MDOT SUPPLIER QUALIFICATION PROGRAM

MDOT SUPPLIER QUALIFICATION STANDARD

FOR

PRESTRESSED CONCRETE BEAMS

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for
PRESTRESSED CONCRETE BEAMS

The Michigan Department of Transportation (MDOT) places a high value and importance on the dependability of suppliers providing main member bridge prestressed concrete beams.

MDOT believes that an effectively implemented, regularly maintained and regularly audited quality management system (QMS) is a key indicator of a Supplier's ability to produce a quality product. MDOT will accept products from suppliers who demonstrate a proactive QMS with procedures and processes that consistently deliver quality to the State. To assess that demonstration of quality MDOT conducts assessments of the readiness of the Supplier's QMS to meet contract requirements for prestressed concrete beam projects.

By implementing the requirements of this Standard consistently, MDOT projects can be produced and delivered with minimum error, deviations and rework. This improves quality for MDOT and should provide profitability for the Supplier.

Prime contractors may choose from this list with confidence that the minimum QMS has been demonstrated by the Supplier. The Supplier has also demonstrated an understanding of MDOT requirements for this product.

Compliance with this program meets the requirements of the required Contractor Quality Control Plan (QC Plan) referenced in the MDOT *Special Provision for Quality Control and Acceptance of Structural Precast Concrete* (12SP-708C) and this program. Note that portions of 12SP-708C are repeated, referenced and identified here for Supplier convenience.

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Revision Log

Revision Date	Description of Revision
1/24/2020	Original
5/26/2021	Updated a position on the signature page with a new personnel name

Program Rules

Standard

Program Rules

Commentary: Throughout this Standard, clarifications and examples have been provided to assist the Supplier in understanding the requirements. Commentary should be considered non-mandatory.

A. Definitions

Definitions are based on MDOT Special Provisions, MDOT Construction Specifications and industry codes and standards referenced by those MDOT documents. In case of a conflict in the contract documents, see Division 1 of the MDOT Standard Specifications for Construction for order of contract document precedence. Definitions offered here are specific to this Supplier qualification program and may not align precisely with some PCI publications or related industry documents.

Note: use of the term Contractor in this section and in MDOT 12SP-708C is synonymous with the term Supplier. Contractor in the 12SP-708C refers to the Prime Contractor and its Suppliers. The Prime Contractor is responsible to meet these requirements and all project contract requirements. However, it is understood that it is the Prime Contractor's Suppliers who are responsible for compliance to the QC requirements.

Air Content of Fresh PCC	The recorded air content of fresh PCC sampled and tested according to MDOT's Special Provision for Quality Control and Acceptance of Structural Precast Concrete (12SP-708C).
Alkali-Silica Reactivity (ASR)	A chemical reaction which occurs over time within PCC between highly alkaline cement paste and reactive forms of silica found in some aggregates. In the presence of moisture, an expansive ASR gel is formed which can exert pressure within the PCC, causing random cracking and premature deterioration of the PCC.
CAR	Corrective action request or corrective action response.
Concern	Concerns may be related to accuracy, consistency, individual actions or other issues that could impact product quality, but do not yet constitute a nonconformance.
Correction	The measure(s) taken to bring a single nonconforming product or process into conformance with specified requirements. It may be a reaction to a process parameter that is approaching an established QC Action Limit. It may also be an action to fix a single nonconformance.
Corrective Action	The action or actions undertaken to identify and eliminate the root cause of a product nonconformance or process nonconformance to prevent its recurrence. Corrective action is not the repair or rework of identified nonconforming product or process to meet specified requirements (correction). Note – the term "corrective action" may also be used in the MDOT special provisions, and in this case means "correction" as defined in this document.
Critical Nonconformance	Finding that directly affects and severely reduces the quality and acceptability of the product, possibly leading to premature failure, excessive maintenance, or diminished service life. Examples of critical nonconformance may include but are not limited to the following items, at a minimum, that are stipulated in the project specifications: Use of nonconforming material (defective, unauthorized, etc.), unauthorized modifications or substitutions, practices violating code or specification requirements, falsification of any record, absence of required documentation for critical items and unqualified individuals performing critical tasks.
Finishing	Finishing is a stage in the manufacture of each element that begins after an element has been cured and does not begin until 28-day compressive strength has been

	achieved. Finishing activities may include grouting of small holes, end finishing and grouting of small tight cracks. Finishing is expected and required for each concrete element.
Floating	Working the top surface of freshly placed PCC to create a specified smooth surface.
Implementation (of a quality procedure)	A quality procedure is implemented when the process is documented and maintained; responsible personnel are aware of their responsibilities in the procedure and the records generated by the procedure are executed. It is maintained when it is audited regularly and updated to meet changing requirements
Inspection and Test Plan (ITP)	That part of a quality control plan that defines detailed quality control activities performed by production, QC, and QA inspection, oversight, approvals, or hold points at specific steps. It is typically a separate document referenced by the quality control plan.
Job Mix Formula (JMF)	The actual batch quantities (mixture proportions) of each constituent included in the PCC mixture, based on adjustments to the target weights attained from the mix design process necessary to optimize the PCC mixture properties.
Major Nonconformance	Finding related to the QMS, which directly or indirectly affect production dependability and consistency, potentially leading to reductions in product performance, quality and reliability. Examples of major nonconformance may include but are not limited to the following items, at a minimum, that are stipulated in the project specifications: unqualified employee, missing procedures, poor equipment condition leading to material or manufacturing nonconformance, material quality, drawing accuracy, vendor services and inadequate supervision.
Minor Nonconformance	Finding related to documentation shortcomings or other minor infractions within the system application that are not expected to cause multiple nonconformities or significant product deficiencies in current or future projects. Examples of minor nonconformance may include but are not limited to the following items, at a minimum, that are stipulated in the project specifications: Expired or incorrect calibration, inadequate training, specification not current, missing procedure steps and illegible identification.
MDOT Program Manager	A managing engineer of the MDOT Bureau of Bridges and Structures – Structures Construction Section or designee with the decision-making authority for the program use and Supplier participants. The Program Manager functions on behalf of the Engineer in decisions about Supplier's capability to supply projects.
PCC Mix Design	The process, by which the PCC mixture performance characteristics are defined, based on selected materials, performance requirements, environmental exposure considerations, placement methods and other factors that control the plastic and hardened properties of the PCC in efforts to produce an economical and durable product. Proportions yielding the desired characteristic are established by testing.
Program	The MDOT Supplier QMS Assessment Program
Production Lot	A discrete cubic yard quantity of PCC containing the same JMF and used for the same application as described in 12SP-708C.
QAI	Quality Assurance Inspector. Term used in this Standard to refer to the Inspector representing the Engineer. The QAI is typically on site daily or at some lesser frequency to observe and perform sample inspections and tests to demonstrate conformity to project requirements on behalf of the Engineer.
QCI	Quality Control Inspector. Term used in this Standard to refer to the Supplier's inspector(s). The QCI is performing and documenting measurements and tests required to demonstrate conformity to project requirements on behalf of the Supplier.

Quality Assurance (QA)	Activities administered by MDOT's quality assurance inspector (QAI) dealing with acceptance of the product, including, but not limited to, materials selection, sampling, testing, fabrication inspection and review of Contractor QC documentation. All PCC QA sampling and testing will be administered by the Engineer.
Quality Control (QC)	All activities administered by the Contractor's quality control inspector (QCI) to monitor, assess and adjust production and fabrication processes to ensure the final product will meet the specified levels of quality. Including, but not limited to: training, materials selection, sampling, testing, project oversight and documentation.
QC Action Limits	A range of values established by the Contractor in the QC plan that if exceeded, requires that correction be taken by the Contractor to restore the continuity and uniformity of the mixture and methods in conformance with specification requirements. The QC action limits must not exceed the QC suspension limits; however, the Supplier must consider risking product acceptance and is expected to address such out of control processes with its nonconformance control and possibly corrective action procedures.
QC Plan	The plan developed by the Contractor describing, in detail, all aspects of production and fabrication for the project to ensure consistent control of quality to meet specification requirements. Note: The Supplier's Quality Systems documentation could satisfy the requirement if it addresses the specifics of MDOT project requirements. If it does not, there must be a supplemental document or documents which identify modifications to the Quality Systems Manual or its referenced procedures. Typically, the QC Plan is a combination of the Quality Systems Manual with referenced procedures, and a document summarizing specific modifications to the manual and procedures needed to meet MDOT-specific requirements (such as 12SP-708C and this SQS Program Standard), and an ITP summarizing the inspections and tests to be performed in executing quality control.
QC Manager	An employee of, or consultant engaged by the Contractor when arrangements have been previously approved by MDOT, responsible for developing and overseeing all aspects of QC for the project. This includes, but is not limited to preparing the QC plan, managing all QC personnel, communicating routinely with the production personnel to ensure quality, initiating corrective action and suspending operations when the process is found to be producing non-conforming materials and preparing and submitting all necessary QC documentation to the Engineer within the specified time period.
QC Suspension Limits	A range of values that if exceeded on a single QC test, requires that the Contractor suspend operations and determine, correct and document the deficiencies before resuming production. The QC suspension limit must not exceed specification limits.
RFI	Request for Information RFIs referred to in this document are formal written communications initiated by the Supplier to the Owner or through the Contractor to the Owner. The requests ask for clarification, missing information, or approval of an alternate solution to fabrication from the design drawings or approved fabrication and erection drawings.
Repairs	Repairs are conducted to bring an element to project conformance for nonconformances such as cracks larger than acceptable by project or code requirements. Repairs may not be required for each element.
Sample	A representative quantity of PCC taken during production which is used to measure the quality characteristics for the PCC.
Sampling Rate	The number of times the fresh PCC is sampled.
Specification Limits	The threshold values placed on a quality characteristic used to evaluate the quality of the material.

Strength Sample Test Result	The average of three companion 28-day compressive strength test specimens for prestressed structural precast concrete taken from the same sample of PCC is considered a strength sample test result.
Strength Test Specimen	A strength test specimen is an individual 6-inch by 12-inch strength test cylinder or 4-inch by 8-inch strength test cylinder molded and cured according to AASHTO T 23/ASTM C 31 and tested according to AASHTO T 22/ASTM C 39. All QC strength test specimens must be the same nominal size. Strength test specimen cylinder size of 4-inch by 8-inch is permitted only if the nominal maximum coarse aggregate particle size, as specified for the coarse aggregate in the PCC mixture, is 1-inch or less.
Sublot	A portion of a production lot represented by a complete set of QC tests of this special provision. The Engineer and Contractor may agree to reduce the typical sublot size based on other project conditions.
Supplier	Capitalized in this Standard, the term refers to the prestressed precast concrete beam fabricator/manufacturer who is seeking the opportunity to provide products and services to MDOT for a specific project. Contractors awarded MDOT projects select only qualified Suppliers for the work.

B. Scope

This requirement applies to Suppliers (as defined above) providing main member bridge prestressed concrete beams. MDOT may apply this assessment requirement to other supply types using project specific special provisions.

C. Requirements for Participation

The Supplier must successfully complete a MDOT QMS assessment prior to the start of manufacture to ensure compliance to contract specifications, as well as compliance with the requirements of the Precast/Prestressed Concrete Institute (PCI) certification program, as required by the contract.

Suppliers must request approval to provide a specific product category. Requests are made in writing to MDOT on the Supplier application form. The Supplier may apply for any of the PCI program categories that the firm has the capability and expertise to provide. Before applying for participation to this program, potential suppliers must be current certified plants by PCI for their declared category. See required program categories described under the Approved Supplier List (ASL) in Section N of this document.

Any costs incurred by the Supplier to participate in the QMS assessment will not be paid for by MDOT. These costs include the Supplier's time, labor and materials to provide the requested documentation and participation in the onsite audit and the resolution of identified nonconformances.

There are two steps to the assessment process, the Documentation Audit and the Onsite Audit

Documentation Audit

A full documentation review of the Supplier's QMS will be conducted remotely by MDOT. The Supplier must resolve critical and major nonconformances from this review prior to scheduling the onsite audit. All document review nonconformances must be resolved prior to granting Supplier approval. Requirements for this audit are detailed later in this document.

Onsite Audit

The fabrication functions typical of the category(s) must be underway for the onsite audit. If the applicant Supplier has no work in house, appropriate exercises or mock work will be determined for demonstration. Notification of a "no work situation" must be received at least 14 days before the scheduled onsite audit to allow for adequate preparation and planning for both the auditor and the Supplier.

An onsite audit can be scheduled within 21 days if project status is critical. All nonconformances identified during the onsite audit must be addressed satisfactorily to consider the onsite audit successful.

The Supplier must resolve critical and major nonconformances from this audit before qualification is achieved and the Supplier is listed on the ASL.

Success is determined after resolution of nonconformances discovered during the assessment process. A full description of nonconformances and the required resolution by corrective action process is included later in this document.

Complete details of the onsite audit are included later in this document.

D. Documentation Audit

Documentation Submission Requirements

Suppliers submit QMS documentation for review and assessment, as soon as possible, to allow for a successful assessment. It is in the Supplier's best interest to submit the requested documentation in a timely fashion, as nonconformances must be resolved before the onsite audit is scheduled.

Submit the QMS documentation in a searchable PDF file, in the smallest size possible. If possible, submit the entire documentation in one PDF file. **Hard (paper) copies are not accepted**.

Include one sample of the following records completed with sample or actual data. As with all evidence gathered during the onsite audit, records submitted for documentation audit are considered confidential. It is highly recommended to redact business sensitive data such as prices, hours, and estimated number of personnel from actual project records prior to submittal. Quality documents (the Quality System Manual and related procedures and forms) should be submitted complete and without redaction, but special accommodations will be considered upon request.

Documents required for review prior to the onsite audit

Submit for the documentation audit:	
	Procedures or other documents covering the program elements
	Sample completed records that support program elements 1 thru 19 of the Standard:
	Sample shop drawing of a representative member that is typical of the prestressed beams to be supplied to MDOT
	Verification of the qualification of mix components Mix design documentation sample including: ▪ Independent certification of source materials and/or general certification by plant as specified in the MDOT Material Source Guide ▪ Identification of the designer and method to submit to Owner ▪ Mix sequence and method ▪ Required tests similar to production tests listed for QC Records Production
	One sample set of QC record(s) for strand data: ▪ Strand material specification (outside source) ▪ Strand diameter (a value) ▪ Strand spacing (per design) (a value or sketch) ▪ Strand pre-tensioning (a value) ▪ Strand final tensioning (per design) (a value) ▪ Strand release sequence (a value or sketch)
	One sample set of QC record(s) for production: ▪ Verification of form construction tolerances (first unit or after form adjustment) ▪ Verification of placement of structural components, reinforcement, accessories and block outs in a form ▪ JMF verification ▪ Air test ▪ Slump test ▪ Unit weight ▪ Temperature (ambient air, concrete) ▪ Creation and ID of strength (transfer and final) test cylinder(s) ▪ Tensioning strand elongation
	One sample job specific quality plan or ITP (completed)
	One sample set of QC records for release of strands: ▪ Symmetric release per order specified ▪ Transfer strength test cylinder result
	Nonconformance report or log
	Purchase Order (PO) form or other purchasing document that defines purchasing requirements for mix components, components placed in forms, weld consumables and buy America requirements for rebar and other steel embeds.
	Correction Action activity form, record or log (completed)
	Post-placement inspection record sheet: ▪ Dimensional accuracy including placement of inserts ▪ Openings are clear and correctly located

	One sample Post Pour Inspection Record which includes as a minimum: ▪ Surface finish and absence of defects ▪ Final acceptance and certification of product ▪ Verification of camber per design
	Procedure Qualification Test Records, one (1) for each process in accordance with AWS D1.4 (if work requires)
	Certifications for all personnel holding these credentials who will work on MDOT projects: ▪ For concrete testing: Michigan Concrete Association (MCA) Level I Concrete Field Testing Technician or *American Concrete Institute (ACI) Concrete Field Testing Technician Grade 1 *Note that the period of effectiveness for the ACI certification is reduced from 5 years to 3 years to be valid for MDOT recognition. ▪ For concrete strength testing: ACI Concrete Strength Testing Technician ▪ For JMF adjustment: PCI PQP Level III Plant Quality Control Technician, or MCA Level II Advanced Concrete Technician ▪ For laboratory aggregate sampling and testing: Michigan Certified Aggregate Testing (MCAT) Level I technician ▪ Other certifications required for general quality control – see Section 5.7 below.
	Welding Procedure Specification, one (1) for each process in accordance with AWS D1.1 Structural Welding Code—Steel, AWS D1.4 and AWS D1.6 (if work requires)
	Welder Qualification Test Record, one (1) for each process in accordance with AWS D1.1 Structural Welding Code—Steel, AWS D1.4 and AWS D1.6 (if work requires)
	Calibration (inspection and test equipment) log or record sample (showing accuracy, frequency and measured deviation): ▪ Holding tanks or metering devices (measuring admixtures to the batch) ▪ Scales ▪ Water measuring devices ▪ Tensioning equipment, dynamometers, hydraulic gages and load cells ▪ Force in hydraulic jacks ▪ Strength specimen testing gages ▪ NDT
	Project Specification Review Record
	Internal Audit Record
	Management Review Record or minutes from one or more meetings addressing the items in QMS Review

Job Descriptions and Evidence of Qualification Include job descriptions and documented evidence of qualification for key personnel as identified in the Supplier organizational chart, including QCIs. Documented evidence of qualification includes certification records, training history with supporting records, and a written record of work experience, preferably verifiable, which supports the responsibilities and authorities detailed in the job description. Documented experience of your registered engineer in the design of precast concrete (on staff or subcontract).
Facility Plan/Plant Layout and Equipment List
Organizational chart of key personnel showing reporting relationships and highlighting QC reporting and access

E. Onsite Audit

The onsite audit will confirm objective evidence of compliance through observation, review of quality documents and interviews with responsible personnel. a simple review may be all that is needed. However, copies of documents and photos of work may be collected as objective evidence and made part of the confidential report. It is understood that the Supplier may wish to redact business sensitive data such as prices, hours, agreements and other proprietary items before making electronic or digital copies.

Proprietary procedures and information cannot be withheld from the audit process if they are needed to demonstrate compliance

The onsite audit will be scheduled after successful completion of the documentation audit.

The audit team will work to avoid disruption to ongoing production as much as possible. However key personnel participation will be necessary to complete the work.

If the audit team schedule is impaired or it is prevented from completing the audit, the elements not sampled will be considered nonconforming.

Commentary: The intent of the requirement is to motivate the Supplier to schedule work and communicate with MDOT auditors such that all elements are sampled. Unacceptable impairment includes but is not limited to: a) vacationing key personnel, b) plant shut-downs without notice, c) lack of materials, d) failed provisions for foul weather concreting. e) access to ongoing projects and project information potentially for other agencies. f) access to documents or processes identified as proprietary by the Supplier. On a case-by-case basis, MDOT auditors will recommend to the MDOT Program Manager halting the audit and rescheduling in lieu of issuing nonconformances.

Please arrange access for the audit team to these functional positions for the onsite portion of the audit. Certifications and qualifications will be verified during the onsite audit. Assure that these personnel are represented in the organizational chart.

- Registered Professional Engineer - (on staff or preferred independent professional)
- Strength Testing Technician(s)
- QCI
- QC Lab Technician(s) performing required testing for concrete and concrete components
- QC Management – Lab manager, Lab Technician, Inspection Manager
- Detailing Staff
- Detailing Management
- Mix Design/Adjustment Technician
- Management team members or Quality Committee – Managers responsible for the review and effective implementation of the QMS. Include those who manage these processes at a minimum: specification review, design and detailing, document control, purchasing, ID and traceability, fabrication process control, Inspection, and the quality management system processes of nonconformance, corrective action, internal audits and training

Commentary: Regarding the requirement for Suppliers to have access to a Registered Professional Engineer, refer to PCI MNL-116, 1.3.2 Engineering, specifically for responsibilities of a plant engineer other than structural design.

F. Required Demonstrations and Observations

	Moisture control practices for when aggregate is wet from weather conditions
	Mixing and Batching – measurement and recording; moisture and temperature control
	Production Testing: ▪ Air ▪ Slump ▪ Temperature ▪ Density
	Placement of structural components, reinforcement, accessories and block outs in a form
	Tensioning operations: ▪ Anchor/cone inspection ▪ Jacking/tensioning procedure and sequence ▪ Measuring strand elongation prior to pour ▪ Transfer/de-tensioning including sequence
	Cylinder break test (any stage and associated record keeping)
	Placement of concrete in the form and floating (if work requires)
	Removal from the form
	Curing including measuring final camber
	Finishing (repair and patching)

These items can be verified onsite by record and interview, however demonstration with production product is preferred.

G. Objective Evidence/Access

The Supplier agrees to allow access to all projects active at the time of an audit that employ processes similar to those that will be used on MDOT work. Auditors will assess the Supplier's control of quality and implementation of the Supplier's own procedures for conformance with project specifications to demonstrate an effective system. Unique requirements of the MDOT specifications or project special provisions will not be assessed on non-MDOT projects. However, Suppliers must have procedures in place and have knowledgeable personnel and equipment to demonstrate capability for any unique MDOT requirements.

H. Audit Team

The team may be a single auditor or multiple personnel to assess a Supplier depending on:

- Size of the facility
- Number of employees
- Observation of the Audit process by auditors or MDOT personnel
- Complexity of the Supplier's QMS
- Complexity of the audit scope or assignment from MDOT.

I. Audit Termination

This is not anticipated; however, the Auditor may terminate the audit immediately for the following reasons:

- Safety
- Refusal of access to product or documentation including non MDOT work needed to demonstrate capability

J. Nonconformances (found during MDOT audits)

Nonconformances discussed here refer to written observations backed by objective evidence and issued officially by MDOT. A definition of each type of nonconformance can be found in the Definitions section of this document. Suppliers' definitions may differ; however the following will apply to nonconformances issued by MDOT regardless. Suppliers' resolve these nonconformances using their internal corrective action process. Send responses to MDOT using the forms provided by MDOT.

See Figure 1 in the mandatory document annex for more detailed requirements

Critical Nonconformance

The Supplier must respond to critical nonconformances within 7 calendar days from receiving formal notification of the findings by MDOT.

Major Nonconformance.

The Supplier must respond to major nonconformances within 14 calendar days from receiving formal notification of the findings by MDOT.

Minor Nonconformance.

The Supplier must respond to minor nonconformances within 21 calendar days from receiving formal notification of the findings by MDOT.

Commentary: Nonconformance is communicated in written audit reports. Seven days is the response time for a critical nonconformance. A critical item suggests that the nonconformance is serious enough that it will impact quality more immediately and jeopardize a product. Seven days is a long time in these cases. Production may be stopped more urgently if the issue is left unchecked and if continuing without correction would produce product that does not meet contract requirements. Extensions for resolution time will be granted on a case-by-case basis.

K. Successful Audit

The results of the onsite audit are reviewed by the MDOT Program Manager.

A successful audit is achieved when all elements of the Supplier's QMS documentation are found compliant or commendable and systems are effective at controlling the quality of product. If any nonconformances are found during the documentation audit, the audit team will attempt to resolve and close them with the Supplier during the documentation audit and before the onsite audit. Some items or issues may be left for verification during the onsite visit.

If any nonconformances are found during the onsite audit, the audit can still be successful if each is addressed and closed before fabrication begins. If critical or major nonconformances are not resolved before the start of fabrication, additional inspections or audits may be imposed by the MDOT Program Manager until they are closed.

Commentary: Expected audit cycle for maintaining approval status is annual. MDOT may however schedule recurring audits more frequently depending on past audit performance.

L. Special Audit

Suppliers may be subject to short notice special audits throughout fabrication until project acceptance. In the event a critical nonconformance, or two or more major nonconformances are observed by MDOT during execution of the contract, MDOT reserves the right to perform a short notice, no less than 24 hours, onsite special audit of the Supplier's QMS and handling of issues. Special audits may be scheduled to resolve critical and major nonconformances that are not adequately addressed by the Supplier.

A special audit may also be requested outside of a project scope when there is concern about the control of a process to maintain Supplier qualification.

M. Ongoing Assurance

The MDOT Program Manager may plan visits by an auditor at any time during project fabrication. The visits may be general surveillance in nature or may have specific target objectives to sample compliance.

N. Approved Supplier List

It is the Contractor's responsibility to use only qualified Suppliers on MDOT projects. Qualified Suppliers have satisfied the requirements of this program and are listed on the Approved Supplier List (ASL) according to their declared product category and approval status. The ASL can be found in MDOT's Structural Fabrication Quality Manual (SFQM). The SFQM will have a link to the ASL located on our webpage.

If a Contractor chooses to select a Supplier who is not on the ASL for products or services to be supplied, the products or services will not be accepted on the project.

Special arrangements may be granted in advance by the Engineer to expedite qualifying an unlisted Supplier before fabrication or the service begins. It is the Contractor's responsibility to obtain this consideration in advance and in writing from the Engineer.

Program Categories

The scope of MDOT document reviews and MDOT audits will include criteria specific to the Supplier's declared category. Contractors may only consider a Supplier for a MDOT project if they are listed for the specified products and services. For prestressed concrete beams, MDOT uses the PCI categories for prequalification certified by PCI for:

- Category B3, Prestressed Straight Strand Bridge Beams, or
- Category B4, Prestressed Deflected Strand Bridge Beams.

ASL Status and Restrictions

The approval status of the Supplier will assist contractors in making selections for their upcoming projects. Details on initial status, maintaining approved status, restrictions, and terms of probation, disqualification, and dismissal are provided in later sub-sections. Depending on initial and continuing audit results, a Supplier's status may be indicated on the Approved Supplier List as:

"Approved" (Full Status): The Supplier can be selected for any work in the categories for which they are listed.

"Approved – Provisional" (Restricted Status): The Supplier can be selected for any work in the categories for which they are listed, but MDOT may restrict the number of project types and/or product quantities allowed to be produced at one time.

"Approved – Probation" (Restricted Status): The Supplier can be selected for any work in the categories for which they are listed, but MDOT may require additional third-party involvement. The level required will be indicated on the ASL as "Level I" or "Level II".

"Disqualified": Full requalification is required for re-entry into the program.

"Dismissed": A period of suspension from the program is required before full requalification and re-entry into the program.

"Hiatus": The Supplier voluntarily removes itself from the Program. The same restrictions as Unlisted apply. They are on the ASL but are not available for selection by a contractor for a project.

Unlisted: The Supplier cannot be selected for MDOT work from bid time to project completion. They are not visible on the ASL.

Initial Status and Unlisted Suppliers

Before placement on the ASL, both the Supplier's QMS documentation and its QMS execution are successfully assessed for compliance to this program.

The Supplier remains unlisted until all document review and onsite audit nonconformances are addressed satisfactorily, assuming there are no critical or major nonconformances.

Contractors may request expedited qualification of unlisted Suppliers prior to project commencement, based on MDOT resource availability and enough notice. After successful assessment per the requirements of this program, MDOT would issue qualification documentation as evidence of approval until such time that the ASL is updated.

Maintaining Approved Status

Unrestricted approved status on the ASL for the categories audited continues by maintaining a functioning QMS, passing recurring MDOT audits without major or critical nonconformances and by producing work without serious product nonconformance. Minor audit nonconformances, if any, are resolved within the required timelines.

Commentary: Serious product nonconformance is determined by MDOT on a case-by-case basis. At a minimum, impacts to critical path and public safety or structural integrity concerns are "serious" by nature.

Provisional Approval

Major audit nonconformance or repeat minor product nonconformance may result in a provisional approval status.

As stated above, the Supplier may be restricted to a single project type, product category or limited product quantity for either a given project or for a given time period.

Probation

Supplier failure to address nonconformances in the time frames described in the Nonconformance Severity Chart or a significant number of major or critical nonconformances or serious repeat product nonconformance may result in probation and imposed third-party requirements.

At its discretion, MDOT may require Supplier QC Oversight (Level I Probation) or Third-Party QC (Level II Probation). Probation level will be indicated on the ASL and communicated to the Supplier in writing. Additional audits may be required to check compliance to the terms of probation.

- **Level I Probation– Supplier QC Oversight:** Supplier must retain and pay for an independent inspection and testing firm acceptable to MDOT to verify compliance to its QSM through oversight. The oversight firm must review all QC reports, material certifications, and be on-site to witness Supplier QC perform all functions stated in their QMS regardless of required frequency.
- **Level II Probation – Third-party QC:** Supplier must retain and pay for an independent inspection and testing firm acceptable to MDOT to execute the Supplier's quality control program. The Supplier continues to execute their QC program and is responsible for the quality of the product.

  Third-party QC will be responsible for developing project-compliant inspection and test plans as well as performing all required Supplier QC activities including producing required QC reports and documentation. Third Party QC will review the work and documentation produced by the Supplier QC operation. They also periodically observe the work of Supplier QC for improved technique and improvement. Significant discrepancies are resolved and may be reported to MDOT.

Commentary: Suppliers achieving Approved-Full Status are not required to use third-party quality control.

MDOT reserves the right to impose additional controls by the Supplier if MDOT is not satisfied the Supplier's QC is capable of functioning without assistance. Note: MDOT QA activities are required as in the past.

Disqualification

Continued failure to comply with program requirements or continued non-response by the Supplier may result in disqualification from the program.

Re-entry into the program requires full requalification per the Reinstatement section below.

Dismissal

Gross disregard for program adherence or long-term unresponsiveness or serious product failures may result in the Supplier being dismissed from the program. Dismissal requires both full

requalification and a specified period of suspension from the program. Reapplication will require evidence of process improvement during the period of absence.

Reinstatement

From provisional approval: MDOT will determine requirements for removing provisional restrictions on a case-by-case basis. Decisions will be based on project performance and may include additional audits to check implementation or product mock-ups or other activities that demonstrate improved capability.

From probation: At its discretion and based on Supplier performance, MDOT will specify the duration of the probation period. Product mock-ups or other activities may be requested by the MDOT Program Manager to demonstrate improved capabilities prior to removing probationary status.

After disqualification: If disqualified from the program, the Supplier may contact the MDOT Program Manager in writing to reapply for listing on the ASL. In order to resume active ASL status, any outstanding CARs from previous audits prior to removal must be fully resolved before the reapplication process can begin. A new set of QMS documentation must be assessed and an onsite audit is required to be reinstated.

After dismissal: During the specified period of suspension, the Supplier must take serious steps to improve its quality management system. After serving the suspension, the Supplier must request reinstatement into the program in writing. The request must include documented evidence of process improvement and a commitment to MDOT program requirements. Reinstatement will require complete requalification including documentation review and onsite audit.

As determined by the MDOT Program Manager, circumstances may warrant further demonstrated performance before reinstatement from any status.

Hiatus

Contact the MDOT Program Manager in writing to voluntarily be removed from the Program and discontinue the periodic assessments required to maintain status. In order to resume active ASL status, any outstanding CARs from previous audits prior to removal must be fully resolved before the reapplication process can begin. Complete requalification including resubmittal of QMS documentation and an onsite audit is required to be listed again.

If the Supplier left the program under disciplinary status (disqualification or dismissal), that status continues during this reapplication process. A Supplier should plan 6-9 months for reinstatement working through this status.

PROGRAM STANDARD
Required QMS Documentation

The required program elements of the QMS are listed below. These elements must be addressed in the Supplier's QMS documentation and implemented in production practice. The documentation and onsite audits will confirm these elements have been addressed by the Contractor.

The documentation organization or style does not need to reflect the titles or order of these elements. A cross reference matrix against these elements is necessary to assist MDOT in evaluating documentation and to assist the Supplier in self evaluating the contents of their documentation and their practices.

The Supplier's QMS documentation must include procedures. The elements listed below may be addressed in a single quality manual or in a combination of documents.

To satisfy the MDOT requirement for a Contractor's quality control plan cited in the project special provisions, the Supplier may use separate documented procedures, a separate ITP, a quality manual, or a combination of all these. Quality control activities including observation, inspection and testing must be identified and related QC Action and QC Suspension Limits must be clearly defined for each activity. All these requirements are further explained in the special provisions and this standard.

Note: MDOT does not require the complete QMS documentation to be contained in single quality manual or document. However, it is suggested that at least a high-level quality manual be created to address the elements on a policy level as required by PCI certification. This high-level document should be crafted to address PCI certification requirements specifically for the requirement for PCI to execute direct approval. MDOT specific procedures may be referenced from that manual or reside separately at the Supplier's discretion and do not need to be directly approved by PCI.

1.0 Documenting Program QMS Elements—Documented Procedures

Documented procedures addressing each element of this program are required. It is not required that there is a separate procedure that addresses each element. The Supplier may combine element subjects and requirements in a way that best suits company culture and the firm's organization and processes.

Provide a cross reference matrix that shows where the system addresses the required program QMS elements. The matrix is best accomplished using a table format listing each procedure or QSM section number and a column for indicating the MDOT program element number addressed. This is an excellent basis to conduct an internal audit of compliance with MDOT program requirements.

Procedures must contain:

1) The purpose of the procedure, what will be accomplished or realized when this procedure is implemented.
2) Process definition that includes steps required for completion
3) Assignment of responsibility for performance
4) Assignment of responsibility for review, revision, and/or approval of the procedure
5) Identification of records that are generated
6) The frequency and accuracy required for the steps, especially for procedures describing inspection activities

Supplier's QMS

2.0 Program Elements of the Supplier's QMS

PROGRAM ELEMENTS		
3		References (current required for the project)
5		Management Responsibility
6		Specification Review
7		Design and Detailing
8		Document Control
9		Quality Record Control
10		Purchasing
11		Material ID and Traceability/Materials
12		Manufacturing Process Control
12.1		Form Loading and Strand Tensioning
12.2		Concrete Production and Placement
12.3		De-Tensioning/Transfer and Stripping
12.4		Final Curing and Finishing
12.5		Fabrication (steel)
12.6		Equipment Maintenance
13		Inspection
14		Control, Calibration and Verification of Inspection, Measuring and Test Equipment
15		Control of Nonconformance
16		Corrective Action
17		Handling and Storage
18		Training
19		Internal Audit

3.0 References

The scope of this program includes the applicable clauses and requirements of the current version (or contract version) of these documents:

- MDOT Standard Specifications for Construction
- MDOT Special Provisions and Supplemental Specifications
- PCI-MNL-116 Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
- PCI QSM-1—Preparation Guidelines for a Quality System Manual of a PCI-Certified Plant
- AWS D1.1 Structural Welding Code—Steel
- AWS D1.4 Structural Welding Code—Reinforcing Steel
- CRSI Code of Standard Practice
- Additional codes and standards called by the documents in this list

4.0 Section number not used

5.0 Management

5.1 Quality Policy Statement

The Supplier must craft a concise statement that is understandable and known by all key personnel. The statement must include how the company views their responsibility for quality and meeting

customer project requirements. Define what national and regional quality standards the system is compliant with.

5.2 Quality Goal

Select at least one quality goal, where the objective is to improve quality efficiency in the delivery of product. This can be part of the quality policy or private to the management team.

Describe how the quality policy is communicated to key personnel.

5.3 Quality System Awareness

Describe how the Supplier assures that personnel are aware of the QMS and their responsibilities to achieve objectives. Choose meetings, internal audits, written communication or other effective method. Show objective evidence to record how awareness was accomplished.

5.4 Organizational Chart

Provide an organizational chart, graphic, narrative or other means to identify the key personnel showing reporting relationships. Assure that the top manager responsible for the facility is identified. Assure that the managers of the purchasing, design and detailing, manufacturing and quality process are identified, highlighting QCI and their reporting. These responsibilities may also be addressed by a QMS Committee responsible for the implementation of the QMS. Identify the Management Team on the organizational chart or other convenient method.

5.5 Job Descriptions and Documented Evidence of Qualification

Include job descriptions and documented evidence of qualification for key personnel as identified in the Supplier Organizational Chart, including QCIs.

Include responsibilities, authorities/decision making level and requirements for qualification in the job description for each key position or function. Personnel may be assigned more than one job function.

Documented evidence of qualification includes certification records, training history with supporting records, and a written record of work experience, preferably verifiable, which supports the responsibilities and authorities detailed in the job description.

5.6 Personnel Requirements

Specific titles and responsibilities are the duty of the Supplier. Titles used here are suggested and used for reference in this Standard, however these responsibilities are required and must be addressed in the Supplier's QMS.

5.6.1 Management Representative for Quality

Management must designate a position that is responsible for the maintenance and implementation of the QMS and the QC Plan that is part of the QMS. This position is a member of management but may perform other functions for the Supplier that do not conflict with these responsibilities. Alternately, this responsibility can be handled by a Quality Committee with a designated member of management with the same responsibilities.

This position has the ability, responsibility and authority to:

- Ensure that documented procedures needed for the quality management systems are established, implemented and maintained in accordance with this Standard
- Report to executive management, the management team or the Quality Committee on the performance of the quality management system and any need for improvement. This can be organized during the required management review
- Assure there is a system of awareness to ensure that all employees are aware of the quality policy and become a part of the QMS at their level of responsibility
- Assure that managers and employees are committed to the system and that awareness of customer requirements is communicated at their level of responsibility
- Communicate with customers on matters relating to the quality management system

5.6.2 QC Manager

The QC Manager may delegate tasks and select responsibilities to personnel under their supervision. they must have full authority and responsibility to take all actions necessary for the successful implementation of the QMS and its QC plan including but not limited to:

- Monitoring and utilizing QC tests, control charts and other QC practices to ensure that delivered materials and proportioning meets specification requirements.
- Monitoring all materials prior to their use, to ensure their continued compatibility toward producing consistent quality.
- Periodically inspecting all equipment utilized in transporting, proportioning, mixing, placing, consolidating, finishing and curing to ensure proper operation.
- Monitoring materials stockpile management, PCC batching, mixing, transporting, placement, consolidation, finishing and curing to ensure conformance with specification requirements.
- Maintaining and submitting all QC records and reports to the Engineer or the QAI.
- Directing the necessary corrective action to ensure continual conformance within specification limits.
- Conducting or monitoring adjustments to the JMF.
- Observing PCC placement during the entire casting operation.

5.6.3 Personnel Qualification

The actual titles for personnel who perform these duties are the decision of the Supplier. Minimum requirements for qualification are listed here for these functions:

Function	Minimum qualification, certification or skill level
QCI	PCI Level II Plant Quality Control Technician
Concrete testing	Fresh Concrete Testing: ▪ MCA Level I Concrete Field Testing Technician, or ▪ ACI Concrete Field-Testing Technician Grade 1 Concrete Strength Testing: ▪ ACI Concrete Strength Testing Technician
Mix Design and Adjusting the JMF	▪ PCI Level III Plant Quality Control Technician, or ▪ MCA Level II Advanced Concrete Technician
Detailing personnel	Able to demonstrate competency to prepare shop drawings in accordance with PCI Drafting Handbook – Precast and Prestressed Concrete MNL-119
Registered Engineer	Currently registered professional engineer experienced in the design of precast concrete (on staff or subcontract)
Detailing Management	Ability and experience drawing and checking shop and erection drawings using prestressed concrete members. Able to train and evaluate detailing personnel and subcontractors

Individuals performing QC tests must demonstrate that they are proficient and capable of sampling and testing PCC or aggregate, where applicable, in accordance with the associated test procedures and MDOT requirements prior to commencement of related work.

Update MDOT within 48 hours when there are critical personnel changes during MDOT project work and before the start of each project by 10 business days.

5.7 Management Review

The Supplier must document the process used to conduct management reviews at planned intervals. The purpose of this review is to continually improve the suitability, adequacy and effectiveness of the plant's quality system. Reviews may be scheduled throughout the year that address all the items at once or only selected items. Subjects may be chosen based on nonconformances, customer focus or other significance to the Supplier. At a minimum, each item must be addressed and documented at least annually.

The management review must consider and record the discussions and actions taken related to each of the following:

- The status of actions from previous management reviews.
- Changes in external and internal issues effecting quality.
- Information on the performance and effectiveness of the quality system, including:
  - Extent to which the quality objectives have been met
  - Process performance and conformity of products and services
  - Monitoring and measurement results
  - Supplier performance
  - External and internal audit results
  - Nonconformities and corrective actions
  - Customer satisfaction and feedback
- The adequacy of resources such as production equipment, structures and production areas, personnel certification or training, measuring and test equipment.
- Opportunities for improvement in process.

5.8 Quality Records

- Management review records
- Personnel certification and qualification records
- Job descriptions
- Documented evidence of qualification
- Facility plan

6.0 Specification Review

The first objective of a successful project management system is understanding the customer's project as defined by specifications, design drawings and general contract documents. The second objective is to translate the customer's project requirements to the Supplier's processes to deliver the project the customer expects. Describe how all applicable contract documents are thoroughly reviewed before a project is accepted.

6.1 Controlling Changes

Describe how changes to product requirements including design and development requirements are reviewed and changes are tracked to ensure full incorporation of the change into the processes affected.

Repeat the review process when contract requirements are revised by contract changes, clarifications from an RFI (request for information), a response to a Supplier proposal, or other official communication from the customer's authorized representative. The Supplier must include a process to communicate changes to responsible personnel.

Re-review is required only for areas affected by the changes which must be incorporated into the Supplier's project planning. For example, changes might include finish on a product, load a product is required to carry, location of embedded items, or openings.

Address these specific documents/criteria:

- Contract documents (design drawings and specifications, special provisions and documented communications)
- Addendums, change orders and plan revisions
- Source of the change
- Documents and procedures affected
- Communicate changes to all applicable parties and data bases
  - Transmittals from the owner or contractor
  - Owner responses to RFI
  - Responses to Supplier proposals

- Delivery schedule, including incentive and disincentive clauses

Show how project specification review is conducted for each MDOT project. Design the review to identify and address critical project requirements that may impact project quality and schedule.

6.2 Notification to MDOT

Describe the plans for transmitting information and records (including purchasing data such as POs, MTRs and other documentation) to the Engineer or QAI (as appropriate).

Identify the personnel positions responsible for these records and creating timely transmittal targets.

Describe how the Supplier assures that the Engineer is provided with a list of subcontractors including fabricators, galvanizers and painters. Include addresses and a list of products they will provide.

Commentary: Refer to the official MDOT correspondence on the use of the Material Source List dated 13 March 2014 for details on this requirement.

Before work begins, determine the means of communication with the Engineer and Contractor representatives as part of the contract review. Record contact information for the Engineer and Contractor representatives and any specific communication requirements mandated by contract documents.

At or before the review, identify a project manager for all communication with the Engineer and QAI.

6.3 Specification Review Record

Show in a specification review record how these items were reviewed. A detailed description of these items is included in the following sub-sections:

- Decisions and Actions
- Request for Information and Proposals for deviation from contract requirements
- Purchasing
- Design
- Detailing
- Submittal and acceptance/review by contractor or owner
- Material identification and traceability
- Fabrication/manufacturing process
- Inspection
- Training and qualification

6.4 Quality records

- Change log (optional)
- RFI log
- Record of specification review

7.0 Design and Detailing

7.1 Design Procedure

Develop, document, and implement an effective procedure to perform effective and consistent reviews of prestressed concrete beam designs and to prescribe or approve methods and procedures for:

a.) Tensioning

b.) Computations and measurements for elongations

c.) Measurements for camber and deflections

d.) Compensation for operational stress variations, and

e.) Any other functions related to prestressing that may affect the quality of the product

Include provisions for initial establishment and controlled modification of concrete forms and tensioning beds. Identify and define the responsibility for analysis; the Supplier must ensure the bed can handle the geometric constraints (number and arrangement of strands), and the forces resulting from tensioning the strands in a particular beam design. Address the requirements for verifying completeness of the modifications, including inspection and documentation.

Ensure there is an available registered design professional experienced in precast concrete design.

7.2 Detailing Procedure

Develop, document and implement an effective procedure to control how fabrication details are created and how they communicate project requirements. Address how the review, generation, revision, approval, control and issue of shop drawings are accomplished and documented. Include responsibility for the management and functions of this element, as well as the responsibility for specific tasks, including but not limited to:

- Ensuring that detailing procedures are followed
- Internal shop drawing review
- Drawing template approval by MDOT as part of the MDOT Shop Drawing Template Program and use prior to starting detailing
- Drawing submittals and owner responses
- Documentation of drawing changes
- How drawings are standardized (use of a detailing standard)
- How drawings are released to production and inspection and revisions are controlled

7.3 Quality Records

- Design/Drawing Submittal Log (or similar)
- Design/Drawing Change Documentation
- Drawing Release for Production Log (or similar)

8.0 Quality Document Control

Develop, document and implement an effective procedure to control documents and data affecting the quality and conformance of the processes and products.

The document control system addresses the QMS Documentation and customer contracts and communications. The Quality Manual, Project Drawings, standard procedures and work instructions are examples of QMS documentation.

Describe how applicable Quality Documents and Quality Records are readily available to personnel who have responsibility in the QMS, either in hard copy or electronically.

Describe how each quality document is identified and maintained so that it is used properly by the right personnel.

Maintain a revision history page or other suitable method to identify changes to the QMS and approval dates for changes to the QMS.

8.1 Forms

Control blank forms with a revision date. Require that a management representative controls a master list of forms. Consider including on blank forms information that instructs the user how to complete the form or what information needs to be captured, entered and analyzed.

8.2 Transmittals

Address how quality documents, submittals, records and other project correspondence are controlled and distributed outside of the company using transmittal systems. Include how revisions are

controlled with this system. Include methods for transmittal to owners, clients, subcontractors and vendors.

Define how required documentation (copies of POs, MTRs, or other documentation required by the Engineer) is made available to the QAI in a timely manner so that inspection or review requirements do not impact project schedules.

8.3 Master List of Quality Documents

List all documents comprising the QMS by document name and revision date or level and assign responsibility for updating the list. Include the quality manual, any separate documented procedures and quality records identified in each procedure and section of the manual.

8.4 Contract Document Control/Log

Maintain a master log of contract drawings and specifications by project and assign responsibility for updating the log. Include document names and revision dates or levels. Use transmittals to track internal distribution of these documents and define distribution lists.

8.5 Fabrication Drawing Control

Maintain a master list/log for tracking shop or erection/installation drawings produced by the Supplier by project and assign responsibility for updating the master list. Include approval process dates and record the dates issued to production. Use transmittals to track internal distribution and define distribution lists.

8.6 Quality Records

- Transmittal
- Master List of Forms
- Master List of QMS Documents (may be combined with Master List of Forms)
- Contract Document Master List
- Fabrication Drawing Master List (may be combined with Contract Document Master List)

9.0 Quality Record Control

Define and document methods for the control of quality records. Provide for the following elements of control for quality records:

- Identification
- Collection
- Storage
- Maintenance
- Retrieval and backup of electronic data
- Retention
- Disposal

Retain project quality records for at least the project completion unless a longer duration is specified in the Supplier's QMS or contract. Retain other quality records that are not project specific as defined by the Supplier or as specifically noted in this Standard.

Ensure all quality records are legible and are stored in such a way that prevents damage, deterioration, or loss. Records may be electronic, hard copy, or a combination with appropriate controls described in the procedure.

10.0 Purchasing

Develop, document and implement an effective procedure to define purchasing requirements. Ensure that all purchased products, materials, services and subcontractors that have a direct impact on quality conform to project requirements.

Describe the internal controls regarding material ordering.

10.1 Purchasing Documents

Describe the effective use of purchasing documents that clearly describe subcontracted work purchased products, materials and services. Purchasing documents may be POs, material requisitions, purchasing agreements, but they must be documents. They may support the requirements for verbal orders made later against the technical agreement in these documents. These documents are accepted by the vendor to apply to the technical requirements for the items and services they supply. The document must include at a minimum:

- Buy America requirements for rebar and other steel products
- Material to be ordered by ASTM requirements
- Quantity to meet contract requirements
- Date of delivery
- Delivery instructions
- Requested Certificate of Compliance that must list the following:
  - Products are made and manufactured in the United States of America
  - Compliance with ASTM manufacturing requirements (MTRs)
  - Quantity not included in shipment communicated on shipping ticket/BOL (backorder info)

Documents for purchasing services such as design, detailing and engineering services.

- Minimum personnel qualification/certification requirements that meet MDOT requirements
- Must have documented experience in precast concrete
- Must meet requirements of PCI MNL-119 and MDOT (for detailing)

10.2 Evaluating Vendors

Describe the methods used and responsibilities to evaluate and approve new vendors and subcontractors before they are permitted to furnish any product or service. Evaluate new vendors based on an on-site visit, references, reputation, facilities and equipment, work samples, or possessing the necessary certifications and capabilities for supplying goods or services. Capture and maintain a list or database of qualified vendors that become your Approved Vendor List (AVL). Describe methods for how the vendor ranking or approval status on the AVL is determined and scheduled for periodic review.

Evaluate all vendors and subcontractors at least annually and more frequently if job conditions change or products and services are questionable.

Consider:

- Quality of the finished products; [may include adherence to specifications/drawings/quality requirements; Accuracy of product in size, marking, condition and appearance; Accuracy of support documents (test reports, certificates of compliance, etc.)]
- Delivery of products in accordance with schedules (on time) and in a proper manner (protected, arriving with proper certs, in required condition, from MDOT approved vendors when required, and other requirements as specified in the PO.)

Records Include:

- POs, purchase agreements or other document that defines the requirements of the product or service purchased. These are written contracts with a stated technical standard for the material, product or service to be purchased.
- Approval record and any applicable documentation that goes with the agreements;
- Qualification records, such as supplier certificates, personnel certificates, etc. for every requirement per the Supplier's certification
- Records of any necessary actions based on the Supplier's evaluations of vendors.

10.3 Purchasing Quality Records

- POs
- Subcontractor waiver from customer
- AVL or similar listing and a record of review
- Subcontractor and vendor qualifications and evaluations.
- Current certification records of subcontractors

11.0 Identification and Traceability

Develop, document and implement an effective procedure for the identification and traceability of materials, fabricated sub-products and final products. The procedure describes how the Supplier assures appropriate identification by specifying at the purchasing process and assuring and applying at the receiving process. The procedure also describes how the identification is marked or maintained from the point of receipt to the point of incorporation and then delivery to the project. The process must assure incorporation of the correct materials into the product and enable MDOT to trace the materials to the product at the levels specified.

Inspection at receiving is a critical part of providing traceability, particularly documenting receipt of materials and review and filing of vendor-supplied documentation. Evaluate vendors on the completeness and accuracy of the documentation they supply with their materials, products and services. Include in that evaluation how well received items are marked.

11.1 Product ID

For finished product, document how each finished prestressed concrete beam is uniquely marked and dated to confirm production and to link the product to the specific conformance testing by the Quality Control Department and to raw materials or assemblies used in its manufacture.

Describe how the unit number and date will link to a production schedule and to in-plant quality control records. Describe how the mark number also links the product to the erection plan. These mark numbers and dates can be marked on the product or cast-in using specific date stamps, piece marks, and/or form numbers.

11.2 Raw Material ID

For bulk materials such as cement, aggregates and admixtures, an inventory system of dates received, dates placed into production and date of next shipment can provide the needed traceability.

Describe how these items and resources are used in the procedure:

- Ticket submittal for project
- MDOT Material Source Guide (MSG)
- MDOT Material Source List Form 0501: Use to record project materials, source of material, basis of acceptance, quantities, and type, size, or class.
- In such a way that testing required for each material type can be completed per MDOT specifications.

11.3 Reinforcing Bars

Identify rebar shipments at receiving in a way that will assure that material purchased for the project is used for that project. Train personnel in special handling for epoxy coated product to prevent damage to the coating.

11.4 Fabricated Metal—Supplier

Steel must be supplied per ASTM specified on approved shop drawings. Material test reports (MTR) must be provided traceable by heat number and be able to demonstrate Buy America status. Raw materials must be identified at receipt and maintain identification until the first fabrication operation. There must be an effective method to later connect the MTRs with the shipment to MDOT. Supplier

must provide assurance of conformance to CRSI Code of Standard Practice if cutting or bending reinforcing steel.

Identify the WPS and welders used for the project. Include WPS(s) and WQTR(s) with the submittal.

11.5 Fabricated Metal—Vendor

Through POs or purchase agreements, the Supplier requires that the vendor identify finished pieces (part number, PO number or other suitable marking or tagging) so that MTRs can be assigned appropriately to the submittal package. Require current welding procedures and qualified welders to perform the work per *AWS D1.1 Structural Welding Code—Steel* for structural steel shapes and per *AWS D1.4 Structural Welding Code—Reinforcing Steel* for welded reinforcing bar products.

It is not required to use an MDOT shop that is participating in the quality program requirements program. Using a qualified shop also does not relieve the Supplier of the need to qualify the vendor. The selected vendor must transmit current welder qualification test records (WQTR), welding procedure specifications (WPS) and MTRs that support the delivered work. Vendor must provide assurance of conformance to CRSI Code of Standard Practice if cutting or bending reinforcing steel.

11.6 Customer Supplied Material

Establish a method for identifying and controlling materials received from the customer intended for inclusion in the fabricated product. Address both materials ordered to specification and materials not ordered to specification; define documentation and identification requirements for both situations. Include provisions for ensuring the materials are correct such as written details/instructions from the customer, including MDOT acknowledgement where applicable.

11.7 Quality Records

- Vendor Delivery Tickets
- MTRs
- Certificates of Conformance
- MDOT Material Source List (Form 0501)

12.0 Fabrication Process Control

Establish documented procedures that address the controls necessary for these production processes at a minimum:

- Fabrication and welding of metal components
- Form loading and strand tensioning,
- Concrete production and placement,
- Transfer and stripping,
- Final curing and finishing, and
- Equipment maintenance.

Define workmanship standards for production with emphasis on concrete consolidation and consistency of product finish.

Define controls for preventing the use of materials prior to acceptance testing which is described in the inspection procedure.

Work instructions providing step-by-step guidance to production personnel are also expected for using production equipment, performing specific tests, defining workmanship standards, using work orders and creating and maintaining personnel qualification records at a minimum.

12.1 Form Loading & Strand Tensioning

Procedures for loading forms must address the following:

- **Casting bed and forms** – Describe the process of verifying casting bed and forms will produce the required shapes and pretensions. Include control of casting bed design and modification, inspection and maintenance of live and dead ends and verification of dimensional accuracy and readiness (release agents, surface quality, etc.) of the forms.
- **Placement of reinforcing steel and hardware** (reinforcing steel, welded wire fabric mats, supports and spacers, inserts, embeds, positioning frames, etc.) – Describe the method of ensuring only specified materials (raw and fabricated) and correct quantities and locations; i.e. using checklists, or marking on shop drawings or other production records, or other means. Address mechanical splices, verification of minimum concrete cover and intentionally extended bars.
- **Fabrication/welding** – Include welding consumable control and stud welding – see 12.5 for details
- **Stringing and tensioning strands** – Describe the procedure for stringing strands and establishing initial tension. Address selection and staging of strand coils or reels, strand chucks and strand debonding. Include provisions for ensuring tensioning equipment readiness (controlling jacking forces and ensuring gauging systems and controls are operative), identifying required tensions and sequence, recording data and making corrections. Describe the method of measuring force.
- **Final tensioning** – Define the method of applying final tensioning. Address equipment operation, force corrections for losses, elongation measurement, elongation calculation and correction, provisions for single and multiple-strand tensioning and provisions for harped strands.

12.2 Concrete Production and Placement

Procedures for concrete production and placement of concrete must address the following:

- **Developing Mix Design and JMF** – Describe the method of defining concrete mix design performance characteristics in terms of mixture properties (strength, slump, air content and unit weight) and how the characteristics are based on selected materials, performance requirements, environmental exposure considerations and placement restrictions such as method and reinforcing openings. Describe the testing required to qualify the mix design and establish the JMF according to one of the four methods of verification acceptable to MDOT (trial batches, same mix, similar mix, or annual verification); define the resulting mix documentation.
- **Batching and JMF Adjustment** – Document the procedure for adding precise proportions of constituents to a mix (batching), addressing the identification and selection of the JMF, the control and sequence of adding constituents and moisture control and compensation. The procedure must define control of the approved JMF and address maintaining and selecting approved JMFs either manually or through automated software. Describe how the JMF target weights (proportions) are adjusted and how the adjustments are documented. Include controls for limiting the water-cementitious material ratio (w/cm) for maintaining workability.
- **Production testing of components and of mix** – Describe the production controls for preventing placement of nonconforming concrete. Include provisions for communicating with quality control and following the ITP established for the project. Describe the method of sampling fresh concrete for the required testing.
- **Mixing and transporting concrete** – Describe the method of mixing including equipment and controls and measurement and limits of mixing times or rotations, addressing cold and hot weather mixing.
- **Placement and consolidation** – Describe the method and equipment used to place fresh concrete addressing prevention of aggregate segregation and compensating for severe weather. Include provisions for consolidation including vibrating equipment used (internal vibrators, external form vibrators, surface vibrators or vibrating tables, consideration of epoxy-coated rebar and method of inserting internal vibrators.

12.3 Transfer and Stripping

Procedures for transfer and stripping beams from forms must address the following:

- **Initial cure** – Describe the method of establishing and monitoring initial curing after concrete placement. Include provisions for temperature requirements, moisture sources or retention, use of membrane compound and accelerated curing if used.
- **Transfer break testing** – Describe the controls for preventing early detensioning of the strands prior to achieving required transfer strength, including specific communication between production and quality control.
- **Detensioning/releasing strands** – Describe the equipment, method and sequence of releasing strands after achieving the required transfer strength. Address single-strand and multi-strand release and include provisions for harped strand as applicable. Include provisions for protecting strand ends and anchorages from moisture penetration. Ensure the stripping procedure includes consideration of removable inserts, fasteners and form parts and defines methods of identification and lifting.

12.4 Final Curing and Finishing

Procedures for finalizing the prestressed concrete beams must address the following:

- **Yard storage and final curing** – Describe the storage of prestressed concrete beams during final cure including support locations, coverings and monitoring curing conditions.
- **Handling and shipping strength** – Describe the method of determining handling and shipping strengths for prestressed concrete beams when these requirements are not provided by MDOT. Include provisions for preventing handling and shipping until required strengths are achieved.
- **Finishing and sealing/coating** – Describe the methods and equipment used to finish concrete products, such as retardation, sandblasting, acid washing, debonding agents, or coatings/sealers.
- **Repair** – Prepare written repair procedures for non-structural repairs. Address curing and application requirements for repair materials.

12.5 Fabrication and Welding of Metal Components

This includes in-house fabrication of reinforcing steel included in the prestressed concrete beams and structural steel components such as external connection angles, braces and diaphragms.

Address cutting, bending and tying of rebar products. Include provisions for zinc and epoxy coatings such as special handling methods or equipment and repairs.

Describe methods of ensuring welding procedures, equipment and welding performance are in accordance with project requirements, especially the referenced AWS welding code. Include maintenance of assembly/fit-up tolerances, preheat or interpass temperatures, welding electrode control and atmospheric conditions. Procedures for welding headed studs and deformed bar anchors must include both automatic stud welding equipment and alternate processes such as SMAW, GMAW or FCAW.

12.6 Equipment Maintenance

Establish a preventative maintenance program for plant equipment that may affect quality. Equipment must be uniquely identified. Provide schedules for inspections and activities and include work instructions and provisions for recording completion and comments for each inspection or activity. Include forms, strand chucks, batching equipment, concrete mixers, admixture dispensers and concrete transport equipment such as trucks.

12.6.1 Form Verification

Form verification and maintenance can be addressed here or in another procedure as the Supplier decides is appropriate. Address how the form surfaces and dimensions are verified in detail after form construction or assembly before the first unit is cast, and after any modifications. Describe the program that assures forms are cleaned and maintained in a manner consistent with project requirements. Include the verification and maintenance necessary for bulkheads, templates, and

similar equipment. Include the performance of maintenance inspections for all anchorage locations on the form for holding cast-in place materials are inspected for wear.

12.6.2 Quality Records

- Records of equipment maintenance

13.0 Inspection

13.1 ITP

The Supplier needs to follow an inspection and test plan or ITP to ensure all criteria defined in the scope of the project are satisfied. The ITP will help assure that the requirements of the Contractor Administered Quality Control Plan required in MDOT 12SP-708C are met.

13.1.1 Planning Inspections and Tests

Required inspection hold points for either QC or QAI may be based upon the Supplier's typical procedures or established specifically for MDOT projects. Information is also gained in communicating with MDOT on project specific interests. Additional points may be necessary depending on project complexity.

Submittal of the ITP is not required, but the Supplier is responsible for reviewing and updating it based on the requirements for each project. Refer to the MDOT Prestressed Concrete Beam Fabrication ITP Sample in the Annex of this Standard for assistance in development. This sample format and content is non-mandatory. The Supplier must develop a suitable format and content to meet specific project requirements and to function appropriately in their company. Discussion of hold points may occur during prefabrication or preconstruction meetings when required by contract.

See Figure 2 in the document annex for a sample of this mandatory requirement. The sample is comprehensive. A Supplier's ITP may be less comprehensive and have more or less specific project related requirements.

The ITP provides a basis to communicate and record:

- The inspection points and characteristics inspected (as detailed in the in-process inspection procedure)
- The frequency required for the inspections and tests
- Supplier personnel responsible
- Process control limits (QC Action Limits)
- Acceptance criteria (QC Suspension Limits)
- Hold points where either the QAI or QCI documents acceptance prior to subsequent processing steps

13.1.2 Coordination with the MDOT Shop Inspector

Establish a method for communicating with the MDOT QAI. It is essential that both Supplier and MDOT inspectors coordinate hold points such as witnessing production or quality control activities, verifying documentation, performing verification inspections or tests, or other activities that could impact schedule.

Address the responsibility to directly communicate production and quality control schedules and updates so that MDOT QAI can honor both their QA obligations and the schedule as much as practical.

MDOT QAIs must be notified of all production and quality control activities; they may consent to the Supplier proceeding without their presence or may request to be present for more than the minimum required number of hold points. Last minute changes should be avoided.

Include provisions for documenting requests for inspections or notifications of specific activities requiring MDOT presence. Ensure the method requires written acknowledgement by the QAI and captures any waived hold points or requests to be present for additional activities beyond the ITP.

13.2 Inspection and Test Status

The procedure must address how the Supplier marks or identifies the inspection and test status of in-process and completed product. The method must be consistent and understood among inspection personnel and the status must be clear to production personnel. The method may be markings or tags on the product or materials, records (accessible hard copy or electronic) that record the current status or a combination. Marking or recording must be updated as soon as possible to protect the process. Status milestones include conditions met or pending such as received, dimensional, waiting for test results, ready for patching or finishing, or under evaluation from the owner for resolution of a nonconformance.

13.3 Inspections to be Completed and Documented

13.3.1 Receipt Inspection/Acceptance Testing

Describe how materials or assemblies are received and verified to conform with the technical requirements of the POs or purchase agreement standards. Those requirements may be referenced by a standard record form. Tickets for bulk products such as aggregates and cement can be marked so they are immediately identified as having been reviewed for conformance and resolved.

Describe the method of acceptance of all constituent materials prior to use or shipment including cement, aggregates, water, admixtures, curing materials, release agents, surface retarders, debonding agents, weatherproofing sealers, reinforcing and prestressing steel, hardware materials and vendor-supplied assemblies. Certificates are not always available for all materials; describe alternate testing to be performed for each material.

13.3.2 In-Process Inspection

Document a procedure that identifies the in-process inspections necessary to ensure product quality. The procedure may reference the ITP for specifics. At a minimum, define the characteristics inspected, frequency or sampling plan and the means of recording acceptance for the following inspections:

- Tensioning inspection – indicate QC activities performed during initial and final tensioning
- Fabrication inspection – indicate QC activities performed before, during and after structural steel, rebar and hardware fabrication
- Pre-placement inspection – indicate characteristics inspected just before concrete placement; QCIs verify set-up details including form conditions, overall lengths, widths and depth, end details, strand deflection points, reinforcing steel material and locations, plates (material and locations), block outs, inserts and lifting loops
- Post-placement inspection – indicate characteristics inspected just after stripping

13.3.3 Final Inspection

All products must be inspected prior to shipment. The inspection procedure must define the characteristics to be inspected, acceptance criteria, when the inspection must be performed, the qualification requirements of the final inspector and how the final inspection status of each product will be identified and documented; it may reference the ITP for specifics. Tolerance for dimensional control is either defined in the project requirements or consistent with PCI MNL 116, Appendix B.

The procedure must describe measurement methods and instrument/equipment precision.

13.3.4 Tests

List the tests performed (may reference the ITP) and reference work instructions or other documents that assure staff is performing tests consistently and in accordance with MDOT and PCI MNL 116 requirements. Identify the position with the responsibility to describe, design and supervise tests. Include test types, frequency, sampling plans and recording methods that are used at the facility.

A sample list of tests that may apply to materials:

- Cement (in the absence of mil certificates)

- Aggregate tests (coarse and fine)
- Water
- Admixtures (review of supplied certification)

…and tests related to production QC:

- Slump
- Air content
- Temperature
- Unit weight
- Concrete strength

13.3.5 Mix Design Certification

Mix designs and their accompanying JMFs must include a statement, signed by a certified PCC technician (MCA Michigan Level II or PCI Level III), that all applicable standard test methods have been followed in verifying the mix design and JMF.

Identify the responsibility for creating this record and determine a sample for personnel to use to promote consistency in presentation.

Describe the procedure for documenting a request for variance when proposing a mix design that does not meet specified contract requirements.

13.4 Inspection (QC) Records

Describe the process to maintain complete records of all QC tests and inspections. Include enough information to allow the test results to be correlated with the items of work represented. Document what action was taken to correct deficiencies. Furnish one copy of all QC records, including test reports for the fresh PCC placement, to the Engineer within 24 hours after the date covered by the record in a format acceptable to the Engineer. The Engineer may withhold acceptance of the products for failure to provide properly documented and timely QC records and reports

13.5 Quality Records

- ITP
- Tensioning Record
- Concrete Batching Record
- Fabrication Record (structural steel, rebar, hardware)
- Pre-concrete placement Inspection Record
- Post-concrete placement Inspection Record

14.0 Control, Calibration and Maintenance of Inspection, Measuring and Test Equipment

Develop, document and implement an effective procedure to control, calibrate and maintain inspection, measuring and test equipment used to demonstrate that products and processes comply with specified requirements.

14.1 Equipment Listing and Identification

Identify the gages and equipment measuring devices that are used to demonstrate the conformance of product, or gages which provide direct process measurements that determine product compliance.

Create an equipment list that provides a means for unique identification of each piece of equipment. Each piece of equipment will bear a unique identification “mark”, serial number or a precise description that ties the equipment specifically to the list and the calibration log. Calibration for each device may vary depending on manufacturer’s requirements and use in the plant. Calibration frequency is at least annual. Specify the accuracy required.

Calibration of the batch plant is required semiannually. Identify what level of authority is required – under the supervision of a licensed engineer for example.

Sample:

Tool	Calibration/Verification Frequency	Accuracy Required	Source
Tensioning Jack #5 Ram Serial #xxxxx Jack Serial #XXXX	Monthly	loads are within 2% of gauge	Internal Load cell # xxxx

Note: Typical list of items that maybe on a calibration list for a Supplier in an onsite batch plant:

Batch Plant:

Coarse Aggregate Feed Hopper Weigh Belt*

Coarse Aggregate Moisture Gauge

Fine Aggregate Feed Hopper Weigh Belt*

Fine Aggregate Moisture Gauge

Fly Ash Feed Hopper Weigh Belt*

Mixer Feed Weigh Hopper*

Water Feed Meter

Admixture # 1 Feed Meter**

Admixture # 2 Feed Meter**

Admixture # 3 Feed Meter**

Admixture # 4 Feed Meter**

QC Test Area:

Air Test Pot Gauge (pressure/vacuum)

Compression Test Force (Pressure) Gauge(s)Scales (used for determining density)

Production Equipment:

Pre-Tension/Final Tensioning Force (Pressure) Gauge(s)

Measuring devices (scales, tapes, etc.)

*May be one, two, or three depending upon Batch Plant configuration

**May be as many as eight (8), depending upon Batch Plant configuration

14.2 Calibration Procedures

Develop a calibration work instruction or procedure that identifies the plan testing parameters, calibration/verification frequency, the accuracy required and if the calibration is done internally by Supplier personnel or by an external source. Include the points where checks are performed in the testing parameters. That could be points of pressure, location of sampling or other appropriate sampling method to assure calibration accuracy throughout the full range of the use of the equipment.

14.2.1 Internal Calibration Procedures.

Describe the qualification required for internal personnel to perform the work and that calibration equipment or master gages needed to perform the work is traceable to a national standard. Describe any stamp or license necessary to be qualified to perform calibration testing.

Identify master gages in a log or list. A master gage is a gage that is purchased and traceable to a national standard, typically from a gage supplier who also supplies documentation (certification of conformance) certifying traceability. Choose what master gages are necessary to calibrate gages used in the scope of supply and demonstrate traceability to a national standard.

14.2.2 External Calibration Services

Assure that external sources are qualified by the Purchasing function or other designated professional. Identify the laboratory, agency or certification required by that source to perform the work. Obtain the agency's testing procedure that identifies any testing standards (AASHTO or ASTM) that must apply to the operation. A testing certificate or report may be all that is needed to identify the test parameters.

14.3 Calibration Log or Calibration Records

Detail the responsibility for maintaining records and identification on gages. Show in a calibration log or other suitable record:

- Gage (description)
- Gage identification
- Specific frequency of calibration
- Accuracy required
- Measurements to be taken
- Actual measurements

- Standard used for calibration
- Date of calibration
- Next due date

14.4 Quality Records

- Calibration certificates of conformance
- Calibration Log/Record
- Personnel qualification licenses or documents

15.0 Control of Nonconformance

Develop and document an effective procedure for recording and controlling nonconformances.

15.1 Nonconforming Processes

Process nonconformances are deficiencies in methods reflected by recurring errors and negative trends in the performance of the QMS. These can be process or system nonconformances in support processes (like detailing, contract review, purchasing, generation of CAD data) and operational functions (like CAD directed equipment, faulty consumables, uncalibrated equipment, poor electrical connections, or consistent human error due to lack of training).

15.2 Nonconforming product

Product nonconformances are deficiencies in products or materials that do not conform to contract plans, shop drawings, NDT procedures, customer intended use requirements, applicable code requirements, or company requirements

PCI suggests categorizing product nonconformances that need repair as nonstructural cosmetic-two levels; and structural nonconformance-two levels, standard (minor) and nonstandard (significant).

15.3 Nonconformance Log and tracking

15.3.1 What to Record

Record and track nonconformances in reports and/or one or more logs of a desired format.

Define what will be recorded, but include the following as a minimum:

- The pieces affected,
- the nature of the nonconformance,
- disposition of affected items still at the Supplier or already shipped, and
- potential ramifications for similar items on previous projects.

15.3.2 Recording Re-inspection

When nonconforming product is repaired or reworked, it is subject to the original inspection criteria; record the results, including the inspector who made the re-inspection and date of acceptance. Link the new record to the original deficiency record if they are separate documents in your system

Include other pertinent information to periodically track and analyze nonconformance trends and recurrence rates.

15.3.3 When to Record

Clearly define the threshold for recording a nonconformance. For product nonconformances, consider basing it on structural severity, costs, time to correct, or other criteria appropriate to your organization.

Process nonconformances may have similar criteria and may be based on significance. However, they are often recorded regardless if only one occurrence is found. A single nonconformance in a QMS process typically indicates only the tip of the iceberg. Waiting for more of the same process nonconformances may expose the process to many more multiple errors.

15.4 Significance

A nonconformance can be considered significant if it is associated with a defect that jeopardizes the safety, functionality, ease of erection/installation, and/or serviceability of the structure. This may include improper material, numerous or repetitive nonconformances, significant dimensional errors, deficient weld properties, or incorrect joints and connections.

15.5 Quality Records

- Nonconformance Report or Log (Supplier Form)
- Nonconformance Report (MDOT Form)

16.0 Corrective Action

16.1 General

Not every nonconformance is considered for corrective action. Identify the responsibility in the organization that evaluates the issue and decides if a CAR will be issued. Issue CARs by looking at summaries of product nonconformances, the results of QMS audits or noted as a regular course of business.

Describe the methods and responsibility to close CARs after evaluating the root cause and implementing the actions developed to prevent recurrence. After the selected actions are taken, verify the deficiency has been corrected to close the CAR. Schedule a re-audit after an appropriate interval to assure continued effective implementation.

16.2 Causes for Corrective Actions

- Significant nonconformances
- Product or process nonconformances are repetitive
- Undesirable conditions affecting productivity, employee safety, customer relations, or other Supplier goals.
- Requests or complaints from an external source
- When performance indicator targets are not met

Invoke the corrective action system when nonconformances are identified during external audits by a customer or agency. The external source may require a response using their own formats, deadlines and requirements; the Supplier must enter the issue into the Supplier's system.

16.3 Recording and Tracking a corrective action activity

Develop a form, log, database, or other suitable method to record the required information for a corrective action. The method must clearly communicate the identification, actions and status of each activity. Ensure the system captures the following information:

reference	The reference or requirement that has not been met. This can be from a product deficiency, customer nonconformance report, internal audit finding, unsatisfied code, specification or contract requirement, or from the Supplier's Quality Manual and procedure documentation.
observation	The specific product issue/objective evidence item/observation that demonstrated noncompliance.
correction	Measures taken to eliminate or contain the specific nonconformance (if required)

responsibility	Identify the individual, manager or team assigned the responsibility for evaluating and addressing the situation as a QMS function
schedule	The timeframe for completion. Due dates for identification of root cause, analysis and action to prevent recurrence.
root cause	Identification of the root cause, including contributing factors to ensure appropriate corrective actions.
actions	Action to eliminate or control the causative factors and prevent a recurrence.
verification	Verification of implementation and effectiveness of measures taken can predictably lead to closure. When a corrective action is executed, conduct a follow up to verify it was implemented in a timely and effective manner and to ensure the steps taken continue to be effective in avoiding recurrence.
closure	Document completion of the corrective action process, including name and signature of the person verifying closure of the issue. Include any future plans to verify effectiveness.

16.4 Review and Monitoring

Identify the responsibility for maintaining the CAR system and monitoring the progress of closing the actions. Prepare a summary of closed and open CARs for assessment at management reviews of the quality system.

Perform adequate root cause analysis and reassessment after implementation of the fix.

Include any closed and open CARs in the scope of the internal audit of that element. This assures that the actions taken continue to be monitored for effective implementation.

16.5 Quality Records

- CARs
- Summary of corrective actions for management review

17.0 Handling and Storage

17.1 Planning and Execution

Develop storage plans for products indicating dunnage type and sizes and driving lanes for handling equipment. Describe the method of reviewing equipment capacity for lifting and handling, including assignment of responsible personnel. Include controls for ensuring conformance to the lifting points and equipment and support locations shown on the plant shop drawings.

Include provisions for performing and documenting regular product storage inspections and controls for preventing delivery of product which has not been final inspected. Describe the method of loading, including tying down loads and preventing application of unexpected loads to products resulting from improper loading.

17.2 Quality Records

- Project Storage Plan
- Storage Inspection Record (or similar)

18.0 Training

The Supplier must develop a program that defines the documented training requirements for each position. Informal training can be documented by a date or other mark in a table or other simple notation or database or list to assure that personnel at all levels have been informed and training on their responsibility for quality. Training programs define scope and frequency of the training. The program must address initial and periodic training, documentation requirements and special training requirements for quality control personnel.

18.1 Initial and Periodic Training

Ensure personnel responsible for the quality of products and services receive initial and periodic training in their specific job functions. Periodic training is expected whenever there is a change in specific duties or whenever a procedural change in a particular job is implemented, or when industry codes and specifications are updated, or customer requirements change. The Supplier must define the required training for each specific critical position in a procedure. The inspection and testing functions must be included in the defined training plan.

When required, conduct training by in-house qualified employees or by a qualified source or institution outside the company. Assure that the requirements for documenting training are met.

Describe provisions for ensuring personnel maintain understanding and describe how the program focuses on requirements that may be infrequent to the shop schedule. Special meetings, refresher training and specific quality plans may be necessary for jobs or activities that are not part of the Supplier's daily work routine.

Specific training requirements may be detailed in Supplier specific supplements.

18.2 Documentation Requirements

Documented training differs from informal training because it requires training records. Training records include instructor, attendees, course outline and date and an evaluation of attendee comprehension. Include supplemental documentation such as training hand-outs or slides to demonstrate meeting specific subject requirements.

18.3 Quality Control Inspectors

Document training records for inspection personnel. Review the knowledge and qualifications of inspectors periodically to ensure compliance to job qualification specifications or industry code requirement changes. Develop an outline of training requirements by verification activity, listing the activity, the position assigned and the required training or certification. Required training must be defined in terms of topic and frequency.

18.4 Quality Records

- Training Record (for training performed by in-house instructors)
- Certificate of Completion (for training performed by hired instructors or firms)
- Quality Control/Verification Personnel Training Requirements Outline

19.0 Internal Audit

Describe in a procedure how internal audits of the QMS are conducted. Audit the requirements of all clauses of this standard at least once a year to verify compliance and effectiveness.

Conduct audits of the entire system at one time, or schedule recurring audits to cover different parts of the system throughout the year. Sections may be scheduled for convenience or by critical importance to the QMS. Identify which personnel are assigned to perform the audit or portions of the audit and how they are qualified to conduct audits in areas other than where they work. Ensure

auditors are independent of the functions they are auditing, except for the Executive Manager representing the QMS.

Show in the record generated what elements were audited. Review the results of the audit with the management personnel responsible for the efficient operation of the audited element or function.

Address how nonconformities are noted during the audit and how they are evaluated to be considered for corrective action. Initiate a corrective action depending upon the severity, frequency and importance of the nonconformity.

19.1 Quality Records

- Record of internal audit results
- Internal and external QMS audit records

20.0 Annex

This Annex is published in a separate document in larger format for easier reading.

20.1 Severity of nonconformance during MDOT audits

This is part of the mandatory program rules and supplements J. Nonconformance

20.2 Sample ITP

This is a comprehensive example to aid the Supplier in creating an ITP appropriate for their own supply. It is likely that the Supplier's ITP will be less comprehensive.