

2021 CDOT Field Materials Manual

Introduction

The purpose of this manual is to provide an official guide to CDOT Field Materials Technicians, whether the individuals are CDOT personnel or consultant, for the sampling and testing of materials on construction projects and the subsequent documentation. It is not the intent to publish a complete summary of all sampling and testing methods and procedures. Further, applicable information may be found in either the referenced AASHTO or ASTM documents.

The testing frequency as shown in the Owner Acceptance (OA) Frequency Guide Schedule for Minimum Materials Sampling, Testing, and Inspection are considered to be the minimum necessary to have the degree of control desired. The Sampling and Testing Procedures have in many cases been modified to make them more applicable to Field testing conditions. Further unauthorized modifications should not be attempted. If a valid reason exists, a shortage of tests can be explained and the work accepted. However, improper test procedures cannot be explained nor accepted.

The testing frequency as shown in the Independent Assurance (IA) Frequency Guide Schedule for Evaluation of OA Sampling and Testing is to be established by the Region Materials Engineer.

It is not our intention to discourage efforts to find better or faster methods of testing. Many of the Colorado Procedures are the result of suggestions from field materials personnel. However, before using a procedure other than that listed, it must be approved by the Materials Advisory Committee (MAC) and the FHWA. In addition, the procedure used must be the same as that specified in the project specifications. If this rule is not followed, the acceptance or rejection action cannot be supported and may result in legal rulings against the Department in cases of litigation. The Frequency Guide Schedule for Minimum Materials Sampling, Testing, and Inspection current at the time of contract advertisement shall apply during the full course of that particular project.

We realize the critical importance of materials and the associated personnel, whether they are Process Control (PC) from the contractor, Owner Acceptance (OA) from CDOT, or Independent Assurance (IA) to any construction project. It is our intent to create a Field Materials Manual (FMM) that always reflects the most current and best procedures, and is as user-friendly as possible. Please take the time to review and read this publication, and provide us with the Colorado Procedure (CP) Comment Form or the FMM & CDOT Materials Forms Comment / Correction Form at any time. Download the CP Comment form to your computer and open the form using Adobe Acrobat. Follow the instructions and submit your comments. The form with your comments will be maintained with the FMM, CP, Section or chapter for future reference.

It is critical to follow the *Documentation for SMM / LIMS – Project Materials to Final Materials* or the *Documentation for Design-Build Quality Assurance Program - Project Materials to Final Materials* which is applicable for the vast majority of CDOT projects.

The 2021 CDOT Field Materials Manual is currently updating and adding documents and instructions to meet the recommendations for updating manuals to comply with Procedural Directive 21.1 “Requirements for the Retention of Records for Specified Design, Construction, Engineering, and Specialty Groups (Paper and Electronic) eff. June 20, 2019 and Procedural Directive 508.1 “Requirements for the Use of the Professional engineer’s Seal” eff. May 21, 2019

Though the CDOT Field Materials Manual (FMM) has been available in both a published print format and on the CDOT web site; future FMM's may only be available electronically as CDOT is moving toward a paperless work environment. CDOT is also implementing electronic signatures to facilitate the timely transmission of documents and project closure. Any changes prior to the issuance of the 2021 FMM will be conveyed through a CDOT Materials Bulletin.

Craig Wieden Digitally signed by Craig Wieden
Date: 2020.06.25 08:45:53 -06'00'

Craig Wieden PE., III
CDOT Materials Engineer

A centralized location for all CDOT Materials related documents and publications is at:

<http://www.codot.gov/business/designsupport/materials-and-geotechnical/>

Materials Advisory Committee (MAC) information:

<http://intranet.dot.state.co.us/best-dot/MAC>

FMM Documents: A special thank you is extended to the members and participants of the MAC Meetings and the associated task forces who are constantly striving to improve testing methodology and CDOT specifications so that the roads in Colorado are progressively built better and are safer for the public.

SUMMARY OF

2020-2021 CDOT Field Materials Manual

Listed Revisions, Additions, and Deletions

Changes from the 2020 and added onto the 2021 FMM: Changes of significance within a particular CP or chapter will contain a “- xx” at the end of the title to coincide with the FMM edition, not the calendar year that changes or revisions were made. Changes to specific text (Sections &/or Subsections) from the previous year will have a RED side-bar in either the left or right margin. The 2020-2021 revisions, additions and Deletions are highlighted in RED.

- FMM Manual-2020-2021 FMM Updates: Updated format to Single column for new chapters and CP's. Vote held
- Cover Page Updates: 2021 Updates- Changed CDOT Logo
- CP Comments Form: 2021 FMM Update: Updated format and added e-signature block, using "Jotform" PD21.1 requirements
- Comments Corrections Form: 2020 FMM Update: Updated format and added e-signature block
- Table of Contents: 2021 Update: Added new Comments Form Added CP63, Added Electronic Documents Chapter. Vote held.
- QA Procedures 2020 FMM updates: Subsections 3.19, 5.2.2, 7.2, 7.5.1.1, 7.11.1, 11.9.1, 11.11, 11.12.2, 11.12.3.2, 13.2.3, 17.1.
- Documentation for SMM / LIMS: 2021 FMM updates, 3.1, 3.1(8), 3.2(17a,b), Added the CDOT Form 473,474 in Adobe Sign Guidelines and updated the forms. Vote .
- Adobe Acrobat Sign instructions: 2021 FMM update Added new chapter with instructions. PD 21.1 Requirements. Vote.
- Documentation for Design -Build: 2020 FMM Updates-Section 4 total rewrite, edit & re-format. 2021 FMM Updates- 3.4.3.1 Statistical Analysis,
- Documentation for Maintenance & LA- 2020 FMM: updated the CDOT Form 473LA, 473M and CDOT 474.Acrobat DC.
- Contractors, Special Notice: 2021 FMM updates 4.1G, Note 1, 7.3.a.(Products needing Pre-Inspection), APL User Guidance- 6, 9, Notes 5,6,7, 8,9.10, APL Category Edits- Adhesives Note 5, Cement Blended (TypeIL,MS) (IL,HS),(IT,MS),(IT,HS), PCCP Grout, Region Approved Plant Mix Grout, Class DR [Pre-Packaged], Environmental Sound Wall, Alternate Traction Device Note 6, Mastic Note 7, Delineator Post Marker Note 8, Concrete Pre-cast Barrier (Type7), Cable Barrier MASH09 TL-3 to meet 2020 compliance, Traffic Control Lighting, Sight Standards. Contractors APL Verification Forms signatures and explanations were added. Added electronic stamp instructions. PD 21.1 requirement.

SUMMARY OF 2020-2021 CDOT Field Materials Manual Listed Revisions, Additions, and Deletions

- OA Schedule and IA Schedule: 2020 FMM updates- Added CDOT Form Links. Item 203, Item 409, Item 412, Item 420, Item 502, Item 506, Item 601, Item 612.
- OA Schedule: 2021 FMM Updates 203, Item 208 reference CDOT Form 157, Item 212 reference CDOT Form 157, Item 411, Item 412 Pavement Smoothness, Item 601,606, Item 607, Item 627
- IA Frequency Guide Schedule: 2020 FMM Updates- Item 203, Item 403, Item 409, Item 412, Item 503, Added Note 4.
- IA Frequency Guide Schedule: 2021 FMM Updates- Item 403, Table IA-1 "Type of Test" Column removed "Nominal Maximum". Added "Flat and Elongated" to Table IA-1. Vote held.
- CP 10: 2020 FMM Updates- Section 2.3, 6.19 Note 2.
- CP 10a: 2021 FMM update: Added new (Field Lab & Personnel Qualifications Checklist Form) Add Line to Table 10-1, E-Learning Technician Training Program. Add Line to Table 10-1, Edits to Table 10-1 Sampling & Testing Personnel Qualifications, ¹ E-Learning Technician Training Program.
- CP 11 (Intro to QML) 2021 FMM update: Added Precast Structures, Added new tab to FMM Manual.
- CP 11-1 (Asphalt Binder) 2021 FMM update: Added new tab to FMM.
- CP 11-2 (Asphalt Emulsion) 2021 FMM update: Added new tab to FMM.
- CP 11-3 (Hydraulic Cement) 2021 FMM update: Added new tab to FMM.
- CP 11-4 (Fly Ash) 2021 FMM update: Added new tab to FMM.
- CP 11-5 (Hydraulic Lime) 2021 FMM update: Added new tab to FMM.
- CP 11-6 (Reinforcing Steel): 2021 FMM Updates- Steel Reinforcing Bars and Steel Dowel Bars, Scope paragraph 2. Added new tab to FMM Manual.
- CP 11-(Epoxy-Coater) 2021 FMM update: Added new tab to FMM.
- CP 11-8 2021 FMM update: Section 1.1, 6.3, 9.8.1, 9.8.1.1, 10.1, 11.4. Added new Pre-Cast Checklist and Pre-Cast certification letter. Vote held. Added new tab to FMM

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- CP 12A: 2021 FMM Updates- addition of Section 13 "Submittal of PC Notebook". Added new tab in the 2021 manual.
- CP 12B: 2021 FMM update: Added new tab in the 2021 FMM.
- CP 12C: 2021 FMM Updates: Addition of Section 7 "Submittal of PC Notebook". Added new tab in the 2021 FMM.
- CP 13: 2021 FMM Updates-Changes to Table 13-1, HMA Air Voids, In-Place Density HMA, Longitudinal Joint Density, Flexural Strength PCCP. Added Tab to the manual
- CP 14: Last Update 2021 FMM: Added Tab to the manual, Materials Bulletin January 2020
- CP 15: Last Update 2021 FMM: Added Tab to the manual, Materials Bulletin January 2020
- CP 16: 2021 FMM Updates- CDOT Form 1324 revised. Added Tab to the manual, Materials Bulletin January 2020
- CP 17: 2020 FMM Update- Replaced Process Documentation Worksheet with CDOT Form 417
- CP 20: Last Update 2008
- CP 21: Last Update 2008
- CP 23: Last Update 2013
- CP 24: 2020 FMM Update- 2.1
- CP 25: 2021 FMM Update- 3.5 Changed 10,000 yds³ to 5000 yds³, Added revisions from Chris Russell Vote held.
- CP 26: Last Update 2014
- CP 30: Last Update 2009
- CP 31: 2020 FMM Update- Subsection 3.1.3.1
- CP 32: Last Update 2003
- CP 33: Last Update 2012

SUMMARY OF 2020-2021 CDOT Field Materials Manual Listed Revisions, Additions, and Deletions

- CP 37: 2020 FMM Update- 2.7
- CP 41: 2020 FMM Update- 13.1
- CP 42: Last update 2005
- CP 43: 2020 FMM Update- 15.1
- CP 44: 2020 FMM Update- The Title, Percent Relative Compaction to, "Just Percent Compaction"
- CP 45: 2020 FMM Update- 7.1
- CP 46: Last update 2008
- CP 47: Last update 1990
- CP 48: 2020 FMM Update- 4.1.1
- CP 50: Last update 2014
- CP 51: 2021 FMM Update- The Title, added the word "Theoretical", Scope 1.1, 3.3, 3.6, 3.9.1, 6.4, Method B title update 10.2
- CP 52: 2021 FMM Update- Subsection 2.2, 2.3, 3.1, 3.2, 4.2, 4.3 (which was 4.2 is renumbered with 4.3,(6), 8.2 delete CDOT Procedural Directives 25.2, 51.2, 51.3 and replace with 25.1. Vote held.
- CP 53: 2021 FMM Update- 1.1 deleted Method C reference, Deleted Method C (8,9), 11.1 deleted the mention of Method C, 13.1. Vote held.
- CP 54: Last update 2013
- CP 55: Last update 2018
- CP 56: 2020 FMM Update-Title, "Guidelines for Using Theoretical Maximum Specific Gravity (RICE) of Project-Produced HMA to Change the Target Specific Gravity for Compaction Compliance".
- CP 57: 2020 FMM Update- 4.2, 6.3 New Form
- CP 58: Last update 2007

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- CP 59: **2021 FMM 3.3 Deleted, 8.1 delete CDOT Procedural Directives 25.2, 51.2, 51.3 and replace with 25.1, Update with electronic Forms.**
- CP 61: **2021 FMM update: 4.2.1., 4.2.4**
- CP 62: **2021 FMM Update- 6.3 delete CDOT Procedural Directives 25.2, 51.2, 51.3 and replace with 25.1. Section 7 Update**
- CP 63: **2021 FMM Update- New Addition of CP 63 added.**
- CP 65: **2020 FMM Update- Text within Example 1 & 2 Table 65-1, Table 65-2, Table 65-3, Table 65-4, Subsection 7.1, 7.6.1, text within Example 3.**
- CP 67: Last update 2008
- CP 69: Last update 2018
- CP 71: Last update 2001
- CP 74: **2021 FMM Update-Added "Smoothness Acceptance Data Submittal Form", 5.4.**
- CP 75: Last update 2008
- CP 76: **2020 FMM Update- Updated the "Checklist for Field Bituminous Equipment Calibration"**
- CP 77: Last update 2018
- CP 78: **2021 FMM Update- 3.2.1,4.1.1, 4.2, 5.1.2, 6.3, 6.6, 9.2.**
- CP 79: **2020 FMM Update- Added MIT Scan Images for Uncut Dowel Baskets. Vote held**
- CP 80: Last update 2013
- CP 81: Last update 2018
- CP 82: **2020 FMM Update- New text for Note 6**
- CP 85: Last update 2013
- Chapter 200: **2020 FMM Update- Added "guide" paragraph at the top of first page.**

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2021 CDOT Field Materials Manual

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- Chapter 300: 2021 FMM Update- Added Change to Note: Forms are currently in development. Statement added "Contact Ed Trujillo Edward.trujillo@state.co.us 303-398-6566 for assistance with any CDOT form."
- Chapter 400: 2021 FMM update: Updated Forms, Added "guide" paragraph on top of first page.
- Chapter 500: 2021 FMM update: Updated Forms, Added "guide" paragraph on top of first page.
- Chapter 600: 2021 FMM update: Added Eric Prieve revisions to chapter 600. Updated Forms, Added "guide" paragraph on top of first page.
- Chapter 700: 2021 FMM update: Updated Forms, Added "guide" paragraph on top of first page.
- Chapter 800: 2020 FMM Update- Deleted Chapter 800, A copy of Chapter 800 will be located with each Nuclear Gauge. Additional copies will be located with each Region Radiation Safety Officer and the Region Safety Officer. Vote held
- Materials Forms – Instructions & Examples: 2020 FMM Update- previously Appendix O, a new chapter, Added CDOT Form 473,474 guidelines and examples. Added Change to Note: Forms are currently in development. Contact Ed Trujillo Edward.trujillo@state.co.us 303-398-6566 for assistance with any CDOT form.
- Electronic Documents 2021 FMM: Added new chapter Introduction to ProjectWise/Projectshare as per 21.1/508.1.
- JSA: 2021 FMM Update: AASHTO Test Method T90, T190. CP-L Test Method 4301, 4302. Update Note: Regions review and update all Job Safety Analysis (JSA) documents.
- AASHTO / ASTM Online: 2021 FMM Update- Added New Instructions for CDOT personnel needing to register to IHS Markit. Add link to webpage with instructions.
- Inspections: 2020 FMM Update- Table of Contents (V) Protocol for the Audit of Region Materials Finals Review and Acceptance Process by the Central Materials Laboratory.
- Protocol for Round Robin Materials Testing of CDOT Region & Consultant Laboratories: Last update 2018.
- The protocol of the Audit of Region Materials, IA Sampling and Testing Program by the Central Materials Laboratory: 2021 FMM Update - Update all AMRL references with the "AASHTO Re:source" reference. Update the distribution list.
- The protocol of the Audit of Region Materials, Finals Materials Review and Acceptance Process by the Central Materials Laboratory: 2021 FMM Update- Update all AMRL references with the "AASHTO

Re:source" reference. Update the distribution list.

SUMMARY OF 2021 CDOT Field Materials Manual Listed Revisions, Additions, and Deletions

- The protocol of the Audit of the Local Agency, Finals Materials Review and Acceptance Process by the Central Materials Laboratory: 2021 FMM Update: Update all AMRL references with the "AASHTO Re:source" reference. Update distribution list.
- Appendix A (MAC Charter) revisions as noted: 2021 FMM Update: Membership change from 10 to 9 with the Research Group removed e-vote to follow. Scope, Guests and Guests Uninvited, Appropriate Topics & Discussion, Taskforce Business, MAC meeting minutes and Executive Summary.
- Appendix A (FPOG): Last update 2018.
- Appendix B Task Force Management Guide: Last update 2018
- Appendix C (Statewide Roster): 2021 FMM Update- Updated region contact information names and phone numbers.
- Appendix D (Definitions): 2020 FMM Update- Owner Acceptance (OA), Owner Verification Testing (OVT).
- Appendix E 2021 FMM Update: AV, AQV, EPE, PEC, OA, OVT, QAP
- Appendix F (Significant Publications): 2021 FMM Update- Updated reference to "Asphalt Institute manual MS-2"
- Appendix G (Colorado Procedures): 2020 FMM Update- Added CP-L 4301, CP-L 4302.
- Appendix H Metric Conversion Tables: 2020 FMM No updates
- Appendix I 2020 FMM update: (Materials Testing Accuracy Criteria): Changed % Soils Relative Compaction (Report to Nearest 0.1%), Base Aggregate Relative Compaction (Report to Nearest 0.1%)
- Appendix J 2021 FMM update: (Laboratory Test Time): Deleted 301 Plant Mix Bituminous Base. Add 409 Flat and Elongated. Added 601 Aggregate Soundness with Sodium Sulfate.
- Appendix K (Establishing Lots or Process Control on the Project) 2020 FMM No updates.
- Appendix L (Random Sampling): 2020 FMM No updates.
- Appendix M (Sample-Processing Procedure): 2020 FMM No updates.
- Appendix N: (Results of Laboratory Check Tests): 2020 FMM Update- Added "Results of Laboratory Check Tests can be used and referenced to more than one project of the RE allows it and if the

following criteria are met"

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