



Traffic Signal Design Manual

2021

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Oregon Department of Transportation

Statewide Project Delivery Branch –Technical Services

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Chapter 1

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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:

- ODOT Traffic Signal Design Manual
- ODOT Traffic Signal Drafting Manual

The ODOT Traffic Signal Design Manual focuses on the design aspects of traffic signals while the ODOT Traffic Signal Drafting 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 Standards Crew is responsible for maintaining and interpretation of the ODOT Traffic Signal Design Manual. This crew is part of the Traffic-Roadway Section which is under the Statewide Project Delivery Branch.

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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 January. 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. However, we do recognize that making certain changes late in the design process may not always be feasible or result in an unacceptable amount of re-design. As such, the State Traffic Signal Engineer will grant exceptions to following the current version of the manual during the design approval phase on a case-by-case basis.

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 Quality Engineer](#).

1.4 Change Requests

If you would like to suggest changes to the ODOT Traffic Signal Design Manual, please contact the [Traffic Signal Quality 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

1. 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:

1. 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.
2. 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.
3. 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.
4. New Section 3.3.6 (Pedestrian Overlap Phases) – This section was added to describe pedestrian overlaps. Added new figure in this section.
5. 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.
6. Updated Figure 3-10 (ring & barrier diagrams: Multiple intersections using a single controller, example 2) – revised OLA designations from “,” to “&” for consistency
7. 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.
8. 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:

1. Section 5.2 (Vehicle signal head layout) – added two bullets, signal heads should be mounted overhead and they should be aligned vertically.
2. 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.
3. Section 5.2.5 (signal head louvers and cut-off visors) – added cut off visors to this section and a new figure
4. 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)
5. 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.

6. 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.
7. Section 5.6 (illumination) – hyperlinked lighting manuals to illumination webpage
8. Section 5.6 (illumination) – added new section for LED fixtures & changed standard from HPS to LED as per the Illumination Engineer
9. Section 5.6.2 (illumination wiring) – added a bullet point describing TC cable and a bullet describing bond wire
10. 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.
11. Section 5.10.1 (Controller Cabinets/Location): Info on opening cabinet door off right-of-way
12. 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.
13. Figure 5-17 (signal head types) – updated figure to include Type 1R and Type 1Y.
14. 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)
15. 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)
16. Figure 5-33 (signs no longer used) – added OR22-14 to the list.

Chapter 6 Detector Plan:

1. 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.
2. 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
3. Section 6.6 (detector input file) – added “stretch” to CO (carryover) definition.
4. 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.
5. 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.
6. 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.
7. 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.

8. 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.
9. Section 6.12 (Use of multiple detection technologies at a single intersection) – added language to limit this to 2 max.
10. Figure 6-43 (camera labeling) and section 6.8.1 (camera placement and labeling) – fixed a typo (clockwise changed to counterclockwise)
11. 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

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

Chapter 11 Temporary Signal Plan

1. 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

1. 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.
2. 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

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

Chapter 23 Quick Reference

1. Chapter 23 (Quick reference) – Added video and radar detection information. Revised layout of detection/input file info.
2. Chapter 23 (Quick reference) – updated sign info (AL/12).
3. Chapter 23 (Quick reference) – added info for cabinet limitations (input, output and conflict monitor constraints)
4. 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.

5. Section 23.6 (sign information): updated chart to include signs AL/3T, AL/20 and the revised AL/12.
6. 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.
7. 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.
8. 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

1. Section 1.1: About Us – Added Jeff Hayes contact information
2. Section 1.2: updated web link to manual
3. Section 1.3: changed updated frequency from twice a year to once a year
4. 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

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

Chapter 4 Starting the Design

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

Chapter 5 Signal Plan

1. General – added note at beginning to go to quick reference chapter for electrical crew preferences form
2. Section 5.1.2: added language to verify crosswalk closures (even existing closed crosswalks) have been approved by the STRE.
3. 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)
4. Figure 5-1 Standard Closed Crosswalk Signing support and installation (TM490): updated figure to match current TM490

5. Section 5.1.2: changed clearance from barricade from 4' to 5' min as per TM490
6. 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.
7. Added new section 5.1.4: information on Roadway ramp detail sheets and pole locations.
8. 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.
9. Section 5.2.1: deleted bi-modal and one section signals from list of unique heads (now are listed on TM460)
10. Figure 5-17 Signal Head Types: updated to include new signal head types defined on TM460
11. Table 5-2 Standard signal Heads for Left Turn Phases: Added info for Type 3LCF and Type 3LBF signal heads.
12. 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)
13. 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)
14. 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.
15. New section 5.4.8 Pushbutton located behind guardrail: Revised information allowing pushbuttons located behind guardrail.
16. 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.
17. 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.
18. Section 5.5.7: removed "signalized right turn slip lanes" from list of typical vehicle pedestal installations
19. Section 5.5: added info about pushbutton mounting (pedestals = yes, big poles =no) with reference back to section 5.4
20. 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.
21. Section 5.15.6: corrected typo for wiring of Type 6L head.
22. Section 5.6.1: deleted statement about contacting illumination engineer for new LED spec (02926) as it is now published.
23. Section 5.7: modified language for fire preemption for clarity

24. Figure 5-56 Standard Drawing TM470 Signal head wiring: updated to include Types 3LBF and 3LCF. Removed Type 4L
25. Updated Figures 5-57 thru 5-63 and corresponding text (wiring for signal head types) to match updated TM460

Chapter 6 Detector Plan

1. Fixed counterclockwise typos for radar and video camera labeling

Chapter 11 Temporary Signal Plan

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

Chapter 12 Flashing Beacon Plan

1. Section 12.4.6 added reference to new moveable bridges chapter
2. Section 12.2: added Standard Detail references for solar power RRFB to list
3. Section 12.6: deleted reference to an old (no longer accessible) standard detail DET4414

Chapter 13 Ramp Meter Plan

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

Chapter 16 Railroads

1. Section 16.3: added language, “The Crossing Order must be completed prior to PS&E.”
2. 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.
3. New section 16.4 Railroad Utility Permits

Chapter 17 Fire Signal Plan

1. 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.
2. Section 17.4.3: Removed single circular green signal indication as an option for a confirmation light. Only option is a tattletale indicator due to the simplicity of a direct hardwire.
3. Section 17.4.5: revised information for Tattletale indicators and referenced DET4400

Chapter 19 Specifications Bid Items and Cost Estimates

1. 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

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

Chapter 21 Construction Support

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

Chapter 23 Moveable Bridges

1. Added an entire new chapter

Chapter 24 Quick Reference

1. 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 tattletail to tattletale
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 (e.g. 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

1.5.6 Revision: January 2021

Changes applicable to all chapters:

1. Reformatting to ODOT document branding and accessibility standards as per the ODOT SPDB Communications Team.
2. Clean up of text, figures and tables for improved readability
3. Updated the titles of units/sections/position descriptions to current labels.

Chapter 2 – Design Approval Process

1. Updated Figure 2-1 Organization Chart
2. Section 2.2 – added reference to HDM and website for Roadway design exceptions and forms. Corrected the design exception language as per the Senior ADA Standards Engineer.
3. Section 2.7: added “unit file code” as another description of “TRS” Drawing numbers, to be consistent with the new ODOT title block. Revised section title to generic “drawing numbers”
4. Section 2.8: added that digital signatures are the preferred method
5. Figure 2-4: deleted Joe Searcy as an authorized signature at his request due to change in job duties
6. Section 2.8.2 – added information for digital signatures to non-ODOT let projects, as this is our preferred method for all plan sheets.

Chapter 3 – Signal Operation and Operational Approval

1. Entire chapter – deleted reference to Preliminary Signal Operations Review (PSOR) form as it is no longer used.
2. Section 3.1 – added “opening of existing closed crosswalks” to list of items the operational approval typical contains as this is a lot more common now due to current ADA requirements.
3. Section 3.3.8 – added text note as an option under ring and barrier diagram for incompatible left turns.
4. Section 3.3.11 – new section – overlap phase with green extension.
5. Section 3.9 – changed “right turn slip lane” to “channelized right turn lane” to be consistent with the Traffic Manual.

Chapter 4 – Starting the Design

1. Section 4.1 – added a bullet to the scoping guidance for review of roadway geometry for issues that impact traffic signals (lane shift, truck turning issues, pedestrian facilities, etc.)
2. Section 4.1 – added a bullet to the scoping guidance for review of ADA features.
3. Section 4.1.1 – added info about transGIS layer for asset info (including ADA ramps and ADA pushbuttons).

Chapter 5 – Signal Plan

1. Entire chapter – consistent use of “curb ramp”
2. Entire chapter – consistent use of “ADA curb ramp design exception” and “general roadway exception”
3. Section 5.1.2 – deleted “bollards with chains” option for detectible barrier as ODOT roadway does not have any approved configurations for this.

4. Section 5.1.2 – changed terminology of “detectable barrier” to “detectable barrier/feature” to include treatments that are not typically thought of a true “barrier” and clarified the purpose of the barrier as per the Statewide ADA Engineer.
5. Section 5.1.2 – added info about crosswalk closure supports on curb ramp detail sheets and review of the curb ramp detail sheets by the signal designer.
6. Section 5.1.3 – added clarification and changed terminology as per the Statewide ADA Engineer.
7. Section 5.1.3 – added an objective no. 3 for crosswalk alignment (helping sight impaired pedestrians navigate) and a statement that skewed intersection should be fixed to address all three objectives best.
8. Section 5.1.5 – in second bullet after figure 5-9, added info about the difficulties of sight impaired pedestrians using a single phase, two-state pedestrian crossing (more reason to not use this type of design).
9. Section 5.1.6 – added another option for signalized driveway design (using roadway standard drawings with 3 modifications) based on discussions with the Statewide ADA Engineer.
10. Section 5.1.7 – added new section for maintenance pads.
11. Section 5.1.8 – added new section to for truck turning templates
12. Section 5.1.9 – added new section for lane shift discussion
13. Section 5.2 – revised span wire information to apply to temporary signals only
14. Section 5.2 – updated section reference typo for pedestrian signal equipment layout
15. Section 5.2.4 – added spanwire installations are only applicable to temporary signals now.
16. Section 5.2.6 – new section – info on tattletale lights
17. Section 5.3.1 – deleted reference to span wires
18. Section 5.3.2 – deleted reference to TM660 (spanwire –no longer exists) and replaced with TM655 (60-75’ mast arm poles). Deleted references to spanwire installations.
19. Section 5.3.4 - added spanwire installations are only applicable to temporary signals now.
20. Section 5.4.2 – changed vertical reach of pushbutton to 42” to 48” – this matches existing TM standard drawings and the new ADA curb ramp design exception criteria.
21. Section 5.4.2 – clarified horizontal reach is a side reach, not a forward reach.
22. Section 5.4.2 – clarified that the clear space shall connect to a pedestrian access route (PAR)
23. Section 5.4.2 – clarified 15 foot maximum from pushbutton to edge of curb is the “travel path”.
24. Section 5.4.3 – added a 4th bullet for deviation – vertical reach of pushbutton less than 42” and a new section reference for discussion of when this may be considered. As per discussions with the ADA standards engineer.
25. Section 5.4.4 – added information about placing the pedestal in front of curbs (as opposed to modifying pedestal foundation to fit behind the curb or incorporating the curb into the foundation) and added a new figure after figure 5-50.

26. Section 5.4.8 – new section – deviation: vertical reach of pushbutton as per the ADA standards engineer.
27. Section 5.5 - added spanwire installations are no longer allowed for permanent signals.
28. Section 5.5.6 – added info for 60-75' mast arm poles and using proper placement so that these longer mast arms are only used when necessary (as they have bigger foundations and are more costly than 55' and under mast arms). Also added dual mast arms for these longer arms is not an option as per the Traffic Structures Engineer.
29. Section 5.5.7 – Added strain poles are no longer allowed for permanent installations and a reference to chapter 11 – temporary signals.
30. Section 5.5.8 – removed reference to span wires
31. Section 5.5.10 – made recessed terminal cabinets standard, removed reference to standard details that no longer exist.
32. Section 5.5.12 – Added strain poles to the list of non-standard designs as they have been removed from the standard drawings. Also added dual mast arms for 60' to 75' mast arms is not an option as per the Traffic Structures Engineer.
33. Section 5.6 – deleted reference to strain poles
34. Section 5.7 – removed span wire installation info for preemption detector.
35. Section 5.12 – added a note about handhole spacing of 1000'
36. Section 5.12 – deleted information junction box info relating to loop detection installation. Added junction boxes should be installed within 50 feet of the nearest signal pole or controller cabinet.
37. Section 5.12.1 – deleted cast iron information and loop detection and interconnection info (fiber optic is the preferred interconnect method and uses handhole boxes, not JB's).
38. Section 5.12.1 – replaced figure 5-83 showing junction box placement for size – not needed due to table 5-5 default minimum junction box type/size simplification (removal of loop detector and interconnect cable) with “ADA softscaping requirements for junction box PCC apron.”
39. Section 5.12.2 – new section for junction box placement
40. Section 5.12.4 – new section – elevation adjustments and considerations.
41. Section 5.12.5 – new section – deviations from junction box placement standards
42. Section 5.13 – For clarity, reworded conduit crossing mainline once requirement and added a figure.
43. Section 5.13 – deleted information about illumination circuit and photo electric cell wiring being contained in its own separate conduit – this was erroneous.
44. Section 5.13.1 – revised text for spare conduit for alternative detection between the pole and JB due to non-invasive being our current standard.
45. Section 5.13.1 – added info about using larger than minimum conduit sizes and additional spare conduits.
46. Section 5.13.1- updated table 5-7 to include more cable/wires (video, radar, etc.)
47. Section 5.13.2 – updated specification and standard drawing references. Corrected information to match TM471, blue sheets, and specifications regarding conduit materials.

48. Section 5.13.3 – updated specification reference.
49. Section 5.13.4 – updated figures 5-86 thru 5-89 to reflect control cable wiring. Removed method 2 (figure 5-87) for routing conduit due to use of control cable, but discuss its use for retro-fit projects.
50. Section 5.13.5 – new section – conduit trenching depths and underground conflicts
51. Section 5.14 – deleted reference to loop wire splicing in junction box exception (loop detection information has been removed from manual and standard drawings as it is no longer ODOT standard).
52. Section 5.14.1 – changed control cable to the standard wire type with single conductor wire allowed for retro fit projects with inadequate existing conduit size only. Updated and reformatted all wiring information. Deleted 6 twisted pair interconnect cable info, as we no longer allow it. Added TC cable description.
53. Section 5.14.2 – deleted info for No. 8 AWG used for traffic signal system neutral and No. 12 AWG used for pedestrian system neutral in pedestals (now the neutral is No. 14 AWG, inclusive to the control cable).
54. Section 5.14.5 – deleted information for single conductor wire installations since control cable is now the standard. Added a reference to Jan 2020 version of manual if using individual conductor wires for retro-fit projects.
55. Section 5.14.6 - Figures 5-91 thru 5-98 (signal/ped head wiring figures) – revised figures to show only using 7 conductor cable. Revised text to show use of only 7 conductor cable and removed permanent span wire installation info. Corrected FYA termination (from ped yellow to overlap green).
56. Section 5.14.7 – figures 5-99 and text updated to show only using 7 conductor cable.
57. Section 5.14.8 – figure 5-100 and text updated to show only using 7 conductor cable. Deleted information on permanent span wire installations.
58. Figure 5-102 wiring phases with individual conductors is deleted – no longer used in new construction.
59. Section 5.14.8 – figure 5-103 updated diagram to show remote pedestrian pedestals.
60. Section 5.14.9 – modified the external terminal cabinet wire entrance information to be only applicable to retrofit projects, as recessed terminal cabinet are now the current standard. Updated figures 5-104 and 5-105 to match TM470 wiring of pedestrian indications/pushbuttons on large pole (single No. 14 AWG THWN).
61. Section 5.14.10 wire economy – individual conductors - this section deleted as 7 conductor cable is the new standard. If individual conductors are used for retro-fit projects, this information can be accessed in the archived Jan 2020 manual.
62. Section 5.14.11 – span wire installations, wiring signal heads – this section was moved to chapter 11 as span wires are only used for temporary applications.
63. Section 5.14.13 spare wires – this section deleted as 7 conductor cable is the new standard. If individual conductors are used for retro-fit projects, this information can be accessed in the archived Jan 2020 manual.

Chapter 6 – Detector Plan

1. Section 6.1 – clarified that radar is the standard for bike detection also.
Section 6.1.1 – added info about new standard details for loop detection
2. Section 6.1.2 – added a statement that multiple detection technologies may be acceptable (new bike/ped detection as an example) and will be approved by the state traffic signal engineer on a case-by-case basis.
3. Section 6.2.1 – deleted info about presence detection that caused confusion.
4. Section 6.2.2 – clarified 460' detection distance speed (55 mph)
5. Section 6.2.2 – all advance detection devices on the green sheets require 900' of detection, therefore, removed all 600' device information.
6. Section 6.3.3 – added info about rapidly improving non-invasive bike detection technologies and to verify available products with the state traffic signal engineer.
7. Section 6.3.3 – added info about bike box detection.
8. Section 6.3.4 – clarified that the count zone detection for max adapt MAY be recommended for optimal performance and to work with region traffic to determine the site specific detection needs.
9. Section 6.4.1 – deleted section as it mainly pertained to loop design. Moved content about radar using algorithms to protect the dilemma zone to section 6.2.2
10. Section 6.4.2 – added RTE approval is required for advance stop bars (consistent with traffic manual). Also added that detection is not typically used between the advance stop line and crosswalk, but may be used if engineering judgement determines a need (non-invasive detection does not have the same issues a loops).
11. Section 6.4.6 – added standard detection for a signalized private residence driveway is a pushbutton.
12. Section 6.8 – added a statement that if standard placement of radar devices on the mast arm pole or mast arm are not feasible (e.g. retro-fit with conduit fill issues), will not provide the desired detection zone coverage, or there are concerns about occultation, detector units should be installed on stand-alone vehicle signal pedestals. Supplemental detector units may also be considered to get the proper detection zone coverage. Work with the region signal timer during the DAP review of the detector zones on the cabinet print (See Chapter 20) to determine the proper placement and number of detector units needed.
13. Section 6.8 – revised nearside guidance about bike lane occlusion to be applicable to all lanes.
14. Section 6.8 – changed nearside offset from 12' to 14'
15. Section 6.8 – added recommendation for a field visit to ensure there are no obstacles to placement of the detection device (trees, vegetation, or other signal heads)
16. Section 6.8 – added a reference to chapter 13 (ramp meters) for side fire radar units
17. Section 6.8 – all advance detection devices on the green sheets require 900' of detection, therefore, removed all 600' device information.

Chapter 8 – Existing Utilities Plan

1. Entire section – updated guidance based on survey of signal designers and construction office’s needs.

Chapter 9 – Details

1. All – revised all references of span wire info to pertain only to temporary installations.
2. Section 9.2.1 – added examples of when a pole entrance chart is not necessary and other options for showing the necessary info.
3. Section 9.2.2 – new section – info about detailing existing signal pole/pedestals on the pole entrance chart
4. Section 9.3.2 – added information about pushbutton mounting degrees. This is due to ADA requirements which has resulted in more exact information needed to ensure the pushbutton placement will pass ADA inspection.
5. Section 9.3.2 – changed terminal cabinet information to reflect recessed terminal cabinets (external terminal cabinets now for temporary applications only)
6. Section 9.3.4 – added info for custom foundations.
7. Section 9.4.2 – deleted info that only pertained to permanent strain poles for MAH calc.
8. Section 9.4.3 - added information about pushbutton mounting degrees. This is due to ADA requirements which has resulted in more exact information needed to ensure the pushbutton placement will pass ADA inspection.
9. Section 9.4.3 - changed terminal cabinet information to reflect external terminal cabinets only for temporary span wire applications)
10. Section 9.4.5 – revised foundation information for temporary wood poles.
11. Section 9.5.2 – new section – stand-alone luminaire pole light pole table info

Chapter 10 – Removal Plan

1. Section 10.2 – added a reference to chapter 19 for LPIF process.

Chapter 11 – Temporary Signal Plan

1. Section 11.2 – added additional information about the benefits of using a temporary signal based on feedback from the Salem PM office.
2. Section 11.6.1 – changed the wood pole submittal review process to be more accurate (contractor submits certifications to the PM office and the traffic structures engineer or EOR will then approve for use on project)
3. Section 11.6.1 –removed language that indicated a difference between temporary span wire installations and permanent spanwire installations.
4. Section 11.6.1 – added information about using a ¼” messenger cable from the large strain pole to the smaller wood post with pedestrian equipment.
5. Section 11.6.2 –removed reference to standard detail 4415 (temporary pre-cast controller foundation) – now a standard drawing.
6. Section 11.6.3 – removed specific standard drawing references and made it generic.

7. Section 11.6.5 – deleted information about consideration for construction staging changes as it applied to loop detection.
8. Section 11.6.5 – removed specific standard drawing references and made it generic.
9. Section 11.6.6 – removed information for loop detection. Added info on coverage issues of non-invasive detection due to limited placement options for the detection units.
10. Section 11.6.7 – revised entire section for better readability
11. Section 11.7.1 – added a statement that dummy phases may not be required to accommodate long red clearance intervals and to verify with Region Signal Timer (matches language in chapter 3).
12. Section 11.7.5 – revised to delete information on loop detection and added information on radar detection.
13. Section 11.7.6 – revised to delete information on loop detection and added information on radar detection.
14. Section 11.9 – updated standard drawing and specification references

Chapter 12 – Flashing Beacon Plan

1. Section 12.1 – Added Through Route Activated Warning Signs (TRAWS) information as it now and ARTS countermeasure.
2. Section 12.4.9 – new section: added some design info for TRAWS
3. Section 12.8 – added a reference to the Traffic Manual for intersection control beacon use and that other treatments may be more effective.
4. Section 12.8 – deleted all references to span wire installations.
5. Section 12.4.6 – radar is default standard now
6. Section 12.9.5 – new section – added info about PHB phasing and use of fire preemption. Also see chapter 20.

Chapter 13 – Ramp Meters

1. Entire chapter – updated standard drawing references and sign sheeting types
2. Section 13.2.1 – revised location of ramp meter assembly related to stop line and edge of pavement to allow for placement of detection unit on the ramp meter assembly on the right hand side of the ramp.
3. Section 13.2.2 – revised lateral location of mast arm pole to allow for placement of detection unit on the mast arm
4. Section 13.3 – removed “be prepared to stop” with “when flashing” sign and replaced it with a supplemental “ramp metered when flashing” sign(s) if sight distance is a concern. Added more info about the purpose of this sign and ramp configuration based on a review of each existing ramp meter in Oregon.
5. Section 13.3 – added flexibility for placing a single ramp meter assemble on either side of the ramp, but preferably on the right. Based on a review of each existing ramp meter in Oregon
6. Section 13.3 – broke this section in to subsections

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7. Section 13.6.1 – revised mounting locations for radar unit. Deleted queue loop based on information about how ramp meters are currently operated.
8. Section 13.6.1 – added info about using ITS pole for mounting detection equipment and count detection using ITS sites rather than going thru the ramp meter controller.
9. Section 13.6.2 – deleted info about the input file and referenced older versions of the signal design manual.
10. Section 13.7.1 – new section, background reference info added to document reason for no longer using queue detection and PTR signs.

Chapter 14 – Pedestrian Signal Plan

1. Entire Chapter – revised to allow pedestrian signals as an option on the state highway as per discussions with the Traffic Active Modes Engineer. Added design guidance for pedestrian signals.

Chapter 15 – Red Light Enforcement Plan

1. Section 15.2 - Added info stating automated speed enforcement may be included in the red light running system.

Chapter 16 – Railroads

1. Section 16 – deleted outdated info about the Right of way manual and added a reference to the Traffic Manual for additional procedural and coordination information.
2. Section 16.2 – corrected field diagnostic review info as per rail section (removed reference to CFR).
3. Section 16.3 – updated rail crossing order search weblinks
4. Section 16.3 – updated info about private crossings (the STOP sign and PRIVATE CROSSING sign are regulated by rail section).
5. Section 16.4 – updated railroad utility permits contact
6. Section 16.5.3 – added a note that the rail owner may send the simultaneous preemption input to the traffic approx. 5 to 10 seconds earlier than the activating the rail road equipment as per ODOT rail comment.
7. Section 16.7.1 – corrected inaccurate wording about interconnect circuits.
8. Section 16.7.1 – updated wiring requirements (use control cable vs. individual conductors)
9. Section 16.7.1 – added picture of rail interconnect access box on bungalow
10. Section 16.9.1 – new section – added information about signal modifications that require an update to the preemption plan sheet (and in turn require updating the crossing order).

Chapter 19 – Specifications Bid Items and Cost Estimate

1. Updated temporary specification references
2. Delete outdated material specification references
3. Added 00902 crosswalk closure support to the list of specifications indirectly related to traffic signals

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4. Added 00962 Metal Illumination and traffic signal supports & 00921 major sign support drilled shafts (for mast arm poles with mast arms 60' to 75') to list of specifications directly related to traffic signals.
5. Section 19.3 – added info about 00921.90 bid item for mast arm poles with mast arms 60 to 75 feet.
6. Section 19.3.1 – deleted the “detector installation” bid item – this work is now part of the “traffic signal modifications” bid item.
7. Section 19.3.1 – added “excludes mast arm pole foundations” for “traffic signal installation” and “traffic signal modifications” bid items.
8. Section 19.3.1 – added info about stand-alone luminaire poles being excluded from the traffic signal lump sum bid item. Also include examples of when it might be good to modify this via special provisions.
9. Section 19.3.2 – added 00921.90 bid item for foundations for long mast arms (60' – 75').
10. Section 19.3.2 – added info about why foundations are separate bid items
11. Section 19.4 – added ATC controller to list of items requiring an LPIF

Chapter 20 – Cabinet Prints

1. Section 20.1 – added ramp meters and other signal installations with a controller cabinet (e.g. TRAWS), to the list of when a cabinet print is required.
2. Section 20.7.6 – new section – information for output file and conflict monitor configuration for PHBs. Developed in conjunction with TSSU.
3. Section 20.7 – figure 20-13 – added info for verifying the typical conflict monitor assignments and following the website instructions if it is different than what is actually used.

Chapter 21 – Construction Support

1. Section 21.5 – revised cabinet print information to reflect new process (submitted at DAP and provided to the contractor via the PM office)

Chapter 24 – Quick Reference

1. Section 24.2 – added note that 2021 new standard is to use control cables.
2. Section 24.8 - Changed FYA output from opposing ped yellow to overlap green. And deleted 4 section FYA head info.
3. Section 24.12 - Removed cast iron junction box info