <https://tplc.newjerseyturnpike.com>. The Contractor shall not implement a closure unless the final status is "Approved." Implementation of closures without final approval shall constitute a violation of the Contract and may result in permit suspension, corrective action, or removal of Work, with no entitlement to additional time or compensation.

The Contractor will coordinate all activities through the Construction Manager and the Construction Manager will coordinate with the Director of Operations or the designated representative before placing, changing, removing any traffic control devices. The Operations Department will coordinate with the State Police for their assistance as needed. The Contractor will work with the State Police at the jobsite and will coordinate the traffic control changes as the State Police direct. All field directions that affect approved layouts shall be documented by the Construction Manager or designee. Field changes not documented and approved in accordance with Contract requirements shall be subject to correction at the Contractor's expense.

All closures will conform to the allowable closure periods and closures as depicted in the approved traffic control plans or in the designated Manual for Traffic Control in Work Zones, whichever governs. The Operations Department may cancel closures and/or require the removal of traffic control devices depending upon field and weather conditions. Violations of the work zone rules by the Contractor may also be cause for cancellations of closures or suspension of the Contractors Traffic Permit. Cancellations and suspensions may also be warranted where device condition, layout, or operations are determined to be unsafe or non-compliant.

The Authority maintains staff at the Traffic Management and Technology Center (TMTC) who are responsible for the monitoring and operating of the Authority's roadways. The Construction Manager shall report any observed impacts to the flow of traffic to the TMTC, including congestion and traffic incidents within the work zone. Reports shall be made promptly and shall include the location, observed conditions, and any corrective measures requested or implemented. Failure to promptly report traffic impacts or incidents may constitute non-compliance with Contract requirements and may require corrective action.

3.2.5. Traffic Shift and Lane Closure Meetings

Prior to all traffic shifts and lane closure installations, a meeting will be held, which will be attended by the Construction Manager, the Contractor's project and work supervisors, the traffic control placement staff, the Traffic Control Coordinator, Authority representatives (Engineering and Operations), and the State Police. The purpose of the meeting will be to ensure that the planned operations are covered by the Contractor's traffic permit, have been approved by the Authority, and are properly coordinated with the State Police. The terms, conditions, and responsibilities for the traffic shift or lane closure will be reviewed and the placement of traffic control devices will be discussed. In addition, a timeline for the proposed activities should be prepared in advance of the meeting that also includes the Contractor's staffing resources. Any questions or concerns will be addressed at the meeting, potential issues will be resolved, and the traffic control changes will be finalized at the meeting. Changes in the traffic control will be documented and will be signed off by all approving agencies before the actual traffic shift or lane closure begins. Meeting minutes shall be documented and distributed to attendees, and final sign-off shall be obtained prior to activation of the shift/closure.

The Construction Manager or the inspection staff will document the layout of the traffic control devices and their effectiveness. The timing, location, and a description of the traffic shift or lane closure will be documented. Issues arising from the traffic shift or lane closures will be documented and measures will be taken when necessary to eliminate the issues. Changes in the traffic control will be documented and will be signed off by all approving agencies before the actual traffic shift or lane closure begins. Post-implementation observations and any corrective actions shall be recorded in daily reports to support traceability and continuous improvement.

3.2.6. Displacement, Noise, and Vibration Monitoring

The primary construction activities for creating vibration are blasting, pile driving, demolition, and embankment and compaction work. The Contractor will conduct pre-construction assessments and will monitor the peak particle velocity (PPV) created by the activity. If fragile buildings are located near the construction site, the Contractor will monitor the PPV created by pile driving, demolition, and other construction activities which create

vibration. Normal construction activities should not create PPV high enough to damage structures, but vibration created may be in the audible and perceptible range, causing annoyance to people in the vicinity. Accordingly, monitoring shall address both structural protection and nuisance/annoyance considerations where applicable.

Where vibration monitoring is required as part of the contract, submittals shall be provided for review and approval pertaining to the monitoring. Submittals shall follow requirements outlined in Specification Section 214, and will provide clear understanding of the frequency of monitoring, as well as a method of alerting if a monitoring limit is exceeded. Submittals shall also identify equipment type, calibration requirements, sensor placement, data recording intervals, reporting format, and responsible personnel.

The threshold of vibration annoyance usually occurs when the vibration exceeds the threshold of perception by around 10-decibels. The criteria for acceptable ground vibration are expressed in root mean square (rms) velocity levels in decibels. Both PPV and rms velocity are normally described in inches per second. Vibration, like noise, is attenuated by distance and unless heavy construction activities occur adjacent to buildings, normal construction activities should not cause issues. If heavy construction does occur adjacent to buildings, the Contractor will be required to monitor the vibration level at the structure. Copies of all rms velocity and PPV monitoring will be provided to the Construction Manager on a daily basis and the Construction Manager or the Construction Manager's staff shall monitor the placement, usage, and recording of vibration and seismic data. Alert and upset levels will be provided in the Contract Documents. Any exceedance of alert or upset limits shall be reported immediately, along with proposed corrective actions and mitigation steps.

The Contractor will conduct a pre-construction vibration assessment for built up areas where heavy construction will occur as depicted in Section 214 of the Specifications. The assessment will be made using the Contractor equipment and schedule of operations as a basis for determining potential issues and for determining appropriate vibration mitigation. All vibration producing operations which are scheduled to occur at the same time will be used cumulatively to determine the total vibration impact. The pre-construction vibration assessment evaluates both PPV and rms velocity vibration and will be submitted to the Construction Manager for review. The assessment should include recommended mitigation measures where appropriate; upon approval from the Construction Manager the Contractor should implement the appropriate mitigation measure. Mitigation implementation shall be documented and incorporated into the Contractor's work planning.

Mitigation measures may include design considerations, alternative construction, or different sequence of construction activities. Right of way constraints may preclude locating the construction farther away from sensitive areas, but hauls routes should be picked that route construction traffic away from sensitive areas and off of residential streets. The use of vibratory compaction equipment and impact demolition should not be allowed in sensitive areas. Demolition by sawing or by hydraulic jaws will result in lower vibration than pavement breakers and hoe rams. If geological conditions allow the use of drilled piles or shafts, consideration should be given to incorporating these into design instead of driven piles. Vibration creating activities should be curtailed during the nighttime hours as vibration sensitivity goes up during the night. Another method of mitigating vibration in sensitive areas is to reduce the number of vibration producing operations in an area, at the same time. This will lower the vibration level, but will spread it out over a

longer period. The selected mitigation approach shall be appropriate for the site conditions and shall be coordinated with the Construction Manager and the Authority as required.

Please refer to Section 104.11 of the Specifications, and other provisions in the Contract Documents, to determine the allowable noise levels in construction zones. The Construction Manager's Order for Professional Services (OPS) Agreement may indicate that the Construction Manager is responsible to provide noise/vibration monitoring services. Where the OPS assigns monitoring responsibilities to the Construction Manager, roles, reporting, and coordination requirements shall be clearly established prior to starting the affected work.

3.2.7. Construction Materials Storage

Refer to Section 105.07 of the Specifications.

When maintaining through traffic on construction projects, equipment and materials stored within the right of way during non-working hours should normally be stockpiled as far as possible from the traveled way. Avoid storage areas beneath any structures unless approval has been previously received from the Construction Manager. Storage shall not reduce clear zones or compromise sight distance, and shall not obstruct access for emergency response.

In general, all storage locations must be approved by the Construction Manager in conjunction with the Authority. Approval shall be obtained prior to placing materials and may be revoked if conditions change or non-compliance is observed.

Storage behind guiderail must provide for partial collapse of rail upon impact. For beam guiderail this is normally a minimum of 4.5-feet on parallel sections of rail. The Contractor shall ensure stored materials do not interfere with guiderail deflection requirements.

The storage areas will be kept in an organized and clean condition. The storage of materials will conform to all national, state, and local regulations. The local fire and emergency management authorities will be notified concerning the storage of any flammable or hazardous materials. The Construction Manager will document the storage area, its condition, and will track the materials stored in the area. The Construction Manager has the authority to require the Contractor to make needed changes to the storage areas. Any unsafe, non-compliant, or unauthorized storage condition shall be corrected immediately.

3.2.8. State, County, and Local Roads

Refer to Section 803 of the Specifications.

The Contractor is responsible for complying with all State and Local regulations when working on roadways other than those owned and operated by the Authority. The traffic control shall be laid out in accordance with the plans and with the standard drawings of the governing entity. The Contractor must immediately notify the Construction Manager of any conflict between the Contract Documents and standards of the governing entity. The Construction Manager will resolve any conflicts that exist between the drawings. No work or traffic pattern change shall proceed until the conflict is resolved and the governing requirements are confirmed.

Prior to beginning construction on local roads, a meeting will be held with the local authorities and emergency services. The Construction Manager will run the meeting and will facilitate the discussions. The Project will be presented and the Work phasing will be explained. The Contractor will present their planned work schedule and the days and hours of operation will be discussed. Input from the local authorities and emergency services will be received and possible changes to the construction schedule and work plan will be discussed. Upon reaching agreement with all parties, the changes will be implemented. Meeting minutes will be taken and distributed to all parties that were in attendance. Meeting minutes shall document decisions, action items, responsible parties, and agreed notice procedures.

Before setting any traffic control, the Contractor will notify the local law enforcement, emergency services, school district, and transit of the change in traffic patterns. The Contract Documents will provide the minimum notice required prior to installing lane or shoulder closings or any traffic shifts and/or detours. If no minimum notice is provided in the Contract Documents, the Contractor shall provide proper written notice as required by the local agency having jurisdiction. Notice shall be provided sufficiently in advance to allow emergency response planning and public communications as required by the jurisdiction.

The Construction Manager or the inspection staff will document the layout of the traffic control devices and their effectiveness. They shall inspect the traffic control on a daily basis for function and for compliance. All traffic control signing shall be in compliance with the Manual of Uniform Traffic Control Devices (MUTCD). The Contractor will remove or cover traffic control signs and devices when they are no longer needed. Deficient devices shall be corrected promptly and documentation shall reflect findings and corrective measures.

The MUTCD requires "devices used are clearly visible, clean, and in good repair." This requirement is further defined by the American Traffic Safety Services Association (ATSSA) "Quality Standards for Work Zone Traffic Control Devices", which is intended to be used by field personnel to help them inspect the work zones. The guide is a national industry standard to determine an acceptable quality level for a typical work zone traffic control device. The guide includes examples of acceptable, marginal, and unacceptable work zone traffic control devices. The Contractor's TCC and the traffic control inspector should both use the ATSSA guidelines when assessing the effectiveness of individual traffic control devices. The Construction Manager will require the Contractor to replace all traffic control devices that do not meet the acceptable guidelines of the ATSSA. Replacement shall occur immediately upon identification of unacceptable devices.

The following link is provided for traffic and parking regulations for roads under the jurisdiction of the State of New Jersey, from interstate highways to local municipalities: http://www.nj.gov/transportation/refdata/traffic_orders/.

The traffic control inspector shall be equipped with the following minimum items, before doing an inspection of the traffic control.

EXHIBIT 3 - 3 TRAFFIC CONTROL INSPECTOR'S TOOLS

Approved Job Information	Daily Essentials

Project Plans with Revisions	Safety Vest
Standard Specifications	Hard Hat
Supplementary Specifications	Boots
Traffic Permit	Ear/Eye Protection
MUTCD Manual	Pen/Pencil/Marker
ATSSA Manual	Scale
	Measuring Tape
Blank Forms	Watch
Personal Diary	Camera
Traffic Control Device Checklist	Clip Board
	Telephone
Contact Information	Lights (night work)
Incident Communication Plan	Project Specific PPE
Map of Nearest Hospitals	360-degree amber vehicle light

All required tools shall be available and used to support consistent inspections, documentation, and timely reporting of deficiencies.

3.2.9. Railroads

Reference Section 106.16 and Section 804 of the Specifications.

The New Jersey Turnpike Authority enters into a railroad agreement whenever construction on the roadway crosses or encroaches on the railroad property. These agreements are typically more complex than Agreements written for utility crossings. The railroad agreements typically cover three areas of work in contracts with the Authority. The first occurs when work is done for the railroad, by the Authority, as part of the construction contract. The second is when the railroad does work that is related to the Authority's construction project. The third type of work is when the railroad provides special protective services for the construction project, usually in the form of flagging services. All three categories shall be clearly identified during project planning and tracked throughout the work.

A railroad agreement will be completed and permission will be obtained prior to entering railroad property. All employees of the Contractor and of the Construction Manager will have completed the appropriate railroad safety training before entering and working on railroad property. All safety and debris netting and retaining features shall be approved by the railroad and will be in place before Work begins on railroad property. No work shall commence within railroad limits until all approvals, protections, and training requirements are verified.

The railroad shall provide, at the Contractor's expense, a flagman with the capability of communicating directly with rail traffic and dispatching, to warn and to coordinate between the Contractor's Work and the rail traffic. Flagging is required if construction activities are closer than 25-feet horizontally from the center of the track or 22-feet vertically above the top of the rail. Special construction activities, such as installing girders over the track, will also require flagging of the tracks. The Construction Manager will verify the location of the Contractor's materials and activities and will assure that flagging is provided as needed

and that the Contractor is properly coordinating the Work activities with the railroad. The Construction Manager will monitor and document all Work done with respect to the Railroad Agreement. This is especially true whenever Work is being carried on under a force account. Force account documentation shall include labor, equipment, materials, and time records in accordance with the agreement requirements.

Railroad agreements require special third-party protective insurance and the railroads require the completion of a railroad safety training course before personnel may enter the railroad property. The Construction Manager will verify that the Contractor has provided all necessary insurance and that all on-site personnel have completed the required safety training, before the Contractor is allowed to enter onto the railroad property. Verification shall be documented in project records.

A Site Specific Work Plan (SSWP), which will be an in-depth submission from the Contractor that will indicate any potential “fouling” of their tracks. Locations of heavy equipment, such as cranes, drilled shafts and pile rigs, and backhoes will be listed in their plan, including swing radius and counterweight options. Timelines for the Work associated with these work plans will also be reviewed and approved by the railroad. Finally, a pre-construction conference will be held with the Contractor, the Construction Manager, the Authority, and the railroad prior to Work beginning. The Work, schedule, safety, SSWP, and construction and rail traffic control will be discussed and documented. The SSWP shall be kept current and revised as operations, equipment, or sequencing changes.

3.2.10. **Marine**

Reference Section 106.17 and Section 805 of the Specifications. All marine operations shall comply strictly with the requirements of these Sections and any applicable permits or regulatory approvals.

The State of New Jersey is bounded by two US Coast Guard Districts. The First District includes that portion of the New Jersey shoreline to the north of the 40-18' latitude, located in Long Branch, and the Fifth District includes the rest of the State. All construction activities being conducted within the navigable waterways shall be coordinated with the US Coast Guard in the appropriate District. This coordination will begin during the design phase of a project and it will continue until the completion of construction. The Contractor shall comply with all Coast Guard notification and operational requirements applicable to the work area. Failure to comply with Coast Guard requirements may result in suspension of Work and shall not constitute grounds for delay, additional time, or compensation.

Before construction begins, that may impact a navigable waterway, notice will be provided at least 14 days in advance. This will allow time to publish the information in the Local Notice to Mariners (NTM) for the District. The notification to the Coast Guard will include the following:

- Date of submission
- Name, phone number, and email address of the project point of contact
- Company name
- Type of work
- Waterway and location where the Work will be done

- Latitude and longitude of the work area (Degrees, Minutes, Thousandths of seconds)
- Work start and stop dates and hours of operation
- Equipment on scene
- Passing arrangements/time to move vessels to not impede navigation
- VHF radio channel monitored
- Disposal site (if used)
- NOAA Chart Number for the area

Incomplete or late notification may delay marine operations and shall not constitute grounds for additional time or compensation.

The usage and size of barges, tugs, and safety boats shall be provided to the Coast Guard District. Updates shall be provided if equipment, limits, or schedule materially change. Material changes shall not be implemented without required approvals, and unauthorized changes shall be subject to corrective action.

The Contractor will comply with all requirements imposed by the Coast Guard or other agencies having oversight of the work area. The Contractor will also abide with all environmental regulations during construction within the waterways. All environmental protection measures required by permits and contract documents shall be implemented and maintained. The Contractor shall be fully responsible for environmental compliance and any violations shall be corrected at the Contractor's expense with no entitlement to additional time or compensation.

The Construction Manager shall be involved in all meetings with the Coast Guard and shall receive copies of all correspondence pertaining to the construction within the navigable waterways. The Construction Manager will verify that the Contractor is using safety lines and netting, and is using safety boats as necessary. All Construction Management staff working in the area shall use the appropriate safety equipment, including safety harnesses and life jackets. Safety equipment requirements shall be enforced at all times while working over or adjacent to water. Failure to comply with required marine safety practices may result in suspension of Work until corrective action is implemented.

EXHIBIT 3 - 4 PRE-CONSTRUCTION CONFERENCE AGENDA



New Jersey Turnpike Authority

Contract No. XXXX.XXX

Project Name

Pre-Construction Meeting Agenda

Engineer: _____

Contractor: _____

Date: _____ **Time:** _____

NJTA Administration Building – Conference Room XX – 12th Floor

1. Execution of Contract (§103.02)

- a. Return three (3) fully executed copies each of Contract Agreement and Power of Execution to the Authority, Director of Law.
- b. Documents required to be submitted within ten (10) calendar days of receipt of the Contract.
- c. Notice to Proceed will be issued when all required documents have been received and executed by the Authority.
- d. Significant Dates:
 - i. Notice of Award Date: _____
 - ii. Notice to Proceed Date: To be determined
 - iii. Approval of Traffic Permit: To be determined
 - iv. Contract Completion Date: _____

2. Contract Bond (§103.02)

- a. Return three (3) fully executed copies of Contract Bond to the Authority, Director of Law.
- b. Bond shall be in a sum of not less than the total amount bid for the Project and shall be maintained by the Contractor until the final payment is made.
- c. Documents required to be submitted within ten (10) calendar days of receipt of the Contract.

3. Maintenance Bond (§109.03)

- a. A bond in the amount of 5% of the final total contract value for a period of one year after acceptance of Authority and must be submitted to obtain final payment.

4. EEO Requirements (Supplemental Appendix A)

- a. Submit Form AA201 Initial Project Workforce Report – Construction, to the Department of Treasury, Division of Contract Compliance, and Dept. of LWD, Construction EEO Monitoring Program.
- b. Contractor to provide the Monthly Project Workforce Report (AA202) and the Subcontractor Payment Report directly to the Department of Treasury, and Dept. of LWD.
- c. Contractor, and their subcontractors, must make good faith effort to hire minority and female workers. All letters to the union halls and the responses must be provided to the Department of Labor Workforce Development, Construction EEO Monitoring Program.
- d. For additional EEO information, contact Susan McCusker at 732-750-5300 X 8733.
- e. Copies of letters sent to Union Halls requesting workforce shall be submitted to Susan McCusker.
- f. An SBE Goal of 25% is required for this contract. **(Confirm contract requirements)**
- g. A DVOB Goal of 3% is required for this contract. **(Confirm contract requirements)**

5. Certificates of Insurance (§106.20)

- a. The contractor is required to obtain their own insurance coverage throughout the term of the contract, final acceptance and for a period of not less than three (3) years following termination of this contract.
- b. Insurance requirements contained in (§106.20) of the Supplemental Specifications.
- c. All certificates shall be submitted through the Authority's Project Management System, CapEx Manager.

Contact Jennifer Romero at JROMERO@njta.com for CapEx sign up and questions.

- d. Furnish certificate (s) of insurance in form satisfactory to the Authority before commencing any services.

6. Traffic Protection and Traffic Control (§800)

- a. The Contractor will not be permitted to engage in lane and shoulder closing operations on Authority roadways and ramps until the Lane Closure and Construction PowerPoint has been viewed and acknowledged by all employees, Subcontractors, suppliers and vendors as noted on the attendance sheet, a copy of which is found on the Authority's website. The PowerPoint presentation is available in the NJTA Lane Closures Program, under user profile, downloads.
 - i. A copy of the "Lane Closure and Construction Safety" PowerPoint presentation can be provided if requested.
- b. Lane and Shoulder Closings shall be in accordance with latest edition of Manual for Traffic Control in Work Zones, which can be found at the Authority's website - http://www.njta.com/media/1501/njta_traffic_control_manual_in_work-zones_122016.pdf.
- c. For all MPT that requires the covering of existing signs, the signs must be covered in a way to not damage the sign. Sign covers, for the purpose of obscuring installed but inactive temporary and permanent signs, shall be large enough to obscure the entirety of the sign, be non-reflective, opaque, and easy to install and remove. The use of plastic bags with duct tape, or similar method, is prohibited. §801.03.A.6
- d. The closure request process is outlined in the Manual for Traffic Control.
- e. The Contractor is advised that all lane closings require State Police assistance for their installation and removal.
- f. The Contractor shall apply for a Traffic Permit at least ten (10) working days prior to the time the Contractor intends to start any operations at the project site. The Contractor shall complete the applicable portion of the Traffic Permit application and return to the Engineer for review. The Engineer shall present the completed Traffic Permit to the Authority for approval. The Traffic Permit application can be found on the Authority's Web Site: <http://www.njta.com/about/traffic-permits>.
- g. The Contractor shall assign a supervisory level employee to be the Traffic Control Coordinator (TCC). The name and telephone number(s) of the TCC shall be submitted to the Engineer with the Traffic Permit Application. The TCC shall have a "TCC Designation Card" as issued by Rutgers' CAIT. Responsibilities of the Traffic Control Coordinator can be found in §801.03. A.6.
- h. The Contractor is advised that the approved lane closing hours are inclusive of the time for installation and removal of traffic protection devices, removal of existing striping, placement and removal of temporary striping and construction barrier, placement of permanent striping and all else necessary either to properly close or reopen lane(s) and shoulders to traffic.
- i. Permissible lane and shoulder closing hours for Authority roadways are noted in the Manual for Traffic Control.
- j. Lane, shoulder and ramp closure requests must be entered into the Authority's lane closing program at <https://tpic.newjerseyturnpike.com> with adequate time for the Engineer's review and approval prior to being sent to the Authority by 12:00pm on each Wednesday for the proposed closings of the following week.
- k. The denial of lane, shoulder or roadway closing or delay of the closing or opening of up to two hours from the scheduled times shall not be considered as a basis for a claim of delay against the Authority.
- l. The Operations Department or State Police may determine that a scheduled half-ramp, mainline lane, shoulder, or roadway closing must be cancelled, postponed, or delayed in opening or opened earlier than originally planned. This change in available work hours shall not be considered as a basis for a claim against the Authority. Lane closings may be cancelled or may be reopened earlier than schedule, as required by weather conditions or other incidents.
- m. Traffic Protection Patrol: The Contractor will always be required to provide a traffic protection patrol when lane, ramp, or partial ramp closings are in place (§801.03. (A). (7)). Traffic Protection Patrol for this contract shall be performed on a full time or part time basis with responsibilities as defined in Subparagraph (§801.03. (A). (7). (a) and (b)).
- n. Contractor shall provide the names and phone numbers for 2 traffic safety coordinators who need to be available 24/7.
- o. To report any emergencies please call, in order:

- i. 911;
 - ii. NJTA EMERGENCY OPERATIONS: 1-800-352-4848 and;
 - iii. The Resident Engineer and;
 - iv. NJTA Liaison Engineer
 - p. To speak with an Operations Supervisor to get in contact with NJSP, Maintenance, or a TCS utilize the numbers below:
 - i. TPK Operations: +1 (732) 376-5673
 - ii. GSP Operations: +1 (732) 376-5678
 - q. Unless otherwise specified, or permitted by the Authority's Engineer or Operations Department, the Contractor's vehicles shall not travel via Z-turns, U-turns, or at the point at which the roadway is coned off. Any vehicle making any illegal movement will be subject to a summons by the State Police. Authorized locations for the use of U-turns and Z-turns will be as shown on the Plans.
 - r. The crossing of live lanes or ramps by any employee is strictly prohibited and will not be tolerated.
- 7. Safety (Sanitary, Health and Safety Provisions (§104.13, §104.14 and §920.03))**
- a. The Resident Engineer shall coordinate and schedule a safety kick off meeting. The contractor shall attend with his designated site safety representative and discuss the operations associated with the project.
 - b. A separate safety kickoff meeting with Operations and the New Jersey State Police shall be scheduled at the beginning of the job. This meeting is to be held at the staging area and attended by the Contractor's designated safety and traffic control personnel.
 - c. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his/her health or safety.
 - d. The contractor shall perform all work safely and in accordance with OSHA 1910 and 1926.
 - e. All employees will be required to wear the necessary personnel protective equipment, i.e. work shoes, hardhats, eye protection, safety harnesses, Class 3 safety vests (§920.03), etc.
 - i. NJTA Operations judges all work activities within the right-of-way on the Garden State Parkway and New Jersey Turnpike as Temporary Traffic Control zones, as defined in the MUTCD 11th Edition, Section 6C.05. Therefore, all workers must always wear Class 3 safety vests during daytime and nighttime activity.
 - f. The Contractor shall submit two (2) copies of the Health and Safety Plan (HASP) (§216.04) and Safe Work Plans (SWP) that comply with the NJTA-HASP and requirements of a satisfactory HASP and SWP as set forth elsewhere in the contract documents, and other data as required by the Authority (§107.02).
 - g. The Contractor shall conduct all operations during the performance of the work to provide protection for the public, and those working within the construction site, from the harmful and disturbing effects of excessive dust. Protection shall include but not be limited to the provisions of Sections 208, 417 and 418. Dust Control (§104.12)
 - h. The Contractor shall conduct all operations during the performance of the Work to provide protection for public, and those working within the construction site, from the harmful and disturbing effects of excessive noise. Noise Control (§104.11)
 - i. The Contractor shall have a Full-Time/Part Time Safety Representative (SR) (§104.13).
 - j. Toolbox Meetings must be memorialized, and evidence of participation must be submitted to RE weekly.
 - k. Safety for COVID 19 Procedures / Protocol Should be included in Health and Safety Plan
- 8. Subcontractors**
- a. Subletting and Assigning Contract (§103.04)
 - i. Provide "Notification of Intent to Subcontract" form listing names of all the planned Subcontractors within thirty (30) days after Notice of Award (§103.04). Notice to be submitted to Resident Engineer via CapEx for review and RE will forward recommendation to the Authority.
 - ii. The Contractor shall perform not less than fifty (50) percent of the total amount of the contract with his own forces. Minus the specialty items.
 - iii. All contractors and subcontractors must comply with the requirements of N.J.S.A. 10:2-1 Discrimination in Employment on Public Works in §106.26 and Supplemental Specification Appendix J.

- b. The specialty items under this contract are:

- XXXXX

9. Plans/Specifications (§104.03)

- a. Plans and specifications will be available to be picked up at the Authority's HQ Security Desk. (Print order will be provided.)
- b. Four (4) copies of the Supplemental Specifications and Plans will be provided. Notify the Engineer if more copies are needed.
- c. The Standard Specifications of the New Jersey Turnpike Authority, Seventh Edition, dated 2016, as amended and augmented by the Supplementary Specifications, along with the Conformed Plans, shall govern the construction of this project and the execution of the contract.
- d. Contractor shall always maintain a complete set of contract documents at the site of the project.

10. Contractor's Organization (§104.06)

- a. Designate the Management Team (Project Manager, Superintendent, Foremen, etc.).
- b. Work shall be carried out through a competent, English-speaking superintendent at the site.
- c. All personnel shall always wear photo ID. ID should have the person's name, company name and company phone number.
- d. Provide a completed NJTA Key Contract Personnel form with 24/7 phone numbers.
- e. Provide to the Resident Engineer a weekly list of manpower, their classification and the equipment utilized on the project.

11. Contractor's Headquarters/Staging Area (§105.07)

- a. Storage/Staging areas for this Contract are to be within the project limits of disturbance. The Contractor will be required to maintain areas in a clean and neat condition.
 - i. A designated Material Storage and Staging area for this contract is available for this Contract and is located at XXX as referenced in Supplementary Specification and Plan Sheet XXX
 - ii. No additional storage areas will be permitted within the Authority's ROW.
- b. Prior to occupying any staging area, the Contractor shall submit to the Engineer a minimum of 10 photographs documenting the initial condition of the staging area.
- c. Upon vacating any staging area on Authority right-of-way, the Contractor shall submit to the Engineer a minimum of 10 photographs documenting the final condition of the staging area.
- d. Complete NJTA Staging Area Inventory/Inspection form within 30 days of occupying any staging area and update every 6 months, and 14 calendar days prior to vacating the staging area.
- e. Contractor shall provide two weeks written notice to the Authority's Engineering Department, Environmental Section prior to vacating the staging area. A copy of the notice should also be submitted to the Engineer, with the appropriate environmental impact form.
- f. Contractor shall be responsible for the general housekeeping of staging and storage areas, including debris, litter clean-up and removal.
- g. Contractor shall restore all storage and staging areas to their original condition as directed by and to the satisfaction of the Engineer. Restoration of staging and storage areas will be completed within 10 days following completion of punch list items of work.
- h. Field office should be in accordance with contract documents.

12. Construction Incident Communication Plan

- a. Should any construction related accident, injury requiring medical attention, or incidents adversely affecting traffic occur, the contractor shall notify the RE immediately. Also, the Authority shall be notified of the situation. Contact NJTA Liaison Ian Cooper at (732) 947-7503.
- b. A contract specific Incident Communication Plan will be completed with Contractor, RE and NJTA info detailing procedures and responsibilities by RE. Copies will be posted at RE office, contractor's trailer and will be distributed electronically. A completed NJTA Key Contract Personnel form with phone numbers 24/7 will be included.

13. Materials (§105.01)

- a. Within 10 days of execution of the contract by the Authority:
 - i. Provide a list of proposed material sources for approval by the Engineer.
 - ii. Provide a list of proposed suppliers for approval by the Engineer.
 - iii. Provide a minimum of 24 hours' notice to the Engineer for inspection of materials delivered to the site for use on the project.
 - iv. After the submission of the initial list of sources of supply the Contractor shall notify the Engineer of all new sources of supply at least thirty (30) calendar days in advance of the proposed shipment of materials from such new sources.
- b. Certificates of Compliance, laboratory testing results and delivery tickets to be submitted in accordance with Standard Specification Section 105.
- c. Unacceptable Materials (§105.09)
 - i. All unacceptable materials not in compliance, whether in place or not, shall be removed immediately upon Engineer's Directive, at the Contractor's expense.
 - ii. All costs associated with failure to comply with the Engineer's Directive and to remove rejected material shall be the responsibility of the Contractor.

14. RFIs, Submittals, Shop and Working Drawings (§104.08)

- a. Contractor to submit all required Shop Drawings, Working Drawings, Written Procedures, & Catalog Cuts/Certifications as stipulated in the Supplementary Specifications on page 11.
- b. Contractor must have approved shop drawings before commencing work involving items requiring shop drawing submittals. Failure to comply will result in delays and non-approval of lane closings for work requiring approved shop drawings.
- c. Refer to each individual section of the Specifications for complete submittals requirements.
- d. All RFIs, Submittals, Shop and Working Drawings will be sent via email from the Contractor to RE Office and copied to the RE and NJTA Liaison. Both the Contractor and RE will maintain a log of all submittal with dates received and sent for review and approval Documents shall be submitted in PDF format. The submittal logs will be cross reference with the Contractor bi-weekly to confirm all submittals have been received.
- e. For Submittals that cannot be sent electronically, Contractor must submit an E-mail with Transmittal form and follow procedure in Standard Specification (§104.08). Submit 3 copies for the Engineer's review.
- f. At the completion of the contract, final copies of all shop and working drawings, with the appropriate approval stamps and original signatures, in electronic PDF and CADD (Micro- Station) format shall be submitted to the Engineer (§104.08).
Contractor shall allow in his schedule fourteen (14) calendar days for Engineer's review of each shop drawing submission. Review by other agencies will require longer periods and the Contractor shall account for these times in the Progress Schedule. No extension of the contract completion date will be issued based on delays in submittal and approval of required shop drawings.

15. Inspections, Tests and Samples (§105.03)

- a. Certifications for all materials are required.
- b. The testing lab for this contract TBD.
- c. Contractor is responsible to carefully deliver concrete test cylinders to testing lab in a timely manner, and supply the Engineer with an adequate supply of bags, tags, and new cylinders. 6"x12" for sampling of materials. (Standard Specification Section 401.16 – page 400-30)
- d. A technician from the lab will be at the batching plants for testing prior to the discharge of material, and will supply an inspector for onsite density testing of the asphalt pavement.
- e. Contractor to inform Engineer of scheduled pours/placements in a timely manner to allow for testing.

16. Progress Schedule (§107.04)

- a. The Contractor shall furnish for approval, within ten (10) calendar days after the date of execution of the contract by the Authority, an interim partial progress schedule containing detailed activities depicting the Contractor's proposed plan and schedule of work to be performed within the first sixty (60) days. The interim progress schedule must be in the form of a network diagram. Construction shall not begin until the partial schedule has been approved.
- b. A complete Baseline progress schedule is to be submitted within the 30 days of the execution of

contract.

- c. Refer to Supplementary Specifications for milestone dates to be met. Milestone dates in Supplementary Specifications, Contract Agreement 1 are as follows:
 - i. Phase 1: XXX
- d. The schedule will be updated monthly to reflect the progress.
- e. Should the contractor fall behind, a recovery schedule will be required. The recovery schedule will reflect how the contractor plans to make up for lost time.
- f. Contractor shall provide a two-week look ahead schedule at each bi-weekly progress meeting.
- g. The Engineer shall not process a "Certificate for Payment to Contractor" until the progress schedule submission has been approved. Ten (10) working days will be required for review and comment on each progress schedule submission.
- h. Both Daily and Two (2) Week Look Ahead schedules are also required. – Refer to Supplementary Specification – Section 107.04, page 29. These schedules shall be provided to the Resident Engineer and NJTA Liaison.
- i. The Contractor in his Daily and Two-Week look Ahead Schedules shall insure that he has identified the task intended to perform so that we can adequately staff the work with inspectors. If the contractor has not provided adequate notification for the work intended to be performed, then the work will not be permitted.

17. Permits, Licenses and Taxes (§106.10)

- a. The Contractor shall procure all permits, grants, and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful prosecution of the work. The Contractor shall be responsible for conformance to all requirements of any permits, grants, or licenses necessary during construction. Should the Contractor violate these requirements and cause the issuing agency to levy any fine against the Authority, the Authority will deduct an equal amount from the Contractor's final payment. The Engineer must be copied on all correspondence with local agencies.
- b. The Contractor is to follow all restrictions and requirements for the following permits obtained by the NJTA for this contract.

18. Utilities (§106.18)

- a. Prior to any ground intrusive activities, the Contractor shall notify the State's One Call System (1-800-272-1000) and comply with the State's Underground Facility Protection Act. Contractor shall provide the Engineer with a copy of all mark-out tickets, and the Engineer and the contractor shall review the mark-out on the site. This shall also apply before the installation of any new temporary ground-mounted signs.
- b. The Resident Engineer shall receive a copy of all mark-out tickets.
- c. Authority Owned Fiber Optic Facilities are within the Contract limits (§106.18. B).
- d. In addition to all applicable utilities, The New Jersey Turnpike Authority must be listed on the mark-out tickets.
- e. Contractor shall notify the NJTA Buildings Maintenance Department for the coordination of any required Authority Owned Utility Shutdowns

19. Certificates for Payment (§108.02), Certified Payroll (§102.13), and Partial Payments (§108.03)

- a. Only those listed on the current Power of Execution form may sign Certificates for Payments and Change Orders.
- b. Only one (1) verifier will be permitted in the CapEx Manager System at any one time.
- c. Progress payments will be made on a monthly, or semi-monthly intervals (when the work accomplished in a two-week period amount to more than \$100,000 or 25% of the contract).
 - i. Closing
- d. The contractor must complete \$250,000 in a two-week period to receive an Interim Payment.
- e. Retainage in the amount of 2% shall be withheld. Ten (10) percent will be withheld for permanent materials furnished but not incorporated into the work. Upon Substantial Completion, Contractor may request reduction to 1% (§108.03. A).
- f. Original Subcontractor / Supplier Payment Certification Forms must accompany each pay certificate. The same person who is on the Power of Execution form must sign these forms and approve the estimates in the CapEx system.
- g. All Certificates of Payment and Change Orders will be prepared in the CapEx Manager System.

- h. Certified Payrolls, as proof of compliance for the New Jersey Prevailing Wage Act, are to be submitted to the Resident Engineer for record purposes.

20. Construction Layout (§104.09)

- a. The Contractor shall perform all work required in connection with the layout for construction of the Project using the traverse control points and data furnished by the Engineer. This work shall be performed by qualified personnel under direct supervision of a licensed Professional Engineer or Land Surveyor.

21. Progress Photographs

- a. The Contractor shall take and provide an average of ten (10) color photographs each month to show the progress of the work until the completion of the project.
- b. Contractor is required to furnish pre-construction photos of each site location as well as monthly progress photos. 24-hour notice needed prior to coming out to job sites. See Section 107.10, page 100-72 of Standard Specifications for quantity, quality and sizing of photos required.
- c. Additional Progress photos will be required for specific repairs identified as Category A deficiencies as per Supplementary Specifications Section 107.10, page 30. Photos are to be taken and provided to the Authority both before and after the repair is completed; this ensures the Category A deficiency is closed out by NJTA Maintenance.

22. Project Progress Meetings

- a. Bi-Weekly progress meetings will be held by the RE. Progress meetings may be reduced to an as-needed basis as the project progresses.
- b. Additional coordination meetings will be held as required.

23. Questions/Comments:

EXHIBIT 3 - 5 PRE-CONSTRUCTION CONFERENCE SIGN-IN SHEET

NEW JERSEY TURNPIKE AUTHORITY
CONTRACT NUMBER TXXX
ATTENDANCE LIST
PRECONSTRUCTION CONFERENCE
Month X, 20XX

	<i>Name</i>	<i>Company</i>	<i>Responsibility</i>	<i>Phone</i>	<i>E-mail Address</i>	<i>Initials</i>
1						
2						
3						
4						
5						
6						
7						
8						
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10						
11						
12						
13						

EXHIBIT 3 - 6 PROGRESS MEETING MINUTES

MINUTES OF PROGRESS MEETING No. 015

Project: New Jersey Turnpike Authority - **Contract NUMBER**
Contract Title: XXXXXXX XXXXX XXXXX XXXXXXX

Location: Field Office
XXXXXX, XXXXXX, NJ

Date & Time: XXXXX XX, XXXX
XX:XXhrs to XX:XXhrs

Attendees: COMPANY
New Jersey Turnpike Authority (NJTA)
Consultant (XXX)
Contractor (YYY)
Designer (ZZZ)

ATTENDEES
NJTA Liaison
Resident Engineer
Office Engineer
Contractor PM
Contractor Superintendent
Designer PM

+

ITEM NUMBER	TOPIC	ACTION BY / STATUS
A.	PROJECT SUMMARY	
A14.1	9/22/16 Contract Bid Amount – \$XXX,XXX,XXX.XX Amended Contract Amount – \$XXX,XXX,XXX.XX Contract NTP Date – XX/XX/XX Project Completion Date – XX/XX/XX Construction Contract Cost Earned to Date: – XX.XX% Construction Work Completed to Date – XX.XX% Time Used with Respect to Project Completion – XX.XX% (XXX Days) THIS ITEM IS CLOSED	
B.	SAFETY ISSUES & MAINTENANCE AND PROTECTION OF TRAFFIC (MPT)	
B14.1	9/22/16 – NJTA Operations informed CONSULTANT about vehicles being located outside of the cone line on the departure side of each site. CONSULTANT has informed CONTRACTOR of this concern and CONTRACTOR stated they will comply. THIS ITEM IS CLOSED	CLOSED
B14.2	9/22/16 – Referring back to meeting note A8.1, CONTRACTOR was informed to install C channels in flatbed trailers when removing or installing PCCB with a live lane of traffic adjacent to the work site. On 9/20/16 CONTRACTOR did not comply with this and was reminded of this requirement. 10/27/16 – CONTRACTOR has not complied with this request and was reminded of this requirement. THIS ITEM IS CLOSED	CLOSED
C.	CONTRACT REQUIREMENTS	

MINUTES OF PROGRESS MEETING NO. 015

C13.1	8/25/16 – On 8/2 the NJTA requested data on the “Helmets 2 Hardhats” program in order to understand how all contracts awarded are complying with this requirement. CONTRACTOR has subsequently provided CONSULTANT with the required information. As of Estimate 12 (7/31/16), CONTRACTOR and all its subcontractors have obtained a total of 3,876.50 veteran man hours equaling 11.83% of the total man hours to date. This percentage exceeds the minimum 8% goal. CONTRACTOR will be providing an update of this information monthly with each estimate. 10/27/16 – This item is now being reopened since CONTRACTOR has yet to provide the most up to date Helmet 2 Hardhat information.	CONTRACTOR
D.	PROGRESS SCHEDULE	
D13.1	8/25/16 – Schedule Update 13 is due on 8/27 for the Month of August. 9/22/16 – CONSULTANT is still waiting for this update. 10/27/16 – CONSULTANT received Update 13 on 10/3/16 and responded on 10/19/16. THIS ITEM IS CLOSED	CLOSED
D14.1	9/22/16 – Schedule Update 14 is due on 9/24 for the Month of September. 10/27/16 – CONSULTANT is still waiting for this update.	CONTRACTOR
D15.1	10/27/16 – Schedule Update 15 is due on 10/29 for the Month of October.	CONTRACTOR
E.	SHOP DRAWINGS/CERTIFICATIONS/WRITTEN PROCEDURES	
E10.4	5/26/16 – CSL report for STR 2T131’s 54 inch drilled shaft concluded a failing result. CONTRACTOR had originally proposed grouting rebar within the existing CSL tubes to add reinforcement around a detected void area. This method was not approved by DESIGNER as additional information is required. CONTRACTOR will be resubmitting this method with design calculations as back up. 6/23/16 – CSL submittal 428.05-023-001 was rejected by DESIGNER on 6/16/16. CONTRACTOR will provide further testing and a revised repair procedure will be submitted for review. 8/04/16 – CONTRACTOR still needs to provide an alternate repair solution. 8/25/16 – CONTRACTOR still needs to provide an alternate repair solution for CSL 16. 9/22/16 – Several days ago, CONTRACTOR stated they would like to abandon the rejected drilled shaft and construct a new, replacement, foundation shaft. CONSULTANT confirmed a replacement shaft could be constructed south of the plan designated location. THIS ITEM IS CLOSED.	CLOSED
E14.2	9/22/16 – CSL Report 25 was approved by DESIGNER on 8/30/16, Report 26 was approved by DESIGNER on 9/1/16, and Report 27 was approved on 9/20/16. All were marked NET. THIS ITEM IS CLOSED	CLOSED
E15.1	10/27/16 – CONTRACTOR has submitted a total of 196 shop drawings for review to date. At this time 152 have been marked as approved for construction with NET status. 11 have been stamped as MCN. 12 require resubmission as they are stamped AAR or REJ. 20 submittals have been stamped as DEAD with the understanding that they are not to be used. 1 submittal is currently under review THIS ITEM IS CLOSED	CLOSED
F.	REQUEST FOR INFORMATION (RFI)	
F15.1	10/27/16 – RFI 34 has been submitted by CONTRACTOR referencing rust on the interior of the end column and previously completed field modifications to the base plate’s bolting pattern on relocated STR 4T01. It appears the original structure’s base plate was modified at the time of installation to align with foundation anchor bolts. The rust is a result of age and old style column construction that used a grout pad beneath the base plate which trapped moisture. CONSULTANT met representatives from the DESIGNER design team on October 18th to examine the structure which is currently stockpiled at the MP 84.1 U-Turn. DESIGNER will provide information if it is determined that corrective work is required.	DESIGNER
G.	CHANGE ORDERS	
G14.1	9/22/16 – No change orders have been issued. A future change order will be compiled for the following work: - Guide rail upgrades at Interchange 14B - COP 2 (MP58.08)	CLOSED

MINUTES OF PROGRESS MEETING NO. 015

H.	CHANGE OF PLAN (COP) ISSUES	
H7.1	<u>2/18/16</u> – DESIGNER has indicated that a future COP #2 will be issued for the structure located at the SB service area North of Interchange 6. <u>3/24/16</u> – This COP is still under review with DESIGNER and the NJTA. <u>4/28/16</u> – This COP is still under review with DESIGNER and the NJTA. It is expected to be approved the week of 5/2/16. <u>5/26/16</u> – COP #2 was issued to CONTRACTOR on 5/6/16. CONSULTANT is awaiting CONTRACTOR's estimated impact of time and money for the work to be performed. CONTRACTOR was informed that Operations will permit a long term right lane closing of the SASI/SASO Ramp for a maximum duration of 48 hours during the replacement. <u>6/23/16</u> – CONTRACTOR has not yet submitted a cost breakdown to CONSULTANT for associated work. The total dollar value for repairs is dependent upon questions raised in RFI-32 (see above). <u>8/04/16</u> – SUBCONTRACTOR has informed CONTRACTOR that there are major concerns with the erection procedure of the replacement components. There is a concern that trying to insert the new panel into the old opening will not work if the structure is slightly bent. SUBCONTRACTOR has suggested that it would be easier and safer to completely remove the truss so work to replace the damaged component unit could be completed at ground level. There is some uncertainty as to whether the previous truck impact caused enough damage at the end frame / truss connection and if disassembly and re-assembly of the shear pin connection would create additional problems. A subsequent field meeting will be scheduled to discuss repair options. <u>8/25/16</u> – On 8/18 a field meeting was held between CONTRACTOR, SUBCONTRACTOR, CONSULTANT, and DESIGNER to discuss the repair procedures for the structure located at MP 58.08. It was determined that the fastest and safest way to replace the damaged sign would be to remove the truss section of the sign structure, perform the repair at ground level then reinstall the truss section. CONTRACTOR/SUBCONTRACTOR also suggested replacing the shear pin connections and elastomeric bearing pads at all four corner locations. CONSULTANT is awaiting CONTRACTOR's cost proposal. <u>9/22/16</u> – CONTRACTOR is currently completing this work. Final cost is to be adjusted by CONSULTANT and CONTRACTOR. This item is being marked as closed and moved to Section F (Change Orders). THIS ITEM IS CLOSED	CLOSED
I.	COST PLUS WORK	
I7.1	<u>2/18/16</u> – CONTRACTOR performed MPT removal and reinstallation operations for the winter storm Jonas starting on 1/22/16 and ending on 1/27/16. An interim payment was made to CONTRACTOR in Estimate #6 for this work performed. <u>3/24/16</u> – CONTRACTOR has yet to submit backup for winter storm Jonas. CONSULTANT is still awaiting this information. <u>4/28/16</u> – CONTRACTOR has yet to submit backup for winter storm Jonas. CONSULTANT is still awaiting this information. <u>5/26/16</u> – CONTRACTOR stated that justification for work performed during winter storm Jonas will be provided within the next week. <u>6/23/16</u> – CONTRACTOR and CONSULTANT reviewed the cost plus format submitted by CONTRACTOR on 6/12/16. CONSULTANT returned comments on 6/20/16. CONTRACTOR needs to make corrections or rebut CONSULTANT's comments. <u>8/04/16</u> – CONTRACTOR has yet to make corrections or rebut CONSULTANT's comments. <u>8/25/16</u> – CONTRACTOR has yet to make corrections or rebut CONSULTANT's comments. <u>9/22/16</u> – CONTRACTOR has yet to make corrections or rebut CONSULTANT's comments. <u>10/27/16</u> – CONTRACTOR has yet to make corrections or rebut CONSULTANT's comments.	CONTRACTOR
J.	OLD BUSINESS	
J10.1	<u>5/26/16</u> – CONTRACTOR is to deliver components to the yard located on the NBHCE for installation by others. <u>6/23/16</u> – CONTRACTOR has yet to inform CONSULTANT when delivery will occur. <u>8/04/16</u> – CONSULTANT forwarded an e-mail to CONTRACTOR on 3/29 requesting updated information concerning the sign structure's delivery. CONTRACTOR has yet to respond. <u>8/25/16</u> – CONTRACTOR has indicated that SUBCONTRACTOR will be delivering the components in the near future (an estimated 2 weeks) and will coordinate work. <u>9/22/16</u> – SUBCONTRACTOR has delivered these components. THIS ITEM IS CLOSED	CLOSED
J12.4	<u>8/04/16</u> – CONSULTANT asked CONTRACTOR when they expected to install the temporary timber pole mounted signs at the four existing sign structure sites which are designated to have their foundations reconstructed. Currently 2 of the 4 locations are in a	CLOSED

MINUTES OF PROGRESS MEETING NO. 015

	long term shoulder closing but no work has been completed for several months. CONTRACTOR has received a delivery of the needed material from the NJTA and will establish an erecting schedule as soon as they discuss same with their subcontractor, SUBCONTRACTOR. <u>8/25/16</u> – CONTRACTOR is currently in the process of purchasing H1 and H2 type timber poles. Erection operations should occur in the near future. <u>9/22/16</u> – CONTRACTOR installed the temporary sign at 2T44. All other locations require additional site work before the temporary signs can be installed THIS ITEM IS CLOSED	
J13.1	<u>9/22/16</u> – CONTRACTOR scheduled to replace components on 9/16 but was rescheduled to 9/23 due to a conflict on the NSW roadway with the NJDOT. Work is now tentatively scheduled to be done during tomorrow's NSW Roadway closing. <u>10/27/16</u> – This work has yet to be completed. CONTRACTOR is waiting for another NSW roadway closing to access the site.	CONTRACTOR
K.	NEW BUSINESS	
K15.1	<u>10/27/16</u> – CONTRACTOR was informed, with the forthcoming cold weather, that insulated blankets will be required to protect newly placed concrete when nighttime temperatures drop below freezing, per ACI 306. Additional cold weather concreting procedures may also be required during the placement of concrete for the drilled shafts and pedestals.	CONTRACTOR
K15.3	<u>10/27/16</u> – On 10/19 an email was sent that detailed 17 outstanding contract items that CONTRACTOR has to address. At this point, only 1 item was fully addressed and 1 item was partially addressed. This list contains items that have been previously mentioned in meeting minutes and others that have been conveyed via phone or emails to CONTRACTOR. No timeframe has been provided by CONTRACTOR as to when the outstanding issues will be addressed.	CONTRACTOR
L.	PAST WORK PROGRESS (Last 3 Weeks)	
L15.1	<u>10/27/16</u> – Highlights of past work include; • XXXXX • XXXXX • XXXXX	
M.	FOUR WEEK LOOK AHEAD	
M15.1	<u>10/27/16</u> – Anticipated work as follows; • Submit shop drawings for review. • XXXXX • XXXXX • XXXXX • XXXXX • XXXXX • XXXXX	
N.	NEXT MEETING	
N15.1	The tentative project meeting schedule is as follows: <u>10/27/16</u> – At this time, all progress meetings will be held in the XXXXX field office located at INSERT ADDRESS. The next meeting will be distributed by XXXXX for the month of June, unless CONSULTANT determines that an interim meeting is required.	

LEGEND:

ITEM NUMBER	TOPIC	BALL IN COURT / STATUS
	Black text indicates that the meeting minutes for this topic are still "active" and being worked on.	OPEN NJTA CONSULTANT CONTRACTOR DESIGNER
	Upon completion of an item, "THIS ITEM IS CLOSED" will be added to the end of the section. This text will remain black for 1 meeting after the item was deemed closed.	CLOSED

MINUTES OF PROGRESS MEETING NO. 015

	Gray text indicates that the item was previously closed and will be removed from the meeting minutes at the next meeting.	CLOSED

NOTE: These meeting minutes represent the writer's understanding of the proceedings of the meeting. Attendees are requested to review these Minutes for accuracy. Any misrepresentation and/or omission shall be brought to the attention of the writer within (7) seven days of the distribution date. *Corrections to previous Minutes will be shown in italics.* Failure to do so will make the foregoing deemed a reasonably accurate record of the proceedings.

Submitted by:

CONSULTANT ENGINEERING

Distribution: All Attendees

File:

XXXXX XXXXXX, P.E.
Resident Engineer

EXHIBIT 3 - 7 PROGRESS MEETING SIGN-IN SHEET

NEW JERSEY TURNPIKE
INTERCHANGE X TO X WIDENING
CONTRACT TXXXX
ATTENDANCE LIST
JOB PROGRESS MEETING NO. 02
January 05 , 20XX

	<i>Name</i>	<i>Company</i>	<i>Responsibility</i>	<i>Phone</i>	<i>E-mail Address</i>	<i>Initials</i>
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

EXHIBIT 3 - 8 CONSTRUCTION INCIDENT COMMUNICATION PLAN

New Jersey Turnpike Authority Contract No. {Insert Contract No.}
{Insert Contract Description}
{Insert Contract Location}

Construction Incident Communication Plan

This plan provides direction to {Insert Contractor Name} (Contractor) and {Insert Consultant Name} (Consultant). The direction instructs the members of the two organizations on responding to construction incidents that may impact New Jersey Turnpike Authority (NJTA) traffic or facilities in a quick and concise manner. This plan follows the NJTA "Construction Incident Notification Chain".

Construction related incidents are something as minor as a delay in picking up a lane closing to things that affect fiber optic cables and structural damage to bridges.

{Insert Contractor Name} Responsibilities

- Plan and progress Construction Contract {Insert Contract No.} safely with minimal interference to NJTA traffic
- Inform and train all assigned personnel to follow the procedures should a traffic incident occur during their working hours
- Inform and train off-shift patrols to report traffic incidents to the NJTA Operations Department and {Insert Consultant Name} using the established procedures
- Plan and progress the tasks in closed lanes or ramps to insure completion within allocated times.
- Should a construction related incident occur that could delay NJTA traffic, the on-site personnel should immediately notify {Insert Contractor Name} Management using the attached telephone list starting with {Insert Contractor Name} Project Manager.
- {Insert Contractor Name} immediately notifies {Insert Consultant Name} management using the attached telephone list starting with the Resident Engineer followed by the Project Manager.

{Insert Consultant Name}, Inc. Responsibilities

- All assigned {Insert Consultant Name} field staff will be advised of this Construction Incident Communication Plan upon their assignment to the project. {Insert Consultant Name} will train them to implement this plan
- On site staff will monitor construction progress and will notify management of delays.
- If a construction related incident delays a lane opening or traffic, {Insert Consultant Name} Resident Engineer will immediately notify the NJTA representative, {Insert NJTA Project Manager Name} and the NJTA Operations Department. Following these two calls the Resident Engineer will call {Insert Consultant Name}'s Project Manager for assistance if warranted.
- {Insert Consultant Name} Project Management will take immediate action with {Insert Contractor Name} to resolve the incident.

CONSTRUCTION INCIDENT NOTIFICATION CHAIN

NJTA Project Manager:
Process Internally.
Report Incident and Actions taken to:
Supervising, Assistant Chief and Chief Engineer.

Consultant Forces:
Process MPT Related Incidents with Operations or NJSP.
Process Workplace Incidents with Contractor.
Verify Resident Engineer Knowledge.
**REPORT IMMEDIATE ACTIONS TAKEN TO NJTA
PROJECT MANAGER OR SUPV. ENGR.**

Contractor's Forces: Reportable Incidents
MPT Delay, or Excessive Back-Up.
Vehicular Accidents unrelated to Project.
Accidents related to Project.
Workplace accidents with/without injury.
**REPORT IMMEDIATE ACTIONS TAKEN TO ON-SITE
INSPECTOR AND RESIDENT ENGINEER.**

Note:

1. {Insert Consultant Name}, Inc. and {Insert Contractor Name} to document actions taken (after immediate and subsequent response) and to whom Incident Information was conveyed.
2. 24-Hour Contact Information shall be available to ensure proper notification of all relevant personnel (Attached).

New Jersey Turnpike Authority Contract No. {Insert Contract No.}
{Insert Contract Description}
{Insert Contract Location}

Construction Incident Communication Plan

Notification Telephone Number List

New Jersey Turnpike Authority Liaison

Supervising Engineer	{Insert Name}	Office: ### ### #### x #### Fax: ### ### #### Cell: ### ### #### Home: ### ### ####
Project Engineer	{Insert Name}	Office: ### ### #### x #### Fax: ### ### #### Cell: ### ### #### Home: ### ### ####

Engineer: {Insert Consultant Name}, Inc.

Field Office	{Insert Location}	Office: ### ### #### Fax: ### ### ####
Project Manager	{Insert Name}	Office: ### ### #### Cell: ### ### #### Home: ### ### ####
Resident Engineer	{Insert Name}	Office: ### ### #### Cell: ### ### #### Home: ### ### ####

Contractor: (Insert Contractor Name)

Project Manager	{Insert Name}	Office: ### ### #### Fax: ### ### #### Home: ### ### #### Cell: ### ### ####
Superintendent	{Insert Name}	Office: ### ### #### Fax: ### ### #### Home: ### ### #### Cell: ### ### ####
Traffic Safety Supervisor	{Insert Name}	Office: ### ### #### Fax: ### ### #### Home: ### ### #### Cell: ### ### ####

{Insert "Original" or "Revision # - Date of Revision"}
Revision in Bold

EXHIBIT 3 - 9 SAMPLE RFI

New Jersey Turnpike Authority Request for Information - RFI			
Date:	_____	Response Timeframe Requested:	14 Work Days
Contract No:	_____	Contract Name:	_____
RFI No:	#0001	Contractor:	_____
To:	_____	Reference:	_____
Drawing Reference:	_____	Trade Contractor:	_____
Spec Reference:	_____		
Information Required & Proposed Solution:			
Attachments: ☐ Yes ☐ No Potential Impact to: ☐ Schedule: _____ Days: ☐ Cost: \$ _____ Approx.			
Firm: _____			
Firm Name		Signed	
Date		Printed	
Date Required			
Response:			
Firm: _____			
Firm Name		Signed	
Date		Printed	

Construction Manager				Contract No. TXXXX - Proj. Descr.						
Request and Answer Log										
Job No:				Date: 01/01/20XX						
Project No:				Page: 1 of XX						
Type	To	Request From	Number	Issue	Title	Answer	Status	Dated	Responded	Required
RFI	DE	CONTRACTOR	00001		RFI0001 Joint Sealer at Noise Barr		MCN	01/01/20XX	01/01/20XX	01/01/20XX
				A potential caulking subcontractor has asked a question about the thickness of the cold applied joint sealer shown on drawing S-410, sheet 1088. He says that a 1" deep joint will void the warranty of all caulk manufacturers. According to him, the maximum joint depth for sealant is 1/2", with 3/8" being the standard. Can these joints be 3/8" thick rather than 1" thick as shown?		The cold-applied joint sealer should satisfy the contract specifications and be installed in accordance with the manufacturer's recommendations.				
RFI	DE	CONTRACTOR	00002		RFI0002 [REDACTED] TOS and Beam Elev		MCN	01/01/20XX	01/01/20XX	01/01/20XX
				Please find attached RFI # 2HD-1(pdf file) from our subcontractor's detailer summarized as follows: Please refer to the top of steel elevations as shown on Design Drawing 732 of 1483. We believe that there may be an error with the bridge seat elevations at the abutments and piers along Girder Line G3 ([REDACTED]). If we start with the given bridge seat elevations, then we match the top of steel elevations charted on Sheet 732. However, a comparison between our calculated top of slab elevations and the top of web elevations results in a fairly uniform dimension from the top of slab to the top of web, with the exception of Girder Line G3. Girder Line G3 appears to be approximately 2-1/2" high, which would indicate that the bridge seat elevations are in error accordingly. Please review the Top of Steel elevations, and the corresponding bridge seat elevations along Girder Line G3. The shop drawings have been prepared utilizing a constant dimension from the top of slab to the top of web, and are currently in the checking process. Any effort to provide an expeditious reply to this RFI would be greatly appreciated in order to avoid a delay in completing the shop drawings.		For revised top of steel elevations and bridge seat elevations for Girder G3 see Addendum No. 2.				
RFI	DE	CONTRACTOR	00003		RFI0003 HDPE Pipe Subst. of CMP		MCN	01/01/20XX	01/01/20XX	01/01/20XX
				Please find attached RFI from our Subcontractor. They are requesting the substitution of HDPE pipe in lieu of the corrugated metal pipe. (Reference made to NJTA Document Change DCA2010-DM-17)		Please clarify the intended use/location of HDPE pipe as there are currently no corrugated metal pipe pay items in the contract.				
RFI	DE	CONTRACTOR	00004		RFI0004 - Struct. [REDACTED] Bearings		MCN	01/01/20XX	01/01/20XX	01/01/20XX
				A note on the bearing detail sheets in the contract plans states "keeper bars shall be provided for bearing type es similar to guide bars for bearing type el expect with larger guide clearance and no sliding surface." In order to provide these keeper bars there would need to be a significant change in the way the mobile pot bearings are designed. DS Brown does not feel that these guide bars are necessary for proper function of the bearing and request that they be removed.		The guide bars may be eliminated for the "ES" bearings at Structures [REDACTED]				

Primavera®

Report: R_REQUEST_01

EXHIBIT 3 - 10 SUPPLEMENTAL UTILITY WORK ORDER

	
New Jersey Turnpike Authority ADMINISTRATION BUILDING - 581 MAIN STREET P.O. BOX 5042 - WOODBRIDGE, NEW JERSEY 07095 TELEPHONE (732) 750-5300	
SUPPLEMENTAL UTILITY ORDER	
SUPPLEMENTAL ORDER NO. _____	
SUPPLEMENT TO UTILITY ORDER NO. _____	
Issued to: _____	
Original Order Covered: _____	
Cause for Overrun: _____	
Estimated Cost of Original and Prior Supplements:	\$ _____
Supplement Cost:	\$ _____
Total Cost:	\$ _____
This Supplemental Order is your authority for submitting additional billing under the same terms and conditions as the original Utility Order for the increased cost incurred.	
APPROVAL RECOMMENDED	
_____ Acting Director of Law	_____ Chief Engineer
Attest: _____	
_____ Assistant Secretary	_____ Executive Director
Date: _____	
Accepted _____ Utility	
By _____ Signature and Title	Date _____
Attest with Corporate Seal: _____ Type name and title	
Website address http://www.state.nj.us/turnpike	

EXHIBIT 3 - 11 SHOP DRAWING LOG UTILIZING "BALL IN COURT" TRACKING

Construction Manager						Contract No. TXXXX - Proj. Descr.					
Job No: XXXX-XXXX Project No: XXXX-XXXX						Submittals by Ball In Court		Date: 2/12/2014 Page: 1 of X			
BIC	Package	Submittal	Latest Revision	Title	Status	Required		Latest Dates			
						Start	Finish	Received	Sent	Returned	Forwarded
(Construction Manager's Name)											
	200	213.02-001	001	Basin 6B APS Testing Report	UR	6/13/2012	6/27/2012	6/13/2012	6/13/2012		
	200	213.02-002	001	Basin 6B APS Testing Final Rpt	UR	6/18/2012	7/2/2012	6/18/2012	6/19/2012		
(Construction Manager's Name)											
	500	532.02-001	002	Asbestos Abatement Certs & Docs.	UR	6/20/2011	7/4/2011	7/19/2011	7/22/2011		
	500	544.01-001	001	Lead Based Paint Removal - SS	UR	4/18/2012	5/2/2012	4/18/2012	4/18/2012		
(Design Engineer's Name)											
	200	210.02-007	008	Str. 67.08 Etra Rd. Demo Plan	UR	1/28/2014	2/11/2014	2/11/2014	2/11/2014		
	400	427.02-013	002	Noise Barrier 2 - Revised Posts	UR	2/5/2014	2/19/2014	2/5/2014	2/5/2014		
	400	439.02-001	002	68.01-Monmouth St. Pier Protection	UR	1/28/2014	2/11/2014	1/28/2014	1/28/2014		
	900	908.01-051	008	67.89NO & Wall 17 CIP Parapet Det.	UR	2/4/2014	2/18/2014	2/4/2014	2/4/2014		
(Program Manager's Name)											
	100	104.16-002	002	Safe Work Plan	UR	2/23/2012	3/8/2012	2/23/2012	2/28/2012		
(Contractor 001's Name)											
	200	210.02-001	001	Noise Barrier Demolition Plan	MCN	4/6/2011	4/20/2011	4/6/2011	4/6/2011	4/22/2011	4/22/2011
	200	210.02-002	002	Str. 67.89 Partial Deck Demo Plan	MCN	5/31/2011	6/14/2011	5/31/2011	6/14/2011	6/16/2011	6/16/2011
	200	210.02-003	002	Partial Deck Demo for NB Rocky Brk.	MCN	7/28/2011	8/11/2011	7/28/2011	7/29/2011	8/10/2011	8/10/2011
	200	210.02-004	003	Demo Plan for Central Shops	MCN	11/18/2011	12/2/2011	11/18/2011	11/22/2011	12/7/2011	12/7/2011
	200	214.01-001	001	Soil Testing - Monmouth Street	AAR	2/21/2012	3/6/2012	2/21/2012	2/21/2012	2/23/2012	2/23/2012
	200	214.03-001	001	Portable Scale for ID-27 & APS	MCN	6/6/2012	6/20/2012	6/6/2012	6/6/2012	6/6/2012	6/6/2012
	200	214.03-002	002	Export Soil Disp. Facility - OCLF	AAR	6/14/2012	6/28/2012	6/14/2012	6/14/2012	6/15/2012	6/15/2012
	200	214.03-003	001	Alt. Portable Scale for ID-27 & APS	MCN	6/13/2012	6/27/2012	6/13/2012	6/13/2012	6/15/2012	6/18/2012
	200	215.01-001	002	Rocky Brook Stream Diversion Plan	MCN	3/3/2011	3/17/2011	3/3/2011	3/3/2011	3/7/2011	3/8/2011
	200	217.06-002	001	Geotechnical Engineer Resume	REJ	10/25/2011	11/8/2011	10/25/2011	10/25/2011	10/25/2011	10/25/2011
	2006	B2006-02	001	Outdoor Lighting - Salt Dome	REJ	3/15/2011	3/29/2011	3/15/2011	3/23/2011	4/1/2011	4/5/2011
	400	401.03-001	002	Slip Form Parapet Proced & Equipmen	MCN	7/25/2012	8/8/2012	7/25/2012	7/26/2012	10/10/2013	10/10/2013
	400	401.08-001	001	Formwork Systems - Hardware	AAR	2/11/2011	2/25/2011	2/11/2011	2/11/2011	4/21/2011	4/21/2011
	400	401.08-002	001	Pier Cap Forms 66.89 67.47 67.08R..	AAR	8/5/2011	8/19/2011	8/5/2011	8/18/2011	9/6/2011	9/16/2011
	400	401.08-003	001	Pier Cap Forms - 67.27 SO NO 67.47H	MCN	10/6/2011	10/20/2011	10/6/2011	10/6/2011	10/14/2011	10/14/2011

EXHIBIT 3 - 12 SAMPLE TYPE 1 CHANGE ORDER

NEW JERSEY TURNPIKE AUTHORITY				Page 1 of 1		
ABC Contractors CONTRACTOR				Change Order No.: 1		
31 Tannery Road Harborburg, NJ 08876				Contract No.: TXXXX		
TYPE 1 ☒ TYPE 2 ☐ TYPE 3 ☐				Date: 12/15/20XX		
				Interchange 1 to 4 Widening Program Interchange 4 Grading, Paving, and Structures		
Contract Description						
Item No.	Quantities	Unit	Descriptions	Unit Price	Additions	Deductions
62	(148.00)	LF	Driving HP 14 X 89 Piles	\$ 24.00		\$ (3,552.00)
63	(43.00)	LF	Steel HP 14 X 89 Test Piles	\$ 97.00		\$ (4,171.00)
65	(138.00)	LF	Furnishing HP 14 X 89 Piles	\$ 40.00		\$ (5,520.00)
67	1.00	EA	Dynamic Pile Load Tests	\$ 1,509.00	\$ 1,509.00	
SAMPLE TYPE 1 CHANGE ORDER						
The resolution of the above referenced Change Order does not constitute a waiver by the Authority of its Standard Specification set forth in Contract No. TXXXX. The Authority and the Contractor hereby agree and acknowledge that the Authority retains the right to enforce its Standard Specifications and/or the Specification set forth in Contract No. TXXXX with regard to future Change Orders, claims and/or Contracts.						
SUB-TOTAL THIS PAGE				\$ 1,509.00		\$ (13,243.00)
An extension of time is not granted by this Change Order unless provided above.				Total for this Change Order		\$ 1,509.00 \$ (13,243.00)
Accepted: _____ Date _____, 20 ____				Net Additions for this Change Order		\$ (11,734.00)
Contractor: ABC Contractors				From Previous Change Orders		\$ - \$ -
By: _____				Total To Date		\$ 1,509.00 \$ (13,243.00)
Approval Recommended: Date _____, 20 ____				Net Deductions		\$ 11,734.00
XYZ Consultants				Original Amount of Contract		\$ 35,000,000.00
Consulting Engineer				Adjusted Amount of Contract to Date		\$ 34,988,266.00
By: _____				NOTED: Date _____, 20 ____		
Resident Engineer				APPROVED: Date _____, 20 ____		
Approval Recommended: Date _____, 20 ____				Comptroller		
Project Engineer or Construction Supervisor				Chief Engineer		
Approval Recommended: Date _____, 20 ____				Supervising Engineer/Construction Manager		
Supervising Engineer/Construction Manager				Rev. 8/04		

Page 1 of 1

NEW JERSEY TURNPIKE AUTHORITY			TYPE 1 ☒ TYPE 2 ☐ TYPE 3 ☐		Change Order No.: 1	
ABC Contractors CONTRACTOR					Contract No.: TXXXX	
31 Tannery Road Harborburg, NJ 08876					Date: 12/15/20XX	
					Interchange 1 to 4 Widening Program Interchange 4 Grading, Paving, and Structures	
Contract Description						
Item No.	Quantities	Unit	Descriptions	Unit Price	Additions	Deductions
62	(148.00)	LF	Driving HP 14 X 89 Piles	\$ 24.00		\$ (3,552.00)
63	(43.00)	LF	Steel HP 14 X 89 Test Piles	\$ 97.00		\$ (4,171.00)
65	(138.00)	LF	Furnishing HP 14 X 89 Piles	\$ 40.00		\$ (5,520.00)
67	1.00	EA	Dynamic Pile Load Tests	\$ 1,509.00	\$ 1,509.00	
SAMPLE TYPE 1 CHANGE ORDER						
The resolution of the above referenced Change Order does not constitute a waiver by the Authority of its Standard Specification set forth in Contract No. TXXXX. The Authority and the Contractor hereby agree and acknowledge that the Authority retains the right to enforce its Standard Specifications and/or the Specification set forth in Contract No. TXXXX with regard to future Change Orders, claims and/or Contracts.						
SUB-TOTAL THIS PAGE				\$ 1,509.00		\$ (13,243.00)
An extension of time is not granted by this Change Order unless provided above.				Total for this Change Order		\$ 1,509.00 \$ (13,243.00)
				Net Additions for this Change Order		\$ (11,734.00)
Accepted: _____ Date _____, 20____				From Previous Change Orders		\$ - \$ -
Contractor: ABC Contractors				Total To Date		\$ 1,509.00 \$ (13,243.00)
By: _____				Net Deductions		\$ 11,734.00
Approval Recommended: Date _____, 20____				Original Amount of Contract		\$ 35,000,000.00
XYZ Consultants				Adjusted Amount of Contract to Date		\$ 34,988,266.00
By: _____				NOTED: _____ Date _____, 20____ APPROVED: _____ Date _____, 20____		
Consulting Engineer						
Resident Engineer						
Project Engineer or Construction Supervisor						
Approval Recommended: Date _____, 20____				Comptroller		
Supervising Engineer/Construction Manager				Chief Engineer		
☐ CONTRACTOR'S COPY☐ CHIEF ENGINEER'S COPY/FILE☐ ENGINEER'S COPY☐ COMPTROLLER'S COPY						

Rev. 8/04

EXHIBIT 3 - 13 SAMPLE TYPE 2 CHANGE ORDER

NEW JERSEY TURNPIKE AUTHORITY				Page 1 of 1		
ABC Contractors CONTRACTOR				TYPE 1 ☐ TYPE 2 ☒ TYPE 3 ☐		
31 Tannery Road Harborburg, NJ 08876				Change Order No.: 2 Contract No.: TXXXX Date: 12/15/20XX Interchange 1 to 4 Widening Program Interchange 4 Grading, Paving, and Structures		
Contract Description						
Item No.	Quantities	Unit	Descriptions	Unit Price	Additions	Deductions
86	(42.00)	EA	In-Pavement Wireless Sensor	\$ 835.00		\$ (35,070.00)
87	(1.00)	EA	Wireless Access Point, Pole Mount	\$ 9,700.00		\$ (9,700.00)
88	(4.00)	EA	Wireless Access Point, ITSS Mount	\$ 8,200.00		\$ (32,800.00)
143X	1.00	CP	Force Account for Emergency & Routine Roadway & Bridge Repairs	\$ 150,000.00	\$ 150,000.00	
144X	1.00	CP	Force Account for Snow Removal Activities	\$ 100,000.00	\$ 100,000.00	
145X	1.00	CP	Force Account for Savoy Pipeline Trench Restoration Activities	\$ 200,000.00	\$ 200,000.00	
SAMPLE TYPE 2 CHANGE ORDER						
The resolution of the above referenced Change Order does not constitute a waiver by the Authority of its Standard Specification set forth in Contract No. TXXXX. The Authority and the Contractor hereby agree and acknowledge that the Authority retains the right to enforce its Standard Specifications and/or the Specification set forth in Contract No. TXXXX with regard to future Change Orders, claims and/or Contracts.						
SUB-TOTAL THIS PAGE				\$ 450,000.00	\$ (77,570.00)	
An extension of time is not granted by this Change Order unless provided above.				Total for this Change Order		\$ 450,000.00 \$ (77,570.00)
				Net Additions for this Change Order		\$ 372,430.00
Accepted: _____ Date _____, 20____ Contractor: ABC Contractors				From Previous Change Orders		\$ 1,509.00 \$ (13,243.00)
				Total To Date		\$ 451,509.00 \$ (90,813.00)
By: _____ Approval Recommended: Date _____, 20____ XYZ Consultants Consulting Engineer				Net Additions		\$ 360,696.00
				Original Amount of Contract		\$ 35,000,000.00
By: _____ Resident Engineer				Adjusted Amount of Contract to Date		\$ 35,360,696.00
				NOTED: Date _____, 20____		
Approval Recommended: Date _____, 20____ Project Engineer or Construction Supervisor				Comptroller		
				APPROVED: Date _____, 20____		
Approval Recommended: Date _____, 20____ Supervising Engineer/Construction Manager				Chief Engineer		
☐ CONTRACTOR'S COPY ☐ CHIEF ENGINEER'S COPY/FILE ☐ ENGINEER'S COPY ☐ COMPTROLLER'S COPY						
Rev. 8/04						

Attachment to Change Order No. 2, Contract TXXXX

Page 1 of 2

EXPLANATIONS AND JUSTIFICATIONS

Change Order Number Two (2) is being submitted to introduce three (3) new "X" items, and remove three (3) existing line items that will not be required. All items are fully explained below as well as supported in the back-up portion of this change order.

Item Number 86, In-Pavement Wireless Sensor
Item Number 87, Wireless Access Point, Pole Mount
Item Number 88, Wireless Access Point, ITSS Mount

These items are being deleted as a result of a Program wide decision by the Authority to defer the deployment of the proposed Traffic Detection System (TDS) until the Widening Program roadway construction is completed. At that time, a single contract will furnish, install, test and calibrate the TDS before traffic is shifted throughout the inner and outer roadways and ramps. Deferring this work will result in a \$ 77,570.00 deduction to this contract.

Item Number 143X, Force Account for Emergency & Routine Roadway & Bridge Repairs

This item is being created to compensate the Contractor for future emergency and routine roadway and bridge repairs, as directed by the Engineer. Due to the lane shift configurations and access requirements for this contract, work that would typically be accomplished as part of the Authority's annual bridge and roadway repairs contracts cannot be constructed within the widening contract limits. As such, it is anticipated that the Contractor will be called upon by the Engineer to construct unscheduled roadway and bridge repairs over the duration of this contract. Payment for work under this item will be made on a cost plus basis in accordance with Subsection 108.04 of the Contract Specifications. Item No. 143X will provide a ceiling amount of \$ 150,000.00 to compensate the Contractor for future repair work performed. The cost for work performed will be deducted against the balance established by this item to allow for timely payment to the Contractor.

Item Number 144X, Force Account for Snow Removal Activities

This item is being created to compensate the Contractor for additional work associated with snow removal activities within the contract limits. When directed by the Authority, the Contractor will be required to mobilize the necessary labor, equipment and materials to perform snow removal activities, which include but are not limited to the following:

- Remove and/or Reset Maintenance and Protection Traffic Devices;
- Removal of accumulated snow in front of and/or behind the concrete construction barrier (PCCB) resulting from the snow plowing activities of the Authority and/or its agents;
- Removal of accumulated snow from the drainage pockets at the base of the PCCB;
- Removal of accumulated snow from Emergency Pull-Off Areas.

Payment for the work under this item will be made on a cost plus basis in accordance with Subsection 108.04 of the Contract Specifications. Item No. 144X will provide a ceiling amount of \$100,000.00 to compensate the Contractor for recently accomplished and future removal operations.

SAMPLE CHANGE ORDER TYPE 2

EXPLANATIONS & JUSTIFICATIONS

Attachment to Change Order No. 2, Contract TXXXX

Page 2 of 2

EXPLANATIONS AND JUSTIFICATIONS

Item Number 145X, Force Account for Savoy Pipeline Trench Restoration Activities

This item is being created to compensate the Contractor for future Savoy Pipeline trench restoration activities as directed by the Engineer. Due to the substandard compaction of the embankment resulting from the backfilling operations conducted by others during the removal of the abandoned Savoy Pipeline; the Contractor will be called upon by the Engineer to restore areas surrounding the Savoy Pipeline trench. The trench restoration limits will be determined by the Engineer and the level of restoration will be dependent on two conditions. The first one being; areas where the existing trench will impact the performance of the proposed embankment; in these locations the Contractor will be required to remove the existing backfill to a depth determined by the Engineer, followed by embankment construction using standard compaction control. The second condition will be areas as determined by the Engineer where the existing trench impacts construction equipment access. In these areas a temporary solution has been developed as depicted in the detail proposed by the geotechnical engineer of the overall program construction manager (attached in the back-up portion of this change order). Payment for work associated with the trench restoration required under both of the conditions noted above will be made by Item No. 145X and will be on a cost plus basis in accordance with Subsection 108.04 of the Contract Specifications. Item No. 145X will provide a ceiling in the amount of \$200,000.00 to compensate the Contractor for future trench restoration work performed. The cost for work performed will be deducted against the balance established by this item to allow for timely payment to the Contractor.

WE RECOMMEND THAT THIS CHANGE ORDER BE APPROVED.

By: Jim Jones, P.E.
Resident Engineer
ABC Consultants

SAMPLE CHANGE ORDER TYPE 2
EXPLANATIONS & JUSTIFICATIONS

NJTA Contract TXXXX

New Contract Item No. 145X

"Force Account for Savoy Pipeline Trench Restoration Activities"

Backup Documentation

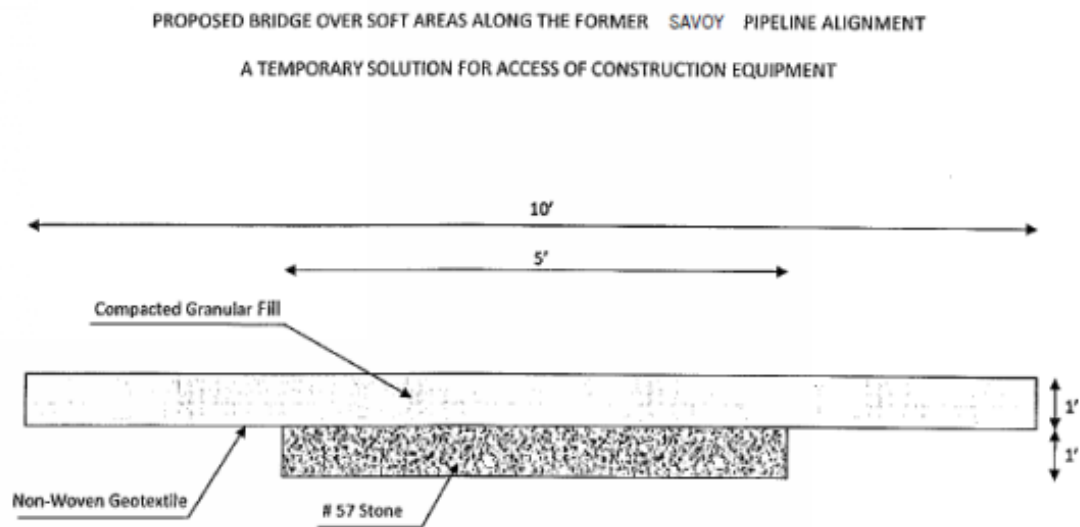
Contractor Proposal: \$ XX,XXX.XX

Engineer's Estimate: \$ XX,XXX.XX

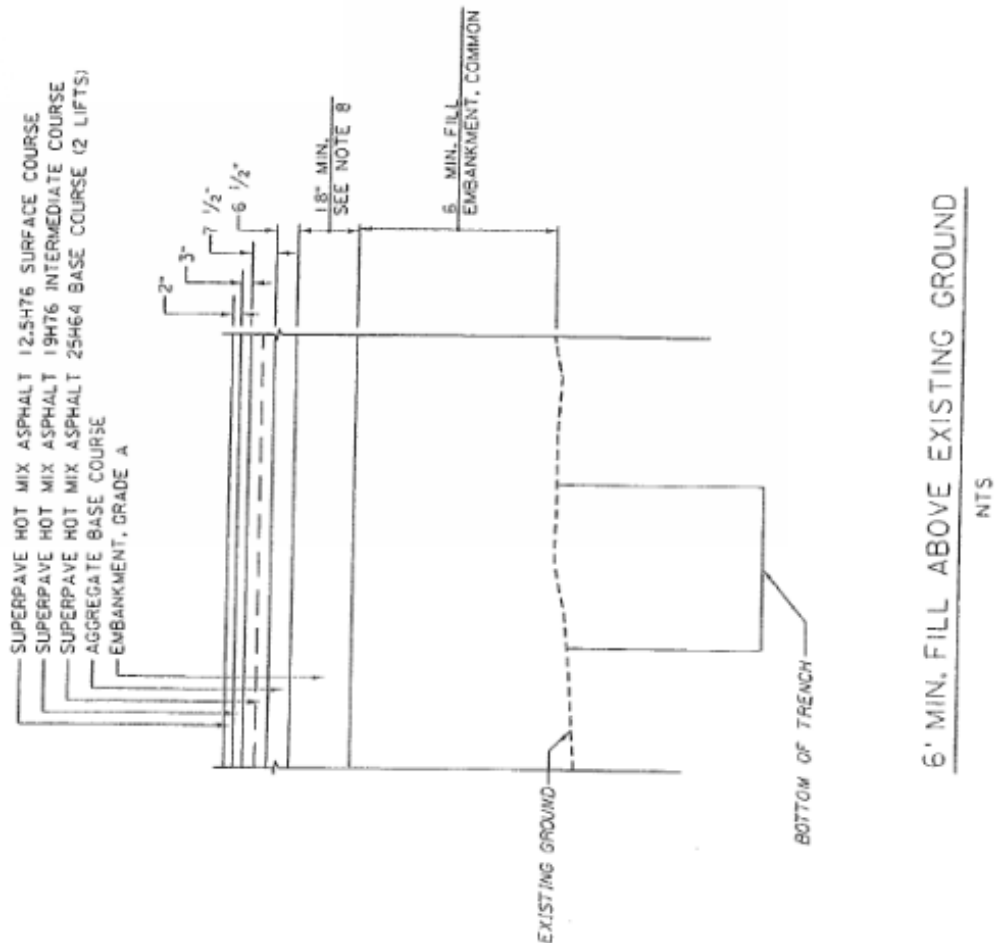
Agreed to Price: \$ XX,XXX.XX

SAMPLE CHANGE ORDER TYPE 2

BACKUP DOCUMENTATION

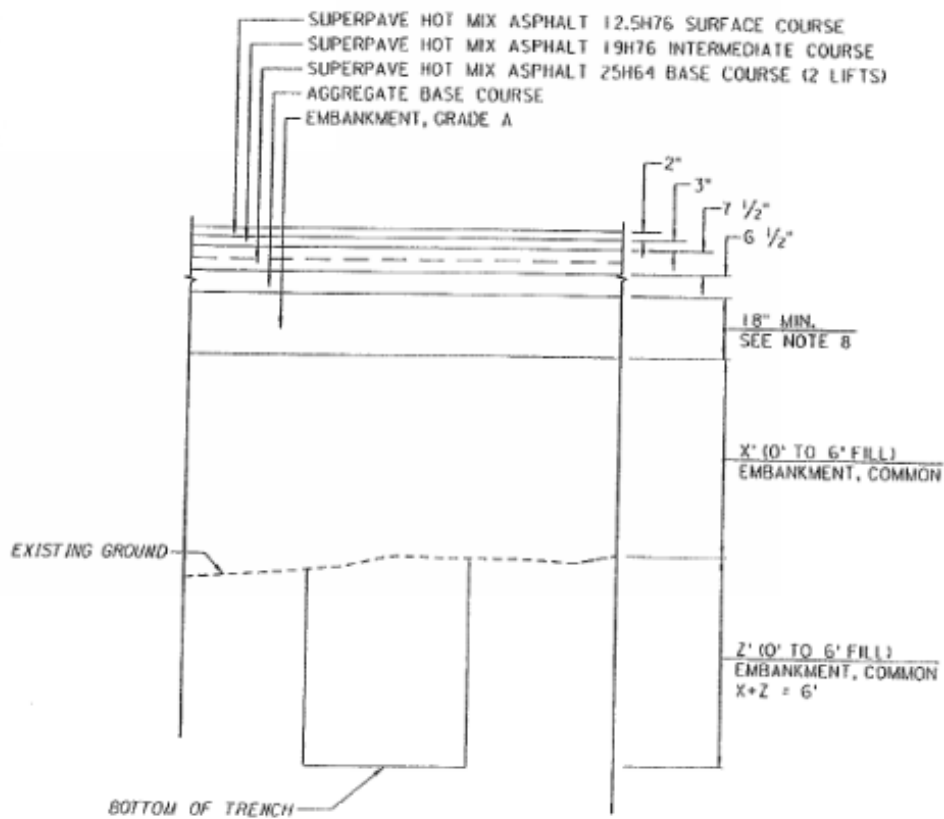


SAMPLE CHANGE ORDER TYPE 2
BACKUP DOCUMENTATION



SAMPLE CHANGE ORDER TYPE 2

BACKUP DOCUMENTATION



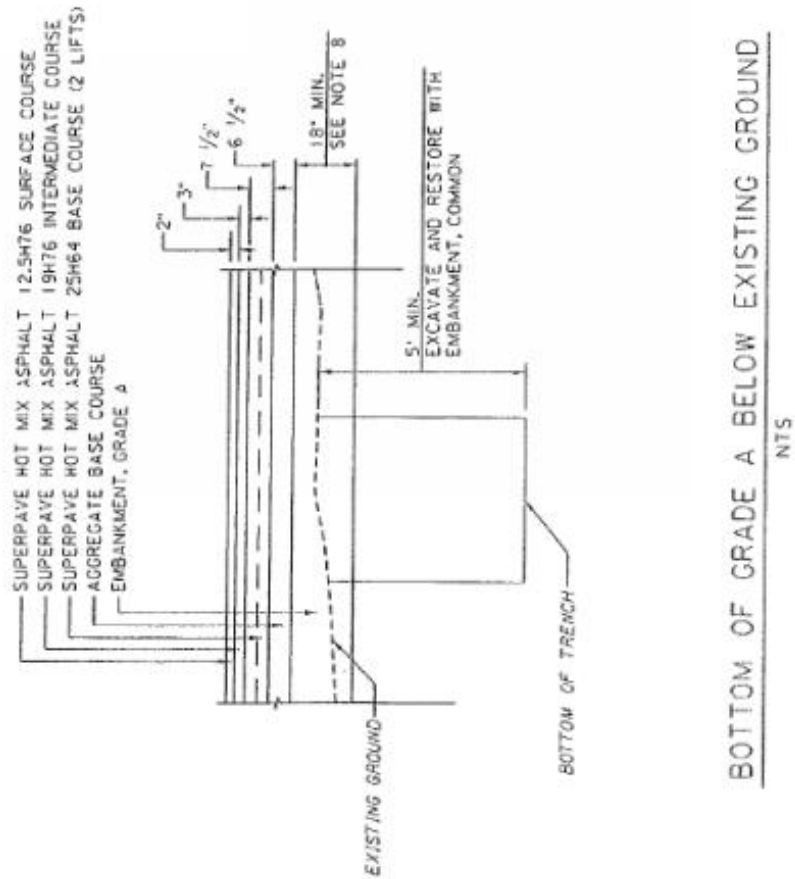
6' MAX. FILL ABOVE EXISTING GROUND

NTS

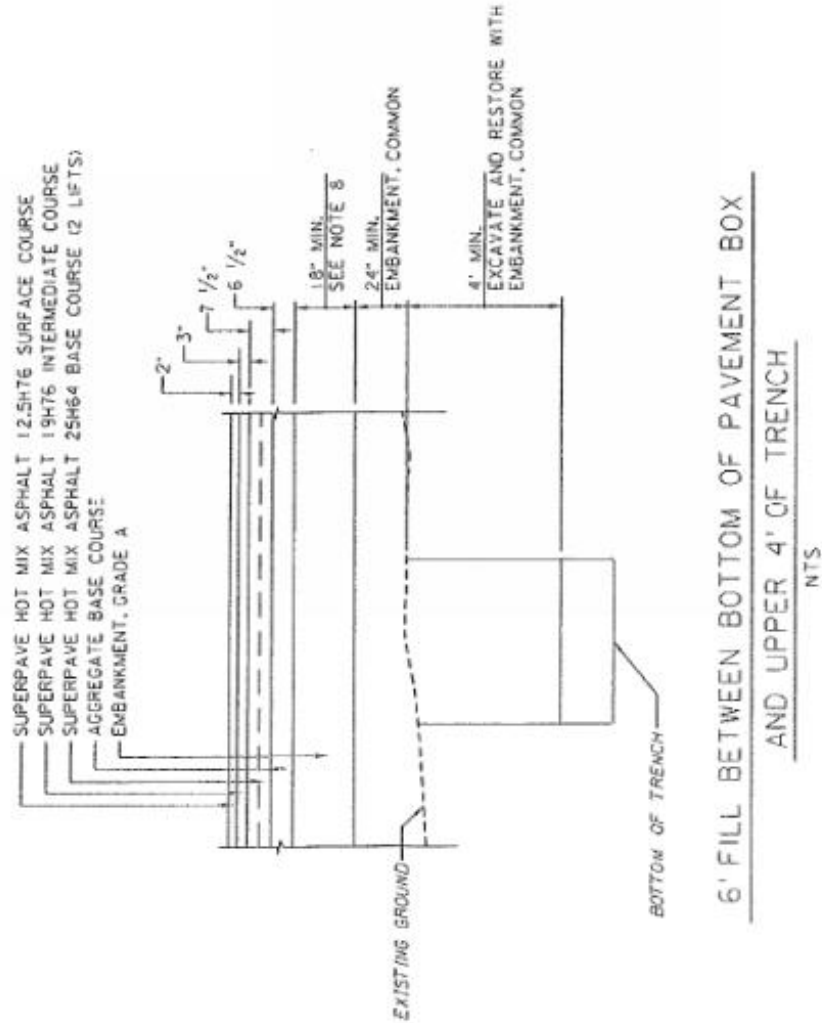
SAMPLE CHANGE ORDER TYPE 2

A

BACKUP DOCUMENTATION

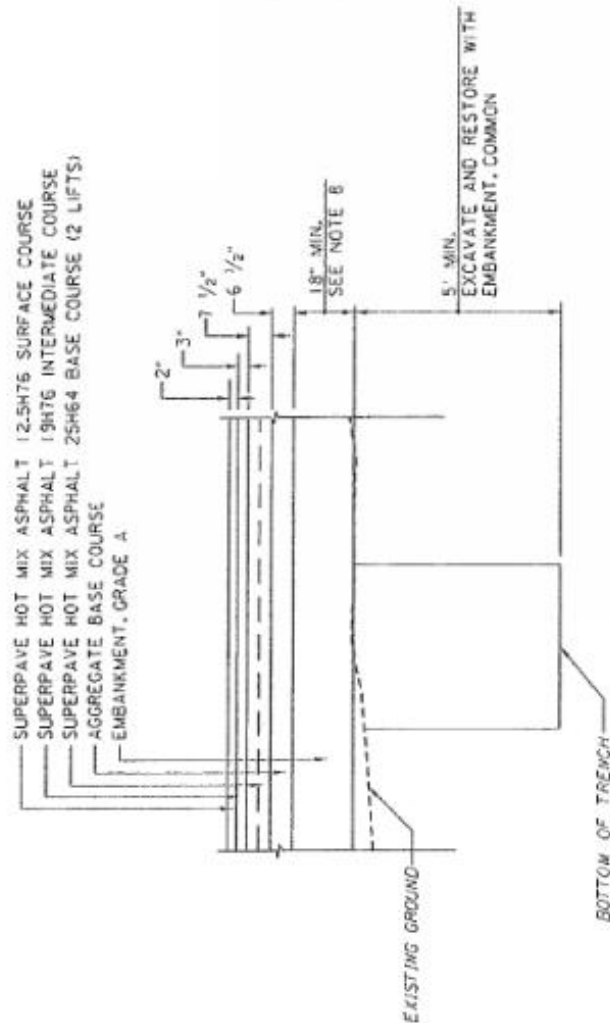


SAMPLE CHANGE ORDER TYPE 2
BACKUP DOCUMENTATION



SAMPLE CHANGE ORDER TYPE 2)

BACKUP DOCUMENTATION



BOTTOM OF GRADE A AT EXISTING GROUND

NTS

SAMPLE CHANGE ORDER TYPE 2
BACKUP DOCUMENTATION

From: [REDACTED]
Sent: Tuesday, March 22, 2011 12:33 PM
To: [REDACTED]
Subject: [REDACTED]
Attachments: image001.png

From: [REDACTED]
Sent: Friday, March 18, 2011 2:28 PM
To: [REDACTED]
Subject: [REDACTED]

Looking at section 4 DCPT results and I'm thinking the following:

- At a minimum the area must be proofrolled and judgment used
- Maintain a minimum of 6ft of compacted fill between the bottom of pavement box (Grade A) and the upper 4ft of trench.
- If less than 6ft of fill is to be placed over the existing ground then the appropriate depth of the surrounding soft ground or trench should be excavated and restored using normal compaction standards and materials as per NJTA Specifications.
- If the bottom of Grade A is at grade, the trench should be excavated to a depth of 4 ft and possibly 5ft.
- If the bottom of Grade A is below existing grade, the trench should be excavated to a depth of 5ft below existing grade.
- After excavation to the appropriate depth the area shall be proofrolled before fill is placed.

For example if the bottom of grade A is 3ft above existing grade, the trench should be excavated 3ft
If the bottom of Grade A is 5ft above the existing grade, 1ft can be excavated, proofrolled and fill placed.
If the bottom of Grade A is 2ft below existing ground the trench should be excavated to a depth of 5ft below existing grade.

Of course all of this must be combined with the judgment of senior field staff.

Have a look at this and give me a call at your convenience.

I'd like to come out and witness some of the placement....Monday OK?

Thanks,
[REDACTED]

SAMPLE CHANGE ORDER TYPE 2

BACKUP DOCUMENTATION

NEW JERSEY TURNPIKE AUTHORITY			Change Order No.: 4			
ABC Contractors CONTRACTOR			Contract No.: TXXXX			
31 Tannery Road Harborburg, NJ 08876			Date: 3/14/20XX			
			Interchange 1 to 4 Widening Program Interchange 4 Grading, Paving, and Structures			
			Contract Description			
Item No.	Quantities	Unit	Descriptions	Unit Price	Additions	Deductions
147X	1.00	LS	Time Extension			
In consideration of an extension of time herewith granted by the Authority, extending the completion date from March 20, 20XX to June 25, 20XX, the contractor releases and discharges the Authority from any and all claims for damages or additional compensation for any delay in or hindrance to the performance of Contract TXXXX occasioned by any act or omission to act by the Authority or any of its representatives, or for any of the reasons enumerated in Standard Specifications 107.06, or for any reason whatsoever and agrees that such claim shall be fully compensated for by an extension of time to complete performance of the work. Original Completion Date: 03/20/XX Revised Completion Date: 06/25/XX The resolution of the above referenced Change Order does not constitute a waiver by the Authority of its Standard Specification set forth in Contract No. TXXXX. The Authority and the Contractor hereby agree and acknowledge that the Authority retains the right to enforce its Standard Specifications and/or the Specification set forth in Contract No. TXXXX with regard to future Change Orders, claims and/or Contracts.						
SUB-TOTAL THIS PAGE				\$	-	\$ -
An extension of time is not granted by this Change Order unless provided above.				Total for this Change Order	\$	-
Accepted: _____ Date _____, 20 ____				Net Additions for this Change Order	\$	-
Contractor: ABC Contractors				From Previous Change Orders	\$ 951,509.00	\$ (90,813.00)
By: _____				Total To Date	\$ 951,509.00	\$ (90,813.00)
Approval Recommended: Date _____, 20 ____				Net Additions	\$	\$ 860,696.00
XYZ Consultants				Original Amount of Contract	\$	\$ 35,000,000.00
Consulting Engineer				Adjusted Amount of		
By: _____				Contract to Date	\$	\$ 35,860,696.00
Resident Engineer				NOTED: _____ Date _____, 20 ____		
Approval Recommended: Date _____, 20 ____				Comptroller		
Project Engineer or Construction Supervisor				APPROVED: _____ Date _____		
Approval Recommended: Date _____, 20 ____				Chief Engineer		
Supervising Engineer/Construction Manager						

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EXHIBIT 3 - 14 SAMPLE TYPE 3 CHANGE ORDER

Page 1 of 1

NEW JERSEY TURNPIKE AUTHORITY			TYPE 1 ☐ TYPE 2 ☐ TYPE 3 ☒		Change Order No.: 3 Contract No.: TXXXX Date: 12/15/20XX Interchange 1 to 4 Widening Program Interchange 4 Grading, Paving, and Structures	
ABC Contractors CONTRACTOR 31 Tannery Road Harborburg, NJ 08876						
Contract Description						
Item No.	Quantities	Unit	Descriptions	Unit Price	Additions	Deductions
146X	1.00	CP	Force Account for Emergency Bridge Repairs to Structure No. 13.5	\$ 500,000.00	\$ 500,000.00	
SAMPLE TYPE 3 CHANGE ORDER						
The resolution of the above referenced Change Order does not constitute a waiver by the Authority of its Standard Specification set forth in Contract No. TXXXX. The Authority and the Contractor hereby agree and acknowledge that the Authority retains the right to enforce its Standard Specifications and/or the Specification set forth in Contract No. TXXXX with regard to future Change Orders, claims and/or Contracts.						
SUB-TOTAL THIS PAGE				\$ 500,000.00	\$ -	
Total for this Change Order				\$ 500,000.00	\$ -	
Net Additions for this Change Order				\$ 500,000.00		
From Previous Change Orders				\$ 451,509.00	\$ (90,813.00)	
Total To Date				\$ 951,509.00	\$ (90,813.00)	
Net Additions				\$ 860,696.00		
Original Amount of Contract				\$ 35,000,000.00		
Adjusted Amount of Contract to Date				\$ 35,860,696.00		
NOTED: Date _____, 20____						
Project Engineer or Construction Supervisor				Comptroller		
Approval Recommended: Date _____, 20____						
Supervising Engineer/Construction Manager				APPROVED: Date _____, 20____		
Chief Engineer						

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Attachment to Change Order No. 3, Contract TXXXX

Page 1 of 1

EXPLANATIONS AND JUSTIFICATIONS

Change Order Number Three (3) is being submitted to introduce one (1) new "X" item, as a result of additional work requested by the Authority. This item is fully explained below as well as supported in the back-up portion of this change order.

Item Number 146X, Force Account for Emergency Bridge Repairs to Structure No. XX.X

This item is being created to compensate the Contractor for the structural repairs required as a result of damage from a tractor trailer accident and fire under existing Structure No. XX.X on the evening of January 14, 20XX. The repairs included structural steel straightening and strengthening to the north and south fascia girders, replacement of all damaged diaphragms, web stiffeners, bearings, replacement of the concrete parapets and associated deck repairs in the span over the southbound roadway. The repairs required immediate attention, and as a result the contractor was directed to mobilize as soon as possible. Payment for the work under this item will be made on a cost plus basis in accordance with Subsection 108.04 of the Contract Specifications. Item No. 146X will provide a ceiling amount of \$ 500,000.00 to compensate the Contractor for the repair work performed. The cost for work performed will be deducted against the balance established by this item to allow for timely payment to the Contractor.

By: Jim Jones, P.E.
Resident Engineer
ABC Consultants

SAMPLE CHANGE ORDER TYPE 3
EXPLANATIONS & JUSTIFICATIONS

EXHIBIT 3 - 15 SAMPLE CHANGE ORDER LOG

NJTA TXXX Change Order Log
SAMPLE CHANGE ORDER LOG

Original Contract Value: \$35,000,000.00									
CO #	Description	Individual Subtotal	CO Subtotal	Total	Contract Amount	Date Drafted	Date Initiated	Date Approved	
1	Item #52 - Driving HP 14 X 89 Piles	(\$3,552.00)				XX/XX/XX	XX/XX/XX	XX/XX/XX	
	Item #53 - Steel HP 14 X 89 Test Piles	(\$4,171.00)							
	Item #55 - Furnishing HP 14 X 89 Piles	(\$5,520.00)							
	Item #57 - Dynamic Pile Load Tests	\$1,509.00							
			(\$11,734.00)	(\$11,734.00)	\$34,988,266.00				
2	Item #96 - In-Pavement Wireless Sensor	(\$35,070.00)							
	Item #97 - Wireless Access point, Pole Mount	(\$9,700.00)							
	Item #98 - Wireless Access Point, ITSS Mount	(\$32,800.00)							
	Item #143X - Force Account for Emergency & Routine Roadway & Bridge Repairs	\$150,000.00				XX/XX/XX	XX/XX/XX	XX/XX/XX	
	Item #144X - Force Account for Snow Removal Activities	\$100,000.00							
	Item #145X - Force Account for Savoy Pipeline Trench Restoration Activities	\$200,000.00							
			\$372,430.00	\$360,696.00	\$35,360,696.00				
3	Item 146X - Force Account for Emergency Bridge Repairs to Structure No. 13.5	\$500,000.00				XX/XX/XX	XX/XX/XX	XX/XX/XX	
			\$500,000.00	\$960,696.00	\$35,860,696.00				
4	147X - Time Extension	\$0.00				XX/XX/XX	XX/XX/XX	XX/XX/XX	
			\$0.00	\$960,696.00	\$35,860,696.00				
5	STATUS PENDING								
	Item #9 - Roadway Excavation, Earth	(\$22,431.00)							
	Item #19 - Verticle Wick Drains	\$12,477.00				XX/XX/XX	XX/XX/XX	XX/XX/XX	
			(\$8,954.00)	\$950,742.00	\$36,701,484.00				
	PENDING UNPROCESSED ISSUES								
	ITS Changes	\$66,700.00							
	LED Lighting	TBD							
	Sanitary Manhole Removal at Access Road	TBD							
	Route XX Doghouse Manhole	\$19,600.00							
	PENDING UNPROCESSED ISSUES TOTAL	\$86,300.00							
	TOTAL CO PROCESSED	\$960,696.00	\$960,696.00	\$960,696.00	\$35,860,696.00				
	TOTAL CO PROCESSED TO DATE AND PENDING CO'S	\$937,042.00	\$937,042.00	\$937,042.00	\$35,937,042.00				

XX/XX/XX

Page 1 of 1

By: John Doe - XYZ Consultants

EXHIBIT 3 - 16 VISITOR WAIVER

INDEMNIFICATION AND WAIVER OF CLAIMS

NEW JERSEY TURNPIKE AUTHORITY
P.O. BOX 5042
WOODBIDGE, NJ 07095-5042

WE/I, the undersigned, in consideration of the granting of permission by the New Jersey Turnpike Authority to enter upon New Jersey Turnpike Authority property do hereby agree to waive any and all claims, causes of action and demands, of whatever nature that may arise in our/my favor, including but not limited to property damage, personal injury, including death, against the New Jersey Turnpike Authority and each of its members, officers, employees and agents by reason of our/my entering upon such New Jersey Turnpike Authority property.

WE/I hereby further agree to defend, indemnify and save harmless the New Jersey Turnpike Authority and each of its members, officers, employees and agents from and against all damages, suits, costs, claims, expenses and judgments of every kind and description including attorneys' fees and court costs, to which the New Jersey Turnpike Authority may be subjected by reason of our/my entering upon New Jersey Turnpike Authority property.

[NAME AND SIGNATURE OF INDIVIDUAL]

[NAME OF COMPANY]

Date: _____

Escort: _____
(Please Print)

Escort: _____
(Signature)

SECTION 4

BRIDGE AND UTILITY CONSTRUCTION INSPECTION

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SECTION 4 – BRIDGE AND UTILITY CONSTRUCTION INSPECTION

4.1. GENERAL

This section is dedicated to some of the more complex procedures and activities associated with the structural tasks for the construction of bridges. This section also calls attention to the complex work associated with pipe jacking and directional drilling. These two activities are the primary method utilized by the Authority for installing utilities under their mainline roadways. Open trench methods are not typically permitted on either mainline roadway, leaving only the two methods for installing sleeves under the roadways. In addition to the requirements stated herein, the Construction Manager shall implement a risk-based inspection approach for bridge and trenchless operations, including pre-activity coordination meetings, review of method statements, verification of monitoring/instrumentation readiness, and documented procedures for settlement, vibration, obstructions, and emergency stabilization. Risk-based inspection measures shall be documented and maintained as part of the Project record, and failure to implement required monitoring or response actions shall require immediate corrective action.

All of these specific tasks are critical to the operation of the Authority's roadways and as such they require close examination/inspection to avoid incidents that could have detrimental effects on either the Authority owned roadways or local/county roadways. For work that may affect adjacent facilities, the Construction Manager shall confirm pre-construction condition documentation, establish thresholds for action (alert/alarm), and implement an escalation protocol that includes immediate notification, work suspension criteria, and corrective action documentation when thresholds are exceeded. Work shall be suspended where threshold limits are exceeded until conditions are evaluated and corrective measures are implemented and documented.

As a means to avoid unforeseen problems, the Construction Manager and the inspection staff will verify that the construction performed by the Contractor and the Contractor's assignees is in conformance with the Contract Plans and Specifications. The Construction Manager will document the Contractor's work in accordance with Section 3.1.10 of this Manual and in the Authority's Construction Management system. Verification shall include confirmation that all required approvals, permits, certifications, and hold points are satisfied prior to work, and that documentation is defensible, traceable, and consistently cross-referenced to pay items, submittals, monitoring data, and corrective actions. Work performed without required approvals or hold point release shall be subject to rejection and corrective action in accordance with the Contract Documents.

The Construction Manager's inspectors shall maintain a daily field diary of the work that they are inspecting. The Construction Manager shall incorporate the diary information into the Construction Management system. A typical daily diary form (Inspector Field Report) is shown as Exhibit 4 - 11. The daily diary form may be modified as needed to meet the Project requirements, but it shall contain the following minimum information:

- Project number and location
- Location of work
- Date of diary
- Weather conditions
- Contractors doing the work

- Size and type of contractor's crew
- Start and end times of work
- Hours worked by crew
- Contractor's equipment list, including time in use and standby time
- Description of work
- Delays, including times and reason for delay
- Instructions, answers, and directives given the contractor
- Quantities of work performed
- Inspector's signature

Where electronic systems are utilized, the diary shall be entered within 24 hours and include time-stamped photographs, geo-referenced location notes when practicable, and links to relevant submittals, sketches, test results, and nonconformance/corrective action records. Failure to maintain complete and timely inspection records may compromise documentation and shall require corrective action.

In addition, the diary should document inspection hold points observed, safety observations and notable hazards, references to applicable pay items, summary of contractor QC testing performed/received, and any conditions that may impact schedule, cost, or claims exposure, including differing site conditions indicators. Observed conditions that may affect safety, structural integrity, or roadway operations shall be reported immediately and documented in the Project records.

A combine field report is shown as Exhibit 4 - 12 which may be used as the Inspector Field Report. An Item Summary Sheet is shown as Exhibit 4 - 13 which may be needed to supplement the Inspector Field Report. Where combined reporting is used, the Construction Manager shall ensure consistency between diaries, quantity tracking, and pay estimate support documentation to maintain an auditable chain of records for final acceptance and closeout. All records shall be complete, traceable, and auditable in accordance with Contract documentation requirements.

4.2. GEOTECHNICAL INSPECTION

4.2.1. Driven Piles

The Authority requires that an inspector be assigned to every pile-driving rig to observe the full driving time for every foundation pile on the Project and prepare reports as outlined in this section. The Construction Manager shall ensure adequate coverage to prevent unobserved driving, including coverage during shift changes, and shall document inspector assignments by rig/date to preserve continuity of inspection records. No pile driving shall proceed without an assigned qualified inspector present, and unobserved driving may be subject to rejection or required verification testing at the Contractor's expense.

Inspection is only as good as the knowledge, experience and qualifications of the inspector. The inspector must understand the operation of the hammer and its accessories, the pile behavior, the soil conditions, and how these three components interact. Most pile installation problems are avoidable if a competent inspector uses systematic inspection procedures coupled with good communication and cooperation with the Contractor and Construction Manager. The inspector must be more than just a "blow

counter". Timely observations, suggestions, reporting, and correction advice can ultimately assure the success of the Project. The earlier a problem or unusual condition is detected and reported by the inspector, the earlier a solution or correction in procedures can be applied, and hence a potentially negative situation can be limited to a manageable size. If the same problem is left unattended, the number of piles affected increases, as do the cost of remediation and the potential for claims or project delays. Thus, early detection and reporting of any problem may be critical to keep the Project on schedule and within budget. Inspectors assigned to pile operations shall be familiar with applicable Specifications, relevant AASHTO/ASTM requirements, and the fundamentals of drivability and wave equation concepts so that field observations are tied to acceptance criteria, stress control, and pile integrity considerations. Inspectors shall document any deviations from approved driving criteria, unusual driving behavior, damage indicators, or refusal conditions and immediately notify the Construction Manager for direction.

The Geotechnical Engineer (GE) shall be involved in the approval process and will assign a Geotechnical Field Representative (GFR) to observe the production. Refer to the Authority's Design Manual for additional information. The Construction Manager shall coordinate communication protocols among the GE, GFR, Contractor, and inspectors, including defined turnaround time for driving criteria updates, documentation of field decisions, and formal distribution of revised criteria to all affected parties. Revised driving criteria shall not be implemented until formally documented and distributed, and unauthorized adjustments to driving parameters shall not be permitted.

There are several items to be checked by the inspector on every pile foundation project for test piles and/or production piles. Test piles may be driven for establishing order lengths or for load testing. Each of these items can be grouped under one of the following areas:

- Review of the foundation design report, and Contract Plans and Specifications prior to the arrival at the Project site.
- Inspection of piles prior to installation.
- Inspection of pile driving equipment before and during operation.
- Inspection of test or indicator piles.
- Inspection during test pile driving and maintenance of driving records.
- Inspection during production pile driving and maintenance of driving records.

The Construction Manager shall require that inspection activities align with required hold points and acceptance checkpoints, and that any nonconformance is documented with corrective action and disposition prior to continuing production work. Pile installation shall not proceed past designated hold points without documented acceptance, and any nonconforming work shall be evaluated and resolved in accordance with the Contract Documents prior to continuation.

The following check list summarizes the tools a pile inspector should have readily available to perform their job:

EXHIBIT 4 - 1 PILE INSPECTOR'S TOOL CHECK LIST

Approved Job Information	Daily Essentials
Project Plans with Revisions	Safety Vest
Standard Specifications	Hard Hat
Supplementary Specifications	Steel Toed Boots
Geotechnical Report	Gloves
Approved Shop Drawings	Ear/Eye Protection
Approved Submittals	Pen/Pencil/Marker
	Safety Harness
Blank Forms	Chalk and Paint
Personal Diary	Scale
Sketch and Note Pads	Measuring Tape
	Watch
Contact Information	Camera
Incident Communication Plan	Clip Board
Map of Nearest Hospitals	Telephone
	Lights

In addition, inspectors should have access to current approved submittals, applicable inspection checklists, and (when utilized) a tablet or device capable of uploading records to the Construction Management system in a secure manner.

4.2.1.1. Inspection of Piles Prior to and During Installation

The inspection check list will be different for each type of pile, but some items will be the same. A certificate of compliance for the piles is generally required by the Specifications. The inspector should obtain this certificate from the Contractor and compare the Specification requirements with the information provided on the certificate. The inspector shall also confirm traceability of pile materials to mill certifications and delivery documentation, including heat numbers where applicable, and verify that storage/handling maintains the condition required for acceptance. The following are specific guidance for each major pile type:

1. Timber Piles

- a) The timber should be of the specified species.
- b) The piles should have the specified minimum length, and have the correct pile toe and butt sizes.
- c) The pile butt must be cut squarely with the pile axis.
- d) The twist of spiral grain and the number and distribution of knots should be acceptable.
- e) The piles should be acceptably straight.
- f) The piles must be pressure treated as specified. Treatment certification shall be provided and verified prior to installation.
- g) The pile butts and/or toe may require banding.

- h) Steel shoes which may be specified must be properly attached.
- i) Pile splices, if allowed by the Contract Plans and Specifications, must meet the Project requirements. Splices shall not be performed without required approvals and shall be inspected and documented prior to acceptance.
- j) Cut off and capping of the piles should be performed as per the Specifications.

In addition, inspectors should confirm that field cuts, damage repair, and treatment/coating touch-up (if permitted) are performed in accordance with the Contract Documents and are documented prior to acceptance. Unapproved field repairs, untreated cuts, or undocumented corrections shall be subject to rejection or corrective action in accordance with the Contract Documents.

2. Precast Concrete Piles

- a) Geometry and other characteristics of the forms. Forms shall conform to approved shop drawings, and deviations shall be corrected prior to casting.
- b) Dimensions, quantity, and quality of spiral reinforcing and prestressing steel strands, including a certificate indicating that the prestressing steel meets Specifications. Mill certifications and prestressing documentation shall be reviewed and retained in the Project records prior to acceptance.
- c) If the pile is to have mechanical or welded splices, or embedded toe protection, the splice or toe protection connection details including number, size and lengths of dowel bars should be checked for compliance with the approved details and for the required alignment tolerance. They should be cast within tolerance of the true axial alignment.
- d) Quality of the concrete (mix, slump, strength, etc.) and curing conditions. Refer to Sections 401 and 434 of the Specifications for methods of testing. Concrete testing results shall meet Specification requirements prior to release, handling, or driving of piles.
- e) Prestressing forces and procedures, including time of release of tension.
- f) Handling and storage procedures, including minimum curing time for concrete strength before removal of piles from forms.
- g) Cut off and capping of the piles should be performed as per Specifications.
- h) Prevent collection of water in formed holes for pier cap reinforcement in order to prevent freezing and pile cracking. Accumulated water or debris shall be removed prior to reinforcement placement or freezing conditions to prevent damage.

Inspectors should also verify that lifting points, storage supports, and handling equipment prevent cracking and spalling, and that any observed damage is evaluated, documented, and dispositioned prior to driving.

Cracked, spalled, or otherwise damaged piles shall not be driven until evaluated and accepted in accordance with the Contract Documents.

3. Steel H-Piles

- a) The piles should be of the specified steel grade, length, or section/weight. Mill certifications shall be verified and retained in the Project records prior to acceptance.
- b) Pile shoes, if required for pile toe protection, should be as specified. Improper or damaged pile shoes shall be corrected or replaced prior to driving.
- c) Splices should be either proprietary splices or full penetration groove welds as specified. The top and bottom pile sections should be in good alignment before splicing. Misaligned or nonconforming splices shall be rejected or corrected in accordance with the Contract Documents prior to driving.
- d) Pile shoe attachments and splices must be welded properly. Refer to Section 406 of the Specifications for inspection of welds detail. All welds shall be inspected and accepted in accordance with Specification requirements prior to continuation of pile driving.
- e) The piles being driven must be oriented with flanges in the correct direction as shown on the plans. Because the lateral resistance to bending of H-piles is considerably more in the direction perpendicular to flanges, the correct orientation of H-piles is very important and cannot be overstated.
- f) There should be no observable pile damage, including deformations at the pile head. Damaged piles shall not be accepted and shall be repaired or replaced in accordance with the Contract Documents.
- g) Coal tar, zinc paint or other coating should be applied as per the Specifications and free from damage, in areas of splicing shoes and additional pile lengths the coating should be field applied in the affected zone as per the Contract Documents. Coating damage shall be repaired prior to acceptance in accordance with Specification and manufacturer requirements.
- h) Cut off and capping of the piles should be performed as per Specifications.

The inspector should also verify that coating repairs are performed under acceptable surface preparation and environmental conditions when required by the coating manufacturer and Contract Documents, and that repaired areas are documented and re-inspected prior to acceptance. Improperly prepared or undocumented coating repairs shall be subject to rejection or corrective action.

4. Cast-In-Place Piles or Casings

- a) The piles should be of specified steel grade, length, or minimum section/weight (wall thickness) and either seamless or spiral welded as specified. Material certifications shall be verified and retained in the Project records prior to installation.

- b) Piles should be driven either open-ended or closed-ended. Closed-ended pipe piles should have bottom closure plates or conical points of the correct size (diameter and thickness) and be welded on properly, as specified. Open end pipe piles should have cutting shoes that are welded on properly. Refer to Section 406 of the Specifications for inspection of welds detail.
- c) The top and bottom pile sections should be in good alignment before splicing
- d) Splices or full penetration groove welds should be installed as specified.
- e) There should be no observable pile damage, including deformations at the pile head. After installation, closed-end pipes should be visually inspected for damage or water prior to filling with concrete.
- f) and any casings found to contain water or exhibiting damage shall be evaluated and corrected prior to concrete placement and coating deficiencies shall be repaired prior to acceptance in accordance with Specification requirements

The inspector should also confirm that concrete placement procedures (including mix requirements, tremie methods if applicable, and prevention of segregation) follow the Contract Documents, and that any water intrusion, debris, or obstruction is addressed and documented prior to placement. Concrete shall not be placed until casing conditions are verified as acceptable and any nonconforming conditions are corrected and documented.

4.2.1.2. Inspection of Driving Equipment

A typical driving system consists of crane, leads, hammer, hammer cushion, helmet, and in the case of concrete piles, a pile cushion. Each component of the drive system has a specific function and plays an important role in the pile installation. The Contract Plans and Specifications may specify or restrict certain items of driving equipment. The inspector must check the Contractor's driving equipment and obtain necessary information to determine conformity with the Contract Plans and Specifications prior to the commencement of installation operations. Prior to beginning work, the inspector and Construction Manager shall verify that the driving system configuration matches the approved submittals and that any field substitutions are reviewed and approved in writing before driving proceeds. Driving operations shall not begin until the equipment configuration is verified and accepted in accordance with the Contract Documents.

Certifications that the equipment is in working order should be supplied by the Contractor prior to use. Where applicable, calibration or verification records for gauges, monitoring devices, and hammer energy measurement systems shall be provided and retained in the project record. Incomplete, expired, or missing certifications or calibration records shall require correction prior to use of the equipment, and unauthorized or nonconforming equipment shall not be permitted for pile driving operations.

1. Hammers

The Specifications under Section 405 discuss this equipment at length. The Construction Manager should clearly review these Specifications. Pile hammers can be categorized in two main types, impact hammers and vibratory hammers. There are numerous types of impact hammers having variations in the types of power source, configurations, and rated energies. All hammer equipment shall conform to the approved submittals and Specification requirements prior to use.

Hammer types include:

- Drop hammers
- Single acting air/steam hammers
- Double acting air/steam hammers
- Differential acting air/steam hammers
- Single acting open end diesel hammers
- Double acting closed end diesel hammers
- Hydraulic hammers
- Vibratory hammers

It is important that the Contractor and the Construction Manager choose the proper hammer for efficient use on a given Project. A hammer which is too small may not be able to drive the pile to the required capacity, or may require an excessive number of blows. On the other hand, a hammer which is too large may damage the pile. The use of empirical dynamic pile formulas to select a hammer energy should be discontinued because this approach incorrectly assumes these formulas result in the desired pile capacities. Results from these formulas become progressively worse as the complexity of the hammers increase. A wave equation analysis, which considers the hammer cushion-pile-soil system, is the recommended method to determine the optimum hammer size. Where wave equation analysis is required or submitted, the Construction Manager shall verify that field conditions (pile type, hammer, cushions, stroke/energy settings, and soil profile assumptions) match the analysis, and shall require updates if the driving system configuration or subsurface conditions change. Pile driving shall not proceed with a hammer or configuration that deviates from the approved analysis without written authorization and updated evaluation.

Also related to hammer selection is pile drivability which refers to the ability of a pile to be driven to a desired penetration depth and/or capacity. Engineering analysis methods are meaningless if the pile cannot be driven to the required design depth and ultimate capacity without sustaining damage. The limit of pile drivability is the maximum soil resistance a pile can be driven against without sustaining damage or a refusal driving resistance with a properly sized driving system. The Construction Manager shall require documentation of refusal criteria, stop-work triggers, and evaluation steps to be followed when refusal or near-refusal conditions are encountered. Pile driving shall be suspended when refusal or damage

indicators are reached until evaluation and direction are provided in accordance with the Contract Documents

Primary factors controlling the ultimate geotechnical capacity of a pile are the pile type and length, the soil conditions, and the method of installation. Since the pile type, length and method of installation can be specified, it is often erroneously assumed that the pile can be installed as designed to the estimated penetration depth. However, the pile must have sufficient drivability to overcome the soil resistance encountered during driving to reach the estimated or specified pile penetration depth. If a pile section does not have a drivability limit in excess of the soil resistance to be overcome during driving, it will not be drivable to the desired pile penetration depth. When drivability concerns arise, the Construction Manager shall coordinate prompt review with the GE/GFR to evaluate potential adjustments including hammer selection, driving parameters, predrilling approval, splice planning, or design modifications as permitted by the Contract Documents. Any changes to the approved driving method or equipment shall require formal review and written authorization prior to implementation.

2. Rigs

Rig selection is limited by the following factors:

- Leads must be fixed for production piles. Extendable leads are sometimes necessary, for example, in areas where the rig must sit above the excavation, preventing the hammer from reaching pile heads below a certain elevation. The extendable leads should be constructed in such a manner that the hammer is given firm lateral support, and is within the extension at all times during the latter stages of driving. Leads shall conform to approved submittals and shall be maintained in stable and aligned condition throughout driving operations
- The rig, if of the crawler or truck-crane type, should have counterweight sufficient to fully counteract the weight of the boom, leads, hammer, and largest pile anticipated regardless of whether the driving is done parallel with the longitudinal axis of the rig or square with that axis. Insufficient counterweight or unstable configuration shall require correction prior to continuation of pile driving operations.
- The boom and leads should be of a length sufficient to handle the longest pile section anticipated, and inadequate boom or lead length that compromises safe handling or alignment shall not be permitted.

The inspector should verify the rig's stability, exclusion zones, and safe operating radius controls, and confirm that lifting and rigging practices comply with applicable safety requirements and site-specific plans. Unsafe rig conditions or noncompliant lifting and rigging practices shall require immediate corrective action and may result in suspension of operations until compliance is achieved.

3. Hammer Cushion

The hammer cushion being used should be checked to confirm it is of the approved material type, size and thickness. The main function of the hammer cushion is to protect the hammer itself from fatigue and high frequency accelerations which would result from steel to steel impact with the helmet and/or pile. The hammer cushion should have the proper material and same shape/area to snugly fit inside the helmet (drive cap). If the cushion diameter is too small, the cushion will break or badly deform during hammer blows and become ineffective. The hammer cushion must not be excessively deformed or compressed. Some air/steam hammers rely upon a certain total thickness (of cushion plus striker plate) for proper valve timing. Hammers with incorrect hammer cushion thickness may not operate, or will have improper kinetic energy at impact. Since it is difficult to inspect this item once the driving operation begins, it should be checked periodically, daily basis, before the Contractor starts pile driving. The Construction Manager shall ensure that cushion inspection and replacement events are recorded in the driving log, including time, cushion type, and thickness, to support interpretation of blow counts and energy transfer. Nonconforming or deteriorated cushions shall be replaced prior to continuation of driving, and failure to maintain proper cushion condition may invalidate driving records and acceptance.

A hammer cushion of manufactured material usually lasts for many hours of pile driving (as much as 200-hours for some manufactured materials), so it is usually sufficient to check before the pile driving begins and periodically thereafter. Pile cushions (usually made of plywood) need frequent changing because of excessive compression or charring and have a typical life of about 1000 to 2000 hammer blows. Pile cushions should preferably be replaced as soon as they compress to one half of the original thickness, or if they begin to burn. No changes to the pile cushion thickness should be permitted near final driving. The required penetration resistance for pile acceptance should only be allowed after the first 100 blows after cushion replacement. The Construction Manager shall confirm that inspectors apply this requirement consistently and document when acceptance blow counts begin following cushion replacement to prevent disputes over capacity verification, and driving performed without compliance with cushion replacement and acceptance criteria shall be subject to review and may require re-evaluation or additional verification.

4. Helmet

The helmet (drive cap) should properly fit the pile. The purpose of the helmet is to hold the pile head in alignment and transfer the impact concentrically from the hammer to the pile. The helmet also houses the hammer cushion, and must accommodate the pile cushion thickness for concrete piles. The helmet should fit loosely to avoid transmission of torsion or bending forces, but not so loosely as to prevent the proper alignment of hammer and pile. Helmets should ideally be of roughly similar size to the pile diameter. Although generally discouraged, spacers may be used to

adapt an oversize helmet, provided the pile will still be held concentrically with the hammer. A properly fitting helmet is important for all pile types, but is particularly critical for precast concrete piles. A poorly fitting helmet often results in pile head damage. Check and record the helmet weight for conformance to wave equation analysis. Larger weights will reduce the energy transfer to the pile. The inspector should document helmet fit observations and any spacers used, including configuration and condition, and notify the Construction Manager if alignment issues or repeated head damage is observed so corrective actions are implemented promptly. Nonconforming helmet fit or repeated pile head damage shall require immediate corrective action and evaluation prior to continuation of driving.

5. Lead System

The lead system being used must conform to Section 405 of the Specifications. The leads perform the very important function of holding the hammer and pile in good alignment with each other. Poor alignment reduces energy transfer as some energy is then imparted into horizontal motion. Poor alignment also generally results in higher bending stresses and higher local contact stresses which can cause pile damage. This is particularly important at end of driving when penetration resistance is highest and driving stresses are generally increased. The Authority's Specifications required fixed leads that are adequately secured to maintain their alignment. The ends of the leads shall be set into the ground and hanging leads are not allowed by the Specifications. A pile gate at the lead bottom which properly centers the pile should be required, as it helps maintain good alignment. The inspector shall verify lead plumbness/alignment checks at the start of each shift and after any move, and document any adjustments made to maintain alignment and reduce bending-induced damage risk. Driving operations shall be suspended if alignment cannot be maintained within acceptable tolerances.

6. Sinking Pile

Predrilling, jetting, or spudding equipment, when approved by the Geotechnical Engineer, should be available for use and meet the requirements. The depth of predrilling, jetting, or spudding should be very carefully controlled so that it does not exceed the allowable limits. Predrilling, jetting, or spudding below the allowed depths will generally result in a reduced pile capacity, and the pile acceptance may become questionable. Any predrilling/jetting/spudding shall be documented by location, depth, method, and time, and verified against approved limits, with records retained to support acceptance and to reduce claims risk. Unauthorized or excessive predrilling/jetting/spudding shall require evaluation and may result in rejection or reduced acceptance capacity.

7. Driving Accessories

The use of followers is prohibited unless approved in writing by the Construction Manager. Any approved follower use shall include written acceptance criteria, documented length/configuration, and confirmation

that driving records account for follower effects in accordance with the Contract Documents and GE guidance. Unauthorized use of followers shall constitute noncompliant work and may invalidate pile acceptance.

4.2.1.3. **Inspection of Pile Driving**

1. Inspection of Test or Indicator Piles

The test piles are often the most critical part of the foundation installation. The safe bearing capacity of piles will normally be determined by static loading tests conducted on selected piles previously driven, or by dynamic load test equipment conducted on selected piles during driving or subsequently by re-driving. When required, the Contractor shall make static pile loading tests or dynamic pile loading tests. Static loading tests shall be made on selected piles previously driven as test piles, as described above, or production piles. Dynamic load tests shall be conducted on selected piles during driving or subsequently by re-driving utilizing the Globe Pile Driving Analyzer (PDA) equipment performed by a firm experienced in the use of the equipment. Testing activities shall be treated as inspection hold points when required by the Contract Documents, and driving criteria updates resulting from test results shall be documented, approved, and distributed before production proceeds. Production pile driving shall not proceed until test results are reviewed and accepted in accordance with the Contract Documents.

The procedures and driving criteria established during this testing phase will be applied to all subsequent production piles. The largest savings are often found at this time. For example, test results may determine that the design pile length results in a greater pile capacity than required and that the piles could be made substantially shorter. Alternatively, problems with the test piles are usually followed by the same problems with production piles. Since problems are in themselves costly, and if left unresolved may eventually escalate, determination of the best solution as quickly as possible should be accomplished. It is the inspector's responsibility to be observant and communicate significant observations precisely and in a timely manner to the design and testing teams. The Construction Manager shall ensure that field observations are recorded with sufficient detail (times, measured values, equipment settings, and locations) to support rapid engineering evaluation and defensible decision-making.

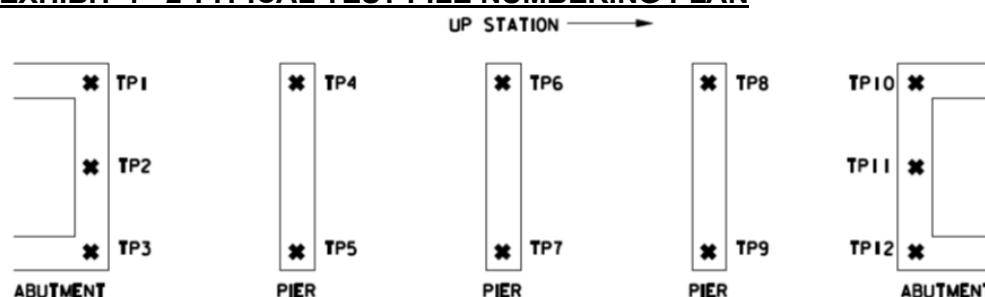
Test piles are often driven before the installation of production piles in order to verify that design bearing capacity can be achieved at the penetration desired and as an aid in determining production pile order lengths and capacity blow counts. However, in many areas throughout the Authority's roadway, reference to existing pile data may be available. If test piles are to be installed, the length to be driven should be determined by the Geotechnical Engineer, the choice being based on penetrations shown on the plans and as modified by an inspection of the boring logs. The length of the test pile should be greater than the estimated pile length in order to provide for variation in soil conditions. Payment for test piles shall be as specified in the Specifications. They are typically paid for on the linear foot

basis, for the length driven and left in place; while test pile cutoffs are not typically paid for. Where historical pile data is referenced, the Construction Manager shall confirm applicability to the specific structure location and subsurface conditions, and document how such data was used in establishing the test program approach.

The actual installation of test piles should be preceded by the setting up of a system of numbering. The numbering should be continuous from left to right in each structural unit (abutment footings, pier footings) as one faces up-station and should progress from structural unit to structural unit in an up-station direction, being continuous throughout the entire structure. The numbering system shall be used consistently across all inspection reports, test reports, pay records, and as-built documentation to prevent discrepancies during final estimate and record drawing preparation. Inconsistent or incomplete identification of test piles shall require correction prior to acceptance of records or test results.

A sample Typical Test Pile Numbering plan is provided herein.

EXHIBIT 4 - 2 TYPICAL TEST PILE NUMBERING PLAN



Each inspector should have, before test pile driving begins, records of all borings in the area, plotted to scale in addition to subsurface profiles taken from the foundation report. There should also be available tables or graphs that indicate the approximate driving resistance of the type pile being driven for a range of blow counts encompassing the blow count required for the desired bearing capacity. These blow count bearing capacity tables or graphs should be made up for several hammer speeds near and at the manufacturer's designated speed (in the case of double-acting hammers). The Construction Manager shall ensure that current revisions and approved criteria are available at the point of work and that outdated criteria are removed from use to prevent field errors. Use of superseded or unapproved criteria shall require immediate correction and may invalidate recorded driving data.

Each test pile should be marked off in feet for its entire length. Comments on driving technique will be found in the section on production pile driving and apply here. Where final penetration resistance is tracked in inches, pre-marking should include inch increments over the anticipated final driving zone to improve accuracy. Improper or missing pile markings shall

be corrected prior to driving to ensure accurate penetration and blow count recording.

A Pile Driving Log will be made out for each test pile as well as all the production piles. A Test Pile Log-Continuous Pile Driving will be made out for each test pile driven on the Project and for any other piles where a log of continuous pile driving is desired. The standard Pile Driving Log and Test Pile Log are found as Exhibit 4 - 14 and Exhibit 4 - 15. Where electronic logging is used, the log shall be locked after entry and corrections shall be tracked with date/time and author identification to maintain record integrity. Incomplete or altered records without proper traceability shall not be accepted as valid documentation.

This report may require several pages per pile depending on the depth to which the pile is driven. Consult the Specifications for each contract to determine the method of test pile payment for a particular contract. The Construction Manager shall ensure that reporting format supports both engineering evaluation and pay support, including clear identification of driven length, cutoff length, splices, and test events. Insufficient or unclear documentation may delay evaluation, acceptance, or payment and shall require correction.

In the case of a timber pile, the tip diameter should be measured and recorded, as well as the butt diameter. The latter is measured at a designated distance from the butt (per AASHTO M168), and this distance should be so recorded. The pile length should be entered on the report, and if the pile is made up in sections, the lengths used in the make-up should be recorded on the first sheet under Pile Driving Summary. If trimming is necessary during driving or if a cut-off is made after driving, this information should be entered on the remarks. All measurements and remarks should be made in a manner that supports traceability and later verification, including reference to pile identification marks and delivery documentation.

The following columns must be filled in during the course of driving, penetration below ground in blows per foot, steam pressure (or air as the case may be) in lbs., and strokes per minute. Any pertinent remarks during the course of driving should be entered in the remarks column. The remarks would include such information as breakdowns, unusual pile or equipment behavior, shutdown and start-up times, reasons for shutdown, etc. After completion, each test pile report should be turned into the Construction Manager for further processing. Turn-in shall occur promptly (preferably same day) to enable timely engineering review and to ensure field issues are addressed before production driving progresses. Delayed submission of driving logs may require re-evaluation of driving data prior to continuation of production work.

Test pile driving should be continuous once driving has started (except for shutdowns incident to splicing). At no time should the Contractor be allowed to cease driving for a prolonged period of time. If a prolonged shutdown necessitated by equipment failure occurs during driving of a test pile, an

adjacent plumb pile location should be used as a new test pile location. The Construction Manager shall document shutdown durations and reasons, and coordinate with the GE to determine whether re-drive/setup effects require revised evaluation of capacity and criteria. Failure to properly document shutdowns and re-drive conditions may require additional testing or evaluation prior to acceptance of pile capacity.

2. Ordering Production Pile Lengths

The GE shall prepare pile driving criteria based on load test data and test pile driving record. The Specifications require that the Contractor prepare an itemized pile order list (pile driving criteria) which must be approved by the Construction Manager before the actual ordering of the piles. The list should show the number of each pile length ordered and in what portion of the structure they are to be driven. The Construction Manager's check of the list should verify that the pile lengths will allow for reasonable variations in penetration. Approval shall include verification that anticipated splices, cutoff allowances, and drivability considerations are accounted for, and that the order list aligns with sequencing constraints and foundation geometry.

3. Inspection of Production Piles

During the production pile driving operations, the inspector's function is to apply the knowledge gained from the test program to each and every production pile. Quality assurance measures for the pile quality and splices; hammer operation and cushion replacement; overall evaluation of pile integrity; procedures for completing the piles (e.g. filling pipe piles with concrete); and unusual or unexpected occurrences need to be addressed. Complete documentation for each and every pile must be obtained, and then passed on to the appropriate destination in a timely manner. The Construction Manager shall ensure that unusual occurrences are evaluated consistently, that corrective actions are documented and closed, and that production decisions are supported by records adequate for engineering validation and dispute avoidance. Production pile installation shall not proceed where unresolved nonconformances, integrity concerns, or deviations from approved criteria exist.

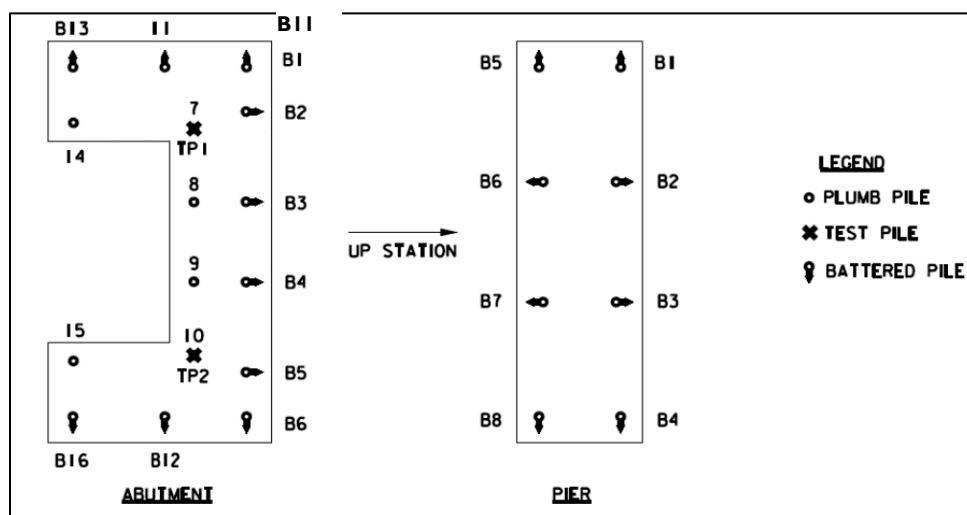
Before driving of production piles begins, the Construction Manager should prepare a pile numbering sheet (if none has been included in the plans). The system of pile numbering, for the sake of clarity and uniformity throughout the Authority's roadway should be as follows:

- The numbering should run from left to right on each structural unit (abutment footings, pier footings) as one faces up-station and should commence at the high station side of the structural unit and proceed to the low station side row by row.
- Each structural unit should have its own numbering sequence.

- Test piles should be included in the general pile numbering and should also bear the test pile numbering as discussed previously under "Inspection of Test Piles or Indicator Piles".
- Batter pile numbers should have the prefix "B", as shown herein.

The pile numbering system shall be used consistently across all inspection logs, driving records, test reports, pay documentation, and as-built records to maintain traceability and prevent discrepancies.

EXHIBIT 4 - 3 PILE NUMBERING SHEET



The inspector should be supplied with a pile plan with the piles numbered thereon as specified above and with a full set of the results of borings in the area, plotted to scale, which should show the underground stratification. Also needed are tables or graphs indicating the approximate bearing capacity of the type pile being driven for a range of blow counts encompassing the blow count required for the desired bearing capacity. These blow count-bearing capacity tables or graphs should be speeds near and at the manufacturer's designated speed (in the case of double-acting hammers). The Construction Manager shall verify that the inspector's reference documents reflect the latest approved revisions and that any addenda affecting criteria are incorporated prior to driving.

As incidental equipment, the inspector should have a clipboard, a watch equipped with a sweep second hand (for counting hammer blows), a good flash light (for illuminating cast-in-place pile interiors), a 100-foot tape and a 6-foot ruler. Additional equipment should include a camera or device capable of photographing pile condition and splices, and where used, access to digital reporting tools to improve record traceability.

The Construction Manager should conduct a meeting, prior to commencement of driving, at which responsible Contractor's personnel,

the Construction Manager and the pile inspectors should be in attendance. Subsurface and surface conditions should be outlined and discussed. Minimum and maximum driving requirements should be stated and the reasons for their adoption given. Driving procedures should be outlined, covering driving sequence, handling and storage of piles, the need for complete excavation prior to driving, and the necessity for safety. Objectionable practices should be mentioned, such as retardation of stroke, breaking of the hammer suspension cable, driving out of alignment, and the insertion of wood chips in the driving head during driving. The need for correct hammer speed in the case of double-acting hammers and full stroke for single-acting hammers should be emphatically stressed. Meeting minutes shall be prepared and retained, and shall include communication protocols, stop-work triggers, vibration/settlement monitoring requirements when applicable, and escalation procedures for unexpected field conditions.

The Construction Manager should make sure that the inspectors are aware of the basic principles of pile driving. Where necessary, a brief refresher on key acceptance and documentation requirements shall be conducted to ensure consistent application across all rigs and shifts.

There is great variation in energy absorption characteristics of various cushioning materials and the effect caused by the insertion of fresh material near the end of driving. The Construction Manager shall make clear to the inspectors that if fresh cushion material is necessary near the apparent end of driving (as may legitimately be the case), the blow count should not be considered valid until time has been allowed for the cushion material to be reasonably well compacted. Cushion replacement events and the restart point for valid blow counts shall be clearly documented to avoid disputes regarding acceptance criteria.

The inspector should initially make sure that pile position, plumbness, and batter are correct. During the course of driving, it is important to be alert for damage to the pile head, which can waste pile energy and indicate erroneously high pile bearing capacity. This damage should be trimmed when necessary. Near the end of driving, the inspector should time the hammer speed, making sure it is correct, and check the air or steam pressure. Finally, record the blow count for the last foot of penetration. Where required, the inspector shall also document any unusual increases in resistance, suspected obstructions, or deviations from expected behavior, and notify the Construction Manager and GE for evaluation prior to continuing.

If metal piles are used and welding is expected in the course of the work, each inspector should have more than a working knowledge of good welding practice and, if necessary, should be supplied with a good manual on the subject. It goes without saying that the welders should be thoroughly experienced and prequalified by a testing laboratory. Poor welding will cause no end of problems such as splice failures during driving and water leakage in shell piles. Usually, one will find that a Contractor is as anxious as the inspector to secure a good welder since costs can skyrocket with

too frequent weld failures. It should be added that another source of weld failure is resumption of driving too soon after the weld is completed. The weld should be fairly cool to the touch before driving of the pile is resumed. Weld inspection shall include verification of required procedures, prequalification documentation, and visual acceptance checks, and any rejected welds shall be documented with location, disposition, and corrective action prior to proceeding.

If a pile fails during driving, it should be pulled and redriven; or if this is not possible, the situation should be reported to the Construction Manager with a view to driving a replacement pile adjacent to the pile which has failed. The Construction Manager shall coordinate with the GE to determine if evaluation of adjacent piles is required and whether revised criteria or sequencing adjustments are necessary due to the failure event.

Counting the number of hammer blows per minute and comparing it to the manufacturer's specification will provide a good indication of whether or not the hammer is working properly. The stroke of the hammer for most single and double acting air/steam hammers can be observed. Check the stroke of a single acting diesel hammer with a saximeter or by computation from the blows per minute. Check the bounce chamber pressure for double acting diesel hammers. Most hydraulic hammers have built-in energy monitors, and this information should be recorded for each pile. Where energy monitors are available, the inspector shall record energy/stroke readings in addition to blow counts to improve the reliability of acceptance evaluations and support engineering review.

Inspection of splices is important for pile integrity. Poorly made splices are a potential source of problems and possible pile damage during driving. In some cases, damage may be detected from the blow count records. Dynamic pile testing can be useful in questionable cases. When splices are suspected of deficiency, the Construction Manager shall document the condition, coordinate evaluation, and determine whether additional testing, repair, or replacement is required prior to acceptance.

Pile driving stresses should be kept within specified limits. If dynamic monitoring equipment was used during test pile driving, the developed driving criteria should keep driving stresses within specified limits. If periodic dynamic tests are made, a check that the driving stresses are within the specified limits can be provided. Adjustments of the ram stroke for all hammer types may be necessary to avoid pile damage. For concrete piles, cushion thicknesses or driving procedures may need adjustment to control tension and compression stresses. If dynamic testing is not used, a wave equation analysis is essential to evaluate the anticipated driving stresses. Driving operations shall be suspended when conditions indicate a risk of exceeding stress limits or damaging piles, and operations shall not resume until parameters are adjusted and documented in coordination with the GE/GFR as required.

Driving of piles at high penetration resistances, above 120-blows per foot (10-blows per inch), should be avoided by matching the driving system with

the pile type, length and subsurface conditions. This should have been accomplished in the design phase by performing wave equation analysis. However, conditions can change across the Project due to site variability. If high resistance occurs, the Construction Manager shall document the location and conditions, coordinate immediate engineering evaluation, and consider adjustments permitted by the Contract Documents to avoid pile damage and maintain schedule.

All piles should be checked for damage after driving is completed. The driving records for all pile types can be compared with adjacent piles for unusual records or vastly different penetrations. Piles suspected of damage (including timber, H, and solid concrete piles) could be tested to confirm integrity and/or determine extent and location of damage using the pile driving analyzer, or for concrete piles, low strain integrity testing methods. Alternatively, the pile could be replaced or repaired, if possible. The Construction Manager shall ensure that suspected damage events are dispositioned through documented evaluation and approval before proceeding with dependent work.

Check for water leakage for closed end pipe piles before placing concrete. The concrete mix should have a high slump and small aggregate. A pipe pile can be easily checked for damage and sweep by lowering a light source inside the pile. The inspector shall document the interior inspection results and confirm that any debris, water, or defects are addressed prior to concrete placement.

Whenever piles are driven, soil is displaced. This can result in both upward movement (pile heave) and lateral movements of previously driven piles. These soil movements can be detrimental to the capacity of previously driven piles as well as to adjacent facilities. Obviously, the greater the volume of soil displaced by pile driving, the greater the potential for undesirable movements of previously driven piles, or damage to adjacent structures. Heave of toe bearing piles is particularly troublesome since the pile may be lifted from the bearing stratum, thereby greatly reducing the pile capacity and increasing the foundation settlement when loaded. It should be noted that saturated, insensitive clays behave incompressibly during pile driving, and have the greatest heave potential. Where heave risk exists, the Construction Manager shall implement a monitoring and verification plan for previously driven piles and adjacent structures, including periodic elevation checks and documentation of any observed movement.

Therefore, the driving sequence of piles in a pier or bent can be important. The driving sequence can affect the way piles drive as well as the influence the new construction has on adjacent structures. This is especially true for displacement piles. For non-displacement piles the driving sequence is generally not as critical. The driving sequence of displacement pile groups should be from the center of the group outward or from one side to the other side but should not be driven from the outside to the center. If groups are driven in that order, displaced soils become trapped and compacted in the center of the pile group. This can cause problems with driving the piles

in the center of the group. The Construction Manager shall verify that the Contractor's sequencing plan aligns with these principles and document any approved deviations along with engineering justification.

When driving close to an existing structure, it is generally preferable to drive the piles nearest the existing structure first and work away. This reduces the amount of soil displaced toward the existing structure. The displacement of soil toward an existing structure has caused problems before. It can be especially critical next to a bascule bridge where, very small movements can prevent the locking mechanism from locking. For sensitive structures, additional monitoring, tighter action thresholds, and immediate notification requirements shall be implemented and documented prior to driving.

On some projects, vibration measurements may be required to ascertain if pile driving induced vibrations are within acceptable and/or specified maximum levels. Vibration damage is relatively uncommon at a distance of 1-pile length away from driving. However, damage from vibration induced settlement of loose, clean sands can be a problem up to 1300-feet away from driving. To document existing conditions of nearby structures, a pre-construction survey of structures within 1300-feet of pile driving activities is often performed prior to the start of construction. The pre-construction survey generally consists of photographing or videotaping existing damage, as well as affixing crack gages to existing cracks in some cases. Where vibration monitoring is required, the Construction Manager shall ensure thresholds and reporting frequency are defined, exceedances are documented, and corrective actions are implemented and tracked to closure.

A cold hammer should not be used when restriking piles after a setup period. 20 hammer blows are usually sufficient to warm up most hammers. Also be sure to record the restrike penetration resistance for each 1-inch during the first 6-inches of restrike. Restrike events shall be documented with time since initial drive, hammer settings, and measured penetrations to support engineering evaluation of setup and capacity confirmation.

4. Data Recording

Driving Records and Reports

The importance of maintaining detailed pile driving records cannot be overemphasized. The driving records form a basis for payment and for making engineering decisions regarding the adequacy of the foundation to support the design loads. Great importance is given to driving records in litigations involving claims. Sloppy, inaccurate, or incomplete records encourage claims and result in higher cost foundations. The better the pile driving is documented, the lower the cost of the foundation will probably be and the more likely it will be completed on schedule. Accordingly, records shall be complete, legible, and maintained in a controlled format that supports auditability and minimizes post-entry modification risk. Incomplete, inconsistent, or altered records without proper traceability shall

not be accepted as valid documentation and may require additional verification.

A necessary part of the inspector's and Construction Manager's duties in production pile driving is the preparation of reports. Two reports are required, the "Inspector's Daily Pile Driving Report" and the "Pile Driving Summary" which are discussed as follows:

Inspector's Daily Pile Driving Report (Production Pile Report)

The inspector should prepare the Daily Pile Driving Report. This report should include information on equipment working at the site and information on piles driven on that day. This information can be obtained from the Pile Driving Log. The standard Daily Pile Driving Report is on the following page. The piles are entered in the order in which they are driven each day (including test piles if they form a part of the structure). The pile number refers to the plan number as assigned by the Construction Manager. Each finished daily report should be turned in to the Construction Manager for further processing. The report should also reference cushion replacement events, unusual occurrences, stoppages, and any testing performed that day so that the daily narrative aligns with acceptance decisions and pay support. Reports shall be submitted promptly and shall accurately reflect field conditions, equipment status, and acceptance criteria used for pile installation.

An example of the Daily Pile Driving Report can be found as Exhibit 4 - 16. Failure to maintain accurate and timely reports may delay acceptance, evaluation, or payment and shall require corrective action.

Pile Driving Summary

This report is to be filled out for each footing by the Construction Manager. The standard Pile Driving Summary Report is found as Exhibit 4 - 17. The information for this report should be extracted from the inspector's daily pile driving reports. The data for each pile should be entered on the report in the numerical order shown on the pile plans, not in the order of driving. All piles should be entered on this report including test piles (if they are included in the structure). The Construction Manager shall verify reconciliation between daily reports, pile logs, test results (if any), and pay quantities prior to signing and submission. Discrepancies shall be resolved and documented prior to approval of the report.

The pay quantity for furnishing timber, steel, precast concrete (reinforced and prestressed), and pipe or shells for cast-in-place concrete piles of the designated sizes and types will be by the measured length, in linear feet, for piles ordered in accordance with

the approved order list. Supporting documentation shall include ordered lengths, delivered lengths, driven lengths, cutoffs, splices, and any authorized waste allowances in accordance with the Contract Documents. Unsupported quantities or missing documentation shall not be approved for payment.

The Pile Driving Summary Report should be signed by both the Construction Manager and the Geotechnical Engineer. A pile sketch showing pile numbers, Test Pile Reports, Pile Driving Log, and Inspector's Daily Driving Reports should be attached to it, and it should be filed until the end of the job, at which time it is turned over to the Authority with other job records. The Construction Manager shall ensure that the compiled package is complete, indexed, and stored in accordance with the Authority's records requirements to support final acceptance and future reference. Incomplete or improperly compiled records may delay acceptance or final payment and shall require correction.

The set-up of pile reports as discussed above referred to the most general type jobs encountered, and it is to be expected that the reports described may have to be modified to include other essential data or items on some contracts. If any doubt arises as to the make-up of reports, the General Consultants are available to offer guidance. Any report modifications shall be documented and implemented consistently across the project to avoid gaps in pay support or acceptance documentation. Unapproved or inconsistent report formats shall require revision to maintain record integrity.

Safety

Pile driving involves the use of heavy equipment and heavy loads. The pile driving inspector should be cognizant of these activities and should be positioned accordingly. One of the more dangerous operations during pile driving is the lifting of the pile and the positioning of it under the hammer for driving. The inspector should remember that a 100-ft. pile can fall 100-feet from the pile location during positioning. It is better to have a planned escape route prior to pile positioning rather than attempt to quickly determine one should difficulties arise during the pile lifting and positioning process. A task-specific hazard review shall be completed prior to operations, including crane swing radius controls, suspended load exclusion zones, and emergency communication protocols. Operations shall not commence until required safety planning and hazard controls are in place.

The area beneath a suspended load should be avoided. If the hoisting device fails or slips, serious injury could occur. The inspector should also avoid the area behind the crane and be cognizant whenever the crane is moving or swinging. The Construction Manager shall verify that exclusion zones are established and maintained, and that inspectors have safe

designated observation points that still allow accurate recordkeeping. Unsafe positioning within exclusion zones shall require immediate corrective action.

The inspector should select a position for maintaining the pile driving record that is a sufficient distance away from the pile location during driving. The area immediately in front of the pile should be avoided. Heavy pieces sometimes fall from a pile hammer or helmet during operation that could cause serious injury if the inspector were positioned under or near the hammer. All pile types can be also damaged during driving. Concrete and timber piles can break suddenly, and long steel piles can buckle. A sudden pile break or buckling can make the area around the pile location quite dangerous due to the broken or buckled section. A sudden loss of resistance beneath an operating pile hammer can also overload the hammer line causing it to break and the hammer to fall. Damage to the head of a concrete pile during driving can also result in heavy concrete pieces falling due to hammer-pile alignment problems or due to pile cushion deterioration. Standing beneath the hammer and monitoring the final pile penetration resistance by placing marks on the pile every 10 or 20 hammer blows should be avoided for the above reasons. The final penetration resistance can be determined instead by marking the pile prior to driving with 1-inch marks over the anticipated final penetration depth. The Construction Manager shall reinforce that inspectors do not enter fall zones to measure final penetration, and that pre-marking practices are used to obtain accurate readings without exposing personnel to unnecessary hazard.

Safety devices such as a hard hat, ear protection, steel toed work boots, eye protection, safety vest, fall protection harness, and life jacket should be worn as job conditions dictate. Additional site specific and Authority safety rules shall also apply and these should be reviewed. Where operations occur adjacent to live traffic or over water, additional protective measures and site-specific requirements shall be verified prior to beginning work, and compliance observations shall be recorded as part of daily documentation when relevant. Failure to comply with required safety measures may result in suspension of operations until compliance is achieved.

4.2.2. Drilled Shafts

The strength and durability of a structure is ultimately dependent upon the quality of its foundation. Once a foundation is constructed and a structure is built upon it, there is no second chance – the foundation must be right the first time. Inspection of drilled shafts and the making of records concerning construction are important and deserve careful attention. The role of the inspector is to monitor the construction process so that proper records can be made, and to provide timely information to the Geotechnical Engineer and the owner concerning deviations from the plans or from standard construction practice.

Inspection activities shall therefore be conducted in a manner that ensures complete traceability of excavation conditions, shaft geometry, reinforcement placement, slurry properties (if applicable), and concrete placement operations so that long-term foundation performance can be validated and supported by defensible records.

The Authority requires that each Construction Manager station an inspector at every drilled shaft installation to observe the full construction duration. All drilled shaft inspectors should be approved by the Authority. Inspector presence shall be continuous during excavation, base cleaning, reinforcement cage placement, and concrete placement operations, and any change in inspector assignment shall be documented to preserve continuity of records and observations. Work performed without required inspection coverage may be subject to review and possible rejection.

The inspector has the responsibility to become familiar with the Contract Plans and Specifications, to make appropriate records, to check the work of the Contractor, and to call attention to any errors or omissions. The inspector has the further responsibility to carry out the work in such a way that the construction is delayed as little as possible. While it is essential that the activities of the inspector be carried out properly, delays will increase costs and can actually lead to a poorer-quality product. Timely observations, suggestions, reporting, and correction advice can ultimately assure the success of the Project. The earlier a problem or unusual condition is detected and reported by the inspector, the earlier a solution or correction in procedures can be applied, and hence a potentially negative situation can be limited to a manageable size. If the same problem is left unattended, the number of shafts affected increases, as do the cost of remediation and the potential for claims or project delays. Thus, early detection and reporting of any problem may be critical to keep the Project on schedule and within budget. The inspector shall promptly notify the Construction Manager and Geotechnical Engineer of any deviations in shaft diameter, depth, alignment, subsurface conditions, slurry properties, reinforcement configuration, or concrete placement parameters that may impact structural performance or contract compliance.

As a minimum, inspector must be able to do the following:

- Be familiar with drilled shaft construction procedures.
- Perform basic calculation.
- Have good communication and record keeping skills.
- Understand the Contract Plans and Specifications.
- Take measurements.
- Understand the basics of drilled shafts (end bearing and side friction).
- Be familiar with the subsurface conditions (soil, rock and groundwater) in the area and be able to compare them with soils described in the Project's geotechnical report.
- Be knowledgeable of contract bid items.
- Be familiar with and follow construction safety procedures.

In addition, the inspector shall be capable of verifying shaft verticality tolerances, confirming required rock socket embedment depths where applicable, evaluating slurry test results against Specification limits, and ensuring that installation records are sufficiently detailed to support acceptance, payment, and potential dispute resolution.

Failure to verify critical acceptance parameters may require additional testing, evaluation, or corrective action prior to acceptance.

4.2.2.1. Pre-Construction

Conference

It is always recommended to have a pre-construction conference with the Construction Manager, Owner's representative, Contractor, Geotechnical Engineer, and Inspector. A chain of communication should be established, and the limits of authority of the inspector should be clarified. Any issues the Contractor foresees should be discussed, and the intent and nature of the Geotechnical Engineer's design communicated. The meeting shall also include review of the approved Drilled Shaft Installation Plan, slurry management procedures, integrity testing requirements, excavation sequencing, contingency measures for caving or groundwater inflow, and documentation expectations. Meeting minutes shall be prepared and retained as part of the project record.

Bearing criteria, including testing, should be reviewed at this meeting. Any special responsibility or authority with regard to record keeping on obstruction time or need for and use of permanent casing should be agreed upon. Acceptance criteria for end bearing confirmation, side resistance assumptions, base cleanliness verification, and required inspection hold points prior to concrete placement shall be clearly defined and acknowledged by all parties.

Agreement on definitions and the extent of documentation for pay items, including auger refusal, obstructions, rock removal, etc. should be established. Contractors should be required to notify the inspector of anything they believe is above and beyond the scope of work and may be deemed an extra. Procedures for documenting potential extra work shall include written notification, photographic documentation where appropriate, and log entries to support evaluation and resolution.

4.2.2.2. Items to be inspected

There are several items to be observed by the inspector on every drilled shaft foundation project for test shafts and/or production shafts. Test shafts may be constructed for verifying the constructability or methods and means to be applied in production shafts and verifying bearing resistance of shafts, they are typically located beyond the zone of influence of production shafts and are not relied upon to support the final structure. Each of these items can be grouped under one of the following areas:

- Review of the foundation report, and the Contract Plans and Specifications (this should be completed as early as possible).
- Review and confirmation of the Contractor's inspection of equipment before and during shaft installation.
- Inspection of the load test or demonstration shafts.
- Inspection of post installation integrity testing.
- Inspection during production shafts and maintenance of installation records.

Inspection activities shall align with defined acceptance checkpoints and documented hold points prior to progression to reinforcement placement or concrete placement. No progression beyond designated hold points shall occur without documented acceptance in accordance with the Contract Documents.

Installation records shall include shaft identification number, start and finish times for excavation, soil and rock descriptions by depth, slurry properties (if applicable), reinforcement cage placement elevation, concrete placement start/finish times, and theoretical versus actual concrete volumes placed. Incomplete or inconsistent installation records shall be corrected prior to acceptance and may require additional evaluation or testing.

The following check list summarizes the tools a drilled shaft inspector should have readily available to perform their job. Failure to utilize required inspection tools and measurement devices may compromise acceptance documentation and shall require corrective action.

EXHIBIT 4 - 4 DRILLED SHAFT INSPECTOR'S TOOL CHECK LIST

Approved Job Information Project Plans (most current set) Project Specifications Drilled Shaft Installation Plan and Procedure Slurry Management Plan (if applicable) Reinforcement Details Integrity Test Details Drilled Shaft Quality Control Methods Shop Drawings/Contractor Submittals Load Test Procedure Indexed Notebook of Driven Piles Test Shaft Program Production Shaft Construction Daily References Drilled Shaft Inspector's Manual, ASDC. Drilled Shaft Inspector's Video, ASDC. Drilled Shaft Foundation Inspection (FHWA-NHI-03-018)	Daily Essentials Hard Hat Boots Ear/Eye Protection Pen/Pencil/Marker Scale Measuring Tape Level/Plumb-bob Stop Watch Calculator Flash Light Protector Camera Safety Vest Blank Forms Shaft Installation Logs Daily Inspection Reports Personal Diary Contact Information Incident Communication Plan Map of Nearest Hospitals

Inspectors shall also have access to calibrated gas detection equipment when confined space conditions may exist, and to approved digital reporting tools when electronic documentation is required by the Authority.

4.2.2.3. Equipment

1. Drilled Shaft Equipment

Typically, a drilling system consists of crane, earth augers, rock core barrels, bellings tools, temporary casings, permanent casings, slurry mixers, desander, grouting equipment, etc. The Contract Plans and Specifications may specify or restrict certain items. The inspector must check the Contractor's equipment and obtain necessary information to determine conformity with the Contract Plans and Specifications prior to the commencement of installation operations. If the Contractor plans to use temporary casing to seal off water bearing layers and then pull the casing after concreting, it is important that the casing be clean and not have old concrete stuck in places on the inside or the outside circumference. The inspector shall verify that all equipment configurations match approved submittals and that casing condition, cleanliness, and dimensional tolerances are acceptable prior to installation.

2. Drill Rigs

Almost all excavations for drilled shafts in the United States are made by some sort of rotary-drilling machine. The machines vary greatly in size and in design; however, the characteristic that principally differentiates the machines is the manner in which the drilling unit, or "rig," is mounted.

Drilling units are mounted on trucks, cranes, crawler-tractors or a few are mounted on skids. The capacity of a drilling rig is expressed in terms of the maximum torque that can be delivered to the drilling tools and the "crowd" or downward force that can be applied. Torque and crowd are transmitted from the drilling rig to the drilling tool by means of a drive shaft or a kelly bar, or simply the "kelly." The drilling tool is mounted on the bottom of the kelly. Many kellys are square in cross section, but other shapes are used as well. The kelly can be a single piece to drill to depths of 50 to 60-feet or it can be telescoped either to drill to greater depths or to allow drilling with low headroom. The kelly passes through a rotary table that is turned by the power unit to provide the torque. In some rigs the weight of the kelly and the tool provides the crowd. In others, hydraulic or mechanical devices are positioned to add additional downward force during drilling.

The inspector shall confirm that the selected rig has adequate torque and crowd capacity for the anticipated subsurface conditions and that rig stability, leveling, and positioning comply with the Contractor's approved installation plan and safety procedures.

3. Drilling Bucket

Drilling buckets are used mainly in soil formations and are not effective in excavating rock. Soil is forced by the rotary digging action to enter the bucket through the two slots in the bottom; flaps inside the bucket prevent the soil from falling out through the slots. After obtaining a load of soil, the tool is withdrawn from the hole, and the hinged bottom of the bucket is opened to empty the cuttings. Drilling buckets are particularly efficient in granular soils, where an open-helix auger cannot bring the soils out. They are also effective in excavating soils under drilling slurries, where soils tend to "slide off" of open helix augers. When used to excavate soil under slurry,

the drilling bucket should have channels through which the slurry can freely pass without building up excess positive or negative pressures in the slurry column below the tool. The cutting teeth on the bucket are flat-nosed. These "gouge" the soil; however, if layers of cemented soil or rock are known to exist, conical, or "ripping," teeth might be substituted for one of the rows of flat-nosed teeth to facilitate drilling through alternating layers of soil and rock without changing drilling tools. Some drilling buckets are designed to be used for bailing water out of the hole. Still other buckets are designed to clean the base when there is water or drilling slurry in the hole.

The inspector shall observe for proper bucket selection relative to subsurface conditions and shall document any signs of borehole instability, excessive slurry pressure fluctuation, or ineffective soil removal that may compromise shaft geometry or base cleanliness.

4. Earth Augers

Earth augers can be used to drill a hole in a variety of soil and rock types and conditions and is most effective in materials that have some degree of cohesion. The auger is equipped with a cutting edge that during rotation breaks the soil or rips the rock. The auger is then withdrawn from the hole, bringing the cuttings with it, and emptied. Problems can arise when drilling in cohesionless sands where soil slides off the auger flights or in some cohesive soils where the tool can become clogged. Care must be exercised in inserting and extracting augers from columns of drilling slurry, as the slurry is prone to development of positive (insertion) and negative (extraction) pressures that can destabilize the borehole.

Augers may be of the single- or double-flight type, and many have a central point or "stinger" that prevents the auger from wobbling. Double-flight augers are usually used for excavating stronger geomaterials than are excavated with single-flight augers.

The number and pitch of the flights can vary widely. The type of auger, single-flight or double-flight, and the number and pitch of flights will be selected after taking into account the nature of the soil to be excavated. Continuous-flight augers, up to a certain length, may be advantageous in some situations.

The cutting face on most augers will result in a flat base in the borehole. Modifying the pitch on auger can make a significant difference in the rate at which soil or rock can be excavated, and the Contractor may have to experiment with the pitch and type of teeth on a Project.

In soil or rock containing clay is often smeared on the sides of otherwise dry boreholes by augers as the cuttings are being brought to the surface in the flights of the auger. This smeared material is problematic when free water exists in the borehole, through side seeps or from water that is introduced resulting in the cuttings becoming sticky. Soil smear can significantly reduce the side resistance of drilled shafts, particularly in rock sockets. A simple way to remove such smear is to reposition the outermost

teeth on the auger so that they face to the outside, instead of downward, and to insert the auger and rotate it to scrape the smeared material off the side of the borehole prior to final cleanout and concreting.

Careful exploration and planning must be done if the excavation must penetrate a layer of cobbles or boulders. The preferred method of excavating cobbles or boulders is with an auger. Modified single-helix augers, designed with a taper and with a calyx bucket mounted on the top of the auger, called "boulder rooters," can sometimes be successful at extracting small boulders. If a boulder is solidly embedded, it can be cored. Coring may be ineffective in many loosely embedded boulders in soil. The removal of such boulders may require that the boulders be broken by impact or by blasting (if permitted) or can sometimes be lifted from the excavation after a rock bolt has been attached.

The inspector shall document soil and rock conditions encountered at each depth increment and confirm that borehole sidewalls are free of smear or loose material prior to final cleanout, particularly where side resistance contributes significantly to shaft capacity.

5. Rock Augers

A flight auger can also be used to drill relatively soft rock (hard shale, sandstone, soft limestone, decomposed rock). Hard-surfaced, conical teeth, usually made of tungsten carbide, are used with the rock auger. Rock augers are usually of the double-helix type. The thickness of the metal used in making the flights is more substantial than that used in making augers for soil. As with soil augers, the geometry and pitch of the teeth are important details in the success of the excavation process.

Rock augers can also be tapered. Some Contractors may choose to make pilot holes in rock with a tapered auger of a diameter smaller than that of the borehole then the hole is excavated to its final nominal diameter with a larger diameter flat-bottom rock auger or with a core barrel. The stress relief afforded by pilot-hole drilling often makes the final excavation proceed easier. Tapered rock augers will not produce a flat-bottomed borehole, so that it is important that a flat base be produced by the nominal diameter tool. Failure to produce a flat base in the borehole will make it very difficult to clean the base and produce a sound bearing surface.

The inspector shall verify final rock socket depth, diameter, and base condition against plan requirements and shall document evidence of competent bearing material consistent with the geotechnical design assumptions.

6. Core Barrels

If augers are ineffective in excavating rock most Contractors will attempt to excavate with a core barrel. The simplest of core barrel is a single, cylindrical steel tube with hard metal teeth at the bottom edge to cut into the rock. The tube cores into the rock until a discontinuity is reached and

the core breaks off. The section of rock contained in the core is held in place by friction from the cuttings and is brought to the surface by simply lifting the core barrel. Excavation by core barrel is a slow process, but it may be necessary in some formations.

Core barrels are also available with double walls where the inner wall is a cylinder of steel that contacts the core, while the outer wall, which contains conical roller bits at the cutting edge, rotates and cuts the rock away. The hardness of the teeth of the conical bits can be altered for drilling in different kinds of rock. Double-walled core barrels are generally capable of extracting longer cores than single-walled core barrels.

Only a slight penetration of rock is often required to provide ample bearing resistance for a drilled shaft in some rock formations, but such rocks are occasionally so hard that a rock auger or core barrel is ineffective in providing even minor penetration. In such a case a barrel or shot barrel similar to the core barrel but with a plain bottom is utilized. Hard steel shot are fed below the base of the rotating core barrel so as to grind away even the hardest rock. The resulting short core is lifted out, exposing the bearing surface. The roller bits grind the rock, which is transported to the surface by flushing drilling fluid down the hole in the direct circulation process, or blowing cuttings out with compressed air. In very hard rock, a small cutter can be placed in the center of the face to cut ahead of the main cutters and relieve stresses in the rock to facilitate excavation.

The inspector shall observe rock coring operations for signs of incomplete base formation, excessive fracturing, or unsuitable bearing material and shall coordinate with the Geotechnical Engineer when subsurface conditions differ from anticipated design parameters.

7. Underreamers or Belling Buckets

A special tool has been designed to increase the bearing area and the load capacity of a shaft by forming an enlarged base, or a bell. This tool, called a belling bucket or underreamer, is designed to be lowered into the hole on the kelly with its arms closed. Upon the reamer reaching the bottom of the shaft, the downward force applied by the drilling machine forces the arms to open and the soil is dug while the tool is rotated. The cuttings are collected inside the tool. This continues until the arms reach a stop, resulting in a fully-formed bell with a predetermined angle and bell dimensions.

The inspector shall verify that the bell dimensions, angle, and cleanliness conform to the Contract Plans and Specifications and that loose material is removed from the enlarged base prior to reinforcement placement and concrete placement.

4.2.2.4. **Construction Methods**

1. Excavation

The Contractor has the responsibility to make an excavation at the proper place and with the proper dimensions. The inspector should log the progress of the drilling and should indicate the types of soils or rock being excavated and note any drilling difficulties. The inspector will be required to certify that the completed excavation is satisfactory. Excavations not meeting required tolerances or acceptance criteria shall not be approved until corrected or dispositioned in accordance with the Contract Documents.

The factors of most concern to the inspector are that load transfer in side resistance and in end bearing are consistent with the assumptions made in the design. The inspector should be familiar with the design assumptions and with the properties of the soil and rock on which the design was made. With regard to load transfer in side resistance, special care may need to be taken when drilling into rock; some drilling techniques can leave the sides of the excavation "gun-barrel slick", and it would be necessary to use special techniques to roughen the sides of the borehole. With regard to load transfer in base resistance, it is usually necessary that the sides of the excavation be protected against collapse of the soil and/or rock or of inflow of water. The Geotechnical Engineer will provide guidance for such issues and should be consulted. Unfavorable sidewall or base conditions that may affect design load transfer shall be reported and evaluated prior to continuation of shaft construction.

The inspector shall document shaft depth, diameter, plumbness, and base condition prior to authorizing reinforcement placement, and any deviation from allowable tolerances shall be immediately reported to the Construction Manager and Geotechnical Engineer for disposition. Reinforcement placement shall not proceed until excavation acceptance has been documented.

The methods of drilled shaft construction can be classified in three broad categories, the dry method, the casing method, and the wet method. The method of construction, selected by Contractor depends on the subsurface conditions and must be specified in the Contractor's submittal. If a different method is utilized this must be reported to the Construction Manager immediately. It is important for the inspector to watch for and record any soil squeeze, sidewall caving, or water inflow that occurs during excavation. Unapproved changes in construction method or uncontrolled ground conditions shall require immediate notification and evaluation prior to continuation of work.

Changes in method shall not proceed without documented notification and approval, and the inspector shall record the date, time, and reason for any method modification. Failure to document and obtain approval for method changes may result in rejection or additional verification requirements.

2. Surface Casing

Even where the soil might be stable, surface casing is required for safety reasons. This entails drilling the initial shaft slightly oversized to the

specified surface casing depth and then setting in the surface casing pushing, tapping, or twisting the casing into the underlying natural soil. The design shaft size is then drilled through the surface casing. Additionally, the Contractor may elect to install smaller diameter casings in order to telescope the casing. This reduces side friction and makes it easier to remove the casing.

Often in sands, the casing may be advanced with a vibratory hammer; however, this approach is not recommended where vibrations may cause sand densification and settlement of adjacent structures.

There are occasions when it is desirable to use a permanent casing when very soft soil exists at the ground surface. It may also be the case where temporary casings cannot be recovered and therefore become permanent. Care must be taken in the installation of temporary casing to ensure that it can be recovered after the concrete is placed given the resistance along the sides of the drilled shaft could be seriously reduced thereby reducing capacity.

The inspector shall document casing embedment depth, verticality, and condition prior to proceeding with excavation below the casing. Where casing extraction is planned, the inspector shall observe and record extraction operations to ensure that concrete head is maintained and that no voids or soil intrusion occur during removal. Any difficulty in casing recovery shall be immediately reported and documented.

3. Dry Excavation Method

The dry excavation method is applicable to soil and rock that are above the water table and that will not cave or slump when the hole is drilled to its full depth. An example of a deposit that meets this requirement is homogeneous stiff clay. The dry method can be employed in some instances with sands above the water table if the sands contain some cohesive material, or if they will stand for a period of time because of apparent cohesion. If the soil at the ground surface is weak or if there is a thin stratum of caving soil near the surface, a short piece of casing, called a "surface" casing, is employed, especially if the rig will be bearing on the soil close to the hole. The surface casing may be temporary or permanent. The dry method can sometimes be used for soils below the water table if the soils are low in permeability and the shaft is excavated and concreted quickly, so that only a small amount of water will seep into the hole during the time the excavation is open. The inspector must ascertain that the amount of water in the bottom of the excavation is within the limits given in the Specifications; however, typically in order to allow for the dry method the following must be met:

- Less than 12-inches of water accumulate at the bottom of the shaft in 1-hour without pumping.
- The sides and bottom the hole remain stable over a 4-hour period immediately following excavation.

- Any loose material and water can be removed from the bottom of the excavation.

If these criteria are not met, the dry method shall not be permitted and an alternative approved method shall be implemented.

The inspector should check the depth of the completed excavation with a weighted tape and record the data. The plumbness of the shaft should be checked. This can be accomplished by hanging a plumb bob from the measured center determined a fixed distance into the shaft and moving it slowly to one side until it touches the shaft wall and record the movement in the north, south, east and west directions. Measured deviations exceeding allowable tolerances shall be reported immediately and evaluated prior to continuation of work.

The bottom of the shaft should be inspected as well, in the event it is not possible to physically inspect the bottom of the shaft due to unacceptable gas readings or other safety considerations, the bottom can be observed by lowering an explosion proof light and the bottom of shaft inspected. If base cleanliness or stability cannot be adequately verified, reinforcement placement shall not proceed until acceptable conditions are confirmed and documented.

The inspector shall document measured shaft depth, groundwater observations, stability duration, and plumbness measurements in the shaft installation log prior to authorizing reinforcement placement. Where physical entry is not feasible, visual inspection methods shall be clearly documented, including equipment used and observed base conditions. Incomplete documentation of excavation acceptance shall require clarification prior to approval for subsequent construction stages.

4. Casing Method

The casing method is applicable when the dry method cannot be employed in instances:

- Where an open hole cannot be maintained.
- Where soil or rock deformation will occur.
- Where constructing shafts below the water table or caving overburden.

The excavation through the zone to be cased proceeds with a drilling tool having a diameter greater than the outside diameter of the casing. Slurry may be introduced into the borehole when caving soils are encountered, the temporary casing is inserted into the hole through the slurry and sealed into the underlying stable soil.

The slurry is usually manufactured on the job using existing soils and water or water and dry bentonite or other approved mineral or a synthetic polymer. The slurry column should extend and be continuously maintained

well above the level of the ground water surface so that any fluid flow is from the excavation into the formation and not into the hole which could destabilize the excavation. During excavation, the drilling tool should be designed to lift the soil up through the slurry rather than mixing it with the slurry. The strategy in the casing method should be to leave only as much soil in suspension in the slurry as the slurry can hold for a long period of time, because some of the slurry will eventually become trapped behind the casing, when it is placed, where excess soil can settle out of suspension and become the source of a defect in the completed drilled shaft.

The inspector should check the sand concentration in the slurry near the bottom of the borehole before the casing is set. If there is excessive sand concentration, some of this sand will settle out in small annular spaces between the casing and the borehole wall and could produce defects. In order to rid the slurry of excessive sand, the Contractor can simply pause for a few minutes to allow the sand to settle out of suspension and then remove the settled material from the base of the borehole with a special cleanout device or exchange the soil-contaminated slurry with clean slurry before setting the casing.

The inspector shall verify and record slurry properties including density, viscosity, sand content, and pH (where required by the Specifications) at intervals specified in the Contract Documents. Slurry head elevation relative to groundwater shall be monitored and maintained to prevent borehole instability. All slurry test results shall be entered into the installation record prior to casing placement and prior to concrete placement.

5. Wet Excavation Method

The "wet" method of construction, sometimes called the slurry-displacement method, usually involves the use of prepared slurry to keep the borehole stable. The slurry-displacement method is an option where there is caving soil or where permeable water-bearing soil is impossible to seal casing into a stratum of soil or rock with low permeability. It can also be used in deep holes where casing might otherwise be used because of the difficulty of handling very long casing. Either mineral slurry (such as bentonite-based slurry) or polymer slurry can be employed.

Mineral slurry is mixed such that some of the particles of granular soil being excavated are put and kept in suspension and are brought out of the hole when the slurry is flushed from the hole by placing the fluid concrete. Polymer slurries have insufficient gel strength to hold sands in suspension so that all of the cuttings down to the size of fine sand must be lifted out with the drilling tool.

There are two general processes for accomplishing wet-method construction. The first process is termed here the "static" process. The second process is termed the "circulation" process. The difference in the two processes is that the cuttings are lifted by the drilling tool in the static

method, but they are transported to the surface in the slurry in the circulation method.

The first step in the static construction process is to position the drilling equipment and to drill using the dry method until the ground water surface is reached then slurry is introduced into the hole and drilling is continued. The excavation is carried to the full depth of the hole with the slurry in place. During excavation, the top of the slurry column is always kept at an elevation above the natural ground water surface. If the water surface is at or above the ground surface, a surface casing that protrudes above the ground surface to serve as a standpipe is necessary to keep the slurry head at its proper position.

Maintaining head position in the slurry column is important with polymer slurries. If introducing the slurry is delayed until a caving stratum encountered, considerable caving could occur before enough slurry can be added to balance the ground water pressure and it may not be possible to arrest the caving once it starts. Such a practice is therefore not recommended.

After the excavation has been drilled to its full depth, steps must be taken to see that the slurry meets appropriate Specifications. If there is too much sediment in suspension, particles can settle to the bottom of the excavation before concrete is poured, resulting in a "soft" base, or as the concrete is being placed, resulting in structural defects in the completed drilled shaft. At this point the bottom of the borehole is cleaned of cuttings and sediments using a mechanical clean-out bucket or a vacuum device such as an air lift.

Prior to concrete placement, the inspector shall confirm that slurry properties meet Specification limits, that the base is free of loose material and sediment, and that cleanout procedures are completed and documented. Concrete placement shall proceed in accordance with approved methods that maintain positive concrete head and prevent segregation or contamination by slurry. Any interruption in concrete placement shall be documented with time and reason, and corrective measures shall be evaluated prior to continuation.

4.2.2.5. **Materials**

1. Drilling Slurry

The Specifications for the slurry should indicate the manner in which the slurry is to be mixed, the properties of the slurry as it is introduced into the borehole, the properties of the slurry at the time of concreting, and the kind of tests that are run to obtain the slurry properties. The inspector should see that the appropriate tests are performed and the results are within the limits provided in the Specifications or manufacturer's Specifications. The inspector shall also ensure that slurry test results are documented in the drilled shaft installation records and entered into the Authority's Construction Management system in accordance with Section 3.1.10 of this Manual, including the date/time, location of sample, and name of the

person performing the test. Slurry properties outside specified limits shall require corrective action and re-testing prior to continuation of excavation or concrete placement.

It is also critical that the inspector understand how drilling slurries work to maintain stable boreholes. It is especially important that slurry be introduced before any sloughing occurs in the borehole. The inspector shall observe and document slurry head elevation relative to groundwater conditions throughout excavation, and shall immediately notify the Construction Manager and Geotechnical Engineer if loss of head, sudden slurry loss, excessive inflow, or signs of sidewall instability occur. Concrete placement shall not proceed until slurry properties and borehole stability are verified to be in compliance with the Contract Documents.

2. Mineral Slurries

Bentonite and other clay minerals when mixed with water in a proper manner form suspension of microscopic plate-like solids within the water. This suspension is the drilling slurry. If the fluid pressures within the slurry column in the borehole exceed the fluid ground water pressures in a permeable formation, the slurry penetrates the formation and deposits the suspended clay plates on the surface of the borehole, in effect forming a membrane, or "mudcake" that assists in keeping the borehole stable. In order for bentonite particles to break down into these separate plates, the mixing water must first hydrate the bentonite. One of the cardinal rules of drilling with bentonite slurry is that all newly mixed bentonite must be allowed to be hydrated for several hours before final mixing and introduction into a borehole. Bentonite slurry should be added to the borehole only after its viscosity stabilizes, which is an indication that the bentonite has become fully hydrated. The inspector shall verify that hydration time and mixing procedures comply with the slurry product requirements and the Contractor's approved slurry plan and shall document any deviation.

Slurry made with bentonite, and to some extent other minerals, serves to put soil particles through which the excavation is progressing in suspension. Below a certain concentration of the soil particles, which depends on the size of the soil particles, the mineral "dosage" (proportion of dry mineral to water), type of mineral being used to make the slurry and other factors, the soil particles will stay in suspension long enough for the slurry to be pumped out of the borehole upon setting casing and/or for the borehole to be completed and the slurry (with suspended cuttings) remaining in the borehole to be flushed out when the fluid concrete is placed in the wet method of construction. The inspector shall confirm that slurry conditioning and desanding operations (when required) are performed so that suspended cuttings do not exceed Specification limits prior to concrete placement.

Longer periods of suspension stability are obtained with bentonite than with attapulgite or sepiolite, which is desirable. However, bentonite tends to flocculate in saline ground water, and solids will fall from suspension under

such a condition more quickly in bentonite slurries than in attapulgite or sepiolite slurries unless special procedures are used. Properly prepared slurry, in addition to keeping the borehole stable, also provides a kind of lubricant and reduces the soil resistance when a casing is installed. The wear of drilling tools is reduced when slurry is employed. Where saline or chemically aggressive groundwater is anticipated or encountered, the inspector shall document observed slurry behavior and notify the Geotechnical Engineer so that special procedures, additives, or alternate slurry types can be evaluated in accordance with the Contract Documents.

3. Polymers

Drilling slurries can also be made of mixtures of chemicals called polymers and potable water. Polymers have been used in preference to bentonite in well drilling for some time in soil profiles that contain considerable clay or argillaceous (clay-based) rock, because bentonite slurries have a tendency to erode clayey rocks and to produce enlargements and subsequent instabilities in the boreholes. Polymer slurries have become popular in drilled shaft construction in all types of soil profiles because they require less conditioning before reuse than bentonite slurries and because they can be disposed of more inexpensively than bentonite slurries. The inspector shall verify that polymer slurry products used are those approved by the Contract Documents or approved submittals, and that mixing water is potable as required.

Polymers that are used in drilling slurries consist of very long, chain-like hydrocarbon molecules, which act somewhat like clay mineral molecules in their interactions with each other and in the way in which they stabilize boreholes. The polymer slurry, like bentonite slurry, permeates into permeable formations (sand, silt, and permeable rock) if the head in the slurry column exceeds the piezometric head in the formation being drilled, and the polymer molecules become lodged in the pores of the soil around the edge of the borehole. Since the polymer molecules are hair-shaped strands and not plate-shaped, they do not form mudcakes, and borehole stability is produced through continual filtration of the slurry through the zone containing the polymer strands, where the drag forces and cohesion formed due to binding of the soil particles in the formation by the polymer strands tend to keep the soil particles in place. The inspector shall document observations of slurry loss, and any evidence that may indicate inadequate stabilization.

Since slurry is continuously being lost to the formation, the Contractor must be diligent in maintaining a positive head in the slurry column with respect to the natural water surface in the formation at all times so that filtration and hole stability continue. This often means continually adding slurry stock to the column of slurry in the borehole that is continuing to permeate the formation. Bentonitic slurries have unit weights that range from about 3 to 20-percent higher than that of water, once soil from the formation has been picked up by the slurry, so that allowing the slurry level in the borehole to drop down to the water level occasionally may not cause problems. However, the unit weights of polymer slurries are essentially equal to that

of water, so that allowing the head in a polymer slurry column to drop to the water level in the formation, even momentarily, may initiate hole sloughing or raveling. A good rule of thumb is to keep the level of polymer slurry at least 6-feet above the piezometric or natural ground water surface at all times. The inspector shall monitor and record slurry elevation at regular intervals and at critical events (tool insertion/removal, pauses in drilling, before cleanout, and before concrete placement) and shall require corrective action when head requirements are not maintained.

4. Blended Slurries

Mineral slurries tend to require considerable effort to mix, treat and dispose of, and they can destabilize (erode away) boreholes in argillaceous (clay-based) geomaterials on occasion. By contrast, they are excellent stabilizers of boreholes in completely cohesionless soils. Polymer slurries, on the other hand, tend to be much easier to mix, treat and dispose of. The proportions of each component can be varied from job to job and hole to hole, as necessary. Since the bentonite component is usually higher than the polymer component, the quality control factors for bentonite can be used for the control of such blended slurries. The inspector shall verify that the Contractor's proposed blended slurry proportions, testing regimen, and conditioning procedures are consistent with the approved submittal and the Contract Plans and Specifications.

If the Contractor proposes to use blended slurry a detailed report specific to the Project must be prepared and signed by a qualified slurry consultant. The inspector shall confirm that the report is received, reviewed, and accepted in accordance with the Contract Documents prior to commencement of slurry use and shall ensure the report is maintained in the project records.

4.2.2.6. Inspection

1. Testing Slurries

Density

A mud balance (lever-arm scale) is typically used to measure the density, or unit weight, of the slurry. A metal cup that will hold a small quantity of slurry is carefully filled out of the slurry cup and cleaned of excess slurry on its exterior. It is then balanced by moving a sliding weight on a balance beam. The density of the slurry is read directly from a scale on the beam in several forms [unit weight (lb/cubic foot, lb/gallon, specific gravity)]. The scale should be properly calibrated with water in the cup before making slurry density readings. This device is accurate, and readings can be taken rapidly. The only problem is to obtain a representative sample because the quantity of the slurry that is tested is small in relation to the quantity in a borehole. Therefore, multiple tests are recommended where feasible. The inspector shall ensure that density samples are taken from representative locations (including

near the bottom where required) and that calibration checks are recorded in the project documentation.

Viscosity

Several measures of viscosity are used in Specifications. The simplest (but most indirect) measurement is with the Marsh funnel, a simple funnel with a small orifice at its bottom end. The Marsh funnel, while simple and expedient, does not truly measure viscosity and can be misleading when monitoring the viscosity of some polymer slurries. The test is performed by placing a finger over the tip of the small orifice at the bottom of the funnel (after making sure that the orifice is clean) and filling the funnel with slurry to a line at the base of a screen located near the top of the funnel. When filling the funnel, the slurry should be poured through the screen to filter out large solid fragments. The slurry then is allowed to flow out of the funnel through the orifice back into an empty slurry cup, which has a mark denoting 1-quart, and the number of seconds required for 1-quart of the slurry to drain from the funnel into the cup is recorded. This measure of time, in seconds, is the "Marsh funnel viscosity." Many specifications for drilling slurry rely on the Marsh funnel, and the device allows adequate control of slurry for many jobs. The inspector shall document the test method used and confirm that it is appropriate for the slurry type, particularly when polymer slurries are used.

Other jobs require more stringent controls, and some specifications are based on the use of instruments that truly measure viscosity. An instrument, generically called a "rheometer" or a "viscometer," that can be used to measure viscosity of drilling slurries. The cup, or "rotating cylinder," can be rotated at a known speed. This will cause a shearing stress to be transmitted to the suspended cylinder, which in turn will cause a twist of the torsional spring. The scale can measure the twist, and thus the shearing stress. Some commercial versions of this device are arranged to be direct reading. Use of this device is almost as simple as using a Marsh Funnel. Where required, the inspector shall verify calibration and document readings at the required rotational speeds and intervals specified by the Contract Documents.

pH Value

The pH of the slurry is an indicator of the degree of acidity or alkalinity of the slurry. Maintenance of a proper range of pH is important to the proper functioning of the slurry and is an indicator of the effectiveness of anti-hardness additives. For example, neutral-to-acid pH (7.0 or lower) can reflect conditions in a borehole that is being drilled through an acidic fill and that a bentonite-based slurry may be in danger of flocculating, or it could indicate that a polymer slurry is mixing with acid ground water and is in danger of agglomerating. Values for the allowable range of pH are given in

the product specification. The pH can be determined readily by the use of pH paper or by a pocket pH meter. The pocket pH meter, which is the size of a large pencil, is more accurate and is easy to use, but it must be calibrated often against a standard buffer solution. The inspector shall record pH readings and calibration checks and shall document any corrective action taken when readings fall outside allowable limits.

Sand Content

An increase in the amount of sand (material retained on a No. 200 sieve) in the slurry is cause for concern that additional sand may not be held in stable suspension. It is important that the sand being held in suspension in a slurry not exceed the amount that can be held there for a period of time long enough to allow the slurry to be displaced by the fluid concrete. The sand content is measured using a standard API (American Petroleum Institute) sand content kit by taking a slurry sample of 100-mL. The sample is usually taken from the slurry cup after stirring vigorously to make sure all of the sand in the original sample in the cup is uniformly distributed in the suspension from which the 100-mL sample is taken. The slurry sample is diluted with water and then passed through a No. 200 sieve. The sand from the slurry is retained on the screen. That sand is then backwashed from the screen into a burette with a graduated, conical base, and the sand content in percent by volume is obtained by reading the scale on the burette. The inspector shall ensure that sand content testing is performed at locations and times required by the Specifications, including near the bottom prior to concrete placement where required.

When testing polymer or blended bentonite-polymer slurries for sand content, particularly if the soil being drilled contains dispersive clay or silt that can be put in suspension temporarily during drilling and become entangled with the polymer strands, it is important that the slurry be washed over the No. 200 screen with a mixture of household bleach containing sodium hypochlorite and water (perhaps 50/50 by volume), several times if necessary, to detach the polymer strands from the soil. Otherwise, the clay/silt polymer assemblages will be registered as sand. In any event, it is important that the final wash water in the burette be clear. Otherwise, the washing process should be repeated until the wash water becomes clear before making the sand content reading. The inspector shall document the washing procedure used and confirm that the final wash water condition is acceptable prior to recording the sand content result.

Hardness

Hardness of mixing water or ground water is measured by a titration process using a standard API kit that can be obtained for this purpose. A small sample of the water is put into an evaporating dish,

and chemicals are added to change its color, usually to purple. An amount of another chemical sufficient to turn the color of the water to a target color, usually blue, is then released from a graduated burette (titrated) into the water, and the volume required for the color change measured. The hardness is then determined from a table provided with the kit from the measured volume of the titrated chemical. A simpler, but less accurate, field kit for hardness is also available. This kit requires that only one chemical be added to the water in order to estimate hardness. The inspector shall record hardness test results where required and verify that anti-hardness additives or treatment measures are implemented when needed.

Free Water and Cake Thickness

A device called a filter-press is commonly used for this test. The device consists of a small slurry reservoir that is installed in a frame, a filtration device, a system for collecting and measuring a quantity of free water, and a pressure source. The test is performed by forcing slurry through a piece of filter paper under a pressure of 100-psi (689-kPa) for a period of 30-minutes. The free water that is recovered is measured in cubic centimeters, and the thickness of the cake that is formed is measured to the nearest millimeter. Before measuring the cake thickness, the superficial gel is washed away. The inspector shall document filter-press results when required and verify compliance with Specification limits prior to acceptance for continued shaft construction operations.

Shear Strength

The shear strength of mineral slurry is influenced by the percentage of mineral that is present, by the thoroughness of mixing, and by the amount of time since agitation. The shear strength at a given time can be measured by use of a device called a shearometer. A determination by the shearometer merely involves the rate in which a thin-walled cylinder will settle in a beaker of slurry. The shear strength test is not commonly performed for drilled shaft slurries but can be of aid in diagnosing problems on occasion. When used to diagnose slurry performance issues, the inspector shall document shear strength readings, the time since agitation, and any corrective action taken.

2. Inspection of Rebar

Rebar shall be inspected for conformity to the shop drawings and plans; the size, spacing coating, length, clear space between bars and grade are all to be verified. Bending of rebar is restricted unless specifically approved by the Design Engineer or Construction Manager. Any rebar coating damaged, through bending, shipping, or handling, shall be repaired by a means approved by ACI and/or CRSI. Within formwork, rebar shall maintain 2" of clear space between the outer most rebar and the associated formwork allowing for 2" of protective concrete cover. Rebar shall not be

placed on bare earth. The inspector shall document acceptance of the reinforcing cage prior to placement, including verification of bar sizes, spacing, tie configuration, cover, and any repairs to coatings, and shall record the date/time of inspection and any nonconforming items requiring correction.

3. Splices

Splices in the longitudinal steel can be made by lapping the bars so that the bond in the rebar is sufficient to develop the full capacity of the bar in tension or compression in each bar at the point of the splice. Again, an appropriate development length, as indicated in the governing code is necessary in both bars on either side of the splice. The tie wire or clamps that are used to connect the bars must have sufficient strength to allow the cage to be lifted and placed in the borehole without permanent distortion of the cage. The steel can also be spliced by welding if weldable steel is available for the job. The inspector shall verify splice type, lap length, and location in accordance with the Contract Plans and Specifications prior to lowering the cage.

Splices in the longitudinal steel can be made also by the use of special connectors if necessary, although their use will increase costs. One such connector encloses the butt joint of two rebar and the ignition of the patented material inside the connector results in a joint with considerable strength. Weldable steel is not required because the temperature necessary to install the connectors is moderate. When special connectors are used, the inspector shall verify that the connector type, installation procedure, and required documentation conform to the approved submittals and the Contract Documents.

Splices in the longitudinal steel, if required, should be staggered so all splices do not occur in the same horizontal plane along the rebar cage. Not more than 50-percent of the splices should be at any one level. Many structural designers prefer not to place any splices in zones near the location of maximum flexural stresses in the drilled shaft-column system when large lateral loads are applied. The inspector should refer to Contract Plans and Specifications for splicing details and if unsure consult the Geotechnical Engineer. The inspector shall document splice staggering and confirm that splices are not located in restricted zones where prohibited by the Contract Plans and Specifications.

There are cases where the cage is so long that it cannot be lifted conveniently in one piece. In such a case, the cage can be spliced in the borehole. The lower portion of the cage is lifted, placed in the excavation, and held with its top at a convenient working level while the upper portion is lifted and positioned so that the two portions of the cage can be spliced together. Wire ties or clamps are usually employed to make the splices, with the ties or clamps in the longitudinal steel being staggered. The entire cage is then lowered to the correct position. Since concrete should be placed in the completed excavation as soon as possible after completion of drilling, time-consuming splicing in the hole should be minimized, or

avoided if possible. Some agencies disallow splices in zones where the probability of steel corrosion is the highest, such as splash zones in a marine environment. If in-hole splicing is performed, the inspector shall document start and finish times, splice method, and measures taken to avoid borehole disturbance and delays prior to concrete placement.

4. Centering Devices

The completed rebar cage must be sized to provide ample room for the fresh concrete to flow up the annular space between the cage and the sides of the excavation, as well as to provide adequate cover for the rebar. The necessary minimum annular space is specified in the contract drawings. Placement of the cage by eye is not recommended for any method of construction. Centering devices should be utilized for this purpose. The centering devices are more effective to assure that the cage is held an appropriate distance away from the walls of the borehole or casing during the concrete pour and serve to center the cage in the excavation so as to maintain the correct location of the center of the cage relative to the center of the column to be placed at the head of the drilled shaft. Fastening the centering skids with tie wires must be done carefully to provide the lateral stability that is needed. Stability of the centering skids can also be provided by bending them to a shape such that the base of a skid will be tied to two of the vertical bars. The centering skids should not be welded to the structural rebar, not even tack welded, unless the rebar is weldable. Rebar that are used as centering skids should be epoxy coated in order to impede corrosion of the rebar cage. Corrosion can be initiated where the bars touch the soil, and the deterioration could progress inward rapidly such that the strength of the drilled shaft could be compromised. The inspector shall verify the type, quantity, spacing, and attachment method of centering devices and shall document confirmation that required concrete cover and annular clearances are achieved.

Three or four centering devices should be placed at equal spacing around the cage at each level where they are installed, and levels of centering devices should be no farther apart longitudinally than about 10-cage diameters. Whatever type of centering devices are used by the Contractor, they must be substantial enough so that they do not collapse as the cage bumps against the side of the excavation, and the Contractor must be diligent to ensure that they are not damaged when the cage is being lifted. The inspector shall observe the cage during lowering and document any evidence of centering device damage, displacement, or cage contact with the borehole wall or casing.

The base of the drilled shaft cage to be suspended off the soil or rock at the bottom of the borehole in order to impede rebar corrosion. Small concrete, mortar or plastic "chairs" can be assembled with the bottom of longitudinal rebar for this purpose. The inspector shall verify that chair type and configuration are compatible with the Contract Documents and that chairs do not obstruct concrete flow or interfere with required base conditions.

5. Strengthening Cage to Resist Lifting Forces

A critical stage in the construction of a drilled shaft is when the cage is lifted from a horizontal position on the ground (its orientation when fabricated), rotated to the vertical, and lowered into the borehole. To strengthen the cage against distortion during lifting operations, temporary or permanent stiffening may be necessary. Transverse stiffeners that can be tied to the sizing hoops or to the longitudinal bars; these stiffeners will need to be removed or left in place, depending on the type, as the cage is lowered so that the tremie or pump line can be lowered into the excavation. The inspector shall verify the lifting plan, pick points, and any temporary stiffening measures, and shall document that stiffeners are removed or left in place in accordance with the Contractor's approved procedure and the Contract Plans and Specifications.

6. Accessories Assembled with Cage

The crosshole sonic logging (CSL) testing access tubes are assembled with the rebar cage. The inspector should check the CSL access tubes to verify they are in agreement with the Contract Plans and Specifications in terms of the quantity, sizes, and spacing of tubes and are sealed properly at the top and bottom to avoid filling with concrete or soil. The inspector shall document tube elevations, securement to cage, and confirmation of sealing prior to placement.

Load cells and sensors for the load test shafts are assembled with the rebar cage. The inspector should check the load cells and sensors are in agreement with the Contract Plans and Specifications in terms of the quantity, sizes, and location of load cell and sensors. The inspector shall verify that instrumentation is protected during handling and lowering and that identification and locations are recorded for testing and future reference.

7. Final Inspection

The inspector should check the drill hole and the drilling fluid satisfy the requirements specified in the Contract Plans and Specifications before the reinforcing cage is placed. Shaft Inspection Device, and Acoustic Televier or Optical Televier shall be specified by the GE in the Contract Documents. The inspector shall document completion of required hold points prior to cage placement, including verification of depth, stability, slurry properties, and base condition, and shall record any Shaft Inspection Device or televier results as required. Reinforcing cage placement shall not proceed until all required inspection hold points are satisfied and documented in accordance with the Contract Documents.

8. Lifting Cage

The inspector should witness the lifting of the rebar cages to see whether there is any permanent distortion due to lifting stresses. Many cages are tied rather than welded, and the cages can distort considerably during lifting

without damage. If the cages have to be spliced, the inspector will check to see that the Contract Plans and Specifications are followed in regard to the details of the splicing. The inspector should also confirm that the Contractor has removed internal stiffeners from the cage as it is being lowered into the hole. The inspector shall document observations of cage alignment, distortion, splice completion, and stiffener removal and shall record any corrective actions taken prior to proceeding.

There is some concern that the lowering of a rebar cage can cause chunks of soil or rock to be loosened, with a detrimental effect on load transfer in base resistance. The cage should be lowered carefully in order to minimize disturbance. Roller-type centering devices are useful in this respect. The inspector shall observe lowering operations and document any evidence of borehole disturbance, or sediment introduction and shall notify the Construction Manager and Geotechnical Engineer if conditions may affect base resistance. If borehole disturbance or base contamination is observed, placement of concrete shall not proceed until the condition is evaluated and dispositioned in accordance with the Contract Documents.

9. Inspection of Test or Demonstration Shafts

The test shafts are often the most critical part of the foundation installation. The procedures and construction methods established during this phase will be applied to all subsequent production shafts. For example, test results may determine that the design shaft length results in a greater shaft capacity than required and that the shafts could be made shorter or problems with the test shafts are usually followed by the same problems with production shafts. These demonstration shafts allow the determination of the best solution as quickly as possible when problems arise. It is the inspector's responsibility to be observant and communicate significant issues precisely and in a timely manner to the design and testing teams. The inspector shall ensure that all test shaft construction parameters, test setup, and results are documented thoroughly and retained as part of the project record to support production shaft acceptance criteria. Production shaft construction shall not proceed until test shaft results are reviewed, accepted, and incorporated into approved construction criteria in accordance with the Contract Documents.

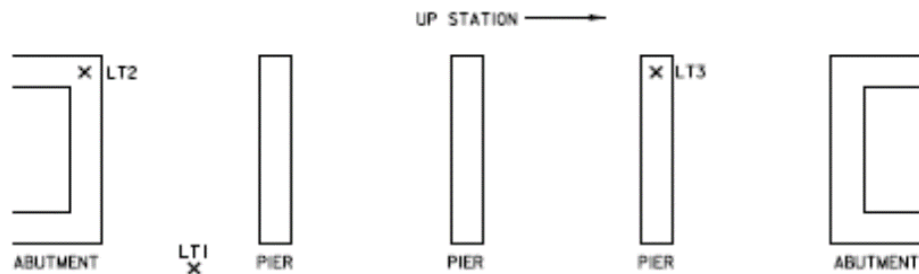
Test shafts are constructed and tested before the installation of production shafts in order to verify that design capacity can be achieved at the depth desired and as an aid in production shaft construction. Often a geotechnical test boring is performed at each test shaft location to verify the ground conditions and the length of test shafts may be modified by an inspection of these boring logs. The inspector shall coordinate with the Geotechnical Engineer regarding any modifications to test shaft length, bearing criteria, or construction method resulting from boring log review. Unapproved deviations from established test shaft parameters shall require evaluation and documented approval prior to continuation of work.

The actual installation of test shafts should be preceded by the setting up of a system of numbering if not already provided in the Contract

Documents. The numbering should be continuous from left to right in each structural unit (abutment footings, pier footings) as one faces up-station and should progress from structural unit to structural unit in an up-station direction, being continuous throughout the entire structure. The inspector shall ensure numbering is consistent with the Contract Documents and that shaft identifiers are used consistently across all logs, reports, test records, and correspondence. Inconsistent or incomplete shaft identification shall be corrected prior to acceptance of records or test results.

A Typical Test Shaft Numbering Plan is shown herein.

EXHIBIT 4 - 5 TYPICAL TEST SHAFT NUMBERING PLAN



Each inspector should have, before test shaft construction begins, logs of borings in the area and subsurface profiles taken from the foundation report. The inspector shall review these records prior to construction and document anticipated versus encountered conditions during excavation.

A Drilled Shaft Log and a Drilled Shaft Elevation and Length report will be made out for each test shaft as well as each production shaft. The standard Drilled Shaft Log and Drilled Shaft Elevations and Lengths report are in Exhibit 4 - 18 and Exhibit 4 - 19. All logs and reports shall be completed and submitted in accordance with the Authority's documentation procedures.

10. Inspection of Production Shafts

During the production shaft construction, the inspector's function is to apply the knowledge gained from the test program to each and every demonstration test shaft or production shaft. Quality assurance measures for the drilled shaft quality. The inspector shall verify that production shaft construction follows the established procedures and criteria developed from test shafts, including equipment, slurry performance, excavation controls, reinforcement placement, and acceptance checkpoints. Production shaft construction shall not proceed where deviations from approved procedures, unresolved nonconformances, or unverified acceptance conditions exist.

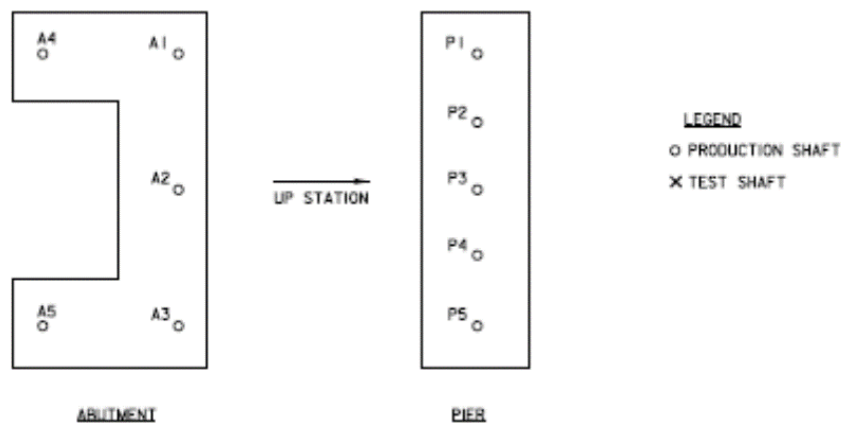
Before construction of production shafts begins, the Construction Manager should prepare a drilled shaft numbering sheet (if none has been included

in the plans). The system of numbering, for the sake of clarity and uniformity throughout the Authority's roadway should be as follows:

- The numbering should run from left to right on each structural unit (abutment footings, pier footings) as one faces up-station and should commence at the high station side of the structural unit and proceed to the low station side row by row.
- Each structural unit should have its own numbering sequence.
- Test shafts should be included in the general numbering and should also bear the test shaft numbering as discussed previously under Inspection of Test or Demonstration Shafts.

The numbering system shall be used consistently across all installation logs, inspection reports, testing records, pay documentation, and as-built records to maintain traceability and prevent discrepancies.

EXHIBIT 4 - 6 TYPICAL DRILLED SHAFT PLAN



The inspector should be supplied with a drilled shaft plan with the shafts numbered thereon as specified above and with a full set of the results of borings in the area, plotted to scale, which should show the underground stratification. The inspector shall confirm that the latest revisions to plans and subsurface information are available and shall document any discrepancies identified during construction. Use of superseded plans or subsurface data shall require immediate clarification and documented resolution prior to continuation of affected work.

The Construction Manager should conduct a meeting, prior to commencement of construction, at which responsible Contractor's personnel, the Construction Manager and the drilled shaft inspectors should be in attendance. Subsurface and surface conditions should be outlined and discussed. Construction procedures should be outlined, covering construction sequence, handling and storage of rebar, and the necessity for safety. The inspector should initially make sure that shaft

position, plumbness is correct. The inspector shall document the meeting and confirm that inspection hold points, communication protocols, and safety requirements are clearly understood prior to commencement of production shaft construction. Production shaft construction shall not begin until pre-construction coordination is completed and documented in accordance with the Contract Documents.

4.2.2.7. **Reports**

The importance of maintaining detailed drilled shaft construction records cannot be overemphasized. The records form a basis for payment and for making engineering decisions regarding the adequacy of the foundation to support the design loads. Great importance is given to records in litigations involving claims. Sloppy, inaccurate, or incomplete records encourage claims and result in higher cost foundations. Therefore, records shall be prepared, maintained in an organized and traceable manner, and retained as part of the official project record in accordance with the Authority's documentation requirements and Section 3.1.10 of this Manual, including version control and clear linkage to pay items, inspections, and acceptance decisions. Incomplete, inconsistent, or untraceable records shall require correction prior to acceptance and may delay evaluation, payment, or final acceptance.

A necessary part of the inspector's and Construction Manager's duties in production shaft construction is the preparation of reports. The inspector should prepare the Drilled Shaft Log, Drilled Shaft Elevation and Length Report and Drilled Shaft Concrete Placement Log and submit them to the Construction Manager. The Construction Manager should prepare Drilled Shaft Acceptance Summary Report. The Summary Report shall be signed by the Construction Manager and by the Geotechnical Engineer. Copies of the Drilled Shaft Log, Drilled Shaft Elevation and Length Report and Drilled Shaft Concrete Placement Log shall be attached to the Drilled Shaft Acceptance Summary Report. The Drilled Shaft Acceptance Summary Report is in Exhibit 4 - 20. In addition, the Construction Manager shall verify that all required supporting documentation is included, such as slurry test records, reinforcing cage inspection records, concreting curve documentation, truck tickets, concrete test results, integrity testing results (when required), and any nonconformance documentation with corrective actions and final disposition, and shall ensure that the reports are uploaded to the Authority's Construction Management system in a timely manner. Reports lacking required supporting documentation shall not be approved until deficiencies are corrected and documented.

4.2.2.8. **Concrete**

1. Concrete Quality and Placement

The inspector should read and become thoroughly familiar with the detailed Specifications for the manufacture of the concrete, its mixing and transportation, its testing, and its placement. It is important that the inspector ensure that the Specifications are followed carefully. An assistant can help to facilitate the checking of the concrete mix at the batch plant. The proportioning of the concrete and additives, if any, can be checked.

The inspector shall also verify that the approved mix design and any approved admixture dosage ranges are being followed, and that delivery tickets are reviewed for batch time, water added, admixtures, and any noted adjustments. Concrete not conforming to the approved mix design or Specification limits shall not be accepted and corrective action shall be implemented.

Concrete cylinder and concrete beam samples can be taken at the job site as required, and the slump can be measured. Air-entrainment can also be checked at the job site, if air entrainment is specified for drilled shaft concrete. Sampling and testing shall be coordinated so that testing activities do not unnecessarily delay concrete placement or keep the excavation open longer than necessary, and all results shall be documented and tied to the specific shaft identification. Test results outside Specification limits shall require immediate evaluation and disposition in accordance with the Contract Documents.

The inspector should observe the placement of the concrete carefully. One way of assuring that the concrete was placed properly, especially when the concrete placement cannot be observed, as in the wet method, is to plot a curve that shows the volume of concrete actually placed as compared to the theoretical volume in increments of depth. These so-called "concreting curves" give an excellent presentation of the stages of the concrete placement and can be instructive in determining whether defects might exist in the drilled shaft. The actual volume of concrete divided by the theoretical volume provides indication for defects in the shaft. The inspector shall ensure that concrete placement is continuous, that the tremie or pump discharge remains properly embedded as required, and that placement records include start and finish times, interruptions, equipment changes, and any events that may affect quality.

2. Chemical Admixtures

Typical ranges of concrete admixtures (except for accelerators, which are not ordinarily used in drilled shafts) are described in the following section on mix proportions. Admixtures are covered by various ACI and ASTM Specifications, some of which are described individually below. Admixtures used shall be those approved in the mix design and consistent with the Contract Plans and Specifications, and any field adjustments shall be documented and reviewed in accordance with the project's quality requirements. Unapproved admixture use or undocumented dosage adjustments shall not be permitted.

3. Air-entraining agents

Air-entraining agents (ASTM C 260) can be used in drilled shaft concrete when deterioration of the concrete by freeze-thaw action is possible (e. g., where the top of the shaft is above the depth of frost penetration). Entrained air will also improve workability and pumpability and reduce bleeding; however, it can produce a slightly more permeable concrete and will also produce a concrete mix that is more susceptible to segregation during free-fall placement than a mix without entrained air. When air entrainment is specified, the inspector shall verify compliance with allowable air content

limits at the point of placement and document any corrective action taken if results are outside specification limits.

4. Retarders

Retarding admixtures may be needed in the concrete mix when the concrete is to be placed during periods of high temperatures ($> 70^{\circ}\text{F}$) in order to reduce the slump loss in the period during which the concrete is being placed in the drilled shaft. This is primarily to provide the Contractor with an adequate period of time to work with temporary casing and tremie-placed concrete. A general rule is that this period should be about 4-hours to allow for unforeseen delays. The inspector shall verify that retarder usage is consistent with the approved mix design and that the concrete remains workable throughout the pour without exceeding specification limits for placement time, temperature, or other acceptance criteria.

5. Water Reducers

Water reducers reduce the friction between the hydrating cement particles in the cement paste before the concrete begins to take its set, thereby increasing the workability (slump) of the fluid concrete without the need for excessive water. In order to achieve the high values of slump that are desirable for drilled shaft construction without water reducers, water/cement ratios need to be in the range of 0.5 to 0.6 (by weight). More than half of the water in such a mix is present only for lubrication of the cement paste during concrete placement and is not needed for cement hydration. The excess water produces a hydrated cement paste that contains many pores, which results in a permeable, weak concrete. Therefore, the inspector shall monitor for improper field water addition and shall verify that required workability is achieved through approved admixtures and approved water/cement ratio limits. Unauthorized water addition shall not be permitted and may result in rejection of the affected concrete.

6. Accelerators

Accelerators have a place in some instances in substructure and superstructure construction, but they should not be used in drilled shaft construction except in extraordinary situations [e. g., possibly when a segment of a drilled shaft is being placed in a stratum of granular soil having rapidly flowing groundwater, when a casing cannot be used to seal off the stratum, in order to minimize leaching of the cement]. Concrete specialists should be consulted whenever the use of accelerators is contemplated, and the Contractor will need to be very attentive to cleaning casings, pumps, pump lines and tremies quickly, before setting occurs. Any proposed use of accelerators shall require review and acceptance consistent with the Contract Documents, and the inspector shall document the reason for use, dosage, placement impacts, and cleaning measures implemented. Use of accelerators without approval shall not be permitted.

7. Other Admixtures

Other types of admixtures are available for special cases. Examples of these are anti-bacterial and anti-fungal agents, alkali-reactivity reducers, bonding admixtures, corrosion inhibitors and pumping aids. Except for pumping aids, which are normally polymer products added to the concrete prior to pumping to aid in lubricating the pump lines, these are rarely used in drilled shaft construction. The inspector should be aware of their existence. Where such admixtures are used, the inspector shall verify conformance with the approved mix design and ensure proper documentation of product data, batch quantities, and testing impacts. Unapproved admixtures shall not be permitted.

8. Concrete Tests

Tests at the Batch Plant

Most concrete for drilled shafts is supplied by ready-mix plants, but in some cases the job is large enough to justify a batch plant at the jobsite. Some suppliers also can bring batched dry ingredients to a job site and blend and mix them with water only when the Contractor is ready to make the pour. In any case tests at the concrete batch plant site are advisable. Items that can be checked are the nature and quantities of the components of the mix, the aggregates, cement, water, and admixtures. The inspector shall verify that materials certifications and delivery documentation are available where required and that batching records are consistent with the approved mix design. Concrete produced without proper certification or batching documentation shall not be accepted.

It would not be unusual for the aggregates to change as a job progresses, such that a new mix design would be required. Depending on how the aggregates are stored, the water content may experience rapid changes with time so that the amount of water to be added to the mix would need to be adjusted daily or even more frequently. If aggregate source, gradation, moisture, or other conditions change, the inspector shall document the change and confirm that any required mix adjustments or revised mix designs are handled in accordance with the Specifications. Unapproved changes in mix design shall not be permitted.

An inspector at the mix plant should check the temperature of the components and of the completed mix for conformance with the Specifications. Temperature monitoring shall include ambient conditions when required by the Specifications and shall be documented with the associated load information. Concrete outside allowable temperature limits shall require corrective action prior to placement.

Tests at the Jobsite

The organization of the job must be such that the time required to perform tests at the job site is kept to a minimum. There are two reasons; first, the excavation should remain open for as short a period of time as possible to reduce the chance of caving in; and second, the concrete should be placed as rapidly as possible so that the workability of the concrete will remain high during the entire pour. Because of the first requirement, batch-plant inspection and the timely ordering and delivery

of concrete should be emphasized. The inspector shall coordinate testing and delivery sequencing so that placement operations proceed efficiently while still meeting all required quality control and acceptance testing requirements. Testing activities shall not unnecessarily delay placement nor compromise compliance with Specification requirements.

The recommended minimum jobsite testing is to measure temperature, slump, air content, and to recover cylinder samples for later strength testing. An experienced worker can measure the slump by the use of a slump cone. It is recommended that at least three cylinder samples be made for each drilled shaft and that a minimum of one cylinder be made from each ready-mix truck. Cylinder samples can be made from small stockpiles that are recovered from each truck in a few seconds, freeing the truck to deposit concrete in the borehole immediately. If the concrete is to be pumped, slump loss can occur in the pump line so that good practice is to take samples for slump testing at the discharge point. It is recommended that at least two slump tests, from the first and last ready-mix truck, be tested for each drilled shaft and more tests may be performed if unsatisfactory results obtained from the first test. Cylinders should be cured and tested in accordance with the Specifications. All test results shall be recorded and correlated to the specific shaft number, truck ticket, and placement time, and curing procedures shall be verified to ensure results are valid and defensible. Concrete not meeting Specification requirements shall be evaluated and dispositioned prior to acceptance, and any rejected loads shall be clearly documented.

9. Addition of Water at Job Site

One reason for rejecting a batch of concrete is that the slump is too low. The question always arises as to the advisability of adding water to the concrete in a ready-mix truck. The added water will increase the workability, but it will have the detrimental effect of reducing the strength and durability of the concrete. The result of adding water at the jobsite could be a significant change in the characteristics of the mix and increase the possibility of segregation as the pour is made. Therefore, water addition shall be strictly controlled and documented in accordance with the mix design and Specifications, including the amount added, time added, and resulting slump and performance checks.

In some cases, only part of the mixing water is added at the batch plant, and the remainder is intended to be added at the jobsite. Furthermore, some mixes will be tolerant of some extra water. In either of these cases, the amount of water permitted to be added at the jobsite should be stated on the mix design sheet carried by the ready-mix truck driver. Additional water can then be added without harm. If the slump is then adequate, the pour can begin. The inspector shall verify that any permissible water addition is stated on the mix design sheet and that additions do not exceed allowable limits.

If travel times from the batch plant to the jobsite are unpredictable, bring dry ingredients to the jobsite, and mixing them with water just prior to the pour, should be considered. If, after all water permitted by the mix design has been added, the slump is still not high enough, the inspector must note the deficiency and inform the Contractor. The Contractor is then faced with the decision of adding water

sufficient to bring the slump up to the minimum value or ordering new concrete. Waiting for new concrete to arrive will allow time for deterioration of the borehole, possibly even sloughing or collapse of the borehole or similar negative events. On the other hand, adding water beyond that which is permitted may preserve the borehole but produce substandard structural concrete. Where it is necessary to produce durable concrete of low permeability (aggressive environments), the addition of excess water should be absolutely disallowed. Where this is not a concern, at the Construction Manager's discretion, work may be allowed to proceed at the Contractor's risk. If the cylinder strengths measured at a later date are not adequate, however, the Contractor should be required to repair or replace the questionable shaft or shafts at the Contractor's expense. Repair and replacement techniques should be approved by the Construction Manager. Any decision to proceed at the Contractor's risk shall be documented with justification, and any proposed repair or replacement approach shall include a clear plan for verification of structural integrity and long-term performance consistent with the Contract Documents.

10. Placement of Concrete

Placement by Free Fall

It is possible to place concrete by free fall if the method of construction is the dry method or the casing method. The Authority's Specifications for drilled shafts associated with sign structures does not allow the placement of concrete by free fall; however, some Specifications allow the concrete to fall freely for a short distance. The problem with the concrete falling freely to position is that there may be segregation. Segregation is more likely to occur if the concrete is allowed to strike an obstruction as it falls. Therefore, the concrete should not fall through the rebar cage or strike the sides of the excavation. The inspector shall verify that placement method complies with the Contract Documents for the specific shaft type and location and shall document free fall distance limits and compliance where permitted. Free fall placement not permitted by the Contract Documents shall not be allowed.

The flow of the concrete in free fall should be directed to the center of the borehole and cage by a drop chute or other acceptable device to keep the stream of falling concrete centered in the hole. A flexible hose that can be cut off as the pour proceeds that is attached to a hopper that receives the concrete from the ready-mix truck provides an adequate drop chute. The drop chute method is allowed a maximum free fall distance of 5-feet. With this drop chute, it is possible to discharge directly from the ready-mix truck (either into the hopper on top or into one of the side holes as the level of concrete in the hole rises), while ensuring that the 5-foot free fall distance is not exceeded. In either case, the length and position of the bottom orifice of the drop chute must be controlled so that the concrete does not strike an obstruction as it falls. The inspector shall observe and document chute configuration and adjustments during placement to confirm the stream remains centered and free fall limits are maintained. Failure to control free fall distance or maintain centered placement may require evaluation of potential segregation or defects prior to acceptance.

Placement of Concrete by Tremie

The placement of concrete must be made by use of a tremie (steel tube) or flexible hose if the free fall placement is not permitted where the excavation is partially filled with a fluid, or the drilled shaft is installed on a batter, or the geomaterial potentially can collapse when shock waves are generated by falling concrete. The tremie or pump line must be used to guide the concrete to an appropriate discharge point in the borehole, usually the center of the bottom of the hole. The inspector shall verify tremie or pump line embedment requirements are maintained throughout placement and that the tremie is not withdrawn above the concrete surface during placement.

Placement by Gravity-Fed Tremie

A gravity-fed tremie is a steel tube, usually with a hopper on the top, that is fed from a pump or by discharging from a bucket. Aluminum should never be used because of reactions with the concrete, and plastic pipe such as PVC should be discouraged because it is not robust enough. The diameter of a tremie tube for gravity placement of concrete depends on the diameter and depth of the excavation; tremies with an inside diameter of 10 to 12-inches are in frequent use. Tremies may be assembled from threaded 10-foot long sections with waterproof joints or welding together sections of pipe to form a single tube. The inside surface of the tremie should be smooth to minimize drag on the concrete. The outside surface of the tremie should also be smooth so that there is no danger of a projection becoming hooked on the rebar cage as the tremie is removed during concreting. The wall thickness of the tremie must be sufficient to provide the necessary strength and stiffness. The inspector shall verify tremie condition, joint integrity, cleanliness, and suitability prior to placement and document any issues requiring correction.

If concrete is being placed where there is water or slurry in the excavation, the tremie must be deployed so that there is a minimum of contamination of the concrete. In order to avoid contamination, the bottom of the tremie may be sealed with some kind of plate before the tremie is placed in the wet excavation or a plug of some description may be inserted at the top of the tremie after the tremie is placed in the wet excavation but before the tremie is charged with concrete. The inspector shall observe and document the plug or seal method used and confirm that initial discharge is controlled to minimize mixing of slurry and concrete.

Placement by Pump

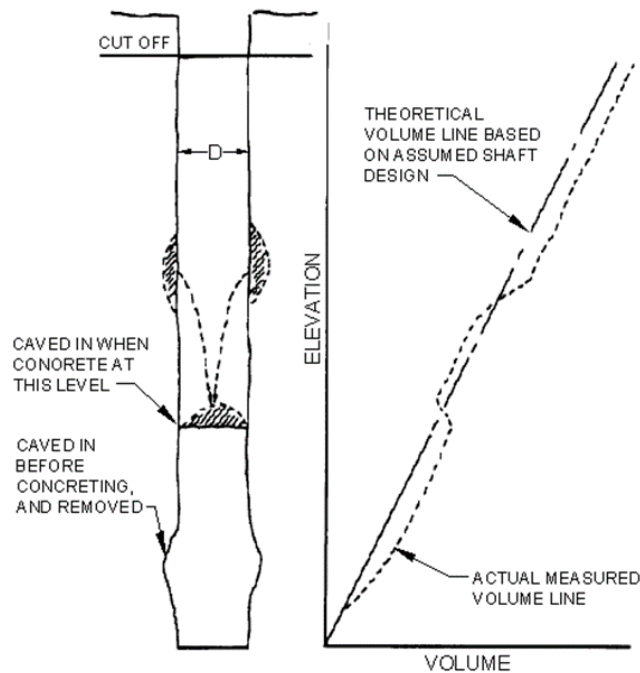
A concrete pump is used frequently to transport the concrete from a convenient discharge location for the ready-mix trucks to the gravity-fed tremie. Another frequent use of the concrete pump is to transport the concrete directly into the borehole. A pump line can be run from the pump directly into the borehole. It is preferable that the portion of the line that is in the borehole be a rigid steel tremie. The line running from the pump to the tremie is usually flexible. However, complete flexible-line systems have

been used successfully as long as they have been designed so that they stay straight within the borehole. The inspector shall verify that pumping equipment is suitable for the operation, that line configuration does not interfere with the reinforcing cage, and that the discharge location and embedment are controlled to prevent segregation or contamination. Concrete pumping operations shall not proceed unless equipment configuration and placement method conform to the Contract Documents and approved procedures.

11. Concreting Curves

Construct a curve to show the actual amount of concrete that was required to fill an excavation incrementally compared to the theoretical incremental volume of the excavation. When the actual volume of concrete placed is less than the theoretical volume for a portion of the depth of pour indicates that the shaft size is smaller than the actual. This is cause for further investigation. Development of the concreting curve requires that an estimate be made of the diameter of the shaft with respect to depth. Accurate plots of the theoretical curves can be made using borehole diameter data from mechanical or laser calipers or sonic borehole loggers or the actual diameter can be estimated by experience based on the nominal diameter. The actual volume of concrete placed as a function of depth can be determined by counting the number of pump strokes in a piston pump (knowing the volume of the pump) for each selected increment of concrete surface depth, which can be measured by means of a weighted tape, even if the concrete is under a slurry, or by measuring concrete volume with a magnetic flow meter. If concrete is placed into the tremie hopper using a bucket, the volume of the bucket will have to be known accurately, and the number of feet of concrete rise in the borehole is measured for each bucket placed. The inspector will complete a Drilled Shaft Concrete Placement Log, including a concrete curve, for each drilled shaft. A sample Drilled Shaft Concrete Placement Log is provided as Exhibit 4 - 21. The inspector shall ensure that the concreting curve is reviewed for anomalies during placement when practical, and that any anomalies are promptly reported and evaluated to determine whether additional inspection, testing, or corrective action is required.

EXHIBIT 4 - 7 EXAMPLE CONCRETING CURVE



4.2.2.9. Completed Shafts

1. Completed Drilled Shaft

The inspector should be present as the concrete reaches the cutoff level to observe the disposal of any contaminated concrete and to observe the preparation of the top of the shaft. This includes a final check on the horizontal position of the center of the shaft, which is usually taken at this point to be coincident with the center of the rebar cage, and elevation. The location of the center of the shaft at this time or at any other time during the construction operation can be determined using offset stakes that are usually set by the Contractor before the excavation of the borehole begins. The inspector shall document cutoff elevation, top preparation method, and confirmation that contaminated concrete (if any) is removed and disposed of in accordance with the Contract Documents and applicable requirements. Shaft top preparation and cutoff elevation not meeting Specification tolerances shall require corrective action prior to acceptance.

Records should be made of the elevation of the completed shaft and its horizontal position relative to its plan location. These records shall be tied to the shaft identifier, survey references, and applicable tolerances and retained as part of the drilled shaft acceptance documentation. Discrepancies between as-constructed location/elevation and plan requirements shall be evaluated and dispositioned in accordance with the Contract Documents prior to final acceptance.

2. Post-Grouting

Because the excavation of a drilled shaft borehole tends to loosen granular soils, especially beneath the base, making the load-settlement response of the base "soft" compared to that of driven piles, some Geotechnical Engineers specify post-grouting to stiffen the base response and to increase the bearing capacity of the shaft. Post-grouting can also be used as a remedial measure when problems are suspected to have occurred during construction. The grout may be introduced through internal tubes cast within the concrete and placed outside the rebar cage, with valves at various elevations. The grout is pumped into the tubes when the concrete is fresh. Use of grout pressures in the range of 50-atmospheres can cause the fresh concrete to fracture and exert very high lateral pressures on the interface. It is emphasized that post-grouting requires considerable expertise on the part of the Contractor. When post-grouting is specified, the inspector shall verify tube configuration, valve locations, grout materials, pressures, volumes, and timing and shall document the post-grouting operation and results in the project records.

3. Drilling Near a Recently Concreted Shaft

The concrete in a recently concreted shaft must achieve an initial set before drilling can be done in the vicinity. The definition of "vicinity" varies widely. Driving, vibration and extraction of casing, particularly in rock, or unbalanced ground pressures due to the opening of a nearby excavation, could cause cracking in the unset concrete, which would conceivably affect its durability and future performance. It is prudent to disallow driving of piles or casing, or opening of boreholes for new drilled shafts, closer than about three shaft diameters clear spacing to the shaft with newly set concrete. Staggering of the construction sequence of closely-spaced drilled shafts to avoid this problem is an effective solution. The inspector should consult the Specifications for specific Project requirements. The inspector shall document construction sequencing controls implemented to protect newly placed shafts and shall report any activities that may compromise curing shafts to the Construction Manager and Geotechnical Engineer immediately.

4. Field Loading Tests

The load-movement behavior of drilled shafts is highly dependent upon the details of local geology and upon the construction procedures followed by the drilled shaft Contractor. Loading tests of drilled shafts are therefore very desirable when it is feasible to perform them. Loading tests are performed to prove that the test shaft is capable of sustaining an axial load and to gain detailed information on load transfer in side and base resistance or lateral/uplift performance. They are also utilized in demonstration shafts to determine production shaft depths. When field loading tests are required, the inspector shall verify that test setup, instrumentation, calibration documentation, and test procedures conform to the Contract Documents and approved submittals and that test data is recorded in a clear and defensible manner.

Borings at the Immediate Testing Site

Whether the loading test is conducted directly along the alignment of the Project or at a nearby special site often borings are taken near the test shaft, so that the characteristics of the soil at the test site can be compared with similar characteristics at the prototype shaft locations within the Project boundaries in the same geologic formation. If multiple geologic formations exist on the site, careful consideration should be given to conducting loading tests within each formation. The inspector shall ensure boring logs and test site documentation are maintained with the test records and are available for correlation with project geology and production shaft acceptance criteria.

Conventional Loading Test

Because full-scale drilled shafts often have very high capacities, a test load of high magnitude will be required. Conventional loading tests of drilled shafts can be performed with portable reaction frames and jacking systems capable of imposing loads on a test shaft or by a hydraulic ram that reacts against a pair of reaction beams (sometimes two or four rams in parallel are used if the capacity of a single available ram is insufficient). The beams transfer the load to reaction shafts that are designed to sustain uplift loading. The inspector shall verify reaction system alignment, stability, and safety measures prior to loading and shall confirm that load steps, hold times, and measurement procedures meet the Contract Documents.

Osterberg Cell Testing

Instead of using a conventional jack, reaction frame and reaction anchor system, the axial loading test can be performed by applying the load with an expendable hydraulic jack and load cell cast within the test shaft called an Osterberg cell. The Osterberg cell consists essentially of two plates of a prescribed diameter between which there is an expandable chamber that can hold pressurized fluid. In practice the hydraulic pressure will usually be measured at the ground surface, but the cell is situated at some distance below the ground surface, so that when it is activated it applies load equally to the drilled shaft above the cell (in an upward direction) and to the geomaterial at the base of the borehole (in a downward direction). Movement can be measured at the top of the cell through telltales. The inspector shall verify that instrumentation is installed and protected as required and that pressure and movement readings are recorded in accordance with the testing procedure.

Statnamic Testing

A Statnamic loading test also can be performed without the need for an expensive reaction system. An advantage of this type of test relative to the Osterberg cell test is that it does not require the loading device to be cast into the shaft. That is, the Statnamic loading test can be performed on a drilled shaft for which a loading test was not originally planned. Like the Osterberg cell test, the principle is very simple. Dead weights (reaction

masses) are placed upon the surface of the test shaft. Beneath the dead weights is a small volume of propellant (fuel) and a load cell. The propellant is ignited and accelerates the masses upward. As this occurs, a reaction force equal to the mass of the reaction masses times their acceleration is produced against the head of the shaft. This force, which increases with time up to 1 to 200-milliseconds, causes the shaft to settle. As the ignition of the propellant stops, the reaction force rapidly decreases and the shaft rebounds. The settlement of the shaft head is measured by means of a laser beam from a source some distance away from the test shaft that is targeted on the shaft head. The load can be graphed against both time and settlement instantaneously. The inspector shall verify that safety controls are implemented for statnamic testing and that measurement systems are set up and documented in accordance with the test procedure. Statnamic testing shall not proceed without an approved test procedure, verified calibration of instrumentation, and documented acceptance criteria consistent with the Contract Documents.

Conventional Uplift Testing

If production shafts are to be subjected to substantial uplift loading during their design lives it is appropriate to perform uplift tests. The key feature of the arrangement is that some of the longitudinal rebar, that are embedded full length in the test shaft, extend upward to a point well above the head of the test shaft. It is helpful if these extended rebar are made of high-strength steel. The reaction beams, which are supported on surface mats, can sometimes be positioned so that the extended rebar pass between the beams, so that no holes need be cut. A thick plate can be connected to span between the extended rebar at some point above the reaction beams, and the loading ram can be placed between a cross beam set on top of the reaction beams and the plate. For cases where the load to be applied is greater than the capacity of a single ram, a center hole hydraulic ram can be placed over two or more rebar to apply the load. These rams should have calibration curves that are nearly equal, especially if the rams are to be pressurized through a common manifold. However, it is desirable that load cells be used for each ram to measure the applied load. The inspector shall verify calibration data, load cell identification, and measurement procedures and ensure that load increments and readings are documented clearly.

Lateral Loading Tests

Drilled shafts are capable of sustaining very large lateral loads because of their high moments of inertia. However, their behavior under lateral loading is highly dependent upon the soil or rock in which they are embedded and upon the condition of shaft-head fixity. Lateral loading tests can be conducted with Osterberg cells or by using the Statnamic device. The inspector shall verify the lateral test setup, instrumentation, reference systems, and acceptance criteria in accordance with the Contract Documents and testing procedure.

Nondestructive Evaluation

When called for in the Contract Documents, specific completed drilled shafts, the number and/or location of which are specified in the Contract Documents, shall be subjected to nondestructive tests to evaluate their structural integrity. Such tests may include (a) downhole tests conducted in access tubes, including crosshole acoustic tests and backscatter gamma ray (gamma-gamma) tests, (b) sonic echo tests, or (c) thermal integrity profile testing. The type of test to be used is specified in the Contract Documents. The inspector shall verify that access tubes, where used, are installed and maintained in a condition suitable for testing and that testing is scheduled after required curing periods.

The Contractor shall be responsible for performing and submitting reports of such tests to the Construction Manager in a timely manner. All testing shall be conducted after the concrete has cured. The Contractor shall employ a registered State of New Jersey Professional Engineer who is qualified to perform, evaluate and report the tests. The Construction Manager shall review reports for completeness and conformance with Contract requirements and shall document acceptance, required follow-up actions, and final disposition in the project records.

Parallel Seismic Test

This test is useful in cases where the top of the shaft, or the top of the cap just above the shaft, are not accessible. In this case, a point on the substructure above the shaft is impacted, and the propagated wave travels down the shaft. Part of the wave energy in the shaft is transmitted into the soil or rock near the shaft, and the time of the arrival of the wave energy in the soil is sensed by hydrophones positioned at various depths in the tube. A change in the arrival rate indicates the presence of a major defect. The inspector shall confirm that test setup, tube condition, and measurement procedures are implemented as required and that results are provided in report form.

Crosshole Acoustic (Sonic and Ultrasonic) Tests

Metal (usually Schedule 40 steel) access tubes can be cast longitudinally into a drilled shaft by attaching the tubes to the reinforcing cage if it is planned to test a particular shaft. It is advisable to place several tubes in the shaft but not to place so many as to impede the flow of concrete. To perform a crosshole sonic or ultrasonic test, an acoustic transmitter is lowered into one of the fluid-filled access tubes, and a receiver is lowered to the same depth in another fluid-filled tube. The transmitter emits an acoustic signal at an assigned frequency, and that signal is picked up by the receiver. The test is repeated at many depths. The inspector shall verify that tubes are properly secured, remain unobstructed, and are filled and capped as required to permit testing.

All access tubes shall have a round, regular inside surface free of defects and obstructions, including all pipe joints, in order to permit the free, unobstructed passage of probes to the bottoms of the tubes. The access

tubes shall be watertight, free from corrosion and free of deleterious material on the outside that can prevent bonding with the concrete. All access tubes shall be fitted with watertight caps on the bottom and top. The inspector shall document tube condition and cap installation prior to concrete placement and note any corrective actions taken.

Sonic Echo Tests

Sonic echo tests shall be permitted in lieu of downhole tests involving access tubes at the discretion of the Construction Manager and the Geotechnical Engineer. Equipment and procedures to be used for sonic echo tests shall be capable of detecting defects that occupy no more than 30-percent of the cross-sectional area of the drilled shaft and are no greater than 6-inches thick. Any substitution of test method shall be documented and approved in accordance with the project requirements.

Thermal Integrity Profile Testing

Thermal Integrity Profile testing in accordance with ASTM D7949 shall be required by the Authority for all shafts with diameters of 6-feet or greater. The inspector shall verify that thermal sensors are installed as required and that testing reports are submitted and reviewed for compliance.

4.2.2.10. Safety

Safety devices such as a hard hat, ear protection, steel toed work boots, eye protection, safety vest, fall protection harness, and life jacket should be worn as job conditions dictate. The inspector shall also comply with the site-specific safety plan, including exclusion zones for lifting, drilling, tremie operations, concrete placement, and testing activities, and shall report unsafe conditions immediately.

Additional site specific and Authority safety rules shall also apply and these should be reviewed. Daily safety briefings, permit requirements, and hazard controls (including working over water, confined space considerations where applicable, and equipment swing radius controls) shall be observed and documented as required by the project safety requirements.

4.2.3. Micropiles

Micropile construction inspection shall be performed in general accordance with the FHWA Micropile Manual (FHWA NHI-05-039). Maintain on site copies of relevant sheets from the Contract Drawings, Specifications, and Shop Drawings on site showing micropile layout and details. The inspector shall confirm that the latest approved revisions of these documents are available on site and that field personnel are working to the current version. Work performed to superseded documents shall require evaluation and documented disposition prior to acceptance.

Verify materials are in accordance with the Contract Documents such as micropile casing diameter, wall thickness, and yield strength, reinforcing bar size and yield strength, centralizers, plates, nuts. Ensure material meet Buy American / Buy American requirements, if applicable. If corrosion protection of reinforcing steel bars is required (i.e.

epoxy coating or galvanization) ensure the reinforcing bars have the corrosion protection required and any scratches are repaired. Keep reinforcing steel clean and wash off any soil or debris prior to inserting in the micropile. The inspector shall document material heat numbers, mill certifications, and delivery condition where required and shall track materials to installed locations for traceability. Materials not meeting Specification requirements or lacking required certifications shall not be incorporated into the Work.

Ensure micropile installation means and methods are performed in accordance with the proposed shop drawing submittals (i.e. Down the Hole Hammer vs Roller bit, etc.). During drilling ensure the casing shoe proposed in the Shop Drawings is installed, ensure the micropile casing is installed within plan tolerance of the proposed location, measure micropile casing lengths and count micropile casing segments to obtain the total casing length including shoe, measure stickup above the reference elevation to obtain the micropile casing tip elevation. For Micropiles in soil the micropile casing is typically installed to the tip of bond zone and retracted up to the permanent tip of casing elevation during grouting. For micropiles bonded in rock, the micropile casing tip is typically seated into rock as shown in the Contract Drawings with the bond zoned drilled below the tip of casing, in rock. Measure drilling rods and count the number of drilling rod segments, to determine the depth drilled. Verify the depth drilled using a weighted tape. Ensure reinforcing bar couplers are utilized in accordance with the Contract Documents, Shop Drawings, and Manufacturer's recommendations. Perform video inspection if required by the Contract Documents for micropiles bonded in rock. The inspector shall document drilling observations, including encountered materials, drilling difficulties, and any deviations from the approved means and methods, and shall promptly report deviations to the Construction Manager for resolution. Unapproved deviations in drilling method, casing installation, or bond zone depth shall require evaluation and documented approval prior to continuation of work.

During grouting record the actual volume of grout per micropile by counting bags of Portland cement used or by using a flowmeter. Record the specific gravity measured with a mud balance as required by the Contract Documents. Verify grout cubes or cylinders are collected at the frequency and quantity required by the Contract Documents. Ensure the tremie tube is placed to the bottom of the micropile and remains a minimum of 5 feet below the top of grout throughout the grouting process. If pressure grouting or post grouting is required by the Contract Documents, record the pressure achieved. The inspector shall also document grout start and finish times, any interruptions, grout refusal or loss conditions, and verification of tremie embedment throughout placement. Grouting operations not meeting Specification requirements for mix, volume, pressure, or embedment shall require corrective action prior to acceptance.

Observe static axial compressive or axial tensile load tests as required by the Contract Documents. Obtain calibration data for the hydraulic jack and load cell. Verification Load Tests are typically tests performed on sacrificial non-production micropiles. Proof Load Tests are typically performed on production micropiles. Perform the load test at the load increments required by the Contract Drawings. Record jack pressure, jack serial number, load cell digits, load cell serial number, dial gauge readings, reaction beam displacement, and piano wire readings as applicable. The inspector shall verify test setup alignment, reference systems, and safety measures and shall ensure that test data and reports are submitted, reviewed, and retained in the project records. Load testing shall not be accepted without documented calibration, complete data records, and verification that test procedures conform to the Contract Documents.

4.3. STEEL AND CONCRETE CONSTRUCTION

The construction of structures, that meet the requirements of the Contract Plans and Specifications, is important to the structures life and durability, and to provide a safe environment for the public. The Construction Manager will provide a qualified inspector at the location of each structure construction. The inspector will possess the qualifications, knowledge, and the level of experience needed to adequately inspect the Contractor's work. The inspector will inspect each stage of construction, in a timely manner, prior to the Contractor proceeding with further work. The inspector shall also verify required hold points, coordinate with the Construction Manager for approvals, and ensure that inspection documentation supports acceptance of the work and is maintained in accordance with Section 3.1.10 of this Manual.

The construction, inspection, and testing shall be in accordance with Section 400 of the Specifications. In addition, all work shall comply with applicable Authority standards and procedures referenced in the Contract Documents, including documentation and quality requirements.

4.3.1. Pre-Construction Conference

It is always recommended to have a pre-construction conference with the Construction Manager, Owner's representative, designer, Contractor, and inspector in attendance. A chain of communication should be established, and the limits of authority of the inspector should be clarified. The Contractor's schedule and workplan should be presented and foreseen issues shall be discussed. Methods of measurement and payment shall be discussed, along with the contract time and the assessment of damages, for failure to complete work on time. The meeting should also address submittal procedures, inspection hold points, testing requirements, work zone and safety expectations, coordination with utilities and stakeholders where applicable, and documentation requirements including daily reporting and photographic records.

4.3.2. Items to be Inspected

There are several items, of the Contractor's work, which the structural inspector shall inspect. In addition, the inspector shall become familiar with the Project and shall check items before any work is undertaken. These items to be inspected may be grouped under the following main areas.

- Review of the Contract Plans, Specifications, submittals, shop drawings, erection plans, and falsework plans.
- Checking the location and layout of the structure.
- Inspection of materials.
- Inspection of the excavation and the foundation conditions.
- Inspection of the Contractor's equipment and formwork.
- Inspection of reinforcing steel.
- Inspection of concrete placement and curing.

- Inspection of structural steel erection.
- Inspection of girder placement.

The inspector shall document inspections and acceptance of each stage in a timely manner and shall immediately report nonconforming conditions to the Construction Manager so corrective actions can be implemented prior to proceeding with subsequent work.

In order to adequately perform the inspections required, the structural inspector should be equipped with the following materials and tools.

EXHIBIT 4 - 8 STRUCTURAL INSPECTOR'S TOOLS CHECK LIST

Approved Job Information	Daily Essentials
Project Plans with Revisions	Safety Vest
Standard Specifications	Hard Hat
Supplementary Specifications	Steel Toed Boots
Geotechnical Report	Gloves
Approved Shop Drawings	Ear/Eye Protection
Approved Submittals	Pen/Pencil/Marker
	Safety Harness
Blank Forms	Chalk and Paint
Personal Diary	Scale
Sketch and Note Pads	Measuring Tape
	Watch
Contact Information	Camera
Incident Communication Plan	Clip Board
Map of Nearest Hospitals	Telephone
	Lights

In addition to the above, the structural inspector should have access to approved digital inspection forms, current revision logs for plans and submittals, and a means to capture and upload photographs when required by project procedures.

4.3.2.1. Pre-Construction Review and Inspection

The structural inspector will thoroughly study the plans, and applicable Specifications which pertain to the work being inspected. The structural inspector will also review the plans for any possible errors and shall check the quantities and elevations. Any errors found shall be brought to the attention of the Construction Manager, so that the information may be transmitted to the designer for verification and correction. The structural inspector shall also verify that all required permits, approvals, and accepted submittals applicable to the work are in place prior to the start of construction activities.

The location of the structure shall be checked in the field to verify that it best fits the terrain and obstructions. No structures shall be relocated without the approval of the owner's representative and the designer. Any field conflicts or constructability issues identified shall be documented and promptly elevated through the established chain of communication for resolution.

The Contractor's falsework plans shall be designed and stamped by an Engineer who is licensed in the State of New Jersey. The plans will be submitted to the Construction Manager for review. Upon receipt of the reviewed falsework plans, the structural inspector will review and become familiar with the plans prior to construction. The structural inspector shall verify that falsework is constructed and maintained in accordance with the reviewed plans, including verification of required inspections, monitoring, and any required adjustments during the work.

4.3.2.2. Location and Survey

All structures will be staked by a licensed land surveyor. A second, independent licensed land surveyor will check the staking of the first crew to verify that all of the staking is done correctly. The inspector shall check the flow lines and grades to verify the structure fits the field conditions. The inspector shall confer with the surveyor, in order to thoroughly understand which lines and offsets have been staked. The inspector shall document survey checks and confirm that control points, benchmarks, and offsets used are consistent with the Contract Documents and any approved survey control information.

It is the Contractor's responsibility for all lines and grades used in the construction and to construct the structure in accordance with the plans. The inspector shall check the Contractor's lines and grades to verify that they conform to the plans. Any discrepancies identified shall be reported immediately to the Construction Manager and addressed prior to continuation of work that may be impacted.

4.3.2.3. Material Inspection

The Contractor will submit shop drawing, including details, camber diagrams, shipping statements, and bolts and parts lists for review by the Construction Manager. When material is delivered to the jobsite, the Construction Manager or structural inspector will verify the delivery of the material and check if all of the material was shop inspected and accepted. The delivery and inspection of all materials shall be documented by the inspector. Structural steel shall be shop assembled to check the fit up of the steel assemblies. Structural steel shall at all times be stored in an upright position and shall be block at the bearing locations, so that twisting or camber changes are not introduced into the completed girders. The inspector shall verify that shipping and inspection documentation matches delivered members and that piece marks and quantities are consistent with approved shop drawings and shipping lists.

Steel deliveries will be stored off the ground and blocked and supported in a manner which prevents warpage or camber change. Special care will be taken to bind and block girders in a manner that provides a safe work environment, while protecting the steel girders. Reinforcing steel will be stored off of the ground and epoxy coated reinforcing steel will be covered with opaque sheeting to prevent UV

damage to the coating. The inspector shall document material storage conditions and verify that handling practices do not damage coatings, members, or bearing surfaces.

The forming, tensioning, and pouring, of prestressed beams will be inspected at the plant. The Construction Manager will provide a qualified inspector at the plant during the setup, tensioning of the strands, and pouring of the beams. The inspector will document the manufacturing of the girders and will view the concrete testing at the time of placement. The precast plant will provide testing of the concrete by an independent testing laboratory and results will be provided to the Construction Manager. Verification testing may be done by the Construction Manager, in accordance with the Specifications. The inspector shall verify that plant records include strand tensioning data, release strength confirmation, curing procedures, dimensional checks, and any repairs, and that these records are maintained with the project documentation.

Prestressed concrete girders should not be delivered to the jobsite until they are being set, in order to prevent damage. Girders should not be cast more than 60-days before being set and loaded. If the time from casting to loading will be greater than 60-days, the girders shall be weighted at the precast plant, to prevent camber creep. The girders shall be supported at their bearing locations on a level surface, to prevent warp or twisting from occurring, while being stored. The inspector shall verify storage and handling practices at the plant and jobsite, including bearing-point support and protection measures, and shall document any conditions that may affect girder integrity or geometry.

4.3.2.4. Inspection of the Excavation and the Foundation Conditions

The Construction Manager will provide an inspector to the structural excavation. The inspector will review the limits of the structural excavation and will determine, from the excavation layout, if cross sections will be needed prior to excavation, to determine the amount of structural excavation. The inspector shall also verify that excavation limits are consistent with the approved staging plans, maintenance of traffic requirements, adjacent utility clearances, and right-of-way constraints prior to commencement of excavation activities. The excavation shall be made to the elevation shown on the plans, unless satisfactory rock is found at a higher elevation. The inspector shall compare the material encountered, during excavation, to the site geology report. Any variation between subsurface conditions encountered and those indicated in the geotechnical report shall be immediately documented in the Daily Report and communicated to the Construction Manager for evaluation of potential design impacts. The foundation shall be made in the material for which the design was made. If the design material or satisfactory material is not found at the plan foundation elevation, the excavation will be drilled to locate satisfactory foundation material. Prior to making any changes in the foundation elevation, the Construction Manager shall obtain the approval of the Designer and the Geotechnical Engineer. The Authority's approval shall then be required before the change is made. All approved elevation changes shall be formally documented through field directives or change documentation in accordance with Authority procedures.

A dewatering system may be required to allow the Contractor to work in an excavation. The inspector will monitor the area, surrounding the dewatering system, for adverse settlement and possible damage. The inspector shall also verify discharge compliance with environmental permits and monitor turbidity, adjacent structure movement, and groundwater drawdown impacts where applicable.

Cofferdam drawings and design will be designed and stamped by a New Jersey Licensed Professional Engineer. The Contractor will submit copies of the cofferdams to the Construction Manager, for review. The drawings and design will be provided to the Owner's Representative for review. If the cofferdam is to be located adjacent to railroad tracks, copies of the cofferdam design and drawings will be provided to the railroad company, for their review and approval. All required third-party approvals shall be obtained prior to installation, and documentation of such approvals shall be maintained in the project records.

The inspector will review the Contractor's cofferdam layout in the field, to verify that it is correctly located and is properly sized for the excavation and construction work required. During the construction of the cofferdam, the inspector will verify the Contractor is constructing the cofferdam to the approved design and drawings. The inspector shall verify sheet pile embedment depth, bracing installation, waler alignment, tieback tensions if applicable, and compliance with approved sequence of installation. All changes to the cofferdam design will need to be properly designed and stamped by the original cofferdam designer. Approval of the redesign is required before construction work proceeds. No field modification shall be accepted without formal engineered documentation and Authority approval.

4.3.2.5. Inspection of the Contractor's Equipment and Formwork

When the Contractor lays out the excavation and sets the formwork, the Construction Manager or the Construction Manager's inspector will verify that the Contractor is properly laying out the work. Layout verification shall include dimensional checks, elevation confirmation, and confirmation of alignment relative to survey control points. The Contractor's formwork will be checked for conformity to the plans and to assure that it is adequately braced and constructed to resist the fluid loads imposed by the plastic concrete and the vibration of the concrete. The inspector shall confirm that formwork design pressures have been considered and that bracing spacing and tie systems are consistent with anticipated concrete placement rates.

Formwork may be either steel or wood, but it shall conform to the lines and grades given in the plans, be mortar tight, and rigid. The forms shall be clean and free of grease or foreign material. Wood forms shall have the plywood grain all running in the same direction and they shall be in good sound conditions. Steel forms shall have locking devices at their ends and shall have functional pin locks. Sectional steel framed forms shall be adequately pinned on all sides. The inspector shall have bent and damaged forms removed and replaced. All formwork shall have exposed corners of the concrete, beveled with $\frac{3}{4}$ " triangular molding. All formwork shall be properly aligned and braced in order to prevent movement during the concrete pour. The formwork shall be thoroughly coated with form oil before placing the reinforcing steel. Oil shall be kept off of the reinforcing steel. Forms

shall be dampened with water prior to the placement of concrete. The use of aluminum will not be allowed in any equipment contacting the fresh concrete. This includes forms, chutes, and finishing equipment. Forms shall not be removed before the time allowed in the Specifications. All form removal shall be completed without damage to the concrete. The inspector shall document all checks of the formwork and corrections made. Photographic documentation of formwork condition and alignment prior to concrete placement shall be included in the project file where required by Authority procedures.

The structural inspector shall verify that all falsework is constructed in accordance with the stamped falsework plans. The Contractor shall use sound wood, that is relatively straight and uniform in diameter. The lumber and pile sizes shall be in accordance with the falsework drawings. Splicing of the wood piles should be avoided, but when allowed, the splices shall be constructed of timbers of nearly the same diameter, with squared ends. All splices shall be braced and banded to prevent movement. The Contractor shall use hardwood wedges and bridge screw jacks for adjustments in the falsework. The Contractor shall employ a means of determining settlement, of the falsework, during the concrete pour. Settlement monitoring devices or reference benchmarks shall be established and readings recorded at intervals during placement. After completion of the construction and the required curing time, all falsework shall be removed. Piling that can't be removed, shall be cut off below the ground elevation. Removal operations shall be conducted in a manner that does not induce shock loading to the structure.

The inspector will check the setup of the bridge deck paver/finisher machine with the Contractor. The inspector is responsible for verifying that the machine is set to the proper cross slope and a pass shall be made over the bridge deck to check the clearance between the paver and the reinforcing steel. The vibrators shall be mechanically inserted across the concrete surface, at a maximum of 12-inch centers. The vibrators shall be inserted between 5 and 15-seconds at each location. The inspector shall verify the proper operation of the vibrators and insertion. The frequency of the vibrators should be checked before paving and again during insertion in the concrete, if there are doubts about the concrete consolidation. The inspector shall document the checking of the paver and other equipment used by the Contractor. Calibration records for mechanical equipment shall be verified prior to deck placement where required by Specifications.

4.3.2.6. Inspection of Reinforcing Steel

The inspector shall review the plan bar lists and will verify that the reinforcing to be installed has the proper bar tags for the location in which it is being installed. The inspector shall also verify that mill certifications and heat numbers correspond to the approved material submittals prior to installation. The inspector shall check the racking of the reinforcing steel and shall verify that all of the steel is located in accordance with the plans. Bar spacing, lap locations, and embedment lengths shall be measured and documented prior to concrete placement. Special attention shall be paid to the orientation of the transverse flexural reinforcement bars and to verifying the size of the reinforcing bars. Anchor bolt locations shall be checked prior to placement of concrete, to prevent interference with reinforcing steel while the bolt holes are being drilled. Template alignment and bolt projection tolerances shall be confirmed before the pour proceeds.

The structural inspector shall check the placement and spacing of reinforcing steel. The lengths of rebar splices shall be checked against splicing details and Specifications, to ensure the proper strength of the structure at the splices. The structural inspector will also check the clearance between the reinforcing steel and the forms and will verify that all reinforcing steel intersections are properly tied. Chairs will be used to maintain cover over the steel reinforcing and to properly support the reinforcement at the correct elevation. In addition, carrier bars will be installed for the upper and lower mats of reinforcing steel at each girder location. Concrete cover measurements shall be taken using a calibrated measuring device and documented in the inspection records prior to placement.

Epoxy coated reinforcing steel requires special storage and handling to maintain its usefulness. It shall be stored under protective opaque sheeting to protect the epoxy coating from deteriorating in the UV light. When lifting epoxy coated reinforcing steel, the Contractor shall use only padded or non-metallic slings. Only coated tie wire will be used to tie epoxy coated reinforcing steel. Only plastic coated bar chairs shall be used to support epoxy coated reinforcing steel. Any cracked or chipped locations in the epoxy coating of bars shall be recoated with epoxy. The inspector shall make a thorough inspection of the epoxy coating for damage and shall pay special attention to bar ends and bends. All repaired areas shall be inspected for complete coverage and curing in accordance with the coating manufacturer's recommendations.

Oil shall be kept off of the steel. Reinforcing steel will be kept clean and all foreign material will be removed from the reinforcing steel and from the formwork before the concrete is poured. All heavy rust or mill scale shall be removed from the steel. Reinforcing steel shall not be placed when excessive corrosion is present that could reduce the bar cross-sectional area beyond Specification limits.

4.3.2.7. Inspection of Concrete Placement and Curing

Before a concrete pour begins, the Construction Manager will check to see if the Contractor has the proper staff and equipment to do the pour. The Construction Manager is also required to check to assure the Contractor has the materials, at the pour location, to adequately protect the concrete from low temperatures and from excessive evaporation of moisture. Weather forecasts shall be reviewed in advance of the pour to anticipate temperature fluctuations, wind events, or precipitation that could impact placement quality. Concrete being delivered to the jobsite will be checked to assure it is the proper mix design and then it will be tested before placing. Delivery tickets shall be reviewed to confirm batch time, water added at plant, and compliance with maximum allowable time to placement. Concrete exceeding allowable delivery or placement time limits shall not be accepted without documented evaluation in accordance with the Specifications. If concrete is placed with a pump, a french horn will be installed in the pump delivery pipe to reduce the free fall of the concrete, when the pump delivery pipe is raised high. Concrete will not be allowed to free fall more than 5-feet, from the end of the pump hose or tremie, to the point of placement. Concrete will be placed in lifts and thoroughly consolidated with a vibrator. The vibrator shall only be used for consolidating the concrete and not for moving it. The concrete shall be cured as soon as possible after the pour, to maintain adequate moisture in the concrete, for

hydration. Curing methods shall be verified for compliance with Specification duration and moisture retention requirements.

Special care will be taken when setting grades, for concrete bridge decks, to take into account not only the dead load deflections, but also falsework deflections, and future creep. The grades and formwork will be set to provide a deck thickness that conforms to the design thickness. The Contractor will adjust the thickness of the concrete haunch over the girders while setting the formwork. The rails for the bridge paver will be heavy enough and well supported so deflection of the rail is minimized. After the steel is set and prior to paving, the Contractor will perform a "dry run" of the paving machine across the bridge to check for proper clearance over the reinforcing and forms. The "dry run" will be witnessed by the Construction Manager. Any interference or insufficient clearance identified during the dry run shall be corrected prior to placement of concrete. Concrete placement shall not proceed until dry run deficiencies are resolved and documented.

Prior to beginning a concrete deck pour the Construction Manager will thoroughly inspect the forming, falsework, paving equipment, plant and delivery vehicles. The Contractor will conduct a pre-pour meeting, which the Construction Manager will attend. All aspects of the pour should be covered and special attention should be given to controlling the evaporation rate during the pour. Surface evaporation rates can be predicted from mix temperature, air temperature, relative humidity and wind velocity, using Figure 1 of ACI 308-92, "Standard Practice for Curing Concrete". The inspector will monitor the temperature, relative humidity, and wind speed, to calculate the evaporation rate. The evaporation rate shall be maintained to less than 0.75-kilograms/square meter/hour this may require changing the timing or date of the pour. The use of wind screens and foggers may be used to change the environmental conditions and to reduce the evaporative rate. The Contractor will have spare tools and equipment at the deck pour site before beginning the pour. Contingency measures for equipment failure shall be discussed and documented during the pre-pour meeting. Concrete placement shall not begin unless environmental controls and contingency measures are in place and verified.

The concrete will be of the proper mix proportions and for maximum smoothness of the finished deck, the concrete should be as uniform and consistent as possible. Tell tales will be used to monitor form and falsework deflections and checks will be made for the finished thickness of the bridge deck and for the depth to the reinforcing. The results of the checks will be recorded in the bridge inspector's diary. The pouring process will not proceed faster than the finishers are able to finish the concrete. The concrete deck surface will be straight edged as the finishing proceeds and irregularities will be corrected. Texturing the surface and beginning the curing of the deck will occur immediately following the finishing. The concrete bridge deck will be water cured, starting with a fog mist immediately following the texturing and continuing with a wet double burlap cure once the concrete has hardened sufficiently. The fog mist will be applied at a rate that prevents washing of the surface cement. Curing duration shall meet or exceed the minimum period specified in the Contract Documents before removal of protective coverings. Premature termination of curing or failure to maintain specified curing conditions shall require evaluation and corrective measures in accordance with the Specifications.

4.3.2.8. Inspection of Structural Steel Erection

Prior to the fabrication of any structural steel, the Contractor shall submit shop drawings to the Construction Manager. The Construction Manager and the Engineer of Record (EOR) shall review and approve the shop drawings, before fabrication begins. Approval status shall be clearly documented, and fabrication shall not proceed under “revise and resubmit” or “approved as noted” conditions unless all comments affecting fabrication have been resolved. The fabricator will provide the Construction Manager with 15-days’ notification, prior to beginning fabrication, to allow an inspector to be assigned to the fabrication. The Contractor shall submit to the Construction Manager detailed erection plans, camber diagrams, and shop details. Shipping statements and lists of field bolts and parts will be provided to the Construction Manager. The fabrication and fit up of the girders, at the plant, shall conform to the requirements of the Specifications. Mill certifications, weld procedure specifications (WPS), and welder qualification records shall be reviewed prior to fabrication activities.

In accordance with the Specifications, the Contractor shall prepare and submit, to the Construction Manager, a transportation plan for loading, hauling, and unloading of the fabricated steel girders. The transportation plan shall adhere to all Authority regulations and all governing state and local roadway regulations. The following links are provided for convenience:

<http://www.njta.com/about/regulations-and-policies>
http://www.nj.gov/transportation/refdata/traffic_orders/

Oversized load permits and route approvals shall be verified prior to shipment.

The girders shall be handled in a manner that prevents twisting or damage to the girders. Special care shall be used to avoid dents, scratches, and gouges from contact with other objects. The girders shall be stored upright and blocked on their bearing locations in a level area. For safety and to prevent damage to the girders, they shall be blocked and bound in a manner that prevents their movement. Storage areas shall be inspected for adequate drainage and stable support conditions.

Prior to erection, the Contractor will accurately survey the bearing locations and centerlines of the girders on all substructure units. The structural inspector shall verify the different bearing devices are located on the proper abutments or piers. The bearings are to be stamped as required by the Specifications and the inspector shall verify position and alignment of all bearing devices. When installed the bearing stampings are to be easily seen and not obscured by the girders. When setting anchor units and expansion joints, the structural inspector verifies the use of temperature corrections, between the design temperature and the steel temperature. The offset for temperature is based on 60-degrees F. The offset at each bearing is equal to the degree difference from 60-degrees F times the span length times a constant of 0.0000065. Temperature readings shall be taken using a calibrated thermometer and documented at the time of erection.

Heavy and long steel girder sections will be picked up at a minimum of two lifting points and proper methods will be used to lift the girders, so damage does not

occur to the flanges or webs. Once girders are set on the substructure units or falsework, they shall be thoroughly blocked and secured until they are adequately connected to supporting elements. The structural inspector will thoroughly inspect the condition of each bearing surface and of all splice surfaces, prior to and at the time of placement of the girders. The inspector will verify that the diaphragms are located in the proper location and with the proper orientation. Temporary bracing shall remain in place until all permanent connections required for stability are completed.

The structural inspector will visually inspect the fit up and bolting of the connections and assure that they are properly snugged and then tightened. The inspector will verify the use of the proper structural bolts and will verify the bolts are tightened in the sequence specified for each joint. Bolts may not be reused following their tightening. The proper number of bolts of each size in each connection will be checked for proper torque or tension. Depending upon the type of connector, DTIs, turn-of nut, or rotational capacity tests, as specified, will be used for checking torque and tension. All testing will be documented on the proper forms. Bolt lot numbers and installation methods shall be recorded for traceability.

Cutting will not be allowed in the field on any structural steel elements. Should it be necessary for the Contractor to perform field welding on structural steel, it shall only be done by ASME certified welders and the Contractor will provide certified copies of test reports for the electrodes used in the welding. Only electrodes of the proper type are to be used. Welding will not be done when the ambient temperature is below 0-degees F. When the steel is below the listed temperature for the welding process and thickness of metal, then the steel will be preheated. Preheating will not exceed the maximum temperature allowed by ASTM A514/A517. All welding will be done in accordance with the Specifications. Stud shear connectors shall be field welded in accordance with the procedures. The inspector shall check the studs to verify the integrity of the welds. Field welds shall be visually inspected and nondestructive testing performed when required by the Specifications.

4.3.2.9. Inspection of Girder Placement

Prior to setting prestressed girders, the bearings and the girder centerlines will be surveyed and the bearing pads will be accurately located. The concrete at each bearing pad location shall be smooth and finished to the proper elevation. The inspector will witness the placing of the bearing pads and will verify they are properly located and positioned. Bearing pad elevation tolerances shall be confirmed prior to girder placement.

Special attention is required when handling and erecting precast post tensioned concrete beams. The sequencing of placement of concrete girders is critical. Strict adherence to the erection plan and governing Specifications is required. During girder placement, the Contractor shall take care to properly lift each girder and shall prevent it from striking other objects. Striking the girder with another girder, on the abutment wall, or the pier cap may damage the girder. The Construction Manager or the Construction Manager's inspector will inspect the girders for cracks at delivery and after they are set in place. Cracked girders will be rejected unless the Authority approves a repair of the beam. Any approved repair procedures shall be documented and inspected prior to acceptance.

The structural inspector will witness the placement of all girders and will verify the correct placement of the girders on the bearing pads. All prestressed girders will be securely braced and all the temporary diaphragms will be installed before the Contractor ceases operations for the day. No girder will be installed and left without diaphragms to connect to another girder. Unless properly connected and secured, girders may walk off of their bearing pads and possibly off of piers. Girders may need to be restrained during the placement, to prevent movement and misalignment. Daily stability checks shall be performed prior to leaving the site.

4.3.2.10. **Safety**

All phases, of the construction of steel and concrete structures, involve the use of equipment and the lifting of heavy loads. The structural inspector shall be familiar with the Contractor's lifting plans and shall be positioned outside of the lifting area and to avoid being in potential pinch zones. The inspector shall always have an escape route available and should avoid the area beneath a suspended load. The inspector shall attend all prelift and safety meetings of the Contractor, so as to be aware of procedures and special concerns with the upcoming work. The inspector shall verify that lift plans are stamped when required and that crane capacity charts are available on site. Lifting operations shall not proceed where required lift plans, certifications, or safety controls are not in place and verified.

Personal safety devices, as in the list in Exhibit 4 - 8, among others, shall be used at all times. In addition, the inspector shall use a life jacket when working over or around water. Other gear can weigh down the inspector and encumber the ability to swim. Even strong swimmers will have little chance of surviving a plunge into water when so equipped. The inspector shall be equipped with a safety harness and shall be tied to safety lines whenever working on elevated girders or piers. All safety practices shall comply with OSHA standards and Authority safety policies. Failure to comply with required safety practices shall require immediate corrective action and may result in suspension of affected operations until compliance is achieved.

4.4. **PIPE JACKING**

Pipe jacking is a technique for installing underground utilities, by jacking, or pushing pipes through the ground. Pipes can be jacked with little or no surface disruption. In a pipe jacking operation, jacks located in the drive shaft propel the pipe. The jacking force is transmitted through pipe-to-pipe interaction to the excavating face. When excavation is accomplished, spoil is transported through the jacking pipe to the drive shaft by manual or mechanical means. Both excavation and spoil removal processes may require workers to be inside the pipe during the jacking operation. All confined space entry requirements shall be strictly followed in accordance with OSHA regulations and site-specific safety plans.

Pipe jacking is capable of a high degree of accuracy, as a laser is used to control line and grade. Installations to an accuracy within an inch are common, with reasonable anticipated tolerances of between + 3-inches for alignment and + 2-inches for grade. Laser calibration and alignment verification shall be performed prior to commencement of each drive and documented in the inspection records.

4.4.1. Pre-Construction Conference

It is always recommended to have a pre-construction conference with the Construction Manager, Owner's representative, Contractor, Geotechnical Engineer, and Inspector. A chain of communication should be established and the limits of authority of the inspector should be clarified. Any issues the Contractor foresees should be discussed and the intent and nature of the Geotechnical Engineer's design communicated. Emergency procedures, contingency plans, and utility protection requirements shall also be reviewed.

Location of the pipes, geotechnical report including boring locations and logs, groundwater level, presence of boulders should be reviewed at this meeting. Potential impacts to adjacent structures and utilities shall be evaluated and baseline condition surveys confirmed.

Agreement on definitions and the extent of documentation for pay items, including obstructions, rock removal, etc. should be established. Contractors should be required to notify the inspector of anything they believe is above and beyond the scope of work and may be deemed an extra. Documentation procedures for differing site conditions shall be clarified.

The following check list summarizes the tools a pipe jacking inspector should have readily available to perform their job:

EXHIBIT 4 - 9 PIPE JACKING INSPECTOR'S CHECK LIST

Approved Job Information	Daily Essentials
Project and Utility Plans (most current set)	Hard Hat
Project Specifications	Boots
Pipe Jacking Installation Plan and Procedure	Ear/Eye Protection
Shop Drawings/Contractor Submittals	Pen/Pencil/Marker
Copy of the Geotechnical Investigation Report	Safety Vest
Blank Forms	Measuring Tape & scale
Pipe Jacking Installation Logs	Level
Daily Inspection Reports	Calculator
Personal Diary	Flash Light
	Camera

Electronic survey equipment, laser receiver calibration tools, and digital documentation capability are recommended to supplement the above items.

4.4.2. Pipe Jacking Equipment and Operation

The equipment of the pipe jacking operation includes:

- Pipe jacking machine – Machine that rotates an auger through the casing pipe as the casing and auger advance together.

- Casing Pipe – Steel pipes welded with continuous circumferential joints, jacked into position during the pipe jacking operation.
- Carrier Pipe – Pipe slipped inside the installed casing pipe.
- Guard Rails – Steel tracks that align the pipe jacking machine to the correct pipe direction and grade.

All equipment shall be inspected prior to operation to verify mechanical condition and safety compliance.

Typically pipe jacking operation involves a procedure in which a pipe is installed underground from one excavation (the access pit) to another (receiving pit). The casing pipe is advanced along its intended alignment using a jacking machine that rotates an auger through the casing. The cuttings are conveyed back into the access pit where they are removed. Spoil handling procedures shall prevent environmental contamination and comply with disposal regulations.

The carrier pipe is inserted after the casing has been installed. Wood block secured to the carrier pipe using stainless steel bands are typically used to maintain the proper clearance. When pushing the pipe into position, care must be exercised to keep pipe sections from becoming unjointed. After the carrier pipe is in final position, blocked properly and checked, the remaining space inside the casing pipe is completely filled with grout. Typically, the space between the casing and the carrier pipe is grouted at the upstream only, allowing any water infiltration within the casing to exit at the downstream end. Grouting operations shall be monitored to confirm complete fill and to prevent void formation.

4.4.3. Operation Inspection

The Inspector shall document tunnel advancement and related construction activities in the Daily Field Report. The access pit shall be of sufficient size to provide ample working space for the boring and jacking equipment, guard rails, reaction blocks, bracing, spoil removal, and sections of pipe as required. Provisions shall be made for the erection of guard rails in the bottom of the pit by providing a crushed stone base or concrete slab where applicable. The Contractor is responsible for providing stable foundation and wall supports during boring operations. Shoring systems shall be inspected for stability and compliance with approved designs.

The boring and jacking machine to be used shall be in good mechanical condition and capable of advancing the bore hole within the required limits of accuracy. The Contractor must push the casing pipe as the bore progresses. All cutting heads shall be removable without retracting the casing pipe. Backstops and guard rails shall be of sufficient strength and rigidity to support the thrust of the boring and jacking machine without displacement. Guard rails shall be accurately laid to line and grade and maintained in this position until completion of the boring and jacking operation. A smooth casing pipe of sufficient strength and diameter shall be forced into the bored hole to provide a tight fit against the earth sides of the bore hole. When unforeseen obstructions or conditions require abandonment of a partially completed bore hole, the Contractor shall plug the end of pipe by filling with grout, and backfill the abandoned bore hole before starting a new hole. Abandonment procedures shall be documented and approved prior to proceeding with a new bore.

4.4.4. Inspection of Pipe Jacking Operation

Prior to pipe jacking operations commencement the inspector should ensure that the access pit and pipe jacking machine is directed and aligned in the position. The access pit should have a crushed stone base to provide uniform support for the guard rails. The dimensions of the access pit, pipe jacking machine type, the casing and carrier pipe diameter should conform to the Contract Plans and Specifications. Verification measurements shall be recorded prior to commencement of jacking.

The jacking machine to be used should be in good mechanical condition and capable to advance the pipe within the required limits of accuracy. Guard rails shall be accurately laid to line and grade and maintained in this position until completion of the jacking operation. Laser readings shall be monitored continuously during advancement.

The casing pipe should be smooth and of sufficient strength to provide a tight fit against the earth sides during jacking. Casing pipe joint should be welded with a continuous circumference weld. Field welds shall be visually inspected prior to advancement.

The inspector shall check that grouting is performed as outlined in the Contract Documents. Typically, the space between the casing and carrier pipe shall be grouted at the upstream end only; therefore, allowing any water infiltration within the casing to exit at the downstream end. The mix requirements for the cement grout shall be specified in the Contract Documents. Typically, it is a mixture of Type I cement and mortar sand. The water shall be adjusted to produce a mixture of consistency suitable for pumping. Generally, a slump of 5 to 9-inches is appropriate. Grout pressures and volumes shall be documented to confirm complete filling.

During pipe jacking process, the inspector must be able to do the following:

- Be familiar with pipe jacking procedures.
- Ensure that the excavation diameter conforms to the outside diameter and circumference of the pipe as closely as possible.
- Ensure that the pipe jacking starts from the low or downstream end, unless specified otherwise. This maintains drainage away from the face of the pipe.
- Be familiar with the subsurface conditions (soil, boulders, rock and groundwater) in the area and be able to compare them with soils described in the Project's geotechnical report.
- Understand and ensure that the work is being performed in accordance with the Contract Plans and Specifications.
- Have good communication and record keeping skills.
- Be knowledgeable of contract bid items.
- Once the pipe jacking has begun the operation should proceed without interruption to prevent the pipe from becoming firmly set within the embankment.
- Be able to determine at any moment the location of the pipe through the laser guide system.
- Inspect the line along the pipe jacking operations to identify any up-heaving, excessive settlements or soil failure.

- Identify possible soil deformations and effects on adjacent structures and utilities.
- Ensure that the line and grade of the pipe's final position conforms to the variances of the lateral alignment and vertical grade as shown in the Contract Plans and Specifications.
- After completion of the jacking operations ensure that the voids around the pipe are filled with grout placed under pressure. Ensure that the grout mix conforms to the Specifications.
- If the pipe is damaged during jacking operation remove and replace damaged pipe as per Specifications.
- If dewatering is being conducted, ensure that is satisfactory and conforms to the Contract Plans and Specifications.
- Ensure that access pit and receiving pit are backfilled as per the Contract Plans and Specifications.
- If it is determined that the pipe installation is being conducted in an unsatisfactory manner, stop this work and place a benchmark at the heading until an alternate procedure is proposed and accepted.
- Be familiar with and follow construction safety procedures.

Daily inspection logs shall clearly document advancement rates, deviations, pressures, and any anomalies encountered.

4.5. DIRECTIONAL DRILLING

Horizontal directional drilling is a trenchless method for installing a pipe or conduit for liquids, gasses, or as a duct for pipe, cable, or wire line products. Typically, the installation is composed of three main steps, the pilot bore, back reaming and pulling of product. The process starts by drilling a pilot bore along a predetermined path, the drill path is monitored by an electronic device housed near the cutting head. This device detects the relation of the drill string and its inclination. Once the entire bore path has been pilot-bored a reamer is placed on the drill head and pulled back through to widen the hole. The final step consists of pulling the product back through the drilled space. All drilling operations shall be performed in accordance with the approved installation plan and applicable industry standards. No drilling operations shall commence until the installation plan, including alignment, profile, allowable tolerances, drilling fluid management plan, and contingency procedures, has been reviewed and accepted in accordance with the Contract Documents.

Directional bores as long as 6,000-feet have been accomplished with diameters as large as 48-inches. The Contractor shall verify that proposed bore length and diameter are consistent with the approved design and that equipment capacity is adequate for the installation.

4.5.1. Pre-Construction Conference

It is always recommended to have a pre-construction conference with the Construction Manager, Owner's Representative, Contractor, Geotechnical Engineer, and Inspector. The Construction Manager's inspector for the direction drilling shall also be present at the

meeting. A chain of communication should be established, and the limits of authority of the inspector should be clarified. Any issues the Contractor foresees should be discussed and the intent and nature of the Geotechnical Engineer's design communicated. Emergency response protocols and environmental protection requirements shall also be reviewed.

Location of the pipes, geotechnical report including boring locations and logs, groundwater level, presence of boulders should be reviewed at this meeting. Additionally, the Contractor shall discuss their frac-out mitigation plan and prepare a formal submission before the work begins. The frac-out mitigation plan shall include containment materials, notification procedures, and restoration measures.

Agreement on definitions and the extent of documentation for pay items, including obstructions, rock removal, etc. should be established. Contractors should be required to notify the Construction Manager of anything they believe is above and beyond the scope of work and may be deemed an extra.

The following check list summarizes the tools a directional drilling inspector should have readily available to perform their job.

EXHIBIT 4 - 10 DIRECTIONAL DRILLING INSPECTOR'S TOOL CHECK LIST

Approved Job Information	Daily Essentials
Project and Utility Plans (most current set)	Hard Hat
Project Specifications	Boots
Pipe Jacking Installation Direction Drilling Plan and Procedure	Ear/Eye Protection
Shop Drawings/Contractor Submittals	Safety Vest
Copy of the Geotechnical Report	Pen/Pencil/Marker
Blank Forms	Scale
Pipe Jacking Installation Direction Drilling Logs	Measuring Tape
Daily Inspection Reports	Level
Personal Diary	Calculator
Contact Information	Flash Light
Incident Communication Plan	Camera
Map of Nearest Hospitals	

Real-time data logging devices are recommended to supplement the above tools.

4.5.2. Terms

The following represents a list of the major items associated with the construction of directionally drilled pipe installations.

- Azimuth - the angle of the well bore direction as projected to a horizontal plane and relative to due North. By industry convention, 0-degree azimuth coincides with North, 90-degree azimuth with East, 180-degree azimuth with South, and 270-degree azimuth with West.
- Azimuthal deviation - the difference in azimuth between actual and planned well paths, typically at a specific measured depth.

- Back reamer – a tool designed to enlarge a pilot hole. Typically employed by attaching to the drill string once it exits the ground (surface to surface installation). Can be used to forward ream a hole.
- Bentonite – an additive used with water to lubricate, stabilize, and clear drill cuttings from a borehole. Bentonite is a naturally occurring mineral used in the drilling process.
- Cable sonde – a downhole transmitter or probe that is powered by electricity generated at the surface.
- Chinese finger – a woven wire device typically used to pull materials into a bore. The finger is placed over the material. When it is pulled, it tightens on the material, becoming tighter the harder it pulls.
- Compactor reamer – a tool used to enlarge the borehole by compressing the soil. Since this type of tool typically will decrease the permeability of the soil, it may not be suitable for horizontal wells.
- Deflection – the amount of flex exhibited by the drill rods. The drill head is typically steered by pushing it into the formation without rotation. There are limits to which the rods can be pushed before they deflect excessively.
- Dry hole – a condition that occurs when the drilling tools advance beyond the drilling mud. Typically caused by trying to drill too fast.
- Filter cake – the wall cake that forms from the platelets in bentonite-based drilling mud. Filter cake is the barrier between the borehole and the formation, limiting the amount of drilling mud needed to complete the borehole.
- Frac out – during normal drilling operations, drilling fluid travels up the borehole into a pit. When the borehole becomes obstructed or the pressure becomes too great inside the borehole, the ground fractures and fluid escapes to the surface.
- Gel strength – the property of drilling fluid that permits it to suspend and transport drill cuttings from the borehole.
- Locator – The above-ground component of a walkover locating system. The locator includes one or more antennae and a receiver to detect the signal transmitted by the downhole transmitter, and a microprocessor to decipher and display the downhole data.
- Strike alert – A protective device used while drilling that sounds an alarm if the drill string contacts a buried electrical utility.

All locating and tracking systems shall be calibrated and verified prior to use.

4.5.3. Inspection

The Construction Manager's inspector must be thoroughly familiar with the Contract Plans including existing utility plans, Specifications and the geotechnical investigation report. With respect to the Specifications, the inspector should be familiar with the definition of obstructions; line and grade tolerances, Contractor's submittals and contingency plan, and know the anticipated subsurface conditions. Baseline documentation of adjacent structures shall be reviewed prior to commencement of drilling.

The method of locating and tracking the drill head during the pilot bore should be established as shown on the Contract Plans and Specifications. Methods such as walkover, wire line and wire line with surface grid verification may be employed. The inspector must be familiar with the specified method employed as well as any sensitive site specific conditions that must be monitored or avoided. Verification readings shall be taken at intervals specified in the Contract Documents.

During installation drilling fluid is utilized to maintain a stable borehole. The drilling fluid is composed of water and clay particulates. The clay is typically bentonite or montmorillonite clay, which has a relatively high shrink-swell capacity. Together the bentonite and water mixture acts as a lubricate to cool the drill head, seal and fill the pore spaced surrounding the drill hole, maintain a stable excavation and suspend the cuttings. In some cases, inert Loss Circulation Materials (LCM's) are added to the mixture. These materials include cotton dust, cotton seed hulls, wood fiber, mica and cedar fiber. In typical horizontal directional drilling operations, some fluid is absorbed by the surrounding soils. This is not a concern; however, it is possible that drilling fluids may reach the surface by following a vertical fracture or weakness in the formation. This is commonly referred to as a frac-out. Drilling fluid properties shall be monitored to maintain appropriate viscosity and gel strength.

All equipment to contain and clean up a frac-out release must be on site or readily available. In the event a surficial release of drilling fluid occurs the following should be initiated:

- The boring shall immediately stop.
- The drill string withdrawn to relieve pressure in the excavation.
- The Construction Manager notified.
- A containment and clean-up operation initiated immediately.

Environmental regulatory agencies shall be notified as required by permit conditions.

When there is any indication that the installed product has sustained damage and may leak work should be stopped and the Construction Manager notified immediately.

The Contractor should provide and the Construction Manager should maintain the following information:

- Know the location of the boring head relative to the boring point of entry by applying methods as directed in the Specifications.
- The type of the drilling fluid and its components.
- Observe drilling fluid mixture for consistency with subsurface soil conditions (e.g., cohesionless soils require a bentonite based slurry with sufficient viscosity and gel strength to provide face stability and prevent loss of ground and void formation at the tunnel face).
- While reaming the hole record the total volume of drilling fluid used and the estimated current total volume of returns.

- In the event that a drilling fluid fracture, inadvertent returns, or loss of circulation occurs during pilot bore drilling operations, the contingency plan provided by the Contractor should be followed.
- Record any abnormal drilling fluid pressure at the time of occurrence.
- Perform periodic visual inspection along the bore path alignment for ground loss.
- If observation and/or relief pits are required based on Specifications, check to verify that the dimensions and location of the pits comply with the Specifications.
- Record the total volume of spoils and/or injection material that discharges from each pit and the distance between the pits. Compare the volume with the amount of the drilling fluid injected in the hole.
- If a drill hole must be abandoned, the hole must be backfilled with grout or bentonite.
- Record any equipment breakdown and repair time.

All drilling logs shall be maintained in real time and submitted daily.

A sample Directional Bore Log sheet is provided as Exhibit 4 - 22.

4.6. ANCHORED WALLS

Anchored walls are typically cut type retaining walls with heights greater than 15 feet and may include anchored sheet pile walls, anchored soldier pile walls, or soil nail walls. Anchor types may include drilled and grouted tiebacks, deadman anchors, helical anchors, or drilled or launched soil nails. Wall type selection shall conform to the approved design and subsurface conditions identified in the geotechnical investigation.

Additional information related to anchored walls is included in FHWA Geotechnical Engineering Circular (GEC) No. 4 – Ground Anchors and Anchored Systems and the Post-Tensioning Institute (PTI) – Recommendations for Prestressed Rock and Soil Anchors. Additional information on soil nail walls is included in FHWA GEC No. 7 – Soil Nail Walls – Reference Manual. All construction and inspection activities shall comply with the latest applicable editions of these referenced publications.

Verify materials are in accordance with the Contract Documents such as reinforcing bar or strand size and yield strength, centralizers, plates, nuts, wedges, etc. Ensure material meet Buy America / Buy American requirements, if applicable. If corrosion protection of reinforcing steel bars is required (i.e. Class I encapsulation, epoxy coating, galvanization, etc.) ensure the reinforcing bars have the corrosion protection required and any scratched are repaired. Keep reinforcing steel clean and wash off any soil or debris prior to inserting in the drilled hole. Material certifications and mill test reports shall be reviewed prior to installation.

Ensure ground anchor installation means and methods are performed in accordance with the proposed shop drawing submittals (i.e. temporary casing size, Down the Hole Hammer vs Roller bit tooling, etc.). Ensure the ground anchor is installed within plan tolerance of the proposed location and inclination tolerance. Measure temporary casing lengths and count temporary casing segments to obtain the total temporary casing length. Measure drilling rods and count the number of drilling rod segments, to determine the depth drilled.

Ensure reinforcing bar couplers are utilized in accordance with the Contract Documents, Shop Drawings, and Manufacturer's recommendations. Anchor inclination and bond zone length shall be verified and documented.

During grouting record the actual volume of grout per ground anchor by counting bags of Portland cement used or by using a flowmeter and compare to the theoretical drill hole volume. Record the specific gravity measured with a mud balance as required by the Contract Documents. Verify grout cubes or cylinders are collected at the frequency and quantity required by the Contract Documents. Ensure the tremie tube is placed to the bottom of the ground anchor and remains a minimum of 5 feet below the top of grout throughout the grouting process. If pressure grouting or post grouting is required by the Contract Documents, record the pressure achieved. Grout take and pressure records shall be maintained for each anchor for acceptance evaluation.

Observe tensile load tests as required by the Contract Documents. Obtain calibration data for the hydraulic jack and load cell. Perform the load test at the load increments required by the Contract Drawings. Record jack pressure, jack serial number, load cell digits, load cell serial number, and dial gauge readings. Ensure the jack is bearing outside of the grout column. Additional information on load testing can be found in ASTM D1143, ASTM D3689, and Post-Tensioning Institute (PTI) Recommendations for Prestressed Rock and Soil Anchors. Test results shall be reviewed for creep, lock-off load, and performance criteria prior to acceptance.

4.7. MECHANICALLY STABILIZED EARTH WALLS

The main advantages of Mechanically Stabilized Earth (MSE) walls compared to conventional reinforced concrete walls are their ease of installation and quick construction. They do not require formwork or curing and each layer is structurally sound as it is laid, reducing the need for support, scaffolding or cranes. They also do not require additional work on the facing. Quality control during backfill placement and compaction is critical to achieving the intended wall performance.

4.7.1. Wall Systems

MSE wall systems for highway, civil engineering and property development projects, and are also known as reinforced earthen walls, retained earthy walls, Hilfiker walls, wire walls, earth retaining structures, reinforced earth walls. All wall systems shall conform to the approved proprietary design and project-specific structural calculations.

4.7.1.1. Single-Stage MSE Walls

A single-stage MSE wall is built using steel soil reinforcement elements that are directly attached to precast concrete facing panels throughout the construction process. Reinforcement connection strength and alignment shall be verified during installation.

Single-stage MSE walls are built quickly, easily and economically, provide exceptional structural performance and are tolerant of substantial total and differential foundation settlements. Backfill material shall meet the gradation and electrochemical requirements specified in the Contract Documents.

4.7.1.2. **Two-Stage MSE Walls**

For projects built on highly compressible soils with large anticipated settlements and differential settlements of 1/100 or higher, a two-stage MSE Wall system is utilized. Settlement monitoring devices shall be installed where required to track foundation performance.

Construction involves first building the wire-faced wall as designed to accommodate the expected foundation settlements. After primary settlement and a portion of secondary settlement is complete, the concrete facing panels are placed approximately 3-feet in front of the wire wall face. Each panel is connected to its corresponding reinforcement in the backfill by means of coil loop connectors and threaded coil rods. This configuration allows for the appropriate relative movements between adjacent facing panels and between the facing panels and the primary soil reinforcement in response to the expected settlements. Alignment and panel spacing tolerances shall be verified prior to final panel connection.

4.7.1.3. **Wire Walls**

Welded wire-faced systems are employed on a wide variety of highway projects. Although not aesthetically faced, these walls are structural equivalents of single-stage walls. The system's lightweight components, inherent flexibility, economy and versatility make it well suited for temporary and permanent applications. Inspection shall verify proper placement of reinforcement layers, compaction lifts, and facing alignment to ensure long-term performance.

4.7.2. **Terms**

The following represents a list of terms associated with the construction of Mechanically Stabilized Earth Walls: These definitions are provided to ensure consistent terminology during construction and inspection activities.

- **Coping** – The coping is used to tie in the top of the wall panels and to provide a pleasing finish to the wall top. It can be cast-in-place or made from prefabricated segments. Coping alignment and attachment shall conform to the approved Shop Drawings.
- **Extensible Reinforcement** – Soil reinforcement made from polymer. These will stretch under a load. Installation shall comply with manufacturer's recommendations regarding tensioning and placement.
- **Filter Fabric** – A geotextile filter fabric is used to cover the joint between panels. It is placed on the backside of the panels. This keeps the soil from being eroded through the joints (fine migration) and allows any excess water to flow out. Filter fabric shall meet the permeability and strength requirements specified in the Contract Documents.
- **Inextensible Reinforcement** – Soil reinforcement made from metallic material (straps, mats, mesh and grids). These materials will not stretch as much under a

load as the extensible reinforcement. Metallic reinforcement shall meet coating and corrosion protection requirements specified in the Contract Documents.

- **Leveling Pad** – The leveling pad is a non-reinforced pad of low strength concrete. It is used to provide a level, consistent surface at the proper grade to place the panels. The leveling pad shall be constructed to the line and grade tolerances shown in the Contract Documents.
- **Original Ground** – This is the existing ground surface at the site. The original ground condition shall be evaluated for suitability prior to wall construction.
- **Backfill (or Retained or Local Backfill)** – Fill material placed behind the reinforcing. The backfill allowed in normal embankment construction. Backfill placement shall comply with compaction and moisture requirements of the Specifications.
- **Select Backfill** – The fill that meets the gradation, corrosion, unit weight, internal friction angle, electrochemical and any other requirements of the Specifications and encapsulates the reinforcement. Select backfill test results shall be reviewed prior to placement.
- **Soil Reinforcement** – Soil reinforcement holds the wall facing panels in position and provides reinforcement for the soil. It serves to hold the soil, reinforcing, and wall facing panel as a cohesive gravity mass. The soil reinforcement can be strips, grids, or mesh. The reinforcement can be made of steel (inextensible materials) or polymers (extensible materials). Reinforcement spacing, embedment length, and connection details shall match the approved Shop Drawings.
- **Spacers** – Wall panel spacers are typically ribbed elastomeric or polymeric pads. They are inserted between panels to help provide the proper spacing. Maintaining proper spacing keeps the panels from having point contact and spalling the concrete. Spacer placement shall be verified during panel erection.
- **Wall Facing Panel** – Wall facing panels are used to hold the soil in position at the face of the wall. The panels are typically concrete but they can be metal, wood, block, mesh or other material. Panel finish and dimensions shall be inspected for compliance prior to installation.
- **Wall/Reinforcement Connection** – This is where the soil reinforcement ties into the wall facing panel. Connection hardware shall be verified for proper installation and engagement.
- **Water** – The water described here is that which may be necessary for bringing the select backfill material up to optimum moisture content. It shall meet the electrochemical properties of the select backfill. Water used shall be free from deleterious substances that could affect reinforcement durability.
- **Wooden Wedges (or Shims)** – Wooden wedges are used to help hold the panels at the correct batter during the filling operation. The wedges should be made from hard wood (such as oak, maple or ash). Wedges shall be removed in accordance with the Specifications to prevent long-term deterioration within the wall system.

4.7.3. **Ground Improvements**

Ground improvement may be required below MSE walls to minimize settlement or differential settlement or to improve global stability or bearing resistance. If ground improvement is required by the Contract Documents, ensure the ground improvement is performed in accordance with the Contract Documents and Shop Drawings. There are many types of ground improvement, but some ground improvement methods which have commonly been implemented for MSE walls in NJ included Column Supported Embankment's, undercutting and replacement, or light fill materials. Additional information related to ground improvement is included in the FHWA GEC No. 13 – Ground Modifications Methods. Consult the geotechnical engineer of record for additional project specific information. Ground improvement verification testing and documentation shall be reviewed prior to proceeding with wall construction. Wall construction shall not proceed until required ground improvement acceptance criteria, testing results, and documentation have been reviewed and found in conformance with the Contract Documents.

Any deviation from the approved ground improvement method, geometry, material type, or installation parameters shall require documented review and acceptance prior to continuation of work.

Settlement monitoring devices, instrumentation readings, or proof testing results shall be recorded, evaluated, and maintained as part of the project record to support acceptance and long-term performance verification.

Inspection or review of ground improvement operations by the Authority or Construction Manager shall not relieve the Contractor of responsibility for achieving specified performance criteria.

4.7.4. Inspection

Before the actual start of construction of the wall, the various parts of the plans, including the shop drawings, drainage, lighting, etc., need to be compared to the contract wall plans to check for conflicts that may not have been noticed in the design stage. The Construction Manager's inspector must be thoroughly familiar with the Contract Plans including drainage and utility plans. The inspector must be familiar with the approved MSE Wall System Shop Drawings. Fabrication and Construction shop drawings will need to be referenced on a daily basis throughout the construction of the wall system. Any discrepancies identified shall be brought to the attention of the Construction Manager and Designer prior to construction.

The MSE manufacturer shall provide the design and engineering for each structure and the services of an on-site technical representative to assist and instruct during construction of the leveling pad and installation of the first two-panel courses, as a minimum. The presence of the technical representative shall be documented.

The following is a minimum checklist to follow when constructing a Mechanically Stabilized Earth (MSE) Wall:

- Ensure the Contractor has submitted wall shop drawings.
- Ensure the Contractor submitted select backfill certification showing that it meets the gradation, density and corrosion and other soil requirements.

- Ensure the Contractor supplied a Certificate of Compliance certifying that the wall materials comply with the applicable sections of the Specifications.
- Verify that the Contractor supplied a copy of all test results performed by the Contractor or the Contractor's Supplier, which are necessary to assure compliance with the Specifications.
- Ensure the Contractor furnished a copy of any instructions the wall Supplier may have furnished.
- Ensure the Shop Drawing has been approved.
- Verify that the Contractor received the correct panels (shape, size and soil reinforcement connection layout) per the approved Shop Drawings.
- Verify that the Contractor received the correct reinforcement (proper length and size).
- Verify that the panels and the reinforcement have been inspected for damage as outlined in the Specifications.
- Ensure that any panels or soil reinforcement which were found damaged have been rejected or repaired in accordance with the Specifications.
- Ensure that panels and the soil reinforcement components are properly stored to prevent damage.
- Verify that the MSE wall area has been excavated to the proper elevation.
- Ensure that the MSE Wall area has been proof-rolled per the Specifications.
- Ensure that all soft or unsuitable materials have been compacted or removed and replaced.
- Verify that the leveling pad area has been properly excavated.
- Verify that the leveling pad has been set to the proper vertical and horizontal alignment.
- Confirm the leveling pad cured for a minimum of 12-hours before any panels are set.
- Ensure the first row of panels have been properly placed. Verify that they have proper spacing, bracing, tilt and where required. Ensure the spacers are installed.
- Ensure that the proper filter fabric and adhesive have been supplied.
- Ensure the filter fabric is being properly placed over the joints.
- Verify that the adhesive is being applied to the panel prior to the placement of filter fabric at the joints.
- Ensure the filter fabric is being stored properly (stored out of the sunlight and protected from UV radiation).
- Verify that the Contractor is using the correct panels (correct size, shape and with the proper number of connections) for that panel's wall location and elevation.
- Ensure that the fill is being placed and compacted in loose 10-inch lifts.
- Ensure that all equipment is kept off of the soil reinforcement until a minimum of 6-inches of fill is placed.
- Verify that lifts are being placed by the proper method and sequence.
- Verify that the fill is being compacted by the correct equipment and in the correct pattern.

- Verify that proper compaction is being met. Typically, a minimum of 95-percent of maximum density must be met for select fill, see Specifications for compaction requirements and constraints for compaction within 5-feet of wall panels.
- Ensure that the fill is being brought up to or slightly above the soil reinforcement elevation before the reinforcement are connected.
- Verify that the soil reinforcement is being properly connected (connections tight and all of the slack in the soil reinforcement removed).
- Verify that the soil reinforcement is in the proper alignment.
- Verify that vertical and horizontal alignment is being checked periodically and adjusted as needed.
- Ensure the Contractor is removing the wooden wedges as per the Specifications. (The wooden wedges shall be removed as soon as the panel above the wedged panel is completely erected and backfilled.)
- Ensure that at the end of each day's operation the Contractor is shaping the last level of backfill as to permit runoff of rainwater away from the wall face or is providing a positive means of controlling runoff away from the wall such as temporary pipe, etc.
- Ensure that the Contractor has backfilled the front of the wall.
- Verify that the correct coping is being installed.

All inspection observations, testing results, and corrective actions shall be documented in the daily inspection report.

EXHIBIT 4 - 11 INSPECTOR FIELD REPORT

Inspector Field Report Effective Date: 04-01-20XX Shift: All Day Owner: John Doe Location of Work: Contract-Wide		Turnpike Int 1-4 Widening - Interchange 4 - Ramps and NSO/SNO Roadways; Grading, Drainage, Paving, Structures & Lighting, Milepost XX.X to XX.X, Township of Anytown, Generic County (Contract No. TXXX.XX.XXX) Contractor: ABC Contractors - Robert T. Builder Contract Number: TXXX.XXX.XXX															
Summary																	
Effective Date: 04-01-20XX Shift Start: All Day Shift Stop:		Owner: John Doe Status: IFR Created Version: 1															
Detail																	
Comment Summary: Comment Detail:		Actual Hours Worked: 8.00	Task/Activity ID: N/A														
Weather		Location of Work															
<table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="width: 15%;">Time</th><th style="width: 20%;">Condition</th><th style="width: 20%;">Temperature</th><th style="width: 45%;">Comments</th></tr></thead><tbody><tr><td>7:00 AM</td><td>Sunny</td><td>72.00 F</td><td></td></tr><tr><td>3:30 PM</td><td>Sunny</td><td>86.00 F</td><td></td></tr></tbody></table>		Time	Condition	Temperature	Comments	7:00 AM	Sunny	72.00 F		3:30 PM	Sunny	86.00 F		Site Location: Contract-Wide			
Time	Condition	Temperature	Comments														
7:00 AM	Sunny	72.00 F															
3:30 PM	Sunny	86.00 F															
Labor		Equipment															
None		<table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="width: 15%;">Subcontractor</th><th style="width: 15%;">Equipment Type/Size</th><th style="width: 10%;">Qty</th><th style="width: 10%;">Hours Used</th><th style="width: 15%;">Item No.</th><th style="width: 10%;">Status</th><th style="width: 25%;">Remarks</th></tr></thead><tbody><tr><td>N/A</td><td>N/A</td><td>0</td><td>0</td><td>N/A</td><td>Idle</td><td></td></tr></tbody></table>		Subcontractor	Equipment Type/Size	Qty	Hours Used	Item No.	Status	Remarks	N/A	N/A	0	0	N/A	Idle	
Subcontractor	Equipment Type/Size	Qty	Hours Used	Item No.	Status	Remarks											
N/A	N/A	0	0	N/A	Idle												
Asphalt Placement		None															
Concrete Placement		None															
Shoulder/Lane Closure		None															
Line Items		None															

Page 1 of 1

EXHIBIT 4 - 12 COMBINED FIELD REPORT

Combined Field Report		Turnpike Int 1-4 Widening - Interchange 4 - Ramps and NSO/SNO Roadways; Grading, Drainage, Paving, Structures & Lighting, Milepost XX.X to XX.X, Township of Anytown, Generic County (Contract No. TXXX.XX.XXX)	
Effective Date: 10-26-2015, Mon		Contractor: ABC Contractors - Robert T. Builder	
Location of Work: Contract-Wide		Contract Number: TXXX.XXX.XXX	
Summary			
Effective Date: 10-26-2015, Mon	Owner: John Doe	Status: CFR Created - not Finalized	Version: 1
Details			
Start Time: 10-26-2015 12:00 AM EDT	Actual Hours Worked: 0.00		
Stop Time: 10-26-2015 12:00 AM EDT	Available Daylight Working Hours: 0.00		
Comment Summary:			
Comment Detail:			
Weather		Location of Work	
None		Site Location: Contract-Wide	
Labor		Equipment	
None		None	
Asphalt Placement			
None			
Concrete Placement			
None			
Shoulder/Lane Closure			
None			
Line Items Placed On CFR			
No Units Placed			
Line Item Summary			
No Units Placed			
Page 1 of 1			

NEW JERSEY TURNPIKE AUTHORITY

Item Summary Sheet

Item No.

Description

Unit Price

Contract Quantity

[illegible]

DATE	REFERENCE	INCREASE	DECREASE	MODIFIED ORIGINAL	FINAL QUANTITY

NEW JERSEY TURNPIKE AUTHORITY

Project _____	Location _____	Structure _____
Foundation _____	Pile Type _____	Pile Wt. (lbs/ft) _____
Type of Hammer _____	Total Plan Length (ft) _____	Plan Cutoff Elev. (ft) _____
Energy Rating _____	Required Bearing Capacity _____	
Type Cushion Matl. _____	FOOTING SKETCH	
Wt. Hammer (lbs) _____		
Wt. Cap &/or Anvil (lbs) _____		
Bearing Formula _____		

Accepted Length _____	Driven Length _____	Cutoff Length _____

Checked By: _____

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

EXHIBIT 4 - 21 DRILLED SHAFT CONCRETE PLACEMENT LOG

NEW JERSEY TURNPIKE AUTHORITY													
DRILLED SHAFT CONCRETE PLACEMENT LOG													
Project _____			Location _____			Structure _____							
Foundation _____			Contractor _____			Shaft Number _____							
Supplier _____			Mix Design _____										
Concreting Curve													
Depth (ft)													
	Concrete Volume Placed (cubic ft)												
	Rock Socket Length			RSL _____		ft		Volume Delivered			VD _____		cuft
Rock Socket Diameter			RSD _____		ft		Volume in Lines			VL _____		cuft	
Theoretical Rock Socket							Wastage			VW _____		cuft	
Volume=0.25*pi*RSL*RSD*RSD			VRS _____		cuft		Volume Placed						
Shaft Diameter			SD _____		ft		VD-VL-VW=			VP _____		cuft	
Shaft Length			SL _____		ft		Theoretical Volume			VT _____		cuft	
Theoretical Shaft							Over Pour						
Volume=0.25*pi*SL*SD*SD			VS _____		cuft		(VP-VT)=			VO _____		cuft	
Total Theoretical Volume=													
VRS+VS			VT		cuft								
Inspected By: _____													
Checked By: _____													

EXHIBIT 4 - 22 DIRECTIONAL BORE LOG

NEW JERSEY TURNPIKE AUTHORITY

DIRECTIONAL BORE LOG

Project Name _____ Start Time _____

Project Number _____ End Time _____

Contractor/Site Representative _____ Breakdown Time _____

Bore Number _____ Starting Location _____

Diameter of Bore _____ Comments _____

Diameter Of Pipe _____

Bore Rod Length _____

	Total Length	Distance From Start Point	Depth	Pull Back Pressure	Volume of Soil Displaced	Volume of Drilling Fluid Injected
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

Inspected By _____

Checked By _____

EXHIBIT 4 - 23 DAILY TUNNELING ACTIVITY LOG

[illegible]

SECTION 5

LICENSE TO CROSS

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Section 5 – LICENSE TO CROSS

5.1. INTRODUCTION

The Construction Manager will obtain copies of the License to Cross Agreements and will ascertain whether all crossings are accounted for, and if the Agreements are properly signed and sealed, before construction begins. The Authority has a standard Agreement, that states the terms and conditions under which a License to Cross is granted. Any proposed crossings or construction easements without a signed Agreement, will not be allowed until an Authority application form is filled out and the Agreement has been signed. The application form is located online at:

<https://www.njta.gov/document/application-for-license-to-cross/>

No work within Authority right-of-way or property shall commence without a fully executed License to Cross Agreement.

The Construction Manager shall establish and maintain a centralized tracking log of all License to Cross Agreements, documenting application date, approval status, revision history, expiration date, and construction status to ensure no unauthorized work occurs on Authority property. Unauthorized encroachments or construction activities shall be reported immediately and may result in suspension of work until compliance is achieved.

The application shall be accompanied with plans, specifications, and other pertinent information related to the proposed construction on the property of the Authority. The minimum plan requirements are as follows (and as listed here: <http://www.njta.com/about/license-to-cross>)

- Scale: 1" = 50' (1:50) or larger (i.e. 1" = 30').
- Plan sheet size shall be 22" x 36" or 24" x 36" (841 x 594-mm).
- All freehand lettering shall be legible.
- New Jersey Plane Coordinate system shall be used.
- Map scale and north arrow shall be shown on every map.
- All revisions to the proposal shall be numbered, dated and noted as to their nature in a revision box on each plan sheet.
- All Authority roadways shall be clearly labeled.
- The baseline (with continuous stationing) of Authority roadways shall be indicated.
- The Authority right of way and all property lines and monument markers shall be shown.
- The limits of disturbance shall be indicated.
- All proposed facilities shall be shown in bold.
- Plans shall be blocked, signed and sealed in accordance with State Board of Professional Engineers and Land Surveyors Administrative Rules and Regulations, Chapter 40 (13:40-1.1, et seq).

Plans shall also clearly identify existing utilities, drainage systems, structures, foundations, environmentally sensitive areas, and any critical Authority infrastructure within the zone of influence of the proposed crossing. Temporary construction features, including staging

areas, access routes, pits, and equipment footprints, shall be shown. Incomplete or deficient plan submissions shall not be accepted for review and shall be returned for correction.

All plan submissions shall be provided in searchable digital PDF format. When requested by the Authority, compatible CAD files shall be submitted to facilitate technical review and coordination. Failure to provide required digital files may delay processing and approval of the License to Cross.

The Authority has set a minimum amount of insurance coverage to be supplied by the applicant, but they reserve the right to increase the required amount. The Construction Manager will obtain copies of the insurance coverage and will verify that the coverage meets the requirements of the License to Cross Agreement. Throughout the crossing construction, the Construction Manager or the Construction Manager's representative will verify that all of the terms and conditions of the License to Cross are carried out according to the Agreement. Noncompliance with License to Cross terms and conditions may result in suspension or revocation of the License and requirement for corrective action at the applicant's expense.

The Construction Manager shall confirm that insurance policies remain active throughout construction and restoration activities and shall require updated certificates prior to policy expiration. Lapsed insurance coverage shall require immediate suspension of work within Authority property until reinstated and verified.

The License to Cross Agreement shall clearly define long-term maintenance responsibility, access rights for future repairs, and restoration obligations affecting Authority property. Post-construction restoration and long-term maintenance obligations shall be verified prior to final acceptance of the crossing work.

5.2. UTILITY

The following applies when a proposed utility crossing is required during an active construction project.

The Utility Owner determines which trenchless method of construction will be proposed for utility crossings of roadways. Open cuts and water jetting will not be allowed for crossings. Prior to a License to Cross Agreement being signed and issued, the utility owner will submit plans for the proposed crossing. The minimum plan requirements are stated in Section 5.1 of this Manual. No trenchless operations shall commence until the License to Cross Agreement and associated plans have been fully approved in writing.

Acceptable trenchless construction methods may include horizontal directional drilling, auger boring other approved methods based on site conditions and Authority review. Selection of construction method shall be supported by geotechnical data and risk evaluation and shall not be changed without documented approval.

The Utility Owner will undertake a geotechnical investigation by a New Jersey licensed geotechnical engineer, with a minimum of two borings before determining the crossing type and before having the plans and specifications prepared. The plans and

specifications will be prepared by and be sealed by a professional engineer licensed in New Jersey prior to being submitted. Design calculations and details of the construction, including shoring, equipment, and schedule will be included with the plan submittal. The Utility Owner will submit traffic control and soil erosion and sediment control plans for review and approval by the Construction Manager. Construction shall not proceed until all required engineering documents are reviewed and accepted in accordance with the License to Cross Agreement.

Geotechnical investigations shall document soil stratigraphy, groundwater elevation, anticipated obstructions, and provide recommendations addressing settlement risk, bore stability, and impacts to adjacent infrastructure.

A risk mitigation plan shall be submitted identifying potential impacts to roadway operations, drainage facilities, adjacent utilities, and Authority assets, along with contingency procedures for loss of ground or obstruction encounters. Failure to implement approved mitigation measures may result in suspension of operations.

The Construction Manager will review the Utility Owner's submittal and application form for completeness and will forward the information to the Authority for review and approval. Applications for trenchless construction in the proximity of existing structures and their foundations will require review by the Authority's structural engineers if the utility structure is 30" or larger and is within twenty times its diameter of an existing structure. The potential effect of lateral loading on the structure and its foundations will be analyzed before approval is given to the plan. Approval shall be contingent upon documented structural evaluation where required.

For crossings near critical infrastructure, the Authority may require additional structural analysis, vibration monitoring, pre-construction condition surveys, or independent peer review prior to granting approval. Costs associated with additional review or monitoring shall be borne by the Utility Owner as provided in the License to Cross Agreement.

The Utility Owner will provide a licensed surveyor to layout the crossing plan and profile. The surveyor will also set ground surface settlement monuments and subsurface settlement monuments. The monuments will be monitored by the surveyor to verify there is no settlement caused by the utility Contractor's operations. The Utility Owner and their Contractor will conduct all of their operations in accordance with OSHA regulations and in accordance with all local and state laws. The Construction Manager will verify their compliance with appropriate laws and regulations during the crossing construction. Monitoring shall continue until construction activities are complete and settlement has stabilized within acceptable limits.

Settlement monitoring results shall be submitted at defined intervals to the Construction Manager, and predetermined threshold limits shall be established that require immediate corrective action or suspension of operations. Exceedance of threshold values shall require immediate notification and implementation of approved contingency measures.

Temporary access routes within Authority right-of-way shall be stabilized, maintained in safe condition, and restored to original or better condition upon completion of the work. Failure to restore Authority property may result in corrective action at the Utility Owner's expense.

All drilling fluids, excavated materials, and spoils shall be contained and disposed of in accordance with applicable environmental regulations. Spills, inadvertent returns, or environmental releases shall be reported immediately and remediated in accordance with regulatory requirements.

The Construction Manager will have an inspector assigned to each utility crossing that is granted under a License to Cross. The inspector will verify and document the utility Contractor's compliance with the utility's plans for the crossing. The inspector will also monitor the utility Contractor's compliance with all environmental concerns including the Project SWPPP. In case of non-compliance with the License to Cross Agreement, the utility plans, or any other issues involving work on the property of the New Jersey Turnpike Authority, the Construction Manager, as the Authority's field representative, has the right to order the utility Contractor to cease operations. Such suspension shall not constitute entitlement to additional compensation or time.

All inspection findings, non-compliance notices, corrective measures, and approvals shall be documented in daily reports and maintained as part of the permanent project record.

Upon completion of the crossing, certified as-built plans prepared and sealed by a New Jersey licensed professional engineer or land surveyor shall be submitted documenting the final horizontal and vertical location of the installed facility relative to the Authority baseline and right-of-way. Final acceptance shall not be granted until required as-built documentation is received and verified.

5.3. TRAFFIC PERMIT

The utility Contractor is responsible for obtaining a Traffic Permit prior to entering upon the property of the Authority. The Contractor shall fill out the application and shall provide a certificate showing proof of the required insurance. Upon receipt of the application and insurance certificate, the application will be reviewed and the Authority may approve the traffic permit. The application and insurance certificate will be sent to the supervising engineer/planning for License to Cross. Address to send these materials are the same as those listed here: <http://www.njta.gov/about/traffic-permits>. No entry onto Authority roadways or right-of-way shall occur without an approved Traffic Permit.

The Traffic Permit application is available online at the following link: <https://www.njta.gov/document/traffic-permit-application/> along with a link to request information pertaining to it at <http://www.njta.com/forms-public-records/opra-form>. The Construction Manager will be provided a copy of the Traffic Permit, Certificate of Insurance, and Indemnification Form.

The Construction Manager shall verify that the approved Traffic Permit aligns with the proposed work schedule, approved lane closure restrictions, and traffic staging plans associated with the License to Cross.

The utility Contractor is responsible for all necessary and approved traffic control and shall coordinate that traffic control with the Construction Manager. All work done under the License to Cross will be subject to the restrictions of the Authority, regarding time and days of construction. The Construction Manager will enforce compliance with all construction

restrictions and requirements. Noncompliance with permit conditions may result in suspension of work or revocation of the Traffic Permit.

Traffic control devices shall conform to the current edition of the Manual on Uniform Traffic Control Devices (MUTCD) and any applicable Authority standards.

Lane closures shall be coordinated to avoid peak travel periods, holiday restrictions, and special events unless otherwise authorized in writing by the Authority.

Failure to comply with approved traffic control measures or permitted work hours may result in suspension of operations, revocation of permits, or assessment of costs incurred by the Authority for corrective action. Suspension or revocation shall not constitute grounds for delay damages or additional compensation unless expressly provided for in the Contract Documents.

SECTION 6

ENVIRONMENTAL

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SECTION 6 – ENVIRONMENTAL

6.1. GENERAL

This section contains procedures and criteria that are essential for the Construction Manager to ensure that the Project minimizes or prevents impacts to the environment and that the Project remains in compliance of any permits issued by Federal, State, and regional regulatory agencies including, but not limited to, the United States Environmental Protection Agency, United States Army Corps of Engineers, United States Coast Guard, New Jersey Department of Environmental Protection (NJDEP), New Jersey Pinelands Commission, Delaware and Raritan Canal Commission, and local Soil Conservation Districts. Noncompliance with permit requirements or environmental commitments shall be treated as a material breach of Contract and addressed immediately.

The Construction Manager shall establish a project-specific Environmental Compliance Matrix identifying all applicable permits, approvals, environmental commitments, and special conditions to ensure that each requirement is tracked, monitored, and documented throughout the duration of the Project. The Environmental Compliance Matrix shall be updated regularly to reflect permit modifications, field changes, and regulatory correspondence.

Environmental compliance shall be incorporated into daily construction oversight activities and shall be treated as a core performance requirement equal to safety, quality, and schedule. Environmental deficiencies shall be documented in daily reports and tracked through resolution.

All environmental commitments identified during design, permitting, environmental impact documentation, or regulatory coordination shall be formally communicated to the Contractor during pre-construction meetings and reinforced throughout construction. Acknowledgment of receipt and understanding of environmental commitments shall be obtained from the Contractor in writing

6.2. PERMITS FROM REGULATORY AGENCIES

The Construction Manager shall ensure that the Contractor conducts the work in accordance with all applicable permits identified in Division 100 of the Specifications. Typical permit conditions consist of, but are not limited to; requiring the placement of soil erosion and sediment control devices, limiting disturbance to those areas authorized by the permits, adhering to timing restrictions related to sediment generating activities and clearing of vegetation, limiting locations and contents of stockpiles, and prescribing procedures required for the handling of contaminated or hazardous material. Violating the conditions of the permits issued for the Project may result in enforcement actions such as fines and stop work orders issued by the regulatory agencies. The Construction Manager shall immediately notify the Authority of any actual or suspected permit violation.

Prior to commencement of construction, the Construction Manager shall conduct a comprehensive review of all permit conditions and confirm that the Contractor has incorporated those requirements into the Project schedule, means and methods, and sequencing plan. No construction activities shall begin until permit compliance integration has been verified.

The Construction Manager shall maintain a Permit Condition Compliance Log documenting ongoing adherence to each condition and noting any corrective measures taken. The Compliance Log shall be available for review by the Authority and regulatory agencies upon request.

The permits issued for the Project typically require that a copy of the approved permit documents be maintained onsite for inspection by the regulatory agency's site inspectors. The Construction Manager shall maintain any permit documents as required by the conditions of permits issued for the Project. Failure to maintain required permit documentation onsite may constitute a permit violation.

Permit documents shall be maintained in an organized Environmental Compliance Binder at the Project field office and shall also be retained electronically to ensure immediate accessibility upon request. Electronic records shall be backed up in accordance with Authority documentation requirements.

The permits issued for the Project grant the regulatory agencies the right to enter the Project site without advance notice to conduct routine site inspections. The site inspections are required to ensure the Project is in compliance with the permits. The Construction Manager shall not deny the regulatory agencies from accessing the Project site or access to the recorded permit documents without substantial justification. Should the regulatory agencies be denied access for any reason, such as a risk to the health and safety of the regulatory agencies' site inspectors, the Construction Manager shall notify the Authority's Environmental Section immediately. Failure to provide reasonable access for the regulatory agencies' site inspectors may result in enforcement actions such as fines and stop work orders issued by the regulatory agencies. Any access restriction shall be documented with justification and corrective measures to restore access as soon as practicable.

The Construction Manager shall accompany regulatory inspectors during site visits when feasible, document all comments, recommendations, or directives issued, and ensure timely communication of such items to the Authority and Contractor. All regulatory directives shall be tracked through closure with documented corrective action.

All regulatory correspondence, inspection reports, and follow-up actions shall be logged and retained as part of the permanent Project environmental record. Environmental records shall be retained in accordance with Authority record retention policies and made available during audits or final closeout.

6.3. STORMWATER DISCHARGE AND SOIL EROSION AND SEDIMENT CONTROL

The Contractor's designated Erosion Control Coordinator (ECC) is responsible for preparing and implementing all applicable Soil Erosion and Sediment Control (SESC) measures in accordance with the certified SESC Plan issued by the local Soil Conservation District and the Standards for Soil Erosion and Sediment Control in New Jersey. The ECC is also responsible for implementing all measures required by the Construction Activity Stormwater General Permit issued for the Project by the local Soil Conservation District under the New Jersey Pollutant Discharge Elimination System (NJPDES).

The Construction Manager shall verify that the ECC possesses the appropriate qualifications and training required by regulatory agencies and that the ECC is actively engaged in monitoring and maintaining SESC measures throughout construction.

The Construction Manager shall confirm that all stormwater best management practices (BMPs) are installed prior to land disturbance and remain functional during all phases of construction.

The Contractor may, with approval and direction from the local Soil Conservation District and the Authority's Environmental Section, modify the approved SESC Plan to better match site conditions, facilitate construction sequencing, or align with the Contractor's means and methods.

All approved modifications to the certified SESC Plan shall be documented in writing, dated, and incorporated into updated plan sheets maintained onsite.

Temporary stabilization measures shall be implemented promptly in inactive areas to prevent erosion and sediment migration.

6.3.1. Responsibility and Roles of the Authority and the Construction Manager

The Authority shall be responsible for providing the Construction Manager and Contractor with copies of all appropriate permitting documents issued for the Project that relate to stormwater discharge and soil erosion and sediment control, as the Authority deems necessary. The permits provided by the Authority include those referenced in Division 100 of the Specifications that have been issued directly to the Authority or the Design Consultant for the Project.

The Construction Manager shall verify receipt of all applicable permit documents prior to construction start and confirm that the Contractor acknowledges and understands all relevant stormwater and erosion control requirements.

The Construction Manager shall be responsible for monitoring and coordinating with the Contractor's ECC. Coordination with the ECC includes notifying the Contractor of any deficiencies that may result in permit and SESC Plan violations. The Construction Manager shall immediately inform the Authority of all approved or unapproved deviations from the certified SESC Plan or Construction Activity Stormwater General Permit. Deficiencies and unapproved deviations from the Construction Activity Stormwater General Permit and certified SESC Plan may result in enforcement actions such as fines and stop work orders issued by the NJDEP or the local Soil Conservation District. The Construction Manager should consult the Authority, local Soil Conservation District, and the Standards for Soil Erosion and Sediment Control in New Jersey for guidance regarding proper installation and maintenance of soil erosion and sediment control measures.

The Construction Manager shall maintain a written log of all deficiencies identified, notifications issued to the Contractor, dates of correction, and verification of compliance.

Where repeated deficiencies are identified, the Construction Manager shall require a corrective action plan from the Contractor detailing measures to prevent recurrence.

6.3.2. Project Site Inspection

The Construction Manager and the ECC shall conduct routine inspections of all SESC measures in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey or the local Soil Conservation District, whichever is most stringent. Inspections shall be performed at the frequency required by permit conditions and after qualifying storm events. The Construction Manager's stormwater and environmental inspection staff must be equipped with all necessary items during their site visits including, but not limited to, the following:

- Personal Protective Equipment in compliance with the Project's safety plan.
- All additional items required by the Project's safety plan for conducting site inspections.
- Any applicable inspection forms.
- Adequate means of recording observations, such as digital camera, field books, and time keeping instrumentation.

Inspection staff shall also have access to the most current approved SESC Plan and any approved plan modifications during site visits. Outdated plans shall be removed from circulation to prevent field errors.

The Construction Manager shall record all SESC measures that require attention due to damage or excessive sedimentation and ensure that the Contractor rectifies the areas of concern. Deficiencies posing imminent environmental risk shall be addressed immediately. As a minimum, the record must include the following:

- Date and time of inspection.
- Names of persons involved in the inspection.
- Date and amount of rainfall in excess of 0.5-inches in previous 24-hours.
- Descriptions and photos of any incidents of non-compliance.
- Maintenance of SESC measures required.
- Recommendations for corrective action.

The Construction Manager shall forward the inspection report to the Authority's Environmental Section by the end of the next full working day for the Authority's records. The Construction Manager shall also forward a copy of the inspection report to the Contractor. Within 5-full working days of the Contractor's corrective actions, the Construction Manager shall submit a revised copy of the inspection report to the Authority. The revised report shall include the date and time of the corrective actions, names of the Contractor's work crew that performed the corrective actions, and names of the site inspectors. The Construction Manager shall be responsible for filing copies of all inspections and photographs at the Project site and maintaining a Corrective Action Log to track all recommendations and corrections. Failure of the Contractor to implement corrective measures within the required timeframe shall be documented and escalated to the Authority.

Inspection reports shall be reviewed periodically to identify patterns or recurring problem areas, and such findings shall be communicated to the Authority for further evaluation if necessary. Recurring deficiencies may warrant revision of erosion control measures or enforcement actions.

All inspection records, photographs, and logs shall be maintained in an organized manner and preserved as part of the permanent Project environmental documentation. Records shall be retained in accordance with Authority record retention policies and made available during audits or regulatory review.

6.3.3. Staging Areas

The Construction Manager shall ensure that the Contractor follows the requirements of Specifications Section 105.07, which includes completion of the "Staging Area Inventory/Inspection Form." After verifying that the form is accurate and complete, the Construction Manager shall e-mail a copy of the form to the Authority's Environmental Section, the Authority's Liaison Engineer, and the Authority's Contracts Coordinator. Staging areas shall not be utilized until required documentation has been reviewed and acknowledged.

The Construction Manager shall verify that staging areas are properly stabilized, protected from erosion, and do not contribute to uncontrolled runoff, sediment discharge, or contamination of adjacent properties or waterways. Staging areas shall comply with all applicable permit conditions and environmental commitments.

Periodic inspections of staging areas shall be conducted to ensure ongoing compliance with environmental and permit requirements. Inspection frequency shall be consistent with permit requirements and adjusted based on site conditions.

6.4. FILL MATERIAL

The Construction Manager shall ensure that the Contractor follows the requirements of Section 203 of the Standard Specifications and any Supplementary Specifications, which include documentation of testing to demonstrate that the material is clean material as defined by the NJDEP. The Construction Manager shall verify that the documentation and testing is accurate and complete prior to confirming the suitability of the borrow material. No fill material shall be placed until clean material verification has been reviewed and accepted.

The Construction Manager shall verify that all laboratory testing documentation is performed by certified laboratories and that chain-of-custody procedures are properly maintained for all submitted samples. Incomplete or improperly documented laboratory results shall be rejected.

The Construction Manager shall confirm that borrow source locations are approved prior to material importation and that haul routes are managed to prevent tracking of sediment, debris, or contamination onto public roadways. Tracking of sediment or debris onto roadways shall be corrected immediately.

All documentation related to clean fill verification shall be retained as part of the permanent Project environmental record. Clean fill documentation shall be traceable to specific placement locations and quantities to support future audits or regulatory review.

6.5. HAZARDOUS MATERIALS

If hazardous materials and/or hazardous waste have been identified during design to be within the proposed limits of construction, such areas will be designated in the Contract Plans. The Construction Manager shall verify that the Contractor has been properly informed with respect to site location and special requirements. Check that such areas are clearly marked. Where hazardous materials and hazardous wastes are encountered, Division 100 and 200 of the Standard Specifications and any Supplementary Specifications will govern the actions and activities of all construction personnel. The Contractor will adhere to the NJDEP regulations for the transport and disposal of any hazardous materials generated or encountered on the Project. This will include a “cradle to grave” tracking and documentation of all hazardous materials. The Construction Manager will receive copies of all tracking and documentation and will verify that all hazardous materials are accounted for.

The Construction Manager shall confirm that all hazardous material handling activities are incorporated into the Project Health and Safety Plan and that personnel are trained in site-specific hazard recognition and response procedures.

The Construction Manager shall ensure that clear signage and restricted access controls are implemented in all designated hazardous material areas.

All hazardous material documentation shall be reviewed for completeness and accuracy prior to acceptance and filing.

6.5.1. Environmental Records and Documentation

The Construction Manager will maintain complete and accurate records and documentation throughout the course of processing hazardous material or a hazardous waste discovery. Written notes, reports, detailed cost records, photographs, and videos all should be considered. Such records will assist the Authority in cost recovery and possible litigation. The Construction Manager shall provide all fully executed hazardous waste manifests to the Authority’s Environmental Section within 30-days of execution.

Manifest for environmental records and documentation are to be signed by the Authority, or their appointed agent, for ownership and generation of environmentally regulated materials.

All environmental records shall be organized chronologically and indexed to facilitate retrieval during audits, regulatory reviews, or legal proceedings.

Electronic copies of all manifests, reports, and correspondence shall be securely backed up and maintained in accordance with Authority record retention policies.

6.5.2. Emergency Response Notification

The Construction Manager will prepare a list of contact names and telephone numbers to use in the event of a hazardous material/hazardous waste situation. Complete and post this list in an obvious location within the Project field office.

The contact list shall be reviewed and updated periodically to ensure accuracy and shall include after-hours emergency contacts for regulatory agencies and Authority personnel.

Emergency contact information shall also be included within the Project Health and Safety Plan and communicated during safety briefings.

6.5.3. Delineation of Contaminated Areas

The Contractor will immediately secure any areas where hazardous materials have been identified, generated or encountered to prevent dispersal of the material into the surrounding environment and to protect the public, workers, and others from potential harm. Only persons that have received the 40-hour OSHA Hazwoper training are to be allowed into the secured area and all health and safety precautions will be taken until the type and level of contamination is determined.

The Construction Manager and the Authority shall be notified by the Contractor immediately after the area is secured by the Contractor. The Construction Manager shall ensure that upon receipt of the analytical results from the environmental lab, a Contaminated Material Management Plan for testing, removal, and disposal of the contaminated material is developed, submitted, and approved, before any removal begins. The plan development will be the responsibility of the Contractor. The plan will be developed under the supervision of a New Jersey Licensed Site Remediation Professional (LSRP) and it shall be in compliance with the NJDEP requirements. The LSRP is typically contracted by the Design Engineer. The plan must be approved by the LSRP and submitted to the Authority for subsequent approval. A copy of the plan will be provided to the NJDEP Division of Solid and Hazardous Waste, for their records.

No work will be allowed within the secured area until approval of the plan is received from the Authority. A pre-entry meeting will be held each day before the personnel enter the contaminated area. This meeting will be held by the Contractor and will cover the work and the testing to be done, safety requirements, and other concerns that may arise.

The Construction Manager shall verify that perimeter controls are sufficient to prevent migration of contamination through runoff, wind, or equipment tracking.

Daily field logs shall document site conditions, personnel entry, monitoring activities, and any deviations from the approved Contaminated Material Management Plan.

6.5.4. Environmental Testing Requirements (Soil and Groundwater)

The Construction Manager will ensure that the Contractor's sampling plans for all excess or suspect material complies with all applicable sections of the Specifications. The Construction Manager shall coordinate with the Authority's Environmental Section for approval of all testing to be conducted and results of tests that have not been previously submitted to the Authority. The Contractor will provide approved storage, hauling, and disposal of materials that are determined to be contaminated. The Contractor will provide testing and documentation to verify that the contamination has not been spread due to construction activities associated with the Project. This includes paint removal sites, construction yards, and any other suspected or possible contamination sites. The Construction Manager will receive copies of all relevant testing and will assure that all necessary sites are tested.

Sampling and analytical procedures shall be performed in accordance with current NJDEP guidance and industry standards to ensure defensible data.

All laboratory reports shall be reviewed for completeness, method detection limits, and regulatory compliance thresholds prior to acceptance.

6.5.5. Handling of Contaminated Materials

The safety of the public and of workers on the jobsite will be of the utmost importance when removing and handling contaminated materials. Protection of health, safety, and the environment shall take precedence over schedule considerations. The Construction Manager's hazardous materials inspection staff shall have an OSHA 40-hour Hazwoper certification and shall be trained in the identification and handling of hazardous materials. Hazwoper certifications shall remain current and documentation shall be maintained onsite.

The inspection and handling of all contaminated materials shall be performed in accordance with all applicable Federal, State, and local regulations. Upon completion of the Project, the Construction Manager shall submit all documentation regarding the handling of contaminated materials to the Authority. Documentation shall include manifests, disposal receipts, laboratory analyses, chain-of-custody records, daily logs, and regulatory correspondence.

The Construction Manager's hazardous materials inspection staff must be equipped with all necessary items during their site visits including, but not limited to, the following:

- Personal Protective Equipment in compliance with the Project's safety plan for exposure to anticipated hazardous materials.
- All additional items required by the Project's safety plan for conducting site inspections.
- All additional items required by Federal, State, and local regulations.
- Any applicable inspection forms.
- Adequate means of recording observations, such as digital camera, field books, and time keeping instrumentation.

Air monitoring equipment shall be available when required by site conditions or the Health and Safety Plan.

The Construction Manager shall confirm that appropriate decontamination procedures are implemented for personnel and equipment exiting contaminated areas. Decontamination activities shall be documented in daily logs.

Temporary storage areas for contaminated materials shall be clearly labeled, secured, and inspected regularly to prevent releases. Secondary containment measures shall be implemented where required by regulation or site-specific conditions.

6.5.6. Discovery During Construction

Where unknown hazardous materials are discovered during construction, the Construction Manager and the Construction Manager's hazardous materials inspection staff shall pay particular attention to the encounter and treat each situation uniquely. They

should use common sense, remain calm, and stay alert. They should have the situation contained, and obtain the needed assistance from the Authority's Liaison Engineer, the Environmental Section of the Authority's Engineering Department, and the Project LSRP. Immediate measures shall be taken to isolate the area and prevent public exposure or environmental release.

The Construction Manager will designate a member of the hazardous material inspection staff with OSHA 40-hour Hazwoper certification as the Emergency Coordinator, who will instruct the staff on the proper procedures for handling and reporting incidents involving hazardous materials. The Emergency Coordinator will instruct the staff to refer to the Project's Emergency Action Plan and the Authority's Emergency Action Plan. The staff will assure that all hazardous material shipments from the jobsite are properly labeled and that a Uniform Hazardous Waste Manifest has been completed. All required regulatory notifications shall be made within mandated reporting timeframes.

Be aware of the possibility of encountering a hazardous material/hazardous waste situation during construction. Upon discovery of a potential hazardous substance, do not open any closed container or otherwise attempt to identify the substance. Halt work, and immediately notify the proper authorities. Unauthorized disturbance of suspect materials is strictly prohibited.

1. Excavation

Hazardous substances could be encountered during excavation. Treat all underground storage tanks, buried containers, and suspect soil and groundwater as potential hazards. Noxious fumes, unusual odors, discolored soils, water surface sheen, and visible fumes and smoke are key indicators. Air monitoring shall be conducted when conditions indicate potential vapor hazards.

2. Illegal Dumping

Be aware that hazardous materials could be illegally dumped within the right of way during off-shift hours. Use common sense and collaborative judgment to assess the nature of the encounter. Treat suspect containers and materials as potential hazards. Security measures shall be implemented to deter unauthorized dumping when feasible.

3. Construction Mishaps

Construction personnel and equipment operations could inadvertently rupture a natural gas or petroleum pipeline or cause a large fuel or chemical spill. Treat such incidents as a hazardous-material situation. Emergency response procedures shall be implemented immediately, including spill containment and evacuation if necessary.

The Construction Manager shall document the time of discovery, actions taken, notifications made, and interim control measures implemented until further direction is received. Incident documentation shall be detailed and preserved for regulatory and legal purposes.

Work shall not resume in the affected area until clearance is provided by the Authority and appropriate environmental professionals. Written authorization to resume work shall be obtained and filed in the Project records.

6.5.7. Stopping Work

Upon discovery of a suspect substance, the Construction Manager shall immediately notify the Authority's Liaison Engineer. Notification shall occur without delay and prior to disturbance of the suspect material.

This action is necessary to avoid health risks to all personnel at the site and the general public. Health and safety take precedence over construction costs and delays. Persons who have come into direct contact with suspect substances (e.g., skin contact, inhalation) or exhibit adverse reactions should receive immediate attention by authorized medical personnel. Persons who have been exposed to suspect substances also should be monitored for adverse delayed reactions based on the recommendations of authorized medical personnel. Medical evaluations and exposure documentation shall be recorded in accordance with OSHA requirements.

The Construction Manager shall document the exact location, time, personnel involved, and immediate response actions taken upon stopping work.

A formal written incident summary shall be prepared and submitted to the Authority within 24-hours of the occurrence. The summary shall include preliminary assessment, notifications made, and interim control measures implemented.

6.5.8. Securing the Area

After work has been stopped, the area surrounding the suspect substance must be secured to prevent inadvertent or unauthorized access by personnel or the general public. Treatments generally consist of cordoning the area, installing temporary fencing, and/or rerouting traffic patterns. Specific actions will depend on the scale, severity, and nature of each situation. In addition, each situation will require appropriate administration of the Contract. After the area has been properly secured, the Construction Manager should consider practical alternatives for the Contractor to continue work on the Project. If unavailable, document work delays, because Contractor negotiations may be necessary. Security measures shall remain in place until formal clearance is provided by authorized environmental professionals.

Security measures shall be inspected periodically to ensure that barriers remain intact and effective until the hazard has been fully addressed. Inspection frequency shall be documented in daily reports.

The Construction Manager shall coordinate with the Authority regarding potential schedule impacts and mitigation strategies associated with the secured area. Any time impacts shall be evaluated in accordance with Contract provisions prior to consideration of extensions.

6.5.9. Emergency Contact Notification

In a situation where an extremely hazardous or life threatening substance is encountered, immediately notify the following:

1. 911 Emergency Response
2. New Jersey State Police
3. Local fire department
4. NJDEP, Emergency Response Section

A coordinated effort is necessary to properly address each hazardous material/hazardous waste situation. To provide continuity within the Project, the Authority's Liaison Engineer should always be kept informed. It is extremely important to maintain complete and accurate records (e.g., contacts made, recommendations, decisions, planned and completed activities, schedules). All verbal notifications shall be followed by written confirmation when required by regulation.

All emergency notifications shall be logged with date, time, and name of the individual contacted. Notification logs shall be preserved as part of the permanent Project record.

Follow-up written confirmation of notifications shall be transmitted to the Authority's Environmental Section as soon as practicable. Failure to make required notifications within mandated timeframes may result in regulatory enforcement.

6.5.10. Remedial Action Plan

When potential contaminated and hazardous material is identified at a Project site, sampling will be done to verify the presence and type of contamination. Contamination may be determined to exist in soil, groundwater, or both. The Contractor will be required to coordinate the development of the remedial action plan with the LSRP responsible for the Project. The LSRP will be responsible for ensuring that the Project site is investigated and remediated in accordance with all applicable Federal, State, and Local regulations. The LSRP, along with the party doing the remediation, will determine the appropriate remedial actions to be taken and will prepare a Project specific Remedial Action Workplan (RAW), which will be submitted to the Authority and NJDEP for review. No remedial activities shall commence without an approved RAW unless emergency response conditions dictate otherwise.

The Construction Manager will be involved in all site investigations and remediation processes, including attending all meetings and correspondences related to the remediation of contamination and hazardous materials. The Construction Manager will be responsible for informing the Authority of all remediation work. The Construction Manager will also create a file of all investigations, testing, removal logs, reports, and correspondence to be maintained at the Project site and submitted to the Authority upon completion of the work. All remediation documentation shall be indexed and traceable to specific site locations and quantities.

The Construction Manager shall verify that all remedial activities are performed in accordance with the approved RAW and that deviations are documented and approved prior to implementation. Unauthorized deviations from the RAW are prohibited.

Progress updates regarding remediation activities shall be provided to the Authority at regular intervals until closure is achieved. Final closure documentation shall be submitted prior to Project closeout.

6.6. ASBESTOS

The Authority's Engineering Department has prepared Asbestos Management Plans (AMPs) for a majority of the buildings and other facilities owned by the Authority. The AMPs contain information regarding the potential presence of asbestos containing materials (ACMs) for all accessible materials such as flooring, walls, insulation, etc. The AMPs should be referenced before any construction is undertaken that may involve materials suspected of containing ACM. Access to the AMPs is available via request to the Environmental Section of the Engineering Department. Upon completion of any construction activity related to ACM abatement, the Construction Manager shall provide all final reports, records and analytical results related to said abatement to the Authority's Environmental Section. Disturbance of suspect ACM shall not occur until proper survey and abatement procedures are completed.

The Construction Manager shall verify that asbestos abatement activities are conducted by properly licensed contractors and in accordance with applicable Federal and State asbestos regulations.

Air monitoring results, clearance certifications, and waste disposal documentation shall be reviewed for completeness prior to final acceptance. Waste shipment records shall confirm disposal at an approved facility.

6.7. MONITORING WELLS

The Authority has monitoring wells throughout its right of way. The Authority's Environmental Section maintains site plans for all Service Areas, Maintenance Districts, State Police, etc. illustrating the location of known monitoring wells. Monitoring wells that have been identified during design to be within the proposed limits of construction, will be designated in the Contract Plans. The Construction Manager shall verify that the Contractor has been properly informed with respect to site location and special requirements outlined in the Supplementary Specifications that will include protection of active licensed wells and decommissioning of abandoned wells. "Decommissioning" means the permanent closure or sealing of any well in accordance with the procedures set forth in N.J.A.C. 7:9D-3. Active monitoring wells shall not be disturbed without prior authorization from the Authority's Environmental Section.

Monitoring wells discovered during construction that were not identified in the Contract Plans should be considered abandoned and the Construction Manager should coordinate with the Authority's Environmental Department to have the well decommissioned. No well shall be decommissioned without documented authorization and proper regulatory procedures.

The Construction Manager shall ensure that protective measures are implemented to prevent damage to active monitoring wells during construction operations. Protective barriers or markings shall be installed where wells are in proximity to equipment or traffic.

Documentation of any well protection or decommissioning activities shall be retained as part of the permanent environmental record for the Project. Decommissioning records shall include location, method, date, and certification by a licensed professional as required by regulation.

SECTION 7 FACILITIES

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SECTION 7- FACILITIES

7.1. GENERAL

This section provides guidance to the Authority's Construction Manager for the successful administration of the Project's construction contract documentation and observation. This section shall be implemented in a manner consistent with applicable Authority requirements, the Contract Documents, International Building Code (IBC), applicable NFPA standards, ADA requirements, and recognized quality assurance best practices including those reflected in NJDOT procedures and Federal Highway Administration (FHWA) quality guidance. Nothing contained in this section shall relieve the Contractor of responsibility for performing the Work in accordance with the Contract Documents. The Construction Manager shall monitor and report the Contractor's activities and progress. Monitoring and reporting shall be performed using consistent, auditable documentation practices and, where feasible, Authority-approved electronic systems for document control, reporting, tracking, and record retention (e.g., SharePoint, Primavera P6, CapEx Manager, BIM/CADD workflows, or other Authority-approved project management platforms). Project documentation shall be entered into the Authority-approved systems in a timely manner and maintained in an organized and traceable format. The Construction Manager shall verify that the construction activities are in conformance with contractual requirements, that open issues and/or activities are resolved and that the required documentation is prepared and maintained. Verification shall include planned inspections, field observations, tracking of deficiencies and corrective actions, confirmation of material acceptance/testing documentation, confirmation of required permits/inspections, and confirmation that schedule-critical hold points are satisfied prior to proceeding. Work shall not proceed beyond established inspection or contractual hold points without documented acceptance by the Construction Manager in accordance with the Contract Documents. If the Construction Manager, or the Authority, elects to employ the services of an architect and/or building engineer for monitoring, observation, and reporting on portions of the work related to vertical building construction, these entities shall follow the same guidelines. The scope and reporting responsibilities of these entities shall be clearly defined to avoid duplication of effort or conflicting direction. All such entities shall be coordinated through the Construction Manager to ensure consistent reporting, unified direction, and avoidance of conflicting instructions to the Contractor, and shall document findings in the same reporting format and frequency required by the Authority. No direction to the Contractor that modifies the Contract Documents shall be issued except through authorized Authority channels. Performance of the tasks outlined in this section will help the Construction Manager meet the Authority's documentation and inspection requirements, deliver a quality, completed project and improve the driving experience of the travelling public. In addition, these tasks shall support risk reduction, cost and schedule predictability, improved lifecycle performance, and maintainable, safe facilities outcomes. All records generated in support of these tasks shall be preserved as part of the permanent Project record. Where ever possible, the Construction Manager should enforce requirements and take full advantage of the construction team's experience and expertise by requiring proactive planning, constructability coordination, early identification of conflicts, and timely resolution of field issues before they affect safety, quality, cost, schedule, or operations. Failure to identify and address issues in a timely manner may result in increased project risk and shall be documented accordingly.

7.1.1. Approach to Building Systems

There are four basic phases for the Construction Manager to follow for each building system: Document Review, Submittals, Pre-Construction and Construction. For each building system, the Construction Manager shall also establish system-specific inspection hold points, testing/commissioning milestones, a coordination responsibility matrix, and a documentation checklist aligned with Contract requirements.

7.1.1.1. Document Review

The Construction Manager shall review each discipline's Contract Documents and check for construction items not coordinated between disciplines or trades, or for items that are assigned to the Contractor to coordinate. This review should include verification of code-required interfaces (fire/life safety, egress, accessibility/ADA, energy compliance where applicable), confirmation of required delegated design elements, and identification of conflicts that could affect installation sequencing, safety, maintainability, commissioning, or future operations. Identification of coordination issues during this review shall not relieve the Contractor of responsibility for performing the Work in accordance with the Contract Documents. The Construction Manager should review coordination items assigned to the Contractor to determine that they are addressed in the construction submittals. The Construction Manager shall require that coordination responsibilities assigned to the Contractor are explicitly reflected in submittals, shop drawings, coordination drawings, and installation plans, and shall verify that the Contractor has identified responsible trades and sequencing. Submittals that do not adequately address required coordination responsibilities shall be returned for revision prior to acceptance. Items not coordinated should be discussed and resolved at the pre-construction conference. Unresolved items shall be recorded in meeting minutes and tracked in an open issues log with assigned owners, required due dates, and escalation protocols until closed. Open coordination issues that may affect safety, schedule, cost, or operational performance shall be elevated to the Authority for resolution if not resolved within the required timeframe.

Resolution of coordination issues shall be documented in writing and incorporated into the project record.

7.1.1.2. Submittals

Construction submittals should be delivered to the Construction Manager for distribution to the Designer Engineer for their review. Submittals shall be managed through a documented workflow including receipt, completeness review, distribution, review timelines, resubmission tracking, final disposition, and controlled distribution of approved documents to the field. The submittal workflow shall ensure that only the latest approved versions of documents are distributed for construction use and that superseded versions are clearly identified and removed from active use. The Construction Manager is responsible for ensuring the Contractor and subcontractors are providing the necessary coordination between trades. This responsibility includes verifying that submittals do not conflict with adjacent trades and confirming that submittals incorporate field-verified existing conditions when applicable. Identification of coordination issues during submittal review shall not relieve the Contractor of responsibility for coordination and proper installation of the Work. The Construction Manager should check that the items required by the Specifications have been submitted and approved prior

to beginning fabrication or construction. The Construction Manager shall enforce “no fabricate/no install” requirements when approvals are not obtained, and shall document any exceptions only if permitted by the Contract Documents and authorized by the Authority. Unauthorized fabrication or installation performed prior to submittal approval shall be documented and may be subject to rejection or corrective work at the Contractor’s expense in accordance with the Contract Documents. A list identifying submittals required by the Specifications, tracking submissions, reviews and approvals should be maintained to monitor submittals. This list shall be maintained as a live Submittal Log (or Submittal Register) and shall be tied to the project schedule, procurement lead times, and critical path activities, and shall include responsible parties and required approval dates to prevent delays. The Submittal Log shall be updated regularly and made available to the Authority and project team to ensure transparency and proactive management of submittal status.

When the planned construction must interface with existing construction, surveying the existing building elements is the initial step to begin the construction process. The Construction Manager shall verify that the Contractor’s planned interfaces with existing conditions are clearly defined, that tolerances are accounted for, and that discrepancies are resolved through RFIs and approved revisions prior to fabrication/installation. Field verification of existing conditions is the responsibility of the Contractor unless otherwise specified in the Contract Documents. Fabrication drawings submitted to the Construction Manager should include the findings of the survey. The Construction Manager shall reject fabrication drawings not based on required surveys until the survey information has been considered. The Construction Manager shall also require that survey documentation (field notes, scan reports, photos, control points, and date-stamped records) be included or referenced in the fabrication drawing submission, and that revisions are made when survey results differ from assumed conditions. Survey documentation shall be retained as part of the permanent project record to support future reference, maintenance activities, and dispute resolution if required. Pre-construction surveys may include a physical survey for dimensions and configurations of existing site or structures, LIDAR scans, photographs and/or video surveys of existing conditions. Where feasible, surveys should include clear benchmarks so that record documentation and as-built verification can be validated. Survey benchmarks and reference control points shall be clearly documented and maintained throughout the construction period to support accurate verification and final as-built documentation.

Coordination Drawing Submission - The Construction Manager, shall establish the project specific requirements for Coordination Drawings during review of the Construction Documents. The requirements for Coordination Drawings are generally discussed in the Construction Specifications Institute (CSI) Division 1 General Requirements, Section 013100 Project Management and Coordination.

The Submittal Matrix indicates which specific sections require preparation of Coordination Drawings by the Contractor. Required Coordination Drawing submissions should be described in the Contractor’s Submittal Schedule as required by CSI Division 1, Section 013300 Submittal Procedures. The Construction Manager shall verify that the Submittal Matrix and Contractor’s Submittal Schedule are complete, realistic, and aligned with procurement lead

times and installation sequencing, and shall require corrective updates when deficiencies are identified. Coordination Drawing submissions shall demonstrate that spatial conflicts between building systems, utilities, and structural elements have been resolved prior to installation.

The format/file type, submittal, review and coordination procedures shall be established and documented during the pre-construction conference. These procedures shall include version control, naming conventions, distribution rules, required attendees, and dispute resolution/escalation steps. Digital coordination platforms (e.g., BIM or model-based coordination tools) may be utilized where appropriate to improve visualization and coordination between disciplines. The pre-construction conference, subsequent coordination meetings and pre-installation meetings shall also include a discussion on the status of applicable Coordination Drawing submissions. These topics should also be considered for inclusion in meeting agendas, where applicable. Coordination Drawing status shall be tracked as a schedule-driving item when necessary, and late submissions shall be documented as potential impacts to schedule and/or quality. Coordination Drawing approval shall not be interpreted as acceptance of means and methods, which remain the responsibility of the Contractor.

7.1.1.3. Pre-Construction

Building contractors summarize their pre-construction coordination efforts in a pre-construction conference prior to beginning construction of a specific trade or building system. The Construction Manager should insist that the Construction Manager, the Designer Engineer, and the Special Inspector (for elements requiring special inspection) are present at the pre-construction conference with the Contractor and subcontractors. In addition, the Construction Manager should ensure attendance by key safety representatives, commissioning participants (when relevant), and major impacted trades, and should require that meeting minutes include action items, due dates, and assigned responsibility for resolution. Pre-construction topics are listed in Section 7.4 through Section 7.12 for various building systems. These topics should also be considered for inclusion in meeting agendas, where applicable. Pre-construction meetings shall also address required permits and inspections, required mockups, material storage/handling, installation tolerances, testing requirements, hold points, quality control plans, housekeeping, and protection of completed work.

7.1.1.4. Construction

During the construction phase of the Project, the Construction Manager is responsible for coordinating the efforts of the Owner's design consultants (A/E of Record) and the A/E of Record's quality control site observations. Section 7.2 discusses the quality control roles on the Project. Common construction issues that should be reviewed on site are discussed in each building system section. The Construction Manager shall also coordinate with special inspection/testing agencies, commissioning agent activities, and Authority stakeholders to ensure that inspections, tests, and approvals occur in a timely manner and are fully documented. The Construction Manager shall maintain a deficiency log (punchlist and pre-punchlist as appropriate), track corrective actions, and verify closure by re-inspection or documented acceptance by the appropriate design professional.

7.2. QUALITY CONTROL

Quality control during the construction phase of Facilities projects should focus on the process for the Contractor's submittal, management of the Contractor's schedule, coordination of subcontractors and trades, special materials testing and the quality and workmanship of in-place work. Quality control shall also include verification of required permits/inspections, compliance with code-mandated special inspections, documentation completeness, commissioning readiness, and effective closeout planning. Quality control activities shall be documented through inspection reports, testing records, meeting minutes, and field observations in order to provide a verifiable record of compliance with the Contract Documents. The Construction Manager shall actively verify that quality activities are planned and that inspection and testing requirements are integrated into the schedule and daily work planning. Inspection and testing hold points identified in the Contract Documents shall be clearly communicated to the Contractor and shall be satisfied prior to proceeding with subsequent construction activities.

The Construction Manager shall confirm that the Contractor's Quality Control Plan (if required by the Contract Documents) has been submitted, reviewed, and implemented prior to the start of applicable construction activities.

Where deficiencies or nonconforming work are identified, the Construction Manager shall ensure that corrective actions are documented, tracked, and verified prior to acceptance of the affected work.

Quality control observations shall be coordinated with the Authority, Designer of Record, and any Special Inspectors to ensure that testing, inspections, and certifications required by applicable codes and standards are completed and properly documented.

Records generated through quality control activities shall be maintained in an organized manner and retained as part of the permanent project documentation to support acceptance decisions, payment verification, and potential dispute resolution.

7.2.1. Roles and Responsibilities

Refer to Section 2 of this Manual for a general discussion regarding roles and responsibilities for the administration of the overall Project.

The following discussion elaborates on Facilities specific issues.

7.2.1.1. Designer

Designers normally involved in Building Projects may include: architects, civil engineers, electrical engineers, structural engineers, fire protection, mechanical, plumbing, security, telecommunications, and/or other specialty consultants.

The Designer's responsibilities include:

1. Verification and execution of the Owner's program and technical requirements as established in the Owner/Design Engineer agreements. This includes verifying code compliance, accessibility requirements, and design intent related to maintainability and

operations, and documenting key assumptions affecting construction. The Designer shall ensure that design documents are coordinated across all disciplines and that design assumptions affecting construction sequencing, tolerances, or system integration are clearly documented.

2. Support during bidding and contracting phase, including responding to bid inquiries, issuing addenda, bid analysis and recommendations to the Owner. Support shall also include clarifying design intent, responding to constructability concerns, and ensuring addenda are coordinated across disciplines. Responses to bidder inquiries and issued addenda shall be documented and distributed through formal channels to ensure all bidders receive consistent information.
3. During the construction phase, reviewing submittals, reviewing RFIs, and coordinating with the Construction Manager/Owner's representative in the field. The Designer shall provide timely responses consistent with Contract review periods and shall document field observations and required corrective actions when design intent is not achieved. Designer responses to submittals and RFIs shall clearly indicate review status and any limitations of review in accordance with the Contract Documents.

7.2.1.2. Owner's Technical Consultant

The Owner's technical consultant can be individual design or construction consultants or a team consisting of design professionals who perform program management or oversight roles. This role is often tied to, or closely related to that of the Construction Manager.

The Owner's technical consultant participates in design phase reviews of design drawings and specifications to become familiar with the scope of the work and the specific responsibilities of the General Contractor and major subcontractors/trades. The Owner's technical consultant shall also support risk identification, cost/schedule oversight, coordination of design clarifications, and escalation of critical issues to the Authority as appropriate. Findings from design reviews or construction oversight activities shall be documented and communicated to the Authority and Construction Manager to ensure timely resolution of identified issues.

7.2.1.3. Construction Manager

The Construction Manager shall use this manual as the guide for project completion. The Construction Manager shall have regular communication with the General Contractor's project superintendent and associated supervisors to ensure the schedule is progressing, to schedule all required testing and inspections, and to resolve any documented deficiencies. If requested by the NJTA, the Construction Manager shall participate in the design phase reviews of design drawings and specifications to become familiar with the scope of the work and the specific responsibilities of the General Contractor and major subcontractors/trades. The Construction Manager shall also coordinate required

Facilities specific inspections and testing with the Facilities General Contractor, Design Engineer and Construction Manager's Materials Testing Laboratory. Refer to the sample Testing Matrix described in Section 7.13.2 and included in Exhibit 7 - 2. The Construction Manager shall additionally: (a) maintain a formal issues log and deficiency log; (b) maintain an inspection and testing schedule tied to the Contractor's look-ahead schedules; (c) verify that testing agencies are properly engaged and that reports are complete, signed, and distributed; (d) ensure that all required permits are current and posted; (e) verify that record documentation (redlines/as-builts) is maintained continuously; and (f) provide timely escalation to the Authority when unresolved issues present risk to safety, quality, schedule, cost, or operations. The Construction Manager shall maintain accurate and timely project documentation including daily reports, inspection records, meeting minutes, testing documentation, and correspondence to support project oversight and acceptance decisions.

Identification of deficiencies or nonconforming work shall be documented and communicated promptly to the Contractor for corrective action.

7.2.1.4. General Contractor

For Building Projects that are a part of a larger roadway/ infrastructure project, the General Contractor for facilities may be a subcontractor to the overall roadway project. The basic contractual responsibilities shall include the overall management of the project delivery, including all activities or work of subcontractors and suppliers. The General Contractor shall be responsible for site security and safety, including fencing, controlled access, and after-hours security patrols (if required). The General Contractor shall provide daily progress logs and regular reporting as defined in the general conditions of the Contract. Quality control covering all aspects of mobilization, construction, communications, commissioning and project closeout is also part of the General Contractor's requirements. The Construction Manager shall verify that the General Contractor maintains a documented Quality Control Plan (QCP), a Safety Plan, and a schedule with short-interval planning (look-aheads), and that subcontractor coordination is demonstrated through meeting minutes, coordination drawings, and field execution. The General Contractor shall remain fully responsible for the work of all subcontractors and suppliers and for ensuring that their work complies with the Contract Documents.

7.2.1.5. Local Code Authority

The local Authority Having Jurisdiction (AHJ) is responsible for the review and approval of plans to issue the required building permits. The professional in responsible charge (A/E of Record) or the General Contractor may be responsible for the coordination of submissions and clarifications required by the Owner. Depending on the scope and complexity of the project, partial or conditional permits may be issued for specific scopes of work. Site clearing, mass excavation, utility and foundation work are often candidates for conditional permits.

The Construction Manager shall coordinate with the Contractor and/or A/E of Record to ensure all necessary permits are on site when inspections are required. The Construction Manager shall also maintain a Permit Log identifying permits

required, permit numbers, issue dates, expiration dates, required inspections, inspection outcomes, and any conditions of approval, and shall ensure that permit documentation is readily available for verification and audits. The Construction Manager shall verify that all permit conditions and required inspections are satisfied prior to proceeding with subsequent phases of work.

7.2.1.6. Department of Community Affairs

All New Jersey building projects require a Construction Building Permit and it must be current for the entire duration of construction until the Certificate of Occupancy (CoO) is issued. The New Jersey Department of Community Affairs (DCA) issues permits from the Division of Codes and Standards and may be contacted at (609) 292-7898. The Division of Codes and Standards establishes and enforces building codes, in partnership with the State's municipalities, to protect the health and safety of New Jersey residents. The Division of Codes and Standards administers the Uniform Construction Code, which comprises the laws and regulations governing buildings, electrical, plumbing, fire protection, energy, mechanical, elevator, radon, asbestos, rehabilitation and barrier-free sub codes, and lead hazard abatement. The Construction Manager shall ensure that all work remains compliant with NJUCC requirements and that required code inspections are scheduled, witnessed (when appropriate), documented, and closed out without unresolved violations. The Construction Manager shall verify that inspection results and approvals are documented and that any deficiencies identified by DCA inspectors are corrected and formally closed prior to requesting subsequent inspections.

A common misconception is that temporary facilities such as toilets and construction trailers do not require permits. All construction projects require permits, no exceptions. However, freestanding outdoor lighting load centers do not require a permit. Authority electrical staff will perform service inspections and will issue a Letter of Inspection to the utility Wiring Inspector. The Construction Manager shall verify that temporary facilities are properly permitted, installed safely, maintained, and removed in accordance with applicable requirements, and that documentation is retained for closeout. Temporary facility permits and inspections shall be tracked in the project permit log to ensure compliance with NJUCC and Authority requirements.

7.2.1.7. DCA Liaison

It is common for the Authority to require the Construction Manager to assign an "Owner's Designated Agent" to serve on behalf of the Authority as liaison between the Contractor and the New Jersey Department of Community Affairs (DCA) for large program projects. If a DCA Liaison is not specifically required by the Authority, the responsibility shall be fulfilled by the Construction Manager.

The DCA Liaison shall serve as the single point of contact with the DCA for all construction phase permit filings, inspection coordination, and applications for Temporary Certificates of Approval/Occupancy and/or Certificates of Approval/Occupancy. The DCA Liaison shall ensure all required permits are obtained, and that all released and permit documents are maintained on site in accordance with the requirements of the New Jersey Uniform Construction Code

(NJUCC). All submittals will be made to and returned from the DCA through the DCA Liaison. The DCA Liaison shall maintain a permit/inspection tracker and provide routine status updates to the Authority and Construction Manager, including upcoming inspection dates, open items, and risk items that could delay approvals.

The DCA Liaison will review all Contractor submissions to verify administrative completeness before forwarding to DCA for processing. Submissions deemed incomplete will be returned to the Contractor for corrective action. The DCA Liaison shall also confirm that submissions reflect current approved design documents, incorporate required professional seals/signatures when applicable, and include supporting documentation required by NJUCC and DCA processes. The DCA Liaison shall maintain records of all submissions, review comments, approvals, and correspondence with DCA as part of the permanent project documentation.

In cases when the Authority has entrusted a Project to the Authority's General Consulting Engineer (GCE) or Program Manager, which may be the case for larger programs, the DCA Liaison shall be responsible for coordinating with and reporting the status of plan releases, Contractor shop drawing reviews, and amended Plan reviews to the GCE/Program Manager. The DCA Liaison shall track the status of all required permit filings, inspections and approvals for the Project and shall report to the GCE/Program Manager (when entrusted with a project) for inclusion in the Monthly Program Status report. Status reporting shall identify critical-path risks, unresolved code comments, expected approval dates, and mitigation actions being taken by the Contractor and project team. Monthly reporting shall include identification of outstanding inspections or permit conditions that could affect occupancy approvals or project completion.

All facilities, buildings, and temporary facilities (such as toilets and construction trailers) require DCA review, permitting and inspection. Only DCA can waive the review and/or permitting process. The Construction Manager shall not allow work to proceed where required permits or inspections have not been obtained, unless otherwise expressly authorized by the Authority and permitted by applicable regulations. Any unauthorized work performed without required permits or inspections shall be documented and may be subject to corrective action in accordance with the Contract Documents.

7.2.2. Special Inspection Documentation

The Authority will engage an independent special inspection and testing laboratory to perform on-site visual inspections, take samples, and perform required materials testing where required or listed in the Contract Documents. Special inspections shall be conducted in accordance with IBC Chapter 17 requirements and any applicable NJUCC provisions, and documentation shall be complete, traceable, and retained for closeout and future reference. Special inspection reports shall clearly identify the inspected work, inspection date, inspector credentials, observed conditions, test results (if applicable), and acceptance or deficiency status.

The Construction Manager shall verify that special inspection reports are reviewed promptly and that any identified deficiencies are communicated to the Contractor and corrected prior to continuation of the affected work.

Final project closeout shall include verification that all required special inspections have been completed and that final inspection summaries and certifications are included in the project record.

Refer to Section 7.13 for submittal and testing requirements.

7.2.2.1. Statement of Special Inspections

Chapter 17 of the International Building Code (IBC) requires that the registered Design Professional in charge prepare a statement of special inspection to be submitted to the building official. This statement shall identify the materials, systems and/or components that require special inspection. The statement shall identify the type and extent of each special inspection and testing as well as whether they shall be continuous or periodic inspections. The statement shall clearly identify inspection frequency, acceptance criteria, and the responsible inspection agency to ensure proper execution and documentation of required inspections. This statement shall identify any additional inspection and testing requirements for seismic or wind resistance. Where applicable, the statement shall reference applicable code provisions and design criteria related to seismic or wind-resisting systems. This statement can be included in the Contract Documents, which is preferable, or can be submitted as a separate document. When included in the Contract Documents, the Statement of Special Inspections should be clearly referenced in the project specifications and drawings to ensure visibility to all project participants. The Construction Manager shall verify that the Statement of Special Inspections is available prior to commencement of relevant work, that it is consistent with Contract Documents, and that special inspection responsibilities and reporting lines are clearly understood by the Contractor and special inspection agency. The Construction Manager shall confirm that all parties involved in special inspection activities understand their roles, reporting requirements, and coordination procedures prior to the start of construction activities requiring special inspection.

The Construction Manager shall also verify that special inspection reports are submitted in a timely manner and that any deficiencies identified through the inspection process are documented and resolved prior to continuation of the affected work.

Records associated with special inspections shall be retained as part of the permanent project documentation and shall be included in the final project closeout package.

7.2.2.2. Daily Inspection Reports

The special inspection agency, normally an independent consultant, shall keep records of all inspections and testing and submit daily inspection reports upon request to the building official, registered Design Professionals and the Construction Manager. These reports shall identify the elements or systems inspected and/or tested, indicate their location in the facility, indicate if the construction was or was not in conformance with the approved construction documents and provide details describing any non-conforming construction.

Discrepancies shall be brought to the immediate attention of the Contractor. The daily reports shall indicate measures taken by the Contractor to bring construction found to be non-compliant into compliance with the Contract Documents. Corrective actions taken by the Contractor shall be documented and verified through follow-up inspection before the affected work is accepted. Daily inspection reports shall be reviewed by the Construction Manager for completeness, timely distribution, and follow-up actions, and shall be cross-referenced to deficiency logs and corrective action tracking. The Construction Manager shall maintain a record of all special inspection reports and ensure that unresolved deficiencies are tracked until properly corrected and closed.

All special inspection reports and related documentation shall be retained as part of the permanent project record and included in the final closeout documentation submitted to the Authority and the building official.

7.2.2.3. Inspection and Testing Log

The special inspection agency shall prepare and maintain a log of all non-compliant construction and submit this log monthly to the building official, registered Design Professional(s), and the Construction Manager. The log shall be maintained as a continuously updated record and made available for review by the Authority and project team upon request. This log shall identify each non-compliant construction found during inspections and testing, shall track measures taken by the Contractor to bring this construction into compliance and note if the construction has been re-inspected/tested and found to be compliant or if the registered Design Professional has accepted the as-built construction without further modification. Each entry in the log shall include the date of discovery, location of the work, description of the deficiency, reference to applicable Contract Documents or code requirements, responsible party, corrective action taken, and date of resolution. Supporting documentation such as photographs, test results, field reports, and correspondence related to the non-compliance shall be referenced or attached where applicable. The Construction Manager shall ensure no non-compliant items remain unresolved at substantial completion, temporary occupancy, or final completion. Prior to issuance of a Temporary Certificate of Occupancy, Certificate of Occupancy, or final project acceptance, the Construction Manager shall verify that all non-compliant items listed in the inspection and testing log have been resolved or formally accepted by the Design Professional of Record in accordance with applicable codes and Contract requirements. The final inspection and testing log shall be included as part of the project closeout documentation and retained in the Authority's permanent project records.

7.2.2.4. Final Report

After all construction has been found to be in compliance with the Contract Documents or accepted as-built by the registered Design Professional, the special inspection agency shall submit a report to the building official, registered Design Professional(s) and the Construction Manager indicating the construction has been found to be in general compliance with the approved construction documents. The Construction Manager shall ensure this Final Report is included in closeout documentation and is aligned with Certificate of Occupancy/Approval requirements.

7.2.3. Commissioning

Commissioning of designated building systems and equipment will be included in all Authority Facilities projects. The Commissioning Agent acts independently on behalf of the Owner/Operator. The Commissioning Agent will manage the commissioning process on behalf of the Owner and is the team leader on the Commissioning Team. The Commissioning Team includes the Owner (the Authority), Program Manager (when entrusted with a project), the Design Engineer, the Construction Manager, and the Contractor. The Construction Manager shall ensure commissioning activities are integrated into the project schedule, that pre-functional and functional testing plans are coordinated with installation progress, and that deficiencies identified through commissioning are tracked to closure prior to final acceptance.

Refer to Section 7.13.3 for a description of the commissioning scope of services and Exhibit 7 - 3 for the Commissioning Specification.

7.2.4. Facilities Record Documents

Final Facilities record documents (including specifications) are required as per the Authority's CADD/BIM manual and as described in the Contract Documents. Record documents shall accurately reflect the final as-constructed conditions and shall incorporate all approved field changes, RFIs, change orders, and design revisions. The Construction Manager should periodically inspect the Contractor's progress to keep an updated, on-going, preliminary record documents set. These may be redlined drawings during construction until the final record documents are submitted. Redlined drawings shall clearly identify field-installed conditions, deviations from the original design, and installation details necessary to support future maintenance and operations. This is particularly critical for all buried construction and the Mechanical, Electrical, and Plumbing (MEP) and Fire Protection disciplines. Buried utilities, concealed systems, and critical infrastructure elements shall be documented prior to concealment to ensure accurate record documentation. It is not advisable to allow the Contractor to perform this activity at the end of the construction period; it should be an on-going effort by the Contractor, which is checked periodically to confirm this work is kept up to date by the independent special inspector. The Construction Manager shall verify that record documentation is maintained continuously throughout construction and shall address deficiencies promptly if documentation falls behind the progress of the work. Refer to the Contract Documents for additional Contractor closeout requirements including MEP product manuals, HVAC maintenance plans, green cleaning practices, maintenance staff training and other post-construction requirements/activities. Record document requirements shall include version control, date-stamped updates, and clear differentiation between design intent and field-installed conditions. All record documents shall be clearly labeled as "Record Documents" or "As-Built Documents" and shall identify the revision history and responsible party for updates. The Construction Manager shall require periodic submission of interim record updates at defined milestones (e.g., monthly or per major system completion) and shall verify that concealed/buried work is documented before concealment. Failure to provide required interim record updates may delay acceptance of the associated work until proper documentation is submitted and verified. Where required, GPS-enabled as-built data and photologs shall be incorporated into final record documentation in accordance with Authority requirements. All final record documentation shall be reviewed for completeness.

and accuracy prior to final acceptance of the Project and shall be retained in accordance with Authority record retention requirements.

7.2.5. Sustainability

The Construction Manager should become familiar with the requirements of the Contract Documents for sustainability and/or certification. The building envelope, mechanical and electrical systems and possibly other construction should be “LEED-Like” in the approach to system design. The Construction Manager shall review sustainability requirements early in the Project to ensure that applicable materials, systems, and construction practices are identified and properly coordinated with procurement and construction activities. The anticipated number of LEED credits will be listed in the Contract Documents and it is intended that the Contractor will participate in attaining these credits, where applicable. The Construction Manager shall monitor the Contractor’s progress in achieving applicable sustainability goals and shall verify that required documentation supporting these efforts is submitted and maintained. LEED certification or registration is not anticipated at this time, but may be considered at a later date. Even when formal certification is not pursued, documentation supporting sustainability practices should be maintained to demonstrate compliance with the intent of the Contract Documents. “LEED-Like” means that prudent LEED performance recommendations with a reasonable payback time are to be incorporated. Examples of credits that involve significant Contractor participation are tracking of sustainable product origins or “chain of custody”, certification of wood products from sustainable tracts of timber and recycling of construction waste materials. The Construction Manager shall verify that materials claiming sustainability attributes are supported by appropriate certifications or documentation, such as chain-of-custody certificates or manufacturer declarations. Those recommendations that do not have a reasonable payback time or are not appropriate to the Project will not be incorporated. Any sustainability-related decisions or deviations from anticipated practices should be documented to provide a clear record of the rationale and approval. The Construction Manager shall require that sustainability-related submittals are tracked and retained as part of the project record. Sustainability-related documentation shall be organized and maintained in a manner that allows verification of compliance with the Contract Documents and facilitates potential future certification or reporting efforts. The Construction Manager should verify that construction practices supporting sustainability goals (dust control, material recycling, source verification, and protection of installed systems to preserve performance) are implemented in the field when required by the Contract Documents. Field observations related to sustainability practices should be documented through inspection reports or daily logs to confirm compliance with project requirements.

7.3. SITE CONSTRUCTION FOR FACILITIES

This section describes surface site improvements associated with facilities and is mostly independent from the highway requirements. It includes “on-grade” site work only for facilities. The Construction Manager shall verify that site work is constructed in accordance with the Contract Documents and applicable codes and standards governing facilities construction. This section supersedes any civil/highway construction, except below grade work and erosion control. Where conflicts arise between facility site work requirements and roadway construction requirements, the Construction Manager shall coordinate with the appropriate design disciplines and the Authority to resolve the conflict prior to proceeding with construction. Site utilities beyond 5-feet of the building’s foundations and storm drainage systems work are covered in other sections of this Manual. Coordination between building site work and utility installations described elsewhere in this Manual shall

be confirmed to ensure continuity of grading, drainage, and utility service connections. This section addresses issues associated with accessibility requirements of the building codes and the Americans With Disabilities Act, which is federally mandated civil rights legislation and is common to buildings, parking and site work. Accessibility requirements shall be treated as critical compliance elements and verified throughout construction to ensure that final site conditions meet applicable accessibility standards. The Construction Manager shall ensure that site work interfaces with roadway/infrastructure work are fully coordinated to avoid gaps in responsibility, conflicting grades, drainage conflicts, or accessibility non-compliance. Coordination meetings between facility construction teams and roadway or infrastructure contractors should be conducted as needed to confirm that interface conditions are understood and properly constructed. Accessibility features shall be verified in the field using measurable criteria (slopes, cross slopes, landings, transitions, detectable warnings where applicable, and clearances) consistent with applicable code requirements and Contract Documents. Field measurements and observations verifying accessibility compliance shall be documented and retained as part of the project inspection records. Any deviations from accessibility requirements shall be corrected prior to final acceptance to ensure compliance with applicable regulations and to avoid potential liability for non-compliant conditions.

7.3.1. Fire Protection

Fire protection site piping and hydrants that serve the Facility will be part of the facility construction. The Construction Manager shall verify that fire protection system components installed on site are consistent with the approved fire protection design and applicable codes and standards.

Final fire protection design for approval by the Authority Having Jurisdiction (AHJ) is often assigned to the Fire Protection Contractor as a delegated design submittal through the Specifications. Delegated design submittals shall clearly identify the responsible professional engineer and include appropriate professional seals where required by applicable regulations. Final permit plans should provide an approved fire protection design, coordinated with both the local water department and fire department. Coordination with the local water authority and fire department shall be documented to confirm that required service capacities, hydrant locations, and access provisions meet jurisdictional requirements. The Construction Manager shall verify that delegated design submissions are properly sealed when required, coordinated with site utilities, and compatible with required flow/pressure criteria, hydrant spacing, and access requirements. Hydrant locations and fire protection piping installations shall be verified in the field to ensure compliance with approved plans and maintain adequate access for fire department operations. The Construction Manager shall verify required testing (hydrostatic tests, flushing, flow tests, and acceptance inspections) and ensure test documentation is maintained for closeout. Testing and acceptance procedures shall be conducted in accordance with applicable NFPA standards and the requirements of the Authority Having Jurisdiction. All fire protection testing reports, inspection records, and acceptance documentation shall be retained as part of the permanent project record and included in the final closeout documentation submitted to the Authority.

7.3.2. Document Review

The Construction Manager shall review the Contract Documents, existing surveys, new contours, parking lots, sidewalks, curb ramps, accessible ramps, level landings and

entrances, railings, storm water retention/detention design, lighting, etc. The Construction Manager shall verify that the design documents are coordinated across disciplines and that site grading, drainage, and accessibility features align with the approved architectural, civil, and structural drawings. The review shall emphasize accessibility compliance, drainage performance, constructability, maintenance access, lighting photometric intent (where applicable), and coordination with utility routes and foundations. Accessibility-related elements shall be reviewed for compliance with applicable building codes and ADA requirements, including slopes, cross slopes, transitions, clearances, and accessible route continuity. Conflicts shall be documented and addressed through RFIs, coordination meetings, or approved revisions prior to construction. Identified conflicts shall be documented promptly and tracked until resolved to prevent delays, rework, or non-compliant construction. Any design clarification or modification resulting from the review shall be incorporated into the project record through approved revisions, addenda, or formal responses to RFIs.

7.3.3. Submittals

See Section 7.13 and the referenced submittal matrix for key submittals related to this scope of work. The Construction Manager shall verify that required submittals are submitted, reviewed, and approved prior to fabrication or installation of related materials and systems. The Construction Manager shall ensure that site submittals include material certifications, mix designs (where applicable), shop drawings for accessibility features (railings, ramps, etc), lighting cut sheets, and any delegated design documentation required by the Contract Documents. Submittals related to accessibility features shall clearly indicate dimensions, slopes, and installation details necessary to verify compliance with applicable accessibility requirements. Lighting submittals shall be reviewed to confirm that fixtures, mounting locations, and photometric performance are consistent with the design intent and applicable safety or operational requirements. Delegated design submittals shall include required professional seals and supporting calculations where applicable and shall demonstrate compatibility with other site systems and structures. Approved submittals shall be distributed to field personnel to ensure that construction activities are performed in accordance with the approved documents.

7.3.4. Pre-Construction

Refer to Section 3.1 of this Manual for general pre-construction conference and documentation requirements.

Often in Facilities projects, construction packages for demolition, excavation, utilities and even footings and foundation are released as early construction packages requiring partial or conditional permits issued by the various AHJs. The Construction Manager should verify through the Contractor and applicable design disciplines that all required permits are in place. The Construction Manager shall also verify that early packages are properly coordinated with the final design intent, that temporary conditions are safely managed, and that documentation clearly defines limits of work, responsibilities, and inspection/testing requirements for early releases.

7.3.5. Construction

The Construction Manager shall review these construction considerations:

1. Site Water Removal/Storm Drainage/Piping/Manholes

Standing water, no matter the source, should always be removed from excavations, and any excess site water must be diverted to locations suitable to local authorities. Subsoil water which causes an area to always remain wet may require a permanent design solution, if one is not already indicated. The Construction Manager shall verify that dewatering and discharge practices comply with permits and environmental requirements, that erosion and sediment controls are maintained, that discharge points are stabilized, and that dewatering operations do not compromise adjacent structures, utilities, or excavations. Dewatering plans and discharge approvals shall be documented where required. Dewatering operations shall also be monitored to ensure that downstream drainage systems, retention areas, and stormwater infrastructure are not adversely impacted.

2. Grading/Excavation/Backfill/Compaction/Engineered Fill for Facilities

The Construction Manager should understand the grading plan, critical grades and elevations at entrances. Grades are dependent on the final first floor or basement level of the building. Grades are also set based on suitability or to maintain soil strata. Often, soils need to be remediated because of wet, non-compactable, or otherwise unsuitable soils, and proof rolling may be needed to test the compatibility of the soils. This can assist the soils engineer in making recommendations for soil stabilization, over-excavation, placing geofabric, or utilizing other methods to assure soil suitability. The Construction Manager shall ensure that geotechnical recommendations are incorporated into field operations, that unsuitable soils are identified and documented, and that corrective measures are performed in accordance with approved procedures and verified through testing. Field conditions that differ from those described in the geotechnical report shall be documented and reported to the Geotechnical Engineer for evaluation.

Backfill material should be clean and free of debris. Backfilling must not occur until all piping in the vicinity and through the foundation walls or grade beams are installed, including utility stub outs and foundation and under slab drainage systems. Backfill against a deep building foundation may require bracing of the foundation wall as required by the structural engineer. Backfill should be compacted in layers to prevent settlement of grade around the excavated space. Backfill material of excavations commonly comes from the original, stockpiled excavated material, if it is suitable. The Construction Manager should verify that fill materials are coming from the right source and the Geotechnical Engineer has qualified the fill materials. The subgrade surface should be scarified to accept fills. Piping should be inspected and excavated areas cleaned wherever backfill is required. The Construction Manager shall verify lift thickness, moisture conditioning, compaction effort, and testing frequency are consistent with specifications, and shall ensure that compaction test results are documented and meet acceptance criteria before subsequent lifts or surface improvements proceed. Compaction testing results shall be reviewed promptly to confirm compliance with specified density requirements prior to continuation of work.

A testing company shall test fill materials. Engineered fills are normally added from off-site locations to improve soils to meet the required characteristics. These replacement soils, along with backfill, are to be placed in individually compacted lifts so proper compaction can be attained. It is also normally specified to add moisture at each lift to attain specified

moisture compaction as directed by the soils engineer. However, too much moisture can cause failure of the fill. A high moisture content, rain and frost (on sand) could lead to re-testing and possible replacement of the fill material. The Construction Manager shall require timely testing reports, document failed tests, require corrective actions (rework, drying, moisture adjustment, removal/replacement), and verify re-testing and acceptance before proceeding. Weather impacts and protective measures (covers, stabilization, scheduling adjustments) shall be documented and coordinated.

The Construction Manager should verify existing trees to remain are protected and the root systems are not removed or only removed to the extent recommended by a landscape architect or other suitable professional. Prominent vegetation to remain should be clearly marked and protected. Parking, material storage and construction activity should not be allowed under tree drip lines. The Construction Manager shall verify that protection measures (fencing, signage, root zone protection, mulch, and access control) are installed prior to major site activity and maintained throughout construction, and shall document any damage or violations and require corrective action. Protection of existing vegetation and landscape features shall be verified periodically to ensure compliance with project environmental and landscape preservation requirements.

3. Air Entrainment

The Construction Manager should be aware of the requirements for all site-related concrete mix designs. All site concrete subject to freeze-thaw cycles should have up to 5-percent air entrainment for durability and to reduce spalling. The Construction Manager shall verify mix design approvals, batch tickets, and field test results (slump, air content, temperature, unit weight as applicable) and shall ensure curing methods are appropriate for weather conditions to protect durability and finish quality.

4. Blasting

Blasting is prohibited unless approved by the Owner and the local Authority Having Jurisdiction. If blasting is permitted, the Construction Manager should verify the Contractor has obtained the proper permits, an expert with blast supervision is utilized, safety rules are observed, and adjacent property subject to possible damage is protected from blasting. If blasting is permitted, the Construction Manager shall also require a blasting plan, pre-blast surveys of adjacent structures/utilities, vibration monitoring thresholds, notification protocols, exclusion zones, and documented post-blast condition verification. All approvals, permits, monitoring results, and incident documentation shall be retained as part of the project record.

7.3.6. Accessible Routes and Sidewalks for Parking Areas

7.3.6.1. General Standard for Construction Manager Inspections

The Construction Manager must enforce the requirements of the ADA/ANSI A117.1 standards as referenced and/or shown in the details in the Contract Documents. The Construction Manager shall also enforce the applicable ADA Standards for Accessible Design and any project-specific Authority requirements, and shall require that accessible route work be constructed to meet the strictest

applicable requirement where multiple standards apply. Verification shall be based on measurable field checks (slopes, cross slopes, transitions, landings, clear widths, detectable warnings where required, and approach geometry) using calibrated instruments such as digital levels and slope meters, and results shall be documented in inspection reports.

Key considerations for review and coordination by the Construction Manager, Contractor and Design Professionals include:

1. Accessible routes from designated accessible parking to designated accessible building entrances. Accessible routes shall be verified for continuity, minimum clear width, running slope and cross slope compliance, stable/firm/slip-resistant surfaces, and proper transitions between materials and elevations, and shall be protected from construction damage until acceptance.
2. Traffic markings, cross walks and signage. Markings and signage shall be verified for proper location, visibility, durability, conformance with approved traffic control plans where applicable, and compliance with MUTCD principles as applicable to pedestrian/parking interfaces. The Construction Manager shall verify that signage posts/foundations do not obstruct accessible routes or required clearances.
3. Curb ramps, accessible ramps, rails and associated landings. Curb ramps and ramps shall be verified for geometry, detectable warning placement where required, landing dimensions, handrail/guardrail height and extensions (when applicable), and proper drainage without creating ponding at landings or ramp runs.
4. Minimum cross slopes along the accessible route for walks, ramps, and building entrances and exits. Cross slopes and running slopes shall be verified during forming and again after placement/finishing, and any non-compliant work shall be corrected prior to acceptance. The Construction Manager shall require rework where compliance cannot be achieved through minor surface correction.

The Construction Manager shall require that these items are coordinated in the field with actual constructed grades, drainage structures, utility structures, pavement markings, and adjacent roadway/site conditions, and that conflicts are resolved through approved revisions prior to placement of final concrete/asphalt.

7.3.6.2. Finish Grading/Landscaping

The Construction Manager should address the installation, plant type condition/quantity/size verification, inspection of seeding, sodding, planting beds, mulch, fertilizer and borders maintenance along with the maintenance of these during review and before ordering. Soil preparation and soil mixtures, plant excavation, tree guy wires, watering, fertilization, trimming and pruning should also be addressed, as well as warranties. The Construction Manager shall verify that landscaping work does not adversely impact drainage patterns, accessible routes, signage visibility, or maintenance access, and shall verify that planting and finish

grading do not cause ponding, erosion, or soil migration onto paved surfaces. The Construction Manager should require that all landscape submittals include plant lists, certifications where required, warranty terms, and seasonal installation constraints, and should verify that stockpiled soil and mulch do not conflict with erosion control requirements.

7.3.6.3. Site Lighting for Facilities

The Construction Manager shall review site lighting mounting details. The minimum foot candle per square foot levels for parking and the pathway to the building's main entrance should be defined by the Designer Engineer. The Construction Manager should review the electrical drawings and Specifications for cabling requirements and controls. The Construction Manager shall also verify pole base construction, grounding, conduit routing, pull boxes/handholes, conductor identification, coordination with security systems, and commissioning/functional testing of lighting controls (timers, emergency lighting circuits where applicable, etc.). The Construction Manager should verify that lighting levels and uniformity support safe pedestrian movement and do not create glare hazards for motorists, and shall require documentation of acceptance testing and as-built circuiting information for record documents.

7.3.6.4. Toll Collection/Ticketing Interface

The Construction Manager's staff should inspect toll booths and surrounding pavement as well as canopies and signage for motorists. The Construction Manager should verify the party(s) responsible for the design, coordination, procurement and integration of prefabricated toll booth structures. Typically, this scope is included in the General Contractor's contract. The inspection of conduit and cables for power, data/voice, security and other low voltage systems will be by the Construction Manager's electrical inspector and these services will terminate at junction boxes within 5-feet of the booths. The Construction Manager should coordinate with the Authority's Systems Integrator as required. The Construction Manager shall also verify clearances, mounting details, equipment pad elevations, drainage around booths, protection from vehicle impact where required, grounding and bonding, separation of power and low voltage systems, labeling of conduits/cables, test and acceptance documentation, and coordination of commissioning with the Authority. The Construction Manager should require that "limits of work" are clearly documented and agreed upon prior to installation, and that system testing and integration milestones are included in the project schedule.

7.4. FOUNDATIONS, BELOW SLAB WORK AND SLABS ON GRADE

Foundations and below slab construction are among the first elements of the Facilities projects to be built. Properly constructed foundations will assist the successful construction of subsequent work. While designs produced using BIM techniques have helped reduce fabrication fit up problems for framing systems, incorrectly constructed or uncoordinated foundation construction continues to be prevalent on many facility projects. Wall dowels, embedded plates and anchor rods that are misplaced in plan or elevation can cause misalignment problems through the structural framing supported by the foundations. Mislocated or uncoordinated under slab utilities can create interferences with columns, walls and spaces above. Taking extra care to coordinate below slab construction, foundations and foundation embeds prior to constructing these elements can help the

Project be successful. Pre-installation coordination meetings between the Contractor, Construction Manager, and relevant trades should be conducted when complex foundation layouts or embedded systems are involved. Careful surveying of forms, below slab utilities and foundation embeds prior to concrete placement will help locate these constructed elements accurately. The required survey of constructed foundations, embedded anchorage and utility stub ups will find incorrectly located construction, if any, and allow these issues to be corrected prior to proceeding so they do not adversely affect the remaining structure. Survey documentation verifying the location of key structural elements shall be retained as part of the project record. Because these elements are difficult and costly to correct after placement, the Construction Manager shall treat foundations and below-slab work as “critical hold point” activities requiring documented pre-pour inspections, verification of layout, and confirmation that all sleeves, embeds, dowels, and utility locations match approved documents. The Construction Manager shall require that the Contractor’s survey control and verification process is documented, repeatable, and tied to established project control points, and shall require corrective action when tolerance exceedances are identified.

7.4.1. Foundations

Though not an exclusive list, the following foundation systems are common on Authority projects:

- Shallow spread footing foundations
- Driven piles
- Auger cast piles
- Drilled shafts
- Micropiles

The Construction Manager shall verify that the foundation system installed matches the Contract Documents, including load criteria, installation procedures, testing requirements, tolerances, and acceptance documentation. Where design is delegated (e.g., micropiles), the Construction Manager shall verify that delegated design approvals are obtained prior to installation.

For detailed information about the inspection of driven piles, Section 4.2.1 of this Manual should be referenced, and for drilled shafts Section 4.2.2 of this Manual should be referenced. Division 200 of the Specifications should be referenced for earthwork and excavation requirements. The Construction Manager shall ensure that referenced sections are actively used to establish inspection checklists, hold points, and documentation requirements, and that any deviations from the Contract Documents are formally reviewed and resolved through approved processes. Inspection and testing activities associated with foundation construction shall be documented and maintained as part of the permanent project record.

7.4.1.1. Document Review

The Construction Manager shall review the following coordination items:

1. Referenced Dimensions

Architectural and MEP drawings are sometimes referenced in the structural foundation drawings for some dimensions necessary to construct the foundations. This dimensional information should be available in the referenced discipline's drawings. The Construction Manager shall verify that all referenced dimensions are identifiable, consistent across disciplines, and constructible, and shall document discrepancies through RFIs prior to layout and forming.

2. Construction Near and Interfaces with Existing Structures, Utilities or Other Construction.

The Construction Manager should discuss with the Design Professionals the basis for the information describing existing structures in the Contract Documents and review the requirements for further investigation and survey required within the Contractor's scope of work. The Contractor shall perform the required investigations and/or surveys as indicated in the Contract Documents and shall document the results for incorporation into fabrication and coordination drawings where applicable. The Construction Manager shall ensure that survey/investigation findings are reviewed, conflicts are resolved, and protective measures (shoring, monitoring, utility protection) are implemented when required.

3. Sleeves for Under Slab Utilities Where They Must Penetrate Foundations.

The necessary information to locate utility penetrations through the foundations, along with the size of sleeves, should be shown on the structural or MEP drawings. When not shown on the structural drawings, the structural engineer should review the locations indicated on the MEP drawings. The structural drawings should have details or notes to guide accommodations of penetrations through walls, grade beams, trench footings or other structural elements. Any restrictions or prohibitions for penetrations through structural elements must also be provided. The Construction Manager shall verify that sleeve locations, sizes, and elevations are coordinated with the actual utility submittals and installation requirements, and shall ensure that penetrations do not compromise structural capacity or fire/life safety requirements. The Construction Manager shall require that changes to penetrations are approved through the appropriate design professional prior to placement.

4. Coordination with Below Slab Utilities

Space should be available to locate under slab utilities to avoid foundation elements. Where plumbing must be located over footings, adequate space between the top of the footing and the slab on grade must be provided to allow the plumbing to turn up to the correct location. The Contract Documents should indicate the minimum clearance below the bottom of slab for horizontal plumbing or conduit. The Construction Manager shall verify that below-slab utilities are routed to avoid conflicts with foundations, embeds, and future framing, and shall require that any conflicts are resolved prior to installation. The Construction Manager shall ensure that

minimum clearances and slopes for plumbing are maintained and that protective measures are provided for utilities where required.

5. Embedded Dowels for Subsequent Concrete Columns, Slabs or Masonry Walls

The Contract Documents should provide information to size and locate reinforcing dowels to be placed with the foundation construction. Requirements to securely tie dowels in place or requirements limiting “puddling” of dowels should be provided when appropriate. The Construction Manager shall verify dowel size, spacing, location, projection, development length, and shall require corrective measures when dowels are displaced, misaligned, or insufficiently secured.

6. Embedded Items for Connection of Elements of Supported Building Systems

The design of components of certain structural or architectural systems is sometimes delegated to others. Systems such as precast concrete wall panels and their connections to the foundations are typically designed by the precast manufacturer. The structural documents should indicate that embeds are required for these systems and that the Contractor must coordinate the embed requirements and locations with the manufacturer. The Construction Manager shall verify that embed requirements are coordinated prior to placement and that embedded items are provided, protected, and installed within tolerances required for the delegated system.

7. The Contract Documents should require a survey of the foundations, anchor rods, foundation embeds and utility stub ups be performed after these elements are constructed and prior to beginning the remaining construction. The Construction Manager shall require submission of survey results and shall verify that tolerance compliance is documented and accepted prior to proceeding with framing or system installation.

7.4.1.2. Submittals

The Construction Manager shall coordinate foundation submittals with the following:

1. Coordination of Foundation Penetrations with MEP Submittals

The Contractor’s foundation shop drawings should locate foundation sleeves. These shop drawings should be compared to the underground utility submittals to verify that they have been coordinated. The Construction Manager shall verify that sleeve locations align with utility routes, diameters, insulation requirements, firestopping requirements where applicable, and installation tolerances, and shall require that conflicts are resolved before concrete placement.

2. Coordination with Systems Whose Design is Delegated to Others

Final structural design loads for systems that are delegated designs are often not available from the system designer at the time foundation documents are prepared. Prior to approving a foundation submittal, the final design loads for delegated design systems must be compared to the foundation design criteria and loads assumed by the Design Professional to verify that the foundation design has adequate capacity to support the delegated systems. The configuration of foundations, stem walls, tie members and slabs must be checked for coordination with the delegated design system submittals and these submittals must provide the necessary information to locate embedded items for connection to the foundation. It should be clear who is responsible to supply these embedded items. The Construction Manager shall ensure that delegated design submittals are approved by the appropriate Design Professional and, where applicable, reviewed by the Geotechnical Engineer, and that responsibilities for providing and installing embeds are clearly identified and enforced.

3. Elevator Coordination

Elevator shaft dimensions, rail guide, divider beam, sump pit, cylinder location and embeds for connections should be coordinated with the elevator manufacturer and the elevator manufacturer's submittals. The Construction Manager shall verify that elevator-related tolerances and embed requirements are met and documented prior to concrete placement, and shall ensure that waterproofing and drainage interfaces for pits and sumps are coordinated.

4. Congested Reinforcing

When foundation elements contain congested reinforcing the maximum aggregate size of the specified concrete mix design should be checked per the American Concrete Institute (ACI) clearance requirements. The Construction Manager shall also verify placement methods, vibration/consolidation approach, and accessibility for proper consolidation, and shall require adjustments (mix design, aggregate size, placement sequencing) as necessary to achieve quality concrete.

5. Design Review of Micropiles

The design of micropiles is often delegated to the pile subcontractor. The design must meet performance criteria provided in the Contract Documents. The micropile submittal must include design information and supporting calculations to be approved by the Design Professional and the Geotechnical Engineer. The Construction Manager shall verify that micropile installation procedures, testing requirements, grout/material requirements, and acceptance criteria are clearly defined and that installation records are complete and retained. Installation records shall include drilling logs, grout volumes and pressures, reinforcement details, and test results sufficient to verify compliance with the approved design and specifications.

Any deviations from the approved micropile design or installation procedures shall be documented and reviewed by the Design Professional and Geotechnical Engineer prior to continuation of the work. All micropile testing and inspection documentation shall be retained as part of the permanent project record and included in the final closeout documentation.

See Exhibit 7 - 1 for a sample submittal matrix for typical foundation submittals. The Construction Manager shall require the Contractor to submit and maintain a project-specific submittal matrix aligned with the Contract Documents and updated as needed.

7.4.1.3. Pre-Construction

A pre-construction conference shall be held following the requirements of Section 3.1.2 of this Manual. Additional potential pre-construction conference agenda items specific to foundations can include:

- Staging areas and restrictions
- Deep foundation pre-construction load tests
- Subgrade preparation
- Soil/bearing capacity testing
- Potential interferences with existing structures or variable existing conditions
- Forming requirements for foundations
- MEP penetrations and sleeves
- Foundation embeds and plan for protecting projecting embedded items from damage from construction equipment
- Construction joints
- Inspection and testing requirements, timing and reporting
- Coordination issues not resolved

The Construction Manager should also include: survey control and verification methods; tolerance requirements; hold points and required pre-pour inspection checklists; concrete placement plan (including backup equipment); weather contingency planning; mass concrete thermal control requirements where applicable; and documentation expectations for daily reports, inspection reports, testing reports, and deficiency tracking.

7.4.1.4. Construction

The Construction Manager shall review the following specific types of foundation item concerns:

1. Deep Foundation Pre-Construction Load Test

Often the Contract Documents will require that test piles or caissons be installed and load tested prior to installing the production foundation elements. The Geotechnical Engineer and Design Engineer should review and approve the results of this load test prior to proceeding with construction of the deep foundations. Load testing procedures shall be

performed in accordance with applicable standards and the Contract Documents to verify that the installed foundation elements meet required load capacities. The Construction Manager shall ensure load test procedures, instrumentation, and acceptance criteria are documented and that test results are included in the project record. Instrumentation calibration records, test setup documentation, and recorded load/deflection data shall be retained to support acceptance of the foundation design.

2. Driven Pile Splices

Long driven piles may require field splices if allowed by the Contract Documents. Any splices must follow approved details contained in the pile submittal and be inspected prior to continuing pile driving. Pile splice details shall be verified to ensure they comply with approved shop drawings, welding procedures, and applicable specifications. The Construction Manager shall verify that splice welding/bolting procedures, inspections, and Testing requirements are satisfied and documented. Inspection records for pile splices shall include weld inspection reports, torque verification (if bolted), and confirmation that splice alignment meets specified tolerances.

3. Driven Pile Length

Driven piles are often driven to refusal. Piles that are intended to resist lateral load must have a minimum depth in soil so that they can develop the expected lateral load capacity. The Construction Manager shall verify that pile installation depths and driving criteria are consistent with the requirements established in the Contract Documents and geotechnical recommendations. The Construction Manager must notify the Design Engineer of any piles not driven to expected lengths and should review the piles' as-placed design capacity to determine if modifications in the foundation system are necessary. Any deviation from the expected pile length or driving resistance shall be documented and evaluated by the Design Professional and Geotechnical Engineer prior to acceptance. The Construction Manager shall ensure pile driving logs are complete, that blow counts and driving criteria are documented, and that any pile acceptance deviations are formally evaluated and resolved.

4. Pile Anchorage

Piles will typically be required to have a minimum embedment into the foundation element bearing on them. Piles that are intended to resist significant tension loads will be anchored into the supporting foundation elements using such measures as field welded headed studs or reinforcing extending from cast piles or caissons. The Construction Manager's staff should inspect the pile cutoff elevations and anchorage prior to placing concrete of the elements they support. Pile cutoff elevations shall be verified through survey or measurement to ensure compliance with the approved design elevations. The Construction Manager shall verify cutoffs, embedment lengths, welding quality, and reinforcement development, and

shall require corrective action where tolerance or anchorage requirements are not met.

5. Pile Installation Tolerance

Pile installation must be monitored and surveyed to identify piles placed outside allowable installation tolerances. The Construction Manager should notify the Design Engineer of all piles placed out of tolerance and determine if modification of pile caps and/or additional piles are necessary to accommodate the incorrectly placed piles. The Construction Manager shall require documented survey results and formal disposition of out-of-tolerance piles prior to pile cap placement.

6. Soil/Bearing Capacity Verification

Where recommended by the Geotechnical Engineer and required by the Contract Documents, the Construction Manager should coordinate the testing of the soil bearing capacity at the bottom of foundation excavations. Testing methods and acceptance criteria shall be consistent with the geotechnical recommendations and applicable project specifications. When the sides of excavations collapsed after a weather event, the Construction Manager should direct the Contractor to clean the foundation excavations of loose material and re-test the soil bearing capacity, if necessary. The Construction Manager shall document bearing verification results, required over-excavation limits, replacement material requirements, and acceptance testing, and shall verify that excavation bottom is protected from disturbance prior to concrete placement.

7. Earth Formed Foundation Elements

Often foundation elements are allowed to be earth formed. When soils are not able to hold a clean vertical excavation, the Construction Manager should consult the Design Engineer to determine if edge forms are necessary. The Construction Manager shall verify excavation stability, compliance with OSHA excavation safety requirements, and suitability of earth-formed surfaces, and shall require forms when earth-formed conditions cannot produce compliant geometry and finish.

8. Form Materials

Foundation elements that are exposed to view often require an improved class of form. The Construction Manager's staff should inspect forming materials for compliance with the Contract Documents. The Construction Manager shall also verify form alignment, bracing, cleanliness, and dimensional control prior to placement.

9. Sleeves

The Construction Manager's staff should inspect the size, elevations and locations of sleeves prior to placing concrete. MEP piping or conduit must not be cast directly into the foundation elements. The Construction

Manager shall verify sleeve restraint and protection to prevent movement during placement and shall confirm that required firestopping/penetration sealing requirements are addressed at the appropriate stage.

10. Reinforcing Splices

The Construction Manager's staff should inspect lap lengths, locations and staggers for compliance with the Contract Documents. The Construction Manager's staff should also inspect the installation of mechanical splices for compliance with the manufacturer's recommended installation procedure. The Construction Manager shall verify bar size, grade, spacing, cover, chairs/supports, cleanliness, and that reinforcement is not displaced during placement. Reinforcement shall be inspected prior to concrete placement to confirm that required clearances and cover are maintained in accordance with the Contract Documents.

11. Corner Bars

Requirements for corner bars are often found in typical details and the general notes of the structural drawings. The Construction Manager's staff should inspect corner bar placement, and other required supplemental reinforcing, for compliance with these requirements. The Construction Manager shall verify that supplemental reinforcing is installed where required for openings and stress concentrations.

12. Anchor Rods

Anchor rods should be supported in-place by jigs and tied to reinforcing so they will not sway when concrete is filling the form or excavation. Anchor rod placement should be surveyed by the Contractor prior to placing concrete. The Construction Manager shall require documented survey verification and shall verify rod projection, plumbness, location, template stability, and protection from disturbance.

13. Shear Lug Block-Outs

Shear lug block-outs are sometimes required at braced frames. The Construction Manager's staff should inspect the block-out forms for size, depth and location. The Construction Manager shall verify tolerances and cleanliness of block-outs and compatibility with base plate and grout details.

14. Dowels and Embeds

The Construction Manager's staff should inspect placement of dowels and embeds prior to placing concrete. Dowels and embeds with limited construction tolerance should be surveyed by the Contractor. The Construction Manager shall require that embeds are identified, protected, and within tolerance, and that any corrective measures are completed prior to proceeding.

15. Construction Joints

The Construction Manager's staff should inspect construction joint placement and construction, including keyways, reinforcing dowels and slip dowels, for compliance with the Contract Documents. The Contractor should be prepared to install a form for a construction joint meeting the Contract Documents in the event that concrete delivery is unexpectedly interrupted. The Construction Manager shall verify that joint surfaces are prepared properly for bonding (where required), that waterstops (where required) are installed correctly, and that unplanned joints are documented and reviewed by the Design Engineer.

16. Vibration and Consolidation of Concrete

The Contractor must be prepared to properly vibrate and consolidate concrete in foundation elements prior to beginning concrete placement. This includes having properly sized vibrators for the elements to be cast as well as spare equipment in case of equipment failure. The Construction Manager shall verify vibration practices are appropriate to prevent honeycombing and segregation and shall verify that placement procedures match the approved plan and specifications.

17. Concrete Curing

Most concrete specifications require unformed concrete surfaces to be properly cured using either moisture curing methods or a spray-on curing compound. However, it is typical practice of many contractors not to take measures to cure unformed concrete surfaces of foundations. Foundations in contact with the ground will usually not exhibit adverse effects from a lack of curing in mild conditions. However, under hot, dry or windy conditions the tops of foundations can form shrinkage cracks. When the weather conditions could have adverse effect on foundation concrete the Construction Manager should insist on proper curing of the foundation elements. The Construction Manager shall document curing methods used and shall require curing consistent with weather conditions, including protection measures during hot/cold weather as required by specifications. The Construction Manager shall also verify curing duration meets specification requirements and that curing measures remain in place for the required time period.

18. Mass Concrete

Per the Portland Cement Association (PCA) "Design and Control of Concrete Mixtures" guide, if concrete elements have a least dimension greater than 3-feet, or contain more than 600-lbs. of cement per yard of concrete, the potential temperature rise from the mass concrete effect should be investigated. If temperature rise and large temperature differential in concrete elements are a potential problem, then a thermal control plan should be developed by the Contractor and submitted for approval by the Design Engineer. ACI 207.1R "Guide to Mass Concrete" can be referenced for more information. The Construction Manager shall

require the Contractor's thermal control plan (when applicable) to include placement temperature controls, insulation/blankets, monitoring locations, temperature differential limits, and corrective actions when limits are exceeded, and shall verify that monitoring results are documented and retained.

19. Protection of Projecting Embedded Items

Projecting embedded items are at risk of damage from construction equipment. These items should be protected by temporary boxes or flagged conspicuously. Embedded steel items at risk for corrosion, when exposed to moisture for an extended time, should be galvanized or coated with grease. The Construction Manager shall verify protection measures are installed and maintained and that damaged items are repaired or replaced in accordance with the Contract Documents and accepted by the Design Engineer. Inspection staff shall document the condition of embedded items prior to installation of supported structural elements.

20. Foundation Insulation

Foundation insulation is sometimes placed in excavations or forms prior to concrete placement. For formed footings or walls, insulation can be placed after the concrete has been poured and forms stripped. The Construction Manager shall verify insulation type, thickness, continuity, protection, and compatibility with waterproofing and drainage systems, and shall verify that insulation is not displaced during backfill. Insulation installation shall also be inspected to ensure compliance with applicable energy code or project-specific thermal performance requirements.

21. Waterproofing/Damp Proofing/Foundation Drainage

These items are often placed around below-grade structures such as elevator pits and retaining walls. The items should be installed by the Contractor and inspected by the Construction Manager's staff prior to backfilling. The Construction Manager shall verify manufacturer installation requirements, substrate preparation, terminations, penetrations, protection boards, drainage media, and testing (if required), and shall require correction of defects prior to backfill. The Construction Manager shall also verify that drainage systems remain free of obstructions and that drainage outlets are properly connected and functional prior to backfill. Inspection records confirming installation of waterproofing and drainage systems shall be maintained prior to concealment.

22. Backfill Procedures at Foundation/Retaining Walls

While there are many types of retaining and foundation walls, two types are often used for the Authority's facilities: Cantilever walls and tied walls. Cantilevered walls rely on a wide footing extending under the backfill soil to restrain the overturning forces of the backfill. Tied walls are braced at the top by another structure, such as a slab or floor framing. Before beginning backfilling operations behind foundation walls, it is important to understand

how this wall is to resist the forces exerted from the backfill. A tied wall will either need the upper structural elements in place and securely fastened prior to backfilling the wall or temporary wall bracing installed until the structure above is completed. The Construction Manager should review the Contract Documents for backfilling requirements and procedures. The Construction Manager shall verify that backfill sequencing, lift thickness, compaction equipment limitations, drainage placement, and wall bracing requirements are followed to prevent overstressing or displacement of walls.

The base of a retaining or foundation wall is designed to resist sliding to prevent the backfill soil from pushing the wall out. The wall can resist this sliding by either a combination of friction and passive soil resistance, or if available a concrete base slab poured tight against the retaining wall can resist the sliding forces. Walls that resist sliding using passive soil resistance may require a key cast below the footing to increase the passive pressure. The Construction Manager should review the Contract Documents to determine if a key is required or if the base slab must be poured tight to the wall prior to beginning backfill operations. The Construction Manager shall verify that keys, base slab interfaces, dowels, and required roughening/contact conditions are installed as required prior to backfill.

23. Survey

At the completion of foundations, all embedded material or sleeves for connection or support of systems interfacing with the foundations should be surveyed by the Contractor. The survey requirement is often included in the Specifications for the system to be supported by the foundation, such as structural steel or precast concrete. The Specifications may require the survey be performed in the presence of the erector and the erector accepts the as-built conditions prior to proceeding. The Contractor should make repairs for missing or misaligned embedded material or sleeves before beginning work on any systems interfacing with or supported by the foundations. The Construction Manager shall require submission of survey reports and confirmation of acceptance by impacted trades when required, and shall verify that corrective actions are completed and documented prior to proceeding.

7.4.2. Utility Tunnel Structures

7.4.2.1. Document Review

The Construction Manager shall review for potential inter-discipline coordination items such as:

- Coordination of waterproofing systems with foundation elements, joints in foundations and walls, and interface with deep foundation elements
- Exterior and interior drainage systems
- Sumps

- Sleeves and supports for MEP systems such as piping and cable trays
- Interface with an adjoining building basement

7.4.2.2. Submittals

See Exhibit 7 - 1 for a sample submittal matrix for typical tunnel system submittals.

The following is a list of systems coordination between the Design Engineer, Contractor and Construction Manager that should occur during submittal review as applicable:

- Coordination with prefabricated toll booth or metal building system submittals
- Hatch, ladder and stair submittals
- Roadway work
- Embeds and sleeves for MEP systems

The Construction Manager shall verify that all tunnel penetrations, supports, and embedded items are fully coordinated with MEP and structural submittals and that installation tolerances are defined and achievable.

7.4.2.3. Pre-Construction

The Construction Manager should conduct a pre-construction conference following the requirements of Section 3.1.2 of this Manual. Additional potential pre-construction conference agenda items specific to Utility Tunnels can include:

- Site drainage
- Waterproofing systems
- Pour sequence
- Construction and control joints
- Inspection and testing
- Crack repair

The Construction Manager should also include documentation of manufacturer's field representation if required by the Contract Documents.

7.4.2.4. Construction

Waterproofing must be carefully installed per the Contract Documents and manufacturer's printed instructions. Prior to placing the tunnel base slab concrete, the below slab waterproofing and seals around deep foundation elements and sleeves must be inspected and approved. Waterstop locations and construction joint seals for sealing the interface with subsequent pours must be inspected and approved by the Construction Manager prior to each concrete placement. The Construction Manager shall verify that waterstops are securely anchored, properly aligned, and protected from displacement during concrete placement. Cracks in the concrete must be repaired as required by the Design Engineer prior to beginning waterproofing of the tunnel's sides or top slab. The Construction Manager shall document crack locations, repair methods, and acceptance by the Design Engineer prior to installation of waterproofing systems. The Construction

Manager shall require documentation of waterproofing inspections, including photo documentation, and shall not allow concealment or backfill until acceptance is documented.

Reference Section 7.5.1.1 for issues involving concrete and steel reinforcement placement in tunnels.

The Contract Documents should be referenced for any restrictions for the timing of backfill placement or the type of compaction equipment used. It may be required that the tunnel walls and top slab be placed and that they reach a minimum compressive strength before backfilling operations begin. The Construction Manager shall verify strength results and required curing durations prior to backfill and shall document compliance.

If the Contractor plans to operate heavy construction equipment such as cranes or road graders around or on top of tunnels, the Design Engineer should be consulted to identify any limitations or restrictions to not overstress the tunnel structure. If the tunnels have not been designed to support specific construction loads, then shoring may be required to brace the tunnel top slab or walls. The Construction Manager shall require written confirmation of allowable construction loads and/or approved shoring plans prior to equipment operation near or over tunnels, and shall document protective measures implemented.

7.4.3. Below Slab MEP Coordination

The Construction Manager shall ensure below slab work is coordinated with all trades. Coordination associated with foundation penetrations, location and type of vapor retarder and sealing of vapor retarder penetrations, puncturing of the vapor retarder, drainage course, underslab drainage, foundation drainage, MEP stub-ups, fire protection standpipe stub-ups, data/voice stub-ups, dropped or recessed slabs, cellular receptacles, monolithic thickened slabs at interior framing for partitions and stair channels, grounding cables, and masonry ledges is required. Perimeter insulation, thrust blocks at plumbing transitions, erosion control as needed, connections to services brought to 5-feet from the perimeter wall/foundation, backfill of trenches are other items that require coordination. Fuel gas and other fuel lines, with the possible exception of propane, should not be installed below slabs. Cleaning, flushing, disinfecting, pressure testing of sanitary sewer lines is normally required. Below slab utility work must be carefully coordinated with the structural foundations system. MEP work must not pass through footings, foundations, grade beams, drilled shafts or other structural entities unless the foundation design has accommodated the penetration with enlarged elements, sleeves or other methods. The Construction Manager shall require that below-slab MEP coordination is demonstrated through coordinated shop drawings prior to installation, and shall enforce inspection hold points prior to concealment. The Construction Manager shall verify vapor retarder continuity and repairs, sealing at penetrations, protection from puncture, and compatibility with slab and flooring systems. The Construction Manager shall require that testing documentation (pressure tests, inspection reports, etc.) is retained for closeout and record documents.

7.4.3.1. Document Review

The Construction Manager shall review the Site/Civil utility plans during design review and post award to become familiar with underground utility work entering the site and connecting to facility system stub-outs shown on the MEP building drawings. The Construction Manager shall verify that the interface points, elevations, and locations are constructible and coordinated, and shall document conflicts through RFIs prior to installation.

7.4.3.2. Submittals

See Exhibit 7 - 1 for a sample submittal matrix for typical below slab system submittals. The Construction Manager shall verify that submittals include testing procedures, materials certifications, and installation requirements necessary to verify compliance.

7.4.4. Subgrade and Slab on Grade

Slab types based on performance include:

- Lightly loaded slabs
- Slabs for heavy racks or forklifts
- Slabs for heavy vehicles and equipment
- Structurally supported slabs

The Construction Manager shall verify that the slab type being constructed matches the intended performance requirements, including thickness, reinforcement, jointing, subbase preparation, vapor retarder requirements, surface flatness/levelness requirements where applicable, curing requirements, and any special durability requirements.

7.4.4.1. Document Review

See Exhibit 7 - 1 for a sample submittal matrix for typical subgrade and slab on grade system submittals. The following is a list of systems coordination that should occur between the Design Professional, Contractor and Construction Manager during submittal review as applicable:

- Sub-base preparation requirements
- Construction and control joints
- Limits to pour areas
- Vapor retarder/barrier requirements with flooring
- Floor slopes and drainage
- Sleeves for below slab utility stub up
- Embed items such as junction boxes, anchorages, drains, and edge armoring angles
- Recessed areas
- Penetrations through vapor barrier and slab
- Embedded items such as junction boxes, conduit, sleeves and piping
- Thickened slabs and dowels for partition support
- Slab recesses for floor finishes and equipment
- Construction and control joint placement

The Construction Manager shall verify that these coordination items are reflected in the Contractor's pour plans and sequencing, that joint layouts are coordinated with architectural finishes and equipment anchorage requirements, that penetrations and embeds are verified for location and protection, and that vapor retarder/barrier requirements are compatible with the specified flooring system. The Construction Manager shall require documentation of pre-pour inspections, including verification of subbase condition, vapor retarder placement and repairs, reinforcement placement, embed installation, and joint layout prior to concrete placement.

7.4.4.2. Pre-Construction

The Construction Manager should conduct a pre-construction conference following the requirements of Section 3.1.2 of this Manual. The Construction Manager shall document the meeting in formal minutes, identify action items with assigned owners and due dates, and track action item closure prior to authorizing slab placement activities. The Construction Manager shall ensure that all slab-related testing and inspection resources (including the testing agency and special inspectors when applicable) are coordinated in advance and aligned with the Contractor's look-ahead schedule. Additional potential pre-construction conference agenda items specific to slabs on grade should include:

- Subgrade and sub-base preparation
- Vapor barriers and penetration details
- Slab recesses and steps
- Thickened slabs
- Floor flatness and levelness criteria and measurement
- Hot or cold weather requirements
- Construction and control joint timing, placement and details
- Finishing
- Curing
- Inspection and testing
- Slab moisture and applied finishes and flooring

7.4.4.3. Construction

The Construction Manager shall ensure the following items are fully coordinated between all subcontractors. Reference Section 7.5.1.1 for construction joints, concrete placement, hot weather and cold weather conditions, finishing slabs, control joints and concrete curing. The Construction Manager shall establish and enforce inspection hold points prior to concrete placement and prior to concealment of any slab-related components, and shall require correction of deficiencies prior to proceeding.

1. Subgrade and Sub-Base

Subgrade preparation and sub-base should be constructed per the Contract Documents with each subgrade fill lift and the sub-base tested for moisture content and compaction per the Specifications. The Construction

Manager shall verify that testing frequency meets the Specifications, that test results meet acceptance criteria prior to subsequent lifts or placement of slab components, and that re-testing is performed after weather events or disturbance.

2. Vapor Retarder

The vapor retarder material, joint laps and seals, penetration seals and punctures, and tear repairs must be inspected and approved prior to concrete placement. The Construction Manager shall verify continuity of the vapor retarder, required overlaps and sealing methods, protection from puncture during reinforcement placement, and documented repair of tears and penetrations in accordance with manufacturer requirements and the Contract Documents.

3. Moisture Sensitive Slabs

Where moisture control of slabs and/or slab edge curling is critical, a layer of fine aggregate may be required by the Contract Documents between the vapor retarder and the grade slab. Construction sequence relative to placement of vapor retarders, fine aggregate layers, casting of slab and curing methods are critical to the timing of placement of moisture sensitive floor coverings. Slabs with aggregate between the bottom of the slab and the vapor retarder can trap unintended rain water if not protected from weather. ACI 302.2R offers guidance for construction of slabs, vapor retarders and slab subgrade. The Construction Manager should review the Contractor's proposed construction sequence and slab protection should be discussed at the pre-construction conference.

4. Reinforcing and Reinforcing Supports

The reinforcing must be in the correct location in the cured slab to be effective and have the intended structural capacity. To be held in the correct location, the slab reinforcing must be adequately supported to support the weight of workers as they place the slab concrete. Construction methods that rely on pulling slab reinforcement or mesh into the slab as the concrete is placed is difficult to accomplish successfully and cannot be inspected for conformance. Therefore, these methods are not recommended. The Construction Manager shall verify reinforcement support systems (chairs, bolsters, supports), reinforcement position and cover, and shall require correction where reinforcement is displaced or inadequately supported.

5. Control and Construction Joints in Heavily Loaded Slabs

The Construction Manager shall verify if joint details for slabs supporting vehicles or heavy loads require all slab reinforcing to be interrupted and dowel baskets placed at control joints and plate dowels at construction joints. The Construction Manager shall verify dowel basket alignment, dowel placement, joint layout, and compliance with specified load-transfer details, and shall require corrective action where misalignment could impact performance.

6. Slabs Exposed to Vehicle Traffic

Maintenance and parking slabs exposed to deicing salts require special corrosion protection measures. Reference Section 7.5.6.2 of this Manual for a discussion of typical corrosion protection measures and construction implications. The Construction Manager shall verify that corrosion protection measures required by the Contract Documents are implemented, including concrete durability requirements, drainage slopes, joint sealants, coatings, and any specified materials or reinforcement protection measures.

7. Sealers and Finishes

Exposed slabs may require a sealer and/or a hardener to be applied after the appropriate curing time. The Construction Manager shall check the slab moisture for compliance with the manufacturer's recommendations for slabs to receive finishes and coatings. The Construction Manager shall verify surface preparation, application procedures, cure times, environmental conditions, and manufacturer requirements for acceptance, and shall require documentation of product data and application records.

8. Protection During Construction

For slabs that remain exposed and in use, the Contractor should appropriately protect these slabs from construction activities until the facility is completed and accepted for occupancy by the Authority. The Construction Manager shall verify protection measures are maintained, that damaged areas are repaired to meet the Contract Documents, and that protection does not create safety hazards or impede accessibility as construction progresses.

7.5. BUILDING STRUCTURAL SYSTEMS

Building Structural Systems are the particular method of assembling and constructing structural elements of a building so that they support and transmit applied loads safely to the ground without exceeding the permitted stresses in the members. Basic types of systems include bearing-wall, post-and-lintel, frame, membrane, and suspension. This section covers issues with structural materials, structural flooring and roofing systems, bearing walls and columns, lateral systems, specialty structures and restoration and repair. The Construction Manager shall ensure that structural construction is performed in accordance with the Contract Documents, applicable codes, and required special inspections, and shall document and track resolution of structural nonconformances as high-priority items.

7.5.1. Structural building materials

7.5.1.1. Cast-In-Place Concrete

1. Approved mix design

Mix designs, with supporting product data and mix design test reports, should be submitted by the Contractor and approved by the Construction Manager for each class of concrete. Each unique mixture of aggregate, additives, cement and other cementitious materials should be tested. When the concrete supplier does not have sufficient historic tests of the specific mix design, trial batch tests must be made per ACI 318.5.3. Trial batch tests will take more than 28-days to perform. To avoid delays prior to planned concrete placement because there is not adequate time to perform trial batch tests, the Contractor should be reminded at the start of the project that testing per the Specifications is required for each mix design. The maximum aggregate size selected should not be significantly smaller than necessary but should be checked based on ACI 318.3.3.2 for each placement location of each mix design. The Construction Manager shall verify that mix designs meet durability exposure requirements, specified strength, air content requirements where applicable, and compatibility with placement conditions and reinforcement congestion, and shall require timely submission to avoid schedule impacts.

2. Concrete supply – Ready mix or jobsite plant

Typically, most concrete for buildings is specified to be supplied from a ready-mix plant rather than a jobsite plant. Typically, only small batches of concrete for lightly loaded structures are permitted to be site mixed. The Construction Manager shall verify supplier qualifications, batch ticket completeness, delivery times, and compliance with specification limits for time from batching to placement and allowable retempering.

3. Reinforcement placement and tolerance

The reinforcement placement and clear concrete cover should be fully inspected by the Construction Manager's staff, necessary corrections made and final approval obtained prior to beginning any concrete placement. The inspector should become familiar with the Contract Documents and the reinforcing placement drawings prior to making inspections. The reinforcing bar size, number and spacing should be inspected. The reinforcement's clearance to the forms as well as the clearance to the top unformed level should be verified. The reinforcement should be securely tied to prevent movement during concrete placement. This includes uplift of the entire reinforcing cage which can happen when concrete is pumped into the bottom of the form and lifts the reinforcement as the concrete fills the form. Locations requiring supplemental reinforcement, often indicated in structural general notes and typical details, should be inspected for the added reinforcing. **The Construction Manager** shall verify reinforcement supports, chairs, and tie requirements, confirm bar identification and cleanliness, and require corrective action when reinforcement is displaced or cover is not maintained.

4. Reinforcement splices

Lap lengths, location and stagger should be inspected by the Construction Manager's staff for compliance with the Contract Documents. The installation of mechanical splices should be inspected for compliance with the manufacturer's recommended installation procedure. The Construction Manager shall verify that mechanical splice product submittals are approved, that installation is performed by qualified personnel where required, and that inspection documentation is maintained.

5. Construction joints

The appropriate configuration, dowels, bonding agents, surface preparation and permissible locations of construction joints should be indicated in the construction documents. Construction joints should be inspected by the Construction Manager's staff prior to concrete placement. The Construction Manager shall verify that any unplanned joints resulting from interruptions are handled in accordance with the Contract Documents and reviewed by the Design Engineer where required.

6. Water on site

The design water/cement ratio of a mix design is based on the total water in the concrete mix including water trapped in the aggregate material, water added at the batch plant and any water added from the truck. No water should be allowed to be added on site unless water was withheld from the mix at the batch plant. The amount of water withheld should be noted on the batch ticket and this should be verified by the Construction Manager before water is added. If the concrete mix is near or at the maximum allowable slump prior to adding water, then additional water should not be added. For additional information about addition of water to a mix on the job site see Section 4.2.2.8 of this Manual. The Construction Manager shall document any authorized on-site water addition, verify compliance with batch ticket limitations, and require rejection of loads where unauthorized water addition occurs.

7. Concrete placement and consolidation

Prior to placement of a day's pour, areas of congested reinforcement should be checked by the Construction Manager's staff against the maximum aggregate size of the mix design. The appropriate tools, including vibrators and spare equipment, should be made available and ready to use by the Contractor. The pour size should be appropriate for the construction personnel available for the day. In the event of an unplanned interruption of concrete supply during the pour, the Contractor should be prepared to install a vertical construction joint to limit the pour to the available concrete. Cold joints in the concrete elements, formed when fresh concrete is placed against hardened concrete, must be avoided except at planned construction joints. The Construction Manager shall verify placement sequencing, vibration practices, and consolidation procedures to prevent honeycombing and segregation, and shall require corrective action where deficiencies are observed.

8. Hot weather concreting

When hot weather conditions, wind, humidity, etc. exist, hot weather concreting procedures complying with ACI 305 should be followed. When hot weather conditions are expected during or after concrete placement, the Contractor should have an approved hot weather concreting plan ready. Generally, concrete temperatures should be maintained below 90-degrees and measures such as covering the steel reinforcement with water soaked burlap and fog-spraying form surfaces may be necessary. After concrete placement, the concrete surface can be shaded, wind breaks provided and fog spray provided during placement and finishing operations. A retarding concrete admixture can be used to slow the set of the concrete and ice can replace mix water to lower the concrete temperature. The Construction Manager shall verify implementation of the approved plan, temperature monitoring, evaporation control measures, and timely curing initiation to reduce plastic shrinkage cracking risk.

9. Cold weather concreting

When the temperature is expected to fall below 40-degrees during concrete placement or for 3-days after finishing, cold weather concreting procedures complying with ACI 306 should be followed. When cold weather conditions are expected the Contractor should have an approved cold weather concreting plan ready. Measures should be taken to maintain the internal concrete temperature at or above 50-degrees until the concrete has reached a compressive strength of 500-psi. For most concrete mixes, this compressive strength can be reached within 48-hours or less. Additional external moisture for curing is typically not needed during cold weather and moisture curing methods should be adjusted to retain surface moisture rather than adding supplemental moisture. The Construction Manager shall verify protection measures, temperature monitoring and logs, and compliance with strength requirements prior to removal of protection or application of loads.

10. Finishing unformed surfaces

The required finish for each concrete element should be identified in the Contract Plans and Specifications. The construction documents may require the Contractor to submit a finish schedule for approval. Successful concrete finishing is extremely time dependent and construction personnel experienced in finishing concrete must be ready to begin when the concrete is ready to be finished. Unformed surfaces are bull floated after screening and before bleed water collects on the concrete surface. Final finishing should not begin until after the bleed water has evaporated from the surface of the concrete. Water must not be added to the concrete surface to facilitate finishing. Any free water worked back into the surface concrete by finishing operations will increase the water cement ratio of the surface layer and can cause dusting and scaling. The Construction Manager shall verify that finishing procedures comply with the specified finish class and that surface defects are corrected in accordance with the Contract Documents.

11. Control joints

Control joints are placed in slabs to encourage shrinkage cracks to occur at the joints rather than randomly in the slab. The sooner a joint is placed in the slab and the deeper the joint the more effectively the joint will form a weakened plane in the slab and encourage shrinkage to be relieved at the joint. Joints can be tooled in wet concrete or sawn in hardened concrete. Tooled joints are the most effective joint since it will be placed before concrete shrinkage can begin. Early entry saws are often specified to allow the joint to be placed in the slab within 2-hours of finishing. The depth of cut of some saw models may be limited, so for thick slabs it may be required to recut the joint with a wet saw. The Contract Documents may require all or part of the slab reinforcing to be discontinuous or cut at the control joint. The Construction Manager shall verify timing, depth, alignment, and layout of joints and require corrective action where joints do not meet Contract requirements, including recutting when necessary.

12. Curing and protection

The acceptable curing methods should be identified in the concrete specifications. The Contractor must have the needed curing materials and application equipment available and be prepared to properly cure the concrete elements prior to beginning concrete placement. Curing should begin immediately after finishing the unformed surfaces of the concrete elements. When moisture curing methods are required, the concrete surface must be kept moist continuously for the minimum number of days required in the Specifications. The Construction Manager shall verify curing start time, continuity, and duration, and shall require adjustments based on weather conditions in accordance with the Contract Documents.

13. Inspection and Testing

As a part of the pre-placement preparations, inspections should be completed, necessary modifications made and final signoff obtained prior to the Contractor placing concrete. The testing agency should be onsite and prepared to perform slump, air, and temperature tests and take samples as required by the Specifications. Except for extremely limited pours, the Specifications will usually require tests and samples be taken at a minimum of once per each day's pour for each class of concrete placed and indicate a frequency in the range of one sample set per every 25 to 100-yards placed that day. The Construction Manager shall verify that sampling locations represent the placed concrete, that cylinders are properly labeled and cured, that break results are tracked, and that nonconforming results trigger documented corrective actions in accordance with the Contract Documents.

14. Relevant information in Section 4.3.2.6 and Section 4.3.2.7 of this Manual pertaining to the inspection of reinforcing and concrete placement should also be reviewed. The Construction Manager shall incorporate applicable requirements from those referenced sections into slab and structural concrete inspection checklists and reporting.

7.5.1.2. **Precast Concrete**

1. Delegated Design for Precast Concrete (P/C) Components and Connections

The engineering design for precast concrete components and their connections is usually delegated to the precast concrete manufacturer. Foundation design, and the design of other structures supporting precast concrete components, is usually done prior to the precast concrete component design. Final loads imposed on these supporting systems by the precast components should be submitted by the precast concrete manufacturer and reviewed for conformance with or impact to the overall structural design by the Design Professional prior to beginning construction. The Construction Manager shall verify that delegated design submittals are approved and that final loads and connection requirements are reconciled with foundation and supporting structure design assumptions prior to installation.

2. Embeds for Connections

The precast concrete manufacturer will design the required embeds for the connection of the precast concrete components to the foundation and other concrete structures. The precast concrete manufacturer may supply the material to be embedded. The location, placement and any necessary supplemental reinforcing must be coordinated with the Contractor prior to construction of the supporting system. The Construction Manager shall verify embed tolerances, protection, and coordination with reinforcement and formwork, and shall require pre-pour inspections for embed placement.

3. Embeds for Architectural Components and MEP Systems

It is sometimes desired to embed connection material in precast concrete components for support of architectural finishes such as awnings, windows or wind screens. Conduit or electrical boxes can be installed in the precast concrete components in the plant. These items must be coordinated at submittal review and locations checked during precast concrete delivery and erection. The Contractor must take precautions before installing post applied anchors into prestressed components. Nicking prestressing cables with a drill can have explosive results, damage the precast concrete member and be dangerous for workers. The precast concrete manufacturer must give permission and assist in locating any post installed anchors to be drilled into prestressed components. The Construction Manager shall require documentation of manufacturer guidance for post-installed anchors in prestressed members and shall coordinate inspection hold points prior to drilling or anchorage installation.

4. Finishes

Precast concrete component finishes should be reviewed and approved by the Design Professional during submittal reviews. A full-scale mock-up is often installed on the project site which is reviewed and approved by the Construction Manager and the Design Professional. As product is delivered to the site its finish should be compared to the mock-up standard and component finishes not meeting this standard either rejected or designated for repair. The Construction Manager shall document acceptance criteria, maintain mock-up as the standard, and track repairs and approvals for any components not meeting finish requirements.

5. Tolerances and Camber

Project Specifications normally reference Prestressed Concrete Institute (PCI) MNL 116/117 for allowable fabrication tolerances and PCI MNL 135 for allowable erection tolerances but may include additional requirements. Joint width tolerances can be relatively straight forward to monitor during erection. Monitoring vertical sway is more difficult. The methods used to verify the allowable tolerances of precast concrete structure during erection should be discussed at the pre-construction conference. The Construction Manager shall require a documented tolerance monitoring plan, including survey methods, acceptance limits, and corrective measures if tolerances are exceeded.

6. Welding of Connections

Heat generated by welding to embedded steel material in precast concrete components will expand that material. Stainless steel will expand more than carbon steel. If heat is excessive, the expansion of the embedded steel can damage the surrounding concrete. To limit heat buildup, the weld size and length should not significantly exceed what is required by the precast concrete erection documents. Large or long welds should be staggered to limit heat buildup. The concrete surrounding embeds should be monitored during welding and if damage occurs the welding procedures should be modified to reduce heat buildup. Connections which will potentially be exposed to weather and deicing salts can be specified to be stainless steel. This typically means that the embed material, loose material and welding rods are to be stainless steel. Review of the loose material and welding supplies should be included in the inspection process. The Construction Manager shall verify welding qualifications, procedures, and inspection requirements (including NDT where specified), and shall require documented acceptance of welded connections.

7. Grouting

Horizontal joints between stacked precast concrete components and between precast concrete components and supporting foundations are usually grouted with cement based, non-shrink, non-metallic grout specified by the precast concrete manufacturer. It is usually necessary to grout columns and wall panels that support floor and roof elements prior to supporting multiple levels of these elements on the column or wall. The time duration for grout to reach the acceptable compressive strength

should be considered in the erection sequence. Specialty items such as grouted splice sleeves can require specialty grouts and grouting procedures supplied by the manufacturer. The Construction Manager shall verify grout product approvals, mixing procedures, placement, curing, and strength verification where required prior to loading or proceeding with erection.

8. Bracing

Precast concrete frames are typically not stable until the lateral system, including the horizontal deck or diaphragm and the diaphragm and frame connections have been completed. These systems will require erection bracing until the lateral load resisting system is complete. Required erection bracing is determined by the precast concrete manufacturer and must be shown on their erection drawings. The Construction Manager shall verify that required bracing is installed and maintained until the lateral system is complete and accepted, and shall treat removal of bracing without authorization as a safety-critical nonconformance.

9. Field Repairs

It is common for precast concrete components to be damaged during shipping or erection. Prior to beginning any field repairs the Contractor must submit a repair procedure detailing the repair process and the materials to be used for review and approval by the Construction Manager, Design Professional and the precast concrete manufacturer. A minimum thickness of patch, compatible with the patch material, should be maintained. For durability, feathering of the patch material should be avoided and the patch material to be used should be selected to minimize shrinkage. When multiple patches are required, one patch should be constructed and reviewed by the Construction Manager and the Design Professional prior to commencing work on the remaining areas to be repaired. The accepted patch can then be used as a standard for review of the remaining patches. The Construction Manager shall document repair approvals, verify curing and finish acceptance, and ensure repaired areas meet durability and appearance requirements.

7.5.1.3. **Post Installed Anchors**

1. Anchor Qualification and International Code Council (ICC) Evaluation Service, LLC (ES) Report

The advent of ACI Appendix D has significantly increased the quality assurance requirements for post installed anchors. Anchors must be evaluated under the procedures described in International Code Council (ICC) AC 01 for masonry anchors and AC 193 for concrete anchors. Expansion and undercut anchors in concrete which will resist earthquake loads must be evaluated under ACI 355.2 and adhesive anchors under ACI 355.4. When anchors resist earthquake loads the specific product must be

qualified to be installed in cracked concrete. Demonstration of this evaluation and stipulations for use are found in the product's ICC-ES Report. A proposed anchor's ICC-ES report must be approved for the governing code and included with the product's submittal for review and approval. The Construction Manager shall verify that the anchor ICC-ES report is current, applicable to the governing code, and matches the proposed installation conditions including base material type, cracked/uncracked concrete conditions, loading direction, and environmental exposure.

2. MPII

The manufacturer's printed installation instructions (MPII) provide hole drilling, hole cleaning and anchor installation instructions. All installation contractors and the special inspectors must have a copy and be familiar with these instructions prior to anchor installation. The Construction Manager shall verify that the latest MPII is available on site, that installers and inspectors acknowledge familiarity, and that deviations are not permitted without Design Professional approval.

3. Anchor Installation Training

The ACI 2011 Appendix D (D.9.2) added the quality assurance requirement for personnel installing horizontally or vertically inclined adhesive anchors to be certified by a program in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program or equivalent program. The Construction Manager shall verify installer certifications and maintain documentation in the project records.

4. Repair Procedures

Post installed anchors are often used to make repairs for misplaced embedded connection material. Unless calculations are prepared for the repair by the Design Professional, the Contractor shall submit supporting calculations based on the specific anchor to be used and configuration of the repair demonstrating adequate capacity of the repair to support the required loads. Calculations shall be prepared by a Professional Engineer licensed in the State of New Jersey. The Construction Manager shall verify that repair submittals include details, calculations, base material verification, installation procedures, and inspection requirements, and shall not allow repair installation prior to approval.

5. Drilling

The MPII indicates the drill bit sizes and types to be used for the anchor installation. Often the instructions will limit the use of core bits because they leave a smooth hole surface that does not provide the necessary texture for the anchors. The Construction Manager shall verify drilling equipment and procedures comply with MPII and that hole tolerances are maintained.

6. Hole Cleaning

Hole cleaning is critical to an adhesive anchor's bond capacity. The anchor hole cleaning, based on the MPlI, must be part of special inspection for adhesive anchors. The Construction Manager shall ensure special inspection occurs during drilling and installation, and shall require documentation that cleaning steps were performed as required.

7. Edge Distances and Anchor Spacing

The distance from the anchor to the edge of the concrete or masonry element and the distance between anchors are critical to the anchor's load capacity. These dimensions are considered when the Design Professional calculates the connection configuration. The required minimum edge distance and spacing should be indicated in the construction documents, or repair procedure, and should be included in an anchor's inspection. If for some reason the Contractor cannot maintain the specified edge distance or spacing, then the Design Professional should be contacted to adjust the connection configuration as required to develop the required load capacity. The Construction Manager shall verify field layout prior to drilling and require Design Professional disposition for any noncompliant spacing or edge distance conditions.

8. Embedment

Embedment of the anchor into the concrete element is also critical to the anchor's capacity. Items constructed in concrete or masonry can prevent proper anchor embedment depth from being achieved. When obstacles in the anchor's hole path are encountered, the Design Professional should be contacted to determine if the reduced potential embedment depth is acceptable or if additional anchors must be installed. The Construction Manager and special inspector should be on the lookout for anchors with short embedment. Anchors that protrude from the base material further than others are a warning of potential shortened and unacceptable embedment depth. Some products have designations stamped on the end of the anchor to indicate the anchor's length which will allow the embedment depth to be determined by observation of the installed anchor. However, the only way to verify embedment of non-proprietary or plain anchor rod material is to observe the installation. The Contractor should be careful when attempting to remove anchors from holes as most anchors are not allowed to be reused. Holes for screw type anchors cannot be reused. The Construction Manager shall require inspection verification of embedment and shall document disposition of any anchors installed with reduced embedment.

9. Coordination with Concrete Masonry Unit (CMU) Grouting

Expansion, undercut and adhesive anchors are required to be installed in grouted masonry to achieve load capacity. Coordination of locations of additional masonry cells to grout for attachment of delegated design items such as metal stairs, architectural screens or mechanical equipment is often left to the Contractor. Some anchors have limitations on how close

they can be installed to a vertical or horizontal masonry joint. All anchor types have edge distance limitations at ends of walls and control joints. Coordination for anchor placement and cell grouting should be considered at submittal review and discussed at the pre-construction conference. The Construction Manager shall verify that required grout cells are identified, constructed, and grouted prior to anchor installation, and that anchor placement does not violate joint proximity limitations.

10. Pre-Installation Mapping of Reinforcement, Tendons and Embedded Items

Nicking prestressing or post-tensioning tendons with a drill can have explosive results, damage the concrete and be dangerous for workers. Concrete core bits can cut through reinforcing. Tendons must be located and mapped on the surface of the concrete prior to drilling for anchors. If core bits are used, all reinforcing should be mapped before beginning coring. When reinforcing is damaged by drilling or coring operations the Design Professional should be contacted. Damaged reinforcing will likely have to be repaired, usually by removal of the surrounding concrete, lapping or splicing in new reinforcing and patching the removed concrete. The Construction Manager shall require a documented scanning/mapping method (e.g., GPR or other approved methods), shall require marked safe drilling zones, and shall ensure repairs are approved and documented prior to proceeding.

11. Special Inspection and ICC-ES Report

Instructions for special inspections are given in each anchor's ICC-ES Report. The inspector must have a copy and be familiar with this report before beginning inspections. The ICC-ES report generally requires an initial inspection where anchor material is verified and hole drilling, cleaning and anchor installation are monitored for each type and size of anchor. Monitoring can be periodic after the initial inspection unless the anchoring product or installation personnel are changed. Special inspections cannot be performed after an anchor is installed. The Construction Manager shall coordinate special inspection scheduling to ensure required observations occur in real time, shall require documentation of initial and periodic inspection requirements, and shall treat uninspected installed anchors as nonconforming work requiring Design Professional disposition.

7.5.1.4. **Structural Concrete Masonry**

1. Foundation Dowels

The placement of foundation dowels should be inspected as part of foundation construction. Dowels are typically to align with vertical wall and pilaster reinforcing. The dowel location should be checked as the masonry walls are marked on the foundations and reinforced cells are indicated. Any missing or misaligned dowels should be repaired using a procedure approved by the Design Professional prior to beginning the CMU construction. The Construction Manager shall require documented verification of dowel size, spacing, projection, alignment, and embedment,

and shall verify repair submittals and approvals are obtained prior to corrective work. The Construction Manager shall require that dowel repairs (including drilled-and-epoxied dowels) comply with approved procedures, applicable code requirements, and manufacturer installation instructions, and shall ensure required special inspection occurs when adhesive anchoring is used.

2. Control Joints

The locations of wall construction joints should be provided by the Design Professional and indicated on the construction drawings. Wall control joint locations should be marked before beginning wall construction and are typically required to begin at the first course of the wall. Where missing control joints are discovered, joints can be cut in both sides of the wall, however this may not be acceptable to the Design Professional because shear keys, ties and vertical reinforcing cannot be post installed. The Construction Manager shall verify control joint locations are laid out in the field prior to placement, that joint details (including bond breakers, backer rods, and sealants where required) match the Contract Documents, and that joint continuity is maintained through finishes and veneer systems where applicable. Any deviation or omitted control joint shall be documented and brought to the Design Professional for disposition prior to concealment or continuation of work.

3. Vertical Reinforcement Placement and Splices

Prior to placing grout, reinforcement locations, spacing, position in the cell and lap lengths must be inspected by the Construction Manager's staff. The reinforcement must be securely tied in place. The documents may require rebar positioners to keep the reinforcing properly located in the cell. The Construction Manager shall verify bar size, grade, continuity, lap splice lengths, cleanliness, and that reinforcement is supported to maintain position during grouting. Where mechanical splices or couplers are used, the Construction Manager shall verify product approvals and installation compliance.

4. Bond Beams and Horizontal Joint Reinforcement

Horizontal joint reinforcement, bond beams and bond beam reinforcement must be inspected by the Construction Manager's staff prior to grout placement. Bar laps may need to be staggered in bond beams with two horizontal bars to provide adequate clearance to place grout. Horizontal joint reinforcement must be adequately lapped at splices and the construction documents may require prefabricated corner and tee pieces be used. The Construction Manager shall verify proper placement, cover, lap lengths, stagger requirements, and confirm that reinforcement does not obstruct grout flow. The Construction Manager shall verify prefabricated corner and tee pieces are installed where required and that bond beam cleanouts and access are provided as required by the Contract Documents.

5. Lintels

Lintels can be precast concrete, steel or masonry construction. Control joints are often located at an opening jamb which will require special details to allow the control joint to stagger around the lintel bearing. Control joints must not be cut through the end of a lintel. The Construction Manager shall verify lintel bearing lengths, alignment, corrosion protection (where applicable), and integration with control joint details. The Construction Manager shall ensure that lintel installation does not conflict with reinforcement placement, bond beams, or embedded items.

6. Embedded Items

Electrical conduit and boxes are sometimes embedded in CMU walls. Conduit and boxes should not be located in cells with vertical reinforcing and boxes should not be located in conflict with bond beams. Locations of these items must be coordinated prior to beginning wall construction and inspected during construction. The Construction Manager shall require coordination drawings showing embedded items, verify that embedded items do not compromise structural requirements, and verify that any required firestopping, box clearances, and cover requirements are maintained.

7. CMU Walls Below Grade

CMU walls below grade are typically required to be grouted solid using a higher strength mortar such as "Type S". The Construction Manager shall verify waterproofing/dampproofing, drainage, protection board, and backfill procedures comply with the Contract Documents prior to concealment. The Construction Manager shall verify grout and mortar types, mix proportions, and testing requirements where applicable.

8. Grouting

Table 7 of ACI 530.1 limits "pour heights", or the height that the wall can be built until it is grouted, by a combination of grout type and clear grout space. Grout lifts, or height to which grout is placed in one continuous operation, must be stopped at the bottom of bond beams and is limited to 12'-8" when grout has the proper slump and cleanouts are provided at the base of grouted cells. Grout lifts are limited to 5'-4" otherwise. The Construction Manager shall verify cleanouts are provided and inspected prior to grouting, verify grout slump and placement procedures, and ensure that grout consolidation methods (including mechanical vibration where permitted) do not displace reinforcement. The Construction Manager shall require documentation of grout placement sequencing and compliance with allowable pour height and lift limitations.

9. Weather Protection

The tops of open cells must be continually protected from rain, snow and debris infiltration. The Construction Manager shall verify protection

measures are maintained daily and after weather events, and that any contaminated cells are cleaned prior to grouting.

10. Curing

Grout lifts must cure for a minimum of 4-hours for lifts over 5'-4". The Construction Manager shall verify curing time compliance, environmental protection during curing, and that construction loads are not applied prior to minimum curing requirements.

11. Coordination with Veneer and Cladding Systems

Some veneer anchor systems utilize a pintle and eye attachment system with the eye either attached to the horizontal joint reinforcing or embedded in a masonry joint. Other architectural cladding systems are often attached to CMU walls with embedded connections. This embedded material must be coordinated and available prior to beginning wall construction. The Construction Manager shall verify embed materials, corrosion protection, spacing, and installation timing, and shall ensure that attachment systems are coordinated with control joints, flashing, moisture management details, and tolerances.

12. Coordination with Framing System

CMU walls often function as bearing walls and support floor or roof framing. Additional vertical bars and/or horizontal bond beams may be required to reinforce walls at point load locations. Embedded material may be required in connections to framing members. Post installed anchors for framing attachment require that a grouted cell be located at all anchors. These items must be coordinated prior to wall construction. The Construction Manager shall verify point load locations, required reinforcement, bearing details, and that grouted cells are provided at anchorage locations. The Construction Manager shall verify any post installed anchor installation is performed under required special inspection and in accordance with approved ICC-ES reports and manufacturer installation instructions.

13. Wall Bracing

Masonry walls, two stories or less, are commonly designed to bear on foundations and be braced horizontally by floor and roof diaphragms. Until a wall is positively attached to the floor and/or roof and the mortar and grout have reached adequate compressive strength, masonry walls need temporary bracing to resist wind loads. It is common for unbraced masonry walls to be pushed over by high winds, destroying the wall and damaging surrounding construction. The Construction Manager should insist that masonry walls exposed to wind loads during construction be temporarily braced until they are permanently anchored to the building structure. The Construction Manager shall require the Contractor to submit a temporary bracing plan where required by the Contract Documents or where conditions warrant, and shall verify bracing is installed, maintained, and not

removed until permanent anchorage and required strength have been achieved.

14. Inspection and Testing, Special Inspection Category

The masonry contractor and special inspector must be familiar with the Contract Plans and Specifications for the masonry work prior to beginning wall construction. Mock-ups for quality and aesthetic quality control can be required. Accepted mock-ups can be incorporated in work to remain. The minimum level of masonry inspection is stipulated by the building code; however, the Specifications can require additional inspection and testing. All engineered masonry must undergo the most rigorous inspection and testing, level "C". The special inspector should begin taking samples and inspecting work with the first course of masonry. When prism tests are required, the prism samples must be made by the masonry contractor while constructing the masonry walls. The Construction Manager shall coordinate required special inspections per IBC Chapter 17 and applicable ACI 530/ASCE 5 requirements, verify sampling frequency and acceptance criteria, and require deficiency tracking and corrective action documentation. The Construction Manager shall verify that inspection reports and test results are submitted promptly and maintained for closeout.

7.5.1.5. **Structural Steel**

1. Connection Design Responsibility

The American Institute of Steel Construction (AISC) Code of Standard Practice requires that Contract Documents indicate one of three design options be indicated for each connection: 1) the complete connection design is shown on the documents, 2) the connection is selected from tables shown within the Contract Documents or AISC design manual based on loads given in the Contract Documents or 3) the connection design is delegated to a licensed engineer retained by the fabricator. When connection design is delegated, limitations on the connection types, connection configuration requirements and the loads that must be resisted should be included in the Contract Documents. All parties should be clear as to the intended connection design responsibility and submittal requirements prior to beginning the submittal preparation. The Construction Manager shall verify the delegated design engineer's licensure in the State of New Jersey where required, ensure connection submittals include design calculations when delegated, and confirm that connection assumptions match the design intent and loads shown in the Contract Documents.

2. AISC Certification of Fabricators

Inspection of shop fabricated construction is usually not required when steel is fabricated by AISC certified fabricators and approved by the code authority. The Specifications may require the fabricator be AISC certified and that current certification documentation is included with the fabricator's

submittals. Shop inspection and testing requirements should be coordinated with the inspection agency and Design Professional prior to beginning any fabrication in a shop that is not certified. The Construction Manager (CM) must confirm if structural steel fabricators are properly certified, understand the limits of their certification, ensure materials can be traced back to their source, and arrange appropriate inspections if needed. Mill test reports and material certifications should be reviewed to confirm that structural steel materials conform to the specified grade and ASTM standards.

3. Erection Tolerances

The Specifications usually reference the AISC Code of Standard Practice for erection tolerances but may add additional tolerance requirements. Tolerances should be checked as the frame is erected. The Construction Manager shall require survey verification of critical plumbness, alignment, elevations, and camber where applicable, and shall require corrective action prior to proceeding where tolerances are exceeded.

4. Finishes and Protection

The Specifications should indicate finish requirements for structural steel and where necessary the Contract Drawings should designate locations of different finishes. All parties should understand these requirements before beginning the submittal preparation. Steel finish should be inspected during erection and the special inspector should be looking for galvanized steel where required by the Contract Documents and that steel is unfinished and clean where it is to be fireproofed. If dissimilar metals, such as stainless steel and galvanized steel are found in contact, the Design Professional should be contacted to determine if there is an accelerated galvanic corrosion concern that may warrant modifications. The Construction Manager shall verify coating thickness where required, touch-up requirements, repair procedures for damaged coatings, and that fireproofing interface requirements are maintained.

5. AISC Certification of Erectors

The Specifications may require that the erector be AISC certified or other experience requirements may be included. Documentation demonstrating compliance must be included in the submittals. The Construction Manager shall verify erector qualifications and ensure erection procedures follow approved erection drawings and safety requirements. Erection plans shall be reviewed to confirm that lifting procedures, sequencing, and temporary stability provisions are clearly defined prior to beginning steel erection.

6. Bracing

Structural steel frames are typically not stable until the lateral system, diaphragms and their connections have been completed. These systems will require erection bracing until the lateral load resisting system is complete. Required erection bracing is determined by the structural steel

fabricator and must be shown on their erection drawings. The Construction Manager shall verify erection bracing is installed and maintained until completion of the lateral system and shall treat removal or modification of bracing without authorization as a safety-critical nonconformance.

7. Inspection During Steel Erection

The general configuration, member size, connections and other items noted above should be inspected during erection. The Construction Manager shall ensure special inspection coverage is provided as required by IBC Chapter 17 and the Contract Documents, and shall verify inspection documentation is maintained for closeout. Inspection activities shall include verification of bolt installation procedures, weld inspections, connection configuration, and compliance with erection drawings.

7.5.1.6. Bar Joists

1. Delegated Design Responsibility and Loading Requirements

Bar joists and joist girders are prefabricated proprietary structural members that are designed by the manufacturer. The design is regulated by the Steel Joist Institute (SJI) and is based on the SJI load tables for standard joists and specific loading diagrams or information on the Contract Documents for special joists. Joists that must support non-uniform loads or point loads must be designated as special joists designed to accommodate the loading shown on the Contract Documents. The Construction Manager shall verify that joist designations match the loading conditions and that any point loads or non-uniform loads are clearly reflected in the approved submittals.

2. Design Load Changes

If the anticipated loading on the bar joists or girders changes after submittal review, the joist manufacturer must be notified to review the design. Significant changes in loads may require joist strengthening or joist replacement. The Construction Manager shall ensure changes are documented through approved processes and shall not allow load changes without written manufacturer and Design Professional disposition.

3. Erection Stability

The SJI Code of Standard Practice has specific requirements for end attachment and bolted diagonal bridging that must be completed prior to releasing hoisting cables. The Construction Manager must ensure bar joists are fully connected and properly braced before crane release and before any construction loads are applied, to prevent structural instability and collapse.

4. Construction Loads

Unless specifically included in the design, bar joists have limited capacity to support non-uniform loads and point loads. Stacking of construction

materials or placing heavy construction equipment on most floors or roofs structured with bar joists should be avoided. The Construction Manager shall enforce load restrictions and require distribution measures, temporary supports, or revised plans when construction loading is unavoidable.

5. Loads Applied Not at Panel Points

SJI requires that all hangers or other framing exerting point loads on joists be applied at panel points of joists. The Contract Documents may provide details to add joist webs in the field to support point loads not at planned panel points. The Construction Manager shall verify that attachments are located at panel points unless approved details are provided, and shall require manufacturer review for field modifications.

6. Inspection

The steel erector and special inspector must be familiar with the Contract Documents and the SJI Code of Standard Practice prior to beginning joist erection. Connections and bridging should be checked against the approved erection drawings and Contract Documents. When field welding is used to attach metal deck, the special inspector should review the joist top chords for damage due to over welding. The location of significant point loads should be checked and the joist manufacturer and Design Professional notified if these do not match the approved erection drawings and Contract Documents. The application of field installed web members should be checked at any point loads applied to bar joists away from planned panel points. **The Construction Manager shall verify inspection documentation is maintained and that corrective actions are tracked to closure.**

7.5.1.7. Metal Deck

1. Installation and Attachment

Metal deck is typically attached to supporting structural members with welds, screws or pins. Welding washers are required for deck less than 22-gauge, but the Steel Deck Institute (SDI) specifically recommends against using welding washers for material 22-gauge or thicker. The construction documents will specify the required deck attachment and may require additional attachment at diaphragm edges or at members that collect diaphragm forces to transfer the lateral load resisting system. Welds must be made by qualified welders per AWS D1.3 Specifications. Welding thin deck material will require a lower power setting which must be constantly monitored to avoid burn through. Care is required when welding deck to bar joists to avoid damage to joist top chords. The Construction Manager (CM) must confirm that metal deck is installed and fastened exactly as designed, that structural load paths (including metal deck and collector elements) are properly completed, and that welding is performed correctly without damaging supporting joists.

2. Shoring Requirements for Concrete Fill

SDI gives maximum allowable un-shored deck spans based on concrete slab thickness, concrete weight and deck span condition; i.e., 1-span, 2-spans or 3-spans for the deck panel. The special inspector should review the installed deck span and span condition in comparison to the SDI allowable maximum spans. The Contractor and special inspector should pay attention to deck installed with single spans and deck panels that have been interrupted by openings. Any deck not meeting the SDI maximum span requirements must be shored prior to placing concrete. The Construction Manager (CM) must ensure that when concrete is placed over the metal deck, proper temporary shoring is installed according to the approved shoring plan and the deck is not loaded (with concrete, materials, or workers) until the required shoring is fully in place and compliant.

3. Finish Repair

The Contract Documents may require the finish at welds and scratches be repaired on exposed deck subject to corrosion and on deck that will be painted. The Construction Manager shall verify repair materials and methods and confirm repairs are completed prior to concealment or coating application.

4. Hanging Loads from Roof Deck

Typically, items such as ceiling grids, pipe, conduit, ductwork, etc. should not be attached directly to metal roof deck unless the deck is filled with concrete or the roof deck has been specifically designed to support the load to be attached and fastening systems specifically designed for attachment to unfilled deck are used. The Construction Manager shall verify that loads are supported by approved framing/support systems and that any deck attachments are approved by the Design Professional and consistent with the deck manufacturer guidance.

5. Protection During Construction

Metal deck can be susceptible to damage from construction activities and must be appropriately protected. The deck should be inspected for damage, and any damage repaired, prior to placing concrete or covering with finish materials. The Construction Manager shall verify protection measures and require repair of damage affecting structural performance or corrosion resistance.

6. Inspection

Deck attachment, sidelap fasteners and the items noted above should be inspected during and after deck installation. The Construction Manager shall ensure inspection reports document compliance with attachment, shoring, and repair requirements.

7.5.1.8. Cold Formed Metal Framing

1. Delegated Design Responsibility and Loading Requirements

Cold formed framing member sizes and connections are both designed by the Design Professional and shown on the documents or their design may be delegated to the cold formed framing supplier. When the design is delegated the loading and performance requirements as well as any restrictions on connection type or design must be included in the construction documents. The Construction Manager must ensure that delegated design is properly approved and that the loads and deflection criteria used in that design match the requirements of the Contract Documents before installation proceeds.

2. Bridging and Flange Bracing

Wall studs and joists are designed based on an assumption that these elements are laterally braced at some maximum spacing. Lateral bracing is normally achieved by some combination of web bridging, flange bracing and/or attachment of sheathing. The Contract Documents or shop drawings must indicate the bridging, bracing and sheathing attachment necessary to meet the design intent. The Construction Manager shall verify bracing/bridging installation and spacing and require correction where omitted or improperly installed.

3. Minimum Material Thickness Requirements

The Contract Documents may require that wall studs or joists be fabricated of a minimum sheet thickness to facilitate attachment of other materials or systems. This is common when masonry veneer or metal wall panels are backed by cold formed studs or photo voltaic panel clips are screwed to roof joists or joists or trusses. The Construction Manager shall verify thickness and product identification against approved submittals.

4. Connections

Cold formed members are normally connected using some combination of welds and/or screws. Weld burn through in welds of thin gauge cold formed members can be a problem when performed in the field and welding of these members should be closely monitored. When wall studs support bearing loads they must be seated tightly to the top and bottom tracks to avoid connection slip. The Construction Manager shall verify screw type/spacing, weld procedures, and seating of load-bearing studs to prevent slip and distress.

5. Connections Designed to Slip

Exterior non-load bearing walls and interior partition walls are often braced by the floor or roof above. To accommodate the vertical live load deflection of the upper structure slip connections or slip tracks are often required by the Contract Documents. The slip connection or slip track must be configured to allow the vertical movement called for in the construction documents. The Construction Manager shall verify slip track configuration,

fastener placement, and that movement capacity is not inadvertently restrained by finishes, firestopping, or improper fastening.

6. Inspection

The general configuration, member size, connections and other items noted above should be inspected by the Construction Manager's staff during construction of the cold formed framing. The Construction Manager shall document inspections and require correction of nonconforming work prior to concealment.

7.5.1.9. Bolts

1. Structural Bolt Types

Bolted connection design, construction and inspection for facilities are controlled by the Specifications for Structural Joints Using ASTM A325 and A490 Bolts, often referred to as the Research Council on Structural Connections (RCSC) Specification. Almost all bolts used in facility structures are high strength, heavy hex bolts meeting either F3125 Grade A325 or A490 Specifications. Bolts and matching nuts are required to have their designation stamped on the bolt head and nut. Only F3125 Grade A325 bolts can be galvanized and only F3125 Grade A325 bolts can be reused. The Construction Manager shall verify bolt identification, lot control, storage conditions, and that reuse is not permitted except where allowed and documented.

2. Bolt Holes

Holes to receive bolts are classified as standard, oversized, short slotted or long slotted. Bolt hole dimensions and limitations can be found in the RCSC Specification. Unless a joint is classified as slip critical, short slots and long slots must be oriented perpendicular to the direction of force. Oversized holes can only be used in joints classified as slip critical except joints resisting only tension. Plate washers are required by the RCSC for long slotted holes and are sometimes required by the RCSC or the Specifications for oversized holes or short slots. The Construction Manager must confirm that bolt holes are fabricated and installed exactly as shown on the approved shop drawings and that the hole type complies with the required joint classification (bearing-type or slip-critical).

3. Bolt Length

Bolts length should be chosen so they extend through the entire nut once tightened, but there is no required minimum extension beyond the nut. Bolts designated as A325X or A490X shall be chosen so the threads are excluded from all the shear planes of a connection. This may require additional washers to allow the bolts to be properly tightened. The RCSC Specification allows up to a total thickness of 1/4-inch of fillers or shims. Thicker fillers or shims require a reduction in bolt capacity so the Design Professional shall be contacted to review the connection design if

additional shim thickness is required for joint field fit up. The Construction Manager must ensure that when steel members are assembled in the field, any gaps between connected parts (known as field fit-up gaps) do not exceed the maximum allowable filler thickness specified in the design.

4. Joint Classification

Structural joints are classified as either Snug Tight, bolts tightened per RCSC 8.1; Pre-tensioned, bolts tightened per RCSC 8.2; and Slip Critical, bolts tightened per RCSC 8.2 and the faying surfaces (joint surfaces in contact at the shear plane) are properly prepared per the RCSC and the Project's Specifications. The Construction Documents and the shop drawings must indicate how each joint is classified. The Construction Manager shall verify joint classification is clearly indicated and that surface preparation meets slip critical requirements where applicable.

5. Bolt Tightening

RCSC 8.1 indicates that bolts in Snug Tight joints shall be tightened with an impact wrench or spud wrench so that the plies of the joint are in firm contact. RCSC 8.2 indicates that bolts in pre-tensioned joints shall be tightened by one of four methods: Turn of the Nut, Calibrated Wrench, Tension Control Bolts or Direct Tension Indicators. The Construction Manager shall verify the selected method is approved, properly implemented, and that calibration records and inspection documentation are maintained.

6. Inspection

Joint, bolt, nut and washer configuration, bolt, nut and washer material, pre-tension, faying surfaces, and finish should be inspected by the special inspector per the requirements of the Specifications and the IBC. The Construction Manager shall coordinate special inspection coverage and ensure inspection reports are submitted and retained.

7.5.1.10. **Welds**

1. Weld Types and Process

Welding and welding processes are controlled by the AISC Specification for Structural Steel Buildings and the AWS D1.1 Structural Welding Code – Steel. The AISC Design Guide 21 – Welded Connections is also a useful reference. The most prevalent welding process used in the field for facilities is Flux Cored Arch Welding (FCAW). A self-shielding flux core is often used in the field and a gas shielded core more prevalent in the shop because of the controlled environment. The Shielded Metal Arc Welding (SMAW) process is still used in the field for tack welding, miscellaneous components and weld repair. For SMAW, low-hydrogen electrodes are required to resist hydrogen-assisted cracking. Electrodes are required to be kept in hermetically sealed containers and once the container is opened kept in a holding oven while not in use. The Construction Manager shall verify

storage and handling requirements are followed, and that field conditions (wind, moisture, temperature) do not compromise weld quality.

2. Weld Procedures

All welds require a written Weld Procedure Specification (WPS). The Contractor develops the WPS and submits for approval by the welding inspector. There are two types of WPS: a prequalified WPS follows strict requirements specified in the AWS D1.1 and does not require a substantiating test, and a qualified WPS that also follows requirements of AWS D1.1 and requires substantiating testing. Most field welding used in facility construction is done utilizing welds with a prequalified WPS. The Construction Manager shall verify WPS availability on site, that WPS matches weld type and position, and that any qualified WPS testing documentation is included when required.

3. Welder Qualifications

Welding personnel shall be qualified per AWS D1.1 and the welding inspector shall check that each field welder has a current certification for weld type and position they are welding on the Project. The Construction Manager shall verify welder qualification records are current and maintained in project files.

4. Welding Coated Steel

AISC M3.5 requires that coatings that could prevent proper welding be removed prior to welding. Heavy paint and galvanizing should be removed from areas to be welded. The Construction Manager shall verify coating removal extents and surface preparation prior to welding.

5. Welding on Existing Structures

If it has not been checked during the design process, the weldability of existing steel must be checked. This is especially true if there is any doubt of the existing steel's chemical composition, and particularly if the existing connections are made with rivets. The Construction Manager should consult the Design Professional for concerns with the weldability of existing steel. When welding in facilities with combustible finish materials the Contractor must protect against potential fire hazards. The distance between lead placement and welding should be minimized to reduce stray current. The Construction Manager shall verify hot work permits and fire watch requirements, confirm protection measures are implemented, and require Design Professional disposition when weldability concerns are identified.

6. Inspection and Testing

The Contract Documents should be referenced for inspection and testing requirements. Minimum special inspection requirements can be found in Chapter 17 of the current version of the IBC which references the AISC

Specification for specific requirements. Inspection and testing is a combination of visual inspection (before, during and after welding) and non-destructive testing of a certain percentage of each weld type. The Construction Manager shall coordinate NDT scheduling, verify acceptance criteria, and ensure nonconforming welds are repaired and re-tested as required.

7. Finish Repair

Welds of steel with protective paint or galvanized coatings must be cleaned and recoated per the Contract Documents. The Contract Documents may require welds exposed to view to be ground smooth prior to re-coating. The Construction Manager shall verify recoating system compatibility and completion prior to concealment or exposure.

7.5.1.11. Pre-Engineered Metal Buildings

1. Delegated Design Responsibility, System Criteria Coordination

Pre-engineered metal buildings (PMB) are constructed with proprietary steel components and cladding and the design of this system is delegated to an engineer retained by the metal building fabricator. The Contract Documents must provide the performance requirements including imposed loads, allowable deflection and building sway criteria. The Design Professional may provide prescriptive load requirements or may require the PMB engineer to develop the live, wind and seismic loads from the building code. The Design Professional should provide superimposed dead loads, such as lighting, mechanical, photovoltaic arrays, bridge cranes or other collateral load requirements, since these cannot be obtained from the building code. Lateral drift of the frame and girt deflection limitations compatible with the anticipated finish materials should be included in the Contract Documents. The Metal Building Manufacturers Association (MBMA) Metal Systems Manual recommends a frame sway of $H/60$ to $H/100$ for frames sheathed in metal panels. This will likely not be stiff enough for frames that support masonry, gyp board partitions or curtain walls. The Construction Manager shall verify that performance criteria are clearly defined, that delegated design calculations and drawings are sealed as required, and that drift/deflection criteria are compatible with attached finishes and cladding systems to prevent performance failures.

2. Coordination with Foundation Design

The Design Professional will likely base the foundation design on preliminary reactions from the PMB fabricator if available, and if not, estimates based on assumed frame configuration and stiffness. Prior to development of foundation shop drawings, the Design Professional should verify that the final PMB load reactions submitted by the PMB manufacturer can be properly supported by the foundation as designed or whether modifications are necessary. The Construction Manager shall ensure final reactions are reviewed and reconciled prior to foundation construction, and that any required foundation modifications are approved prior to placement.

3. Anchor Rods

The design of anchor rods is usually delegated to the PMB manufacturer for loads imposed by the metal building structure. The PMB design engineer may provide only the diameter and configuration of the anchor rods and leave the design of the embedment and any anchor reinforcing in the concrete foundation to the Design Professional. The size, embedment, configurations and any additional concrete reinforcing must be coordinated before beginning foundation construction. The Construction Manager shall verify anchor rod layout templates, surveys, tolerances, and embed reinforcement placement prior to concrete placement and shall require corrective action when misalignment is identified.

4. Shop Inspection

Special inspections of fabricators are not required when the fabricator is approved by the Authority Having Jurisdiction. ICC International Accreditation Service (IAS) Inspection Program of Metal Building Systems can assist the fabricator in the authority approval process. Special inspection of the metal building field inspection should follow the requirements for a steel frame, bolted connections and welded connections. The Construction Manager shall verify any required approvals, maintain documentation, and coordinate field special inspections consistent with the Contract Documents and IBC Chapter 17.

5. Repairs

When modifications or repairs are required to the PMB system the PMB engineer shall develop a repair procedure, supported by calculations were necessary, for approval by the Construction Manager and Design Professional prior to beginning any work. The Construction Manager shall require repair documentation, verify implementation, and ensure repairs are inspected and accepted prior to proceeding.

7.5.1.12. Wood Glulam

1. Delegated Design Responsibility and Loading Requirements

Glulam beams and girders are prefabricated proprietary structural members that may be designed by the manufacturer. If the Design Professional has not indicated sizes and required allowable stresses, performance information must be included in the Contract Documents. This performance information must include intended load paths, design loads and deflection limitations. The Contract Documents should show how the glulam members interface with other elements. Complete connections should be shown or clearly delegated to the glulam manufacturer. The Construction Manager shall verify that delegated glulam design is properly credentialed and sealed if needed, that all design criteria (loads, combinations, deflection/drift, vibration, and serviceability) are clearly defined and consistent, and that connection design responsibility is clearly

assigned. The CM shall require coordination drawings for all glulam interfaces (including bearing, moisture protection, fire-resistance, and tolerances) and ensure proper handling, storage, and installation procedures are followed in accordance with manufacturer recommendations.

2. Connections Exposed to Corrosive Environments

Metal connections exposed to corrosive environments must be designed to be protected from the environment as well as any chemicals introduced to the glulam members. Coatings should be inspected and any damage must be repaired as indicated in the Contract Documents. The Construction Manager shall verify that connection materials, coatings, and protective systems comply with the Contract Documents and are compatible with treated wood, prevent galvanic corrosion, and that any field modifications are performed per approved procedures. The CM shall also require documentation of coating repairs and inspections, including verification of concealed connections prior to enclosure.

7.5.2. Structural Flooring Systems

Structural floor systems are often constructed of some combination of the following systems:

- Structural steel, composite metal floor deck and concrete fill
- Cast-in-place (CIP) concrete flat slab or joist system
- Precast concrete hollow core plank with CIP concrete topping
- Precast concrete double tees with CIP concrete topping

The Construction Manager shall verify that the selected floor system and any transitions between systems are fully coordinated for elevations, bearing, stiffness compatibility, vibration performance, fire ratings, acoustic requirements, and interface details with MEP, architectural finishes, and envelope components.

7.5.2.1. Document Review

The Construction Manager shall review for potential inter-discipline coordination items such as:

- Edge of slab location and construction
- Heavy equipment loads such as HVAC, pumps, vaults, etc.
- CMU partitions
- MEP items embedded in concrete floors
- Housekeeping pads
- Beam web openings for conduit runs
- Concentrations of conduit and pipe penetrating the floor
- Floor openings (restrictions for cutting openings)
- Floor recesses
- Access flooring
- Sleeves for electrical conduit, plumbing, stand pipes or ducts

- Deck strengthening or framing for openings
- Bracing for eccentric connections or hanging loads such as stairs
- Construction joints in concrete floors
- Floor slopes and drainage

In addition, The Construction Manager shall review firestopping, rated assemblies, vibration/deflection criteria, floor flatness and levelness, corrosion protection, embed tolerances, pour and joint coordination with finishes, moisture testing before flooring, and any coring/cutting restrictions requiring Design Professional approval. The CM shall also verify that no-cut zones, tendon locations (where applicable), and required scanning procedures are clearly identified in the Contract Documents.

7.5.2.2. **Submittals**

See Exhibit 7 - 1 for a sample submittal matrix for typical floor system submittals.

The following is a list of potential systems coordination items between the Design Professional, Contractor and Construction Manager that should occur during submittal review:

- Crane and hoist loading and support
- Special loading and design criteria provided in construction documents
- Coordination with embedded electrical conduits and floor boxes, concrete reinforcing and slab thickness
- Submitted elevator information and shaft dimension coordination
- Submitted MEP equipment weights, sizes, clearances and supports
- Duct and shaft sizes
- Additional deck support and framing coordination for openings that are not shown
- Coordination with fire protection or structural elements

The Construction Manager shall require delegated design shop drawings and calculations, manufacturer data and certifications, special inspection submittals (as applicable), concrete mix designs and testing plans, required shoring/reshoring plans, deck attachment and diaphragm details, post-installed anchor submittals for equipment supports, and a coordinated penetration/sleeve plan aligned with current MEP drawings. The CM shall also ensure submittals address required building code special inspections (IBC Chapter 17) and are reviewed for constructability and cross-trade coordination.

7.5.2.3. **Pre-Construction**

The Construction Manager should conduct a pre-construction conference following the requirements of Section 3.1.2 of this Manual. Additional potential pre-construction conference agenda items specific to structural floor systems should include:

- Floor member bearing details at CMU and CIP concrete bearing walls and pilasters
- Structural camber and slab thickness tolerance
- Embedded items and sleeves
- Concrete floor finishes
- Slab curing and protection
- Floor flatness and levelness criteria and measurement
- Coordination of opening sizes, spacings and locations to be cored after concrete placement
- Crack repair criteria
- Inspection and testing

7.5.2.4. **Construction**

The Construction Manager, the Construction Manager's staff and the special inspectors, when applicable, shall ensure the following items are checked and fully coordinated with all trades:

1. Erection Tolerances

As discussed in Section 7.4, anchor rod locations or column bearing elevations that are constructed outside of project tolerances will translate these errors directly to the floors above if not corrected prior to column, wall and floor construction. As the structural frame is erected, column sway must be checked to maintain the proper horizontal location of the floor system. Edge member sweep and camber must be checked by the Construction Manager so they are in the proper location for attachment of supported systems such as curtain walls and other wall systems. The Construction Manager shall require survey verification of critical elevations, plumbness, and alignment at each level, and shall require corrective actions prior to proceeding when tolerances are exceeded.

2. Natural Camber

Steel and wood beams should be erected with their natural camber or crown oriented up unless the Contract Documents require otherwise. The Construction Manager shall verify camber orientation and confirm that anticipated deflections and camber do not conflict with slab thickness, topping requirements, finish elevations, or attachment of supported systems.

3. Slab Edge Angles

The slab edge angles and pour stops are often fastened to the structure in the field. This can allow for correction of edge member sweep or minor frame out of plumbness. These angles should be placed in reference to the global building dimensions rather than the supporting edge member. Edge angles that have a long cantilever, or support attachment for other systems, often have anchorage embedded into the concrete slab. When this

anchorage is rebar, the grade must be weldable (ASTM A706). The grade of any welded concrete reinforcement should be checked by the Construction Manager in the field for weldability. The Construction Manager shall verify that slab edge angles are properly aligned with established control lines and elevations, that anchorage embedment and reinforcing details comply with the Contract Documents, and that all field welding is performed by qualified personnel in accordance with approved welding procedures and specifications.

4. Headed Studs

Headed studs are often used as welded shear anchors in composite construction. Studs are normally welded to steel beam framing in the field after the floor deck is placed. Special considerations may be required for studs to be welded to steel beam members that are erected with finish coatings. Stud locations and quantities should be inspected. As a part of the Special Inspection program, a portion of the headed studs are to be bend tested prior to floor slab concrete placement. The Construction Manager shall verify stud welding procedures, stud base metal condition (including coating removal where required), bend test results and documentation, and shall ensure any failed studs are replaced and re-tested per the Contract Documents and applicable standards.

5. Embedded Items

Embed spacing and location and any interference with slab reinforcement and shear connectors must be inspected and corrected prior to floor slab concrete placement. The Construction Manager shall verify that embedded items are securely anchored to prevent movement during concrete placement, that required corrosion protection is provided in accordance with the Contract Documents, and that embed locations and tolerances are accurate to properly support and align attached structural, architectural, or MEP systems.

6. Sleeves

Sleeve size and location and additional reinforcing around sleeves must be inspected by the Construction Manager prior to floor slab concrete placement. The Construction Manager shall verify that sleeves are properly located and installed without compromising structural performance, including confirmation of any required trimming or additional reinforcement around openings. The CM shall also ensure sleeves are coordinated with firestopping requirements and maintain compliance with rated floor and wall assemblies.

7. Reinforcement in Cast-In-Place Concrete Structural Flooring Systems

Cast-in-place concrete structural flooring system reinforcement size, location, laps and clearances must be inspected by the Construction Manager prior to each concrete pour. When reinforcing cages are tied and then placed into forms, lap splices and interfaces with reinforcing of

intersection members must be carefully planned by the Contractor prior to tying cages. The Construction Manager shall require pre-pour inspection sign-off, verify supports/chairs maintain intended cover, confirm mechanical splice installation where used, and ensure reinforcement is not displaced during concrete placement and vibration. The Construction Manager shall also verify reinforcement bar size, spacing, grade, and clear cover comply with the Contract Documents and applicable ACI requirements.

8. Reinforcement in Concrete Slabs of Composite Construction

These slabs typically have field reinforcing and diaphragm chord and collector reinforcing located around the perimeter or boundaries of the slab and collector reinforcement near lateral load resisting elements such as shear walls, braced frames or moment frames. Crack control reinforcing is often required to be centered over girders and run perpendicular to the deck span. Often additional reinforcement is specified at reentrant corners, around openings and sleeves and as armoring reinforcement at embeds. This reinforcement should be inspected and approved prior to placing concrete. The Construction Manager shall verify that diaphragm reinforcement is continuous, that collector and chord reinforcement is properly placed, and that deck attachment patterns and reinforcing details together meet the structural diaphragm design intent. The CM shall also ensure that reinforcement at reentrant corners and around openings is installed as detailed to minimize cracking and prevent slab distress. The Construction Manager shall also verify that reinforcing steel does not interfere with deck attachments, shear studs, or other embedded items required for composite action.

7.5.3. Structural Roof Systems

Structural roof systems are often constructed of some combination of the following systems:

- Joist girders, steel bar joists and metal deck
- Structural steel, steel bar joists and metal deck
- Cold formed metal framing and metal deck
- Cast-in-place concrete flat slab and joist system
- Precast concrete hollow core plank with or without CIP concrete topping
- Precast concrete double tees with or without CIP concrete topping

The Construction Manager shall verify that the roof structural system is properly coordinated with roofing assemblies, insulation and tapering layouts, and the intended drainage design to ensure proper slope and water flow. The CM shall also confirm coordination with fall protection requirements and structural support frames for rooftop equipment to ensure safe access, adequate load capacity, and compliance with the Contract Documents.

7.5.3.1. Document Review

The Construction Manager shall review for potential inter-discipline coordination items such as:

- Photovoltaic panels.
- Mechanical equipment size, location and weight coordination with roof structure
- Coordination of support of heavy or concentrated piping
- Coordination of fire suppression and fire protection systems
- Roof frames for MEP equipment and roof hatches
- Screen walls
- Antennas
- Roof slopes and drains coordinated with structure slope
- Coordinate architectural blocking details at roof edge and interior openings with structural edge conditions
- Building cranes, hoists, hook height clearances, deflection tolerances and operational clearances
- Fall protection and/or window washing equipment attachment and loading

The Construction Manager shall also review roof penetrations and curb details, thermal movement joints, air and vapor barrier interfaces, rooftop equipment vibration isolation requirements, access and maintenance clearances, lightning protection grounding coordination, and any construction loading restrictions applicable to light-framed roof systems.

7.5.3.2. Submittals

See Exhibit 7 - 1 for a sample submittal matrix for typical roof system submittals. The following is a list of systems coordination between the Design Professional, Contractor and Construction Manager that should occur during submittal review as applicable:

- Submitted mechanical equipment size, location and weight coordination with roof structure and support frame
- Loads and support points of heavy pipe or pipe concentrations coordination with roof structure
- Special loading and design criteria provided in Contract Documents
- Submitted elevator over run, hoist beam and machine beam requirements with roof structure
- Coordination with fire protection of structural elements
- Crane and hoist loading and support

The Construction Manager shall require delegated rooftop equipment support framing submittals and calculations, attachment details for solar panel systems, screen walls, and fall protection anchorage, and verification of deck attachment patterns and diaphragm requirements. The CM shall also confirm that roof

penetrations are coordinated to avoid conflicts with joists, web members, or reinforcement.

7.5.3.3. **Pre-Construction**

The Construction Manager should conduct a pre-construction conference following the requirements of Section 3.1.2 of this Manual. Additional potential pre-construction conference agenda items specific to structural roof systems should include:

- Roof member bearing details at CMU and CIP concrete bearing walls and pilasters
- Distribution of construction loads on light framed roof structures
- Identify restrictions for locations and types of attachment of items to be supported by or suspended from roof structure or roof deck
- Joist reinforcement details
- Inspection and testing

The Construction Manager shall also address sequencing and temporary bracing, diaphragm completion requirements prior to removing erection bracing, weather exposure protections, fall protection during erection, and coordination of roof drainage slope verification prior to roofing installation.

7.5.3.4. **Construction**

The Construction Manager, the Construction Manager's staff and the special inspectors, when applicable, shall ensure the following items are checked and fully coordinated with all trades:

1. Roof framing should be checked by the Construction Manager to verify that it slopes toward roof drains. The Construction Manager shall verify roof drain elevations and slope lines against control points and document acceptance prior to roofing installation.
2. Where horizontal bracing is required at the roof level, the installation of this bracing should be inspected prior to roof deck installation. The Construction Manager shall verify bracing is installed per approved drawings and not modified without authorization.
3. Joist bridging and bottom flange beam bracing should be installed per the Contract Documents and inspected. The Construction Manager shall verify that all required bridging and bracing are fully installed and secured before releasing hoisting cables and, where required, before deck placement to prevent instability or collapse.
4. Diagonal kickers, attached to the roof system, are sometimes used to brace wall elements or other systems. To limit horizontal deflection of these kickers due to vertical deflection of the roof, it is sometimes required by the Contract Documents to hold attachment of these kickers to the roof framing until the roof dead loads are in place. This requirement should be

coordinated with the construction sequence and the attachments inspected once made. The Construction Manager shall verify construction sequencing complies with this requirement and document the attachment timing and inspection results.

5. Locations and details of equipment frames, hanging loads and joist reinforcing should be verified during inspections for all roof top equipment. The Construction Manager shall verify that rooftop equipment supports do not overload joists or deck and that loads are transferred to designated support points as shown in the Contract Documents and approved submittals.
6. The Construction Manager shall verify if additional deck reinforcement is required at penetrations in the roof deck per the Contract Documents. The Construction Manager shall ensure trimming reinforcement and framing for penetrations is installed prior to roofing and prior to concealment.
7. The Construction Manager shall verify if additional welds, screws or pins are required at diaphragm perimeters, at collectors and/or at lateral resisting elements. The Construction Manager shall confirm diaphragm attachment patterns match approved drawings and that special inspection documentation is maintained where required.

7.5.4. Bearing Walls and Columns

Structural bearing walls are most often constructed of structural concrete masonry, precast concrete or cold formed framing. Section 7.5.1 of this Manual can be referenced for information covering bearing walls. Column construction most often matches the material used for the floor or roof structure supported by the columns. The Construction Manager shall verify bearing conditions, load paths, and alignment, and ensure that any field modifications affecting load path are submitted for Design Professional review prior to implementation.

7.5.4.1. Pre-Construction

The Construction Manager should conduct a pre-construction conference following the requirements of Section 3.1.2 of this Manual. Additional potential pre-construction conference agenda items specific to bearing walls and columns should include:

- Temporary lateral bracing
- Embedded items
- Column splices

The Construction Manager shall also address tolerance and survey control, inspection hold points prior to concealment, and coordination of penetrations and attachments affecting bearing elements.

7.5.4.2. Construction

The reinforcement placement for cast-in-place concrete corbels on columns or walls is a common field issue. Correct placement of this reinforcement is critical to the support capacity of the corbel. If this reinforcement is to be welded it must be of a weldable grade such as ASTM A706. This reinforcement must be thoroughly inspected prior to closing forms and placing concrete. The Construction Manager shall require documented pre-pour inspection sign-off for corbel reinforcing, verify bar sizes, locations, cover, anchorage, and weldability where welding is specified, and ensure any deviations are corrected prior to concrete placement.

7.5.5. Lateral Systems

Resistance to lateral loads is usually provided by shear walls, braced frames or moment frames. Shear walls are most often constructed of structural concrete, masonry, precast concrete or cold formed framing and can provide both gravity support and lateral load resistance. Section 7.5.1 of this Manual can be referenced for information about shear walls. While braced frames and moment frames can be constructed with precast concrete, it is more common to resist lateral loads in precast structures using shear walls.

Braced frames are typically constructed with steel framing including cold formed steel framing. Moment frames are typically constructed using steel or cast-in-place concrete. The Construction Manager shall recognize that lateral force-resisting systems are safety-critical components of the structure and shall rigorously enforce all required special inspections, material traceability, and connection verification to ensure full compliance with the Contract Documents and applicable codes.

7.5.5.1. Document Review

The International Building Code requires the Contract Documents to clearly identify the lateral load resisting system and its components. The Construction Manager shall verify that the designated lateral system is consistently identified across structural drawings, details, specifications, and general notes, and that collector/chord elements and diaphragm requirements are clearly shown.

7.5.5.2. Pre-Construction

The Construction Manager should conduct a pre-construction conference following the requirements of Section 3.1.2 of this Manual. Additional potential pre-construction conference agenda items specific to lateral systems should include:

- Temporary bracing required until the lateral load resisting system is complete
- Inspection and testing of members and connections

The Construction Manager shall also address sequencing constraints, erection stability, bolting and welding procedures, NDT requirements, and documentation workflows for inspection reports and corrective actions.

7.5.6. Specialty Structures

7.5.6.1. Salt Storage

Providing the intended durability of structural components in contact with, or close to, the stored salt is of primary concern for these structures. Often the concrete mix design will include corrosion resisting measures such as a low water/cement ratio, added fly ash or slag, corrosion inhibiting additive or polypropylene fibers. These concrete mixes must be reviewed for compliance with the Contract Documents and verified the correct mix is delivered to the site. Any water added to the concrete mix in the field should be carefully monitored to not exceed amounts withheld at the batch plant. Clear concrete cover over reinforcing will often be increased as a durability improvement measure to lengthen the time it takes for chlorides to reach the steel reinforcing. The location of reinforcing in the forms and the elevation of reinforcing in the slabs should be carefully inspected prior to each pour to maintain the required concrete cover. Any visible cracks should be repaired as required by the Contract Documents or under direction of the Design Professional. Coatings protecting steel components or connections should meet the thickness requirements of the Contract Documents and any damage to these coatings be appropriately repaired by the Contractor. The Construction Manager shall require enhanced documentation of durability-related controls including mix delivery tickets, batch water controls, curing methods, concrete cover verification, and coating QA/QC records, and shall ensure repairs are performed using approved materials and procedures suitable for chloride exposure environments.

7.5.6.2. Parking Garages

Since vehicles tend to carry salt laden snow in the winter, parking facilities have similar durability concerns as salt storage facilities. The measures noted above also pertain to parking structures.

Parking garages, especially garages constructed with precast concrete, can have miles of sealed joints. Careful preparation for and application of sealant in joints can extend the life of the joint and reduce future maintenance. The joint width and depth must meet the criteria specified in the Contract Documents. This may require cutting wider joints or repairing the concrete edges of joints that exceed the width limit. The Contract Documents will typically require the concrete surfaces to receive sealant be prepared by grinding, cleaning and priming. Backer rods and bond breaks should be placed as required by the Contract Documents. Once the joint is prepared, it is filled with sealant and tooled as required. Construction activity around the joints should be controlled while the sealant material is curing to prevent debris from falling into the sealant. The Specifications often call for a trial joint to be prepared and tested for adhesion before production work begins and then regular adhesion tests be made as the Work progresses.

Parking garages may have traffic coatings applied to all or part of the drive and parking surfaces. The Specifications and the manufacturer's instructions should be carefully followed by the Contractor when applying these coatings. The Specifications may require tests to measure the thickness of each layer of the application. To provide adequate slip resistance, the Contract Documents may require an aggregate be broadcast into one or more application layers of the traffic coating. This aggregate should be supplied by, or approved by, the traffic coating manufacturer and the manufacturer's application instructions carefully followed.

The Construction Manager shall verify that surface preparation, environmental conditions, and curing requirements for traffic coatings comply with manufacturer specifications. Thickness testing and adhesion testing of coating systems shall be documented to confirm compliance with the Contract Documents.

A flood test may be required by the Contract Documents to check for proper flow of water to the drains and for the presence of ponding on the drive and parking surfaces, cracks on these surfaces and leaks at joints and in the traffic coatings. The test is typically performed by thoroughly wetting the drive and parking surfaces for several minutes and allowing the water to drain. Ponding and significant leaks will be readily apparent. Cracks will be highlighted as the surfaces dry. The Design Professional should direct any repairs necessary to correct issues discovered by the flood test.

7.5.6.3. Prefabricated Toll Booths and Pre-Engineered Canopies

The engineering design of these structures is typically delegated to the manufacturer and the coordination is similar to that discussed in Section 7.5.1.11 of this Manual for pre-engineered metal buildings. Where these elements are supported by tunnel structures coordination will be required with these below grade structures. The Construction Manager shall verify that interface tolerances and anchorages comply with the Contract Documents, that electrical and communications stub-ups are properly coordinated with the structure, and that loads are correctly transferred to the supporting tunnel structures. The CM shall also require survey verification of layout and elevations prior to installation.

7.5.7. Structural Restoration and Repair

It is critical to the long-term performance of restoration and repairs made to structures to properly identify and remedy the causes of deterioration and damage prior to making repairs. The Design Professional should direct the investigation of causes and development of repair details and procedures. This is often a continuing process as the conditions of obscured structural elements are uncovered by the Contractor. The Contract Documents should identify hold points to pause construction work and allow the Design Professional to review uncovered conditions and provide updated repair or restoration instructions. The Construction Manager shall enforce hold points, ensure investigation findings are documented, and verify that repair procedures are approved prior to execution.

7.5.7.1. Non-Compliant Construction

When construction is found not to be compliant with the Contract Documents, the Contractor must submit repair procedures including details, product information and supporting calculations for approval by the Design Professional and Construction Manager prior to proceeding with any modifications. If the non-compliant construction reduces the integrity or capacity of a structural system, then the Design Professional may need to prepare calculations and details for modifications to bring the structural system to the intended capacity. The modifications must be re-inspected as appropriate for the work involved. The Construction Manager shall ensure all noncompliance is documented, corrective

actions are tracked, re-inspections are recorded, and no concealment occurs prior to acceptance.

7.5.7.2. Cast-In-Place Concrete Restoration

Areas of damaged or spalled concrete should be marked for careful selective removal. Under direction of the Design Professional, removals must be made without damaging the existing corroded reinforcing and continue until all compromised concrete is removed and all corroded reinforcing is exposed. Removals will continue per the repair documentation to expose an adequate length of undamaged reinforcing to allow for proper lap or mechanical splice with the new reinforcement. The edge of the removal will typically be prepared with a vertical saw cut per the Contract Documents. Before continuing with the repair, the removal should be inspected by the Construction Manager to verify it has been extended appropriately, loose material removed and properly cleaned and bond surfaces prepared.

New reinforcing will be lapped or mechanically spliced with the existing reinforcing to return the structural capacity to the concrete element. The Contract Documents may call for a concrete bonding agent, scratch coat, corrosion inhibitor applied to the reinforcing and/or cathodic protection anodes to be tied to the reinforcing and embedded in the patch material.

The repair mix should be chosen to match the removal. Typical bag repair mixes allow for an approximate maximum application depth of 1-inch. This depth can be increased if the repair mix is extended with aggregate. For removals of varying depth, the deep areas may need to be filled with an extended patch mix held down from the surface 1-inch and then topped with the mix without aggregate. Another option is to deepen the shallow portions of the removal to a minimum depth, matching the extended mix. A tooled sealed joint may be required around the perimeter of the patch. The Construction Manager shall verify repair material compatibility, curing requirements, surface preparation requirements, and that repair boundaries and reinforcement splices meet approved repair details.

7.5.7.3. Prestressed Concrete Restoration

Restoration of prestressed or post-tensioned concrete is similar to conventionally reinforced cast-in-place concrete repairs except extra care must be taken to avoid damaging prestressing cables, post-tensioning strands and post-tension anchorages. The locations of these items must be clearly understood before beginning any removal. Ground penetrating radar, X-ray or pacometers may be needed to locate reinforcing and anchorages. The restoration contractor must have adequate experience restoring prestressed or post-tensioned concrete and have clear direction from the Design Professional. The Construction Manager shall verify scanning/mapping is performed prior to removals and that removal limits do not compromise tendon systems.

7.5.7.4. Steel Restoration

The chemical composition and weldability of existing steel must be determined before beginning steel restoration work or developing repair details. Coupon tests

for chemical composition and strength may be required. Damaged or corroded steel that is embedded in masonry, concrete or architectural finish materials must be uncovered to develop repair details unless complete construction documents of the original construction are available. As in concrete restoration, there must be hold points in the process where the Design Professional is re-engaged to develop or verify proposed repairs. The Construction Manager shall ensure coupon testing results and repair procedures are documented, that field welding follows approved WPS and qualified personnel requirements, and that repairs are inspected and accepted prior to re-covering.

7.6. BUILDING ENVELOPE

The building envelope includes slabs on grade, foundation walls, walls, fenestration, doors, service doors, louvers, soffits, roofs, penthouses, and all envelope penetrations, including expansion and control joints. It can also include structural walls and roofs. Newer energy codes and standards place significant emphasis on properly designed envelopes with air barrier systems. All penetrations or interfaces of differing system must be properly sealed. The trapping of water vapor within a wall or roof assembly is to be avoided, so if vapor retarders are required for low or high humidity control, they may have to be permeable. The Construction Manager shall verify envelope continuity for air, water, and thermal control layers, ensure penetrations and interfaces are sealed per the Contract Documents and manufacturer requirements, and require mock-ups or field testing where specified to confirm performance.

7.6.1. Roof Systems

1. Standing Seam Metal Roofing

Typically standing seam roof design consists of pre-manufactured system of panels, flashings, battens, clips and fasteners. Key elements of the system include appropriate underlayments to allow for thermal movement, moisture barriers and ice shield membranes as specified for specific projects. The Construction Manager shall verify that clip spacing, thermal movement detailing, underlayment installation, flashing continuity, and fastener types are fully compliant with the Contract Documents and the roofing manufacturer's published requirements.

2. Composition Shingles

Composite shingles are often utilized in a pitched roof configuration. Key elements include proper underlayment, ice shield as specified, decking, flashing and ventilation of concealed spaces especially attic spaces and eaves. The Construction Manager shall verify ventilation pathways, flashing integration, and installation sequencing to prevent moisture intrusion.

3. Modified Bitumen Built-Up Roof

Typical for low slope or "flat" roof configurations. Key considerations include: product thickness and coatings, proper seam and flashing construction. The Construction Manager should verify proper slopes of underlayment or tapered insulation prior to installation of roofing material. The Construction Manager shall verify substrate preparation, seam welding/adhesion requirements, flashing terminations, and drainage performance prior to acceptance.

4. Polyvinyl Chloride

A PVC roof membrane is made up of two plies of PVC material with a polyester reinforcement scrim in between. Distinctive to PVC membranes are hot-air welded seams. The Construction Manager shall verify the proper seam overlap and temperature of the heat gun when welding these seams together. The Construction Manager shall require seam test procedures as specified (probe testing, sample welds, and any required destructive testing), verify welding conditions (wind, moisture, temperature) are suitable, and ensure repairs are completed and documented prior to concealment or warranty closeout.

7.6.2. Wall Systems

1. Insulated Precast Concrete Panels

Quality Control of panel finish in the plant and upon delivery to the site is typically required by the Specifications as well as the general requirements for quality control. The Construction Manager's and/or the A/E's review and acceptance of precast panels and other elements prior to placement is critical to the overall quality of the installation. Once installed a damaged or inferior panel is difficult to remove and replace. A mock-up for the purpose of establishing acceptable patching and repair methods is recommended prior to installation of panels. The Construction Manager shall require and document verification of plant quality control records, applicable PCI certification and plant audit documentation (when specified), mix design approvals, curing records, insulation continuity, wythe connector/tie type compliance, embedded item placement tolerances, lifting insert locations, patch/repair materials, and shipping/handling protection measures prior to acceptance. The Construction Manager should require photo documentation at key hold points including mock-up approval, first-article panel approval, and first field installation acceptance prior to full production installation. The Construction Manager shall enforce acceptance criteria for panel finish, color consistency, surface tolerances, cracking, spalls, honeycombing, embed alignment, and joint geometry as required by the Contract Documents and manufacturer recommendations.

2. Cast-In-Place Concrete

Coordination for special inspections and material testing as well as any special aesthetic finish requirements for architecturally exposed surfaces is critical. Coordination of forming methods and form quality is critical to achieving the desired results. Again, the Specifications allow for patching and repairs of unacceptable areas but it is often difficult to achieve a homogeneous finish. The Construction Manager shall verify special inspection requirements and reporting per the Contract Documents and the governing building code, including IBC Chapter 17 where applicable, and shall enforce pre-placement hold points for reinforcement, embeds, formwork, and surface finish mock-ups when required. The Construction Manager should require submittal and approval of project-specific forming drawings and finish schedules (when applicable), including tie layout, liner types, chamfer/reveal details, and patch/repair procedures with defined acceptance criteria. The Construction Manager shall require documented

concrete delivery tickets, field test results, curing procedures, hot and cold weather concreting procedures, and corrective action tracking for nonconforming work.

3. Concrete Masonry Units (CMU)

CMU exterior wall construction can be non-load bearing infill between structural members or fully reinforced load bearing systems requiring close inspection for placement of reinforcing, grout and other components detailed for the installation of veneers or other cladding.

The Construction Manager shall verify inspection and testing requirements for engineered masonry, including special inspection level per the governing code and Contract Documents, and shall enforce verification of reinforcement size/placement, grout type, grout lift heights, consolidation methods, cleanouts, and curing/protection requirements. The Construction Manager should require a masonry mock-up (where specified) that includes typical corners, openings, control joints, flashings, weeps, ties, and finishes to establish workmanship and aesthetic acceptance standards prior to production work.

Joint system considerations include:

a) Building Expansion Joints

Projects which include larger buildings and additions to existing buildings often require building expansion joints that extend through the full thickness of the wall system including structural members. The design should include large scale details that clearly show the relationship of all components. Mock-up samples are often required.

The Construction Manager shall verify continuity of expansion joints across structural members, air barrier systems, waterproofing, insulation, fire-resistive assemblies, finishes, and sealant systems, and shall enforce inspection prior to concealment. The Construction Manager should require project-specific joint details showing transitions at foundation-to-wall and wall-to-roof conditions, and shall verify joint materials meet movement capability, durability, and compatibility requirements.

b) Material expansion or contraction joints

Material expansion or contraction joints in exterior veneers, panels and other cladding systems or between dissimilar materials are required. They are intended to allow for accepted differential thermal expansion and contraction and require careful attention during the design, submittal-mock-up and construction phases.

The Construction Manager shall verify joint spacing, depth/width geometry, backer rod installation, primer use (when required), sealant type and compatibility, adhesion testing (when specified), and protection during cure. The Construction Manager should enforce verification that joints are not bridged by finishes, fasteners, or reinforcing that would restrict movement unless specifically detailed in the Contract Documents.

4. Light Gage and Cold Formed Metal Stud Wall Systems

As with CMU walls, metal stud walls can be designed as non-load bearing infill or fully load bearing panels. In each case the interaction of the stud assemblies with the upper floor or roof structure to properly isolate or transfer loads is critical. The Construction Manager shall verify stud gage, spacing, corrosion protection, deflection/slip track details, bracing/bridging requirements, sheathing attachment patterns, and fire/smoke rated assembly requirements where applicable. Where delegated design is used, the Construction Manager shall verify submission of sealed shop drawings by a New Jersey Professional Engineer when required by the Contract Documents and shall confirm field installation conforms to approved delegated design submittals.

7.6.3. Document Review

The Construction Manager shall become familiar with the requirements of the Contract Documents for the roof type(s) required for the Project, especially where energy efficiency and air-barrier requirements are concerned. Take note of the basic roof and wall construction type or types if multiple systems are indicated. A series of typical wall sections should be provided in the Contract Plans to indicate how foundation to wall and wall to roof transitions are designed.

The Construction Manager shall verify that air barrier continuity, vapor retarder placement, insulation continuity, flashing transitions, and control/expansion joint details are coordinated between architectural, structural, civil, and MEP disciplines. The Construction Manager should identify conflicts, omissions, and constructability concerns during document review and ensure they are resolved through formal RFI and/or clarification processes prior to installation.

7.6.4. Submittals

Refer to the submittal matrix contained in Exhibit 7 - 1. The Construction Manager should verify and enforce the submission requirements of the Contract Documents including product samples, project specific roofing and flashing details, sample warranty, mock-up (if required by the Specifications).

Refer to Section 7.2 of this Manual for a general discussion regarding for roles and responsibilities regarding the submittal, review and approval process. Submittal requirements are listed in the Specifications. Issues critical to the roofing scope include:

1. Complete manufacturer's product data.
2. Sample warranty.
3. Project specific details shall include: Seams, terminations, penetrations, flashings etc. Often contractors/suppliers will only provide manufacturer's standard, generic details for approval. It is the Contractor's responsibility to provide detailed shop drawings showing the project specific conditions. The A/E along with the Construction Manager should enforce this requirement.
4. Roofing insulation data and shop drawings.
5. Flashing and penetration shop drawings.

Issues critical to the wall system scope include:

1. Product data for metal studs indicating specified gage, size, and finish.
2. Shop drawings for cold formed load bearing assemblies, sealed by a New Jersey Professional Engineer.
3. Manufacturer's data for all masonry units required for the Project including details of any special shapes. Data and samples for joint reinforcing, flashings and all cavity wall accessories, veneer ties, through wall flashings, weeps, and cavity netting.
4. Detailed shop drawings for all architectural precast panels, trim, copings etc. The Construction Manager shall require a submittal log and tracking system that identifies required submittals by specification section, planned submission dates, review durations, resubmission cycles, approval status, and field release status, and shall enforce that no fabrication or installation begins prior to required approvals. The Construction Manager should require manufacturer installation instructions, compatibility letters for membranes/sealants, project-specific details (not generic), and documentation of required testing or inspections (including any required third-party manufacturer inspections) where applicable.

7.6.5. Pre-Construction

The Contract Documents generally list requirements for the Contractor and related subcontractors to schedule and preside over pre-installation meetings for most major envelope systems. These requirements should be clearly identified in the Contract Documents and then in the Contractor's initial submittal matrix. Each pre-construction/pre-installation meeting should be identified in the Contractor's construction schedule. The Construction Manager should clearly define the inspection parameters and responsibilities between the Construction Manager and other inspectors retained by the Client at these meetings.

The Construction Manager shall document meeting minutes, attendance, decisions, and action items, and shall establish hold points for first installation of each envelope system, including approval of mock-ups, acceptance of substrates, and verification of environmental/weather limitations prior to installation. The Construction Manager should confirm responsibilities for testing (water infiltration, air leakage, adhesion, seam testing) where required by the Contract Documents and coordinate required notice periods for inspections.

7.6.6. Construction of Roof Systems

The submittal and pre-construction process should result in a clear scope of work including a defined staging area, delivery of materials and sequencing of installation. Important items to follow and coordinate include:

1. Stored materials are protected from damage and weather.
2. Proper safety protocols are in place including temporary railings, tie-offs, fire protection etc.
3. Exposed areas and terminations of in-place daily work are protected from weather.

4. Periodic inspection of seam construction for uniformity and compliance with the manufacturer's standards.
5. Tapered insulation and crickets.
6. Coal tar pitch dams.
7. The final Commissioning Scope of Work (SOW), as it will be implemented by the Commissioning Agent.
8. The Design Consultants, Construction Manager, and the Contractors.
9. Roof systems will be commissioned by the Authority's Maintenance Department's roofing consultant.

The Construction Manager shall verify slope to drain prior to membrane installation, enforce daily watertightness requirements, confirm manufacturer-required seam testing procedures, verify flashing terminations and penetration details match approved shop drawings, and ensure warranty inspection requirements are satisfied prior to final acceptance. The Construction Manager should require photo documentation of concealed conditions including insulation layout, vapor barrier placement (where applicable), seam welds, and flashing transitions prior to covering.

7.6.7. Construction of Wall Systems

The submittal and pre-construction process should result in a clear scope of work including a defined staging area, delivery of materials and sequencing of installation. Storefront systems, windows, doors and service doors are addressed in Section 7.7 of this Manual. The installation of the air barrier system through all exterior materials will also be addressed here. Important items to follow and coordinate are listed below.

The Construction Manager shall verify substrate readiness, environmental limitations, air barrier continuity, flashing and drainage plane continuity, and inspection of concealed conditions prior to covering. The Construction Manager should require installation checklists for each wall system and enforce first-installation hold points to confirm workmanship, sequencing, and interface details.

7.6.7.1. Insulated Precast Panels

1. These are factory assembled panels with an inner wythe of concrete, insulation board and a thinner outer wythe of concrete. Mock-up panels are usually required and established as the standard of quality. If not specifically detailed on the Contract Plans; the mock-up should include a corner, an opening and any other intersecting elements that will require field coordination.
2. Continuity of insulation at wall attachments.
3. Requirements should be noted in the Contract Plans and/or Specifications regarding the type of tie between concrete wythes.

4. Insulation type and thickness, including the facing material of the insulation.
5. Connection and embeds to structural system and to the slab or foundation wall.
6. If mock-ups are required, a typical sealant joint and insulation of joints should be included for approval.
7. Provisions for the attachment of coping if shown in the Contract Documents.
8. Fireproofing or concealment of connections in rated walls, if required.
9. If mock-ups are required, aesthetics, color and consistency of the outer panel appearance should be approved and compared to in-place work.
10. Understand the final finish of the concrete (sandblast, acid etch, etc.).
11. Specification requirements for plumbness and alignment.
12. Review quality control (QC) testing of concrete for performance requirements.
13. Review the Specifications for insulation performance characteristics.
14. Reinforcing steel location and size as well as clearance to faces of forms.
15. Non-insulated and special precast panels.

The Construction Manager shall verify joint backing materials, sealant compatibility and adhesion, panel lifting/rigging procedures, storage/handling conditions, embed tolerances, and panel-to-panel joint geometry prior to sealing. The Construction Manager should require correction of misalignment prior to final joint seal installation and should enforce protection of exposed insulation and joint materials from UV and moisture until permanent sealing is complete.

7.6.7.2. Cast-In-Place Concrete

1. Verify the correct concrete mix type is used for each condition. These requirements will have been established by the design and confirmed through the submittal process.
2. Aesthetics, color and consistency of appearance and finish.
3. Verification that quality formwork and/or form liners if specified, are properly braced to prevent movement or deflection during the placement and curing process.
4. Specification requirements for plumbness and alignment.

5. Review QC testing of concrete for performance requirements.
6. Chamfered corners, reveals and other form block-outs.
7. Reinforcing size, spacing and ties as indicated in the Contract Documents.
8. Reinforcing steel clearance to faces of forms.
9. Construction tolerances per the Specifications.
10. Verify aggregate will fit around tight spaces between reinforcing steel.
11. Review embed size, placement and location.
12. Review vibration requirements. Verify with the Contractor and special inspector requirements for each type of installation.
13. Review acceptance criteria of non-cohesive pours, honeycombing and patching requirement.
14. Review curing and cold weather procedures.
15. Understand the final finish of the concrete (sandblast, acid etch, etc.).

The Construction Manager shall enforce pre-pour inspections for embeds, reinforcement, form alignment, and surface finish mock-ups where specified, and shall require documented corrective actions for defects. The Construction Manager should require consistency checks across pours for architecturally exposed surfaces and ensure patch materials and procedures match approved mock-ups.

7.6.7.3. Concrete Masonry Units (CMU)

1. Verify if exterior water repellant is to be incorporated and if was reviewed in submittals.
2. Review CMU product submittal for Specification compliance.
3. Review doweling, reinforcing size and spacing.
4. Horizontal reinforcing requirements per the Contract Documents.
5. Inspect brick veneer tie type and spacing per the Contract Documents if required.
6. Inspect the bond pattern, tooling and striking/compaction of mortar joints.
7. Understand the limit of grout height around vertical reinforcing.
8. Verify specified testing requirements for each type of mortar.
9. Verify the locations of each mortar type to be used (Types M, S, N).

10. Verify if a CMU QC mock-up is required. The mock-up should include a typical corner, any special shapes like sills, bullnoses and lintels, window opening, typical flashings, control joints, etc.
11. Verify that the cavity in cavity walls remains free of mortar droppings.
12. Verify if flashings, end dams and weep tubes are installed where required. The Contractor should keep weep tubes free of mortar.
13. Verify discontinuity of horizontal reinforcing at control joints.
14. Verify if mortar has been cleaned from CMUs.
15. Ensure corners are protected from damage during construction.

The Construction Manager shall verify installation of through-wall flashings, end dams, and weeps per the Contract Documents and ensure drainage pathways remain unobstructed. The Construction Manager should require documented inspection prior to concealment of cavity components and enforce protection of completed masonry from weather exposure consistent with specification requirements.

7.6.7.4. Light Gage and Cold Formed Metal Studs

1. Verify that required submittals have been submitted and approved.
2. Verify that specified sill seal gasket is installed below the sill channel.
3. Verify that required cross bracing is installed.
4. Verify that provisions for expansion and movement have been addressed. This includes providing slip joints at the top of walls to isolate structural loads from non-load bearing stud panels and building expansion joints with a continuous break from the exterior sheathing through to the interior finishes.
5. Verify proper installation of vapor barrier materials, taping of seams and termination at openings.

The Construction Manager shall verify fastener types/spacing, stud alignment and plumbness, corrosion protection, and that vapor/air barrier transitions are continuous at penetrations and openings. The Construction Manager should enforce inspection prior to closing walls to confirm bracing, slip track function, and rated assembly requirements where applicable.

7.7. OPENINGS

Curtain walls, storefronts/entrances, windows, doors, service doors, MEP penetrations and other openings through the building envelope system shall be reviewed and coordinated by the Construction Manager. Special emphasis shall be placed on the

continuity of the air barrier systems (as required by the energy code) at the opening, no matter what the size. The systems below shall be checked for damage and cleanliness by the Construction Manager. Security devices need to be inspected by the Construction Manager's staff as part of the security system.

The Construction Manager shall verify flashing integration, air/water barrier continuity, compatibility of sealants and adjacent materials, and required testing (air infiltration and water penetration where specified) prior to acceptance. The Construction Manager should require field verification of opening dimensions, tolerances, and embed/anchor locations prior to fabrication where practical, and shall ensure that penetrations are sealed at each "layer" of the assembly as required by the Contract Documents.

7.7.1. Exterior and Interior Construction Openings

1. Curtain Wall and Storefront System

Emphasis will be on the system's expansion allowances, deflection of structural members and floor edge beams, glazing characteristics, color of gaskets/tape/blocks, entrance doors, finishes, and details where these systems meet exterior walls as well the structural support for them. Embeds and anchors, slip connections, sealants, drainage, door closers and hardware, finishes, safety glazing requirements, and flashing details should be addressed, especially end dam flashings at heads and sills. Sealants and backer rods, anchor placement, and cleaning of the entire Curtain Wall or Storefront System should be included.

The Construction Manager shall verify approved shop drawings and installation instructions are followed, confirm anchorage and embed locations and tolerances, inspect drainage/weep paths, confirm compatibility of dissimilar metals, and verify field testing requirements where specified. The Construction Manager should ensure protection of glazing and finishes during construction and verify final cleaning, punchlist resolution, and operational performance prior to acceptance.

2. Windows

Windows should meet American Architectural Manufacturers Association's (AAMA) requirements for quality. The certification of quality standards should be mandated in the Contract Documents. Safety glazing and labeling, flashings, glazing characteristics, color, sills, drainage, hardware, sealant and backer rods, anchor placement, and cleaning of the window system is included under installation quality. The Specifications should describe any required water and air infiltration testing procedures the Contractor will need to perform. The continuity of the building envelope air barrier shall be a priority.

The Construction Manager shall verify AAMA certification documentation where required, inspect flashing and sill pan installations, confirm drainage and weep systems are functional, and verify specified air/water testing is performed and documented where required. The Construction Manager should enforce continuity of air barrier transitions at window perimeters and confirm compatible sealant systems and backer rod installation.

3. Doors

As with all building envelope penetrations, doors shall be checked for continuity of the air barrier system, head flashing and end dams, sills, weather stripping, insulation of exterior and acoustical doors, hardware, fire/smoke ratings/labels/gaskets, glazing, closer types, pull force and power assist hardware, magnetic hold opens or hold-open closers and their activation systems, wood vs. steel doors, finishes, and checking the weather resistance characteristics needed for exterior doors.

The Construction Manager shall verify ADA accessibility clearances, hardware schedule compliance, fire/smoke label compliance and inspection coordination, functional testing of closers/hold-opens, weather resistance detailing, and verification that thresholds are set per the Contract Documents to prevent water and air infiltration.

4. Service Doors

This usually involves coiling or roll-up overhead doors, but can also involve more efficient and easier to repair insulated, sectional doors. Coiling doors are typically difficult to insulate as compared to sectional doors. Both door types normally have electric closers with switches that should be located on the Contract Plans. Roll-up type service doors should also be reviewed for clearances and operation. The type and location of the operator, top or side (right or left) mounted, may need to be checked for available clearance. Sometimes the switches are on both sides of these doors and are keyed. Some may be glazed. All should be equipped with a continuous door bottom safety switch, which should be tested by the Construction Manager. The voltage and horsepower of the motors should be verified by the Electrician and Design Professional to ensure that the motors are properly wired. Locking hardware should be omitted on overhead doors. The drop time of a coiling service door which is fire-rated needs to be tested to meet Underwriter's Laboratories' (UL) or Factory Mutual (FM) Approval's requirements. A delay device to overcome short power interruptions on rated doors may be specified and the installation of this delay device needs to be verified.

The Construction Manager shall require documented functional testing of safety devices, limit switches, reversing mechanisms, and fire-rated drop testing where applicable, and shall verify coordination with electrical power requirements, controls, and emergency power interfaces where specified. The Construction Manager should ensure door guides, hood clearances, and operator clearances match approved shop drawings and field conditions prior to final acceptance.

5. Wall, Roof and Louver Openings

Any penetration of the air barrier of the wall or roof needs to be inspected for sealing of the penetrations to prevent air leakage from the facility. The penetration seal should be compatible with the adjacent materials of the penetration and of the air barrier. Sealing of the penetration is required at each "layer" of the air barrier assembly and may be different from each other.

The Construction Manager shall verify penetration seals at each layer (air barrier, vapor retarder where applicable, water barrier) and ensure firestopping and smoke

sealing requirements are satisfied where penetrations occur through rated assemblies. The Construction Manager should require product compatibility documentation and ensure penetrations are not left unsealed prior to concealment.

6. Interior Openings

Interior openings include typical wood and hollow metal doors, sidelights, coiling doors, return air routes and Z-boots, supply air ductwork, piping, cable tray and bus ducts, conduits and wiring, sprinkler piping, etc. Where these building elements penetrate partitions, fire/smoke partitions, or acoustical partitions, is it critical to review the product information and verify that the appropriate fire stops, fire and/or smoke dampers or acoustical seal treatments are installed per the Contract Documents.

The Construction Manager shall verify listed and approved firestop systems are installed exactly per tested configurations, confirm and installation, and ensure required inspection documentation is maintained. The Construction Manager should require inspections prior to concealment and enforce correction of any noncompliant penetrations immediately.

7. Acoustical doors require acoustical hardware, such as door seals, gaskets and sweeps or door bottoms. Refer to the Specifications and final approved hardware schedules and cut sheets.

The Construction Manager shall verify installation of acoustical seals and required undercut limitations, and shall confirm field performance criteria where specified.

7.7.2. Document Review

The Construction Manager shall review the Contract Documents to become familiar with types of doors and windows required for the Project. Schedules and details will define the scope. A review of the exiting plan and an understanding of the basic egress requirement from various areas of the facility will be beneficial in the administration and inspection of doors and related electrical and life safety systems.

The Construction Manager shall verify coordination of door hardware, power requirements, access control/security interfaces, and life-safety system interfaces, and shall identify conflicts between schedules, plans, and details prior to procurement and installation.

7.7.3. Submittals

See Exhibit 7 - 1 for a sample submittal matrix for Opening submittals.

Key Submittals for Openings shall include:

- Product information for all components
- Clear and complete door and hardware schedules
- Warranty information.

- Reference Exhibit 7 - 1 for additional submittals.

The Construction Manager shall require complete shop drawings for openings including anchorage, flashing, interfaces with air/water barriers, electrical requirements for powered hardware, and all required certifications and listings (AAMA, UL, etc.) as applicable.

7.7.4. Pre-Construction

A pre-construction conference shall be held following the requirements of Section 3.1.2 of this Manual. The scope for openings should be reviewed as a part of the overall pre-construction conference. A pre-installation conference may be necessary after the submittal process is complete to discuss any additional issues that may have arisen during the review of the items.

The Construction Manager shall establish inspection hold points for first installations, verify field measurements and substrate readiness, and confirm testing/inspection requirements and responsibilities prior to proceeding.

7.7.5. Construction

The Construction Manager, the Construction Manager's staff and the special inspectors, when applicable, shall ensure the following items are checked and fully coordinated with all trades:

1. All roof openings should be inspected for seals at the water barrier and other components of the air barrier system.
2. Roof hatches should be sealed where the hatch door meets the top of the curb.
3. Curbs for mechanical or electrical penetrations should be sealed at vertical to horizontal transitions. The area between the curb of the opening and the penetrating element should be made air tight.
4. Louvers should be flashed and sealed around the perimeter as described above.
5. Door thresholds are typically detailed to be set in a continuous bed of sealant to ensure air and moisture won't infiltrate the system, especially wind driven rain or snow melt. Continuous weather stripping and drip caps at door heads are critical in the performance of the opening.

The Construction Manager shall require documentation of concealed seal conditions prior to covering, enforce correction of incomplete or incompatible seals, and verify operational and water-shedding performance prior to final acceptance.

7.8. INTERIOR CONSTRUCTION: PARTITIONS, FINISHES AND EQUIPMENT

Interior finishes include the interior finish of columns, fixed or movable walls, and fixed or movable partitions. Interior partition types will be shown on the drawings. The Construction Manager shall review each type by looking at the legend for partitions and the partition wall sections. Note those that are acoustical or fire/smoke rated as they will need specific terminations when abutting other construction. The finishes on the partitions are normally

shown on a finishes legend. Finishes on rated partitions may be required to provide flame spread and smoke development limitations. Equipment must be coordinated with all trades to ensure proper fit and installation. Reference Section 7.9 for possible equipment and its requirements for inspection and review.

The Construction Manager shall verify that rated assemblies, acoustical assemblies, and accessibility requirements are maintained through all interfaces and penetrations, and shall enforce required inspections prior to concealment.

7.8.1. Interior Finishes

The Construction Manager, the Construction Manager's staff and the special inspectors, when applicable, shall ensure the following items are checked and fully coordinated with all trades:

1. Review Contract Documents and coordinate with framing trades to ensure proper slip joint assemblies are provided at the roof/floor deck and other structural elements that can impart a load, through deflection, to the partitions below.
2. Deflection issues of adjacent materials at the top and sides of partitions.
3. Review the details within the Contract Documents to establish the extent of acoustically rated partitions. The Specifications will establish sealant materials and inspection/testing procedures for compliance.
4. The Contract Plans should clearly show door clearances required for accessibility at both the pull and push side of doors. Though this is a design issue, observation in the field to verify the construction trades follow plans can help to avoid issues later.
5. Penetration limitations on rated partitions.
6. Components within partitions, such as conduits, junction boxes, lighting fixtures, etc.
7. Components passing through partitions.
8. Installation and weather protection of partitions during construction.
9. Protection of finish materials from moisture is the responsibility of the Contractor. If rain, a plumbing leak, or other moisture event occurs the Contractor shall demonstrate to the Construction Manager that all affected material is repaired or replaced and all moisture within the area, including concealed spaces is thoroughly dry prior to completion.
10. Many materials need to be acclimatized with the building and the HVAC running to control the climate before the new materials are installed. This is critical so the moisture levels, as well as the temperature of the new materials can be equalized with the temperature and humidity of the building's interior. Failure to execute this acclimatization can result in stretching or compression of materials, particularly,

but not limited to wood products and wall coverings. The Specifications should address temperature and humidity restrictions for installation of each material.

11. Floor surfaces are usually specified to meet a minimum friction coefficient to prevent slipping.
12. Installation must be accomplished by each trade by experienced workmen with approved materials and adhesives.

The Construction Manager shall enforce installation prerequisites including substrate readiness, environmental controls, moisture testing where applicable, and verification of manufacturer installation instructions. The Construction Manager should require documented corrective actions for any nonconforming conditions, including damaged materials, insufficient acclimatization, or moisture intrusion prior to installation.

7.8.2. Document Review

The Construction Manager should review and become familiar with the finish schedule in the Contract Document.

The Construction Manager shall verify finish transitions, substrate requirements, moisture limitations, and required primers/adhesives per the Specifications and manufacturer requirements, and shall confirm that finish selections align with durability and maintenance requirements for Authority facilities.

7.8.3. Submittals

See Section 7.13 and the referenced submittal matrix for key submittals related to this scope.

The Construction Manager shall verify submission of product data, samples, mock-ups where required, warranties, maintenance data, and installation instructions for all finishes and adhesives, and shall enforce approval prior to procurement and installation.

7.8.4. Construction

The Construction Manager, the Construction Manager's staff and the special inspectors, when applicable, shall ensure the following items are checked and fully coordinated with all trades:

7.8.4.1. Substrate Conditions

Surfaces must be installed on clean, dry and smooth substrates often over control or expansion joints.

The Construction Manager shall verify substrate moisture content and flatness/levelness criteria where required by the Contract Documents and manufacturer instructions, and shall ensure control/expansion joints are treated per finish system requirements.

7.8.4.2. Finishes

The following is a general list of finishes along with a few of the critical issues related to installation and inspection. Finishes installation and inspection will concentrate on the following:

- Fire, smoke and flame spread requirements
- Cleanliness
- Plumbness and smoothness of substrates
- Moisture content of materials
- Moisture content of concrete floors
- Humidity at time of installation
- Preparation of substrates
- Primer application
- Confirmation of drywall finish level
- Thin set adhesive and grout for tile
- Tile Council of North America and National Terrazzo and Matrix of America installation directions met
- Recess and levelness of recessed floor mat installation
- Sealer preparation installation
- Ground/polished concrete installation/mock-up
- Carpet and carpet tile installation and pattern/nap direction

The Construction Manager shall verify required testing methods and acceptance criteria for moisture in slabs prior to installation of moisture-sensitive finishes where required by the Specifications and manufacturer instructions, and shall enforce protection of installed finishes from subsequent construction activities. The Construction Manager should require mock-ups for specialty finishes where specified and maintain approved mock-ups as the workmanship standard for acceptance.

7.8.4.3. Moisture, Temperature and Off-Gassing During Installation

Installation details will bring a particular focus on temperature, humidity control and moisture in concrete slabs and within the conditioned, enclosed interior of the building. The Construction Manager shall require the Contractor to provide continuous temperature and relative humidity monitoring logs (daily at minimum, or continuous where feasible) for the affected areas during installation of moisture- and VOC-sensitive finishes, and shall document conformance to the manufacturer's required installation ranges. Excessive moisture is unacceptable in substrates, in particular concrete slabs, as the moisture will deteriorate the adhesive finish and material surfaces as well as promote mold growth. The Construction Manager shall require documented substrate moisture testing results prior to installation (including, where applicable, industry-standard testing methods referenced by the Specifications), and shall not allow installation to proceed until results are confirmed acceptable and recorded in the project file. This is similar for primers, paints and coatings on drywall and other surfaces. The Construction Manager shall verify surface preparation and moisture suitability prior to primer/paint application and require corrective action where conditions are outside

manufacturer limits to avoid blistering, peeling, or coating failure. Interior materials that can breathe will let any trapped moisture escape. The Construction Manager should verify compatibility of the specified finish systems with the building envelope/vapor retarder design to reduce risk of trapped moisture and interstitial condensation. LEED recommends that buildings be aired out after all interior materials are installed for a period of weeks to mitigate off-gassing. Where LEED or LEED-like requirements apply, the Construction Manager shall verify that the Contractor's indoor air quality (IAQ) management and flush-out/air-out plan is submitted, approved, and implemented, including documentation of duration, ventilation rates, and filtration requirements before occupancy or beneficial use. Carpet and paint seem to be the biggest sources of off-gassing of unwanted fumes. The Construction Manager shall verify low-VOC compliance documentation for carpet, adhesive, paint, primer, sealants, and coatings (as required by the Specifications), and shall confirm materials are stored, mixed, and applied in accordance with manufacturer instructions to minimize indoor air quality impacts and rework.

7.8.4.4. Specifications and Industry Standards

The installation must meet the requirements of the Specifications which often reference the requirements of industry standards and common work practice. Many of these standards were developed by ANSI or ASTM. Some standards include, but are not limited to: The Construction Manager shall verify the Contractor is using the current adopted editions required by the Contract Documents and that any conflicts between manufacturer requirements, industry standards, and the Specifications are identified and resolved through formal RFI/submittal review prior to installation.

1. Tile Council of North America (TCNA) and the Porcelain Tile Council Agency (PTCA)

Refer to the current version of the TCNA and PTCA handbooks which references various ASTM standards for tile installation information. The Construction Manager shall require mock-ups for critical tile areas (public-facing and high-traffic spaces) and shall verify substrate flatness, movement joint locations, waterproofing transitions, and setting material compatibility before tile installation proceeds.

2. National Terrazzo and Matrix of America (NTMA)

Refer to this organization's recommendations for terrazzo installation, including divider. The Construction Manager shall verify divider strip layout, crack isolation provisions, curing time requirements, and protection measures during grinding/polishing to prevent damage to adjacent finishes and to reduce dust migration.

3. National Concrete Masonry Association (NCMA)

Refer to the design resources and concrete masonry units' section of NCMA's web site as well as the Contract Documents. The Construction Manager shall verify reinforcement placement, grout consolidation, curing,

and control joint installation in accordance with the Contract Documents and applicable NCMA guidance.

4. Gypsum Association (GA), United States Gypsum (USG) and National Gypsum Company (NGC)

These organizations have materials, recommendations, and useful resources for numerous installations of gypsum board products. The Construction Manager shall verify that any fire-rated or smoke-rated gypsum assemblies match the tested/listed assembly requirements (including fasteners, joint treatment, insulation, and penetrations) and that substitutions are not accepted without EOR review and Authority approval.

7.8.5. Interior Finish Materials

7.8.5.1. Construction

1. Gypsum board partitions must be constructed in a manner that complies with fire and/or smoke partitions and acoustical partitions as shown on the drawings.
2. Wet or molded gypsum board must be removed. The Construction Manager shall require immediate segregation and removal of damaged gypsum materials from the building to prevent contamination and shall document corrective action in daily reports.
3. The spacing of screws needs to reflect the spacing indicated by the manufacturer for the rating and code requirements indicated. The Construction Manager shall verify screw spacing through random field checks prior to finishing and shall require corrections before taping/mudding proceeds.
4. The layering and offsetting of joints is critical as well as taping and mudding when installing a multiple layer system. The Construction Manager shall verify joint offset requirements and fastening patterns prior to concealment and shall require a representative mock-up where multiple layer systems are used in critical spaces.
5. There are five levels of finish available for gypsum board systems. The various levels required on the Project should be discussed at the pre-construction conference or applicable progress meeting. Mock-ups are recommended for higher finish levels. The Construction Manager shall require the Contractor to identify gypsum finish levels by room/area on a finish schedule and obtain written agreement at the pre-construction conference to reduce disputes at substantial completion.

0 = No finishing, taping, or corner beads are required.

1 = Joints have tape set in joint compound, free of excess compound, tool marks are permitted.

2 = Joints and interior joints are tape embedded in joint compound, struck with joint knife, leaving a thin layer of compound over tape. Fastener head and accessories are covered with joint compound, free of excess compound, tool marks and ridges are permitted.

3 = Joints and interior angles are same as Level 2, then covered with an additional joint compound layer. Fastener heads and accessories have two independent coats of compound. Joints are smooth and have no tool marks.

4 = Joints taped like Level 2 with two separate coats of joint compound on all flat surfaces and one coat over interior angles. Fastener heads and accessories have three separate coats of compound. No tool marks or ridges. Prime before painting.

5 = Joints and interior angles are taped like Level 2, then two coats of joint compound over all joints and one over interior angles. Fasteners and accessories are same as Level 4. A thin layer of compound applied over the entire face of exposed gypsum board. Smooth with no tool marks or ridges. Prime before painting.

6. Partitions indicated as fire rated should be inspected by the AHJ. The Construction Manager shall coordinate required AHJ inspections and shall not allow concealment until the AHJ inspection is complete and documented where required by the Contract Documents.

7.8.5.2. Primers

Confirm what materials require primers on the substrates. Confirm VOC level restrictions. Primers must be compatible with their top coats. Installation per manufacturers written instructions. The Construction Manager shall require submittals that demonstrate primer/topcoat system compatibility and shall verify storage, mixing, and application conditions meet the manufacturer's written requirements to prevent adhesion failure and rework.

7.8.5.3. Paint

Substrates must be cleaned, properly prepared, and primed when required. Verify the number of coats required for each paint system to be used. Dirt and dust in the paint is not acceptable and the Contractor should provide corrective measures to prevent this. The Contractor should protect adjacent surfaces that are not to be painted. Splatter and overspray are not acceptable on final coats. Verify the primer on structural steel is coordinated and suitable for the specified paint. See the paint specifications in the Contract Documents. The Construction Manager shall require the Contractor to submit a surface preparation plan (including patching, sanding, cleaning methods, and protection measures) and shall verify ambient conditions (temperature/humidity) meet manufacturer requirements during application and curing.

7.8.5.4. Carpet and Carpet Tile

Refer to the Specifications, the Carpet and Rug Institute (CRI) and referenced ASTM Standards. CRI states that failure to comply with their recommendations can result in contamination, delamination, dimensional changes, permanent indentation, wrinkles and bubbles, pile reversal, creases and pattern distortion. Substrate moisture testing is required by the flooring contractor for carpet tile before installation. Adhesives may dictate much of the installation requirements for carpet tile. Carpet tiles may have numerous patterns that also drive the installation methods. Carpet tile installation can vary based on full, partial or no glue down of the tiles. The Construction Manager shall verify that the flooring contractor's moisture test results, adhesive compatibility, trowel notch requirements, open time, cure time, and rolling requirements are documented and that installation sequencing protects new carpet from construction traffic, dust, and staining.

7.8.5.5. Sealed Concrete, Hardeners and Polished Concrete

Sealed concrete requires a clean substrate and a sealer is sprayed onto the surface to prevent the concrete from off dusting onto materials and clothing. Hardeners are normally a metallic granular material, broadcast over wet, finished concrete slabs.

A popular finish is grinding or polishing concrete with a large grinding/polishing machine. Sometimes a hardener and densifier is added to the polish to make the surface more abrasion- and contaminant-resistant. Polished concrete, whether new or existing, needs almost no maintenance and has a non-uniform appearance of the exposed aggregates which creates a varied surface finish. The polishing "gloss" can be varied. However, care must be taken to provide the proper coefficient of friction. Mock-ups should be provided to determine the acceptable level of polishing. Polished concrete can also be stained. The Construction Manager shall require documentation of the sealer system, application rates, cure time, and slip resistance criteria, and shall verify mock-ups establish the acceptable gloss, aggregate exposure, staining uniformity (if used), and coefficient of friction prior to full installation.

7.8.5.6. CMU Block Fillers (Primer)

Concrete masonry units (CMUs) are typically coated with concrete block filler to smooth the voids in the surface of the block faces. Along with its primary purpose of providing a level surface, it provides a bonding coat on all types of masonry and concrete surfaces. Since block filler paints are not abrasion- and wear-resistant, two topcoats should be applied. The Construction Manager shall verify surface cleaning, curing, and moisture conditions prior to application, and shall confirm the specified number of coats and dry film thickness requirements (where applicable) are achieved.

7.8.5.7. Wall Base

Many types of wall base are available such as adhered rubber, tile, terrazzo, and carpet. Where adhered rubber base is specified, outside corners are either pre-fabricated or carefully back-mitered in the field. Interior joints are butted or mitered. Adhesive should meet low VOC requirements. Quality installation of

outside and inside corners is often lacking and the installer will attempt to wrap a 90-degree corner. This is not acceptable. In the field, a representative example of an acceptable installation should be established as a baseline goal. The Construction Manager shall require a field mock-up of inside and outside corners, transitions, and end terminations, and shall use the approved mock-up as the acceptance standard for the remainder of the installation.

7.8.5.8. Gypsum Board Ceilings

The Construction Manager shall verify the finish level required as these types of ceilings often have a Level 5 finish requirement. The Construction Manager should also check for the need for greater wind resistance (higher up and down loads) as well as the number and spacing of screws and brackets required if located at or near an entrance or vestibule. The Construction Manager shall verify framing/support spacing, suspension requirements, and fastening patterns meet manufacturer guidance and Contract requirements, and shall require protection from moisture and damage prior to final acceptance.

7.8.5.9. Suspended Acoustical Panel Ceilings

Grids must be installed level. Inspect for tie spacing and wire gauge, uplift resistance of the grid as well as hold down clips on panels in areas susceptible to higher wind exposures at or near an entrance or vestibule. Inspect both panels and grids for damage or soiling. Soiled panels shall be replaced. Work of other trades should not be hung from ceiling suspension wire. Verify if light fixtures, diffusers, speakers, etc., are required to be hung independently from the grids. The Construction Manager shall verify ceiling plenum coordination drawings are followed, confirm independent support requirements for MEP devices, and require documented corrective actions where grid levelness, hanger spacing, or component support does not meet the Specifications.

7.9. EQUIPMENT

The Construction Manager shall review all equipment specifications and schedules and discuss potential installation or acquisition issues with the Contractor at the start of the Project. Many types or pieces of equipment are long lead items and must be ordered at the inception of the Project. Some equipment will be procured and provided by the Owner and installed by the Contractor. Equipment (either under the general contract or provided and installed by others) for the various facility buildings may be included in the following general categories. The Construction Manager shall require a long-lead procurement log and submittal schedule identifying lead times, required approvals, delivery dates, storage requirements, and installation dates, and shall track this information through progress meetings to prevent schedule impacts.

7.9.1. Equipment General Categories

1. Kitchen/Break Room - Refrigerators, microwave ovens, ice machines, etc. The Construction Manager should verify if products and/or installations are included under the general contract or if the equipment is furnished by the Owner. The Construction Manager should also coordinate power, domestic water supply and waste/drains. The Construction Manager shall verify utility rough-ins, shutoff

locations, and access for maintenance, and shall confirm coordination is reflected in shop drawings and as-built documentation.

2. Toilet/Bath Accessories - The Contract Documents will include locations along with schedules and specifications for each type of accessory needed. Backing requirements for items such as grab bars should be verified by the Construction Manager. The Construction Manager shall verify blocking/backing is installed prior to wall closure and that ADA requirements (where applicable) are met.
3. Marker and Tack Boards
4. Cranes, Hoists and Vehicle Lifts
5. Car Wash and Water Recovery Treatment Systems
6. Parking Control Equipment
7. Dock Equipment Recessed Levelers - Powered Operation

7.9.2. Document Review

The Construction Manager should become familiar with the general equipment requirement shown on the plans, especially specialty equipment such as vehicle maintenance and shop equipment requiring special foundations, structural support and power. The Construction Manager shall verify specialty equipment foundation and embed requirements are coordinated with structural and MEP drawings prior to concrete placement and shall require pre-installation meetings for complex equipment.

7.9.3. Submittals

See Section 7.13 of this Manual and the referenced submittal matrix for key submittals related to this scope. The Construction Manager shall verify submittals include manufacturer installation requirements, utility requirements, weights/loads, anchorage details, and commissioning/startup requirements where applicable.

7.9.4. Pre-Construction

A pre-construction conference shall be held following the requirements of Section 3.1.2 of this Manual. Equipment installation requiring coordination with other multiple design disciplines and trades should be reviewed in detail. The Construction Manager should verify that all parties involved participate in the submittal and coordination drawing process. The Construction Manager shall require identification of required pre-installation meetings, field verification points, and hold points prior to equipment delivery and setting.

7.9.5. Construction

1. Commissioning for equipment includes but may not be limited to: vehicle lifts, bridge cranes, and wash systems. The Construction Manager shall verify the commissioning plan identifies responsibilities, prerequisites, test procedures, and documentation requirements, and shall ensure deficiencies are tracked to closure.

2. Refer to the Section 7.13.3 for the Commissioning Section and the Commissioning Specification in Exhibit 7 - 3 for a description of responsibilities during the design phase, construction phase and occupancy phase of the Project.
3. The Construction Manager shall coordinate and oversee the required pre-installation meetings in advance of the installation of major equipment. The Construction Manager shall document meeting minutes, action items, and required field verifications including anchor bolt layout, clearances, and utility readiness.

7.9.6. Vertical Transportation

7.9.6.1. Stairs

Interior stairs will typically be a steel stringer system with metal pan treads and landing. Metal guard and hand rails are typically pipe or tube sections. The construction documents will typically detail the major components including all critical dimensions. The Construction Manager shall verify critical dimensions including riser/tread geometry, guard height, handrail continuity, and required clearances per applicable code and Contract Documents.

7.9.6.2. Submittals

Stair shop drawings should be coordinated with other building structural systems as early as possible. Exterior metal stairs should be galvanized per the Specifications. The Construction Manager and submittal reviewers should verify early that the proper materials and galvanization procedures are being provided. The Construction Manager shall verify field touch-up and repair procedures for galvanized coatings are included and performed where coatings are damaged during handling/installation.

7.9.6.3. Construction

The Construction Manager's staff should field verify the required clearances including minimum headroom. Materials and connections should also be verified to check they meet the proper requirements for finish, and concrete tread and landing infills are protected during the curing process and through construction activities. The Construction Manager shall require protection measures to prevent damage to finishes and shall verify welds/bolted connections, coatings, and alignment meet the Specifications prior to acceptance.

7.9.6.4. Elevators

As noted in Section 7.4, initial coordination for foundation layout and below slab plumbing are critical. Early submission of shop drawings should be enforced. The Construction Manager shall require coordination drawings and verification of pit dimensions, embeds, sump/power requirements, and access/clearance requirements prior to concrete placement and prior to delivery of elevator equipment.

7.10. MECHANICAL SYSTEMS

This section discusses review of shop drawings and Contract Documents, review of submittals and cut sheets with product capacity information, electrical information, etc., and coordination with other trades, particularly within plenums. This section also discusses plumbing; however, plumbing below slabs on grade is discussed in Section 7.4.3 of this Manual.

Disciplines are inspected periodically by the Construction Manager's mechanical engineers with the designer's mechanical engineer or inspector. Work must be installed in a workmanlike manner, consistent with industry standards.

Mechanical equipment, including boilers, chillers, pumps and air handling units, should be inspected as it relates to noise, vibration, utilities and controls, testing and performance, fire safety, and other issues germane to the equipment.

Mechanical systems include heating, air conditioning, ventilating, exhaust, energy recovery systems, ductwork, and hydronic piping systems. The Construction Manager should become familiar with these systems and the specific equipment required for the Project. The Construction Manager shall require coordination of mechanical scope with architectural ceilings, structural systems, and electrical controls, and shall document field inspections and deficiencies through written reports and issue tracking logs.

7.10.1. Document Review

General document review processes are described in Section 7.1 of this Manual. Document review specific to mechanical systems should be performed by the Construction Manager as early in the design process as possible. The Construction Manager should become familiar with the specific equipment and their locations within the building and verify, with the Engineer of Record (EOR), that the required installation and maintenance access, as well as code required clearances are provided by the design. It is important to establish early if the design is for a basic roof top installation with gas fired electric heating or a more complex hydronic system with chilled water cooling and hot water heating. The Construction Manager shall verify equipment access/maintenance paths and replacement routes are feasible and shall identify conflicts early through formal coordination comments and RFIs.

7.10.2. Construction

Key considerations for coordination and inspection:

- Protection of in place systems during construction
- Coordination of hanging and support accessories
- Installation and protection of duct and piping insulation
- Continuous coordination with other trades
- Temporary and final duct and pipe identification
- Testing and balancing
- Commissioning

The Construction Manager shall require written protection plans for in-place systems, documented inspection hold points for concealed work, and verification that labeling/identification matches as-built documentation and Authority maintenance needs.

7.10.3. HVAC Distribution

The HVAC distribution systems include:

- Supply air, return air
- Combustion air
- Exhaust air
- Cooling and heating system water piping
- Refrigerant system piping
- Steam heating system piping

7.10.3.1. Document Review

The overlay coordination drawing is to be submitted by the Contractor. This will determine phasing of the installation and coordination by the respective trades. Review of system layout is required by the EOR under the shop drawing submittal process. The EOR is responsible for the review and acceptance of the Contractor's submissions by establishing that all applicable trades and scopes of work have been included in the coordination documents. Building Information Modeling (BIM) in the form of Revit or similar software system is often utilized to perform this evaluation, and may be required by the Contract Documents. The Construction Manager should become familiar with the general layout of the systems.

7.10.3.2. Submittals

1. It is the EOR's responsibility to review HVAC distribution submittals. The Construction Manager shall provide a cursory review to become familiar with the scope of the work including:
 - Products, materials and accessories
 - Routing, coordination and sequencing

The Construction Manager's cursory review should also confirm that submittals include installation details, seismic/wind bracing (if required), and insulation/vapor barrier requirements consistent with the Specifications.

2. A critical element of the Contractor's submittal responsibility may be defined in the Contract Documents as delegated design responsibility to design and engineer the structural support of all mechanical equipment and distribution systems based on parameters described in the Contract Documents and/or required by applicable codes. The Construction Manager shall verify delegated design submittals are sealed where required and include calculations, details, and installation requirements suitable for field verification.
3. The Contractor should not be allowed to proceed with procurement or installation of HVAC equipment or distribution systems without review and acceptance of the submittal documents by the EOR and Construction

Manager. The Construction Manager shall document submittal acceptance status in a tracking log and verify procurement/installation does not proceed without required approvals.

7.10.3.3. Pre-Construction Mechanical/Distribution

1. The Construction Manager shall hold a pre-construction conference following the requirements of Section 3.1.2 of this Manual.
2. The Contractor shall schedule a pre-construction conference upon receiving notice to proceed. The meeting should be attended by:
 - General Contractor staff consisting as a minimum of: Project Manager, Project Engineer, field superintendent, Quality Control manager, Safety manager.
 - Subcontractors staff consisting as a minimum of: Respective Project Managers and foremen
 - Owner's Representatives staff consisting as a minimum of: Construction Manager, Project Manager/Contracting Officer, Architect/Engineer of Record
3. Additional potential pre-construction conference agenda items specific to Mechanical/Distribution scope can include:
 - Project Directory including rolls and responsibilities
 - Review status of required submittals
 - Review of sequencing and coordination with other trades

The Construction Manager shall require meeting minutes, action items, and agreed inspection hold points, including coordination of above-ceiling work prior to ceiling closure and verification of access clearances.

7.10.3.4. Construction

1. The Construction Manager should review the proper protection and storage of delivered materials. The Construction Manager shall verify storage conditions meet manufacturer requirements and that materials are protected from moisture, dirt, and physical damage prior to installation. The Construction Manager shall also verify that materials are properly labeled, remain in their original packaging where required, and that storage locations prevent deterioration, contamination, or deformation prior to installation.
2. The Construction Manager should confirm that the hanging and supporting of HVAC distribution systems is acceptable to the EOR for Mechanical and Structural Design. The Construction Manager shall verify hangers, inserts, anchors, and supports match approved submittals and that field deviations are reviewed and accepted by the EOR. Inspection shall also verify spacing of hangers and supports, anchorage into structural elements, and

compatibility with fireproofing, ceiling systems, and other building components.

The Construction Manager shall ensure that installed supports do not overstress structural elements and that coordination with structural drawings and load allowances has been confirmed

3. The EOR may be asked to conduct periodic site observations including written reports noting compliance or non-compliance with the Contract Documents, along with participating in scheduled progress meetings. The Construction Manager shall track EOR observation items and verify corrective actions are completed and documented.

Items identified as non-compliant shall be tracked through completion to ensure that deficiencies are corrected prior to system testing, commissioning, or project closeout.

7.10.4. Controls

Construction inspection for the controls system will be done on a system wide basis, and performed by the installer/provider who will set up the program in a format designated by the Authority. The Contract Documents should specify the use of a web based controls program that can access all facilities owned or operated by the Authority and should be accessible by multiple users within the Authority. The Construction Manager's mechanical inspector should verify the specified hardware and software is provided, and observe initial system operation. The Construction Manager should coordinate the installation of the controls program with the Commissioning Agent. The Construction Manager shall verify the controls system includes required user access levels, cybersecurity/IT coordination (where applicable), naming conventions, and Authority training, and shall require delivery of final sequences, graphics, and as-left settings as part of closeout.

7.10.4.1. Document Review

General document review procedures are described in Section 7.1 of this Manual.

Document review specific to the Sequence of Operations (SOR) for Mechanical systems should be performed by the Construction Manager as early in the design process as possible. The Construction Manager shall verify the SOR aligns with the controls submittals, and intended operations, and shall document discrepancies for resolution prior to programming.

7.10.4.2. Submittals

The Contractor shall not be allowed to proceed with procurement or installation of equipment and related controls infrastructure and devices prior to acceptance of the submitted documents by the EOR and Construction Manager.

During the submittal process the EOR and Construction Manager should review the system for compliance with the requirements of the approved sequence of operations (SOR).

7.10.4.3. Pre-Construction

A pre-construction conference shall be held following the requirements of Section 3.1.2 of this Manual.

Requirements for the Controls scope should be an integral part of the overall pre-construction activities and specific pre-installation coordination meetings. The Construction Manager shall require a controls coordination meeting specifically addressing interface with mechanical equipment start-up, commissioning timeline, and Authority access/IT requirements.

7.10.4.4. Construction

Refer to the Section 7.13.3 for the Commissioning Section and the Commissioning Specification in Exhibit 7 - 3 for a description of responsibilities during the design phase, construction phase and occupancy phase of the Project.

The Construction Manager shall coordinate and oversee the required pre-installation meetings in advance of installation of controls systems and equipment. The Construction Manager shall verify field device locations, labeling, and accessibility, and shall ensure functional testing are performed and documented prior to acceptance.

7.10.5. Plumbing Systems-Above Grade

This section discusses review of the Contract Documents as well as review of the submittals and cut sheets, including materials and layouts. Systems are inspected by the Construction Manager's plumbing engineering consultant and/or inspector for the local AHJ. Work must be installed in a workman like manner consistent with industry standards.

Plumbing equipment typically includes water heaters, sump pumps, backflow devices, and circulating pumps and will be inspected as they relate to certification and balancing adjustments.

The Construction Manager should become familiar with the systems and specific equipment required for the Project. The Construction Manager shall verify that plumbing installations are coordinated with architectural finishes, and maintenance clearances, and that testing requirements are completed and documented prior to concealment.

7.10.5.1. Document Review

General document review procedures are described in Section 7.1 of this Manual. Document review specific to plumbing systems should be performed by the Construction Manager as early in the design process as possible, becoming familiar with the building layout including spaces requiring a concentration of fixtures, equipment and related piping, such as toilet rooms, mechanical rooms, domestic water service entrance, fire line service entrance. The Construction Manager should review expectations and minimum requirements for code required minimum clearances and maintenance access. The Construction Manager shall verify penetrations/firestopping requirements prior to installation and wall closure.

7.10.5.2. Submittals

Items to be coordinated with plumbing submittals include:

1. It is the project EOR's responsibility to review submittals. The Construction Manager shall provide a cursory review to become familiar with the scope of the work including products and materials accepted by the EOR. The Construction Manager's cursory review should confirm the submittals include installation requirements, access/clearance needs, and testing/commissioning requirements where applicable.
2. A critical element of the Contractor's submittal responsibility may be defined in the Contract Documents as delegated design responsibility. This requires the Contractor to design and engineer the structural support of the plumbing equipment and distribution systems based on parameters described in the Contract Documents and/or required by applicable codes. The Construction Manager shall verify delegated design submittals are complete and sealed where required.
3. The Contractor shall not be allowed to proceed with procurement or installation of plumbing equipment or distribution systems without review and acceptance of submitted documents by the EOR and Construction Manager.
4. During the submittal process the EOR and Construction Manager should review the system layout. The Construction Manager should become familiar with the general layout of the systems. Overlay coordination drawings should be submitted by the Contractor and applicable trades for the purpose of identifying conflicts and establishing sequence of installation. The Construction Manager shall verify coordination drawings address above-ceiling conflicts, access to valves/cleanouts, and protection of installed work prior to close-in.

7.10.5.3. Pre-Construction – Plumbing Distribution

1. The Construction Manager shall hold a pre-construction conference following the requirements of Section 3.1.2 of this Manual.
2. The Contractor shall schedule a pre-construction conference upon receiving notice to proceed. The meeting should be attended by:
 - General Contractor staff consisting as a minimum of: Project Manager, Project Engineer, field superintendent, Quality Control manager, Safety manager
 - Subcontractors staff consisting as a minimum of: Respective Project Managers and foremen.

- Owner's Representatives staff consisting as a minimum of: Construction Manager, Project Manager/Contracting Officer, Architect/Engineer of Record.
3. Additional potential pre-construction conference agenda items specific to Plumbing/Distribution scope can include:
 - Project Directory including rolls and responsibilities
 - Review status of required submittals
 - Review of sequencing and coordination with other trades

The Construction Manager shall require documented meeting minutes and shall establish inspection hold points for concealed piping, firestopping, and pressure testing prior to close-in.

7.10.5.4. **Construction**

1. The Construction Manager should review the proper protection and storage of delivered materials and equipment. The Construction Manager shall verify storage and handling meet manufacturer requirements and that materials are protected from weather, contamination, and damage.
2. The Construction Manager should confirm the handling and supporting of plumbing and distribution system is acceptable to the EOR for plumbing and structural design. The Construction Manager shall verify hangers, supports, housekeeping pads, anchors, and inserts match approved submittals. Inspection shall also confirm proper spacing of supports, anchorage into structural elements, and compatibility with structural load limitations and fireproofing systems.
3. The EOR may be asked to conduct periodic site observations including written reports noting compliance or non-compliance with the Contract Documents, along with participating in scheduled progress meetings. **The** Construction Manager shall track EOR observation items and verify closure of deficiencies. The Construction Manager shall maintain a log of EOR observations and ensure corrective actions are documented and completed prior to system testing or concealment of work.
4. The Construction Manager should review that the Contractor is supplying the proper protection of installed systems and equipment during construction. The Construction Manager shall verify temporary protection remains in place until final acceptance.
5. The Construction Manager should review that the Contractor is supplying the proper hanging and support including equipment housekeeping pads.
6. The Construction Manager should oversee the installation and protection of required pipe insulation as it is critical to the performance of the completed systems. Exposed distribution piping is susceptible to condensation which can cause long term maintenance issues for the

building owner. The Construction Manager shall verify insulation continuity, vapor barrier integrity, and sealing at joints/terminations to prevent condensation and long-term corrosion. Inspection shall also confirm insulation thickness and material type match the approved submittals and that insulation remains intact after system testing and installation activities.

7. The Construction Manager should become familiar with the extent of required fire barriers and rated wall, roof and floor assemblies for the project. Review and coordination of penetrations and sealant/firestop systems is critical. The Construction Manager shall require firestop submittals, inspection checklists, and photographic documentation for above-ceiling and concealed firestopping prior to concealment. Firestop installations shall be verified for compliance with tested assemblies, manufacturer requirements, and applicable fire-resistance ratings specified in the Contract Documents.
8. The Construction Manager should ensure the Work is being coordinated with other trades.
9. The Construction Manager should become familiar with the contract and commissioning requirements for identification of installed equipment and distribution piping. The Construction Manager shall verify labeling matches as-builts and Authority maintenance requirements. Equipment tags, valve identification, and piping labels shall be inspected to ensure consistency with system schematics and maintenance documentation required for project closeout.
10. The Construction Manager should oversee the testing, flushing and cleaning of distribution piping as it is a condition of acceptance for substantial completion and ultimately final commissioning of the systems. The Construction Manager shall require test reports and flushing documentation to be submitted and retained as part of closeout.
11. Commissioning

See Section 7.13.3 for information related to this scope and Exhibit 7 - 3 for the Commissioning Specification. The Construction Manager shall coordinate commissioning activities with the Contractor, commissioning authority, and Design Professional to ensure all system performance requirements are verified prior to final acceptance.

7.11. ELECTRICAL AND LOW VOLTAGE SYSTEMS

Many electrical construction inspection issues are much more technical than other systems. The intent of this section is to provide general information to a Construction Manager not fully knowledgeable with electrical design and construction. Periodic inspection by an electrical engineer or the Designer's electric engineer is anticipated. In electrical power systems, low voltage most commonly refers to the main's voltage as used by domestic and light industrial and commercial consumers. "Low voltage" in this context still presents a risk of electric shock, but only a minor risk of electric arcs through the air. The Construction Manager shall ensure that qualified electrical inspection

resources are available for critical inspections and testing activities to protect the Authority and confirm compliance with the Contract Documents.

7.11.1. Codes and Standards

All work is to conform to the latest adopted Uniform Construction Code – N.J.A.C. 5:23, with all adopted modifications:

- National Electrical Code (NEC)
- International Mechanical Code
- International Fuel Gas Code
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1-2007
- National Standard Plumbing Code
- International Building Code
- N.J.A.C 5:23-6 Rehabilitation Subcode
- Barrier-Free Subcode 5:23-7 and ICC/ANSI A117.1-2003.

All of these codes and standards are adopted by the New Jersey Administrative Code with technical revisions. See <http://www.state.nj.us/oal/rules/accesssp/>. The Construction Manager shall verify the governing code edition and Authority requirements at project start and document any code-driven impacts through the RFI/submittal process.

7.11.2. Testing

1. Underwriter's Laboratory (UL) or other nationally recognized testing lab label is required on many types of equipment and materials. The Construction Manager shall verify labels are present, legible, and match the submitted product data.
2. UL or other testing lab tests (or engineered determinations, if allowable) of fire and smoke stop protections systems and lighting protection systems are required. Laboratory tests of fire protection penetrations shall include seals, wiring systems or devices, as well as all other miscellaneous materials. The Construction Manager shall verify that field installations match tested/listed assemblies and that firestop systems are installed by qualified personnel where required.
3. Field test records should include the date, time, temperature and weather conditions, NEC test reference and type of test, extent of test, circuit designation if applicable, name and serial number of equipment that was tested, as well as the signature of those who witnessed the tests. The Construction Manager shall require test records be submitted in a standardized format and retained as part of project closeout.
4. The EOR should be advised of field testing on site with enough notice for this engineer to witness the test, if necessary. The Construction Manager shall coordinate testing schedules through progress meetings and written notices.

5. When product testing is required by the code it shall comply with UL or another recognized laboratory.
6. Testing for shorts, grounds and insulation resistance (Megger Tests) and other tests are beyond the scope of this Manual. Other tests that might be performed are for rotating equipment, switch and manual motor operational tests, reduced voltage starters, variable and adjustable motor controls, circuit breaker tests, protective relays, operation tests of relays, rod electrodes, lightning protection system, emergency generator and ATS tests, if these are provided and miscellaneous tests. The Construction Manager should verify the Contract Documents define required testing and commissioning responsibilities and confirm all required test reports are completed prior to substantial completion.

7.11.3. Hazardous Areas

Where hazardous activities, gases, fuels, etc. occur that could explode with an electrical spark, strict adherence to NEC's Class 1, Div. 1 requirements are required to be implemented as indicated in the Contract Documents. This NEC requirement involves the potential hazard, the area affected by the requirement, services to the equipment, architectural and/or electrical remedy of the hazard. The Construction Manager shall verify hazardous area boundaries, equipment ratings, and labeling requirements are identified and installed per the Contract Documents and NEC requirements.

7.11.4. Inspection of Delivered and Stored Materials

1. Upon delivery of electrical materials, the Construction Manager's staff should note if any containers appear to be wet, dirty, or otherwise damaged. In addition, the contents inside the packaging should be noted along with a package ID number if possible. The Construction Manager's staff should also verify storage and handling requirements in manufacturer documentation are met to prevent damage.
2. The Construction Manager's staff should note if any containers are stored where weather conditions could damage stored material or where soil materials could possibly contaminate the product and find their way into the containers. Electrical equipment shall not be stored outdoors unless it is rated for outdoor use, such as outdoor transformers. The Construction Manager's staff should verify protective coverings, elevation from ground, and security measures are provided for stored equipment.
3. The Construction Manager's staff should note the storage condition of materials sensitive to high or low humidity. The Construction Manager's staff should verify humidity-sensitive equipment is stored in conditioned areas when required.

7.11.5. Coordination Drawings

The Contract Documents may require coordination drawings be prepared to coordinate the work of other trades, including partition and slab penetrations, building structure, doors, HVAC ducts and equipment, as well as other construction elements. The Construction Manager should verify if the General Contractor is providing these drawings for review. The Construction Manager shall verify coordination drawings include above-

ceiling and in-wall electrical routing, clearances, and access requirements prior to rough-in and prior to ceiling/wall closure.

7.11.6. **OSHA**

Safety is the responsibility of the Contractor. However, there are numerous OSHA requirements regarding electrical service and electrical power tools, extension cords, grounding, space around equipment, tight fit of electrical components at splices, intersections, etc. The General Contractor should have these and other safety issues particular to the Project incorporated into the overall safety and training programs. The Construction Manager shall verify that electrical safety planning includes lockout/tagout provisions, GFCI use, cord management, and required clear working clearances at electrical equipment.

7.11.7. **Workmanship**

1. The electrical code calls for neat and orderly installation of wiring, conductors, conduit, hangers, maximum support spacing devices, etc. A neat and orderly installation is a sign of a quality job, installed by electricians who care about their work. The Construction Manager shall document workmanship deficiencies and require corrections prior to concealment and prior to energization.
2. Conductors that look like a bird's nests within cabinets and/or have over-stripped insulation at terminations are unacceptable. Vertical conduits should be properly supported per the Specifications.
3. Electrical work that hangs off the work of other trades is unacceptable.
4. Lengths of flexible conduit are limited by code for multiple systems.
5. Look for organized conduit runs that are parallel to partitions, walls or ceiling grids; the minimum allowable conduit radii are maintained; the conduits are not overloaded with conductors or cabling that exceed allowable loads; conductors and cables are properly color coded. The Construction Manager's staff should verify conduit fill compliance and require corrections where overfill is observed.
6. Cable trays and busways must be installed per the manufacturer's instructions and per the NEC. They must be coordinated with the work of other trades. The Construction Manager's staff should verify the intersections to each other are bonded tightly together.
7. Cable trays and bus ducts penetrating rated partitions or walls must have specific fire stop systems designed for the system penetrating the rated construction. The Construction Manager's staff should inspect these penetrations to see that they meet the UL or other lab description for the rating required. The Construction Manager's staff should require photographic documentation of firestop systems prior to concealment.
8. Cabling in cable trays is neatly placed in an organized fashion.

9. Loose mechanical connectors and lugs as well as identification labeling that is obstructed and not easily seen are unacceptable. The Construction Manager's staff should verify that bolted connections are tight and contacts are not dirty, oily, wet and free of paint. Locknuts and bushings are not acceptable grounding service conduit. Ground rod installation is per NEC.
10. Grounding requirements to test by instrument and electrical continuity should be visually verified everywhere by the Construction Manager's staff.
11. Panel boards, both main and secondary, should be wired in a neat manner with additional conductor lengths to make changes to the cable locations.
12. The Construction Manager's staff should verify that conduit used is appropriate and code wiring methods are being followed.
13. The NEC requires that all junction boxes be accessible, everywhere. Therefore, it is best to avoid locating j-boxes over hard, inaccessible ceilings, unless access doors are utilized. The mounting height of the j-boxes boxes should also allow access to them particularly above suspended acoustical panel ceilings. Best practice is to locate j-boxes in ceiling areas in spaces with no ceilings or with lay in ceilings.
14. The Construction Manager should review all miscellaneous powered items like overhead doors, door hold opens, security conduits, cameras, etc. so that coordination and conduit placement can occur, especially in masonry construction. Some doors will come with their own switches, but will need conduit from the switches to the motors.
15. The Construction Manager should verify the extent of labeling required in the Specifications. The Construction Manager should verify labeling format and nomenclature align with Authority maintenance standards and as-built documentation.

7.11.8. Power Systems and Distribution

7.11.8.1. Document Review

The Construction Manager shall review and become familiar with the Electrical and Mechanical Contract Documents and shall review the electrical shop drawings and/or submittals. The Owner's Maintenance Department shall also review/approve the shop drawings and submittals. Reviews should pay specific attention to the sealing of the penetrations of the electrical systems at rated construction. The Construction Manager should reference the NEC-National Electrical Code, FPA-30 and 30A. The Construction Manager shall verify penetration sealing/firestopping is coordinated across trades and that responsibilities are clearly assigned to avoid gaps in rated construction.

7.11.8.2. Pre-Construction

A pre-construction conference for electrical work is recommended with the following as part of the agenda:

1. The Construction Manager shall hold a pre-construction conference following the requirements of Section 3.1.2 of this Manual.
2. Additional potential pre-construction conference agenda items specific to Power Systems and Distribution scope can include:
 - Power, grounding and distribution
 - Lighting
 - Emergency power and lighting
 - Miscellaneous power requirements
 - Data, voice and security systems
 - Coordination with other systems
 - Location of electrical work above ceilings

The Construction Manager shall require an approved coordination drawing set and establish inspection hold points prior to ceiling closure and prior to energization of major equipment.

7.11.8.3. **Construction**

1. Refer to Section 7.4 for below grade/below slab work related to this system.
2. Overhead service entrances from power poles must have drip loops before cables enter the “mast head”. Mast heads/conduits have location restrictions on exterior walls near wall openings.
3. Wet transformers inside of a building require more ventilation for heat removal and is a critical issue for all transformers, but dry transformers run cooler than oil/liquid filled transformers. Sufficient clear space around transformers is required per NEC and the manufacturer’s instructions. Liquid filled transformers will likely have numerous specification requirements that need to be checked. The Construction Manager’s staff should check to see that liquid filled transformers are properly filled with the correct coolant in the field. Grounding of all transformers needs to be inspected to NEC requirements. (Note: transformer rooms may require two separate exit doors that swing out and have panic hardware.) The Construction Manager’s staff should verify room ventilation, spill containment (where required), signage, access control, and required clearances are provided and maintained.
4. Transformers and building switchgear may be located in an exterior location. All outdoor equipment, lighting, etc., must be labeled as tested for exterior use. Exterior building switchgear should be installed on a level pad, usually near the building transformer. These exterior locations are unsightly and take up exterior space, but inherently have less noise and cooling issues than interior located transformers. The Construction Manager’s staff should inspect that transformer housings and neutrals of the primary and secondary winding are grounded to the grounding system per the NEC. Transformer bushings need to be defect free as well as dirt and moisture

free. The Construction Manager's staff should verify the transformer labeling information with the Specifications. The Construction Manager's staff should verify exterior equipment is protected from vehicle impact where applicable and that corrosion protection measures are provided.

5. The Construction Manager's staff should verify UL or other testing lab labeling of power and lighting panels on the exterior of the panel cabinets. Look for neat and organized wiring to the breakers in these cabinets.
6. All panels should be identified with a label indicating the panel number that matches the panel ID shown on drawings or schedules.
7. The design electrical engineer should inspect the service entrance, transformers and switchgear or switchboards for compliance to the Contract Documents. The Construction Manager shall track and close out all design electrical engineer inspection comments.

7.11.9. Equipment Clearances, Leveling, Attachment and Adjustment

1. Most electrical equipment like panels, motor controllers, transformers and building switchgear require a safety area of 3-feet or more in front of doors for servicing. Other access clearances may be required at the side and back of equipment as per the manufacturer's installation instructions. This distance can approach 10-feet in front of the doors of building switchgear and building transformers for service by workers with wood pole tools. Furthermore, clearance requirements shall adhere to the NEC & OSHA requirements. The Construction Manager shall verify that required clearances are maintained and not compromised by storage, piping, ducts, or architectural elements.
2. Equipment anchor bolts and floor plates must be in the proper location as per the shop drawings. The Construction Manager's staff should verify all removable cover panels are installed on equipment before final acceptance.
3. The Construction Manager's staff should verify that the ground bus connection is installed in the proper location per the Contract Documents and shop drawings.
4. The Construction Manager's staff should verify switch gear is plumb and level and that any shipping blocking has been removed from the gears and relays.
5. The Construction Manager's staff should verify adjustments are made to taps and plug settings per manufacturer's installation instructions and the Contract Documents. The Construction Manager's staff should also verify fuses are in place and are the specified type and check the voltage of electrical current interrupting capacity or current limiter. The Construction Manager's staff should require documentation of final settings and as-left conditions for Authority maintenance records.

7.11.10. Switchgear, Switchboards, Panelboards

1. The term switchgear, used in association with the electric power system, refers to the combination of electrical disconnects, fuses and/or circuit breakers used to

isolate electrical equipment. Switchgear is used both to de-energize equipment to allow work to be done and to clear faults downstream. Rear access and access clearance is likely to be necessary to install certain breakers in switchgear. The Construction Manager's staff should verify required working clearances, rear access needs, and equipment access paths are maintained throughout construction and not compromised by piping, ductwork, architectural elements, storage, or temporary installations, and that clearances comply with NEC and OSHA requirements. The Construction Manager's staff should verify arc-flash and shock hazard labels are provided where required and that equipment rooms are not used for storage.

2. A switchboard is a device that directs electricity from one source to another. Switchgear and individual compartments' switchboards require rear access for terminating electrical lines and outgoing feeder cables. Group mounted switchgear are typically accessed only for incoming lines and feeder cables; thus switchboards 45-inches deep or less can normally be placed with their rear against a wall. These need to be cleaned before being energized. The Construction Manager's staff should verify that cleaning is performed immediately prior to energization, that all debris, dust, and moisture are removed from interiors of cabinets, and that cleaning activities are documented. The Construction Manager's staff should verify torqueing of terminations is performed in accordance with manufacturer requirements and that torque values are documented as part of closeout.
3. Main and subpanel boards should be cleaned and circuits labeled as a part of closeout. Subpanels collect multiple circuits and are fed from the main panel. Panel boards or electrical cabinets are segregated for power, lighting, and low voltage systems. These need access for servicing. The Construction Manager's staff should verify panel schedules match the Contract Documents and final as-built conditions, and that permanent labeling is legible, durable, and consistent with Authority maintenance conventions. The Construction Manager's staff should verify spare capacity and dedicated spaces comply with the Contract Documents and that directories are accurate after all field changes.
4. Electrical power, lighting and low voltage system subpanels all need to be grounded, with 3-foot of clearance in front of the panel doors. The Construction Manager's staff should verify grounding and bonding continuity is visually verified and, where required by the Contract Documents, tested and documented, and that the 3-foot clearance is maintained at substantial completion and not obstructed by equipment, shelving, piping, or furnishings.

7.11.11. **Motor Controller Units**

Motor controllers are devices or groups of devices that serve to govern in some predetermined manner the performance of an electric motor. A motor controller might incorporate manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, regulating the speed, or limiting the torque, and protecting against overloads and faults. These might be required for air handler motor fans or other motor driven devices and all will require 3-feet of clearance in front of access doors of the units. The Construction Manager's staff should verify that motor controller identification labeling matches the equipment served, that disconnecting means and lockout/tagout provisions are provided where required, and that access clearances are maintained and

coordinated with piping, ductwork, and architectural finishes. The Construction Manager's staff should verify startup and functional testing documentation is provided when required by the Contract Documents.

7.11.12. **Disconnect Switches**

These switches all need to be located per the NEC and tested for on/off function. Disconnect switches serve as the switch for the main electrical feed, panels and subpanels, and some equipment. The Construction Manager's staff should verify disconnect switches are readily accessible, properly labeled to identify the equipment served, and located in accordance with NEC requirements for sight and proximity where applicable, and that testing/verification is documented.

7.11.13. **Miscellaneous Power Installations**

Verify all miscellaneous equipment is powered as required with the proper power voltage and amp capacity. Items included, but not limited to, are: fans, fan powered boxes, low voltage equipment/transformers, door operators, parking controls, plaza equipment and booths, site lighting, powered restroom accessories, elevators and lifts, and special equipment. The Construction Manager's staff should verify circuit identification, load compatibility, and coordination with equipment cut sheets, and should verify GFCI and weatherproofing requirements are met where applicable. The Construction Manager's staff should confirm all miscellaneous powered items are included in commissioning/functional verification where required and that final labeling and as-built documentation reflects actual field conditions.

7.11.14. **Low Voltage Systems**

1. Low voltage systems include security, door motor controls, voice and data, toll system data, BMS controls, etc. The Construction Manager's staff should verify coordination requirements for these systems are included in coordination drawings and that device locations, pathways, and access requirements are coordinated with architectural finishes and furniture systems.
2. Most of the above systems need 120V or 220V power to their transformers and controllers. The Construction Manager's staff should verify dedicated circuits, power quality requirements, grounding/bonding, and surge protection requirements (where specified) are provided and documented.
3. The Construction Manager's staff should verify if low voltage cabling (usually 12 or 24) is not required to be in conduit from the system's main components to remote devices. The Construction Manager's staff should verify pathway requirements are clearly defined in the Contract Documents and that exposed cabling is installed neatly, protected from damage, and supported in compliance with the NEC and manufacturer requirements.
4. The Construction Manager's staff should verify if plenum rated cable is acceptable per the Contract Documents in lieu of cable inside conduit is allowed. The Construction Manager's staff should verify cable ratings, listing, and fire/smoke performance documentation is provided for installed cabling and that installation locations comply with Contract requirements and applicable codes.

7.11.15. Spare Breakers and Attic Stock

1. The Construction Manager's staff should verify that spare breaker blanks are in the panels per the Contract Documents. The Construction Manager's staff should verify spare spaces and spares are correctly sized, compatible with the installed panels, and labeled, and that any required spare capacity is maintained.
2. The Construction Manager's staff should verify that spare breakers and all electrical attic stock is delivered to the Owner. The Construction Manager's staff should verify attic stock quantities, part numbers, and storage locations are documented, and that attic stock is transferred with receipt acknowledgment as part of closeout.

7.11.16. Wiring Methods

The NEC is the code utilized for wiring method requirements. The Construction Manager's staff should confirm the governing code edition applicable to the Project and verify compliance with all Contract Document requirements that may exceed minimum NEC requirements.

1. The Construction Manager's staff should verify with the NEC the requirements and limitations for rigid and flexible conduit. The Construction Manager's staff should verify that flexible conduit lengths comply with code and that vibration isolation intent is met where equipment vibration could be transmitted.
2. The Construction Manager should review the Contract Documents for the service entrance raceways. The Construction Manager should verify routing, penetration sealing, and coordination with structural elements and building envelope requirements are addressed prior to installation.
3. The Construction Manager's staff should verify minimum conduit sizes based on conductor size and conductors per NEC tables for electrical, communications and other low voltage systems. The Construction Manager's staff should verify conduit fill, derating requirements, and heat dissipation considerations are addressed where applicable. Inspection should confirm conductor grouping and conduit sizing prevent overheating and meet NEC ampacity adjustment requirements.
4. The Construction Manager's staff should confirm NEC compliance for stub-ups and vertical conduit connectors at slabs. The Construction Manager's staff should verify stub-up locations are coordinated with equipment layouts, housekeeping pads, and sleeves prior to slab placement. Pre-pour inspections should verify conduit placement, clearances, and protection to prevent displacement during concrete placement. and sleeves prior to slab placement.
5. The Contractor should tape off conduit stub-ups and sleeves before pouring concrete. The Construction Manager's staff should verify stub-ups are protected from concrete infiltration and displacement during pours and that protection remains in place until conduits are ready for use. Inspection should confirm conduit ends remain sealed and free from debris prior to conductor installation.

6. The Construction Manager's staff should verify that distances between conduit supports comply with NEC requirements for the load being carried. The Construction Manager's staff should verify supports, inserts, anchors, and fasteners are appropriate for the substrate and environmental exposure, including corrosion resistance where required.
7. The Construction Manager's staff should confirm which conduits will be concealed and those that are concealed by other construction. The Construction Manager's staff should establish inspection hold points for concealed conduit prior to close-in and verify photographic documentation where appropriate.
8. The Construction Manager's staff should verify that the proper conduit fittings required, i.e. waterproof, cast and rain tight, concrete tight and expansion joints, are provided. The Construction Manager's staff should verify fittings are installed in locations appropriate to the exposure and that expansion fittings are provided where thermal movement or structural movement is anticipated.
9. The Construction Manager's staff should verify the minimum radii and maximum number of allowable bends in a single conduit. The Construction Manager's staff should verify pull points are provided where required and that conduit routing avoids excessive bends that could damage conductors during pulling. Inspection shall confirm that conduit runs remain accessible for maintenance and future cable replacement where required.
10. The Construction Manager's staff should verify locations where listed, plenum-rated and non-listed, non-plenum rated cable, both without conduit, are permitted and any limitations for each type. Cable entrance is allowed to be non-listed non-plenum rated when it terminates inside, within 50-feet, of the cable penetration of the envelope. The Construction Manager's staff should verify the transitions are clearly identified, and that penetrations are sealed and firestopped as required by the Contract Documents.
11. If required by the Contract Documents, Under-Floor Raceways; Presets and Aftersets should be installed parallel to the building grids without damage and have tight, sealed joints. The Construction Manager's staff should verify raceway layout is coordinated with furniture systems and final device locations, and that joints remain sealed to prevent moisture intrusion.
12. The Construction Manager's staff should verify that conduit field cuts are square, reamed and free of burrs and foreign matter. The Construction Manager's staff should verify conduit interiors are clean prior to wire pulling to reduce insulation damage and long-term reliability issues.
13. The Construction Manager's staff should confirm that sleeves are installed ahead of concrete foundation walls and slab pours. The Contractor should ensure all stub-ups are protected from concrete infiltration. The Construction Manager's staff should verify sleeve sizes, locations, and firestopping requirements are coordinated prior to pours and documented through pre-pour inspections.
14. Vertical conduit is to run plumb and horizontal conduit parallel to non-sloping floors. The Construction Manager's staff should verify conduit routing is neat and

organized and coordinated with architectural lines and ceiling grids where exposed.

15. The Construction Manager should confirm if galvanized pull wires are required per the Specifications. The Construction Manager should verify pull wire material, gauge, and continuity requirements are met where specified.
16. Corrosion resistant materials are required in spaces that will have corrosive materials. The Construction Manager's staff should verify corrosion exposure areas are identified and that conduits, supports, fittings, and fasteners are appropriate for the environment. Inspection should verify corrosion-resistant coatings or materials are installed where specified to extend system durability.
17. See the NEC for flex conduit requirements serving equipment, motors, lighting, etc. The Contractor should provide a conduit system that will not transmit vibration from equipment. The Construction Manager's staff should verify vibration isolation intent is met and that flexible connections are installed where required.
18. See the NEC and NFPA 30-A for numerous requirements concerning the containment or physical separation of the hazard from sparks occurring in potentially explosive areas or where hazardous materials are stored. The Construction Manager's staff should verify hazardous area classifications, boundary limits, and equipment ratings are consistent with the Contract Documents. Inspection should verify explosion-proof equipment and conduit fittings are installed where required for hazardous locations.
19. Pull wires should be provided by the Contractor with the specified wire material. The Construction Manager's staff should verify pull wires are installed in all conduits as required and remain intact at close-in. Inspection should confirm pull wires remain accessible and undamaged for future cable installation.
20. The Construction Manager's staff should confirm that each metal clad and non-metallic clad cable type is installed per the NEC requirements. The Construction Manager's staff should verify supports, protection from physical damage, and bend radius requirements are met.
21. See the NEC table which shows which types of conduits and cables are allowed for various service entrance wiring methods, including underground, wet/damp, embedded concrete or masonry, or in an exposed condition. The Construction Manager's staff should verify service entrance materials and installation methods match the Contract Documents and applicable NEC requirements. Inspection should confirm that grounding and bonding provisions are installed in accordance with NEC requirements for service entrance systems.
22. Total conduit bends of RMC (rigid metal conduit) shall not exceed 360 degrees between junction boxes or pull points. Other conduit materials have differing requirements and should be verified. The Construction Manager's staff should verify pull point placement and conduit routing meet the requirements for the specific conduit material used. Inspection shall verify that conduit runs remain accessible for maintenance and cable replacement where required by the Contract Documents.

7.11.17. Document Review

1. The Construction Manager should review the specific NEC requirements for all above grade distribution systems. The Construction Manager should verify any Authority standards and Specification requirements that exceed minimum NEC requirements are also incorporated.
2. The Construction Manager should review the detail requirements from the Contract Documents. The Construction Manager should verify details related to sleeves, penetrations, firestopping, supports, and coordination are addressed prior to rough-in.
3. The Construction Manager should verify if painting or coating of underground conduits or encasement is required. The Construction Manager should verify coating systems are applied per manufacturer requirements and inspected prior to backfill.
4. The Construction Manager should confirm the method and location of termination of conduit ends and grounding. The Construction Manager should verify grounding/bonding details are consistent with Contract Documents and applicable codes and are not omitted at terminations.
5. The Contractor should seal building ends of raceways entering from the distribution system. The Construction Manager's staff should verify sealing methods comply with the Contract Documents for fire, smoke, water, pest, and air barrier requirements where applicable.
6. The Construction Manager should verify the types of allowable conduits: Rigid Metal, Intermediate Metal, IMC, and/or Electrical Metallic Tubing (EMT). The Construction Manager should verify conduit types installed match permitted types for each location and exposure condition.
7. All conductors in a circuit should comply with the NEC for installation regulations, including the installation of neutral conductors in the same raceway. The Construction Manager's staff should verify neutrals and equipment grounding conductors are installed as required and that field modifications do not create code violations.
8. Underfloor Duct/Underfloor Raceway Systems:
 - a. These steel raceways mentioned above are installed with the floor concrete floor with junction boxes placed on top of the raceways making them fairly deep. The Construction Manager's staff should verify coordination of raceway depth with structural slab thickness and finished floor elevations.
 - b. Joints between sections are to be tight fitting to keep out water. This system requires the installation of end caps. The Construction Manager's staff should verify joints are sealed and end caps are installed to prevent water intrusion and debris accumulation.

- c. Preset and afterset inserts must be mechanically fastened to the raceway and leveled. The Construction Manager's staff should verify leveling and alignment prior to concrete placement and confirm inserts are protected during pours.
- d. Tap locations are usually made to cabinets, panels, and receptacles. The Construction Manager's staff should verify tap locations match the furniture/equipment layouts shown in the Contract Documents.
- e. Multiple services can be provided by Underfloor systems. The segregations of the services need to be consistent through all runs of the system. Each segment shall comply with the NEC for required sizes based on use. The Construction Manager's staff should verify segregation is maintained at all junction boxes and transitions.
- f. Underfloor ducts need to have grounding in all sections and connections throughout. The Construction Manager's staff should verify grounding continuity is maintained through all sections and documented where required.

7.11.18. **Plenum Rated Cable**

According to Article 800 of the NEC, plenum cables must comply with the Specifications for flammability and smoke density outlined in Underwriters Laboratories (UL) and National Fire Protection Association (NFPA) testing methods. This applies to any exposed cabling, including low voltage cabling located in spaces above a ceiling or below and access floor acting as a return air system. Plenum-rated cables are distinguished from other types of cabling by the special types of plastics used in their jackets. Because plenum cables are routed through air circulation spaces which contain very few fire barriers, they need to be coated in flame-retardant, low smoke materials such as polyvinyl chloride (PVC), fluorinated ethylene polymer (FEP), or a polyolefin. These plastics offer good resistance against fire, and in the event that they do begin to burn, they will not emit significant quantities of harmful fumes. (there are some jurisdictions that may not allow FEP due to toxicity concerns) The Construction Manager's staff should verify listed plenum cable markings are visible on installed cable where feasible, that cable routing is supported and protected from damage, and that penetrations through rated assemblies are firestopped per the Contract Documents.

Listed, plenum-rated cable is jacketed with a fire-retardant plastic jacket of either a low-smoke PVC or a FEP. Listed, plenum-rated cable in most cases does not require conduit and is permissible in vertical and horizontal air stream spaces, plenums and shafts, depending on the jurisdiction and cable used. The construction of plenum cables is regulated under standard NFPA 90A: Standard for the Installation of Air Conditioning and Ventilating Systems. All materials intended for use on wire and cables to be placed in plenum spaces should be designed to meet fire test standards in accordance with NFPA 262 and outlined in NFPA 90A. The Construction Manager's staff should verify acceptance of plenum cable without conduit is consistent with the Contract Documents and jurisdictional requirements and that any transitions to non-plenum cable comply with limitations described in the Contract Documents.

7.11.19. **Wireways**

Wireways are surface mounted conduits or metal troughs, used to protect wiring and cables. The NEC limits the number of conductors that can be installed. "Wiremold" is a common product used for this installation and is often cited in a generic fashion instead of "wireway". The Construction Manager's staff should verify conductor fill limits, support spacing, grounding/bonding continuity, and protection against physical damage, and confirm that wireways are installed straight, level, and neatly coordinated with architectural finishes.

7.11.20. **Busways**

1. Busways are conductors that serve as a connection for two or more electrical circuits and may be in the form of stranded conductors or cables, but most commonly rigid bars. The Construction Manager's staff should verify busway ratings and configurations match the Contract Documents and approved submittals.
2. Busways require NEC described supports, sway bracing, expansion joints, tight joint connections, plug-in features and top devices with the required accessibility. The Construction Manager's staff should verify supports and bracing match approved submittals and that required accessibility is maintained.
3. Lugs, clamps, supports, expansion, plug ins, accessible seismic and expansion joints are types of attaching systems that move freely and have good contact with differing conductor types, such as copper and aluminum. The Construction Manager's staff should verify tightening/torque requirements are met and documented and that dissimilar metal connections are protected per manufacturer requirements.
4. Cable trays are restricted to only certain types of cables and the loads on supports are limited. The Construction Manager's staff should verify allowable cable types, fill, support spacing, and loading limits are not exceeded.
5. Conductor Sizing, Conductor Colors and Neutrals

Check a sampling of the stranded or conductor sizes on circuits in conduits. The Construction Manager's staff should verify conductor sizing includes consideration of voltage drop requirements where specified and that conductor insulation ratings are appropriate for the installation.

The Construction Manager's staff should confirm the following in the field if this concurs with the Contract Documents:

The Construction Manager's staff should verify field conditions match the Contract Documents and that deviations are documented and resolved through the RFI/submittal process.

1. Only white or neutral grey can be used for grounding the circuit breaker. The Construction Manager's staff should verify color coding and labeling are consistent and not altered in the field without approval.

2. Generally, white is used as the ground circuit, except for NEC exceptions. The Construction Manager's staff should verify any NEC exceptions applied are compliant and documented.
3. Examine each type of insulation and jacket, conductor material, and stranding, if appropriate. See if proper bending of conduit turns is being used. The Construction Manager's staff should verify bend radius requirements and pulling methods do not damage conductors.
4. Check that circuits are not undersized. The Specifications may require upsizing when runs from panel boards to center of load equal 100-feet for 120V circuits or 230-feet. for 277V circuits The Construction Manager's staff should verify compliance with any upsizing and voltage drop requirements and document verification.
5. White should be used throughout the entire systems of grounded connectors The Construction Manager's staff should verify consistency across the entire system and at all terminations.
6. When a grounding conductor is used for equipment that is run with circuit conductors, it shall be bare, or green covered; check the Specifications. The Construction Manager's staff should verify grounding conductors are continuous and terminated properly.
7. Observe ends of conduits for burrs and debris. Check for use of approved conduction/conduit lubricant. The Construction Manager's staff should verify lubricant used is approved and does not degrade conductor insulation.
8. Color coding of conductors of branch circuits should be enforced when required by the Specifications. The Construction Manager's staff should verify field marking is durable and legible.
9. Unless prescribed otherwise, the following colors should be used:
 - a) Black = Hot
 - b) Red = Second hot wire when it is for a 120V circuit
 - c) White = Neutral (NEC does allow white to be hot if restrictions are applied)
 - d) Green or Bare = grounding wire
10. Access flooring plenum is not permitted to accommodate both electrical and HVAC systems. The Construction Manager's staff should verify pathways and segregation are maintained and conflicts are resolved prior to close-in.
11. Switches need to be accessible. Mount per the height specified and ANSI A117.1-2003. The Construction Manager's staff should verify ADA-related mounting heights and accessibility clearances are maintained at substantial completion.
12. Power junction and low voltage boxes are located in coordination with the Owner provided open office cubicles as shown in the Contract Documents. The Construction Manager's staff should verify coordination with actual furniture layouts and field conditions prior to rough-in.

13. Final hook up of the cubicles will be by the furnishings installer. The Construction Manager's staff should verify responsibilities and coordination requirements are clearly defined to avoid gaps in scope and schedule impacts.
14. Exterior power is shown in the Contract Documents. The Construction Manager's staff should verify weatherproofing, GFCI protection, and labeling requirements are met where applicable.
15. Confirm with the Contract Documents that dimming switches or if applicable, the type of dimming system that is to be installed as well as on/off occupant sensors. The Construction Manager's staff should verify commissioning/functional testing requirements for dimming and occupancy controls are completed and documented prior to acceptance.

7.11.21. **Devices – Receptacles, Boxes and Outlets**

1. The Construction Manager's staff should verify device and device cover color provided is the color is specified. The Construction Manager's staff should verify device types, ratings, and finishes match the Contract Documents and approved submittals.
2. Receptacles may be required to be cast boxes in outdoor, wet, damp or horizontal locations. They may require covers as well. The Construction Manager's staff should verify covers are the correct type (including in-use covers where required) and installed properly.
3. Hub box cast boxes shall be provided when specified. The Construction Manager's staff should verify cast box types and gaskets are appropriate for exposure conditions.
4. All concealed junction boxes must have access, even if they only have plain covers. All junction boxes should have blank covers if no devices are installed on them. The Construction Manager's staff should confirm where access door locations are needed if not shown in the Contract Documents. The Construction Manager's staff should verify access panels are sized and located to maintain code-required access and are reflected in as-built drawings.
5. The Construction Manager's staff should check pull box and junction box size and do not allow overcrowding of boxes with excessive conductors. The Construction Manager's staff should verify conductor fill complies with NEC and that boxes are not used as unauthorized pull points.
6. The Construction Manager's staff should review special equipment outlets are roughed in, if shown on drawings. The Construction Manager's staff should verify special outlets are correctly located, labeled, and coordinated with equipment cut sheets.
7. The Construction Manager's staff should verify location of floor outlets with the designer if dimensions are not given. The Construction Manager's staff should

verify floor outlet locations are coordinated with furniture plans and field conditions prior to core drilling or rough-in.

8. Junction, switch and receptacle boxes need to be secure, not relying on conduit to hold them in place. The Construction Manager's staff should verify proper fastening and alignment prior to device installation and final finishes.
9. The Construction Manager's staff should verify wall power receptacles, telecom receptacles and equipment receptacles are located at a consistent minimum center line height of 18-inches above the finished floor. The Construction Manager's staff should verify heights are maintained after finish installation and not compromised by base, wainscot, or casework.
10. Light fixtures are normally placed to give the most light at the desired location on utility and mechanical/electrical/data-telecom rooms. The Construction Manager should coordinate wall switch locations with door swings, equipment locations and equipment control locations. The Construction Manager should verify coordination is reflected on coordination drawings and that final locations support safe access and operations.
11. Ground fault receptacles should be installed in restroom, exterior locations, unfinished basements and tunnels, kitchens and wet areas per the Contract Drawings and the NEC. The Construction Manager's staff should verify GFCI protection is tested and documented.
12. Do not place receptacles or other boxes in the same stud space. Install putty like box wraps around junction boxes to reduce noise coming thorough acoustical walls. The Construction Manager's staff should verify acoustical assemblies maintain rating integrity and that box wraps are installed as required.
13. The Construction Manager's staff should verify inspection by a code authority is executed before covering boxes. The Construction Manager's staff should document inspections and approvals and prevent concealment until inspections are complete where required.
14. The Construction Manager's staff should verify grounding continuity is attained and maintained. The Construction Manager's staff should verify bonding jumpers and grounding conductors are installed and not omitted at devices and boxes.
15. Junction boxes shall not provide ceiling support for ceiling fans. The Construction Manager's staff should verify fan-rated boxes and supports are provided where required.
16. Walls wider than 2-feet require receptacles; every 6-feet around inside of exterior walls, every 10-feet in corridors. The Construction Manager's staff should verify spacing and locations comply with the Contract Documents and applicable codes.
17. Wall switches must be of proper amp and voltage rating. Markings should say "AC Only" or "AC". Marking "DC Only" or "DC" is for Direct Current. Do not mix AC and DC into a switch box. Switches must have the toggle up as the on position and switch boxes shall be in the hot leg of the circuit, not the neutral. The Construction

Manager's staff should verify device ratings and proper wiring methods are followed and that labeling is not covered by paint or finishes.

18. Thermostat boxes should not be placed in direct sunlight. They should be set at a height that does not interfere with office systems, furniture, or partitions. The Construction Manager's staff should verify thermostat locations are coordinated with furniture layouts and HVAC design intent.
19. Wall boxes for horn/strobe lights are 88-inches (or more when light level is calculated). The Construction Manager's staff should verify mounting heights comply with the Contract Documents and applicable code requirements.
20. Allow 6-inches of loose conductors within electrical boxes to install devices. The Construction Manager's staff should verify conductor lengths are adequate and terminations are neat and not damaged.
21. See ANSI A117.1-2003 and drawings to locate signal and enunciation controls at elevator lobbies. The Construction Manager's staff should verify accessibility and mounting requirements are met.
22. See electrical and architectural drawings for power junction boxes for items such as: overhead door motor and switches, dock lights, dock leveler, compactor heater, scissor lifts, motorized blinds, power for security equipment and security devices like security entrance locks, cameras as well as and head ends, radios and other systems.

On many systems like powered overhead doors, the switch is by the manufacturer for the electrician to install. Switches may be low voltage systems, especially at door controls, with open or closed status. The Construction Manager's staff should verify coordination and conduit placement occurs prior to masonry closure and that manufacturer-provided switches are properly integrated and tested.
23. The Construction Manager's staff should verify code allowable partition opening sizes and spacing in rated partitions and ceilings with the electrical or building code authority or the code itself. The Construction Manager's staff should verify rated assembly integrity is maintained and that any penetrations are properly firestopped.
24. Identification for Electrical Systems. The Construction Manager's staff should verify identification requirements are clearly defined and implemented for all systems.
25. See the Specifications for multiple types of marking/identification requirements for power, lighting, low voltage systems, etc. Panel and breaker identification must be permanently marked. Lettering sizes are also Specification driven. The Construction Manager's staff should verify identification is durable, legible, and consistent with Authority maintenance needs.
26. Identification for Electrical Systems Specification may include compliance with appropriate quality standards or ANSI, NFPA, and UL and CFR. The Construction

Manager's staff should verify the specified standards are met and documentation is included in closeout.

27. Types of identification may include color coding, letter sizes, type of materials required or allowed, write on types, for conductors, marker tags, tape, warning signs and instruction signs. The Construction Manager's staff should verify materials are compatible with the environment and will not peel or fade prematurely.
28. Do not cover any information or labels related to UL, NFPA, NEC, etc. applied to equipment at the factory. All surfaces to receive identification materials, including equipment must only be attached to clean and dry surfaces per the manufacturer's instructions. The Construction Manager's staff should verify surfaces are properly prepared and that identification does not compromise equipment listings or safety markings.
29. The Construction Manager's staff should identify any hazardous work areas with warning labels. The Construction Manager's staff should verify warnings remain in place and are coordinated with site safety plans.

7.11.22. **Lightning Protection**

The standard for lightning protection systems is NFPA 78 (see Section 13-9 for below ground portions of the system).

A typical lightning protection system consists of lightning aerials or air terminals approximately 18-inches high, designed to attract lightning, allowing the electrical charge to be directed to grounding rods in the earth via roof conductors.

Typical grounding rods are 10-feet or greater in length driven so the top is about 6-inches below grade, outside of sidewalks, pavement, etc., $\frac{3}{4}$ -inch diameter, 3 to 8-feet beyond the building perimeter at two points on opposite ends of a below grade electrode subsystem. The loop is to be placed 2-feet below grade. If a second loop is required, it should be set 10-feet beyond the first loop. Nearby towers may affect design. The Construction Manager's staff should verify grounding electrode layout, separation distances, and corrosion considerations are coordinated with underground utilities and structures.

1. Air Terminals and Roof Attachment

- Air terminals are placed at a spacing determined by NFPA 78 or as shown on the shop drawings.
- Terminals should be attached in accordance with the roofing manufacturer's details. The Construction Manager's staff should verify roof penetrations and attachments do not compromise roofing warranties and that flashing/sealing details are installed per manufacturer requirements.

2. Conductor Cable

- Conductors should be fastened to the roof in accordance with the roofing manufacturer's details.
- Conductors shall horizontally connect air terminals and vertically to the grounding rods/earth electrode subsystem. The Construction Manager's staff should verify conductor routing is protected from physical damage and that connections are secure and accessible for inspection where required.

3. Grounding Rods and Earth Electrode Subsystem

- See NFPA 78 Section 13-3 for below grade work.
- Installation should match the shop drawings submittal and comply with NFPA-78. The Construction Manager's staff should verify testing documentation is provided where required and that as-built locations of grounding components are recorded.

7.11.22.1. **Document Review**

If a lightning protection system is specified for the Project, the Contract Documents and engineered, sealed shop drawings shall be reviewed. The lightning system provider is usually the designer of the system. The designer must provide a registered professional, engineered seal as the designer on the shop drawings. Also refer to NFPA-78. The Construction Manager should verify that the sealed design addresses site-specific risk factors and that coordination with other roof systems and penetrations is documented.

7.11.22.2. **Submittals**

Submittals include system design shop drawings with the designer's seal, system plan of roof and elevations of vertical conductors, cut sheets of products and attachment details.

Authority buildings, in particular toll plazas, require UL Label certification at completion of the lightning protection system. The Construction Manager's staff should verify the UL Label certification process requirements are understood early, scheduled, and documented in closeout.

7.11.22.3. **Pre-Construction**

The lightning protection system needs coordination to avoid conflicts with the work of other trades, particularly utilities and structures below grade. The Construction Manager shall require coordination drawings and a utility conflict review prior to installation of below grade components.

7.11.22.4. **Construction**

Installation should match the shop drawing submittal and comply with NFPA-78. Installation of the system in highly corrosive soils should be avoided. The Construction Manager's staff should verify corrosion-resistant materials are used where required and that soil conditions are evaluated if corrosivity is suspected.

7.11.23. **Emergency Generators and ATS/UPS Systems**

7.11.23.1. **Document Review**

If this system is provided in the Contract Documents, the Construction Manager shall review the Contract Documents and NEC and NFPA-110. Review the Specifications and electrical construction drawings for systems that are to be served by these emergency power systems, if they require emergency power from a system other than batteries. The Construction Manager should verify load calculations, fuel storage/containment requirements, ventilation/exhaust routing, and integration with fire alarm and controls systems are addressed and coordinated prior to procurement.

7.11.23.2. **Submittals**

The Construction Manager's staff should review shop drawings and product cut sheets. The Construction Manager's staff should verify submittals include dimensions/weights, access/maintenance clearances, anchorage and vibration isolation details, exhaust and louvers, fuel system details, electrical one-lines, and commissioning/testing requirements.

7.11.23.3. **Pre-Construction**

1. The Construction Manager shall hold a pre-construction conference following the requirements of Section 3.1.2 of this Manual.
2. The Contractor shall schedule a pre-construction conference upon receiving notice to proceed. The meeting should be attended by:
 - General Contractor staff consisting as a minimum of: Project Manager, Project Engineer, field superintendent, Quality Control manager, Safety manager
 - Subcontractors staff consisting as a minimum of: Respective Project Managers and foremen and the Mechanical and Electrical Contractors.
 - Owner's Representatives staff consisting as a minimum of: Construction Manager, Project Manager/Contracting Officer, Architect/Engineer of Record
3. Additional potential pre-construction conference agenda items specific to Emergency Generators scope can include:
 - Project Directory including rolls and responsibilities
 - Review status of required submittals

- Review of sequencing and coordination with other trades
- Review systems of this emergency power system, overall calculated load, physical dimensions required for transport and installation, louver size, exhaust system location, ATS system, UPS system, fuel and spill containment, fuel capacity, tank location and testing.
- Review exterior modular generator units as they are most frequently delivered with a container-like weatherproof painted steel housing. These will likely require a concrete pad to anchor the unit to as well as door stoop.
- Review options that are to be provided on the system that may be unusual.

The Construction Manager shall require documented meeting minutes, action items, and inspection hold points, including coordination of deliveries, crane picks, pad/anchorage verification, and enclosure/weatherproofing requirements.

7.11.23.4. **Construction**

1. The construction of these systems is governed by NFPA-110 and the NEC. Louvers should have backdraft dampers and the louver perimeter should be sealed to the air barrier if the system is installed within the building. The Construction Manager's staff should verify sealing continuity, damper operation, and that louvers and penetrations do not compromise rated construction where applicable.
2. At interior locations, the inner walls become exterior walls and possibly subjected to all the environmental forces and conditions of a normal exterior wall, except that it is subject to noise. The Construction Manager should review this wall construction. The Construction Manager should verify acoustic treatment, fire rating requirements, and air/vapor barrier continuity are addressed.
3. The Construction Manager's staff should verify if a thrust or anti-vibration block is necessary below the generator to reduce vibration. The Construction Manager's staff should verify vibration isolation matches approved submittals and manufacturer requirements.
4. The Construction Manager's staff should check the performance of the gen set engine by listening for smoothness or knocking, and check the oil level and oil pressure. The Construction Manager's staff should also verify the required load specified can be generated, check the speed and smoothness of the ATS and verify vertical exhaust pipe discharges have an exterior automatic gravity weather exhaust protection damper. The Construction Manager's staff should verify load bank testing requirements (where applicable) and document test results, alarms, and as-left settings.

5. The Construction Manager's staff should verify there is sufficient airflow for engine cooling and the backdraft dampers functions properly. The Construction Manager's staff should verify airflow pathways are unobstructed and that damper operation is tested.
6. The Construction Manager's staff should check that the engine is not leaking coolant or lubricant. The Construction Manager's staff should verify spill containment provisions are in place where required.
7. The Construction Manager's staff should verify the engine fan, belts and alternator as well as the starter motor and battery work properly. The Construction Manager's staff should verify battery charger operation and alarm indications.
8. The Construction Manager's staff should check voltage ratings of all key components, including battery and charger as well as the starting motor. The Construction Manager's staff should verify ratings match submittals and Contract Documents.
9. The Construction Manager's staff should confirm that ventilation is sufficient and dampers work as designed to cool the engine. The Construction Manager's staff should verify ventilation controls and interlocks function as intended.
10. The Construction Manager's staff should check the ATS operation, governor and cranking cycle. The Construction Manager's staff should verify automatic transfer sequences are tested under realistic conditions as required by NFPA-110.
11. The Construction Manager's staff should check the ATS, ATS lab report, function and settings. The Construction Manager's staff should verify settings are documented and provided to the Owner as part of closeout.
12. The Construction Manager's staff should verify recycling does not occur on emergency shutdown. The Construction Manager's staff should verify shutdown logic and alarms are tested and documented.
13. The Construction Manager's staff should verify all manufacturers' field tests and any NFPA-110 tests are completed successfully. The Construction Manager's staff should verify complete test reports are delivered, including witness signatures where required.
14. The Construction Manager's staff should verify the container enclosure, if provided, is waterproof and doors are sealed to the frame. The Construction Manager's staff should verify door hardware, gasketing, and corrosion protection are suitable for the environment.
15. The Construction Manager's staff should verify the remote annunciator panel is functioning and if a remote notification is sent to Operations, that it is tested. The Construction Manager's staff should verify Operations

training is provided and that remote notification pathways are tested end-to-end and documented.

7.11.24. **Light Fixtures**

7.11.24.1. **Document Review**

1. The Construction Manager's staff should review the electrical drawings, Specifications, and architectural reflected ceiling plans.
2. The Construction Manager's staff should review the control system, if any, in addition to local switching. The Construction Manager's staff should verify fixture types, mounting details, and control intent align with photometric intent and Contract requirements.

7.11.24.2. **Submittals**

1. The Construction Manager's staff should verify lighting fixture submittal reviews are completed by the designer.
2. The Construction Manager's staff should verify if all fixtures are of the appropriate construction for their use, i.e., NEMA (National Electrical Manufacturers Association) normally provides these use types with the fixture cut sheets.
3. The Construction Manager's staff should verify the lighting designer has reviewed the fixture submittal and that the fixtures will properly fit the ceiling grid, especially for narrow and recessed channel grid systems. The Construction Manager's staff should verify emergency/egress lighting and exit sign requirements are addressed in submittals where applicable.

7.11.24.3. **Pre-Construction**

1. Coordination of the placement of lighting fixtures with work of other trades is needed, including verifying light fixture placement with the reflected ceiling plans. Fixtures must not conflict with speakers, diffusers, sprinkler heads, sound masking speakers, etc.
2. The Construction Manager should verify that all fixtures clear structure, ductwork, sprinkler lines and conduits.
3. The Construction Manager's staff should confirm that all fixtures will fit in the vertical plenum space provided with ductwork, structural and sprinkler systems. Lay-in fixtures need at least 2-inches from the bottom of the ceiling grid so they can be lifted over the top of the grid. These typical lay-in fixtures are approximately 6-inches high on average.
4. Fixtures must not allow air leakage at the air barrier locations of the building envelope, unless they are air-tight and insulated. The Construction Manager's staff should verify if fixtures supplied for recessed exterior installation are rated for building insulation to be placed against the fixture.

This also applies to fixtures penetrating insulated attics. The cut sheets for these fixtures should show if the fixtures can be in contact with building insulation.

5. The Construction Manager's staff should review exterior signage lighting, pole and wall or soffit mounted exterior lighting, building entrances/exits, site bollard lighting, etc.
6. The Construction Manager's staff should verify the location of any exit signs requiring pendant mounting on an extension rod and that clear exit signs require contrasting backgrounds for better visibility.
7. The Construction Manager's staff should verify the ballast provided meets UL requirements and the Specifications or lighting schedules.
8. The Construction Manager's staff should verify voltage of each lighting system in the building.
9. The Construction Manager's staff should verify Controls, Photocells, Timers, and Blinds Interface, if specified, for control of artificial and natural light.
10. The Construction Manager should discuss the lighting controls system and any relationship with the BMS controls system. Verify if any of the above is to be provided. The Construction Manager should require a coordinated reflected ceiling plan (RCP) and above-ceiling coordination confirmation prior to installation, and should verify commissioning/functional testing of lighting controls including time schedules, occupancy sensors, photocells, and integration points (if any) prior to acceptance.

7.11.24.4. **Construction**

1. The Construction Manager's staff should reject fixtures with bad ballasts until a new working ballast can be installed.

The Construction Manager's staff shall document all rejected fixtures in writing, notify the Contractor immediately, and verify that replacement ballasts or drivers comply with the Specifications, approved submittals, manufacturer installation instructions, UL listing requirements, and applicable NEC provisions prior to acceptance. Where LED drivers are used instead of ballasts, the same inspection and rejection requirements shall apply.

2. The Construction Manager's staff should verify an attic stock of fixtures, lamps and ballasts are delivered to the Owner.

The Construction Manager's staff shall verify attic stock quantities are consistent with the Contract Documents and approved submittals, confirm packaging and labeling are intact, and obtain written acknowledgment from the Owner documenting receipt. Spare components shall be stored in a secure, dry, temperature-controlled environment until turnover.

3. The Construction Manager's staff should inspect fixtures for damage, dents, broken glass or light diffusers.

Any damaged fixtures shall be rejected and replaced. The Construction Manager shall verify that protective coverings remain in place until final cleaning and that lenses, trims, housings, and finishes are free of scratches, discoloration, or defects prior to acceptance.

4. The Construction Manager's staff should inspect randomly chosen fixtures for type of ballast, UL labels, overall finish, and fit within ceiling grids, ease of lamp removal, lamp type and temperature (color) characteristics. The Construction Manager's staff shall verify compliance with specified voltage, lumen output, correlated color temperature (CCT), color rendering index (CRI), dimming capability, driver type, short circuit protection rating, and compatibility with lighting control systems as indicated in the Contract Documents.
5. The Construction Manager's staff should verify the performance of emergency fixtures and exit signs, if provided. Emergency lighting systems shall be tested for proper transfer to emergency power, battery duration (minimum 90 minutes unless otherwise specified), illumination levels, and visibility in accordance with the Contract Documents, NFPA 101, and NEC requirements. All testing results shall be documented.
6. Refer to the Section 7.13.3 for the Commissioning Section and the Commissioning Specification in Exhibit 7 - 3 for a description of responsibilities during the design phase, construction phase and occupancy phase of the Project.

The Construction Manager shall coordinate lighting commissioning activities with the Commissioning Agent and ensure all deficiencies identified during pre-functional and functional testing are corrected prior to substantial completion.

7.12. FIRE DETECTION AND EXTINGUISHERS

A fire alarm system consists of several devices working together to detect and warn people through visual and audio appliances when smoke, fire, carbon monoxide or other emergencies are present. These alarms may be activated automatically from smoke and heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pull stations. Alarms can be either motorized bells or wall mountable sounders or horns. They can also be speaker strobes which sound an alarm, followed by a voice evacuation message which warns people inside the building not to use the elevators. The Construction Manager must be familiar with all aspects and components of the fire detection and extinguishing systems.

The Construction Manager shall ensure that all fire detection and extinguishing systems are installed, tested, and commissioned in strict accordance with the Contract Documents, NFPA standards, the latest adopted Uniform Construction Code – N.J.A.C. 5:23, and the requirements of the Authority Having Jurisdiction (AHJ).

7.12.1. Fire Detection and Annunciation

7.12.1.1. Document Review

The Construction Manager shall review the location of fire panels as they are often dictated by the fire official, but are normally required to be installed in the main entrance vestibule or lobby so it is easily found by the fire department in an emergency. Secondary panels may be required in certain rare instances.

The Construction Manager shall verify required clear working space, environmental protection, accessibility, illumination, signage, and security for fire alarm control panels in accordance with NFPA 72, NEC Article 110, and the Contract Documents.

7.12.1.2. Submittals

The Construction Manager shall review all portions of the Fire Detection and Annunciation systems as they tend to be complex. The sealed shop drawings and calculations become the construction documents once they are approved by fire officials. The design should be based on the specified and standards requirements as indicated in the Contract Documents. The architect's designer for this system should only have reviewed these documents for compliance with the design intent.

The Construction Manager shall verify that submittals include battery calculations, voltage drop calculations, device address lists, wiring diagrams, riser diagrams, integration details with HVAC, BMS, elevators, access control systems, and required certifications prior to installation.

7.12.1.3. Pre-Construction

1. The Construction Manager shall hold a pre-construction conference following the requirements of Section 3.1.2 of this Manual.

Meeting minutes shall document roles, sequencing, outage procedures, system integration requirements, testing procedures, and coordination with the AHJ.

2. The Contractor shall schedule a pre-construction conference upon receiving notice to proceed. The meeting should be attended by:
 - General Contractor staff consisting as a minimum of: Project Manager, Project Engineer, field superintendent, Quality Control manager, Safety manager
 - Subcontractors staff consisting as a minimum of: Respective Project Managers and foremen
 - Owner's Representatives staff consisting as a minimum of: Construction Manager, Project Manager/Contracting Officer, Architect/Engineer of Record.

Attendance shall be documented and responsibilities clearly defined in meeting minutes.

3. Additional potential pre-construction conference agenda items specific to Plumbing/Distribution scope can include:

- Project Directory including rolls and responsibilities
- Review status of required submittals
- Review of sequencing and coordination with other trades
- Detection and annunciation devices include heat detectors, smoke detectors, fire detectors and combination smoke/fire detectors (plus special versions for these detectors that are placed in ducts), fire alarm pulls, visual and audio annunciators, as well as combination visual and audio annunciation devices.
- Discuss how existing and new fire alarm systems are to be integrated if that is the plan for serving new additions to existing buildings.
- Other components that may be connected to the fire alarm system, such as door hold-open devices.
- Shutting down a facility while it is occupied to tie into an existing facility's alarm system is not likely approved by the fire official, unless a written plan is provided indicating the time required for integration and stating that this tie-in will occur during off-hours work with minimum staff occupancy. The Construction Manager should verify if the Contract Documents address this.
- A new fire alarm system might be allowed to function independently in an addition if allowed by the fire official and the standards, but this is unusual.

The Construction Manager shall verify written notification procedures, temporary fire watch requirements (if applicable), and coordination with the local fire department prior to any shutdown or tie-in activities.

7.12.1.4. Construction

1. The Construction Manager's staff should verify all devices are tested and function properly. Record all tests, failures, passed tests and status for all devices.

Testing documentation shall include date, time, device identification, test method, deficiencies, corrective actions, and signatures of responsible parties.

2. Prior to testing, the Construction Manager should warn building occupants and confirm that other subordinate functions are bypassed from the alarm system, if not part of the test. The Construction Manager should inform and

coordinate the testing with the local fire department, if required, or as a courtesy.

Written notification shall be issued prior to testing and coordination with the fire department shall be documented when required by the Contract Documents or AHJ.

3. The Construction Manager's staff should verify these devices are installed at the locations and heights as indicated by the Contract Documents and NFPA. Strobes have specific height requirements for normal height spaces. Spaces that are larger with higher ceilings will require strobe placement per a specific formula/calculation.

The Construction Manager shall verify mounting heights, candela ratings, spacing calculations, and coverage areas comply with NFPA 72 and the Contract Documents.

4. Pull stations are usually located near exits.

The Construction Manager shall verify mounting height, accessibility clearances, and visibility comply with ANSI A117.1-2003 and applicable Barrier-Free Subcode requirements.

5. Devices have mounting restrictions for accessibility by the handicapped community. These are indicated in ANSI A117.1-2003.

Compliance with accessibility requirements shall be verified and documented.

6. Alarm panel requirements are specified in NFPA 13.

The Construction Manager shall verify panel installation, grounding, labeling, battery backup, and environmental conditions comply with applicable NFPA standards and the Contract Documents.

7. Detection systems inform the fire panel excessive heat, fire and smoke. Unless voice annunciation is required, automatic annunciation will be activated for vacating the building. The fire panel may be programmed to communicate with the BMS to close dampers, shut off HVAC systems or fans, start exhaust systems, etc. The control of these fire functions may also be manual, at the fire alarm control panel. This is primarily the inspection responsibility of the alarm/suppression designer and installer. The function of these components should be part of the testing of the system. The design intent should be clear in the Contract Documents.

The Construction Manager shall witness integrated system testing to verify proper interface between the fire alarm system and HVAC, BMS, elevators, smoke control systems, door hold devices, and other connected systems as required by the Contract Documents and NFPA 72.

8. The alarm annunciator systems are required to incorporate visual alarms with the audio alarms. The lumen and decibel output is tested for compliance with the Contract Documents.

Measured sound pressure levels and visual intensity shall be documented and verified for compliance with NFPA requirements.

9. The Construction Manager and the Construction Manager's staff should also reference the Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems – NFPA-3. Most fire annunciation systems visible to the public are finished in either white or red colors. The Construction Manager's staff should check the specified color in the Contract Documents and submittals.

Finish color, labeling, and tamper resistance shall be verified for compliance with the Specifications.

10. The Construction Manager's staff should verify panels and other equipment have quality testing/certification information on each piece of equipment. Certification labels shall be photographed and maintained in the project records.

11. The Construction Manager's staff should confirm all visual and audible alarms are clearly visible from all areas and per code of the Authority Having Jurisdiction.

Field verification shall include walkthrough confirmation under representative conditions.

12. The Construction Manager should observe the completed operations for the final certification of the whole fire detection/alarm and suppression system and document it accordingly.

Final acceptance documentation shall include AHJ approval certificates, integrated test reports, as-built drawings, and O&M manuals.

7.12.2. Sprinkler Systems

7.12.2.1. Document Review

1. General document review procedures are described in Section 7.1.1.1 of this Manual.

The Construction Manager shall ensure sprinkler system document review includes verification of hazard classification, occupancy classification, density calculations, water supply availability, and coordination with architectural and structural features per the Contract Documents.

2. References: NFPA Standards and Requirements and Testing (Need alarm detection references)

The Construction Manager shall verify that all referenced NFPA standards are the latest adopted editions under N.J.A.C. 5:23 and that alarm detection references are properly coordinated with NFPA 72.

3. Fire Flow Testing and Marking of Hydrants – NFPA 291

The Construction Manager shall verify fire flow test documentation, hydrant marking, and flow data are consistent with design calculations and water supply assumptions in the approved shop drawings.

4. Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems – NFPA 3

The Construction Manager shall incorporate integrated testing requirements into the overall commissioning schedule and ensure participation of all affected trades.

5. Standard for the Installation of Sprinkler System – NFPA 13

The Construction Manager shall verify installation, spacing, deflector distance from ceilings, obstruction rules, seismic bracing (if required), and hydraulic calculations comply with NFPA 13 and the Contract Documents.

6. National Fire Alarm and Signaling Code – NFPA 72

The Construction Manager shall verify coordination between sprinkler supervisory devices and the fire alarm system per NFPA 72.

7. Standard for the Installation of Standpipe and Hose Systems – NFPA 14

Where applicable, the Construction Manager shall verify standpipe installation, hose valve locations, pressure ratings, and testing procedures comply with NFPA 14.

8. Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection System – NFPA 25

The Construction Manager shall verify testing and inspection requirements are incorporated into pre-functional and final acceptance procedures.

9. Standard for Supports, Hangers Slope and Drainage – NFPA 33

The Construction Manager shall verify pipe support spacing, hanger types, slope for drainage, and seismic bracing (if required) comply with the referenced standard and Contract Documents.

10. Code for Motor Fuel Dispensing Facilities and Repair Garages: NFPA 30A.
This code shall apply to motor fuel dispensing facilities and motor fuel dispensing facilities located inside buildings. This covers storage of liquids, fuel dispensing systems, building construction requirements, electrical

installations, operational requirements, vapor processing and recovery systems.

The Construction Manager shall verify compliance with NFPA 30A where applicable, including electrical classification, explosion-proof equipment requirements, and fire protection integration.

11. Recommended Practice on Static Electricity – NFPA 77

Where applicable, the Construction Manager shall verify bonding and grounding measures are installed per NFPA 77 and coordinated with electrical systems.

7.12.2.2. Submittals

1. See the recommendations in NFPA 13-10-1-2. Samples of sprinklers with finishes and other components may also have been a submittal requirement.

The Construction Manager shall verify sprinkler head finish, temperature rating, K-factor, listing, and compatibility with ceiling type per approved submittals.

2. Sprinkler shop drawings should locate all heads dimensionally. Special heads should be noted. Special heads include sidewall and high or low temperature types. Other types and finishes should be indicated.

The Construction Manager shall verify dimensional accuracy, obstruction compliance, ceiling coordination, and identification of special application heads in accordance with NFPA 13.

3. The height of the system above the floor should be shown on the shop drawings, including pipe slope for drainage.

The Construction Manager shall verify minimum clearances, pipe slope, and drainability are consistent with NFPA requirements and field conditions.

4. Testing station locations and low point drainage plugs should be shown on the shop drawings.

The Construction Manager shall verify accessibility of inspector's test connections and main drains.

5. Coordination with ductwork and other systems should be reflected on the shop drawings. Routing around obstructions should be shown, as well as the distance from obstructions or changes in ceiling heights.

The Construction Manager shall verify clash detection coordination and confirm obstruction rules per NFPA 13 are satisfied.

6. Calculations should be submitted for the designer's and fire official's review.
The Construction Manager shall verify hydraulic calculations reflect actual field conditions and water supply data.

7.12.2.3. **Pre-Construction**

1. Refer to Section 3.1.2 and Section 7.1.1.3 of this Manual for pre-construction requirements.

The Construction Manager shall ensure sprinkler system coordination, phasing, tie-in procedures, and shutdown notifications are addressed in pre-construction meetings.

2. Coordination drawings, referenced elsewhere in this chapter.

The Construction Manager shall verify sprinkler piping is coordinated with structural elements, mechanical ductwork, electrical conduits, and ceiling systems prior to installation.

7.12.2.4. **Construction**

Sequencing of installation and coordination between trades is critical during the planning as well as the construction phase for Facilities as rough-in for system elements begins with the site utility installation, foundations and sub-slab phases and then incrementally as portions of the facility structure and envelope are completed.

The Construction Manager shall verify underground fire service installation, hydrostatic testing, flushing, thrust blocking, and connection to municipal supply are inspected and documented prior to concealment. Hydrostatic and final acceptance tests shall be witnessed and recorded.

7.12.3. **Hand Held Extinguishers**

The Contract Documents will show the locations and types of hand held fire extinguishers (FE) required. The hazard level of the facility or areas within the facility will dictate spacing and travel distance.

The Construction Manager shall verify extinguisher classification (A, B, C, D, K), size, mounting height, travel distance, and signage comply with NFPA 10 and the Contract Documents.

7.12.3.1. **Document Review**

1. The Construction Manager should review life safety and architectural floor plans for hazard or occupancy designation, FE type and installation details. The Construction Manager shall verify occupancy classification and hazard rating align with extinguisher type and distribution.

2. The Construction Manager's staff should note designations for recessed or semi-recessed cabinets and verify that partition thicknesses will accommodate the cabinets without compromising finishes, fire ratings or acoustical ratings. The A/E should be engaged if necessary to verify this information.

The Construction Manager shall verify fire-rated assemblies remain compliant after cabinet installation and coordinate with the A/E where modifications are required.

7.12.3.2. Submittals

1. Cabinet product data and FE data.

The Construction Manager shall verify listing, labeling, and manufacturer certifications.

2. The Construction Manager's staff should verify signage and labeling requirements. This may be subject to AHJ review.

The Construction Manager shall confirm compliance with visibility, height, and identification requirements per NFPA 10 and the Authority Having Jurisdiction.

7.12.3.3. Pre-Construction

The Construction Manager should discuss layout coordination to reveal any conflicts with concealed work such as structural elements, piping or conduits, etc. The Construction Manager shall verify mounting locations do not conflict with rated assemblies, utilities, or accessibility clearances.

7.12.3.4. Construction

The Contractor should protect cabinets and FEs until final AHJ inspection. The Construction Manager shall verify protective coverings remain in place until final inspection and acceptance by the AHJ.

7.13. SUBMITTAL AND TESTING MATRICES AND COMMISSIONING SERVICES

The Construction Manager shall be familiar with all submittal and testing matrices and commissioning services as listed below. This Manual refers to submittal and testing matrices and commissioning services throughout Section 7 – Facilities.

The Construction Manager shall actively utilize these matrices as project management tools to track compliance, identify deficiencies, and ensure timely completion of required submittals, inspections, testing, and commissioning activities.

7.13.1. Submittal Matrix

The submittal matrix has been created as a guide to the Construction Manager for developing a list of required submittals and a log to track the submittal, review and approval. The submittal matrix has been developed as a spreadsheet that can be edited by the Construction Manager to create the Project Submittal Log. The matrix lists potential submittals in a column on the left side of sheet and the different building systems along the top row of the sheet. The shading of the intersecting cells gives guidance to the Construction Manager of the potential applicability of specific submittals for the Project. The Construction Manager will use this guidance, the Specifications, the counsel of the Design Professionals, and the Construction Manager's understanding of the project requirements to develop the submittal log. The spreadsheet includes a tab that provides instructions for editing the document. The spreadsheet is included as a separate file and portions of the matrix are included in Exhibit 7 - 1.

The Construction Manager shall maintain the Submittal Log as a live document, regularly update status, track review durations, identify overdue items, and coordinate with the Contractor to prevent delays in procurement and installation.

7.13.2. Testing Matrix

The testing matrix is similar to the submittal matrix and provides guidance for developing a log for tracking required inspections and testing. The spreadsheet includes a tab that provides instructions for editing the document. The spreadsheet is included as a separate file and portions of the matrix are included in Exhibit 7 - 2.

The Construction Manager shall maintain the Testing Log as a formal record of all required inspections, field tests, functional tests, integrated tests, deficiencies, corrective actions, and final approvals.

7.13.3. NJTA Commissioning Services

Building Commissioning is a process that starts early in the design process and continues through construction and one year into the building operation. It involves the monitoring of building systems' performance to evaluate whether they are designed and operate in accordance with the Contract Documents and the Owner's Project Requirements (OPR). Two of the principal goals of Commissioning are to have the facilities operate at optimum energy efficiency and to provide a safe and comfortable environment for the building occupants. Commissioning activities should verify that installed systems operate as intended, are properly integrated with other building systems, and meet performance expectations established in the Owner's Project Requirements.

Commissioning includes the designation of a commissioning authority, the Commissioning Agent, who acts independently on behalf of the Owner/Operator. The designated Commissioning Agent will be identified in the Contract Documents. The Commissioning Agent will manage the commissioning process on behalf of the Owner (the Authority), Program Manager (when entrusted with a project), the Design Consultant, the Construction Manager, and the Contractor. The Commissioning Agent shall coordinate commissioning planning, documentation review, and testing activities with the project team to ensure building systems are installed and perform in accordance with the design intent.

The Commissioning Agent meets and coordinates with the members of the Commissioning Team at various stages of the project and issues reports which may include actions to be taken to resolve any non-compliance issues identified.

Commissioning shall be performed on all buildings. If a Commissioning Specification is not provided in the Contract Documents, the Construction Manager shall follow the Commissioning Specification supplied in Exhibit 7 - 3.

The Construction Manager shall verify that commissioning documentation, including commissioning plans, checklists, and testing procedures, are completed and maintained throughout construction.

The Construction Manager shall integrate commissioning milestones into the project schedule, coordinate pre-functional and functional testing, ensure timely correction of deficiencies, verify training of Owner personnel, confirm delivery of complete O&M manuals and as-built documentation, and support post-occupancy warranty reviews during the one-year operational period.

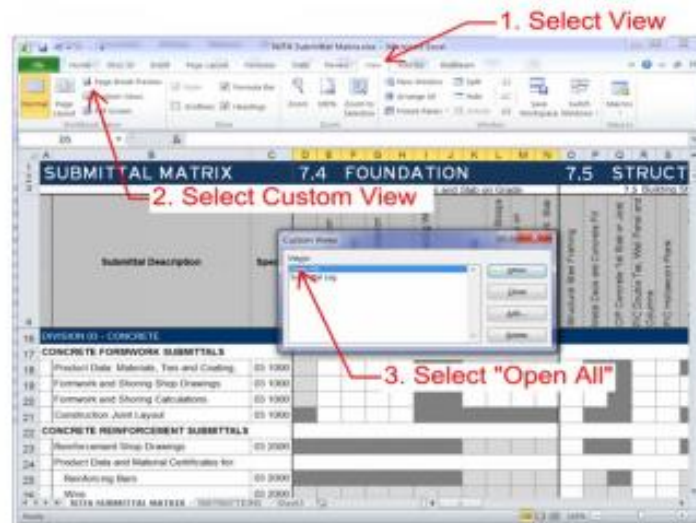
Training sessions for the Authority's operations and maintenance staff shall be documented and scheduled prior to final acceptance to ensure proper operation and long-term maintenance of building systems.

EXHIBIT 7 - 1 SAMPLE SUBMITTAL MATRIX

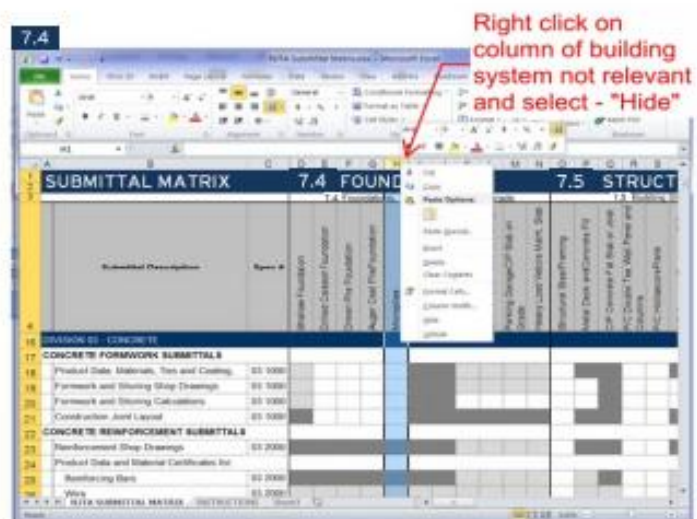
SUBMITTAL LOG PREPARATION INSTRUCTIONS

Step 1 - Open View & Select Building Systems

Open Custom View under View
and select "Open All"



Review the building systems
options under each of the chapter
headings and hide those not
relevant to the project.



SUBMITTAL LOG PREPARATION INSTRUCTIONS

Step 2 - Select Submittals for the Project

The shaded cells for each building system can be used as a guide for determining relevant submittals. The shading is intended to indicate the following:

Dark Grey: Submittals often required for the building system.

Light Grey: Submittals sometimes required for the building system or is one of several possible choices of submittals.

Blank: Submittals not relevant or infrequently required for the building system.

Review the project specifications and building system shading to determine what submittals are not required. The project specifications should include a list of required Action Submittals and Informational Submittals required for the project in Part One of each specification section. The CM should contact the Design Professional(s) for the project if the specification does not require a submittal that seems relevant.

Delete the Excel rows of submittals not required and edit the specification numbers as necessary.

The screenshot shows an Excel spreadsheet titled 'NFTA Submittal Matrix'. The spreadsheet is organized into columns for building systems (7.4 Foundations, 7.5 Structure, 7.6 Envelope) and rows for submittal categories. The 'Reinforcement' section is highlighted, and a red arrow points to a row that is not shaded, indicating it is not required. A red text box with the instruction 'Right click on row of submittal not required and select "Delete"' is overlaid on the spreadsheet.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings: For the following:
 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
 3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." **Show elevations of reinforced walls.**
 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- D. Samples for Initial Selection:
 1. Decorative CMUs, in the form of small-scale units.
 2. Pre-faced CMUs.

SUBMITTAL LOG PREPARATION INSTRUCTIONS

Step 3 - Add Required Submittals not Listed

Review the project specifications and collect submittals required but not included in the matrix. Copy and paste a new submittal row and edit the submittal information appropriately as shown.

1. Right click on row of submittal in matrix similar to submittal to insert. Choose "Copy"

2. Right click on row just below insert location for new submittal and choose "Insert Copied Cells".

3. Edit new row to reflect desired submittal.

The screenshot shows an Excel spreadsheet titled "NTA Submittal Matrix". The "SUBMITTAL MATRIX" tab is active. The spreadsheet has columns for Submittal Description, Spec #, and various review categories (e.g., Design, Construction, etc.). A red arrow points to a row in the matrix, and another red arrow points to a row just below it, indicating the process of copying and inserting a new row.

Step 4 - Identify Informational Submittals and Reviewer(s)

Open Custom View under View and select "Submittal Log"

Edit the Project name and Number at the top of the page.

Place an "X" in the Informational Submittal row for these submittals indicated as "Informational" in the project specification and that do not require a response from the NJTA CM or Design Professional. The rows with response information will be grayed out.

Fill in the appropriate submittal reviewer(s) in the Reviewer row.

Project name and no.

Place an "X" in this column for each Informational Submittal

Indicate submittal reviewer in this column

The screenshot shows the "SUBMITTAL MATRIX" tab in Excel. The "Project Name" and "Project No." are visible at the top. The spreadsheet has columns for Submittal Description, Spec #, and various review categories. A red arrow points to the "Project Name" field, and another red arrow points to a column header, indicating the process of identifying informational submittals and placing an "X" in the appropriate column.

7.13.1 SUBMITTAL MATRIX			7.4 FOUNDATION										
			7.4 Foundations, Tunnels and Slab on Grade										
Submittal Description	Spec #		Shallow Foundation	Drilled Caisson Foundation	Driven Pile Foundation	Auger Cast Pile Foundation	Micropiles	Foundation and Retaining Walls	Tunnel Structures	Interior Slab on Grade	Exterior Stoops	Parking Garage CIP Slab on Grade	Heavy Load Vehicle Maint. Slab
DIVISION 02 - EXISTING CONDITIONS													
STRUCTURE DEMOLITION													
Qualification Statements	02 4116												
SELECTIVE DEMOLITION													
Qualification Statements	02 4119												
Warranty	02 4119												
Closeout Submittals	02 4119												
DIVISION 03 - CONCRETE													
MAINTENANCE OF CAST-IN-PLACE CONCRETE													
Mockup	03 0130												
CONCRETE FORMWORK SUBMITTALS													
Product Data: Materials, Ties and Coating,	03 1000												
Formwork and Shoring Shop Drawings	03 1000												
Formwork and Shoring Calculations	03 1000												
Construction Joint Layout	03 1000												
CONCRETE REINFORCEMENT SUBMITTALS													
Reinforcement Shop Drawings	03 2000												
Product Data and Material Certificates for:													
Reinforcing Bars	03 2000												
Wire	03 2000												
Welded Wire Fabric	03 2000												
Metal Accessories	03 2000												
Rebar Splicing Coupler	03 2000												
Deformed Bar Anchors	03 2000												
Slab Dowel Joint Bars	03 2000												
LEED Credit MR 4	03 2000												
LEED Credit MR 5	03 2000												
CAST-IN-PLACE CONCRETE SUBMITTALS													
Product Data, Material Certificates & Test Reports:													
Cementitious Materials	03 3000												
NW Aggregates	03 3000												

7.13.1 SUBMITTAL MATRIX			7.4 FOUNDATION										
			7.4 Foundations, Tunnels and Slab on Grade										
Submittal Description	Spec #		Shallow Foundation	Drilled Caisson Foundation	Driven Pile Foundation	Auger Cast Pile Foundation	Micro piles	Foundation and Retaining Walls	Tunnel Structures	Interior Slab on Grade	Exterior Stoops	Parking Garage CIP Slab on Grade	Heavy Load Vehicle Maint. Slab
LW Aggregates	03 3000												
Air Entrainment	03 3000												
Water Reducers	03 3000												
Corrosion Inhibitor	03 3000												
Fiber Reinforcement	03 3000												
Expansion and Isolation Joint Filler Strips	03 3000												
Semi rigid Joint Filler	03 3000												
Curing Materials	03 3000												
Bonding Agent	03 3000												
Epoxy Bonding Compound	03 3000												
Epoxy Adhesive	03 3000												
Waterstops	03 3000												
Construction Joint Device	03 3000												
Contraction Joint Insert	03 3000												
Underslab Vapor Barrier	03 3000												
Grout	03 3000												
Post Installed Anchor ICC/ICBO Reports	03 3000												
LEED Credit MR 4	03 3000												
LEED Credit IEQ 4.3	03 3000												
LEED Credit ID1.1	03 3000												
LEED Credit MR 5	03 3000												
Samples													
Waterstops	03 3000												
Vapor Retarder	03 3000												
Architectural Aggregate	03 3000												
Design Mix for each Concrete Class	03 3000												
Laboratory Trial Mix Test for each Mix	03 3000												
Standard Deviation Analysis for each Mix	03 3000												
Batch Plant Certificates	03 3000												
Schedule and Placement Sequence	03 3000												
Delivery Tickets	03 3000												
Cold Weather Procedures	03 3000												

7.13.1 SUBMITTAL MATRIX			7.4 FOUNDATION										
			7.4 Foundations, Tunnels and Slab on Grade										
Submittal Description	Spec #		Shallow Foundation	Drilled Caisson Foundation	Driven Pile Foundation	Auger Cast Pile Foundation	Micro piles	Foundation and Retaining Walls	Tunnel Structures	Interior Slab on Grade	Exterior Stoops	Parking Garage CIP Slab on Grade	Heavy Load Vehicle Maint. Slab
Hot Weather Procedures	03 3000												
Covered Boxes for Cylinders	03 3000												
Floor and Slab Treatments	03 3000												
Product Warranties	03 3000												
Repair Materials (with repair procedure)	03 3000												
Qualification Data													
Installer	03 3000												
Professional Engineer	03 3000												
Manufacturer	03 3000												
Minutes of Preinstallation Conference	03 3000												
Mockup	03 3000												
ARCHITECTURAL CONCRETE													
Mockup	03 3300												
PRECAST CONCRETE SUBMITTALS													
Product Data, Material Certificates & Test Reports:													
Portland Cement	03 4100												
Aggregates	03 4100												
Admixtures	03 4100												
Mild Reinforcing	03 4100												
Prestressing Tendons	03 4100												
Wire	03 4100												
Bearing Materials	03 4100												
Steel Connection Materials	03 4100												
Hot-Dip Galvanizing	03 4100												
Grout	03 4100												
LEED Credit MR 4	03 4100												
LEED Credit MR 5	03 4100												
LEED Credit ID 1.1	03 4100												
Design Mix for each Concrete Class	03 4100												
Laboratory Trial Mix Test for each Mix	03 4100												
Standard Deviation Analysis for each Mix	03 4100												
Shop Drawings													

7.13.1 SUBMITTAL MATRIX			7.4 FOUNDATION										
			7.4 Foundations, Tunnels and Slab on Grade										
Submittal Description	Spec #		Shallow Foundation	Drilled Caisson Foundation	Driven Pile Foundation	Auger Cast Pile Foundation	Micro piles	Foundation and Retaining Walls	Tunnel Structures	Interior Slab on Grade	Exterior Stoops	Parking Garage CIP Slab on Grade	Heavy Load Vehicle Maint. Slab
Erection Drawings	03 4100												
Production Drawings	03 4100												
Engineering Calculations	03 4100												
Samples													
Architectural Precast	03 4100												
Certifications													
Design Compliance	03 4100												
Material Compliance	03 4100												
Manufacturer's Instructions	03 4100												
Instructions for Handling and Erection	03 4100												
Current Welder Certificates	03 4100												
Qualification Data													
Manufacturer Experience	03 4100												
Manufacturer Plant PCI Certification	03 4100												
Erector Qualifications	03 4100												
Weld Procedures	03 4100												
Minutes of Preinstallation Conference	03 4100												
Mockup	03 4100												
PRECAST ARCHITECTURAL CONCRETE													
Mockup	03 4500												
TILT-UP CONCRETE													
Mockup	03 4713												
GLASS-FIBER-REINFORCED CONCRETE (GFRC)													
Mockup	03 4900												
DIVISION 4 - MASONRY													
MASONRY CLEANING													
Mockup	04 0110												
MAINTENANCE OF UNIT MASONRY													
Mockup	04 0120												
UNIT MASONRY (General)													
Product Data and Material Certificates for:													

7.13.1 SUBMITTAL MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Submittal Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
DIVISION 02 - EXISTING CONDITIONS													
STRUCTURE DEMOLITION													
Qualification Statements	02 4116												
SELECTIVE DEMOLITION													
Qualification Statements	02 4119												
Warranty	02 4119												
Closeout Submittals	02 4119												
DIVISION 03 - CONCRETE													
MAINTENANCE OF CAST-IN-PLACE CONCRETE													
Mockup	03 0130												
CONCRETE FORMWORK SUBMITTALS													
Product Data: Materials, Ties and Coating,	03 1000												
Formwork and Shoring Shop Drawings	03 1000												
Formwork and Shoring Calculations	03 1000												
Construction Joint Layout	03 1000												
CONCRETE REINFORCEMENT SUBMITTALS													
Reinforcement Shop Drawings	03 2000												
Product Data and Material Certificates for:													
Reinforcing Bars	03 2000												
Wire	03 2000												
Welded Wire Fabric	03 2000												
Metal Accessories	03 2000												
Rebar Splicing Coupler	03 2000												
Deformed Bar Anchors	03 2000												
Slab Dowel Joint Bars	03 2000												
LEED Credit MR 4	03 2000												
LEED Credit MR 5	03 2000												
CAST-IN-PLACE CONCRETE SUBMITTALS													
Product Data, Material Certificates & Test Reports:													
Cementitious Materials	03 3000												
NW Aggregates	03 3000												

7.13.1 SUBMITTAL MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Submittal Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
LW Aggregates	03 3000												
Air Entrainment	03 3000												
Water Reducers	03 3000												
Corrosion Inhibitor	03 3000												
Fiber Reinforcement	03 3000												
Expansion and Isolation Joint Filler Strips	03 3000												
Semi rigid Joint Filler	03 3000												
Curing Materials	03 3000												
Bonding Agent	03 3000												
Epoxy Bonding Compound	03 3000												
Epoxy Adhesive	03 3000												
Waterslops	03 3000												
Construction Joint Device	03 3000												
Contraction Joint Insert	03 3000												
Underslab Vapor Barrier	03 3000												
Grout	03 3000												
Post Installed Anchor ICC/ICBO Reports	03 3000												
LEED Credit MR 4	03 3000												
LEED Credit IEQ 4.3	03 3000												
LEED Credit ID1.1	03 3000												
LEED Credit MR 5	03 3000												
Samples													
Waterslops	03 3000												
Vapor Retarder	03 3000												
Architectural Aggregate	03 3000												
Design Mix for each Concrete Class	03 3000												
Laboratory Trial Mix Test for each Mix	03 3000												
Standard Deviation Analysis for each Mix	03 3000												
Batch Plant Certificates	03 3000												
Schedule and Placement Sequence	03 3000												
Delivery Tickets	03 3000												
Cold Weather Procedures	03 3000												

7.13.1 SUBMITTAL MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Submittal Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
Hot Weather Procedures	03 3000												
Covered Boxes for Cylinders	03 3000												
Floor and Slab Treatments	03 3000												
Product Warranties	03 3000												
Repair Materials (with repair procedure)	03 3000												
Qualification Data													
Installer	03 3000												
Professional Engineer	03 3000												
Manufacturer	03 3000												
Minutes of Preinstallation Conference	03 3000												
Mockup	03 3000												
ARCHITECTURAL CONCRETE													
Mockup	03 3300												
PRECAST CONCRETE SUBMITTALS													
Product Data, Material Certificates & Test Reports:													
Portland Cement	03 4100												
Aggregates	03 4100												
Admixtures	03 4100												
Mild Reinforcing	03 4100												
Prestressing Tendons	03 4100												
Wire	03 4100												
Bearing Materials	03 4100												
Steel Connection Materials	03 4100												
Hot-Dip Galvanizing	03 4100												
Grout	03 4100												
LEED Credit MR 4	03 4100												
LEED Credit MR 5	03 4100												
LEED Credit ID 1.1	03 4100												
Design Mix for each Concrete Class	03 4100												
Laboratory Trial Mix Test for each Mix	03 4100												
Standard Deviation Analysis for each Mix	03 4100												
Shop Drawings													

7.13.1 SUBMITTAL MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Submittal Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
Erection Drawings	03 4100												
Production Drawings	03 4100												
Engineering Calculations	03 4100												
Samples													
Architectural Precast	03 4100												
Certifications													
Design Compliance	03 4100												
Material Compliance	03 4100												
Manufacturer's Instructions	03 4100												
Instructions for Handling and Erection	03 4100												
Current Welder Certificates	03 4100												
Qualification Data													
Manufacturer Experience	03 4100												
Manufacturer Plant PCI Certification	03 4100												
Erector Qualifications	03 4100												
Weld Procedures	03 4100												
Minutes of Preinstallation Conference	03 4100												
Mockup	03 4100												
PRECAST ARCHITECTURAL CONCRETE													
Mockup	03 4500												
TILT-UP CONCRETE													
Mockup	03 4713												
GLASS-FIBER-REINFORCED CONCRETE (GFRC)													
Mockup	03 4900												
DIVISION 4 - MASONRY													
MASONRY CLEANING													
Mockup	04 0110												
MAINTENANCE OF UNIT MASONRY													
Mockup	04 0120												
UNIT MASONRY (General)													
Product Data and Material Certificates for:													

7.13.1 SUBMITTAL MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Submittal Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
Reinforcement	04 2000												
Ties and Anchors	04 2000												
Miscellaneous Anchors	04 2000												
Embedded Flashing	04 2000												
Miscellaneous Masonry Accessories	04 2000												
LEED Credit MR 5	04 2000												
Shop Drawings	04 2000												
List of Materials Used in Mockups	04 2000												
Mix Designs													
Mortar Mix Design	04 2000												
Grout Mix Design	04 2000												
Cold and Hot Weather Procedures	04 2000												
Mockup	04 2000												
BRICK MASONRY													
Product Data and Material Certificates for:													
Concrete Brick	04 2113												
Brick	04 2113												
Stone Trim	04 2113												
Mortar Materials	04 2113												
Masonry Cleaners	04 2113												
Samples for Initial Selection													
Concrete Facing Brick	04 2113												
Face Brick	04 2113												
Stone Trim	04 2113												
Colored Mortar	04 2113												
Weep Holes/Vents	04 2113												
Samples for Verification													
Concrete Facing Brick	04 2113												
Face Brick	04 2113												
Stone Trim	04 2113												
Colored Mortar	04 2113												
Weep Holes/Vents	04 2113												

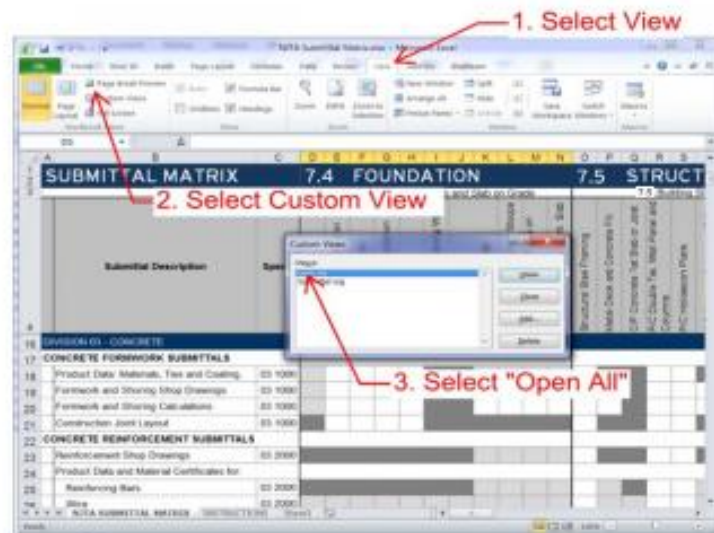
7.13.1 SUBMITTAL MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Submittal Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
Accessories embedded in Masonry	04 2113												
Mockup	04 2113												
CONCRETE UNIT MASONRY													
Product Data and Material Certificates for:													
Concrete Masonry Units	04 2200												
Concrete or Masonry Lintels	04 2200												
Mortar Materials	04 2200												
Grout Materials	04 2200												
Statement of Compression Strength	04 2200												
Samples for Initial Selection													
Decorative or Pre-faced CMU	04 2200												
Colored Mortar	04 2200												
Weep Holes/Vents	04 2200												
Samples for Verification													
Exposed, Decorative or Pre-faced CMU	04 2200												
Colored Mortar	04 2200												
Accessories embedded in Masonry	04 2200												
Mockup	04 2200												
EXTERIOR STONE CLADDING													
Mockup	04 4200												
Extra Materials/Attic Stock	04 4200												
ANCHORED STONE MASONRY VENEER													
Mockup	04 4313.13												
ADHERED STONE MASONRY VENEER													
Mockup	04 4313.16												
CAST STONE MASONRY													
Mockup	04 7200												
DIVISION 5 - METALS													
STRUCTURAL STEEL SUBMITTALS													
Product Data/Test Reports													
Steel Mill Test Reports	05 1200												

EXHIBIT 7 - 2 SAMPLE TESTING MATRIX

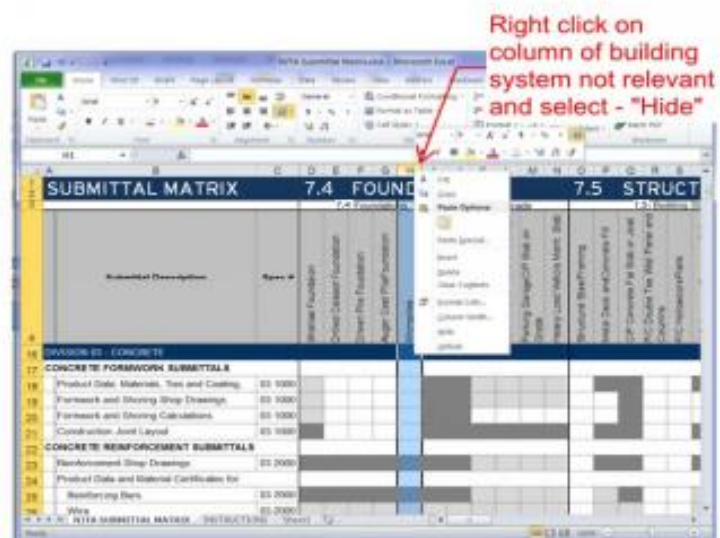
TESTING LOG PREPARATION INSTRUCTIONS

Step 1 - Open View & Select Building Systems

Open Custom View under View
and select "Open All"



Review the building systems
options under each of the chapter
headings and hide those not
relevant to the project.



TESTING LOG PREPARATION INSTRUCTIONS

Step 2 - Select Inspections and Testing for the Project

The shaded cells for each building system can be used as a guide for determining relevant inspections and testing. The shading is intended to indicate the following:

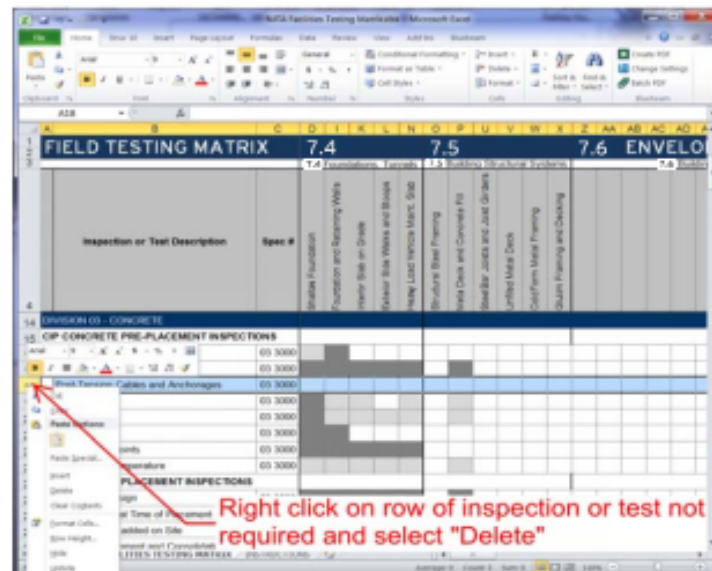
Dark Grey: Inspections or tests often required for the building system.

Light Grey: Inspections or tests sometimes required for the building system or is one of several possible choices.

Blank: Inspections or tests not relevant or infrequently required for this building system.

Review the project specifications and building system shading to determine what inspections and testing is not required. The CM should contact the Design Professional(s) for the project if the specification does not require an inspection or test that seems relevant.

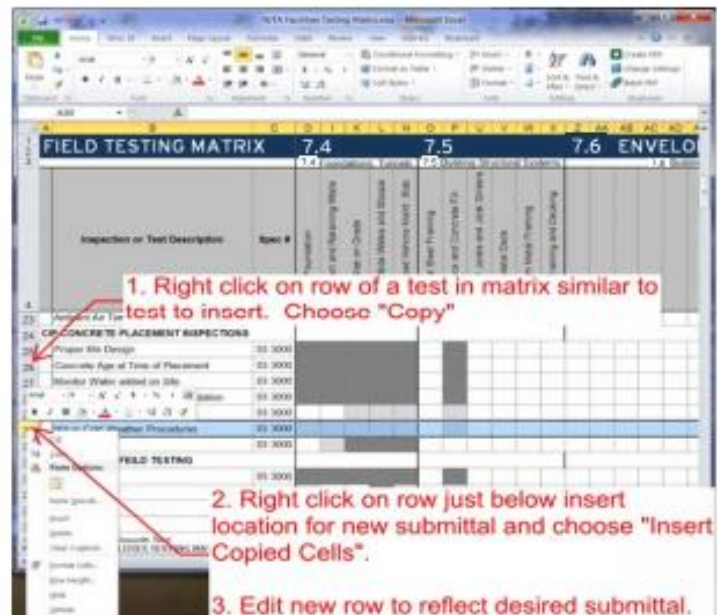
Delete the Excel rows of inspections or tests not required and edit the specification numbers as necessary.



TESTING LOG PREPARATION INSTRUCTIONS

Step 3 - Add Required Inspections and Tests not Listed

Review the project specifications and collect inspections and tests required but not included in the matrix. Copy and paste a new row and edit the inspection or testing information appropriately as shown.

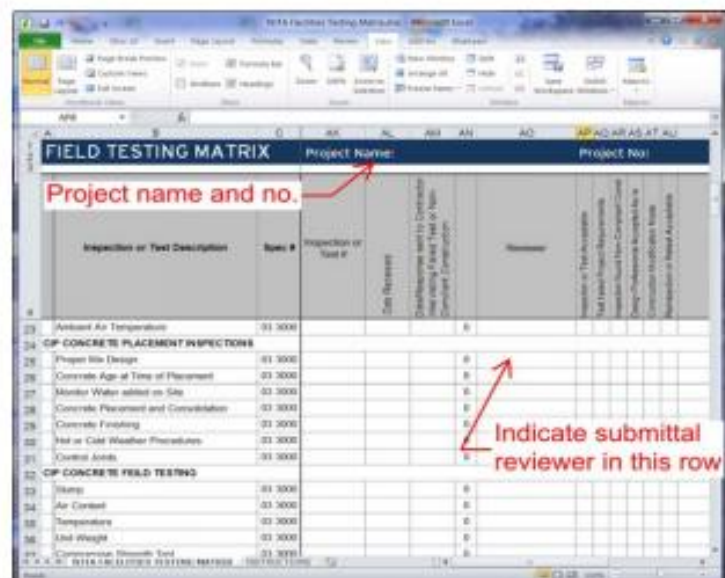


Step 4 - Identify Reviewer(s)

Open Custom View under View and select "Submittal Log"

Edit the Project name and Number at the top of the page.

Fill in the appropriate submittal reviewer(s) in the Reviewer row.



7.13.2 TESTING MATRIX			7.4 FOUNDATION										
			7.4 Foundations, Tunnels and Slab on Grade										
Inspection or Test Description	Spec #		Shallow Foundation	Drilled Caisson Foundation	Driven Pile Foundation	Auger Cast Pile Foundation	Micro-piles	Foundation and Retaining Walls	Tunnel Structures	Interior Slab on Grade	Exterior Side Walks and Stoops	Parking Garage CIP Slab on Grade	Heavy Load Vehicle Maint. Slab
DIVISION 03 - CONCRETE													
CIP CONCRETE PRE-PLACEMENT INSPECTIONS													
Formwork	03 3000												
Mild Reinforcing	03 3000												
Post-Tension Cables and Anchorages	03 3000												
Sleeves	03 3000												
Embeds	03 3000												
Waterstops	03 3000												
Construction Joints	03 3000												
Ambient Air Temperature	03 3000												
CIP CONCRETE PLACEMENT INSPECTIONS													
Proper Mix Design	03 3000												
Concrete Age at Time of Placement	03 3000												
Monitor Water added on Site	03 3000												
Concrete Placement and Consolidation	03 3000												
Concrete Finishing	03 3000												
Hot or Cold Weather Procedures	03 3000												
Control Joints	03 3000												
CIP CONCRETE FIELD TESTING													
Slump	03 3000												
Air Content	03 3000												
Temperature	03 3000												
Unit Weight	03 3000												
Compressive Strength Test	03 3000												
Chloride Permeability	03 3000												
Shrinkage	03 3000												
Freeze-thaw Resistance	03 3000												
Floor Flatness and Levelness	03 3000												
Floor Slab Moisture Testing	03 3000												
DIVISION 31 - EARTHWORK													
EARTH MOVING													
Proofrolling	31 2000												
Fill Material Composition Compliance	31 2000												

7.13.2 TESTING MATRIX			7.4 FOUNDATION										
			7.4 Foundations, Tunnels and Slab on Grade										
Inspection or Test Description		Spec #	Shallow Foundation	Drilled Caisson Foundation	Driven Pile Foundation	Auger Cast Pile Foundation	Micro-piles	Foundation and Retaining Walls	Tunnel Structures	Interior Slab on Grade	Exterior Side Walks and Stoops	Parking Garage CIP Slab on Grade	Heavy Load Vehicle Maint. Slab
Lift Thicknesses	31 2000												
Bearing Capacity Tests at Footing Subgrade	31 2000												
Soil Compaction: Paved and Building Slabs	31 2000												
Soil Compaction: Foundation Wall Backfill	31 2000												
Soil Compaction: Trench Backfill	31 2000												
CONCRETE PILES													
Pile Foundations Special Inspections	31 6213												
Dynamic Pile Testing	31 6213												
STEEL PILES													
Pile Foundations Special Inspections	31 6216												
Field Welding Procedures and Certificates	31 6216												
Welding Procedure Qualification Records	31 6216												
Welding Inspection	31 6216												
Dynamic Pile Testing	31 6216												
AUGERCAST PILES													
Special Inspection of Auger Cast Piles	31 6316												
Proper Mix Design	31 6316												
Flow Cone Tests	31 6316												
Grout Volume Measurements	31 6316												
Grout Compressive Strength Tests	31 6316												
Test Piles	31 6316												
Low Strain Integrity Testing	31 6316												
MICRO-PILES													
Special Inspection of Micro-piles	31 6317												
Proper Mix Design	31 6317												
Grout Density Measurements	31 6317												
Grout Compressive Strength Tests	31 6317												
Micro-pile proof Load Testing	31 6317												
DRILLED CONCRETE PIERS AND SHAFTS													
Bearing Strata Tests	31 6329												
Special Inspection of Drilled Piers	31 6329												
Concrete Pre-placement Inspections	03 3200												
Concrete Placement Inspections	03 3200												
Concrete Field Testing	03 3200												

7.13.2 TESTING MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Inspection or Test Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
DIVISION 03 - CONCRETE													
CIP CONCRETE PRE-PLACEMENT INSPECTIONS													
Formwork	03 3000												
Mild Reinforcing	03 3000												
Post-Tension Cables and Anchorages	03 3000												
Sleeves	03 3000												
Embeds	03 3000												
Waterstops	03 3000												
Construction Joints	03 3000												
Ambient Air Temperature	03 3000												
CIP CONCRETE PLACEMENT INSPECTIONS													
Proper Mix Design	03 3000												
Concrete Age at Time of Placement	03 3000												
Monitor Water added on Site	03 3000												
Concrete Placement and Consolidation	03 3000												
Concrete Finishing	03 3000												
Hot or Cold Weather Procedures	03 3000												
Control Joints	03 3000												
CIP CONCRETE FIELD TESTING													
Slump	03 3000												
Air Content	03 3000												
Temperature	03 3000												
Unit Weight	03 3000												
Compressive Strength Test	03 3000												
Chloride Permeability	03 3000												
Shrinkage	03 3000												
Freeze-thaw Resistance	03 3000												
Floor Flatness and Levelness	03 3000												
Floor Slab Moisture Testing	03 3000												
PRECAST CONCRETE INSPECTIONS													
Erection and Bracing Procedure	03 4100												
Field Welding Procedures and Certificates	03 4100												
Component Condition prior to Erection	03 4100												

7.13.2 TESTING MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Inspection or Test Description		Spec #	Structural Steel Framing	Metal Deck and Concrete Fill	C/P Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	C/P Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
Frame Plumbness and Alignment	03 4100												
Grout Placement	03 4100												
Grout Injection in Splice Sleeves	03 4100												
Bearing pad Placement	03 4100												
Welding	03 4100												
Concrete Damage around Weldments	03 4100												
Repair of Coatings on Steel Items	03 4100												
Bolted Connections	03 4100												
PRECAST CONCRETE FIELD TESTING													
Compressive Strength for Grout	03 4100												
Nondestructive Weld Testing	03 4100												
NON-SHRINK GROUT FIELD TESTING													
Compressive Strength Tests													
POST-INSTALLED ANCHOR INSPECTION													
Verify Anchor Type and Size													
Initial Installation per MPII & ICC-ES Report													
Periodic Inspections													
DIVISION 5 - STEEL													
STRUCTURAL STEEL INSPECTIONS													
Erection and Bracing Procedure	05 1200												
Member Condition Prior to Erection	05 1200												
Base Plate Levelling and Grouting	05 1200												
Review Survey Report	05 1200												
Required Camber of Beams	05 1200												
Field Welding Procedures and Certificates	05 1200												
Welding Procedure Qualification Records	05 1200												
Welding Inspection	05 1200												
Inspection of Bolted Connections	05 1200												
Frame Details	05 1200												
Column Compression Joints	05 1200												
Placement and Connections for Steel Joists	05 2100												
STRUCTURAL STEEL FIELD TESTING													

7.13.2 TESTING MATRIX			7.5 STRUCTURE										
			7.5 Building Structural Systems										
Inspection or Test Description	Spec #		Structural Steel Framing	Metal Deck and Concrete Fill	CIP Concrete Flat Slab or Joist	P/C Double Tee, Wall Panel and Columns	P/C Hollowcore Plank	CIP Concrete Topping on P/C	Steel Bar Joists and Joist Girders	Unfilled Metal Deck	Cold Form Metal Framing	Glulam Framing and Decking	Pre-engineered Metal Bldg.
Nondestructive Weld Testing	05 1200												
Bolt Pretensioning	05 1200												
Guard Rails per ASTM E 935	05 5213												
COLD FORMED STEEL													
Welding Inspection	05 4000												
Inspection of Screw Attachment	05 4000												
DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES													
GLUED-LAMINATED CONSTRUCTION													
Condition of Members before Erection	06 1800												
Inspection of Frame and Connections	06 1800												
DIVISION 7 - THERMAL AND MOISTURE PROTECTION													
APPLIED FIREPROOFING													
Special Inspection: Condition of Substrate	07 8100												
Special Inspection: Thickness of Application	07 8100												
Special Inspection: Density	07 8100												
Special Inspection: Bond Strength	07 8100												
Special Inspection: Condition of Application	07 8100												
INTUMESCENT FIREPROOFING													
Tests and Inspections	07 8123												
PENETRATION FIRESTOPPING													
Tests and Inspections	07 8413												
FIRE-RESISTIVE JOINT SYSTEMS													
Tests and Inspections	07 8446												

EXHIBIT 7 - 3 SAMPLE COMMISSIONING SPECIFICATION

PART 1 GENERAL

1.1. SUMMARY

- A. This Section includes, but is not limited to, the following provisions for the coordination of the Construction Phase Commissioning Process for the Project.
 - 1. Commissioning Description.
 - 2. Equipment and Systems to be Commissioned
 - 3. Commissioning Authority
 - 4. Commissioning Submittals
 - 5. Closeout Submittals
 - 6. Quality Assurance
 - 7. Commissioning Responsibilities
 - 8. Commissioning Meetings
 - 9. Commissioning Reports.
 - 10. Maintenance Materials
 - 11. Test Equipment
 - 12. Prefunctional Checklist Completion and Startup Procedures.
 - 13. Functional Performance Test Procedures.
 - 14. Functional Performance Test Methods.
 - 15. Deficiencies and Test Approvals
 - 16. Demonstration
- B. Related Sections:
 - 1. Division 01 - General Requirements
 - 2. Section 22 08 00 - Commissioning of Plumbing systems.
 - 3. Section 23 08 00 - Commissioning of HVAC: Mechanical systems.
 - 4. Section 26 08 00 - Commissioning of Electrical systems.
 - 5. Section 11 11 26 - Vehicle Wash
 - 6. Section 14 45 50 - Vehicle Lifts
 - 7. Section 41 22 13.13 - Bridge Cranes

1.2. REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers: ASHRAE Guideline O – The Commissioning Process
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers: ASHRAE Guideline 1 - The HVAC Commissioning Process
- C. US Green Building Council (USGBC) - LEED Reference Standards

1.3. DEFINITIONS

- A. **Basis of Design:** A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- B. **Commissioning – See Section 1.4**
- C. **Commissioning Authority:** An entity identified by the Owner who leads, plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.
- D. **Commissioning Plan:** A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
- E. **Contract Documents:** These include a wide range of documents that will vary from project to project and with the Owner's needs and with regulations, laws, and countries. Contract Documents frequently include price agreements, construction management process, subcontractor agreements or requirements, requirements and procedures for submittals, changes, and other construction requirements, timeline for completion, and the Construction Documents.
- F. **Deferred Testing:** Testing which has been deferred to a time when conditions are more favorable toward conducting a complete and comprehensive test.
- G. **Deficiency** – A problem or concern raised by members of the Commissioning Team regarding documentation, equipment installation or operational issue which is not in conformance with Contract Documents.
- H. **Owner's Project Requirements:** A written document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- I. **Systems Manual:** A system-focused composite document that includes the operation manual, maintenance manual and additional information of use to the Owner during the Occupancy and Operations Phase.

1.4. COMMISSIONING DESCRIPTION

- A. The Commissioning Process is a quality-oriented process for verifying and documenting that the performance of facilities, systems and assemblies meets defined objectives and criteria. The Commissioning Process verifies that the Owners Project Requirements have been met by validating and documenting quality design and installation methods. The Commissioning Process encompasses and coordinates system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training, and verification of actual performance.
- B. Commissioning Intent:

1. Verify equipment and systems are designed and installed in accordance with Owner's Project Requirements, Basis of Design, manufacturer's instructions, industry accepted minimum standards, and Contract Documents.
 2. Verify equipment and systems receive adequate operational checkout by Contractor.
 3. Verify and document proper performance of equipment and systems.
 4. Verify complete operation and maintenance documentation is delivered to Owner.
 5. Verify Owner's operating personnel are adequately trained and that adequate materials for retraining of Owner's operating personnel are provided.
- C. Commissioning does not relieve Contractor of responsibility to provide a finished and fully and properly functioning Project.
- D. Construction Phase Commissioning Process Overview and General Order of Commissioning Tasks:
1. Construction Phase Commissioning begins with initial construction phase commissioning kickoff meeting.
 2. Commissioning progress meetings are conducted throughout construction, to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to Commissioning Authority during normal submittals, with detailed start-up procedures.
 4. Commissioning Authority works with Contractor and equipment and system installers to develop startup plans and startup documentation formats, including prefunctional checklists to be completed by installers prior to equipment startup.
 5. In general, checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels.
 6. Equipment and system installers execute and document prefunctional checklists and perform initial startup and checkout. Commissioning Authority documents checklists and startup are completed according to accepted start up documents.
 7. Commissioning Authority, in cooperation with installing contractors of systems to be commissioned, develops specific equipment and system functional performance test procedures.
 8. Contractor and equipment and system installers review procedures.
 9. Equipment and system installers execute procedures under direction of, and documented by Commissioning Authority.
 10. Items of non-compliance in material, installation or setup are documented by CxA, reported to Owner, corrected, and system retested. Corrective measures and retesting may be at Contractors expense.

11. Commissioning Authority reviews operation and maintenance documentation for completeness with respect to inclusion into Systems Manual
12. Commissioning is completed before Substantial Completion
13. Commissioning Authority reviews, approves and coordinates training provided by equipment and system installers and verifies training was completed.
14. Deferred testing is conducted, as specified.

1.5. EQUIPMENT AND SYSTEMS TO BE COMMISSIONED

- A. Section - 22 08 00 for equipment and system lists.
- B. Section - 23 08 00 for equipment and system lists.
- C. Section - 26 08 00 for equipment and system lists.
- D. Section - 11 11 26 – Vehicle Wash
- E. Section - 14 45 50 –Vehicle Lifts
- F. Section – 41 22 13.13 Bridge Cranes

1.6. COMMISSIONING AUTHORITY

- A. The Contractor shall work in cooperation with the CxA as an integral part of the process. The Contractor shall perform all start up testing and adjusting of their respective equipment. The CxA shall provide third party verification of the installation and operation of the systems to be commissioned.

1.7. COMMISSIONING SUBMITTALS

- A. The Commissioning Authority shall be provided with one copy of all Contract Documents including addenda, change orders, requests for interpretation and meeting minutes.
- B. The General Contractor shall furnish copy of submittals directly to Commissioning Authority for review and approval in accordance with procedures specified in Section 104.08 NJTA Standard and Supplementary Specifications and Division 01 Section 013300 – Submittals.
 1. Make submittals for each piece of equipment or system indicated to be commissioned.
 2. Distribute one copy of approved submittals to Commissioning Authority.
- C. Furnish copy of preliminary installation, operation and maintenance data manuals to Commissioning Authority for each piece of equipment or system indicated to be commissioned.

1. Submit required materials within 10 days after submittals for each piece of equipment or system required under Section 104.08 of the NJTA Standard and Supplementary Specifications and Division 01 Section 013300 Submittals
- D. Contractor shall provide additional submittals as requested by Commissioning Authority for each piece of equipment or system indicated to be commissioned. Additional documentation requested by the Commissioning Authority may include:
1. Manufacturer's printed detailed installation and start-up, operating, troubleshooting and maintenance procedures.
 2. Equipment performance curves.
 3. Factory test reports.
 4. Full sequence of operation and control diagrams.
 5. Proposed testing, adjusting, and balancing procedures.
 6. Complete warranty information, with Owner responsibilities to keep warranty in force identified.
 7. Lists of installation and checkout materials shipped with equipment.
 8. Manufacturer's field checkout forms to be used by factory or field technicians.
 9. Other documentation necessary for Commissioning Process.
- E. Furnish copy of each of the following to the Commissioning Authority for review and approval and for use by the CxA in developing commissioning documents. Include the following as minimum:
1. Start up plans for each piece of equipment to be commissioned
 2. Manufacturer's standard startup procedures copied from installation manuals.
 3. Manufacturer's standard field checkout sheets.
 4. Supplemental procedures and checklists prepared by equipment and system installers to accommodate Project conditions.
 5. Sensor and actuator calibration procedures.
- F. Submit written training plan to Commissioning Authority for review and approval prior to conducting training including the following at a minimum:
1. Equipment included in training session.
 2. Intended audience.
 3. Location of training.
 4. Objectives.
 5. Subjects covered.
 6. Duration of training on each subject.
 7. Instructor for each subject.
 8. Instructional methods to be used.
- G. Commissioning Authority will review and accept submittals related to the Commissioning Process.

