# 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, quality personnel, training and the Quality Management System. The QMP shall list procedures for meeting all requirements of the Contract Documents. The Contractor shall submit the QMP to CDOT for Approval. The QMP must have CDOT's Approval before NTP2 will be issued. The Contractor shall fully implement the Approved QMP.

## 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 for quality and its commitment to quality. The QMP shall delineate the procedure used by the Contractor's executive management to implement the Contractor's quality policy. The Contractor's executive management shall ensure that this policy is understood, implemented, and maintained 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 included in this Section.

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 the quality policy and the QMP.

### 3.1.2 Quality Planning

The Contractor shall include in the QMP its planning methods to meet the requirements of the Contract Documents. The Contractor shall include the following Activities in its quality planning efforts in order to meet the Contract Documents requirements for the Work: (The Activities specified herein are a minimum for the program.)

1. Develop and define quality objectives for the Project.
2. Identify the necessary processes, resources, and Quality Assurance personnel that are needed to assure that the Work meets the requirements of the Contract Documents including environmental commitments, public information requirements, maintenance of traffic requirements, safety, Project management processes and the QMP.
3. Ensure the compatibility of design, construction, installation, public information, inspection, and testing procedures.
4. Develop and maintain the currency of Quality Control, Quality Assurance and quality improvement procedures.
5. Identify and define all measurable Contract Documents 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 a procedure for preparation, control, Approval, and distribution of the QMP.
10. Develop a procedure for Quality Assurance auditing to ensure the Contractor, sub contractors and material suppliers understand and are effectively implementing the QMP.
11. Develop a procedure for corrective and preventative actions regarding quality compliance.
12. Develop a procedure and ensure the Contractor's executive management reviews the QMP.

### 3.1.3 Quality Control

The Contractor shall be responsible to establish, document, and implement, a Quality Control program. The Quality Control program shall be described in the QMP and include all procedures necessary for the Contractor to control the quality of its production processes to produce products that meet the requirements of the Contract Documents. The Contractor shall develop a testing and inspection schedule to control the production processes.

Construction quality control activities shall utilize statistical analyses of material test results including mean, variance, range, and running averages. The results of these activities shall be used by the Contractor to set up control charts to monitor and track variations in materials over time. The control charts and the analytical results on which they are based shall be provided to CDOT as requested.

Tests or inspections performed by production or Quality Control personnel as part of the Quality Control process shall not be used to satisfy the Quality Assurance requirements.

### 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 methods and procedures by which the Work will be certified by the Contractor as complying with the requirements of the Contract Documents.

Quality Assurance personnel shall not be involved in any Quality Control Activities and shall be separate from 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 Documents. 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 quality improvement program. 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.

The QMP shall establish and maintain documented procedures for planning and implementing Contractor quality audits to measure the effectiveness of the Quality Management Plan 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 three Working Days following completion of the audit.

The Contractor's Project management personnel shall timely implement 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 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.

The Contractor shall consider CDOT's auditing efforts and the overall goals of the Project to determine where Contractor quality improvement audits shall be performed.

### 3.1.6 Quality Personnel

The Contractor's executive management shall have overall responsibility for success of the quality program, and shall ensure that responsibilities and authority are defined and communicated within their organization.

The Contractor shall identify a Quality Manager for all Design activities and a Quality Manager for all Construction activities. The Quality Manager shall be responsible for all Quality Control and Quality Assurance activities. The Contractor's Quality 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 Documents. The Contractor's Quality Manager shall review and approve the QMP prior to submittal to CDOT. The Contractor's Quality Manager shall be responsible for assuring, certifying and providing documented evidence that the Work meets the requirements of the Contract Documents. At a minimum, the Quality Manager shall report the status of the Project's quality monthly to CDOT.

All construction Quality Assurance testing personnel 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 in order to meet the requirements of the Contract Documents. The

Contractor shall maintain appropriate personnel records that may be examined by CDOT upon request.

### 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., Inspection and Test Plan, Contractor auditing procedures, etc.).

The Contractor shall provide training to all personnel that may interface with CDOT's oversight efforts (audit process) to ensure that they understand their roles and responsibilities for cooperating and responding to audits.

## 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 Documents.

The QMP shall list all deliverables to CDOT as required by the Contract Documents and this Section.

### 3.2.1 Contractor Responsibility to Respond to Nonconforming Work Notices

The Contractor shall respond in writing to CDOT for Nonconformance Reports (NCRs) identified by importance level 1 or level 2. The Contractor's response shall identify how it proposes to remedy the Work identified as nonconforming, 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 NCRs.

### 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 Documents. The QMP shall describe the hierarchy of the Contractor's organization. The QMP shall graphically depict the principle quality participants, showing lines of responsibility, authority, communication, and interfaces with CDOT, other involved agencies and any other team members having a significant quality role, including Subconsultants, Subcontractors, and Suppliers. The Quality Manager and Quality Assurance staff 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 organizational 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 Quality Manager, and Quality Control and Quality Assurance staff, and other key personnel, and their authority to implement quality improvements for the Project.

The Quality Manager and Quality Assurance staff shall have no responsibilities in the production of the Work. The Contractor's Quality Manager, and all Quality Control and Quality Assurance

staff shall have the authority to stop Work that does not comply with requirements of the Contract Documents.

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 Nonconforming Work into the Project until the deficiency is corrected.

The Contractor's Quality Manager shall have the following responsibilities defined in the QMP:

1. Facilitate compliance of Work with the requirements of the Contract Documents and the Approved 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 Subconsultants, Subcontractors and Suppliers meet the requirements of the Contract Documents.
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 Documents, to provide evidence of quality Activities performed and quality results achieved.
8. Ensure that Quality Assurance staff is 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 Documents throughout the Contractor's entire project organization.

## 3.3 Quality Assurance

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

The QMP shall establish procedures for procuring services. The procedure shall include a review and approval process by the Contractor's organization for adequacy of specified

technical requirements and the adherence to quality requirements. Procurement documents shall contain data clearly describing the service needed. The proposal documents shall describe how Subcontractors and Subconsultants are evaluated prior to award.

The QMP shall describe the measures to be taken to ensure that Subcontractors and Subconsultants meet, implement, document, and maintain the Quality System requirements.

The selection of Subcontractors and the type and extent of control exercised by the Contractor shall be dependent upon the type of product or service and, where appropriate, on records of Subcontractors' and Subconsultants' previously demonstrated capability and performance.

### 3.3.1 Design Quality Assurance

The QMP shall include procedures that address all elements of design including architectural, civil, structural, geotechnical, survey, hydraulic, environmental, traffic, safety, and temporary work. 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 Release for Construction Documents and As-Built Documents.

The Contractor shall identify in the QMP design input requirements. The Contractor shall perform on-going audits of the design input requirements. The Contractor shall maintain an accessible, centrally controlled design manual, database, or list that contains all relevant design inputs to be used by design personnel for the Project. The Contractor shall provide a process in the QMP to ensure that the design inputs are communicated to, and accessible by, the relevant designers responsible for incorporating design inputs into the design. The Contractor shall include in the QMP how changes to 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 Documents, including provisions for Subconsultant's designs and configuration management Activities.
2. Procedures to identify and track Design Document deliverables .
3. Procedures for approval of Released for Construction Documents .
4. Procedures for approval, tracking and recording Revisions to Release for Construction Documents.

The Contractor's design Quality Assurance program shall include:

1. Basic Configuration confirmation: The Contractor shall prepare a Field Inspection Review (FIR) level plan showing how the Contractor's design meets the Basic Configuration requirements and submit to CDOT for Approval. The FIR level plan packages shall include a cover sheet, typical sections, plan and profile for mainline and ramps, bridge and major drainage structure general layouts, master drainage plan, preliminary wall layouts and roadway cross sections at 50 foot intervals. Six bound FIR plan sets shall be submitted to CDOT for Approval. The Contractor shall perform periodic internal audits throughout design development and construction of the Project to

ensure compatibility with the FIR Plans. A structural concept report (Book 2, Section 15.2.7.2) shall be submitted at least two weeks prior to FIR level plans.

2. Task Force Meetings: The Contractor shall conduct weekly task force meetings to coordinate the design development within the Contractor's organizations and with 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 draft minutes to CDOT four Working Days after each meeting.

3. Design Progress Review Meetings: The Contractor shall hold design progress review meetings at certain stages of the design development process (e.g. 15-30-60% packages) and invite 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 five Working Days after each meeting.

4. Released for Construction Documents and Revisions to Released for Construction Documents: These Documents allow the Contractor to initiate construction in advance. The Documents shall include a Materials Testing and Inspection Plan (MTIP). This plan will give testing quantities and frequencies, and Quality Assurance inspection hold points to confirm minimum QMP requirements have been met. The Contractor's Quality Manager shall these Documents prior to release for construction. One copy of the Documents shall be submitted to CDOT or made available to CDOT electronically prior to the Contractor beginning construction. The Contractor's Quality Assurance process for the Documents shall be thoroughly documented in the Contractor's QMP.

   Prior to release of Release for Construction plans for structure construction, the following items shall be required:

   A. The independent design check shall have been completed and the original final structural design calculations shall be revised and corrected based on comments from the independent design check for the structural element to be constructed.

   B. The Rating Package as defined in the CDOT Rating Manual shall be completed prior to release of the superstructure construction drawings.

5. As-Built Documents: As-Built Documents shall be stamped by the Engineer and submitted to CDOT for Acceptance. CDOT may audit As-Built Documents to ensure completeness and compliance with the requirements of the Contract Documents. CDOT shall not Accept As-Built Documents until the Contractor has addressed, resolved, and incorporated, to the satisfaction of CDOT, any prior Contractor or CDOT Acceptance review comments. The Contractor shall ensure and provide documentation to CDOT that all review comments have been addressed. The As-Built Documents submittal shall include:

   A. All plans reflecting Release for Construction Documents or Revisions to Release for Construction Documents.

   B. Design calculations.

C. Design reports.

D. Specifications.

E. Electronic CADD files as specified elsewhere in the Contract Documents

The Contractor shall include in the QMP a process for a Licensed Engineer in responsible charge for the design to prepare, review, and approve all changes, including field design changes, Release for Construction Documents and As-Built Documents. The Contractor shall maintain a master list of approved 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 Assurance

The Contractor shall implement, maintain and utilize an electronic Quality Management System (QMS) to input and document Quality Assurance testing for Materials generated and produced for the Project and Quality Assurance inspections of the Work. CDOT shall have access to, and use of the QMS to determining compliance with Contract requirements. The Contractor shall submit the QMS to the CDOT Project Director for Approval within 60 days of NTP – 1 issuance.

The QMS shall be a collection and reporting system that seamlessly integrates QA / QC inspection and testing data, and shall be customizable to generate reports without the need to re-enter data. The QMS shall also have the capability for the Contractor's reviewer to approve a report via an electronic signature.

The QMS shall collect and store all of the Contractor Quality Assurance tests and CDOT Verification tests including Contractor and CDOT laboratory tests. The QMS software shall be capable of displaying and printing both detailed and summarized information for all tests. The QMS shall be capable of performing statistical analysis to ensure that the compared materials come from the same family of materials and meet the requirements of the Contract Documents. All of the stored data shall be made available for review via the Internet. Any required interface for internet access to the Contractor's QMS data shall be the responsibility of the Contractor.

The Contractor shall provide initial training in the use of the QMS to contract staff and CDOT project staff.

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

1. Certification: The Contactor 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, and submit to CDOT for Approval, an Inspection and Test Plan 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 Documents. The Contractor shall use the Quality Management System (QMS) for recording Quality Assurance inspections or the inspection requirements included in the Frequency Guide Schedule for Minimum Materials Sampling and Testing, and Inspection requirements identified under the column titled " Project Verification Sampling & Testing Frequency" as applicable. The Contractor shall conduct each inspection in accordance with the Approved inspection procedures. No inspection shall be performed prior to obtaining CDOT Approval of the

inspection procedures. 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 Documents; (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: The Contractor shall follow the CDOT Field Materials Manual and the Frequency Guide Schedule for Minimum Materials Sampling and Testing, and Inspection requirements identified under the column titled "Project Verification Sampling & Testing Frequency" for all Quality Assurance tests required. The Contractor shall document the results in the Quality Management System (QMS) and will show if the test passed or failed based on the "pass/fail criteria" established in the Contract Documents. 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 fourteen 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 Documents. As a minimum, document results of tests in report format. Include the following:

    A. Contract or Project Identification Number.
    A. Identification of items tested.
    B. Quantity.
    C. Date and time test conducted.
    D. Location of items tested.
    E. Test procedure used.
    F. Name of technician.
    G. Acceptance criteria.
    H. Results - Acceptance or rejection.
    I. Authorized signature.

### 3.3.3 Inspection, Product Control and Test Plan

The QMP shall include an Inspection, Product Control and Test Plan 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 Documents are met The Inspection, Product Control and Test Plan shall identify all inspections and tests required including, at a minimum, reference to the requirements of the Contract Documents, 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 Inspection, Product Control and Test Plan shall develop criteria in writing based upon the best-available industry standard information and technology.

The Inspection, Product Control and Test Plan shall include procedures for delivery, handling, and storage of furnished products ensuring that 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 Inspection, Product Control and Test Plan shall describe all Quality Assurance inspection and test Activities to be carried out including Quality Assurance hold points. The Quality Assurance hold points will allow CDOT to inspect or test the Work prior to the Contractor moving to an Activity that precludes further inspection or testing by CDOT of the identified hold point Activity. CDOT and the Contractor shall agree upon the time the Contractor will hold Work progress to allow for CDOT inspection or testing for each Activity type and document in the QMP. The Contractor shall notify CDOT when it has met a hold point requirement in a manner Acceptable to CDOT. CDOT may designate Quality Assurance hold points in the manufacturing and installation process.

The Inspection, Product Control and Test Plan 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 Inspection, Product Control and Test Plan shall include processes to control, calibrate and maintain test 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 Inspection and Test Plan shall:

1. Identify the test required, 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.

### 3.3.4 Reporting, Record Keeping of Construction Quality Assurance Documentation

The Contractor shall maintain construction workmanship and materials quality records of all inspections and tests performed per the Approved Quality Management Plan (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.

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

The Contractor shall include in the QMS all QA test measurements and test results including failing results and inspection records. The Contractor shall submit test data and approved test results to CDOT using the QMS within twenty-four hours following the inspection or test. 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.*

To enhance coordination of CDOT's Independent Assurance 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. The Contractor will 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. 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 Approved QMP procedures. 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.

The Contractor's Engineer shall approve the recommended remedy for the Nonconforming Work. CDOT shall Approve the Contractor recommendation to remedy the Nonconforming Work unless the remedy is to remove and replace the Nonconforming Work.

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 the CDOT Project Director.

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 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 Documents or is Approved for use by CDOT.

### 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 audits 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 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 the CDOT Project Director.

## 3.5 CDOT Quality Acceptance Reviews

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

1. Design Acceptance reviews: Design Acceptance reviews will be performed on the products of design (drawings, specifications, and other design deliverables). Design Acceptance reviews are performed on an ongoing basis during the Project.

2. Construction Acceptance reviews: Construction Acceptance reviews will be performed on construction Activities. Construction Acceptance reviews will also include Verification sampling and testing of Materials.

3. Operational Acceptance reviews: Operational Acceptance reviews will be performed on the implementation of all Contactor Work Activities excluding design and construction. Operational Activities include the requirements of the Contract Documents such as public information, maintenance of traffic, environmental compliance, safety, Project management processes and meeting the requirements of the Approved QMP.

Acceptance reviews will entail the collection and documentation of objective evidence to determine whether the requirements of the Contract Documents have been met. The results of CDOT Acceptance reviews will be recorded by CDOT and will be documented on standardized Acceptance review report forms with copies provided to the Contractor. Conforming and Nonconforming Work reviews will be provided to the Contractor.

### 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 Documents. CDOT will enter Verification test results in the Contractor's QMS. CDOT will perform a statistical analysis to ensure that the Contractor's Quality Assurance test results correlate statistically with the CDOT Verification test results and meet the requirements of the Contract Documents. If CDOT determines that the compared test results do not correlate, CDOT will perform Independent Assurance tests to determine the cause of the differences.

Materials accepted on basis of a Certificate of Compliance (COC) may be sampled, inspected or tested by CDOT at any time.

### 3.5.2 CDOT Independent Assurance

CDOT will perform Independent Assurance audits and tests to ensure that:

1. CDOT Verification personnel and Contractor Quality Assurance personnel are trained, certified and demonstrate that they understand the test procedures they are performing and;

2. The test equipment used by the CDOT Verification personnel and the Contractor Quality Assurance personnel is calibrated and;

3. Split sample test results correlate.

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 Assurance tests and CDOT Verification test results.

### 3.5.3 Governmental Person Inspections

Governmental 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 six hardcopies and two electronic copies of the QMP to CDOT for Approval within 60 Days from NTP 1. NTP 2 shall not be issued until the QMP has been Approved by CDOT.

### 3.6.2 Design Deliverables

The Contractor shall submit to CDOT all Release for Construction Documents, Revisions to Release 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 11 by 17 inch hard copies 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 Accepted.

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 Submittal 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. 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.

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.

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 Documents.

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:

A. The software requirements for all submitted design deliverables will be InRoads/Microstation, in accordance with the current CDOT standards in effect at NTP1. Project Files shall be organized and submitted in accordance with CDOT's ProjectWise format.

B. All design deliverables shall be in English units. The Project coordinate system shall comply with the CDOT Survey Manual.

C. 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
(27) Landscape/Seeding Plans
(28) Grading Plans
(29) Lighting Plans

(30) Bridge Plans
(31) Wall Plans
(32) Roadway Cross Sections
(33) Estimated Material Quantities
(34) Other Details, as needed

The Contractor shall provide one 11 by 17 inch hard copy and one set of electronic files on CD-Rom, of Utility As-Built Documents, each to CDOT and to the respective Utility Owner for Utility Work constructed by the Contractor, within 90 Days after the Utility Owner has accepted the Utility Work. 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, Utility as-built drawings for their Utility Work showing the foregoing information and with one 11 by 17 inch hard copy and one set of electronic files on CD-Rom to CDOT. The Contractor will be required to show this information on the As-Built Documents. All As-Built Documents electronic files shall be submitted in *.dgn and *.pdf or other Approved format.

CADD files shall be in accordance with the appropriate Standards in this Section. 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.

The structure of the Reference Drawings, Contract Drawings, and CADD files are recommended as a guideline for file setup.

### 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, that the deliverable is complete, and meets the requirements of the Contract Documents.

### 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 hardcopies of all manufacturers' warranties, guarantees, instruction sheets, parts lists, and other product data within twenty Days of installation of the items to which they relate, and in any event prior to Final Acceptance. The Contractor shall ensure that the product data cited in this section 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:

| Deliverable | Acceptance or Approval | Schedule |
|---|---|---|
| Quality Management Plan | Approval | Within 60 Days following NTP1 |
| Other Meeting Minutes (defined in QMP) | Acceptance | Four Working Days after Meeting |
| Field Inspection Review (FIR) Level Plan Set | Approval | Within 90 Days following NTP1 |
| Task Force Meeting Minutes | Acceptance | Four Working Days after Meeting |
| Design Progress Meeting Minutes | Acceptance | Five Working Days after Meeting |
| Summary of Activity Specific Material Quantities (Inspection and Test Plan) | Acceptance | Every Six Months |
| Released for Construction Documents | Acceptance | As defined in Contract Schedules |
| Revisions to Released for Construction Documents | Acceptance | As defined in Contract Schedules |
| As-Built Documents | Acceptance | As defined in Contract Schedules |
| Quality Management System | Approval | Within 60 Days of NTP 1 issuance |