



Office of Roadway Engineering
Traffic Engineering Manual (TEM)
April 19, 2019 Revision

As of April 19, 2019 this publication has been revised.

The revision involves updates of the Title Sheet, preface materials, and Part 6.

The updated manual and the separate revision package, which includes a Revision Log, are available from the **ODOT Design Reference Resource Center**, or from the **Office of Roadway Engineering's website**.

Per ODOT policy, revisions will only be available via the web pages noted above.

For questions, comments, or concerns please contact:

Duane Soisson, P.E., Traffic Control Design Engineer
614-466-3649, or Duane.Soisson@dot.ohio.gov

or,

Scott Roeder, P.E., Traffic Standards Engineer
614-752-6109, or Scott.Roeder@dot.ohio.gov

Intentionally blank



Office of Roadway Engineering
Traffic Engineering Manual (TEM)
Revision Log

April 19, 2019 Revision (of the October 2002 Edition)

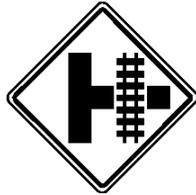
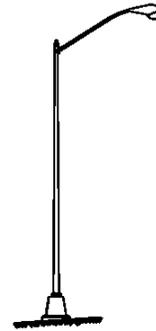
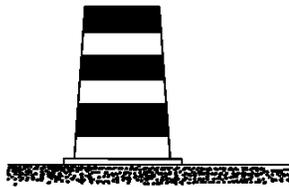
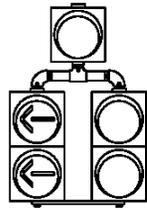
The following is a detailed list of the changes made in the Preface Materials and Part 6 of the TEM as of April 19, 2019:

Revision Involves:			Type *	Section Title & Revision Description
Chapter / Section	Page	New Page		
* Key for Revision Type: Change - change in a standard, new information, revising text to provide clarification, updating references, or correcting a mistake in the text, more than simple editorial change; Deletion - deleting a section, form, table or figure; Editorial - correcting a simple typing or drawing mistake, simple editorial changes such as rephrasing a statement or making a format change.				
Preface Materials				
Title Sheet	i - ii	i - ii	Editorial	Updated to reflect the April 19, 2019 date for this revision.
Preface & Mission Statement	iii - iv	iii - iv		No change.
Pub. Record	v – xvii	v – xviii	Editorial	Updated per this revision.
Table of Contents	xvii – xlvi	xix – xlvi	Editorial	Updated per this revision.
Part 1, General				
Part 2, Signs				
Part 3, Markings				
Part 4, Highway Signals				
Part 5, Low-Volume Roads				
Part 6, Temporary Traffic Control				
	6-1 – 6-12	6-1 – 6-12		Table of Contents. Updated per this Revision.
602-8	6-23	6-23	Change	Temporary Traffic Control Elements, Work Vehicles. In first paragraph, last sentence, added “on multi-lane highways (45 mph and above)” after “protection” and changed “the shadow vehicle may be equipped with a...(TMA)...” to “the shadow vehicle shall be equipped with a ...(TMA)...”.
	6-24 – 6-25	6-24 – 6-25		Included as part of the Revision Set.
603-3	6-26	6-26	Change	Pedestrian and Worker Safety, Worker Considerations. In item 5, former last sentence, replaced “rear-mounted impact attenuator” with “truck-mounted or trailer attenuator (TMA)”. Added new last sentence, “TMAs are required on multi-lane highways (45 mph and above).”

Revision Involves:			Type *	Section Title & Revision Description
Chapter / Section	Page	New Page		
	6-29	6-29		Included as part of the Revision Set.
605-2	6-30	6-30	Change	Temporary Traffic Control Zone Devices, General Characteristics of Signs. In Subsection 605-2.3, Placement , next-to-last paragraph, former last sentence, replaced “, the shadow vehicle, or the trailer may have an impact attenuator.” with “or shadow vehicle may have a truck-mounted or trailer attenuator (TMA).” Added new last sentence, “TMAs are required for shadow vehicles on multi-lane highways (45 mph and above).”
	6-49	6-49		Included as part of the Revision Set.
605-15	6-50 – 6-51	6-50 – 6-51	Change	Temporary Traffic Control Zone Devices, Crash Cushions. In Subsection 605-15.1, General , added “or trailer” after “truck-mounted” in line 4. In Subsection 605-15.3, Truck-Mounted or Trailer Attenuators (new title), first paragraph, first sentence, added “or trailer” after “Truck-mounted”; in second sentence, changed “If used, ...” to “When used...”, In second paragraph, first sentence, changed “..., a TMA should be used...” to “..., a TMA shall be used...”. In second paragraph, second sentence, changed “TMAs may be used...” to “TMAs shall be used...”.
	6-52	6-52		Included as part of the Revision Set.
	6-61	6-61		Included as part of the Revision Set.
607-9	6-62	6-62	Change	Typical Applications, Mobile Operation on Multi-Lane Road (OMUTCD Figure 6H-35). Revised “may” to “shall” and added “or trailer” after “truck-mounted”.
	6-107	6-107		Included as part of the Revision Set.
641-5	6-108	6-108	Change	Plan Preparation / Production, Closing Right or Left Lane of a Multi-lane Divided Highway (MT-95.30, 95.40, and 95.50). In Subsection 641-5.1, General , third paragraph, first sentence, deleted “, and truck-mounted or self-contained impact attenuators”.
	6-109	6-109		Included as part of the Revision Set.
641-6	6-110	6-110	Change	Plan Preparation / Production, Closing Right or Left Lane of a Multi-lane Undivided Highway (MT-95.31, 95.32, and 95.41). In Subsection 641-6.1, General , fourth paragraph, first sentence, deleted “, and truck-mounted or self-contained impact attenuators”.
641-7	6-111	6-111	Change	Plan Preparation / Production, Closing Right or Left Shoulder of a Multi-Lane Divided Highway (MT-95.45). In Subsection 641-7.1, General , third paragraph, first sentence, deleted “, and truck-mounted or self-contained impact attenuators”.
	6-112	6-112		Included as part of the Revision Set.
660-1	6-171	6-171	Change	Maintenance / Operations, General. Added a new third paragraph, “As of the April 19, 2019 publication...”

Revision Involves:			Type *	Section Title & Revision Description
Chapter / Section	Page	New Page		
660-3	6-172 – 6-173	6-172 – 6-173	Change	Maintenance / Operations, Temporary Traffic Control (TTC) for Pothole Patching. In Subsection 660-3.3, Pothole Patching on Multi-Lane Facilities that Will Violate the Permitted Lane Closure Schedule (PLCS) , added new sentence to Item 2. “For shadow vehicles, any truck-mounted or trailer attenuator...” In Subsection 660-3.4, Pothole Patching on Multi-Lane Facilities that Will Not Violate the Permitted Lane Closure Schedule (PLCS) , added new sentence to Item 1, “For shadow vehicles, any truck-mounted or trailer attenuator...”. In Item 2, deleted “, Detail A” in first sentence and “on the use of truck-mounted attenuators and/or” in last sentence; deleted Items 3 and 4.
	6-174	6-174		Included as part of the Revision Set.
	6-223	6-223		Included as part of the Revision Set.
698-9	6-224	6-224	Change	Figure 698-9, Pothole Patching on Multi-Lane Facilities That Will Violate the PLCS. Deleted “(OPTIONAL)” under Truck Mounted Attenuator label. In Note 2, deleted “when the shadow vehicle has a TMA”.
698-10	6-225 – 6-226	6-225 – 6-226	Change	Figure 698-10, Pothole Patching on Multi-Lane Facilities That Will Not Violate the PLCS. On sheet 1, deleted Note 3 and renumbered Notes. Deleted “(Sheet 1 of 2)” in Figure title and deleted “Detail A” label above the Notes. Deleted sheet 2.
Part 7, Zones and Studies				
Part 8, Rail Grade Crossings				
Part 9, Bicycles				
Part 10, Reserved for Future Use				
Part 11, Highway Lighting				
Part 12, Zones and Traffic Engineering Studies				
Part 13, ITS				
Part 14, Miscellaneous				
Part 15, Appendix				

Traffic Engineering Manual



October 23, 2002 Edition
(Includes revisions through April 19, 2019.)

Ohio Department of Transportation
Office of Roadway Engineering

Revisions of this Manual are published on a quarterly basis, as needed. They are published only on-line, at the Office of Roadway Engineering (ORE) and DRRC websites noted below.

**Ohio Department of Transportation
Office of Roadway Engineering
1980 W. Broad St., P.O. Box 899
Columbus, OH 43216-0899**

Web addresses:

ODOT: <http://www.dot.state.oh.us>

Office of Roadway Engineering (ORE):

<http://www.dot.state.oh.us/divisions/Engineering/Roadway>

Office of Traffic Operations (OTO):

<http://www.dot.state.oh.us/divisions/Operations/traffic/>

ODOT Publications (Design Reference Resource Center (DRRC)):

<http://www.dot.state.oh.us/drrc>

Traffic Engineering Manual (TEM) website:

<http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/traffic/TEM/Pages/default.aspx>

An Equal Opportunity Employer

PREFACE

The **Traffic Engineering Manual (TEM)** has been developed to assure uniformity in application of **ODOT** traffic engineering policies, guidelines, standards and practices. The **OMUTCD** establishes the basic, minimum traffic control standards for any street, highway, bikeway or private road open to public travel in **Ohio**, and all supplemental **ODOT** traffic engineering design, construction and operations related information is either contained in the **TEM** or referenced from it.

This Manual contains standards, policies, etc. established for use in **ODOT** work; however, various situations will present themselves where engineering knowledge, experience and judgment will have to be used to determine how to apply the information included herein to specific situations. Comments, questions and proposed revisions should be submitted to the **ODOT Office of Roadway Engineering, Design Standards Section**, at the address noted on page ii. Email and telephone contact information is also available on the **Contacts for Traffic Standards Publication web page**.

**Ohio Department of Transportation
MISSION STATEMENT**

To provide easy conveyance of people and goods from place to place, we will:

- Take care of what we have
- Make our system work better
- Improve safety
- Enhance capacity

PUBLICATION RECORD

2002 October 23, 2002 Edition, effective December 2, 2002

New edition, updating and consolidating information previously published in the ODOT Traffic Control Application Standards Manual, the Traffic Control Design Information Manual, the Construction Guidelines for Traffic Control Devices and various separate policies, guidelines and procedures.

2003 January 17, 2003 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet, Publication Record, and Table of Contents;**
- **in Part 1,** a revised Table 197-1;
- **in Part 2,** a revised Section 208-3, and editorial changes in Section 205-2.3.1;
- **in Part 3,** a revised Table of Content, revised Sections 304-2, 342-2, 342-3, 342-4, 342-5 and 343, and editorial changes in Sections 301-1, 301-3, 302-1, 304-1, 304-3, 304-6, 306, 307, 320-4, 320-5, 340-1, 340-2, 340-3 and 350-2;
- **in Part 4,** a revised Table of Content, revised Sections 442-3, 442-5, 442-9, 442-10, 442-11, 442-15, 442-16 and 442-19, deleted Sections 442-14, 442-17 and 442-18, and editorial changes in Sections 401-1, 403-1, 404-1, 420-1, 421-1, 441-9, 442-4, 442-6, 442-7, 442-8, 442-12, 442-13, 443, 450-3.2 thru 450-3.6, 450-4.1, 450-4.3, 450-4.4, 450-6.2, 450-6.3, 450-8.2, 450-8.5, 450-8.7, 450-8.8, 450-9, 450-10.2 thru 450-10.7 and 450-11.1 thru 450-11.8;
- **in Part 6,** a revised Table of Content, a new Section 605-8.4, revised Sections 605-6.5, 607-40, 607-41, 640-14, 640-24.1, 641-8.4, 641-10.5, 642-3, 642-9, 642-16, 642-17, 642-19, 642-20, 642-21, 642-24, 642-25, 642-26, 642-27, 642-28, 642-30, 642-31, 642-32, 642-35, 642-39, 642-41, 670-7 and Figure 698-3a, and editorial changes in Sections 605-2.1, 605-7.3, 605-11.3, 605-11.4.1, 605-11.5, 605-11.10.2, 606-2, 606-12, 606-14, 606-15, 607-1, 620-3, 620-6.1, 620-6.2, 620-6.3, 640-1, 640-8, 640-11.3, 640-11.6, 640-11.7, 640-18.2, 640-21, 640-22, 641-2.6, 641-5.1 thru 641-5.4, 641-5.6, 641-6.1 thru 641-6.5, 641-7.2, 641-8.5, 641-9.6, 641-9.7, 641-10.4, 641-10.8, 641-11, 641-12, 641-13, 641-14, 641-15, 641-16, 641-17, 641-19, 642-2, 642-4, 642-5, 642-6, 642-9, 642-10, 642-12, 642-18, 642-22, 642-29, 642-33, 642-34, 642-36, 642-37, 642-38 and 642-40;
- **in Part 11,** a revised Table of Content, revised Sections 1141-3.1, 1142-2 thru 1142-19, 1142-21 thru 1142-23, 1142-26, 1142-31, 1142-32 and 1142-34, and editorial changes in Sections 1142-20, 1142-24, 1142-25, 1142-27 thru 1142-30, 1142-33, 1142-35 and 1143;
- **in Part 12,** a revised Table of Content and revised Section 1215; and
- **in Part 14,** the Index was revised.

2003 April 18, 2003 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- new **Cover Sheet, Publication Record and Table of Contents;**
- **in Part 2,** revised Section 201-8 and Table 297-9;
- **in Part 3,** revised Sections 302-3 and 343; and editorial corrections in Section 302-2 and Table 397-1;
- **in Part 4,** new Sections 442-17, 442-18 and 442-19; a revised Table of Contents and revised Sections 442-1 thru 442-16 and Figures 498-3 and 498-5;
- **in Part 6,** a revised Table of Contents, and revised Sections 602-5.3, 605-10.2, 642-1 thru 642-32 and Table 697-9; and editorial changes in Sections 605-11.4.1, 640-12.2, 640-20, 640-23.3.4, 640-23.5, 641-7.4, 641-15, 642-9, 642-36;
- **in Part 11,** new Sections 1150-1 thru 1150-21 and 1160-11 thru 1160-14; a revised Table of Contents; and editorial changes in Section 1100-1, 1140-4.3.5, 1140-5.6.2, 1140-5.7.2, 1140-7.3, 1141-4.2.3, 1142-16, 1142-17 and 1142-18; and
- **in Part 12,** revised Section 1202-1.

2003 October 17, 2003 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet and Table of Contents,** and an updated **Publication Record;**
- **in Part 1,** a revised Table of Contents, and revised Sections 100-2, 100-5, 101-1, 101-2, 101-3.2, 101-3.3, 101-3.4, 101-4, 101-5, 102-2, 102-3.2, 102-3.4, 102-3.5, 102-5, 103-3.1, 103-3.3, 103-3.8, 103-4, 103-5, 104-1, 104-2, 105-1, 106-2, 106-3, 130-2.1, 130-2.3, 140-2.6, 194-9, 197 and 198, and Form 196-3, Tables 197-1, 197-2, 197-3, 197-9 and 197-10, and Figures 198-1a, 198-1b, 198-1c and 198-2; deleted Section 106-4 and Figure 198-1d; editorial changes in Sections 100-1.4 and 103-3.4; and general editorial/formatting changes;
- **in Part 3,** a new Section 301-14; revised and renumbered Sections 301-12.4 and 301-12.5 (now Sections 301-12 and 301-13, respectively); a revised Table of Contents, and revised Sections 301-1, 301-4 through 301-11, 302-1, 303-1, 303-2, 304-1, 304-3, 304-5, 304-6, 305, 306 and 310, and Figures 398-1, and 398-3 through 398-5; deleted Sections 301-12.1 through 301-12.3; editorial changes in Sections 301-2 and 320-1; and general editorial/formatting changes;
- **in Part 4,** new Sections 401-6 through 401-8, 402-3.5, 403-7, 408-2, 440-5 and 440-6, and Forms 496-8 through 496-18; a revised Table of Contents, and revised Sections 400-1, 401-1, 401-3, 401-4, 402-1, 402-3.1 through 402-3.4, 403-1 through 403-3, 403-5, 403-6.1, 404-1 through 404-3, 405-1, 406-1 through 406-3, 407-2, 408-1, 420-4.1 through 420-4.4, 420-4.7, 420-4.8, 421-1, 441-3, 450-10.4, 450-10.6, 496 and 497, and Table 497-3; and general editorial/reformatting changes;
- **in Part 5,** revised Sections 500 and 595;
- **in Part 7,** a revised Table of Contents, and revised Sections 700, 701, 702-1 through 702-5, 702-7 and 704; and general editorial/reformatting changes;
- **in Part 8,** a revised Table of Contents, and revised Sections 800, 801-1, 801-2.2, 802-1, 802-2, 803, and 804; and general editorial/reformatting changes;
- **in Part 9,** a revised Table of Contents and revised Section 900; and general editorial/reformatting changes;
- **in Part 10,** revised Sections 1000 and 1095; and
- **in Part 11,** a revised Table of Contents, and Sections 1100-1, 1103-6.8, 1140-4.6.2, 1142-14, 1142-15, 1142-25, 1160-6 and 1160-8; and an editorial change in Section 1160-13.

2004 January 16, 2004 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and **Table of Contents**, and an updated **Publication Record**;
- **in Part 2**, a revised Table of Contents, and revised Sections 200-1, 201-1 through 201-3, 201-5, 201-7, 201-8, 201-10 through 201-13, 202-1, 202-4 through 202-7, 203-1, 203-2, 204-1 through 204-4, 205-1, 205-2.1, 205-2.3.3, 205-3, 206-1, 206-3 through 206-15, 207, 207-1, 207-2.1, 207-3.1, 207-4, 207-5, 207-6.1, 207-6.3, 207-6.4, 207-7, 208-1, 208-2, 208-3, 208-4, 208-6, 209-1, 209-2.2, 209-2.3, 209-3, 209-4, 209-5, 210-2, 211-1, 212-1, 220-7, 240-2.3, 240-3, 250-3.1, 295-2, 297 and 298, and Tables 297-1 and 297-4, and Figures 298-1, 298-2, 298-4a, 298-4b, 298-5a through 298-5d, 298-6a, 298-6b, 298-7, 298-22 and 298-24; deleted Sections 201-6, 206-2 and 295-3, and Figure 298-6c; and general editorial/formatting changes;
- **in Part 3**, editorial corrections in Section 398;
- **in Part 6**, new Sections 605-5.12 through 605-5.15, 606-19, 606-20, 640-26, 642-42 through 642-45, 670-6.1 through 670-6.3; a revised Table of Contents, and revised Sections 601-1, 602-4.1, 602-4.4.4, 602-5.1 through 602-5.6, 602-5.8, 602-6, 602-7, 603, 604, 605-1 through 605-3, 605-4.2, 605-4.3, 605-5.1 through 605-5.11, 605-6, 605-7, 605-8, 605-9605-10.1, 605-10.2, 605-11.1 through 605-11.9, 605-11.10.1, 605-11.11 through 605-11.13, 605-12, 605-13, 605-14.1, 605-14.2, 605-14.5, 605-15.1, 605-15.2.2, 605-15.2.3, 605-16 through 605-20, 606-1 through 606-18, 607-1 through 607-15, 620-3, 620-6.1, 640-4, 640-5.3, 640-12.1, 640-12.4, 640-18.2, 640-20, 640-22, 641-5.2, 641-5.3, 641-6.3, 641-6.5, 641-7.3, 641-8.3, 641-9.3, 641-9.6, 641-10.3, 641-10.4, 641-11 through 641-13, 641-15, 641-17, 641-19, 642-24, 642-27, 642-31 through 642-34, 660-2, 670-6 through 670-8, 695-2, 697, 698, and Tables 697-5 through 697-9, and Figures 698-1 through 698-4; deleted Sections 605-6.1 through 605-6.5, 605-9.1 through 605-9.3, 605-10.3, 605-11.14, 607-16 through 607-44, 670-9, 670-10, and Tables 697-10 through 697-14, and Figures 698-5 through 698-49; editorial corrections in Sections 620-2.2, 642-5, 642-30; and general editorial/formatting changes.
- **in Part 11**, revised Section 1141-3.1;
- **in Part 12**, a revised Table of Contents, and revised Sections 1210, 1211, 1212-1, 1212-2.2, 1212-2.3, 1213-1, 1213-2, 1213-3, 1214, 1215, 1220-3, 1220-5.1, 1230-2.1 and 1230-6.13; and editorial corrections in Sections 1220-5.7 and 1230-6.9.
- **in Part 13**, a revised Table of Contents, and revised Sections 1301-2, 1301-3, 1305, 1312 and 1399, and general editorial/formatting changes.

2004 April 16, 2004 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and **Table of Contents**, and an updated **Publication Record**;
- **in Part 1**, a new Section 140-7; and revised Tables 197-1 and 197-10;
- **in Part 2**, a new Section 240-8; a revised Table of Contents and Sections 240-1 and 295-2;
- **in Part 3**, a new Section 350-3; a revised Table of Contents, revised Sections 301-1, 301-2, 301-14, 302-2 thru 302-4, 304-4, 320-1, 320-5, 340-2 thru 340-4, 342-2, 343 and 397, and revised Table 397-1; deleted Sections 342-3 thru 342-5; and a minor editorial correction in Section 301-10;
- **in Part 4**, a new Section 440-7; a revised Table of Contents and Section 440-1;
- **in Part 6**, new Sections 630-5, 641-23 and 642-46, and Figures 698-5 through 698-9; a revised Table of Contents, revised Sections 606-16, 606-17, 607-10, 607-12, 607-13, 607-15, 630-1, 640-12.1, 640-12.4, 640-23.3.1 and 698; and editorial corrections/changes in Sections 640-2, 642-44 and 642-45

2004 July 16, 2004 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and **Table of Contents**, and an updated **Publication Record**;
- **in Part 1**, a revised Table of Contents and Sections 10-1.3, 100-5, 101-3.3, 101-4, 101-5, 102-3.1, 102-3.2, 102-3.3, 102-5, 103-4, 103-5, 104-3, 140-2.3, 140-2.4, 140-7, 150-1, 160, 193-10.2, 194-14 and 198, and Figures 198-1a and 198-2; deleted Figures 198-1b and 198-1c; and editorial corrections/changes in Sections 100-1.1, 100-1.4, 100-6, 101-2, 101-3.2, 101-3.4, 102-1, 102-2, 102-3.6, 103-1, 140-2.2, 140-2.5, 140-2.6, 193-10.1, 193-11, 193-12, 194-3, 194-6, 194-9, 194-10, 194-11 and 194-17.
- **in Part 2**, five renamed sections: existing Sections 205-2, 205-3, 205-3.1, 205-3.2 and 209-1.1 are now 205-3, 205-4, 205-4.1, 205-4.2 and 211-3, respectively; new Sections 202-8, 205-2, 205-5, 206-16, 207-8, 209-6, 209-7 and 211-2, and Figures 298-28 thru 298-36; a revised Table of Contents, and Sections 200-1, 201-1, 201-4, 201-5, 201-7, 201-8, 202-4 thru 202-7, 203-1, 203-2, 204-1 thru 204-4, 205-1, 205-2.1, 205-2.2, 205-2.3.2, 205-2.3.3, 206-1, 206-3, 206-4, 206-5.1, 206-5.2, 206-5.5, 206-6, 206-7.2, 206-7.3, 206-8, 206-14, 206-15, 207-1, 207-2.1 thru 207-2.3, 207-3.1, 207-5.2, 207-5.3, 207-6.2, 207-6.3, 207-7, 208-1 thru 208-4, 208-6, 209-1, 209-2.1, 209-2.2, 209-3, 209-4.1, 209-4.2, 209-5, 210-2, 211-1, 211-2, 212-1 thru 212-3, 220-4 thru 220-7, 220-8.2, 220-8.3, 220-8.5, 221-1, 240-2.1, 240-2.2, 240-3, 240-4.3, 240-4.5, 240-4.7 thru 240-4.9, 240-5.3, 240-5.6, 240-5.7, 240-6.3, 240-6.4, 240-7.1 thru 240-7.3, 240-8, 241-1, 241-3, 241-7, 242-1 thru 242-4, 250-2, 250-3.1, 250-4.3, 250-5.3, 250-5.7, 250-8.1, 260-1, 260-4.2, 260-4.3, 260-6.1 and 298, and Tables 297-1 and 297-6, and Figures 298-5a thru 298-5d and 298-22; and editorial corrections/changes in Sections 200-3, 201-2, 201-3, 201-10 thru 201-13, 202-1, 205-2.4, 206-7.1, 206-7.4, 207-2, 207-4.2, 207-4.4, 207-5.1, 207-6.1, 207-6.4, 209-2.3, 209-2.5, 209-2.6, 220-8.4, 221-5, 240-7.5 thru 240-7.7, 241-2, 241-6, 242-5, 250-3.2, 250-3.3, 250-4.1, 250-4.2, 250-4.6, 250-5.2 and 250-6.2, and Tables 297-2, 297-4, 297-9, 297-11.
- **in Part 3**, four renamed sections: existing Sections 340-2, 340-3, 340-4 and 340-5 are now 341-2, 341-3, 341-4 and 341-5, respectively; new Sections 340-2, 341, 341-1, 350-4, 360-1, 360-2 and 360-3; a revised Table of Contents and revised Sections 301-14.1, 302-1, 340-1, 350-3 and 360; and a minor editorial corrections/changes in Sections 300-1 and 301-14.4;
- **in Part 4**, new Sections 442-20, 442-21, 442-22 and 442-23; a revised Table of Contents and Sections 401-6 and 440-7, and Form 496-13; and editorial corrections/changes in Sections 442-1, 442-3, 442-4, 442-5, 442-6, 442-7, 442-8, 442-9, 442-10, 442-11, 442-12, 442-13, 442-14, 442-15, 442-16 and 442-19;
- **in Part 6**, new Sections 630-6 and 640-27, and Form 696-1; a revised Table of Contents, revised Sections 605-4.3, 605-5.3, 605-5.12 thru 605-5.15, 605-11.3, 630-4, 630-5, 640-12.2, 642-24, 642-27, 642-33, 696 and 698, and Figures 698-3a, 698-3b and 698-4; and editorial corrections/changes in Sections 607-10, 607-13, 607-15, 640-18.2, 642-14, 642-15, 642-42 and 642-46.

- in **Part 11**, new Sections 1141-3.7 thru 1141-3.9; a revised Table of Contents and Sections 1140-6.1.1.4, 1140-6.1.2.2, 1141-2, 1141-3.1 thru 1141-3.6 and 1141-4; and an editorial corrections in Section 1142-35.
 - in **Part 14**, a revised listing.
- 2004 October 22, 2004** – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a new **Cover Sheet** and **Table of Contents**, and an updated **Publication Record**;
 - in **Part 1**, a revised Table of Contents and Section 103-3.2; and editorial corrections/changes in Sections 100-3.3 and 140-7;
 - in **Part 4**, editorial corrections/changes in Sections 442-20, 442-21 and 442-23; and
 - in **Part 6**, new Section 642-47; a revised Table of Contents, revised Sections 605-11.3, 640-18.2, 641-5.1, 641-6.1, 642-9, 642-19 and 642-24.
- 2005 January 21, 2005** – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a revised **Preface** and an updated **Cover Sheet, Revision Record** and **Table of Contents**;
 - in **Part 1**, new Sections 194-21 and 194-22; a revised Table of Contents and Sections 100-3, 100-4, 101-3.3, 102-1, 102-3.4, 103-3.1, 103-3.2, 103-3.4, 103-3.7, 103-5, 105-1, 105-3, 120-1 thru 120-3, 140-7, 193-3, 193-10.1, 193-14, 193-15, 194-1, 194-2, 194-13, 194-15, 194-16 and 194-19, Tables 197-2, 197-8 and 197-9, and Figure 198-1; editorial corrections or changes in Sections 101-2, 101-4, 101-5, 102-2, 102-3.2, 102-3.5, 102-3.6, 102-4, 103-4, 104-1 thru 104-3, 106-1, 106-3, 130-2.3, 130-3, 130-4, 130-6, 140-1, 140-2.4, 140-2.6, 140-2.7, 140-5, 150-1, 150-2, 160, 193-5, 193-10.2, 193-12, 193-20, 194-5, 194-9 thru 194-11, 195-1, 196, 197 and 198, Forms 196-1 thru 196-4, Tables 197-3 thru 197-6, 197-7 and 197-10; and minor format changes.
 - in **Part 2**, new Sections 205-6 and 210-3; revised Table of Contents and Sections 205-4, 209-4 and 240-8, and Table 297-7;
 - in **Part 4**, new Forms 496-19 and 496-20, and Table 497-6; a revised Table of Contents, revised Sections 403-5, 403-6, 403-6.1, 403-6.4, 403-7, 440-3, 440-5 thru 440-7, 441-2, 441-3, 441-8, 441-11, 496 and 497, and revised Forms 496-3 and 496-4; editorial corrections in Form 496-6; and deleted Section 403-6.5; and
 - in **Part 6**, a revised Table of Contents, revised Sections 605-4.3, 605-10.1, 642-21, 642-28, 642-30 thru 642-32 and 642-44; and editorial corrections or changes in Sections 642-33, 642-34, 642-36, 642-37, 642-40 thru 642-43, 642-45 and 642-47, and Tables 697-3 thru 697-5 .
- 2005 April 15, 2005** – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a new **Cover Sheet** and **Table of Contents**, and an updated **Publication Record**;
 - in **Part 1**, revised Tables 197-2 and 197-3;
 - in **Part 3**, a revised Table of Contents, revised Sections 301-1, 301-7, 301-14.4, 302-2, 302-6, 307-2, 310, 320-1, 320-4, 341-1, 342-2 and 343, and Table 397-2; and minor editorial/format changes;
 - in **Part 4**, a revised Table of Contents, Sections 401-6, 401-7, 404-2, 442-20, 442-21, 442-22 and 442-23, Form 496-2, and Table 497-5; deleted Forms 496-12 through 496-18; editorial revisions in Forms 496-8 through 496-11, and 496-19, Table 497-6, and Figure 498-37; and minor editorial/format changes;
 - in **Part 6**, a revised Table of Contents, revised Sections 630-4, 630-5, 640-23.4, 640-23.5, 641-9.6, 641-23, 642-46 and Form 696-1; and minor editorial/format changes;
 - in **Part 11**, a revised Section 1142-30;
 - in **Part 12**, a revised Section 1220-5.6; and
 - in **Part 13**, added copies of ODOT Policies 16-004(P), 22-007(P), 25-005(P), 122-002(P), 322-002(P), 512-002(P), and Standard Procedures 122-004(SP) and 510-005(SP); revised Sections 1301-2, 1310, 1312, 1314 and 1399; and minor editorial/format changes.
- 2006 January 20, 2006** – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a new **Cover Sheet** and an updated **Preface, Publication Record** and **Table of Contents**;
 - in **Part 1**, a new Section 193-11; deleted Section 193-14; three renumbered Sections (Sections 193-11 thru 193-13 are now Sections 193-12 thru 193-14); a revised Table of Contents, Sections 101-2, 101-3.2 thru 101-3.4, 101-4, 101-5, 102-2, 102-3.4 thru 102-3.6, 102-4, 103-3, 103-3.4 thru 103-3.6, 103-4, 103-5, 104-4, 106-1 thru 106-3, 120-1, 120-2, 130-2.2, 130-2.3, 140-2.3, 140-2.4, 193-4 thru 193-7, 193-9, 193-15 thru 193-18, 194-1 thru 194-3, 194-6 thru 194-8, 194-19, Chapter 197, Forms 196-1 thru 196-4, Tables 197-1 thru 197-3 and 197-5 thru 197-10, and Figures 198-1 and 198-2; and editorial revisions in Sections 100-1.2, 100-1.4, 100-4 thru 100-6, 101-3.1, 102.3.1 thru 102-3.3, 102-5, 103-3.2, 104-2, 105-1, 120-3, 130-1, 130-2.1, 130-5, 140-1, 140-2.6, 140-2.7, 140-3, 140-4, 140-5, 140-7, 193-1, 193-2, 193-10, 194-4, 194-21 and 195-1, and Chapters 160 and 180;
 - in **Part 5**, revised Chapters 500 and 595;
 - in **Part 7**, revised Chapter 704, Sections 702-5, 702-6, 705-1, 705-2 and 705-4; and editorial revisions to the Table of Contents, Chapters 795 and 796, and Forms 796-4 and 796-5;
 - in **Part 8**, revised Chapters 803, 805 and 840, Sections 801-2.2, 801-2.3, 802-1, 802-2, 880-2, 895-1, 895-2, 895-3, and 895-4; and editorial revisions to Chapters 850 and 860, Sections 830-1 880-1;
 - in **Part 9**, a new Section 995-4; revised Table of Contents, Chapters 900, 930, 940 and 950, and Sections 995-1 and 995-2; and
 - in **Part 10**, revised Chapters 1000 and 1095
- 2006 April 21, 2006** – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 2**, a new Figure 298-37; deleted Figure 298-5d; a revised Table of Contents, Chapter 243, Sections 200-1, 201-1 thru 201-4, 201-8, 201-10 thru 201-13, 202-5, 202-7, 202-8, 203-2, 204-1, 204-2, 205-2, 205-4 thru 205-6, 206-1, 206-3, 206-4, 206-5.2, 206-6, 206-7.2, 206-8, 206-10 thru 206-12, 206-14, 206-15, 207-1, 207-4.4, 207-5.1, 207-6.1, 207-6.3, 207-6.4, 207-7, 208-1, 208-2, 208-4 thru 208-6, 209-1, 209-4.1, 209-5 thru 209-7, 211-1 thru 211-4, 212-1, 212-3, 220-4, 220-5, 221-2, 221-4, 240-2.2, 240-3, 240-4.1, 240-4.2, 240-4.6, 240-4.8, 240-4.9, 240-5.3 thru 240-5.5, 240-6.2, 240-7.2, 240-7.3, 240-7.6, 240-7.7, 241-5, 242-4, 250-2, 250-2, 250-3.1 thru 250-3.4, 250-4.2 thru 250-4.6, 250-5.2 thru 250-5.8, 250-6.2, 250-6.4, 250-6.5, 250-7.1, 250-7.2, 250-7.4 thru 250-7.6, 250-8.1, 250-8.2, 260-4.2, 260-4.3, 260-5, 260-6.1, 260-6.2, 295-1 thru 295-4, Figure Index, Figures 298-4a and 298-5a thru 298-5c; and editorial revisions in Chapter 230, Sections 200-2, 201-5, 201-9, 202-1, 202-4, 202-6, 203-1, 204-4, 205-1, 206-2, 206-5.1, 206-7.1, 207-2.2, 207-2.3, 207-3.1, 207-3.2, 207-3.3, 207-5.2, 207-5.3, 209-2.5, 209-4.2, 210-1, 210-3, 220-1, 220-7, 220-9, 221-1, 221-3, 221-5, 240-1, 240-2.1, 240-4.3, 240-4.5, 240-4.7, 240-5.7, 240-6.3, 240-7.4, 240-7.5, 240-8, 241-1, 241-6, 241-7, 242-1, 250-4.1, 250-5.1, 250-6.1, 250-6.3, 260-1, 260-4.1 and Figure 298-22; and minor editorial/format changes;
- **in Part 3**, new Sections 304-7, 341-6, 342-3 thru 342-5, and 350-5 thru 350-8; deleted Section 360-3; a revised Table of Contents, a revised title for Chapter 303, revised Chapters 310 and 343, Sections 300-1, 300-3, 301-1 thru 301-4, 301-6 thru 301-12, 301-14.1, 301-14.2, 301-14.4, 301-14.5, 302-1, 302-5, 303-1, 303-3, 304-2, 304-6, 307-2, 320-1, 320-4, 341-2, 341-5, 342-2, 360-1 and 360-2, Form 396-1, Figures Index, and Figures 398-2 thru 398-5; and editorial revisions to the Tables Index, Sections 300-2, 301-13, 303-4, 304-3, 340-1, 340-2, 341-1, 341-4, 342-1, 350-3 and 350-4, Chapters 330, 370 and 380, and Table 397-1; and minor editorial/format changes; and
- **in Part 4**, new Sections 442-24 thru 442-29, revised Table of Contents, Chapter 443, Sections 400-1, 401-2, 401-3, 401-6, 403-2, 403-7, 404-2, 404-3, 406-2, 407-2.2 thru 407-2.4, 420-4.2, 420-4.8, 440-6, 441-7, 441-8, 442-3, 442-13, 442-17 thru 442-19, 450-1, 450-3.2 thru 450-3.5, 450-6.2, 450-6.3, 450-8.4, 450-8.5, 450-10.2 thru 450-10.7, 450-11.2, 450-11.5 thru 450-11.8, 460-3.4, 495-1, Forms Index, Table 497-5, Figures Index, and Figures 498-7, 498-23 and 498-27; and editorial revisions to Chapters 430, 470 and 480, Sections 400-2, 400-3, 401-4, 402-1, 402-2, 402-3.1 thru 402-3.3, 402-4, 403-1, 403-3, 403-5, 403-6.1, 403-6.2, 404-1, 406-1, 407-1, 408-1, 408-2, 420-2, 420-4.1, 420-4.4, 420-4.5, 420-5, 440-1 thru 440-3, 440-5, 440-7, 441-1, 441-2, 441-5, 441-10, 441-11, 442-1, 450-5, 450-6.1, 450-8.1, 450-10.1, 460-5, 460-7, 460-8, 460-9.2, 460-9.3, and Forms 496-2, 496-6 and 496-7; and minor editorial/format changes.

2006 July 21, 2006 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 4**, new Section 450-12; a revised Table of Contents and Section 420-4.6;
- **in Part 6**, new Sections 600-6, 606-21, 606-22, 642-48 thru 642-52, and Table 697-10; deleted Section 605-14.5; a revised Table of Contents, Sections 601-2, 602-3, 602-5.1, 602-5.3, 602-5.6, 602-5.7, 603-2, 603-3, 604-2, 604-3, 604-6, 605-1, 605-2.1 thru 605-2.3, 605-4.3, 605-5.1, 605-5.2, 605-5.5 thru 605-5.7, 605-5.9 thru 605-5.15, 605-6, 605-7.2, 605-7.3, 605-8.4, 605-9, 605-10.1, 605-10.2, 605-11.1 thru 605-11.13, 605-12.1 thru 605-12.5, 605-13.1, 605-14.1, 605-14.2, 605-14.4, 605-15.1, 605-16 thru 605-18, 605-20, 606-1, 606-3, 606-6 thru 606-9, 606-11 thru 606-20, 607-1, 607-6, 607-10, 607-13, 607-15, 620-3, 620-5, 630-5, 640-2, 640-5.2, 640-9, 640-12.1, 640-13.2, 640-18.1, 640-18.2, 640-24.1, 640-24.2, 640-25, 640-26, 641-5.4, 641-5.6, 641-6.4, 641-8.4, 641-9.6, 641-10.6, 641-11 thru 641-14, 641-18, 641-23, 642-4, 642-6, 642-17, 642-21, 642-24, 642-25, 642-27, 642-39, 642-44, 642-46, 670-5 and Tables Index; and editorial revisions in Chapter 643, Sections 600-1 thru 600-5, 602-1, 602-5.8, 602-6, 602-7.1, 602-7.3, 602-8, 603-1, 604-1, 604-4, 605-3.1, 605-4.1, 605-4.2, 605-5.8, 605-7.1, 605-8.1, 605-8.3, 605-13.2, 605-15.2, 605-19, 606-2, 606-5, 606-10, 607-4, 607-7, 607-11, 607-12, 620-1, 630-1, 630-3, 630-4, 640-1, 640-3, 640-4, 640-5.1, 640-6, 640-7.1, 640-8, 640-11.3, 640-11.5, 640-13.1, 640-14, 640-16, 640-17, 640-19 thru 640-21, 640-23.1, 640-23.3, 640-23.4, 641-1, 641-2.1, 641-2.3, 641-2.5, 641-2.7, 641-2.8, 641-3, 641-4, 641-5.1 thru 641-5.3, 641-6.1 thru 641-6.3, 641-6.5, 641-7.1, 641-7.3, 641-8.1, 641-8.3, 641-9.3, 641-10.1, 641-10.3, 641-10.7, 641-15 thru 641-17, 641-19, 642-1, 642-10, 642-30, 642-43, 642-47, 650-1, 660-1, 660-2, 670-1, 670-2, 670-6.2, 695-1, 695-2, 695-5, 695-6 and Table 697-1d; and minor editorial/format changes;
- **in Part 11**, deleted Section 1142-32; a revised Table of Contents, Chapter 1150, Sections 1104-3, 1130-5, 1140-4.2, 1140-4.4, 1140-4.6, 1140-5.7, 1140-5.9, 1140-7.3, 1141-3.6, 1142-14, 1142-15, 1142-24, 1160-2, 1160-3.1 and Figures Index; editorial revisions in Chapter 1195, Sections 1100-1, 1100-2, 1100-3, 1103-6.6, 1103-6.8, 1104-1, 1104-2, 1105-1 thru 1105-3, 1106-2.2, 1107-3, 1120-3, 1130-2, 1130-3.1, 1130-4, 1140-1, 1140-3.2, 1140-3.3, 1140-3.5, 1140-4.7, 1140-5.3 thru 1140-5.6, 1140-5.8, 1140-6.1, 1140-6.2, 1140-8, 1141-1, 1141-2, 1141-3.1 thru 1141-3.3, 1141-4.1 thru 1141-4.5, 1142-8, 1142-13, 1142-25, 1142-28, 1142-31, 1142-35, 1160-1, 1160-4, 1160-13.5, the Tables Index, Tables 1197-4 thru Table 1197-7 and Figure 1198-4; and minor editorial/format changes.

2006 September 5, 2006 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**; and
- **in Part 6**, deleted Table 697-6; a revised Table of Contents, Sections 605-8.4, 605-12.2, 605-15.2, 606-10, 606-16, 607-10, 630-5, 640-5.1, 640-9, 641-5, 641-6.2, 641-6.4, 641-11, 641-18, 641-19, 642-10, 642-42, Tables Index, and Figures 698-6 and 698-8; and editorial revisions in Sections 601-2, 630-4, 630-6, and Table 697-10; and minor editorial/format changes.

2006 October 20, 2006 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 3**, revised Form 396-1;
- **in Part 4**, revised Section 420-4.2;
- **in Part 6**, a revised Table of Contents and Sections 642-26, 642-50 and 642-51;
- **in Part 8**, revised Chapter 805; and
- **in Part 12**, new Sections 1215-1 thru 1215-5 and 1230-7, Form 1296-13, Table 1297-5 and Figures 1298-17 thru 1298-40; a revised Table of Contents, Chapters 1210 and 1211, Sections 1201-1 thru 1201-5, 1202-1, 1212-2, 1212-3, 1213-1, 1213-2, 1220-2, 1220-6, 1230-1 thru 1230-3, 1230-6, 1250-2, Forms Index, 1296-1, 1296-2, 1296-11, 1296-12, Tables Index,

Figures Index and Figures 1298-2, 1298-6, 1298-7, 1298-10, 1298-11, 1298-12, 1298-15, 1298-16; and editorial revisions in Chapters 1200, 1214, 1280 and 1295, Sections 1212-1, 1212-4, 1213-3, 1220-1, 1220-3 thru 1220-5, 1250-1; and minor editorial/format changes.

2007 January 19, 2007 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 1**, revised Figure 198-1;
- **in Part 2**, new Sections 202-9, 202-10, 204-5, 204-6, 220-10 and 221-6, Tables 297-12 and 297-13, and Figures 298-38 through 298-44; a revised Table of Contents, Sections 201-1, 201-3, 202-7, 203-1, 205-3, 208-1 and 221-5, Tables Index, Figures Index, Figure 298-6, 298-14, 298-15 and 298-27; editorial corrections in Sections 200-1, 201-5, 201-7, 204-4, 207-5, 207-6, 240-4, 250-4, 250-7 and 260-5, Table 297-4, and Figures 298-26 and 298-28 through 298-32; and minor editorial/format changes;
- **in Part 4**, new Sections 442-30, 442-31 and 442-32, and Figures 498-39, 498-40, 498-41 and 498-42; a revised Table of Contents and Figures Index; editorial corrections in Sections 407-2 and 450-10, and Figure 498-1; and minor editorial/format changes;
- **in Part 6**, a new section 620-7; a revised Table of Contents and Sections 605-1, 605-2, 605-11, 620-2, 620-4, 640-18, 642-24, 642-27, 642-33 and 642-34; editorial corrections in Sections 605-4, 605-5, 620-1, 641-17 and 641-19; and minor editorial/format changes; and
- **in Part 7**, revised Chapter 704.

2007 April 20, 2007 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 1**, revised Sections 103-3, 103-4, 104-2 and 104-3, Table Index, and Tables 197-1 through 197-3, and 197-5 through 197-10;
- **in Part 2**, a revised Table of Contents, Section 207-4, Figures 298-15 and 298-22; and editorial corrections in Figures 298-12, and 298-13 ;
- **in Part 4**, new Sections 402-5 and 402-6, and Tables 497-7 and 497-8; a revised Table of Contents, Forms Index, Forms 496-12 and 496-13, and Tables Index; editorial corrections in Sections 402-3, 404-2, 404-3 and 450-8, and Figures 498-6 through 498-8, 498-21, 498-26, and 498-28 through 498-35; and minor editorial/format changes;
- **in Part 6**, new Sections 641-24 and 642-53, a revised Table of Contents and Sections 602-2, 605-14, 607-12, 607-13, 640-1, 640-12, 641-23, 642-9, 642-21, 642-22, 642-30, 642-31, 642-44 and 642-48; editorial corrections in Sections 640-2, 641-6, 641-7, 641-19, 642-10, 642-11, 642-16 and 642-42; and minor editorial/format changes;
- **in Part 11**, revised Section 1140-5; and
- **in Part 12**, a revised Table of Contents and Section 1220-3.

2007 July 20, 2007 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 1**, new Sections 120-7, 150-3, 195-3 through 195-7 and Figures 198-3 through 198-6; revised Table of Contents, Chapters 106, 160, 180 and 195, Sections 100-1, 100-4, 101-2, 101-5, 102-1 through 102-3, 120-1 through 120-6, 130-2, 140-7, 193-9 and 195-1, Forms 196-1 and 196-3, Tables 197-2, 197-3, 197-9 and 197-10, and Figures Index; editorial corrections in Sections 193-7, 193-10, 193-15 and 193-16; and minor editorial/format changes;
- **in Part 2**, a revised Table of Contents and Sections 220-2, 220-3, 240-4, 260-4 and 295-2;
- **in Part 3**, revised Sections 320-2 and 320-3;
- **in Part 4**, new Sections 401-9 and 440-8; a revised Table of Contents and Sections 401-2, 404-3, 420-2, 420-3 and 420-4;
- **in Part 6**, new Chapter 608, Section 695-7, Forms 696-2 through 696-9, and Figure 698-10; a revised Table of Contents, Sections 600-4, 600-6, 601-2, 602-3, 602-5, 605-3, 605-14, 605-17, 605-19, 606-14, 606-20, 630-4, 630-5, 640-12 through 640-14, 640-18, 641-2, 641-24, 642-35, 642-51, 642-52, 695-6, Forms Index, Form 696-1 and Figures Index; editorial corrections in Sections 607-13, 620-7, 630-1, 630-6, 640-23, 640-26, 641-6 and Figure 698-1; and minor editorial/format changes;
- **in Part 8**, revised Chapter 805;
- **in Part 11**, a revised Table of Contents and Sections 1120-3 through 1120-5;
- **in Part 12**, new Chapters 1203, 1204 and 1205, a revised Table of Contents, Chapters 1200, 1201, 1202, 1210, 1211, 1212, 1213, 1220, 1250, 1280, Forms Index, Form 1296-1, Tables Index, Figures Index, and Figures 1298-1, 1298-3 through 1298-5, 1298-21 and 1298-24; deleted Chapters 1213 through 1215, and 1230; editorial corrections in Form 1296-2 and Figures 1298-21 and 1298-24; and minor editorial/format changes;
- **in Part 13**, new title, Table of Contents and Chapters replaced existing text, which was relocated Part 15;
- **in Part 14**, new title, Table of Contents, Chapters 1400, 1401, 1402, 1415, 1420, 1430, 1450, 1480, 1495, Forms Index, and Form 1496-1; and deleted the index; and
- added **Part 15**.

2007 October 19, 2007 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 1**, revised Table of Contents, Section 120-4, and Tables 197-1 and 197-2; an editorial correction in Sections 101-2; and minor editorial/format changes;
- **in Part 2**, revised Figures 298-10 and 298-29 through 298-32; editorial corrections in Section 240-4 and Figures 298-8, 298-9, 298-11 and 298-26; and minor editorial/format changes;
- **in Part 3**, an editorial correction in Table 397-1;

- **In Part 4**, a revised Table of Contents and Section 406-3; deletion of Section 402-6; and an editorial correction in Section 401-9;
- **in Part 6**, revised Table of Contents and Sections 641-12, 641-13, 641-14, 641-15, 642-30, 642-39 and 642-41;
- **in Part 11**, a revised Table of Contents; and editorial corrections to Chapters 1103 and 1120, and Section 1150-3;
- **in Part 13**, a revised Section 1301-3, Forms Index, and Form 1396-1.

2008 January 18, 2008 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 4**, new Section 460-10 and Table 497-9; a revised Table of Contents, Sections 440-4, 442-13, 442-17, 442-24, and Tables Index; and minor editorial/format changes;
- **in Part 6**, new Form 696-6; renumbered Forms 696-1 through 696-9 (now Forms 696-1a, 696-1b, 696-2a, 696-2b, 696-3a, 696-3b, 696-4a, 696-4b and 696-5); a revised Table of Contents, Sections 605-2, 605-9, 605-13, 605-14, 605-18, 606-6, 606-16, 630-5, 640-2, 640-12, 640-19, 641-9, 641-10, 642-18, 642-39, 642-44 and 695-7, and Forms Index; editorial corrections in Sections 606-1, 640-11, 641-1, 641-12 through 641-15, and Figure 698-3a; and minor editorial/format changes; and
- **in Part 13**, revised Sections 1301-1 and 1301-2, Forms 1396-1 and 1396-2, and Table 1397-1.

2008 April 18, 2008 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 1**, revised Tables 197-2 and 197-9; ;
- **in Part 2**, revised Table of Contents and Sections 240-4 through 240-6; and minor editorial/format changes;
- **in Part 3**, revised Table of Contents, Sections 342-3, 350-7 and 350-8; and minor editorial/format changes;
- **in Part 4**, new Section 401-10; a revised Table of Contents, Chapter 443, Sections 403-6, 403-7, 440-2, 440-6, 441-6, 441-9, 442-1, 442-3, 442-6, 442-11, 442-17 through 442-19, 442-24, 450-3, 450-8, 450-10, 450-11, 460-4, 460-7, 460-8, Forms Index, Forms 496-14, 496-15, 496-19, Tables 497-1, 497-4, and Figures 498-10, 498-22, 498-25, 498-34 and 498-37; editorial corrections in Section 442-32, the Figures Index and Figure 498-37; and minor editorial/format changes;
- **in Part 6**, new Section/Plan Note 642-54; a revised Table of Contents, Sections 605-9, 605-11, 605-13, 620-6, 640-2, 641-10, 642-39; and minor editorial/format changes; and;
- **in Part 7**, new Chapter 742 with new Sections 742-1 and 742-2; a revised Table of Contents, and Section 702-4; and minor editorial/format changes
- **in Part 11**, editorial correction in Section 1142-25; and minor editorial/format changes;
- **in Part 13**, deleted Form 1396-2; revised Table of Contents, Section 1301-1, Forms Index and Figures Index; and minor editorial/format changes.

2008 July 18, 2008 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 2**, new Section 206-17 and Table 297-14; a revised Table of Contents and Sections 201-6, 240-4, 260-5, the Table Index and Figure 298-18; and minor editorial/format changes;
- **in Part 3**, revised Table of Contents; deleted Sections 341-6, 342-4 and 342-5;
- **in Part 4**, new Section 440-9; a revised Table of Contents and Section 440-3;
- **in Part 6**, new Section 604-21, a revised Table of Contents, Sections 605-11, 605-18, 605-20, 607-15, 640-2, 642-24, 642-39, 642-41 and 642-50; and minor editorial/format changes;
- **in Part 7**, revised Table of Contents and Section 702-4; and minor editorial/format changes; and
- **in Part 12**, new Forms 1296-14 through 1296-16, and Table 1297-6; revised Table of Contents, Chapters 1201 and 1202, Sections 1203-1 through 1203-5, the Forms Index, Forms 1296-1, 1296-3, 1296-4, 1296-11, the Tables Index, the Figures Index, Figures 1298-3 through 1298-5; and minor editorial/format changes.

2008 October 17, 2008 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;
- **in Part 2**, new Section 201-14; a revised Table of Contents and Section 210-3;
- **in Part 3**, new Table 397-5; revised Table of Contents, Section 350-2 and Tables 397-1, 397-3 and 397-4; deleted Figure 398-6; editorial changes in Sections 301-13, 302-2, 303-3, 307-2, 320-4, 350-6, 350-7, 350-8, the Tables Index and the Figures Index; and minor editorial changes;
- **in Part 4**, a revised Table of Contents, Chapter 430, and Sections 401-3, 442-26, 442-28, 460-2 and 460-2; editorial changes in Sections 401-10 and 403-3; and minor editorial changes;
- **in Part 6**, a revised Table of Contents, Sections 605-13, 605-20, 620-6, 640-18, 640-23, 641-23, 642-24, 642-25, 642-48 and 642-50; editorial changes in Sections 602-6, 605-2, 605-9, 605-10, 605-11, 605-19, 608-2, 620-3, 620-7, 641-9, 641-10, 641-24, 642-21, 642-27, 642-41, 642-54 and 670-6; and minor editorial/format changes;
- **in Part 7**, revised Table of Contents; and an editorial change in Section 702-2;
- **In Part 11**, revised Figure 1198-12;
- **In Part 12**, new Section 1213-6; revised Table of Contents, Chapter 1210, Section 1213-1 and Forms 1296-1 and 1296-14; editorial changes in Section 1212-10; and minor editorial/format changes; and
- **in Part 13**, new Figures 1398-2 and 1398-3; revised Table of Contents, Sections 1301-1, 1301-2, 1301-3, Form 1396-1 and Table 1397-3; and editorial changes in the Forms Index and the Figures.

2009 January 16, 2009 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new **Cover Sheet** and an updated **Publication Record** and **Table of Contents**;

- **in Part 2**, a revised Table of Contents and Sections 201-3 and 240-5; and minor editorial/format changes;
- **in Part 3**, new Section 342-4; and a revised Table of Contents;
- **in Part 4**, new Sections 442-33 through 442-39; a revised Table of Contents, Sections 403-5, 440-3, 440-4 and 450-8, Tables Index, Tables 497-4 and 497-5, Figures Index and Figures 498-3 through 498-5, 498-12, 498-35 and 498-37; editorial change for Section 401-10; and minor editorial changes;
- **in Part 6**, new Section 641-19 and renumbered existing Sections 641-19 through 641-24, a revised Table of Contents, Sections 603-2, 605-5, 605-11, 605-13, 640-6, 640-22, 640-24, 640-25, 641-9, 641-10, new 641-21 (formerly 641-20), new 641-22 (formerly 641-21), 642-4, 642-6, 642-14, 642-15, 642-35, 642-38 and 642-39; editorial change in Section 642-41; and minor editorial/format changes; and
- **in Part 13**, new Section 1301-4 and Form 1396-2; deleted Figure 1398-1 and renumbered Figures 1398-2 and 1398-3; revised Table of Contents, Sections 1301-1 through 1301-3, Forms Index, Form 1396-1, Tables Index, Table 1397-1, and the Figures Index; editorial corrections in Table 1397-3; and minor editorial/format changes.

2009 March 6, 2009 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents; and
- **in Part 2**, a revised Section 240-4.

2009 April 17, 2009 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents; and
- **in Part 2**, new Tables 297-15, 297-16, 297-17 and 297-18; a revised Table of Contents, Sections 206-8, 206-13, 207-2, 207-3, 240-4, the Tables Index, and Figures 298-5a and 298-5b; editorial change in Section 207-4; and minor editorial/format changes;
- **in Part 3**, new Sections 301-15 and 341-6; and a revised Table of Contents and Sections 301-10, 302-1 and 341-4; and editorial changes in Chapters 350, 360, 370, 380, 395 and Table 397-2;
- **in Part 4**, a revised Table of Contents, Chapter 443, Sections 401-7, 403-2, 440-3, 440-6, 442-7, 442-8, 442-13, 442-17, 442-18, 442-25 and 442-32, and Figure 498-5; editorial changes for Sections 442-20 and 442-22; and minor editorial changes;
- **in Part 6**, new Section 604-5 and renumbered existing Sections 604-5 and 605-6, new Section 640-28, and new Section 641-19 and renumbered existing Sections 641-19 through 641-25, and new Figures 698-11 and 698-12; a revised Table of Contents, Sections 601-2, 605-2, 605-5, 605-11, 605-14, 605-19, 606-10, 620-4, 640-9, 640-11, 640-12, 640-19, 640-22, 640-23, 641-5, 641-6, 641-9, 641-10, 641-17, 641-18, new 641-20 through 641-22 (formerly 641-19 through 641-21), new 641-24 through 641-26 (formerly 641-23 through 641-25), 642-6, 642-14, 642-15, 642-18, 642-30, 642-31 642-36, 642-37, 642-44, 642-46, 642-50, 642-53, and 642-54, the Tables Index, and the Figures Index; editorial changes in Sections 641-8 and 642-24, and Form 696-1a; and minor editorial/format changes;
- **in Part 9**, new Sections 940-1 and 940-2, and a new Chapter 942, with new Sections 942-1 and 942-2; a revised Table of Contents and Chapter 940;
- **in Part 12**, a new Section 1213-7; a revised Table of Contents, Chapter 1210, Sections 1203-2, 1203-3, 1213-1, the Forms Index, Form 1296-2 and Form 1296-14; editorial changes in Sections 1203-1 and Form 1296-1; and minor editorial/format changes;
- **in Part 13**, a revised Table of Contents, Sections 1301-1, 1301-2, 1301-3 and 1301-4, and Form 1396-1; and minor editorial/format changes; and
- **in Part 15**, a revised Table of Contents, Chapter 1505, and Section 1501-3; and minor editorial/format changes.

2009 July 17, 2009 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 1**, new Section 195-8, a revised Table of Contents, Chapter 106, Sections 100-1, 100-4, 100-5, 101-4, 101-5, 102-1, 102-3 through 102-5, 103-1, 103-3 through 103-5, 104-1 through 104-4, 105-1, 120-3, 120-6, 130-2, 130-4 through 130-6, 140-7, 193-7, 193-11, 194-1, 194-17, 194-18, 195-3 through 195-6, Forms Index, Forms 196-1 and 196-3, Tables Index, Tables 197-1 through 197-3, Tables 197-9 and 197-10, and Figure 198-2; editorial changes in Section 140-2 and Figure 198-6; and minor editorial/format changes;
- **in Part 2**, new Sections 202-11 and 242-6; a revised Table of Contents, Sections 201-3, 201-6, 201-8, 201-11, and Section 295-2; editorial changes in Sections 202-6 and 206-11; and minor editorial/format changes;
- **in Part 3**, revised Chapter 343, Sections 302-5, 304-3, 320.1, 320-5, and Form 396-1; editorial changes in Sections 301-3, 301-7, 301-10, 301-14, 350-7 and Table 397-1; and minor editorial changes;
- **in Part 4**, new Section 403-8; a revised Table of Contents, Chapter 443; Sections 402-2, 402-3, 408-2, 420-1, 421-1, 421-2, 440-3, 440-8, 441-7, 442-27, 442-29, 450-1, 460-7, 460-9, and the Forms Index; editorial changes in Sections 440-4, 442-5, 442-22, 442-32 and 442-33; and minor editorial changes;
- **in Part 6**, a revised Table of Contents, Sections 600-4, 605-4, 605-11, 605-13, 605-14, 608-4, 608-11, 608-12, 620-3, 620-7, 640-9, 641-3, 641-4, 641-10, 642-50, 650-2, 650-3, 660-3, 670-3, 695-2, 695-4, 695-6, and 695-7; editorial changes in Sections 601-2, 604-5, 605-9, 605-10, 608-2, 608-4, 630-4, 630-5, 640-23, 640-26, 642-43, 642-44, and the Forms Index; and minor editorial/format changes;
- **in Part 13**, revised Sections 1301-3 and 1301-4, the Forms Index, and the Tables Index; editorial change in Section 1301-1; and minor editorial/format changes.

2009 October 16, 2009 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 1**, new Section 140-8, a revised Table of Contents; revised Sections 120-4 and 193-19, and Table 197-2; and minor editorial/format changes;

- in **Part 3**, a revised Section 342-2;
- in **Part 4**, a revised Table of Contents, Sections 420-5, 440-7, 450-10, 450-11, Forms 496-4 and 496-6, the Figures Index, and Figures 498-3 through 498-5, 498-23, 498-27, 498-29, 498-30 and 498-33; an editorial correction in Sections 420-4; and minor editorial changes;
- in **Part 11**, a revised Table of Contents; revised Sections 1140-4, 1142-24 and 1142-26, and Figure 1198-12; editorial corrections in Sections 1140-6, 1140-8, 1142-25; and minor editorial/format changes.

2010 January 15, 2010 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- in **Part 1**, revised Section 101-5, Forms 196-3 and 196-4, and Table 197-2;
- in **Part 2**, new Sections 202-12, 202-13 and 260-7, a revised Table of Contents and Sections 201-8 and 240-2;
- in **Part 3**, new Section 301-16, and a revised Table of Contents, Section 301-14 and Table 397-2;
- in **Part 4**, a revised Table of Contents and Section 440-3; and minor editorial changes.

2010 April 16, 2010 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- in **Part 1**, new Sections 130-7 and 140-9; a revised Table of Contents and Sections 140-8, 195-2, and Tables 197-2 and 197-9; and an editorial correction in Section 130-6;
- in **Part 4**, new Sections 403-9, 403-10, 442-40, 442-41 and 442-42; a revised Table of Contents and Sections 402-3, 403-3, 403-6 and 420-5; and minor editorial/format changes;
- in **Part 8**, new Sections 804-1 through 804-4, 830-3, 830-4, 840-1 through 840-4, 895-5, a new Forms Index and Form 896-1, and a new Figures Index and Figure 898-1; a revised Table of Contents, Chapters 804 and 840, Section 830-1; and minor editorial/format changes; and
- in **Part 10**, a revised Chapter 1000.

2010 May 14, 2010 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- in **Part 6**, new Section 660-4 and new Figures 698-13 and 698-14; a revised Table of Contents and Section 660-1, and a revised Figures Index; editorial corrections in Sections 601-2, 608-4, 608-6, 608-8, 630-4, 630-5, 640-1, 640-13, 640-14, and Figure 698-1; and minor editorial/format changes.

2010 July 16, 2010 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- in **Part 2**, a revised Table of Contents and Sections 202-4, 202-12, 202-13 and 205-3, Tables 297-1, 297-4, 297-12, 297-13 and 297-17, and Figures 298-20, 298-22 and 298-28; editorial corrections in the Figures Index and Figure 298-10; and minor editorial/format changes;
- in **Part 3**, a revised Table of Contents and Sections 301-1, 301-8 and 301-15; and an editorial correction in Section 301-16;
- in **Part 4**, a revised Table of Contents and Sections 440-3, 442-25, 442-26, 442-27, 442-28, 442-29, 442-31, 442-40, 442-41 and 450-8;
- in **Part 6**, a revised Table of Contents and Sections 605-6, 605-8, 642-41, 642-44 and 670-4, Table 697-1b, and Figure 698-3b;
- in **Part 7**, a revised Section 742-2; and
- in **Part 9**, new Chapters 901 and 902; a revised Table of Contents and Chapter 900, and Sections 940-1 and 940-2.

2010 October 15, 2010 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents; ;
- in **Part 1**, a revised Table of Contents and Sections 140-7 and 195-8, and Table 197-9;
- in **Part 2**, a revised Table of Contents and Sections 209-2, 211-1 through 211-4 and 240-8; editorial corrections in Tables 297-16 and 297-17; and minor editorial/format changes;
- in **Part 3**, revised Chapter 343, Sections 302-1, 304-1, 304-3, 307-1, 320-5, 341-2, 350-3, 350-6 and 350-8; and minor editorial changes;
- in **Part 4**, a revised Figure 498-21;
- in **Part 6**, a revised Table of Contents and Sections 602-8, 605-11, 606-16, 607-10, 640-12, 641-9, 641-21, 641-25 and 695-4; an editorial correction in Section 640-18; and minor editorial changes; and
- in **Part 9**, a revised Table of Contents and Chapter 930 (replacing the existing text with new Sections 930-1 and 930-2).

2011 January 21, 2011 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- in **Part 2**, a revised Table of Contents and Sections 212-1 through 212-3, 240-4 , 240-7, 250-4, 250-5, 250-7 and 250-8; and minor editorial/format changes;
- in **Part 3**, revised Table of Contents and Section 301-9, the Figures Index, and Figure 398-1;
- in **Part 4**, a revised Table of Contents and Sections 403-6, 420-4, 440-2, 440-5, 440-7, 442-27, 442-29, Tables 497-1 and 497-6; and an editorial change in Figure 498-38;

- **in Part 6**, a revised Table of Contents and Sections 605-19, 605-20, 607-10, 642-50 and 642-51 and Figures 698-3a and 698-3b,
- **in Part 8**, a revised Section 804-4; and
- **in Part 11**, a revised Table of Contents and Chapter 1142, deleting fourteen Plan Notes, while renumbering and revising the others.

2011 April 15, 2011 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 1**, revised Forms 196-3, 196-4 and 197-9, and Figure 198-1;
- **in Part 2**, revised Sections 241-6;
- **in Part 4**, a revised Sections 440-5, 441-7, 441-10, 442-10, 460-2 and 460-3; editorial changes in Sections 440-3, 440-8, 441-3, 441-5, 441-6, 442-12 and 442-14; and other minor editorial/format changes;
- **in Part 6**, new Section 650-4; a revised Table of Contents and Sections 600-2, 602-6, 602-8, 603-3, 605-2, 605-14, 605-15, 608-5, 608-8, 620-7, 640-4, 640-11, 640-12, 640-13, 640-17, 640-18, 641-2, 641-5, 641-6, 641-7, 641-8, 641-9, 641-25, 642-6, 642-24, 642-26, 642-30, 642-31, 642-33, 642-48, and 650-3, the Tables Index, and Table 697-7; editorial changes to Sections 600-5, 602-4, 602-5, 602-7, 604-5, 605-4, 605-5, 605-6, 605-7, 605-11, 605-13, 605-17, 605-18, 605-19, 605-20, 606-6, 606-7, 606-9, 607-10, 630-5, 640-2, 640-5, 640-25, 640-28, 641-10, 641-12 through 641-17, 641-19, 641-20, 641-21, 641-26, 642-9, 642-10, 642-15, 642-16, 642-19, 642-21, 642-25, 642-27, 642-28, 642-34, 642-35, 642-39, 642-40, 642-41, 642-50 through 642-54, 670-6 and 695-4, Tables 697-1c, 697-2, 697-4, 697-8 and 697-9, and the Figures Index; and other minor editorial/format changes;
- **in Part 8**, a revised Section 804-4.
- **in Part 12**, new Forms 1296-6b, 1297-7b, 1296-17, 1296-18 and 1296-19; a revised Table of Contents, Chapter 1250, Sections 1203-1, 1203-2, 1203-3, 1203-4, 1203-5, 1204-2, 1204-5, the Forms Index, Forms 1296-6a, 1296-7a and 1296-16, the Tables Index, Table 1297-7, the Figures Index and Figure 1298-1; and editorial changes in Forms 1296-2, 1296-4, 1296-11 and 1296-12; and other minor editorial/format changes; and
- **in Part 14**, a revised Table of Contents, the Chapter 1415 title and Sections 1401-1, 1401-2, 1401-3, 1401-6, 1402-1, 1415-1, 1415-2, 1415-3; editorial changes in Sections 1401-4 and 1401-5, the Form Index, and Form 1496-1; and other minor editorial/format changes.

2011 July 15, 2011 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 2**, a revised Table of Contents and Section 206-5;
- **in Part 4**, an editorial change in Section 460-8; and
- **in Part 11**, a revised Table of Contents, Section 1140-4, the Figure Index, and Figure 1198-6; and other minor editorial/format changes.

2011 October 21, 2011 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 2**, a revised Table of Contents;
- **in Part 3**, revised Sections 301-5 and 350-4; and other minor editorial changes;
- **in Part 4**, revised Sections 420-4 and 450-8; and other minor editorial changes;
- **in Part 6**, revised Sections 642-37 and 642-41; and a minor editorial correction; and
- **in Part 11** a revised Table of Contents; revised Section 1120-5; deleted Section 1142-15; and other minor editorial changes.

2012 January 20, 2012 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 1**, revised Forms 196-3 and 193-4, and Table 197-3; and made editorial corrections in Sections 100-1 100-4, 101-4, 101-5, 102-4, 102-5, 103-1, 103-4, 103-5, 104-1 104-3, 104-4, 105-1, 106, 195-3, 195-5, 195-6, 195-8, 196-1, 196-2, 196-3, and 196-4;
- **in Part 3**, revised Chapters 305, 306, and 310, Sections 300-1, 301-1, 301-4, 301-5, 301-6, 301-7, 301-8, 301-9, 301-10, 301-11, 301-12, 301-14, 303-1, 303-2, 304-1, 304-3, 304-5, 304-6, 341-2, 342-2, 342-4, 350-3, 350-5, 350-6, 350-7, 350-8, Table 397-2, and Figures 398-2, and 398-3;
- **in Part 4**, a revised Table of Contents; Sections 400-1, 401-7, 403-2, 403-6, 403-10, 404-3, 405-1, 406-1, 406-3, 407-2, 408-1, 408-2, 420-4, 420-5, 421-1, 441-3, 450-10, Table 497-3; and deleted Section 403-7;
- **in Part 5**, revised Chapter 500;
- **in Part 6**, revised Sections 602-5, 602-6, 604-5, 604-6, 604-7, 605-3, 605-5, 605-6, 605-7, 605-9, 605-10, 605-11, 605-12, 605-13, 605-14, 606-15, 605-17, 605-18, 605-21, 606-14, 606-18, 606-19, 606-21, 606-22, 607-1, 607-2, 620-6, 640-18, 640-26, 641-5, 641-7, 641-8, 641-9, 641-10, 641-12, 641-13, 641-14, and 641-15;
- **in Part 8**, a new Part Title; a revised Table of Contents, Chapters 800, 803 and Sections 802-1, 804-1, 804-2, 804-3, 830-3, 840-2, 840-3, and 840-4;
- **in Part 9**, revised Chapter 900;
- **in Part 10**, contents have been incorporated into Part 8; Part 10 now reserved for future use; and
- **in Part 11**, a revised Table of Contents, and Section 1141-4.

2012 April 20, 2012 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;

- **in Part 1**, a revised Table of Contents; revised Sections 101-2, 101-3, 101-4, 102-2, 102-3, 102-5, 103-2, 103-3, 103-5, 120-4, 120-6, 120-7, 130-6, 140-7, 193-7, 193-15, 193-19, 194-6, 194-10, 194-14, 195-3, and 195-4; revised Tables 197-1, 197-2, 197-9, 197-10; and revised Figures 198-1, 198-5 and 198-6.
- **in Part 2**, a revised Table of Contents; new Sections 202-14 and 242-7; revised Sections 200-1, 201-1, 201-2, 201-3, 201-5, 201-6, 201-7, 201-8, 201-10, 201-11, 201-12, 201-13, 202-1, 202-4, 202-5, 202-6, 202-7, 202-9, 202-10, 202-11, 202-12, 203-1, 203-2, 204-2, 204-3, 204-4, 205-1, 205-2, 205-3, 205-4, 205-5, 205-6, 206-1, 206-3, 206-4, 206-5, 206-6, 206-7, 206-8, 206-10, 206-11, 206-12, 206-14, 206-15, 206-16, 206-17, 207-1, 207-2, 207-3, 207-4, 207-5, 207-6, 207-7, 207-8, 208-1, 208-2, 208-3, 208-4, 208-5, 209-1, 209-2, 209-3, 209-4, 209-5, 209-6, 209-7, 210-3, 211-1, 211-2, 211-3, 211-4, 212-1, 212-2, 220-5, 220-6, 220-7, 220-10, 221-1, 221-2, 221-3, 221-4, 221-5, 221-6, 240-2, 240-3, 240-4, 240-5, 240-6, 240-7, 240-8, 241-5, 242-3, 242-4, 242-5, 242-6, 250-3, 250-4, 250-5, 250-6, 250-7, 260-2, 260-4, 260-5, 295-2; deleted Section 210-2; revised Tables 297-1, 297-2, 297-8f, 297-9, 297-10, 297-12; and deleted Table 297-13; revised Figures Index, revised Figures, 298-4a, 298-4b, 298-5a, 298-5b, 298-7, 298-9, 298-11, 298-12, 298-13, 298-15, 298-18, 298-29, 298-30, 298-31, 298-32, 298-42; and deleted Figure 298-10
- **in Part 3**, a revised Table of Contents, new Section 342-5; revised Sections 301-4, 301-9, 301-10, 301-13, 301-14, 302-6, 304-4, 304-5, 304-6, 340-2, 341-2, 342-2, and 350-8; revised Chapter 305, deleted Chapter 303; and other minor editorial/format changes.
- **in Part 4**, a revised Table of Contents, new Sections 442-43 and 442-44; revised Sections 401-7, 402-2, 402-3, 403-2, 404-2, 404-3, 407-2, 420-1, 420-4, 421-1, 440-3, 440-7, 441-6, 441-8, 442-5, 442-9, 442-19, 442-21, 442-25, 442-29, 442-36, 442-39, 442-40, 442-41, 450-3, 450-6., 450-8, 450-10, 460-3; revised Forms 496-2 and 496-5; revised Table 497-3, revised Figures Index, and revised Figures 498-1, 498-3, 498-4, and 498-5; and other minor editorial/format changes.
- **in Part 6**, a revised Table of Contents, revised Chapter 643; revised Sections 602-4, 602-8, 605-10, 606-7, 607-1, 607-15, 620-7, 640-21, 640-26, 640-28, 641-5, 641-6, 641-9, 641-17, 642-41, 650-2, 660-2, and 660-3; and revised Figures 698-13 and 698-14.
- **in Part 11**, a revised Table of Contents; and deleted Section 1142-4.

2012 July 20, 2012 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 1**, a revised Table of Contents; revised Chapter 106; revised Sections 100-1, 100-4, 100-5, 100-6, 101-4, 102-4, 102-5, 103-1, 103-3, 103-4, 105-1, 105-2, 120-5, 193-1, 193-3, 194-1, 194-22, 195-1, and 195-2; revised Form 196-3; revised Tables Index; deleted Tables 197-1 and 197-2 (with subsequent Tables renumbered).
- **in Part 2**, a revised Table of Contents; new Section 241-8; revised Sections 202-14, 240-4; and Revised Figures 298-5b, 298-6a, 298-6b, 298-6c, 298-6d, 298-7, 298-8, 298-9, 298-22, 298-28, 298-29, 298-30, 298-31, 298-32, 298-33, 298-34, 298-35, 298-36, 298-39, 298-40, 298-41, 298-42, and 298-43.
- **in Part 3**, a revised Table of Contents; new Section 341-6; revised Sections 301-8, 301-12, 301-14, 302-6, 304-4, 304-5, 304-6, and 307-2, revised Figures Index; deleted Section 341-5; and deleted Figure 398-1 (with subsequent Figures renumbered).
- **in Part 4**, a revised Table of Contents; new Sections 403-7, 442-45, 442-46, and 442-47; revised Sections 440-3, 442-4, 442-21, and 442-44; and deleted Section 442-42.
- **in Part 6**, a revised Table of Contents; new Section 642-46; revised Chapters 643, and 695: revised Sections 604-5, 605-14, 605-18, 605-19, 605-20, 608-10, 620-1, 620-7, 630-5, 640-2, 640-6, 640-19, 640-28, 641-5, 641-6, 641-9, 641-10, 641-13, 641-17, 641-19, 641-20, 641-21, 642-26, 642-35, 642-41, 642-45, 642-50, 660-2, and 660-4; revised Table 697-5; revised Forms Index; revised Figures Index; deleted Form 696-5: and deleted Figures 698-11 and 698-12 (with subsequent Figures renumbered).
- **in Part 7**, a revised Table of Contents; new Section 702-8; revised Chapters 701 and 704; revised Sections 702-2, 702-3, 702-4, 702-5, 702-6, 702-7, 705-1, 705-2 and 705-4; revised Forms Index 796; revised Forms 796-2 and 796-3; and an editorial correction in Table 797-1.
- **in Part 11**, a revised Table of Contents; and revised Sections 1140-5, 1140-6, 1142-10, 1142-12, 1142-16 and 1142-18.
- **in Part 12**, a revised Table of Contents; revised Chapter 1202; revised Sections 1211-1, 1211-4, 1211-10, 1212-1, 1212-8, 1212-10, 1213-6, and 1213-7; revised Forms Index; deleted Form 1296-13; revised Tables Index; deleted Table 1297-5; and an editorial correction in Table 1297-4.

2012 October 19, 2012 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover Sheet and an updated Publication Record and Table of Contents;
- **in Part 2**, revised Sections 207-7, 208-6, 220-8 and 242-6; an editorial correction in Section 208-4;
- **in Part 3**, revised Section 302-5; and editorial corrections in Sections 301-16 and 341-6;
- **in Part 4**, a revised Table of Contents; a new Figure 498-43; revised Chapter 443, Sections 401-8, 403-3, 403-6, 403-8, 403-9, 404-2, 407-2, 420-1, 420-4, 421-1, 421-2 and 450-10, the Forms Index, and the Figures Index; and an editorial correction in Section 440-3;
- **in Part 6**, a revised Table of Contents; revised Sections 605-5, 606-6, 641-3, 641-4 and 642-37; and
- **in Part 12**, revised Sections 1213-6 and 1213-7.

2013 January 18, 2013 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a new Cover, Title Sheet and an updated Publication Record and Table of Contents;
- **in Part 2**, a revised Table of Contents; new Sections 240-9 and 242-8; revised Sections 240-4, 241-7, 242-5 and Table 297-4; and an editorial correction in Section 240-8;
- **in Part 4**, a revised Table of Contents; new Sections 405-3, 442-48, 442-49 and 442-50; revised Chapter 443; revised Sections 403-9, 420-1, 420-5, 421-1, 440-3, 440-5, 440-7, 442-44, 450-3, 450-6, 450-8 and 450-10; and miscellaneous minor editorial/format corrections;
- **in Part 6**, revised Sections 642-41 and 670-6;
- **in Part 9**, a revised Table of Contents; and revised Section 902-2; and

- **in Part 11**, a revised Table of Contents; revised Sections 1103-6 and 1140-4; and an editorial correction in Section 1120-5.
- 2013 April 19, 2013** – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a revised Title Sheet, Publication Record and Table of Contents; and
 - **in Part 6**, revised Table of Contents; revised Sections 642-41 and 642-46, and deleted Section 642-45.
- 2013 July 19, 2013** - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a revised Title Sheet, Publication Record and Table of Contents;
 - **in Part 4**, revised Section 403-10; and an editorial correction in Section 442-32;
 - **in Part 6**, revised Table of Contents; added new Figure 698-11; revised Sections 601-2, 602-5, 603-2, 605-2 – 605-5, 605-7, 605-11 – 605-14, 605-17 – 605-19, 606-10, 606-11, 606-13, 606-16, 606-17, 607-1, 607-7, 607-10, 607-12, 607-13, 607-15, 608-6 thru 608-11 (now 608-5 thru 608-10), 608-13 (now 608-11), 620-3, 620-4, 620-7, 630-4, 630-5, 640-2, 640-5, 640-6, 640-9, 640-11 thru 640-13, 640-15, 640-18, 640-19, 640-22, 640-25, 640-26, 640-28, 641-2 – 641-19, 641-21 – 641-26, 642-6, 642-14, 642-15, 642-21, 642-24, 642-30, 642-31, 642-34, 642-44, 642-53, 650-3, 660-2, 660-4, 670-3, 670-6, 670-7, 695-2 and 695-4; 695-7 (now 605-6); revised Forms Index; revised Tables Index, Table 697-5 and renumbered Tables 697-8 – 697-10 (now 697-6 – 697-8); revised Figures Index, revised and renumbered Figures 698-3a and 698-3b (now 698-2), and renumbered Figures 698-4 and 698-6 thru 698-12 (now 698-3 thru 698-11); deleted Sections 608-5, 608-12, 650-4, 695-6, Form 696-5 (now Figure 698-11), Tables 697-6 and 697-7, and Figures 698-2 and 698-5; editorial corrections in Sections 600-1, 600-2, 600-5, 605-6, 606-14, 607-3, 640-8 and 640-24; and miscellaneous minor editorial/format corrections;
 - **in Part 7**, revised Table of Contents; revised Chapters 701 and 704, Sections 702-6, 705-2, 705-4, 742-1 and 742-2; deleted Chapter 795; editorial corrections in Sections 702-3, 702-4, 702-5 and 705-1, and Form 796-2; and miscellaneous minor editorial/format corrections;
 - **in Part 9**, revised Table of Contents; revised Chapters 900, 901 and 950, Sections 902-1, 930-1, 930-2, 940-1, 942-2, 995-1, 995-2 and 995-4 (now 995-3); deleted Chapter 980 and existing Section 995-3; and miscellaneous minor editorial/format corrections; and
 - **in Part 12**, revised Form 1296-17.
- 2013 October 18, 2013** - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a revised Title Sheet, Publication Record and Table of Contents;
 - **in Part 3**, revised Sections 302-1 and 302-3;
 - **in Part 4**, revised Table of Contents; revised Chapter 443, Sections 401-4, 442-13, 442-17, 442-30, 442-31, 442-45, 460-2, 460-3 and 460-7; deleted existing Sections/Plan Notes 442-18, 442-33 – 442-38; editorial corrections in Sections/Plan Notes 442-4 – 442-6, 442-9 – 442-11, 442-14, 442-16, 442-41, 442-43, 442-44 and 442-46 – 442-49; and miscellaneous minor editorial/format corrections;
 - **in Part 6**, revised Table of Contents; revised Sections 605-5, 605-20, 641-11, 641-19; editorial corrections in Sections 641-18; and miscellaneous minor editorial/format corrections;
 - **in Part 12**, revised Table of Contents; revised Sections 1213-1, 1213-2, 1213-4 (now 1213-3), 1213-6 (now 1213-4), 1213-7 (now 1213-5), the Forms Index, Forms 1296-11, the Figures Index, and Figure 1298-2; deleted Chapters 1220, 1250, 1280 and 1295, Sections 1213-3 and 1213-5, and Form 1296-12; editorial corrections in Form 1296-13; and miscellaneous minor editorial/format corrections; and
 - **in Part 14**, revised Table of Contents; new Chapter 1416 and Section 1416-1; revised Chapter 1400, Sections 1401-1 through 1401-6, 1415-1 – 1415-3, 1415-5 (now 1415-4); deleted Chapters 1402, 1420, 1430, 1450, 1480, 1495, Section 1415-4, the Forms Index and Form 1496-1; and miscellaneous minor editorial/format corrections.
- 2014 January 17, 2014** - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):
- a revised Title Sheet, Publication Record and Table of Contents;
 - **in Part 2**, revised Table of Contents; new Figures 298-45 through 298-47; revised Sections 201-9, 207-2, 207-3, 209-7, 240-7, 242-6, 242-7, 250-2 and 250-8, Tables 297-17 and 297-18, the Figure Index and Figure 298-18; deleted existing Plan Note 242-7; editorial corrections in Chapter 243, Sections 240-5 and 250-7, and Figures 298-6b, 298-31 and 298-32; and miscellaneous minor editorial/format corrections;
 - **in Part 3**, revised Table of Contents; revised Sections 301-1, 301-4, 301-12, 301-13, 301-15, 304-7, 341-2, 350-3, 350-4 and 350-8; editorial corrections in Sections 301-3, 301-8, 301-9, 301-10, 301-11, 301-14, 304-1, 304-2, 304-3, 304-5, 304-6, 341-1, 341-3 and 350-2; and miscellaneous minor editorial/format corrections;
 - **in Part 4**, revised Sections 402-3, 420-4, 450-3, 450-8 and 450-10; editorial changes in Sections 420-1, 450-4 and 450-9; and miscellaneous minor editorial/format corrections;
 - **in Part 6**, revised Table of Contents; revised Sections 604-5, 605-14, 605-19, 605-21 (now 605-20), 608-3, 608-6 through 608-8, 640-21, 640-27, 641-19, 641-21, 641-26, 641-46, 642-51 through 642-53, 650-1, 650-3 (now 650-2), 660-1, 660-4 (now 660-3), 670-4, Table 697-8, Figures 698-4 and 698-6, and the Figures Index; deleted existing Sections 605-20, Plan Notes 642-26 and 642-50, and Sections 650-2 and 660-3; editorial corrections in Chapter 643, Sections 605-18, 608-1, 608-10, 640-5, 640-20, 640-26, 641-17, 641-20, 641-25, 642-27 through 642-29, 642-33 through 642-38, 642-41, 642-43, 642-44, 642-48, 642-49, 642-55, 670-2 and 695-4; and miscellaneous minor editorial/format corrections;
 - **in Part 8**, revised Table of Contents; new Chapter 843; revised Chapters 800, 803 and 805, Sections 801-2, 804-3, 804-4, 830-1, 895-3 (now 895-1), 895-4 (now 895-2), 895-5 (now 895-3), the Forms Index, the Figures Index and Figure 898-1; deleted Chapters 850, 860 and 880 and Sections 895-1 and 895-2; editorial corrections in Sections 802-1, 802-2, 804-2, 830-4 and 840-2; and miscellaneous minor editorial/format corrections; and

- in **Part 13**, revised Table of Contents; new Figures 1398-3 through 1398-5; revised Chapter 1300, Sections 1301-1, 1301-3, 1303-1 through 1303-4, 1303-6 through 1303-10, the Forms Index, Forms 1396-1 and 1396-2, the Tables Index, Tables 1397-2 and 1397-3, the Figures Index and Figures 1398-1 and 1398-2; editorial corrections in Sections 1301-2, 1301-4 and 1303-5; and miscellaneous minor editorial/format corrections.

2014 April 18, 2014 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- in **Part 13**, a new Form 1396-3, a revised Table of Contents, revised Sections 1301-1, 1301-2, 1301-3 and 1301-4, and a revised Forms Index, Tables Index and Table 1397-1.

2014 July 18, 2014 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 2**, revised Table of Contents; revised Sections 201-1, 201-3, 201-7, 201-8, 202-13, 203-1, 204-2, 205-6, 206-7, 206-8, 206-11, 207-2, 207-3, 211-2, 211-4, 220-7, 220-8, 221-3, 240-7, 242-1 through 242-5, 260-2 and 295-2, the Forms Index, Form 296-3, the Tables Index, Tables 297-1 and 297-3, the Figures Index, and Figures 298-3, 298-4a-b, 298-5a-c and 298-6a-c; deleted Form 296-5; editorial corrections in Sections 200-3, 202-9, 220-1, 221-1, 221-6, 240-1, 240-2, 240-4 through 240-6, 241-1, 241-7, 250-2 through 250-8, Table 297-10, and Figures 298-38a, 298-38b and 298-46; and miscellaneous minor editorial/format corrections;
- in **Part 3**, revised Table of Contents; revised Sections 301-1, 301-2, 301-7, 301-14, 340-2, 341-2, 342-2, 350-3, 350-4 and 350-8; deleted Chapter 303; editorial corrections in Chapter 305, 310 and 343, Sections 300-3, 302-1 through 302-3, 302-6, 307-1, 307-2, 320-1, 320-4, 320-5, 341-4, 341-6, 342-1, 350-5, 350-6, the Tables Index and Tables 397-1, 397-3, and Figures 398-1 through 398-4; and miscellaneous minor editorial/format corrections;
- in **Part 4**, revised Table of Contents; new Section 403-11; revised Sections 401-4, 401-7, 401-9, 402-2, 403-7, 407-2, 408-2, 440-3, 440-7, 442-14, 442-20, 442-43, 442-48, 460-8, 495-2, the Form Index, Forms 496-3, 496-5 and 496-7, and Figures 498-3 through 498-5, 498-12, 498-13, 498-16 through 498-20, 498-23, and 498-36 through 498-38; deleted Section/Plan Note 442-50 and Forms 496-16, 496-17 and 496-18; revised/renumbered Form 496-19 to 496-16, and Form 496-20 to 496-17; editorial changes in Chapter 443, Sections 400-3, 401-1, 403-1, 403-9, 404-1, 420-4, 420-5, 421-1, 421-2, 440-1, 440-2, 440-4 through 440-6, 441-1, 441-3, 441-8 through 441-11, 442-1, 442-4, 442-5, 442-6, 442-9 through 442-13, 442-17 through 442-19, 442-21, 442-32, 442-41, 442-44, 442-46, 450-1, 450-3, 450-6, 450-8, 450-10 and 450-11, Forms 496-4, 496-6, and 496-8 through 496-11, the Table Index, Tables 497-4 and 497-8, and Figure 498-31; and miscellaneous minor editorial/format corrections;
- in **Part 6**, revised Table of Contents; new Section 641-27; revised Sections 607-10, 620-7, 641-5, 641-6, 641-9, 641-10, 641-17, 641-21, 641-25, 642-6, 642-21, 642-37 and 642-44; editorial corrections in Sections 600-3, 605-2, 605-9, 605-11, 605-14, 605-15, 607-1, 607-13, 607-15, 620-3, 620-6, 630-1, 640-1, 640-2, 640-11, 640-18, 641-1, 641-2, 641-8, 641-16, 642-1, 642-2, 642-5, 642-9, 642-12 642-20 and 642-24; and miscellaneous minor editorial/format corrections;
- in **Part 8**, editorial corrections in Section 802-2;
- in **Part 9**, revised Table of Contents; revised Sections 940-2 and 942-2; editorial corrections in Section 942-1; and miscellaneous minor editorial/format corrections;
- in **Part 11**, revised Table of Contents; revised Sections 1106-2, 1120-5, 1140-4, 1141-1, 1141-3, 1141-4, 1142-14, 1160-6 and 1160-8, and Figure 1198-11; editorial corrections in Chapter 1143, Sections 1100-1, 1100-3, 1103-6, 1130-4, 1130-5, 1140-3, 1140-5 through 1140-8, 1142-2, 1142-3, 1142-5 through 1142-8, 1142-13, 1142-17, 1142-18, 1142-20, 1150-2, 1150-5, 1150-6, 1150-10, 1150-13, 1160-4, 1160-11, 1160-13, Tables 1197-3 through 1197-7, and Figure 1198-4; deleted Chapters 1170, 1180 and 1190; and miscellaneous minor editorial/format corrections; and
- in **Part 14**, editorial corrections in Sections 1415-1 and 1415-2; and miscellaneous minor editorial/format updates.

2015 January 16, 2015 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 2**, revised Table of Contents; new Sections 206-18 and 240-10; revised Section 240-9; and miscellaneous minor editorial/format corrections;
- in **Part 3**, revised Sections 301-6 and 302-2, and Table 397-1; and miscellaneous minor editorial/format corrections;
- in **Part 4**, revised Table of Contents; new Sections 440-10, 440-11, 440-12 and 442-50, new Form 496-18, and new Figures 498-44, 498-45 and 498-46; revised Chapter 443, Sections 402-2, 403-8, 420-5, 440-1, 440-3, 440-7, 442-3, 442-7, 442-8, 442-12, 442-13, 442-17, 442-18, 442-21, 442-22, 442-23, 442-24, 442-39, 442-41, 442-43, 442-44, 442-48, 442-49, 450-10, the Forms Index, Forms 496-3, 496-4, 496-5 and 496-16, Table 497-6, the Figures Index, and Figures 498-13, 498-21, 498-36 and 498-37; editorial changes in Figures 498-4, 498-12 and 498-38; and miscellaneous minor editorial/format corrections;
- in **Part 6**, revised Table of Contents; new Section 641-28; revised Chapter 643, Sections 605-4, 605-14, 605-17, 640-2, 640-9, 640-12, 640-18, 640-19, 641-11, 642-24, 642-26, 642-41, 642-55 and 660-2, and Table 697-5; and miscellaneous minor editorial/format corrections;
- in **Part 7**, revised Sections 705-4 and 742-2;
- in **Part 8**, editorial corrections in Chapter 843;
- in **Part 11**, revised Table of Contents; new Sections 1142-22 and 1142-23; revised Section 1140-6; and miscellaneous minor editorial/format corrections;
- in **Part 12**, revised Table of Contents; revised Chapter 1211 and Sections 1203-2, 1203-3, 1203-5 and 1204-5, the Forms Index (1296), Forms 1296-1, 1296-2, 1296-6b, 1296-7b, 1296-14, 1296-16, 1296-17 and 1296-18, the Tables Index (1297), Table 1297-7, the Figures Index (1298), and Figures 1298-1a through 1298-1c, and 1298-6 through 1298-22; an editorial correction in Chapter 1202; deleted Chapter 1212 and Figures 1298-23 through 1298-40; and miscellaneous minor editorial/format corrections;
- in **Part 13**, revised Table of Contents; new Chapter 1343; and miscellaneous minor editorial/format corrections; and
- in **Part 14**, revised Table of Contents; revised Sections 1415-1 and 1415-3; and miscellaneous minor editorial/format updates.

2015 July 17, 2015 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- **in Part 1**, revised Table of Contents; revised Chapters 104, 106, 160, 180, 193, 194 and 195; revised Sections 100-1 through 100-5, 101-1, 101-3, 101-4 and 101-5, 102-2 through 102-5, 103-1 through 103-5, 105-3, 120-1, 120-2, 120-4, 120-6, 120-7, 130-2, 130-4, 130-5, 140-2, 140-7, 150-1 through 150-3; deleted existing Forms 196-1, 196-2 and 196-4, and renumbered 196-3 to 196-1; revised Table 197-1, deleted Tables 197-3 through 197-6, and renumbered and revised Tables 197-7 and 197-8 to 197-3 and 197-4, respectively; revised Figures 198-4 through 198-6; made editorial changes to Chapter 170, Sections 101-2, 102-1, 105-1, 105-2, 120-3, 130-3, 130-6, 130-7, 140-6, the Forms Index, the Tables Index, the Figures Index, and Figures 198-1 through 198-3; and miscellaneous minor editorial/format corrections;
- **in Part 2**, revised Table of Contents; new Sections 201-15 and 202-15; revised Sections 201-3, 201-6, 202-8, 202-11, 206-16, 207-2, 209-2, 240-6, 242-5, 242-6 and 242-7; made editorial changes to Chapters 202, 205 through 209, 241, 242 and 243, and Sections 201-5, 201-10 through 201-14, 240-5, 240-9 and 298-20; and miscellaneous minor editorial/format corrections;
- **in Part 3**, revised Table of Contents; revised Section 301-12 and Table 397-1; made editorial changes in Sections 301-13 through 301-15 and 304-3; deleted Section 304-7; and miscellaneous minor editorial/format corrections;
- **in Part 4**, revised Table of Contents; revised Sections 401-1 through 401-3, 403-1, 407-2, 420-4, 420-5, 440-1, 440-3, 440-7, 440-8, 440-10, 441-1, 442-14, 442-33, 442-44, 442-45, 442-46, 442-48, 442-49, 450-6, 450-8, 450-10, 450-11, 495-2, the Forms Index, Forms 496-3 through 496-5, 496-10, 496-16 and 496-17, Table 497-1, the Figures Index, and Figures 498-2, 498-3, 498-5, 498-9 and 498-15; editorial changes in Chapter 408, 421, 441, 443, Sections 403-2, 403-3, 420-1, 440-4, 440-5, 440-12, 442-39, 442-43, Forms 496-8, 496-9, 496-11, and 496-18, the Tables Index, Table 497-4, Figures 498-12, 498-13, 498-37 and 498-45; and miscellaneous minor editorial/format corrections;
- **in Part 6**, revised Table of Contents; Sections 601-2, 602-3, 605-1, 605-3, 605-4, 605-6, 605-14, 605-15, 606-14, 607-1, 608-7, 608-8, 620-2, 630-4 through 630-6, 640-5, 640-13, 640-14, 640-18, 641-2, 642-5, 642-21, 642-27, 642-30, 642-31, 642-35, 642-41, 695-2 and 695-6, and Figure 698-2; editorial changes in Chapters 602, 605, 606, 607, 608, 620, 630, 640, 641, 642, 643 and 695 and miscellaneous minor editorial/format corrections;
- **in Part 7**, revised Section 705-4 and editorial changes to Chapter 705;
- **in Part 11**, revised Table of Contents; new Section 1120-8; revised Sections 1120-2, 1140-4, 1140-6; editorial changes in Chapter 1141, and Sections 1120-5, 1140-5, 1140-7, 1140-8; and miscellaneous minor editorial/format corrections;
- **in Part 12**, revised Table of Contents; revised Sections 1203-1, 1203-3, 1203-5, 1204-5, 1213-4, and Forms 1296-6a, 1296-6b, 1296-7a, 1296-7b, 1296-14; and an editorial change in Section 1203-2;
- **in Part 13**, revised Table of Contents; new Chapters 1340, 1342 and 1395, and Tables 1397-4 through 1397-9; revised Chapter 1343; revised Sections 1303-1, 1303-3 through 1303-7, 1303-10; editorial changes in Chapters 1300 and 1301, and Sections 1303-2, 1303-8, 1303-9, the Forms Index, the Tables Index, Tables 1397-1 and 1397-3, and Figures 1398-1 through 1398-5; and miscellaneous minor editorial/format corrections; and
- **in Part 15**, revised Table of Contents; revised Chapter 1599, and Sections 1501-1 through 1501-3 and 1505-1; editorial changes in Sections 1505-2 and 1505-3; deleted Chapters 1510 through 1514 and 1596; and miscellaneous minor editorial/format updates.

2015 October 16, 2015 – Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- an updated Title Sheet, Preface, Publication Record and Table of Contents;
- **in Part 6**, revised Table of Contents; new Section 641-29; revised Sections 605-3, 605-6, 640-17, 640-18, 640-26, 641-5 through 641-9, 642-24 and 642-26; editorial changes in Sections 605-4, 605-7, 640-19, 640-22, 640-24, 640-25, 640-28, 641-2, 641-10 through 641-28; and miscellaneous minor editorial/format corrections; and
- **in Part 12**, revised Table of Contents; revised Sections 1203-4, 1203-5; revised Forms Index and Forms 1296-6a, 1296-6b, 1296-7b, 1296-16, 1296-17, 1296-18; revised Tables Index and Table 1297-7; revised Figures Index and Figures 1298-1a, 1b and 1c; editorial changes in Sections 1203-1 and 1203-2; and miscellaneous minor editorial/format corrections.

2016 January 15, 2016 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- **in Part 2**, a revised Table of Contents; new Section 221-7; new Figure 298-48; revised Sections 201-9 and 209-2; revised Table 297-4; revised Figures Index and Figure 298-48; and editorial changes in Section 221-6 and Figure 298-47;
- **in Part 3**, a revised Forms Index;
- **in Part 4**, a revised Table of Contents; revised Sections 402-3, 404-2, 420-4, 420-5, 440-7, 441-5, 441-8, 442-13, 442-18, 442-19, 442-21, 442-41, 450-3, 450-6, 450-10, 460-3, 460-7; revised Table 497-6; and revised Figures 498-12, 498-13 and 498-36;
- **in Part 6**, a revised Table of Contents and revised Section 641-17;
- **in Part 11**, a revised Table of Contents; revised Sections 1140-4, 1142-6, 1142-7, 1150-9, and revised Figure 1198-12; and
- **in Part 13**, revised Sections 1303-3, 1303-6, and 1340-2; and revised Tables 1397-5 and 1397-6.

2016 July 15, 2016 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- **in Part 1**, a revised Form 196-1 and revised Table 197-4;
- **in Part 2**, a revised Table of Contents; revised Sections 202-5, 202-14, 205-2, 211-1, 211-2, 211-3, 211-4, 240-8, 242-6 and 260-5;
- **in Part 3**, a revised Table of Contents, revised Sections 301-4, 301-15, 302-6, 304-4, and 304-5; a revised Table 397-1, revised Figures Index and Figure 398-1; and deleted Figures 398-3 and 398-4;

Traffic Engineering Manual

- in **Part 4**, a revised Table of Contents; new Section 403-12; revised Sections 402-2, 442-20, 442-45, and 460-3; and deleted Section 442-23;
- in **Part 6**, a revised Table of Contents; new Sections 601-3, 641-7, 641-10, 641-20, 641-23, 641-24 and 642-57; revised Sections 601-2, 602-5, 605-11, 605-13, 605-14, 605-19, 606-14, 606-16, 607-12, 607-13, 607-15, 608-4, 608-7, 630-4, 630-5, 640-2, 640-5, 640-9, 640-13, 640-14, 640-18, 640-24, 640-28, 640-29, 641-2, 641-12, 642-24, 642-30, 642-31, 642-35, and 642-38; revised Forms 696-1a, 696-1b, 696-3a and 696-3b; revised Tables Index; and revised Table 697-1c.
- in **Part 11**, a revised Section 1142-21 and revised Table 1197-3;
- in **Part 12**, revised Sections 1203-2, 1203-3, and 1204-1; revised Forms 1296-2, 1296-5, 1296-8 and 1296-9; and revised Table 1297-6;
- in **Part 13**, revised Section 1303-4 and revised Table 1397-7; and
- in **Part 15**, revised Chapter 1599 and new Standard Procedure 123-001(SP).

2017 January 20, 2017 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 1**, revised Section 120-4;
- in **Part 2**, a revised Table of Contents; new Section 242-9; revised Sections 202-2 and 242-8;
- in **Part 3**, a revised Table of Contents; new Sections 301-17, 301-18, 301-19 and 307-3; revised Section 342-4;
- in **Part 4**, a revised Table of Contents; revised Sections 403-2, 403-3, 420-4, 442-24, 442-33, and 442-45; and revised Table 497-1;
- in **Part 6**, a revised Table of Contents; new Sections 642-58 and 642-59; new Figure 698-12; revised Sections 605-6, 605-7, 605-12, 605-14, 605-15, 605-16, 606-16, 607-15, 620-7, 630-5, 640-8, 640-12, 640-18, 640-26, 640-29, 641-5, 641-6, 641-11, 641-34, 642-8, 642-24, 642-43, and 642-57;
- in **Part 7**, revised Form 796-4;
- in **Part 9**, revised Section 902-2;
- in **Part 11**, a revised Table of Contents; new Section 1142-4; revised Sections 1140-5 and 1141-4;
- in **Part 14**, revised Sections 1415-1, 1415-2, and 1415-3.

2017 July 21, 2017 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 1**, a revised Table of Contents; revised Sections 120-4 and 140-7; revised Form 196-1; revised Tables Index; deleted Table 197-4; and revised Figure 198-1;
- in **Part 2**, revised Section 242-9 revised Table 297-17; and revised Figure 298-29;
- in **Part 3**, a revised Table of Contents; new Sections 301-20, 301-21, 302-7, 307-4 and 342-6; revised Sections 301-2, 301-13 and 350-7; revised Tables Index; new Table 397-6; and revised Table 397-1; revised Figures Index; an editorial change in Figure 398-1; and deleted Figure 398-4.
- in **Part 4**, a revised Table of Contents; revised Sections 402-1, 403-2, 403-12, 440-6, 442-20 and 460-6;
- in **Part 6**, a revised Table of Contents; revised Sections 605-11, 605-19, 606-13, 630-5, 640-2, 640-12, 640-18, 640-29, 641-5, 641-6, 641-9, 641-11, 641-12, 641-14, 641-15, 641-16, 641-17, 641-19, 641-26, 641-30, 642-20, 642-32, 642-44, 642-48, 642-49, 642-51, 642-57, and 642-58; an editorial change in Section 642-8; deleted Section 642-46; revised Form 696-1a; revised Table 697-4; revised Figures 698-5 and 698-7;
- in **Part 7**, revised Form 796-4;
- in **Part 8**, revised Form 896-1;
- in **Part 11**, a revised Table of Contents; new Section 1142-24; revised Sections 1120-6, 1140-5, and 1160-8; revised Table 1197-3; and revised Figure 1198-11.
- in **Part 12**, revised Section 1203-1; and
- in **Part 13**, a revised Table of Contents; revised Sections 1303-6, and 1342-7; deleted Section 1342-12; and revised Form 1396-3;

2018 January 19, 2018 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 2**, a revised Table of Contents, and revised Sections 201-14, 202-2, 240-9, 240-10 and 242-8;
- in **Part 3**, revised Section 301-4;
- in **Part 4**, a revised Table of Contents; revised Sections 403-5, 405-3, 420-5, 440-6, 440-11, 442-4, 442-13, 442-15, 442-16, 442-25 and 442-50;
- in **Part 6**, a revised Table of Contents; revised Sections 600-1, 605-11, 605-12, 640-2, 640-9, 640-19, 641-30, 641-33, 642-18, 642-36, 642-37, 642-55, 642-56 and 642-59; and revised Table 697-3;
- in **Part 9**, a revised Table of Contents; new Sections 901-1 and 901-2, and deleted Section 995-3.
- in **Part 11**, a revised Table of Contents; revised Sections 1103-6, 1107-4, 1120-5, 1140-3, 1140-4, 1140-8, 1141-3, 1142-22, 1142-23 and 1160-3; and revised Tables 1197-3, 1197-5 and 1197-6;
- in **Part 12**, revised Section 1203-2; and
- in **Part 13**, a revised Table of Contents; revised Sections 1303-4, 1303-5, 1342-3, 1342-7 and 1342-12; and revised Table 1397-5, and 1397-9.

2018 July 20, 2018 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 1**, a revised Table of Contents; new Section 100-6; and renumbered Section 100-7;

- ▲ in **Part 2**, a revised Table of Contents; revised Sections, 202-15, 206-8, 240-9, 240-10 and 242-8; a revised Tables Index; and deleted Table 297-17.
- in **Part 3**, a revised Table of Contents; new Sections 343-1 and 343-2; revised Sections 301-6 and 342-4;
- in **Part 4**, a revised Table of Contents; new Section 442-43; revised Sections 401-1, 402-3, 403-1, 403-2, 403-3, 403-12, 404-2, 405-3, 407-2, 420-1, 420-4, 420-5, 440-3, 440-11, 442-13, 442-20, 442-24, 442-25, 442-49, 443, 460-6, and 495-2; editorial changes in Sections 400-3 and 442-19;
- in **Part 6**, a revised Table of Contents, new Sections 608-12 and 640-23, revised Sections 605-11, 605-16, 605-19, 608-1, 608-2, 608-3, 608-5, 608-7, 608-9, 608-11, 630-5, 640-2, 640-5, 640-12, 641-18, 641-22, 642-24, 642-41, 642-44, 642-45, 642-51, 642-52, 642-55, 642-57, and 642-59; an updated Forms Index; new Forms 696-5, 696-6, 696-7; revised Forms 696-1a, and 696-1b; revised Figures Index; revised Figure 698-11; and an editorial change in 641-20.1;
- in **Part 11**, a revised Table of Contents; revised Sections 1102, 1120-1, 1120-4, 1120-5, 1120-6, 1120-8, 1140-1, 1141-3, 1141-4, 1142-16; an editorial change in Section 1100-3; revised Table 1197-4; and revised Figure 1198-11;
- in **Part 12**, a revised Table of Contents; revised Section 1203-2; and revised Forms Index;
- in **Part 13**, a revised Table of Contents; new Sections 1303-12, 1303-13, and 1342-13; revised Sections 1301-2, and 1342-12; and
- in **Part 14**, a revised Table of Contents; and deleted Section 1401.

2019 January 18, 2019 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- ▲ in **Part 2**, a revised Table of Contents; revised Sections 201-3 and 202-10; a revised Tables Index; and new Table 297-3;
- in **Part 3**, a revised Table of Contents; and revised Section 301-6;
- in **Part 4**, a revised Table of Contents; new Section 404-4; revised Sections 403-2, 404-1, 442-24, 442-46; deleted Section 442-14; a revised Forms Index; and new Form 496-19;
- in **Part 6**, a revised Table of Contents; revised Sections 605-15, 608-4, 608-5, 608-7, 630-4, 640-24, 641-20, 641-26, 642-4, 642-5, 642-6, 642-29, 642-52 and 642-59; revised Tables Index 697; revised Tables 697-1d and 697-1e;
- in **Part 11**, a revised Table of Contents; new Sections 1104-4, 1142-25, and 1142-26, revised Sections 1104-3, 1120-8, 1140-4, 1143; and revised Table 1198-11;
- in **Part 12**, a revised Table of Contents; revised Sections 1203-1 and 1203-3; and revised Form 1296-6a.

2019 April 19, 2019 - Revision consists of the following (as well as related pages needed for double-sided printing of the revised pages):

- a revised Title Sheet, Publication Record and Table of Contents;
- in **Part 6**, a revised Table of Contents; revised Sections 602-8, 603-3, 605-2, 605-15, 607-9, 641-5, 641-6, 641-7, 660-1, and 660-3; and revised Figures 698-9 and 698-10.

Intentionally blank

TABLE OF CONTENTS

	Page
Part 1 - GENERAL	1-1
TABLE OF CONTENTS	1-1
100 INTRODUCTION	1-5
100-1 Uniformity in Traffic Control Standards.....	1-5
100-2 ODOT's Role/Responsibility.....	1-6
100-3 Jurisdiction.....	1-6
100-4 OTE Contacts.....	1-6
100-5 ODOT Organization.....	1-7
100-6 ODOT Training Available.....	1-7
100-7 Other Resource Reference and Contact Information.....	1-8
101 OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES	1-9
101-1 Legal Authority.....	1-9
101-2 Organization.....	1-9
101-3 Format.....	1-9
101-4 Distribution.....	1-11
101-5 Revisions.....	1-11
102 TRAFFIC ENGINEERING MANUAL	1-13
102-1 General.....	1-13
102-2 Organization.....	1-13
102-3 Format.....	1-14
102-4 Distribution.....	1-16
102-5 Revisions.....	1-16
103 STANDARD CONSTRUCTION DRAWINGS	1-17
103-1 General.....	1-17
103-2 Organization.....	1-17
103-3 Format.....	1-17
103-4 Distribution.....	1-17
103-5 Revisions.....	1-18
104 PLAN INSERT SHEETS	1-18
105 CONSTRUCTION & MATERIAL SPECIFICATIONS	1-19
105-1 General.....	1-19
105-2 Distribution.....	1-19
105-3 Revisions.....	1-19
106 OTHER PUBLICATIONS	1-20
120 TRAFFIC CONTROL DEVICES AND MATERIALS	1-23
120-1 General.....	1-23
120-2 Specifications.....	1-23
120-3 New Products.....	1-23
120-4 Patented or Proprietary Materials, Specifications or Processes.....	1-23
120-5 Cooperative Purchasing Program.....	1-25
120-6 Alternative Purchasing Program for Local Agencies.....	1-25
120-7 Alternate Bids for Traffic Control and Lighting Items.....	1-29
130 PLANNING / PROGRAMMING	1-33
130-1 General.....	1-33
130-2 Engineering Studies.....	1-33
130-3 Design and Roadside Safety Issues.....	1-33
130-4 Functional Classification.....	1-33
130-5 National Highway System (NHS).....	1-34
130-6 Access Management.....	1-34
130-7 Railroads and Highway-Rail Grade Crossings.....	1-34

140	DESIGN INFORMATION.....	1-37
140-1	General	1-37
140-2	Traffic Control Plan Requirements	1-37
140-3	Designer Notes.....	1-39
140-4	Plan Notes.....	1-39
140-5	Plan Detail Sheets	1-39
140-6	Estimating	1-39
140-7	Review Submissions.....	1-39
140-8	Salvage of Project Materials	1-40
140-9	Spare Parts	1-41
150	CONSTRUCTION	1-43
150-1	General	1-43
150-2	Pre-Construction Conference.....	1-43
150-3	Local Government Agency/ Utility Force Account Work	1-44
160	MAINTENANCE / OPERATIONS	1-45
170	OTHER CONSIDERATIONS.....	1-45
180	RESEARCH	1-45
193	NATIONAL REFERENCE RESOURCES	1-47
193-1	General	1-47
193-2	AASHTO Design Guide (A Policy on Geometric Design of Highways and Streets).....	1-47
193-3	AASHTO Guide for the Development of Bicycle Facilities.....	1-47
193-4	AASHTO Roadside Design Guide (RSDG)	1-47
193-5	AASHTO Roadway Lighting Design Guide.....	1-47
193-6	ADA Accessibility Guidelines	1-48
193-7	(ANSI/IES Approved) Roadway Lighting (RP-8).....	1-48
193-8	(ANSI Approved) Tunnel Lighting (RP-22-11).....	1-49
193-9	FHWA Lighting Handbook	1-49
193-10	FHWA Railroad-Highway Grade Crossing Handbook	1-49
193-11	Highway Capacity Manual (HCM)	1-49
193-12	Highway Safety Manual (HSM)	1-49
193-13	ITE Manual of Traffic Signal Design	1-49
193-14	ITE Manual of Transportation Engineering Studies.....	1-49
193-15	ITE Traffic Engineering Handbook	1-49
193-16	ITE Traffic Generation	1-49
193-17	Manual on Uniform Traffic Control Devices (MUTCD)	1-49
193-18	Standard Highway Signs and Markings Book.....	1-50
193-19	Traffic Control Devices Handbook (TCDH).....	1-50
194	ODOT REFERENCE RESOURCES	1-51
194-1	General	1-51
194-2	Bridge Design Manual (BDM)	1-51
194-3	Construction Administration Manual of Procedures	1-51
194-4	Construction and Materials Specifications (C&MS).....	1-51
194-5	Consultant Contract Administration Manual.....	1-51
194-6	L&D Manual Volume 1 - Roadway Design.....	1-51
194-7	L&D Manual Volume 2 - Drainage Design	1-52
194-8	L&D Manual Volume 3 - Highway Plans.....	1-52
194-9	Pavement Design Manual (PDM).....	1-52
194-10	Project Development Process (PDP) Manual	1-52
194-11	Specifications for Consulting Engineers	1-53
194-12	Specifications for Subsurface Investigations	1-53
194-13	Standard Bridge Drawings	1-53
194-14	Standard Roadway Drawings.....	1-53
194-15	Standard Pavement Construction Drawings	1-53
194-16	Standard Hydraulic Construction Drawings	1-53
194-17	State Highway Access Management Manual.....	1-53
194-18	Straight Line Diagrams (SLDs).....	1-54

	194-19 Supplemental Specifications	1-54
	194-20 Supplements.....	1-54
195	TRAFFIC ENGINEERING REFERENCE RESOURCES	1-55
	195-1 General.....	1-55
	195-2 Guidelines for Traffic Control in Work Zones	1-55
	195-3 Quality Standards for Temporary Traffic Control Devices and Acceptable Delineation Methods for Vehicles.....	1-55
	195-4 Sign Designs and Markings Manual (SDMM)	1-55
	195-5 Signal Design Reference Packet.....	1-55
	195-6 Temporary Traffic Control Manual (TTCM).....	1-55
196	FORMS INDEX	1-57
	Form 196-1. ORE Publication Order Form	1-59
197	TABLES INDEX.....	1-61
	Table 197-1. Resource Reference/Contact Information	1-63
	Table 197-2. Ohio Counties and ODOT Districts	1-67
	Table 197-3. Traffic Engineering Publications.....	1-68
	Table 197-4. Reserved for Future Information	1-69
198	FIGURES INDEX.....	1-71
	Figure 198-1. ODOT Table of Organization	1-73
	Figure 198-2. ODOT District Locations and Addresses	1-74
	Figure 198-3. Alternative Purchasing Program for Local Agencies	1-75
	Figure 198-4. Local Government Agency / Utility Force Account Work	1-78
	Figure 198-5. Sample Letter Requesting Alternate Bids.....	1-79
	Figure 198-6. Sample Letter Stating Local Decision on Alternate Bids	1-80
 Part 2 – SIGNS		 2-1
	TABLE OF CONTENTS	2-1
200	GENERAL.....	2-9
	200-1 Introduction.....	2-9
	200-2 Construction Projects.....	2-9
	200-3 Force Account (ODOT Operations) Work	2-9
201	REGULATORY SIGNS	2-11
	201-1 General.....	2-11
	201-2 Prohibition of U-Turns at Median Crossovers	2-11
	201-3 STOP Signs.....	2-11
	201-4 No Turn on Red Signing.....	2-13
	201-5 Safety Belt Signing (R16-H1)	2-14
	201-6 Speed Limit Signs.....	2-14
	201-7 Signing for Engine Brake Restrictions (R20-H1, R20-H2, R10-H20bP, R10-H20cP).....	2-15
	201-8 Move Over Signs (R25-H1)	2-16
	201-9 Truck Restrictions	2-16
	201-10 Lane-Use Control Signs.....	2-17
	201-11 YIELD Signs (R1-2)	2-17
	201-12 DO NOT ENTER Signs (R5-1)	2-17
	201-13 KEEP RIGHT (LEFT) Signs (R4-7, R4-8).....	2-17
	201-14 Traffic Law Photo Monitoring Signs (R10-18), Automated Traffic Enforcement and Surveillance Devices	2-17
	201-15 KEEP RIGHT EXCEPT TO PASS Sign (R4-16)	2-18
202	WARNING SIGNS.....	2-19
	202-1 General.....	2-19
	202-2 Warning Signs for Children	2-19
	202-3 HIDDEN DRIVE Signs	2-19
	202-4 No Reentry Signing (W13-H10P, W13-H11P).....	2-19
	202-5 Narrow and One-Lane Bridges.....	2-20

202-6	Amish Buggy Signing Where Paved Shoulder Becomes Narrower (W11-H14a, W11-H14P)	2-20
202-7	Low Clearance Signs.....	2-21
202-8	Entrance Sign (W11-H13).....	2-21
202-9	Transition Signing.....	2-21
202-10	Stop Ahead Signs (W3-1)	2-22
202-11	Reduced Speed Limit Ahead Signs (W3-5, W3-5a).....	2-22
202-12	GROOVED PAVEMENT Sign (W8-15)	2-22
202-13	METAL BRIDGE DECK Sign (W8-16).....	2-22
202-14	Object Markers and End-of-Roadway Markers	2-22
202-15	Signing for High Water.....	2-23
203	GUIDE SIGNS.....	2-25
203-1	General	2-25
203-2	Minor Interchanges.....	2-25
204	ROUTE SIGNS	2-27
204-1	General	2-27
204-2	Ohio Byway Signing (M8-H3, M8-H3P)	2-27
204-3	Business Routes (M1-2, M1-3, M4-3, D20-H1, D20-H2).....	2-27
204-4	Lake Erie Circle Tour Signing (M8-H1, M8-H2)	2-28
204-5	Appalachian Highway Signing (M1-H11)	2-29
204-6	Municipal Street System Signing.....	2-29
205	CONVENTIONAL ROAD DESTINATION AND DISTANCE SIGNS.....	2-31
205-1	General	2-31
205-2	Conventional Road Destination Signs	2-31
205-3	Signing for Traffic Generators at Intersections.....	2-31
205-4	Weigh Station Signing for Conventional Roads	2-35
205-5	Street Name Signing for At-Grade Intersections on Conventional Roads.....	2-36
205-6	Signing for Historical Markers on Conventional Roads	2-36
206	GENERAL INFORMATION SIGNS	2-39
206-1	General	2-39
206-2	Reserved for Future Information	2-39
206-3	Township Limit Signing (I-H2e)	2-39
206-4	Signing for Unincorporated Communities (I-H2d)	2-39
206-5	Highway Advisory Radio (HAR) Signing (D12-H6, D12-H7, D12-H8P, D12-H9).....	2-39
206-6	Carpool Signing (D12-2)	2-41
206-7	Signing for Countywide 9-1-1 Systems (D12-H14)	2-42
206-8	Memorial Highway/Bridge Signing (D6-H5)	2-43
206-9	TARGET ENFORCEMENT AREA Sign (D12-H15)	2-44
206-10	Signing for Over/Underpasses on Freeways and Expressways	2-45
206-11	Drinking Water Protection Area Signs (I-H15)	2-45
206-12	TOURISM INFO 1-800-BUCKEYE Sign (D7-H10P)	2-45
206-13	ROAD CONDITIONS 1-888-2-OH-ROAD Sign (D12-H10) (Discontinued).....	2-46
206-14	Community Recognition Signing	2-46
206-15	Maintenance Marker Sign (D10-H8, D10-H8a).....	2-46
206-16	Reserved for Future Information	2-47
206-17	WATERSHED Signs (I-H3d).....	2-47
206-18	ODOT Bridge and Culvert Signs (I-H25a, I-H25b, I-H25c)	2-47
207	GENERAL SERVICE SIGNS	2-49
207-1	General	2-49
207-2	Logo (Specific Service) Program.....	2-49
207-3	TODS Program.....	2-50
207-4	Hospital and Emergency Medical Care Facility Signing (D9-2, D9-H2a, D9-H2b, D9-H13g, D9-H13h, D12-H17, D12-H17aP, D12-H17b)	2-51
207-5	Generic General Service Signing.....	2-53
207-6	Tourist Information Center Signing.....	2-54
207-7	Drug Enforcement Signs (D12-H22, D12-H23).....	2-56
207-8	Recreational and Cultural Interest Area Guide Signs.....	2-57

208	REST AREA SIGNS.....	2-59
	208-1 General.....	2-59
	208-2 REST ROOMS CLOSED Sign (D5-H33)	2-59
	208-3 SAFETY BREAK FREE COFFEE Sign (D5-H51P, D5-H52P).....	2-59
	208-4 NO FACILITIES Sign Panel (D5-H17)	2-60
	208-5 Other Rest Area Signs	2-60
	208-6 Report Drunk Drivers Sign (D12-H13)	2-60
209	FREEWAY & EXPRESSWAY DISTANCE & DESTINATION SIGNS.....	2-63
	209-1 General.....	2-63
	209-2 Signing for Generators at Interchanges on Freeways & Expressways.....	2-63
	209-3 Control City Destinations for Ohio's Interstate Highway System.....	2-66
	209-4 Weigh Station Signing for Freeways and Expressways.....	2-66
	209-5 Interchange Exit Numbering (E1-H5P) and Reference Location Signs (D10-1 through D10-5, D10-H5a)	2-67
	209-6 Street Name Signing for At-Grade Intersections on Expressways and Multi-Lane Conventional Roads.....	2-67
	209-7 Signs for Option Lanes.....	2-68
210	MISCELLANEOUS SIGNS.....	2-71
	210-1 General.....	2-71
	210-2 Reserved for Future Information.....	2-71
	210-3 Decorative Signs in State Right-of-Way.....	2-71
211	SIGN DESIGNING.....	2-73
	211-1 General.....	2-73
	211-2 Standard Signs	2-73
	211-3 Designable Guide Signs.....	2-73
	211-4 Sign Design Computer Program.....	2-73
212	SIGN LIGHTING.....	2-75
	212-1 General.....	2-75
	212-2 Sign Lighting for Overhead Guide Signs.....	2-75
	212-3 Sign Lighting for Other Traffic Signs.....	2-75
220	MATERIALS AND HARDWARE	2-77
	220-1 General.....	2-77
	220-2 Patented or Proprietary Materials, Specifications or Processes	2-77
	220-3 Purchasing Materials for Installation and Use by Local Agencies.....	2-77
	220-4 Sign Reflectivity	2-77
	220-5 Sign Reflectivity Inspections.....	2-77
	220-6 Use of Reflective Sheeting for Permanent Traffic Control Signs.....	2-78
	220-7 Use of Fluorescent Yellow-Green Sheeting	2-78
	220-8 Production and Purchasing of Signs and Related Materials.....	2-78
	220-9 Salvaging Sign Material	2-79
	220-10 Use of Fluorescent Yellow Sheeting.....	2-80
221	SIGN SUPPORTS.....	2-81
	221-1 General.....	2-81
	221-2 Splicing of U-Channel Posts.....	2-81
	221-3 Overhead Sign Support Inspection.....	2-81
	221-4 Erecting Highway Signs On or Near Utility Poles	2-82
	221-5 Solid Wood Posts	2-82
	221-6 Sign Post Reflectorization	2-83
	221-7 Laminated Veneer Wooden Box Beam Sign Supports.....	2-83
230	PLANNING / PROGRAMMING	2-84
240	DESIGN INFORMATION.....	2-85
	240-1 General.....	2-85
	240-2 Signs and Sign Attachments	2-85
	240-3 Overhead Sign Clearance After Pavement Overlay	2-86
	240-4 Overhead Sign Supports.....	2-87
	240-5 Ground-Mounted Sign Supports.....	2-93

240-6	Guardrail Protection For Signs	2-95
240-7	Sign Lighting.....	2-96
240-8	Stage 2 and 3 Plan Submittals.....	2-96
240-9	Rectangular Rapid Flashing Beacon (RRFB) Sign Assembly	2-96
240-10	Solar-Powered Devices	2-97
241	PLAN PREPARATION / PRODUCTION	2-99
241-1	General	2-99
241-2	Signs	2-99
241-3	Signal and Sign Supports	2-99
241-4	Power Service	2-99
241-5	Quantities	2-99
241-6	Bid Item Descriptions.....	2-99
241-7	Sign Support, Detail Design Requirements	2-99
241-8	Object Markers and End-of-Roadway Markers.....	2-100
242	PLAN NOTES.....	2-101
242-1	General	2-101
242-2	Power Supply for Sign Lighting.....	2-101
242-3	630 Overhead Sign Support Modification, by Type.....	2-101
242-4	Reference Location Signs.....	2-102
242-5	630 Modification of Barrier Wall Assembly	2-102
242-6	Reserved - Existing Note Deleted	2-102
242-7	Reserved - Existing Note Deleted	2-102
242-8	630 Signing Misc.: Solar-Powered Rectangular Rapid Flashing Beacon (RRFB) Sign Assembly.....	2-102
242-9	Signing, Misc.: Solar-Powered LED Enhanced (Sign Type, Sign Size).....	2-105
243	SPECIFICATIONS	2-106
250	CONSTRUCTION	2-107
250-1	General	2-107
250-2	Sign Service.....	2-107
250-3	Foundations.....	2-107
250-4	Overhead Supports in General.....	2-109
250-5	Overhead Sign Supports By Type.....	2-114
250-6	Ground-Mounted Sign Supports.....	2-120
250-7	Signs.....	2-123
250-8	Sign Lighting.....	2-127
260	MAINTENANCE / OPERATIONS.....	2-131
260-1	General	2-131
260-2	Responsibilities.....	2-131
260-3	Maintenance on Interstate Routes Within Municipalities	2-131
260-4	Maintenance on Non-Interstate State Highways Within Municipalities	2-131
260-5	Systematic Sign Replacement Program	2-133
260-6	Maintenance of STOP and YIELD Signs at County and Township Road Intersections.....	2-134
260-7	Maintenance of Sign Lighting.....	2-135
295	REFERENCE RESOURCES.....	2-137
295-1	General	2-137
295-2	Sign Designs and Markings Manual (SDMM)	2-137
296	FORMS INDEX	2-139
Form 296-1.	Request for Business Route Signs on a County Road.....	2-141
Form 296-2.	Request for Business Route Signs within a Corporation.....	2-142
Form 296-3.	HAR Installation and Maintenance Agreement	2-143
Form 296-4.	Overhead Sign Support Inspection	2-149
297	TABLES INDEX.....	2-151
Table 297-1.	Sizes of Lane-Use Control Signs.....	2-155
Table 297-2.	Lake Erie Circle Tour Routes	2-158
Table 297-3.	Reserved for Future Information.....	2-159

Table 297-4.	Signing for Traffic Generators on Freeways & Expressways	2-160
Table 297-5.	Control City Destinations for Ohio's Interstate System	2-162
Table 297-6.	Sign Copy	2-162
Table 297-7.	Types of Overhead Sign Supports	2-163
Table 297-8a.	Weight of Overhead Supports - Truss	2-165
Table 297-8b.	Weight of Overhead Supports - Semi-Overhead & Center Mount	2-167
Table 297-8c.	Weight of Overhead Supports - Butterfly	2-168
Table 297-8d.	Weight of Overhead Supports - Single Arm	2-169
Table 297-8e.	Weight of Overhead Supports - Cantilever	2-170
Table 297-8f.	Weight of Overhead Supports - Structure Mounted	2-171
Table 297-9.	Bolt Size and Maximum Torque for Beams	2-172
Table 297-10.	Bolt Tension	2-172
Table 297-11.	Sign Lighting Lamps and Ballast	2-172
Table 297-12.	Guide Sign Sizes	2-173
Table 297-13.	Reserved for Future Information	2-181
Table 297-14.	Watershed Sign Locations	2-181
Table 297-15.	Specific Service (Logo) Signing Program Eligibility Criteria	2-182
Table 297-16.	TODS Signing Program Eligibility Criteria	2-183
Table 297-17.	Reserved for Future Information	2-184
Table 297-18.	Memorial Highways and Bridges Established by ORC Sections 5511.01 and 5511.09	2-185
298	FIGURES INDEX	2-187
Figure 298-1.	Signing for Median Crossovers	2-191
Figure 298-2.	STOP Signs at Intersections	2-192
Figure 298-3.	Reserved for Future Information	2-193
Figure 298-4.	Regulatory and Warning Signs	2-193
Figure 298-5.	Route and Information Signs	2-195
Figure 298-6.	Rest Area and Miscellaneous Signs	2-198
Figure 298-7.	Amish Buggy Signing where Paved Shoulder Becomes Narrower	2-201
Figure 298-8.	Placement of Overhead Exit Direction Sign - Span Type	2-202
Figure 298-9.	Placement of Overhead Exit Direction Sign - Cantilever Type	2-202
Figure 298-10.	Reserved for Future Information	2-203
Figure 298-11.	Sight Distance Requirements for Overhead Guide Signs	2-203
Figure 298-12.	Design Chart for TC-12.30 Sign Supports	2-204
Figure 298-13.	Design Chart for Overhead Sign Support Trusses	2-205
Figure 298-14.	Design Chart for Single Post Installations	2-206
Figure 298-15.	Design Chart for Two Post Installations	2-207
Figure 298-16.	Design Chart for Two Beam Installations	2-208
Figure 298-17.	Design Chart for Three Beam Installations	2-209
Figure 298-18.	Design Chart for TC-17.10 Sign Supports	2-210
Figure 298-19.	Two and Three Beam Installation Details	2-211
Figure 298-20.	TC-16.21 Overhead Sign Support	2-212
Figure 298-21.	TC-17.10 Span Wire Sign Support	2-213
Figure 298-22.	Lane-Use Control Signs Index	2-214
Figure 298-23.	Mounting a Sign Support on Concrete Barrier	2-216
Figure 298-24.	Staking Sign Locations	2-217
Figure 298-25.	Foundation Excavations	2-218
Figure 298-26.	Solid Wood Posts	2-219
Figure 298-27.	Design Chart for Solid Wood Posts	2-220
Figure 298-28.	Example of Signing for an Expressway At-Grade Intersection with a Numbered Route	2-221
Figure 298-29.	Example of Signing for an Expressway At-Grade Intersection with an Unnumbered Route	2-222
Figure 298-30.	Example of Signing for a Multi-Lane Rural Conventional Road Intersection with an Important Public Road	2-223
Figure 298-31.	Example of Signing for a Single Lane Rural Conventional Road Intersection with an Important Public Road	2-224
Figure 298-32.	Example of Signing for a Single Lane Rural Conventional Road Offset Intersection with an Important Public Road	2-225
Figure 298-33.	Signing for an Optional Lane Exit without a Secondary Exit	2-226

Figure 298-34. Example of Signing for an Optional Lane Exit with a Secondary Exit - Low-Volume Primary Exit	2-226
Figure 298-35. Example of Signing for an Optional Lane Exit with a Secondary Exit - High-Volume Primary Exit.....	2-226
Figure 298-36. Exmapple of Signing for an Optional Lane Exit with a Secondary Exit - Major Splits	2-226
Figure 298-37. Examples of Signing for Historical Markers	2-227
Figure 298-38a.Route Signing for Municipal Street Systems (Example A).....	2-228
Figure 298-38b.Route Signing for Municipal Street Systems (Example B).....	2-229
Figure 298-39. Example of Freeway and Expressway Rest Area Signing.....	2-230
Figure 298-40. Example of Conventional Road Rest Area Signing.....	2-230
Figure 298-41. Example of Conventional Road Rest Area Signing.....	2-230
Figure 298-42. Example of Clearance Signs on a Low Clearance Structure	2-230
Figure 298-43. Example of Freeway Transition Signing	2-231
Figure 298-44. Example of Conventional Highway Transition Signing	2-232
Figure 298-45. Freeway Guide Signing Arrangement (Example A).....	2-233
Figure 298-46. Freeway Guide Signing Arrangement (Example B).....	2-234
Figure 298-47. Freeway Guide Signing Arrangement (Example C)	2-235
Figure 298-48. Design Charts for Lamintated Veneer Wooden Box Beam Sign Supports	2-236

Part 3 - MARKINGS 3-1

TABLE OF CONTENTS.....3-1

300 GENERAL	3-5
300-1 Introduction	3-5
300-2 Construction Projects.....	3-5
300-3 Force Account (ODOT Operations) Work.....	3-5
301 PAVEMENT & CURB MARKINGS.....	3-6
301-1 General	3-6
301-2 Selection of Pavement Marking Materials.....	3-6
301-3 Pavement Marking in Incorporated Villages	3-6
301-4 Longitudinal Markings.....	3-7
301-5 Stop Lines	3-7
301-6 Crosswalk Markings.....	3-8
301-7 Parking Space Markings.....	3-8
301-8 Pavement Marking Words and Symbols.....	3-9
301-9 Two-Way Left-Turn Arrows	3-9
301-10 Speed Measurement Markings	3-9
301-11 Railroad Approach Markings.....	3-10
301-12 Speed Hump Markings	3-10
301-13 Dotted Lines	3-11
301-14 Chevron and Diagonal Crosshatch Markings.....	3-11
301-15 Elongated Route Shield Symbol Markings.....	3-12
301-16 Guidelines to Apply Pavement Markings over Chip Seal Surface or Chip Seal Surface Covered with Fog Seal.....	3-13
301-17 Wrong-Way Arrows.....	3-14
301-18 Lane-Reduction Arrows	3-14
301-19 Guidelines to Apply Contrast Markings (Black and White)	3-14
301-20 Guidelines to Install Bicycle Facility Markings with Heat-Fused Preformed Thermoplastic Pavement Marking Material (Item 647).....	3-17
301-21 Inlaid Concrete Bridge Deck Long Line Markings	3-18
302 RAISED PAVEMENT MARKERS	3-19
302-1 General	3-19
302-2 Guidelines and Placement Standards	3-19
302-3 Administrative Responsibilities.....	3-19
302-4 Maintenance.....	3-20
302-5 Raised Pavement Markers in Villages.....	3-20
302-6 Narrow and One-Lane Bridges.....	3-20

	302-7 Fire Hydrant Markings.....	3-20
304	DELINEATORS.....	3-21
	304-1 General.....	3-21
	304-2 Delineator Types.....	3-21
	304-3 Application Guidelines.....	3-21
	304-4 Narrow and One-Lane Bridges.....	3-21
305	COLORED PAVEMENTS	3-22
306	BARRICADES AND CHANNELIZING DEVICES	3-22
307	BARRIER REFLECTORS	3-22
	307-1 General.....	3-22
	307-2 Application on ODOT-Maintained Highways.....	3-22
	307-3 Reflector Color.....	3-22
	307-4 Reflector Types.....	3-23
310	ISLANDS	3-24
320	MATERIALS AND HARDWARE	3-24
	320-1 General.....	3-24
	320-2 Patented or Proprietary Materials, Specifications or Processes	3-24
	320-3 Purchasing Materials for Installation and Use by Local Agencies.....	3-24
	320-4 Use of Type G Sheeting.....	3-24
	320-5 Barrier Reflectors.....	3-24
330	PLANNING / PROGRAMMING	3-25
340	DESIGN INFORMATION	3-25
	340-1 General.....	3-25
	340-2 Stage 2 and 3 Plan Submittals	3-25
341	PLAN PREPARATION / PRODUCTION	3-27
	341-1 General.....	3-27
	341-2 Pavement Marking.....	3-27
	341-3 Work Zone Pavement Marking Materials.....	3-28
	341-4 Raised Pavement Markers.....	3-28
	341-5 Air Speed Zone Markings.....	3-29
	341-6 Bikeway Pavement Markings	3-29
342	PLAN NOTES	3-31
	342-1 General.....	3-31
	342-2 Handicap Symbol Marking	3-31
	342-3 621 Raised Pavement Marker Removed	3-31
	342-4 Air Speed Zone Marking	3-32
	342-5 Green Colored Pavement for Bike Lanes	3-32
	342-6 Item Special – Inlaid Concrete Bridge Deck Long-Line Markings	3-33
343	SPECIFICATIONS	3-34
	343-1 General.....	3-34
	343-2 Supplement 1047 Pavement Marking Evaluation on ODOT-Maintained Highways.....	3-34
350	CONSTRUCTION	3-36
	350-1 General.....	3-36
	350-2 Work Zone Performance Evaluations	3-36
	350-3 Raised Pavement Marker (RPM) Casting Installation	3-36
	350-4 Raised Pavement Marker (RPM) Reflector Replacement	3-37
	350-5 Remedial Action for Improperly Installed RPM Castings	3-38
	350-6 Delineators	3-41
	350-7 Barrier Reflectors.....	3-42
	350-8 Pavement Markings	3-42
360	MAINTENANCE / OPERATIONS	3-49
	360-1 General.....	3-49
	360-2 Maintenance of Raised Pavement Markers (RPMs).....	3-49

370	OTHER CONSIDERATIONS.....	3-52
380	RESEARCH.....	3-52
395	REFERENCE RESOURCES.....	3-52
396	FORMS INDEX	3-53
	Form 396-1. Air Speed Check Zone Request	3-55
397	TABLES INDEX	3-57
	Table 397-1. Material Selection for Pavement Marking and Expected Marking Life in Years.....	3-59
	Table 397-2. Area Calculations for Words and Symbols	3-62
	Table 397-3. Rating Daytime Color of Long Line Pavement Marking	3-63
	Table 397-4. Rating Night Visibility of Long Line Pavement Marking.....	3-64
	Table 397-5. Durability of Long Line Pavement Marking.....	3-65
	Table 397-6. Compatibility of Pavement Marking Materials for Restripe Situations	3-66
398	FIGURES INDEX	3-67
	Figure 398-1. Cardinal Direction Markings.....	3-68
	Figure 398-2. Marking a Narrow or One-Lane Bridge	3-69
	Figure 398-3. Reserved for Future Information	3-70
 Part 4 - SIGNALS		 4-1
	TABLE OF CONTENTS.....	4-1
400	GENERAL	4-9
	400-1 Introduction	4-9
	400-2 Construction Projects.....	4-9
	400-3 Force Account (ODOT Operations) Work.....	4-9
401	TRAFFIC CONTROL SIGNALS - GENERAL.....	4-11
	401-1 General	4-11
	401-2 Installation of Traffic Signals on State Highways	4-11
	401-3 Periodic Review of Signals.....	4-11
	401-4 Removal of Traffic Signals Under ODOT Jurisdiction	4-11
	401-5 Identifying Maintenance Responsibility for a Traffic Signal	4-13
	401-6 Village Signal Permit Procedures.....	4-13
	401-7 Signal Agreements	4-14
	401-8 Open Architecture Traffic Signal Controllers.....	4-17
	401-9 Americans with Disabilities Act (ADA) Requirements.....	4-17
	401-10 Special or Off-Duty Law Enforcement Officer Operation of ODOT Traffic Traffic Signal Procedures.....	4-17
402	TRAFFIC CONTROL SIGNAL NEEDS STUDIES	4-19
	402-1 General	4-19
	402-2 Traffic Volumes.....	4-19
	402-3 Signal Warrant Practices and Procedures	4-19
	402-4 Unwarranted Existing Signalized Intersections.....	4-22
	402-5 Removing Right-Turn Vehicles from Signal Warrant Analysis.....	4-22
403	TRAFFIC CONTROL SIGNAL FEATURES AND OPERATION	4-25
	403-1 General	4-25
	403-2 Yellow Change and Red Clearance Intervals	4-25
	403-3 Flashing Operation of Traffic Control Signals	4-26
	403-4 Approach Monitoring.....	4-26
	403-5 Traffic Law Photo Monitoring, Automated Traffic Enforcement and Surveillance Devices	4-27
	403-6 Emergency-Vehicle Preemption Control Systems	4-27
	403-7 Flashing Yellow Arrow (FYA) Operation	4-28
	403-8 Signal Operation Changed Sign (W3-H2a, W3-H2b).....	4-28
	403-9 Yellow Trap	4-29
	403-10 Railroad Preemption Control Systems.....	4-30

	403-11 Conflict Monitors	4-33
	403-12 Central Signal System Control Station (CSSCS)	4-40
404	PEDESTRIAN CONTROL FEATURES	4-41
	404-1 General.....	4-41
	404-2 Pushbuttons.....	4-41
	404-3 Accessible Pedestrian Signals and Locator Tones	4-41
	404-4 Pedestrian Hybrid Beacons.....	4-42
405	FLASHING BEACONS	4-43
	405-1 General.....	4-43
	405-2 STOP Signs and Intersection Control Beacons	4-43
	405-3 Rectangular Rapid Flashing Beacon (RRFB).....	4-43
406	SPECIAL PURPOSE TRAFFIC CONTROL SIGNALS	4-43
	406-1 General.....	4-43
	406-2 Temporary Traffic Signals	4-43
	406-3 Traffic Control Signals for Emergency Vehicle Access Guidelines	4-43
407	OTHER ELECTRICAL DEVICES	4-45
	407-1 General.....	4-45
	407-2 PREPARE TO STOP WHEN FLASHING Signs (W3-H4a).....	4-45
408	IN-ROADWAY LIGHTS.....	4-49
	408-1 General.....	4-49
	408-2 Use of In-Roadway Lights on State Highways	4-49
420	MATERIALS AND SIGNAL HARDWARE	4-51
	420-1 General.....	4-51
	420-2 Patented or Proprietary Materials, Specifications or Processes	4-51
	420-3 Purchasing Materials for Installation and Use by Local Agencies.....	4-51
	420-4 Vehicular Signal Heads.....	4-51
	420-5 Detection	4-53
421	SIGNAL SUPPORTS	4-57
	421-1 General.....	4-57
	421-2 Signal Support Inspections.....	4-57
430	PLANNING / PROGRAMMING	4-58
440	DESIGN INFORMATION	4-59
	440-1 General.....	4-59
	440-2 Electrical Power for Traffic Signals.....	4-59
	440-3 Single-Arm Overhead Signal Support.....	4-59
	440-4 Two-Arm Signal Support Design	4-61
	440-5 Span Wire Signal Support Design Software (SWISS).....	4-62
	440-6 Traffic Signal Timing Analysis	4-62
	440-7 Stage 2 and 3 Plan Submittals	4-62
	440-8 ADA Requirements on Traffic Signal Projects.....	4-64
	440-9 Paying Locals with Project Funds.....	4-64
	440-10 Span-Mounted Traffic Signal Support Structures.....	4-65
	440-11 Solar-Powered Devices.....	4-68
	440-12 Signal Cable in Breakaway Transformer Base.....	4-68
441	PLAN PREPARATION / PRODUCTION	4-69
	441-1 General	4-69
	441-2 Reserved for Future Information.....	4-69
	441-3 Signal and Sign Supports.....	4-69
	441-4 Power Service	4-69
	441-5 Underground Facilities	4-69
	441-6 Quantities	4-70
	441-7 Bid Item Descriptions.....	4-70
	441-8 Signal Support, Detail Design Requirements.....	4-70
	441-9 Service Cable	4-71
	441-10 Two-Arm Signal Supports	4-72

441-11	Guarantees	4-72
441-12	Alternate Bids.....	4-72
442	PLAN NOTES.....	4-73
442-1	General	4-73
442-2	Power Supply for Traffic Signals	4-73
442-3	Signal Activation.....	4-73
442-4	632 Removal of Traffic Signal Installation.....	4-73
442-5	632 Interconnect Cable, Misc.: (by Size), with Support Messenger, As Per Plan	4-74
442-6	632 Loop Detector Units, by Type, As Per Plan.....	4-74
442-7	Detection Maintenance	4-75
442-8	Work Inspection.....	4-75
442-9	632 Loop Detector Lead-In Cable, Direct Burial	4-75
442-10	632 Combination Signal Support, Type TC-81.21 and Sign Support, TC- (with Light Pole Extension).....	4-75
442-11	632 Combination Strain Pole, Type TC-81.10 and Sign Support, TC- (with Light Pole Extension).....	4-76
442-12	Strain Pole and Pedestal Foundation Elevations	4-76
442-13	632 Vehicular Signal Head, (LED), (By Type), As Per Plan	4-76
442-14	Reserved – Existing Note Deleted.....	4-77
442-15	Guarantee	4-77
442-16	633 Alternate Bid Item	4-77
442-17	Reserved – Existing Note Deleted.....	4-78
442-18	632 Pedestrian Signal Head (LED), (Countdown), Type D2, As Per Plan	4-78
442-19	632 Relamp Existing Signal Section with LED Module, By Lens Type, As Per Plan	4-78
442-20	633 Controller Unit, Type 2070E, with Cabinet, By Type, As Per Plan	4-79
442-21	Reserved – Existing Note Deleted.....	4-79
442-22	Reserved – Existing Note Deleted.....	4-79
442-23	Reserved – Existing Note Deleted.....	4-79
442-24	Controller Unit, Type TS2/A2, with Cabinet, Type TS2, As Per Plan.....	4-80
442-25	633 Preemption	4-80
442-26	633 Preemption Receiving Unit.....	4-81
442-27	633 Preemption Detector Cable.....	4-82
442-28	633 Preempt Phase Selector	4-82
442-29	633 Preempt Confirmation Light, LED.....	4-82
442-30	Pull Box, 24" x 35" x 26".....	4-83
442-31	632 Pole Entrance Fitting.....	4-83
442-32	Grounding and Bonding.....	4-83
442-33	Underdrains for Pullboxes.....	4-85
442-34	Reserved – Existing Note Deleted.....	4-85
442-35	Reserved – Existing Note Deleted.....	4-85
442-36	Reserved – Existing Note Deleted.....	4-85
442-37	Reserved – Existing Note Deleted.....	4-85
442-38	Reserved – Existing Note Deleted.....	4-86
442-39	Reserved – Existing Note Deleted.....	4-86
442-40	633 Uninterruptible Power Supply (UPS), Battery Replacement	4-86
442-41	633 Uninterruptible Power Supply, (USP), 1000 Watt, As Per Plan.....	4-86
442-42	Reserved for Future Use.....	4-87
442-43	632 Auger-In Foundation, 8-inch Diameter by (Depth in Feet)	4-87
442-44	632 Signal Support Foundation.....	4-88
442-45	632 Signal Support, Mechanical Damper for TC-81.21 Mast Arm (Greater Than 59' in Length), As Per Plan.....	4-88
442-46	632 Signal Support, (By Type), As Per Plan.....	4-88
442-47	632 Signalization, Misc.: Unlash and Relash Messenger Wire.....	4-89
442-48	809 Advance Radar Detection	4-89
442-49	809 Stop-Line Radar Detection.....	4-90
442-50	General Electrical Requirements for Solar-Powered Devices	4-90

443	SPECIFICATIONS	4-92
450	CONSTRUCTION	4-93
	450-1 General.....	4-93
	450-2 Foundations.....	4-93
	450-3 Electrical Appurtenances	4-93
	450-4 Power Service for Traffic Signals.....	4-96
	450-5 Pole and Support Inspection - General.....	4-96
	450-6 Traffic Signal Supports.....	4-96
	450-7 Sag and Vertical Clearance.....	4-98
	450-8 Signal Span Messenger Wire and Appurtenances.....	4-98
	450-9 Method of Measurement for Cable and Wire	4-104
	450-10 Signal Equipment and Wiring	4-104
	450-11 Signal Performance Tests and System Checks	4-111
	450-12 Controller Change Orders	4-116
460	MAINTENANCE / OPERATIONS	4-117
	460-1 General.....	4-117
	460-2 Responsibilities.....	4-117
	460-3 Preventive Maintenance.....	4-118
	460-4 As Required Maintenance.....	4-119
	460-5 Malfunction Response.....	4-119
	460-6 Record Retention.....	4-120
	460-7 Training	4-120
	460-8 Reserved for Future Information.....	4-120
	460-9 Signal Databases.....	4-121
	460-10 Signal Inspection Items.....	4-121
	460-11 Dark Signals	4-121
470	OTHER CONSIDERATIONS.....	4-123
480	RESEARCH	4-123
495	REFERENCE RESOURCES	4-123
	495-1 General.....	4-123
	495-2 Signal Design Reference Packet (SDRP).....	4-123
496	FORMS INDEX	4-125
	Form 496-1. Signal Support Inspection Form.....	4-127
	Form 496-2. Traffic Signal Stage 3 Check List	4-128
	Form 496-3. Traffic Signal Controller Timing Chart for Actuated Signals	4-130
	Form 496-4. Traffic Signal Detector Chart.....	4-130
	Form 496-5. Coordination Timing Chart.....	4-130
	Form 496-6. Report of Electrical Tests.....	4-131
	Form 496-7. Signal Inspection Form	4-133
	Form 496-8. Application to Install and Operate a Traffic Control Signal	4-135
	Form 496-9. Application for Approval of Traffic Control Signal Operation	4-136
	Form 496-10. Permit for Operation of a Traffic Control Signal	4-137
	Form 496-11. Application to Modify Operation of a Traffic Control Signal	4-138
	Form 496-12. Right Turn Factorization Sheet	4-139
	Form 496-13. Example of a Completed Right Turn Factorization Sheet	4-140
	Form 496-14. Application for a Permit to Have a Special or Off-Duty Law Enforcement Officer (LEO) to Operate a Traffic Control Signal.....	4-141
	Form 496-15. Permit for a Special or Off-Duty LEO to Operate a Traffic Control Signal.....	4-142
	Form 496-16. Field Wiring Hook-Up Chart	4-143
	Form 496-17. Example of Field Wiring Hook-Up Chart.....	4-143
	Form 496-18. Vehicular/Ped Volume Chart.....	4-144
	Form 496-19. Pedestrian Hybrid Evaluation Matrix	4-144
497	TABLES INDEX	4-145
	Table 497-1. Cross Section Area of Conduit, Cable and Wire	4-147
	Table 497-2. Cable and Wire Identification	4-148
	Table 497-3. Minimum Sight Distance	4-149

	Table 497-4. Types of Overhead Signal Supports	4-150
	Table 497-5. Areas for Signal Heads.....	4-151
	Table 497-6. Height from Bottom of Signal Head to Messenger Wire or Mast Arm.....	4-152
	Table 497-7. Minor Street Analysis Parameters-Minor Leg Lane Configurations and Right Turn Reductions.....	4-153
	Table 497-8. Minor Street Analysis Parameters- Mainline Congestion Factors for Limiting Right Turn Reductions.....	4-154
	Table 497-9. Village Signal Permit Number Assignments	4-154
498	FIGURES INDEX	4-155
	Figure 498-1. Emergency Traffic Signals Guidelines	4-159
	Figure 498-2. Sample Field Wiring Hook-Up Charts	4-160
	Figure 498-3. Suggested Loop Placement for Mainline vs. Large-Volume Side Street	4-161
	Figure 498-4. Suggested Loop Placement for Mainline vs. Ramp/T Intersection	4-165
	Figure 498-5. Suggested Loop Placement for Mainline vs. Low-Volume Side Street	4-169
	Figure 498-6. Concrete Pull Box.....	4-173
	Figure 498-7. Trench Details.....	4-174
	Figure 498-8. Exothermic Weld.....	4-175
	Figure 498-9. Power Service.....	4-176
	Figure 498-10. Strain Pole Supports	4-177
	Figure 498-11. Strain Pole Attachment Details	4-178
	Figure 498-12. Single Arm Support	4-179
	Figure 498-13. Sag and Vertical Clearance Diagram	4-180
	Figure 498-14. Cable Support Assembly	4-181
	Figure 498-15. Aerial Interconnect Cable	4-182
	Figure 498-16. Method of Measurement for Signal Cable.....	4-183
	Figure 498-17. Method of Measurement for Interconnect Cable.....	4-184
	Figure 498-18. Method of Measurement for Detector Lead-In Cable.....	4-185
	Figure 498-19. Method of Measurement for Power Cable.....	4-186
	Figure 498-20. Method of Measurement for Service Cable	4-187
	Figure 498-21. Vehicular Signal Heads	4-188
	Figure 498-22. Pedestrian Signal Heads	4-189
	Figure 498-23. Loop Detector Placement and Installation.....	4-190
	Figure 498-24. Loop Detector Slots and Wiring	4-191
	Figure 498-25. Loop Detector Wiring.....	4-192
	Figure 498-26. Magnetometer Probes and Lead-In	4-193
	Figure 498-27. Vehicle Loop Test Targets.....	4-194
	Figure 498-28. Short-Circuit Test	4-195
	Figure 498-29. Circuit Continuity Test of Loop Wire (Before Splice to Lead-In Cable)	4-196
	Figure 498-30. Circuit Continuity Test of Loop Wire and Lead-In Cable	4-197
	Figure 498-31. Circuit Continuity Test of Signal Cable Disconnected from Heads or Other Cables Such as Interconnect and Loop or Magnetometer Lead-In.....	4-198
	Figure 498-32. Circuit Continuity Test of Signal Cable With Cable Connected to the Signal Heads and Lamps Installed.....	4-199
	Figure 498-33. Cable Insulation Test (Loop Detector Wire)	4-200
	Figure 498-34. Cable Insulation Test (Signal Cable).....	4-201
	Figure 498-35. Reserved for Future Use	4-202
	Figure 498-36. Plan Details for Strain Poles.....	4-202
	Figure 498-37. Plan Details for Signal Supports - Arm Lengths.....	4-203
	Figure 498-38. Plan Details for Signal Supports - Mast Arm Orientation	4-204
	Figure 498-39. Example of Wire Size for Equipment Grounding Conductor – PTSWF with Pedestrian Indications	4-205
	Figure 498-40. Example of Wire Size for Equipment Grounding Conductor – PTSWF without Pedestrian Indications	4-206
	Figure 498-41. Example of Wire Size for Equipment Grounding Conductor – Mast Arms.....	4-207
	Figure 498-42. Example of Wire Size for Equipment Grounding Conductor – Span Wire	4-208

	Figure 498-43 Dilemma Zone Graph	4-209
	Figure 498-44 Span Support Guidelines.....	4-210
	Figure 498-45 Example of a Wiring Diagram	4-212
	Figure 498-46 Example of a Phasing Diagram.....	4-213
Part 5 - LOW-VOLUME ROADS.....		5-1
	TABLE OF CONTENTS	5-1
500 GENERAL.....		5-3
595 REFERENCE RESOURCES		5-3
Part 6 - TEMPORARY TRAFFIC CONTROL.....		6-1
	TABLE OF CONTENTS	6-1
600 GENERAL.....		6-13
600-1	Introduction.....	6-13
600-2	Construction Projects.....	6-13
600-3	Force Account (ODOT Operations) Work	6-13
600-4	Public Communication	6-14
600-5	High vs. Low-Volume Highways	6-14
600-6	Incident Management Areas	6-14
601 FUNDAMENTAL PRINCIPLES		6-15
601-1	General.....	6-15
601-2	Work Zones on ODOT-Maintained Highways	6-15
601-3	District Work Zone Traffic Manager (DWZTM).....	6-15
602 TEMPORARY TRAFFIC CONTROL ELEMENTS.....		6-17
602-1	General.....	6-17
602-2	Temporary Traffic Control Plans.....	6-17
602-3	Temporary Traffic Control Zones.....	6-17
602-4	Components of Temporary Traffic Control Zones	6-17
602-5	Tapers	6-19
602-6	Detours, Alternate Routes and Diversions	6-21
602-7	One-Lane, Two-Way Traffic Control	6-21
602-8	Work Vehicles.....	6-22
603 PEDESTRIAN AND WORKER SAFETY		6-25
603-1	General.....	6-25
603-2	Pedestrian Considerations	6-25
603-3	Worker Considerations.....	6-25
604 FLAGGER CONTROL		6-27
604-1	General.....	6-27
604-2	Qualifications for Flaggers.....	6-27
604-3	High-Visibility Safety Apparel	6-27
604-4	Hand-Signaling Devices.....	6-27
604-5	Automated Flagger Assistance Devices (AFADs).....	6-27
604-6	Hand-Signaling Procedures	6-28
604-7	Flagger Stations.....	6-28
605 TEMPORARY TRAFFIC CONTROL ZONE DEVICES		6-29
605-1	General.....	6-29
605-2	General Characteristics of Signs	6-29
605-3	Regulatory Signs	6-30
605-4	Special Regulatory Signs	6-31
605-5	Warning Signs	6-33
605-6	Special Warning Signs.....	6-36
605-7	Guide Signs.....	6-37
605-8	Special Guide Signs.....	6-39
605-9	Portable Changeable Message Signs (PCMSs).....	6-39

605-10	Arrow Boards.....	6-40
605-11	Channelizing Devices	6-40
605-12	Lighting Devices	6-45
605-13	Temporary Traffic Control Signals.....	6-46
605-14	Temporary Traffic Barriers	6-47
605-15	Crash Cushions.....	6-50
605-16	Reserved for Future Information	6-51
605-17	Rumble Strips.....	6-51
605-18	Screens	6-51
605-19	Barrier Reflectors and Object Markers	6-52
605-20	Future and Experimental Devices	6-53
606	TYPE OF TEMPORARY TRAFFIC CONTROL ZONE ACTIVITIES.....	6-55
606-1	General	6-55
606-2	Typical Applications.....	6-56
606-3	Work Duration	6-56
606-4	Location of Work.....	6-56
606-5	Modifications to Fulfill Special Needs	6-57
606-6	Work Outside of Shoulder.....	6-57
606-7	Work on the Shoulder with No Encroachment	6-57
606-8	Work on the Shoulder with Minor Encroachment.....	6-57
606-9	Work Within the Median.....	6-58
606-10	Work Within the Traveled Way of Two-Lane Highways	6-58
606-11	Work Within the Traveled Way of Urban Streets.....	6-58
606-12	Work Within the Traveled Way of Multi-Lane, Nonaccess Controlled Highways.....	6-58
606-13	Work Within the Traveled Way at an Intersection	6-58
606-14	Work Within the Traveled Way of Expressways and Freeways.....	6-59
606-15	Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway	6-59
606-16	Crossovers	6-59
606-17	Interchanges.....	6-59
606-18	Movable Barriers	6-60
606-19	Work in the Vicinity of Highway-Rail Grade Crossings.....	6-60
606-20	Control of Traffic Through Incident Areas.....	6-60
606-21	Work Affecting Pedestrian and Bicycle Facilities	6-60
606-22	Temporary Traffic Control Through Nighttime Hours.....	6-60
607	TYPICAL APPLICATIONS	6-61
607-1	General	6-61
607-2	Blasting Zone (OMUTCD Figure 6H-2).....	6-62
607-3	Road Closed with Off-Site Detour (OMUTCD Figure 6H-8)	6-62
607-4	Lane Closures on Low-Volume, Two-Lane Road (OMUTCD Figure 6H-11).....	6-62
607-5	Lane Closure on Two-Lane Road Using Traffic Signals (OMUTCD Fig. 6H-12).....	6-62
607-6	Temporary Road Closure (OMUTCD Figure 6H-13).....	6-62
607-7	Detour for One Travel Direction (OMUTCD Figure 6H-19).....	6-62
607-8	Right Lane Closure - Far Side of Intersection (OMUTCD Figure 6H-22)	6-62
607-9	Mobile Operation on Multi-Lane Road (OMUTCD Figure 6H-35)	6-62
607-10	Lane Shift on Freeway (OMUTCD Figure 6H-36)	6-62
607-11	Interior Lane Closure on Freeway (OMUTCD Figure 6H-38)	6-63
607-12	Median Crossover on Freeway (OMUTCD Figure 6H-39).....	6-63
607-13	Median Crossover for Entrance Ramp (OMUTCD Figure 6H-40).....	6-63
607-14	Partial Exit Ramp Closure (OMUTCD Figure 6H-43).....	6-63
607-15	Work in Vicinity of Entrance Ramp (OMUTCD Figure 6H-44 and Traffic SCDs MT-98.10 and 98.11).....	6-64
608	INCIDENT MANAGEMENT	6-65
608-1	General	6-65
608-2	Ohio Traffic Incident Management (TIM) Program.....	6-65
608-3	Incident Logging.....	6-67
608-4	Permitted Lane Closure Schedule (PLCS)	6-67
608-5	Detour Playbook.....	6-67

	608-6 Hazardous Materials (HazMat).....	6-68
	608-7 Diesel Spills.....	6-68
	608-8 Incident Command System (ICS) / National Incident Management System (NIMS).....	6-72
	608-9 Freeway Service Patrol (FSP).....	6-72
	608-10 OHGO Website.....	6-73
	608-11 Evacuation Plans.....	6-74
	608-12 Variable Speed Limits.....	6-74
620	MATERIALS AND HARDWARE	6-75
	620-1 General.....	6-75
	620-2 Safety Criteria.....	6-75
	620-3 Sheeting	6-75
	620-4 Temporary Sign Supports	6-75
	620-5 Roll-Up Signs.....	6-75
	620-6 Pavement Markings	6-76
	620-7 NCHRP 350 Compliance	6-76
630	PLANNING / PROGRAMMING	6-79
	630-1 General.....	6-79
	630-2 Compendium of Traffic Control Options.....	6-79
	630-3 Detours.....	6-79
	630-4 Permitted Lane Closure Schedule (PLCS).....	6-79
	630-5 Maintenance of Traffic Alternative Analysis (MOTAA).....	6-80
	630-6 Conceptual Maintenance of Traffic.....	6-83
640	DESIGN INFORMATION.....	6-85
	640-1 General.....	6-85
	640-2 Geometrics	6-85
	640-3 Sequence of Operation	6-86
	640-4 Lane Closure	6-87
	640-5 Use of Shoulders	6-87
	640-6 Work Zone Drop-Offs.....	6-88
	640-7 Ramp Closure.....	6-89
	640-8 Detours.....	6-89
	640-9 Construction Access Points.....	6-89
	640-10 Private Driveway Access.....	6-90
	640-11 Temporary Roads	6-90
	640-12 Crossover Construction.....	6-92
	640-13 Capacity	6-93
	640-14 Considering Holidays and Special Events	6-94
	640-15 Project Length Restrictions	6-94
	640-16 Work on Detour and Alternate Routes.....	6-95
	640-17 Coordination With Adjacent Projects	6-95
	640-18 Speeds in Work Zones.....	6-95
	640-19 Law Enforcement Officers (LEOs).....	6-99
	640-20 Temporary Traffic Control Devices	6-100
	640-21 Removal of Logo (Specific Service) Signs and Tourist-Oriented Directional Signs (TODS)	6-100
	640-22 Temporary Lighting.....	6-100
	640-23 Traffic Incident Management (TIM) During MOT.....	6-100
	640-24 Disincentives	6-100
	640-25 Pedestrian Considerations	6-102
	640-26 Advance Work Zone Information Signs	6-103
	640-27 Retiming of Existing Traffic Signals	6-104
	640-28 Freeway/Expressway Termination (“Permanent”).....	6-104
	640-29 Work Zone Intelligent Transportation Systems	6-105
641	PLAN PREPARATION / PRODUCTION	6-107
	641-1 General.....	6-107
	641-2 Temporary Traffic Control / Maintenance of Traffic (MOT) Plans	6-107
	641-3 Traffic Plan Insert Sheets (PISs)	6-108

641-4	Traffic Standard Construction Drawings (SCDs).....	6-108
641-5	Closing Right or Left Lane of a Multi-Lane Divided Highway (MT-95.30, 95.40 and 95.50)	6-108
641-6	Closing Right or Left Lane of a Multi-Lane Undivided Highway (MT-95.31, 95.32 and 95.41)	6-110
641-7	Closing Right or Left Shoulder of a Multi-Lane Divided Highway.....	6-111
641-8	Closure of a Two-Way Left Turn Lane (MT-95.60).....	6-112
641-9	Closure of Right Lane of Three-Lane Section with Two-Way Left-Turn Lane (MT-95.61)	6-112
641-10	Reserved for Future Use.....	6-113
641-11	Median Crossover Operation (MT-95.70, 95.71, 95.72, 95.73, 95.82 and 100.00)	6-113
641-12	Signalized Closing, One Lane of a Two-Lane Highway (MT-96.11, 96.20 and 96.26)	6-117
641-13	Flagger Closing One Lane of a Two-Lane Highway (MT-97.10, 97.11, 97.12 and 97.20)	6-122
641-14	Lane Closure at Entrance Ramp (MT-98.10 and 98.11)	6-122
641-15	Lane Closure at Exit Ramp (MT-98.20 and 98.21).....	6-123
641-16	Lane Closure in Deceleration Lane (MT-98.22)	6-124
641-17	Typical Lane Closures for Ramps (MT-98.28 and 98.29)	6-125
641-18	Traffic Control for Long Line Pavement Marking Operations (MT-99.20)	6-126
641-19	Freeway/Expressway Closure in Work Zones (MT-99.50)	6-126
641-20	Short-Term Closure of Multi-lane Divided Highway (MT-99.60)	6-128
641-21	Road Closure Using Type 3 Barricades (MT-101.60)	6-128
641-22	Barrier and Impact Attenuator Delineation (MT-101.70).....	6-129
641-23	Impact Attenuator Placement (MT-101.75)	6-129
641-24	Reserved for Future Use	6-129
641-25	Drop-Offs in Work Zones (MT-101.90)	6-129
641-26	Transition Plans for Use of Shoulder (MT-102.10, 102.20 and 102.30)	6-130
641-27	Temporary Sign Support (MT-105.10)	6-131
641-28	Detour of Pedestrians (MT-110.10)	6-132
641-29	New or Revised Traffic Control Signals (MT-120.00).....	6-132
641-30	Work Zone Delineation (MT-99.30)	6-132
641-31	Longitudinal Channelizer (PIS 2010180)	6-133
641-32	Typical Closures at Entrance Ramp and Turn Bay Closures (MT-98.30)	6-134
641-33	Construction Access Points (MT-103.10)	6-134
641-34	Work Zone Speed Zones for High-Speed (≥ 55 MPH) Multi-Lane Highways (MT-104.10).....	6-135
642	PLAN NOTES.....	6-137
642-1	General	6-137
642-2	Item 614, Maintaining Traffic.....	6-137
642-3	Item 614, Maintaining Traffic (At All Times).....	6-137
642-4	Item 614, Maintaining Traffic (Time Limitation on a Detour).....	6-137
642-5	Item 614, Maintaining Traffic (Winter Time Limitations)	6-137
642-6	Item 614, Maintaining Traffic (Lanes Open During Holidays or Special Events).....	6-138
642-7	Item 614, Maintaining Traffic (Lane Closure/Reduction Required)	6-138
642-8	Item 614, Maintaining Traffic (Notice of Closure Sign).....	6-138
642-9	Item 614, Maintaining Traffic (Estimated Quantities).....	6-139
642-10	Item 614, Maintaining Traffic (ROAD CLOSED Sign)	6-139
642-11	Item 614, Maintaining Traffic (Signs and Barricades).....	6-140
642-12	Item 614, Maintaining Traffic (Closing Paragraph for Note)	6-140
642-13	Placement of Asphalt Concrete.....	6-140
642-14	Trench for Widening	6-140
642-15	Overnight Trench Closing	6-140
642-16	Concrete Median Barrier Replacement	6-140
642-17	Drum Requirements.....	6-141
642-18	Reserved for Future Information	6-141
642-19	Dust Control	6-141
642-20	Work Zone Markings and Signs	6-141

642-21	Item 622, Portable Barrier, 50", As Per Plan.....	6-141
642-22	Item 614, Replacement Sign	6-142
642-23	Item 614, Replacement Drum.....	6-142
642-24	Work Zone Speed Zones (WZSZs)	6-143
642-25	Designated Local Detour Route	6-145
642-26	Reserved – Existing Note Deleted.....	6-146
642-27	Work Zone Increased Penalties Sign (R11-H5a)	6-146
642-28	Earthwork for Maintaining Traffic.....	6-147
642-29	Floodlighting	6-147
642-30	Item 614, Work Zone Impact Attenuator for 24" Wide Hazards (Unidirectional or Bidirectional).....	6-147
642-31	Item 614, Work Zone Impact Attenuator for Hazards Over 24" and Less Than 36" Wide, (Unidirectional or Bidirectional).....	6-148
642-32	Approved Maintenance of Traffic (MOT) Policy Exception(s)	6-149
642-33	Extra Advance Warning Signs (Note A).....	6-150
642-34	Extra Advance Warning Signs (Note B).....	6-150
642-35	Item 614, Work Zone Crossover Lighting System	6-151
642-36	Multi-Plan, Time-of-Day Operation of Work Zone Signal.....	6-151
642-37	Fully-Actuated Operation of Work Zone Traffic Signal	6-152
642-38	Overhead-Mounted Work Zone Signals.....	6-153
642-39	Lighting.....	6-153
642-40	Maintenance of Canoe Traffic	6-153
642-41	Item 614, Portable Changeable Message Signs, As Per Plan.....	6-154
642-42	Maintenance of Traffic Signal/Flasher Installation.....	6-156
642-43	Advance Work Zone Information	6-157
642-44	Worksite Traffic Supervisor	6-158
642-45	Traffic Incident Management (TIM) During MOT.....	6-160
642-46	Reserved – Existing Note Deleted.....	6-161
642-47	Speed Measurement Markings.....	6-161
642-48	Item 614, Work Zone Raised Pavement Marker, As Per Plan	6-162
642-49	Item 614, Work Zone Raised Pavement Markers on Concrete Surfaces	6-162
642-50	Reserved – Existing Note Deleted.....	6-163
642-51	Delineation of Portable and Permanent Barrier.....	6-163
642-52	Delineation of Temporary and Permanent Guardrail.....	6-164
642-53	Item 614, Longitudinal Channelizer	6-164
642-54	Item 614, Business Entrance (M4-H15) Sign, As Per Plan.....	6-165
642-55	Item 614, Law Enforcement Officer (With Patrol Car) for Assistance During Construction Operations	6-166
642-56	Reserved – Existing Note Deleted.....	6-167
642-57	Work Zone Queue Detection Warning Sign	6-167
642-58	Notification of Traffic Restrictions	6-167
642-59	Work Zone Egress Warning System.....	6-168
643	SPECIFICATIONS	6-170
650	CONSTRUCTION	6-170
650-1	General.....	6-170
650-2	Quality Standards for Temporary Traffic Control Devices and Acceptable Delineation Methods for Vehicles	6-170
660	MAINTENANCE / OPERATIONS	6-171
660-1	General.....	6-171
660-2	Reserved for Future Information.....	6-171
660-3	Temporary Traffic Control (TTC) for Pothole Patching	6-171
670	OTHER CONSIDERATIONS	6-175
670-1	General.....	6-175
670-2	Bikeways	6-175
670-3	Waterways.....	6-175
670-4	Motorcycles	6-175
670-5	Towing Operations.....	6-175
670-6	Rest Areas.....	6-175

	670-7 Railroad Crossings	6-176
	670-8 Transit Considerations.....	6-177
695	REFERENCE RESOURCES.....	6-178
	695-1 General	6-178
	695-2 Temporary Traffic Control Manual (reprint of OMUTCD Parts 1, 5 and 6).....	6-178
	695-3 Flagger Handbook.....	6-178
	695-4 Quality Standards for Temporary Traffic Control Devices and Acceptable Delineation Methods for Vehicles.....	6-178
	695-5 Guidelines for the Use of Portable Changeable Message Signs.....	6-178
	695-6 Guidelines for Traffic Control in Work Zones (Pocket Guide).....	6-178
696	FORMS INDEX.....	6-179
	Form 696-1a. Work Zone Constraints.....	6-181
	Form 696-1b. Example of a Completed Work Zone Constraints Form.....	6-182
	Form 696-2a. Bridge Information.....	6-183
	Form 696-2b. Example of a Completed Bridge Information Form.....	6-184
	Form 696-3a. Ramp Information	6-185
	Form 696-3b. Example of a Completed Ramp Information Form.....	6-186
	Form 696-4a. Cost Comparison	6-187
	Form 696-4b. Example of a Completed Cost Comparison Form	6-188
	Form 696-5 Example TIM Meeting Agenda.....	6-189
	Form 696-6 Example Traffic Incident Management Plan (TIMP) Checklist	6-190
	Form 696-7 Example TIM Roster Template	6-191
697	TABLES INDEX.....	6-192
	Table 697-1a. Construction / Traffic Maintenance Strategies.....	6-194
	Table 697-1b. Corridor Options Outside Work Zone.....	6-197
	Table 697-1c. Traffic Flow Options Inside Work Zone	6-199
	Table 697-1d. Time Limitations with Disincentive Options	6-203
	Table 697-1e. Contracting Procedure Options.....	6-205
	Table 697-1f. Administrative Options.....	6-207
	Table 697-2. Rate of Flow (Two-Way) for a Signalized One-Lane, Two-Way Closing	6-209
	Table 697-3. Initial Timing Chart	6-210
	Table 697-4. Minimum Lane Widths for Maintaining Traffic on Curves (Where $D > 10$ degrees)	6-211
	Table 697-5. Sample Phasing Chart for Actuated Signal Control	6-212
	Table 697-6. Maximum Closure Lengths.....	6-212
	Table 697-7. Barrier Offset on Curved Roadways	6-213
	Table 697-8. Decision Sight Distance for Entrance Ramp Applications.....	6-213
698	FIGURES INDEX.....	6-214
	Figure 698-1. Component Parts of a Traffic Control Zone.....	6-216
	Figure 698-2. Temporary Traffic Control Signs	6-217
	Figure 698-3. Median Crossover for Entrance Ramp.....	6-218
	Figure 698-4. Two-Lane Crossover Design (Existing 4-Lane Facility)	6-219
	Figure 698-5. Example of Typical Sections (Existing 4-Lane Facility).....	6-220
	Figure 698-6. Two-Lane Crossover Design (Existing 6-Lane Facility)	6-221
	Figure 698-7. Example Typical Sections (Existing 6-Lane Facility).....	6-222
	Figure 698-8. Sample Lane Configuration Diagrams and Cross Sections	6-223
	Figure 698-9. Pothole Patching on Multi-Lane Facilities That Will Violate the PLCS.....	6-224
	Figure 698-10. Pothole Patching on Multi-Lane Facilities That Will Not Violate the PLCS	6-225
	Figure 698-11 WTS Daily Inspection Report.....	6-227
	Figure 698-12 One-Lane Crossover Design (Existing 4-Lane Facility)	6-229

Part 7 - SCHOOL AREAS..... 7-1

TABLE OF CONTENTS.....7-1

700 GENERAL.....7-3

701 SCHOOL ROUTES AND ESTABLISHED SCHOOL CROSSINGS.....7-3

702	SCHOOL SIGNS	7-3
	702-1 General.....	7-3
	702-2 Use of Fluorescent Yellow-Green Retroreflective Sheeting.....	7-3
	702-3 School Speed Limit Signs	7-3
	702-4 School Speed Limit Sign with Beacons	7-3
	702-5 SCHOOL ENTRANCE Signs (S3-H3)	7-4
	702-6 Responsibilities for School Signs with Beacons.....	7-4
	702-7 School Bus Stop Ahead Sign (S3-1); SCHOOL BUS TURN AHEAD Sign (S3-2).....	7-5
704	SCHOOL AREA MARKINGS	7-6
	704-1 General.....	7-6
	704-2 SCHOOL Pavement Markings.....	7-6
705	SCHOOL ZONES	7-7
	705-1 General.....	7-7
	705-2 Requesting a School Zone Extension.....	7-7
	705-3 Withdrawing a School Zone Extension	7-8
	705-4 Documentation.....	7-8
742	PLAN NOTES	7-9
	742-1 General.....	7-9
	742-2 631 School Speed Limit Sign Assembly, Solar-Powered, As Per Plan	7-9
796	FORMS INDEX	7-11
	Form 796-1. Agreement for School Signs with Beacons.....	7-12
	Form 796-2. Letter Confirming Operation of School Signs with Beacons	7-14
	Form 796-3. Letter Confirming School Bus Stop Ahead / SCHOOL BUS TURN AHEAD Signs.....	7-15
	Form 796-4. School Zone Extension Request Form.....	7-16
	Form 796-5. School Zone Extension Withdrawal Form.....	7-17
797	TABLES INDEX	7-18
	Table 797-1. School Zone Number Assignments.....	7-18
 Part 8 – RAIL GRADE CROSSINGS		8-1
	TABLE OF CONTENTS	8-1
800	GENERAL	8-3
801	SIGNING	8-3
	801-1 General.....	8-3
	801-2 STOP Signs at Highway-Rail Grade Crossings	8-3
802	MARKINGS	8-5
	802-1 General.....	8-5
	802-2 Railroad Pavement Marking Symbol	8-5
803	ILLUMINATION	8-5
804	FLASHING LIGHT SIGNALS, GATES & TRAFFIC CONTROL SIGNALS	8-6
	804-1 General.....	8-6
	804-2 Definitions.....	8-6
	804-3 Railroad Preemption of Traffic Signals	8-8
	804-4 Highway-Rail Grade Crossing Warning System Interconnection Design Guidelines.....	8-9
805	RUMBLE STRIPS	8-10
830	PLANNING / PROGRAMMING	8-11
	830-1 General.....	8-11
	830-2 Grade Separation Program	8-11
	830-3 New or Upgrade Highway Traffic Signal Projects.....	8-11
	830-4 New or Upgrade Railroad Warning System Projects.....	8-12
840	DESIGN INFORMATION	8-13

Traffic Engineering Manual

840-1	General	8-13
840-2	Design of Locations with Railroad Preemption	8-13
840-3	Design of Pre-Signals	8-16
840-4	Design of Queue Cutter Signals.....	8-17
843	SPECIFICATIONS	8-18
895	REFERENCE RESOURCES.....	8-19
895-1	Railroad Grade Separation Program Policies and Procedures Manual	8-19
895-2	Railroad-Highway Grade Crossing Handbook	8-19
895-3	AREMA Communication & Signal Manual of Recommended Practice	8-19
896	FORMS INDEX	8-21
896-1	Highway-Rail Grade Crossing Warning System / Railroad Configuration and Timing Requirements.....	8-21
898	FIGURES INDEX	8-22
898-1	Example of an Interconnection Warning Label	8-22

Part 9 - BICYCLE FACILITIES 9-1

	TABLE OF CONTENTS.....	9-1
900	GENERAL	9-3
900-1	General Background.....	9-3
900-2	Designated Bicycle Routes	9-3
901	SIGNING.....	9-4
901-1	General	9-4
901-2	Bicycle 3-Foot Clearance Sign (R3-H16).....	9-4
902	MARKINGS	9-4
902-1	General	9-4
902-2	Bike Box	9-4
930	PLANNING / PROGRAMMING	9-5
930-1	Planning	9-5
930-2	Funding	9-5
940	DESIGN INFORMATION	9-7
940-1	General	9-7
940-2	Solar-Powered Crossing Sign Assembly	9-7
942	Plan Notes	9-7
942-1	General	9-7
942-2	631 Crossing Sign Assembly with Warning Beacon, Solar Powered.....	9-7
950	CONSTRUCTION	9-9
960	MAINTENANCE / OPERATIONS.....	9-9
995	REFERENCE RESOURCES.....	9-9
995-1	General	9-9
995-2	ODOT Design Guidance for Bicycle Facilities.....	9-9

Part 10 - RESERVED FOR FUTURE USE 10-1

Part 11 - HIGHWAY LIGHTING 11-1

	TABLE OF CONTENTS.....	11-1
1100	GENERAL	11-9
1100-1	Introduction	11-9
1100-2	Construction Projects.....	11-9
1100-3	Force Account (ODOT Operations) Work.....	11-9
1101	DISTRICT SYSTEM LIGHTING PLAN (DSLPL).....	11-11

1102	JURISDICTIONAL BOUNDARIES	11-11
1103	WARRANTS AND GUIDELINES	11-13
	1103-1 General.....	11-13
	1103-2 Warrants for Highway Lighting	11-13
	1103-3 Accident History.....	11-13
	1103-4 Land Use	11-13
	1103-5 Background Lighting	11-14
	1103-6 Special Locations.....	11-14
1104	CONSISTENCY OF TREATMENT	11-19
	1104-1 General.....	11-19
	1104-2 System Consistency	11-19
	1104-3 Fixture Consistency	11-19
	1104-4 Correlated Color Temperature (CCT) Consistency	11-19
1105	LEVELS OF LIGHTING	11-21
	1105-1 General.....	11-21
	1105-2 Continuous Freeway Lighting (CFL).....	11-21
	1105-3 Complete Interchange Lighting (CIL).....	11-21
	1105-4 Intermediate Interchange Lighting (IIL).....	11-21
	1105-5 Partial Interchange Lighting (PIL).....	11-21
1106	LIGHTING CRITERIA	11-23
	1106-1 General.....	11-23
	1106-2 ODOT Lighting Criteria.....	11-23
	1106-3 Local Criteria	11-23
1107	GUIDELINES FOR REDUCTION/REMOVAL OF EXISTING LIGHTING	11-25
	1107-1 General.....	11-25
	1107-2 DSLP Evaluation.....	11-25
	1107-3 Change in Land Use	11-25
	1107-4 User Objections	11-25
1120	MATERIALS AND HARDWARE	11-27
	1120-1 General.....	11-27
	1120-2 Patented or Proprietary Materials, Specifications or Processes	11-27
	1120-3 Purchasing Materials for Installation and Use by Local Agencies	11-27
	1120-4 Existing Aesthetic Lighting Systems	11-27
	1120-5 Local Preferences.....	11-27
	1120-6 Operating Voltage.....	11-27
	1120-7 Ballasts.....	11-28
	1120-8 Solid-State (LED) Luminaires	11-28
1130	PLANNING / PROGRAMMING	11-29
	1130-1 General.....	11-29
	1130-2 Programming of Projects.....	11-29
	1130-3 Funding Considerations	11-29
	1130-4 State Participation.....	11-30
	1130-5 FAA Requirements.....	11-30
	1130-6 Light Fixtures	11-30
	1130-7 Maintenance Concerns	11-30
	1130-8 Scope Preparation for Specific Projects	11-31
1140	DESIGN INFORMATION	11-33
	1140-1 General.....	11-33
	1140-2 General Theory.....	11-33
	1140-3 Lighting Theory.....	11-33
	1140-4 Luminaires and Sources	11-38
	1140-5 Circuit Design	11-51
	1140-6 Foundations.....	11-55
	1140-7 Grounding.....	11-58
	1140-8 Suggested Procedure for Light Tower Foundation Design	11-59

1141	PLAN PREPARATION / PRODUCTION	11-61
1141-1	General	11-61
1141-2	Coordination with Utilities.....	11-61
1141-3	Plan Composition	11-61
1141-4	Submissions and Project Development Reviews.....	11-65
1142	PLAN NOTES.....	11-70
1142-1	General	11-70
1142-2	625, Pull Box Cleaned	11-70
1142-3	625, Conduit Cleaned and Cables Removed.....	11-70
1142-4	625, Anchor Bolt and Concrete Repair.....	11-70
1142-5	Luminaire, High Mast, As Per Plan.....	11-71
1142-6	Luminaire, Low Mast, As Per Plan	11-71
1142-7	625, Luminaire, Conventional, As Per Plan	11-71
1142-8	625, Luminaire, Post-top, As Per Plan.....	11-72
1142-9	625, Luminaire, Underpass, As Per Plan.....	11-72
1142-10	625, Luminaire, Installation Only, As Per Plan.....	11-72
1142-11	Lamps	11-72
1142-12	625, Light Pole, Installation Only, As Per Plan.....	11-72
1142-13	625, Light Tower, Installation Only, As Per Plan.....	11-73
1142-14	Light Pole Anchor Bolts On Structures	11-73
1142-15	Reserved for Future Information	11-73
1142-16	Conduit Expansion and Deflection	11-73
1142-17	625, Power Service, As Per Plan	11-74
1142-18	Special, Power Service Fence	11-74
1142-19	High Voltage Test Waived	11-74
1142-20	Padlocks and Keys	11-74
1142-21	Special, Maintain Existing Lighting.....	11-74
1142-22	625 Lighting, Misc.: FAA Type L-864 Obstruction Lighting, LED.....	11-75
1142-23	625 Lighting, Misc.: Bridge-Mounted Marine Navigation Lighting, LED	11-76
1142-24	625, Decorative Post-Top Luminaire, Solid-State (LED), Lantern Style, 3000K, Black Finish.....	11-77
1142-25	625, Decorative Post-Top Luminaire, Solid-State (LED), Acorn Style, Refractive Glass, 3000K, Black Finish	11-78
1142-26	625, RGBW Aesthetic Lighting System	11-78
1143	SPECIFICATIONS	11-85
1150	CONSTRUCTION	11-86
1150-1	Introduction	11-86
1150-2	Materials.....	11-87
1150-3	Luminaires.....	11-88
1150-4	Lamps	11-89
1150-5	Supports.....	11-90
1150-6	Foundations.....	11-92
1150-7	Pull Boxes (Manholes).....	11-93
1150-8	Junction Boxes (Handholes)	11-93
1150-9	Conduit.....	11-94
1150-10	Trench.....	11-94
1150-11	Power Service	11-94
1150-12	Grounding	11-95
1150-13	Wiring and Cabling	11-96
1150-14	Connections	11-98
1150-15	Test Procedures	11-99
1150-16	Provide Information to Maintaining Agency	11-100
1150-17	Documentation Requirements.....	11-100
1160	MAINTENANCE / OPERATIONS.....	11-101
1160-1	General	11-101
1160-2	Lighting Maintenance Practice Process.....	11-101
1160-3	Determination of Responsibility.....	11-101
1160-4	Emergency Maintenance	11-102

	1160-5 Reactive Maintenance.....	11-102
	1160-6 Periodic Inspection.....	11-102
	1160-7 Required Preventive Maintenance.....	11-102
	1160-8 Recommended Preventive Maintenance	11-102
	1160-9 Replacement Luminaires	11-103
	1160-10 Failure Analysis	11-103
	1160-11 Repairing Broken Conduit and Duct Cable	11-103
	1160-12 Troubleshooting Lamps.....	11-104
	1160-13 Pole Replacement/Foundation Repair.....	11-106
	1160-14 Bracket Arm Repairs.....	11-107
1196	FORMS INDEX (no forms at this time).....	11-109
1197	TABLES INDEX.....	11-109
	Table 1197-1. Suggested Data for the District System Lighting Plan	11-111
	Table 1197-2. Codes for Use in the District System Lighting Plan	11-112
	Table 1197-3. Warrants for Freeway and Interchange Lighting.....	11-113
	Table 1197-4. Average Maintained Luminance Design Values	11-114
	Table 1197-5. Nominal Mounting Height and HPS Wattage.....	11-115
	Table 1197-6. Typical Bracket Arm Lengths (HPS).....	11-115
	Table 1197-7. Recommended Conduit Sizes	11-116
	Table 1197-8. Lighting Load Table.....	11-116
	Table 1197-9. Recommended Lateral Soil Pressures for Foundations.....	11-117
	Table 1197-10. Foundation Embedment Nomograph	11-118
	Table 1197-11. Allowable Lateral Soil Resistance	11-119
	Table 1197-12. Highway Lighting Responsibilities.....	11-119
1198	FIGURES INDEX.....	11-121
	Figure 1198-1. Roadway Lighting Fixture Distribution.....	11-123
	Figure 1198-2. Effects of Full Cut-Off and Non Cut-Off Luminaires.....	11-124
	Figure 1198-3. Typical Luminaire Placement Partial Interchange Lighting (PIL).....	11-125
	Figure 1198-4. Detail of Luminaire Placement for Class I Exit Terminal (PIL).....	11-126
	Figure 1198-5. Partial Lighting Applications to the Basic Diamond Interchange	11-127
	Figure 1198-6. Reserved for Future Information	11-128
	Figure 1198-7. Intersection Lighting Examples.....	11-129
	Figure 1198-8. Luminaire Mounting Arrangements.....	11-129
	Figure 1198-9. Overpass Key Unit Locations	11-130
	Figure 1198-10. Underpass Key Unit Locations	11-131
	Figure 1198-11. Control Center Data Chart.....	11-132
	Figure 1198-12. Voltage Drop Study	11-133
Part 12 – ZONES AND STUDIES		12-1
	TABLE OF CONTENTS	12-1
1200	GENERAL.....	12-5
1201	TRAFFIC CONTROL ZONES	12-5
1202	SCHOOL ZONES.....	12-5
1203	SPEED ZONES.....	12-5
	1203-1 General.....	12-5
	1203-2 Procedures for Requesting and Authorizing Speed Zones.....	12-6
	1203-3 Speed Zone Studies	12-13
	1203-4 Withdrawal of Authorization.....	12-16
	1203-5 Documentation and Records Management.....	12-17
1204	PARKING CONTROL ZONES	12-19
	1204-1 General.....	12-19
	1204-2 Procedure for Authorizing Parking Control Zones.....	12-19
	1204-3 Engineering Study.....	12-19
	1204-4 Withdrawal of Authorization.....	12-19

	1204-5 Documentation and Records Management	12-20
1205	OTHER ZONES	12-20
1210	TRAFFIC ENGINEERING STUDIES	12-21
1211	SAFETY STUDY GUIDELINES	12-23
	1211-1 What is a Safety Study?	12-23
	1211-2 Table of Contents	12-27
	1211-3 Title Page	12-27
	1211-4 One Page Project Summary	12-27
	1211-5 Executive Summary	12-27
	1211-6 Purpose and Need Statement	12-27
	1211-7 Existing Conditions	12-28
	1211-8 Crash Data and Analysis	12-32
	1211-9 Summary of Supplemental Traffic Studies	12-37
	1211-10 Recommendations and Prioritization	12-37
	1211-11 Appendices (If Completed or Authorized)	12-38
1213	OTHER TRAFFIC ENGINEERING STUDIES	12-41
	1213-1 General	12-41
	1213-2 Determining Curve Advisory Speeds.....	12-41
	1213-3 Delay Studies	12-42
	1213-4 Systematic Signal Timing & Phasing Program (SSTPP).....	12-42
	1213-5 Road Safety Audits (RSAa).....	12-43
1296	FORMS INDEX	12-45
	Form 1296-1. Speed Zone Request for Narrow and Low-Volume Rural Roads	12-47
	Form 1296-2. Speed Zone Warrant Sheet	12-51
	Form 1296-3. Sample Speed Study Data Sheet	12-55
	Form 1296-4. Completed Sample Speed Study Data Sheet.....	12-56
	Form 1296-5. Speed Check Form	12-57
	Form 1296-6. Speed Limit Revision (Forms a and b).....	12-58
	Form 1296-7. Withdrawal of Issued Speed Limit Revision (Forms a and b).....	12-60
	Form 1296-8. Field Report on Parking Practices.....	12-62
	Form 1296-9. Establishment of No-Parking Restrictions	12-64
	Form 1296-10. Withdrawal of Issued No-Parking Restrictions	12-65
	Form 1296-11. Curve Study Sheet	12-66
	Form 1296-12. Reserved – Existing Form Deleted	12-67
	Form 1296-13. Reserved – Existing Form Deleted	12-67
	Form 1296-14. Freeway and Rural Expressway Speed Zone Evaluation Sheet	12-67
	Form 1296-15. Speed Zone Request for Unimproved Highways and Residential or Commercial Subdivision Streets	12-68
	Form 1296-16. Reserved – Deleted the Existing Form.....	12-69
	Form 1296-17. Work Zone Speed Zone Evaluation Sheet for High-Speed (≥ 55 mph) Multi-Lane Highways	12-70
	Form 1296-18. Work Zone Speed Zone (WZSZ) Tracking Report.....	12-71
	Form 1296-19. Sample OSHP Concurrence Sheet.....	12-72
1297	TABLES INDEX	12-73
	Table 1297-1. Symbols for Use with the Speed Study Data Sheet.....	12-75
	Table 1297-2. Speed Zone Warrant Analysis – Highway Development.....	12-76
	Table 1297-3. Speed Zone Warrant Analysis – Roadway Features	12-77
	Table 1297-4. Speed and Parking Zone Revision Number Assignments	12-78
	Table 1297-5. Reserved for Future Information	12-79
	Table 1297-6. Speed Zone Warrant Analysis – Roadway Characteristics.....	12-80
	Table 1297-7. Warranted Work Zone Speed Limits for Work Zones on High-Speed (≥ 55 mph) Multi-Lane Highways	12-81
1298	FIGURES INDEX	12-83
	Figure 1298-1. Work Zone Speed Zoning Process (Figures a, b and c).....	12-87
	Figure 1298-2. Examples of Signal Timing and Phasing Improvements	12-90
	Figure 1298-3. Examples of Type A Roadway Characteristics for Speed Zoning for <i>Form 1296-1</i>	12-91

Figure 1298-4.	Examples of Type B Roadway Characteristics for Speed Zoning for Form 1296-1.....	12-94
Figure 1298-5.	Examples of Type C Roadway Characteristics for Speed Zoning for Form 1296-1.....	12-97
Figure 1298-6.	Sample Full Safety Study Table of Contents	12-98
Figure 1298-7.	Title Page – Example 1	12-99
Figure 1298-8.	Title Page – Example 2	12-100
Figure 1298-9.	One Page Project Summary – Example 1	12-101
Figure 1298-10.	One Page Project Summary – Example 2.....	12-102
Figure 1298-11.	Executive Summary Outline	12-103
Figure 1298-12.	Existing Conditions Diagram – Roadway Section.....	12-104
Figure 1298-13.	Existing Conditions Diagram - Intersection	12-105
Figure 1298-14.	Intersection Collision Diagram – Example 1.....	12-106
Figure 1298-15.	Intersection Collision Diagram – Example 2.....	12-107
Figure 1298-16.	Roadway Section Collision Diagram Example	12-108
Figure 1298-17.	Summary of Crash Pattern Tables	12-109
Figure 1298-18.	Crash Histogram	12-110
Figure 1298-19.	ECAT Project Safety Performance Summary Report – Existing Conditions	12-111
Figure 1298-20.	ECAT Project Safety Performance Summary Report – Proposed Safety Improvements	12-112
Figure 1298-21.	Proposed Conditions Diagram – Example 1	12-113
Figure 1298-22.	Proposed Conditions Diagram – Example 2	12-114

Part 13 – INTELLIGENT TRANSPORTATION SYSTEMS (ITS)..... 13-1

	TABLE OF CONTENTS	13-1
1300	GENERAL.....	13-3
1301	23 CFR 940 COMPLIANCE.....	13-3
	1301-1 General.....	13-3
	1301-2 Architecture	13-5
	1301-3 Systems Engineering Analysis (SEA).....	13-6
	1301-4 Ellis Requirements for ITS Projects.....	13-11
1303	FREEWAY MANAGEMENT SYSTEM ON ODOT-MAINTAINED HIGHWAYS	13-13
	1303-1 General.....	13-13
	1303-2 Traffic Management Center (TMC).....	13-13
	1303-3 Closed Circuit Television (CCTV).....	13-13
	1303-4 Communication.....	13-15
	1303-5 Dynamic Message Signs (DMS).....	13-16
	1303-6 Vehicle Detection or SFRD	13-18
	1303-7 Highway Advisory Radio (HAR).....	13-19
	1303-8 Travel Time.....	13-20
	1303-9 Road Weather Information System (RWIS)	13-20
	1303-10 Ramp Metering	13-21
	1303-11 Traffic Incident Management.....	13-22
	1303-12 Variable Speed Limits	13-22
	1303-13 Hard Shoulder Running.....	13-22
1340	DESIGN INFORMATION	13-23
	1340-1 General.....	13-23
	1340-2 Stage 1, 2 and 3 Plan Submittals	13-23
1342	PLAN NOTES	13-25
	1342-1 General.....	13-25
	1342-2 CCTV Installations	13-25
	1342-3 Dynamic Message Sign Installations	13-25
	1342-4 Vehicle Detection Installations.....	13-25
	1342-5 Highway Advisory Radio Installations.....	13-25
	1342-6 Ramp Metering Installations.....	13-25
	1342-7 Items 625E25740 and 625E25750: Conduit 4” Multi-Cell Schedule 40 &	

	Schedule 80, 725.20.....	13-25
1342-8	Tracer Wire	13-26
1342-9	Fiber Optic Cable Markers	13-27
1342-10	DMS & DDMS Support Structures.....	13-27
1342-11	Item 625E29931: Median Jundtion Box, As Per Plan.....	13-27
1342-12	Utilities	13-28
1342-13	Protection of Traffic Monitoring Equipment.....	13-28
1343	SPECIFICATIONS	13-29
1395	REFERENCE RESOURCES.....	13-31
1395-1	General	13-31
1395-2	Traffic Operations Handbook	13-31
1395-3	Traffic Authorized Product (TAP) List	13-31
1396	FORMS INDEX	13-33
1397	TABLES INDEX	13-35
1397-1	Exempt, Low-Risk and High-Risk ITS Projects.....	13-37
1397-2	ITS User Services.....	13-38
1397-3	Regional ITS Architectures in Ohio	13-40
1397-4	Closed Circuit Television (CCTV) Installations	13-41
1397-5a	Full-Size Walk-In Dynamic Message Sign (DMS) Installations.....	13-42
1397-5b	Front Access Dynamic Message Sign (DMS) Installations.....	13-43
1397-6	Destination Dynamic Message Sign (DDMS) Installations	13-44
1397-7	Vehicle Detection (SFRD) Installations.....	13-45
1397-8	Highway Advisory Radio (HAR) Installations	13-46
1397-9	Ramp Metering Installations.....	13-47
1398	FIGURES INDEX	13-48
1398-1	Project Development Process (PDP)	13-49
1398-2	Fiber Optics Termination Diagram (Node Cabinet Assembly).....	13-50
1398-3	Fiber Optics Termination Diagram (Underground Splice Enclosure).....	13-51
1398-4	Fiber Optics Termination Diagram (Fiber Backbone Splice Chart).....	13-52
1398-5	ITS Device Communication Diagram	13-53
Part 14 – MISCELLANEOUS.....		14-1
	TABLE OF CONTENTS.....	14-1
1400	GENERAL	14-3
1415	RUMBLE STRIPS (INCLUDING STRIPES) IN THE ROADWAY	14-4
1415-1	General	14-4
1415-2	Transverse Rumble Strips	14-4
1415-3	Rumble Stripes.....	14-6
1415-4	Rumble Strips in Temporary Traffic Control Zones.....	14-7
1416	OTHER DEVICES.....	14-8
Part 15 - APPENDIX		15-1
	TABLE OF CONTENTS.....	15-1
1500	GENERAL	15-3
1501	DEFINITIONS	15-3
1501-1	General	15-3
1501-2	Acronyms and Abbreviations	15-3
1501-3	Words and Phrases	15-7
1505	FREQUENTLY ASKED QUESTIONS (FAQs)	15-35
1599	OTHER POLICIES AND STANDARD PROCEDURES	15-37

TABLE OF CONTENTS

Part 6 - TEMPORARY TRAFFIC CONTROL

600 GENERAL 6-13
600-1 Introduction 6-13
600-2 Construction Projects 6-13
600-3 Force Account (ODOT Operations) Work 6-13
600-4 Public Communication 6-14
600-5 High vs. Low-Volume Highways 6-14
600-6 Incident Management Areas..... 6-14

601 FUNDAMENTAL PRINCIPLES 6-15
601-1 General..... 6-15
601-2 Work Zones on ODOT-Maintained Highways 6-15
601-3 District Work Zone Traffic Manager (DWZTM)..... 6-15

602 TEMPORARY TRAFFIC CONTROL ELEMENTS..... 6-17
602-1 General..... 6-17
602-2 Temporary Traffic Control Plans..... 6-17
602-3 Temporary Traffic Control Zones..... 6-17
602-4 Components of Temporary Traffic Control Zones 6-17
602-4.1 General 6-17
602-4.2 Advance Warning Area..... 6-17
602-4.3 Transition Area 6-18
602-4.4 Activity Area 6-18
602-4.4.1 General 6-18
602-4.4.2 Work Space..... 6-18
602-4.4.3 Traffic Space 6-18
602-4.4.4 Buffer Space..... 6-18
602-4.5 Termination Area..... 6-19
602-5 Tapers 6-19
602-5.1 General 6-19
602-5.2 Merging Taper..... 6-20
602-5.3 Shifting Taper..... 6-20
602-5.4 Shoulder Taper..... 6-20
602-5.5 Downstream (Ending) Taper 6-20
602-5.6 One-Lane, Two-Way Taper 6-20
602-5.7 Lane Width Transition..... 6-20
602-5.8 Multiple Tapers..... 6-20
602-6 Detours, Alternate Routes and Diversions..... 6-21
602-7 One-Lane, Two-Way Traffic Control..... 6-21
602-7.1 General 6-21
602-7.2 Flagger Method 6-22
602-7.3 Temporary Traffic Signal Method..... 6-22
602-7.4 Stop or Yield Control Method..... 6-22
602-8 Work Vehicles..... 6-22

603 PEDESTRIAN AND WORKER SAFETY..... 6-25
603-1 General 6-25
603-2 Pedestrian Considerations 6-25
603-3 Worker Considerations..... 6-25

604 FLAGGER CONTROL..... 6-27
604-1 General 6-27
604-2 Qualifications for Flaggers 6-27

600 TEMPORARY TRAFFIC CONTROL Traffic Eng. Manual

604-3	High-Visibility Safety Apparel	6-27
604-4	Hand-Signaling Devices	6-27
604-5	Automated Flagger Assistance Devices (AFADs)	6-27
604-5.1	General.....	6-27
604-5.2	STOP/SLOW Automated Flagger Assistance Devices (AFADs)	6-28
604-5.3	Red/Yellow Lens Automated Flagger Assistance Devices (AFADs).....	6-28
604-6	Hand-Signaling Procedures	6-28
604-7	Flagger Stations	6-28
605	TEMPORARY TRAFFIC CONTROL ZONE DEVICES	6-29
605-1	General	6-29
605-2	General Characteristics of Signs	6-29
605-2.1	General.....	6-29
605-2.2	Design	6-29
605-2.3	Placement	6-30
605-2.4	Sheeting for Temporary Traffic Control Signs and Hand-Signaling Devices.....	6-30
605-3	Regulatory Signs	6-30
605-3.1	General.....	6-30
605-3.2	ROAD CLOSED Signs (R11-2, R11-H4a)	6-31
605-3.3	Weight Limit Signs (R12-1, R12-2, R12-3, R12-4, R12-4, R12-H5 and R10-H20bP).....	6-31
605-3.4	Work Zone Speed Limit Sign (R2-1).....	6-31
605-4	Special Regulatory Signs	6-31
605-4.1	General.....	6-31
605-4.2	Work Zone Increased Penalties Sign (R11-H5a)	6-31
605-5	Warning Signs	6-33
605-5.1	General.....	6-33
605-5.2	Design	6-34
605-5.3	Sizes	6-34
605-5.4	Spacing	6-34
605-5.5	ROAD (STREET) CLOSED AHEAD Sign (W20-3)	6-34
605-5.6	ONE LANE ROAD AHEAD Sign (W20-4)	6-34
605-5.7	LANE(S) CLOSED AHEAD Sign (W20-5, W20-5a).....	6-34
605-5.8	Flagger Sign (W20-7, W20-7a).....	6-35
605-5.9	SURVEY CREW AHEAD Sign (W21-H6)	6-35
605-5.10	Blasting Zone Signs (W22-1, W22-2, W22-3)	6-35
605-5.11	Construction Arrow Sign (W1-H16)	6-35
605-5.12	SHOULDER CLOSED Signs (W21-5a, W21-5b)	6-35
605-5.13	Shoulder Drop-Off Sign (W8-17)	6-35
605-5.14	UNEVEN LANES Sign (W8-11).....	6-36
605-5.15	NO CENTER LINE and NO EDGE LINE Signs (W8-12, W8-H12a)	6-36
605-6	Special Warning Signs	6-36
605-6.1	General.....	6-36
605-6.2	Notice of Closure Signs (W20-H13).....	6-36
605-6.3	No Reentry Signing (W13-H7, W13-H8)	6-37
605-6.4	VARIABLE SPEED LIMIT AHEAD Sign (W3-H5b)	6-37
605-7	Guide Signs	6-37
605-7.1	General.....	6-37
605-7.2	DETOUR Signs (M4-8, M4-8a, M4-8b, M4-9, M4-9a, M4-9b, M4-9c, M4-10)	6-38
605-7.3	Advance Work Zone Information Signs	6-38
605-8	Special Guide Signs	6-39
605-8.1	General.....	6-39
605-8.2	TRUCK Marker (M4-4).....	6-39
605-8.3	Exit Open/Closed Signs (E5-2, E5-2a, E5-H2b, E5-H2c)	6-39

600 TEMPORARY TRAFFIC CONTROL Traffic Eng. Manual

605-9	Portable Changeable Message Signs (PCMSs)	6-39
605-10	Arrow Boards	6-40
605-10.1	General.....	6-40
605-10.2	Design.....	6-40
605-11	Channelizing Devices	6-40
605-11.1	General.....	6-40
605-11.2	Placement.....	6-41
605-11.3	Cones.....	6-41
605-11.4	Drums.....	6-42
605-11.4.1	General.....	6-42
605-11.4.2	Lights on Drums.....	6-42
605-11.5	Barricades, Tubular Markers and Vertical Panels.....	6-42
605-11.6	Direction Indicator Barricade.....	6-42
605-11.7	Barrier Used as a Channelizing Device.....	6-43
605-11.8	Temporary Raised Islands.....	6-43
605-11.9	Opposing Traffic Lane Divider.....	6-43
605-11.10	Pavement Markings.....	6-43
605-11.10.1	General.....	6-43
605-11.10.2	Conflicting Pavement Markings.....	6-44
605-11.11	Temporary Pavement Markings.....	6-44
605-11.12	Raised Pavement Markers.....	6-45
605-11.13	Delineators.....	6-45
605-12	Lighting Devices	6-45
605-12.1	General.....	6-45
605-12.2	Floodlights.....	6-45
605-12.3	Flashing Warning Beacons.....	6-46
605-12.4	Steady-Burn Electric Lamps.....	6-46
605-12.5	Warning Lights.....	6-46
605-12.6	LED Enhanced Signs.....	6-46
605-13	Temporary Traffic Control Signals	6-46
605-13.1	General.....	6-46
605-13.2	Duration of Work.....	6-47
605-13.3	Portable Traffic Signal (PTS).....	6-47
605-14	Temporary Traffic Barriers	6-47
605-14.1	General.....	6-47
605-14.2	Length of Need.....	6-48
605-14.3	Movable Barrier.....	6-48
605-14.4	Temporary Guardrail.....	6-48
605-14.5	Portable Barrier (PB).....	6-48
605-14.5.1	Portable Barrier Delineation and Glare Screens.....	6-48
605-14.5.2	End Treatment.....	6-49
605-14.5.3	Anchoring PB.....	6-49
605-14.5.4	Grading of Cross Slopes.....	6-49
605-14.6	Plastic Water-Filled Barrier.....	6-49
605-14.7	Cable Barrier.....	6-50
605-15	Crash Cushions	6-50
605-15.1	General.....	6-50
605-15.2	Stationary Crash Cushions.....	6-50
605-15.3	Truck-Mounted or Trailer Attenuators.....	6-51
605-16	Reserved for Future Information	6-51
605-17	Rumble Strips	6-51
605-18	Screens	6-51
605-19	Barrier Reflectors and Object Markers	6-52
605-19.1	General.....	6-52
605-19.2	Delineation of Concrete Barriers, Bridge Parapets and Portable Barrier.....	6-52
605-19.2.1	Increased Barrier Delineation (Delineation Panels and Triple-Stacked Reflectors).....	6-52

600 TEMPORARY TRAFFIC CONTROL Traffic Eng. Manual

605-19.3	Delineation of Guardrail	6-53
605-20	Future and Experimental Devices.....	6-53
606	TYPE OF TEMPORARY TRAFFIC CONTROL ZONE ACTIVITIES	6-55
606-1	General	6-55
606-2	Typical Applications	6-56
606-3	Work Duration	6-56
606-4	Location of Work.....	6-56
606-5	Modifications to Fulfill Special Needs.....	6-57
606-6	Work Outside of Shoulder	6-57
606-7	Work on the Shoulder with No Encroachment	6-57
606-8	Work on the Shoulder with Minor Encroachment	6-57
606-9	Work Within the Median.....	6-58
606-10	Work Within the Traveled Way of Two-Lane Highways.....	6-58
606-11	Work Within the Traveled Way of Urban Streets	6-58
606-12	Work Within the Traveled Way of Multi-lane, Non-access Controlled Highways	6-58
606-13	Work Within the Traveled Way at an Intersection	6-58
606-14	Work Within the Traveled Way of Expressways and Freeways	6-59
606-15	Two-Lane, Two-Way Traffic on One Roadway of a Normally Divided Highway	6-59
606-16	Crossovers.....	6-59
606-17	Interchanges	6-59
606-18	Movable Barriers.....	6-60
606-19	Work in the Vicinity of Highway-Rail Grade Crossings.....	6-60
606-20	Control of Traffic Through Incident Areas.....	6-60
606-21	Work Affecting Pedestrian and Bicycle Facilities	6-60
606-22	Temporary Traffic Control Through Nighttime Hours	6-60
607	TYPICAL APPLICATIONS.....	6-61
607-1	General	6-61
607-2	Blasting Zone (OMUTCD Figure 6H-2)	6-62
607-3	Road Closed with Off-Site Detour (OMUTCD Figure 6H-8).....	6-62
607-4	Lane Closures on Low-Volume, Two-Lane Road (OMUTCD Figure 6H-11)	6-62
607-5	Lane Closure on Two-Lane Road Using Traffic Signals (OMUTCD Figure 6H-12).....	6-62
607-6	Temporary Road Closure (OMUTCD Figure 6H-13).....	6-62
607-7	Detour for One Travel Direction (OMUTCD Figure 6H-19).....	6-62
607-8	Right Lane Closure - Far Side of Intersection (OMUTCD Figure 6H-22)..	6-62
607-9	Mobile Operation on Multi-lane Road (OMUTCD Figure 6H-35)	6-62
607-10	Lane Shift on Freeway (OMUTCD Figure 6H-36).....	6-62
607-11	Interior Lane Closure on Freeway (OMUTCD Figure 6H-38).....	6-63
607-12	Median Crossover on Freeway (OMUTCD Figure 6H-39)	6-63
607-13	Median Crossover for Entrance Ramp (OMUTCD Figure 6H-40)	6-63
607-14	Partial Exit Ramp Closure (OMUTCD Figure 6H-43).....	6-63
607-15	Work in Vicinity of Entrance Ramp (OMUTCD Figure 6H-44 and Traffic SCDs MT-98.10 and 98.11)	6-64
608	INCIDENT MANAGEMENT	6-65
608-1	General	6-65
608-2	Ohio Traffic Incident Management (TIM) Program	6-65
608-3	Incident Logging.....	6-67
608-4	Permitted Lane Closure Schedule (PLCS).....	6-67
608-5	Detour Playbook.....	6-67
608-6	Hazardous Materials (HazMat)	6-68
608-7	Diesel Spills	6-68
608-7.1	General	6-68

600 TEMPORARY TRAFFIC CONTROL Traffic Eng. Manual

608-7.2	For PLCS Segments	6-68
608-7.2.1	General	6-68
608-7.2.2	Diesel Spill Training	6-69
608-7.2.3	Cleanup Procedures	6-69
608-7.2.4	Removal and Disposal	6-70
608-7.2.5	Documentation	6-71
608-7.2.6	Additional Requirements	6-71
608-7.3	For Non-PLCS Segments	6-71
608-8	Incident Command System (ICS) / National Incident Management System (NIMS)	6-72
608-9	Freeway Service Patrol (FSP)	6-72
608-9.1	General	6-72
608-9.2	FSP Hours of Operation	6-72
608-9.3	Duties of FSP	6-72
608-9.4	Evaluation	6-73
608-10	OHGO Website	6-73
608-11	Evacuation Plans	6-74
608-12	Variable Speed Limits	6-74
620	MATERIALS AND HARDWARE	6-75
620-1	General	6-75
620-2	Safety Criteria	6-75
620-2.1	National Cooperative Highway Research Program (NCHRP) 350 Criteria	6-75
620-2.2	Other Safety Criteria	6-75
620-3	Sheeting	6-75
620-4	Temporary Sign Supports	6-75
620-5	Roll-Up Signs	6-75
620-6	Pavement Markings	6-76
620-6.1	General	6-76
620-6.2	Materials	6-76
620-6.3	Dimensions	6-76
620-7	NCHRP 350 Compliance	6-76
620-7.1	History of NCHRP 350	6-76
620-7.2	Categories	6-76
620-7.3	Responsibilities	6-77
620-7.3.1	Office of Roadway Engineering (ORE)	6-77
620-7.3.2	Office of Structural Engineering (OSE)	6-77
620-7.3.3	Office of Construction Administration (OCA)	6-77
620-7.3.4	Districts	6-77
630	PLANNING / PROGRAMMING	6-79
630-1	General	6-79
630-2	Compendium of Traffic Control Options	6-79
630-3	Detours	6-79
630-4	Permitted Lane Closure Schedule (PLCS)	6-79
630-5	Maintenance of Traffic Alternative Analysis (MOTAA)	6-80
630-6	Conceptual Maintenance of Traffic	6-83
640	DESIGN INFORMATION	6-85
640-1	General	6-85
640-2	Geometrics	6-85
640-3	Sequence of Operation	6-86
640-4	Lane Closure	6-87
640-5	Use of Shoulders	6-87
640-5.1	General	6-87
640-5.2	Provisions for Use of Shoulders	6-87
640-5.3	Emergency Pull-Offs	6-88

	640-5.4 Existing Rumble Strips on Shoulders	6-88
640-6	Work Zone Drop-Offs.....	6-88
640-7	Ramp Closure	6-89
	640-7.1 Volume Considerations.....	6-89
	640-7.2 Geometric Considerations.....	6-89
640-8	Detours.....	6-89
640-9	Construction Access Points.....	6-89
640-10	Private Driveway Access	6-90
640-11	Temporary Roads	6-90
	640-11.1 General	6-90
	640-11.2 Design Speed.....	6-90
	640-11.3 Geometrics	6-90
	640-11.4 Superelevation.....	6-91
	640-11.5 Lane Width	6-91
	640-11.6 Guardrail Offset and Sideslopes.....	6-91
	640-11.7 Pavement.....	6-91
640-12	Crossover Construction	6-92
	640-12.1 General	6-92
	640-12.2 Traffic Separation	6-92
	640-12.3 Considerations for Reversed Flow.....	6-92
	640-12.4 Crossover Geometric Design	6-92
640-13	Capacity	6-93
	640-13.1 General	6-93
	640-13.2 Queue Length Predictions for Freeways and Expressways	6-93
640-14	Considering Holidays and Special Events.....	6-94
640-15	Project Length Restrictions.....	6-94
640-16	Work on Detour and Alternate Routes.....	6-95
640-17	Coordination with Adjacent Projects	6-95
640-18	Speeds in Work Zones.....	6-95
	640-18.1 Design and Advisory Speeds	6-95
	640-18.2 Speed Limit Reductions	6-96
	640-18.2.1 General	6-96
	640-18.2.2 Process.....	6-96
	640-18.2.3 Guidelines	6-96
	640-18.2.4 Overall Signing Requirements	6-97
	640-18.2.5 Adjacent Projects and Speed Zones	6-97
	640-18.2.6 Work Zone Speed Zones (WZSZs) Using Digital Speed Limit (DSL) Sign Assemblies	6-98
	640-18.2.7 Work Zone Speed Zones (WZSZs) Using Temporary Flatsheet Speed Limit Signs	6-98
	640-18.3 Work Zone Increased Penalty Signs (R11-H5a)	6-99
640-19	Law Enforcement Officers.....	6-99
	640-19.1 Law Enforcement Officers (LEOs) for Assistance During Construction Operations	6-99
	640-19.2 Reserved for Future Information.....	6-99
640-20	Temporary Traffic Control Devices	6-100
640-21	Removal of Logo (Specific Service) Signs and Tourist-Oriented Directional Signs (TODS).....	6-100
640-22	Temporary Lighting	6-100
640-23	Traffic Incident Management (TIM) During MOT.....	6-100
640-24	Disincentives.....	6-100
	640-24.1 Requirements/Guidelines.....	6-100
	640-24.2 Lane(s) Closed on Mainline.....	6-101
	640-24.3 Detour	6-101
	640-24.4 Other Considerations	6-101
640-25	Pedestrian Considerations.....	6-102
640-26	Advance Work Zone Information Signs.....	6-103
640-27	Retiming of Existing Traffic Signals.....	6-104

600 TEMPORARY TRAFFIC CONTROL Traffic Eng. Manual

640-28	Freeway/Expressway Termination (“Permanent”).....	6-104
640-29	Work Zone Intelligent Transportation Systems	6-105
	640-29.1 Work Zone Queue Detection Warning System	6-105
	640-29.2 Work Zone Egress Warning System.....	6-105
641	PLAN PREPARATION / PRODUCTION	6-107
641-1	General.....	6-107
641-2	Temporary Traffic Control / Maintenance of Traffic (MOT) Plans.....	6-107
	641-2.1 General.....	6-107
	641-2.2 Plan Sheets	6-107
	641-2.3 Plan Notes.....	6-107
	641-2.4 Sequence of Operation Notes	6-107
	641-2.5 Designer Notes	6-107
	641-2.6 Quantities	6-107
	641-2.7 Plan Reviews.....	6-107
	641-2.8 Exception Approval	6-108
641-3	Traffic Plan Insert Sheets (PISs).....	6-108
641-4	Traffic Standard Construction Drawings (SCDs).....	6-108
641-5	Closing Right or Left Lane of a Multi-lane Divided Highway (MT-95.30, 95.40 and 95.50).....	6-108
	641-5.1 General.....	6-108
	641-5.2 Advance Warning Sign Groups	6-108
	641-5.3 Advisory Speed Plaque (W13-1)	6-109
	641-5.4 Pavement Markings	6-109
	641-5.5 Illumination	6-109
	641-5.6 Bid Items	6-109
641-6	Closing Right or Left Lane of a Multi-lane Undivided Highway (MT-95.31, 95.32 and 95.41).....	6-110
	641-6.1 General.....	6-110
	641-6.2 Advance Warning Sign Groups	6-110
	641-6.3 Advisory Speed Plaque (W13-1)	6-110
	641-6.4 Pavement Markings	6-110
	641-6.5 Bid Items	6-111
641-7	Closing Right or Left Shoulder of a Multi-lane Divided Highway (MT-95.45)	6-111
	641-7.1 General.....	6-111
	641-7.2 Advance Warning Signs Groups	6-111
	641-7.3 Bid Items	6-111
641-8	Closure of a Two-Way Left Turn Lane (MT-95.60).....	6-112
	641-8.1 General.....	6-112
	641-8.2 Advance Warning Signs Groups	6-112
	641-8.3 Advisory Speed Plaque (W13-1)	6-112
	641-8.4 Bid Items	6-112
641-9	Closure of Right Lane of Three-Lane Section with Two-Way Left-Turn Lane (MT-95.61).....	6-112
	641-9.1 General.....	6-112
	641-9.2 Advance Warning Signs Groups	6-113
	641-9.3 Advisory Speed Plaque (W13-1)	6-113
	641-9.4 Pavement Markings	6-113
	641-9.5 Bid Items	6-113
641-10	Reserved for Future Use	6-113
641-11	Median Crossover Operation (MT-95.70, 95.71, 95.72, 95.73, 95.82, and 100.00)	6-113
	641-11.1 General.....	6-113
	641-11.2 Crossover Design	6-114
	641-11.3 Advisory Speed Plaque (W13-1)	6-114
	641-11.4 Pavement Markings	6-114
	641-11.5 Illumination	6-115

	641-11.6 Provisions for Reverse Flow and Use of the Shoulder.....	6-115
	641-11.7 Bid Items.....	6-116
641-12	Signalized Closing, One-Lane of a Two-Lane Highway (MT-96.11, 96.20 and 96.26)	6-117
	641-12.1 General	6-117
	641-12.2 Duration of Work.....	6-118
	641-12.3 Capacity and Flow Rates	6-118
	641-12.4 Traffic Signal Details.....	6-119
	641-12.5 Pavement Markings	6-120
	641-12.6 Driveways and Side Roads	6-120
	641-12.7 Lighting.....	6-121
	641-12.8 Field Reviews	6-121
	641-12.9 Bid Items	6-121
641-13	Flagger Closing One Lane of a Two-Lane Highway (MT-97.10, 97.11, 97.12 and 97.20).....	6-122
641-14	Lane Closure at Entrance Ramp (MT-98.10 and 98.11).....	6-122
641-15	Lane Closure at Exit Ramp (MT-98.20 and 98.21)	6-123
641-16	Lane Closure in Deceleration Lane (MT-98.22).....	6-124
641-17	Typical Lane Closures for Ramps (MT-98.28 and 98.29)	6-125
641-18	Traffic Control for Long Line Pavement Marking Operations (MT-99.20).....	6-126
641-19	Freeway/Expressway Closure in Work Zones (MT-99.50)	6-126
	641-19.1 General	6-126
	641-19.2 Signing.....	6-126
	641-19.3 Channelization Devices.....	6-127
	641-19.4 Multiple Lane Closures	6-127
	641-19.5 Portable Barriers and Impact Attenuators.....	6-127
	641-19.6 Bid Items	6-128
641-20	Short Term Closure of Multi-lane Divided Highway (MT-99.60)	6-128
	641-20.1 General	6-128
	641-20.2 Signing	6-128
641-21	Road Closure Using Type 3 Barricades (MT-101.60).....	6-128
641-22	Barrier and Impact Attenuator Delineation (MT-101.70).....	6-129
641-23	Impact Attenuator Placement (MT-101.75).....	6-129
641-24	Reserved for Future Use	6-129
641-25	Drop-Offs in Work Zones (MT-101.90).....	6-129
641-26	Transition Plans for Use of Shoulder (MT-102.10, 102.20 and 102.30) ..	6-130
641-27	Temporary Sign Support (MT-105.10)	6-131
641-28	Detour of Pedestrians (MT-110.10).....	6-132
641-29	New or Revised Traffic Control Signals (MT-120.00).....	6-132
641-30	Work Zone Delineation (MT-99.30)	6-132
	641-30.1 General	6-132
	641-30.2 Asphalt Surfaces and Temporary Concrete Surfaces	6-132
	641-30.3 Permanent Concrete Surfaces	6-133
641-31	Longitudinal Channelizer (PIS 2010180)	6-133
641-32	Typical Closures at Entrance Ramp and Turn Bay Closures (MT-98.30).....	6-134
641-33	Construction Access Points (MT-103.10).....	6-134
641-34	Work Zone Speed Zones for High-Speed (≥55 MPH) Multi-Lane Highways (MT-104.10).....	6-135
642	PLAN NOTES	6-137
	642-1 General	6-137
	642-2 Item 614, Maintaining Traffic	6-137
	642-3 Item 614, Maintaining Traffic (At All Times).....	6-137
	642-4 Item 614, Maintaining Traffic (Time Limitation on a Detour).....	6-137
	642-5 Item 614, Maintaining Traffic (Winter Time Limitations).....	6-137
	642-6 Item 614, Maintaining Traffic (Lanes Open During Holidays or	

Special Events)..... 6-138

642-7 Item 614, Maintaining Traffic (Lane Closure/Reduction Required)..... 6-138

642-8 Item 614, Maintaining Traffic (Notice of Closure Sign) 6-138

642-9 Item 614, Maintaining Traffic (Estimated Quantities)..... 6-139

642-10 Item 614, Maintaining Traffic (ROAD CLOSED Sign) 6-139

642-11 Item 614, Maintaining Traffic (Signs and Barricades)..... 6-140

642-12 Item 614, Maintaining Traffic (Closing Paragraph for Note) 6-140

642-13 Placement of Asphalt Concrete 6-140

642-14 Trench for Widening..... 6-140

642-15 Overnight Trench Closing..... 6-140

642-16 Concrete Median Barrier Replacement..... 6-140

642-17 Drum Requirements 6-141

642-18 Reserved for Future Information 6-141

642-19 Dust Control 6-141

642-20 Work Zone Markings and Signs..... 6-141

642-21 Item 622, Portable Barrier, 50”, As Per Plan..... 6-141

642-22 Item 614, Replacement Sign..... 6-142

642-23 Item 614, Replacement Drum..... 6-142

642-24 Work Zone Speed Zones (WZSZs)..... 6-143

642-25 Designated Local Detour Route..... 6-145

642-26 Reserved – Existing Note Deleted 6-146

642-27 Work Zone Increased Penalties Sign (R11-H5a) 6-146

642-28 Earthwork for Maintaining Traffic 6-147

642-29 Floodlighting 6-147

642-30 Item 614, Work Zone Impact Attenuator for 24” Wide Hazards
(Unidirectional or Bidirectional)..... 6-147

642-31 Item 614, Work Zone Impact Attenuator for Hazards Over 24” and
Less than 36” Wide (Unidirectional or Bidirectional)..... 6-148

642-32 Approved Maintenance of Traffic (MOT) Policy Exception(s) 6-149

642-33 Extra Advance Warning Signs (Note A)..... 6-150

642-34 Extra Advance Warning Signs (Note B)..... 6-150

642-35 Item 614, Work Zone Crossover Lighting System..... 6-151

642-36 Multi-Plan, Time-of-Day Operation of Work Zone Signal 6-151

642-37 Fully-Actuated Operation of Work Zone Traffic Signal 6-152

642-38 Overhead-Mounted Work Zone Signals..... 6-153

642-39 Lighting..... 6-153

642-40 Maintenance of Canoe Traffic 6-153

642-41 Item 614, Portable Changeable Message Signs, As Per Plan..... 6-154

642-42 Maintenance of Traffic Signal/Flasher Installation..... 6-156

642-43 Advance Work Zone Information 6-157

642-44 Worksite Traffic Supervisor 6-158

642-45 Traffic Incident Management (TIM) During MOT 6-160

642-46 Reserved – Existing Note Deleted 6-161

642-47 Speed Measurement Markings 6-161

642-48 Item 614, Work Zone Raised Pavement Marker, As Per Plan 6-162

642-49 Item 614, Work Zone Raised Pavement Markers on Permanent
Concrete Surfaces..... 6-162

642-50 Reserved – Existing Note Deleted 6-163

642-51 Delineation of Portable and Permanent Barrier 6-163

642-52 Delineation of Temporary and Permanent Guardrail 6-164

642-53 Item 614, Longitudinal Channelizer 6-164

642-54 Item 614, Business Entrance (M4-H15) Sign, As Per Plan 6-165

642-55 Item 614, Law Enforcement Officer (With Patrol Car) for
Assistance During Construction Operations 6-166

642-56 Reserved – Existing Note Deleted 6-167

642-57 Work Zone Queue Detection Warning Sign..... 6-167

642-58 Notification of Traffic Restrictions..... 6-167

642-59 Work Zone Egress Warning System..... 6-168

600 TEMPORARY TRAFFIC CONTROL Traffic Eng. Manual

643	SPECIFICATIONS	6-170
650	CONSTRUCTION.....	6-170
650-1	General	6-170
650-2	Quality Standards for Temporary Traffic Control Devices and Acceptable Delineation Methods for Vehicles.....	6-170
660	MAINTENANCE / OPERATIONS	6-171
660-1	General	6-171
660-2	Reserved for Future Information	6-171
660-3	Temporary Traffic Control (TTC) for Pothole Patching	6-171
660-3.1	General.....	6-171
660-3.2	Incident Management/Emergency Work Zones	6-172
660-3.3	Pothole Patching on Multi-Lane Facilities that Will Violate the Permitted Lane Closure Schedule (PLCS).....	6-172
660-3.4	Pothole Patching on Multi-Lane Facilities that Will Not Violate the Permitted Lane Closure Schedule (PLCS).....	6-172
660-3.5	Pothole Patching on Two-Lane/Other Facilities	6-173
670	OTHER CONSIDERATIONS.....	6-175
670-1	General	6-175
670-2	Bikeways	6-175
670-3	Waterways.....	6-175
670-4	Motorcycles.....	6-175
670-5	Towing Operations.....	6-175
670-6	Rest Areas.....	6-175
670-6.1	General.....	6-175
670-6.2	Rest Area Closures.....	6-176
670-6.3	Restroom Closures	6-176
670-7	Railroad Crossings	6-176
670-8	Transit Considerations	6-177
695	REFERENCE RESOURCES.....	6-178
695-1	General	6-178
695-2	Temporary Traffic Control Manual (reprint of OMUTCD Parts 1, 5 and 6).....	6-178
695-3	Flagger Handbook	6-178
695-4	Quality Standards for Temporary Traffic Control Devices and Acceptable Delineation Methods for Vehicles.....	6-178
695-5	Guidelines for the Use of Portable Changeable Message Signs	6-178
695-6	Guidelines for Traffic Control in Work Zones (Pocket Guide)	6-178
696	FORMS INDEX.....	6-179
Form 696-1a.	Work Zone Constraints.....	6-181
Form 696-1b.	Example of a Completed Work Zone Constraints Form	6-182
Form 696-2a.	Bridge Information	6-183
Form 696-2b.	Example of a Completed Bridge Information Form	6-184
Form 696-3a.	Ramp Information	6-185
Form 696-3b.	Example of a Completed Ramp Information Form	6-186
Form 696-4a.	Cost Comparison	6-187
Form 696-4b.	Example of a Completed Cost Comparison Form	6-188
Form 696-5	Example TIM Meeting Agenda	6-189
Form 696-6	Example Traffic Incident Management Plan (TIMP) Checklist....	6-190
Form 696-7	Example TIM Roster Template.....	6-191

697 TABLES INDEX 6-192

- Table 697-1a. Construction / Traffic Maintenance Strategies..... 6-194
- Table 697-1b. Corridor Options Outside Work Zone..... 6-197
- Table 697-1c. Traffic Flow Options Inside Work Zones 6-199
- Table 697-1d. Time Limitations with Disincentive Options..... 6-203
- Table 697-1e. Contracting Procedure Options..... 6-205
- Table 697-1f. Administrative Options 6-207
- Table 697-2. Rate of Flow (Two-Way) for a Signalized One-Lane, Two-Way Closing..... 6-209
- Table 697-3. Initial Timing Chart 6-210
- Table 697-4. Minimum Lane Widths for Maintaining Traffic on Curves (Where $D > 10$ degrees)..... 6-211
- Table 697-5. Sample Phasing Chart for Actuated Signal Control..... 6-212
- Table 697-6. Maximum Closure Lengths 6-212
- Table 697-7. Barrier Offset on Curved Roadways..... 6-213
- Table 697-8. Decision Sight Distance for Entrance Ramp Applications 6-213

698 FIGURES INDEX 6-214

- Figure 698-1. Component Parts of a Traffic Control Zone 6-216
- Figure 698-2. Temporary Traffic Control Signs 6-217
- Figure 698-3. Median Crossover for Entrance Ramp 6-218
- Figure 698-4. Two-Lane Crossover Design (Existing 4-Lane Facility)..... 6-219
- Figure 698-5. Example Typical Sections (Existing 4-Lane Facility)..... 6-220
- Figure 698-6. Two-Lane Crossover Design (Existing 6-Lane Facility)..... 6-221
- Figure 698-7. Example Typical Sections (Existing 6-Lane Facility)..... 6-222
- Figure 698-8. Sample Lane Configuration Diagrams and Cross Sections 6-223
- Figure 698-9. Pothole Patching on Multi-Lane Facilities That Will Violate the PLCS..... 6-224
- Figure 698-10. Pothole Patching on Multi-Lane Facilities That Will Not Violate the PLCS..... 6-225
- Figure 698-11. WTS Daily Inspection Report 6-227
- Figure 698-12. One-Lane Crossover Design (Existing 4-Lane Facility)..... 6-229

Intentionally blank

During working hours, the shadow vehicle shall display a yellow high-intensity rotating, flashing, oscillating, or strobe light. For additional protection on multi-lane highways (45 mph and above), the shadow vehicle shall be equipped with a truck-mounted attenuator (TMA) (*see Section 605-15.3*).

A shadow vehicle may also be placed, unoccupied, within the traffic control zone immediately in advance of the work space in a stationary operation. When a shadow vehicle is used in this way, a separate space should be provided for it. This space should be long enough to accommodate the vehicle itself, plus an open space in front of the vehicle to provide for the “roll ahead” which may occur following impact. This area is usually delineated by channelizing devices.

C&MS 614.03 contains information about delineation requirements for work vehicles (also see **Supplemental Specification 800**). Also, the document described in **Section 695-4, Quality Standards for Temporary Traffic Control Devices and Acceptable Delineation Methods for Vehicles**, provides illustrations of acceptable delineation for supply vehicles.

Intentionally blank.

603 PEDESTRIAN AND WORKER SAFETY**603-1 General**

In addition to creating vehicular restrictions, work zones and incident areas may also cause conflicts for pedestrian traffic and workers. Pedestrians and workers are exposed to hazardous conditions from both the work activity and the traffic. This Chapter addresses the need to provide for pedestrian and worker safety in temporary traffic control zones. Also see **OMUTCD Chapter 6D**.

603-2 Pedestrian Considerations

Where pedestrian traffic is present, pedestrian safety and needs must be addressed. See **OMUTCD Sections 6D.01 and 6D.02**.

There are three threshold considerations in planning for pedestrian safety in temporary traffic control zones on highways and streets:

1. Pedestrians should not be led into conflicts with work vehicles, equipment, or operations.
2. Pedestrians should not be led into conflicts with vehicles moving through or around the work zone or incident area.
3. Pedestrians should be provided with a safe, convenient travel path that replicates as nearly as possible the most desirable characteristics of sidewalks or footpaths.

In accommodating the needs of pedestrians, it should always be remembered that the range of pedestrians that can be expected is very wide, including the blind, the hearing impaired, and those with walking handicaps. All pedestrians need protection from potential injury and a smooth, clearly delineated travel path.

Therefore, every effort should be made to separate pedestrian movement from both work site activity and vehicular traffic. Whenever possible, signing should be used to direct pedestrians to safe street crossings in advance of an encounter with a temporary traffic control zone. Signs should be placed at intersections so that pedestrians, particularly in high-traffic-volume urban and suburban areas, are not confronted with mid-block activity areas that will induce them to skirt the temporary traffic control zone or make a mid-block crossing. It must be recognized that pedestrians will only infrequently retrace their steps to make a safe crossing. Consequently, ample advance notification of sidewalk closures is critically important. Refer to **OMUTCD Figures 6H-28 and 6H-29** for typical traffic control device usage and techniques for pedestrian movement through work areas. Traffic control for a pedestrian detour is also presented in **Traffic SCD MT-110.10**.

Cuts into work areas across pedestrian walkways should be kept to a minimum, because they often create unacceptable changes in grade and rough or muddy terrain. Pedestrians cannot be expected to traverse these areas willingly. They will tend to avoid the cuts by attempting non-intersection crossings.

The engineer in charge of traffic control for temporary traffic control zones should provide both a sense of security and safety for pedestrians walking past work sites and consistent, unambiguous channelization to maintain foot traffic along the desired travel paths. The activity area should be regularly inspected so that effective pedestrian temporary traffic control is maintained.

603-3 Worker Considerations

Equally as important as the safety of road users traveling through the work zone or incident area is the safety of workers (**see OMUTCD Section 6D.03**). Temporary traffic control zones present temporary and constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the personnel on or near the roadway.

600 TEMPORARY TRAFFIC CONTROL **Traffic Eng. Manual**

Maintaining the temporary traffic control zones with road user flow inhibited as little as possible, and using temporary traffic control devices that get the road user's attention and provide positive direction are of particular importance.

The following are key elements of traffic control management that should be considered in any procedure for assuring worker safety:

1. Training - All workers should be trained in how to work next to vehicular traffic in a way that minimizes their vulnerability. Workers having specific temporary traffic control responsibilities should be trained in temporary traffic control techniques, device usage and placement.
2. Worker Safety Apparel - All workers exposed to the risks of moving roadway traffic or construction equipment should wear highly-visible safety apparel (**see OMUTCD Sections 6D.03 and 6E.02**).
3. Temporary Traffic Barriers - Temporary traffic barriers should be placed along the work space depending on such factors as lateral clearance of workers from adjacent traffic, speed of traffic, duration of operations, time of day and volume of traffic.
4. Speed Reduction - Reducing the speed of vehicular traffic, mainly through regulatory speed zoning (**see Section 640-18**), funneling, lane reduction, or the use of law enforcement officials or flaggers should be considered.
5. Shadow Vehicle - In the case of mobile and constantly moving operations, such as pothole patching and striping operations, a shadow vehicle, equipped with appropriate lights, Warning Signs and/or a truck-mounted or trailer attenuator (TMA) may be used to protect the workers from impacts by errant vehicles. TMAs are required on multi-lane highways (45 mph and above).
6. Road Closure - If alternate routes are available to handle road users, the road may be closed temporarily. This may facilitate quicker project completion and thus further reduce worker vulnerability.
7. Law Enforcement Use - In highly vulnerable work situations, particularly those of relatively short duration, law enforcement units may be stationed to heighten the awareness of passing vehicular traffic and to improve safety through the temporary traffic control zone.
8. Lighting - For nighttime work, consider lighting the temporary traffic control zone and approaches.
9. Special Devices - Judicious use of special warning and control devices may be helpful for certain difficult work area situations. These include rumble strips, changeable message signs, hazard identification beacons, flags and warning lights. Intrusion warning devices may be used to alert workers to the approach of errant vehicles. However, misuse or overuse of special devices or techniques may lessen their effectiveness.
10. Public Information - Improved driver performance may be realized through a well-prepared and complete public relations effort that covers the nature of the work, etc. (**see Section 600-4**).

605 TEMPORARY TRAFFIC CONTROL ZONE DEVICES

605-1 General

The design and application of temporary traffic control devices used in temporary traffic control zones should consider the needs of all road users. All traffic control devices used on street and highway construction, maintenance, utility, or incident management operations shall conform to the applicable provisions of the [OMUTCD](#).

OMUTCD Chapter 6F addresses the design and application of traffic control devices for use in temporary traffic control zones. Additional information on the standards and guidelines for the design and use of these devices is included in this Part of the **TEM**.

The traffic control devices discussed herein include signs, pavement markings, raised pavement markers, channelizing devices, lighting devices, beacons, warning lights, traffic signals, and other devices used to regulate, warn or guide traffic.

Chapter 607 provides additional information on the use of these devices in typical applications, **Chapter 640** provides additional design and plan preparation information, **Chapter 650** addresses construction issues, **Chapter 660** addresses maintenance issues, and **Chapter 670** addresses various other considerations.

Crashworthiness and crash testing information on temporary traffic control devices are found in **AASHTO's Roadside Design Guide (RSDG) (see Section 193-4)**. Additional materials and hardware information, including NCHRP 350 information, is addressed in **Chapter 620**.

As noted in [OMUTCD Section 6F.02](#), where the color orange is required, fluorescent red-orange or fluorescent yellow-orange colors may also be used. The fluorescent version of orange provides higher conspicuousness than standard orange, especially during twilight.

605-2 General Characteristics of Signs

605-2.1 General

Temporary traffic control zone signs convey both general and specific messages by means of words or symbols and have the same three categories as all road user signs: regulatory, warning and guide described in [OMUTCD Part 2](#).

Commonly used work zone signs are discussed in detail in [OMUTCD Chapter 6F](#) and in **Sections 605-2 through 605-10**. Illustrations of temporary traffic control signs that are discussed in this Manual, but not shown in the **OMUTCD** are provided in **Figure 698-2**.

The **OMUTCD** and this Part of the **TEM** also provide examples of common applications of these signs. **ODOT** standards for application of work zone signing on construction projects are provided in the [Traffic SCDs](#) and the **TEM**, and material requirements are addressed in **Chapter 620** and [C&MS 614](#). Also see **Part 2** of this Manual for further signing information.

When standard orange flags or flashing warning lights are used in conjunction with signs, they shall not block the sign face.

605-2.2 Design

The colors for Regulatory Signs shall follow the standards in [OMUTCD Chapter 2B](#). Warning Signs in temporary traffic control zones shall have a black legend on an orange background, except for the Railroad Advance Warning Sign ([OMUTCD Section 8B.04](#)), and except for signs in [OMUTCD Chapter 2C](#) that are permitted to have yellow or fluorescent yellow-green

backgrounds, and those in [OMUTCD Chapter 6I](#) permitted to have fluorescent pink backgrounds (*also see Section 605-5.2*). Colors for Guide Signs shall follow the standards in [OMUTCD Chapter 2D](#), except for Guide Signs noted in *Sections 605-7 and 605-8*.

As noted in [OMUTCD Section 6F.02](#), existing yellow or fluorescent yellow-green Warning Signs already in place within temporary traffic control zones may remain in use when applicable. Color for other signs shall generally follow the standard for all highway signs.

605-2.3 Placement

Signs should be placed on the right side of the roadway unless otherwise specified in the **OMUTCD** or the **TEM**. On multi-lane divided highways, signs should be dual-mounted unless it is not physically possible to do so. [OMUTCD Section 6F.03](#) and [Figure 6F-1](#) provide guidelines for height and lateral clearance of temporary post-mounted signs. [Traffic SCD MT-105.10](#) also addresses temporary sign supports. For increased visibility, a 7-foot mounting height may be used in rural areas.

As noted in [OMUTCD Section 6F.03](#), signs mounted on portable supports may be placed within the roadway itself. Signs may also be mounted on or above barricades. Signs mounted on barricades and barricade/sign combinations shall be crashworthy.

Neither portable nor permanent sign supports should be located on sidewalks, bicycle lanes, or areas designated for pedestrian or bicycle traffic.

Methods of mounting signs other than on posts are illustrated in [OMUTCD Figure 6F-2](#). Except as noted below for mobile operations, signs mounted on portable supports should not be used for a period of more than three days. Signs mounted on Type III barricades should not cover more than fifty percent of the top two rails or thirty-three percent of the total area of the three rails.

For information regarding signing for work zone speed zones see *Section 640-18.2*.

For mobile operations, a sign may be mounted on a work vehicle, a shadow vehicle, or a trailer stationed in advance of the temporary traffic control zone or moving along with it. The work vehicle or shadow vehicle may have a truck-mounted or trailer attenuator (TMA). TMAs are required for shadow vehicles on multi-lane highways (45 mph and above).

See *Section 221-4* for information about erecting signs on or near utility poles.

605-2.4 Sheeting for Temporary Traffic Control Signs and Hand-Signaling Devices

For flatsheet signs and hand-signaling devices, Type G, H or J retroreflective sheeting shall be provided for the background and for the retroreflective legends. As an exception, any hand-signaling devices in **ODOT** maintenance inventory with Type F sheeting may remain in use until they have reached the end of their service life. New Type F hand-signaling devices shall not be permitted.

605-3 Regulatory Signs

605-3.1 General

Regulatory Signs in temporary traffic control zones are addressed in [OMUTCD Chapter 6F](#). *Section 605-3* will be used to provide additional information about Regulatory Signs discussed in the **OMUTCD** if needed. Information about Regulatory Signs used in temporary traffic control zones that are not currently addressed in the **OMUTCD** are discussed in *Section 605-4*.

If a temporary traffic control zone requires regulatory measures different from those existing, the existing permanent regulatory devices shall be removed or covered and superseded by

605-14.5.2 End Treatment

The exposed end of the PB should be located at a distance from the edge of the traveled way equal to the clear zone distance for the facility as discussed in [L&D Manual Volume 1, Section 600.2](#). When this is not practical, impact attenuators shall be provided on the exposed ends of PB located within the clear zone.

Except as noted, exposed ends of PB located outside the clear zone shall be tapered. The leading end of PB does not need be tapered if shielded by another run of overlapping PB, permanent concrete barrier, or fully anchored guardrail (with anchor assembly). However, the PB should extend/overlap at least 50 feet with a guardrail end. Connections or field transitions to guardrail are not crashworthy and are not permitted. Abutting or connecting PB to permanent concrete barrier or parapets is non-standard and requires special anchoring and design details. See [Traffic SCD MT-101.80](#) for design guidance for transitioning portable concrete barrier (does not pertain to portable steel barriers) to permanent concrete barrier.

For acceptable flare rates for PB, see [L&D Manual Volume 1, Figure 602-1](#) and the SCDs. See [Section 620-2](#) for information on the NCHRP 350 requirements.

605-14.5.3 Anchoring PB

Anchoring of PB may be considered to prevent excessive deflections of the barrier on the roadside, e.g., on bridge decks where a deflection could cause the PB to fall from the deck. Anchoring of PB located on bridges is required as shown in [SCD PCB-91](#). Anchoring drawings for minimum deflection of portable steel barrier are shown in the Approved Products List maintained by [ORE](#). Anchored PB is not intended for use where uni- or bi-directional traffic is running along both sides of the PB.

605-14.5.4 Grading of Cross Slopes

Where PB is located beyond the edge of the paved shoulder, the cross slope within the clear zone, including the surface on which the PB is placed, shall be graded at 10:1 or flatter. If the cross slope is steeper than 10:1, the PB shall be terminated on the paved or graded surface rather than on the cross slope. The PB shall be extended along the paved or graded surface as necessary to satisfy the length of need ([L&D Manual Volume 1, Section 602.1.2](#)), and then terminated using an impact attenuator.

605-14.6 Plastic Water-Filled Barrier

A plastic water-filled barrier (PWFB) cannot be used as a direct substitute for PB. In locations where the water-filled barrier is used primarily as a channelizing device, the length of the barrier is determined in a manner similar to that for drums. They may also provide a higher level of channelization at certain locations where drums would normally be used, such as at exit ramps. When specifying a PWFB, the designer must consider the following factors:

1. There is assurance adequate clearance exists behind the barrier to accommodate the expected deflections.
2. The PWFB must meet the appropriate [NCHRP Report 350](#) Test Level and have an [FHWA](#) acceptance letter for that test level. For example, the Rhino Barrier does not meet TL-3, but it does meet TL-2. A complete listing of accepted devices is [on-line](#).
3. Products have met crash testing criteria by testing with a number of interconnected units to achieve the necessary tension needed. Therefore, before a product can be specified, the designer must ensure this minimum length is provided in the plans, even if it greater than the length of need as calculated in [Section 605-14.2](#).
4. The PWFB shall be flared outside the clear zone unless terminated with a crashworthy end treatment.

The designer is encouraged to accommodate all of the products in a generic design. However, if the site has limitations, and only one or two PWFB will work on a project due to the limitations of the other products, the designer is obligated to specify only the appropriate PWFB. Unless the designer specified a particular PWFB, a contractor is free to choose any of the **FHWA** accepted **NCHRP Report 350** PWFB.

The contractor shall install the selected product as per the manufacturer's recommendations and in accordance with the factors stated above. All Test Level 3 products were crash tested by utilizing some sort of a steel cage, or connectors, so it is imperative the contractor install these "upgrade kits" to match the crash tested design.

605-14.7 Cable Barrier

1. Existing Cable Barrier

If shifting traffic closer than 8 feet to existing cable barrier, portable barrier shall be added adjacent to opposing traffic for separation.

2. Proposed Temporary Cable Barrier

Cable barrier shall not be installed for temporary applications.

3. Proposed Permanent Cable Barrier

It is recommended to wait until the end of the project to install proposed permanent cable barrier. If separation is required prior to installation, use portable barrier for separation of opposing traffic per [L&D Manual Volume 1, Figure 601-2E and Section 603.1.4.6](#).

605-15 Crash Cushions

605-15.1 General

As noted in [OMUTCD Section 6F.86](#), crash cushions are systems that mitigate the effects of errant vehicles that strike obstacles, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle. The two types of crash cushions that are used in temporary traffic control zones are stationary crash cushions and truck-mounted or trailer attenuators. Crash cushions in temporary traffic control zones help protect the drivers from the exposed ends of barriers, fixed objects, shadow vehicles and other obstacles. Specific information on the use of crash cushions can be found in **AASHTO's Roadside Design Guide (see Section 193-4)**.

Crash cushions shall be crashworthy. They shall also be designed for each application to stop or redirect errant vehicles under prescribed conditions. Crash cushions shall be periodically inspected to verify that they have not been hit or damaged. Damaged crash cushions shall be promptly repaired or replaced.

605-15.2 Stationary Crash Cushions

Stationary crash cushions are used in temporary traffic control zones in the same manner as permanent highway installations to protect drivers from the exposed ends of barriers, fixed objects and other obstacles. Stationary crash cushions shall be designed for the specific application intended.

See **Sections 642-30 and 642-31** for related **Plan Notes** and additional information.

Sand barrel arrays may be used in work zones to provide temporary protection for wide hazards. For ease of moving, they may be mounted on pallets or skids that are 4 inches or less

in height.

See [L&D Manual Volume 1, Section 603.4.4 and 603.4.5](#) for additional information.

605-15.3 Truck-Mounted or Trailer Attenuators

Truck-mounted or trailer attenuators (TMAs) shall be energy-absorbing devices attached to the rear of shadow trailers or trucks and they should be used in accordance with the manufacturer's specifications. When used, they shall be located in advance of the work area, workers or equipment to reduce the severity of rear-end crashes from errant vehicles. Chapter 9 of **AASHTO's Roadside Design Guide** (see *Section 193-4*) and *Section 602-8* contain additional information regarding the use of shadow vehicles.

If an adjacent lane closure (in compliance with the PLCS) and/or a lane shift cannot be implemented to achieve lateral clearance from joint coring (or other similar operation with short periods of encroachment) located at the edge of a closed area without positive protection that is immediately adjacent to an open lane of traffic, a TMA shall be used to protect the specified operation. TMAs shall be used even if additional measures are implemented to achieve lateral clearance. When used, TMAs should be NCHRP Report 350 or MASH TL-3 compliant and should be operated and located per manufacturer recommendations and AASHTO's Roadside Design Guide.

For more detail see [L&D Manual Volume 1, Section 603.2](#).

605-16 Reserved for Future Information

605-17 Rumble Strips

Rumble strips (see [OMUTCD Section 6F.87](#) and *TEM Section 1415*) consist of intermittent narrow, transverse areas of rough-textured or slightly raised or depressed road surface that alert drivers to unusual vehicular traffic conditions. Through noise and vibration they attract a driver's attention to such features as unexpected changes in alignment and to conditions requiring a stop.

The first rumble strip pad should be placed before the advance warning devices. The last pad should be placed a minimum of 250 feet in advance of the traffic condition.

A RUMBLE STRIPS sign (W8-H15a) warning drivers of the onset of rumble strips may be placed in advance of any rumble strip installation.

Although the intent of the rumble strips is to alert the road user, the noise may also attract the attention of non-road users on adjacent property. This would be unacceptable in residential areas.

Temporary portable rumble strips used for temporary traffic control shall follow requirements set forth in [SCD MT-97.20](#).

605-18 Screens

Screens (see [OMUTCD Section 6F.88](#)) are used to block the road users' view of activities that can be distracting. Screens might improve safety and vehicular traffic flow where volumes approach the roadway capacity because they discourage gawking and reduce headlight glare from oncoming vehicular traffic. They can also help contain the work area and reduce the accumulation of dust and debris on the pavement.

On **ODOT**-maintained highways a glare screen shall be used at all crossover locations unless a 50-inch portable barrier (PB) is provided. The upper portion of the 50-inch portable barrier (PB) serves as a glare screen (see [Roadway SCD RM-4.1](#) for details).

Paddle, or intermittent, type glare screens may be mounted on the top of 32-inch PB.

Where glare screen is provided, the glare screen shall be equipped with vertical stripes on the paddles as shown in [Traffic SCD MT-101.70](#).

See **Section 642-21 (Plan Note 642-21)**, [L&D Manual Volume 1, Section 604](#) and [Traffic SCD MT-95.70 or MT-95.71](#) for additional guidance.

The choice of 32-inch PB, with screen, or 50-inch is often left to the contractor. However, glare screen can be a maintenance problem. If PB will be in place over the winter during plowing operations, or if the PB is otherwise expected to be hit a lot, the 50-inch PB should be specified. Plowing over the top of a 50-inch PB is possible; however, it is not preferred.

605-19 Barrier Reflectors and Object Markers

605-19.1 General

Materials used for barrier reflectors shall conform to [C&MS 626](#). The minimum reflective surface area for the reflector portion of a barrier reflector should be 7 square inches.

Attachment of the reflector shall be by a suitable corrosion resistant fastener, bracket or adhesive. Barrier reflectors shall be the same color as the adjacent edge line. When adjacent to a reversible traffic direction lane, barrier reflectors shall be white on one side and yellow on the other side, such that regardless of the direction of travel of the road user, the yellow barrier reflectors will be visible to the road user's left side and white barrier reflectors will be visible to the road user's right side. For additional information on type, color and One-Way vs Bi-Directional barrier reflectors, see **Sections 307 and 307-4**.

Object markers shall conform to [C&MS 614.03](#). Barrier object markers shall be 6 inches wide and at least 12 inches high. They shall have orange (fluorescent red-orange or fluorescent yellow-orange) retroreflective sheeting (see [C&MS 614.03](#) for more information on materials). If used with two-way traffic, object markers shall be mounted in pairs facing traffic from each direction.

605-19.2 Delineation of Concrete Barriers, Bridge Parapets and Portable Barrier

Barrier reflectors and object markers shall be mounted on all portable barrier (PB) used for traffic control; and, on all permanent concrete barrier (including bridge parapets) located within 5 feet of the edge of the adjacent travel lane. (See **Plan Note 642-51** in **Chapter 642**.) When PB contains glare screen (**see Section 605-18**), three vertical retroreflective stripes shall be placed on consecutive paddles as described in [Traffic SCD MT-101.70](#).

Barrier reflectors and object markers shall be installed as shown in [Traffic SCD MT-101.70](#), **with a** maximum spacing for the barrier reflectors and object markers of 50 feet. Where both barrier reflectors and object markers are provided on the same device, these items shall be staggered.

See **Section 641-22** for more information about [Traffic SCD MT-101.70](#).

605-19.2.1 Increased Barrier Delineation (Delineation Panels and Triple-Stacked Reflectors)

One of the increased barrier delineation methods shown in [Traffic SCD MT-101.70](#) shall be installed on all portable and permanent barrier located within 5 feet of the edge of the traveled lane under either of the following conditions: along tapers and transition areas; or along curves (outside only) with degree of curvature greater than or equal to 3 degrees.

Delineation panels shall consist of panels of delineation, approximately 34 inches long and 6 inches wide and shall be "crimped" and shall be aligned horizontally. Panels shall be provided at the rate of one per section of portable barrier, or one panel every 10 feet on permanent barrier, spaced evenly along the length of the run. The panels shall be mounted

607 TYPICAL APPLICATIONS**607-1 General**

Chapter 606 presented a general discussion of typical temporary traffic control activities. **Chapter 607** provides more detailed information about typical applications for a variety of situations commonly encountered.

Temporary traffic control applications are presented in [OMUTCD Chapter 6H](#), in this **TEM** Chapter (and the related figures in **Chapter 698**), and in the [Traffic SCD MT series](#). Applications shown in the **OMUTCD** present minimum standards permitted within **Ohio**. Traffic control applications presented in the **Traffic SCDs** are intended for use on **ODOT** administered projects, and are more restrictive than the applications presented in the **OMUTCD**. As noted in **Section 600-3**, applicable **SCDs** are also recommended for use in **ODOT** force-account work as much as practical. Additional guidance in proper application of temporary traffic control devices is presented in [C&MS 614](#).

In addition to information in the **OMUTCD**, figures and tables found in this Part of the **TEM** provide information for the development of temporary traffic control plans. **OMUTCD Table 6C-3** is used for the determination of taper lengths, and **OMUTCD Table 6C-1** can be used for Warning Sign spacing for various areas and roadway types.

While not every situation is addressed, the information illustrated in the **OMUTCD**, the **TEM** and the **Traffic SCDs** can generally be adapted to a broad range of conditions. In many instances, an appropriate temporary traffic control plan is achieved by combining features from various typical applications. For example, work at an intersection might present a near-side work zone for one street and a far-side work zone for the other street. These treatments are found in two different typical applications, while a third typical application shows how to handle pedestrian crosswalk closures.

Procedures for establishing temporary traffic control zones vary with such conditions as road configuration, location of the work, work activity, duration of work, road user volumes, road vehicle mix (buses, trucks and cars) and road user speeds. Examples presented in the **OMUTCD** are guides showing how to apply principles and standards. Applying these guidelines to actual situations and adjusting to field conditions requires judgment. In general, the procedures illustrated represent minimum solutions for the situations depicted.

Other devices may be added to supplement the devices shown in the various applications presented in these documents. Device spacing may be adjusted to provide additional reaction time or delineation. Fewer devices may be used based on field conditions.

The legend for the symbols used in typical applications presented in the **OMUTCD** and the **TEM** is provided in **OMUTCD Table 6H-2**. In many of the typical applications, sign spacings and other dimensions are indicated by letters using the criteria provided in **OMUTCD Table 6C-1**. Most of the typical applications show temporary traffic control devices for only one direction.

The following are general comments regarding the use of **OMUTCD** typical applications for **ODOT** work:

1. References to “activated rotating, flashing, oscillating or strobe lights” shall be interpreted as “activated yellow rotating, flashing, oscillating, or strobe lights.”
2. The Construction Arrow sign (W1-H16) may be used instead of the arrow board for lane closures on low-volume, low-speed roads and urban streets. The Construction Arrow sign may be used to supplement the arrow board on high-volume roads.
3. Traffic control signing for lane closures on multi-lane highways may be supplemented by Changeable Message Signs.

4. In long-term situations, additional advance Warning Signs may be desirable.
5. Portable barrier is one method that may be used to close a lane. Use of a barrier should be based on the need determined by an engineering analysis. The layout of the barrier should prevent vehicles from impacting the ends of the barrier. According to the **Roadside Design Guide (RSDG) (Section 193-4)**, the barrier should be flared beyond the clear zone. An alternative procedure is to place an impact attenuator to protect traffic from the end of the barrier (*see Section 605-14*).
6. Where ramps exist within the limits of the project, the EXIT OPEN, EXIT OPEN AHEAD, EXIT CLOSED, and EXIT CLOSED AHEAD signs shall be used, as shown in the [Traffic SCD MT-98 series](#).
7. Where entrance ramps are located within the project limits and the mainline gaps are insufficient to provide proper merging, consideration should be given to closing the ramps.

607-2 Blasting Zone (OMUTCD Figure 6H-2)

On a divided highway, the signs should be mounted on both sides of the directional roadways.

607-3 Road Closed with Off-Site Detour (OMUTCD Figure 6H-8)

For unnumbered routes, the M4-9 DETOUR sign may be used instead of the M4-8 DETOUR.

607-4 Lane Closures on Low-Volume, Two-Lane Road (OMUTCD Figure 6H-11)

In long-term operations, a double-yellow No-Passing Zone should be added on the approach for the closed lane. The No-Passing Zone shall have a length of "A" as determined from [OMUTCD Table 6C-1](#).

607-5 Lane Closure on Two-Lane Road Using Traffic Signals (OMUTCD Figure 6H-12)

For high-volume applications, consideration should be given to installation of the BE PREPARED TO STOP sign (W3-4) in advance of the Signal Ahead sign (W3-3).

607-6 Temporary Road Closure (OMUTCD Figure 6H-13)

When the temporary road closure occurs at night, Type A flashing lights should be used on advance Warning Signs and the flagger station shall be illuminated, except in an emergency.

607-7 Detour for One Travel Direction (OMUTCD Figure 6H-19)

A DETOUR sign with an advance arrow (M4-9) may be used in advance of a turn. On multi-lane streets, a DETOUR sign with an advance turn arrow should be used in advance of a turn.

607-8 Right Lane Closure - Far Side of Intersection (OMUTCD Figure 6H-22)

For long-term operations, pavement markings may be used to highlight the right-only movement.

607-9 Mobile Operation on Multi-lane Road (OMUTCD Figure 6H-35)

Shadow vehicle 2 in this figure shall be equipped with a truck-mounted or trailer attenuator.

607-10 Lane Shift on Freeway (OMUTCD Figure 6H-36)

Additional signing should be provided as shown in [Traffic SCDs MT-102.10, MT-102.20 and MT-102.30](#). This signing includes the TRUCKS USE LEFT (RIGHT) LANE sign (R-4-5, R-4-H5a) if

641 PLAN PREPARATION / PRODUCTION**641-1 General**

The [L&D Manual Volume 3](#) describes ODOT plan preparation and production guidelines and standards. Maintenance of Traffic (MOT) plans are addressed in **Chapter 1306** of that manual. Additional information specific to MOT plans is provided in this Chapter and **Chapter 640**. The detail needed in MOT plans depends on the complexity of the project. Adjustments in the field may be necessary when unforeseen circumstances arise.

The following sections provide information about various components of the Temporary Traffic Control (or MOT) Plan, including detail information about **Traffic SCDs and PISs**.

641-2 Temporary Traffic Control / Maintenance of Traffic (MOT) Plans**641-2.1 General**

As noted in **Section 602-2**, Temporary Traffic Control (or MOT) Plans are used to describe the temporary traffic control measures that are to be used for facilitating the road users through a work zone. These plans play a vital role in assuring a continuity of safe and efficient traffic flow through the work zone.

641-2.2 Plan Sheets

The traffic control plan may include plan sheets for each sequence of operation, to show all temporary signing and pavement marking applicable to the phase. Additionally, removal or covering of non-applicable signs should be indicated on the plan.

641-2.3 Plan Notes

Standard maintenance of traffic **Plan Notes** are in **Chapter 642**. Additionally, the designer must provide notes to explain any requirements of the contractor which are not covered in the standard notes or elsewhere in the plans or the specifications.

641-2.4 Sequence of Operation Notes

The designer should also provide sequence of operation notes in order to insure that the traffic is maintained as may have been agreed upon by ODOT and the public. For additional information regarding development of a sequence of operation, see **Section 640-3**.

641-2.5 Designer Notes

In addition to the information found throughout this Part of the **TEM**, Designer Notes specifically related to the **Standard Construction Drawings (SCDs)** have been included in this Chapter. Designer Notes have also been included with the **Plan Notes** in **Chapter 642**.

641-2.6 Quantities

As shown in [C&MS 614](#) and in the [Item Master](#), many of the traffic control quantities should be itemized, including signing, pavement marking and concrete barriers. (The [Item Master](#) and the **Summary of Contracts Awarded** are both available from the [Office of Estimating](#).) Non-itemized quantities will be paid for as **Item 614 Maintaining Traffic**.

641-2.7 Plan Reviews

The Stage 2 MOT plans for projects that have a MOTAA and the subsequent stage MOT Plans for projects with an exception request shall be submitted per **Policy 21-008(P)**, the **PDP**, and the **L&D Manual Volume 3, Section 1306** (see **Section 601-3**).

Other MOT plans may be submitted to the [Office of Roadway Engineering \(ORE\) Traffic Control Design Section](#) for review/advice.

641-2.8 Exception Approval

Lane closures shall meet the requirements of the permitted lane-closure schedule provided in **Section 630-4**. Any request for exception to this lane-closure schedule shall be submitted for exception approval. Any exception request, if not submitted for review and approval during the planning stage, should be submitted as soon as possible during the design stage so that the MOT plan can be developed accordingly.

641-3 Traffic Plan Insert Sheets (PISs)

[Traffic PISs](#) are addressed in general in **Chapter 104**. They are addressed as appropriate throughout the text of this Manual; and this Chapter provides specific information about the application of most of the **Traffic PISs**. **Traffic PISs** are used in a plan as a plan sheet. They can be used as is or modified as needed. They are available from the [ORE website](#) and through the [Design Reference Resource Center \(DRRC\)](#).

641-4 Traffic Standard Construction Drawings (SCDs)

[Traffic SCDs](#) are addressed in general in **Chapter 103**. They are addressed as appropriate throughout the text of this Manual; and this Chapter provides specific information about the application of most of the **Traffic SCDs**. Applicable **SCDs** are listed on the plan title sheet. The **SCDs** are available from the [Traffic Standard Construction Drawings \(SCDs\) website](#) and through the [Design Reference Resource Center \(DRRC\)](#).

641-5 Closing Right or Left Lane of a Multi-lane Divided Highway (MT-95.30, 95.40 and 95.50)

641-5.1 General

Traffic SCD MT-95.30 depicts traffic control for closing one or two of the right or left lanes of a multi-lane divided highway using drums. **MT-95.40** is used when construction procedure or the condition requires that the work area be protected by portable barrier (PB) in accordance with **Section 605-14**. **MT-95.50** incorporates Speed Limit signing and Increased Penalty signing with the lane-reduction signing called for in **MT-95.30** and **MT-95.40**. **MT-95.50** also provides additional Advance Warning Sign Groups. These sign groups, when used, are in addition to the advance signing provided in **MT-95.30** and **MT-95.40**.

The designer should check the existing median width to determine if sufficient width exists for erection of the median signs. If not, a smaller size median sign should be specified in [C&MS 614 Maintaining Traffic](#).

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs). When required, these units must be specifically identified in the plans. When included, these items shall have separate notes and/or details as well as separate pay items.

641-5.2 Advance Warning Sign Groups

[Traffic SCD MT-95.50](#) allows the designer to require extra Advance Warning Sign Groups (AWSGs) when traffic is expected to back-up beyond the standard advance Warning Signs. Whenever this **SCD** is specified in a plan, the designer should analyze the anticipated traffic demand, peaking characteristics, capacity and expected queue lengths, and include this analysis with the preliminary Maintenance of Traffic submission. If the queue is expected to extend beyond the normal ROAD WORK AHEAD sign (W20-1), extra AWSGs should be

specified in the **Item 614 Maintaining Traffic Plan Note** (see **Sections 642-2 and 642-33**). The first extra AWSG should be located a distance, in whole miles, in advance of the lane taper which is at least equal to the longest anticipated queue length. Additional AWSGs should be located at 1 to 2 mile intervals between the first AWSG and the normal Warning Signs location. AWSGs would typically be specified for 2 miles, 3 miles, 5 miles and 8 miles up to the distance needed to deal with the anticipated queue.

If the construction will extend over a holiday period, or any other anticipated period of unusually high traffic demand, a separate queue length analysis should also be made for that period. This condition may require more AWSGs and **Plan Note 642-34 (Section 642-34)** would be used.

The **Plan Note (Section 642-33 or 642-34)** added within **Item 614 Maintaining Traffic** should specify the distance (in whole miles) on the W16-3a Distance plaque which is placed below the RIGHT/LEFT LANE CLOSED AHEAD sign (W20-5, W20-5a). This sign should be located approximately 1 mile in advance of the calculated end of the queue. The distance shown on the plate should be the distance to the beginning of the lane taper.

641-5.3 Advisory Speed Plaque (W13-1)

Advisory Speed Plaques are described in [OMUTCD Sections 2C.08 and 6F.52](#). The designer may specify the use of the Advisory Speed plaque (W13-1) by a **Plan Note** in **Item 614 Maintaining Traffic**. Unless specified, this plaque would only be used when directed by the project engineer. The designer may also specify the speed to be shown. An advisory speed reduction, if any, would normally be 10 miles per hour. If the speed is not specified, the speed is as directed by the project engineer. See **Section 640-18.1** (Design and Advisory Speeds) for additional information.

641-5.4 Pavement Markings

The work zone edge line parallel to the roadway (i.e., beyond the taper edge line) shall be used if the lane closure is greater than 3 days. The use should be specified in the **Item 614 Maintaining Traffic Plan Note** with an estimated quantity carried to the General Summary. See the notes on [Traffic SCD MT-95.30](#) or [MT-95.40](#), and [C&MS 614.11](#) for the type of work zone line to specify. Use of this line should be based on engineering judgment and include consideration of the length of the work, time of the closure, sequence of the work, including any need to remove the line in subsequent phases, encroachment on other lanes or the shoulder, the type of work, the geometrics in the area, and the relative cost of paint and work zone tape.

641-5.5 Illumination

In cases of unusual horizontal/vertical curvature, the designer may want to provide illumination of the taper area(s) depending on traffic volumes, accident history or patterns (particularly those involving crossing of the center line). See **Part 11** of this Manual for general lighting design principles. For guidance in unusual situations, the [Office of Roadway Engineering \(ORE\)](#) should be contacted.

For guidance in use of temporary lighting for crossovers, see [Traffic SCD MT-100.00](#) and **Plan Note 642-35** in **Chapter 642**. For floodlighting see **Plan Note 642-29** in **Chapter 642**.

641-5.6 Bid Items

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums, Arrow Board(s), Warning Lights and Shadow Vehicle.

The following items will be shown as separate quantities in the plans, when required:

Item 614,	Work Zone Edge Line, Class 1, (By Width), (By Type)	Mile
Item 622,	Portable Barrier, ____"	Foot

Item 614, Barrier Reflector	Each
Item 614, Work Zone Impact Attenuator	Each
Item 614, Object marker, ____-way	Each

641-6 Closing Right or Left Lane of a Multi-lane Undivided Highway (MT-95.31, 95.32 and 95.41)

641-6.1 General

Traffic SCDs MT-95.31 and 95.32 depict traffic control for closing the right and left lane, respectively, of a multi-lane undivided highway using drums. **MT-95.41** is used to close the right or left lane on a multi-lane undivided highway when construction procedure or the condition requires that the work area be protected by portable barrier (PB) in accordance with **Section 605-14**.

The designer should evaluate the possibility or extent of encroachment into open traffic lanes. This evaluation should include consideration of the existing geometrics (including lane and shoulder widths), the type of work being performed during the various construction stages and any additional width required for location of drums or cones and for work zone edge line when used. Depending upon the available lane width of the right lane, for the left-lane closing in **Traffic SCD MT-95.32**, it may be necessary to shift traffic onto the shoulder using drums or cones and/or work zone edge line. In this case, consideration should be given to removal of the existing right edge line.

For the right and left-lane closings shown in **Traffic SCDs MT-95.31 and 95.32**, if the traffic or any of the traffic control devices are expected to encroach on or over the center line, it may be necessary to close the left lane of opposing traffic, in accordance with **MT-95.32**. For short-term daylight closures, it may be possible to narrow the opposing lanes or shift them onto the shoulder using cones for guidance. Engineering judgment is necessary to determine the best solution. This evaluation should include consideration of the geometrics, traffic volumes and speeds, traffic composition and duration of the work.

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs). These units when required must be specifically itemized in the plans. When included, these items shall have separate notes and/or details as well as separate pay items.

641-6.2 Advance Warning Sign Groups

Additional Advance Warning Sign Groups (AWSGs) should not normally be required. If an analysis should indicate the need for this group, see **Section 641-5.2**. In this case, **Traffic SCD MT-95.50** shall be included in the plan with a reference in the **Item 614 Maintaining Traffic Plan Note** requiring additional AWSGs as shown on **MT-95.50**, except that median-mounted signs would not be used.

641-6.3 Advisory Speed Plaque (W13-1)

Advisory Speed plaques are described in **OMUTCD Sections 2C.08 and 6F.48**. The designer may specify the use of the Advisory Speed plaque (W13-1) by a note in **Item 614 Maintaining Traffic (Section 642-2)**. Unless specified, this plaque would only be used when directed by the project engineer. The designer may also specify the speed shown (see **OMUTCD Section 6F.48**). An advisory speed reduction, if any, would normally be 10 miles per hour. If the speed is not specified, the speed would be as directed by the project engineer. See **Section 640-18.1** (Design and Advisory Speeds) for additional information.

641-6.4 Pavement Markings

The work zone edge line parallel to the roadway (i.e., beyond the taper edge line) shall be used

if the lane closure is greater than 3 days. The use should be specified in the **Item 614 Maintaining Traffic Plan Note (Section 642-2)** with an estimated quantity carried to the General Summary. See the notes on [Traffic SCD MT-95.31, MT-95.32 or MT-95.41](#), and [C&MS 614.11](#) for the type of work zone line to specify. Use of this line should be based on engineering judgment and include consideration of the length of the work, time of the closure, sequence of the work, including any need to remove the line in subsequent phases, encroachment on other lanes or the shoulder, the type of work, the geometrics in the area, and the relative cost of paint and work zone tape.

641-6.5 Bid Items

The following items would normally be included with the lump sum bid for **614 Maintaining Traffic**: Signs, Cones, Drums, Arrow Board(s), Warning Lights and Shadow Vehicle.

The following items will be shown as separate quantities in the plans, when required:

Item 614,	Work Zone Edge Line, Class 1, (By Width), (By Type)	Mile
Item 622,	Portable Barrier, ____”	Foot
Item 614,	Barrier Reflector	Each
Item 614,	Work Zone Impact Attenuator	Each
Item 614,	Object marker, ____-way	Each

641-7 Closing Right or Left Shoulder of a Multi-lane Divided Highway ([MT-95.45](#))

641-7.1 General

Traffic SCD MT-95.45 depicts traffic control for closing the left of right shoulders of a multi-lane divided highway using portable barrier.

The designer should check the existing median width to determine if sufficient width exists for erection of the median signs. If not, a smaller size median sign should be specified in [C&MS 614 Maintaining Traffic](#).

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs). When required, these units must be specifically identified in the plans. When included, these items shall have separate notes and/or details as well as separate pay items.

641-7.2 Advance Warning Sign Groups

Additional Advance Warning Sign Groups (AWSGs) should not normally be required. If an analysis should indicate the need for this group, see **Section 641-5.2**. In this case, [Traffic SCD MT-95.50](#) shall be included in the plan with a reference in the **Item 614 Maintaining Traffic Plan Note** requiring additional AWSGs as shown on **MT-95.50**, except that median-mounted signs would not be used.

641-7.3 Bid Items

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums, and Warning Lights.

The following items will be shown as separate quantities in the plans, when required:

Item 622,	Portable Barrier, ____”	Foot
Item 614,	Barrier Reflector	Each
Item 614,	Work Zone Impact Attenuator	Each
Item 614,	Object marker, ____-way	Each

641-8 Closure of a Two-Way Left Turn Lane (MT-95.60)**641-8.1 General**

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs), and truck-mounted or self-contained impact attenuators. When required, these units shall have separate notes and/or details as well as separate pay items.

The designer should evaluate the possibility or extent of encroachment into open traffic lanes. This evaluation should include consideration of the existing geometrics (including lane and shoulder widths), the type of work being performed during the various construction stages and any additional width required for the location of drums or cones and temporary edge lines when used. Depending upon the available lane width of the right lane, it may be necessary to shift traffic onto the shoulder using drums or cones and/or a temporary edge line. In this case, consideration should be given to removal of the existing right edge line.

641-8.2 Advance Warning Signs Groups

Additional Advance Warning Sign Groups (AWSGs) should not normally be required. If an analysis indicates the need for this group, it would have to be included in the plan with a reference in **Item 614 Maintaining Traffic** that the additional AWSG(s) shall be included as part of the signing required for [Traffic SCD MT-95.60](#) (see **Section 641-5.2**).

641-8.3 Advisory Speed Plaque (W13-1)

Advisory Speed plaques are described in [OMUTCD Sections 2C.08 and 6F.52](#). The designer may specify the use of the Advisory Speed plaque (W13-1) by a **Plan Note** in **Item 614 Maintaining Traffic**. Unless specified, this plaque would only be used when directed by the project engineer. The designer may also specify the speed to be shown (see [OMUTCD Section 6F.52](#)). A speed reduction would normally be 10 miles per hour. If the speed is not specified, the speed would be as directed by the project engineer. See **Section 640-18.1** (Design and Advisory Speeds) for additional information.

641-8.4 Bid Items

The following items would normally be included with the lump sum bid for **Item 614 Maintaining Traffic**: Signs, Cones, Drums, Warning Lights and Shadow Vehicles.

641-9 Closure of Right Lane of Three-Lane Section with Two-Way Left-Turn Lane (MT-95.61)**641-9.1 General**

For some work area locations, it may be desirable to provide additional safety devices such as portable changeable message signs (PCMSs), and truck-mounted or self-contained impact attenuators. When required, these units shall have separate notes and/or details as well as separate pay items.

The designer should evaluate the possibility or extent of encroachment into open traffic lanes. This evaluation should include consideration of the existing geometrics, including lane and shoulder widths, the type of work being performed during the various construction stages, and any additional width required for the location of drums or cones and work zone edge lines, when used. Depending upon the available lane width of the lane, it may be necessary to shift traffic onto the shoulder using drums or cones and/or work zone edge line. In this case, consideration should be given to removal of the existing right edge line.

660 MAINTENANCE / OPERATIONS**660-1 General**

The consequence of poor maintenance practices are a reduction in safety to road users and an unnecessarily large exposure to liability claims. **District Roadway Services** personnel are responsible for establishing and maintaining temporary traffic control zones for **District** maintenance work and force account operations projects. Additional information is provided separately in this Manual regarding maintenance activities related to signing, markings, traffic signals, lighting and temporary traffic control.

For information about removal of Logo or Tourist-Oriented Directional Signs (TODS) see **Section 640-21**.

As of the April 19, 2019 publication, ODOT maintenance forces are still in the process of acquiring truck-mounted and trailer attenuators (TMA) and may not be able to provide TMAs in all instances indicated. During the transition period, TMAs are expected to be used as indicated once they are available to the crews for use. This paragraph will be removed once an adequate statewide supply of TMAs have been acquired and deployed for use by the department.

660-2 Reserved for Future Information

The OPI and QAR procedures previously described in this Section are no longer in place; therefore, the text has been deleted.

660-3 Temporary Traffic Control (TTC) for Pothole Patching**660-3.1 General**

As noted in **Section 600-3**, ODOT maintenance work zones shall “comply with the requirements in the **OMUTCD** and this Manual.” While recognizing that the ODOT “**SCDs and C&MS** do not necessarily provide the only method to achieve a given objective,” **Section 600-3** indicates that **Districts** should “also follow the provisions in applicable **SCDs and Construction and Materials Specifications (C&MS)** sections.”

As noted in **Section 606-1**, the general goal in work zone TTC is “safety with minimum disruption to road users.” However, as noted in **OMUTCD Section 6A.01** another goal of TTC is to provide for the efficient construction and maintenance of the highway, as well as efficient resolution of traffic incidents that may occur. Judgment is a key factor in balancing these goals, and determining what control is needed/appropriate. **OMUTCD Chapter 6B** provides a review of the fundamental principles of TTC.

OMUTCD Section 6G.02 and **TEM Chapter 606** address work duration as a factor in determining the devices used in TTC zones.

For pothole patching, it may take longer to set up and remove the TTC zone than to perform the work. This can significantly increase the delay for road users and increase workers’ exposure to road hazards. Therefore, simplified control procedures may be warranted. The **OMUTCD** allows a highway agency some discretion in determining the TTC to provide. However, the agency’s application of these devices should be consistent and commensurate with the conditions present in order to minimize risk to workers and the traveling public.

Permitted lane closure schedules (PLCS) have been established for **Interstates** and Interstate look-a-likes as well as other multi-lane roads deemed to be major or important by the **District** (see **Section 630-4**). The PLCS designates hours where volumes are low enough that work can be performed in a closed lane and still provide sufficient capacity for the lower traffic volumes. Whenever possible, any work hours should conform to the restrictions of the PLCS.

660-3.2 Incident Management/Emergency Work Zones

Emergencies affecting the health and safety of the traveling public can occur that necessitate action on **ODOT's** part before all the necessary equipment and personnel can be gathered to establish TTC per the **OMUTCD**, **Traffic SCDs** and **TEM** (see **OMUTCD Chapter 6I** and **TEM Chapter 608**). Circumstances such as these call for judgment in regards to the initial TTC devices deployed (based on availability) when using less than what is desirable. For emergency pothole patching on **ODOT**-maintained highways, the TTC procedures described in this **Section** should be followed to the extent practical.

660-3.3 Pothole Patching on Multi-Lane Facilities that Will Violate the Permitted Lane Closure Schedule (PLCS)

The following procedure is for pothole patching that occupies one location up to an hour (Short Duration per **OMUTCD Section 6G.02** and **TEM Section 606-3**) on multi-lane facilities during times that are in violation of the PLCS.

Below is a hierarchy list of preferred methods for addressing TTC needs while pothole patching under these conditions:

1. Schedule the work to be completed during times that do not violate the PLCS (**see Section 660-3.4**). All non-emergency work should be scheduled for times that will not violate the PLCS.
2. Dispatch workers and equipment to close the lane in which work will be performed per **OMUTCD Figure 6H-33** (and/or the appropriate lane closure **Traffic SCD**). For shadow vehicles, any truck-mounted or trailer attenuator (TMA) depicted as required in the **OMUTCD** (or appropriate **SCD**) or labeled as optional in the **OMUTCD** shall be required.
3. Dispatch workers and equipment to close the lane in which work will be performed per **Figure 698-9**.

When working in the interior lane(s) of a directional roadway with three or more lanes, multiple lanes should be closed per **OMUTCD Figure 6H-37** to remove the unique safety hazards to workers and motorist that are created by an interior-lane only closure. For emergency pothole patching necessitating an interior-lane closure, the **District** should use the resources available and **LEOs** to comply with **OMUTCD Figure 6H-37** to the extent practical.

Refer to **OMUTCD Chapter 6G**, **OMUTCD Figure 6H-35** and **TEM Chapter 606** for other pothole patching work durations such as Mobile, etc., and the associated TTC for these work conditions.

660-3.4 Pothole Patching on Multi-Lane Facilities that Will Not Violate the Permitted Lane Closure Schedule (PLCS)

The following procedure is for pothole patching that occupies one location up to an hour (Short Duration per **OMUTCD Section 6G.02** and **TEM Section 606-3**) on multi-lane facilities during times that are not in violation of the PLCS. For locations where the roadway facility is not addressed by the PLCS, non-emergency pothole patching work should be scheduled to occur during non-peak/lower volume hours.

Below is a hierarchy list of preferred methods for addressing TTC needs while pothole patching under these conditions:

1. Dispatch workers and equipment to close the lane in which work will be performed per **OMUTCD Figure 6H-33** (and/or the appropriate lane closure **Traffic SCD**). For shadow vehicles, any truck-mounted or trailer attenuator (TMA) depicted as required in the OMUTCD (or appropriate SCD) or labeled as optional in the OMUTCD shall be required.
2. If the **OMUTCD Figure 6H-33** cannot be achieved during emergency pothole patching work, or to close a lane using this application is not practical due to the very short work duration, dispatch workers and equipment to close the lane in which work will be performed per **TEM Figure 698-10**. (This lane closure method is not intended to be used for Mobile Operations (see **OMUTCD 6G.02**, **OMUTCD Figure 6H-35** and **Section 606-3**). Factors such as volume, terrain or lack of shoulder should be considered when deciding the need to request the presence of a law enforcement vehicle with flashing lights.

When working in the interior lane(s) of a directional roadway with three or more lanes, multiple lanes should be closed per **OMUTCD Figure 6H-37** to remove the unique safety hazards to workers and motorist that are created by an interior-lane only closure. For emergency pothole patching work necessitating an interior-lane closure, the **District** should use the resources available and LEOs to comply with **OMUTCD Figure 6H-37** to the extent practical.

Refer to **OMUTCD Chapter 6G**, **OMUTCD Figure 6H-35** and **TEM Chapter 606** for other pothole patching work durations such as Mobile, etc., and the associated TTC for these work conditions.

660-3.5 Pothole Patching on Two-Lane/Other Facilities

The following procedure is for pothole patching that occupies one location up to an hour (Short Duration per **OMUTCD Section 6G.02** and **TEM Section 606-3**) on two-lane/other facilities. Non-emergency pothole patching work should be scheduled to occur during non-peak/lower volume hours.

Below is a hierarchy list of preferred methods for addressing TTC needs while pothole patching under these conditions:

1. Dispatch workers and equipment to close the lane in which work will be performed per **OMUTCD Figure 6H-10** (see also **OMUTCD Sections 6C.10** and **6G.10**, and **Section 606-10**) OR for low-speed, low-volume facilities per **OMUTCD Figure 6H-18** (see also **OMUTCD Sections 6C.10** and **6G.10**, and **Section 606-10**).
2. On two-lane/other facilities where there are very low volumes, providing sufficient gaps to perform very short duration work, the use of high-intensity rotating, flashing, oscillating or strobe lights only may suffice. The work vehicle would be positioned on the shoulder or as far off the roadway as possible. This method of TTC is only intended for use on very low-volume two-lane/other facilities where the pothole patching work duration is very short and the roadway geometry and terrain do not necessitate additional measures (shadow vehicle, TMA, LEO, lane closure, etc.).

Refer to **OMUTCD Chapter 6G**, **OMUTCD Figure 6H-17** and **TEM Chapter 606** for other pothole patching work durations such as Mobile, etc., and the associated TTC for these work conditions.

Intentionally blank

Figure 698-8. Sample Lane Configuration Diagrams and Cross Sections

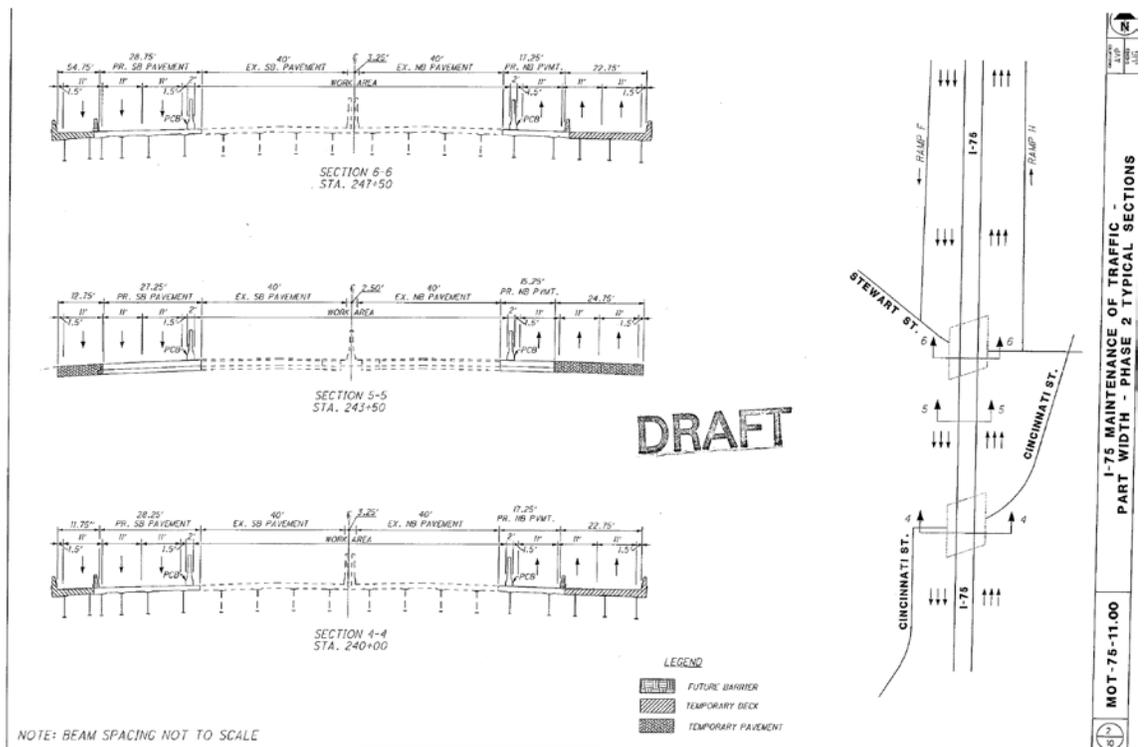
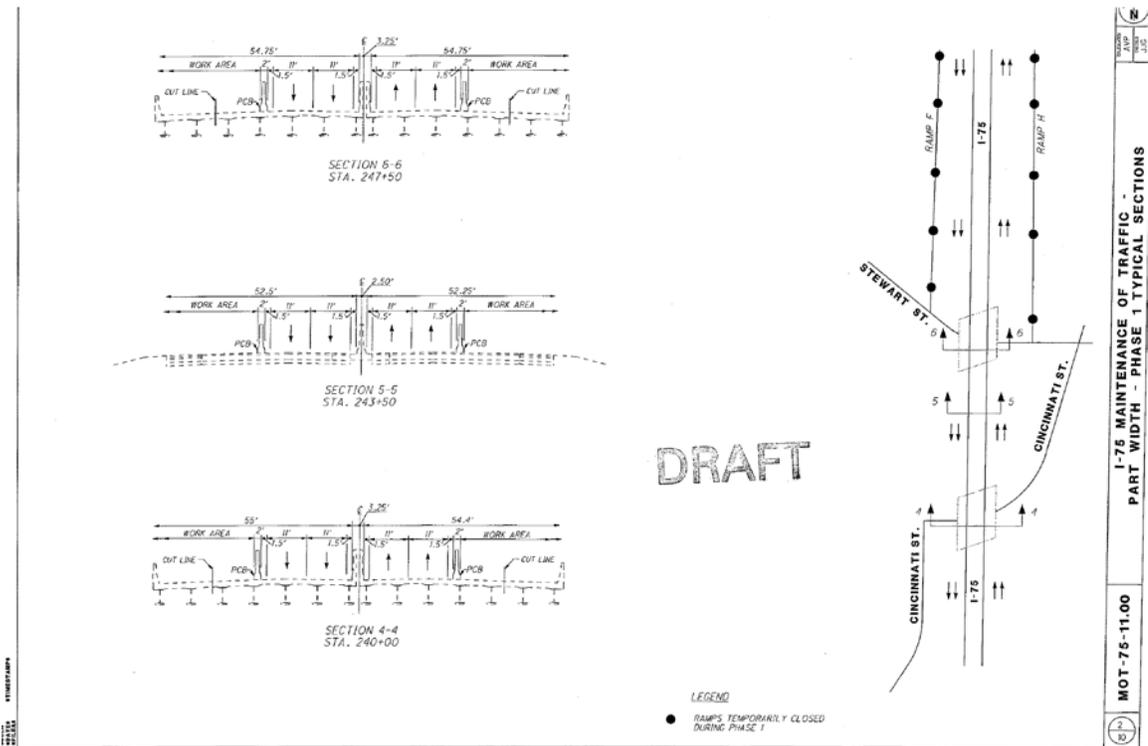
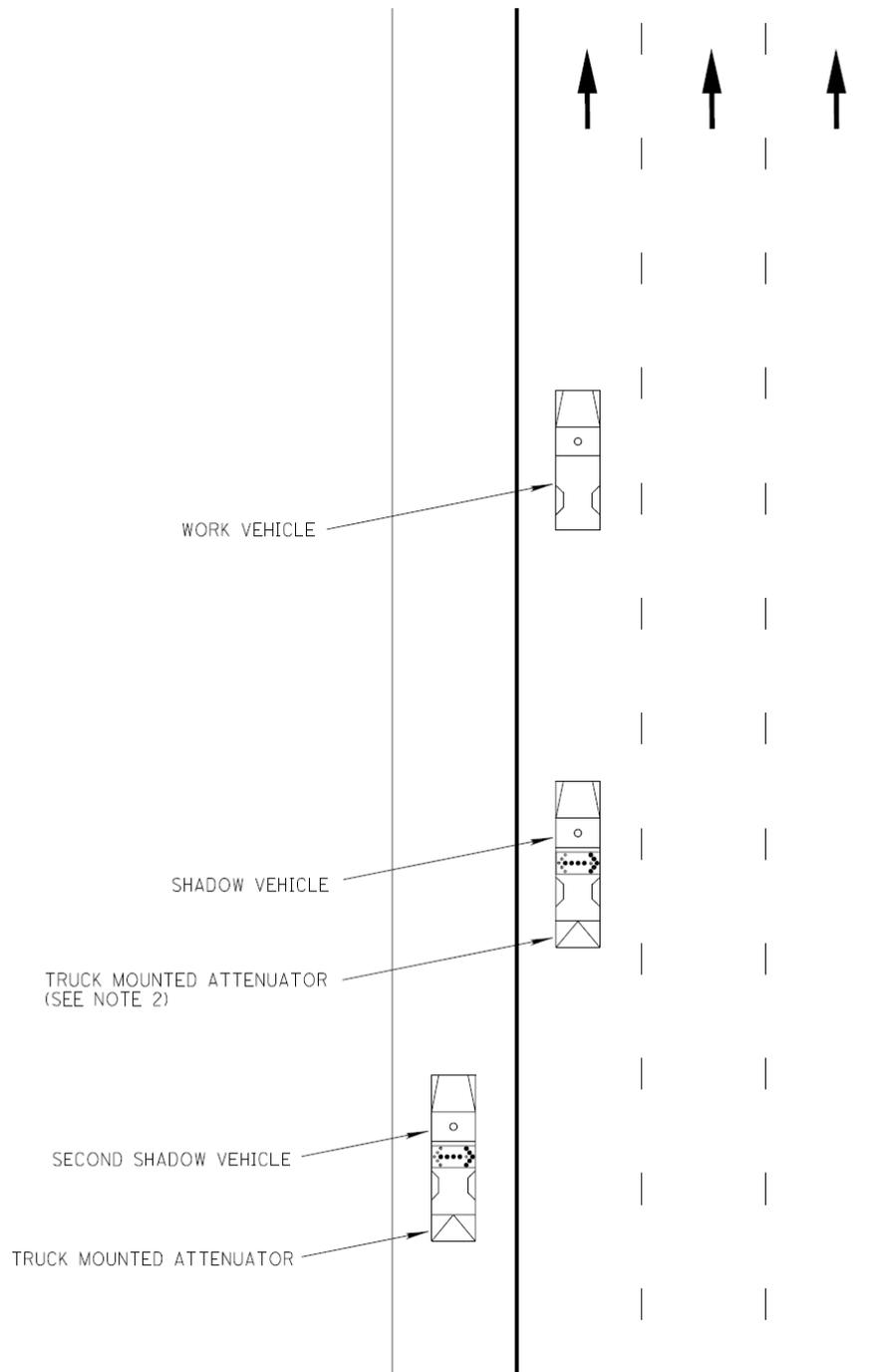


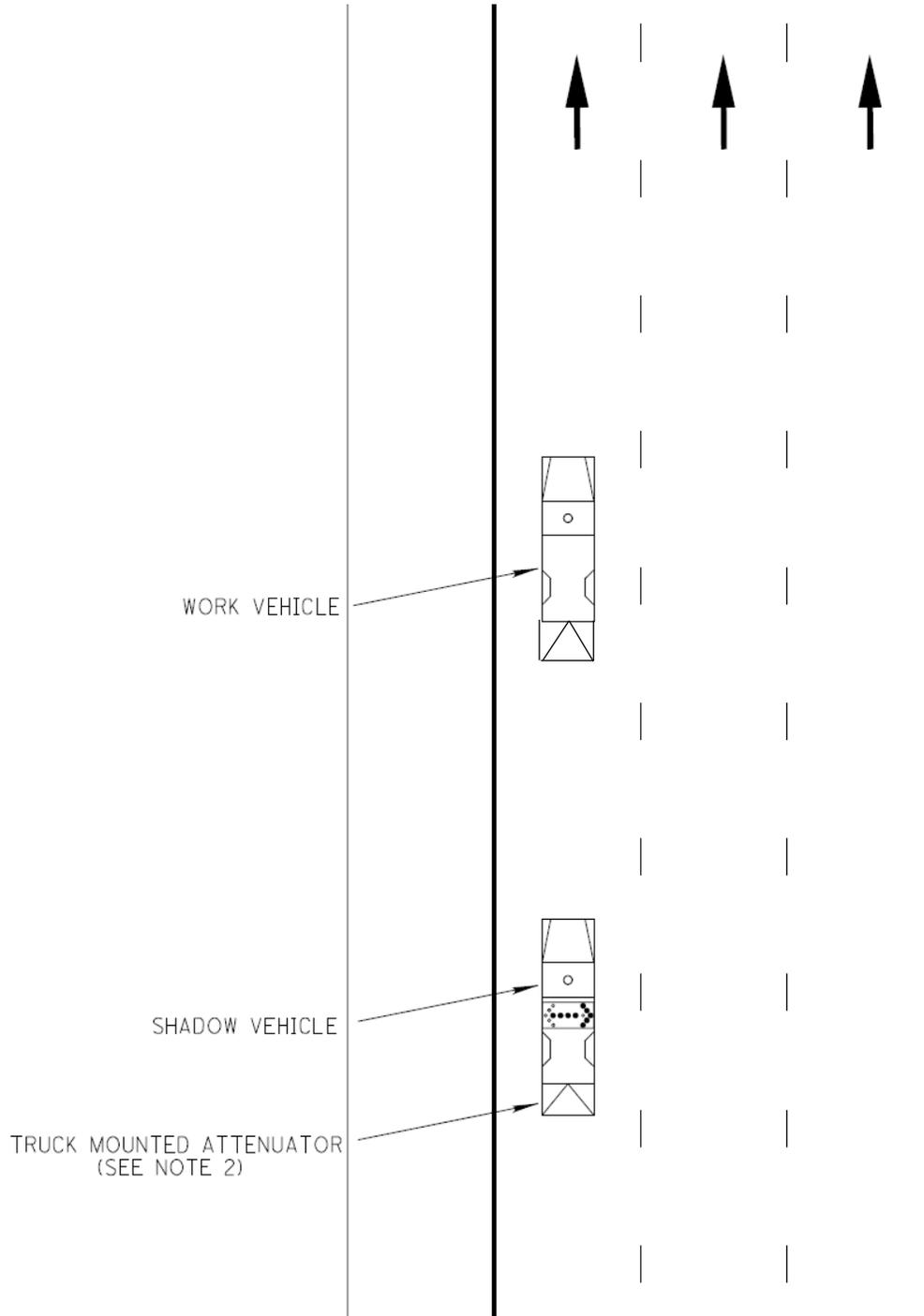
Figure 698-9. Pothole Patching on Multi-Lane Facilities That Will Violate the PLCS



Notes:

- 1.) All vehicles shall be equipped with high-intensity rotating, flashing oscillating or strobe lights.
- 2.) Preferred location of work vehicle and the first shadow vehicle is in the lane adjacent to the shoulder.
- 3.) Both shadow vehicles shall be equipped with arrow boards.
- 4.) The second shadow vehicle may be replaced by a law enforcement officer (LEO).

Figure 698-10. Pothole Patching on Multi-Lane Facilities That Will Not Violate the PLCS



Notes:

1. The shadow vehicle shall be equipped with an arrow board.
2. The preferred location of the work vehicle is in the lane adjacent to the shoulder.
3. All vehicles shall be equipped with high-intensity rotating, flashing, oscillating or strobe lights.

This page intentionally blank