

Chapter 1

INTRODUCTION

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1 INTRODUCTION

The material contained herein is for information purposes only and may be used to aid new employees and those unfamiliar with ODOT traffic engineering practices, in accessing and applying applicable standards, statutes, rules, and policies related to traffic signal operation and design.

There are two main manuals that shall be used to create Traffic Signal Plans and Specifications on the state highway system:

1. ODOT Traffic Signal Design Manual
2. ODOT Traffic Signal Drafting Manual

The ODOT Traffic Signal Design Manual focuses on the design aspects of traffic signals while the second manual focuses on the drafting of the completed design. Both manuals assume you have a basic understanding of the topics presented.

1.1 About Us

The Traffic Signal Standards Unit is responsible for maintaining and interpretation of the ODOT Traffic Signal Design Manual. This group is part of Traffic Engineering Services, which is a unit within the Traffic-Roadway Section.

Doug Bish, P.E.
Traffic Services Engineer (Manager)
503-986-3594
Doug.W.Bish@ODOT.state.or.us

Scott Cramer, P.E.
Traffic Signal Engineer (Crew Lead)
503-986-3596
Scott.B.Cramer@ODOT.state.or.us

Katryn Johnson, P.E.
Traffic Signal QC Engineer
503-986-3595
Katryn.L.Johnson@ODOT.state.or.us

Joe Searcy, General Journeyman Electrician
Traffic Signal Standards Specialist
503-986-3577
Herbert.J.Searcy@ODOT.state.or.us

Sarah McCrea, P.E.
Traffic Control Systems Engineer
503-986-3251
Sarah.A.MCCREA@odot.state.or.us

1.2 Availability

This manual is a web-only document, which can be accessed and printed in its entirety from the ODOT Traffic Signal Information web site:

<http://www.oregon.gov/ODOT/Engineering/Pages/Signal-Design-Manual.aspx>

1.3 Updates

This manual is updated continually and revisions will be made as necessary, typically on a yearly basis in June or July. The revised manual becomes effective on the official revision date (month/year format). All design work prior to final plans shall follow the requirements of the current version of this manual.

If you wish to receive notification of future revisions of this manual and other updates for ODOT traffic signal standards, subscribe to our e-mail notification system by e-mailing the [Traffic Signal QC Engineer](#).

1.4 Change Requests

If you would like to suggest changes to the ODOT Traffic Signal Design Manual, please contact the [Traffic Signal QC Engineer](#).

1.5 Document Revision Summary

1.5.1 Revision: December 2013

- Complete reformat of document
- New information on video detection
- New information on roadway design
- New procedure for Railroad Preemption Plan Sheet
- New information on operational approval
- New information on design approval

1.5.2 Revision: October 2014

- Minor revisions based on comments received during the draft manual release in December 2013

1.5.3 Revision: January 2016

Chapter 2 Design Approval Process:

1. Figure 2-1 (organization chart) – updated chart
2. Section 2.5 (Design Approval Process): Info on plan requirements at each milestone

Chapter 3 Signal Operation & Operational Approval:

3. Section 3.3.1 (ring and barrier diagram) – added bold note clarifying intent of the ring and barrier diagram; to clearly show the conflicts that require conflict monitoring.
4. New Section 3.3.3 (Flashing yellow left turn arrow with NOT-PED) – This section was added to describe the FYA not-ped feature and explain why it is NOT shown in the ring and barrier diagram.
5. Section 3.3.5 (not-ped overlap phases) – added a note to reference new section 3.3.3 (flashing yellow left turn arrow with NOT-PED) to make sure designers go to the right section for FYA not-ped info.
6. New Section 3.3.6 (Pedestrian Overlap Phases) – This section was added to describe pedestrian overlaps. Added new figure in this section.
7. Updated Figure 3-9 (ring & barrier diagrams: Multiple intersections using a single controller, example 1) – revised OLA designations from “,” to “&” for consistency. Fixed lane use typo.
8. Updated Figure 3-10 (ring & barrier diagrams: Multiple intersections using a single controller, example 2) – revised OLA designations from “,” to “&” for consistency
9. New Section 3.3.11 (dummy phases) – this section was added to describe dummy phases. Added two figures to this section showing a dummy phase.
10. Updated Figure 3-11 (ring & barrier diagrams: Multiple intersections using a single controller, example 3) – revised OLA designations from “,” to “&” for consistency

Chapter 5 Signal Plan:

11. Section 5.2 (Vehicle signal head layout) – added two bullets, signal heads should be mounted overhead and they should be aligned vertically.
12. Added new section 5.2.3 (supplemental near-side signal heads) – added info to clarify and show examples of use of near side signal heads.
13. Section 5.2.5 (signal head louvers and cut-off visors) – added cut off visors to this section and a new figure
14. Table 5-3 (standard signal heads for right turn phases) – added 2 rows to the table to describe standard heads for signalized right turn slip lanes (Type 3R only, NOT type 2). Clarified that the opposing left turn CAN NOT be a permissive left turn if there is single receiving lane. Added figure 5-23 (signal head placement for right turn phases – Right turn slip lanes)
15. Table 5-3 (standard signal heads for right turn phases) – added a reference to the MUTCD section that prohibits a permissive opposing left turn movement and protected right turn movement to occur concurrently.

16. New Section 5.3.2 (Street name signs and guide signs – custom designed signs) – moved some info about custom signs into its own section for easier reference. Added info about max size of custom sign.
17. Section 5.6 (illumination) – hyperlinked lighting manuals to illumination webpage
18. Section 5.6 (illumination) – added new section for LED fixtures & changed standard from HPS to LED as per the Illumination Engineer
19. Section 5.6.2 (illumination wiring) – added a bullet point describing TC cable and a bullet describing bond wire
20. Section 5.9 (battery back-up) – deleted erroneous reference to Signal Policy and Guidelines (SP&G) – added information that was once contained in the SP&G.
21. Section 5.10.1 (Controller Cabinets/Location): Info on opening cabinet door off right-of-way
22. Section 5.13.1 (Conduit Size): 2” spare conduit for detection required between signal pole and first JB in the same quadrant. To allow for future retrofit of alternative detection.
23. Figure 5-17 (signal head types) – updated figure to include Type 1R and Type 1Y.
24. Figure 5-27 (signal head placement for right turn phasing) – updated the sign used with the Type 5 signal head (from OR22-14 to OR10-15)
25. Figure 5-31 & 5-32 (common signs used for traffic control) – updated sign AL/12: removed OR22-14 (“right turn yield to peds on green ball symbol”) info and replaced with OR10-15 (turning vehicles stop for ped) info. Added sign AL/3T (“No trucks” R5-2) and sign AL/20 (“Except bus” OR3-7a)
26. Figure 5-33 (signs no longer used) – added OR22-14 to the list.

Chapter 6 Detector Plan:

27. New Section 6.3.2 (Overlap Phase Detection) – added this section discuss the need for overlap phase detection to be assigned to a parent phase.
28. Section 6.4 (standard detection layout) – revised this section to be more general and moved the chart into the Inductive loop detection section. Added a figure illustrating the standard layout
29. Section 6.6 (detector input file) – added “stretch” to CO (carryover) definition.
30. Section 6.6.1 (332S cabinet: 2070 controller with a C11 connector) – changed the 8 asterisks locations to include “count” as a function, as per Darren LAWRENCE.
31. Section 6.7.12 (Induction Loop Detection/Conduit): 2” spare conduit for detection required between signal pole and first JB in the same quadrant. To allow for future retrofit of alternative detection.
32. Section 6.7.12 (induction Loop Detection/Conduit): added info as per Region 4 - Regions may have a larger minimum conduit size than the statewide minimum – verify with Region.
33. Section 6.8.3 (Standard video detection zone layout) – revised this section to show new video detection standard layout. Added a figure illustrating the standard layout.
34. Section 6.10 (radar detection) – separated the radar and microwave detection information. Revised and added radar information. Added new radar detection standard layout. Added a figure illustrating the standard layout.
35. Section 6.12 (Use of multiple detection technologies at a single intersection) – added language to limit this to 2 max.

36. Figure 6-43 (camera labeling) and section 6.8.1 (camera placement and labeling) – fixed a typo (clockwise changed to counterclockwise)
37. Figure 6-52 (use of inductance loops and video detection at the same intersection) – updated illustration to reflect current standards for video detection placement.

Chapter 9 Details Plan

38. Section 9.3.3 (equipment on mast arm) – fixed a typo – should be rounded to nearest ½ foot, not 1/10 of a foot.
39. Section 9.3.5 (Luminaires) – changed standard from HPS to LED

Chapter 11 Temporary Signal Plan

40. Section 11.6.3 (Service Cabinet and Meter Base) – Reference to old standard details was removed and reference to revised standard drawing added.

Chapter 19 Specifications, Bid Items & Cost Estimate

41. Section 19.2 (Review & Approval of the special provisions) – added a reference to figure 19-4 as an example of a modification that requires review and concurrence of the technical expert.
42. Added new section 19.4 (letter of public interest finding) – this section was added to explain when and why this is needed.

Chapter 20 Cabinet Prints

43. Section 20.3 (procedure for producing cabinet prints) – revised this section based on the new procedure established in Sept 2014.
44. Section 20.4 (creating the cabinet print) – made a few revisions (file naming convention and added info about FINAL CABINET PRINTS location)
45. Chapter 20 (Cabinet Prints) – reformatted chapter to follow 332S cabinet print layout. Added info about 332S cabinet.

Chapter 23 Quick Reference

46. Chapter 23 (Quick reference) – Added video and radar detection information. Revised layout of detection/input file info.
47. Chapter 23 (Quick reference) – updated sign info (AL/12).
48. Chapter 23 (Quick reference) – added info for cabinet limitations (input, output and conflict monitor constraints)
49. Section 23.3 (loop detector information): added info as per Region 4 - Regions may have a larger minimum conduit size than the statewide minimum – verify with Region.
50. Section 23.6 (sign information): updated chart to include signs AL/3T, AL/20 and the revised AL/12.
51. Section 23.7 (junction box & conduit information): 2” spare conduit for detection required between signal pole and first JB in the same quadrant. To allow for future retrofit of alternative detection.
52. Section 23.13 (junction box and conduit information): added info as per Region 4 - Regions may have a larger minimum conduit size than the statewide minimum – verify with Region.
53. Chapter 23 (Quick reference) – added info about the checklists and hyperlinked examples

1.5.4 Revision: June 2017

1. Updated web link on cover page
2. General, minor wordsmithing on several areas (content and intent remain unchanged).

Chapter 1 Introduction

3. Section 1.1: About Us – Added Jeff Hayes contact information
4. Section 1.2: updated web link to manual
5. Section 1.3: changed updated frequency from twice a year to once a year
6. Section 1.3: added link to our subscribe/unsubscribe list for e-mail notification of changes and updates to the manual

Chapter 2 Design Approval Process

7. Section 2.1: updated Figure 2-1 (organization chart)
8. Section 2.2: added info about Roadway Design Exceptions for ADA pushbutton accessibility and link to section 5.4 for more info.
9. Section 2.5: added “temporary workzone” to list of other disciplines plans that could be helpful during review
10. Section 2.8: Added quick reference section electrical crew preferences form

Chapter 4 Starting the Design

11. Section 4.3.2: updated hwy number cross reference guide web link

Chapter 5 Signal Plan

12. General – added note at beginning to go to quick reference chapter for electrical crew preferences form
13. Section 5.1.2: added language to verify crosswalk closures (even existing closed crosswalks) have been approved by the STRE.
14. Section 5.1.3: added language that doesn’t require curb ramps if there is no sidewalk, such as at rural intersections (specifies curb ramps are required if sidewalk is present)
15. Figure 5-1 Standard Closed Crosswalk Signing support and installation (TM490): updated figure to match current TM490
16. Section 5.1.2: changed clearance from barricade from 4’ to 5’ min as per TM490
17. Section 5.1.3: Added information related to new ADA requirements for ramp design and updated figure 5-4, figure 5-5, figure 5-6, and figure 5-7.
18. Added new section 5.1.4: information on Roadway ramp detail sheets and pole locations.
19. Section 5.1.4: Changed requirement for a two-phase pedestrian crossing configuration from “shall be staggered...” to “should be staggered”. And added language about countdown heads mitigating the confusion associates with non-staggered two-phase pedestrian crossings.
20. Section 5.2.1: deleted bi-modal and one section signals from list of unique heads (now are listed on TM460)
21. Figure 5-17 Signal Head Types: updated to include new signal head types defined on TM460
22. Table 5-2 Standard signal Heads for Left Turn Phases: Added info for Type 3LCF and Type 3LBF signal heads.

23. Figure 5-27 Signal Head Placement for Left Turn Phasing: Updated figure to include Type 3LCF and 3LBF heads. Deleted illustration that showed using a type 4L signal head with an approach that does not have an exclusive left turn lane (this is not allowed by MUTCD section 4D.17 paragraph 06)
24. Figure 5-40 Common signs used for traffic control: Added “STRE approval required” for signs AL/3U and AL/3T (U-Turn Permitted and No trucks)
25. Section 5.4 (Pedestrian Signal Equipment Layout): completely revised with added information related to ADA pushbutton accessibility from technical bulletin TRS16-01(B). Additional info for two ramps sharing one turning space.
26. New section 5.4.8 Pushbutton located behind guardrail: Revised information allowing pushbuttons located behind guardrail.
27. Section 5.4.10 Indication Type: Changed “shall” to “Should” for upgrading all pedestrian signals for an entire intersection at the same time to allow more flexibility for ADA constraints.
28. Section 5.5.5: changed illumination requirements from “if warranted” to a default standard of including illumination on all mast arm and strain poles at an intersection.
29. Section 5.5.7: removed “signalized right turn slip lanes” from list of typical vehicle pedestal installations
30. Section 5.5: added info about pushbutton mounting (pedestals = yes, big poles =no) with reference back to section 5.4
31. Section 5.6: changed illumination requirements from “if warranted” to a default standard of including illumination on all mast arm and strain poles at an intersection.
32. Section 5.15.6: corrected typo for wiring of Type 6L head.
33. Section 5.6.1: deleted statement about contacting illumination engineer for new LED spec (02926) as it is now published.
34. Section 5.7: modified language for fire preemption for clarity
35. Figure 5-56 Standard Drawing TM470 Signal head wiring: updated to include Types 3LBF and 3LCF. Removed Type 4L
36. Updated Figures 5-57 thru 5-63 and corresponding text (wiring for signal head types) to match updated TM460

Chapter 6 Detector Plan

37. Fixed counterclockwise typos for radar and video camera labeling

Chapter 11 Temporary Signal Plan

38. Section 11.2 – added restriction to allow only one signal mast arm to be installed per intersection at day of turn on.
39. Section 11.6.5 – made reference to section 5.4 for pushbutton accessibility requirements
40. Figure 11-15 – fixed typo in lane use in the phase rotation diagram
41. New Section 11.7.3 Stop Line Location

Chapter 12 Flashing Beacon Plan

42. Section 12.4.6 added reference to new moveable bridges chapter
43. Section 12.2: added Standard Detail references for solar power RRFB to list

44. Section 12.6: deleted reference to an old (no longer accessible) standard detail DET4414

Chapter 13 Ramp Meter Plan

45. Removed references to TM497 (details have since been deleted from this drawing).
46. Removed references to TM497 (deleted) and replaced with TM492

Chapter 16 Railroads

47. Section 16.3: added language, "The Crossing Order must be completed prior to PS&E."
48. Section 16.6.1: added provision for allowing one 10 conductor 12 AWG gauge conductor cable instead of individual conductors at the Region Electrical Crew direction.
49. New section 16.4 Railroad Utility Permits

Chapter 17 Fire Signal Plan

50. Section 17.4.1: added a provision for flashing yellow operation on the mainline if the STRE Operational Approval documents the use. For example a unique application: the fire signal in downtown Roseburg on Douglas Ave uses Flashing Yellow due to the extremely close proximity to a traffic signal and is meant to approaching stop vehicles while the traffic signal clears the queue that blocks the fire entrance.
51. Section 17.4.3: Removed single circular green signal indication as an option for a confirmation light. Only option is a tattle-tail indicator due to the simplicity of a direct hardwire.
52. Section 17.4.5: revised information for Tattle-tail indicators and referenced DET4400

Chapter 19 Specifications Bid Items and Cost Estimates

53. Section 19.5.1: added clarification to power hook-up anticipated cost (includes conduit, trenching and wiring from the power source to the service)

Chapter 20 Cabinet Print

54. Section 20.1: added language requiring cabinet prints for temporary signals (for each stage/phase there is a change to interior components)
55. Section 20.4: changed format of prints from 8.5x11 to 11x17
56. Section 20.6: deleted requirement for TSSU to complete the conflict monitor diode card
57. Section 20.6.3: revised section to describe to designers how to complete the conflict monitor diode card
58. Section 20.6.5: fixed typo – A6 (not A4) is not monitored
59. Section 20.9: added Railroad preemption site specific constraints to list of info that should be on the intersection drawing.

Chapter 21 Construction Support

60. Added new section 21.4.1 for Field verification forms (Signal Pole and Signal Pole Foundation)

Chapter 23 Moveable Bridges

61. Added an entire new chapter

Chapter 24 Quick Reference

62. Added section 23.14: electrical crew preferences with forms.

1.5.5 Revision: January 2020

Chapter 1 Introduction

1. Section 1.1 - Changed Traffic Control Systems Engineer from Jeff Hayes to Sarah McCrea

Chapter 2 Design Approval Process

1. Section 2.3 – new section for Overhead Structures and Vertical Clearance Standards as per tech bulletin RD17-02(b).
2. Section 2.5 – minor modifications to the DAP plans information, percent completion for each stage, and name for 100% complete plans.
3. Section 2.5 – added information about the ProjectWise process and a new figure “Project Comment Log Sample”.
4. Section 2.6 – added information about the ProjectWise process
5. Section 2.7 – added information about digital signatures

Chapter 4 Starting the Design

1. Section 4.1 – New section on Scoping, including information on the traffic signal asset management report and goals/priority Improvements.
2. Section 4.5 – Added information about the ProjectWise process.

Chapter 5 Signal Plan

1. Section 5.1 – Deleted reference to 1R preservation projects.
2. Section 5.1.2 – Completely revised to reference new guidance and process for crosswalk closures documented in the 2020 Traffic Manual Update.
3. Section 5.1.2 – moved general info about detailing vs. referencing with other discipline’s plan sheets to chapter 19
4. Section 5.1.3 – added information about keeping the crosswalk distance short for railroad interconnected signals.
5. Section 5.2 – changed FYA standard signal head to type 3LCF as per memos from the State Traffic Signal Engineer dated May 16, 2018 and July 23, 2018 in all the locations necessary in this section.
6. Section 5.2.3 – Added info for supplemental signal heads for sun glare with a new figure
7. Section 5.4 – fixed reference section typo
8. Section 5.4 – Added reference to guiding documents: MUTCD, Oregon supplements, ADAAG, and PROWAG and deleted bullet item that pushbuttons should meet MUTCD section 4E-08 requirements.
9. Section 5.4 – changed turning space dimension from 4’x5’ to 4.5’ x 5.5’ as per roadway section
10. Section 5.4.2 – Changed 10 foot minimum separation of buttons to 8 feet minimum.
11. Section 5.4.3 – Added information about priority of requirements/recommendations
12. Section 5.4.4 - Updated figure to include language that the entire pushbutton does NOT need to be included in the horizontal reach range area. Also fixed reference figure typo
13. Section 5.4.4 – added info for pushbutton parallel to crosswalk it serves.
14. Section 5.4.5 – Revised section to reflect new large pole foundation details shown in TM653 (now flat from foundation control point to edge of baseplate with a tolerance of 0”-1/4” between foundation and adjacent concrete or asphalt finish grade)

15. Section 5.4.6 – Added info about use of 8 foot minimum separation and buttons located in the 8 -10 foot separation range
16. Section 5.4.6 – revised figures for 4’ minimum dimension for dimension between crosswalk striping and curb for diagonal ramp and added that obtaining this minimum measurement may not be possible with small radii.
17. Section 5.4.7 – added info about producing object (extension bracket) cannot extend more than 4” into the circulation path and a reference to RD720.
18. Section 5.4.9 – new section for info about the extended pushbutton press feature
19. Section 5.4.12 – new section for Audible pedestrian signals – reference to Traffic Signal Policy and Guidelines
20. Section 5.5.2 – New section for Overhead Structures and Vertical Clearance Standards as per tech bulletin RD17-02(b).
21. Section 5.5.3 – Added low voltage utility clearance guidelines with new figure
22. Section 5.10.1 – added info about maintaining the 5’ minimum pedestrian clear circulation path when the controller cabinet door is open if possible.
23. Section 5.15 – new section added for Background/Reference information to allow for documentation that was contained in memos from the State Traffic Signal Engineer dated May 16, 2018 and July 23, 2018 about type 3LCF signal heads for FYA. Moved other historical only info into this section as well.

Chapter 6 Detector Plan

1. Revised entire chapter and section layout: Radar is the new default standard detection. Deleted info related to loops. Detector plan sheets are no longer required (all radar info is shown on the signal plan). Cabinet prints will now show detector zone and configuration information.

Chapter 7 Interconnect Plan

1. Section 7.1 – revised section to address central communication (now required for all traffic signals) and local communication (connection of multiple controllers in a corridor for signal progression).
2. Section 7.2 – updated text to state current controller type (ATC) and software (maxtime)
3. Section 7.3 – Revised allowable forms of communication as per ITS unit. Fiber optic is the preferred form. Other options include 4.9 GHz radio, cellular broadband and leased dedicated Ethernet. Twisted pair copper (VDSL) is no longer allowed for new installations.
4. Section 7.7.1 – removed outdated information and updated text to current controller type (ATC)
5. Section 7.7.2 – revised section to emphasize fiber optic installation
6. Section 7.7.4 – revised section to only show fiber optic wiring installation and added a new figure showing the fiber optic cable splice diagram created by the ITS unit.
7. Section 7.7.5 – deleted telephone connection section as per ITS unit.

Chapter 11 Temporary Signal Plan

1. Section 11.2 – added the 5th bullet about TPAR
2. Section 11.6.6 – changed section title to “Vehicle Detection”. Added a statement that video and radar are the preferred method of detection. Added a statement that loop detection should be avoided if possible.
3. Section 11.6.8 – minor text modification for better readability

Chapter 12 Flashing Beacon Plan

1. Section 12.1 – updated table to include actuated system for Emergency Vehicles
2. Section 12.4.4 and 12.4.5 – added a reference back to section 5.4 for pushbutton placement and to locate the buttons where they are easily accessible for all intended users (peds and/or cyclists).
3. Section 12.4.7 – added a reference to Chapter 5 for pushbutton placement.
4. Section 12.4.8 – New section for actuated system for Emergency Vehicles

Chapter 13 Ramp Meter Plan

1. Figure 13-7 – Removed reference to TM497 (no longer exists). Removed loops from illustration.
2. Section 13.6 – Revised section to match changes made in chapter 6 (detector plan). Radar is new default standard. Deleted info related to loops.

Chapter 16 Railroads

1. Section 16.7.1 – revised pedestrian features to reference section 5.4.9 for extended pushbutton press feature.

Chapter 17 Fire Signal Plan

1. Section 17.1 – added a highlight box to alert designers that actuated flashing beacon systems for fire trucks are a good alternative to a traditional fire signal and reference to Chapter 12 for design info.
2. Section 17.3 – minor text modification for better readability
3. Entire chapter – changed tattle-tail to tattle-tale
4. Section 17.3.1 – This is a new section: Solutions For Existing Fire Signals Located at Intersections
5. Entire Chapter – clean-up of figure call-out notes for consistency throughout whole manual

Chapter 18 Standard Drawings and Details

1. Section 18.1 & Figure 18-1 – updated to text and figure to current method of listing standard drawings on plan sheets (no longer shown in the title block)

Chapter 19 Specifications Bid Items and Cost Estimate

1. Section 19.2 – added Specifications Engineer also is required to review and concur with special provision modifications that fall outside of the normal boiler plate instructions.
2. Section 19.3 - moved general info about detailing vs. referencing with other discipline’s plan sheets to chapter 19
3. Section 19.3.5 – New section – added info about bid item for crosswalk closure supports.

Chapter 20 Cabinet Prints

1. Section 20.2 and Section 20.3 – changed timeframe for putting the cabinet print in the INCOMING subfolder from just before testing at TSSU to DAP (this will allow signal timers adequate time to review and comment on new sheet 7 which details the detection unit placement, zones, and zone configuration).
2. Section 20.5.2 – added info for SDLC (i.e. leave detector input location slots 1 thru 10 blank).
3. Section 20.5.8 – added information for 332s cabinet detector input termination using video, radar, or SDLC
4. Section 20.6 – fixed typos and incorrect microstation references
5. Section 20.6 – changed FYA standard termination from ped yellow to overlap as per memos from the State Traffic Signal Engineer dated May 16, 2018 and July 23, 2018 in all the locations necessary in this section.
6. Section 20.10 – new section added for Background/Reference information to allow for documentation that was contained in memos from the State Traffic Signal Engineer dated May 16, 2018 and July 23, 2018 about FYA.

Chapter 21 Construction support

1. Section 21.2 – added information for digital signatures
2. Section 21.7 – added information for digital signatures

Chapter 22 State Force Work

1. Figure 22-1 – updated to current title block

Chapter 24 Quick Reference

1. Deleted video and radar specific info and replaced with: Non-Invasive Detection Information, (consistent with Chapter 6).
2. Removed input file info for 170 and 2070 controllers