CITY OF CHICO

Chico California

QUALITY ASSURANCE PROGRAM MANUAL

In conjunction with the Caltrans 2018 Standard Specifications

November 2021

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CITY OF CHICO
CHICO, CALIFORNIA

QUALITY ASSURANCE
PROGRAM MANUAL

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CITY OF CHICO
DEPARTMENT OF PUBLIC WORKS
DATE: November 01, 2021

I. INTRODUCTION

1. PURPOSE

The purpose of this Quality Assurance Program (QAP) manual is to provide Departmental guidelines for quality assurance on construction projects to ensure City of Chico wide uniformity with respect to calibrating testing equipment, certifying personnel, sampling and testing materials, preparing material records and to provide assurance that the materials and workmanship incorporated into the construction projects are in conformance with the contract specifications.

The City of Chico, Department of Public Works is responsible for managing Quality Assurance (QA) on all City of Chico Public Works projects. Quality assurance includes both acceptance sampling and testing and independent assurance sampling and testing. The City's QAP will be updated every five years or more frequent if there are changes of the testing frequencies or to the tests themselves.

A list of acronyms associated with this Quality Assurance Program (QAP) is presented in Appendix A.

2. WHAT IS QUALITY CONTROL

Quality Control (QC) is a plan of action by the Contractor to ensure that materials and products incorporated into the construction meet specific standards. QC is the responsibility of the contractor. The City of Chico does not test or inspect materials for QC or assist in controlling the Contractor's production operations.

Guidelines for performing QC on City of Chico construction projects are described in Section 6-2.02 "Quality Control", of the Caltrans 2018 Standard Specifications.

3. WHAT IS QUALITY ASSURANCE

Quality Assurance (QA) is a series of planned or systematic actions required by the Department to verify that the products or materials entering the work comply with the contract special provisions or standard specifications. QA is a combination of acceptance sampling and testing and independent assurance sampling and testing. Quality Assurance is further described in Section 6-2 "Quality Assurance" of the Caltrans 2018 Standard Specifications.

4. INDEPENDENT ASSURANCE PROGRAM

Independent assurance shall be provided by personnel from Caltrans, the Agency's certified materials laboratory, or the consultant's certified materials laboratory. Independent assurance testing will be used to verify that sampling and testing procedures are being performed properly and that testing equipment is in good working condition. Consultants will not be allowed to perform QC tests for the contractor and independent assurance tests for the City of Chico on the same project.

5. QUALITY ASSURANCE PROGRAM MANAGER

The City of Chico, Department of Public Works shall appoint a Quality Assurance Program Manager (QAPM). The QAPM is responsible for overseeing acceptance testing on City of Chico construction projects. If a consultant is used for acceptance testing, the QAPM shall perform oversight for the acceptance testing. It is the responsibility of the QAPM to maintain a file consisting of copies of Acceptance Testers certifications, letters of decertification, notes to file, etc.

The City of Chico shall only use personnel and laboratories who are Caltrans Certified on State and Federally funded projects.

6. PROJECT CERTIFICATION

Upon completion of a Federal-aid project, a "Materials Certificate" shall be completed by the Resident Engineer. The Agency shall include a "Materials Certificate" in the Report of Expenditures submitted to the Caltrans District Director, Attention: District Local Assistance Engineer. A copy of the "Materials Certificate" shall also be included in the Agency's construction records. The Resident Engineer in charge of the construction function for the Agency shall sign the certificate. All materials incorporated into the work which did not conform to specifications must be explained and justified on the "Materials Certification", including changes by virtue of contract change orders.

7. PROJECT RECORDS

All material records of samples and tests, material releases and certificates of compliance for the construction project shall be incorporated into the Resident Engineer's project file. If a Federal- aid project:

1. The files shall be organized as described in Section 16.8 "Project Files" of the Local Assistance Procedures Manual.

2. It is recommended that the complete project file be available at a single location for inspection by Caltrans and Federal Highway Administration (FHWA) personnel.

3. The project files shall be available for at least three years following the date of final project voucher.

4. The use of a "Log Summary," as shown in Appendix Hof the QAP Manual, facilitates reviews of material sampling and testing by Caltrans and FHWA, and assists the Resident Engineer in tracking the frequency of testing.

5. When two or more projects are being furnished identical materials simultaneously from the same plant, it is not necessary to take separate samples or perform separate tests for each project; however, copies of the test reports are to be provided for each of the projects to complete the records.

II. ACCEPTANCE TESTING

1. INTRODUCTION

Acceptance testing is the regular testing of materials or products that will be incorporated into a construction project to verify that the materials or products comply with contract special provisions and standards specifications. Acceptance tests will continue as work progresses.

Testing frequencies for performing acceptance testing on City of Chico construction projects are described in Chapter 16 of the Local Assistance Procedures Manual. The Sampling and Testing Frequency Table can be found in Appendix C. These frequencies will be used as a guide for testing on projects and may be adjusted. Guidance documents for sampling of materials may also be found in the:

1. Materials testing manuals
2. Standard specifications
3. Special provisions

2. WHO PERFORMS ACCEPTANCE TESTS?

On City of Chico construction projects, acceptance tests are to be performed by properly trained and certified personnel. Acceptance Tests shall conform to California Test Methods (CTM) and/or other comparable testing methods including American Society of Testing Methods (ASTM).

Consultants that perform acceptance sampling and testing for the City of Chico shall work under the direction of the Department and the QAPM. Under no circumstances shall said consultants be allowed to perform acceptance tests for the City of Chico and perform quality control duties for the contractor on the same construction project.

3. TRAINING OF ACCEPTANCE TESTERS

A. Acceptance Testers (Consultants Contracted By The City Of Chico)

Consultants may be contracted by the City of Chico to perform acceptance testing on City of Chico projects as needed. Prior to performing acceptance tests for the City of Chico, they must prove to the Department of Public Works that they and their employees are certified through the Independent Assurance Program (IAP). The Consultant shall submit to the Department of Public Works a Quality Assurance Program Manual for review, a copy of which will be kept on file by the Department.

The materials laboratory shall employ personnel (testers) who are certified by one or more of the following: a) Caltrans District Materials Engineer b) Nationally recognized non-Caltrans organizations such as the American Concrete Institute, Asphalt, National Institute of Certification of Engineering Technologies, etc. c) Other recognized organizations approved by the State of California and/or Recognized by local governments or private associations.

It is the responsibility of the Acceptance Tester to report all test results to the Resident Engineer. Filing and maintaining of the test results and summaries are the responsibility of the Resident Engineer. Test results from consulting engineers shall be given directly to the Resident Engineer.

4. LABORATORY CERTIFICATION

At least once during each calendar year a CalTrans IA person verifies that this laboratory has all necessary equipment to perform the California Test (CT). That sampling/testing personnel possess current CalTrans Form TL-0111 "Certificate of Proficiency". Prior to the issuing of CalTrans Form TL-0113 "Qualifying Laboratories". The lab manager of the lab which perform Acceptance Testing, should be a California registered engineer.

5. LABORATORY EQUIPMENT

A. Consultant - Owned Testing Equipment (City of Chico Construction Projects)

Prior to materials testing on a City of Chico construction project, consultants must provide written certification to the Department of Public Works that qualified personnel properly calibrated each piece of equipment involved with the project. All current calibration stickers shall be affixed to each piece of equipment showing the date of last calibration. All testing equipment shall be in good working order and shall be calibrated at least once each year.

B. Proficiency Testing Program

The consultant Materials Testing Laboratory will participate in one or more of the: a) AASHTO Materials Reference Laboratory (AMRL), b) Cement and Concrete Reference Laboratory (CCRL), or c) Caltrans' Reference Samples Program (RSP). The Consultants Laboratory will continue to participate in one or more of the programs as long as CalTrans continues the certification programs. The QAPM and/or a Certified Acceptance Testers will be responsible for administering the tests for the correlation testing program.

III. INDEPENDENT ASSURANCE TESTING

1. PURPOSE

The primary purpose of independent samples and tests are:

I. To verify that project sampling and testing of materials are performed correctly
II. To ensure that the equipment is properly calibrated.

Independent assurance samples are taken at random for the purpose of making independent checks on the reliability of the acceptance test results. Independent assurance tests shall be at the discretion of the project Resident Engineer.

2. PROCEDURES

Independent assurance testing shall be performed on every type of materials test required for the project. Both independent assurance test samples and acceptance test samples shall be taken from the same material source location. The test sample shall be split and test results shall be compared between the independent assurance test and the acceptance test. Independent assurance test must be kept separate throughout the entire test procedures. The independent assurance sample shall not be used for determining compliance with contract requirements.

Personnel shall be certified in all required testing procedures, as part of the independent assurance testing, and shall not be involved in any aspect of the acceptance testing. Proficiency tests shall be performed on Sieve Analysis, Sand Equivalent, and Cleanness Value tests. All other types of independent assurance shall be witness tests.Poor correlation between acceptance testers' results and the independent assurance testers' results indicate probable deficiencies with the acceptance sampling and testing procedures. The following procedures shall be performed to verify that the acceptance testing is being performed correctly:

1. Verifying that equipment used for acceptance testing is properly calibrated and in good working condition.
2. Witnessing sampling and testing by the Acceptance tester.
3. Review the applicable California Test Method with the acceptance tester.

IV. TEST METHODS

1. CALIFORNIA TEST METHODS

Caltrans' Division of New Technology, Materials and Research have developed a three-volume manual of Materials Testing Research, which contains California Test Methods. The primary purpose of the Materials Testing Manual is to establish standards in sampling and testing. These standards ensure that materials and workmanship in California transportation systems facilities are uniformly tested.

The California Test Methods are categorized as follows:

100- 199 "Calibration and Operation"
200 - 299 "Soils and Aggregate"
300 - 399 "Flexible Pavement"
400 - 499 "Chemical"
500 - 599 "Portland Cement and Concrete"
600 - 699 "Structural Materials"
700 - 799 "Environmental"

The consultant shall refer, follow, and conform to these methods. Note: other testing methods may be incorporated. (See Part 2-1)

2. TESTING FREQUENCY

Frequency tables are in Appendix C of this document.

3. REPORTING ACCEPTANCE TESTING RESULTS

The following are time periods for reporting material test results to the Resident Engineer:

I. When the aggregate is sampled at material plants, test results for Sieve Analysis, Sand Equivalent and Cleanness Value should be submitted to the Resident Engineer within 24 hours after sampling.
II. When materials are sampled at the job site, test results for compaction and maximum density should be submitted to the Resident Engineer within 24 hours after sampling.
III. When soils and aggregates are sampled at the job site:
    a. Test results for Sieve Analysis, Sand Equivalent and Cleanness Value should be submitted to the Resident Engineer within 72 hours after sampling.
    b. Test results for “R” Value and asphalt concrete extraction should be submitted to the Resident Engineer within 96 hours after sampling. When sampling products such as Portland Cement Concrete (PCC), cement-treated base (CTB), hot mix asphalt (HMA), and other such materials; the time of such sampling shall be varied with respect to the time of the day

insofar as possible, in order to avoid a predictable sampling routine. The reporting of AT results, if not performed by the Resident Engineer's staff, shall be done on an expedited basis such as by email or telephone.

V. TESTING MANUFACTURED MATERIALS

1. CERTIFICATE OF COMPLIANCE

The Caltrans Standard Specifications permit the Resident Engineer to accept materials prior to sampling and testing if a certificate of compliance accompanies them. Other personnel approved to accept on this basis shall be the Assistant RE and the QAPM.

Should the City request Caltrans to conduct the source inspection, and the request is accepted, all sampling, testing, and acceptance of manufactured and prefabricated materials will be performed by Caltrans' Office of Materials Engineering and Testing Services.

A certificate of compliance shall conform to the requirements of the contract specifications. The Certificate of Compliance does not preclude at any time sampling and testing by the Department as the Departments may deem necessary.

Please see Appendix B for a list of materials that are typically accepted on the basis of a Certificate of Compliance.

2. Materials Requiring a Buy America Certification

Steel and iron products incorporated into the project must comply with Buy America requirements of the CFRs. All steel and iron products must be delivered with a COC stating all manufacturing processes involved in the production of the products occurred within the United States. These processes include:

Rolling • Drilling • Extruding • Coating • Machining • Welding • Bending • Smelting • Grinding

In addition to the COC requirements mentioned earlier in this section, a Buy America COC must also include the mill markings or heat numbers.

The Buy America requirements apply to the entire construction contract if any federal-aid money has been authorized for any phase of the project, not just the construction phase. A local agency cannot circumvent the Buy America requirement by declaring that the material is being paid for with the non-federal portion of the funding.

Buy America does not apply to temporary steel such as that used in falsework, sheet piling or shoring. A minimal use of foreign iron and steel is allowed provided that the total delivered cost to the project site is less than $2,500.00 or 0.1 percent of the contract amount, whichever is greater. Supporting invoices, including the cost of transportation, must be on file in the project records.

A local agency's failure to comply with Buy America provisions will result in the loss of federal funding for not only the applicable contract items, but likely will result in the loss of all federal funding authorized for the construction phase of the project.

3. SOURCE INSPECTIONS

The Department of Public Works may request Source Inspections on a reimbursement basis on projects with federal funds. The request shall be submitted at least 30 days prior to the submittal of the "Request for Authorization to Proceed with Construction." See Chapter 16, Administer Construction Contracts, of the Local Assistance Procedures Manual for proper procedures to request a source inspection.

During the Design phase of the project, the Project Engineer may submit a “Source Inspection Request” see Attachment #2 (Exhibit 16-V of the LAPM) to the Agency, consultant, or Caltrans for inspection and testing of manufactured and prefabricated materials by their materials laboratory.

Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AMRL	AASHTO Materials Reference Laboratory
ASTM	American Society of Testing and Materials
Caltrans	California Department of Transportation
CCRL	Cement and Concrete Reference Laboratory
CTM	California Test Methods
Department	City of Chico of City Department of Public Works
FHWA	Federal Highway Administration
NICET	National Institute of Certification in Engineering Technologies
NIST	National Institute of Standards and Technology
NRMCA	National Ready-Mixed Concrete Association
QA	Quality Assurance
QAPM	Quality Assurance Program Manager
QC	Quality Control

Materials Accepted by Certificate of Compliance *B*

ASPHALT
Asphalt (Oil)
Liquid Asphalt
Asphaltic Emulsion

CONCRETE
Portland cement
PCC admixtures

EROSION CONTROL
Soil amendment
Fiber
Mulch
Stabilizing emulsion
Seed
Fertilizer

PIPE (ALL TYPES)
Plastic pipe supply line (Limited circumstances)
Plastic pipe irrigation line
Culvert and drainage pipe joints
Plastic pipe
Reinforced concrete pipe
Aluminum pipe Aluminum arch pipe
Corrugated Steel Pipe
Corrugated Steel Pipe arch
Structural metal plate pipe arches and pipe arches
Perforated steel pipe
Aluminum underdrain pipe
Polyvinyl chloride pipe or polyethylene tubing
Steel entrance tapers, pipe down drains, reducers, coupling bands and slip joints
Aluminum entrance tapers, pipe down drains, reducers, coupling bands and slip bands
Flap Gates

ROADWAY ILLUMINATION AND SIGNING
Glass Beads
Paint (traffic)
Thermoplastic
Reflective and Non-Reflective signing material
Sign Blanks
Pavement Markers
Reflectors

Materials Accepted by Certificate of Compliance *B*

SIGNALS AND ELECTRICAL COMPONETS

Conductors
Painting of electrical equipment
Electrical components
Controller Cabinet
Controller Unit
Vehicle Detector Units
Amplifiers
Conduit Rigid Steel and Rigid Non-Metallic
Standards
Steel Pedestals
Signal Arms
Signal Faces
Signal Heads
Pull Boxes
Wiring
Heat Shrink Tubing
Pedestrian Push Buttons
Detectors
Light Emitting Diode
Slip Bases
Luminaries

STEEL PRODUCTS

Plain and fabric reinforced elastomeric bearing pads
Steel reinforced elastomeric bearing pads reinforcing steel
Structural steel
Epoxy coated bar reinforcement
Anchor Bolts
Steel Bridge Rail
Cable Anchor Assembly and Hardware
Metal Beam Guard Rail
Metal Beam Guard Rail End Sections

WOOD PRODUCTS

Structural Timber and Lumber
Treated Timber and Lumber
Lumber and Timber

Materials Accepted by Certificate of Compliance *B*

MISCELLENOUS

Lime
Preformed elastomeric joint seal
Waterstops (Special Condition)
Metal target plates
Engineering fabrics
Epoxy
Silicone
Curing Compound
Piles

Appendix C

City of Chico QAP Sampling and Testing Frequency Table
for projects OFF the SHS.

HOT MIX ASPHALT (HMA) / ASPHALT CONCRETE (AC)

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Aggregate Gradation (Sieve)	CT 202	1 Per 1000 Tons or Part Thereof; Minimum 1 per day during production/placement of at least 300 tons per day.	At Plant Per CT 125 (a)
Sand Equivalent	CT 217		
Asphalt Binder Content	CT 382		At Plant Per CT 125 (a) Loose Mix Behind Paver Per CT 125
In-Place Density and Relative Compaction (Nuclear)	Nuclear (b)	1 Per 1000 Tons or Part Thereof; Minimum 1 per day during production/placement of at least 300 tons per day. (b)	Random Locations Per CT 375 (c
	CT 375 or ASTM D2950 (c		
Theoretical Maximum Specific Gravity and Density (Rice)	CT 309	1 Per Day During Production/Placement of At Least 300 Tons Per Day	Loose Mix Behind Paver Per CT 125
HMA Moisture Content	CT 266 or CT 370		
Stadiometer Value (d)	CT 366		
Hamburg Wheel Trackers	AASHTO T 324 (Modified)	Production Start-up and 1 Per Day During Production/Placement of At Least 1000 Tons Per Day (Superpave JMF Only)	At Plant Per CT 125 (a) Loose Mix Behind Paver Per CT 125
Gyration compaction	AASHTO T 312	Production Start-up and 1 Per Day During Production/Placement of At Least 1000 Tons Per Day (Superpave JMF Only)	At Plant Per CT 125 (a) Loose Mix Behind Paver Per CT 125
Asphalt Binder	Sample per Section 92	Sample 1 min. per day for production over 300 tons per day; See (f) regarding testing.	At Plant Per CT 125
Smoothness	12-foot Straightedge	As necessary to confirm contract compliance.	Final Pavement Surface

(a) Exact tonnage of sample location to be determined by Random Sampling Plans

(b) Compaction determined by Nuclear Density Device. Core testing required if compaction fails the nuclear test (c) Correlation between core densities and nuclear device required only if compaction fails the nuclear test

(d) Report the average of 3 tested briquettes from a single split source

(e) Use CT 309 to determine maximum theoretical density in lieu of CT 367 calculated maximum theoretical density

(f) No testing required unless warranted by concern; sample and store until completion of project

SUBGRADE (DISTURBED BASEMENT SOIL) OR EMBANKMENT

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Maximum Density and Relative Compaction	CT 216/CT 231 or ASTM D1557 and D6938	1 Min. Test per 5000 sq ft under vehicle traveled way and shoulder 1 Min. Test Per 300 linear foot under sidewalk	Random locations as determined by the Engineer in place after compaction.

AGGREGATE BASES AND SUBBASES, IMPORTED BORROW

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Sieve Analysis	CT 202	1 Min. Test Per Material Source	Sample from site stockpile/plant prior to placement.
R-Value	CT 301		
Sand Equivalent	CT 217		
Maximum Density and Relative Compaction	CT 216/CT 231 or ASTM D1557 and D6938	1 Min. Test per 5000 sq ft	Random locations as determined by the Engineer in place after compaction.

STRUCTURE BACKFILL, SELECT BACKFILL

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Sieve Analysis	CT 202	1 Min. Test Per Material Source	Sample from site stockpile/plant prior to placement
R-Value	CT 301		
Sand Equivalent	CT 217		
Maximum Density and Relative Compaction	CT 216/CT 231 or ASTM D1557 and D6938	1 Min. Test Per 2 Vertical Lifts of Placement	Random locations as determined by the Engineer in place after compaction.

PORTLAND CEMENT CONCRETE (PCC) - STRUCTURAL AND SIGNAL/LIGHTING FOUNDATIONS

COARSE AGGREGATE

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Sieve Analysis	CT 202	1 min. test per 500 cu yds and per each material source ; 1 min. test on smaller projects; If bridge, 1 min. set per separate pour per abutment/pier/deck.	Sample from site stockpile/plant prior to placement
Cleanness Value	CT 227		

FINE AGGREGATE

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Sieve Analysis	CT 202	1 min. test per 500 cu yds and per each material source ; 1 min. test on smaller projects; If bridge, 1 min. set per separate pour per abutment/pier/deck.	Sample from site stockpile/plant prior to placement
Sand Equivalent	CT 217		

WET MIX

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location/Time of Sampling
Slump/Penetration	CT 533 or ASTM C143	1 per 150 cyd or per day	Sample from truck/work site
Unit Weight and Air Content	ASTM C231	1 per 150 cyd or per day	
Cylinders	CT 539/540 ASTM 192, ASTM C39	1 min. set of 5 (4x8) per day per every 150 cyds; If bridge, 1 min. set per separate pour of abutment/pier/deck.	

Note: Test methods and/or testing frequencies may be adjusted based on specific project requirements.

Appendix

Examples of Materials Certificates *D*

Appendix K - Examples of Materials Certificates/Exceptions (Signed by the Resident Engineer at the Completion of the Project)

Federal-aid Project No.: Project HP21L – 5055 – 111

Subject: Materials Certification

This is to certify that the results of the tests on acceptance samples indicate that the materials incorporated in the construction work and the construction operations controlled by sampling

☒ and testing were in conformity with the approved plans and specifications.

☐ All materials exceptions to the plans and specifications on this project are noted below.

No exceptions were found to the plans and specifications on this project.

Bill Sanders	Bill Sanders	7/7/07
Resident Engineer (Print Name)	**Resident Engineer (Signature)**	**(Date)**

Note: The signed original of this certificate is placed in the Resident Engineer's project files and one copy is mailed to the DLAE and filed under "Report of Expenditures."

See the attachment (next page)

Appendix K (continued)

Attachments: Materials Exceptions (Acceptance Testing)

Type of Test	Description of Work	Total Tests Performed On the Project	Number of Failed Tests	Action Taken
Slump Test	Concrete Sidewalk	8	1	When the measured slump exceeded the maximum limit, the entire concrete load was rejected.
Sand Equivalent	Aggregate for Structural Concrete	10	1	The tested S.E. was 70 and the contract compliance specification was 71 minimum. However, the concrete 28-day compressive strength was 4800 psi. The concrete was considered adequate and no materials deductions were taken.
Compaction	Sub grade Material	12	1	One failed test was noted. The failed area was watered and reworked. When this was completed, a retest was performed. The retest was acceptable.
Compaction	Hot Mix Asphalt	12	1	One failed area was noted. It was reworked and retested. The second test met specifications.

Bill Sanders — Resident Engineer (Print Name)

Bill Sanders — Resident Engineer (Signature)

July 4, 2007 — Date