Quality Assurance Program for the Carolina Crossroads Project

08/31/18
(Draft QAP)

Contents

Section 1

Scope

1.1 General

The South Carolina Department of Transportation (SCDOT) has developed this quality assurance program (QAP) for the Carolina Crossroads (CCR) project. This QAP utilizes contractor-performed inspection and testing in the acceptance program. The QAP has been established to be compliant with the Code of Federal Regulations (23 CFR 637, Subpart B) – "Quality Assurance Procedure for Construction," Federal Highway Administration (FHWA) Technical Advisory 6120.3 and other guidance documents.

1.2 Program Components

The QAP is comprised of two major components. The acceptance program includes quality acceptance (QA) performed by the Contractor's independent quality firm (IQF) and owner verification (OV) performed by SCDOT. The QAP allows the use of IQF's QA as part of the acceptance program when QA results are verified by OV results performed by SCDOT (or their designee). The independent assurance program consists of independent assurance (IA) performed by SCDOT to verify equipment and personnel performing testing as part of the acceptance program. Contractor-performed quality control (QC) cannot be used as part of the acceptance program and is not subject to the IA program. Figure 1 shows the relationship between the different components of the QAP.

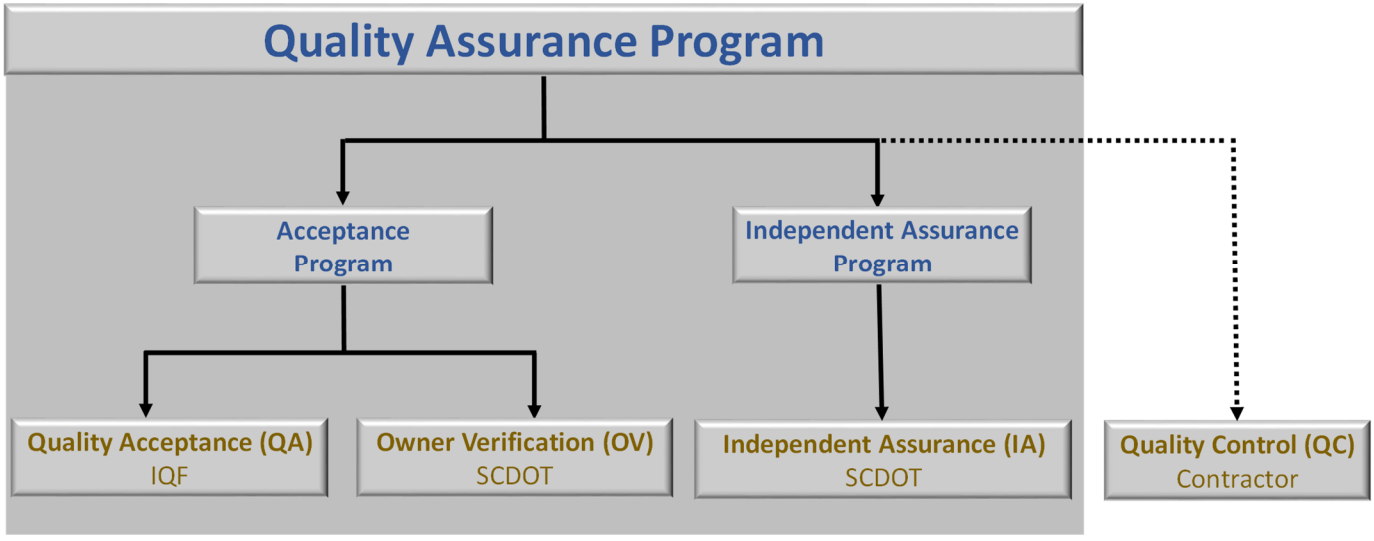

Figure 1: Components of the Quality Assurance Program (QAP)

Section 2 addresses the quality control program and includes requirements for the quality control program. Section 3 addresses the acceptance program that includes requirements for QA and OV.

Section 4 provides requirements for the IA program.

1.3 Construction Quality Management Plan

The Contractor's Construction Quality Management Plan (QMP) will describe its policies, procedures, and staffing to manage construction quality in accordance with the Contract. The Contractor will define processes and procedures for QC to achieve compliance with the Contract. The IQF will also define processes and procedures for QA materials testing and comprehensive product inspection which will be used in acceptance decisions as described in this Program. The Construction QMP must be submitted according to the submittal process in the Contract and must be reviewed and approved by SCDOT 90 days prior to the start of construction.

1.4 Owner Verification Plan

SCDOT will develop an Owner Verification Plan (OVP) that describes its processes and procedures for performing OV of the IQF's QA inspection and testing.

1.5 Conflict of Interest

To avoid an appearance of a conflict of interest, each function must be performed by a separate entity or a separate SCDOT group. The OV, IA and referee functions will only be performed by an SCDOT group or an entity contracted directly by SCDOT. There are six functions identified in the QAP and shown below.

- Contractor Production
- Contractor Quality Control (QC)
- IQF Quality Acceptance (QA)
- SCDOT Owner Verification (OV)
- SCDOT Independent Assurance (IA)
- SCDOT Referee

Section 2

Quality Control

2.1 General

The Contractor is responsible for the quality of the Work. Project quality will be enhanced through the daily efforts of all workers involved with the work as described in the Contractor's Construction Quality Management Plan (QMP). The Contractor's entire workforce will actively participate in quality control to minimize/eliminate re-work.

The quality control (QC) program should be sufficient in scope to pre-empt and avoid repeated discoveries of Non-conforming Work. Repeated discoveries of Non-conforming Work by Contractor's quality acceptance (QA) or SCDOT's owner verification (OV) or, in the opinion of SCDOT, excessive use of engineering judgment will be considered a breakdown of the QC program. This will be cause for investigation and corrective action prior to recommencement of affected work activities. Corrective action may include the revision to existing QC procedures, addition of new QC procedures, re-training of QC personnel, removal and replacement of QC personnel, or other such actions necessary to restore the effectiveness of the QC program.

Contractor's QC efforts are not part of the acceptance program.

2.2 Quality Control Staffing

During periods of construction, the Contractor shall assign an on-site Quality Control Manager (CQM) responsible for management of the QC portion of the Construction QMP. The CQM will not be involved with scheduling or production activities and will report directly to the Contractor's management team. The CQM will ensure that the methods and procedures contained in the approved Construction QMP are implemented and followed by the Contractor and Subcontractors in the performance of the Work. The CQM shall be a qualified employee of the Contractor who is at the project site and has the authority to reject materials or Work without additional approval from someone else within the Contractor's organization.

The Contractor's and Subcontractors' construction workforce are all considered to be members of the Contractor's QC staff, as each member is responsible for the quality of the Work. Personnel responsible for performing the QC inspection will be independent from Independent Quality Firm (IQF) personnel, be knowledgeable in their duties, and receive documented training. Personnel performing QC sampling and testing will be knowledgeable in the testing methods and procedures.

2.3 Quality Control Requirements

The Contractor's QMP must comply with the following QC requirements.

1. Authority and responsibility for the administration of the Construction QMP including the production and updating of the Construction QMP;
2. Structure, responsibilities, and hierarchy of the QC organization including roles and responsibilities of Contractor management, production, and quality control;
3. Interface between Contractor's QC activities, IQF's QA activities and SCDOT's OV and independent assurance (IA) activities;
4. Document control standards, the platform for data systems, document identification standards, and processes for logging and distributing controlled documents including requirements and methods for controlling documents and document control system accessibility by quality organization personnel including the IQF;
5. Construction QC organization and staffing plan including periods of time that the QC staff members will be present onsite and the level of experience, knowledge and skill levels of QC staff;
6. Designation of Contractor, supplier, and subcontractor staff on each crew responsible for performing daily field inspections of their own Work and for preparing daily QC reports to document the inspection performed including report forms to be used by the responsible QC personnel;
7. Proper maintenance, control, calibration, and certification of tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality;
8. Procedures to ensure that elements of the Work are not started or continued without formal communication with the IQF and SCDOT. Inspections, tests and hold points must be identified and communicated to the IQF and SCDOT. Procedures to progress beyond hold points will be developed so no work may be covered until it has been subject to an acceptance hold point by the IQF and SCDOT as specified in Appendix A which provides a list of minimum hold points and whether SCDOT needs to sign off on the hold point;
9. Released for construction (RFC) process and procedures including requirements related to the different types of construction documents that can be used in the field for construction including verification that only RFC plans are distributed for such use;
10. Issuance and receipt of RFC plans, shop plans, procedures, including changes thereto that describe activities affecting quality including measures that ensure that approved documents, including authorized changes thereto, are reviewed for adequacy and approved for release by Contractor's authorized personnel and are distributed to and used at the location where the prescribed activity is performed. This should also include review and approval of changes to documents performed by the same organization(s) that performed the original review and approval;
11. Documentation of instructions, procedures, mix designs and appropriate drawings to ensure that all activities undertaken by or on behalf of Contractor affecting the quality of the Work is properly prepared and approved for use. Such instructions, procedures, mix designs and drawings must include quantitative and qualitative criteria to be used to determine compliance;

12. Purchased materials, equipment, and services must conform to the Contract, governmental approvals, applicable Laws, rules, and the design documents. These measures must be consistent with good industry practice and must include provisions for source evaluation and selection, objective evidence of quality furnished by subcontractors and suppliers, inspection at the manufacture or vendor source, and examination of products upon delivery. These procedures will include identification, documentation, segregation, disposition, and notification to SCDOT, and if appropriate, third parties;
13. Request for Information (RFI) to resolve discrepancies and/or questions in the plans and specifications, so that all changes are documented and approved by Contractor's design engineers. These procedures will include change management and RFI processes as it relates to construction and the quality organization. Discuss the interface between design and construction quality personnel and define the procedures that will ensure that change of any type is not implemented outside of the RFC process;
14. Pre-construction coordination meetings including the identification of items that will require a pre-activity meeting and the typical agenda stating who will typically participate in the meeting, and generally how such meetings will be used to improve the quality of the product being constructed;
15. Non-conforming Work including how Contractor will comply with the requirements of the Contract and how the Contractor will identify, classify, resolve, and document Non-conforming Work, and who is involved in the different steps in the process;
16. Quality program as it relates to implementation of environmental management and compliance;
17. Quality program as it relates to implementation of the traffic management such as monitoring, correcting, maintaining, and reporting on traffic control activities;
18. Accommodation of inspections, sampling and tests by third parties when applicable;
19. Adequacy of material (quantity) available for IQF sampling and testing and SCDOT OV sampling and testing;
20. Identification and control of materials, equipment, and elements of the Work including procedures consistent with current industry standards to ensure that identification of the item is maintained by appropriate means, either on the item or on records traceable to the item, as necessary, throughout fabrication, erection, installation and use of the item;
21. Use of markings, such as stamps, tags, labels, routing cards, or other suitable means, to record the status of inspections and tests performed upon individual items of the Work;
22. Handling, storage, shipping, cleaning, and preservation of materials and equipment to prevent damage or deterioration;
23. Identification and resolution of conditions adverse to quality, such as failures, malfunctions, deficiencies, defective material and equipment, deviations, and other Non-conforming Work are promptly identified and corrected including determination of cause of the condition and corrective action taken to preclude repetition. This will include documenting and reporting, in writing using the modified SCDOT Nonconformity Corrective Action Report, to SCDOT and to appropriate levels of Contractor's management (a) the identification of the non-conforming condition adverse to quality, (b) immediate action taken to prevent this non-conformity, , (c) root cause analysis, (d) improvements to the quality system to prevent similar occurrences, and (e) plan to monitor the effective implementation of improvement(s) identified;

24. Summary of the documentation that comprises the construction quality records, and define the procedures to make sure quality records are immediately available to SCDOT for review;
25. Checking and verification of the accuracy and adequacy of construction or right-of-way stakes, lines, and grades established by the Contractor; and
26. Procedures for ensuring that construction alignment and grades are in accordance with the Contract.

2.4 Quality Control Reporting, Record Keeping, and Documentation

The CQM will maintain all QC construction workmanship and materials quality records of all inspections and tests performed per the approved Construction QMP. These records will be submitted monthly to SCDOT in accordance with the approved Construction QMP.

Section 3

Acceptance Program

3.1 General

The acceptance program includes both the independent quality firm's (IQF) quality acceptance (QA) and SCDOT's owner verification (OV) functions. Regarding materials testing, the contractor-performed QA test results will be used in the acceptance decision if they are validated and/or verified by the OV test results. Regarding workmanship and other inspection-driven features of the work, the IQF's inspection observations and conclusions will be used in the acceptance decision provided that OV activities verify the QA processes, procedures and documentation in the approved construction quality management plan (QMP).

The IQF's QA staff will be separate from the Contractor's production and quality control (QC) staff.

3.2 Engineering Judgment

The use of engineering judgment is part of the acceptance program and the IQF needs the ability to render decisions in the field regarding the work performed. SCDOT recognizes that the IQF is an element of the Contractor's team working with the Contractor to check for and determine compliance with the approved plans and specifications. SCDOT recognizes that the IQF should be afforded the opportunity, in concert with their independent role, to render engineering decisions with respect to appropriate documents for inspection and testing provided that the following criteria are met:

1. The IQF will formally submit an engineering judgment list of inspection and testing items that it is requesting approval from SCDOT to exercise engineering judgment on. This list will be reviewed and approved by SCDOT at its sole discretion. The IQF may only exercise engineering judgment on items on the SCDOT-approved list. This engineering judgment list will be maintained by the IQF and will only be revised with approval of SCDOT at its sole discretion.
2. Engineering judgment may be applied by the SCDOT Construction Manager and the Independent Quality Manager (IQM). Delegation of authority must be approved by SCDOT. These individuals will be an employee of SCDOT, SCDOT's Consultant, or IQF and must be a Registered Professional Engineer in the State of South Carolina. Engineering judgment may only be applied within an individual's area of expertise.
3. Engineering judgment to accept material or Work failing specifications will never be applied solely to promote "partnering" or to help the Contractor. Quality of work is always the greatest concern. The schedule will not be a consideration with respect to quality delivery of the Project.
4. Engineering judgment to accept materials or work failing specification requirements will be applied only in cases that will otherwise meet the intent of the design or that rejection of material compromises quality of a more significant item (e.g. by rejecting a load of concrete for a structural element that is subject to a cold joint).

5. Engineering judgment will only be applied to individual tests. Patterns of failure will not be accepted and will be considered a breakdown in QC activities and shall be addressed in the Construction QMP. Recurring use of engineering judgment for the same plan or specification deviation should result in process corrections to the construction operations to assure material and work is conforming to plan and specification requirements. Engineering judgment cannot be used to widen a specification requirement on a continuing basis.
6. The IQM will utilize engineering judgment to direct that an amount of acceptance testing greater than the required minimum be done when deemed necessary.
7. The individual making the engineering judgment will apply good engineering practices to ensure quality of accepted material by performing additional tests, through engineering analysis, etc. and will document his/her acceptance and justification.
8. Engineering judgment in acceptance of Work not meeting specification requirements will be applied only to situations that are technically sound, in consideration of localized conditions. Engineering judgment will not be utilized to waive specification for conditions that have project-wide implications. The acceptance of material or Work not meeting specifications in a single instance at a specific location will not become a project-wide decision. Each situation will be judged on the merits of its unique characteristics.
9. SCDOT may, at any time, remove or limit engineering judgment authority from the IQM if his/her engineering judgment is not exercised appropriately or in a manner non-compliant with the requirements in this section.
10. SCDOT and Federal Highway Administration (FHWA) have oversight agreements in place that require specific documentation relating to non-conforming material that can remain in place. Any application of engineering judgment will be accompanied by appropriate documentation defined in the Construction QMP.
11. The IQM is encouraged but not required to consult with SCDOT prior to making acceptance decisions based on engineering judgment.
12. IQF personnel will not be placed, or appear to be placed, in a position that exhibits signs that they were pressured by the Contractor to accept, approve, or continue the duties of the IQF scope of work as detailed in the project under duress.

3.3 Sampling and Testing

This section provides requirements for sampling, testing, and acceptance requirements to be used in the acceptance decision.

3.3.1 Sample Types and Uses

Sampling is either random or fixed, depending on whether the location was selected randomly (random) or if a specific location was subjectively identified (fixed). Sampling is also either independent or dependent, based on whether the location was independently selected (independent) or whether it is based on the location of another sample (dependent/split). Only SCDOT and IQF samples selected randomly and independently shall be used to meet guide schedule testing frequency requirements. A failing IQF random independent test requires a passing fixed test at the original failing location and an additional passing random independent test within the lot for acceptance.

The IQF shall perform additional (fixed) tests when the quality of material is questionable at a location other than the randomly selected location. If these additional fixed tests fail, they shall be addressed in a similar manner to a failing random independent test. Fixed tests do not count towards meeting minimum IQF testing frequencies.

A comparison process for performing and analyzing split samples between SCDOT and IQF is necessary during the initial implementation of this quality assurance program (QAP) to ensure that SCDOT and IQF equipment and testing procedures are in alignment. These samples will be analyzed by SCDOT and the results discussed with the IQF to assure laboratory and technician test results compare favorably. When the allowable deviation from the limits in Figure 106D (Deviation Guide for Comparing Quality Control Test Results to Independent Assurance Sample Test Results) of the *SCDOT Construction Manual* are exceeded, corrective actions for either or both parties will be identified, and corrective actions will be incorporated as appropriate. This process will help provide initial alignment of the SCDOT and IQF laboratories and testing procedures. The IQF must commit resources and sample material as necessary to accommodate splitting alignment activities described in the QAP.

Split samples will also be performed throughout the life of the Project as necessary to investigate non-validating material categories and verify or realign testing equipment and personnel.

3.3.2 Inspection and Testing Notification

On a weekly basis, the Contractor will update and provide the IQF and SCDOT with a rolling 3-week look-ahead schedule consistent with the current CPM Schedule and showing the anticipated start and finish of Work activities. The look-ahead schedule will include offsite fabrication activities and planned onsite construction activities. The look-ahead schedules will include anticipated inspection activities, review by third parties, and all associated hold points for each of the Work activities.

Additional inspection and testing notifications requirements are included in the Contract.

3.3.3 Quantities and Testing Frequency

The quality of materials and construction incorporated into the Project are controlled by sampling and testing and must be accepted based on compliance with Contractor's specifications and the Contract. Compliance is determined by acceptance sampling and testing. The IQF must randomly sample at prescribed frequencies based on the IQF sampling guide schedule that meet or exceed those presented in the Appendix B. The IQF's sampling guide schedule must be published in the Contractor's Construction QMP. Sampling and testing must be performed by qualified laboratories and by qualified sampling and testing personnel who participate in the independent assurance program.

The IQF's sampling guide schedule frequencies shall be fulfilled using only random and independent samples and tests. It must indicate the material type to be sampled, the controlling specification(s), the frequency of sampling, the location where sampling will occur, the testing to be performed, and the

acceptance criteria. Material test identification and labelling will be in accordance with standard SCDOT practices with some modifications to accommodate the separation of materials into appropriate categories for statistical validation or verification. The IQF shall comply with and follow the SCDOT test identification and labelling practices for the Project.

For materials that are sampled on a time designated lot basis, the Construction QMP must define the methodology to estimate the relationship between the production lot quantity and the time required to produce such quantity. This relationship is required for the IQF to determine the required number of acceptance samples.

Materials may be accepted through material certifications and manufacturer's test reports. Certificates and test reports approved by the SCDOT Resident Construction Engineer (RCE) in the *SCDOT Standard Specifications for Highway Construction* will be reviewed and approved by the IQF. Certificates and test reports approved by the SCDOT Office of Materials and Research (OMR) in the *SCDOT Standard Specifications for Highway Construction will be reviewed and approved by the SCDOT OMR*.

The IQF will continuously track and record the quantities of materials incorporated into the Project. Monthly, the IQF will reconcile their accepted (testing and inspection) quantities with installed quantities recorded by QC and report them to SCDOT to verify compliance with the approved guide schedule in the Construction QMP. SCDOT will use the report to verify compliance of both the IQF and OV testing frequency.

SCDOT, or its designee, will perform oversight inspection and material verification sampling/testing. To verify IQF test results, OV testing will be performed at a frequency shown in Appendix C – Owner Verification Levels for Materials Verification. OV testing frequency will be established at SCDOT's sole discretion.

3.4 Quality Acceptance Requirements

The Construction QMP must establish a systematic approach to define the processes, methods, procedures, and documentation for the delivery of QA on the Project. These methods and procedures must clearly define the levels of authority and responsibility for the administration of the IQF's portion of the Construction QMP. This will include the procedures used by the IQF to ensure that the Work is inspected and tested to verify compliance with the RFC plans.

The IQF must not rely wholly on the results of sampling and testing in determining the acceptability of materials and construction work. The sampling and testing must be complemented by sufficient visual inspection of the materials to determine whether the samples and tests are reasonably representative. In addition, there should be sufficient inspection of the construction operations and processes to assure uniformly satisfactory results.

3.4.1 Quality Acceptance Staffing, Facilities, and Equipment

The size of the IQF staff must reflect the volume of QA activities necessary for the Work in progress and the IQF shall maintain such staff size in accordance with the approved Construction QMP. The IQF staff must perform comprehensive inspection and testing services typically performed by SCDOT on traditional projects, unless otherwise indicated in the Contract.

The IQF shall update the construction QA staffing requirements as necessary throughout construction to reflect changes in the actual construction schedule. The IQF shall ensure full-time coverage of all active construction activities unless approved in advance by SCDOT in its sole discretion.

The IQF will assign an on-site Independent Quality Manager (IQM) responsible for management of the quality acceptance portion Construction QMP, which may be used in SCDOT's acceptance decision if verified by SCDOT. The IQM will meet the following requirements.

1. Be a licensed professional engineer in the state of South Carolina and will be an employee of the IQF;
2. Report jointly to Contractor's board of directors (construction joint venture or construction company if only one prime contractor) and SCDOT. The IQM will not report to any person or party directly responsible for design or construction production; and
3. Submit monthly construction IQF certifications (Appendix D).

The IQM will review, approve, authorize, examine, interpret, and confirm any methods or procedures requiring review, approval, authorization, examination, interpretation, confirmation, etc., as designated in the SCDOT Standard Specifications. The IQM is considered the "Resident Construction Engineer" for the purpose of this document when interpreting the SCDOT Standard Specifications, Contract, standards, policies, and technical provisions during construction; however, the IQM is not considered the Designer (of Record). Acceptance decisions by the IQM must be verified through the OV program or through the non-conformance report (NCR) process. The IQM will have the authority to stop Work.

The IQF inspection and materials sampling/testing staff will be employed by the IQF and be under the direction of the IQM to verify compliance with the Contract for any or all parts of the Construction Work and the materials used by any member of the Contractor’s team.

IQF inspection and materials sampling/testing staff will have been trained in the applicable inspection and material sampling and testing procedures. The IQF's staff will be experienced in highway inspection and materials testing. The training and experience of the IQF staff will be commensurate with the scope, complexity, and nature of the activity to be inspected and tested. IQF personnel qualifications will include SCDOT certifications in accordance with the *SCDOT Technician Certification Policy* for testing and inspection as well as appropriate nationally recognized certifications applicable to inspection or testing

activities. IQF materials sampling/testing personnel shall also be subject to SCDOT's IA program. Documentation of the training, certification, and experience will be maintained by the IQF and made available for review and audit.

The IQF will use an AASHTO-accredited laboratory and will be approved by SCDOT 30-days prior to beginning the portion of Work for which the laboratory will be performing the testing. Unless otherwise approved by SCDOT, the laboratory or field laboratory will be located on site or within five miles of the Project.

3.4.2 Quality Acceptance Requirements

The Contractor's Construction QMP must comply with the following QA requirements.

1. IQF organizational and staffing plan including (a) the period of time that the IQF staff members must be present on the site, and (b) the required minimum knowledge, technical skills, and experience level of the personnel related to the various inspection functions, such as grading, drainage, structures, and electrical inspections. Also identify the administrative/clerical support staff for management of records/documents pertinent to IQF activities;
2. Compliance with guide schedule testing frequencies including how IQF sampling and testing frequencies and quantities are tracked to ensure compliance with the Contract and how that information will be transmitted to SCDOT, in a manner acceptable to SCDOT, at least daily;
3. Procedures for inspecting, checking, and documenting the Work;
4. Discuss what will be inspected, how it will be inspected, who will be involved in the inspection, what acceptance criteria will apply, and identify the IQF hold points and hold point criteria that must be satisfied before proceeding including the manner in which SCDOT OV will be accommodated during the inspection process;
5. Define and provide the IQF procedures that will be used for documenting compliance of specific items of work;
6. Identify the inspection references and other resources that are intended to be used in addition to the those currently used by SCDOT ;
7. Define and provide inspection documentation format for technician diaries and test reports that may be used in addition to that currently used by SCDOT;
8. Test data organization methodology including the planned materials information database structure and sample identification methodology that documents sample ID structure, material type and usage codes, and location referencing standards. Material codes and other test identifiers must be consistent with those provided by SCDOT;
9. Materials test summary reports including the format and data to be included in the reports;
10. Materials information management software and end user computer devices that will be utilized for collecting, organizing, processing, retrieving, and reporting test data including how the IQF will capture data and transmit reports to SCDOT in an electronic format acceptable to SCDOT;
11. Content and format of the sampling and testing requirements for all types of materials that will be used on the Project including how it will be consistent with those identified in Appendix C;

12. Checking and verification that all collected samples and performed material tests are reported with the proper material codes, type codes or other identifiers required by SCDOT to perform OV including internal QC methodology that will be used to check and assure data integrity;
13. Review and approval of test results including the categorization of test results in a manner acceptable to SCDOT, transmitting test results to SCDOT in a format acceptable to SCDOT for use in fulfilling its verification requirements, and working collaboratively with SCDOT to resolve nonverification between IQF and SCDOT test results;
14. Specific items, or components of items, that are planned to be accepted on the basis of certification and how material certificates will be collected or received, how they will be checked in the field by inspection, how they will be matched up and assigned to specific quantities of received material, how they will be stored and organized to facilitate future audits, what system will be used for tracking certificates and who will be responsible for managing the program;
15. Assessing compliance with the sampling and testing plan that include a process for tracking planned verses actual testing status including the nature and content of weekly reports that will be provided by the IQF to show sampling and testing plan compliance, and the manner in which non-compliance situations will be rectified, or otherwise justified;
16. Review and approval process of all Portland cement concrete, asphaltic concrete, soil-lime treatment, soil-cement treatment and mix designs by a licensed professional engineer;
17. Education, training, and certification of IQF personnel are achieved and maintained including electronic log available to SCDOT that contains personnel certification status and expiration dates;
18. Track and assure that personnel performing QA activities are evaluated annually by SCDOT's Independent Assurance staff for the sampling and testing they perform including reporting to SCDOT which individuals are due for evaluation;
19. Ensure that IQF personnel are present when work is being performed including how the Contractor shall identify and communicate inspection needs or hold points to the IQF and SCDOT and how to complete inspections or hold points;
20. Use of Engineering judgment to substantiate the acceptance of material failing to meet the specification if the material still meets the intended purpose and indicate how the IQF will comply with these guiding principles;
21. Format for documentation of the IQF's application of engineering judgment including, at a minimum, a unique identifying number for each instance, and a written document identifying the type and location of the non-conforming work, the circumstances and the engineering evaluation rationale and conclusions, and any supporting documentation such as calculations or sketches, as appropriate;
22. Proper maintenance, control, calibration, and certification of tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality at specified periods to maintain accuracy within industry standards;
23. Comprehensive system of planned and periodic internal audits of the Construction QMP to determine adherence to and the effectiveness of both the QC and QA portions of the Construction QMP including written procedures and checklists, follow-up actions, and re-audit of deficient areas and correction actions;
24. Ensure compliance with Buy America requirements of 23 CFR 635.410 including tracking

quantities and dollars of domestic and foreign steel to be made available to SCDOT at least monthly;
25. Checking the accuracy and adequacy of construction stakes, lines, and grades established by Contractor;
26. Summary of the documentation that comprises the construction quality records including how the records shall be immediately available to SCDOT for review;
27. Summary of anticipated construction audit documentation to be submitted to SCDOT, and the procedures to ensure all results of audits for construction are submitted to SCDOT five business days after the audit is completed;
28. Weekly report(s) which continuously track and record the quantity of material incorporated into the Project as well as documentation that the IQF is meeting the minimum sampling and testing frequencies;
29. Pre-approved materials used on the Project: Verification of approved status on SCDOT's qualified products list (QPL) and how materials no longer approved on SCDOT's QPL will be sampled and tested by the IQF;
30. Materials sampling and testing including the processes for random sampling, tracking materials samples, processing materials samples, review and approval of test records, and tracking compliance with materials testing frequency;
31. Addressing failed IQF test results including a fixed test at the original failing test location and a new random independent test at a new random-determined location in the same lot are required;
32. Addressing failed OV test results and non-validation of IQF test results in accordance with Section 3.6 of this document;
33. Storm water pollution prevention plan (SWPPP) implementation monitoring including daily inspection and reporting; and
34. Traffic control inspection and hold point prior to starting construction work associated with the traffic control plan. If the traffic control set up is not fully compliant with the traffic control plan, the IQM will have to make an engineering determination that the setup is sufficiently compliant with the traffic control plan before work covered by the traffic control plan can be started.
35. Survey crew to verify Contractor's survey in accordance with the SCDOT Construction Manual and the SCDOT Standard Specifications for Highway Construction.

3.4.3 Quality Acceptance Reporting, Record Keeping, and Documentation

The IQF shall document and maintain documentation showing how the IQF has complied with the Construction QMP requirements, including:

1. An electronic daily log of all inspections performed for both Contractor and Subcontractor operations in a format acceptable to SCDOT and must be made available to SCDOT upon request. The daily inspection reports must identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed. The responsible inspector or technician and supervisor must sign the daily inspection reports. IQF shall

provide reports of the QA daily inspections (including any material certificates associated with the work) to SCDOT in an electronic format acceptable to SCDOT within 24 hours after the work shift;

2. An electronic system for recording all material test results and certifications. The responsible technician and his/her supervisor must sign the daily test reports. Contractor shall provide the results of the daily test to SCDOT in the format acceptable to SCDOT within 24 hours of test completion and without prior review by the Contractor; and
3. Inspection and materials quality program that must deliver all inspection reports, laboratory and field test results to SCDOT in an electronic format acceptable to SCDOT. This electronic reporting is intended to allow Contractor and SCDOT to make timely and accurate decisions on workmanship and material quality issues.

The IQF must review, approve and maintain all originals of material certificates and manufacturer's test reports as required by the specifications prior to incorporating material into the Work. The material certificates must be made available to SCDOT.

3.5 Owner Verification Requirements

SCDOT will perform OV to verify IQF inspections, test results and conclusions. For materials testing, verification will be achieved through comparisons between IQF testing results and OV testing results or the observation of IQF test performance. For workmanship and inspection activities, OV will verify that the IQF is performing the inspection procedures adequately and documenting the results in accordance with the Construction QMP. In addition to real-time evaluations, SCDOT will also conduct periodic audits to verify Contractor's compliance with the approved Construction QMP.

SCDOT will develop a comprehensive Owner Verification Plan (OVP) for the Project and submit it to FHWA for their concurrence. SCDOT's OVP will include internal procedures used by SCDOT to ensure that the IQF's frontline acceptance activities are performed in accordance with the approved Construction QMP and to verify adherence to the Construction QMP. SCDOT will complete the development of the OVP in parallel with approval of the Contractor's Construction QMP.

The OVP will clearly address, at a minimum, how SCDOT will address the following requirements:

1. Methods and procedures that clearly define the authority and responsibility for the administration of the OVP.
2. Procedures for overseeing and inspecting the Work for compliance with Contractor's Construction QMP for each construction operation.
3. Procedures to ensure that the education, training, and certification of personnel performing OV activities are achieved and maintained, and that Work is performed in accordance with the approved OVP.
4. Procedures to oversee the status and disposition of any identified non-compliance with the plans and specifications.

5. Measures to ensure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly maintained, controlled, calibrated, certified, and adjusted at specified periods to maintain accuracy within industry standards.
6. A system of planned and periodic audits of the Contractor's Construction QMP to determine adherence to and the effectiveness of the Construction QMP. Audit results will be documented, reviewed, and sent to SCDOT and the Contractor. Follow-up action, including re-audit of deficient areas following corrective action, will be taken where indicated.
7. A system of planned and periodic audits to determine adherence to and the effectiveness of the OVP. Audit results will be documented, reviewed, and sent to SCDOT. Follow-up action, including re-audit of deficient areas following corrective action, will be taken where indicated.
8. Procedures for performing periodic inspection of Work to verify that the IQF has inspected the Work in compliance with the RFC plans, specifications, and Shop Plans and Working Drawings. The procedure should identify a target oversight inspection frequency and methods for performing verification inspections.
9. Procedures on how OV material sampling and testing will be performed including the process for generating random test locations, tracking material samples, processing material samples, review and approval of test records, and tracking compliance with material testing frequency.
10. Procedures for reviewing QA and OV test results for compliance with mutually agreed-upon processes and naming conventions to ensure data integrity for accurate statistical analyses.
11. Procedures for verifying that only tests performed by qualified IQF testing personnel are submitted to SCDOT.
12. Procedures for auditing QC and QA records, documentation, procedures, and processes to verify compliance with the Contract and approved Construction QMP.
13. Roles and procedures for reviewing and approving Shop Plans, Working Drawings and mix designs.
14. Target frequencies for the independent sampling and testing that are to be conducted as a part of OV. The initial target frequency will include a higher frequency of testing at the beginning of the Project and will be adjusted, as appropriate throughout the Project, based on the observed consistency of the product, the statistical comparison between OV and IQF test results and SCDOT engineering judgment.
15. Procedures for ensuring that OV testing is performed at the frequencies stipulated in the OVP.
16. Identification of the platform and data structure of the database management system that will be used to collect, store and retrieve OV test data. Identification of a strategy to coordinate data between the IQF and SCDOT.
17. Procedures for performing statistical analyses in compliance with procedures outlined in this QAP.
18. Procedures for satisfying IA obligations on this Project.
19. Procedures for review and approval of NCR resolutions proposed by the Contractor.

3.6 Owner Verification Levels of Material Verification

Each material testing procedure expected to be performed by the IQF, and verified by SCDOT, has been assigned a level of materials verification (Appendix D).

For Level 1 test procedures, verification is achieved through continuous analyses. Verification involves statistical analyses using test result comparison packages that have been prepared for specific materials during specific time frames. The F-test is used to determine if the OV and QA data population variances are equal, and the t-test is used to determine if their means are equal. The F- and t- tests are performed continually through the life of the project. The target OV testing frequency is approximately ten percent of the QA testing frequency and can be increased at SCDOT's discretion.

For Level 2 test procedures, verification is achieved through independent verification. Verification involves obtaining independent OV samples and utilizing engineering judgment to compare OV test results with the corresponding QA test results. Test result verification is accomplished on a quarterly basis or as dictated by actual construction operations and schedule. The target OV testing frequency is once per quarter and can be increased at SCDOT's discretion.

For Level 3 test procedures, verification is achieved though observation verification. Verification involves observing the IQF performing the specific test methods. This type of verification will occur once per test method, unless otherwise determined necessary by SCDOT.

If the OV results or observation verification do not verify the QA test results, SCDOT and the IQF will both proactively investigate and resolve the nonverification. SCDOT and the IQF will also proactively take prudent steps to minimize the occurrence of nonverification.

3.7 Material Quality and Acceptance

In addition to the need to investigate and resolve the nonverifications, the material in question must be immediately evaluated to determine if it can be left in place or must be removed, reworked, or repaired regardless of whether the material category is verifying or not. If material is to remain incorporated into the Project, the material in question will be evaluated using the process described in this section. The IQF or SCDOT may exercise engineering judgment to determine whether the material will perform its intended purpose. There are four possible combinations of passing and failing results between the OV and QA test results.

1. Both the OV and QA test results are within specification limits.

   Material may be incorporated.

2. OV test results are within specification limits but QA test results are outside of specification limits.

   Material may be incorporated if the IQF exercises engineering judgment to accept the material or if the material is accepted through the NCR process.

3. Both the OV and QA test results are outside of the specification limits.

   Material may be incorporated if the IQF exercises engineering judgment to accept the material or if the material is accepted through the NCR process. The acceptance of material is subject to one of the two scenarios below:

   a. OV test results indicate reasonable conformance with specification requirements, and SCDOT exercises engineering judgment to concur with acceptance of material based on the IQF's engineering judgment or through the NCR process.
   b. OV test results do not indicate reasonable conformance with specification requirement. IQF then performs a fixed test at the OV failed test location. Based on the results of the previously completed OV and IQF tests, the additional OV and/or IQF fixed test results and the subsequent investigation discussions between SCDOT and IQF, SCDOT determines whether the material may be incorporated and SCDOT records the disposition.

   If the material is reworked, the IQF must perform a fixed test at the SCDOT OV failed location followed by random-independent tests by both the IQF and SCDOT. Random-independent test results representing material prior to rework should be excluded from new statistical analyses.

4. OV test results are outside of specification limits but QA test results are within specification limits.

   Material may be incorporated subject to SCDOT's response in the two scenarios below.

   a. OV test result indicates reasonable conformance with specification requirements. SCDOT exercises engineering judgment to concur with acceptance of material based on the IQF's engineering judgment or through the NCR process.
   b. OV test result does not indicate reasonable conformance with specification requirement. IQF then performs a fixed test at the OV failed test location. Based on the results of the previously completed OV and IQF tests, the additional OV and/or IQF fixed test results and the subsequent investigation discussions between SCDOT and IQF, SCDOT determines whether the material may be incorporated and SCDOT records the disposition.

   If the material is reworked, the IQF must perform a fixed test at the SCDOT OV failed location followed by random-independent tests by both the IQF and SCDOT. Random-independent test results representing material prior to rework should be excluded from new statistical analyses.

3.8 Referee Testing

While expected to occur very rarely, disputes over specific QA and OV test results may be resolved in a reliable, unbiased manner by referee testing and evaluation performed by SCDOT's Materials & Research Group or an independent third-party testing laboratory as appointed by SCDOT's Materials & Research Group. The decision by SCDOT, or its designee, is final. Referee testing is solely an owner function.

Therefore, if a third-party laboratory is utilized, SCDOT will pay for this testing.

3.9 FHWA Reporting

SCDOT will submit quarterly reports to FHWA for concurrence with SCDOT's compliance with the OVP. The reporting period for specific pay items or materials is dependent on the pace of construction, the number of tests performed in each analysis category, the time period of the sampling, and the specification and quality requirements.

The FHWA quarterly report must address the following areas:

1. Statistical analysis and verification results;
2. Non-validation investigation;
3. Split sample test results
4. Engineering judgment log
5. Non-conformance log; and
6. IQFM Monthly Certifications

3.10 Owner Verification Inspection

SCDOT will perform oversight inspection to verify the IQF's QA inspection processes and procedures.

3.11 SCDOT Direct Acceptance

SCDOT will perform direct acceptance of precast, prestressed, structural steel elements, and asphalt cores. The IQF will not be engaged in the acceptance of these elements of Work and owner verification will not be required or performed.

Section 4

Independent Assurance Program

4.1 General

The Code of Federal Regulations (23 CFR 637, Subpart B) requires the implementation of an Independent Assurance (IA) program. SCDOT, or its designee, will implement the IA program as described in this section.

The IA program evaluates the sampling/testing personnel and testing equipment used in acceptance of materials. The Code of Federal Regulations allows observations, split sample results, and proficiency sample results as means of evaluating testing personnel within a State's IA program. The IA program allows for the inclusion of calibration checks, split sample results, and proficiency sample results for evaluating acceptance testing equipment. The IA program does not directly determine the acceptability of materials but evaluates all personnel and equipment involved in the acceptance decision.

4.2 SCDOT Independent Assurance for Testing Personnel

Independent assurance for testing personnel will be in accordance with *SCDOT Construction Manual* Section 103.1.11 Independent Assurance (IA) Sampling and Testing.

4.3 Qualification of Testing Personnel

All personnel supervising or performing sampling and testing activities for SCDOT must meet the qualification requirements in the *SCDOT Technician Certification Policy*.

4.4 Qualification of Laboratories

Laboratories providing testing on the Project will be AASHTO-accredited and will be approved by SCDOT prior to beginning the portion of Work for which the laboratory will be performing the testing. SCDOT will review the QA and OV laboratories periodically to verify compliance with their AASHTO-accreditation requirements and/or verify that test procedures are being performed correctly.

4.5 Qualification of Special Inspections

Inspectors performing inspections on Intelligent Transportation Systems (ITS), lighting, or signals must have both International Municipal Signal Association (IMSA) Traffic Signals Technician Level II and IMSA Fiber Optic Technician Level II certifications.

Appendix A

Minimum Hold Points

[Contents of this appendix are only an example. Specific requirements for the Carolina Crossroads project will be developed in the future.]

Appendix A – Minimum Hold Points

Discipline	Hold Point	IQF Approval Required	SCDOT Approval Required
Environmental Mitigation	Prior to crossing any stream, dewatering, diverting watercourses, or building cofferdams	Yes	TBD
	Before beginning construction for conformance with the Storm Water Pollution Prevention Plan (SWPPP) and NPDES permit	Yes	TBD
	Bi-weekly and after each rainfall event of 1/2 inch or more, for monitoring and maintaining temporary erosion and pollution hold devices	Yes	TBD
Embankments	One per shift per crew for drainage and utility installation with QA pre-backfill inspection documentation for all associated work provided at the hold point	Yes	TBD
	After all clearing, grubbing, and excavation, prior to embankment placement	Yes	TBD
	Before beginning borrow pit excavation for permissions and materials testing	Yes	TBD
	Per specifications for lift requirements (applicable to all embankments, including walls)	Yes	TBD
	Prior to removal of surcharge	Yes	TBD
	Prior to placing embankment or MSE backfill on ground improvements	Yes	TBD

Drainage	Before placing drainage pipe for bedding and pipe conditions	Yes	TBD
	After pipe placement and bedding compaction and before beginning backfill	Yes	TBD
	After backfill for roundness of pipe and other defects	Yes	TBD
	Before opening for structure grouting and pipe and structure cleanliness	Yes	TBD
Structures			TBD
Bridges	At completion of bridge embankment settlement and before start of bridge foundation pile driving	Yes	TBD
	At QA approval of pile-driving submittals (including design calculations, wave analysis, and hammer specification)	Yes	TBD
	After completion of pile driving at each structure support (pile group), including pile-driving results and records	Yes	TBD
	After excavation for drilled shafts and spread footings	Yes	TBD
	Before sonic logging drilled shafts	Yes	TBD
	Before beginning drilled shaft remediation, if needed	Yes	TBD
	Before placement of reinforced concrete in superstructure and substructure elements, including pre-drilled piling	Yes	TBD
	Before and after construction of MSE fill system behind abutments	Yes	TBD
	After removal of unsound bridge deck concrete from existing bridges	Yes	TBD
	Before and after structural steel erection	Yes	TBD
	Before allowing traffic below erected structural steel girders or concrete beams	Yes	TBD
	Before and after post-tensioning and grouting operations	Yes	TBD
	Before backfilling bridge components	Yes	TBD
	Before placement of reinforcing steel above	Yes	TBD

	permanent steel stay-in-place deck forms and above partial depth precast concrete deck panels		
	Before filling full-depth concrete deck panels grout pockets	Yes	TBD
Walls	Before placement of leveling pad for any retaining wall system	Yes	TBD
	After placement of every 10 feet (measured vertically) of MSE wall panels or blocks	Yes	TBD
	Before placement of reinforced concrete	Yes	TBD
	After rebar placement but before final form placement for cast-in-place retaining walls	Yes	TBD
	Before backfilling at any type of retaining wall system	Yes	TBD
	Before and after post-tensioning and grouting operations for tie-back anchors and soil nails	Yes	TBD
Drainage Box Structures	After excavation for drainage box structures	Yes	TBD
	Before placement of reinforced concrete for drainage box structures	Yes	TBD
	After rebar placement but before final form placement for drainage box structures taller than 6 feet	Yes	TBD
	Before backfilling drainage box structures	Yes	TBD
Sign, Signal, Lighting, and ITS Support Structures	After installation of foundations for sign, signal, lighting, and ITS support structures	Yes	TBD

Temporary Structures	Prior to allowing traffic on, below, above, or adjacent to temporary structures, shoring, or bracing	Yes	TBD
Surfacing, Paving, and Concrete	After batch plants are set up, for calibration	Yes	TBD
	Before placement of each course above subgrade on permanent roadway components (treated base, granular base, etc.)	Yes	TBD
	Before placement of each lift of asphalt or PCC paving on permanent roadway components	Yes	TBD
	Before any placement of concrete	Yes	TBD
Traffic Devices and Management of Traffic	Before opening to traffic	Yes	TBD
	Before implementation of a full or partial closure on any roadway	Yes	TBD
	Before changing the traffic configuration or alignment on any roadway	Yes	TBD
Lighting	Before installation of High Mast light tower poles	Yes	TBD
	Before installation of lighting systems to any structural element	Yes	TBD

Appendix B

Independent Quality Firm

Minimum Sampling Guide Schedule

[Requirements will be similar to current SCDOT acceptance sampling and testing practices. Specific requirements for the Carolina Crossroads project will be developed in the future.]

Appendix C

Owner Verification Materials

Levels of Verification

[Specific requirements for the Carolina Crossroads project will be developed in the future with a level specified for each acceptance test.]

Appendix D

Monthly Independent Quality Firm Certification

[Contents of this appendix are only an example. Specific requirements for the Carolina Crossroads project will be developed in the future.]

[Independent Quality Firm's Letterhead or Logo]

South Carolina Department of Transportation
Carolina Crossroads Project

Independent Quality Firm Certification

Draw Request No. __ Certification

The undersigned hereby certifies that:

1. Except as specifically noted in the certification, all Work that is the subject of the Draw Request, including Subcontractors, and Suppliers, has been checked or inspected by the Construction Independent Quality Firm, with respect to the Construction Work;
2. Except as specifically noted in the certification, all Work that is the subject of the Draw Request has been inspected and tested in accordance with the approved Construction Quality Management Plan, and there are no known deficiencies, non-conformances or other deviations that are outstanding associated with the Work that is the subject of this Draw Request. Therefore, the Work conforms to the requirements of the Contract;
3. All the measures and procedures provided in the Construction Quality Management Plan are functioning properly and are being followed;
4. The construction percentages and incorporated material values indicated are accurate and correct; and
5. All quantities for which payment is requested on a unit price basis are accurate.

Exceptions:

_____

_____

_____

Name: _____
(Print)

Signature:

_____
Independent Quality Manager

Date: _____

Seal: