MDOT
Michigan Department of Transportation

Maintenance Work Zone Traffic Control Guidelines

Maintenance Division
April 2007

Engineering Manual Preamble

This manual provides guidance to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. It is expected when making significant or impactful deviations from the technical information from these guidance materials, that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the timeframes allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. MDOT Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform Services only in areas of their competence.
3. Issue public statement only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

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List of Traffic Control Typicals

Introduction

Temporary signing is a very important part of any maintenance operation. The purpose of this guidance document is to provide guidance for the placement of temporary signing in maintenance work zones.

If in the use of these guidelines you have questions or come across items that should be included or need modification contact the Region Support Unit of the Maintenance Division at 517-322-3300.

Traffic Control Plans

Traffic control plans typical to most maintenance operations are shown in Appendix A. These standard plans should be used as guidelines for the layout of traffic control devices within work zones. Certain job and traffic conditions may warrant modification of these plans or the use of traffic control measures not shown within these guidelines. If there is a need to modify one of these guides, please contact your local TSC or Region traffic representative for assistance.

General Signing Guidelines

All traffic control devices in work zones must be crashworthy. The requirements and criteria can be found in the National Cooperative Highway Research Program (NCHRP), Report 350.

It is required that Part 6 of the MMUTCD be followed to ensure that the signs used in work zones meet current standards.

For closures in non-pedestrian areas a five (5) foot minimum bottom height is required and driven posts are suggested for long term closures. In pedestrian areas a seven (7) foot minimum bottom height is required.

For visibility, signs should be placed within six (6) to twelve (12) feet of the edge of the traveled lane or no closer than two (2) feet to the back of curb.

Existing permanent signing in the work zone which conflicts with temporary signs shall be covered during the work operation. Sign covers shall be removed when the work operation ceases. Signs should be covered so that the reflective material is not damaged. One example of how to cover a sign is given on page A46.

Temporary signing shall be covered or removed when the work operation ceases (this is the source of most signing complaints). If a work zone is left unattended for any reason, all reduced speed signs, less than 60 mph, shall be removed, covered or laid down with legs off, unless it is determined that a lower speed limit must remain in place to maintain work zone safety/integrity.

It is recommended that drums be used in long-term stationary and intermediate-term stationary work zones, instead of cones. Cones and drums should not be inter-mixed within the work zones.

END ROAD WORK (G20-2) signs shall be used in all cases if the duration of a work zone is long-term stationary and intermediate-term stationary.

It is important that the work zone be driven on a daily basis to ensure that the motorist will not be confused by the signing sequence, drums or cones and that all lighted arrows are aimed correctly.

Warning Signs

- The minimum size of all diamond shaped warning signs is 48" x 48".
- Reflectorized signing is required.
- All warning signs may be equipped with an orange or day-glo flag mounted above the sign.
- Type A warning lights will not be required with the use of roll-up signs.
- The **"advance signing sequence"** consists of three signs; ROAD WORK AHEAD (W20-1), INJURE/KILL WORKER (R5-18b) and TRAFFIC FINES DOUBLED (R5-18). Refer to pages A48 & A49 for proper signing sequence.

Sign Spacing – "D" Distances

The spacing between signs is based upon the permanently posted roadway speed. The sign spacing distances are minimums and may be adjusted to meet changing roadway and traffic conditions.

Table 1. Sign Spacing ("D" Distances)

Speed* (mph)	**"D" Distance** (ft.)	**Speed*** (mph)	**"D" Distance** (ft.)
25	250	50	500
30	300	55	550
35	350	60	600
40	400	65	650
45	450	70	700

*Posted speed prior to work zone

Tapers – "L" Lengths

Whenever tapers are to be used near interchange ramps, crossroads, curves, or other influencing factors, it may be necessary to adjust the length of tapers, or extend the tangent section of the lane closure so the taper can be established in advance of these factors. Recommended minimum values for taper lengths, "L", are shown in Table 2.

Table 2. Taper Lengths

Taper Length, L (ft)		**Posted Speed Limit,** mph (Prior to Work Zone)									
		25	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**
Offset / Lane Width (ft)	**8**	83	120	163	213	360	400	440	480	520	560
	9	94	135	184	240	405	450	495	540	585	630
	10	104	150	204	267	450	500	550	600	650	700
	11	115	165	225	293	495	550	605	660	715	770
	12	125	180	245	320	540	600	660	720	780	840
	13	135	195	266	347	585	650	715	780	845	910
	14	146	210	286	374	630	700	770	840	910	980
	15	157	225	307	400	675	750	825	900	975	1050

Cone and Drum Spacing for Channelization

Spacing of channelizing devices, in feet, along the taper should not exceed the posted speed in miles per hour and twice the posted speed in the parallel area (e.g., a 45 mph posted speed road should normally have devices spaced no greater than 45 ft apart along the taper and 90 ft in the parallel section). Cones or drums on a tangent, to keep traffic out of the closed lane, should be spaced in accordance with the extent and type of activity, the speed limit of the roadway, and the vertical and horizontal alignment of the roadway.

Buffer Space

Buffer Space is a feature that separates traffic flow from the work activity. No equipment, materials or vehicles shall be stored in the buffer space. The shadow vehicle, if used, must be placed beyond the longitudinal buffer space.

Table 3. Buffer Space Length for Posted Speeds

Speed* (mph)	**Buffer Length** (ft)	**Speed*** (mph)	**Buffer Length** (ft)
20	33	50	279
25	50	55	329
30	83	60	411
35	132	65	476
40	181	70	542
45	230		

*Posted speed prior to work zone

Shadow Vehicle

A shadow vehicle should be used for lane closures on all roadways which have 45 mph or greater posted speeds and two or more lanes in each direction.

A shadow vehicle may be used in other work zones as deemed necessary. Factors to be considered in determining need include the following:

- Time of day of the closure
- Seasonal variations in traffic volume
- Length of lane closure and anticipated duration
- Traffic speeds
- Frequency of traffic stopping/turning movements

The shadow vehicle should be a loaded truck having 23,000 GVWR or greater with the brakes set, front wheels turned away from traffic and parked at the beginning of the roll-ahead space.

The roll-ahead space is the space between the shadow vehicle and the work area. This additional space is needed only when a shadow vehicle is used.

Table 4. Guidelines for Roll-Ahead Distances for Shadow Vehicles

Type of Activity	Prevailing Speed (Posted Speed Prior to Work Zone)	Weight of Shadow Vehicle	Roll-Ahead Distance (Distance From Front of Shadow Vehicle to Work Area)
Mobile	45 mph	**5 Tons**	100 ft
	50-55 mph		150 ft
	60-70 mph		175 ft
Stationary	40 or Less	**5.5 Tons**	25 ft
	45 mph	**12 Tons**	25 ft
	50-55 mph		25 ft
	60-70 mph		50 ft

Truck Mounted Attenuators (TMAs)

It is the department's goal that a TMA be used anytime a shadow vehicle is deemed necessary. See Appendix B for detailed information.

Arrow Panels

The Michigan Manual of Uniform Traffic Control Devices, states: "For stationary lane closure, the arrow panel should be located on the shoulder at the beginning of the merging taper. Where the shoulder is narrow, the arrow panel should be located in the closed lane."

Table 5. Arrow Display Types and Requirements

Panel Type	Minimum Size (in)	Min. Legibility Distance (miles)	Minimum Number of Lighted Elements
A	48 x 24	½	12
B	60 x 30	¾	13
C	96 x 48	1	15
D	None*	½	12

*Length of arrow equals 48in., width of arrowhead equals 24 in.

Type A arrow displays are appropriate for use on low-speed urban streets. Type B are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways. Type C arrow displays are intended to be used on high-speed, high-volume traffic control projects. Type D arrow panels are intended for use on authorized vehicles. A Type D arrow panel shall conform to the shape of the arrow.

An arrow display shall not be used on a two-lane, two-way roadway in the arrow mode. The panel shall display the caution mode (bar mode) when used on these roadways.

When maintaining a standard lane closure (page A30), a Type C arrow panel should be used. When maintaining a standard lane closure with traffic regulators (page A11), the arrow for the closed lane should be a Type C arrow. The arrow used for the active lane should be either a Type B or Type C.

See page (A1) for correct alignment of arrow bars.

Partial Lane Closures

Partial lane closures should be avoided. If any part of the lane is to be occupied, the whole lane should be closed. If the work within a closure moves more than two (2) miles from the original signing sequence, a new signing sequence should be set and the original set removed.

Mobile Operations

The following activities are considered to be mobile operations, any activities not included in Table 6 below should not use mobile traffic control.

Table 6. Mobile Maintenance Activities

Activity	Description	Work location
13200	Approach Sweeping	Intersections
13400	Expressway Patrol	Shoulder, and minor non-vehicular encroachment in traveled way
13500	Freeway Lighting	Shoulder and/or occupy a lane
13600	Curb Sweeping	Occupy lane, continuously mobile ≈ 5 mph
12200	Catch Basin Clean-out	Occupy lane
12400	Litter Pickup	Shoulder and outside shoulder
17200	Vegetation Control	Shoulder
11100	Routine Blading	Shoulder and minor non-vehicular encroachment in traveled way
11200	Gravel Shoulder Maintenance	Shoulder and minor non-vehicular encroachment in traveled way
11400	Shoulder Spot Seal Patching (kettle)	Shoulder, edge of metal
11400	Shoulder Bituminous Patching	Shoulder, edge of metal
10300	Patrol Patching	Drive on shoulder and minor non-vehicular encroachment in traveled way

Table 7 below should be used to help choose the appropriate mobile typical based on the location of work and its environment.

Table 7. Traffic Typical Applications for Mobile Operations

Location of Work	Traffic Volume (ADT)	Sight Distance (Horizontal, Vertical)	Typical
Outside Shoulder			
Freeway/Non-Freeway	All Volumes	n/a	MD – 01
Shoulder			
Non-Freeway	<10,000	Adequate Limited	MD – M11 MD – M12
	>10,000	n/a	MD – M12
Freeway	<10,000	Adequate Limited	MD – M11 MD – M12
	>10,000	n/a	MD – M12
Shoulder (Minor Non-Vehicular Encroachment in Traveled Way)*			
Non-Freeway	<10,000	Adequate Limited	MD – M11 MD – M12
	>10,000	n/a	MD – M12
Freeway	n/a	n/a	MD – M12
Roadway			
Two-Lane, Two-Way	<10,000	Adequate Limited	MD – M22 MD – M25
	>10,000	n/a	MD – M25
Multi-Lane w/ Shoulder	<50,000 >50,000	n/a n/a	MD – M23 MD – M24
Multi-Lane, Curbed	All Volumes	n/a	MD – M21

* Minor non-vehicular encroachment in the traveled way is to be brief and not to exceed one lane of traffic from the median or outside shoulders.

Maintenance operations which involve minor non-vehicular encroachment on lanes other than those immediately adjacent to the median or outside shoulder are not considered mobile operations.

Any operations that do not fall within these parameters should be reviewed by your traffic and safety representative.

Adequate Sight Distance: For mobile operations, it is a length of roadway that the driver can see that is greater than or equal to the stopping sight distance as a function of the posted speed limit. See table 8 below.

Limited Sight Distance: For mobile operations, it is a length of roadway that the driver can see that is shorter than the stopping sight distance as a function of the posted speed limit. See table 8 below.

Table 8. Stopping Sight Distance as a Function of Posted Speed Limit

Speed (mph)	25	30	35	40	45
Distance (ft)	200	250	305	360	425
Speed (mph)	**50**	**55**	**60**	**65**	**70**
Distance (ft)	495	570	645	730	820

Definitions

The following definitions are taken from the Michigan Manual of Uniform Traffic Control Devices.

Section 6G.02 Work Duration (MI)

Support:
Chapter 6D and Sections 6F.68 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.

Work duration is a major factor in determining the number and types of devices used in work zones. The duration of a work zone is defined relative to the length of time a work operation occupies a spot location.

Standard:

The five categories of work duration and their time at a location shall be:

A. Long-term stationary is work that occupies a location more than 3 days.

B. Intermediate-term stationary is work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.

C. Short-term stationary is daytime work that occupies a location for more than 1 hour within a single daylight period.

D. Short duration is work that occupies a location up to 1 hour.

E. Mobile is work that moves intermittently or continuously.

Long-Term Stationary Work

Support:

At long-term stationary work zones, there is ample time to install and realize benefits from the full range of temporary traffic control procedures and devices that are available for use. Generally, larger channelizing devices, temporary roadways, and temporary traffic barriers are used.

Guidance:

Inappropriate markings in long-term stationary work zones should be removed and replaced with temporary markings.

Standard:

Since long-term operations extend into nighttime, retroreflective and/or illuminated devices shall be used in long-term stationary work zones.

Intermediate-Term Stationary Work

Support:

In intermediate-term stationary work zones, it might not be feasible or practical to use procedures or devices that would be desirable for long-term stationary temporary traffic control zones, such as altered pavement markings, temporary traffic barriers, and temporary roadways. The increased time to place and remove these devices in some cases could significantly lengthen the project, thus increasing exposure time. In other instances, there might be insufficient pay-back time to economically justify more elaborate temporary traffic control measures.

Standard:

Since intermediate-term operations extend into nighttime, retroreflective and/or illuminated devices shall be used in intermediate-term stationary work zones.

Short-Term Stationary Work

Support:

Most maintenance and utility operations are short-term stationary work.

Short-Duration Work

As compared to stationary operations, mobile and short-duration operations are activities that might involve different treatments. Devices having greater mobility might be necessary such as signs mounted on trucks. Devices that are larger, more imposing, or more visible can be used effectively and economically. The mobility of the work zone is important.

Maintaining reasonably safe work and road user conditions is a paramount goal in carrying out mobile operations.

Guidance:

Safety in short-duration or mobile operations should not be compromised by using fewer devices simply because the operation will frequently change its location.

Option:

Appropriately colored or marked vehicles with high-intensity rotating, flashing, oscillating, or strobe lights may be used in place of signs and channelizing devices for short-duration or mobile operations. These vehicles may be augmented with signs or arrow panels.

Support:

During short-duration work, it often takes longer to set up and remove the work zone than to perform the work. Workers face hazards in setting up and taking down the work zone. Also, since the work time is short, delays affecting road users are significantly increased when additional devices are installed and removed.

Option:

Considering these factors, simplified control procedures may be warranted for short-duration work. A reduction in the number of devices may be offset by the use of other more dominant devices such as highintensity rotating, flashing, oscillating, or strobe lights on work vehicles.

Mobile Operations

Support:

Mobile operations often involve frequent short stops for activities such as litter cleanup, pothole patching, or utility operations, and are similar to short-duration operations.

Guidance:

Warning signs, high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle, flags, and/or channelizing devices should be used and moved periodically to keep them near the mobile work area.

Option:

Traffic regulators may be used for mobile operations that often involve frequent short stops.

Support:

Mobile operations also include work activities where workers and equipment move along the road without stopping, usually at slow speeds. The advance warning area moves with the work area.

Guidance:

When mobile operations are being performed, a shadow vehicle equipped with an arrow panel or a sign should follow the work vehicle, especially when vehicular traffic speeds or volumes are high. Where feasible, warning signs should be placed along the roadway and moved periodically as work progresses.

Under high-volume conditions, consideration should be given to scheduling mobile operations work during off-peak hours.

If there are mobile operations on a high-speed travel lane of a multi-lane divided highway, arrow panels should be used.

Option:

For mobile operations that move at speeds less than 5 km/h (3 mph), mobile signs or stationary signing that is periodically retrieved and repositioned in the advance warning area may be used.

At higher speeds, vehicles may be used as components of the work zones for mobile operations. Appropriately colored and marked vehicles with signs, flags, high-intensity rotating, flashing, oscillating, or strobe lights, truck-mounted attenuators, and arrow panels or portable changeable message signs may follow a train of moving work vehicles.

For some continuously moving operations, such as street sweeping and snow removal, a single work vehicle with appropriate warning devices on the vehicle may be used to provide warning to approaching road users.

Standard:

Mobile operations that move at speeds greater than 30 km/h (20 mph), such as pavement marking operations, shall have appropriate devices on the equipment (that is, high-intensity rotating, flashing, oscillating, or strobe lights, signs, or special lighting), or shall use a separate vehicle with appropriate warning devices.

Work Zone Defined

The following definitions are taken from the MICHIGAN VEHICLE CODE Act 300 of 1949.

257.79d "Work zone" defined.

Sec. 79d.

"Work zone" means a portion of a street or highway that meets any of the following:

(a) Is between a "work zone begins" sign and an "end road work" sign.

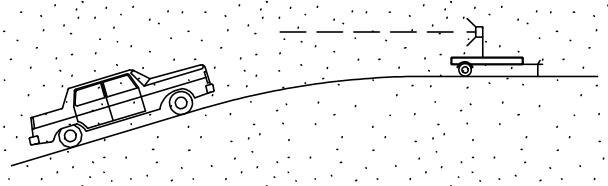
(b) For construction, maintenance, or utility work activities conducted by a work crew and more than 1 moving vehicle, is between a "begin work convoy" sign and an "end work convoy" sign.

(c) For construction, maintenance, surveying, or utility work activities conducted by a work crew and 1 moving or stationary vehicle exhibiting a rotating beacon or strobe light, is between the following points:

(i) A point that is 150 feet behind the rear of the vehicle or that is the point from which the beacon or strobe light is first visible on the street or highway behind the vehicle, whichever is closer to the vehicle.

(ii) A point that is 150 feet in front of the front of the vehicle or that is the point from which the beacon or strobe light is first visible on the street or highway in front of the vehicle, whichever is closer to the vehicle.

Appendix A



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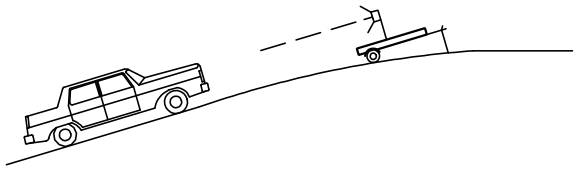

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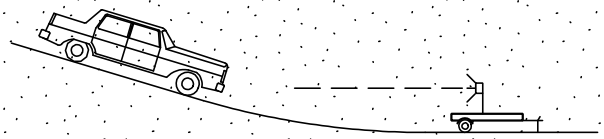

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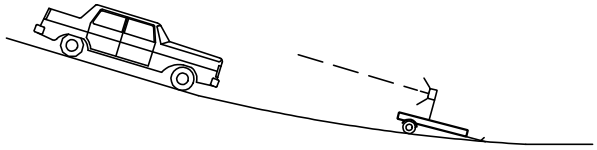

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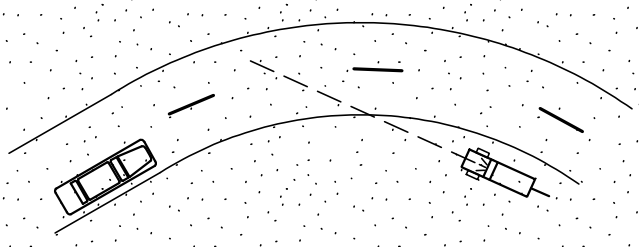

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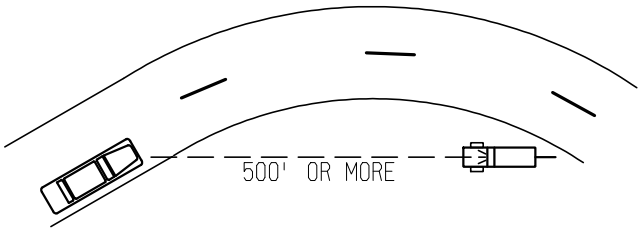

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MDOT
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OPERATIONS

NOTE:
EXERCISE CARE WHEN PLACING "LIGHTED ARROW" ON VERTICAL OR HORIZONTAL CURVES. ADJUST ALIGNMENT OF "LIGHTED ARROW" TO ALLOW MAIN BEAM OF LAMPS TO BE SEEN BY DRIVER FOR MAXIMUM EFFECTIVENESS.

USE OF LIGHTED ARROW ON A HILL OR CURVE

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NOTES

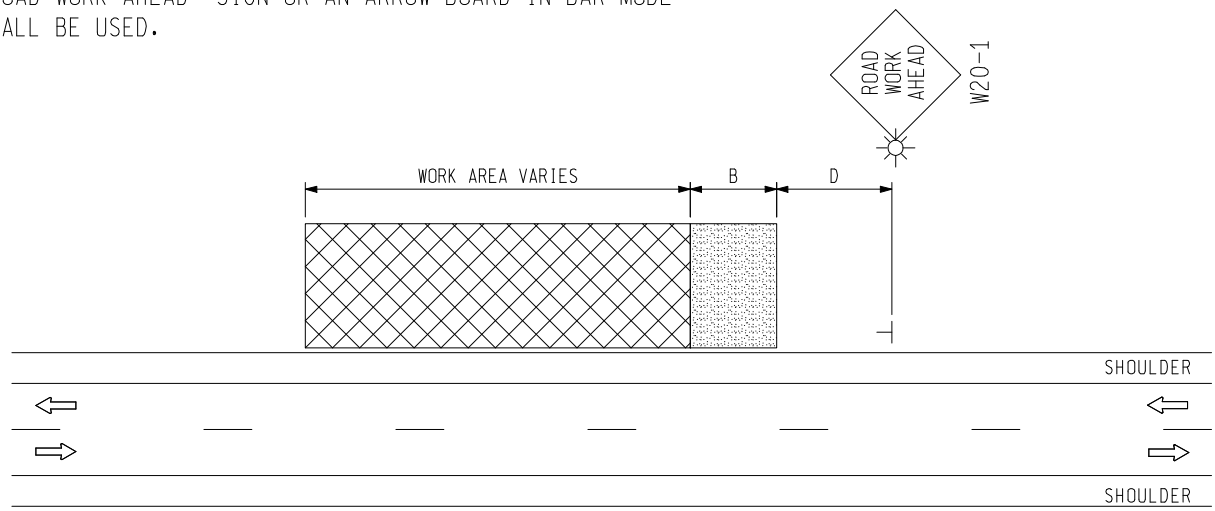
NO SIGNS ARE REQUIRED IF DURATION IS SHORT-DURATION OR MOBILE.

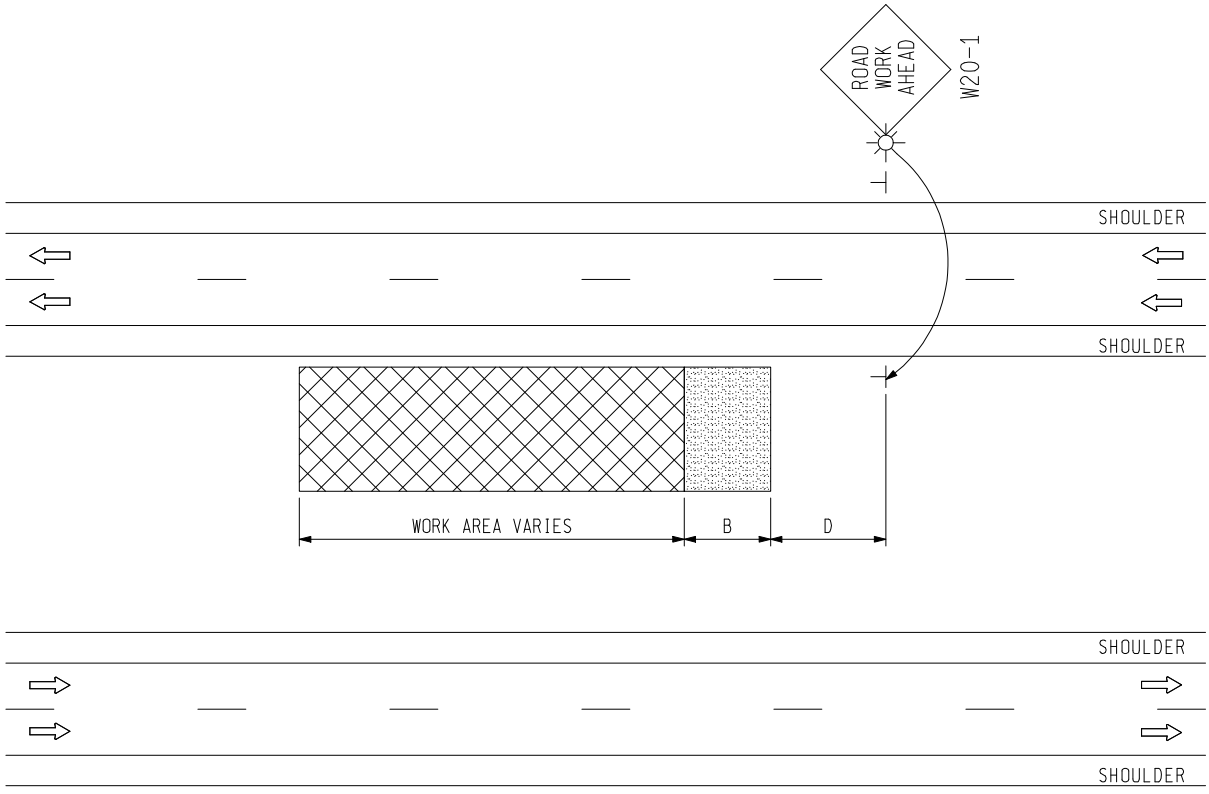
IF THE OPERATION HAS A VEHICLE(S) PARKED ON THE SHOULDER, OR VEHICLES ACCESSING THE WORK SITE VIA THE HIGHWAY OR CROSSING THE HIGHWAY TO PERFORM OPERATIONS, A "ROAD WORK AHEAD" SIGN OR AN ARROW BOARD IN BAR MODE SHALL BE USED.

KEY

TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)

TRAFFIC FLOW





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MDOT Michigan Department of Transportation
OPERATIONS

WORK OUTSIDE SHOULDER

DURATION: APPLIES TO ALL DURATIONS

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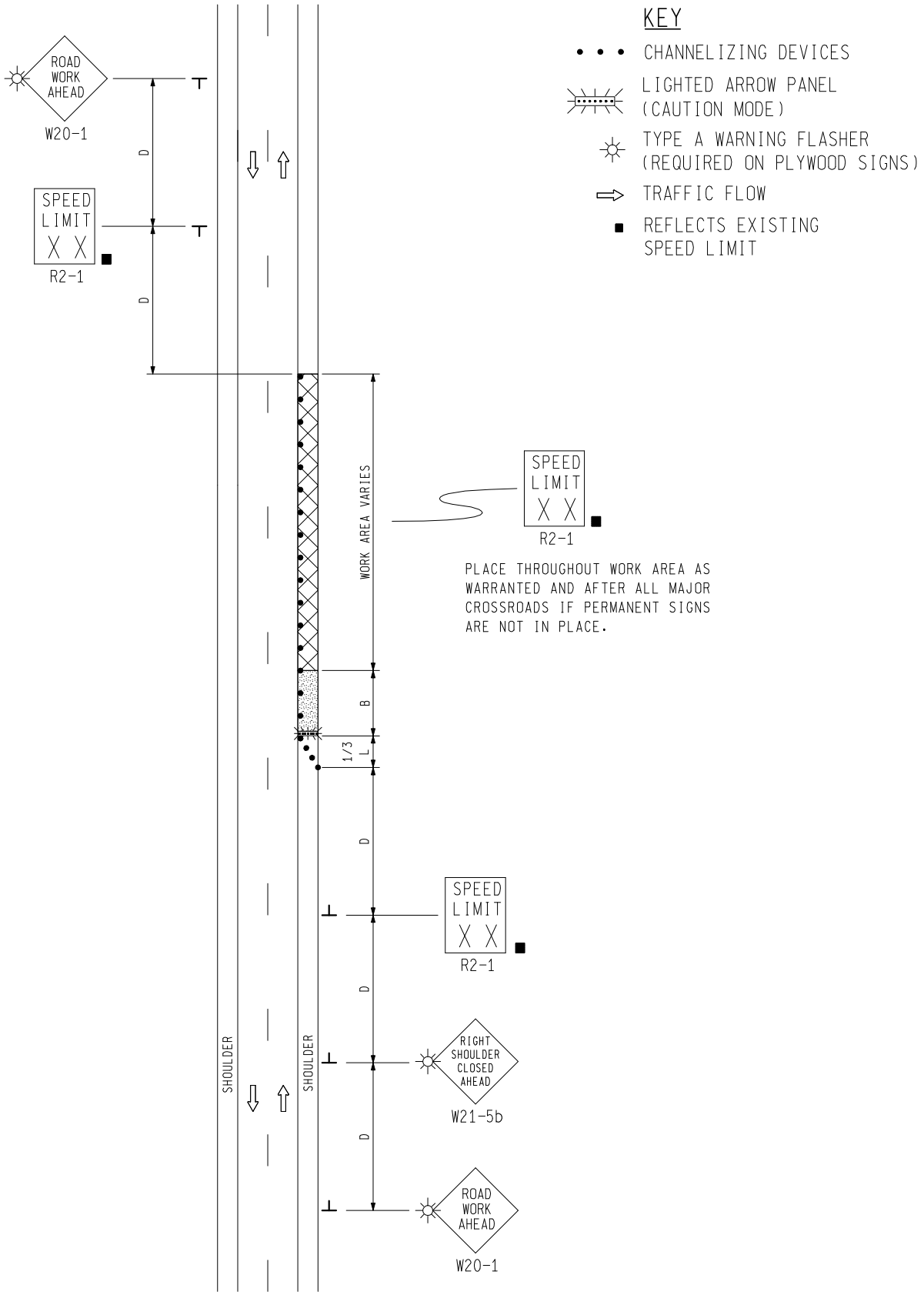

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MDOT Michigan Department of Transportation OPERATIONS	SHOULDER CLOSURE ON A TWO-LANE, TWO-WAY ROADWAY NO SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY	
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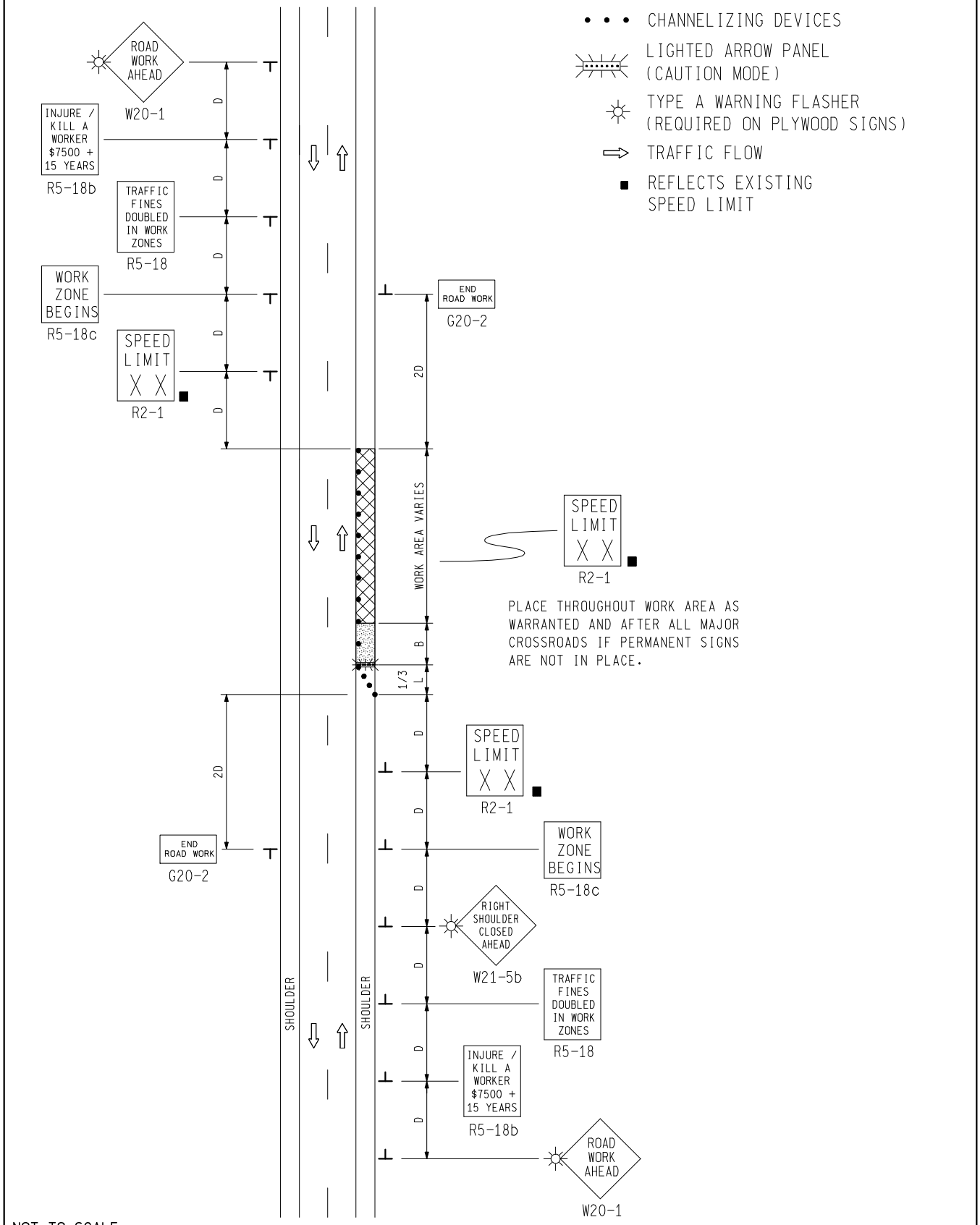

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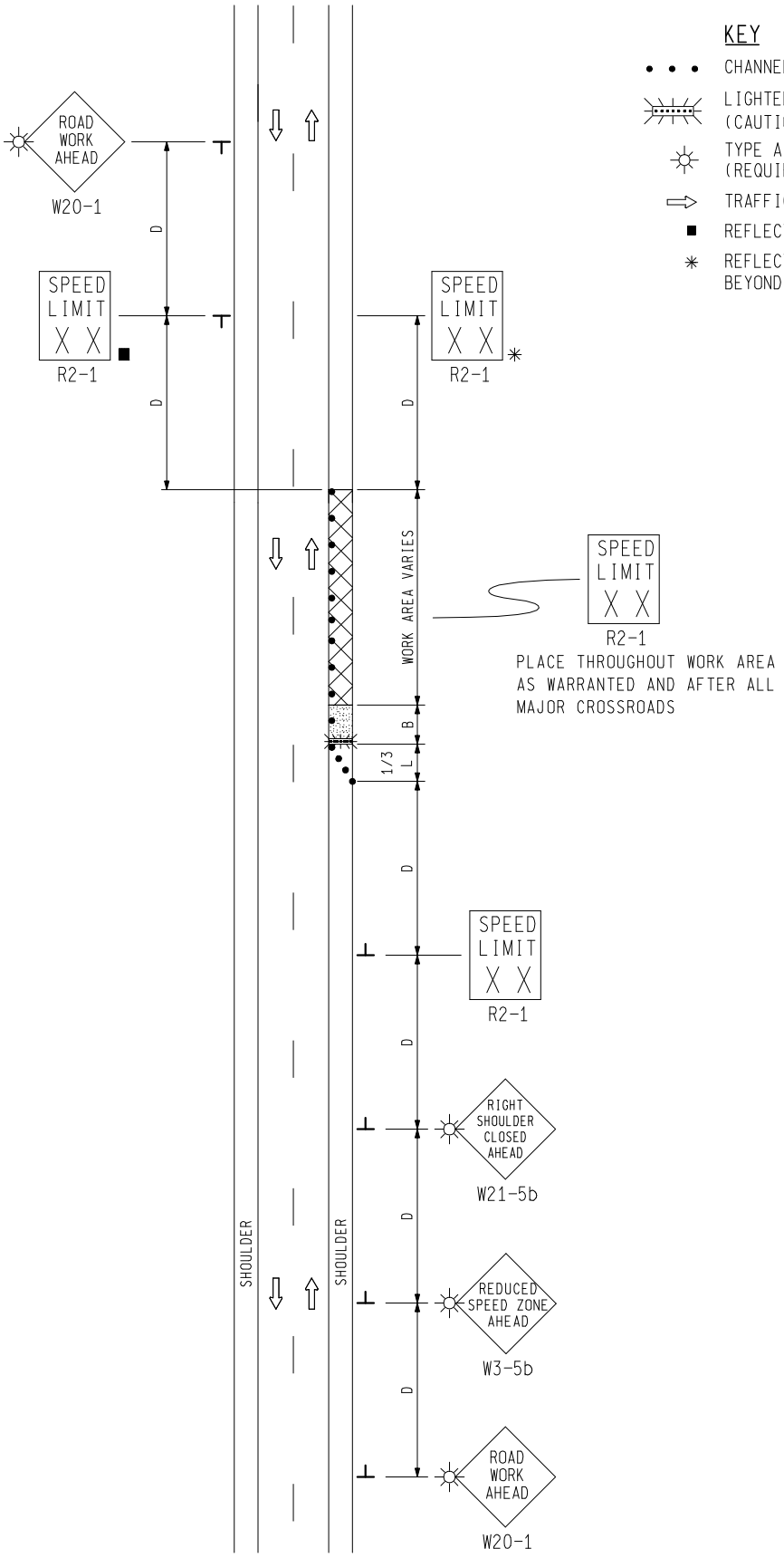
MDOT Michigan Department of Transportation OPERATIONS	SHOULDER CLOSURE ON A TWO-LANE, TWO-WAY ROADWAY NO SPEED REDUCTION	DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE: | MD - 11b | PAGE A4



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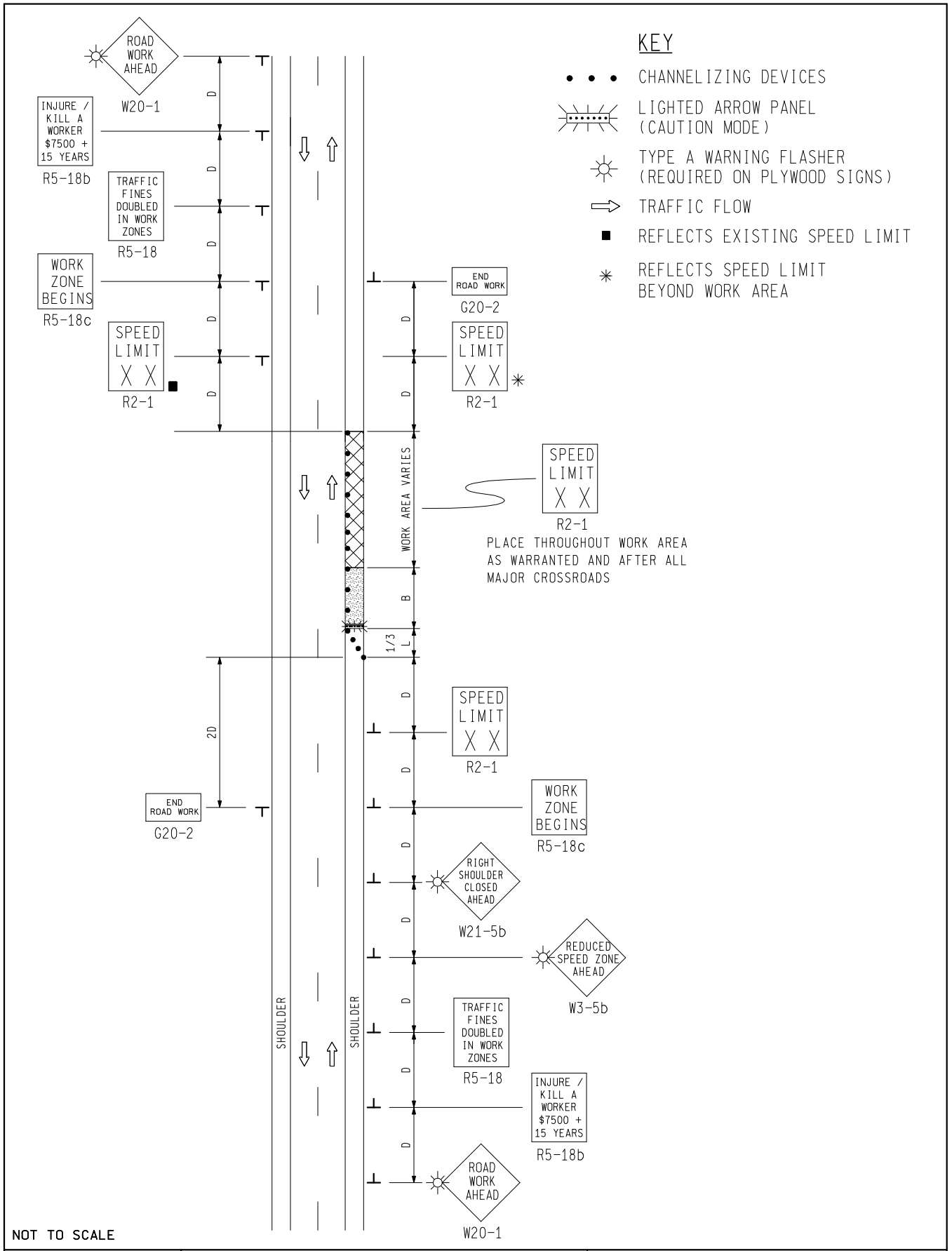

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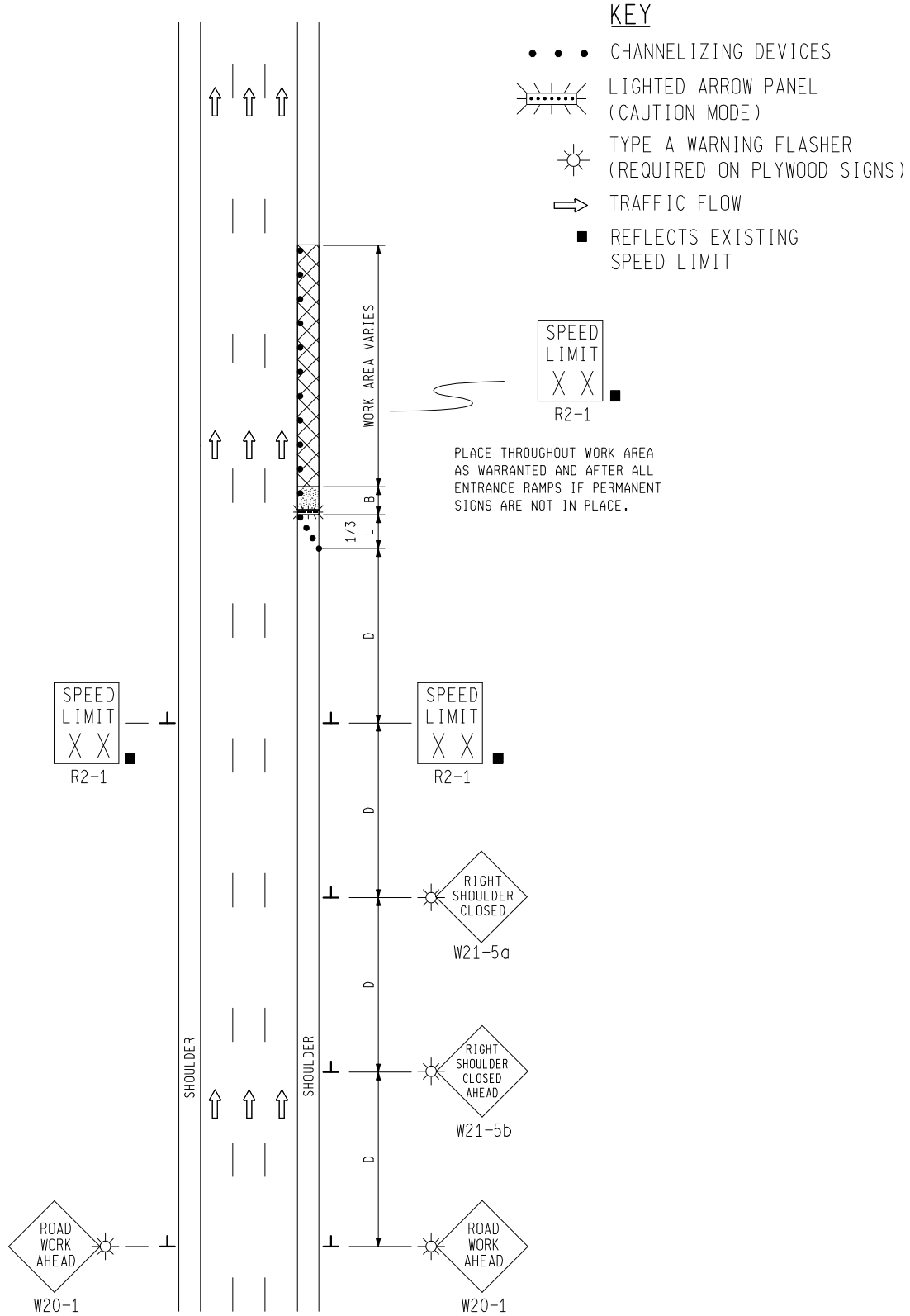

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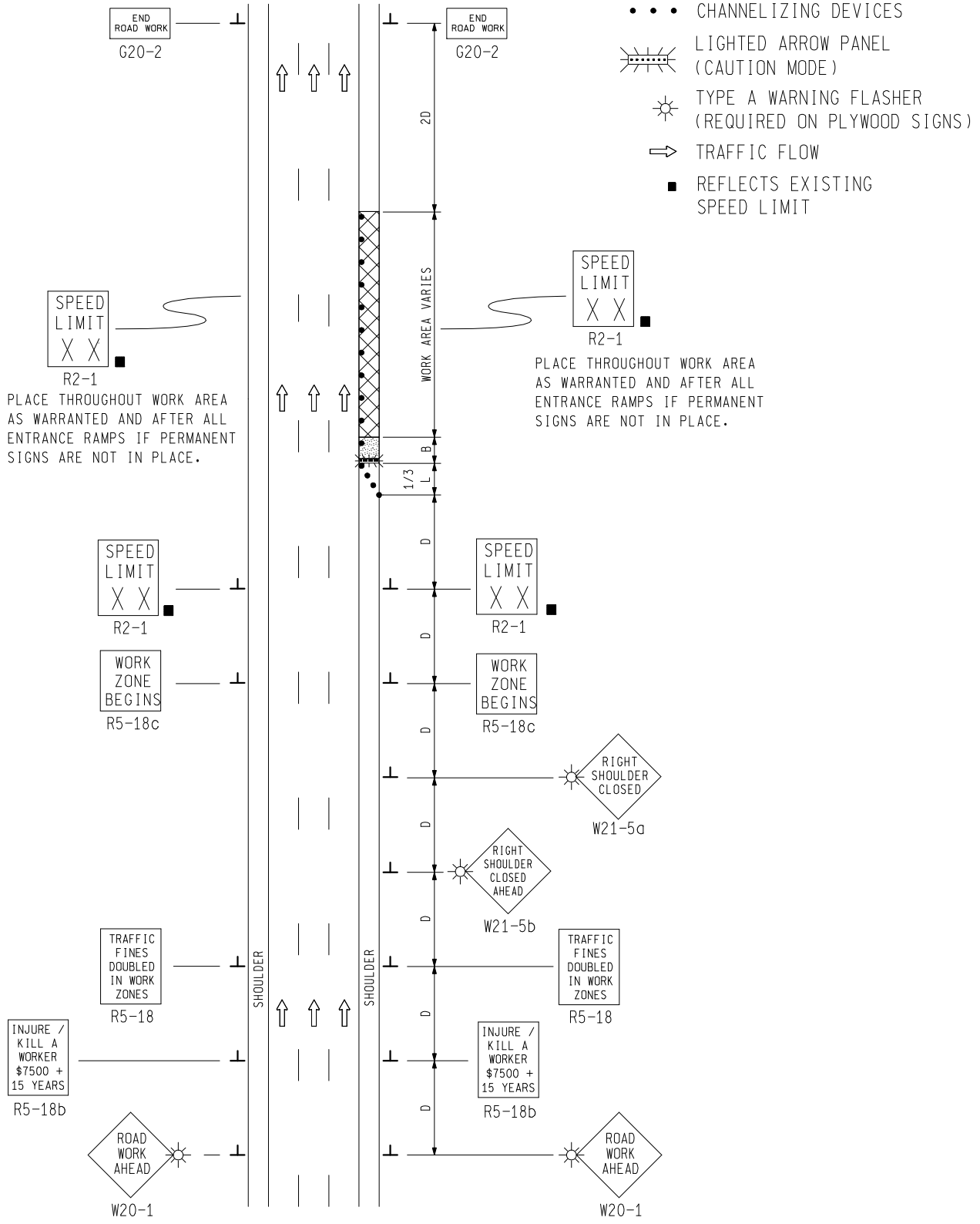

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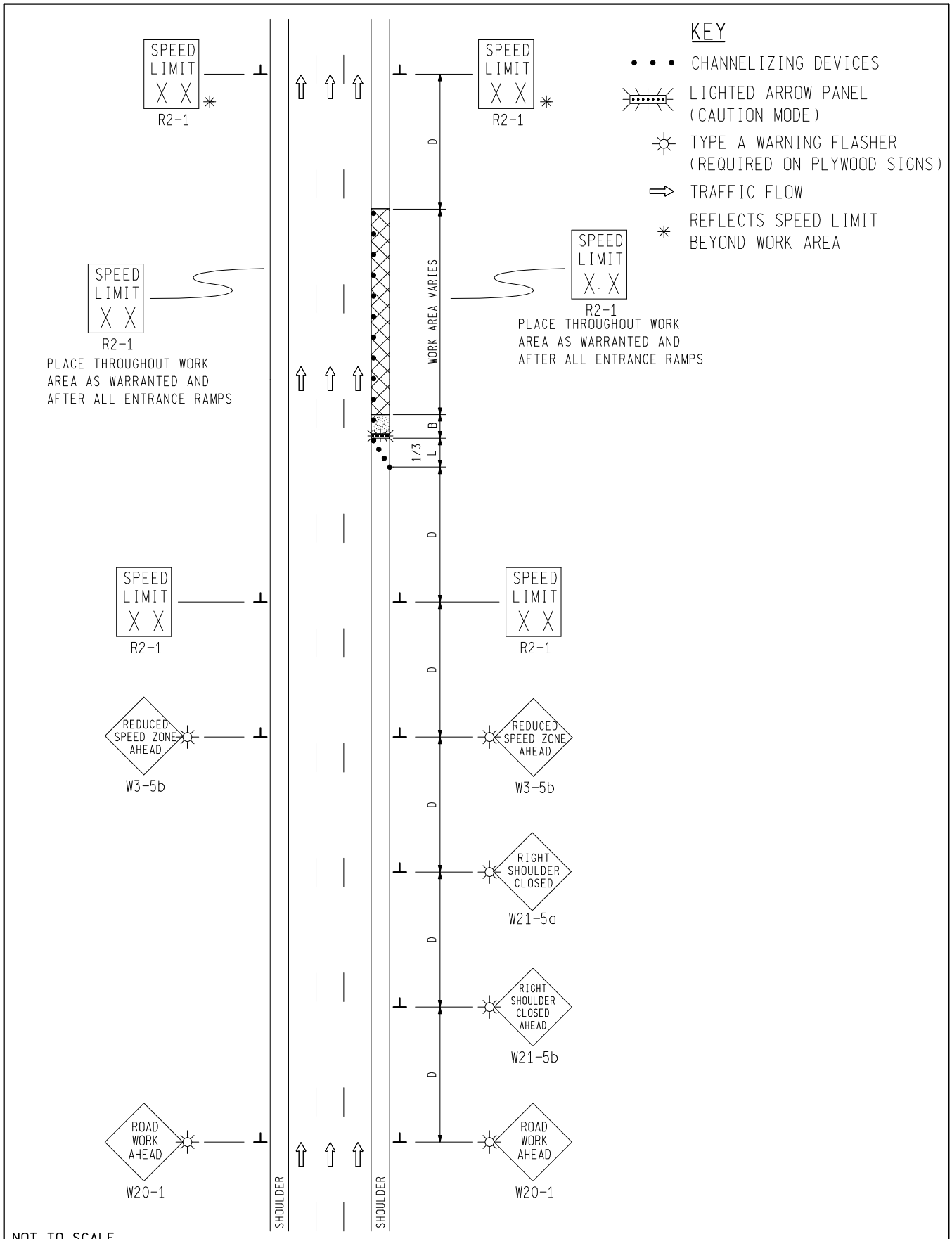
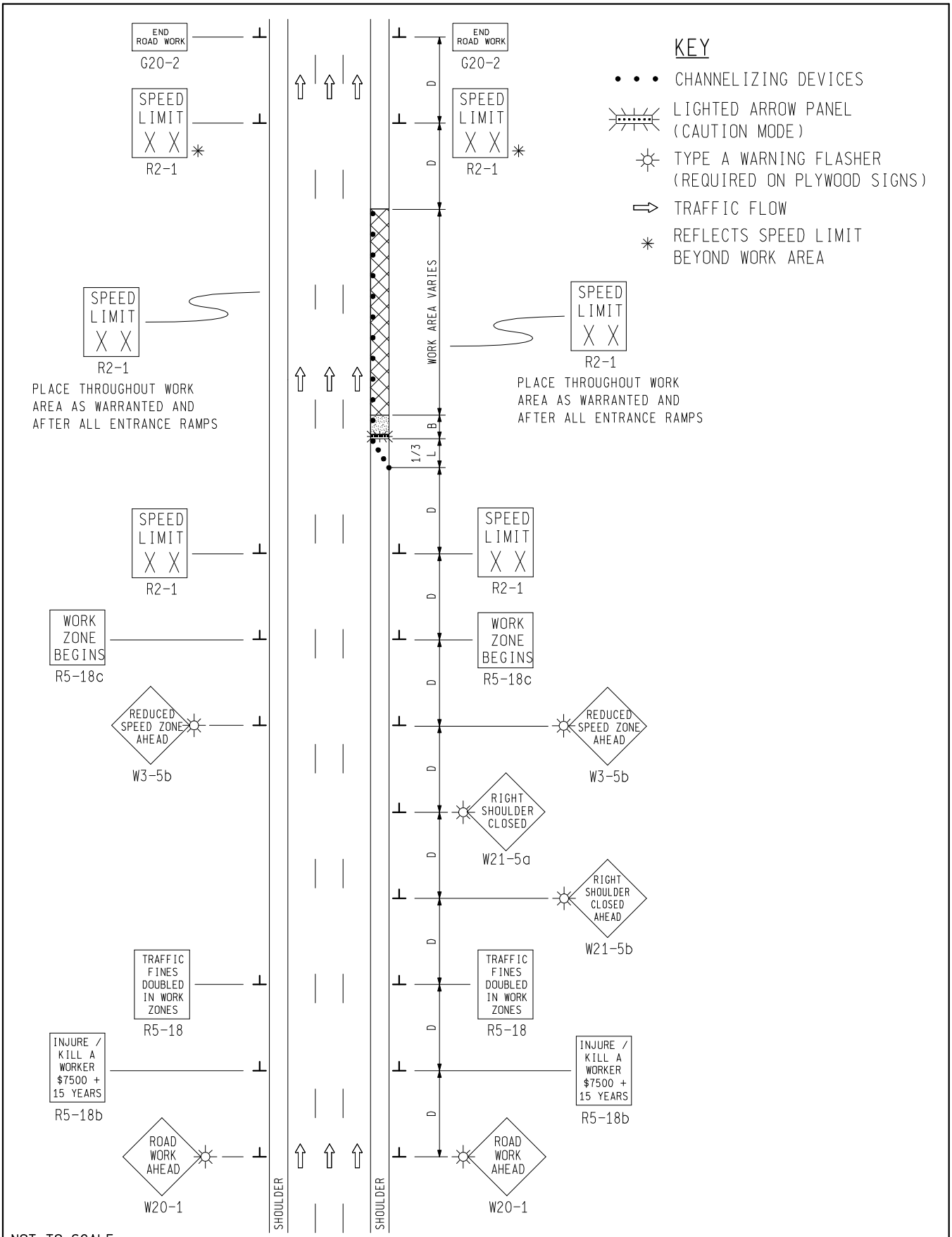
MDOT Michigan Department of Transportation OPERATIONS	SHOULDER CLOSURE ON A DIVIDED ROADWAY OR FREEWAY NO SPEED REDUCTION	DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 12b
			PAGE A8



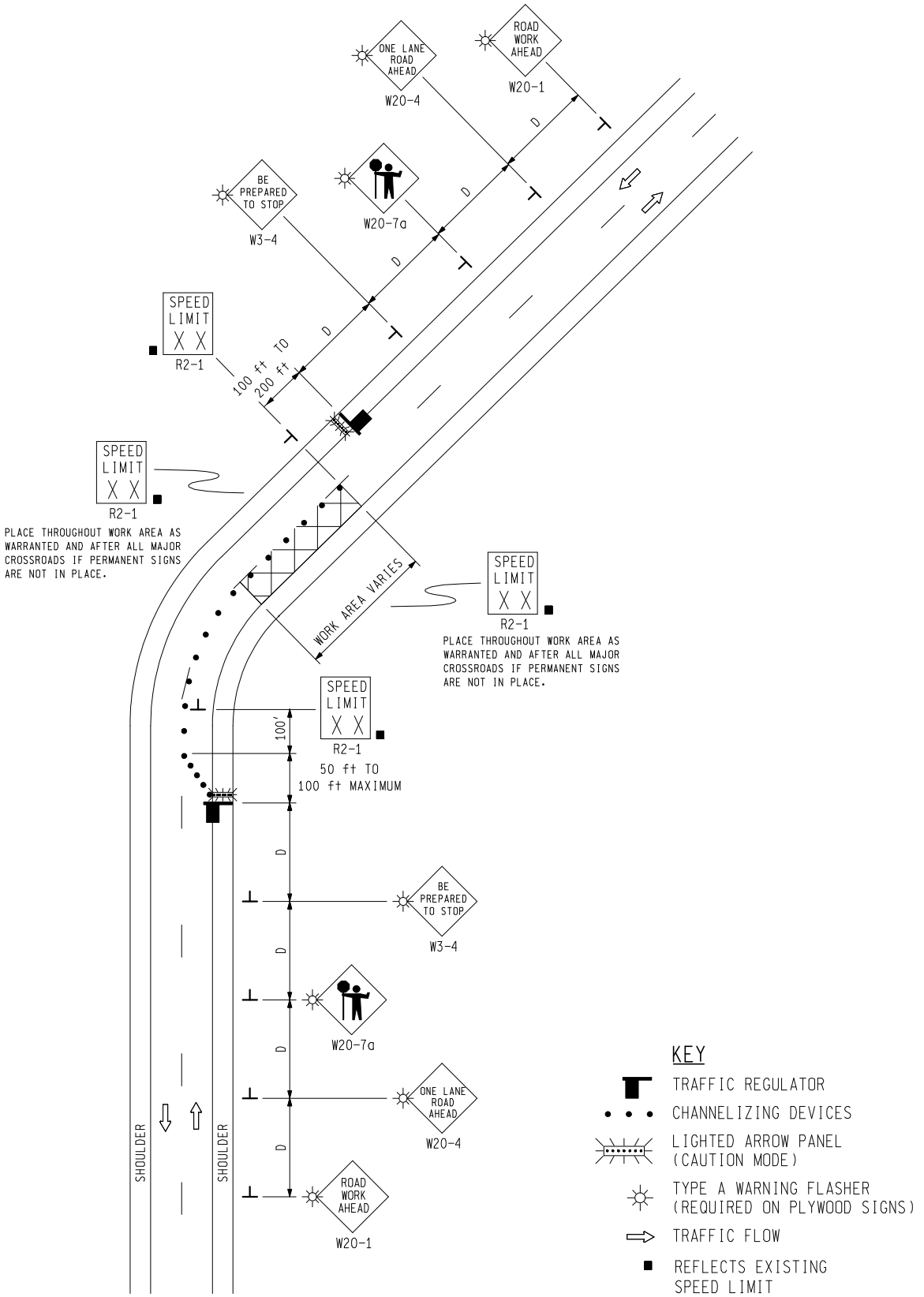
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	SHOULDER CLOSURE ON A DIVIDED ROADWAY OR FREEWAY WITH A MAXIMUM 10 MPH SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY, SHORT DURATION	
		01/01/07 REV. DATE:	MD - 12c
			PAGE A9



NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	SHOULDER CLOSURE ON A DIVIDED ROADWAY OR FREEWAY WITH A MAXIMUM 10 MPH SPEED REDUCTION	DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE: | MD - 12d | PAGE A10



NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

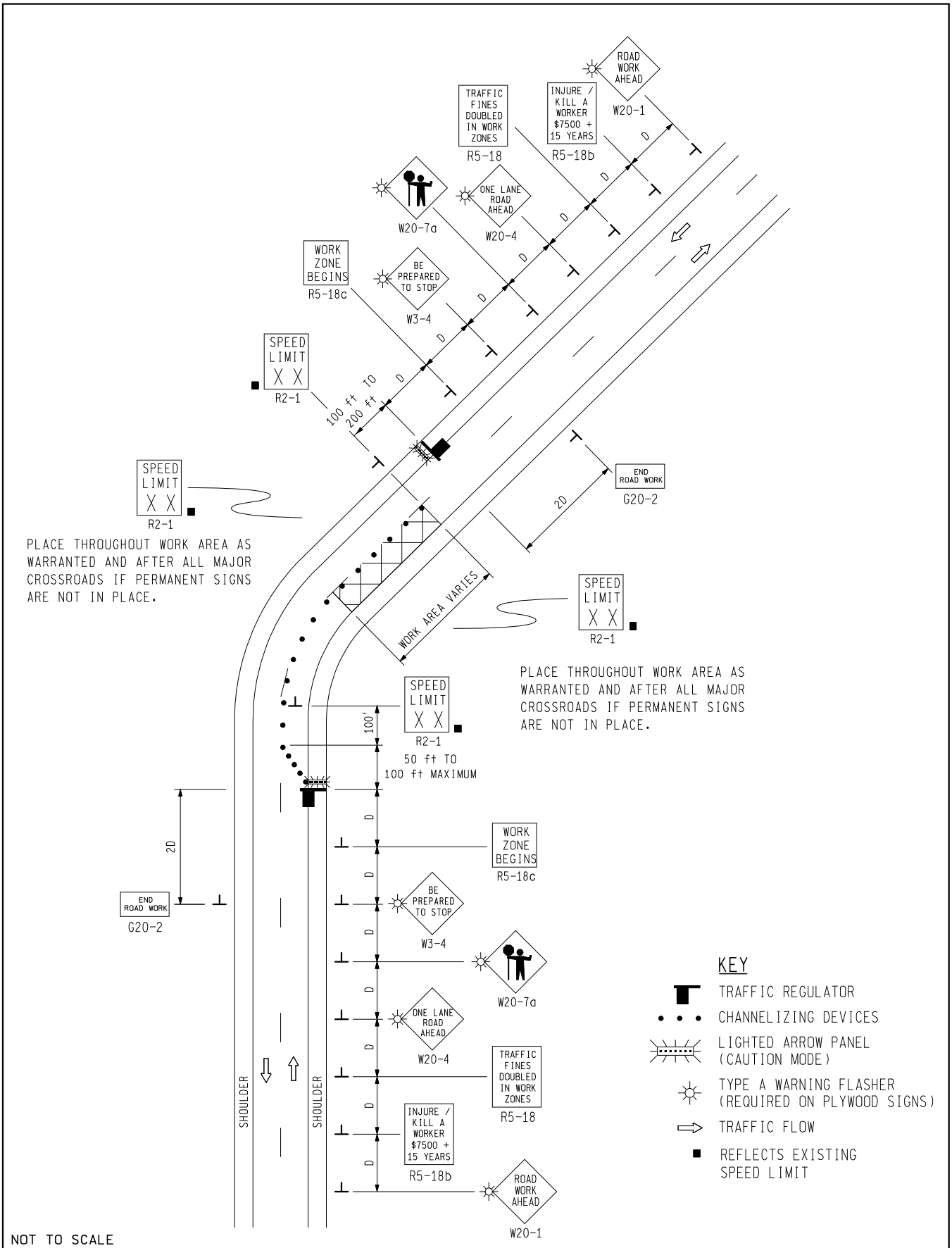
LANE CLOSURE FOR A TWO-LANE TWO-WAY ROADWAY UTILIZING TRAFFIC REGULATORS, NO SPEED REDUCTION

DURATION: SHORT-TERM STATIONARY

01/01/07
REV. DATE:

MD - 21a

PAGE A11



NOT TO SCALE

MDOT Michigan Department of Transportation

OPERATIONS

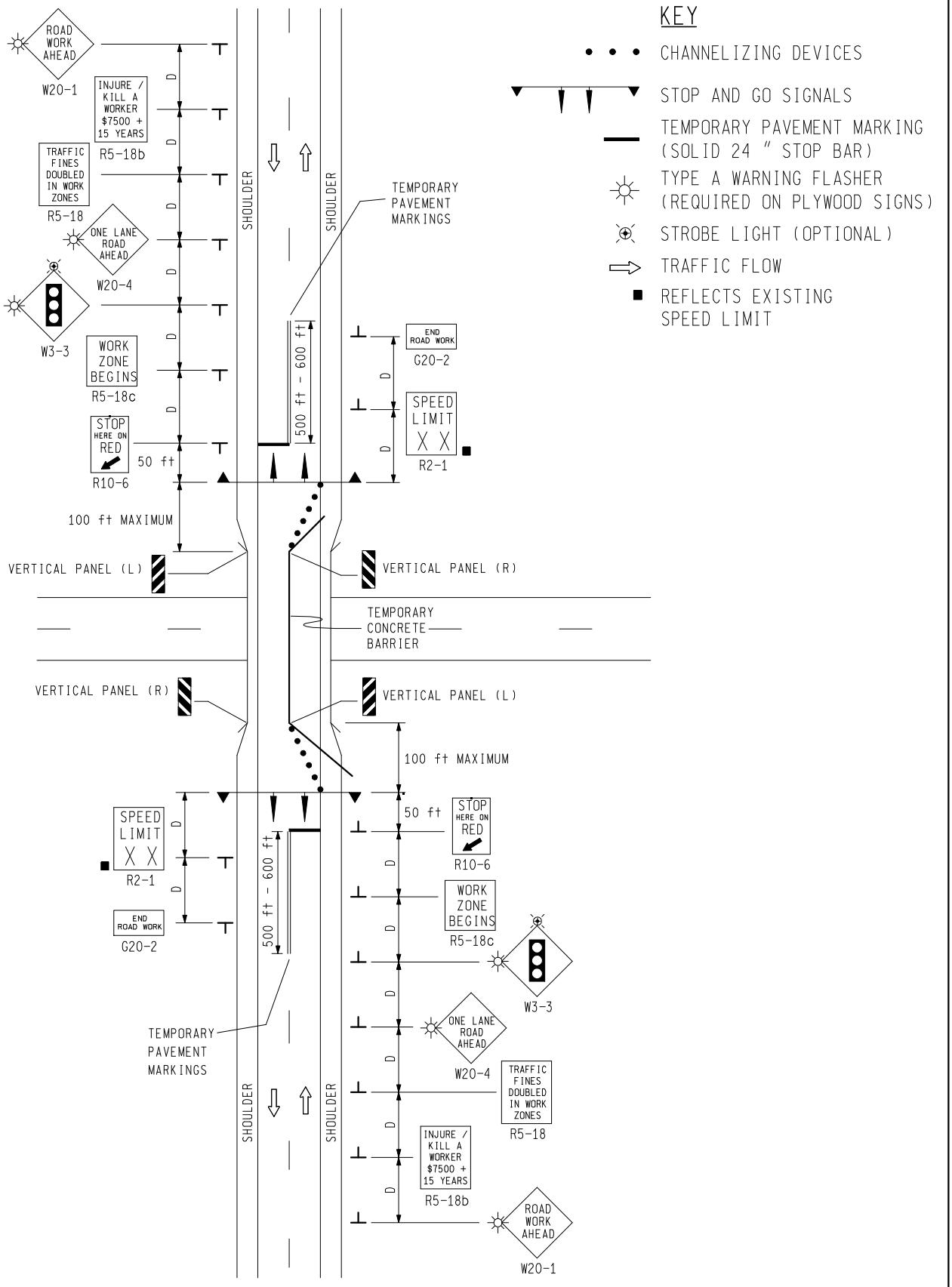
LANE CLOSURE FOR A TWO-LANE TWO-WAY ROADWAY UTILIZING TRAFFIC REGULATORS, NO SPEED REDUCTION

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY

01/01/07
REV. DATE:

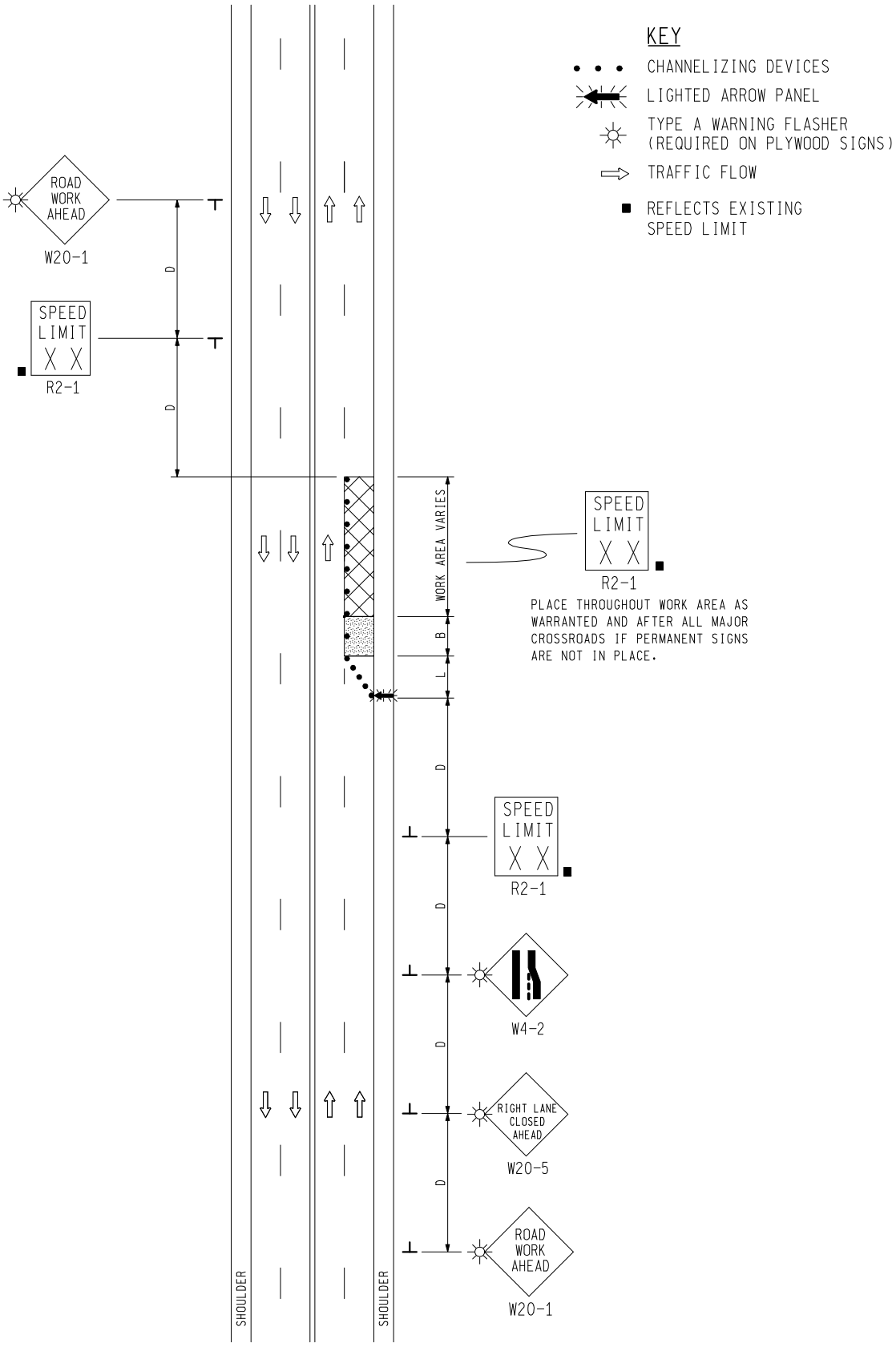
MD - 21c

PAGE A12



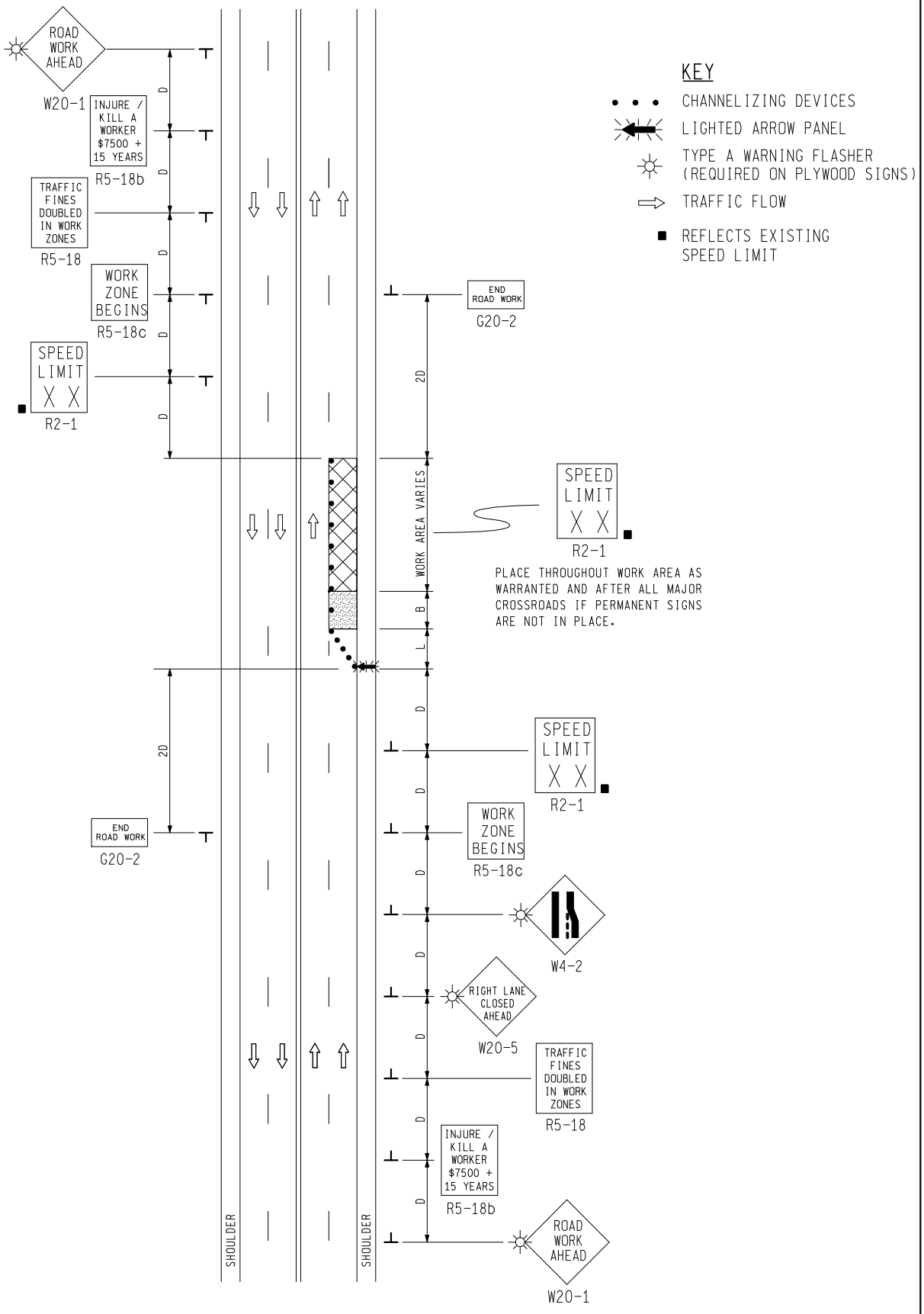
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	TEMPORARY TRAFFIC SIGNAL, TWO-LANE, TWO-WAY ROADWAY	DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE: | MD - 22 | PAGE A13



NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	ONE-LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, NO SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE: | MD - 23a | PAGE A14



NOT TO SCALE

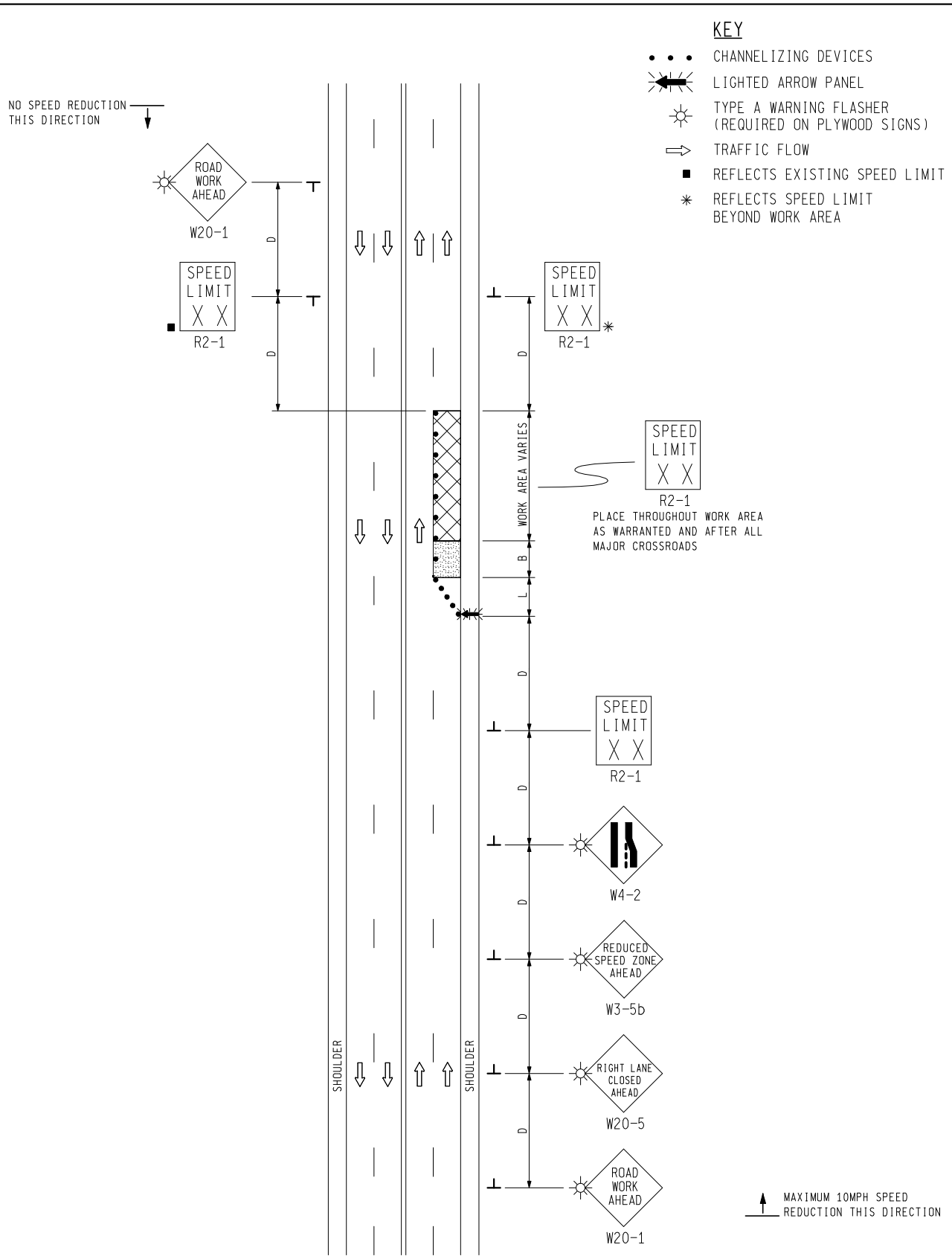
MDOT Michigan Department of Transportation
OPERATIONS

ONE-LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, NO SPEED REDUCTION

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY

01/01/07
REV. DATE:

MD - 23b



NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

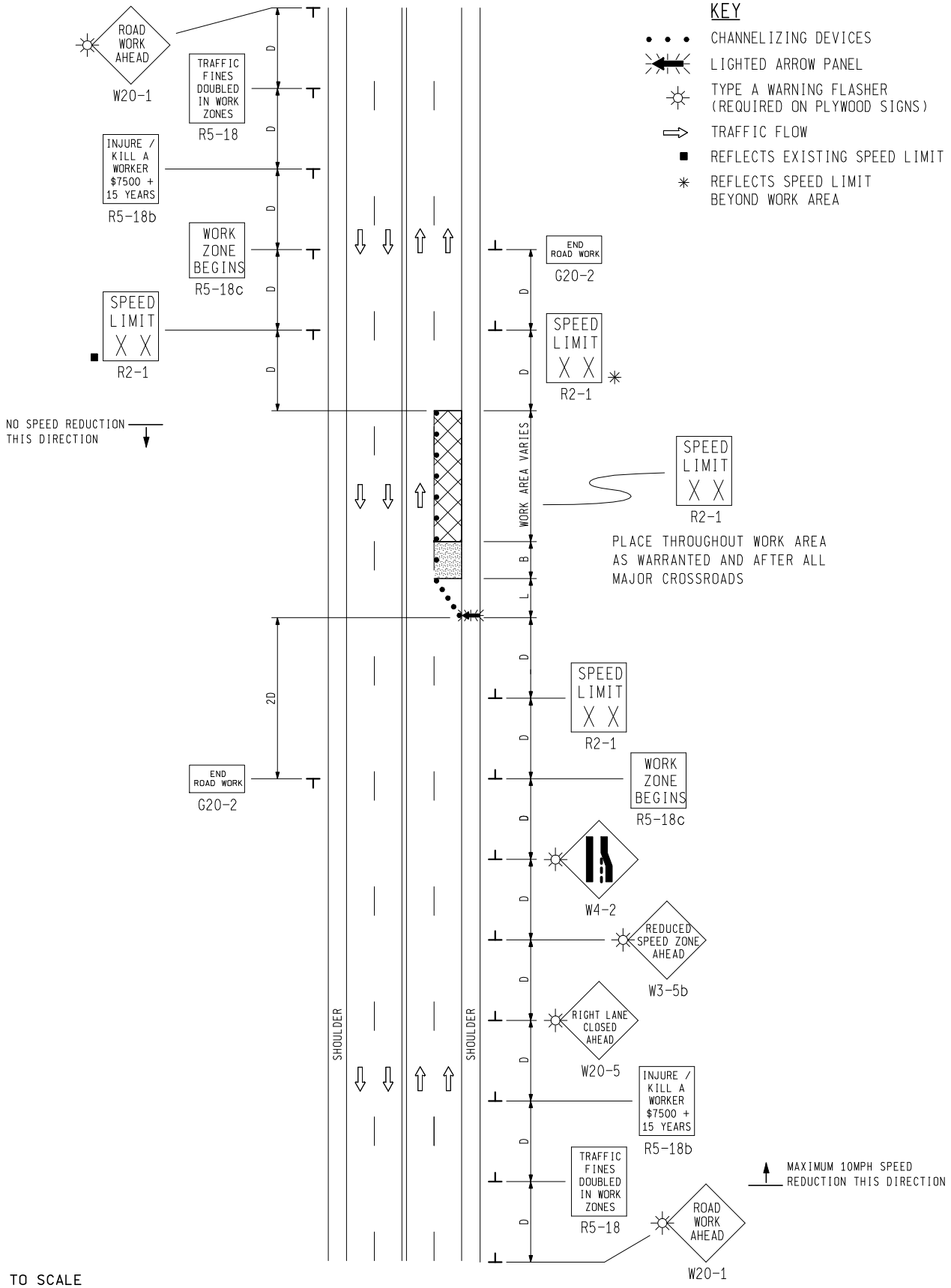
ONE-LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, WITH A MAXIMUM 10 MPH SPEED REDUCTION

DURATION: SHORT-TERM STATIONARY

01/01/07
REV. DATE:

MD - 23c

PAGE A16



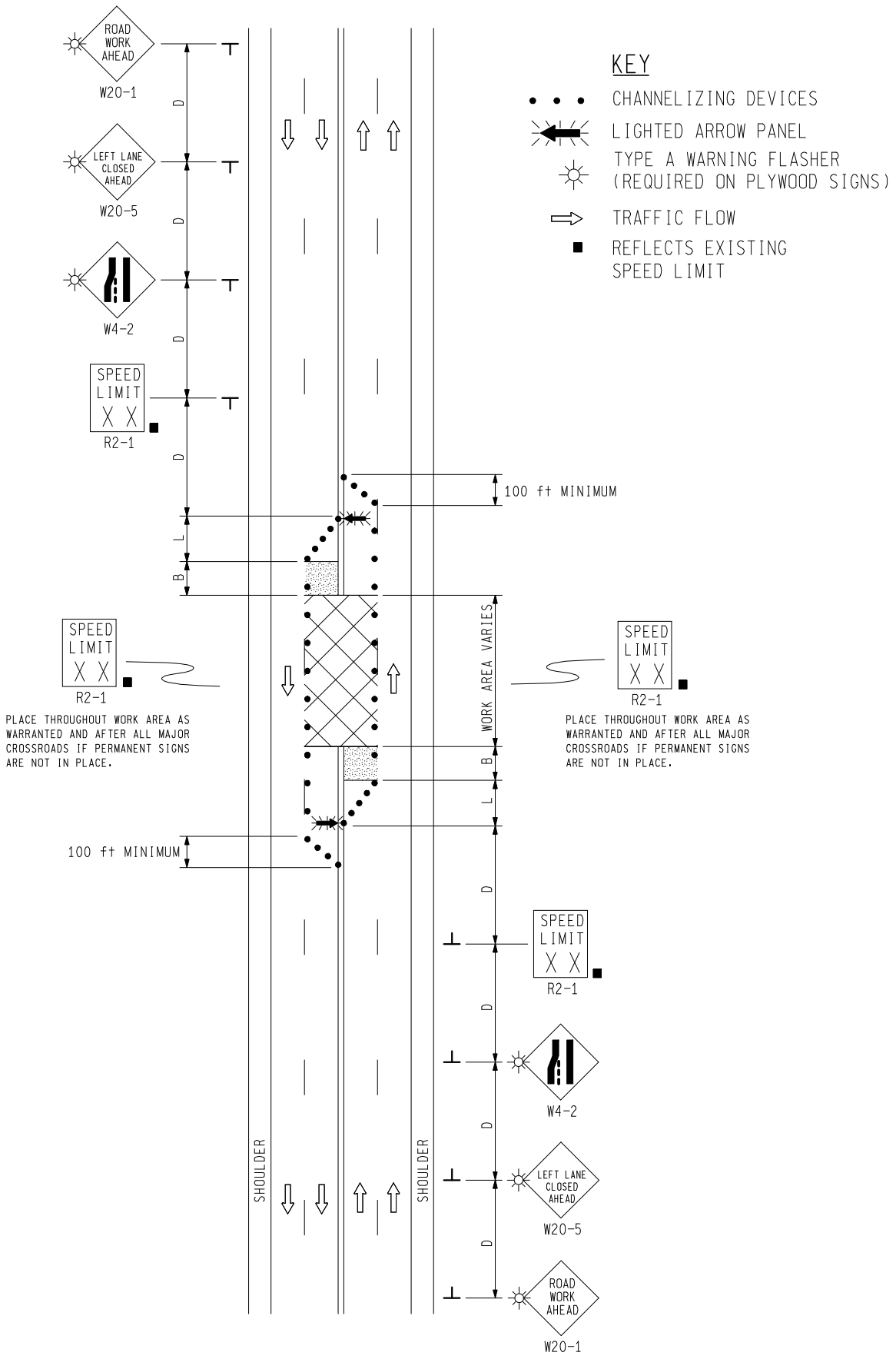
NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

ONE-LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, WITH A MAXIMUM 10 MPH SPEED REDUCTION

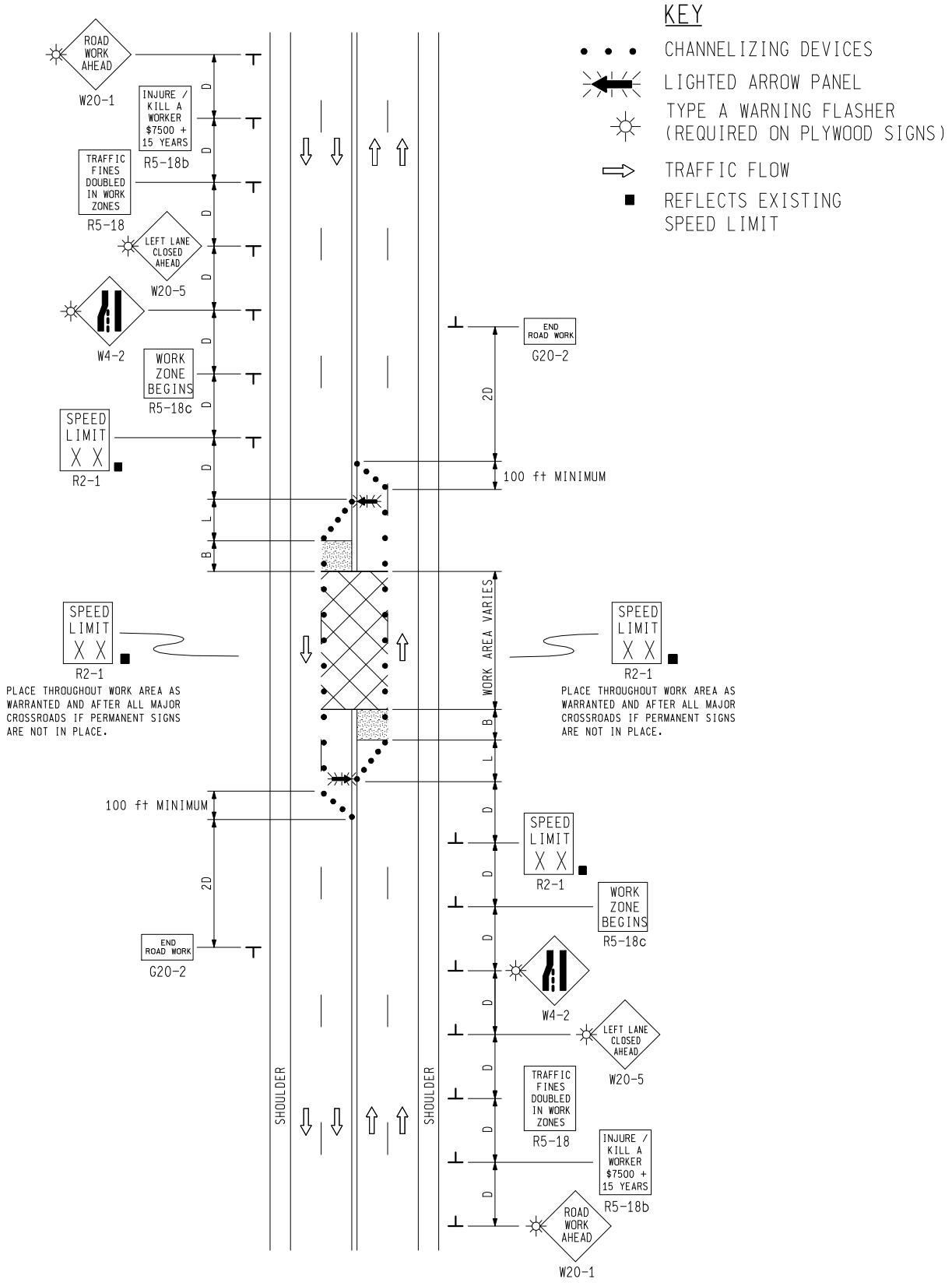
DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY

01/01/07 REV. DATE:	MD - 23d	PAGE A17



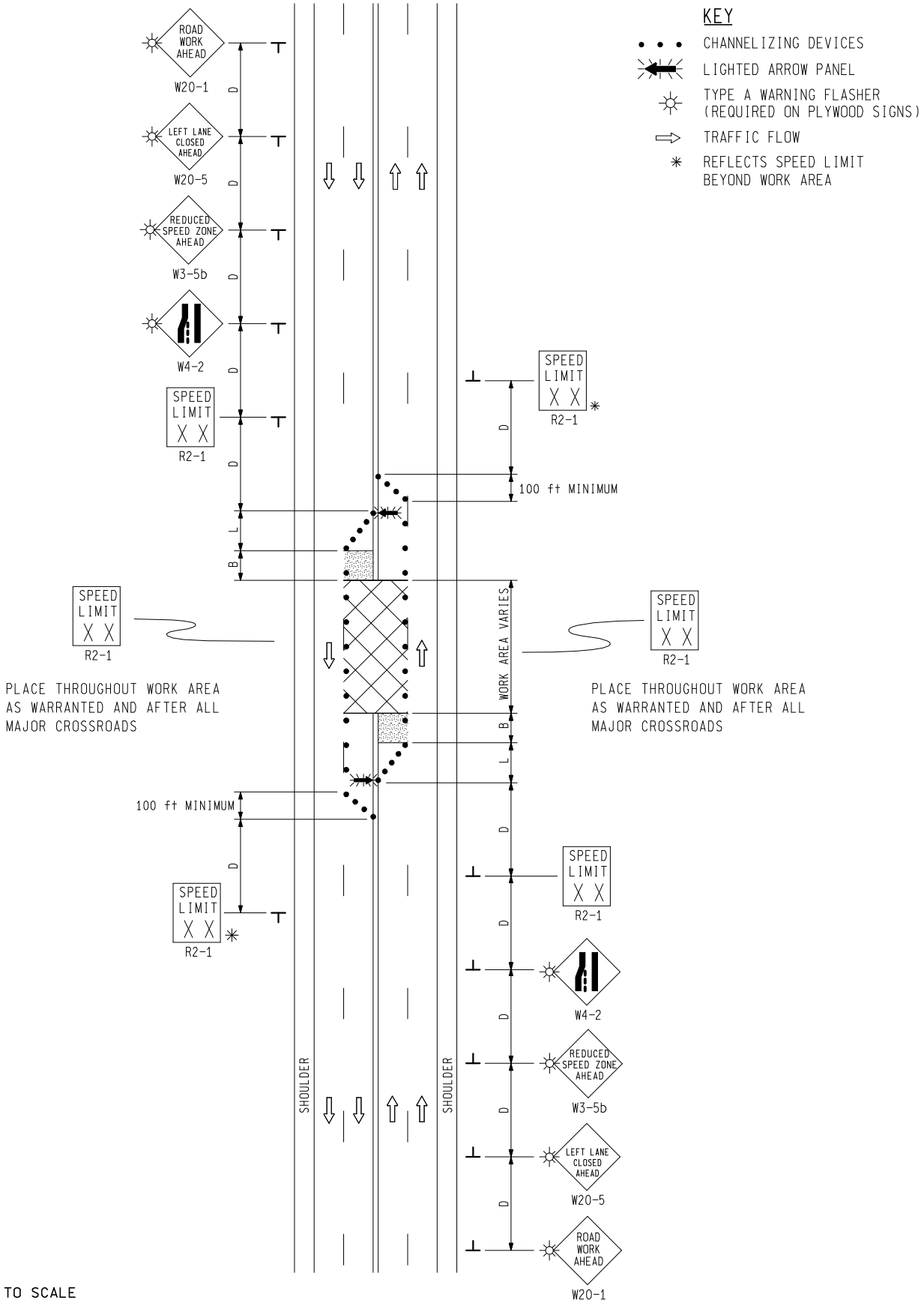
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER TWO LANES OF A MULTI-LANE UNDIVIDED ROADWAY, NO SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE:	MD - 24a	PAGE A18



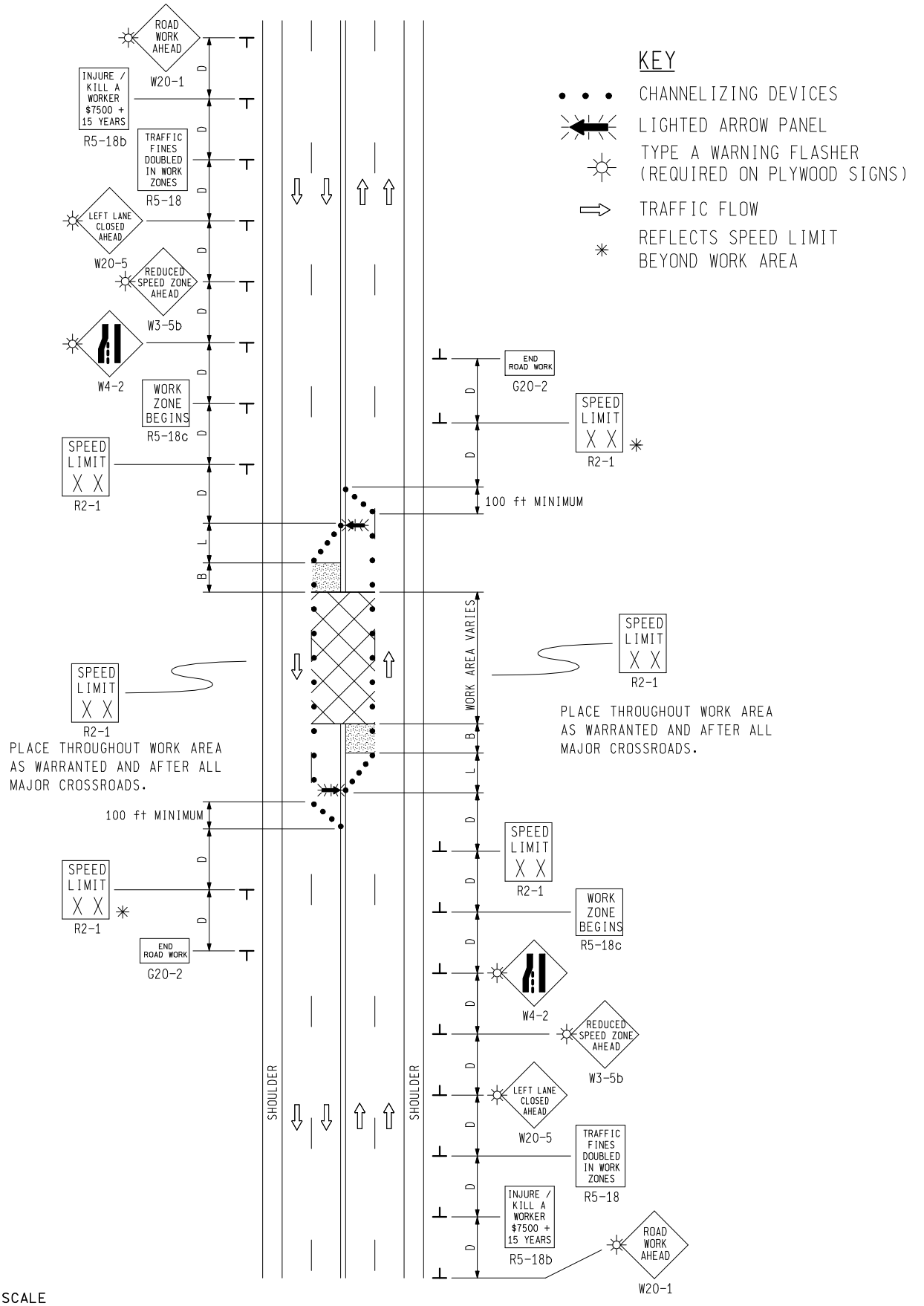
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER TWO LANES OF A MULTI-LANE UNDIVIDED ROADWAY, WITH NO SPEED REDUCTION	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE: MD - 24b PAGE A19



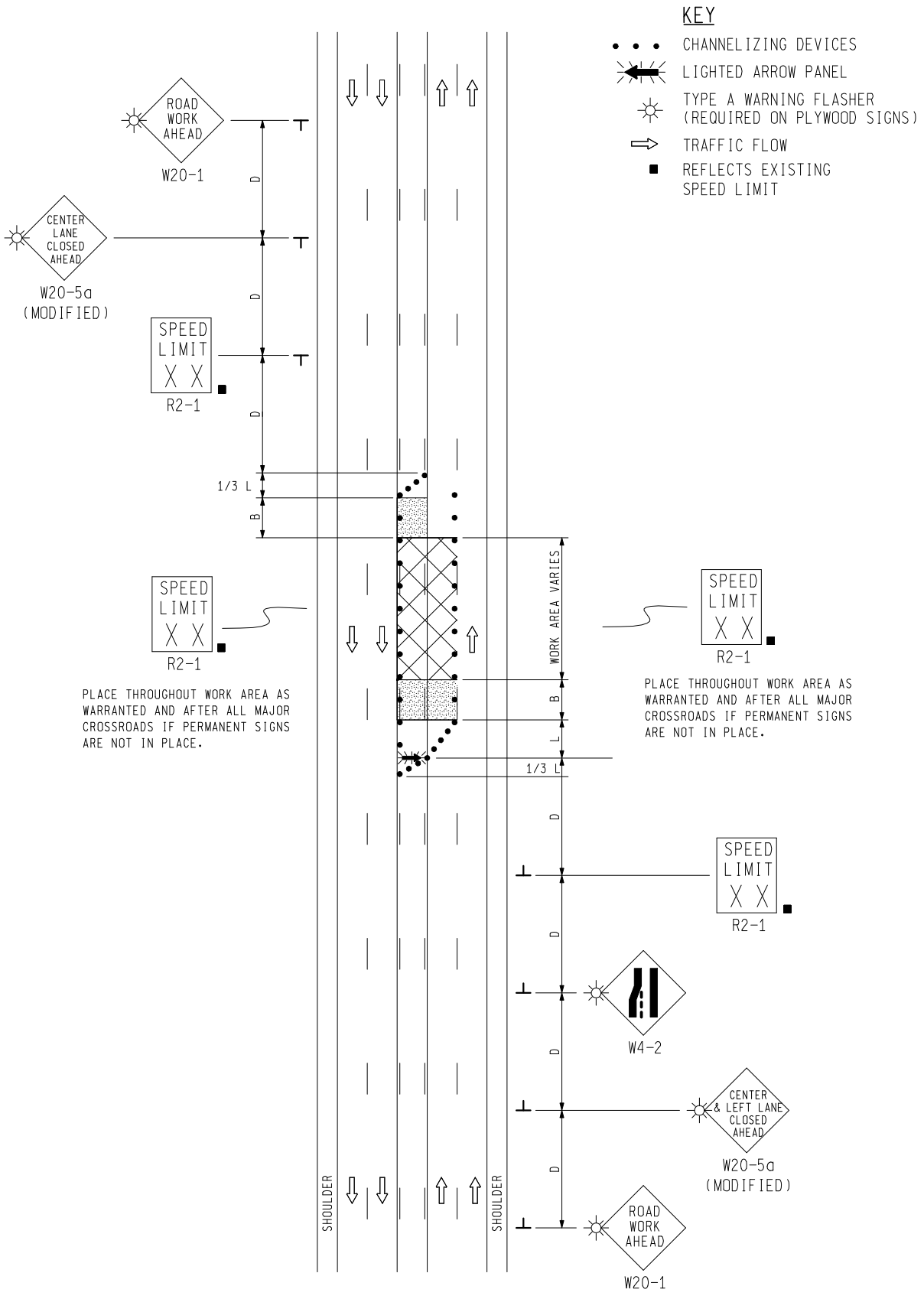
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER TWO LANES OF A MULTI-LANE UNDIVIDED ROADWAY, WITH MAXIMUM 10 MPH SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE: | MD - 24c | PAGE A20



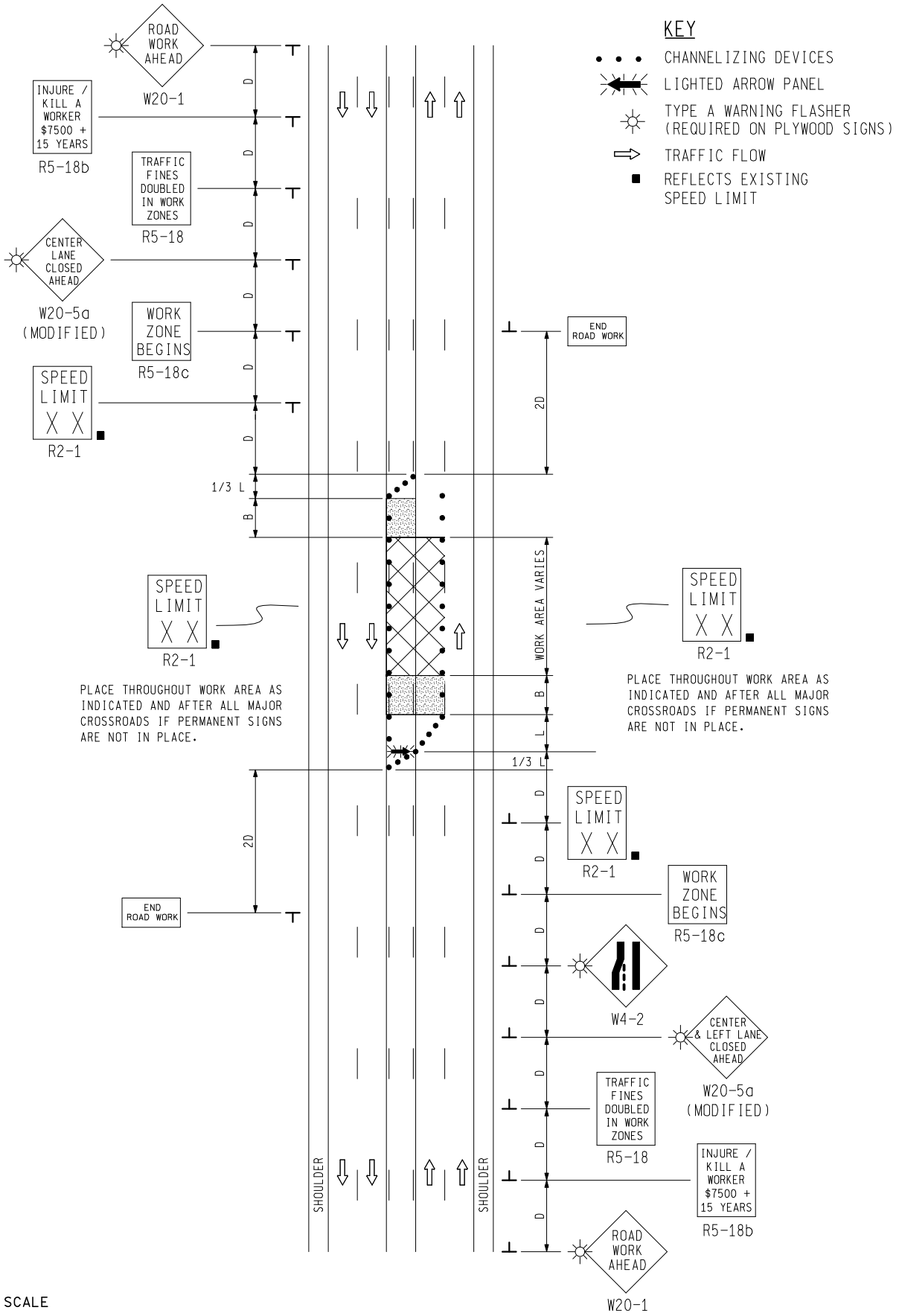
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER TWO LANES OF A MULTI-LANE UNDIVIDED ROADWAY, WITH MAXIMUM 10 MPH SPEED REDUCTION	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 24d
			PAGE A21



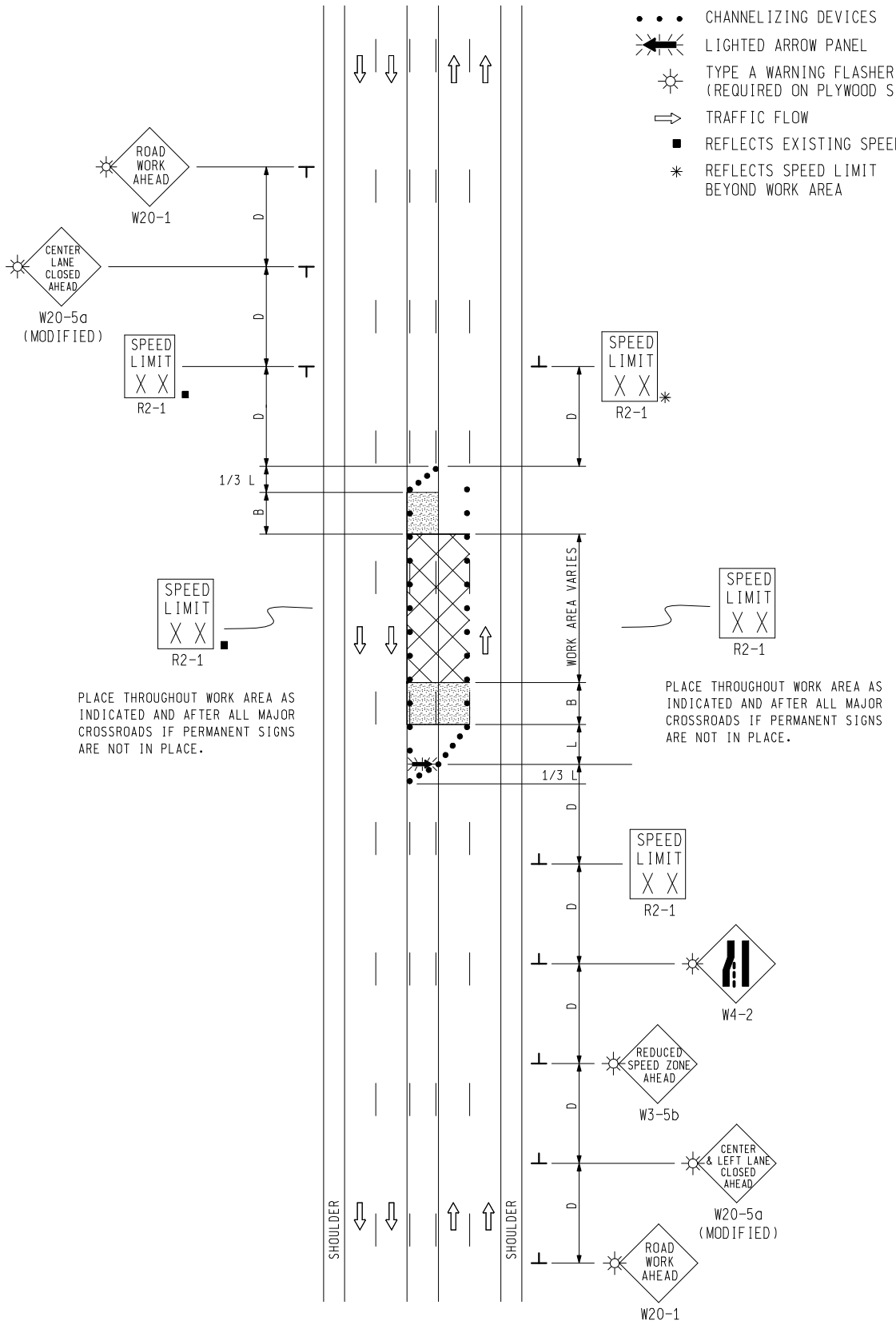
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANE OF A MULTI-LANE UNDIVIDED ROADWAY, NO SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE:	MD - 25a PAGE A22



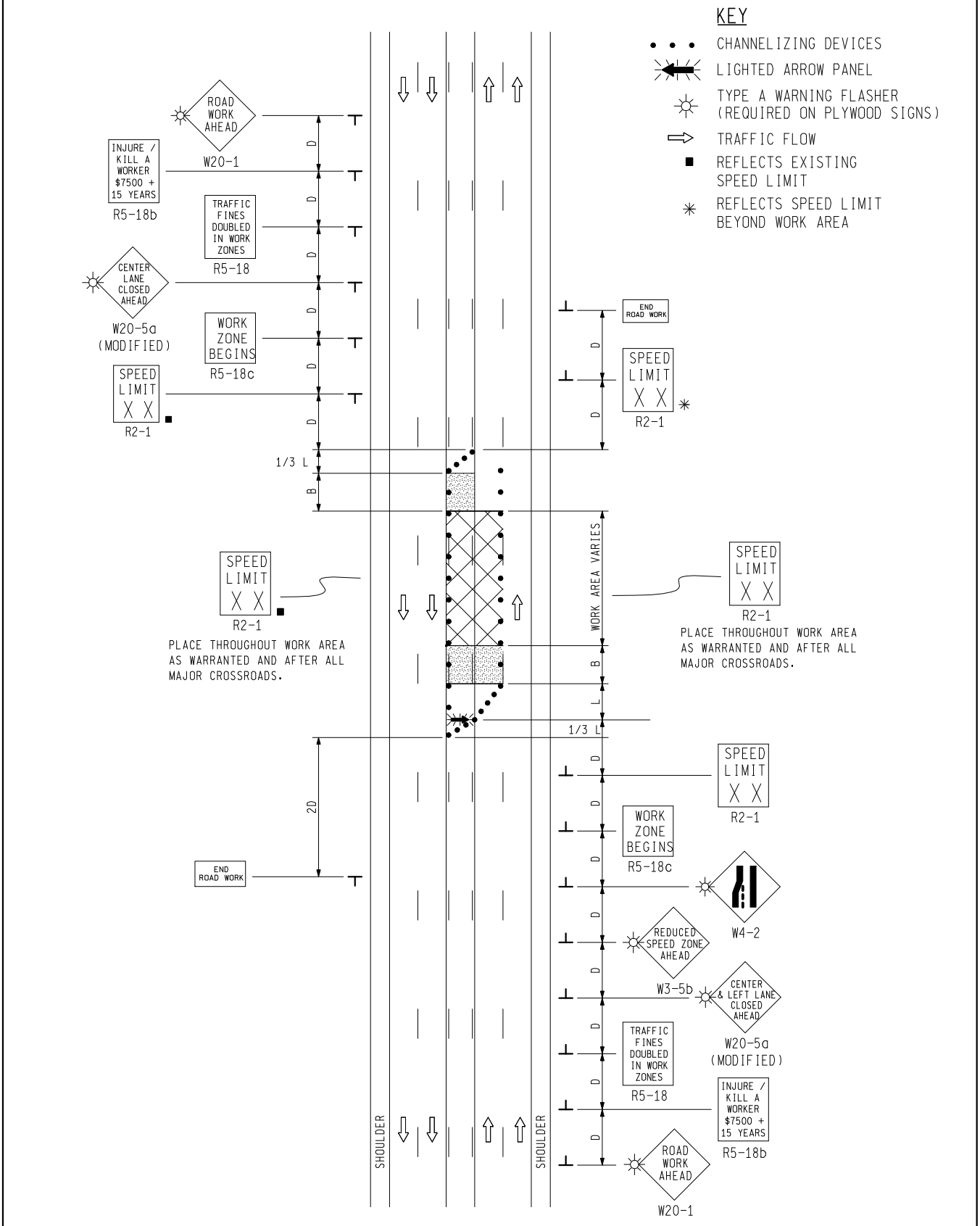
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANE OF A MULTI-LANE UNDIVIDED ROADWAY, NO SPEED REDUCTION	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 25b
			PAGE A23



NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANE OF A MULTI-LANE UNDIVIDED ROADWAY, WITH MAXIMUM 10 MPH SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE: | MD - 25c | PAGE A24



NOT TO SCALE

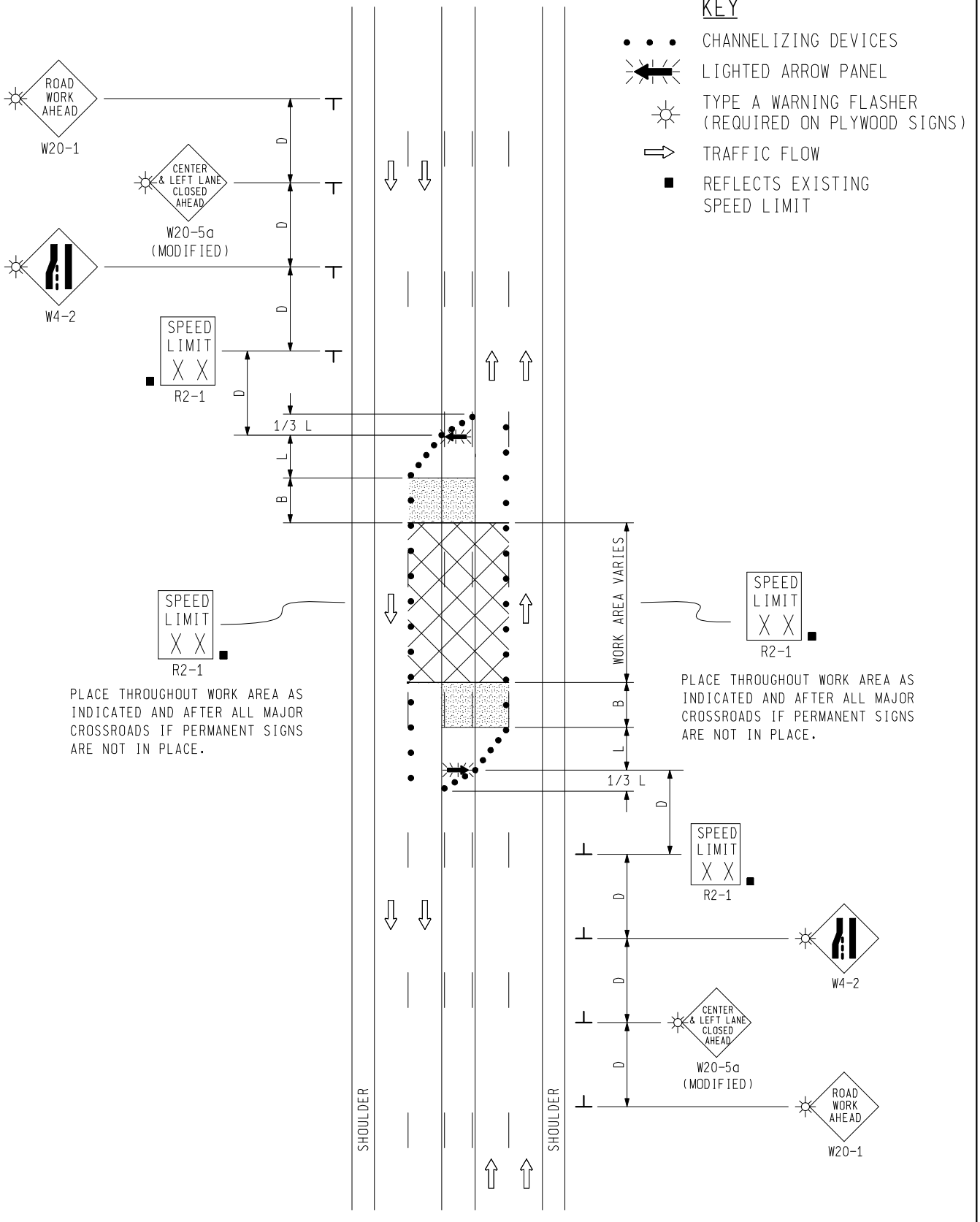
MDOT Michigan Department of Transportation
OPERATIONS

CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANE OF A MULTI-LANE UNDIVIDED ROADWAY, WITH MAXIMUM 10 MPH SPEED REDUCTION

DURATION: LONG-TERM STATIONARY
INTERMEDIATE-TERM STATIONARY

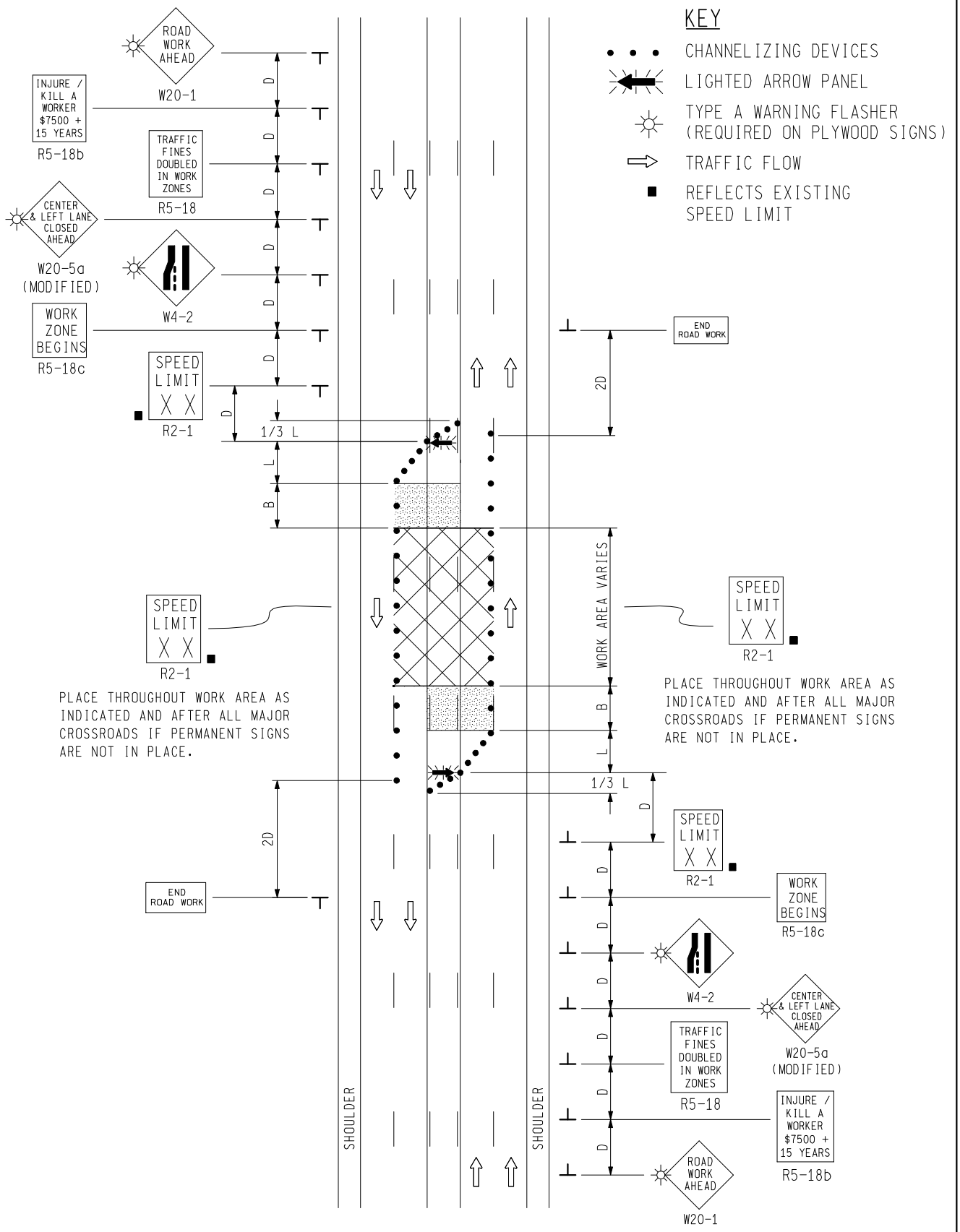
01/01/07
REV. DATE:

MD - 25d



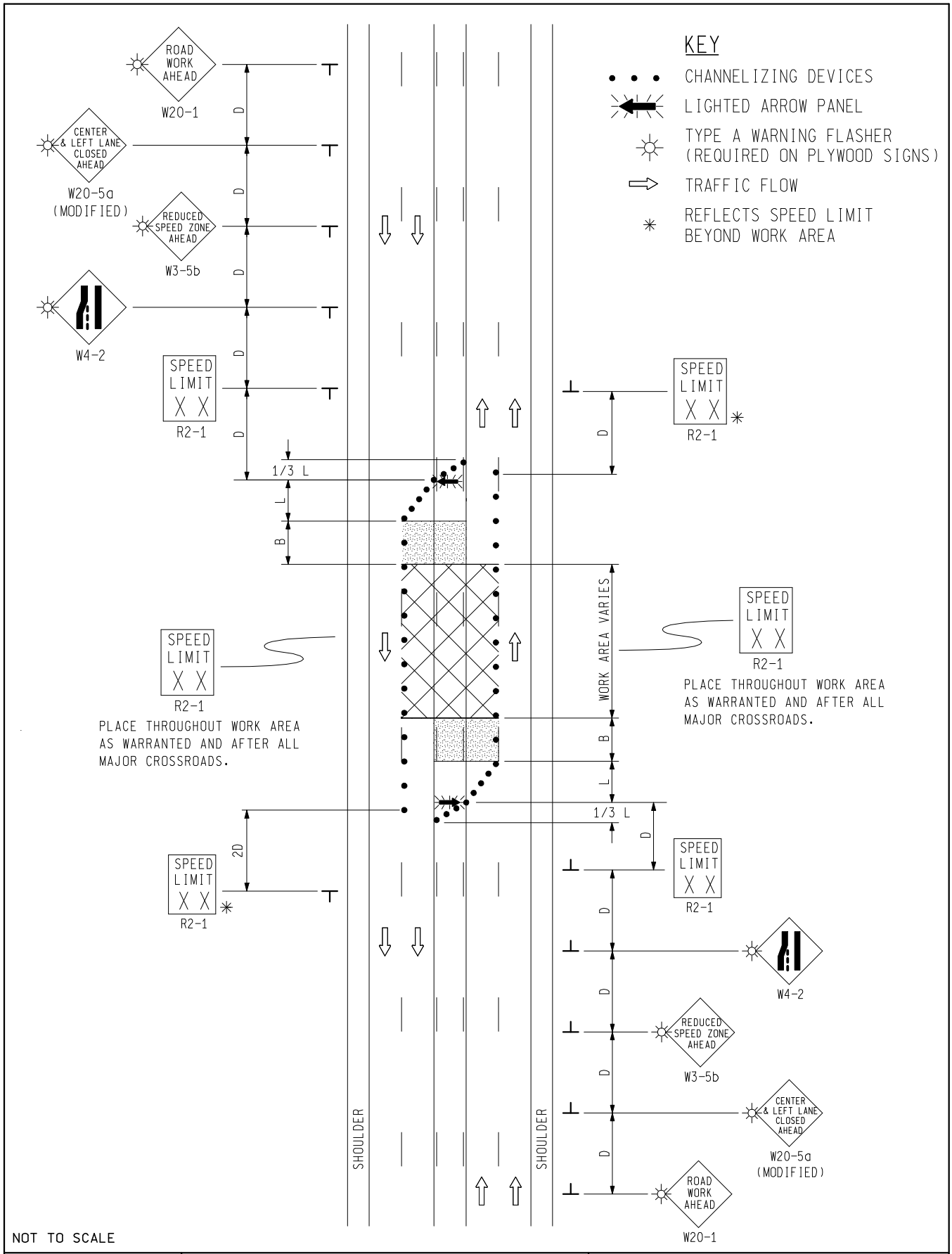
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANES OF A MULTI-LANE UNDIVIDED ROADWAY, NO SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE: | MD - 26a | PAGE A26



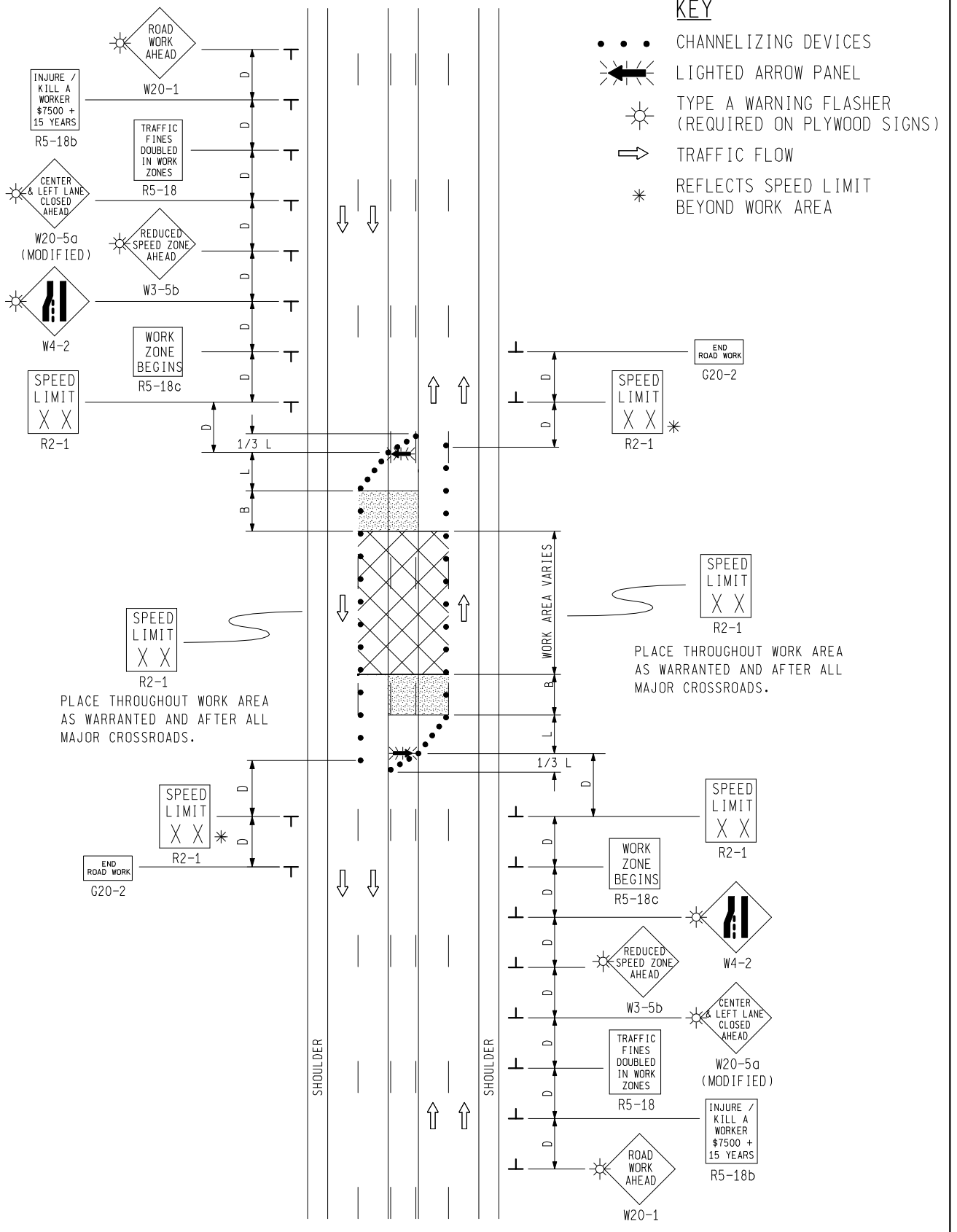
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANES OF A MULTI-LANE UNDIVIDED ROADWAY, NO SPEED REDUCTION	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE: | MD - 26b | PAGE A27



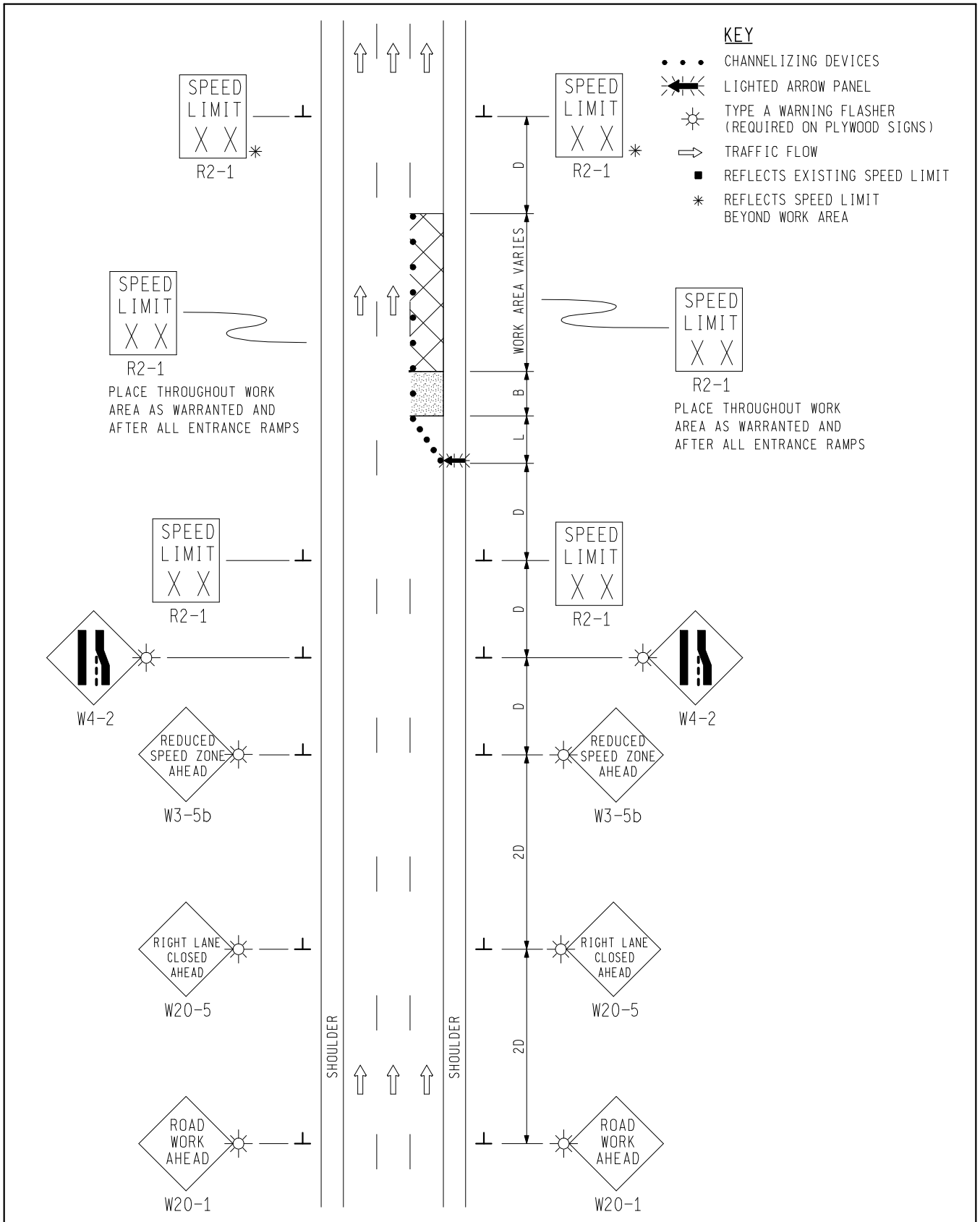
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANES OF A MULTI-LANE UNDIVIDED ROADWAY, WITH MAXIMUM 10 MPH SPEED REDUCTION	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE: | MD - 26c | PAGE A28



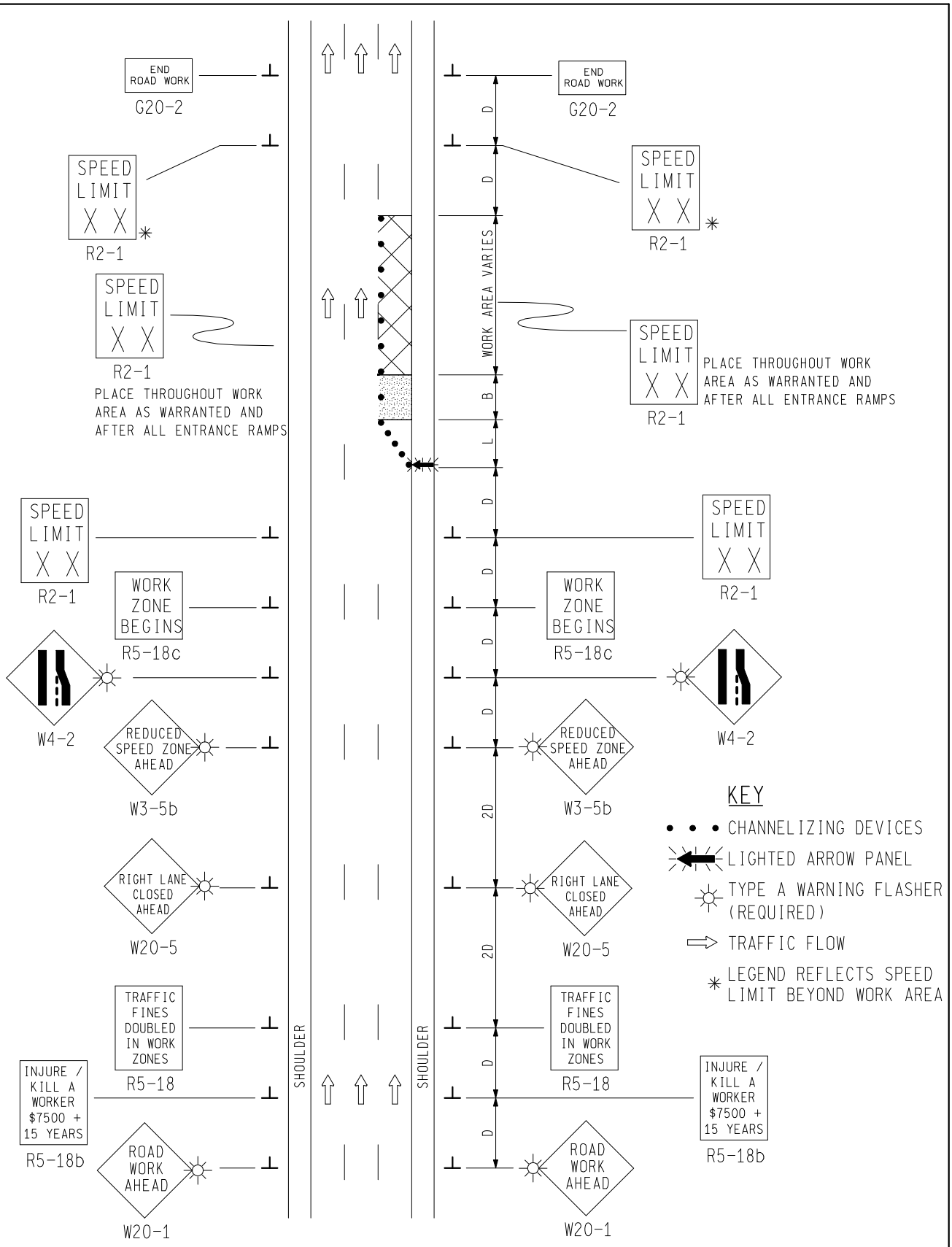
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	CLOSURE FOR THE CENTER LANE AND ADJACENT THROUGH LANES OF A MULTI-LANE UNDIVIDED ROADWAY, WITH MAXIMUM 10 MPH SPEED REDUCTION	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE: MD - 26d PAGE A29



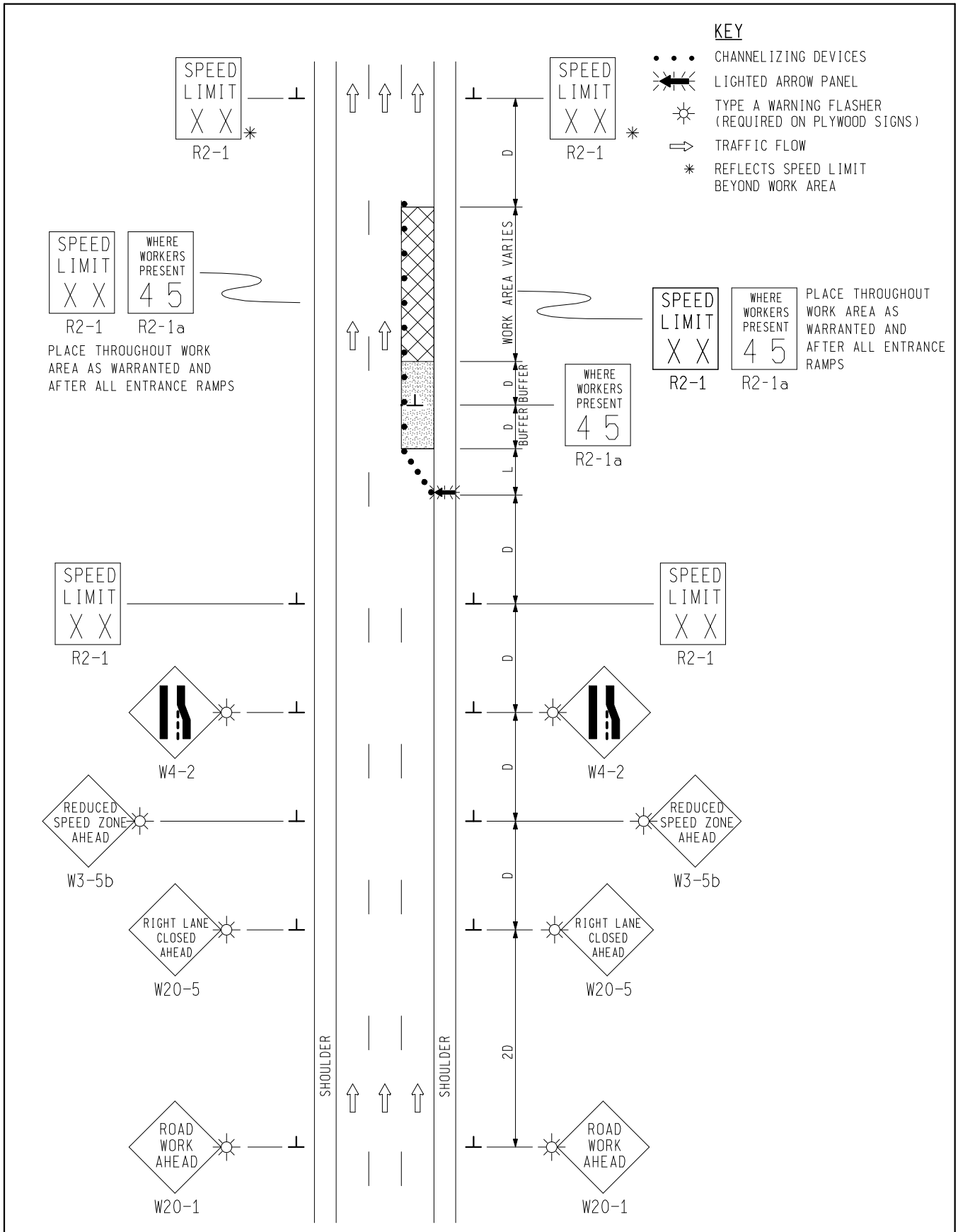
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	ONE-LANE CLOSURE ON A FREEWAY USING A SINGLE STEP DOWN IN SPEED LIMIT WHERE EXISTING SPEED LIMIT IS 55 MPH	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE:	MD - 27c PAGE A30



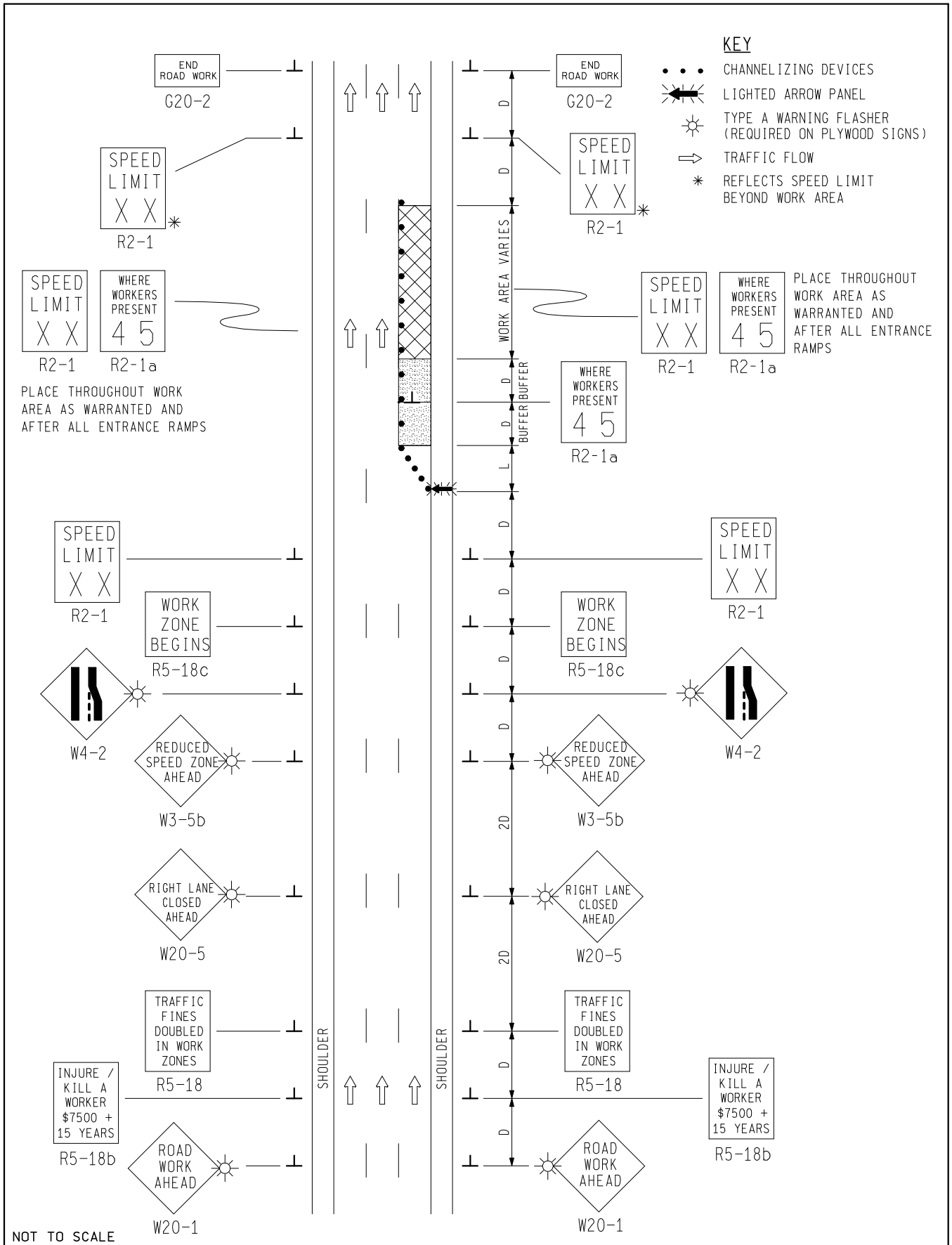
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	ONE-LANE CLOSURE ON A FREEWAY USING A SINGLE STEP DOWN IN SPEED LIMIT WHERE EXISTING SPEED LIMIT IS 55 MPH	DURATION: INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE:	MD - 27d PAGE A31



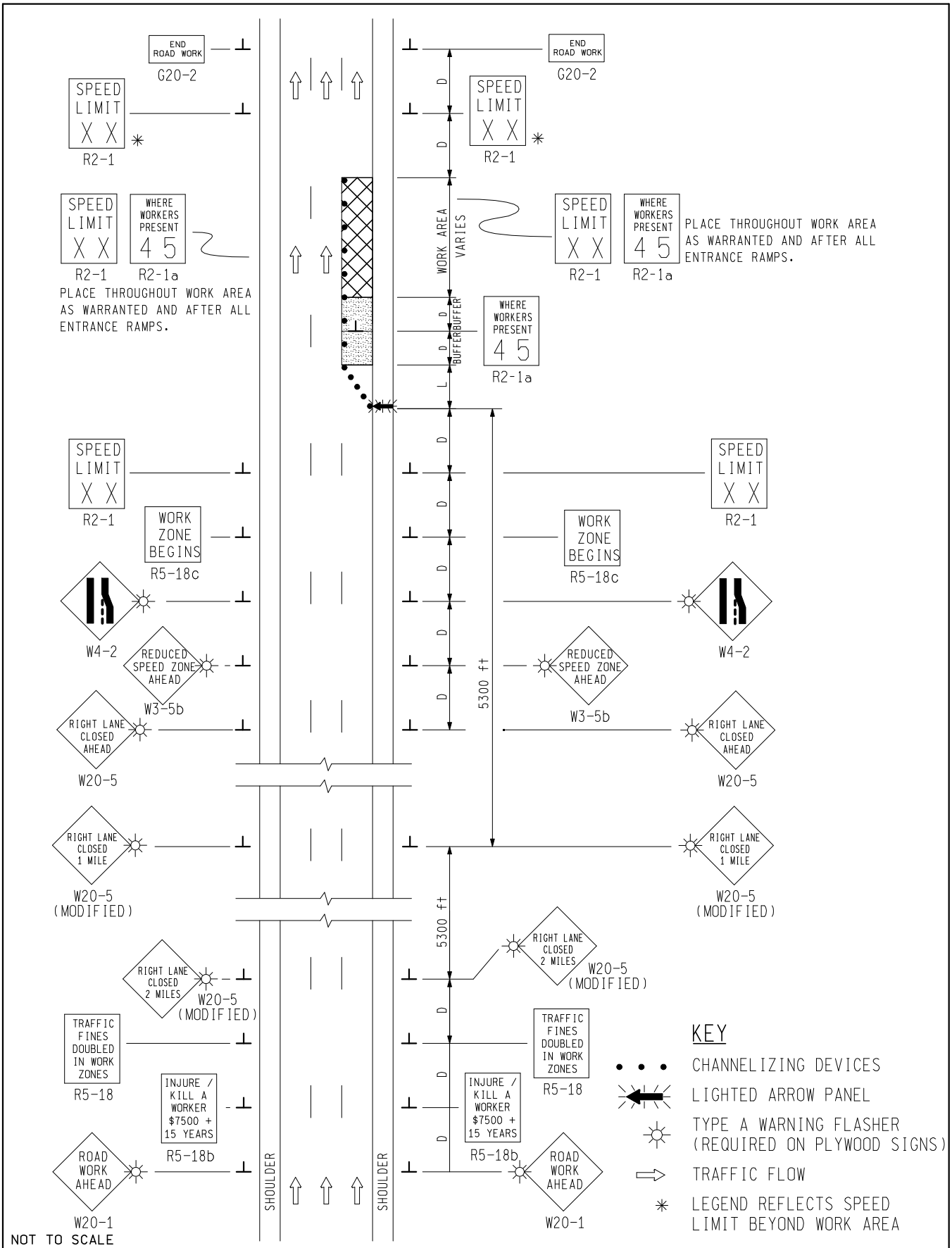
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	ONE-LANE CLOSURE ON A FREEWAY USING "WHERE WORKERS PRESENT" AND A SINGLE STEP DOWN IN SPEED LIMIT WHEN EXISTING SPEED LIMIT IS 70 MPH OR LESS	DURATION: SHORT-TERM STATIONARY 01/01/07 REV. DATE:	MD - 27e PAGE A32



NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	ONE-LANE CLOSURE ON A FREEWAY USING "WHERE WORKERS PRESENT" AND A SINGLE STEP DOWN IN SPEED LIMIT WHEN EXISTING SPEED LIMIT IS 70 MPH OR LESS	DURATION: INTERMEDIATE-TERM STATIONARY 01/01/07 REV. DATE:	MD - 27f PAGE A33



NOT TO SCALE

MDOT Michigan Department of Transportation

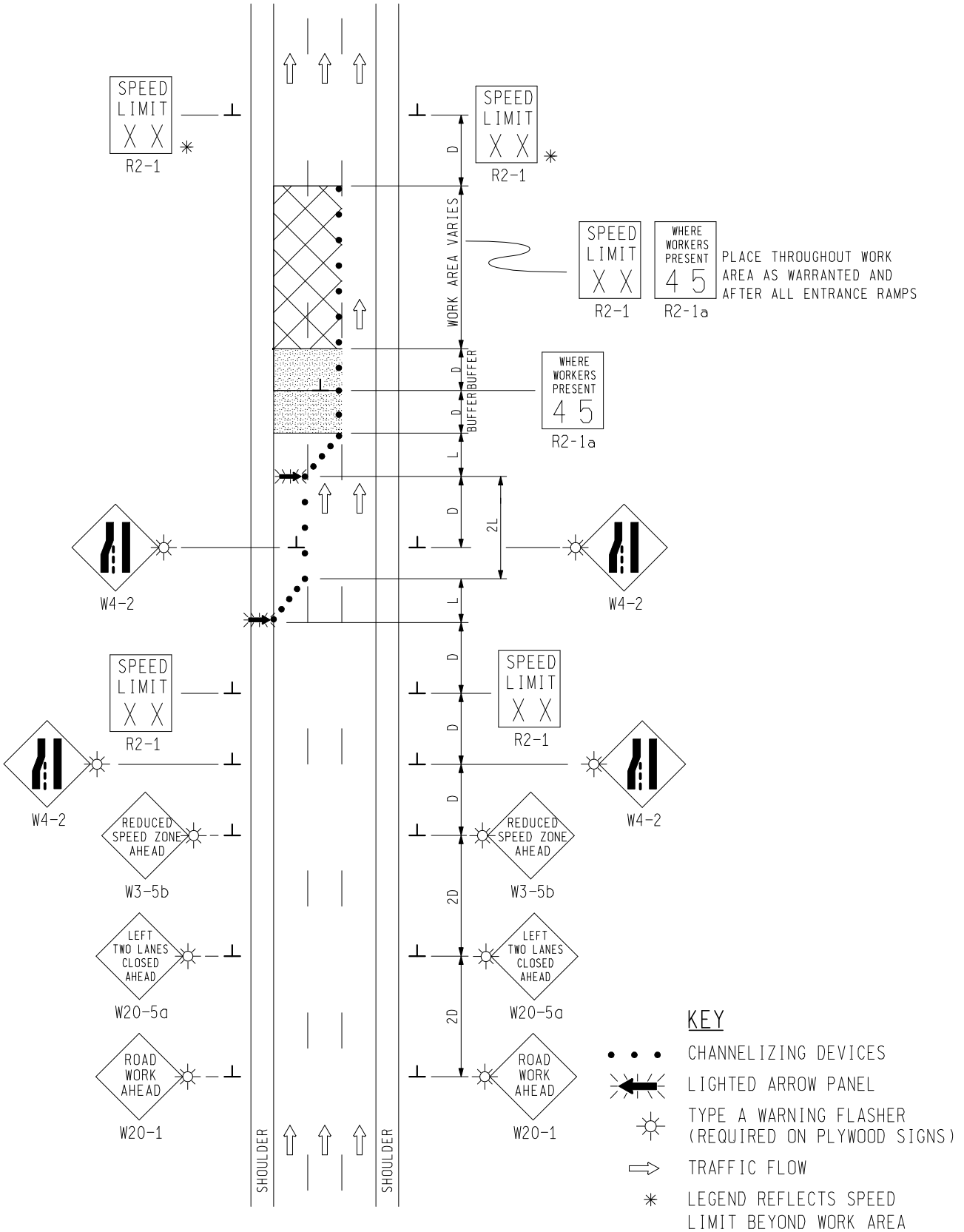
OPERATIONS

ONE-LANE CLOSURE ON A FREEWAY USING "WHERE WORKERS PRESENT" AND A SINGLE STEP DOWN IN SPEED LIMIT WHEN EXISTING SPEED LIMIT IS 70 MPH OR LESS

DURATION: LONG-TERM STATIONARY

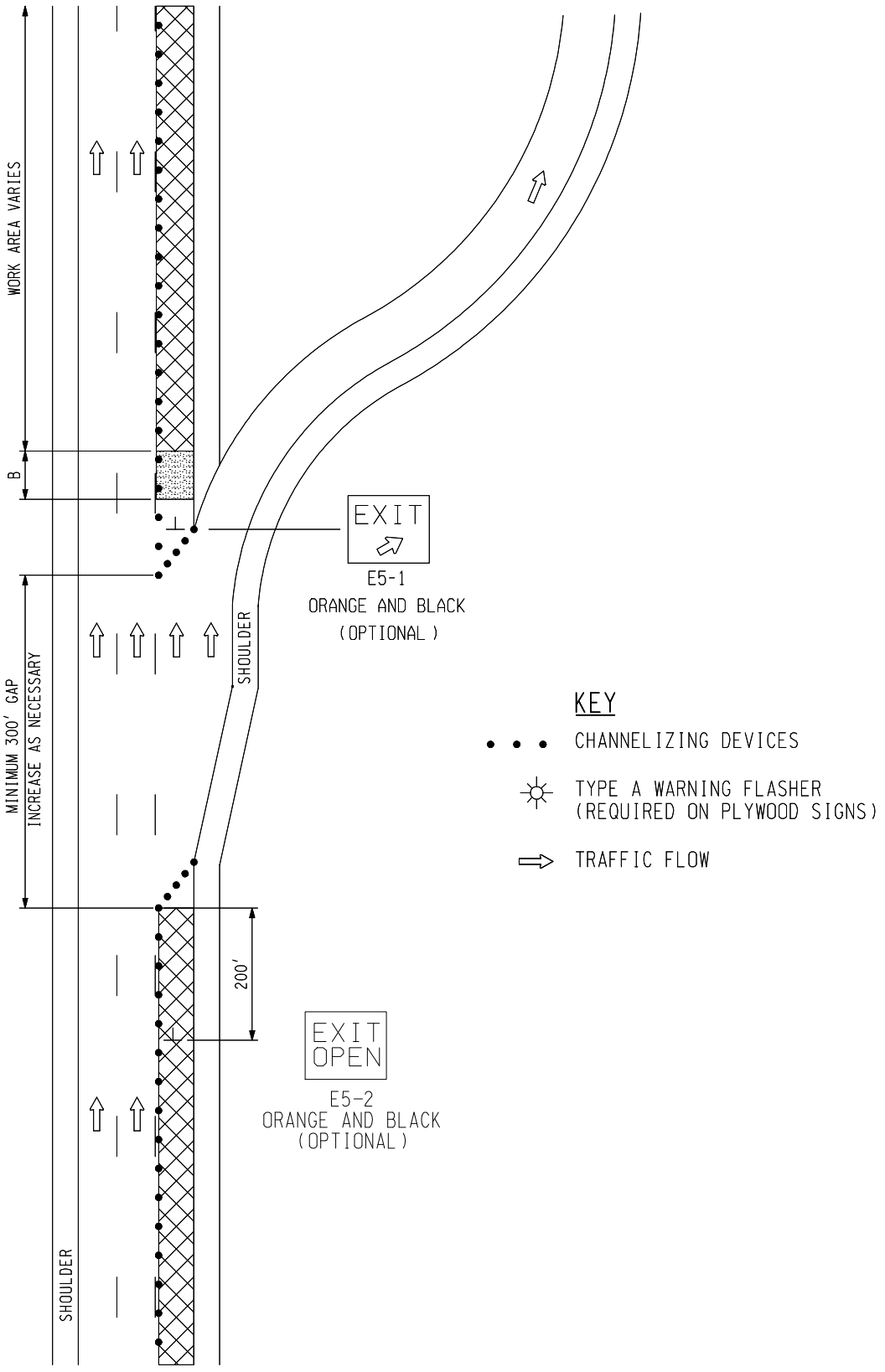
01/01/07
REV. DATE:

MD - 27g



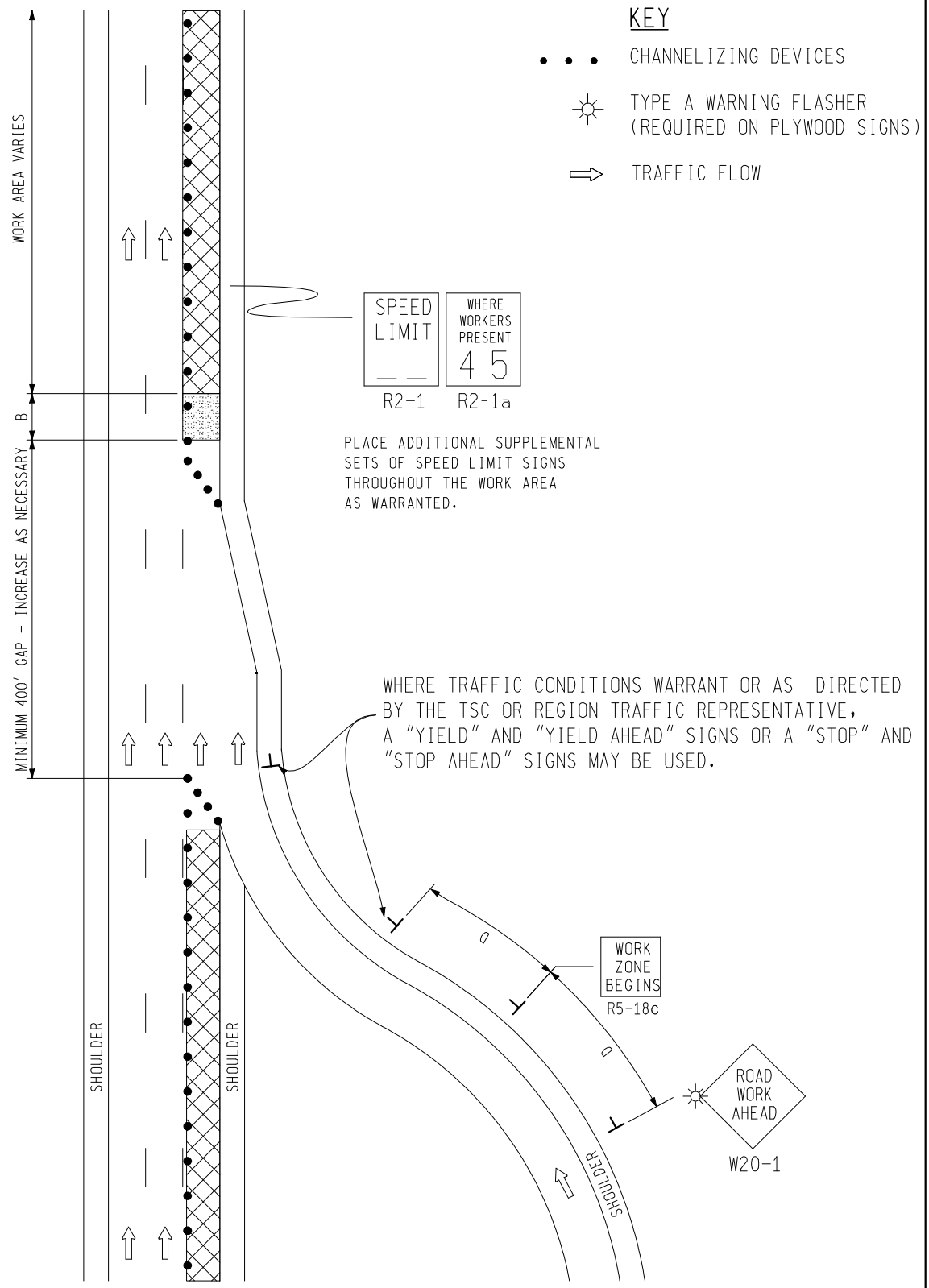
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	TWO-LANE CLOSURE ON A FREEWAY USING "WHERE WORKERS PRESENT" AND A SINGLE STEP DOWN IN SPEED LIMIT WHEN EXISTING SPEED LIMIT IS 70 MPH OR LESS	DURATION: SHORT-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 28c
			PAGE A35



NOT TO SCALE

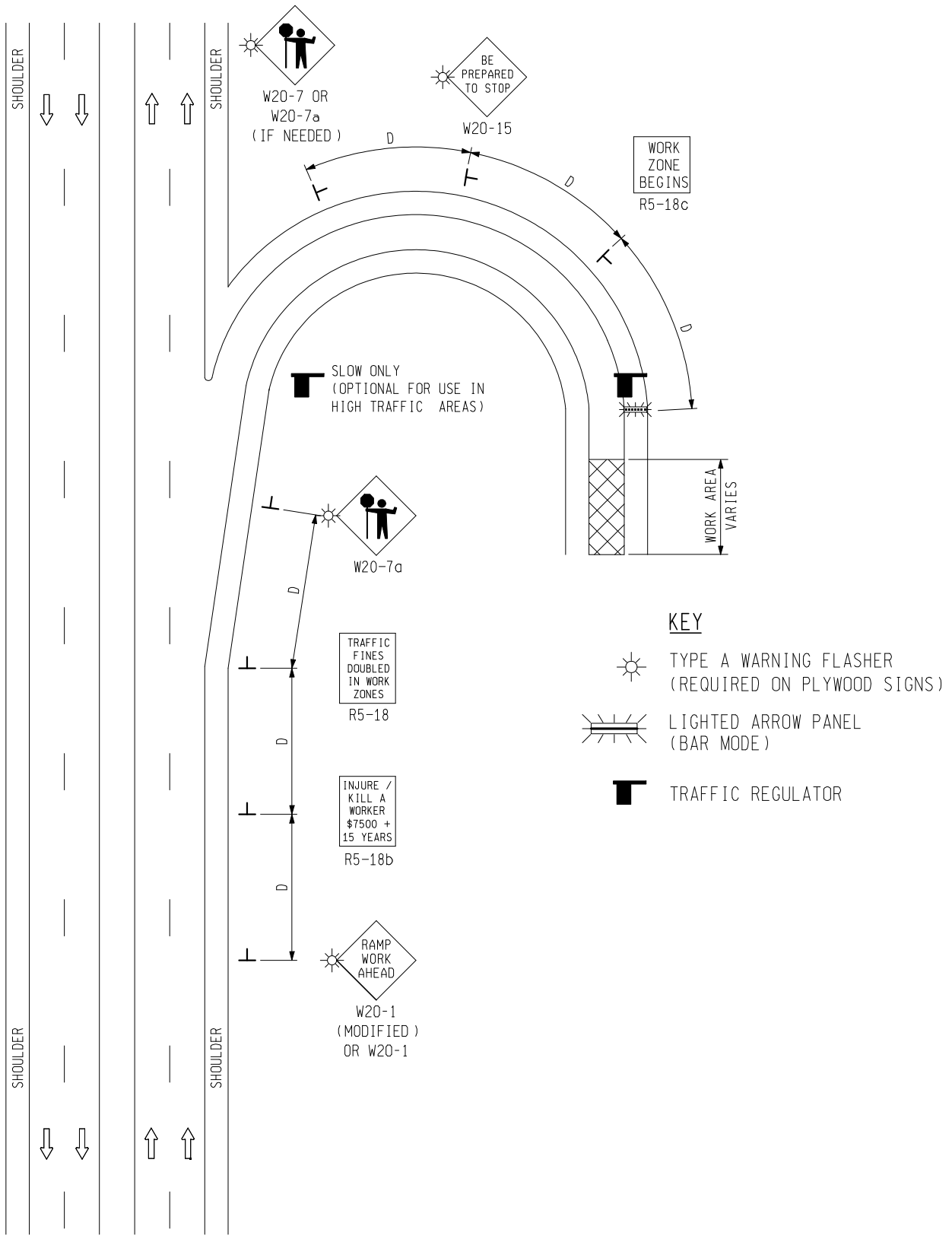
	SINGLE LANE CLOSURE ON FREEWAY THROUGH ENTRANCE RAMP AREA	DURATION:	LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY SHORT-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 31	PAGE A36



ADVANCED SIGNING AND CHANNELIZING SHALL CONFORM TO THE TYPICAL FOR A SINGLE LANE CLOSURE

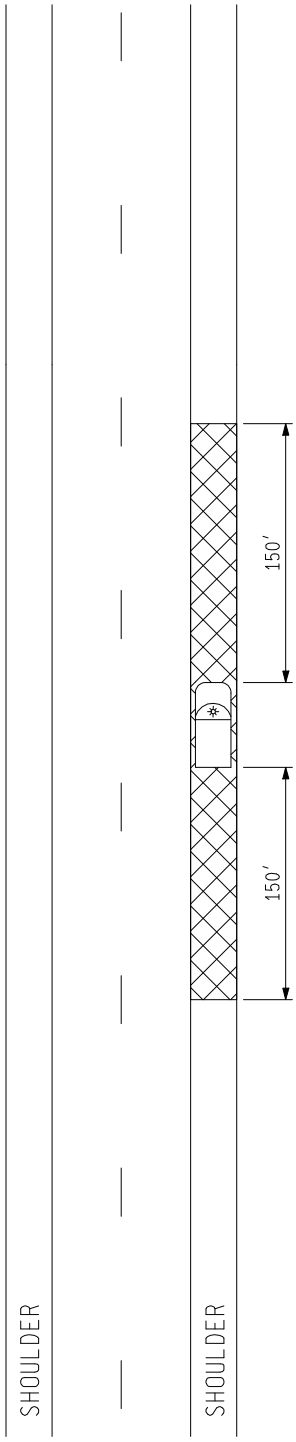
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	SINGLE LANE CLOSURE ON FREEWAY THROUGH ENTRANCE RAMP AREA	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY SHORT-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 32
			PAGE A37



NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	TRAFFIC CONTROL PLAN FOR WORK OPERATIONS ON EXIT RAMPS	DURATION: LONG-TERM STATIONARY INTERMEDIATE-TERM STATIONARY SHORT-TERM STATIONARY	
		01/01/07 REV. DATE:	MD - 33
			PAGE A38



KEY

VEHICLE FROM WHICH WORK IS BEING PERFORMED

TRAFFIC FLOW

NOTES

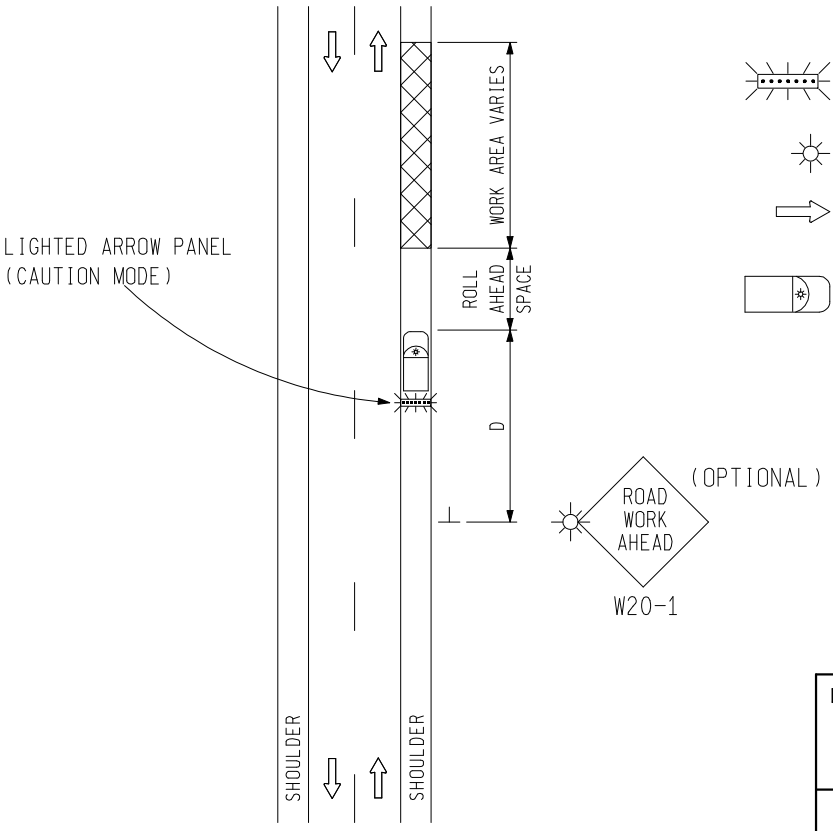
AT A MINIMUM, TRAFFIC CONTROL SHALL CONSIST OF AN APPROPRIATELY SAFETY COLORED VEHICLE (OR A VEHICLE WITH CONSPICUITY TAPE ON BOTH SIDES AND THE REAR) WITH A ROTATING BEACON. NO SIGNS OR CHANNELIZING DEVICES ARE REQUIRED.

THE FOLLOWING FACTORS SHOULD BE CONSIDERED IN DETERMINING THE NEED FOR ADDITIONAL ADVANCE WARNING:

1. TRAFFIC VOLUME
2. POSTED AND OPERATING SPEED LIMITS
3. HORIZONTAL AND VERTICAL ALIGNMENTS
4. URBAN OR RURAL SITE

NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	SHOULDER WORK WITH TRAFFIC VOLUMES LESS THAN 10,000 AND ADEQUATE SIGHT DISTANCES	DURATION: MOBILE		
		01/01/07 REV. DATE:	MD - M11	PAGE A39



KEY

LIGHTED ARROW PANEL (CAUTION MODE)

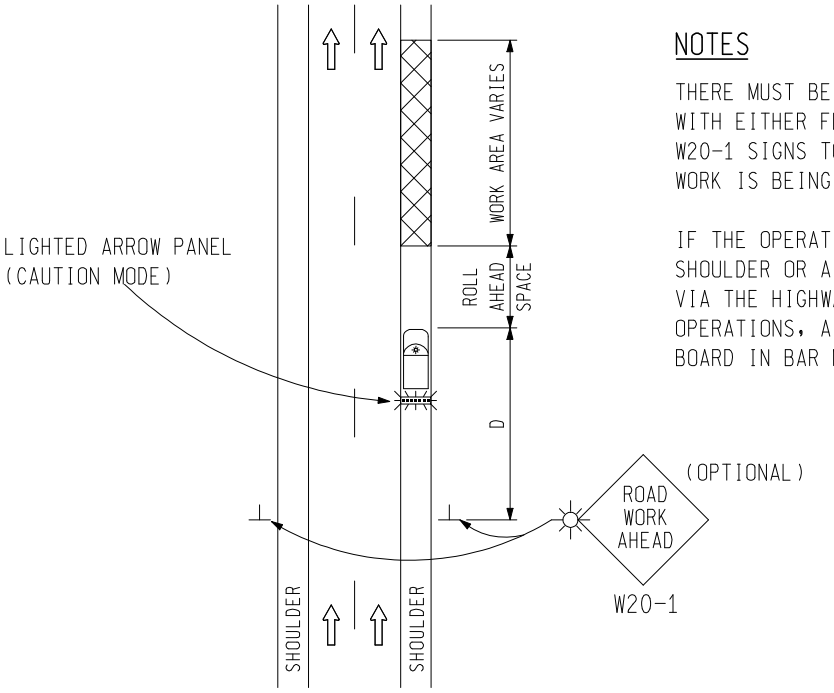
TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)

TRAFFIC FLOW

SHADOW VEHICLE WITH FLASHING OR ROTATING LIGHTS AND OPTIONAL TRUCK MOUNTED ATTENUATOR

DURATION: SHORT DURATION, MOBILE

SHOULDER WORK ON A TWO-LANE, TWO-WAY ROADWAY



NOTES

THERE MUST BE EITHER AN APPROPRIATELY MARKED VEHICLE WITH EITHER FLASHING OR ROTATING LIGHTS OR OPTIONAL W20-1 SIGNS TO INDICATE TO THE PUBLIC THAT WORK IS BEING DONE IN THE AREA.

IF THE OPERATION HAS A VEHICLE(S) PARKED ON THE SHOULDER OR A VEHICLE(S) ACCESSING THE WORK SITE VIA THE HIGHWAY OR CROSSING THE HIGHWAY TO PERFORM OPERATIONS, A ROAD WORK AHEAD SIGN OR AN ARROW BOARD IN BAR MODE SHALL BE USED.

NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

SHOULDER WORK ON A DIVIDED ROADWAY OR FREEWAY

DURATION: SHORT DURATION, MOBILE

01/01/07 REV. DATE:	MD - M12	PAGE A40

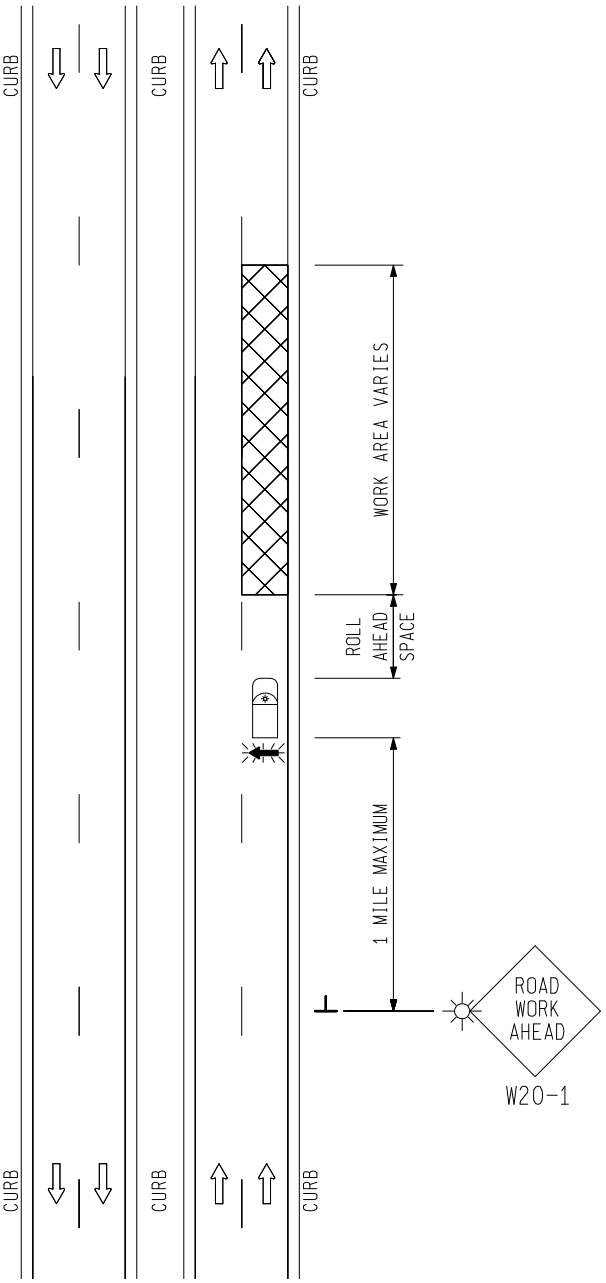
KEY

LIGHTED ARROW PANEL

TYPE A WARNING FLASHER
(REQUIRED ON PLYWOOD SIGNS)

TRAFFIC FLOW

SHADOW VEHICLE WITH FLASHING
OR ROTATING LIGHTS AND OPTIONAL
TRUCK MOUNTED ATTENUATOR



NOTES

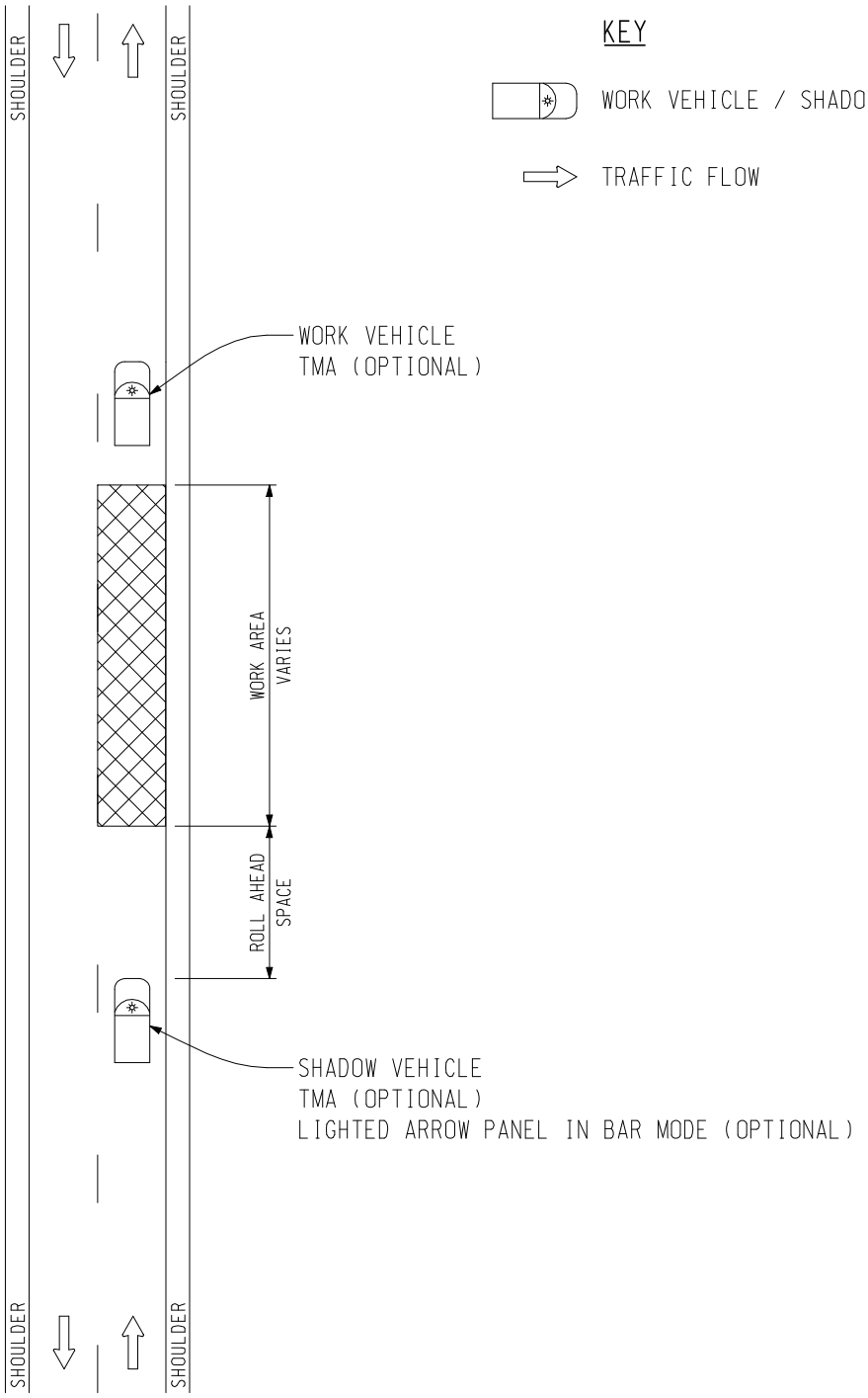
"ROAD WORK AHEAD" SIGN SHALL BE WITHIN ONE MILE OF WORK AREA.

THIS DETAIL IS ONLY ALLOWED IN AREAS WITHOUT SHOULDERS AND SPEED LIMITS OF 45 MPH OR LESS.

USED FOR PATROLLING, MINOR PATCHING AND OTHER ACTIVITIES IN AREAS WITH CURBED ROADWAY.

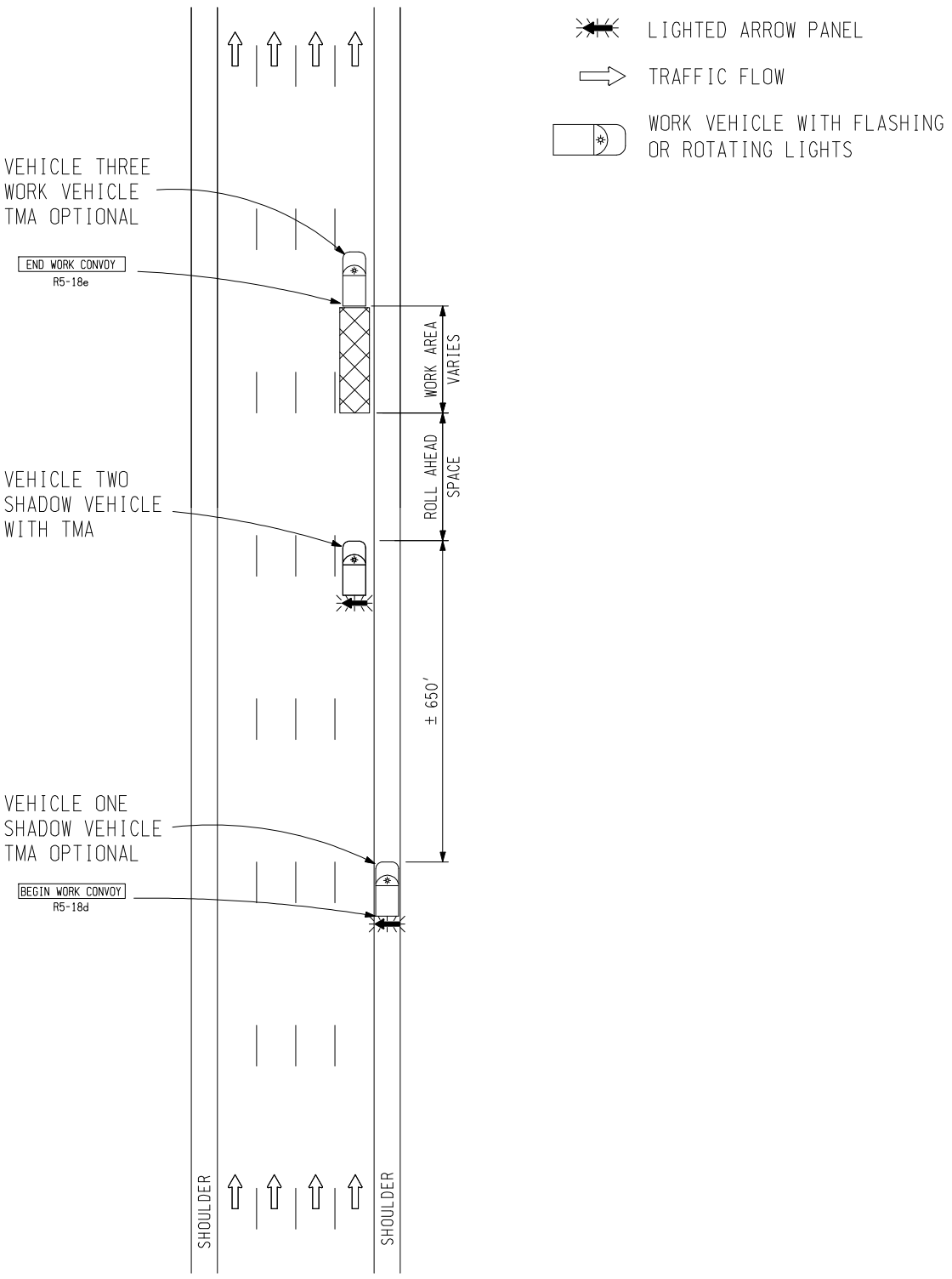
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	LANE CLOSURE OF MULTI-LANE ROADWAY WITH CURBS AND SPEED LIMITS 45 MPH OR LESS	DURATION: SHORT DURATION, MOBILE	
		01/01/07 REV. DATE:	MD - M21
			PAGE A41



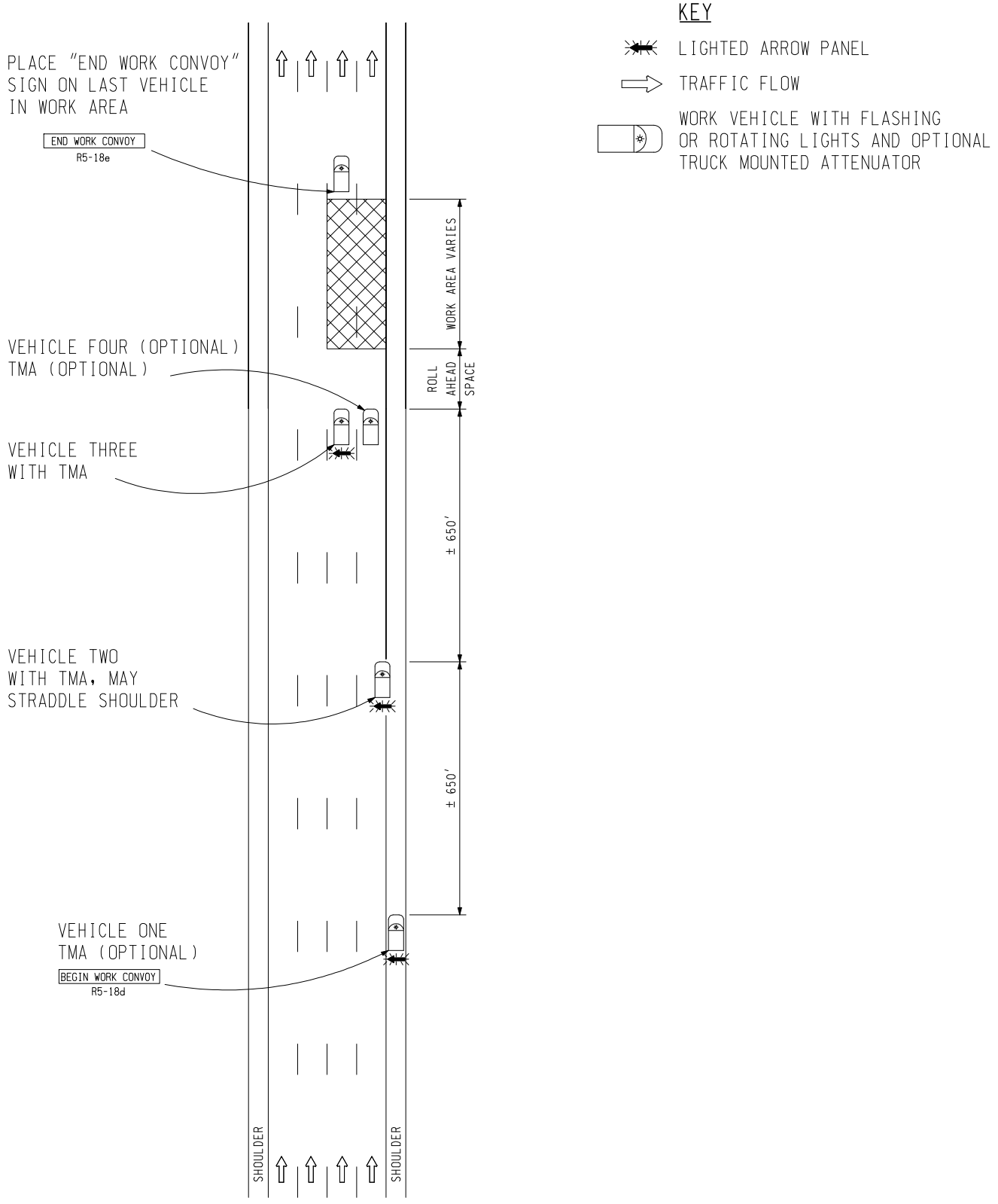
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	MOBILE OPERATION ON A TWO-LANE ROADWAY	DURATION: MOBILE		
		01/01/07 REV. DATE:	MD - M22	PAGE A42



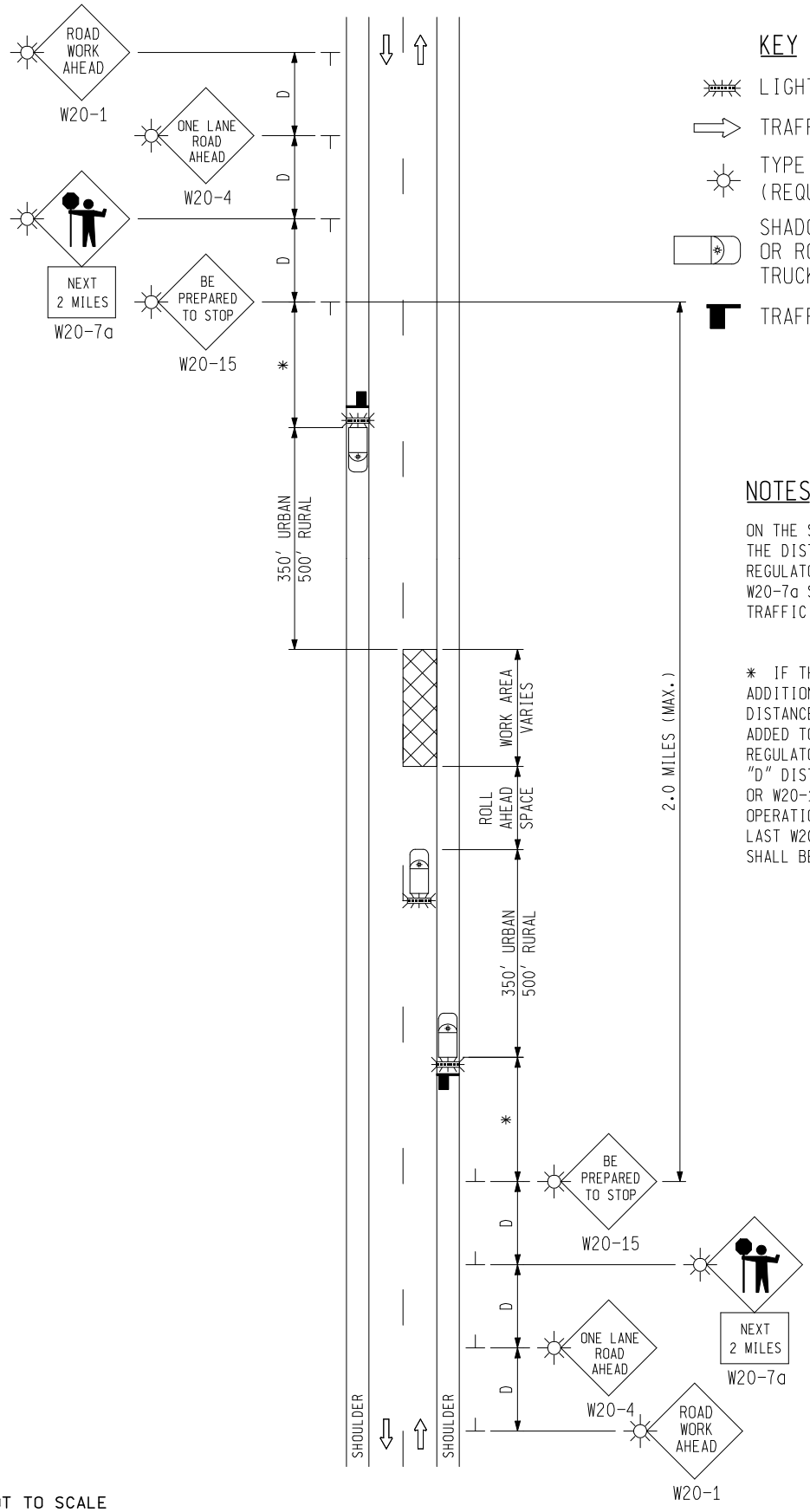
NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	MOBILE OPERATION ON MULTI-LANE ROADWAY	DURATION: SHORT DURATION, MOBILE 01/01/07 REV. DATE:	MD - M23 PAGE A43



NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	URBAN FREEWAY OPERATION	DURATION: SHORT DURATION, MOBILE	
		01/01/07 REV. DATE:	MD – M24
			PAGE A44



KEY

- LIGHTED ARROW PANEL (BAR MODE)
- TRAFFIC FLOW
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- SHADOW VEHICLE WITH FLASHING OR ROTATING LIGHTS AND OPTIONAL TRUCK MOUNTED ATTENUATOR
- TRAFFIC REGULATOR

NOTES

ON THE SIDE OPPOSITE THE WORK AREA AS THE DISTANCE BETWEEN THE TRAFFIC REGULATOR AND W20-7a SIGNS DECREASES, W20-7a SIGNS CLOSER THAN "D" TO THE TRAFFIC REGULATOR SHALL BE PICKED UP.

* IF THE DISTANCE EXCEEDS $^1/_2$ MILE AN ADDITIONAL W20-7A SIGN (WITHOUT THE DISTANCE AHEAD PLACARD) SHALL BE ADDED TO THE SEQUENCE. THE TRAFFIC REGULATOR SHALL STAY A MINIMUM OF A "D" DISTANCE BEYOND THE LAST W20-7a OR W20-15 SIGN IN THE SEQUENCE. AS THE OPERATION MOVES $^1/_2$ MILE BEYOND THE LAST W20-7a SIGN ANOTHER W20-7a SIGN SHALL BE ADDED TO THE SEQUENCE.

NOT TO SCALE

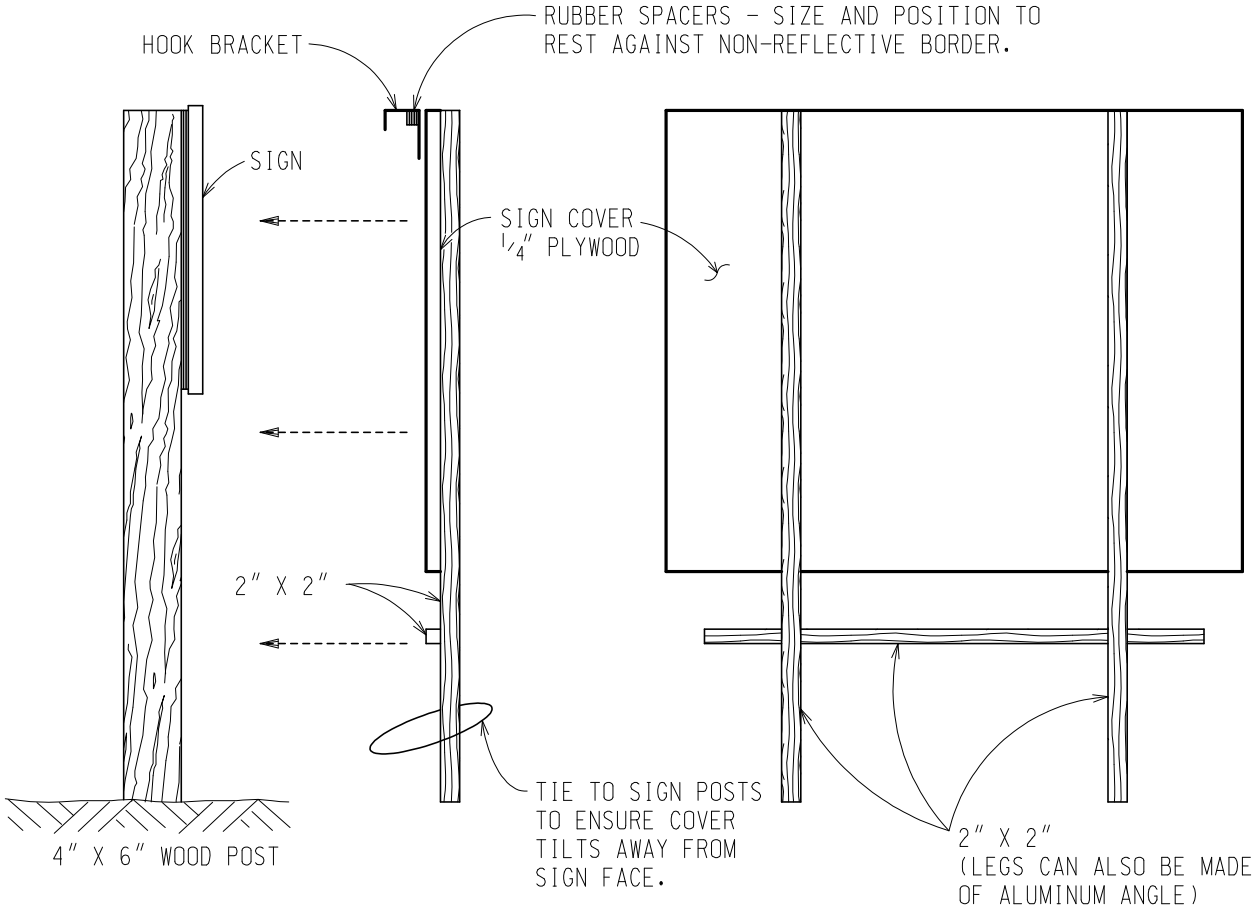
MDOT Michigan Department of Transportation
OPERATIONS

MOVING LANE CLOSURE ON A TWO-LANE ROADWAY

DURATION: SHORT DURATION, MOBILE

01/01/07
REV. DATE:

MD - M25



THIS COVER IS PRIMARILY DESIGNED TO COVER SPEED LIMIT SIGNS ON FREEWAYS. IF YOU ARE TRYING TO COVER ANOTHER KIND OF SIGN, PLEASE CONTACT TSC OR REGION TRAFFIC REPRESENTATIVE.

NOT TO SCALE

MDOT Michigan Department of Transportation OPERATIONS	SIGN COVER	01/01/07 REV. DATE:	MD - COVER	PAGE A46

DISTANCE BETWEEN TRAFFIC SIGNS "D"

"D" DISTANCES	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
D (FEET)	250	300	350	400	450	500	550	600	650	700

GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE "B"

"B" LENGTHS	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
B (FEET)	50	83	132	181	230	279	329	411	476	542

MINIMUM MERGING TAPER LENGTH "L" (FEET)

OFFSET FEET	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)										
	25	**30**	**35**	**40**	45	50	55	60	65	70	
8	**83**	**120**	**163**	**213**	360	400	440	480	520	560	TAPER LENGTH "L" IN FEET
9	**94**	**135**	**184**	**240**	405	450	495	540	585	630	
10	**104**	**150**	**204**	**267**	450	500	550	600	650	700	
11	**115**	**165**	**225**	**293**	495	550	605	660	715	770	
12	**125**	**180**	**245**	**320**	540	600	660	720	780	840	
13	**135**	**195**	**266**	**347**	585	650	715	780	845	910	
14	**146**	**210**	**286**	**374**	630	700	770	840	910	980	
15	**157**	**225**	**307**	**400**	675	750	825	900	975	1050	

THE FORMULAS FOR THE MINIMUM LENGTH OF A MERGING TAPER IN DERIVING THE "L" VALUES SHOWN IN THE ABOVE TABLES ARE AS FOLLOWS:

"L" = $\frac{W \times S^2}{60}$ WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 40 MPH OR LESS

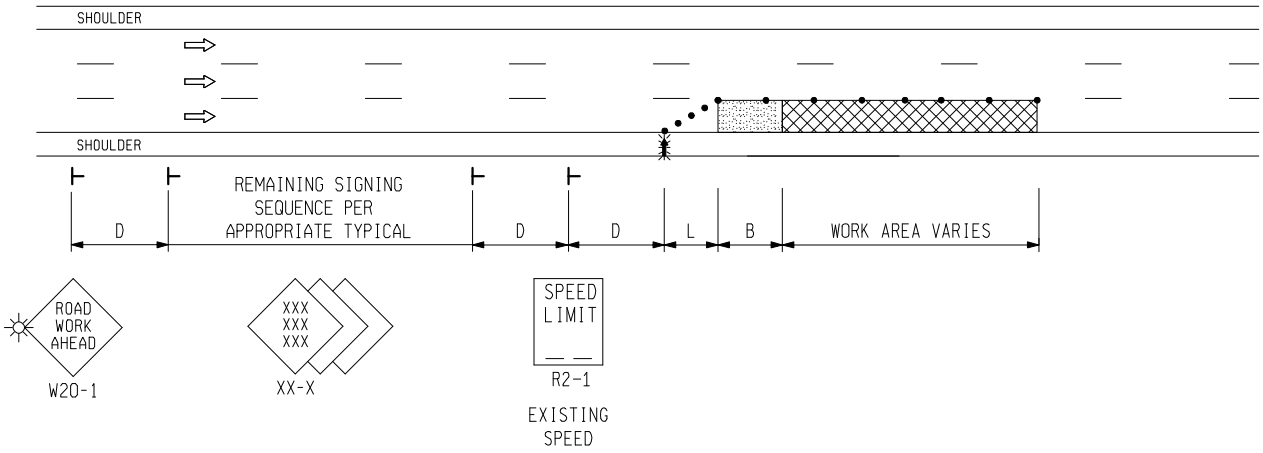
"L" = W x S WHERE POSTED SPEED PRIOR TO THE WORK AREA IS 45 MPH OR GREATER

L = MINIMUM LENGTH OF MERGING TAPER
S = POSTED SPEED LIMIT IN MPH PRIOR TO WORK AREA
W = WIDTH OF OFFSET

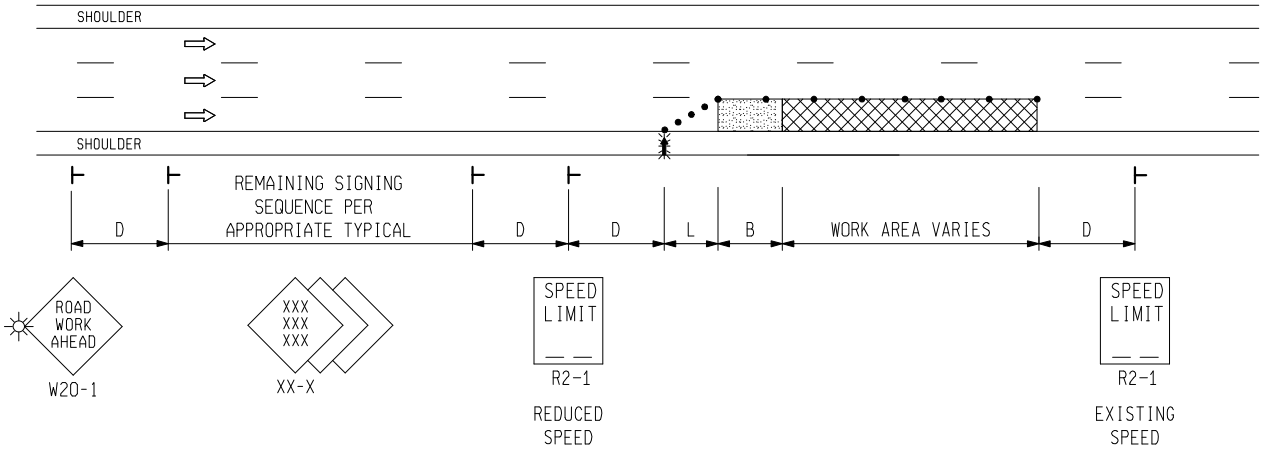
TYPES OF TAPERS	TAPER LENGTH
UPSTREAM TAPERS	
MERGING TAPER	L - MINIMUM
SHIFTING TAPER	1/2 L - MINIMUM
SHOULDER TAPER	1/3 L - MINIMUM
TWO-WAY TRAFFIC TAPER	100 ' - MAXIMUM
DOWNSTREAM TAPERS (USE IS OPTIONAL)	100 ' - MINIMUM (PER LANE)

NOT TO SCALE

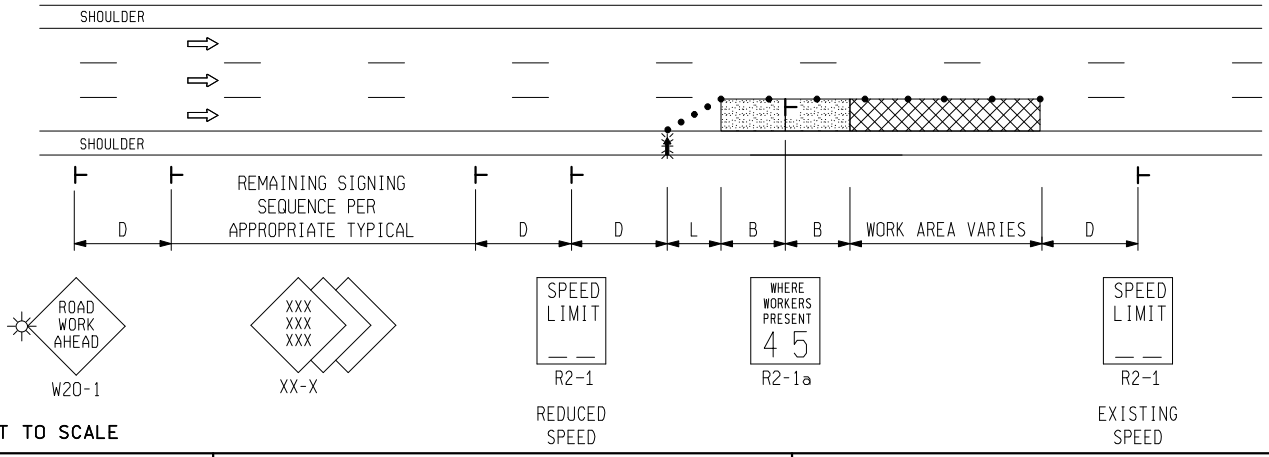
NO SPEED REDUCTION THROUGH WORK ZONE



REDUCED SPEED THROUGH WORK ZONE



REDUCED SPEED THROUGH WORK ZONE USING "WHERE WORKERS PRESENT"



NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

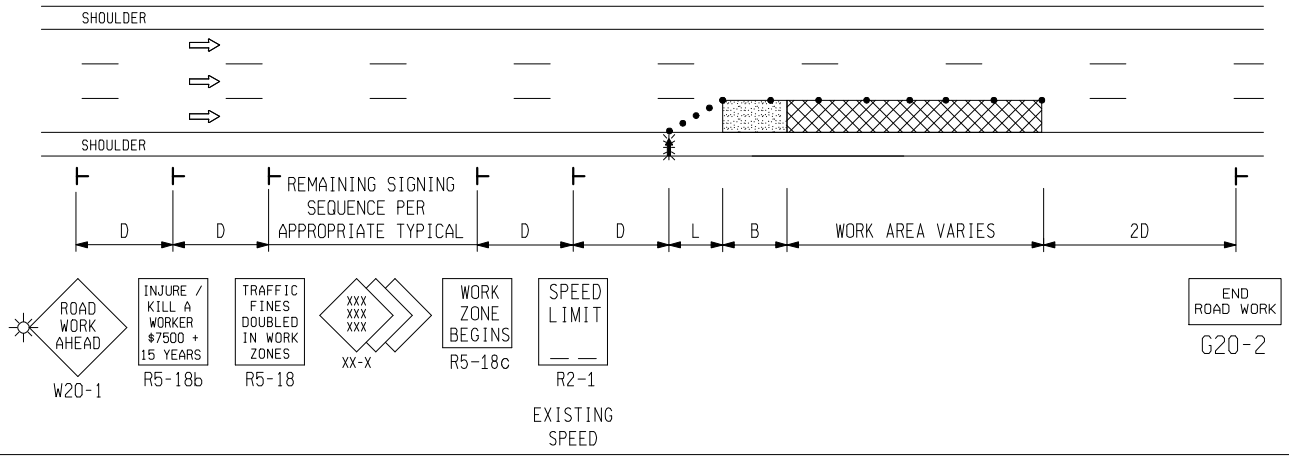
WORK ZONE SIGNING SEQUENCE AND SETUP

DURATION: SHORT-TERM STATIONARY

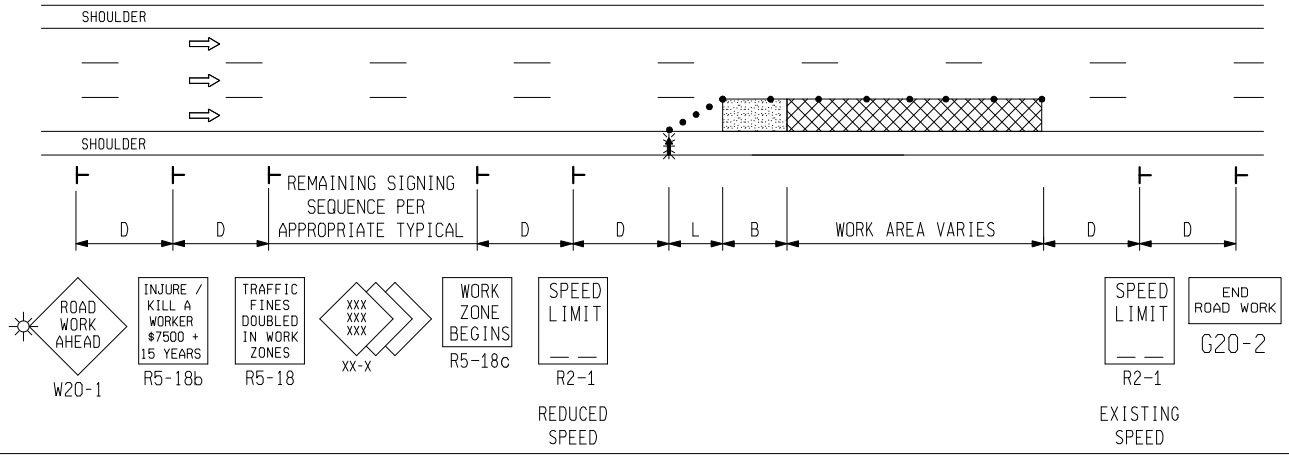
01/01/07
REV. DATE:

MD - WZSH

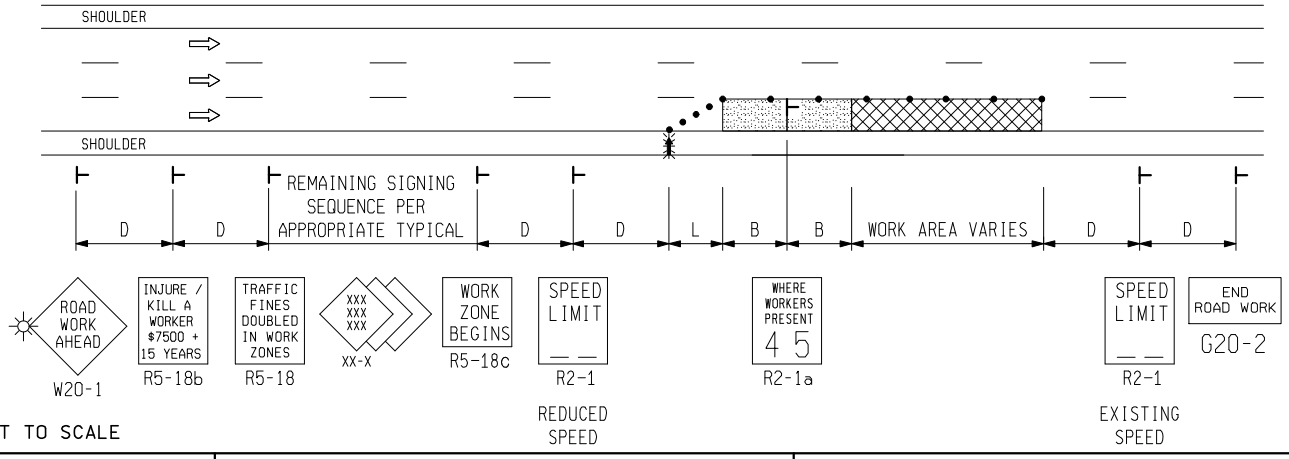
NO SPEED REDUCTION THROUGH WORK ZONE



REDUCED SPEED THROUGH WORK ZONE



REDUCED SPEED THROUGH WORK ZONE USING "WHERE WORKERS PRESENT"



NOT TO SCALE

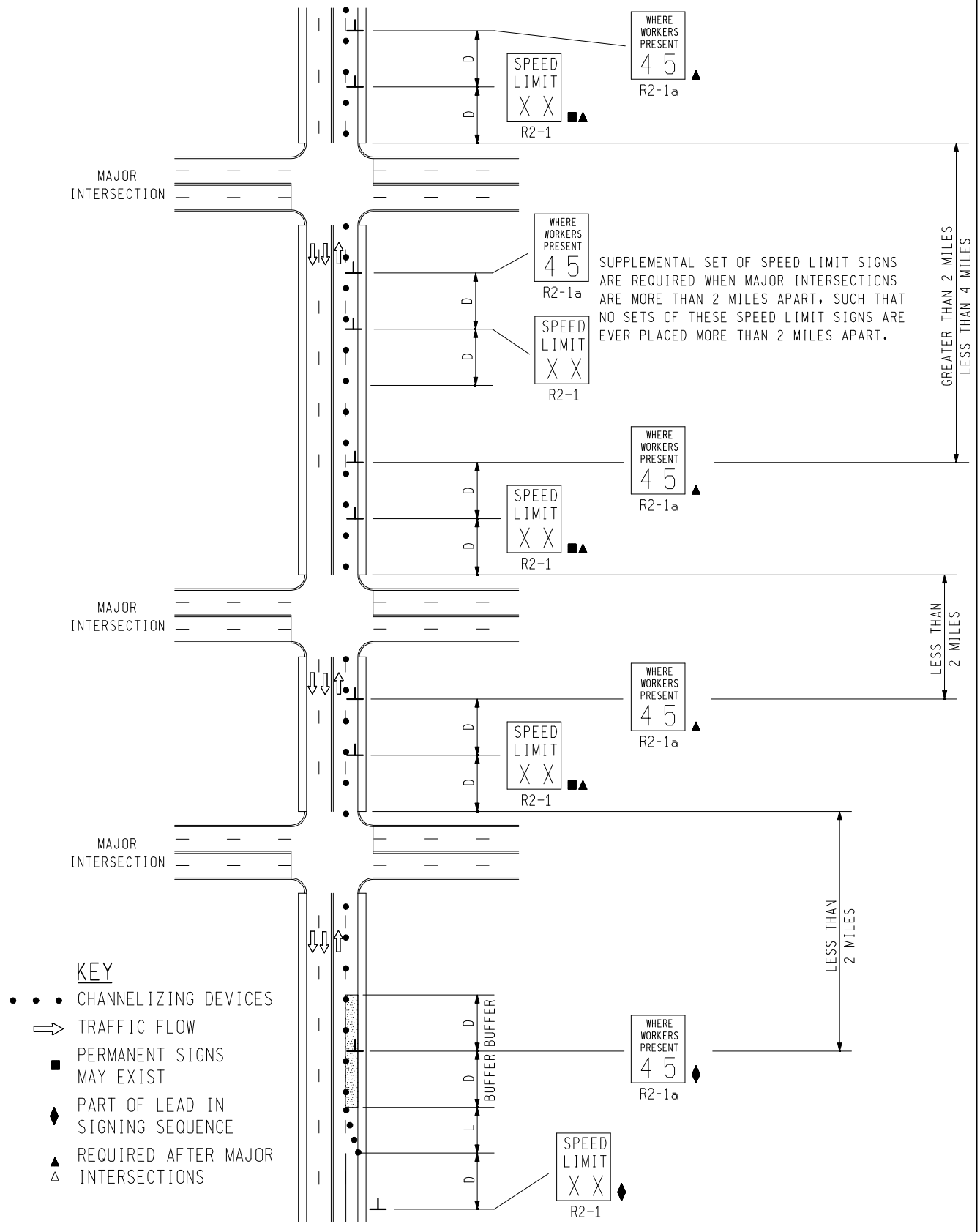
MDOT Michigan Department of Transportation
OPERATIONS

WORK ZONE SIGNING SEQUENCE AND SETUP

DURATION: LONG-TERM STATIONARY
INTERMEDIATE-TERM STATIONARY

01/01/07
REV. DATE:

MD - WZLG

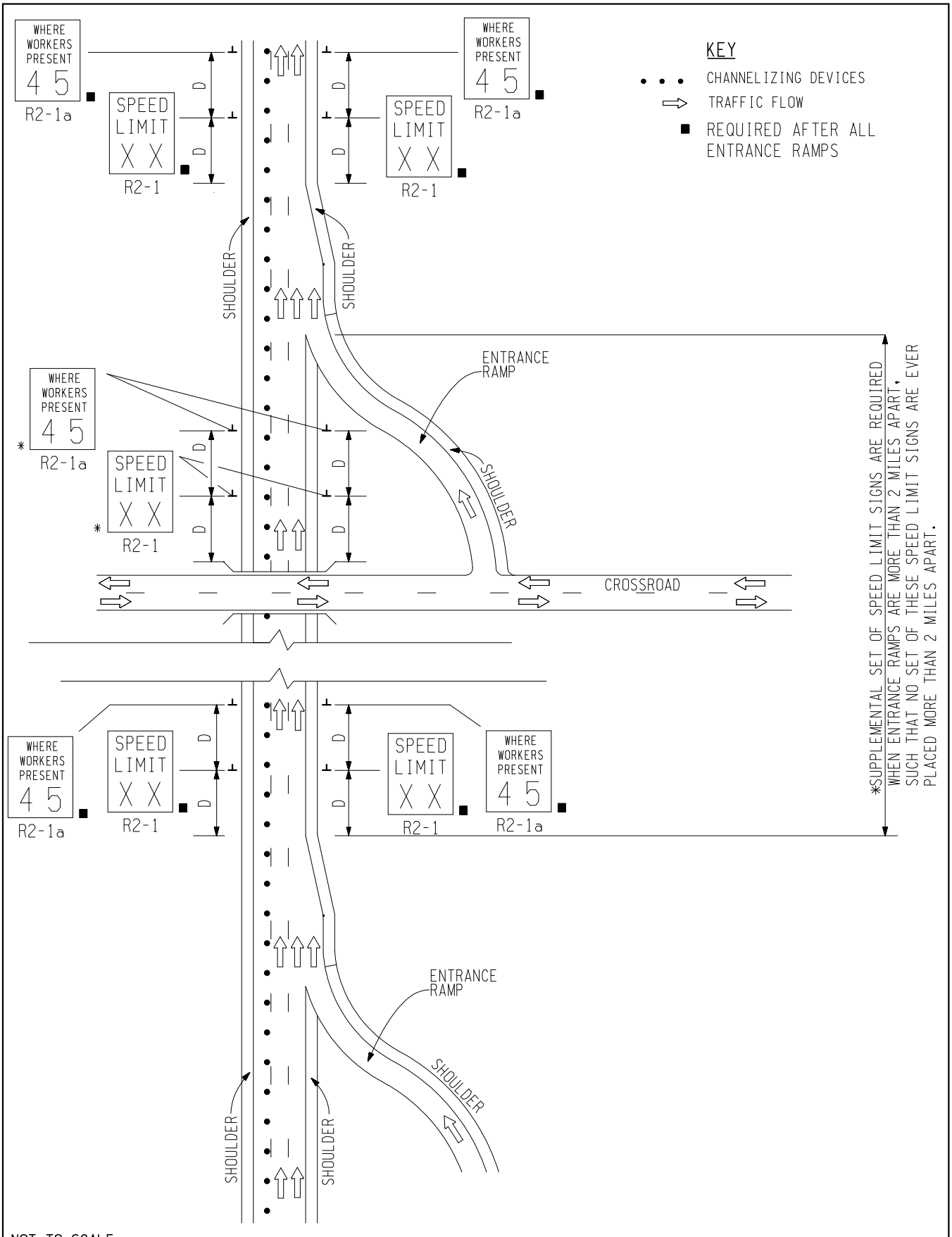


NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

TYPICAL TEMPORARY TRAFFIC CONTROL FOR SUPPLEMENTAL SPEED LIMIT TREATMENT ON A TWO-WAY ROADWAY WHERE WORKERS PRESENT

01/01/07 REV. DATE:	MD – WWP 1	PAGE A50



NOT TO SCALE

MDOT Michigan Department of Transportation
OPERATIONS

TYPICAL TEMPORARY TRAFFIC CONTROL
FOR SUPPLEMENTAL SPEED LIMIT
TREATMENT ON LIMITED ACCESS ROADWAYS
WHERE WORKERS PRESENT

01/01/07
REV. DATE:

MD - WWP 2

Appendix B

Guidelines for Truck Mounted Attenuator Used by Maintenance Forces Working on MDOT Projects

The following guidelines have been developed to provide MDOT maintenance forces guidance on typical applications, equipment and operation of TMAs (Truck Mounted Attenuator). TMAs are devices that are mounted to the rear of a truck which may reduce the impact of a rear-end collision.

Examples of TMA application

TMAs should be considered for use when maintenance operations are conducted where the posted speeds are 45 mph or greater; where personnel and/or equipment occupy a lane customarily used by traffic. Following are other work and traffic scenarios that could warrant the use of a TMA.

- When shadow vehicles are used as a protective vehicle.
- Operations requiring aerial work on scaffolding, lifts, hoists, bucket trucks, etc., that are exposed to moving traffic that require a stationary lane closure. Due to the danger associated with aerial work it is recommended that TMAs be considered for work on roadways with speeds less than 45 mph.
- When conducting moving/intermittent operations such as sign installations, luminaire installations, etc.
- Implementing lane closures, traffic shift operations, painting operations, etc.
- Placing/retrieving traffic control devices related to work zone activities.

Exception: The use of a TMA while performing the installation and maintenance of a traffic signal is not recommended.

Equipment Requirements

TMA

All TMA's used shall meet or exceed the requirements of NCHRP 350 test level 2 or test level 3 as described below for work zone traffic control devices.

A TMA rated for (NCHRP 350 – Test Level 2) may be used on non-freeway roadways with a normal posted speed of 40 mph or less. Test Level 2 TMA's shall be prohibited for use on all freeways, non-freeway roadways, and work zones with posted speed limits of 45 mph or greater.

A TMA rated for (NCHRP 350 – Test Level 3) shall be utilized on freeways, non-freeway roadways and work zones with posted speed limits of 45 mph or greater. Test Level 3 TMA's may be used on all roadways and work zones regardless of the posted speed limit.

The face of the TMA, visible to approaching traffic shall have reflectorized alternating yellow and black stripes, sloping downwards in both directions from the center of the attenuator.

Vehicle

Stationary Operation: This work shall consist of furnishing a vehicle with the required gross vehicle weight as shown in the tables below and installing and operating a truck mounted attenuator according to the manufacturer's recommendations. Material loaded onto the vehicle to obtain the required gross weight shall be securely attached to the vehicle. Hazardous materials will not be

allowed on this vehicle. Materials that will be off loaded and incorporated into the maintenance activities shall not be considered part of the vehicle gross weight. The TMA shall not be mounted on a lift vehicle that is used in an aerial maintenance operation.

Mobile Operation: This work shall consist of furnishing a vehicle with the required gross vehicle weight as shown in the tables below and installing and operating a truck mounted attenuator according to the manufacturer's recommendations. Material loaded onto the vehicle for transport or during work operations shall be securely attached to the vehicle. Hazardous materials will not be allowed on this vehicle. Materials that will be off loaded and incorporated into the maintenance activities shall not be considered part of the vehicle gross weight.

Operation and Placement of TMAs

Operation

The TMA shall be operated as per manufacturer's recommendations, and/or as directed by the maintenance supervisor. This includes, but is not limited to, the following:

- The height from the bottom of the TMA to the roadway surface shall be 12 inches (+/- 1 inch).
- The TMA shall be parallel (level) with the roadway surface.
- The manufacturers of the approved TMAs recommend a shoulder harness and headrest to be provided for the operator of the TMA vehicle.

For stationary operations, when operating the vehicle with the attenuator installed, the vehicle shall be in gear if it has a standard transmission (park if an automatic transmission), with the brakes set and steering wheels turned away from the work area and traffic, if possible.

Placement

Refer to the Maintenance Guidelines: Work Zone Traffic Control for proper placement of the TMA. Additional guidance on the proper placement of TMAs may also be found in the manufacturer's documentation and/or as directed by the maintenance supervisor. In a traffic control operation the TMA vehicle should be the first vehicle encountered by the motorist. Please note that some operations require more than one TMA. The number of TMAs required are based on the number of lanes that are closed. An additional TMA may be used on the shoulder of urban freeways.

The use of a TMA does not eliminate or reduce the requirement for the correct application of traffic control devices and measures outlined in the Maintenance Guidelines: Work Zone Traffic Control. If there is a need or desire to use TMAs in situations not covered in the documents mentioned previously, placement requirements will be as directed by the maintenance supervisor.

TMAs should not be used as an attenuator for a temporary/permanent barrier ending except during barrier installation. Other types of attenuators will provide better and broader attenuation characteristics.

Refer to **Table 1** or **Table 2** below for the proper roll-ahead distance of the TMA vehicle.

TABLE 1: Test Level 2 – Guidelines for Roll-ahead Distance for TMA Vehicles

Weight of TMA Vehicle	Prevailing Speed (mph) (Posted Speed Prior to Work Zone)	Roll-Ahead Distance* (Distance from front of TMA Vehicle to Work Area)
5.5 Tons (Stationary)	40 or Less	25 ft

* Roll-ahead distances are calculated using a 4,410 pound impact vehicle weight.

TABLE 2: Test Level 3 – Guidelines for Roll-ahead Distance for TMA Vehicles

Weight of TMA Vehicle	Prevailing Speed (mph) (Posted Speed Prior to Work Zone)	Roll-Ahead Distance* (Distance from front of TMA Vehicle to Work Area)
5 Tons (Mobile)	60-70 50-55 45	175 ft 150 ft 100 ft
12 Tons (Stationary)	60-70 50-55 45	50 ft 25 ft 25 ft

* Roll-ahead distances are calculated using a 10,000 pound impact vehicle weight.