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Publication Distribution To: All holders of the Work Zone Traffic Control Guidelines	
Publication Title Work Zone Traffic Control Guidelines	Publication Number M 54-44
Originating Organization Maintenance and Operations, Traffic Office	

**Please be advised that this revision is electronic only.**

### Guidance revisions

- Page 4, item 4; added wording about vehicle beacon usage and when to turn them off after placing an arrow panel in a stationary lane closure operation.
- Pages 10 & 11 revisions to ANSI vest wording for consistency

### Plan revisions

- Taper and Buffer Chart Pg. 17 of manual (Revised the 2ft lateral buffer space note to be consistent with TCP's)
- TCP 1 Alternating One-Way Traffic Control Plan (Revised the channelizing device spacing chart to eliminate taper confusion with the flagger, updated general notes)
- TCP 5 – Low Speed Shoulder Closure Plan (Removed the word “shoulder” from the taper length chart for consistency with other taper charts in the manual)
- TCP 6 – High Speed Shoulder Closure Plan (Removed the word “shoulder” from the taper length chart and revised the channelizing device spacing chart for consistency with other taper charts in the manual)
- TCD 2 – Typical Motorcycle Signing Detail (Revised the warning sign examples to delete the “BUMP” sign that is not part of the criteria for when to place the signs and added a note that listed the four criteria under what conditions to use the motorcycle warning signs)

### Who to Contact:

Please contact Marty Weed (360) 705-7293 [WeedM@wsdot.wa.gov](mailto:WeedM@wsdot.wa.gov) with questions, comments, or suggestions for improvements to the manual.

### Available On-Line:

The Work Zone Traffic Control Guidelines, M 54-44, is available on the Internet at:  
<http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/Workzone.pdf>

### Instructions:

Chapter	Remove		Insert	
<b>Guidance revisions</b>				
Page 3-4	Page 3-4	1 sheet	Page 3-4	1 sheet
Page 9-12	Page 9-12	2 sheets	Page 9-12	2 sheets
<b>Plan revisions</b>				
Page 17-18	Page 17-18	1 sheet	Page 17-18	1 sheet
Page 19-20	Page 19-20	1 sheet	Page 19-20	1 sheet

Page 23-26	Page 23-26	2 sheets	Page 23-26	2 sheets
Page 67-68	Page 67-68	1 sheet	Page 67-68	1 sheet

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2. **Alertness:**  
There is no place on a “*traffic exposed*” work crew for a daydreamer or distracter. Each individual, for their own protection and that of the crew, must stay constantly alert and watchful.
3. **Attitude:**  
A positive, safety-conscious, attitude on the part of each crewmember will contribute greatly to the overall safety of crew operations.
4. **Responsibility:**  
Each person is responsible for ensuring their own safety and to see all standards are followed. This includes ensuring temporary signs, warning devices, and flag persons are placed appropriately to protect both the motorists and workers. **Motorist and worker safety are of primary importance.**

## Equipment

1. **Traffic Control Device Crash Test Requirements:**  
After October 1, 2000, all new purchases of Category II traffic control devices (portable sign stands with signs, type 1, 2, & 3 barricades, vertical panels, intrusion alarms, and other work zone devices under 100 lbs.) shall be compliant with the federal NCHRP 350 crash test requirements. WSDOT will phase out existing devices as they complete their normal service life. All Category II devices will be "350" compliant by December 31, 2007.
2. **Condition and Care of Equipment:**  
All personal equipment and traffic control devices shall be kept clean to provide protection for the crew through better visibility to the motorist. The condition of signs and traffic control devices shall be “acceptable or marginal” as defined in the book “*Quality Guidelines for Work Zone Traffic Control Devices*”, and will be accepted based on a visual inspection. A sign or traffic control device determined to be “not acceptable” shall be removed from the project. Copies of the Quality Guidelines book may be obtained from the American Traffic Safety Services Association (ATSSA.)
3. **Signs:**  
Signs that are no longer retro-reflective (visible and legible at night) or are in poor condition are to be replaced. Standard 48" x 48" temporary warning signs are diamond shape with black letters or symbols on an orange background. See appendix 2-2, for information on work zone signs and example sheet of Type X sheeting samples.

Some work areas might require the use of special or regulatory signs, contact region traffic office for assistance with special signs. Use of double-faced (back-to-back) signs or signs made of plywood substrate are not allowed. Sign supports must be in good condition and be capable of withstanding normal wind stresses along the highway.

#### 4. **Vehicles:**

- **Work Zone Vehicle** - All construction vehicles, except hauling vehicles, used within the work zone must be equipped with an approved flashing warning beacon. When the beacons are used in conjunction with an arrow board the flashing beacon should be turned off for a stationary operation once the arrow is setup. Consideration must be given to the location of workers in relation to the work vehicles. Worker safety can be jeopardized if the motorists' attention is focused on the work vehicle and beacon when the workers are at an unexpected location.
- **Protective Vehicle** - Usually a stationary vehicle (in stationary work zones) strategically placed in advance of the work area, between the buffer space and the roll-ahead space, to protect workers from oncoming traffic. The use of a Truck Mounted Attenuator (TMA) on this vehicle is recommended. Allow for roll-ahead distance resulting from an impact. Refer to the data block on the TCP's for specific information. The Protective vehicle can be a work vehicle if no other vehicles are available.
- **Shadow Vehicle** - Very similar to the protective vehicle but usually a moving vehicle (mobile work zones). All of the above guidelines for the protective vehicle applies to the shadow vehicle except for the roll-ahead distances only apply to a stationary operation. An arrow panel or truck mounted Portable Changeable Message Sign (PCMS) may also be used on the shadow vehicle.

#### 5. **Truck Mounted Attenuators (TMA):**

A truck mounted attenuator (TMA) is a portable impact attenuator attached to the rear of a large truck. Ballast is added to the truck to minimize the roll-ahead distance when impacted by a vehicle. The TMA is used as a shield to prevent errant vehicles from entering the work zone. If a TMA is not available, the use of a protective or shadow vehicle is still highly recommended.

#### **Considerations for the use of TMA's:**

- **Speed of Traffic** - Higher operating speeds leave less reaction time and impacts generally result in more severe injuries and damage. Therefore, the higher the operating speed the more probability that a TMA is necessary.
- **Type of activity** - Mobile, intermittent or stationary.
- **Duration of project** – Typically daily maintenance operations are suitable for TMA's but for longer term operations positive protection from devices such as temporary concrete barrier should be considered.
- **Roadway environment** - Access controlled vs. non-access controlled, urban vs. rural, and roadway geometrics. Access controlled facilities frequently give drivers a false sense of security since interruptions are not expected. Therefore, activities on freeways may be more susceptible to incidents than are activities on non-access controlled facilities, where drivers are generally more alert.

## 17. Specific Warning Sign Requirements

### **Examples:**

- Abrupt Lane Edge
- Motorcycles Use Extreme Caution
- Bump
- Traffic Revision Ahead
- Road Narrows
- Grooved Pavement
- Rough Road
- Loose Gravel
- No Shoulder
- Water Over Roadway

Not all warning signs are shown on the traffic control plans but are required to address specific work zone hazards when conditions warrant, particularly if the hazard is not obvious or cannot be seen by approaching motorists.

## 15. Personal Protective Wear:

- Hard hats are required when working on or around the following:
  - Asphalt Plant, Crushers, Blasting Area, and Asphalt grinding operations.
  - Construction of bridges, structures, retaining walls, etc.
  - Overhead work such as working in a trench, rock-fall areas, sign installation, installing poles, work under bridges, electrical conductors, etc.
  - Working near operating equipment with arms, booms, buckets, etc.
  - Work around cranes, pile driving, drilling.
  - During work as a flagger.
  - Brush cutter work, danger tree work, and other logging operations.
  - On any construction site whenever there is a potential exposure to danger from falling objects to persons working or occupying the area.
  - Any designated hardhat area.

The wearing of soft caps is permitted in accordance with the WSDOT Personal Protective Equipment Chapter of the Safety Procedures and Guidelines Manual (Chapter 5). Supervisors have the authority to require employees to wear hard hats for other activities where there is a danger from impact and/or penetration of falling and flying objects. Employees must have a hard hat on site and readily available for use when work conditions require their use.

## 15. High Visibility Apparel:

- While working on foot in a highway right of way (fence line to fence line) or in other areas where job duties are performed in proximity to moving vehicles/equipment, WSDOT workers shall:

### **For Flagging Operations:**

- During daylight hours, flaggers must wear an ANSI/ISEA approved class II high-visibility vest; while flagging, a hard hat is required at all times.
- During hours of darkness, flaggers shall wear a ANSI approved Class II vest with high-visibility Class E orange pants.
- During hours of darkness, flaggers must wear a high-visibility hardhat with at least 12 square inches of retro-reflective material applied to the hardhat to provide 360 degrees of visibility.
- During inclement environmental conditions with limited visibility (e.g., snow, fog, heavy rain) an ANSI Class III high-visibility ensemble is required. An example of a class III ensemble would include an ANSI Class II high-visibility vest worn in tandem with ANSI Class E orange retro-reflective pants or an ANSI class III raingear ensemble.
- High-visibility garments shall always be the outermost garments.

### **For NON-Flagging Operations:**

- During hours of darkness, employees shall wear ANSI/ISEA approved class II garments (e.g., vests, jackets, pullovers, T-shirts) and white coveralls or ANSI Class E pants.
- During daylight hours, employees shall wear ANSI/ISEA approved class II garments (e.g., vests, jackets, pullovers, T-shirts), except that during daylight hours, an orange T-shirt with two 2-inch wide yellow stripes front and back may be worn.

**Exceptions to these high visibility requirements:** (1) when personnel are out of view of, or not exposed to, traffic, (2) when personnel are inside a vehicle, or (3) where it is obvious that such apparel is not needed for employee safety from traffic.

### **The standard WSDOT garments are either:**

- ANSI/ISEA standard Class II Fluorescent Orange-Red textured Woven polyester vest with Fluorescent lime yellow or ANSI approved equal strips from state contract,
- ANSI/ISEA standard Class II lightweight Fluorescent Orange-Red Mesh vest with Fluorescent lime yellow or ANSI approved equal strips from state contract, or
- ANSI/ISEA standard Class II Surveyors with Fluorescent lime yellow or ANSI approved equal strips from state contract,
- ANSI/ISEA standard Class E high-visibility pants from state contract,
- ANSI/ISEA class III ensemble raingear from state contract.

A standard WSDOT approved T-shirt may be purchased by WSDOT employees and/or their respective organizations and worn in lieu of the WSDOT Safety Vest by employees during daylight hours and when not working as a flagger. T-shirts shall not have any words or “ads” affixed to them. The WSDOT T-shirt standard requires a crew neck, base color orange, minimum 2 each 2” horizontal yellow bars on front and back with at least 2” apart vertically. The Appointing Authority and/or Region Safety Manager shall have final approval authority over both the T-shirt itself and its use.

In the link below is access to Washington State purchasing contracts for high visibility apparel (contract #00403) and high visibility raingear (contract #12200). Please use the contract numbers to find the contract documentation.

<http://www.ga.wa.gov/pca/pcacust.htm>

## Flagging

- Flagging should be employed only when all other methods of traffic control are inadequate to direct, or control, traffic.
- Locate the flagger off the traveled portion of the roadway. More than one flagger may be necessary to achieve traffic control in both directions. A means of communication between flaggers must be considered in these situations. Communication by hand held radio is the recommended procedure.
- Only persons who have successfully completed an approved flagging course and who possess current flagging certification recognized in Washington State can be used as flaggers.
- Freeway characteristics do not lend themselves to effective flagging. High speed multiple lanes and normal driver expectancy do not provide an opportunity for the flagger to actually warn or direct traffic, therefore flagging on freeways and freeway ramps is not normally recommended. However, using a “spotter” may be helpful to protect the work crew.
- In a mobile flagging operation when the flagger is moving with the operation, all signs associated with the flagger shall be moved ahead whenever work advances to more than 2 miles from the advance warning signs; also, **the flagger ahead (symbol or text message) sign must be within 1,500 feet of the flagger.**
- During hours of darkness flagger stations shall be illuminated without causing glare to the traveling public.
- When flagging in the vicinity of signalized intersections special consideration must be made to address the specific needs to traffic movements. The signal must be either turned off or set to red “flash” mode. At no time shall traffic be flagged with an active signal.
- **The placement of a flagger at the center of an intersection to control traffic is not allowed,** the only person allowed to legally control traffic from the center of an intersection is a uniformed police officer.

### **Flagger’s Rules of Conduct**

1. Be clearly visible to approaching traffic at all times.
2. Do not stand in front of parked/stopped cars.
3. Always be aware of oncoming traffic.
4. Do not step into, or turn your back on the traffic.

5. Stand on the shoulder of the road observing traffic and the work zone. You may have to stand on the opposite side of the road to effectively direct traffic around the work.
6. Choose the best flagging position that will provide the greatest color contrast between you and the background.
7. If at all possible, do not stand in the shade.
8. Never flag from inside a vehicle.
9. Do not lean, sit or lie on a vehicle.
10. Stand alone. Do not permit a group of workers to congregate around you.
11. Familiarize yourself with the nature of the work being performed. Be able to answer motorists' questions. Be aware of the work in progress.
12. Establish a warning signal with the work crew in case of an emergency.
13. Plan an escape route in case of an emergency.
14. Stay alert! Be ready to respond to an emergency.
15. Record the license number and description of any vehicle whose driver disobeys your instructions and threatens the safety of the work area. Report information to authorities.
16. Be courteous and professional.
17. Keep your mind on your job; do not do any other work when flagging.
18. Do not involve yourself in unnecessary conversation with workers, pedestrians, or motorists.
19. Do not leave your position until you are appropriately relieved.
20. Cover, turn or remove the "FLAGGER AHEAD" sign when a flagger is no longer on duty.
21. Always carry your flagger certification card while on the job.

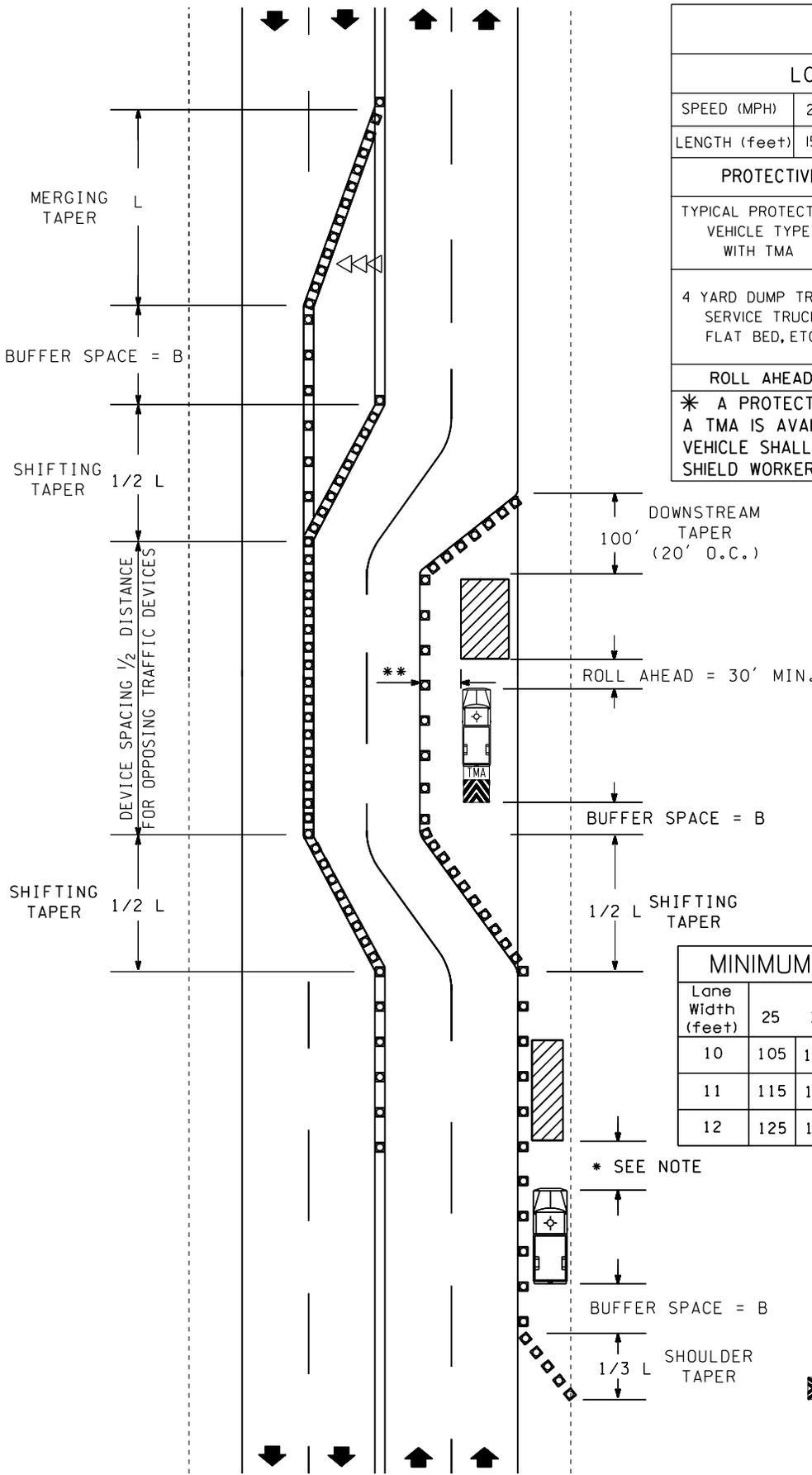
## **Pedestrians, Bicycles and Other Roadway Users**

Give consideration to pedestrian and bicycle traffic where appropriate. Provide alternative routes where designated walkways or bicycle routes are temporarily interrupted due to work operations. Alternative routes need to be free of obstructions and hazards (e.g., holes, debris, mud, construction and stored equipment, etc.). Clearly delineate all hazards near or adjacent to the path (e.g., ditches, trenches, excavations, etc.). Refer to MUTCD Part VI, Chapter 6D for additional requirements.

### **Pedestrians:**

Most public highways and streets cannot deny access to pedestrians if no other route is available to them. All pre-existing ADA compliant pedestrian facilities within the work zone must continue to comply with ADA requirements for barrier-free access during work operations. Consider the following when addressing pedestrian issues within and around work zones:

- Pedestrians should not be led into conflicts with work site vehicles, equipment, and operations.
- Pedestrians should not be led into conflicts with vehicles moving through or around the work site.
- Pedestrians should be provided with a safe, convenient path that replicates as nearly as practical the most desirable characteristics of the existing sidewalks or a footpath.
- Pedestrians generally will not go out of their way. Make alternate pathways reasonable.



BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)							STATIONARY OPERATION (feet)		
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)							30 MIN.		
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

\*\* LATERAL BUFFER SPACE IS 2 FEET FOR HIGH SPEED WORK ZONES.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40

MINIMUM TAPER LENGTH (L) IN FEET										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	265	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	780	840

**LEGEND**

- ◀◀◀ ARROW PANEL
- □ □ CHANNELIZING DEVICES
- PROTECTIVE VEHICLE WITH OR WITHOUT TMA - RECOMMENDED
- PROTECTIVE VEHICLE WITH TMA - RECOMMENDED

TAPER AND BUFFER SPACE DETAILS

# TAPER / CHANNELIZING DEVICE TABLE

MERGING, SHIFTING & SHOULDER TAPER LENGTHS  
AND NUMBER OF CHANNELIZATION DEVICES USED

(All minimums)

Lane Width	10 Feet				11 Feet				12 Feet				Shoulder Tapers (Assumes 10' Shoulders)		
	L		1/2 L		L		1/2 L		L		1/2 L		*1/3L		
MPH	Merging	Devices	Shifting	Devices	Merging	Devices	Shifting	Devices	Merging	Devices	Shifting	Devices	MPH	(ft) Length	Devices
20	70	6	35	3	75	6	40	3	80	6	40	3	20	25	3
25	105	6	55	4	115	7	60	4	125	7	65	4	25	35	3
30	150	8	75	5	165	9	85	5	180	10	90	5	30	50	3
35	205	8	105	5	225	9	115	5	245	9	125	5	35	70	4
40	270	10	135	6	295	11	150	6	320	12	160	6	40	90	4
45	450	16	225	9	495	18	250	9	540	19	270	10	45	150	6
50	500	14	250	8	550	15	275	8	600	16	300	9	50	170	6
55	550	15	275	8	605	16	305	9	660	18	330	9	55	185	6
60	600	16	300	9	660	18	330	9	720	19	360	10	60	200	6
65	650	17	325	9	715	19	370	10	780	21	390	11	65	220	7
70	700	19	350	10	770	20	385	11	840	22	420	12	70	235	7

\*L for shoulder taper equals  
Shoulder Width x Speed.  
Figures shown are for a  
10' shoulder.

\* The number of channelizing devices listed is the minimum required. Use of more devices should be considered if additional delineation is desired.

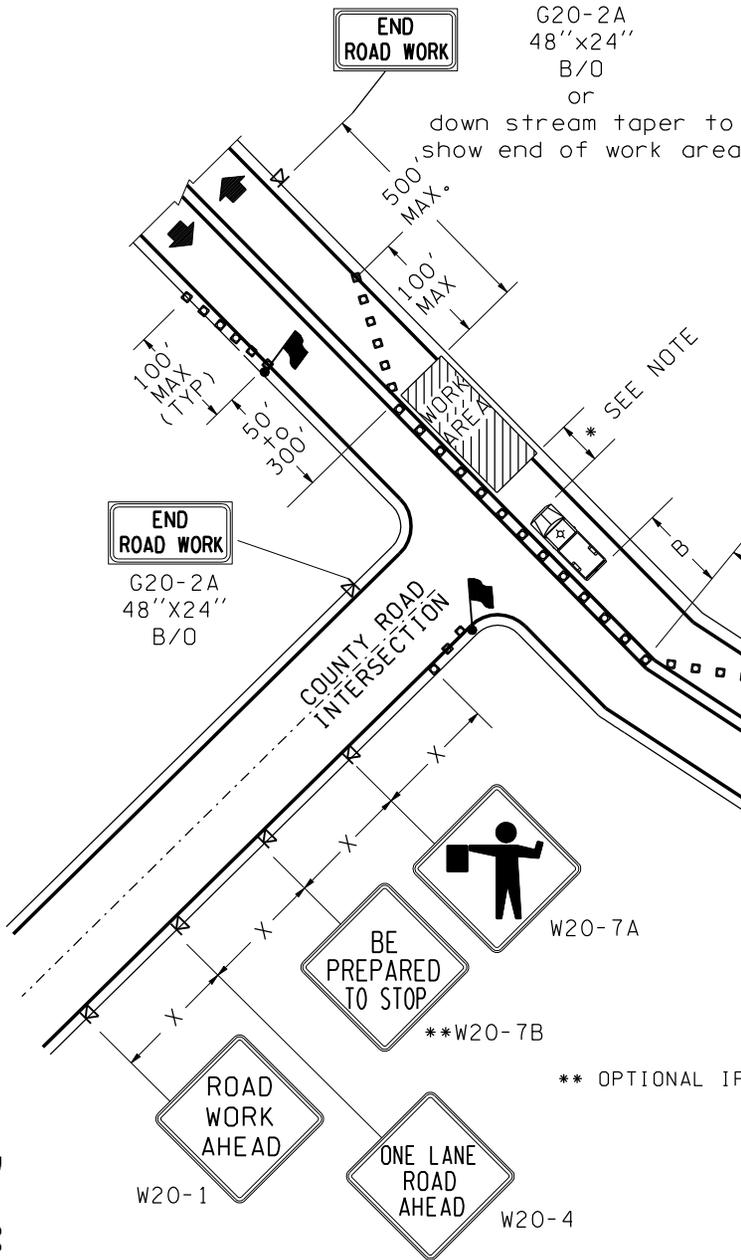
\*\* Termination taper, when used should have a minimum length of 100' per lane with devices placed approximately 20' O.C.

## **STATIONARY WORK ZONES**

### Traffic Control Plans (TCP's) 1 to 13

Stationary work zones are used for work activities that exceed one hour but could last for several days. Signs and channelizing devices are required for stationary work zones. Devices, such as sequential arrow panels, barricades and protective vehicles, may also be used depending on the situation. For longer term projects, temporary concrete barrier, temporary pavement markings and post mounted signs might be typical devices. Examples of stationary work zone operations include: light standard repair, paving, sign installation and bridge repair. Stationary work zone traffic control is usually associated with a substantial work operation that may have many workers, equipment, truck hauling and flagging. Traffic operation, all work activities, workers and flaggers must be incorporated into the work zone and provided for during planning and selecting the Traffic Control Plans (TCP's).

The following TCP's show typical stationary traffic control setups.



SIGN SPACING = X (feet) (1)		
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.  
 (2) This spacing may be reduced in urban areas to fit roadway conditions.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	-
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)						STATIONARY OPERATION (feet)			
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)						30 MIN.			
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

CHANNELIZING DEVICE SPACING (feet)			
MPH	TAPER	TANGENT	
50/70	-	80	
35/45	-	60	
25/30	-	40	

\*\* OPTIONAL IF 40 MPH OR LESS

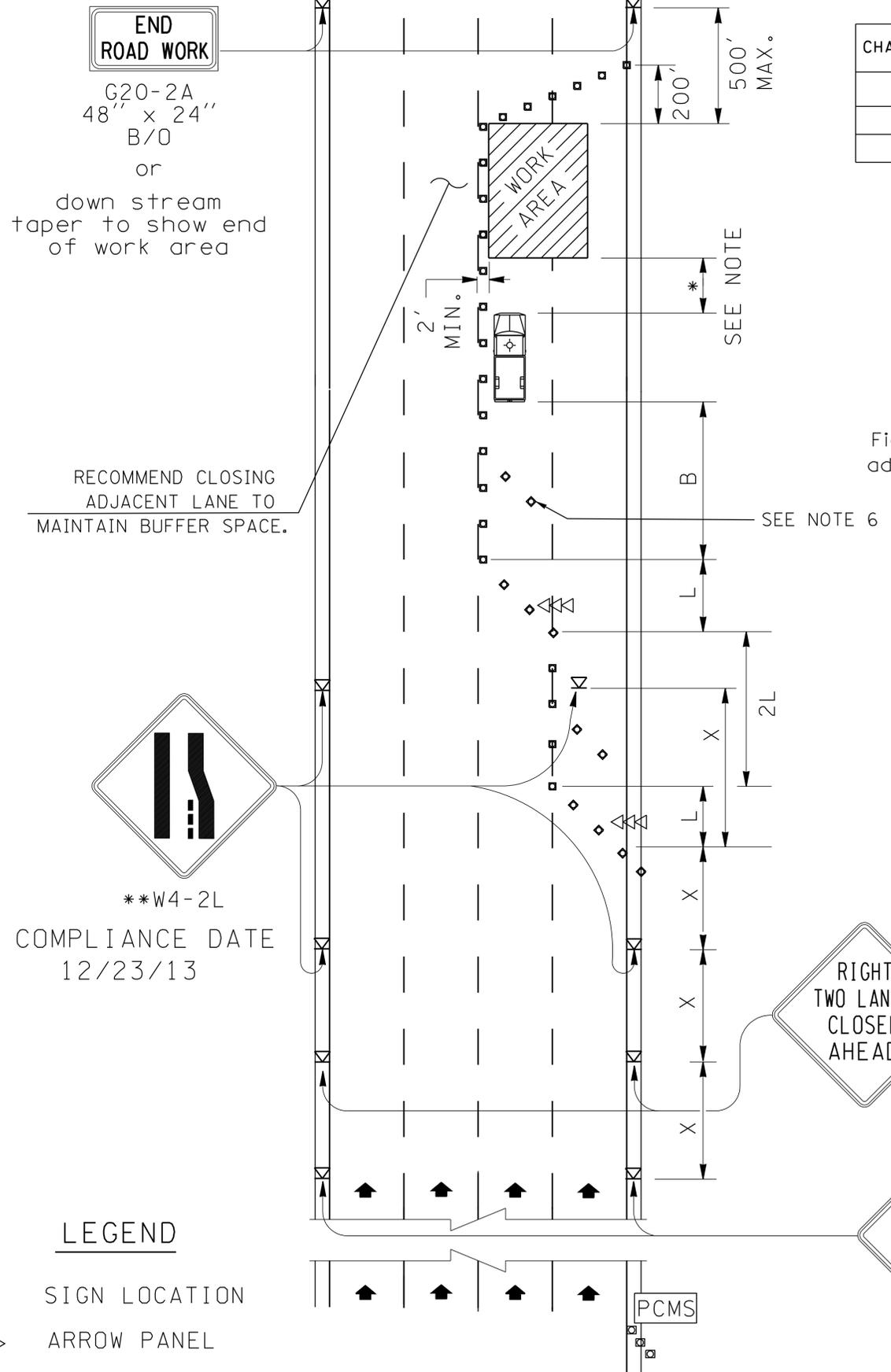
**LEGEND**

- FLAGGING STATION
- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED

**ALTERNATING ONE-WAY TRAFFIC  
 FLAGGER CONTROLLED  
 TCP 1**

GENERAL NOTES

- NIGHTWORK REQUIRES ADDITIONAL ROADWAY LIGHTING AT FLAGGING STATIONS. REFER TO WSDOT STD. SPECIFICATIONS FOR ADDITIONAL DETAILS.
- RECOMMEND EXTENDING CHANNELIZING DEVICE TAPER ACROSS SHOULDER.
- PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
- SIGN SEQUENCE IS THE SAME FOR BOTH DIRECTIONS OF TRAVEL ON THE ROADWAY.
- FOR LOW-VOLUME SITUATIONS WITH SHORT WORK ZONES ON STRAIGHT ROADWAYS WHERE THE FLAGGER IS VISIBLE TO ROAD USERS APPROACHING FROM BOTH DIRECTIONS, A SINGLE FLAGGER, POSITIONED TO BE VISIBLE TO ROAD USERS APPROACHING FROM BOTH DIRECTIONS, MAY BE USED.
- WHEN USED, THE DOWNSTREAM TAPER DEVICE SPACING SHOULD BE 20' O.C.



**LEGEND**

- ▣ SIGN LOCATION
- ▢ ARROW PANEL
- ▣ CHANNELIZING DEVICES
- ▣ PROTECTIVE VEHICLE - RECOMMENDED
- ▣ PCMS PORTABLE CHANGEABLE MESSAGE SIGN

**CHANNELIZING DEVICE SPACING (FEET)**

MPH	TAPER	TANGENT
50/70	40	80
40/45	30	60

(SAMPLE MESSAGE)

**PCMS**

1	2
2 LANES CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

Field locate 1 mile +/- in advance of lane closure.

**BUFFER DATA**

LONGITUDINAL BUFFER SPACE = B

SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE

TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN.

ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT

\* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.

**MINIMUM TAPER LENGTH (L) IN FEET**

Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	-	-	-	265	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

**SIGN SPACING = X (feet) (1)**

Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)

ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.  
(2) This spacing may be reduced in urban areas to fit roadway conditions.

**GENERAL NOTES**

1. PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
2. CONTACT REGION TRAFFIC OFFICE FOR WORK HOUR RESTRICTIONS.
3. RECOMMEND EXTENDING DEVICE TAPER ACROSS SHOULDER. (L/3 TAPER)
4. DEVICES SHALL NOT ENCROACH INTO ADJACENT LANES.
5. PCMS RECOMMENDED.
6. USE TRANSVERSE DEVICES IN CLOSED LANE EVERY 1000'+- (RECOMMENDED).
7. TRAFFIC SAFETY DRUMS RECOMMENDED FOR ALL TAPERS ON HIGH SPEED ROADWAYS. (SEE DEVICE MATRIX)
8. WHEN USED, DEVICE SPACING FOR THE DOWNSTREAM TAPER SHOULD BE 20' O.C.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	-	-	-	-	-	-
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)						STATIONARY OPERATION (feet)			
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)						30 MIN.			
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

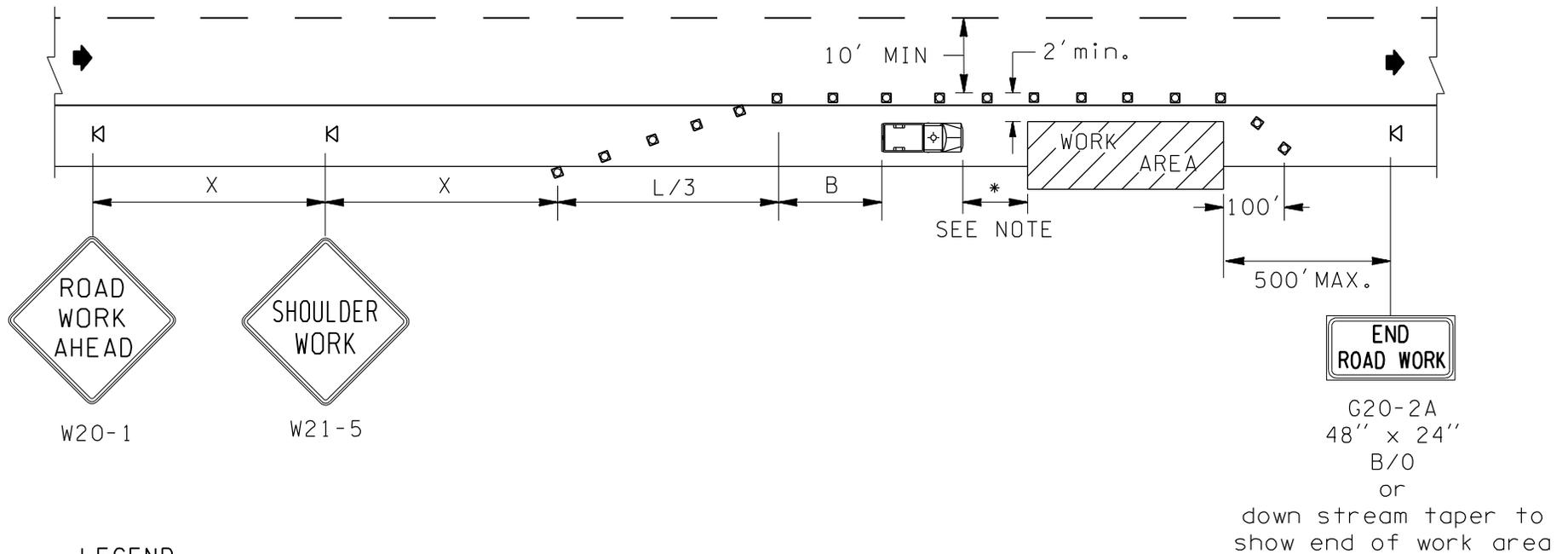
SIGN SPACING = X (FEET) (1)			
Rural Roads & Urban Arterials	35/40 MPH	350'+-	
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)	
Urban Streets	25 MPH or LESS	100'+- (2)	

All signs are 48" x 48" black on orange unless otherwise designated.  
 (1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.  
 (2) This spacing may be reduced in urban areas to fit roadway conditions.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
35/40	30	60
25/30	20	40

MINIMUM TAPER LENGTH IN FEET (L)										
Shoulder Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
6	63	90	123	165	-	-	-	-	-	-
8	84	120	162	210	-	-	-	-	-	-
10	105	150	204	270	-	-	-	-	-	-

3 DEVICES MINIMUM SPACED 10' O.C. IN TAPERS FOR SHOULDER WIDTHS LESS THAN 6 FEET



**LEGEND**

- ⊠ SIGN LOCATION
- □ □ CHANNELIZING DEVICES
- 🚚 PROTECTIVE VEHICLE - RECOMMENDED

**GENERAL NOTES**

1. PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
2. WHEN USED, THE DEVICE SPACING FOR THE DOWNSTREAM TAPER SHOULD BE 20' O.C.

**SHOULDER CLOSURE - LOW SPEED**  
**TCP 5**

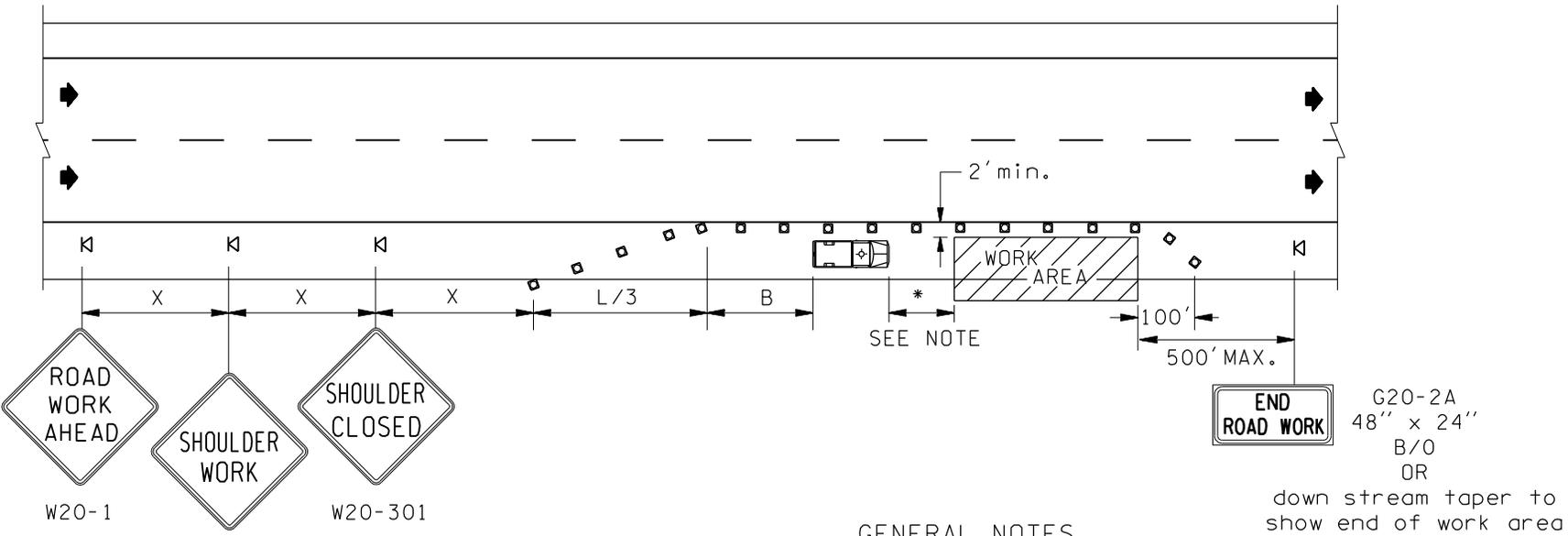
BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	-	-	-	-	360	425	495	570	645	730
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)					STATIONARY OPERATION (feet)				
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)					30 MIN.				
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
45	30	60

MINIMUM TAPER LENGTH IN FEET (L)										
Shoulder Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
6	-	-	-	-	270	300	330	360	390	420
8	-	-	-	-	360	405	450	480	525	570
10	-	-	-	-	450	510	555	600	660	705
3 DEVICES MINIMUM SPACED 10' O.C. IN TAPERS FOR SHOULDER WIDTHS LESS THAN 6 FEET										

SIGN SPACING = X (feet)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.



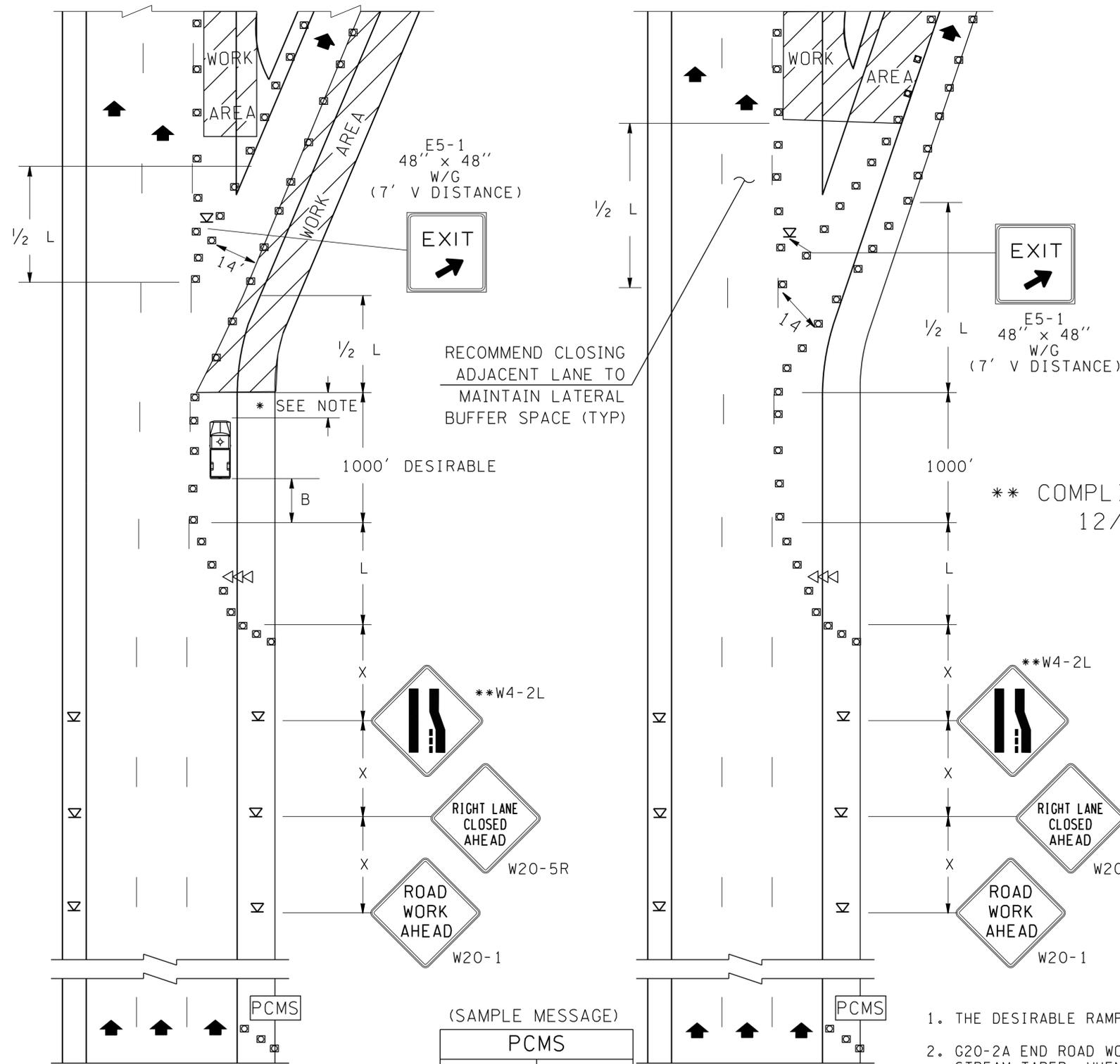
**LEGEND**

- ⊠ SIGN LOCATION
- □ □ CHANNELIZING DEVICES
- 🚚 PROTECTIVE VEHICLE - RECOMMENDED

**GENERAL NOTES**

1. NO ENCROACHMENT ON TRAVELED LANE. IF ENCROACHMENT IS NECESSARY, LANE SHALL BE CLOSED.
2. PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
3. WHEN USED, DEVICE SPACING FOR THE DOWNSTREAM TAPER SHOULD BE 20' O.C.

**SHOULDER CLOSURE - HIGH SPEED  
TCP 6**



**LEGEND**

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PORTABLE CHANGEABLE MESSAGE SIGN (RECOMMENDED)

(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

Field locate 1 mile +/- in advance of lane closure.

**TEMPORARY OFF-RAMP FOR MULTI-LANE ROADWAYS**  
TCP 7

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)							STATIONARY OPERATION (feet)		
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)							30 MIN.		
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

LANE WIDTH (feet)	MINIMUM TAPER LENGTH = L (feet)									
	Posted Speed (mph)									
10	-	-	-	270	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

SIGN SPACING = X (feet)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-

ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.  
All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
40/45	30	60

**GENERAL NOTES**

- THE DESIRABLE RAMP WIDTH IS 14' AND A 20:1 RAMP TAPER.
- G20-2A END ROAD WORK SIGN SHOULD BE INSTALLED 500' BEYOND THE WORK AREA OR USE A DOWN STREAM TAPER. WHEN USED, DEVICE SPACING FOR THE DOWN STREAM TAPER SHOULD BE 20' O.C.
- CONTACT REGION TRAFFIC OFFICE FOR WORK HOURS RESTRICTIONS.
- PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
- RECOMMEND EXTENDING CHANNELIZATION DEVICE TAPER ACROSS SHOULDER. (L/3 TAPER)
- DEVICES SHOULD NOT ENCROACH INTO ADJACENT LANES.
- TRAFFIC SAFETY DRUMS RECOMMENDED FOR ALL TAPERS ON HIGH SPEED ROADWAYS. (SEE DEVICE MATRIX)
- USE TRANSVERSE DEVICES IN CLOSED LANE EVERY 1000' +- (RECOMMENDED)
- CONSIDER SHORT TERM CLOSURE OF RAMP.

SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.  
 (2) This spacing may be reduced in urban areas to fit roadway conditions.



W21-801



W8-2001

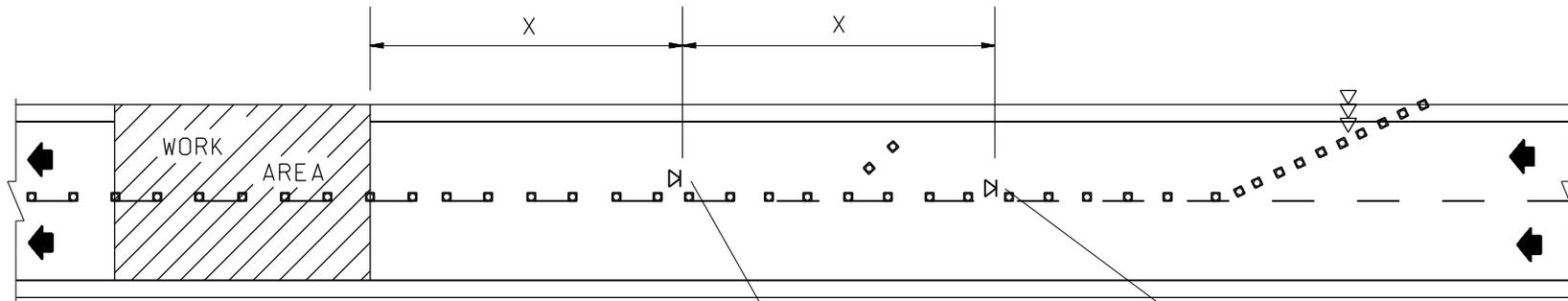


W8-7



W21-1801

MOTORCYCLE WARNING SIGN (W21-1701) SHOULD BE INSTALLED AT 1 MILE SPACING, THROUGHOUT THE WORK ZONE WHERE THE CONDITION EXISTS, AS PART OF A SEQUENCE OF OTHER APPROPRIATE STANDARD WARNING SIGNS ALSO, ON 1 MILE SPACING.



CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40



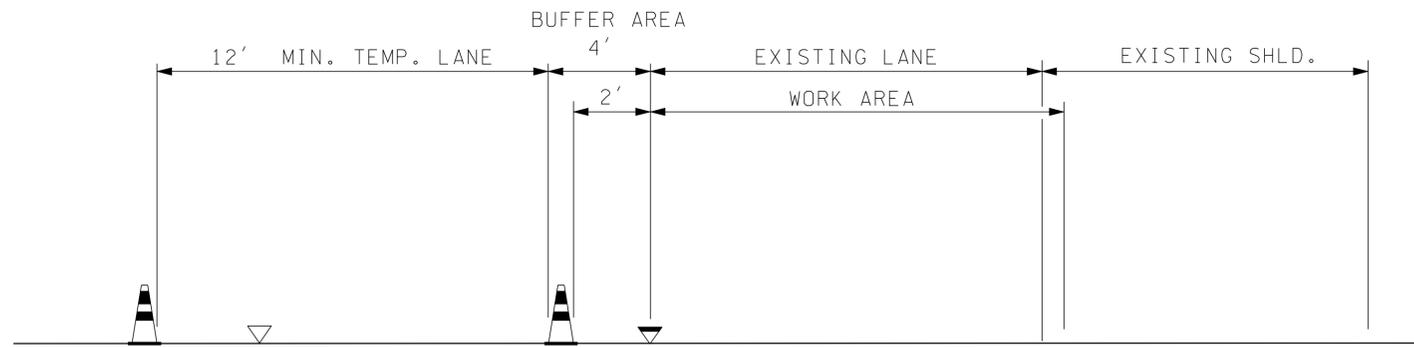
NOTES

- REFER TO TCP3 FOR TYPICAL LANE CLOSURE SIGNING DETAILS, DEVICE SPACING REQUIREMENTS AND LANE CLOSURE TAPER LENGTHS.
- MOTORCYCLES USE EXTREME CAUTION SIGNS (W21-1701) SHALL BE INSTALLED WHEN THE FOLLOWING ROADWAY CONDITIONS EXIST:
  - GROOVED PAVEMENT
  - ABRUPT LANE EDGE
  - STEEL PLATES
  - LOOSE GRAVEL OR EARTH
 SPECIFIC SIGNS FOR EACH OF THE CONDITIONS NOTED SHALL BE INSTALLED ALONG WITH MOTORCYCLES USE EXTREME CAUTION SIGNS.

LEGEND

- ▤ SIGN LOCATION
- ▤▤▤ ARROW PANEL
- ▣▣▣ CHANNELIZING DEVICES

TYPICAL MOTORCYCLE SIGNING DETAIL  
 TCD 2



TYPICAL SECTION A-A

- TEMPORARY TRAFFIC CONTROL DEVICES
- EXISTING EDGE STRIPE
- EXISTING LANE STRIPE

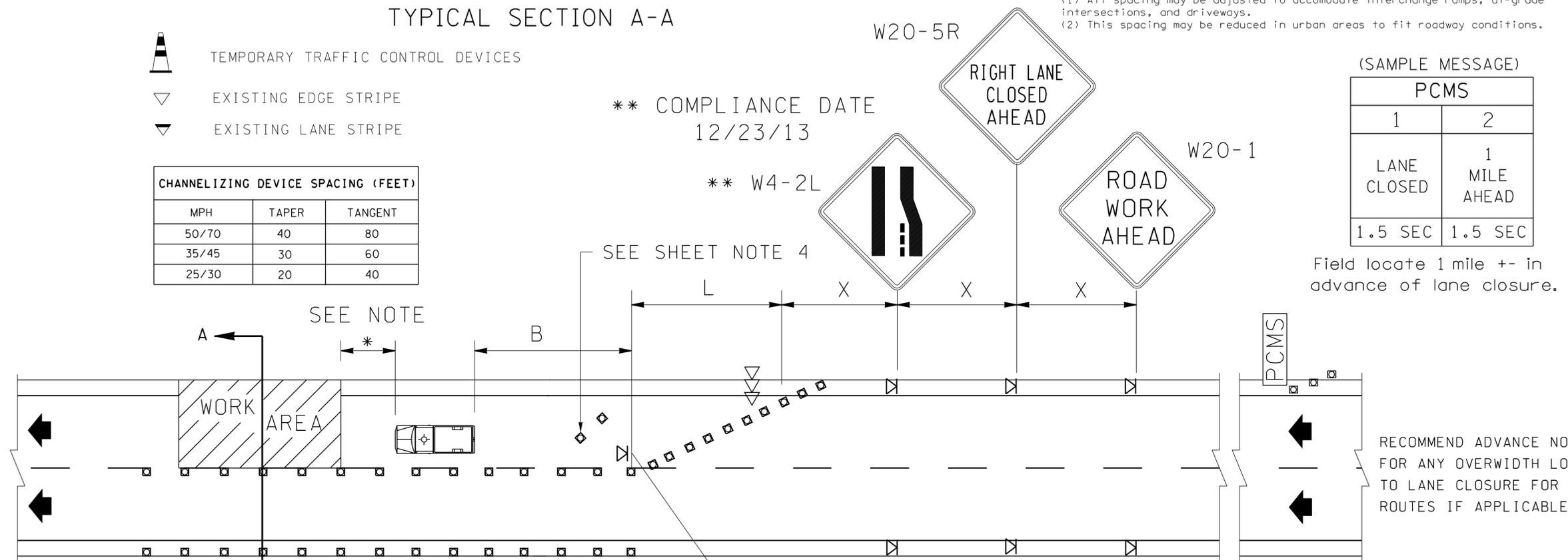
CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40

SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.  
 (2) This spacing may be reduced in urban areas to fit roadway conditions.

\*\* COMPLIANCE DATE  
12/23/13

\*\* W4-2L



(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

Field locate 1 mile +- in advance of lane closure.

RECOMMEND ADVANCE NOTICE FOR ANY OVERWIDTH LOADS PRIOR TO LANE CLOSURE FOR ALTERNATE ROUTES IF APPLICABLE.

NOTES

1. PROTECTIVE VEHICLE RECOMMENDED-MAY BE A WORK VEHICLE.
2. CONTACT REGION TRAFFIC OFFICE FOR WORK HOUR RESTRICTIONS.
3. RECOMMEND EXTENDING DEVICE TAPER ACROSS SHOULDER. (L/3 TAPER)
4. USE TRANSVERSE DEVICES IN CLOSED LANE EVERY 1000'+- (RECOMMENDED).
5. TRAFFIC SAFETY DRUMS RECOMMENDED FOR ALL TAPERS ON HIGH SPEED ROADWAYS. (SEE DEVICE MATRIX)
6. PCMS RECOMMENDED.

LEGEND

- WARNING BEACON - REQUIRED
- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PORTABLE CHANGEABLE MESSAGE SIGN

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)									STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)									30 MIN.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
* A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

MINIMUM TAPER LENGTH = L (feet)										
LANE WIDTH (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	780	840

TYPICAL LANE CLOSURE WITH SHIFT TCD 3