TENNESSEE DEPARTMENT OF TRANSPORTATION

WORK ZONE FIELD GUIDE INNOVATIONS

PROJECT TEAM

TDOT
- Michelle Nickerson, PE, PTOE
- Civil Engineering Manager I

CDM Smith
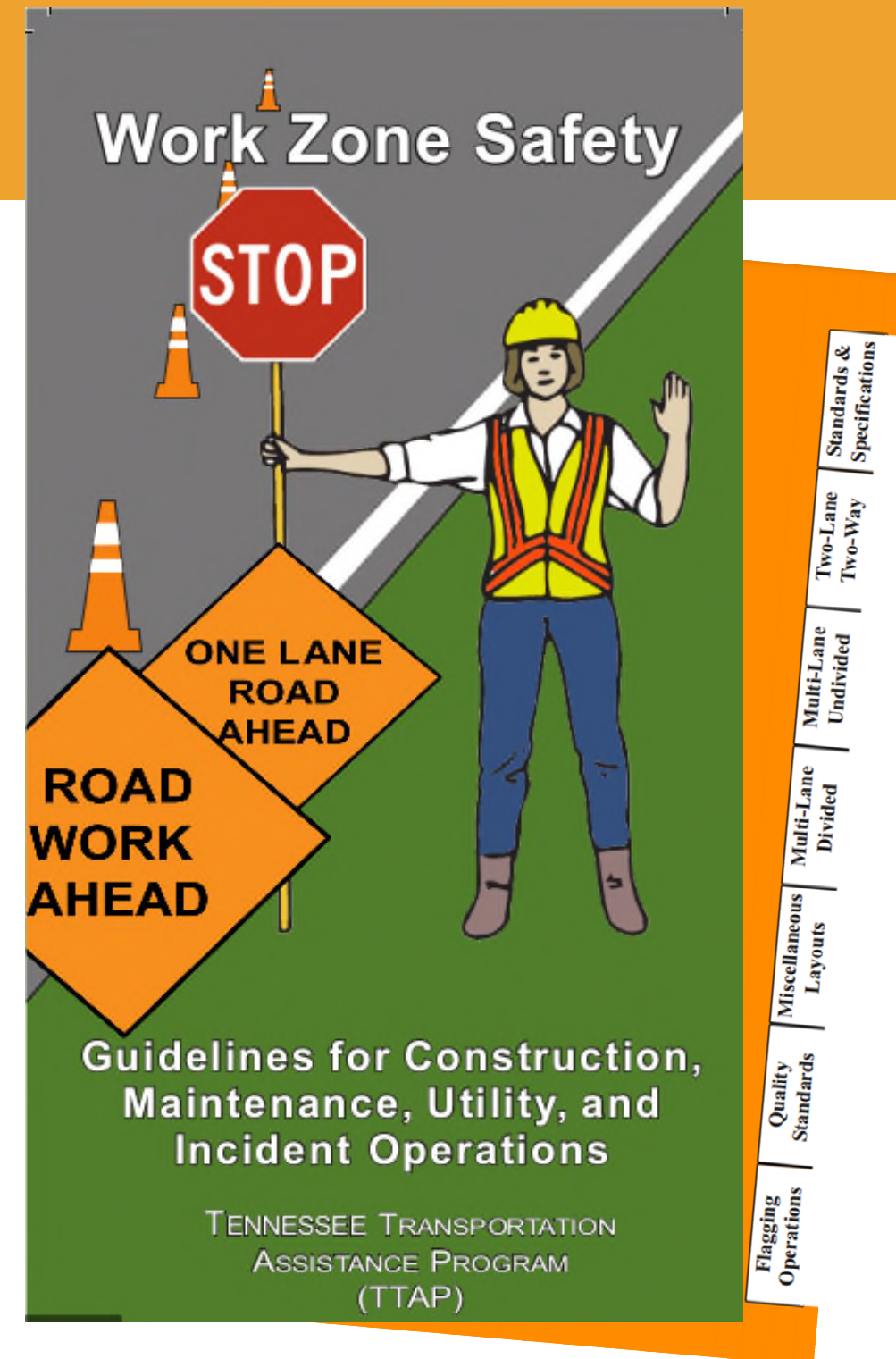- Melody Butler, PE, AICP
- Transportation Engineer

CDM Smith
- Brandon Denny, PE
- Transportation Engineer

HISTORY

- TDOT used to publish a small flipbook for common TTC layouts, but it was time for an update.

- New Work Zone Flip Book published Fall 2019, included many more layouts.

- Adapted from Minnesota Manual

EXISTING MANUAL

- What is the problem?

  - Adapted from PDF, difficult to edit

  - Included layouts TDOT didn't use and missing others

- TDOT wanted users to take ownership and have input

- TDOT engaged CDM Smith to update the manual
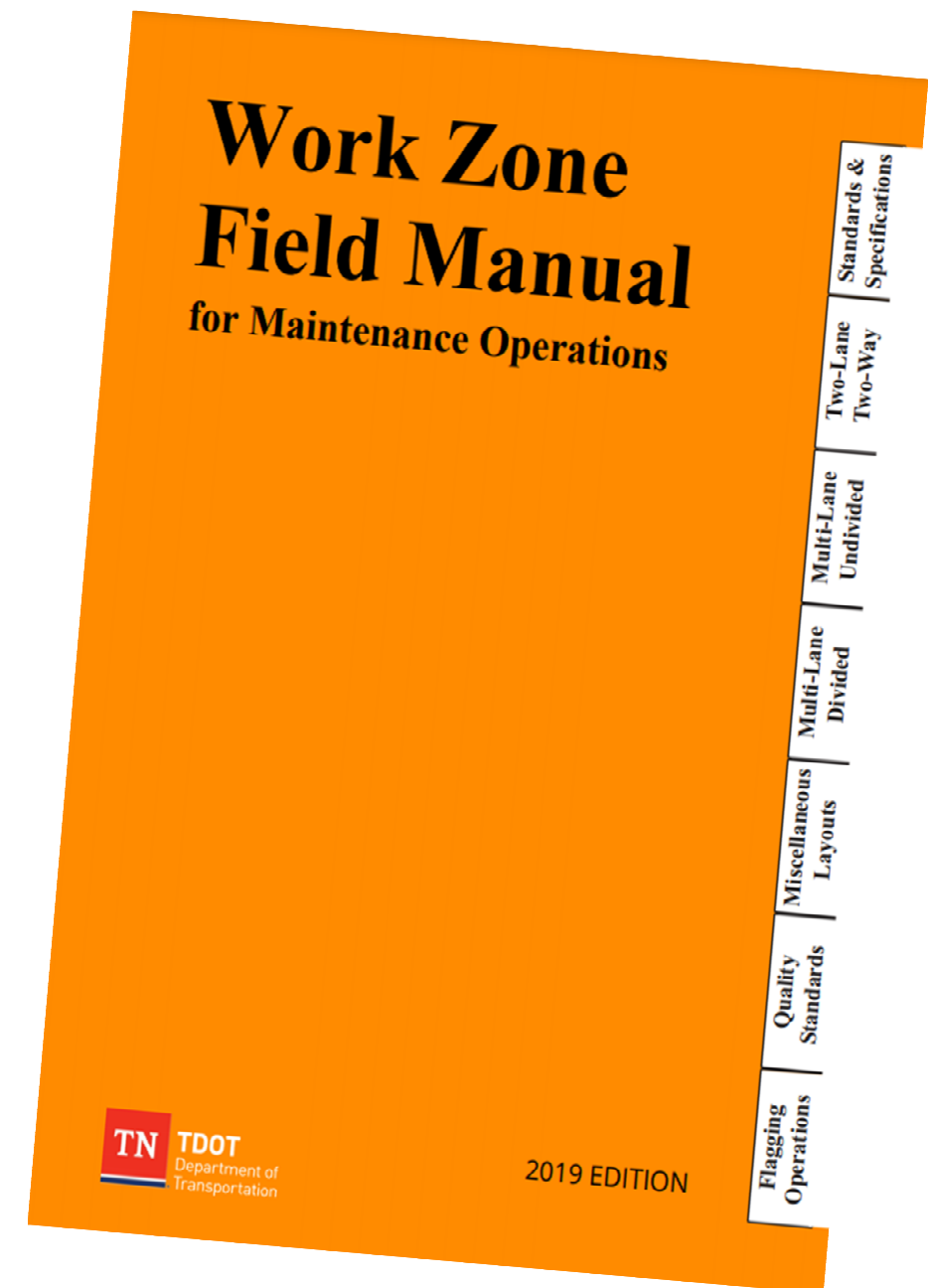
CDM SMITH INVOLVEMENT

What is a Work Zone Field Manual?

- Guide for roadway crews

- Layouts for Temporary Traffic Control Zones

- Builds off of Part 6 of the MUTCD

CDM SMITH INVOLVEMENT

What we thought we were getting into:

- Simple update to TDOT's existing 180-page manual

- Review other states' manuals for best practices (VA, OH, MN, TX)

- Clean up page numbers

- Cross check TDOT's work zone standard drawings to existing layouts

- Create library of typical applications using RapidPlan software

- Print 2,500 copies

- Project Deadline – October(ish) 2020

K. The Field Manual

Index

* See inside front cover of each section for specific index to layouts.

Adapted from MNDOT Work Zone Field Manual with permission

This document as well as other work zone resources are available on the TDOT Work Zone website.

MEETINGS WITH TDOT STAFF

Project Kickoff Meeting – August 14, 2020

- Review scope

- Identify known issues:

  - Formatting

  - Tapers – TDOT uses "L" for all taper types (different from MUTCD)

  - Signs in MN manual that TDOT does not use

  - Flagger guidance does not match TDOT training

  - Remove any layouts designated for Local Roads

  - Need additional layouts for maintenance activities – mowing in median, slope mowing

Brainstorming Meeting – August 27, 2020

Steering Committee Meeting – September 8, 2020

DO YOU THINK THE CURRENT WORK ZONE FIELD MANUAL IS EASY TO USE AND UNDERSTAND?
WHAT COULD BE DONE TO MAKE IT MORE USER-FRIENDLY?

- Easy to use and understand?

  - Yes – 6

  - Depends on level of experience – 2

  - Somewhat – 1

- Comments:

  - Could have a better Table of Contents or Index

  - Show which layouts apply to tasks/activities (2)

  - Make dimensions easier to follow on layouts

  - Make less wordy

  - Better use of tabs (2)

  - Pocket guide on phone

  - Make it more of a quick reference guide (2)

  - Add all activities performed on a daily basis

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MANUAL MATERIALS PREFERENCES

- Spiral – 3

- Binder – 4

- Undecided – 1

- Both – 1

- Comments:

  - Current pages are difficult to make notes on

  - Materials often get tossed around in the trucks

  - Would be nice to take out pages to make copies for crew

  - Spiral is easy to open and lay flat

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REORGANIZATION OF MANUAL

Suggested Temporary Traffic Control For Work Activities	TA-1 pg. 19	TA-3 pg. 20	TA-4 pg. 21	TA-6 pg. 22	TA-8 pg. 23	TA-9 pg. 24	TA-10 pg. 26	TA-11 pg. 27	TA-17 pg. 30	TA-20 pg. 32
Mowing	X			X					X	
Pothole Patching							X	X		
Pavement Marking/ Striping							X	X	X	
Road Closings					X	X				X
Road Grading							X	X	X	
Sign Installation/ Repair	X		X							
Tree Removal	X			X			X			
Trenching	X	X		X			X		X	

- Comments:
  - Organize in table by task and then by road type
  - Include a chart with each Maintenance Activity Code which references the correct layout

- Create a separate "Quick Reference Guide" that would be concise and contain the most frequently used typical applications and appropriate checklists to ensure TTC is set up safely and properly. This would be a spiral bound manual that could be left in the work trucks and/or be placed in the front of the larger manual.

- Produce a more comprehensive manual with all instructions, definitions, and less frequently typical applications to be housed in the Operations Manager's offices.

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CONTEXT SENSITIVITY

- Would like to provide a decision tree or prompt questions that help to identify which typical application to use

    - Would mainly be environmental questions such as:

        - Is there an adequate shoulder?

        - How many lanes?

        - Divided/Undivided?

        - Horizontal or vertical curves?

        - Sun position?

        - Shoulder Dropoffs?

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GUIDANCE SECTION FORMATTING

- In general, guidance is too wordy. Need to focus on providing bulleted lists and diagrams for:

  - Selecting a Typical Application layout

  - Installing/Removing TTC (with checklist)

  - TTC Devices

  - Quality Classifications and Requirements

  - Evaluation Guide: Signs, Channelizing Devices, Barricade Panels, Warning Lights, Flashing Arrow Boards, Portable Changeable Message Signs, Trailer Mounted Electronic Traffic Control Devices

  - Flagging Operations

EVALUATION GUIDE:
FLASHING ARROW BOARDS

Acceptable co[...]

An arrow bo[...]

- All lamps [...] operating l[...] properly.
- No lamps [...]
- All lamps [...]
- All lamps [...]
- DOT Refl[...]

Unacceptable [...]

An arrow bo[...]

- The arrow [...]
- The trailer [...] roadway s[...]
- The truck- [...] roadway s[...] authority d[...]

CAUTION

Marginal

An arrow [...]

- At leas[...] Alterna[...]

Unacceptab[...]

An arrow[...] following c[...]

- Less th[...] less tha[...] shapes [...]
- The arr[...]

DOUBLE ARROW MODE

Marginal

An arrow board in this mode is marginal if it meets the following condition:

- Two (2) lamps out in the stem and both heads completely functional with no lamps out.

Unacceptable

An arrow board in this mode is considered unacceptable if it meets any of the following conditions:

- More than two (2) lamps out in the stem,
- One (1) lamp out in the head, or
- The arrow board message is not visible at 1000 feet.

FLASHING A[...]

Marginal

An arrow bo[...]

- Up to two [...]

Unacceptable

An arrow bo[...] conditions:

- Any lamp [...]
- More than [...]
- The arrow [...]

6K-104

WOULD YOU PREFER EACH LAYOUT SHOW THE DIMENSIONS RATHER THAN LETTERS SIGNIFYING THE DIMENSIONS THAT YOU MUST LOOK UP IN A TABLE?

- Yes – 6

- No – 1

- Not sure – 2

- Comments:

  - Dimensions would be easier, especially if we are getting so detailed in the layouts that we cover most circumstances

  - Letter symbols allow for one drawing to address multiple speeds, ADT, etc.

  - Show both

  - Manual should include field cues (skip lines, utility poles, etc.) to help field crews estimate distances

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MEETINGS WITH TDOT STAFF

Brainstorming Meeting – August 27, 2020

- Included Operations Staff and Field Managers (people who use the manual regularly)
- Sent questions ahead of time to spark ideas and conversation
- Received invaluable feedback to make the manual more user-friendly
  - Main Manual
    - Includes every typical application, definitions, quality standards, etc.
    - 3-ring binder
    - Lives in Supervisor's Office
  - Quick Reference Guide
  - Include Decision Tree to determine whether a mobile or static setup is more appropriate and whether a shoulder closure or lane closure should be used
  - In general, make less wordy and condense information
  - Add dimension tables to each layout sheet

Steering Committee Meeting – September 8, 2020

MEETINGS WITH TDOT STAFF

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  - Main Manual

  - Quick Reference Guide

    - Includes most commonly-used typical applications, activity matrix, and check lists

    - Spiral-bound

    - "Rite in the Rain" paper

    - Durable materials that can be thrown in field trucks

  - Include Decision Tree to determine whether a mobile or static setup is more appropriate and whether a shoulder closure or lane closure should be used

  - In general, make less wordy and condense information

  - Add dimension tables to each layout sheet

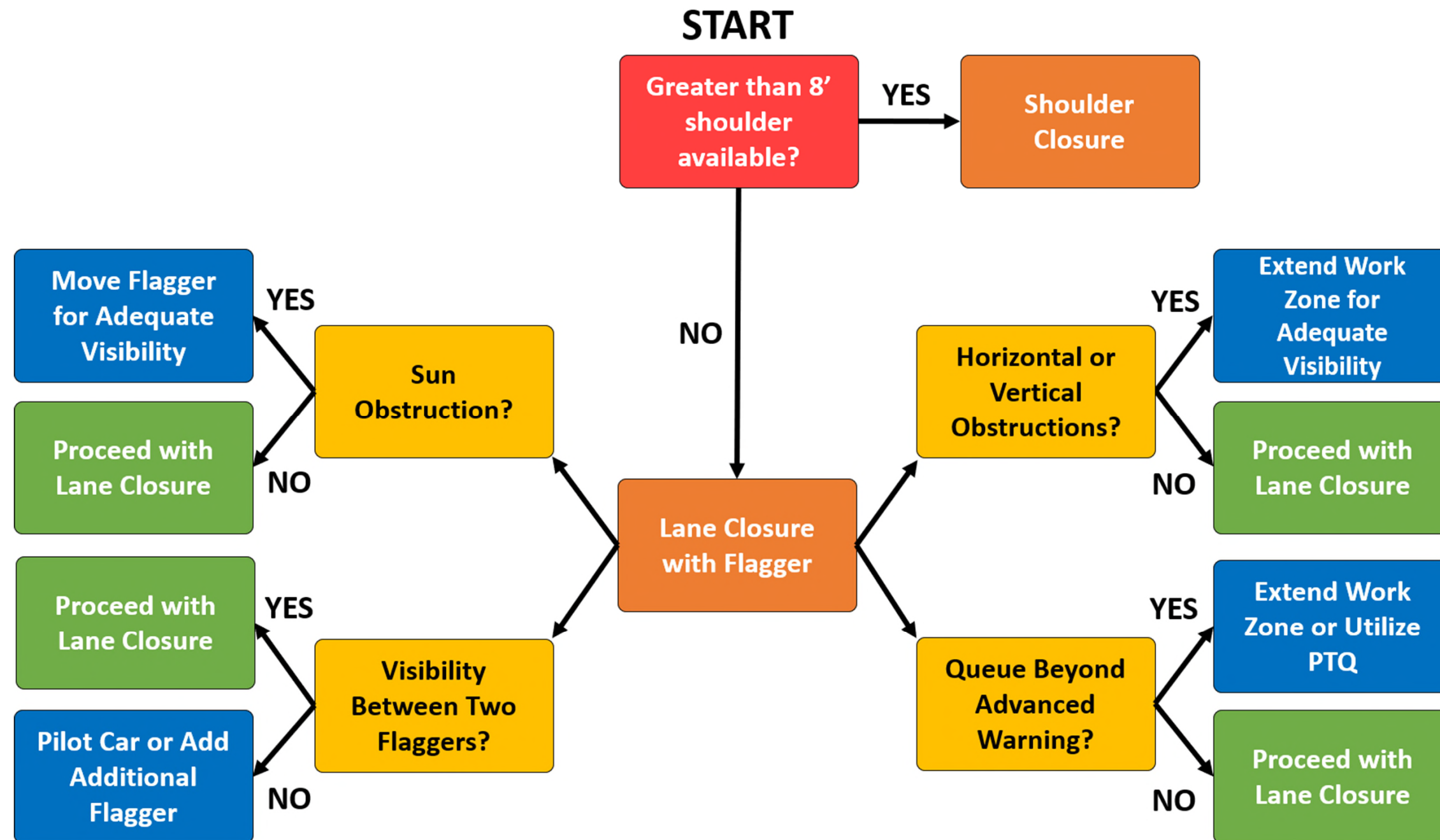## Steering Committee Meeting – September 8, 2020

GENERAL ACTIVITY

TYPICAL APPLICATION

Typical Application	Pothole Repair	Paving Activities	Shoulder Maintenance	Storm Sewer Maintenance	ROW/Boom/Slope Mowing	Litter/Animal/Large Debris Clearing	Off-Shoulder Maintenance	Street Cleaning	Bridge Repair	Pavement Marking/Striping	Guardrail/Crash Repair	Sinkhole/Slope Repair	Emergency Management	Chemical Application/Spraying
(4) Shoulder Closure			x	x	x	x			x		x	x	x	x
(5) Off Shoulder				x	x	x	x				x	x		x
(8) 2-Lane Mobile Lane Closure		x			x			x			x			x
(9) 2-Lane Stationary Lane Closure	x	x	x	x		x			x	x	x		x	
(20) Multi-Lane Undivided Left Lane Closure	x	x				x					x		x	
(21) Multi-Lane Undivided Outside Lane Closure	x	x	x	x		x			x	x	x		x	
(23) Multi-Lane Divided Mobile Shoulder > 8ft Closure	x		x		x	x								x
(24) Multi-Lane Divided Mobile Shoulder < 8ft Closure	x		x		x	x								x
(25) Multi-Lane Divided Mobile Lane Closure		x			x			x			x			x
(26) Freeway Mobile Double Lane Closure	x	x												
(28) Multi-Lane Divided Short Duration Lane Closure				x				x						x
(29) Multi-Lane Divided Outside Lane Closure Nighttime	x		x	x					x		x		x	

UPDATED MANUAL –

ACTIVITY MATRIX

UPDATED MANUAL – DECISION TREE

START

Greater than 8' shoulder available? — YES → Shoulder Closure

NO → Lane Closure with Flagger

Lane Closure with Flagger → Sun Obstruction?
- YES → Move Flagger for Adequate Visibility
- NO → Proceed with Lane Closure

Lane Closure with Flagger → Visibility Between Two Flaggers?
- YES → Proceed with Lane Closure
- NO → Pilot Car or Add Additional Flagger

Lane Closure with Flagger → Horizontal or Vertical Obstructions?
- YES → Extend Work Zone for Adequate Visibility
- NO → Proceed with Lane Closure

Lane Closure with Flagger → Queue Beyond Advanced Warning?
- YES → Extend Work Zone or Utilize PTQ
- NO → Proceed with Lane Closure

UPDATED MANUAL – DECISION TREE

Flashing Arrow Boards

Flashing Arrow Mode

Acceptable

Acceptable Flashing Arrow Mode meets all of these conditions:

- All lamps properly aligned for the intended driver's line of vision.
- No lamps are burnt out.
- All lamps dim properly.
- All lamps are the same level of intensity.

Marginal

Marginal Flashing Arrow Mode meets this condition:

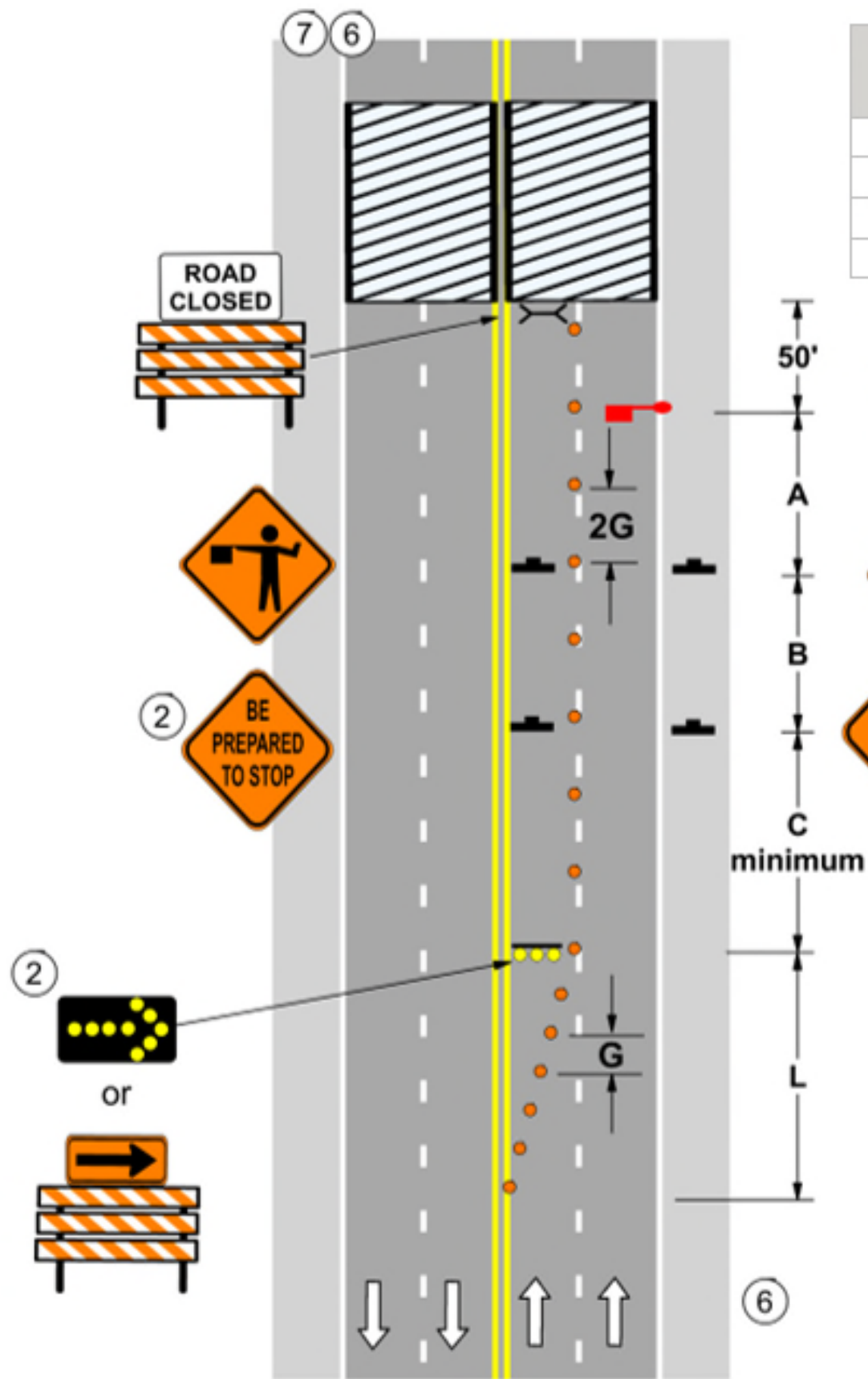- Up to two (2) lamps are out in the stem and no lamps out in the head.

Unacceptable

Unacceptable Flashing Arrow Mode meets any of these conditions:

- Any lamp out in the head.
- More than two (2) lamps out in the stem.

UPDATED MANUAL –

CONDENSE INFORMATION

Road Type	Advance Warning (ft)		
	A	B	C
Urban < 45 mph	100	100	100
Urban ≥ 45 mph	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

Posted Speed	Taper Length (L) (ft)	Decision Sight Distance (D) (ft)
30	180	620
35	260	720
40	320	820
45	660	940
50	720	1040
55	780	1140
60	840	1280
65	900	1380
70	960	1480
75	1020	1580

Posted Speed	Channelizing Device Spacing (ft)	
	G	2G
< 45	20	40
≥ 45	40	80

UPDATED MANUAL –

DIMENSIONS ON LAYOUTS

TDOT REFERENCES

- Personal Protective Equipment (PPE) Policy

- Warning Light Manual

- Manual on Uniform Traffic Control Devices

- TDOT Standard Operating Guide (SOG) 477-01

- Truck and Trailer Mounted Attenuators Manual

- 4Us Checklist

- Temporary Portable Rumble Strip Evaluation Guideline

- Automated Flagging Assistance Device Evaluation Guideline

- Flagging Guidance Training Presentation

- Protect the Queue SOG

- Protect the Queue Guidance Presentation

TDOT REVIEW

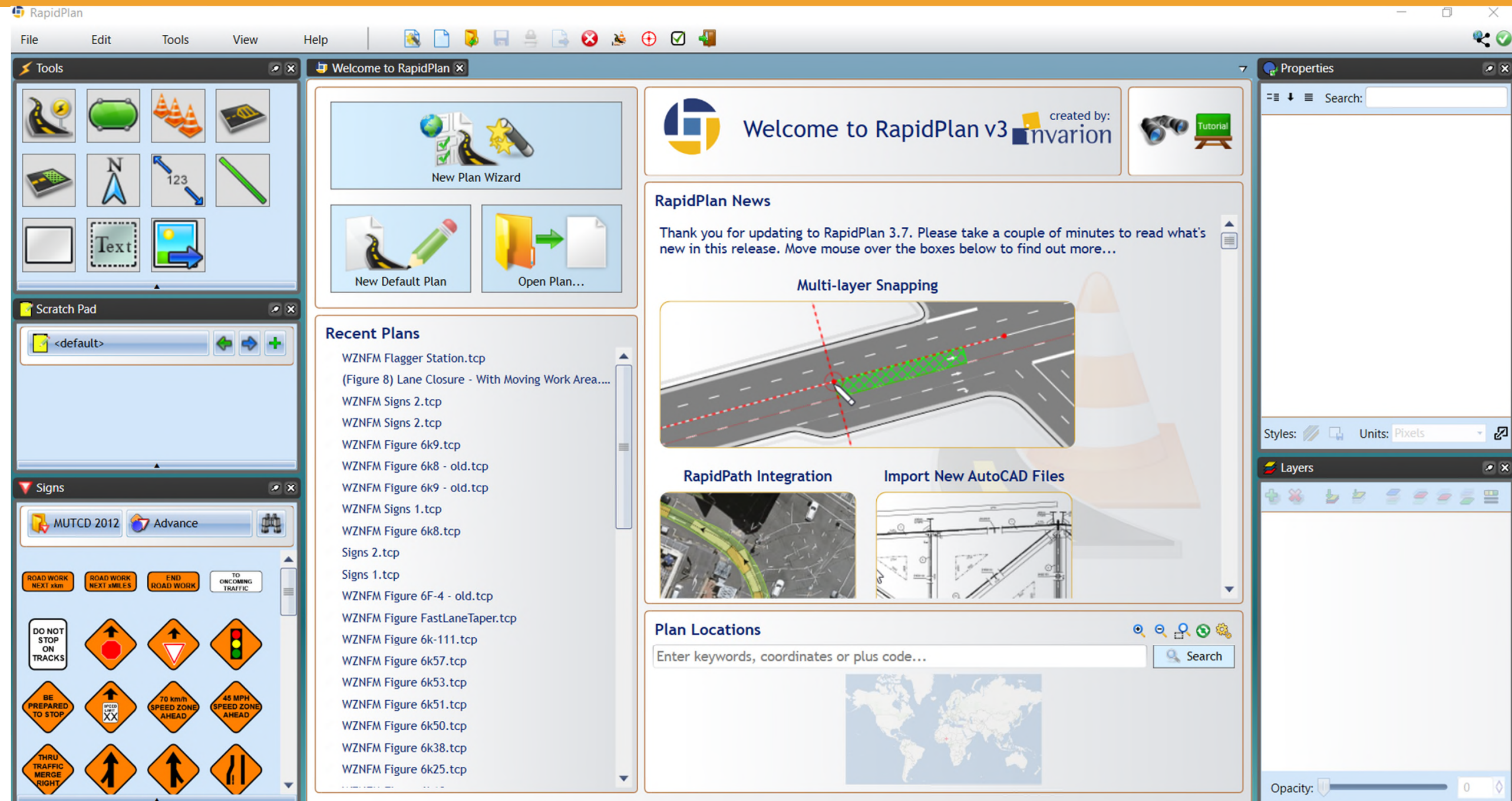Regions   Operations Staff   Safety Office   Traffic Engineering   FHWA

CREATING LAYOUT GRAPHICS

MUTCD TYPICAL LAYOUTS

Figure 6H-11. Lane Closure on a Two-Lane Road with Low Traffic Volumes (TA-11)

Typical Application 11

Figure 2G-24. Example of Signing for the Intermediate Entry to, Egress from, and End of Access-Restricted Priced Managed Lanes
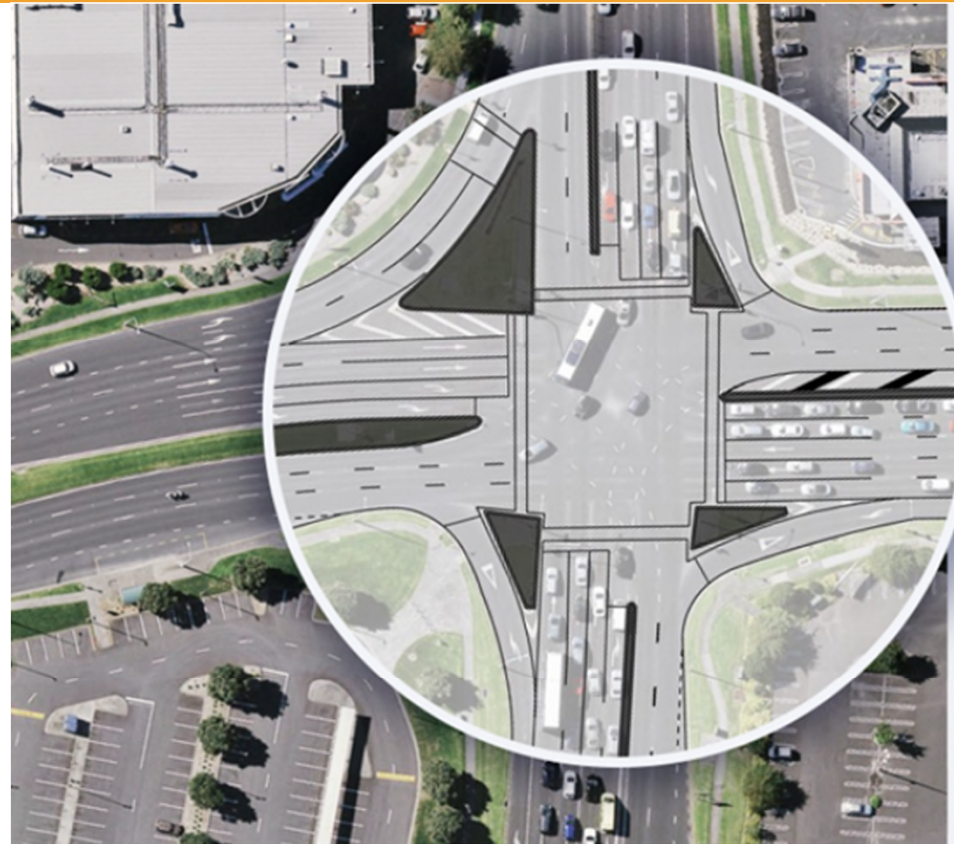
RAPIDPLAN CAPABILITIES

- Draw over aerial imagery

- Import pre-drawn road layouts of existing roadways

- Import CAD files, export to CAD

- **Utilize pre-loaded sign libraries**

- **Utilize pre-loaded templates**

PROGRAM BENEFITS

Established sign library

Simple scaling and annotations

Easy to layout devices

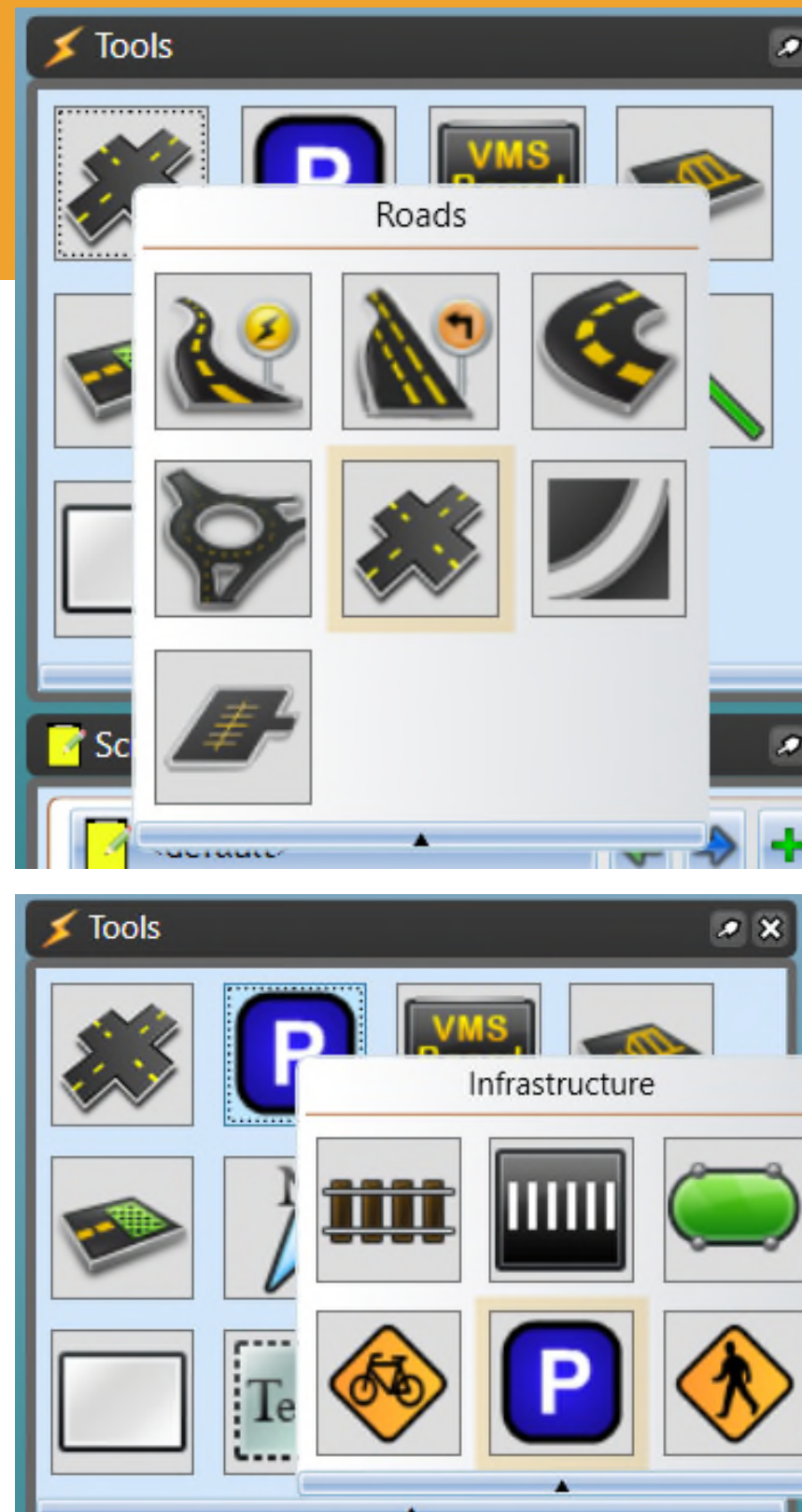Symbols library

Intuitive snapping for easy object alignment

PROS/CONS

Pros:

- With limited background, easy to jump in
- Simple, intuitive interface
- Full roads with various marking types can be drawn with a simple click from pre-loaded templates
- Easy to share and adjust files for future changes

Cons:

- Creating is easier than printing
- Sign library can be limited/misaligned with MUTCD
- Equipment symbols are limited

Pro/Con

- Help is setup as video tutorials

CDM SMITH INVOLVEMENT

What we actually did:

LEARNED A LOT ABOUT COMMUNICATION!