

### **3.0 QUALITY MANAGEMENT**

The Contractor shall develop a Quality Management Plan (QMP) that documents the Contractor's commitment to quality and all quality requirements of the Contract. The QMP shall include the Contractor's quality policy and approach for Quality Control, Quality Assurance, quality improvement, assignment of quality personnel and resources, and training of the associated Quality Management Systems (QMSs). The Contractor shall submit the QMP for design related Work to CDOT for Approval prior to issuance of NTP1. The entire QMP for all remaining Work on the Project must have CDOT's Approval before NTP2 will be issued. The Contractor shall fully implement the Approved QMP. Any subsequent addendums, required during execution of the Work, shall also require CDOT's Approval.

The Contractor shall be responsible for all Quality Control and Quality Assurance activities for the Project. CDOT will perform Verification, either by testing or assessment, of the Contractor's Work for conformance to requirements of the Contract.

The Contractor shall provide a Colorado Registered Professional Engineer in responsible charge of overall quality for the Project.

#### **3.1 Administrative Requirements**

##### **3.1.1 Quality Policy**

The QMP shall include the Contractor's executive management written definition and endorsement of the Contractor's policy for quality, including objectives and its commitment to quality. The QMP shall delineate procedures used by the Contractor's executive management to implement the Contractor's quality policy. The Contractor's executive management shall ensure that its policy is implemented at all levels of the organization.

The Contractor shall publish and post a statement of its commitment to quality, and the organization's quality objectives, in several locations throughout the Project. The statement shall explain the Contractor's commitment to quality and the responsibility the Contractor has for assuring that it meets the quality requirements for the Project.

The quality policy statement shall be made known to and understood by all Contractor employees, Subconsultants, Subcontractors, and Suppliers. The Contractor shall conduct a formal indoctrination program for all Contractor employees, Subconsultants, Subcontractors, and Suppliers on its quality policy and the QMP.

##### **3.1.2 Quality Planning**

The Contractor's QMP shall use industry standard inspection procedures, as well as those outlined in CDOT's Construction Manual, Field Materials Manual, and Standard Specifications.

The Contractor shall prepare and implement a Materials Testing & Inspection Plan (MTIP) as part of the Approved QMP that includes the appropriate criteria, tests, and inspection requirements identified in CDOT's Construction Manual, Field Materials Manual, and Standard

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Specifications. The MTIP shall also include Contractor-developed inspection checklists of requirements as set forth herein. Specific elements addressed in the MTIP shall include identification of Project Work items and associated criteria of the item(s) that will be inspected.

The QMP shall include procedures to be taken for Nonconforming Work. Inspections shall be performed during all phases of the Work from NTP1 to Final Acceptance to assure that the Work meets and is being performed in accordance with requirements of the Contract.

An examination of the quality of workmanship shall also be conducted to confirm that all Work is being performed in accordance with all Contract requirements. Appropriate follow-up inspections, sampling, and testing of Materials shall be performed as each item of Work progresses to assure consistency in workmanship, compliance with Contract requirements, (including Design and Construction Documents), and satisfactory performance of the Work in service.

The Contractor shall include in the QMP its planning methods to meet the requirements of the Contract. The Contractor shall include the following activities, at a minimum, in its quality planning efforts to ensure conformance to Contract requirements:

1. Define and develop quality objectives and associated QMSs for the Project.
2. Identify the necessary processes, resources, and Quality Assurance personnel that are needed to assure the Work meets the requirements of the Contract.
3. Provide methods to ensure the compatibility of design, construction, inspection, and testing procedures.
4. Include procedures to develop and maintain the currency of Quality Control, Quality Assurance, and quality improvement.
5. Identify and define all measurable Contract requirements.
6. Identify construction Quality Assurance hold points for Contractor Quality Assurance testing and inspection and to allow CDOT the opportunity to perform its Verification responsibilities.
7. Identify, define, and implement standards of workmanship for all applicable Work features (e.g., concrete finishing).
8. Identify, define, prepare, and maintain quality records and quality plans.
9. Develop procedures for preparation, control, Approval, and distribution of the QMP.
10. Develop procedures for internal Quality Assurance (auditing) to ensure the Contractor employees, Subconsultants, Subcontractors, and Suppliers understand and are effectively implementing the QMP. The Contractor, as a minimum, shall audit their implementation of the QMP on a quarterly basis.
11. Develop procedures for preventive and corrective measures regarding quality compliance and to address procedures to be taken for Nonconforming Work.
12. Identify the process to ensure the Contractor's executive management reviews implementation of QMP associated QMSs at planned intervals to ensure their continued suitability, adequacy, and effectiveness. Such reviews should include Quality Assurance/Quality Control (QA/QC) results, CDOT's Verification results, status of

corrective/preventive actions, follow-up items from previous executive management reviews, changes to the QMP and associated QMSs, and a summary of positive results with recommendations for any needed improvements.

13. The QMP shall include QC checklists. The QC checklists shall be developed and maintained by the Contractor at the Project Site and organized for execution of each WBS Activities (III, IV, V, VI & VII) and all other associated Contract requirements. The QC checklists shall be available for CDOT personnel review at all times. Unmaintained or not up-to-date QC checklists will constitute immediate Nonconforming Work. Work shall not proceed until the QC checklist is updated and made compliant to the requirements herein. The Contractor shall use current CDOT forms, manuals and handbooks to develop QC checklists.

### **3.1.3 Quality Control**

The Contractor shall be responsible to establish, document, and implement a Quality Control Plan. The Quality Control Plan shall include all procedures necessary for the Contractor to control the quality of its production processes to meet the requirements of the Contract. The Contractor shall develop a testing and inspection schedule to control the production processes.

Tests or inspections performed by production or Quality Control personnel as part of the Quality Control Plan shall not be used to satisfy the Quality Assurance requirements. All QC and QA personnel shall be capable of performing all tests (both in the field and in the lab), have the necessary personnel to respond to the workload, and provide the equipment/facilities to perform all tests. All testing personnel need to be certified and the labs need to be certified and on the AMRL accredited list.

### **3.1.4 Quality Assurance**

The Contractor shall be responsible to establish, document, and implement a Quality Assurance program. The Contractor shall include in the QMP the Quality Assurance methods and procedures by which the Work will be certified by the Contractor as complying with the requirements of the Contract.

Quality Assurance personnel shall not participate in any Quality Control activities and shall be independent of the Quality Control personnel.

The Contractor shall identify in the QMP all necessary resources and personnel to perform all Quality Assurance activities required to ensure all Work meets the requirements of the Contract. The QMP shall identify the construction Quality Assurance hold points for Contractor Quality Assurance testing and inspection and shall describe how the Contractor will notify CDOT so that it may have the opportunity to perform its Verification responsibilities.

### **3.1.5 Quality Improvement**

The Contractor shall be responsible to establish, document, and implement a program for quality improvement. The Contractor shall include in the QMP the methods for identifying, analyzing, evaluating, and implementing solutions to continuously improve quality. The QMP shall establish and maintain specific procedures to ensure a successful quality improvement program.

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The QMP shall establish and maintain documented procedures for planning and implementing Contractor quality audits to measure the effectiveness of the QMP and identify quality improvement opportunities. The Contractor shall schedule and perform internal quality audits on the basis of the status and importance of the activity to be audited.

Personnel that are assigned to audit Work activities shall not have direct quality responsibilities for the respective activities they audit. The results of the audits shall be recorded and reviewed with the personnel having responsibility in the area audited not later than 3 Working Days following completion of the audit.

The Contractor's project management personnel shall ensure timely implementation of the necessary corrective actions to improve any deficiencies found during the audit. The Contractor's follow-up activities shall ensure the implementation and effectiveness of the corrective action taken. Corrective actions shall identify the root causes of deficiencies and shall be developed, implemented, and tracked to prevent the recurrence of future deficiencies. Corrective actions shall be monitored through review of documents, surveillance, or follow-up audits. Records of corrective actions shall be kept together with the respective audit records and submitted to CDOT upon request.

Additionally, the Contractor shall consider CDOT's Verification efforts to determine where Contractor quality improvement audits shall be performed and potential corrective actions implemented.

### **3.1.6 Quality Personnel**

The Contractor's executive management shall have overall responsibility for successful execution of the QMP and shall ensure that responsibilities and authority are defined and communicated within their organization. The Contractor shall identify a Quality Assurance manager that reports directly to executive management and shall be responsible for all Quality Assurance activities for the Project. The Quality Assurance manager cannot be the same individual as the Quality Control manager. Additionally, the Quality Assurance manager shall ensure design intent is consistent with completed construction. This may require additional oversight and staffing of separate individuals for these associated Quality Assurance activities for the Project.

The Contractor shall identify a Quality Control manager for all design activities and a Quality Control manager for all construction activities. These can be the same or separate individuals. The Contractor's Quality Control manager shall develop and document procedures, instructions, and process controls to ensure the Work being produced by the Contractor meets the requirements of the Contract. The Contractor's Quality Control manager shall review and approve the QMP, and any revisions, prior to submittal for CDOT's Approval. The Contractor's Quality Control manager shall be responsible for assuring, certifying, and providing documented evidence that the Work meets the requirements of the Contract. At a minimum, the Quality Control manager shall provide monthly status reports of the Project's quality to CDOT.

All construction Quality Assurance and Quality Control testing personnel performing concrete and hot bituminous pavement process control tests shall meet the standards established in Section CP-10 of the CDOT Field Materials Manual.

The Contractor shall ensure that personnel performing Work shall have the education, training, skills, and experience to meet the requirements of the Contract. The Contractor shall maintain appropriate personnel records that may be examined by CDOT upon request. Additionally, all testing and lab facilities and equipment need to be maintained in condition suitable for continued certification and in conformance with the AMRL accredited list requirements.

### **3.1.7 Training**

The Contractor shall establish and maintain documented procedures for identifying training needs and requirements and shall provide training of all personnel performing activities affecting quality. Personnel performing specific assigned tasks affecting quality shall be trained in the specific plans, processes, and procedures as assigned in the QMP (e.g., MTIP, Contractor auditing procedures, etc.).

The Contractor shall provide training to all personnel that may interface with CDOT's Verification efforts to ensure it understands its roles and responsibilities for cooperating and responding to CDOT Verification activities.

## **3.2 Quality Management Plan Requirements**

The QMP shall state the Contractor's commitment to quality and provide a clear definition of the scope of activities and detail the methods to ensure the Work meets the requirements of the Contract.

The QMP shall list all deliverables to CDOT as required by the Contract.

### **3.2.1 Contractor Responsibility to Respond to Nonconformance Notices**

For Verification purposes, CDOT will perform assessments or testing of the Work. Contractor training for CDOT assessments/testing will be provided by CDOT to ensure full understanding of this process. These efforts do not relieve the Contractor of responsibility for all Work completed on the Project.

CDOT will forward all assessment/testing reports, including notices of Nonconforming Work (if any) to the Contractor. Notices of Nonconforming Work will be issued as a Nonconforming Work Notice (NWN) and identified further by its level of importance (level 1 or 2) with Level 1 being of the highest importance. The Contractor shall respond in writing to CDOT NWNs within 3 Working Days of issuance.

The Contractor's response shall identify how it proposes to remedy the Work identified as Nonconforming Work and the date by which the remedy shall be completed. The Contractor shall describe in the QMP its approach and methodology for resolving and responding to CDOT's NWNs.

### **3.2.2 Responsibility and Authority**

The Contractor shall include in the QMP an organizational chart that illustrates a commitment to an effective quality program to ensure all Work meets the requirements of the Contract. The QMP shall describe the hierarchy of the Contractor's organization. The QMP shall graphically depict the principal quality participants showing lines of responsibility, authority and communication with CDOT, other involved agencies, Subconsultants, Subcontractors, and Suppliers and any other team members having a significant quality role. The Quality Assurance Manager shall be shown on the organization chart to report to the Contractor's executive management and be independent of the Contractor's Project Manager. The organization charts shall be updated and distributed to CDOT when any changes to the organization are made.

The QMP shall describe the roles and responsibilities of the Contractor's Quality Control and Assurance managers, associated staff, and shall describe their authority to implement quality improvements for the Project.

The Contractor's Quality Control/Assurance managers and staff shall have no responsibilities in the production of the Work. The Quality Control/Assurance managers and staff shall have the authority to stop Work that does not comply with requirements of the Contract.

The responsibilities of all personnel who manage, perform, and ensure the quality of the Work include:

1. Initiate action to prevent the occurrence of Nonconforming Work.
2. Identify, evaluate, and document quality problems.
3. Recommend or initiate quality improvement solutions through established organizational channels.
4. Ensure the implementation of quality improvement solutions.
5. When Nonconforming Work is identified, stop incorporating Work that is affected by the Nonconforming Work into the Project until the deficiency is corrected.

The Contractor's Quality Control and Quality Assurance managers shall have the following responsibilities defined in the QMP:

1. Facilitate compliance of Work with the requirements of the Contract and the QMP.
2. Approve Contractor quality processes and procedures.
3. Provide adequate resources and trained personnel for Quality Control and Quality Assurance Activities.
4. Ensure the adequacy and enforcement of quality procedures, processes, inspections, and tests for all Work.
5. Establish and implement procedures to control and ensure the Work performed by Contractor employees, Subconsultants, Subcontractors, and Suppliers meet the requirements of the Contract.
6. Ensure the QMP is being implemented and report in writing regularly to the Contractor's executive management regarding the status of the implementation of the QMP.

7. Ensure that quality records are properly prepared, completed, maintained, and delivered to CDOT, as required by the Contract, to provide evidence of quality activities performed and quality results achieved.
8. Ensure that Quality Assurance manager and staff are independent of the Contractor's Project Manager, and regularly reports to the Contractor's executive management.
9. Continually promote awareness of the requirements of the Contract throughout the Contractor's entire project organization.

### **3.3 Design/Construction Quality Processes and Procedures**

The QMP shall establish the Contractor's procedures for procuring design/construction services to complete the Work for the Project. The procedures shall include a review and approval process by the Contractor's organization for adequacy of specified technical requirements and adherence to quality requirements. Documentation shall be provided that contains data clearly describing the services needed and measures to be taken to ensure that Contractor employees, Subconsultants, Subcontractors, and Suppliers meet, implement, document, and maintain the QMP requirements.

#### **3.3.1 Design Quality**

The QMP shall include procedures that address all Work elements of design. The Contractor shall identify in the QMP all applicable computer programs to develop and check designs.

The QMP shall describe how the design team schedules the design efforts, including task force meetings, design reviews, constructability reviews, design meetings, independent design checks, and a schedule for Released for Construction and As-Built Documents.

The Contractor shall identify in the QMP the requirements for QC design input. The Contractor shall perform ongoing QA audits of these QC design input requirements. The Contractor shall maintain an accessible, centrally controlled design manual, database, or list that contains all relevant QC design inputs to be used by design personnel for the Project. The Contractor shall provide a process in the QMP to ensure that the QC design inputs are communicated to and are accessible by the relevant designers responsible for the design. The Contractor shall include in the QMP how changes to QC design inputs are identified, reviewed, and approved by authorized personnel prior to their implementation.

The QMP shall also include:

1. Procedures to control and independently ensure that the design meets the requirements of the Contract.
2. Procedures to identify and track Design Document deliverables.
3. Procedures for approval, tracking and recording revisions to Design Documents.
4. The Contractor shall have a formal procedure for comment resolution included in the QMP.
5. Procedures for approval of Released for Construction Document

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The Contractor shall conduct weekly task force meetings to coordinate the design development within the Contractor's organizations, CDOT and other affected agencies. As a minimum, the Contractor shall prepare an agenda and conduct each meeting to discuss the status of the design, coordinate the design development between design disciplines, discuss constructability issues, and identify any questions associated with design requirements. The Contractor shall take meeting minutes for all task force meetings and provide minutes to CDOT within 5 Working Days after each meeting.

The Contractor shall hold design progress review meetings at certain key milestones of the design development process (e.g., 60%, 90% completion) and coordinate with CDOT to attend. The design progress meetings shall be scheduled, conducted, and documented by the Contractor. The meetings minutes shall be taken by the Contractor and submitted to CDOT within 5 Working Days after each meeting.

Released for Construction Documents, and revisions to these documents, shall be coordinated to include a MITP. The MITP shall give testing quantities, frequencies and Quality Assurance inspection hold points in conformance to requirements of the Contract. The Contractor's Quality Control Manager shall approve these documents prior to their release for construction. One hard copy and an electronic file of the documents shall be submitted to CDOT prior to the Contractor beginning construction. The Contractor's Quality Control process for the documents shall be thoroughly documented in the Contractor's QMP. Released for Construction Documents for structures shall conform to the requirements of Section 15 – Structures.

As-Built Documents shall be submitted to CDOT for Acceptance. CDOT may assess As-Built Documents to ensure completeness and compliance with the requirements of the Contract. CDOT shall not Accept As-Built Documents until the Contractor has adequately addressed any prior Contractor QC reviews, QA audits or CDOT assessments/testing. The Contractor shall ensure and provide documentation to CDOT that all have been addressed. The As-Built Documents submittal shall include:

1. All plans reflecting Released for Construction Documents or any revisions to Released for Construction Documents
2. Resolution of prior Contractor QC reviews, QA audits or CDOT assessments/testing
3. Design calculations
4. Design reports
5. Specifications
6. Electronic CADD files, as specified elsewhere in the Contract

The Contractor shall include in the QMP a process for a Colorado registered engineer in responsible charge for the design to prepare, review, and approve all Released for Construction Documents, revisions to Released for Construction Documents, field design changes and As-Built Documents. The Contractor shall maintain a master list of approved submittals, revisions and field design changes. The QMP shall include a process to communicate design changes to the construction Site on a timely basis consistent with the progress of construction activities.



### **3.3.2 Construction Quality**

The Contractor shall be responsible for performing and documenting all required construction QA/QC activities necessary to control the Work. The QMP shall extend to both permanent and temporary Work (erosion control, traffic control, etc.). Records of inspection and testing activities shall be submitted to a CDOT. Materials test reports will also require analysis and comparison to CDOT Verification Test results.

As a minimum, the Contractor's Construction Quality Assurance Program shall include the elements defined below:

1. Certification: The Contractor shall include in the QMP a process to certify to CDOT that the Work produced meets the requirements of the Contract Documents.
2. Inspection: The Contractor shall include in the QMP, a MTIP that shall include detailed inspection procedures to be used in cases where inspections are to serve as the basis for verifying compliance with the requirements of the Contract. The Contractor shall conduct each inspection in accordance with the Approved QMP. The Contractor shall document whether the inspections passed or failed based on the "pass/fail criteria" established in the procedure and the requirements of the Contract; (e.g., concrete depth checks on deck pours, rebar clearance/size, locations, elevations, stationing etc.). The Contractor shall include failing inspection results, when applicable, in the inspection documentation.
3. Testing: At a minimum, the Contractor shall follow the CDOT Field Materials Manual and its Frequency Guide Schedule for Minimum Materials Sampling, Testing, and Inspection requirements identified under the column titled "Project Verification Sampling & Testing Frequency" for all Quality Assurance tests required and recorded on the associated CDOT standard forms. The Contractor shall document the results and show if the test passed or failed based on the "pass/fail criteria" established in the Contract. The Contractor shall include failing tests results in the test documentation. Independent Laboratories shall submit signed and certified test reports to the Contractor not more than 14 Working Days after completion of the tests for all tests which require an independent Laboratory. CDOT may witness any test conducted for Independent Assurance purposes. The Contractor shall develop and maintain a current Test log for all tests required by the Contract. As a minimum, the Contractor shall document results of tests in report format. Include the following:
  - Contract or project identification number
  - Identification of items tested
  - Quantity
  - Date and time test conducted
  - Location of items tested
  - Test procedure used
  - Name of technician

- Acceptance criteria
  - Results - acceptance or rejection
  - Authorized signature
4. Certificates of Compliance (COCs) / Certified Testing Results (CTRs): The Contractor shall include in the QMP a method of handling and documenting Work/products accepted in the Work by COC or CTR. The Contractor shall obtain COCs / CTRs prior to incorporation in the Work and before inclusion on the monthly invoice, and maintain a complete log of all COCs and CTRs. The log and all COCs / CTRs shall be available for CDOT's Verification at any time. The Contractor shall include in the COC/CTR log, signed certification that all Materials represented by each COC/CTR was installed in the Work. Certification shall be according to requirements of the Contract. The Contractor shall submit all COCs/CTRs to CDOT prior to Final Acceptance.
  5. Quality Reviews: The Contractor's Quality Manager shall document formal reviews to verify that the QMP is being effectively implemented.

### **3.3.3 Materials Testing and Inspection Plan (MTIP)**

The QMP shall include a MTIP describing all of the proposed inspections and tests procedures, including products provided by Suppliers during the manufacturing, receiving, and installation process, to ensure the requirements of the Contract are met. The MTIP shall identify all inspections and tests required including, at a minimum, reference to the requirements of the Contract, frequency of the inspections and tests, and the Contractor-developed Quality Assurance processes. Where no inspections or test standard exists in any of the CDOT manuals, the MTIP shall develop criteria based upon the best-available industry standard information and technology.

The MTIP shall include procedures for delivery, handling, and storage of furnished products ensuring they are properly handled and stored to prevent damage, deterioration, or theft. It shall also document procedures for stored items and Materials consistent with the expected duration and type of storage, and procedures for monitoring special processes utilized in fabrication, assembly, and testing of specified products. Special processes are those requiring qualified/certified production, inspection, and test personnel to perform highly skilled Work, such as welding, brazing, soldering, non-destructive testing, machining, coating, or plating.

The MTIP shall describe all Quality Assurance inspection and test activities to be carried out including Quality Assurance hold-points, and establish authority within the Contractor's organization for releasing Work beyond the hold-point. While the Contractor shall notify CDOT when Work has progressed to a hold-point, it shall be the responsibility of the Contractor's Quality Control Manager to verify that all requirements have been met prior to allowing the Work to progress.

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The MTIP shall include a summary of activity-specific Material quantities to document that the minimum sampling, testing, and inspection requirements have been met. This summary shall be performed and provided to CDOT monthly. (The Contractor may follow the CDOT Form 250 as a minimum basis for their Materials documentation record.)

The MTIP shall include processes to control, calibrate, and maintain test equipment (both field and lab equipment), to ensure it meets industry standards and other applicable requirements. Test equipment used by the Contractor shall be of a quality and capacity that ensures that measurements made are to levels of accuracy and precision that are required by the test procedure. The MTIP shall:

1. Identify the test required and the accuracy required, and select the appropriate test equipment.
2. Define procedures to calibrate all test equipment prior to initial use and at prescribed maintenance intervals against certified equipment and measurement standards of the National Institute of Standards and Technology or other similar recognized technical standards customarily accepted in the industry. Where no standard exists, the basis for calibration shall be developed in writing based upon the best-available information and technology.
3. Identify test equipment with a suitable indicator to show the calibration status of the test equipment.
4. Maintain current calibration records for test equipment.
5. Define procedures to ensure that environmental conditions are suitable for calibrating test equipment.
6. Define procedures to ensure that the handling and storage of test equipment is such that the accuracy and fitness for use is maintained.
7. Define procedures to safeguard test equipment, including test hardware and test software, from adjustments that would invalidate calibration settings.
8. Contractor shall submit a list of any and all equipment to be used with calibration dates and certifications

#### **3.3.4 Reporting and Record-Keeping of Construction Quality Control Documentation**

The Contractor shall maintain construction workmanship and materials quality records of all inspections and tests performed per the QMP. These records shall include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of Nonconforming Work and causes for rejection, etc.; proposed remedial action; and corrective actions taken. These records shall cover both conforming and nonconforming Work, and shall include a statement that all supplies and materials incorporated in the Work are in full compliance with the Contract Documents.

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The Contractor's Quality Control manager shall ensure that quality records are properly prepared, completed, maintained, and delivered to CDOT, as required by the Contract, to provide evidence of quality activities performed and quality results achieved.

The Contractor shall submit all Quality Control test measurements and test results, including failing results, and inspection records. The Contractor shall submit test data and approved test results to CDOT. The responsible technician and the technician's supervisor shall sign the daily test reports.

The Contractor's Quality manager shall also maintain a daily log of all inspections performed for both Contractor and Subcontractor operations. The daily inspection reports shall identify inspections conducted, dates of inspections, results of inspections, locations and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed. The responsible technician and the technician's supervisor shall sign the daily inspection reports. These daily inspection reports shall document the day's events, activities, and discussions in a format consistent with the requirements contained within CDOT's Field Materials Manual and Construction Manual.

To enhance coordination of CDOT's Verification activities during construction, the Contractor shall provide CDOT with a weekly look-ahead of specific scheduled construction activities designating location and planned quantities of materials to be placed, and protocols for identifying completed Work. The Contractor shall provide CDOT with the actual construction activities conducted during the previous week, designating location and quantities of materials that were placed.

### **3.4 Nonconforming Work**

The Contractor shall include in the QMP procedures to develop and maintain a system to identify, control, remedy and report Nonconforming Work, including Nonconforming Work identified by CDOT. The QMP shall include procedures to identify Nonconforming Work and to withhold progress payment requests on the monthly Invoice until the Nonconforming Work is remedied. The Contractor shall remedy Nonconforming Work in accordance with the QMP. The responsibility for review and for the disposition of Nonconforming Work shall be established in the QMP. The Contractor shall identify Nonconforming Work by completing a Nonconformance Report (NCR). A NCR shall include:

1. Identification of Nonconforming Work, including tagging Work products
2. Evaluation of the Nonconforming Work
3. Recommendation for "repair" or "use as is" dispositions
4. Cause of Nonconforming Work
5. Proposed corrective action to prevent recurrence
6. Responsibility for accomplishing corrective action
7. Schedule of Work with a date of remedy completion
8. Signature lines for the Quality Control Manager and CDOT verifying that the Nonconforming Work recommended remedy has been completed in accordance with the approved disposition

The Contractor's Engineer shall approve the recommended remedy for the Nonconforming Work prior to its submittal to CDOT. The Contractor shall not perform the recommended remedy prior to its submittal to CDOT for "repair" and "use as is" dispositions.

The Contractor shall develop and maintain a Nonconforming Work log to track and identify the status of Nonconforming Work. An updated log shall be submitted to CDOT weekly and shall be used by the Contractor to look for Nonconforming work trends to determine if corrective actions are needed.

All NCRs shall be recorded by the Contractor and provided to CDOT.

The Contractor shall include in the QMP procedures for controlling the use of Nonconforming Work including the tagging of Nonconforming Work products. Nonconforming Work product tags shall only be removed by the originator of the NCR or the originator's supervisor, and only when the Contractor demonstrates to CDOT that the Nonconforming Work product meets the requirements of the Contract.

### **3.4.1 Corrective and Preventative Action**

The QMP shall describe corrective and preventative action procedures that the Contractor shall use to identify and improve processes that produce, or may produce, systemic Nonconforming Work identified by the Contractor or by CDOT. The Contractor's corrective and preventative action procedures shall include:

1. Methods to investigate the cause of systemic Nonconforming Work and to determine what corrective action is needed to prevent recurrence
2. Methods to analyze all processes, Work operations, quality records, service reports, and CDOT assessments/testing to detect and eliminate the possibility of systemic Nonconforming Work from occurring
3. Methods to prioritize corrective and preventive action efforts based upon the level of risk to the quality of the Work
4. Controls to ensure that effective corrective and preventative actions are taken when the need is identified
5. Methods to implement and record changes in procedures resulting from corrective and preventative actions

### **3.4.2 Punch List Work**

The Contractor shall develop a Punch List and Punch List log as required in the Contract. The Punch List and Punch List log shall be completed by Quality Control and Quality Assurance personnel. CDOT, including CDOT Maintenance, and other affected agencies shall be invited by the Contractor to attend walks of the Work to include items on the Punch List. The Contractor Punch List and Punch List log shall be provided to CDOT.

### **3.5 CDOT Owner Verification Reviews**

CDOT's Owner Verification will use a sampling approach to assess the Contractor's compliance with the requirements of the Contract Documents. CDOT reviews of sampled Work for Contract compliance are defined as Verification reviews. The four types of CDOT Verification reviews are:

1. Design Verification reviews: Design Verification reviews will be performed on the products of design (drawings, specifications, and other design deliverables). Design Verification reviews are performed on an ongoing basis during the Project.
2. Construction Verification Inspections: Construction Verification Inspections will be performed on construction activities.
3. Construction Verification Testing: CDOT will perform sampling and testing of Materials to validate the Contractor Quality Control/Assurance testing programs.
4. Process assessment: Process assessments will be performed on the implementation of all Contractor Work activities. Such activities may include the requirements of the Contract, such as public information, Maintenance of Traffic, environmental compliance, safety, project management processes, and meeting the requirements of the QMP.

Verification reviews will entail the collection and documentation of objective evidence to determine whether the requirements of the Contract have been met. The results of CDOT Verification reviews will be recorded by CDOT.

#### **3.5.1 CDOT Verification Tests**

CDOT will perform periodic Verification tests to ensure that the Contractor's Materials meet the requirements of the Contract. CDOT will ensure that the Contractor's Quality Assurance test results correlate within the minimum differences specified within the CDOT Field Materials Manual for all independent assurance tests and meet the requirements of the Contract. If CDOT determines that the compared test results do not correlate, the Contractor shall perform additional tests to determine the cause of the differences.

#### **3.5.2 CDOT Independent Assurance**

CDOT will perform independent assurance reviews and tests to ensure that:

1. Contractor Quality Control/Assurance personnel are trained and certified and demonstrate that they understand the test procedures they are performing.
2. The test equipment used by the Contractor's Quality Control/Assurance personnel is calibrated.
3. Split sample test results correlate.
4. The facilities used are AMRL certified

Independent assurance test results will also be used as referee tests to assess statistically significant differences, determined by CDOT in its sole discretion, between Contractor Quality Control/Assurance tests and CDOT Verification test results.

### **3.5.3 Governmental Person Inspections**

Government Persons shall have the right to inspect the Work, provided that the Governmental Person has jurisdiction over the Work and as required by Applicable Law.

## **3.6 Deliverable Requirements**

### **3.6.1 Quality Management Plan**

The Contractor shall submit the QMP for design related Work to CDOT for Approval prior to issuance of NTP1. The entire QMP for all remaining Work on the Project must have CDOT's Approval before NTP2 will be issued. The Contractor shall fully implement the Approved QMP. Any subsequent addendums, required during execution of the Work, shall also require CDOT's Approval. This information shall be submitted in hardcopy form and electronically.

### **3.6.2 Design Deliverables**

The Contractor shall submit to CDOT all Released for Construction Documents, Revisions to Released for Construction Documents, and As-Built Documents.

The Contractor shall identify on its Contract Schedules when the design deliverables identified above will be submitted to CDOT.

The Contractor shall provide two hard copies (11 x17 inches for plans, 8.5 x 11 inches for specifications), and one set of electronic files on CD-Rom of the design deliverables to CDOT. As-Built Documents shall show all changes. All changes shall be noted using CADD. Hand-drawn changes will not be allowed.

The design deliverables shall be delivered to CDOT indexed and clearly marked to indicate the date of issue and stage of development (e.g., Released for Construction Documents). All design deliverables shall include a title block, consistent with the standard Project drawing format established as part of the QMP, with the following information:

1. Date of issuance and including all prior revision dates
2. Contract title and number
3. The names of the Contractor, Subconsultants, Subcontractors, Suppliers, and manufacturers as applicable
4. Subject identification by Contractor drawing or Contract reference

All design deliverables shall be sealed by the Engineer consistent with applicable Legal Requirements and the requirements of the Contract. All design deliverables shall include a sufficient blank space, in the lower right corner, just above the title block on the drawings, and in the lower right corner of the title page of specifications and calculations, in which the Contractor's Engineer may indicate the action taken, indicating their review and approval.

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If a design deliverable requires review approval from a Local Agency or permitting authority, the Contractor shall gain such concurrence prior to submitting the design deliverable to CDOT.

Specifications applicable to a design deliverable shall be submitted with the design deliverable.

When calculations accompany drawings in a submittal, the body of the calculations shall contain cross-references to the individual drawing to which the pages of the calculations pertain.

Calculations required shall demonstrate conformance with the requirements of the Contract.

The CADD drawings and associated documents shall be organized in a logical manner, have a uniform and consistent appearance, and clearly depict the intent of the design and construction.

In addition:

1. The software requirements for all submitted design deliverables shall be InRoads/Microstation, in accordance with the current CDOT standards in effect at the time of Proposal submittal by the Contractor. Project files shall be organized and submitted in accordance with CDOT's ProjectWise format.
2. All design deliverables shall be in English units. The Project coordinate system shall comply with the CDOT Survey Manual.
3. The Contractor shall prepare As-Built Documents for the Project that shall include, but not be limited to, the following:
  - 1) Title Sheet
  - 2) Index
  - 3) Standard Plan List
  - 4) Roadway Design Data
  - 5) General Notes
  - 6) Pavement Details
  - 7) Roadway Details
  - 8) Drainage Details
  - 9) Geotechnical Plans
  - 10) Environmental Mitigation, as necessary
  - 11) Permanent Signing Plans
  - 12) Aesthetic Elements
  - 13) Roadway Typical Sections
  - 14) Roadway Geometric Layout Plans
  - 15) Roadway Geometric Layout Tables
  - 16) Roadway Plan
  - 17) Roadway Profile
  - 18) Detour Construction and Phasing Plans
  - 19) Detour Construction and Phasing Profiles
  - 20) Intersection Plans
  - 21) Bike Path Plan and Profile
  - 22) Pavement Plans
  - 23) Drainage Plans
  - 24) Pavement Marking Plans
  - 25) Utility Plans
  - 26) ITS Plans



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- 27) Landscape/Seeding Plans
- 28) Grading Plans
- 29) Lighting Plans
- 30) Bridge Plans
- 31) Wall Plans
- 32) Park Plans
- 33) Other Details, as needed
- 34) Specifications

The Contractor shall provide one set each of electronic files on CD-Rom of Utility As-Built Documents to CDOT and to the respective Utility Owner for Utility Work constructed by the Contractor, after the Utility Owner has accepted the Utility Work in conformance with the requirements of Section 7 - Utilities. These electronic deliverables shall conform to those requirements set forth in the Contract for CADD requirements, except as modified by the specific requirements of the individual Utility Owners. The Utility As-Built Documents shall show locations of existing Utilities, structures, trees, streets, and existing highway right-of-way limits. Additionally, the Contractor shall obtain from each Utility Owner, performing its own construction, one set of Utility As-Built Documents for their Utility Work showing the foregoing information with electronic files on CD-Rom provided to CDOT. The Contractor shall be required to show this information on the As-Built Documents. All As-Built Documents electronic files shall be submitted in \*.dgn and \*.pdf format.

CADD files shall be in accordance with the appropriate requirements of the Contract and those agencies requiring this information as part of the Contractor's Work. Highway-related files shall conform to CDOT Standards. All CADD files shall be documented in a tabular format describing the path, file name, and description.

### **3.6.3 Document and Data Approval**

The Contractor shall ensure that all deliverables include a signed and dated certification by the originator of the deliverables and that the deliverable is complete and meets the requirements of the Contract.

### **3.6.4 Document and Data Changes**

The Contractor shall ensure that any changes to deliverables provided to CDOT as revised are in a format that can enable changes to be readily apparent and trackable (e.g., documents use the redline/strikeout method).

### **3.6.5 Product Data**

The Contractor shall submit to CDOT for Acceptance two hard copies of all manufacturers' warranties, guarantees, instruction sheets, parts lists, and other product data within 20 Days of installation of the items to which they relate. The Contractor shall ensure that the product data cited is organized and indexed in a manner that allows easy retrieval of information. The Contractor shall maintain proper records of product data.

### 3.7 Deliverables

At a minimum, the Contractor shall submit the following to CDOT for review, Approval, and/or Acceptance:

<b>Deliverable</b>	<b>Review, Acceptance, or Approval</b>	<b>Schedule</b>
Quality Management Plan	Approval	For design related Work, prior to issuance of NTP1. The entire QMP for all remaining Work on the Project must have CDOT's Approval before NTP2
Quality Management Plan Revisions	Approval	Prior to release
Other Meeting Minutes (defined in QMP)	Acceptance	5 Working Days after meeting
Task Force Meeting Minutes	Acceptance	5 Working Days after meeting
Design Progress Meeting Minutes	Acceptance	5 Working Days after meeting
Released for Construction Documents	Acceptance	As defined in Contract Schedules
Revisions to Released for Construction Documents	Acceptance	As defined in the Contract
As-Built Documents	Acceptance	As defined in the Contract
Two hard copies of all manufacturers' warranties, guarantees, instruction sheets, parts lists, and other product data	Acceptance	Within 20 Days of installation of the items to which they relate
COC/CTR Record	Acceptance	Prior to Final Acceptance
Final Materials Documentation	Acceptance	Prior to Final Acceptance