Pennsylvania Work Zone Safety Implementation Plan

Final Report

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COMMONWEALTH OF PENNSYLVANIA

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List of Acronyms

ADA	Americans with Disabilities Act
BOMO	Bureau of Maintenance Operations
DOT	Department of Transportation
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
HACS	Highway Administration Customer Survey
HPMS	Highway Performance Monitoring System
ITS	Intelligent Transportation Systems
LOS	Level of Service
MAP-21	Moving Ahead for Progress in the 21st Century Act
MMUCC	Model Minimum Uniform Crash Criteria
MOU	Memorandum of Understanding
MUTCD	Manual on Uniform Traffic Control Devices
PA Turnpike	Pennsylvania Turnpike
PennDOT	Pennsylvania Department of Transportation
PSP	Pennsylvania State Police
RCRS	Road Condition Reporting System
RULD	Road User Liquidated Damages
TCP	Traffic Control Plan
TMC	Transportation Management Center
TMP	Traffic Management Practice
TTC	Temporary Traffic Control
TTCD	Temporary Traffic Control Device
v/c	volume-to-capacity
VMS	Variable Message Sign
WZRSA	Work Zone Road Safety Audit
WZSIP	Work Zone Safety Implementation Plan

Executive Summary

In 2012, more than 600 people in the United States were killed in motor vehicle crashes in work zones, including 21 people in Pennsylvania. Work zone fatalities accounted for 1.7 percent of traffic fatalities in Pennsylvania, compared to the national average of approximately 1.9 percent, from 2008 to 2012.[1]

The Pennsylvania Department of Transportation (PennDOT) expects a greatly increased number of work zones in the next 5 to 10 years due to $2.3 billion being made available for transportation projects by the passage of Act 89 by the Pennsylvania State Legislature in 2013. This will increase the potential for additional traffic crashes, injuries, and fatalities in Pennsylvania work zones.

Work zones can be made safer for road users and workers through the use of data monitoring and analysis, examination of current practices, and implementation of new technologies to supplement current practices. An increase in communication with travelers, especially real-time, will benefit the safety of both road users and workers.

A Work Zone Safety Implementation Plan (WZSIP) is a data-driven plan tailored to the needs of a State highway agency. The WZSIP identifies work zone crash data trends and provides a link between the data trends and the State's work zone policies and practices. For the purposes of developing Pennsylvania's WZSIP, the project team analyzed the PennDOT crash database and read the details of fatal work zone crash reports to identify trends.

Based on the crash trends identified and countermeasures available, PennDOT and its safety partners have an opportunity to prevent future crashes in its work zones by implementing the strategies outlined within this plan.

[1] Based on PennDOT's crash database from 2008–2012 and Fatality Analysis Reporting System (FARS) database from 2008–2012, respectively.

1. Introduction

The purpose of this plan is to provide PennDOT and its safety partners with information and recommendations to support improved work zone safety on Pennsylvania roadways. This plan is a collaborative effort among the Federal Highway Administration (FHWA) and its contractor, ATSSA; Pennsylvania Department of Transportation (PennDOT); Pennsylvania State Police (PSP); Pennsylvania Turnpike (PA Turnpike); and others.

1.1. Work Zone Safety

According to the Fatality Analysis Reporting System (FARS), 609 people were killed nationally in motor vehicle crashes in work zones in 2012; 21 of these fatalities occurred in Pennsylvania.[2] Work zone safety can be improved through the use of data monitoring and analysis, examining and refining current practices and policies, new practices, and implementing new technologies to supplement current practices.

In 2004, the FHWA published the *Work Zone Safety and Mobility Rule* to focus on work zone impacts as well as on methods and strategies to limit these impacts on the traveling public. Since the introduction of these approaches and subsequent implementation efforts from transportation agencies, work zone fatalities have decreased by over 50 percent (from 1,186 in 2002 to 609 in 2012).

Implementation challenges include resource limitations, inconsistent work zone definitions in State crash reports, and lack of available detail. It can be difficult for agencies to identify their real work zone safety problems or to determine the most cost-effective way to address them. This leads to a lack of confidence in countermeasure selection, as safety professionals do not always know if their safety efforts are solving an actual or perceived problem.

1.2. Implementing Work Zone Safety under MAP-21

The *Moving Ahead for Progress in the 21st Century Act* (MAP-21) was signed into law by President Obama on July 6, 2012. MAP-21 authorizes the use of federal funds to aid highway improvements, highway safety programs, transit programs, and other purposes. MAP-21 specifies that work zone safety applications can consist of collection, analysis, and improvement of safety data; road safety audits; installation of barriers and crash attenuators; and geometric improvements for safety purposes or that improve safety.[3] MAP-21 supports and encourages the use of innovative project delivery through the use of intelligent transportation systems (ITS) technologies, and by following practices that improve work zone safety for motorists and/or workers and the quality of the facility. According to the Act, "… the Secretary shall carry out research and development activities — To reduce the number of fatalities attributable to infrastructure design characteristics and work zones ..."[4]

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[2] FARS shows 20 work zone fatal crashes for 2012, while PennDOT's crash database shows 21 for 2012.
[3] Inclusions of the Highway Safety Improvement Program under MAP-21.
[4] MAP-21 Legislation. Available at: http://www.govtrack.us/congress/bills/112/hr4348/text Sec. 503.2.B.ii.

2. Work Zone Safety Data Analysis

Work zone crashes pose significant risk not only to drivers involved in the crashes, but to other motorists in the work zones and anyone in the work areas. Collecting crash data allows work zone practitioners to learn more about the causes of the crashes and to apply necessary modifications to existing and future work zones. The first step to identifying safety needs in any jurisdiction is analyzing available safety-related data. This information would typically include data from the state law enforcement crash reports and traffic volume counts.

Crash data can be further analyzed by incorporating exposure elements, including length of work zone, work zone duration, and traffic volume; and by determining what percentage of that volume are large trucks. Exposure-based analysis is often conducted after the construction project completion, if performed at all in a work zone setting, due to the time lag in receiving crash data. However, exposure data is essential to calculating crash rates; practitioners may be unaware of how much is needed and what to do with the large volume that is available.

2.1. The Process: Work Zone Crash Data Analysis

The project team adhered to the following process for analyzing PennDOT's work zone crash data:

1. Collect/transfer crash data from PennDOT
2. Identify the work zone crashes within the crash database
3. Analyze both the work zone crashes and all crashes within the database
4. Analyze crash report details (including patrol officers' narratives) for all fatal work zone crashes

2.1.1. Collect/Transfer Data

PennDOT provided five years (2008–2012) of crash data from their State database for the analysis. For each year, PennDOT provided the following tables: a crash table, a vehicle table, a person table, a driver action table, a flag table, a harmful event table, a roadway table, and an environmental factors table.[5] Each of these tables included a unique crash identifier that enabled the project team's data analysts to link the tables for more meaningful analyses. This set of data included information about all crashes on all roads (e.g., Interstates—both turnpikes and non-turnpikes, turnpike spurs, State highways, local and county roads, and private roads).

2.1.2. Identify Work Zone Crashes in Pennsylvania

The project team aggregated the data across all five years and partitioned the entire set of crashes to only include work zone crashes. Work zone crashes were defined by the Yes/No variable located in the crash database: [WK_ZONE_IND]. This variable is police-reported, so the set of crashes may not have been perfectly representative of all crashes involving work zones. For example, a crash occurring outside work zone limits due to queuing may not always have been marked as a work zone crash by officers at the scene. In contrast, a crash may have occurred within work zone limits but might not have involved the work zone directly; for

[5] PennDOT made available information for all drivers and all vehicles involved in the crashes, but only information from Units 1 and 2 (vehicle), and Persons 1 and 2 were used in the analysis.

example, some crashes involving alcohol-impaired drivers, those suffering from a medical condition, or those occurring when the work zone is not active could still be coded as work zone crashes.

The project team further narrowed crashes that were determined to have occurred within a work zone and categorized by crash severity using the KABCO Injury scale.[6]

2.1.3. Analyze Crash Database

From the reduced set of work zone-defined crashes, the project team performed queries to determine what types of factors may have been the most likely to contribute to work zone crashes. The project team determined these factors by comparing frequencies of work zone crashes to total crashes within a factor. For example, in Pennsylvania, consider that 11 percent of all fatal crashes involved a pedestrian. Narrowing the data down to consider only work zone crashes, nearly 20 percent of fatal work zone crashes involved pedestrians. This overrepresentation of fatal pedestrian-involved crashes in work zones could indicate a number of things:

- Work zones during the 2008–2012 study period had a higher frequency of pedestrians as compared to non-work zone locations;
- A high proportion of work zones during 2008-–2012 occurred in urban areas, where pedestrians are more likely to be present; or
- Pedestrians have a higher frequency of being involved in a fatal work zone crash for some other reason.

The analysis team's assumption regarding the crash data was that while the inconsistencies were noted, the team assumed that work zone crashes were identified using the [WK_ZONE_IND] field in the database. Some of the data limitations of the PSP crash data system related to the team's work zone crash data analysis include:

- The crash datasets were archived by crash year as opposed to one large contiguous dataset.
- The number, impacts, locations, and durations of work zones were not available.
- Crash database did not contain data regarding presence of law enforcement in the work zone at the time of the crash.
- Crashes flagged as being in a work zone were completely subjective by the officer in the field. This created an inconsistent approach to data logging. Many work zone crash field reports reviewed were not actually in or caused by a work zone.

The project team analyzed crash-, vehicle-, person-, driver action-, flag-, harmful event-, roadway-, and environmental-level variables for fatal work zone crashes. The team used the variables listed in Table 1 to identify general work zone crash trends.

[6] The KABCO scale is a five point indexing system that consists of: fatal injury (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C), and no injury/property damage only (O).

Table 1. Data Variables Used in Analysis

Crash Table	Flag	Flag Cont.
CRASH_YEAR	INTERSTATE	OVERTURNED
DAY_OF_WEEK	STATE_ROAD	MOTORCYCLE
ILLUMINATION	LOCAL_ROAD	BICYCLE
WEATHER	LOCAL_ROAD_ONLY	HVY_TRUCK_RELATED
COLLISION_TYPE	TURNPIKE	VEHICLE_FAILURE
TCD_TYPE	WET_ROAD	TRAIN_TROLLEY
URBAN_RURAL	SNOW_SLUSH_ROAD	PHANTOM_VEHICLE
PERSON_COUNT	ICY_ROAD	ALCOHOL_RELATED
FATAL_COUNT	SUDDEN_DEER	DRINKING_DRIVER
FHE	SHLDR_RELATED	UNDERAGE_DRNK_DRV
TCD_FUNC_CD	REAR_END	UNLICENSED
WK_ZONE_IND	HO_OPPDIR_SDSWP	CELL_PHONE
Person Table	HIT_FIXED_OBJECT	NO_CLEARANCE
PERSON_TYPE	SV_RUN_OFF_RD	RUNNING_RED_LT
UNIT_NUM	WORK_ZONE	TAILGATING
PERSON_NUM	NON_INTERSECTION	CROSS_MEDIAN
SEAT_POSITION	INTERSECTION	CURVE_DVR_ERROR
SEX	SIGNALIZED_INT	LIMIT_65MPH
INJ_SEVERITY	STOP_CONTROLLED_ INTUNSIGNALIZED_INT	SPEEDING
ALC_DRUG_SUSPECTED	SCHOOL_BUS	SPEEDING_RELATED
Vehicle Table	SCHOOL_ZONE	AGGRESSIVE_DRIVING
UNIT_NUM	HIT_DEER	FATIGUE_ASLEEP
VEH_MOVEMENT	HIT_TREE_SHRUB	DRIVER_16YR
OWNER_DRIVER	HIT_EMBANKMENT	DRIVER_17YR
GRADE	HIT_POLE	DRIVER_65_74YR
RDWY_ALIGNMENT	HIT_GDRAIL	DRIVER_75PLUS
Roadway	HIT_GDRAIL_END	UNBELTED
ROAD_OWNER	HIT_BARRIER	PEDESTRIAN
Driver Table	HIT_BRIDGE	DISTRACTED
UNIT_NUM		
SEQ_NUM		

The following list of data elements is not currently collected on Pennsylvania crash forms. Revising the current crash form to include the following fields would potentially allow for more in-depth and meaningful work zone crash analysis, if they were collected:

- If officer was present in the work zone at the time of the crash
- What type of work zone (e.g., pavement overlay, bridge rehabilitation)
- If there were any roadway changes (e.g., lane closure, taper, shoulder closure, narrow lanes)
- If a construction worker was killed or severely injured in the crash
- If queuing occurring at the time of the crash due to activities within work zone

Additionally, in some cases the crash database lacked follow-up information pertaining to toxicology lab results for crashes involving impaired drivers and updated injury information after victims were taken from the crash scene. Field report narratives were incomplete and inconsistent across the State. Some narratives were intricately detailed and lengthy, while others lacked details related to how the crash occurred or how the work zone may have contributed to the crash.

2.1.4. Analyze Crash Report Details

PennDOT had 111 fatalities stemming from work zone crashes from 2008 to 2012. The project team read the entirety of the law enforcement-completed crash reports for these crashes with two purposes:

1. Verify key data fields
2. Review crash narratives to identify trends not contained within data fields

For fatal crashes, the project team confirmed that crash reports indicated a work zone was present at the crash site and reviewed the data fields shown in Table 2.

Table 2. Data Fields Verified for Fatal Crashes Only

Crash Table	Person Table	Vehicle Table
WK_ZONE_IND	PERSONTYPE	GRADE
LIGHTCONDITIONS	RESTRAINTCODE	RDWY_ALIGNMENT
ROADWAYALIGNMENT	AGE	
TRAFFICFLOW	DATEOFBIRTH	
TYPEOFTRAFFICCONTROL	LICENSESTATE	
WEEKDAY	ALCOHOLDRUGIMPAIRMENT	
ALCOHOLINVOLVED		
SPEEDRELATED		
FATAL_COUNT		
V1_ContribFactor		
V1_DriverDistraction		
V2_ContribFactor		
V2_DriverDistraction		

The project team reviewed the crash narratives and diagrams for fatal crashes and recorded the following details into the spreadsheet:

- Work zone involvement or contribution to crash
- Factors, actions, or roadway characteristics that may have contributed to the crash
- Whether a construction worker was fatally injured as a result of the crash
- Other information that could determine if or how the work zone may have contributed to the crash

From the crash narratives, the project team identified several previously undocumented work zone crash trends. These trends are detailed in Section 2.2.2.

2.2. Safety Data Analysis Results

The following sections show the details related to work zone crash trends on all roads in Pennsylvania.

2.2.1. Work Zone Safety Data Overview

From 2008 to 2012, Pennsylvania roadways experienced 616,563 vehicle crashes with 8,294 crashes, approximately 1.3 percent of all crashes, occurring in work zones (Figure 1). Figure 2 shows that from 2008 to 2012, work zone fatalities accounted for 1.7 percent of fatalities in Pennsylvania; whereas, the national average was 1.9 percent.[7] This figure also compares the 6,644 fatalities on Pennsylvania roads from 2008 to 2012 with 111 occurring in work zones.

[7] Based on PennDOT's crash database from 2008–2012 and FARS database from 2008–2012, respectively.

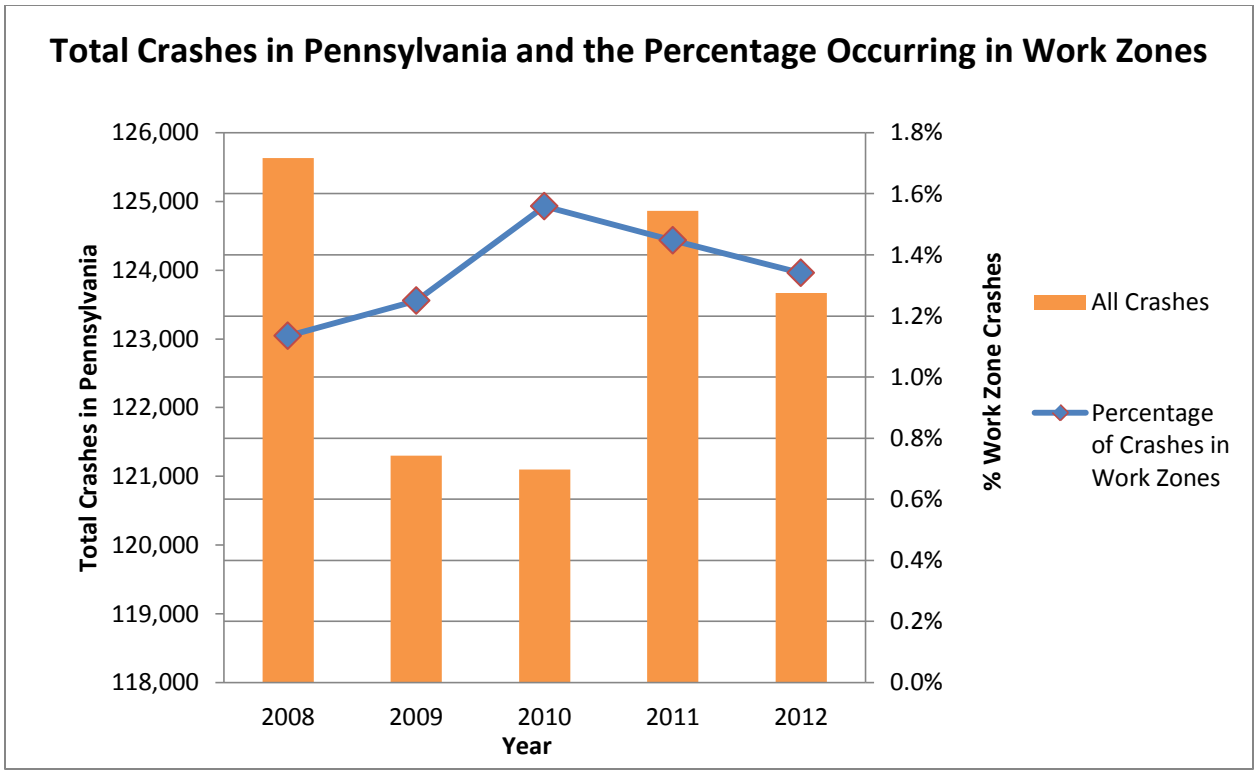

Figure 1. Pennsylvania Crashes from 2008–2012

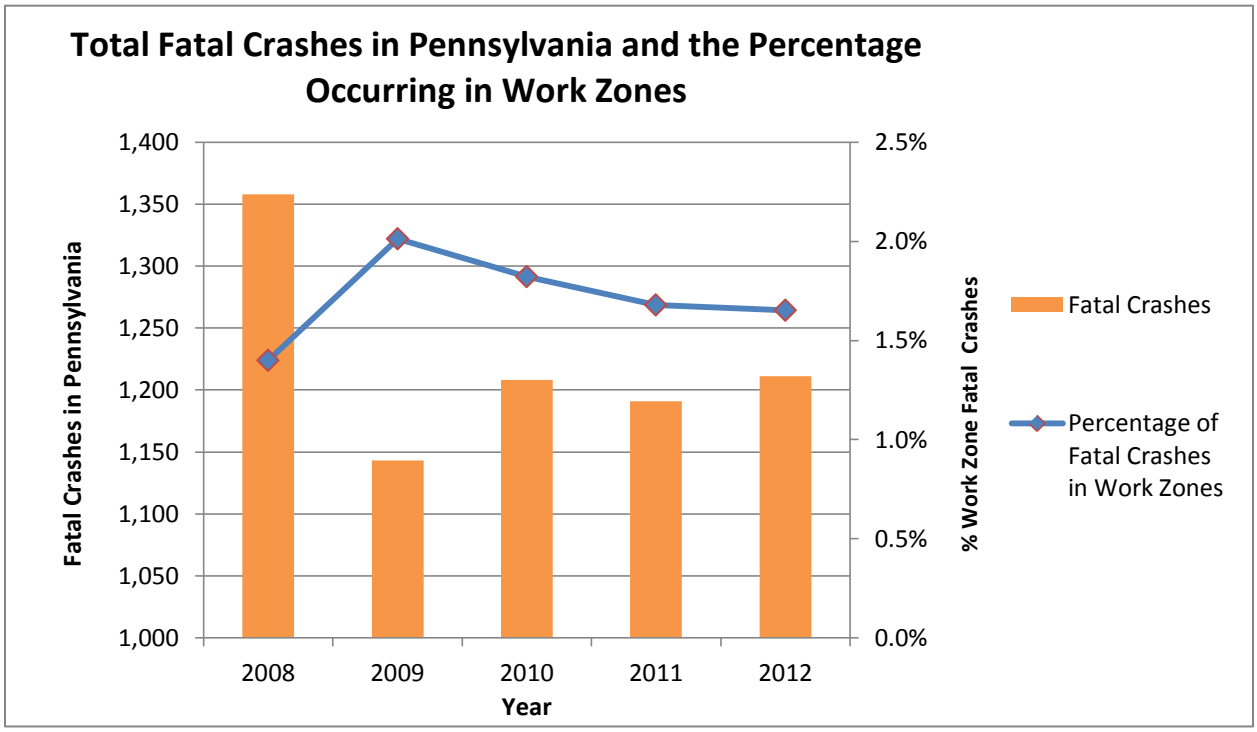

Figure 2. Pennsylvania Fatal Crashes from 2008–2012

The number of work zone crashes and fatalities by county is displayed in Table 3. The five counties with the highest number of work zone crashes and fatalities are:

Work Zone Crashes

1. Allegheny
2. Montgomery
3. Westmoreland
4. Philadelphia
5. Cumberland

Work Zone Fatalities

1. Allegheny
2. Montgomery
3. Westmoreland
4. Philadelphia
5. York

Table 3. Work Zone Crashes and Fatalities by County

County	Crashes			Fatalities		
	WZ Crashes	WZ Crashes Percent Of Total	All Crashes	WZ Fatalities	WZ Crashes Percent Of Total	All Fatalities
Adams	69	0.8%	5279	2	1.8%	90
Allegheny	1249	15.1%	59061	12	10.8%	334
Armstrong	39	0.5%	2747	1	0.9%	57
Beaver	127	1.5%	7462	3	2.7%	85
Bedford	47	0.6%	3487	1	0.9%	75
Berks	296	3.6%	23234	3	2.7%	248
Blair	89	1.1%	6894	2	1.8%	75
Bradford	36	0.4%	3603	0	0.0%	63
Bucks	209	2.5%	30928	4	3.6%	289
Butler	104	1.3%	9190	2	1.8%	118
Cambria	86	1.0%	6751	0	0.0%	80
Cameron	0	0.0%	287	0	0.0%	6
Carbon	73	0.9%	3551	1	0.9%	54
Centre	51	0.6%	6428	0	0.0%	76
Chester	293	3.5%	22340	2	1.8%	174
Clarion	42	0.5%	2442	0	0.0%	44
Clearfield	76	0.9%	4822	1	0.9%	103
Clinton	29	0.3%	2115	1	0.9%	36
Columbia	101	1.2%	3801	0	0.0%	62
Crawford	36	0.4%	4629	0	0.0%	66
Cumberland	387	4.7%	12211	2	1.8%	107
Dauphin	150	1.8%	14639	2	1.8%	158
Delaware	125	1.5%	22524	4	3.6%	112
Elk	12	0.1%	1519	0	0.0%	37
Erie	102	1.2%	13378	2	1.8%	168
Fayette	104	1.3%	5973	0	0.0%	126
Forest	1	0.0%	395	0	0.0%	12
Franklin	164	2.0%	7229	2	1.8%	105
Fulton	28	0.3%	1471	0	0.0%	24

County	Crashes			Fatalities		
	WZ Crashes	WZ Crashes Percent Of Total	All Crashes	WZ Fatalities	WZ Crashes Percent Of Total	All Fatalities
Greene	38	0.5%	1983	3	2.7%	46
Huntingdon	22	0.3%	2084	0	0.0%	50
Indiana	108	1.3%	4194	5	4.5%	77
Jefferson	29	0.3%	2263	0	0.0%	34
Juniata	5	0.1%	1288	0	0.0%	27
Lackawanna	294	3.5%	12790	3	2.7%	95
Lancaster	271	3.3%	26780	2	1.8%	278
Lawrence	109	1.3%	3903	3	2.7%	55
Lebanon	38	0.5%	6980	1	0.9%	96
Lehigh	173	2.1%	22552	3	2.7%	164
Luzerne	225	2.7%	15956	0	0.0%	178
Lycoming	92	1.1%	6202	2	1.8%	86
McKean	17	0.2%	1766	1	0.9%	43
Mercer	63	0.8%	6427	0	0.0%	94
Mifflin	12	0.1%	1933	0	0.0%	38
Monroe	145	1.7%	11276	3	2.7%	162
Montgomery	765	9.2%	41644	8	7.2%	208
Montour	5	0.1%	1063	0	0.0%	7
Northampton	104	1.3%	14326	0	0.0%	126
Northumberland	28	0.3%	3431	1	0.9%	53
Perry	18	0.2%	2518	1	0.9%	68
Philadelphia	420	5.1%	53813	6	5.4%	474
Pike	40	0.5%	3215	0	0.0%	39
Potter	8	0.1%	685	0	0.0%	11
Schuylkill	91	1.1%	6891	2	1.8%	135
Snyder	9	0.1%	1975	1	0.9%	36
Somerset	46	0.6%	4177	1	0.9%	64
Sullivan	4	0.0%	454	0	0.0%	13
Susquehanna	32	0.4%	2507	1	0.9%	57
Tioga	23	0.3%	2580	1	0.9%	55
Union	18	0.2%	1786	0	0.0%	35
Venango	20	0.2%	2916	0	0.0%	52
Warren	25	0.3%	2046	0	0.0%	42
Washington	204	2.5%	10013	2	1.8%	144
Wayne	16	0.2%	2653	1	0.9%	36
Westmoreland	425	5.1%	16462	7	6.3%	240
Wyoming	14	0.2%	1717	0	0.0%	40
York	213	2.6%	22924	6	5.4%	202
Total	**8294**	**100.0%**	**616563**	**111**	**100.0%**	**6644**

2.2.2. Work Zone Safety Trends Identified from Crash Data Analysis and Crash Narrative Reviews

As a result of querying PennDOT's crash data, the project team identified several general work zone safety trends, including:

- Of the 8,294 work zone crashes:
  - 21.7 percent occurred in rural areas and 78.3 percent occurred in urban areas
  - 83 percent occurred on Interstate (non-turnpike) and State highways
  - 74 percent occurred in construction work zones, 17.6 percent occurred in maintenance work zones, and 3.1 percent occurred in utility work zones
- Of the 111 work zone fatalities:
  - 38.7 percent occurred in rural areas and 61.3 percent occurred in urban areas
  - 86.5 percent occurred on Interstate (non-turnpike) and State highways
  - 74 percent occurred in construction work zones, 16 percent occurred in maintenance work zones, and 3.6 percent occurred in utility work zones

Table 4 shows the flags resulting in the highest percentage of fatal work zone crashes from 2008 to 2012, as indicated in the shaded column. Note that the percent of work zone fatal crashes is not additive, as several flags may have been associated with a single crash (e.g., driver was speeding, drinking, and not wearing a seatbelt).

Table 4. Flags Associated with Work Zone Fatal Crashes

Fatal Crashes				
FLAG	**Fatal WZ Crashes**	**% Fatal WZ Crashes**	**All Fatal Crashes**	**% Fatal WZ Crashes/All Fatal Crashes**
AGGRESSIVE_DRIVING	63	60.6%	3692	1.7%
SPEEDING_RELATED	47	45.2%	2785	1.7%
HVY_TRUCK_RELATED	36	34.6%	720	5.0%
UNBELTED	36	34.6%	2667	1.3%
SV_RUN_OFF_RD	35	33.7%	3087	1.1%
ALCOHOL_RELATED	28	26.9%	2127	1.3%
DRINKING_DRIVER	28	26.9%	1989	1.4%
REAR_END	26	25.0%	360	7.2%
HIT_FIXED_OBJECT	23	22.1%	2556	0.9%
PEDESTRIAN	22	21.2%	743	3.0%
OVERTURNED	19	18.3%	1367	1.4%
SPEEDING	19	18.3%	1163	1.6%
LIMIT_65MPH	16	15.4%	350	4.6%

Fatal Crashes				
FLAG	**Fatal WZ Crashes**	**% Fatal WZ Crashes**	**All Fatal Crashes**	**% Fatal WZ Crashes/All Fatal Crashes**
WET_ROAD	14	13.5%	899	1.6%
HO_OPPDIR_SDSWP	14	13.5%	681	2.1%
MOTORCYCLE	14	13.5%	1045	1.3%
UNSIGNALIZED_INT	11	10.6%	865	1.3%
DRIVER_65_74YR	11	10.6%	621	1.8%
DRIVER_75PLUS	11	10.6%	634	1.7%
DISTRACTED	9	8.7%	280	3.2%
HIT_BARRIER	7	6.7%	162	4.3%
STOP_CONTROLLED_INT	6	5.8%	488	1.2%
SIGNALIZED_INT	5	4.8%	422	1.2%

WZ = work zone

After reading the individual crash report narratives for the 111 fatalities from 2008–2012, the project team identified the following work-zone related, fatal crash trends (Figure 3):[8]

- 21 (18.9%) back-of-queue fatal crashes occurred as a result of work zone congestion and secondary crashes
- 11 (9.9%) fatal crashes were attributed to alcohol
- 8 (7.2%) fatal crashes involved pedestrians, none of which involve construction workers
- 6 (5.4%) fatal crashes resulted as vehicles made contact with construction equipment or materials storage inside the work zone
- 6 (5.4%) fatal crashes involved motorcycles
- 5 (4.5%) fatal crashes may have been attributed to improper worker or flagger practices
- 3 (2.7%) fatal crashes occurred within utility work zones
- 3 (2.7%) fatal crashes were related to motorists traveling the wrong way on a divided highway (one related to a concrete median opening)
- 2 (1.8%) fatal crashes related to locations with edge drops

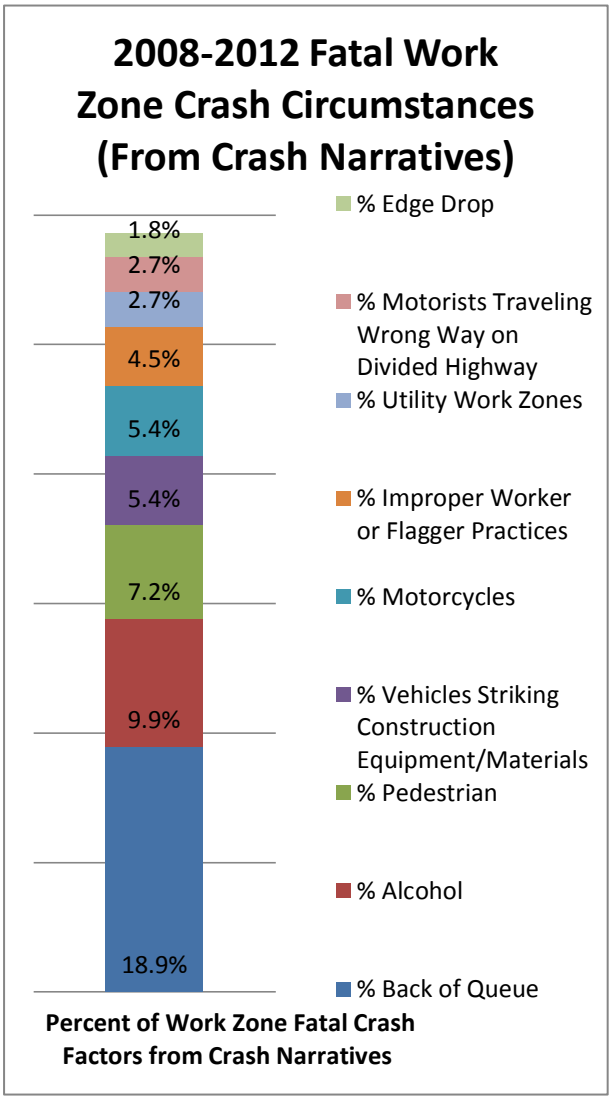

Figure 3. Factors Related to Fatal Work Zone Crashes from 2008–2012

[8] Note that only the most common contributing circumstances are identified in the figures.

3. State Practices and Recommendations

In addition to reviewing crash histories and other safety-related data, it is important to understand a State's current policies, procedures, and practices regarding work zone safety in order to identify successful efforts and areas for improvement.

3.1. Process for Reviewing State Policies, Procedures, and Practices

PennDOT provided the project team with several policies and examples of practices. Prior to the Work Zone Safety Implementation Plan Workshop, the project team reviewed:

- 2008–2012 Crash Database (work zone crashes only)
- 2012 Work Zone Self-Assessment
- *Policy for Work Zone Safety and Mobility* (PennDOT Publication 46)
- *Temporary Traffic Control Guidelines* (PennDOT Publication 213)
- Edge Drop Policy (Section 901—Maintenance and Protection of Traffic During Construction)
- Memorandum of Understanding between PennDOT and the PSP (MOU Agreement Number 470975)
- Sample Transportation Management Plans
  - ECMS # 82309 (SR 80 Section M15 in Columbia County)
  - ECMS # 99251 (SR 80 Section M33 in Northumberland County)

The project team developed a state-of-the-practice matrix to populate while reviewing the resources. The lists below show the questions the project team considered while reviewing the resources.

Policy-related:

- Are all districts/regions aware of statewide Work Zone Safety and Mobility Policy and do they follow it? What is the oversight for use of these policies?
- Are work zones coordinated across district or regional boundaries? How is this achieved?
- Are motor carriers, emergency responders, emergency medical services, transit operators, and law enforcement partners consulted and/or informed of work zones? If so, in what manner?
- Has the agency established formal agreements, such as MOUs, with utility suppliers to promote the proactive coordination of long-range transportation plans with long-range utility plans, with the goal of reducing project delays and minimizing the number of work zones on the highways?
- When, how, and in what stage of project development can stakeholders be integrated into the project?
- How are work zone locations, progress, and alternate routes communicated?

Training Programs:

- Do you have a crash data collection and/or analysis training program? If so, briefly describe the content, how often these trainings are given, and who is required to attend?
- Do you have a work zone safety training program—flagger, temporary traffic control devices (TTDC), moving operations, etc.? How often are these trainings given and who is required to attend?

- Does the agency provide training to uniformed law enforcement personnel on work zone devices, positioning in the work zone, and layouts, or do they ensure law enforcement personnel receive proper training elsewhere?

Work Zone Data:

- What types of data are collected in work zones? Speed, volume, location, travel time, injury type/severity, etc.

Work Zone Reviews:

- Do you perform work zone policy reviews at the agency level (e.g., agency work zone policies and/or review of statewide work zone data)? If so, how often are reviews conducted what elements are reviewed, and is the information documented? How are the results of the review used?
- Do you perform work zone road safety audits (WZRSAs)? If so, please explain your WZRSA program and process.
- Do you perform work zone inspections for each active work zone (including maintenance, construction, and utility work zones)? How often are inspections performed what elements are inspected, and is the information documented? Are work zone inspections conducted by agency staff or by contract? How are the results of the inspection used?
- Does the agency conduct customer surveys to evaluate work zone traffic management practices and policies on a statewide/area-wide basis?

Transportation Management Plans:

- Who is responsible for providing input on development of a project's transportation management plan, including the traffic control plan (TCP) and construction staging plan?
- How does your agency determine which safety and mobility strategies to use in an active work zone?
- When is traffic modeling used to simulate work zone conditions and inform strategies and staging selection?
- How will the traffic management practices (TMPs) be monitored?

Work Zone Traffic Control:

- Are revisions to temporary traffic control (TTC) plans allowed by the contractor? If so, what process is used to vet the recommendations and who approves?
- What is your agency's policy related to the use of TTCD?
- What is your agency's standard practice for setting speed limits in work zones?

Contractor Participation:

- Are incentives/disincentives used to reduce construction/active work zone durations? If so, how is their use decided and by whom?
- When bidding types I, II, and III projects, does the agency use performance-based criteria to eliminate contractors who consistently demonstrate their inability to complete a quality job within the contract time?
- Does the agency use independent contractors or contractor associations to provide construction process input to expedite project contract times for types I and II projects?
- When developing the TCP for a project, does the agency involve contractors on types I and II projects?

Practice-related:

- In your agency, how is the enforcement role in work zones carried out?
- Does your agency or State law allow for the use of automated enforcement?

- What is your agency's policy on night and weekend work?
- What is your agency's policy for lateral lane restrictions?
- What is your policy regarding pedestrian facilities?
- If lighting is used in work zones, what guidance do you have for its use and placement?
- What is your agency's policy for allowable edge drop-off, i.e., how long and under what conditions the situation may exist and the height of the drop-off? What are the requirements for mitigation?
- Does your agency have any existing work zone performance measures?
- Has the agency established strategic goals specifically to reduce congestion and delays in work zones?
- Has the agency established measures (e.g., vehicle throughput or queue length) to track work zone congestion and delay?

Work Zone Simulation and Analysis:

- Is work zone simulation used to determine potential work zone impacts?
- What is PennDOT's policy for rerouting traffic from the work zone when queues are anticipated? How are detour routes selected? Are analyses performed on the detour routes to see if they have extra capacity available for rerouted traffic? Are locals consulted if their routes are used for detours? How is this handled? How is the public informed of detour routes?
- Does the agency's planning process actively use analytical traffic modeling programs to determine the impact of future types I and II road construction and maintenance activities on network performance?
- Does the agency's regular planning process analyze the network to develop adequate alternate options for routing traffic in anticipation of various needs for future road construction and maintenance?

Work Zone Cost Estimating:

- Does the agency's transportation planning process include a planning cost estimate review for work types I, II, and III that accounts for traffic management costs (e.g., incident management, public information campaigns, positive separation elements, uniformed law enforcement, and ITS)?

Using a combination of the data analysis and findings from the State Practice review, the project team, in conjunction with PennDOT, developed the topics shown in Table 5 for the workshop roundtable session.

Table 5. Work Zone Safety Roundtable Topics

Work Zone Safety Roundtable Topics
• Establishing Consistent, Effective, and Safe Work Zone Speed Limits • Work Zone Queuing • Developing, Applying, and Evaluating Work Zone Performance Measures • Collecting, Analyzing, and Improving Work Zone Data • Improving Pedestrian Safety in Work Zones

The project team discussed the topics shown in Table 5 with roundtable attendees during the afternoon workshop session and again the next morning. A complete listing of attendees is shown in Appendix H:

For each roundtable topic, the project team prompted attendees with the following questions related to practices of policies:

- Establishing Consistent, Effective, and Safe Work Zone Speed Limits:
  - What criteria are important to PennDOT in setting work zone speed limits (e.g., highway classification, work type, proximity to travel lane)?
  - Is automated speed enforcement a viable option?
- Work Zone Queuing:
  - When does PennDOT typically employ traffic modeling to determine potential road network impacts?
  - How do the findings help in developing the TMP, TCP, and construction staging?
  - How does PennDOT typically determine road network impacts and potential ways to mitigate these impacts?
  - Are existing queue protection methods working?
  - Are queue detection/prediction (ITS) devices used?
  - How is it decided to use incentive/disincentive clauses and who approves? Is this practice used often?
- Collecting, Analyzing, and Improving Work Zone Data:
  - Do practices outlined in policy actually happen? If so, has it led to any revisions to practices or policies?
  - How are/were data collected (i.e., TMP 82309 and 99251) and used?
- Developing, Applying, and Evaluating Work Zone Performance Measures:
  - Is PennDOT actively trying to establish work zone Safety/Mobility performance measures?
  - What might those look like?
  - Who will be responsible for measurement and accountability of meeting performance measures?
  - Has PennDOT considered customer surveys as a means to develop performance measures and to improve work zone safety and mobility?
  - Will PennDOT be developing statewide standards rather than qualitative measures?
- Improving Pedestrian Safety in Work Zones:
  - Are pedestrian/bike accommodations being included in work zone plans?

The roundtable discussion surrounding these topics provided the project team with a better understanding PennDOT's work zone practices. A synopsis of the discussion with respect to each topic is found in Section 3.2.

3.2. Current State Practices & Recommendations

During the roundtable discussions, attendees shared practices related to various aspects of work zone safety. The sections that follow summarize the roundtable discussions and the project team's recommendations stemming from our knowledge of PennDOT's work zone crash data, policies, procedures, and practices. Table 6, at the end of Chapter 3, provides a consolidated summary matrix of the following observations and recommendations to improve work zone safety in Pennsylvania.

3.2.1. Establishing Consistent, Effective, and Safe Work Zone Speed Limits

PennDOT's work zone crash data indicated there may be an issue with the consistency of work zone speed limits, as shown by the following:

- There were 66 fatal crashes in work zones that were flagged as speeding or speed-related.
- Aggressive driving was listed as a contributing circumstance in 63 fatal crashes. This mainly included speeding, but it could also imply failure to yield to traffic, failure to follow signs, taking turns without proper clearance, driving on the wrong side of the road, or other aggressive driving behaviors.

Current issues surrounding work zone speed limits include setting consistent speed limits, depiction of active/inactive work zones, driver compliance, speed differentials throughout the work zone, and consistent work zone speed limits within and across district lines.

Establishing Work Zone Speed Limits

There is no statewide guidance to apply when establishing work zone speed limits in Pennsylvania. Each district has their own approach to defining work zone speed limits; speed limits also may vary within districts (distinguished by project). Engineering studies are only required for work zone speed limits below 25 mph or for speed reductions over 10 mph lower than the posted speed limit. There is no lower limit associated with work zone speed limits—the State Department of Transportation (DOT) can set the limit as low as the study indicates.

At the time of the workshop, the PA Turnpike used two speed limits according to work type: 55 mph where work was being separated by concrete barrier and 40 mph where a lane closure (cones only) existed. The PA Turnpike has recently transitioned all work zone speed limits to 55 mph since raising the regulatory speed limit along the turnpike to 70 mph as a part of Act 89.

Participants at the roundtable discussion indicated that the priority for setting work zone speed limits should be to decrease or avoid queues, but engineers should pay attention to how speed limits may interact with TTC and/or road layouts and the effect this may have on drivers.

Some projects have utilized additional warning devices, such as temporary rumble strips (on flagging operations) or speed display signs, in advance of work zones to warn or alert drivers on high speed roads that the speed limit will be reduced.

Minnesota DOT[9] provides a number of requirements surrounding the establishment of regulatory work zone speed limits including minimum and maximum speed limits and maximum allowable speed reductions. Other State DOTs, such as North Carolina[10], have distinguished between activities that warrant temporary speed reductions versus projects that needed long-term speed limit reductions. By having separate methods, North Carolina DOT was able to remove ineffective and often ignored speed limit signs in work zones.

[9] http://www.dot.state.mn.us/speed/pdf/WZSpeedLimitGuideline.pdf
[10] https://connect.ncdot.gov/projects/WZTC/Documents/WZSafetyAndMobilityDraftGuidelines07_23_2007.pdf

Recommendation for Establishing Work Zone Speed Limit Criteria	• PennDOT Central Office and districts should collaborate to define criteria related to establishing consistent work zone speed limits to improve driver expectations/compliance, contacting neighboring States to establish consistency wherever possible. • PennDOT should develop and implement a statewide policy for establishing work zone speed limits. • PennDOT and PA Turnpike should continue to coordinate such that motorists see consistent work zone traffic control and speed limit application on high speed roadways. • Follow the lead of North Carolina and other States to differentiate activities that warrant temporary speed limit reductions versus long-term reductions, or consider designing work zones to accommodate the road's posted speed limit.

Driver Expectations and Consistent Speed Limit Application

Another aspect of the work zone speed limit discussion was consistent means of signing work zone speed limits in active work zones (through orange "mouse ears", plaques attached to regulatory signs, or other methods). Consistent signing in active and inactive work zones according to Manual on Uniform Traffic Control Devices (MUTCD) guidelines is important. Additionally, work zone speed limit signs are not always covered during non-active work times. This may lead to driver complacency and active ignoring of other work zone related signs.

Figure 4. Orange Plaques Used on Reduced Speed Limit Signs (Non-Work Zone)

PennDOT uses orange plaques on top of some speed limit signs (non-work zone) to draw attention to a reduced speed limit. This has caused some confusion as one attendee noted that he thought a work zone was imminent. These orange plaques (Figure 4) are used in situations where the posted speed limit is reduced from 65 mph to 55 mph on the Interstates and Turnpikes. It is believed that this practice stems from Figure 2A-1B in the MUTCD which permits the use of red or orange flags (not plaques) to improve sign conspicuity (Figure 5). Furthermore, interpretation of the text indicates that red flags are used for regulatory signs and orange flags should be reserved for work zone speed reductions. One thought on the use of flags over plaques is that flags provide a dynamic cue as flags whip from passing vehicles, whereas plaques remain static under all conditions.

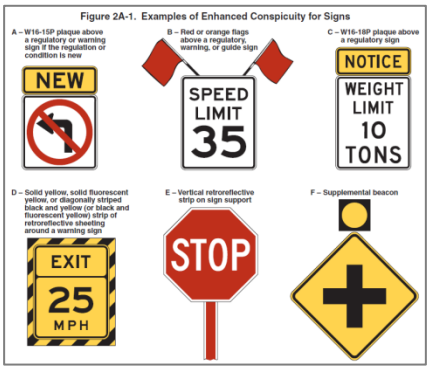

Figure 5: MUTCD Figure 2A-1 (Examples of Enhanced Conspicuity for Signs)

Consistency within work zone signing and design is directly related to safety. Consistency of work zone signing and speed limits yields driver expectations and meeting driver expectations improves compliance and safety. Coordinating project schedules during the design stage could

lead to increased work zone speed limit consistency, but the uncertainty of a project's design staying on schedule creates additional coordination complications.

Recommendations for Maintaining Driver Expectations and Consistently Applying Work Zone Speed Limits	• Ensure MUTCD compliance with respect to using orange work zone signing appropriately. • Ensure that orange mouse ears are sending the intended message to the driving public. • Explore how currently collected speed data can be used in work zone applications (i.e., consider variable speed limits).

Automated Speed Enforcement

Data analysis revealed that 60 percent of fatal work zone fatal crashes involved aggressive driving. The MOU between PennDOT and the PSP indicated work zone queue protection as their first priority; speed enforcement is only permitted when no queue exists.

Legislative discussion to approve automated speed enforcement is currently taking place. At this point in the exploration process, PennDOT and PSP are not able to influence the legislature. If approved, PennDOT should consider using automated speed enforcement as a means of reducing speeding in work zones.

In Maryland work zones where deployed (known as *SafeZones*), automated speed enforcement has been tremendously effective in slowing traffic down, evidenced by the drop in the percentage of citations issued at these work zones.[11] Since Maryland law enforcement began using speed cameras in highway construction areas, work zone-related crashes, fatalities and injuries reached a more than 10-year low: fatalities in work-zone crashes decreased by more than half from nine in 2009 to three in 2012. In the same timeframe, people injured decreased from 827 to 640 and overall work zone crashes decreased from 1,685 to 1,392. Speeding violations in *SafeZones* construction sites have decreased by more than 80 percent. When the program began, approximately seven out of every 100 drivers in the *SafeZones* construction areas were exceeding the speed limit by 12 mph or more; today, that is fewer than two drivers out of every 100 are receiving citations.[12]

Recommendations for Implementing Automated Speed Enforcement	• If legislation approves the use of automated speed enforcement, PennDOT has agreed to use this as a means to improve work zone speed compliance.

Work Zone Speed Limit Compliance

Officer presence within a work zone is primarily for queue protection, accomplished by stationing officers who move their vehicles as the queue lengths change. If the queue dissipates, PSP may transition to vehicle code enforcement in the work zone until a queue forms again. Over time, some drivers recognize that the police officers are not conducting

[11] http://www.safezones.maryland.gov/mdsafezones.html
[12] http://sha.md.gov/OC/SafeZones_fact_sheet.pdf

enforcement, which leads to speed limit non-compliance within the work zone. Non-compliance with speed limits could negatively impact work zone traffic flow. For example, lower speed limits lead to shorter tapers which could impact non-compliant drivers by shortening the space available for them to merge.

Pennsylvania State law states that any project on limited access highways over $300k must include speed display signs to alert drivers of upcoming work zones. PennDOT does not currently use any form of traffic control device to alert drivers to reduce speeds in impending work zones (i.e., temporary rumble strips, speed display signs) as a standard work zone practice for other project locations or sizes.

PSP states that some work zones are not conducive for speed enforcement due to limited or lack of pull-off locations within the work zones. The presence of police pull-off locations could, in itself, improve speed compliance.

Recommendations for Improving Work Zone Speed Limit Compliance	• If automated speed enforcement is not used, PSP should continue using active speed enforcement in advance of and within (when available) the work areas. • PennDOT should consider expanding the MOU to include speed enforcement when necessary. • Continue expanding the use of traffic control devices (i.e., variable message signs (VMS) to alert drivers of upcoming work zones. • PennDOT should include PSP in TCP development such that enforcement pull-off sites are located within the work zones, if desired. (Note: consider specifying which projects based on length, speed, etc.)

Coordination Between Districts and Projects

One PennDOT district indicated that they try to coordinate work zone staging and speed limits with other projects along the same corridor regardless of district lines; however, this is not standard practice. Many project engineers focus on their projects and do not anticipate project-to-project interaction, which may lead to closely spaced or overlapping work zones, causing driver confusion regarding speed limits and/or lane closures.

Recommendations to Ensuring Coordination Between Districts and Projects	• Consider facilitating communication and collaboration on projects across corridors to establish and maintain consistent work zone speed limits. • Consider modifying Pub 46 to include policy on speed limit reductions.

3.2.2. Work Zone Queuing

The provided crash data and supplementary narratives indicated that there may be an issue with work zone queuing:

- Queuing was associated with at least 21 fatal work zone crashes
- 25 percent of fatal work zone crashes involved rear end collisions
- The 2012 Self-Assessment rated PennDOT as a 3 of 15 related to using traffic modeling programs to determine queues

Lane Closures

Some districts open and close lanes within the work zones to allow passing and to reduce delays associated with slow moving vehicles where grades are impeding traffic flow. This idea came from an old policy that limited lane closures to less than or equal to three miles. This works similar to road metering and has worked well.

PA Turnpike does not allow lane closures when simulation shows a volume-to-capacity (v/c) ratio of greater than 0.85. Additionally, the Turnpike strives to keep two lanes open in each direction at all times. Similarly, PennDOT does not allow for lane closures during times when delay is greater than 20 minutes over two hours.

Recommendations Regarding Lane Closures	• Since queuing typically occurs at merge points, PennDOT should consider minimizing the number of merge points within a work zone wherever feasible (allowable exceptions may include roadways with large grades). • Set criteria for minimum distance between merge points. • PennDOT and the Turnpike should discuss and collaborate on best practices related to congestion and queuing.

Work Zone Simulation

Per policy, traffic modeling is required to simulate work zones and inform strategies/staging when the project is on an Interstate, PA Turnpike, or freeway and has a lane closure greater than three days.

PA Turnpike requires simulation for every project (Turnpike is only I-76). They do not allow contractors to perform work during any time (time of day, day of week, etc.) that the simulation displays a v/c ratio greater than 0.85. They will take appropriate measures, such as redesigning the TMP, changing the work schedule, and/or revising the project's staging plans, to ensure that they meet their 0.85 threshold.

Some PennDOT districts consider "simulation" as spot location assessments using capacity spreadsheets of level of service (based on calculations from the Highway Capacity Manual), whereas others use simulation software such as VISSIM to determine how volumes from on/off ramps impact level of service (LOS). One district commented that capacity spreadsheets (queuing) do not accurately reflect field conditions and they rely on previous similar experience to predict traffic impacts.

In 2011 and 2012, PennDOT ranked themselves a 3 out of 15 in their work zone Self-Assessment related to using traffic modeling programs to determine the impact of significant projects, both construction and maintenance, on network performance (national average is 9.1).

In 2011 and 2012, PennDOT ranked themselves a 3 and 5, respectively, out of 15 in their work zone Self-Assessment related to using the agency's planning process to analyze the network to develop adequate alternate options for routing traffic in anticipate of future projects (national average is 8.9).

Recommendations for the Use of Work Zone Simulation	• PennDOT should consider expanding the use of simulation software that accounts for entering and exiting vehicles from the mainline and connects the simulation process to the road user liquidated damages (RULD) methodology. • PennDOT should continue using field experience to confirm or refute simulation outputs.

Means to Reduce Queuing

In 2011 and 2012, PennDOT ranked themselves a 1 out of 15 in their work zone Self-Assessment related to using contractors or contractor associations to provide input on reducing project duration (national average is 9.7). PennDOT also ranked themselves a 2 of 15 at involving contractors in developing the TCP.

To reduce the probability of a queue forming in the work zone, the PA Turnpike redesigns projects to accommodate a v/c ratio of 0.85 or less.

The Transportation Management Center (TMC) currently receives road sensor information and video related to speed and travel times. This information is disseminated to motorists via 511, PA511.com website, and field-installed message boards. Some districts actively communicate to the TMC when work zones go live or are complete, which relays messages to the public of where/when lane closures will occur. Public information related to potential work zone conditions (queuing, delay) is used to help travelers shift to other routes and/or times of travel.

PennDOT does not currently utilize incentive/disincentive clauses to reduce queuing. The roundtable group discussed the use of value engineering to reduce queue lengths, but the group concluded that there would be no monetary benefit or cost benefit to the contractor associated with reducing queues.

Recommendations for Reducing Queuing	• Consider using crowdsourcing applications to supplement current incident notifications and speed detection performed by the TMC. Current road condition reporting system (RCRS) policy only allows for verified traffic information sources and staff is evaluating whether crowdsourcing may be added in the future. • PennDOT and PA Turnpike should collaborate on best practices related to congestion and queuing. • PennDOT should consider developing a quick clearance policy for congestion. • PennDOT should continue to be open to experimental devices with the intent to improve work zone safety and mobility. • PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.

Back-of-Queue Law Enforcement Presence

PennDOT allows use of active back-of-queue protection from PSP and static “watch for stopped vehicles” signs.

Current PennDOT practice on Federally-funded projects is to utilize PSP to monitor the end of the queue. For back-of-queue protection, a PSP officer is stationed within 0.25 miles upstream from the end of the queue. The PSP vehicle may or may not face traffic with its emergency lights activated and its headlights on during the day or off during the night. The PSP requires at

least a two-week advanced notice to request back-of-queue protection on projects that expect queuing problems. Typically, queue protection is staffed by voluntary overtime PSP members.

If a queue exists and it meets the MOU, PSP will staff. If the queue dissipates, PSP will perform vehicle code enforcement.

The PennDOT also allows use of static "watch for stopped vehicle" signs upstream of the work zones. Some contractors use automated queue detection devices. Some districts expressed a desire to use these systems but felt they were cost prohibitive. Bureau of Maintenance Operations (BOMO) is currently working to bring a pilot project to test these devices to be deployed in the coming weeks.

Recommendations for Back-of-Queue Law Enforcement Presence	• PennDOT should prioritize the identification of potential queues and notify PSP more than two weeks prior to the work. • Consider using queue length detectors or other end of queue warning devices to allow PSP to perform other safety-related tasks (e.g., PennDOT's Advanced Queue Warning System Demonstration).

Maximum Queuing Policy

The roundtable discussion indicated that PennDOT does not have an explicit maximum or minimum queuing policy at this time.

North Carolina DOT[13] established a work zone mobility performance index that can be used statewide on interstates and freeways. Roadways qualify to be rated as exceptional, acceptable, and unacceptable based on the percentage of days that a work zone meets three levels of criteria:

- *Criteria 1*: All queues less than .75 miles are acceptable for any duration of time.
- *Criteria 2*: Queues reaching .75 miles and extending to maximum length of 2 miles are considered acceptable for duration of up to 2 hours for any given day's work operation. (Note: If conditions exist longer than 2 hours, then the work zone impacts are unacceptable. Alternative strategies shall be considered per the provision of this policy.)
- *Criteria 3*: Queues that exceed 2 miles in length for any period of time are unacceptable.

PA Turnpike tries to eliminate queuing by limiting a v/c ratio to less than 0.85 within a work zone. The Missouri DOT[14] operates under a similar concept. Any time their simulation program indicates that traffic is approaching a capacity restriction level; work is required to be performed during off-peak hours, at night, or during weekend hours.

Recommendations for Creating a Maximum Queue Policy	• PennDOT should consider enacting a maximum queue policy similar in nature to the Missouri DOT's or North Carolina DOT's work zone performance criteria. • PennDOT and PA Turnpike should collaborate on best practices related to congestion and queuing.

[13] http://ops.fhwa.dot.gov/wz/p2p/itswkshop052113/kite/kite.pdf
[14] http://epg.modot.org/index.php?title=616.13_Work_Zone_Capacity%2C_Queue_and_Travel_Delay

3.2.3. Developing, Applying, and Evaluating Work Zone Performance Measures

The FHWA defines work zone performance measures as quantitative metrics that describe how an individual work zone impacts its road users or how a group of work zones impact the collective audiences.[15] Work zone performance measures help agencies identify areas where work zones meet, exceed, or fall short of meeting certain safety and/or mobility goals.

Existing Performance Measures

Although PennDOT does not have specific targeted goals for reducing work zone fatalities and serious injuries, the agency is a "Vision Zero" State that promotes reducing all motor vehicle fatalities and serious injuries by half by the year 2030 as they further drive to eliminate all roadway fatalities. By proxy, this includes reducing work zone fatalities and serious injuries.

PennDOT does not currently have work zone performance measures; however, the DOT uses a threshold of 20 minutes of added delay for 2 consecutive hours compared against the base condition of the roadway to determine if a project is "significant". Workshop attendees indicated that this was selected because the public could easily identify and relate to these criteria.

The PA Turnpike does not have any strict performance measures (with the exception of the v/c ratio which acts as a performance predictor).

Recommendations for Modifying Existing Performance Measures	• PennDOT should continue to explore various means to quantitatively measure and evaluate mobility and safety indicators.

Evaluating Performance Measures

PennDOT considered using a customer-input survey for rating work zones, but their legal counsel advised against it since "work zone deficiencies" could be used against them in later court cases. Missouri DOT experienced a similar setback and decided to require internal employees to submit a certain number of work zone evaluations every year.

PennDOT employees indicated that the Highway Administration Customer Survey (HACS) may have included work zone related questions at one time. PennDOT may be able to add work zone questions through this effort.

Recommendations to Evaluating Performance Measures	• PennDOT should consider using technical and non-technical staff to perform work zone evaluations. Accountability for completing work zone reviews monthly/quarterly could become an employee expectation in yearly employee performance reviews.

Accountability for Meeting Performance Measures

The workshop discussion indicated that an action-leader should be selected to monitor work zone performance measures. The group discussed including performance measure

[15] FHWA's Resources on Work Zone Safety and Mobility Performance Monitoring and Measurements: http://www.ops.fhwa.dot.gov/wz/resources/publications/fhwahop13014/index.htm

accountability into the action-leader's yearly performance review, in addition to the district engineer's yearly performance review.

Contractors should also be held accountable for meeting certain performance measure goals. Currently, if contractors score low on their overall performance ratings/evaluations, they are asked to meet with the district where they may be prohibited from bidding on certain project types, but it is uncommon to ban a contractor from bidding on all State projects.

Recommendations for Meeting Performance Measures	• PennDOT should consider assigning responsibility and accountability for meeting work zone performance measures. These could become factors in yearly employee performance reviews.

Developing Other Performance Measures

PennDOT's Traffic Engineering Manual cites the BOMO as the lead oversight for monitoring work zone performance measures. The manual also states that Central Office will select and evaluate a group of work zones to measure the effectiveness of approved work zone alternatives for each project. The evaluation will focus on additional project-related travel time through the project area and work zone related fatalities and crashes.

PennDOT is actively trying to establish work zone safety and mobility performance measures. The workshop attendees brainstormed potential performance measures including, but not limited to, queue measurements and work zone-specific fatality and injury criteria. The fatality and injury data should be separate from the State's Strategic Highway Safety Plan. Performance measures from other States may also be considered, such as[16]:

- Provide an environment conducive to roadway user and worker safety.
  - Work toward zero work zone fatalities.
  - Reduce crashes in all types of work zones.
- Minimize impact of work zones on roadway user.
  - Limit traffic delays to 15 minutes or less.
  - Provide customers real-time work zone information.

PennDOT intends to implement the Real-Time System Management Information Program, as required by 23 CFR 511 within a few years. As a result, PennDOT could utilize information gleaned from this program to monitor performance measures.

Recommendations to Develop Other Performance Measures	• PennDOT should develop statewide quantitative performance measures rather than qualitative or subjective indicators. • PennDOT could model other States or agencies that currently have performance measures related to work zone safety and mobility. • PennDOT should consider current and future data sources while determining possible performance measures.

[16] http://epg.modot.mo.gov/index.php?title=616.14_Work_Zone_Safety_and_Mobility_Policy

3.2.4. Collecting, Analyzing, and Improving Work Zone Data

Work zone data collection varies by district in Pennsylvania. All of the districts collect the work zone data that is required by State and national agencies; however, some districts exceed expectations by creating and implementing TMPs for certain “non-significant” projects and performing extra analysis on work zone safety and mobility data.

Data Collection Regarding Performance Measures

In 2011 and 2012, PennDOT rated themselves a 3 of 15 in their work zone Self-Assessment related to conducting customer surveys to evaluate work zone TMPs on a statewide/area-wide basis. The current national average for this practice is 6.9 out of 15.

While data is not formally captured or input for statewide distribution or analysis, some districts do capture project level delay/queuing/crash data and share this with other district-level personnel. However, it is believed that this data is not analyzed consistently (varies from district to district). Since data are collected in all districts, it is believed that some districts will use this data in the future to assist with related projects.

Although data collection and/or monitoring of project-level delay, queuing and/or crash data is required on significant projects, this data is rarely shared with other districts or analyzed in a consistent manner by the districts or State. Additionally, very few districts collect and analyze data on non-significant projects resulting in minimal data available to improve smaller work zone efforts. The following examples indicate some of the data that is collected on some projects:

- ECMS #99251 was a "significant project" so the contractor’s traffic control supervisor was expected to maintain a daily record of crashes, work zone incidents, and maximum daily queue lengths due to the construction using the MPT Daily Record form included in the contract.
- ECMS #82309 was a "non-significant" project that was not required to have a TMP, however, the district still collected crash data, travel time data, and queue length as primary sources to determine the effectiveness of work zone traffic management strategies.

If a work zone experiences a mobility problem, such as long delays or excessive queuing, the traffic control supervisors often notify the project engineers and the issues are solved via phone or short informal emails, after approval by the District Engineer.

District 6 is testing new statewide software that will be used to collect and process performance evaluation methods. Once this data is captured, reports can be generated to evaluate how well certain traffic management strategies are performing.

TMCs typically collect and evaluate data such as speeds, congestion, and delay. This information, although not work zone specific, is shared with the public via the 511 program’s website and/or dynamic message signs. PennDOT could utilize this data to assist with work zone data collection.

Data collection is moving toward using data that is already collected for the Highway Performance Monitoring System (HPMS) and finding ways to apply these data toward work zones. The Maryland State Highway Administration successfully utilized their Regional Transportation Information System to collect data related to delay, congestion, and queue

length in order to monitor performance measures such as number of days when queuing occurred, average queue duration, average queue length, maximum queue length, percent of time a queue exceeds a certain value, and maximum per-vehicle delay. Since traffic volume can also be collected, additional performance measures could include percent of traffic that encounters a queue, vehicle-hours of delay, average delay per entering vehicle, and percent of traffic experiencing a delay that exceeds a defined threshold.

Recommendations for Collecting Data for Performance Measures	• PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.

Work Zone Crash Data

The workshop attendees indicated that work zone crash data are captured in report form at the project level by construction staff and law enforcement. These reports are elevated to the district level where they are reviewed. A formal inspection of the work zone takes place to determine if the work zone requires TTC revisions, staging modifications, etc. Sometimes the reports are passed to the safety and tort groups, but information regarding the inspection or outcomes are not shared on a statewide nor district-wide basis.

Pennsylvania only retains records for crashes ("reportable crashes") that either have property damage to the vehicle requiring it to be towed or an injury (complaint of injury or hospitalization). The PSP currently restricts access to fatal crash reports to anyone outside of PSP until they have been finalized.

Pennsylvania law enforcement agencies are trying to become 100 percent electronic by 2015. No changes will be made to the crash report until reporting becomes 100 percent electronic. PennDOT uses Model Minimum Uniform Crash Criteria (MMUCC) as its baseline for capturing crash data; It is unlikely that any additional fields, if desired, will be added onto the crash report.

Recommendations for Collecting Work Zone Crash Data	• Consider allowing PennDOT partial or full access to PSP's fatal crash reports as they are being developed such that potentially attributing work zone crash factors can be resolved before the work zone is no longer active.

Crash Reporting

PennDOT considers a reportable crash as any crash that result in property damage to a vehicle requiring it to be towed or an injury that requires hospitalization. Agencies may write up other crashes, but only those meeting the above criteria are reported to the DOT.

Crash narratives are vague with respect to roadway and/or work zone details, typically focusing mostly on the people and cars but neglecting how (or if) the work zone or roadway conditions contributed to the crash. The research team was unable to determine how some crashes occurred due to missing information on how the work zone may have contributed to the crash. Several States have varying methods of improving work zone crash data collection including:

- *Wyoming DOT*: The Wyoming State traffic engineer monitors construction related accidents, analyzes the data, and submits an annual report to the State construction engineer. Data collected includes the number of crashes that occur in:
    - Detour or lane transition
    - While flagging is present
    - Involving a traffic control device
    - Involving contractor equipment
    - Resulting in injuries
    - Resulting in fatalities
    - In an urban area
    - In a rural area
    - During the day
    - During the night
- *Kansas DOT* collects and analyzes information on crashes in construction zones and then informs law enforcement and construction managers about the crash frequency. As a part of this effort, Kansas DOT staff members provide recommendations for work zone safety improvements to officials for consideration during projects and after projects for future efforts.
- *Montana DOT* collects and analyzes data on construction crashes and evaluates whether changes need to be made at an individual work zone or to the agency's policies.
- *Ohio DOT* uses a real-time crash analysis tool to track work zone crashes on a subset of pre-selected work zones. Ohio DOT collects data on crashes in these work zones and compares the data to historical data to identify changes in trends. The data are captured in near real-time by electronic queries and bi-weekly visits to law enforcement agencies. Ohio DOT uses this data to monitor crash frequencies at the selected work zones to ensure they stay at or below the crash frequency at the same location prior to the establishment of the work zone.

PennDOT looks at the consistency between crash reports and talks with the agencies that are submitting incorrect, inconsistent, or incomplete reports. For example, some agencies struggle to distinguish the difference between crash types such as an angle crash versus a head-on left turn crash, which may create inconsistencies between agency reporting.

Motor vehicle crashes involving horse and buggy are reported to the State, but PennDOT does not collect data on crashes involving only horse/buggy crashes.

If a supplemental report is created, it is not necessarily added to the crash file. Agencies submit initial police reports within 15 days of a crash. If a supplemental crash report is required, it is written afterwards, but it could take six months to a year to complete the supplemental report for a fatal crash.

Recommendations for Crash Reporting	• Consider enhancing the State's collection of crash-related data. • Consider developing an interactive online training tool to help facilitate consistent crash reporting among local law enforcement agencies. Training should be completed by every officer responding to crashes every few years.

3.2.5. Improving Pedestrian Safety in Work Zones

The provided crash data and supplementary narratives indicated that there may be an issue with pedestrian safety and mobility in work zones:

- 8 pedestrians were killed in work zones (does not include construction workers)
- Vague crash data narratives do not help explore potential contributing circumstances related to pedestrian crashes

Policy and Application

PennDOT's policy to address pedestrians and bicycles in work zones appears fairly comprehensive, yet there appears to be a misunderstanding regarding who is responsible for considering pedestrian facilities within work zones. The independent oversight program reviews indicated that the construction staff did not always feel responsible for including pedestrian facilities because they were not explicitly stated within the TCPs. Sometimes contractors suggest that pedestrian accommodations be made within a work zone, but the districts are not required to act on the suggestions.

Pedestrian accommodations within work zones are a regular topic of discussion in some districts. In addition to adding temporary TCPs for pedestrians, these districts may further limit the number of consecutive intersections or intersection quadrants that can be closed at one time in order to better accommodate pedestrian movements and eliminate pedestrian detours.

> "Pedestrians are considered and accommodated very differently across all PennDOT Districts."
> – Workshop Attendee

Other districts provide limited or no pedestrian traffic control elements in project plans; rather, they rely on notes or special provisions to provide the details by which the contractor should establish pedestrian TTCs. In these cases, the notes or special provisions may not provide adequate details regarding not only requiring pedestrian accommodations in the work zone design plans but also specifically how pedestrian facilities should be addressed. Some district representatives indicated that they included vague notes about providing pedestrian accommodations due to the added costs of providing temporary pedestrian facilities or added costs of extending the work schedule for a small number of pedestrians.

Pedestrians are included in peak hour traffic counts, but these may not be an accurate representation of pedestrian activity in rural or low volume areas.

Vague crash data narratives do not help explore potential contributing circumstances related to pedestrian crashes. Improving this aspect of pedestrian crash reports may help PennDOT understand whether pedestrian accommodations are being included adequately, or if pedestrians are not obeying traffic control devices.

Recommendations for Policy and Application of Work Zone Pedestrian Facilities	• Pedestrian studies should be performed prior to work zone design to determine if pedestrian facilities currently exist and are necessary during the work. • PennDOT should recommend that work zone staging accommodates pedestrians when appropriate (pending pedestrian studies). • PennDOT should encourage obvious notation and clear instructions regarding work zone pedestrian accommodations.

Pedestrian Mobility

Pedestrian access and mobility trainings exist but they are typically geared toward permanent pedestrian accommodations, not temporary applications like work zones. Training related to pedestrians in work zones has not occurred since 2006.

Typically, if work zone plans do consider pedestrian accommodations, they do not always consider all types of pedestrians including pedestrians of various ages and pedestrians requiring Americans with Disabilities Act (ADA) accommodations.

The Minnesota DOT gathered input from pedestrians with disabilities regarding devices used to redirect pedestrians through and around work zone areas. From these sources and from the Federal MUTCD, Minnesota DOT developed standards and guidelines to implement Temporary Pedestrian Access Routes through areas impacted by maintenance and construction. Standard layouts have been designed and are available in the *Temporary Traffic Control Zone Layouts Field Manual* (February 2011), which is part of Minnesota's MUTCD.

FHWA offers additional guidance on maintaining pedestrian pathways in TTC zones.[17] They suggest that if a project allows pedestrian access through part of the TTC zone, the pathway should be properly maintained. This includes, but is not limited to, regular pathway inspections, ensuring proper pedestrian signal timing schemes, removing pedestrian hazards or obstructions, ensuring pedestrians are not led into direct conflicts with vehicles/equipment, providing convenient and accessible pathways that replicate existing sidewalks/footpaths, providing notifications of road or sidewalk closures, and providing audible information devices for visually impaired pedestrians.

Recommendations for Pedestrian Mobility	• PennDOT should consider trainings on how to accommodate a variety of pedestrians (pedestrian, bicyclists, mobility impaired, etc.) in the work zone designs. • PennDOT should consider developing standards and guidelines for accommodating various types of pedestrians.

[17] http://www.atssa.com/galleries/default-file/WZ%20Guidance%20Sheet%20FINAL%20LAYOUT%20TO%20FHWA.pdf

3.2.6. Other Discussion Topics

Throughout the workshop, several additional topics led to engaging conversations which warranted additional recommendations for the PennDOT.

Work Zone Crash Exposure

The workshop attendees participated in a discussion regarding measurement of crash exposure levels with respect to different work zone types (construction, utility, etc.) and other variables (i.e., day versus night, lane closure versus no lane closure, worker presence, use of positive protection, etc.). With the passing of Act 89, additional monies have been allocated for transportation funding which has resulted in projects receiving funding earlier than expected, many of which include local road projects with workers who are not well trained to handle work zone issues. Due to this influx of project funding, the number of work zone crashes may increase in the next few years.

Recommendations for Determining Work Zone Crash Exposure	• Consider monitoring the number of crashes with respect to several work zone variables (i.e., construction vs. utility work zone, day versus night, lane closure versus no lane closure, worker presence, use of positive protection, etc.) in order to help determine future work zone strategies. • Improve the construction inspection process to include check-boxes for active (workers present) versus non-active (workers not present) work zones.

Stop Signs as a Form of Ramp Metering

Stop signs are used periodically at the end of on-ramps as traffic merges onto the mainline where active work zones exist. It is believed that this process originated as a form of ramp metering; however, it has the potential to create queues on the on-ramps and negatively impact traffic mobility on the mainline and on local roads. Ramp yield entry is encouraged, but stop signs may be used at the end of an on-ramp in cases where the nature of the work or a physical restriction prohibits ramp yield.

Recommendations for Using Stop Signs on On-ramps	• Use this method sparingly, as a last resort. For example, it may be appropriate to use in circumstances where there is a short acceleration lane or where the mainline necks down due to lane closures, bridges, or other physical restriction.

Short-Duration Utility Work Zones

Some of the common issues with these work zone types are:

- Work zones can be unexpected since mobile or short-duration operations are only active during short periods of time
- Work zone traffic control devices and/or placement are not in compliance with MUTCD standards
- Distracted flaggers or unsafe worker practices

Although flagger distraction is included in the list above, PennDOT believes that utility work zone safety has improved since a certified flagger company has been employed by utility providers.

PennDOT approves utility work zone permits after reviewing TCPs and permits are issued for a range of dates during which the work could be performed any time. Since the DOT does not know exactly when the work is being performed, they are unable to inspect the work zones for TCP compliance. This has caused some utility providers or contractors to become complacent about work zone setup and safety.

There is a desire to notify road users in real-time of lane closures and restrictions. Currently, PennDOT allows those updating road and lane conditions to phone-in updates to a central system, wait for operators to input this information into the PA511 system, and then become available for public viewing. Allowing all PennDOT employees, contractors, utility providers, and those impacting lane closures direct access to the public notification system may alleviate conflicting situations between actual road conditions and PA511 information.

The current permit template issued to utility providers states that the PSP is available to help monitor traffic in utility work zones. During the workshop, the PSP commented that they will not be present to monitor utility work zones since they only monitor traffic and queues for large Federally-funded projects. Language requiring PSP presence should be removed from the utility project permits.

Recommendations for Short-Duration Utility Work Zones	• Consider setting up a process where utility workers contact the DOT within an hour or two of setting up their work zone so the DOT knows when the work is being performed. • Consider implementing a lane reservation system which gives utilities and other contractors the opportunity to record when they are working. • Improve construction inspection process to include check-boxes for active (workers present) versus non-active (workers not present) work zones. • Develop an application allowing anyone who establishes work zones or performs work on Pennsylvania roadways (maintenance forces, contractors, utility providers, etc.) to update in real-time active lane restrictions or lane closures. This application would feed the RCRS used by PA511 to update the public on travel conditions during active work zones, inclement weather events, and other situations.

Work Zone Traffic Control Manager

PennDOT discussed requiring that a work zone traffic control manager be designated for each contracted project on State roads. This manager would reside onsite, satisfy the Final Rule training and certification requirements (shown below), and would oversee all lane closures and lane restrictions for the individual project.

Final Rule

> **§ 630.1012(e): Responsible Persons.** The State and the contractor shall each designate a trained person, as specified in § 630.1008(d), at the project level who has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.
>
> **§ 630.1008(d): Training.** States shall require that personnel involved in the development, design, implementation, operation, inspection, and enforcement of work zone related transportation management and traffic control be trained, appropriate to the

job decisions each individual is required to make. States shall require periodic training updates that reflect changing industry practices and State processes and procedures.

Recommendations for Providing a Work Zone Traffic Control Manager	• Consider requiring the identification, training, and certification of a work zone traffic control manager that satisfies the Final Rule requirements. The manager will be responsible for overseeing lane closures and lane restrictions on a project-by-project basis, or through consulting with other work zone traffic control managers where overlap between projects may exist.

Table 6 provides an overview of all critical issues, State practices as observed by the project team, and recommendations. It is designed to serve as a "quick reference" to the content in Chapter 3.

Table 6. Current State Practices and Recommendations for Improvement

State Work Zone Safety Implementation Plan		
State: Pennsylvania		
Assessment Date: June 19, 2014		
Critical Issue	**Current State Practices**	**Recommendations**
Establishing Consistent, Effective, and Safe Work Zone Speed Limits		
Establishing Work Zone Speed Limit Criteria	There is no statewide guidance to apply when establishing work zone speed limits. Each district has their own approach to defining work zone speed limits; it also may vary within district (distinguished by project). Engineering studies are only required for work zone speed limits below 25 mph or for speed reductions over 10 mph lower than the posted speed limit. There is no lower limit associated with work zone speed limits – the DOT can set the limit as low as the study indicates. Lower speed limits lead to shorter tapers which could impact non-compliant drivers. PA Turnpike uses a work zone speed limit of 55 mph since raising the non-work zone speed limit to 70mph.	• PennDOT Central Office and districts should collaborate to define criteria related to establishing consistent work zone speed limits to improve driver expectations/compliance. Contact neighboring States to establish consistency wherever possible. • PennDOT should develop and implement a statewide policy for establishing work zone speed limits. • PennDOT and PA Turnpike continue to coordinate such that motorists see consistent work zone traffic control and speed limit application on high speed roadways. • Follow the lead of North Carolina DOT and other States to differentiate activities that warrant temporary speed limit reductions versus long-term reductions, or consider designing work zones to accommodate the road's posted speed limit.
Maintaining Driver Expectations and Consistently	During non-active work zones, work zone speed limit signs are not always covered. This may lead to drivers ignoring other work zone related signing. PennDOT uses orange plaques, "mouse ears", on top of some speed limit signs (non-work zone) to draw attention to the speed limit. This has caused some confusion as one attendee noted that he thought a work zone was	• Ensure MUTCD compliance with respect to using orange work zone signing appropriately. • Ensure that orange mouse ears are sending the intended message to the driving public. • Explore how currently corrected speed data can

Critical Issue	Current State Practices	Recommendations
Applying Work Zone Speed Limits	imminent. These orange plaques are used in situations where speed limit is reduced from 65 mph to 55 mph on Interstates and Turnpikes. Road closed ahead signs placed on the mainline for an intersecting street.	be used in work zone applications (i.e., consider variable speed limits).
Implementing Automated Speed Enforcement	Data analysis revealed that 60 percent of fatal work zone crashes involved aggressive driving. PSP currently participate in work zone back-of-queue protection only. Legislative discussion to approve automated speed enforcement is currently taking place. PennDOT and PSP have no influence on this matter. (Look into crash reduction, revenue generation, civil matter not criminal)	• If legislation approves automated speed enforcement, PennDOT has agreed to use this as a means to improve work zone speed compliance.
Improving Work Zone Speed Limit Compliance	PennDOT does not currently use any form of traffic control device to alert drivers to reduced speeds in impending work zones (i.e., temporary rumble strips, speed display signs) as a standard practice. State law states that any project over $300k on limited access highways must use speed display signs. PSP states that some work zones do not allow for speed enforcement due to limited or lack of pull-off locations within the work zone.	• If automated speed enforcement is not used, PSP should continue using active speed enforcement in advance of and within (when available) the work areas. • PennDOT should consider expanding the MOU to include speed enforcement when necessary. • Continue expanding the use of traffic control devices (i.e., VMS) to alert drivers of upcoming work zones. • PennDOT should include PSP in TCP development such that enforcement pull-off sites are located within the work zone, if desired. (Note: Consider specifying which projects based on length, speed, etc.)
Ensuring Coordination Between Districts and Projects	At least one district looks at work zone speed limits across district lines, but others look at individual projects and do not anticipate project-to-project interaction.	• Consider facilitating communication and collaboration on projects across corridors to establish and maintain consistent work zone speed limits. • Consider modifying Pub 46 to include policy on speed limit reductions.

Critical Issue	Current State Practices	Recommendations
Work Zone Queuing		
Lane Closures	Some districts open and close lanes within the work zones to allow passing to and reduce delays associated with slow moving vehicles where grades are impeding traffic flow. This idea came from old policy that limited lane closures to less than or equal to three miles. This works similar to road metering and has worked well. PA Turnpike does not allow lane closures when simulation shows a v/c ratio of greater than 0.85. PennDOT does not allow for lane closures during times when delay is greater than 20 minutes over 2 hours.	• Since queuing typically occurs at merge points, PennDOT should consider minimizing the number of merge points within a work zone wherever feasible (allowable exceptions may include roadways with large grades). • Set criteria for minimum distance between merge points. • PennDOT and the Turnpike should discuss and collaborate on best practices related to congestion and queuing.
Use of Work Zone Simulation	Per policy, traffic modeling is required to simulate work zones and inform strategies/staging when the project is on an interstate, PA turnpike, or freeway and has a lane closure greater than 3 days. In 2011 and 2012, PennDOT ranked themselves a 3 out of 15 in their WZ Self-Assessment related to using traffic modeling programs to determine the impact of significant projects, both construction and maintenance, on network performance (national average is 9.1). In 2011 and 2012, PennDOT ranked themselves a 3 and 5, respectively, out of 15 in their work zone Self-Assessment related to using the agency's planning process to analyze the network to develop adequate alternate options for routing traffic in anticipate of future projects (national average is 8.9). PA Turnpike requires simulation for every project (turnpike is only I-76). They do not allow contractors to perform work any time (time of day, day of week, etc.) that the v/c ratio greater than 0.85. Some PennDOT districts consider "simulation" as spot location assessments using capacity spreadsheets (based on HCM) of level of service, whereas others use simulation software such as VISSIM to determine how volumes from on/off ramps impact LOS. One district comments that capacity spreadsheets (queuing) do not accurately	• PennDOT should consider expanding the use of simulation software that account for entering and exiting vehicles from the mainline and connect the simulation process to the RULD methodology. • PennDOT should continue using field experience to confirm or refute simulation outputs.

Critical Issue	Current State Practices	Recommendations
	reflect field conditions and they rely on previous similar experience to predict traffic impacts.	
Reducing Queuing	In 2011 and 2012, PennDOT ranked themselves a 1 out of 15 in their work zone Self-Assessment related to using contractors or contractor associations to provide input on reducing project duration (national average is 9.7). PennDOT also ranked themselves a 2 of 15 at involving contractors in developing the TCP. PA Turnpike redesigns projects to accommodate a v/c ratio of 0.85 or less. PSP uses stationary vehicles (moving with queue) in advance of the work zone to help reduce motorist speeds going into the work zone but does not typically enforce speed (speed only monitored/enforced if no queue exists). This may lead to drivers who do not comply with posted WZ speeds. Some contractors use automated queue detection devices. Some districts expressed a desire to use these systems but feel they are cost prohibitive. BOMO is currently working to bring a pilot project to test these devices to be deployed in the coming weeks. TMC currently receives road sensor information and video related to speed and travel times. This information is disseminated to motorists via 511, PA511.com website, and field installed message boards. Some districts actively communicate to the TMC when work zones go live and are complete, which relays messages to the public of where/when lane closures will occur. Public information related to potential work zone conditions (queuing, delay) is used to help travelers shift to other routes and/or times of travel.	• Consider using crowdsourcing applications to supplement current incident notifications and speed detection performed by the TMC. Current RCRS policy only allows for verified traffic information sources and is evaluating whether crowdsourcing may be added in the future. • PennDOT and PA Turnpike should collaborate on best practices related to congestion and queuing. • PennDOT should consider developing a quick clearance policy for congestion. • PennDOT should continue to be open to experimental devices with the intent to improve work zone safety and mobility. • PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.
Back-of-Queue Law Enforcement Presence	PSP stations an officer in vehicle approximately 0.25 mile upstream of the queue with emergency lights activated and headlights on during day, off at night. This occurs only on federally-funded projects and is staffed as PSP voluntary overtime. If back-of-queue enforcement is requested, the PSP requires a two week advanced notice.	• PennDOT should prioritize the identification of potential queues and notify PSP more than two weeks prior to the work. • Consider using queue length detectors or other end of queue warning devices to allow PSP to perform other safety-related tasks (e.g.,

Critical Issue	Current State Practices	Recommendations
	DOT allows use of static "watch for stopped vehicles" signs and active back-of-queue protection from PSP. If a queue exists and it meets the MOU, PSP will staff. If the queue dissipates, PSP will perform vehicle code enforcement.	PennDOT's Advanced Queue Warning System Demonstration).
Creating a Maximum Queuing Policy	PennDOT does not have a maximum or minimum queuing policy at this time. PA Turnpike tries to eliminate queuing by limiting a v/c ratio to less than 0.85.	• PennDOT should consider enacting a maximum queue policy similar in nature to the Missouri DOT's or North Carolina DOT's work zone performance criteria. • PennDOT and PA Turnpike should collaborate on best practices related to congestion and queuing.
Developing, Applying, and Evaluating Work Zone Performance Measures		
Modifying Existing Performance Measures	PennDOT strives to keep work zone related travel delays to less than 20 min (per 2 hour period) compared to the base condition. This is considered a threshold and not necessarily a performance measure. This criteria was selected because it is meaningful to the public. PennDOT promotes reducing work zone fatal and serious injuries by half by 2030. The Pennsylvania Turnpike does not have any strict performance measures (with the exception of the v/c ratio which acts as a performance indicator). The turnpike attempts to keep two lanes open in each direction at all times. National performance measures (23 CFR 511) will be implemented within a few years: reporting travel information in real-time.	• PennDOT should continue to explore various means to quantitatively measure and evaluate mobility and safety indicators.
Evaluating Performance Measures	PennDOT considered using a customer-input survey for rating work zones but were advised against this from their legal counsel due to the potential for citing work zone "deficiencies" that could be used against them in later court cases. HACS may have had work zone related questions at one time. PennDOT	• PennDOT should consider using technical and non-technical staff to perform work zone evaluations. Accountability for completing work zone reviews monthly/quarterly could become an employee expectation in yearly employee performance reviews.

Critical Issue	Current State Practices	Recommendations
	believes they may be able to add work zone related questions through the use of HACS.	
Meeting Performance Measures	There was discussion about potentially including accountability for performance measures in the district engineer's yearly performance evaluations (employee performance reviews). If contractors score low on their overall performance ratings/evaluations, they are asked to meet with the district, but it's uncommon to ban contractors from bidding on all projects (sometimes they're prohibited from bidding on certain project types).	• PennDOT should consider assigning responsibility and accountability for meeting work zone performance measures. These could become factors in yearly employee performance reviews.
Developing Other Performance Measures	PennDOT's Traffic Engineering Manual cites the BOMO as the lead oversight for monitoring work zone performance measures. The manual also states that Central Office will select and evaluate a group of work zones to measure the effectiveness of approved work zone alternatives for each project. The evaluation will focus on additional project-related travel time through the project area and work zone related fatalities and crashes. PennDOT is actively trying to establish work zone safety and mobility performance measures. Queuing may be a performance measure (TBD).	• PennDOT should develop statewide quantitative performance measures rather than qualitative or subjective indicators. • PennDOT could model other States or agencies that currently have performance measures related to work zone safety and mobility.
Collecting, Analyzing, and Improving Work Zone Data		
Collecting Data for Performance Measures	Example ECMS #82309 (a "non-significant" project) collected crash data, travel time data, and queue length as primary sources to determine the effectiveness of work zone traffic management strategies. Since ECMS #99251 was a "significant project," the contractor's traffic control supervisor was expected to maintain a daily record of crashes, work zone incidents, and maximum daily queue lengths due to the construction using the MPT Daily Record form included in the contract. In 2011 and 2012, PennDOT ranked themselves a 3 of 15 in their work zone Self-Assessment related to conducting customer surveys to evaluate work zone	• PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.

Critical Issue	Current State Practices	Recommendations
	traffic management practices on a statewide/area-wide basis (national average is 6.9). While data is not formally captured or input for statewide distribution or analysis, some districts do capture project level delay/queuing/crash data and share with other district level personnel. However, it is believed that this data is not analyzed consistently (from varies district to district). Since data are collected in all districts, it is believed that some districts will use this data in the future to assist with related projects. Statewide software is being tested (in District 6) to collect and process performance evaluation methods. Once this data is captured, reports can be generated. TMCs are collecting and evaluating the data (speeds, congestion and delay) and are sharing this information with the public via 511, website and/or dynamic message signs. Data collection is moving toward using data that is already collected for HPMS and finding ways to apply these towards work zones.	
Collecting Work Zone Crash Data	Work zone crash data are captured in report form at the project level by construction staff and law enforcement. These reports are elevated to the district level, reviewed, and a formal inspection of the WZ takes place to determine if revisions to TTC, staging, etc. are needed. Pennsylvania only retains records for crashes ("reportable crashes") that either have property damage to the vehicle requiring it to be towed or an injury (complaint of injury or hospitalization). Pennsylvania law enforcement agencies are trying to be 100 percent electronic by 2015. No changes will be made to the crash report until reporting becomes 100 percent electronic. PennDOT uses MMUCC as its baseline for capturing crash data. It is unlikely that any additional fields, if desired, will be added onto the crash report.	• Consider allowing PennDOT partial or full access to PSP's fatal crash reports as they are being developed such that potentially attributing work zone crash factors can be resolved before the work zone is no longer active.

Critical Issue	Current State Practices	Recommendations
Crash Reporting	Crash narratives are vague with respect to roadway and/or work zone details. Research team was unable to determine how pedestrian crashes occurred as a result of contributing circumstances lacking in narratives. PennDOT looks at the consistency between crash reports and talks with the agencies that are submitting incorrect, inconsistent, or incomplete reports. For example, some agencies struggle to distinguish the difference between crash types such as an angle crash versus a head-on left turn crash, which may create inconsistencies between agency reporting. Motor vehicle crashes involving horse and buggy are reported to the State, but PennDOT does not collect data on crashes involving only horse/buggy crashes. If a supplemental report is created, it is not necessarily added to the crash file. (Initial police reports will be submitted within 15 days of a crash. Supplemental crash reports are written afterwards. It could take six months to a year to complete the supplemental report for a fatal crash.)	• Consider enhancing the State's collection of crash-related data. • Consider developing an interactive online training tool to help facilitate consistent crash reporting among local law enforcement agencies. Training should be completed by every officer responding to crashes every few years.
Improving Pedestrian Safety in Work Zones		
Policy and Application of Work Zone Pedestrian Facilities	PennDOT's policy to address pedestrians and bicycles in work zones appears fairly comprehensive. Pedestrians are a regular topic of discussion in some districts. These districts limit the number of consecutive intersections or intersection quadrants that can be closed at one time. Other districts do not always provide adequate details in the work zone design plans regarding accommodation of pedestrians. This is sometimes due to the added costs of providing temporary pedestrian facilities or added costs of extending the work schedule. Pedestrians are included in peak hour traffic counts, but these may not be an accurate representation of pedestrian activity in rural or low volume areas. Pedestrian accommodations are sometimes noted in the plans or mentioned briefly within the plan's special provisions.	• Pedestrian studies should be performed prior to work zone design to determine if pedestrian facilities currently exist and are necessary to provide during the work. • PennDOT should recommend that work zone staging accommodates pedestrians when appropriate (pending pedestrian studies). • PennDOT should encourage obvious notation and clear instructions regarding work zone pedestrian accommodations.

Critical Issue	Current State Practices	Recommendations
	Vague crash data narratives do not help explore potential contributing circumstances related to pedestrian crashes	
Pedestrian Mobility	Pedestrian access and mobility trainings exist, but they are typically geared towards permanent pedestrian accommodations, not temporary applications like work zones. Training related to pedestrians in work zones has not occurred since 2006. Work zone plans don't always contain adequate ADA accommodations. (Maintain existing ADA accommodations and apply work zone pedestrian accommodations with this in mind).	• PennDOT should consider trainings on how to accommodate a variety of pedestrians (ped, bicyclists, mobility impaired, etc.) in the work zone designs. • PennDOT should consider developing standard and guidelines for accommodating various types of pedestrians.
Other Discussion Topics		
Determining Work Zone Crash Exposure	No known information exists that distinguishes which types of work zones have the most crashes per traffic volume or work zone duration. Some attendees expressed that they thought utility work zones were less safe than long term work zones, but since they aren't set up as long we may not see as many crashes in those areas. Since the passing of Act 89, many more construction projects have been funded. This leads to a higher exposure rate which will likely lead to a higher crash rate in the next few years.	• Consider monitoring the number of crashes with respect to several work zone variables (i.e., construction vs. utility work zone, day versus night, lane closure versus no lane closure, worker presence, use of positive protection, etc.) in order to help determine future work zone strategies. • Improve the construction inspection process to include check-boxes for active (workers present) versus non-active (workers not present) work zones.
Short-Duration Utility Work Zones	Common issues of short-duration work zones include: 1. Driver's don't typically expect to encounter short-duration work zones 2. Traffic control devices/placement aren't necessarily compliant with MUTCD standards 3. They often contain unsafe work practices such as distracted flaggers. PennDOT believes that using a certified flagger company has recently improved safety in utility work zones. PennDOT approves and authorizes utility work zone permits based on a range of dates in which the work may be performed. The permit template allows utility	• Consider setting up a process where utility workers contact the DOT within an hour or two of setting up their work zone so the DOT knows when the work is being performed. • Consider implementing a lane reservation system which gives utilities and other contractors the opportunity to record when they are working. • Improve construction inspection process to

Critical Issue	Current State Practices	Recommendations
	workers to request PSP to help monitor traffic, but PSP only monitors traffic on large Federally-funded projects. Currently, PennDOT allows those updating road and lane conditions to phone-in updates to a central system, wait for operators to input this information into the PA511 system, and then become available for public viewing. Allowing all PennDOT employees, contractors, utility providers, and those impacting lane closures direct access to the public notification system may alleviate conflicting situations between actual road conditions and PA511 information.	include check-boxes for active (workers present) versus non-active (workers not present) work zones. • Develop an application allowing anyone who establishes work zones or performs work on Pennsylvania roadways (maintenance forces, contractors, utility providers, etc.) to update in real-time active lane restrictions or lane closures. This application would feed the RCRS used by PA511 to update the public on travel conditions during active work zones, inclement weather events, and other situations.
Using Stop Signs on On-ramps	Stop signs are used periodically at the end of on-ramps as traffic merges onto the mainline where an active work zones exist. This creates queues on the on-ramps and affects mobility on the mainline and on local roads. Ramp yield entry is encouraged, but some work doesn't allow this (restricted lane widths, bridge work, tapers, etc.).	• Use this method sparingly, as a last resort. For example, it may be appropriate to use in circumstances where there is a short acceleration lane or where the mainline necks down due to lane closures, bridges, or other physical restriction.
Providing a Work Zone Traffic Control Manager	PennDOT discussed requiring that a work zone traffic control manager be designated for each contracted project on State roads. This manager would reside onsite, satisfy the Final Rule training and certification requirements (§ 630.1008(d) and § 630.1012(e)), and would oversee all lane closures and lane restrictions for the individual project.	• Consider requiring the identification, training, and certification of a work zone traffic control manager that satisfies the Final Rule requirements. The manager will be responsible for overseeing lane closures and lane restrictions on a project-by-project basis, or through consulting with other work zone traffic control managers where overlap between projects may exist.

4. Conclusion

Improving work zone safety can be as simple as facilitating communication or as technological as implementing intelligent transportation systems. Practicing proper work zone safety is beneficial for the state DOTs, contractors, workers, and road users alike. By making small improvements to existing practices, PennDOT has the potential to increase work zone safety, thereby reducing the number of fatal and incapacitating injury collisions that occur within their bounds.

4.1. High Priority Recommendations

Categories and subsequent recommendations cited by the project team include the following:

1. Establishing Consistent, Effective, and Safe Work Zone Speed Limits

Why It Matters: PennDOT crash data and narratives indicated that speeding contributed to nearly 60 percent of all fatal work zone crashes. Additionally, over 50 percent of crashes were flagged as aggressive driving crashes which include factors such as speeding, failure to yield to traffic, driving on the wrong side of the road, or other aggressive driving behaviors.

High Priority Recommendations:

- If legislation approves automated speed enforcement, PennDOT has agreed to use this as a means to improve work zone speed compliance.
- If automated speed enforcement is not used, PSP should continue using active speed enforcement in advance of and within (when available) the work areas.
- PennDOT should consider expanding the MOU to include speed enforcement when necessary.
- Continue expanding the use of traffic control devices (i.e., VMS) to alert drivers of upcoming work zones.
- PennDOT Central Office and districts should collaborate to define criteria related to establishing consistent work zone speed limits to improve driver expectations/compliance. Contact neighboring States to establish consistency wherever possible.
- PennDOT should develop and implement a statewide policy for establishing work zone speed limits.
- PennDOT and PA Turnpike continue to coordinate such that motorists see consistent work zone traffic control and speed limit application on high speed roadways.
- Follow the lead of North Carolina DOT and other States to differentiate activities that warrant temporary speed limit reductions versus long-term reductions, or consider designing work zones to accommodate the road's posted speed limit.
- PennDOT should ensure compliance with the MUTCD with respect to using orange work zone signing appropriately.
- Ensure that orange mouse ears are sending the intended message to the driving public.
- Explore how currently corrected speed data can be used in work zone applications (i.e. consider variable speed limits)

- PennDOT should include PSP in TCP development such that enforcement pull-off sites are located within the work zones, if desired. (Note: Consider specifying which projects based on length, speed, etc.)
- Consider facilitating communication and collaboration on projects across corridors to establish/maintain consistent speed limits.
- Consider modifying Pub 46 to include policy on speed limit reductions.

2. Work Zone Queuing

Why It Matters: Queuing was a factor in at least 20 percent of all fatal work zone crashes. Additionally, districts across the State have varying approaches to completing work zone simulation requirements for significant projects.

High Priority Recommendations:

- Since queuing typically occurs at merge points, PennDOT should consider minimizing the number of merge points within a work zone wherever feasible (allowable exceptions may include roadways with large grades).
- Set criteria for minimum distance between merge points.
- PennDOT and the Turnpike should discuss and collaborate on best practices related to congestion and queuing.
- PennDOT should consider expanding the use of simulation software that accounts for entering and exiting vehicles from the mainline and connect the simulation process to the RULD methodology.
- PennDOT should continue using field experience to confirm or refute simulation outputs.
- Consider using crowdsourcing applications to supplement current incident notifications and speed detection performed by the TMC. Current RCRS policy only allows for verified traffic information sources and is evaluating whether crowdsourcing may be added in the future.
- PennDOT should consider developing a quick clearance policy for congestion.
- PennDOT should continue to be open to experimental devices with the intent to improve work zone safety and mobility.
- PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.
- PennDOT should prioritize the identification of potential queues and notify PSP more than two weeks prior to the work.
- Continue using queue length detectors or other end of queue warning devices to allow PSP to perform other safety-related tasks (e.g., PennDOT's Advanced Queue Warning System Demonstration).
- PennDOT should consider enacting a maximum queue policy similar in nature to the Missouri DOT's or North Carolina DOT's work zone performance criteria.

3. Developing, Applying, and Evaluating Work Zone Performance Measures

Why It Matters: Work zone performance measures help agencies identify areas where work zones meet, exceed, or fall short of meeting certain safety and/or mobility goals.

High Priority Recommendations:

- PennDOT should continue to explore various means to quantitatively measure and evaluate mobility and safety indicators.
- PennDOT should consider using technical and non-technical staff to perform work zone evaluations. Accountability for completing work zone reviews monthly/quarterly could become an employee expectation in yearly employee performance reviews.
- PennDOT should consider assigning responsibility and accountability for meeting work zone performance measures. These could become factors in yearly employee performance reviews.
- PennDOT should develop statewide quantitative performance measures rather than qualitative or subjective indicators.
- PennDOT should model other States or agencies that currently have performance measures related to work zone safety and mobility.
- PennDOT should consider current and future data sources while determining possible performance measures.

4. Collecting, Analyzing, and Improving Work Zone Data

Why It Matters: Collecting, analyzing, and maintaining crash data is an important step toward improving safety in all areas of transportation. Collection of work zone data varies by district in Pennsylvania. All of the districts collect the work zone data that is required by State and national agencies; however, some districts exceed expectations by creating and implementing TMPs for certain “non-significant” projects and performing extra analysis on work zone safety and mobility data.

High Priority Recommendations:

- PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.
- Consider allowing PennDOT partial or full access to PSP’s fatal crash reports as they are being developed such that potentially attributing work zone crash factors can be resolved before the work zone is no longer active.
- Consider enhancing the State’s collection of crash-related data.
- Consider developing an interactive online training tool to help facilitate consistent crash reporting among local law enforcement agencies. Training should be completed by every officer responding to crashes every few years.

5. Improving Pedestrian Safety in Work Zones

Why It Matters: Eight pedestrians, not including flaggers or other workers, were killed in work zones between 2008 and 2012.

High Priority Recommendations:

- Pedestrian studies should be performed prior to work zone design to determine if pedestrian facilities currently exist and are necessary to provide during the work.
- PennDOT should recommend that work zone staging accommodates pedestrians when appropriate (pending pedestrian studies).
- PennDOT should encourage obvious notation and clear instructions regarding work zone pedestrian accommodations.
- PennDOT should consider trainings on how to accommodate a variety of pedestrians (ped, bicyclists, mobility impaired, etc.) in the work zone designs.
- PennDOT should consider developing standard and guidelines for accommodating various types of pedestrians.

6. Other Discussion Topics

Why It Matters: Determination of work zone crash exposure rates and temporary TCP compliance in short-duration utility work zones are two areas where workshop attendees expressed additional concern. Additionally, work zone crash exposure rates can help identify quantifiable work zone performance indicators or measurements.

High Priority Recommendations:

- Consider monitoring the number of crashes with respect to several work zone variables (i.e., construction vs. utility work zone, day versus night, lane closure versus no lane closure, worker presence, use of positive protection, etc.) in order to help determine future work zone strategies.
- Improve construction inspection software to include check-boxes for active (workers present) versus non-active (no workers present) work zones.
- Consider setting up a process where utility workers contact the DOT within an hour or two of setting up their work zone so the DOT knows when the work is being performed.
- Consider implementing a lane reservation system which gives utilities and other contractors the opportunity to record when they are working.
- Develop an application allowing anyone who establishes work zones or performs work on Pennsylvania roadways (i.e., maintenance forces, contractors, utility providers, etc.) to update in real-time active lane restrictions or lane closures. This application will feed the RCRS used by PA511 to update the public on travel conditions during active work zones, inclement weather events, and other situations.
- Use stop signs on on-ramps sparingly, as a last resort. For example, it may be appropriate to use in circumstances where there is a short acceleration lane or where the mainline necks down due to lane closures, bridges, or other physical restriction.
- Consider requiring the identification, training, and certification of a work zone traffic control manager that satisfies the Final Rule requirements. The manager will be

responsible for overseeing lane closures and lane restrictions on a project-by-project basis, or through consulting with other work zone traffic control managers where overlap between projects may exist.

4.2. Next Steps

This section captures each recommendation made in this document and identifies whether the recommendation meets the following criteria:

- Time to implement the recommendation is immediate, in the short term, or in the long term
- Cost to implement the recommendation is low, midrange, or high
- The impact of implementing the recommendation, related to work zone road user and worker safety, is:
    - High (statewide effects with the potential to strongly reduce the number and severity of work zone crashes)
    - Midrange (some statewide effects with the potential to impact the number and severity of work zone crashes)
    - Project-specific (relevant to a single project or project type)

The evaluation criteria presented in Table 7 can be used by PennDOT to prioritize recommendations and define their next steps in the implementation of solutions to improve work zone safety.

Table 7. Work Zone Safety Improvement Recommendations and Implementation Criteria

Recommendation	Relative Implementation Time			Relative Cost*			Relative Impact		
	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
Establishing Consistent, Effective and Safe Work Zone Speed Limits									
PennDOT Central Office and districts should collaborate to define criteria related to establishing consistent work zone speed limits to improve driver expectations/compliance. Contact neighboring States to establish consistency wherever possible.		√		√			√		
PennDOT should develop and implement a statewide policy for establishing work zone speed limits.		√		√			√		
PennDOT and PA Turnpike continue to coordinate such that motorists see consistent work zone traffic control and speed limit application on high speed roadways.	√			√			√		
Follow the lead of North Carolina DOT and other States to differentiate activities that warrant temporary speed limit reductions versus long-term reductions, or consider designing work zones to accommodate the road's posted speed limit.		√		√				√	
Ensure MUTCD compliance with respect to using orange work zone signing appropriately.	√			√			√		
Ensure that orange mouse ears are sending the intended message to the driving public.		√		√				√	
Explore how currently collected speed data can be used in work zone applications (i.e. consider variable speed limits).			√		√			√	
If legislation approves automated speed enforcement, PennDOT has agreed to use this as a means to improve work zone speed compliance.			√		√		√		
If automated speed enforcement is not used, PSP should continue using active speed enforcement in advance of and within (when available) the work areas.	√				√		√		
PennDOT should consider expanding the MOU to include speed enforcement when necessary.		√		√			√		
Continue expanding the use of traffic control devices (i.e., VMS) to alert drivers of upcoming work zones.	√				√		√		
PennDOT should include PSP in TCP development such that enforcement pull-off sites are located within the work zone, if desired. (Note: consider specifying which projects based on length, speed, etc.)	√				√		√		
Consider facilitating communication and collaboration on projects across corridors to establish and maintain consistent work zone speed limits.	√								
Consider modifying Pub 46 to include policy on speed limit reductions.		√							

Recommendation	Relative Implementation Time			Relative Cost*			Relative Impact		
	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
Work Zone Queuing									
Since queuing typically occurs at merge points, PennDOT should consider minimizing the number of merge points within a work zone wherever feasible (allowable exceptions may include roadways with large grades).	√				√				√
Set criteria for minimum distance between merge points.		√		√					√
PennDOT and the Turnpike should discuss and collaborate on best practices related to congestion and queuing.		√		√			√		
PennDOT should consider expanding the use of simulation software that account for entering and exiting vehicles from the mainline and connect the simulation process to the RULD methodology.		√			√				√
PennDOT should continue using field experience to confirm or refute simulation outputs.	√			√					√
Consider using crowdsourcing applications to supplement current incident notifications and speed detection performed by the TMC. Current RCRS policy only allows for verified traffic information sources and is evaluating whether crowdsourcing may be added in the future.			√		√		√		
PennDOT and PA Turnpike should collaborate on best practices related to congestion and queuing.	√			√					√
PennDOT should consider developing a quick clearance policy for congestion.		√							
PennDOT should continue to be open to experimental devices with the intent to improve work zone safety and mobility.	√				√		√		
PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.			√		√				√
PennDOT should prioritize the identification of potential queues and notify PSP more than 2 weeks prior to the work.	√				√				√
Consider using queue length detectors or other end of queue warning devices to allow PSP to perform other safety-related tasks (e.g., PennDOT's Advanced Queue Warning System Demonstration).		√			√		√		
PennDOT should consider enacting a maximum queue policy similar in nature to the Missouri DOT's or North Carolina DOT's work zone performance criteria.		√		√			√		
Developing, Applying, and Evaluating Work Zone Performance Measures									
PennDOT should continue to explore various means to quantitatively measure and evaluate mobility and safety indicators.			√		√		√		
PennDOT should consider using technical and non-technical staff to perform work zone evaluations. Accountability for completing work zone reviews monthly/quarterly could become an employee expectation in	√			√				√	

Recommendation	Relative Implementation Time			Relative Cost*			Relative Impact		
	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
yearly employee performance reviews.									
PennDOT should consider assigning responsibility and accountability for meeting work zone performance measures. These could become factors in yearly employee performance reviews.		√		√			√		
PennDOT should develop statewide quantitative performance measures rather than qualitative or subjective indicators.		√			√		√		
PennDOT could model other States or agencies that currently have performance measures related to work zone safety and mobility.		√		√				√	
Collecting, Analyzing and Improving Work Zone Data									
PennDOT should continue to collect and give travel delay information to motorists. They should also find opportunities to further expand the collection and dissemination of delay and congestion information.			√		√		√		
Consider allowing PennDOT partial or full access to PSP's fatal crash reports as they are being developed such that potentially attributing work zone crash factors can be resolved before the work zone is no longer active.		√		√				√	
Consider enhancing the State's collection of crash-related data.			√	√				√	
Consider developing an interactive online training tool to help facilitate consistent crash reporting among local law enforcement agencies. Training should be completed by every officer responding to crashes every few years.			√		√			√	
Improving Pedestrian Safety in Work Zones									
Pedestrian studies should be performed prior to work zone design to determine if pedestrian facilities currently exist and are necessary to provide during the work.	√			√					√
PennDOT should recommend that work zone staging accommodates pedestrians when appropriate (pending pedestrian studies).	√				√		√		
PennDOT should encourage obvious notation and clear instructions regarding work zone pedestrian accommodations.		√		√			√		
PennDOT should consider trainings on how to accommodate a variety of pedestrians (ped, bicyclists, mobility impaired, etc.) in the work zone designs.			√		√			√	
PennDOT should consider developing standards and guidelines for accommodating various types of pedestrians.			√	√			√		

Recommendation	Relative Implementation Time			Relative Cost*			Relative Impact		
	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
Other Topics									
Consider monitoring the number of crashes with respect to several work zone variables (i.e., construction vs. utility work zone, day versus night, lane closure versus no lane closure, worker presence, use of positive protection, etc.) in order to help determine future work zone strategies.			√	√				√	
Improve the construction inspection process to include check-boxes for active (workers present) versus non-active (no workers present) work zones.		√		√				√	
Consider setting up a process where utility workers contact the DOT within an hour or two of setting up their work zone so the DOT knows when the work is being performed.		√		√			√		
Consider implementing a lane reservation system which gives utilities and other contractors the opportunity to record when they are working.			√		√		√		
Improve construction inspection process to include check-boxes for active (workers present) versus non-active (workers not present) work zones.		√		√				√	
Develop an application allowing anyone who establishes work zones or performs work on Pennsylvania roadways (maintenance forces, contractors, utility providers, etc.) to update in real-time active lane restrictions or lane closures. This application would feed the RCRS used by PA511 to update the public on travel conditions during active work zones, inclement weather events, and other situations.			√		√		√		
Only use stop signs at the end of an on-ramp as a last resort. For example, it may be appropriate to use in circumstances where there is a short acceleration lane or where the mainline necks down due to lane closures, bridges, or other physical restriction	√			√				√	
Consider requiring the identification, training, and certification of a work zone traffic control manager that satisfies the Final Rule requirements. The manager will be responsible for overseeing lane closures and lane restrictions on a project-by-project basis, or through consulting with other work zone traffic control managers where overlap between projects may exist.			√		√		√		

*** Approximate costs.**

Appendix A: Publication 46 – PennDOT's Traffic Engineering Manual, Work Zone Safety and Mobility Policy (Section 6.3), February 2012

Specifically, the Department will attempt to avoid working on all four-lane limited access highways on Fridays and the day before the holidays listed in Article 10 of the Master Agreement. In addition, this policy may be applied at other times and on other highways when specific local circumstances create an increased risk to employee safety. However, this general policy shall not prohibit work during emergencies or for work necessary to minimize hazards.

6.3 Work Zone Safety and Mobility

Work Zone Safety and Mobility Policy (WZSM)

The Department is responsible for designing and maintaining work zones that limit the impact to motorists, while maintaining safety for highway workers and the traveling public.

Policy Scope

This policy applies to all projects that receive Federal and/or State funds and the following conditions apply:

- Project is located on any of these fully-controlled, limited access highways: interstate, PA Turnpike, or freeway (interstate look-a-like), and
- Project occupies a location for more than 3 days with either intermittent or continuous lane closures.

These conditions meet the "sustained work zone impacts" intent referenced in FHWA's Work Zone Safety & Mobility Final Rule (23 CFR 630 Subpart J). While the Final Rule centers around interstate projects within the boundaries of a Transportation Management Area (TMA), this policy simplifies the process and encompasses all interstate/freeway projects regardless of being within a TMA or not.

Also, any project meeting the above conditions, along with additional travel times greater than 20 minutes for two consecutive hours, is deemed as a "Significant Project" and must meet further criteria as defined later in this policy.

Policy Objectives

The intent of this policy is to provide safe work zones that minimize delay for the traveling public and reduce community impacts while maintaining fiscal responsibility. This policy also is intended to bring the Department into compliance with FHWA's Work Zone Safety and Mobility Final Rule (23 CFR 630 Subpart J).

The goals of this policy are to:

- Establish a systematic approach for improving work zone safety and mobility that will include the consideration of transportation management and congestion mitigation from the project planning stage throughout the life of the project.
- Expand work zone management beyond typical traffic safety and control within the project footprint to address corridor, network, and regional issues including day-to-day operations and the effective dissemination of public information.

Responsible Organizations

The Bureau of Maintenance and Operations (BOMO) and the Bureau of Design (BOD) are responsible for administering this policy for PennDOT. This policy is cross-cutting with all organizations involved in the planning, design, and construction of highway projects. Organizations responsible for implementing this policy include:

- Bureau of Design
- District Offices
- Bureau of Construction and Materials
- Bureau of Maintenance & Operations
- Center for Program Development and Management

Program Management

BOMO will monitor the effectiveness of this work zone policy through Independent Oversight Program (IOP) process reviews, an assessment of work zone performance measures, and coordination with District Traffic Engineers.

BOMO will serve as the lead Bureau for the PennDOT Work Zone Safety and Mobility Committee which will include membership from all Central Office Engineering Bureaus, District representation, and the FHWA. The Committee shall be responsible for reviewing the effectiveness of this policy and making changes as necessary.

WZSM Implementation

This section provides direction for implementing the requirements of PennDOT's Work Zone Safety and Mobility policy.

Objectives & Goals

PennDOT's Work Zone Safety and Mobility policy includes six broad objectives:

- Develop and implement systematic procedures to assess work zone impacts during planning and project development, and effectively manage safety and mobility during project implementation.
- Mitigate traffic and mobility impacts for the project area and for the surrounding network.
- Use field observations, available work zone crash data, and operational information to mitigate work zone impacts for specific projects during implementation. Continually pursue improvement of work zone safety and mobility by analyzing work zone crash and operational data from multiple projects to improve processes and procedures.
- Train personnel involved in the development, design, implementation, operation, inspection, and enforcement of work zone related transportation management and traffic control in a manner appropriate to the job decisions each individual is required to make. Update the training periodically to reflect changing industry practices, processes, procedures, and technologies.
- Perform FHWA/PennDOT Independent Oversight Review of work zones to evaluate the effectiveness of this policy and work zone management on projects.
- Provide guidance in the development and implementation of Transportation Management Plans (TMP) on "Significant Projects".

PennDOT's Work Zone Safety and Mobility Policy includes three goals:

- Strive to keep work zone-related additional travel delays under 20 minutes when compared to the base condition.

- 10% annual reduction in work zone-related fatalities & crashes (current year vs. last 5-year running average).
- Strive to implement appropriate level TMP elements on all projects listed in Section 6.3, page 6-4, regardless of whether a formal TMP submission is required.

Determination of Significant Projects

All highway construction projects defined in the Section **Policy Scope** on page 6-4 shall be considered as Significant Projects unless a work zone analysis shows that added travel delays do not exceed 20 minutes for 2 consecutive hours.

Refer to **Exhibit 6-1**, **Exhibit 6-2** and **Exhibit 6-3** for more information.

Exhibit 6-1 **Determination of Significant Projects - Flow Chart**

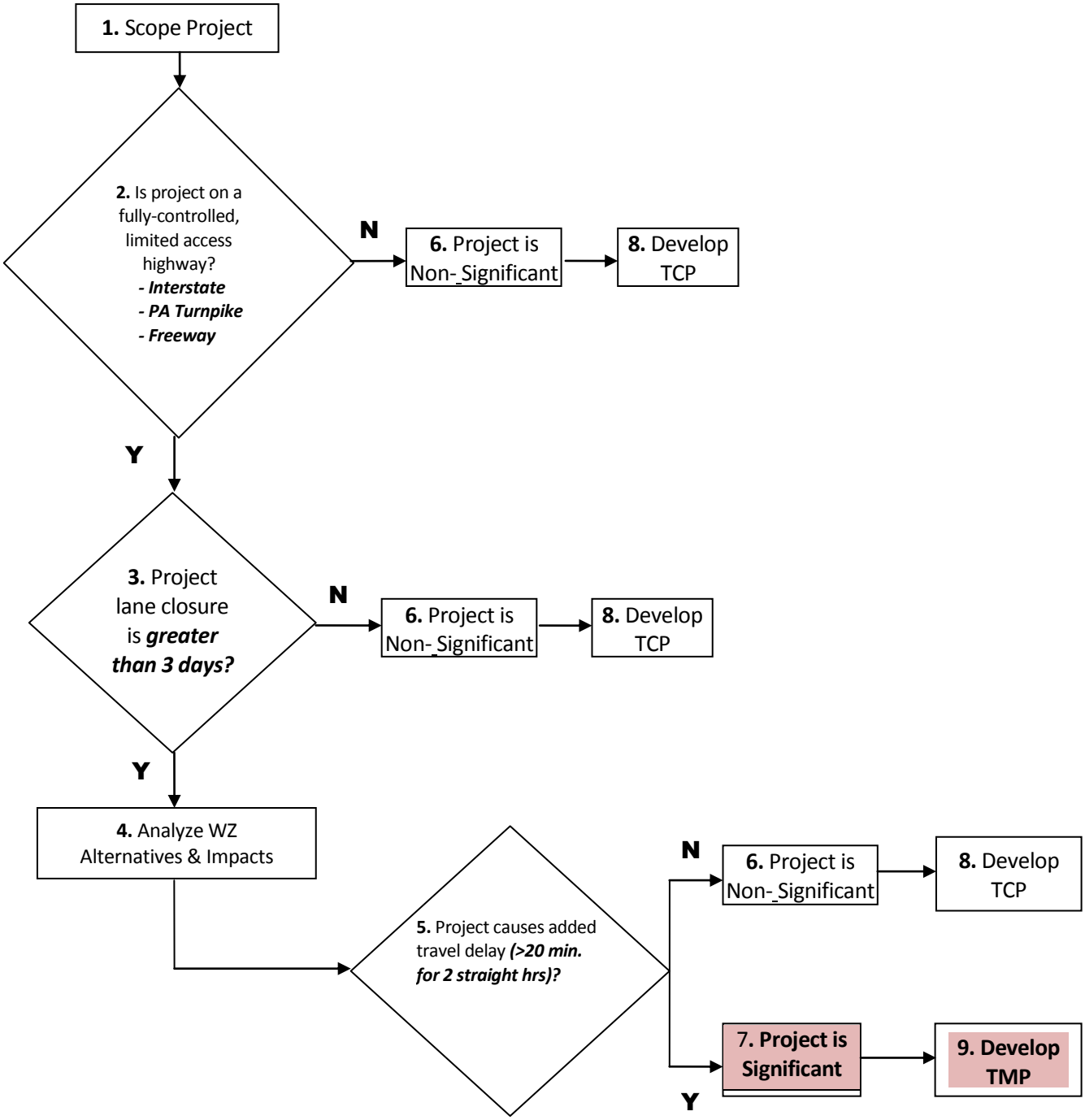

Exhibit 6-2 Determination of Significant Projects - Flow Chart Step Descriptions

Step	Process Title	Comments
1	Scope Project	Refer to Design Manual (DM) 1A, Chapter 5
2	Project Location	Is the project located on an interstate (including the PA Turnpike) or a freeway with fully-controlled, limited access?
3	Project lane Closures	Will the project have either intermittent or continuous lane closures (including detours) for more than 3 days?
4	WZ Alternatives Analysis & Impacts	WZ Alternative Analysis - identify ***potential, practical (viable)*** WZ alternative setups which fit the nature of the project and will minimize traffic impacts to motorists (could be 1 or more). • Conduct WZ impacts analysis for these viable WZ alternatives as indicated below. WZ Impacts - use Delay Analysis Workbook (DAWB), QuickZone, Synchro, HCS or other computer modeling programs. • Note: prior analysis done for a recent similar project (≤3 yrs old) may be used to estimate impacts in lieu of new model development, if project characteristics are similar (WZ setups, location, traffic volumes, grades, access, etc.); if this prior analysis & impacts meets acceptable delays, there is no need for additional impact analysis.
5	Traffic Delay Thresholds	Acceptable Project Delay Impacts (Project is Non-Significant) • Additional (project-related) travel time through the project area (includes detours) is ≤ 20 minutes. Unacceptable Project Delay Impacts (Project is Significant) • Additional (project-related) travel time through the project area (includes detours) is > 20 minutes for time periods of 2 or more consecutive hours. *Note: Added travel time shall be determined as per Step 4 (under WZ Impacts).*
6	Non-Significant Project	Project does not meet policy parameters for being a Significant project • For selected WZ approach, request approval as a Non-Significant project. **(See Exhibit 6-3).** ○ Traffic delay analysis and preliminary project mitigation strategies (for the selected WZ approach) must be submitted & approved as part of **the Non-Significant** determination process.
7	Significant Project	Project meets policy parameters for being a Significant Project • For selected WZ approach, request approval as a Significant Project. **(See Exhibit 6-3).** ○ Work zone alternative analysis and preliminary project mitigation strategies (for the selected WZ approach) must be submitted & approved as part of the Significant Project determination process.

Step	Process Title	Comments
8	Develop TCP	Must develop and complete a Traffic Control Plan (TCP) for the approved WZ approach. • While a formal TMP submission isn't required, appropriate-level TMP elements need considered on these Non-Significant Projects as well. • Consider the development of an appropriate level TMP for the project, even though not required by policy.
9	Develop TMP	Must develop and complete a Transportation Management Plan (TMP) for the approved WZ approach. • Includes a Traffic Control Plan (TCP), Transportation Operations Plan (TOP) and Public Information Plan (PIP).

Exhibit 6-3 **Determination of Significant Project – Submission Approval Process**

Approval Process	PennDOT Oversight (PennDOT has approval authority)	Federal Oversight (FHWA has approval authority)
Non-Significant Project Determination	**Step 6** • **District Executive must approve** the traffic delay analysis & prelim. Project mitigation strategies. • BOD receives a copy of the DE approval along with the delay analysis.	**Step 6** • BOD must review/concur with the traffic delay analysis & prelim. Project mitigation strategies. • **FHWA must approve.**
Significant Project Determination	**Step 7** • District Executive must review/concur with the work zone alternatives analysis & prelim. project mitigation strategies. • **BOD must approve.**	**Step 7** • BOD must review/concur with the work zone alternatives analysis & prelim. project mitigation strategies • **FHWA must approve.**

Note: Significant Projects approval submissions should include the following types of information:

- List of alternative TCPs considered.
- Reasons for selection of preferred TCP and why thresholds can't be met.
- Documentation for submitted TCP.
  - Results of computer modeling.
  - Impacts on transportation system.
  - Impacts on community.
  - Estimated costs.
  - Any municipal official input.
- Other mitigation strategies (may be qualitatively assessed such as public information elements because delay savings could be difficult to determine).

Applying WZSM in Project Development Process

Engineering District offices shall address transportation management and congestion mitigation issues in all phases of project delivery from the project planning stage throughout the life of the project to improve work zone safety and mobility, refer to **Exhibit 6-4**.

Exhibit 6-4 **WZSM in Project Development Process - Key Items**

Project Development Stage	Key Items Due
Planning	• Potentially Significant Projects shall be identified as early in the project development process as possible so that work zone impacts may be fully evaluated, appropriate funding allocated and overall network & region-wide impacts considered. • Districts shall work with MPOs and RPOs in the programming of projects to consider minimization of road user impacts and appropriate sequencing of projects. The cumulative impacts of multiple projects in the region's TIP shall be considered.
Scoping Field View (SFV)	Preliminary considerations shall be given to potential work zone alternatives & impacts and to what degree those considerations may influence the evaluation and selection of a build alternative. Additional studies and information needs shall be identified that will assist in determining whether the project is significant. Determine the status of the project as: • Non-Significant • Significant • To be determined (TBD)
Preliminary Engineering	• An analysis of work zone alternatives & impacts is required prior to Design Field View, this analysis shall be conducted using prior analysis or prior documented delays for another project, QuickZone, Highway Capacity Manual/Software (HCS), Synchro, Delay Analysis Workbook (May 2008 Final).xls or other pre-approved modeling methods.
Prior to Design Field View (DFV)	Make final determination of the project as: • Non-Significant • Significant Note: Approval of either the delay analysis or work zone alternatives analysis must occur prior to the DFV. Attach final approvals to ECMS project development checklist.
Design Field View (DFV) Submission	• Non-Significant Projects – provide a DFV level TCP. • Significant Projects – provide a draft TMP, including DFV level TCP
Final Design Office Meeting (FDOM) Submission	• Non-Significant Projects – provide a Final TCP. • Significant Projects – provide a Final TMP, including a Final TCP.

Plans, Specifications, and Estimates (PS&E)	• At the time the PS&E is submitted to Central Office, the TMP must be attached to the Project Development Checklist in ECMS. The PS&E shall include appropriate provisions for implementing the TMP. This may include: ○ Allowable working hours, transportation operation requirements, public information requirements, pay items, performance data collection items, special provisions, etc. • The contract special provisions in each Significant Projects shall specify that a Work Zone Traffic Control Supervisor (or similar designation) be provided by the Contractor. This person has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.
Construction	• PennDOT must designate a person trained in the fundamentals of this policy at the project level. This person will usually be the PennDOT or consultant Inspector-in-Charge. • Contractor must designate a Work Zone Traffic Control Supervisor (or similar designation); this person has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.
Conduct Performance Assessment & Process Reviews	• Work Zone Independent Oversight Program. • Produce WZ Annual Report. • Assess performance of work zones by analyzing crash & operational data. • Use the performance assessment to improve WZ processes & procedures.

Applying WZSM in the Design-Build Process

For projects defined in the Section **Policy Scope** on page **6-4**, the Department must prepare sufficient documentation regarding anticipated temporary traffic control and project phasing so that the design-build team can develop final plans and specifications for the project. In order to carry out the requirements of the work zone safety and mobility policy on design-build projects, the Department must complete the work zone alternatives analysis (including analysis of delay impacts) prior to design field view and/or advertisement **(complete steps 1 thru 7 in Exhibit 6-2)**.

The Department must provide the design-build team with enough details to allow the team to fully develop the required elements of the TMP for the project. Therefore, information such as number of lanes required, when lane closures are permitted, detour requirements, expected project completion date, and other key parameters shall be provided to the design-build team. The Department shall also identify specific contract bid items relating to maintenance and protection of traffic that the design-build team should include in the contract.

If allowed by the contract, when developing the PS&E the contractor may propose changes to the Department's selected work zone approach; however, the contractor must analyze work zone impacts expected from their proposed alternative and receive approval from PennDOT (and FHWA as appropriate) before any changes are authorized.

PennDOT's procedures for implementing design-build projects are found in Publication 448, Innovative Bidding Toolkit.

Performance Measures

Central Office will select and evaluate a group of projects that may consist of "Significant Projects" and "Non-Significant Projects". The evaluation will measure the effectiveness of the approved work zone alternatives for each selected project. The evaluation will focus on two main areas: 1) additional project-related travel time through the project area, and 2) work zone-related fatalities & crashes.

Additional Travel Time/Delays (Mobility):

The objective is to evaluate additional project-related travel time (delays) through the project area, including baseline data prior to the construction being implemented. The Department's 511PA Travel Information System (511PA) and Road Condition Reporting System (RCRS) will be used to capture the needed data and information.

- The 511PA System operates 24/7 on selected major highways. The baseline data generated for this evaluation is currently being collected and archived through 511PA. This will allow the evaluation process to incorporate information from established time periods before, during, and after construction. Any work zone project within the 511PA coverage could potentially be selected and evaluated for effectiveness.
- As projects are selected for this performance measure evaluation, Central Office will coordinate with the District Office (Traffic & Construction Unit staffs) to ensure that all traffic restrictions are documented accurately in the RCRS.
- The RCRS data indicating the actual times when the lane restrictions are placed and removed are very essential for this evaluation. Therefore, it is imperative that this information is accurately documented in RCRS by District Traffic and Construction Unit representatives.
- The data and information used to evaluate a project's work zone safety and mobility performance will be retained electronically for future use by the Department on similar projects (scope, location, etc.).
- The evaluation findings will be shared with both FHWA and the District Offices.

Work Zone-Related Fatalities & Crashes (Safety):

Fatality and crash data will be collected at the project level and District level. The construction representative shall ensure that:

- A diary is kept in accordance with the Project Office Manual.
- The inspections and findings related to work zone reviews are documented.
- All crash reports are obtained and forwarded to the District Traffic Engineer.
- A complete file of inspections, crashes and correspondence related to work zones is maintained by the construction project manager. Verification of fatal and crash statistics will be cross-checked with the Department's Crash Record System.
- This information will be available to FHWA and appropriate PennDOT personnel.

WZSM Transportation Management Plan (TMP)

A Transportation Management Plan (TMP) shall be developed for each Significant Project and submitted as per Exhibit 6-4. A TMP lays out a set of coordinated strategies and describes how these strategies will be used to manage the approved work zone alternative of the project. The level of detail included in the TMP

will be appropriate for the size and complexity of the project. A sample TMP is discussed at the end of this section, and included in the Chapter 6 Appendix on page 6-61. A TMP shall contain the elements listed in Exhibit 6-5. While a formal TMP submission isn't required for Non-Significant Projects, appropriate-level TMP elements need considered on these projects as well.

Exhibit 6-5 TMP Elements

Element	Requirement
1. Introduction	Cover page, table of contents, list of tables, list of abbreviations and symbols, and terminology.
2. Executive Summary	Overview of each of the TMP components.
3. Roles and Responsibilities	• TMP (Work Zone) manager. • Stakeholder/review committee. • Approval contact(s). • TMP implementation task leaders (e.g., ADE Construction, Press Officer, Portfolio Manager, etc.).
4. Project Description	Information such as: • Project type. • Project background. • Project area/corridor. • Project goals and constraints. • Proposed construction phasing. • General schedule and timeline. • Related project information.
5. Traffic Conditions	For the project area: • Including data collection and modeling approach. • Existing roadway characteristics (history, roadway classification, number of lanes, geometrics, urban/suburban/rural). • Existing and historical traffic data (volumes, speed, capacity, volume/capacity, percent trucks, queue length, peak traffic hour). • Existing traffic operations (signal timing, traffic controls). • Local community and business concerns/issues. • Traffic growth rates (for future construction dates). • Prior documentation of work zone delays on similar projects.

6. Work Zone Impact Assessment	• Description of only the approved WZ strategy, including the potential WZ impacts of this strategy. Note, do not reiterate the whole WZ alternatives analysis in the TMP!
7. Work Zone Impact Management Strategies	For project, detour routes, corridor, region by construction phase, including TCP strategies, TOP strategies and PIP strategies. Findings and recommendations.
7a. Traffic Control Plan (TCP)	Always required for both Significant and Non-Significant Projects. **See Design Manual Part 3, Chapter 4**. A Traffic Control Plan addresses traffic flow and control through the work zone (required on all projects).
7b. Transportation Operations Plan (TOP)	The Section **WZSM Transportation Management Plan (TMP)** on page **6-12** addresses sustained operations and management of the work zone impact area (including impacts to adjacent roadways in the network and impacts to other traffic movements).
7c. Public Information Plan (PIP)	The Section **WZSM Public Information Plan (PIP)** on page **6-17** addresses communication with the public and concerned stakeholders.
8. TMP Performance	Strategies to monitor TMP performance.
9. Contingency Plans	Potential problems and corrective actions to be taken, standby equipment or personnel.
10. Break out of TMP costs	Itemized costs.

The typical responsibility for development of the Transportation Management Plan including the Traffic Control Plan (TCP), Traffic Operations Plan (TOP), and Public Information Plan (PIP) is as follows:

Project Design By	TMP Development Responsibility
Consultant	Consultant
Design-Build	Contractor *
In House	District

**** Note: unless traffic control excluded as a design/build item.***

Contractors who propose an alternate TCP must submit a new or revised TMP including an impact analysis, TOP, and PIP.

Sample Transportation Management Plan (TMP)

In the **Chapter 6 Appendix** on page **6-61** is a sample Transportation Management Plan (TMP) created for a project on a rural interstate highway with low traffic impacts. The level of detail included in the TMP for each project will be appropriate for the size and complexity of the project. The sample TMP was drafted using information that is readily available from other sources such as ECMS.

WZSM Transportation Operations Plan (TOP)

The Transportation Operations Plan (TOP) is a required part of the TMP on Significant Projects and is a description of the strategies that are being used to address safety and mobility. It shall be coordinated with the stakeholders (i.e., other DOTs, police, fire, emergency medical services, traffic control centers, transit, schools, etc.). The level of detail included in the TOP will be appropriate for the size and complexity of the project. A checklist of items that may be included in the TOP follows:

Traffic Demand Mitigation Strategies

- ☐ Transit service improvements
- ☐ Transit incentives
- ☐ Shuttle services
- ☐ Ridesharing/carpooling incentives
- ☐ Park-and-ride promotion
- ☐ HOV lanes
- ☐ Toll/congestion pricing
- ☐ Ramp metering
- ☐ Parking supply management
- ☐ Variable working hours
- ☐ Telecommuting

Corridor/Network Management Strategies

- ☐ Signal timing/coordination
- ☐ Temporary traffic signals
- ☐ Street/intersection improvements
- ☐ Bus turnouts
- ☐ Turn restrictions
- ☐ Parking restrictions
- ☐ Truck restrictions
- ☐ Separate truck lanes
- ☐ Reversible lanes
- ☐ Pennsylvania Late Merge
- ☐ Dynamic Late Merge
- ☐ Ramp Metering
- ☐ Suspension of ramp metering
- ☐ Ramp closures
- ☐ Street closures

- ☐ Incorporate Permanent ITS
- ☐ Railroad crossing controls
- ☐ Coordination with other construction sites
- ☐ Alternate routes

Work Zone Safety Management Strategies

- ☐ Work Zone speed limits
- ☐ Temporary traffic signals
- ☐ Temporary concrete barrier
- ☐ Movable barrier
- ☐ Attenuators
- ☐ Rumble strips
- ☐ Warning signs
- ☐ Automated Flagger Assistance Device
- ☐ Multidisciplinary taskforce
- ☐ QA reviews
- ☐ Dedicated traffic control supervisor
- ☐ Training
- ☐ Safety meetings
- ☐ Detour
- ☐ Alternate routes

Traffic/Incident Management and Enforcement Strategies

- ☐ Formal Incident Management Plan (include copy)
- ☐ ITS
- ☐ Transportation Management Center
- ☐ Aircraft
- ☐ Traffic Screens
- ☐ Call boxes
- ☐ Mile-post markers
- ☐ Service patrols
- ☐ Supplemental police assistance/enforcement
- ☐ Automated enforcement

WZSM Public Information Plan (PIP)

The Public Information Plan is a required part of the TMP for Significant Projects. Public information is a cooperative effort with the Central Office Press Office (when necessary), the District Press Office, Community Relations Coordinator, Traffic Unit, Design Unit, and Construction Unit. The PIP shall be developed well in advance of the start date of the project, since much of the communications should be undertaken prior to start of construction. Therefore, initiation of the Public Information Plan shall begin with the scoping field view. The level of detail included in the PIP will be appropriate for the size and complexity of the project.

Checklist for Public Information Plan

Each PIP should consist of the following elements:

1. Brief summary of project (situation analysis)
    - ☐ Project purpose and need
    - ☐ Project cost and funding source breakdown
    - ☐ Start Date
    - ☐ Completion date
    - ☐ Description of the Traffic Control Plan. Begin with conceptual plan and update as plan develops.
    - ☐ Closures and detours
        - Official detour
        - Time of day for lane drops and closures
2. List of affected stakeholders to be targeted
    - ☐ Municipalities, counties, townships, villages, MPOs/RPOs, recreational facilities, and special event sponsors
    - ☐ Local and state law enforcement
    - ☐ Emergency services
    - ☐ Affected business community
    - ☐ Schools
3. Communications plan and timeline for each part of the plan
    - ☐ Standard communications tools
    - ☐ Project-specific communications tools
    - ☐ Contact information for person responsible for each aspect
4. Milestones for updates
5. Means of evaluation of communications plan
    - ☐ In-progress
    - ☐ Post-construction

Some examples of communications tools are listed below:

- Press releases, media alerts, public service announcements
- Focus group/stakeholder meetings
- Brochures, maps
- Public involvement meetings
- Editorial board meetings
- Dedicated project web page (e.g.I-70 org)
- Changeable message board communications
- Community and group informational talks
- Local government and legislator meetings
- Dedicated phone number for information (District PIO line or other)
- Targeting tourist areas with maps and brochures (hotels, restaurants, chambers, visitor centers, etc.)
- Business letters/brochures/maps packets to major businesses affected (hospitals, colleges, large corporations)
- Business letters to any company along a ramp or route closing (Ex: SR 256 – businesses claimed they were not given enough warning)
- Dedicated am-band radio station with construction info on loop (Highway Advisory Radio – HAR)
- Billboards along affected routes
- Post "future detour" signs to allow motorists to become familiar with the route
- Regular updates to trucking companies and largest freight carriers in area

Please refer to Publication 295, Public Involvement Handbook, for further general guidance and tools that can be used in developing the PIP.

WZSM Definitions

See **Definitions** on Page **6-1**.

6.4 District Responsibilities

District Traffic Unit

Field Reviews

1. In general, the District Traffic Units should have a District-wide program of inspecting work zone traffic control on construction projects, maintenance operations, and permit/utility work within the District. Nighttime inspections of work zone traffic control should be included in the program.
2. The inspection of work zone traffic control and the reporting of findings to the appropriate District unit should be a major item for the employee performing the maintenance and protection of traffic function.

Appendix B: Publication 213 – Temporary Traffic Control Guidelines, June 2014

OS-299 (11-13)

pennsylvania
DEPARTMENT OF TRANSPORTATION
www.dot.state.pa.us

TRANSMITTAL LETTER

PUBLICATION:
213 - June 2014 Edition

DATE:
06/06/14

SUBJECT:

Revisions to Publication 213 "Temporary Traffic Control Guidelines"

INFORMATION AND SPECIAL INSTRUCTIONS:

Internal links are included in the electronic document. All Table of Contents/Reference Guide items are linked to the appropriate page. To return to the Table of Contents/Reference Guide, click on the title at the top of any page.

Pennsylvania Typical Application (PATA) numbers have changed in the updated publication. See attached sheet for the old PATA number reference.

All Publication 213 changes can be found at the following link:
ftp://ftp.dot.state.pa.us/public/Bureaus/BOMO/Traffic%20Signal%20Portal/Public/Publication%2021 3/CT%20Comments/

CANCEL AND DESTROY THE FOLLOWING:

Publication 213 dated April 1, 2010

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APPROVED FOR ISSUANCE BY:

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By: Richard N. Roman, P.E.
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Bureau of Maintenance and Operations

Old PATA	New PATA			
5	101	401		
6	301	601		
7	102			
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9a S	104			
9a L1	203			
9a L2	204			
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10AFAD-1	112	113		
10AFAD-2	114			
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11b	Eliminated			
11c	Eliminated			
11d	Eliminated			
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17	125			
18	126	305	102	602
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26d	Eliminated			
26e	Eliminated			
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Bureau of Maintenance and Operations

Temporary Traffic Control Guidelines

Publication 213

pennsylvania
DEPARTMENT OF TRANSPORTATION

PUB 213 (06-14)

Application

Publication 213 applies to contractors; utilities; Federal, State, County, and Municipal governments; and others performing construction, maintenance, emergency, permit work, utility work, or any other type of work on highways or so closely adjacent to a highway that workers, equipment, or materials encroach on the roadway or interfere with the normal movement of traffic. This also includes any special event that necessitates the need for temporary traffic control. Refer to Chapter 212.402 for a complete list of types of work that are exempt from the requirements contained in this publication and the Manual on Uniform Traffic Control Devices (MUTCD).

The Pennsylvania Typical Application drawings mentioned hereafter will be referenced as PATA (Example: PATA 107).

Publication 213 has precedence over information found in the MUTCD. Furthermore, the PATA drawings shall be utilized in lieu of a MUTCD Typical Application drawing when roadway conditions are similar (For example, PATA 306 and PATA 603 would have precedence over MUTCD TA-35 for a mobile operation on a multi-lane highway). Standard Applications (000 series) are general in nature and meant to be a possible component of temporary traffic control zones shown in most PATA drawings (100 through 600 series). Multiple PATA drawings (100-600 series) may be combined to create a customized temporary traffic control zone, however, customized traffic control setups shall be approved by the PennDOT District Traffic Unit prior to implementation. Install traffic control devices as shown on an approved customized traffic control plan if a PATA drawing or MUTCD Typical Application drawing does not apply.

The traffic control schemes shown in this publication are normally applicable for both urban and rural areas. Since it is not practical to provide detailed guidelines for all the situations that may conceivably arise, applications are presented for only the most common situations. These are minimum desirable applications for normal situations, and additional protection may be needed when special complexities or potential hazards prevail. The protection prescribed for each situation shall be consistent with the general provisions found in the most recent editions of Title 67 PA Code, Chapter 212, Official Traffic Control Devices and the Manual on Uniform Traffic Control Devices as issued by the Federal Highway Administration and should be based on common sense; engineering judgment; the speed and volume of traffic; the duration of the operation; the exposure to potential hazards; the physical features of the highway including horizontal alignment, vertical alignment, and the presence of intersections and driveways; and other important factors.

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PATA Reference Guide
Freeways And Expressways

Number of Lanes	Work Description	Short-Term	Long-Term	Mobile
Any	Work Space On Or Beyond The Shoulder (No Roadway Encroachment)	401		601
	Work Space Beyond Shoulder		501	
	Work Space On Shoulder		502	
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3 or More	Work Space In Two Adjacent Lanes	403	504	
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A-1. Not Used.

A-2. Distances shown in this publication are minimum standards and may be increased slightly to fit field conditions. Do not increase distances labeled as a maximum distance. Channelizing device spacing intervals should be maintained as shown on PATA drawings and spacing charts.

A-3. It is essential to satisfy the needs and control of all highway users (including motorists, bicyclists, pedestrians, and persons with disabilities in accordance with the Americans with Disabilities Act of 1990) traveling through the work zone. This also applies to the management of traffic incidents.

A-4. When existing pedestrian facilities are disrupted, closed, or relocated, the temporary facilities shall be detectable and include accessibility features consistent with those present in the existing facility. Sidewalk widths must be 60" minimum; however the width may be reduced to 48" if 60"x60" passing areas are provided every 200'. The accessible path must be 48" minimum. Both permanent and temporary pedestrian facilities must provide access to persons with disabilities.

A-5. Do not perform work over lanes open to live traffic unless expressly authorized by the District Traffic Engineer. Work taking place on maintenance platforms, catwalks, open boom trucks, etc., requires closure of the lane or lanes immediately below. This restriction does not apply to work within an enclosed environment such as inside a walk-in permanent dynamic message sign.

A-6. All detours involving state-designated highways shall have the prior approval of PennDOT. All detours involving local highways shall have the prior approval of the appropriate local authorities.

A-7. Temporary pavement markings are not required for short-term and mobile operations. When temporary pavement markings are placed, all existing pavement markings and raised pavement marker lenses that conflict with the temporary traffic pattern shall be removed. Temporary pavement markings shall be removed when the permanent markings are reinstalled.

A-8. All workers engaged in or entering into any field operation involving maintenance, construction, design, surveying, inspection, traffic studies, etc. and/or are exposed to moving vehicles and equipment are required to wear hard hats meeting ANSI Type II requirements and high-visibility vests, t-shirts or sweatshirts which meet the ANSI Class 2 or 3 safety garment requirements. A raincoat or jacket which meets ANSI Class 2 or 3 safety garment requirements may be worn during inclement weather. Furthermore:

- All visitors and others present on a work site in an official capacity must comply with the requirements detailed above.

- PennDOT employees shall refer to Publication 445, Safety Policy Manual, and any applicable PennDOT memoranda regarding Personal Protective Equipment (PPE) and work attire.

- Emergency and incident responders and law enforcement personnel within the temporary traffic control (TTC) zone should wear high-visibility public safety vests that meet the performance requirements of the ANSI/ISEA 207-2011 (see MUTCD, Section 1A.11), or equivalent revisions.

A-9. Authorized vehicles as defined in Title 75, Section 102 (Pennsylvania Consolidated Statutes), are approved to be equipped with flashing or revolving yellow warning lights. Authorized vehicles include shadow vehicles, work vehicles, private escort vehicles, etc. Lights must be activated when the vehicle is used in conjunction with an active operation. White flashing or revolving lights are only authorized to be mounted on emergency vehicles as per The Pennsylvania Code, Chapter 173. Emergency vehicles are those operated by state and local police, fire departments, etc.

A-10. Parking may be prohibited along conventional highways in conjunction with road work. Coordinate with local authorities to request temporary parking prohibition signing and enforcement. Parking is prohibited by statute on all limited access highways including entrance and exit ramps.

A-11. For all construction projects involving road work, a temporary traffic control (TTC) plan must be included or PATA drawings must be referenced to address temporary traffic control. Existing traffic signals within the work zone and along detour routes, if any, may require timing and/or phasing modifications to accommodate temporary traffic patterns. The primary contractor is responsible to submit a letter to the District Traffic Engineer to either confirm that existing traffic signal timing is adequate to control temporary traffic patterns without a significant decrease in the level of service, or that traffic signal timings will require modification to maintain acceptable levels of service. This letter shall be received prior to placing lane restrictions. A copy of the capacity analysis report may be requested by the District Traffic Engineer. The contractor is required to abide by the temporary signal permit process prior to beginning work if signal modifications are recommended by the District Traffic Unit. Refer to Publication 46, Chapter 12, and Publication 149, Chapter 14.

General Notes - Section A
General Items (Page 2 of 2)

A-12. Mobile operations (PATA 300 and 600 Series) that occupy a travel lane shall proceed in the direction of normal traffic flow. Mobile operations taking place off of the roadway shall proceed in the same direction as the nearest lane of traffic flow.

General Notes - Section B
Flaggers and Flagging Operations (Page 1 of 2)

B-1. All flaggers at a minimum shall have training as per the most current version of Publication 408, Section 901.3(y), Flagger Training. Because flaggers are responsible for public safety and make the greatest contact with the public, it is essential to practice safe traffic control and public contact techniques. Flaggers must demonstrate the following abilities:

- Receive and communicate specific instructions clearly, firmly, and courteously.

- Move and maneuver quickly in order to avoid danger from errant vehicles. This means a flagger shall not be in a sitting position and no vehicles shall be parked near the flagging station.

- Control signaling devices (such as stop/slow paddles and flags) in order to provide clear and positive guidance to drivers approaching a temporary traffic control zone.

- Maintain situational awareness, protect the work crew, and provide guidance and direction to the traveling public.

B-2. Flaggers must be clearly visible to traffic for a minimum distance of E. This distance is based upon the speed limit and is found on the applicable PATA notes page.

B-3. Flaggers must be aware of the public image they project at all times. Behavior that could be construed as unprofessional, such as utilizing cell phones for personal conversations, texting, etc., is prohibited while performing flagging duties. Flaggers actively performing traffic control duties shall not participate in work not directly related to traffic control.

B-4. Additional flaggers shall be utilized to maintain control of traffic at all side roads, driveways, etc. that intersect the work zone between the flagger locations. If necessary, provide additional flaggers to properly control all movements within an intersection.

B-5. When multiple flaggers are used, they shall be in communication with each other at all times.

B-6. Except in emergency situations, each flagger station shall be illuminated at night with a portable overhead lighting source that provides an average luminance of 5 foot candles covering an area of 2,500 square feet (approximately 50'x50' or 28' radius). This may be achieved with lights of 30,000 to 40,000 lumens. The lighting source shall have a minimum color temperature of 3,000 degrees and a maximum of 4,000 degrees. Position the light so flaggers can be seen and not cause excessive glare to motorists.

B-7. When a highway-rail grade crossing exists within the work zone, or it is anticipated that queues resulting from the lane closure might extend through a highway-rail grade crossing, provisions shall be made to eliminate conflicts, which may require placing a flagger at the crossing. Coordination with the railroad is required.

B-8. It is recommended that flaggers stop traffic for as little time as possible.

B-9. The stop/slow paddle is the primary traffic control device used by flaggers. The stop/slow paddle:

- Shall be held under control of the flagger at all times. Do not support the paddle by inserting the shaft into a channelizing device, cart, or other device which is not listed in Publication 35 Bulletin 15 as an approved paddle support device.

- Shall display an 18" minimum stop sign on one face and a diamond shaped slow sign on the opposite face, both of which shall be retroreflective.

- Shall be attached to a shaft that has a minimum length of 72".

B-10. A red flag shall be used at intersections where a single flagger controls traffic approaching from more than one direction. A red flag may also be used in emergency situations when a stop/slow paddle is not available. It is unacceptable to control traffic with an orange flag that is normally used to supplement warning signs. Red flags:

- Shall be solid red in color with no stripes or patterns.

- Shall have a minimum size of 24" square.

- Shall be securely fastened to a staff that has a length of approximately 36".

- Shall be weighted on the free edge so the flag will hang vertically, even in high winds.

- Shall be retroreflective when used during nighttime operations.

- Shall not be waved as a notice for drivers to proceed.

General Notes - Section B
Flaggers and Flagging Operations (Page 2 of 2)

B-11. Flaggers may be required to control traffic at signalized intersections when existing signal timing/ phasing is not adequate to control traffic in work zones. Traffic signals are owned, operated, and maintained by the local municipality in which they are located and are programmed to operate automatically in accordance with traffic signal permits issued by the Department. Do not control traffic at a signalized intersection with a red flag while the signal is functioning in standard green-yellow-red operation. Municipal officials and/or the local police department shall be contacted to place the signal in flash mode or manual control mode. Requests shall be made in advance as coordination of resources may be necessary. Local officials may opt to have police manually control the signal or require efforts from the municipal signal contractor. Do not open a traffic signal control cabinet door prior to receiving approval from local authorities. Flagging operations may begin when the signal is placed in flash mode. In locations where multiple signalized intersections are located close together, it may be necessary to place multiple traffic signals in flash mode to control traffic flow through the work zone. Use additional flaggers as necessary to control traffic through each intersection. Return traffic signal operation to automatic control in accordance with the signal permit immediately upon conclusion of work.

General Notes - Section C
Traffic Control Devices - Channelizing Devices (Page 1 of 1)

C-1. Cones shall only be used during short-term operations. All channelizing devices shall be retroreflective when used during nighttime operations.

C-2. Direction Indicator Barricades may be used for all tapers approaching a work zone. Utilization is recommended on tapers approaching work zones on freeways and expressways.

C-3. Channelizing devices may be substituted for temporary longitudinal edge line pavement markings shown on any PATA 200 or 500 series drawing. If channelizing devices are used in place of longitudinal edge lines, they shall be spaced at a distance (in feet) equal to the regulatory speed limit; for example a 45 MPH speed limit requires 45' spacing. Channelizing devices cannot be substituted for taper edge line pavement markings.

C-4. Channelizing devices placed along a conventional highway centerline should be placed on the same side of the double yellow line as the work space, thereby reducing the impact to motorists traveling on the opposite side of the roadway. When the type of work requires devices to be placed on or along the opposite side of a centerline or lane line, ensure that minimum lane width of 10' is provided.

C-5. Tapers within a lane shall utilize a minimum of 6 channelizing devices, however, more may be required based upon the regulatory speed limit and lane width. Shoulder tapers consisting of 6 channelizing devices are required when closing paved shoulders that have a width of 8' or more. Shoulder tapers are optional when closing unpaved shoulders or those less than 8' in width.

C-6. Barricades and vertical panels with stripes shall have alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass.

C-7. Channelizing devices used to form a taper or longitudinal line must be all of a single type and identical in size and appearance. For example, cones, drums, barricades, and vertical panels may not be intermixed within the same taper or longitudinal line, however, the type of device used in a taper may differ from the type of device used in a longitudinal line.

C-8. Trailer mounted equipment such as speed display trailers, portable changeable message signs, etc. located on the shoulder or within the clear zone must be delineated with channelizing devices. Drums are the most preferred channelizer for delineation because they are highly visible, have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of road users. Also, drums are generally used in situations where they will remain in place for a prolonged period of time. If the trailer is located behind barrier then delineation is not required. Refer to PATA 009 for further guidance.

General Notes - Section D
Traffic Control Devices - Signs and Warning Lights (Page 1 of 2)

D-1. Warning signs for temporary traffic control shall have orange background and black border/legend. Warning signs for incident management areas shall have pink background with black border/legend. Orange warning signs may be used in incident management areas if pink signs are not available.

D-2. Sign sheeting shall be of an approved type and listed in Publication 35 (Bulletin 15). Signs manufactured with a mesh or transparent quality are prohibited. Refer to the 2011 Traffic Sign Retroreflective Sheeting Identification Guide in Appendix B of this publication or Publication 46, Exhibits 2-3 and 2-4, for retro-reflective material and level information. Signs bearing Type VII through XI retro-reflective material are considered equivalent and interchangeable.

D-3. When traffic control signs are placed in a temporary traffic control area, all permanent signs that provide a conflicting message shall be covered or removed. See Publication 408, Section 901.3(a), for details on covering signs.

D-4. When a Flagger Ahead (W20-7) sign is displayed, a flagger must be present. Cover or remove this sign immediately upon conclusion of flagging duties.

D-5 When work is suspended, remove all temporary traffic control devices from the roadway and cover warning signs or turn signs from the view of traffic while remaining in the upright position.

D-6. Do not mount temporary traffic control warning signs onto existing sign installations unless the permanent sign has been removed from the post. With the exception of supplemental advisory speed or distance plaques, do not mount multiple warning signs on the same post. This could result in mounting heights below the minimum standard. Drivers need adequate time to read, comprehend, and react to each sign and posting multiple signs on the same post may provide too much information for some drivers to process safely. Temporary traffic control devices shall not be attached to utility poles or other structures unless the owner grants written permission and the signs can be properly positioned to convey their message effectively.

D-7. Sign sizes and size requirements based upon type of highway can be found in Appendix A. Refer to Publication 236 Handbook of Approved Signs for additional and most current information.

D-8. Do not place sign supports on sidewalks, bicycle facilities, or areas designated for pedestrian or bicycle traffic unless there are no suitable alternative locations; an exception is made for signs related to sidewalk and/or bicycle facility closures which are directed towards pedestrians and bicyclists. If sign supports are placed on sidewalks, an accessible path of 48” minimum width shall be provided. This accessible path must remain free from signs, sign supports, horizontal panels, Type III barricade rails, material storage, etc. Refer to PATA 010 for further guidance.

D-9. Install additional signing in advance of the Road Work (W20-1) sign where traffic approaching the work zone is queued beyond all advance warning signs. Additional signs may include the Be Prepared To Stop (W3-4) sign, Lane Closed (W20-5 series) signs, Portable Changeable Message Signs (PCMS), or other standard signs as appropriate.

D-10. As a general rule, signs shall be located on the right-hand side of the roadway. On divided highways and one-way highways where it is physically possible, signs should also be placed on the left-hand side of the roadway.

D-11. Attach red Type B flashing lights to all stop signs which are installed on a temporary basis; attach yellow Type B flashing lights to all temporary yield signs.

D-12. Standard orange flags or yellow flashing warning lights may be used in conjunction with warning signs. Practice consistency in application of supplemental flags and/or lights. A single light or up to three flags may be attached to a temporary warning sign. Each warning sign installation in a work zone shall have the same number of flags or lights. Do not block the sign face with flags or lights. White flashing lights are reserved for usage with the Active Work Zone When Flashing (W21-19) sign of Act 229 and in conjunction with stop/ slow paddles. Refer to Publication 46, Chapter 6.10, and the MUTCD, Section 6F.83, for guidance on flashing lights.

D-13. Signs specific to an operation (such as mowing or utility work) may be used as an alternative to the Road Work Ahead (W20-1) or Road Work Next XX Miles (G20-1) signs where appropriate. Furthermore the Road Work Next XX miles (G20-1) sign may be used in lieu of the Road Work Ahead (W20-1) sign on any construction or maintenance job two miles or more in length, where traffic is maintained through the job.

D-14. Do not utilize portable sign supports on long term operations where the sign will be displayed for more than 3 consecutive days.

General Notes - Section D
Traffic Control Devices - Signs and Warning Lights (Page 2 of 2)

D-15. When distances are posted on temporary traffic control signs with a 'miles' unit of measure, display the distance in terms of whole miles or fractions with denominators of 2, 4, and 8 (For example, 1/2 mile, 1/4 mile, 3/8 mile, etc.) The use of decimals for this purpose is prohibited.

D-16. Stationary warning signs may be omitted for mobile operations if warning signs are mounted on work vehicles, shadow vehicles, or trailers that move along with the operation.

General Notes - Section E
Traffic Control Devices - Portable Changeable Message Signs (Page 1 of 1)

E-1. PCMS message text included with approved traffic control plans shall be displayed exactly as shown. If messages are not provided or other messages are desired, use the criteria established in the MUTCD, Section 2L.05, to create the desired message and contact the District Traffic Unit, District Traffic Management Center (DTMC), or Regional Traffic Management Center (RTMC) to request approval prior to posting. Once a message has been approved, requesters may retain it and maintain a log of previously approved messages for future postings. The log should contain the message text, requested date, approved date, and name of approver. Alteration of a previously approved message is considered a new message and requires approval. This is to ensure consistency with PCMS message content, phase timing, and appearance. PCMS boards are an important resource and their effectiveness is dependent upon many factors including proper installation, accurate message content, and panel displays. Improper messages or incorrect message content will erode motorist confidence in PCMS messages. Refer to the MUTCD, Sections 2L and 6F.60, for more information on PCMS message structure.

E-2. PCMS deployed along the roadway should be placed behind barrier, if practical. Where barrier is not available, PCMS should be placed off the shoulder and outside the clear zone. If there are no options other than to place a PCMS on the shoulder then it shall be placed as far as practical from the edge line with the trailer hitch facing away from oncoming traffic. Delineation (drums are preferred) is required when the PCMS is placed within the clear zone and not behind barrier. Refer to PATA 009 for further guidance.

E-3. PCMS may be placed on the left or right side of the roadway. When multiple PCMS are placed in the same direction of travel, place them on the same side of the roadway; separated from each other by a distance of at least 1000’ on freeways and expressways and at least 500’ on other highways. PCMS should not be located within an interchange except for toll plazas and managed lanes.

General Notes - Section F
Traffic Control Setup and Removal (Page 1 of 2)

F-1. Temporary traffic control zones are to be set up by utilizing the following:

- PATA Drawing without modifications.
- MUTCD Typical Application without modifications.
- PATA Drawing with approved modifications.
- MUTCD Typical Application with approved modifications.
- Customized Temporary Traffic Control plans created specifically and approved for the work area.

Furthermore, the PATA drawings shall be utilized in lieu of a MUTCD Typical Application when roadway conditions are similar (For example, PATA 306 and PATA 603 would have precedence over MUTCD TA-35 for a mobile operation on a multi-lane highway).

F-2. Guidelines for installation and removal of traffic control setups:

- Utilize PATA 007A when setting up and removing temporary traffic control signs and devices on a freeway or expressway when there will be no roadway encroachment.
- Utilize PATA 007B when setting up and removing temporary traffic control signs and devices on a freeway or expressway when a vehicle will occupy a travel lane.
- Install signs beginning with the first sign motorists will pass when entering the advance warning area and continue placing signs downstream on the same side of the roadway until complete. Cover, remove, or modify existing signs with conflicting messages in conjunction with temporary sign placement. Refer to Publication 408, Section 901.3(a), for details on covering signs.
- Flaggers may begin controlling traffic after placement of all advance warning signs.
- Channelizing devices shall be installed in the direction of travel. A shadow vehicle may be placed between approaching traffic and the workers who are installing channelizing devices. After channelizing devices are installed, the vehicle may moved and work may begin.
- Immediately upon completion of work, remove traffic control devices in the reverse in which they were installed. Applicable traffic control zone components should be addressed in the following order: 1) Termination Area 2) Activity Area 3) Transition Area 4) Any Flagger Stations 5) Advance Warning Area.

F-3. Shadow Vehicle and Impact Attenuator information can be found in Publication 46, Section 6.11. In conjunction with any temporary traffic control zone, shadow vehicles:

- Are mandatory with a Truck Mounted Attenuator for work on expressways, freeways, and ramps.
- Are optional for work on all other highways (unless labeled as mandatory on the PATA).
- Shall be equipped with flashing, oscillating, or revolving yellow lights. These are to be active on all shadow vehicles and must be visible from any direction (360° visibility). Hazard warning lights and turn signals are not considered flashing lights for this purpose.
- Shall not be involved in the operation as a work vehicle.
- Shall not be located within the buffer space.
- Shall be used in pairs (separated by a minimum distance of A) for bridge inspection teams while working on freeways or expressways (unless otherwise approved by the District Traffic Engineer).
- May be mobile if they are kept between 125’ and 200’ from workers or nearest work vehicle in a continuously moving operation. This distance may be increased to 1000’ for paving operations.
- May be used in emergency situations to protect concrete barrier blunt ends. District Traffic Engineer approval is required if shadow vehicle will be in place longer than three days.

F-4. An optional three cone advance setup may be used to alert oncoming traffic to a flagger location. If used, the cone located nearest to the flagger should be placed on the roadway centerline directly across from the Flagger Symbol (W20-7) sign. Place two additional cones upstream equally spaced at a distance of 10’ to 50’. If additional cones are desired, one may be placed on the roadway centerline directly across from advance warning signs. Refer to PATA 002 for further guidance.

General Notes - Section F
Traffic Control Setup and Removal (Page 2 of 2)

F-5. Consider using temporary longitudinal barrier to protect workers in all multi-lane work zones if the speed limit is 45 MPH or greater, workers are present within one lane width of an active lane, and a lane or shoulder is closed continuously for more than three days. Refer to Publication 72M, Roadway Construction Standards, for barrier installation details.

F-6. Paved shoulders may be used for traffic if they are structurally sound, have sufficient width and depth to safely support traffic, and are free of debris. Shoulders that will be used for traffic in conjunction with long-term operations may require extra attention, such as:

- Mill and fill existing edge line and shoulder rumble strips.
- Eradicate and paint new white edge lines.
- Review the condition and elevation of inlet grates. Tack-weld grate inlets to frames.
- Refer to Publication 13M, Design Manual Part 2, for cross slope information.

General Notes - Section G
Equipment, Vehicle, and Material Storage (Page 1 of 1)

G-1. The buffer space shall be kept free from work activity and storage of equipment, vehicles, or material.

G-2. Equipment, vehicles, and material shall be stored a minimum of 30 feet from the edge of the nearest open travel lane, or they shall be adequately stored behind a longitudinal barrier. If these criteria cannot be met, than store these items as far as practical from the nearest roadway edge and behind barricades, drums, or other protective devices. Publication 13M, Design Manual 2, Chapter 12, Table 2.3, presents minimum unobstructed distances that shall be maintained behind various guiderail systems.

G-3. If site conditions prevent equipment, vehicles, and material from being stored as indicated in the previous note or if these items are staged for use in an operation, then barricades, drums, or other protective devices shall be placed around these items.

G-4. Worker's vehicles parked in a work zone shall be placed in such a manner that does not compromise the safety of workers, pedestrians, or the traveling public. Parking behind barrier is most preferred. If barrier does not exist then position vehicles outside of the clear zone, if possible.

General Notes
Definitions (Page 1 of 2)

Activity Area - Area of a temporary traffic control zone comprised of the buffer space and the work space usually separated from traffic flow by channelizing devices or barrier located parallel to the travel lanes.

Buffer Space - Area that separates traffic flow from the work space. Buffer spaces must remain clear of equipment, vehicles, workers, and materials. The length of longitudinal buffer spaces is defined as distance E on PATA figures and may be increased for downgrades or other conditions that affect stopping sight distance.

- Longitudinal buffer space is located in advance of and after the work space.
- Lateral buffer space is located between flowing traffic and the activity area.

Complex Condition (Temporary/Portable Traffic Signals) - A condition where driveways and/or side roads are located between the temporary signal installation locations. Additional signal installations or flaggers are required in additional to those shown on any PATA 700 series drawing.

Conventional Highway - Any highway other than a freeway or expressway.

Emergency Work – Emergencies may arise where it will be necessary to begin work even though all of the specific traffic control provisions may not be satisfied. In these cases all available safety measures shall be taken and the work zone shall be brought into compliance with this publication as soon as possible.

Expressway - A divided arterial highway for through traffic with partial control of access and generally with grade separations at major intersections.

Freeway - A highway to which the only means of ingress and egress is by interchange ramps.

Highway - The entire width between the boundary lines of every way publicly maintained when any part thereof is open to the use of the public for purposes of vehicular travel.

Long-Term Stationary Operation - Work that occupies a location for a period of more than 24 hours.

Mobile Operation - An operation where the work zone beginning and ending points move as the work activity moves. Work that moves intermittently or continuously for up to 24 hours.

Non-Complex Condition (Temporary/Portable Traffic Signals) - A condition where driveways and/or side roads do not exist in the temporary traffic control zone utilizing temporary traffic signals. PATA 700 series drawings can be implemented and run automatically exactly as shown without flagger assistance or additional signals.

Numbered Traffic Route - A highway that has been assigned an Interstate, United States, or Pennsylvania Route Number, consisting of one, two, or three digits, sometimes with an additional designation such as business route, truck route, or other similar designation.

PATA (Pennsylvania Typical Application) - Drawings within this publication that depict temporary traffic control conditions.

Portable Sign Post - Rigid device with steel posts for mounting temporary traffic control devices where minimum mounting heights of at least 5’ are required. Refer to Publication 111, Traffic Control – Pavement Markings and Signing Standards TC-8717, for details.

Portable Sign Support - A folding, collapsible, or telescoping device for posting temporary traffic control devices where minimum mounting heights of 1’ are acceptable.

Roadway - That portion of a highway improved, designed, or ordinarily used for vehicular travel, exclusive of the sidewalk, berm, or shoulder.

Roll Ahead Space - Space provided between the shadow vehicle and the work space in a closed lane. This space shall be clear of equipment, vehicles, workers, and materials. Shown as distance H on PATA drawings.

Rural Highway - A type of roadway normally characterized by lower volumes, higher speeds, and fewer conflicts with turning vehicles and pedestrians. Rural highways often have speed limits greater than 35 MPH, but are not freeways or expressways.

Shadow Vehicle - A vehicle positioned within the activity in advance of the work space and work vehicles. The primary purpose of the shadow vehicle is to provide advance information to approaching drivers while protecting workers and work vehicles. Any vehicle can be used as a shadow vehicle as long as it is equipped with a flashing, oscillating, or revolving yellow light which is visible from any direction (360° visibility) and is not being used as a work vehicle. The yellow light must be activated within an active work zone.

General Notes
Definitions (Page 2 of 2)

Short-Term Stationary Operation - An operation that will occupy a location for up to 24 hours. The work zone will have stationary beginning and ending points. Work activity may move freely within these limits.

Shoulder - The part of a highway adjacent to the roadway which has a surface constructed with the same or similar material as the roadway. Shoulder width is measured from the center of the painted edge line to the outside edge of pavement, concrete, or finished surface.

Sidewalk - That portion of a street between curb lines, or the lateral lines of a roadway, and the adjacent property lines, intended for use by pedestrians. A 48" minimum usable width must be maintained.

Taper - A series of channelizing devices and/or paint lines installed for the purpose of moving traffic out of or into the normal path. Various taper types have differing minimum lengths, most of which are based upon an 'L' distance. The formula to determine distance L is shown on the corresponding PATA notes page. It should be noted that the taper length is a distance per lane; so if a single taper covers two lanes, the total taper length will be double the calculated or minimum distance.

- Merging Taper - Used when drivers in multiple lanes are required to merge into a common road space. Minimum length is L.

- Shifting Taper - Used when a lateral shift is needed. Minimum length required is distance 1/2 L, unless traffic is approaching a one-lane, two-way condition; in this case the minimum length is 50'.

- Shoulder Taper - Required when closing a paved shoulder having a width of 8' or more; optional in other conditions. Minimum length is 1/3 L, unless traffic is approaching a one-lane, two-way condition; in this case the minimum length is 25'.

- Downstream Taper - Used in the termination area to provide a visual cue to the driver that access is available back into the original lane or path that was closed. Minimum distance is 50' per lane.

Temporary Traffic Control Zone - An area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel.

Truck Mounted Attenuators (TMA) - Shall be mandatory for placement on shadow vehicles utilized on freeways and expressways, including exit and entrance ramps. The TMA is optional on all other highways. When a TMA is used, the weight of the shadow vehicle must be greater than the minimum weight specified by the TMA manufacturer.

Urban Area or Urban Highway - A type of roadway normally characterized by wide ranges of traffic volumes, frequent intersections and driveways, significant pedestrian traffic, speed limits of 35 MPH and below, and most often parking along one or both sides of the roadway.

Warning Lights - Yellow lights that operate in steady burn or flashing mode. Warning lights on authorized vehicles may flash or revolve. Type A, B, C, and D warning lights are portable, powered, yellow, lens-directed enclosed lights.

Worker - A person on foot whose duties place him or her within the right-of-way of a highway, such as highway construction and maintenance forces, survey crews, utility crews, responders to incidents, and law enforcement personnel when directing traffic, investigating crashes, and handling lane closures, obstructed roadways, and disasters within the right-of-way of a highway.

Work Space - Area within a temporary traffic control zone that is set aside for workers, work vehicles, equipment, and material storage.

Work Vehicle - A vehicle available for use by workers within an activity area. All work vehicles shall be located outside of the buffer space and roll ahead space for shadow vehicles. Work vehicles being used in an active work zone must utilize the flashing, oscillating, or revolving yellow lights which are visible from any direction (360° visibility).

Work Zone - The area of a highway where construction, maintenance, or utility work activities are being conducted, and in which traffic control devices are required in accordance with Title 67, Chapter 212.

General Notes
Reference Publications (Page 1 of 1)

Pennsylvania Consolidated Statutes Title 75, (Vehicle Code)

The Pennsylvania Code Title 67 (Transportation), Chapter 212 (Official Traffic-Control Devices)

Information regarding Temporary Traffic Control and devices are found in:

- The Manual on Uniform Traffic Control Devices (MUTCD), Part 6.
- Title 67, Chapter 212
- U.S. Department of Transportation, Federal Highway Administration 2011 Traffic Sign Retroreflective Sheeting Identification Guide
- American Traffic Safety Services Association (ATSSA) publication entitled "Quality Guidelines for Temporary Traffic Control Devices".
- Publication 46, Chapter 6.
- Publication 408, Section 901.

Publication 13M, Design Manual Part 2 – Highway Design

Publication 14M, Design Manual Part 3 – Plans Presentation

Publication 35, Approved Construction Materials

Publication 46, Traffic Engineering Manual

Publication 111, Pavement Markings and Signing Standards TC-8600 and TC-8700

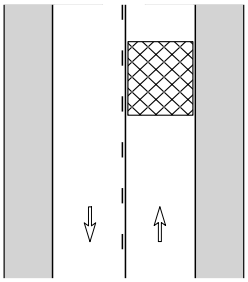
Publication 149, Traffic Signal Design Handbook

Publication 234, Flagging Handbook

Publication 236, Handbook of Approved Signs

Publication 408, Specifications

General Notes
Legend For Pennsylvania Typical Application Drawings



Work space
(hatched area)

Direction of traffic flow
(arrows)

Shadow Vehicle equipped with
a TMA, flashing or revolving yellow
light, and an arrow panel

Shadow Vehicle equipped with
a TMA and a flashing or
revolving yellow light

Shadow Vehicle equipped with
a flashing or revolving yellow light

Pilot Vehicle equipped with
a flashing or revolving yellow light

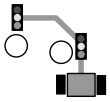
Work Vehicle equipped with
a flashing or revolving yellow light

Portable Changeable Message
Sign (PCMS) on trailer

Flashing Arrow Panel
on trailer

Flashing Arrow Panel (Merge Mode)

Flashing Arrow Panel (Caution Mode)



Portable Traffic Signal
on Trailer (circles contain
signal head number)

Portable Traffic Signal
on Pedestal (circles contain
signal head number)

Flagger Location

Flagger/Operator

Flagger with
Stop/Slow Paddle

Flagger with
Red Flag

Automated Flagger
Assistance Device

Channelizing Devices

Sign Location

Type B flashing light (red)

Type B flashing light (yellow)

Type B flashing light (white)

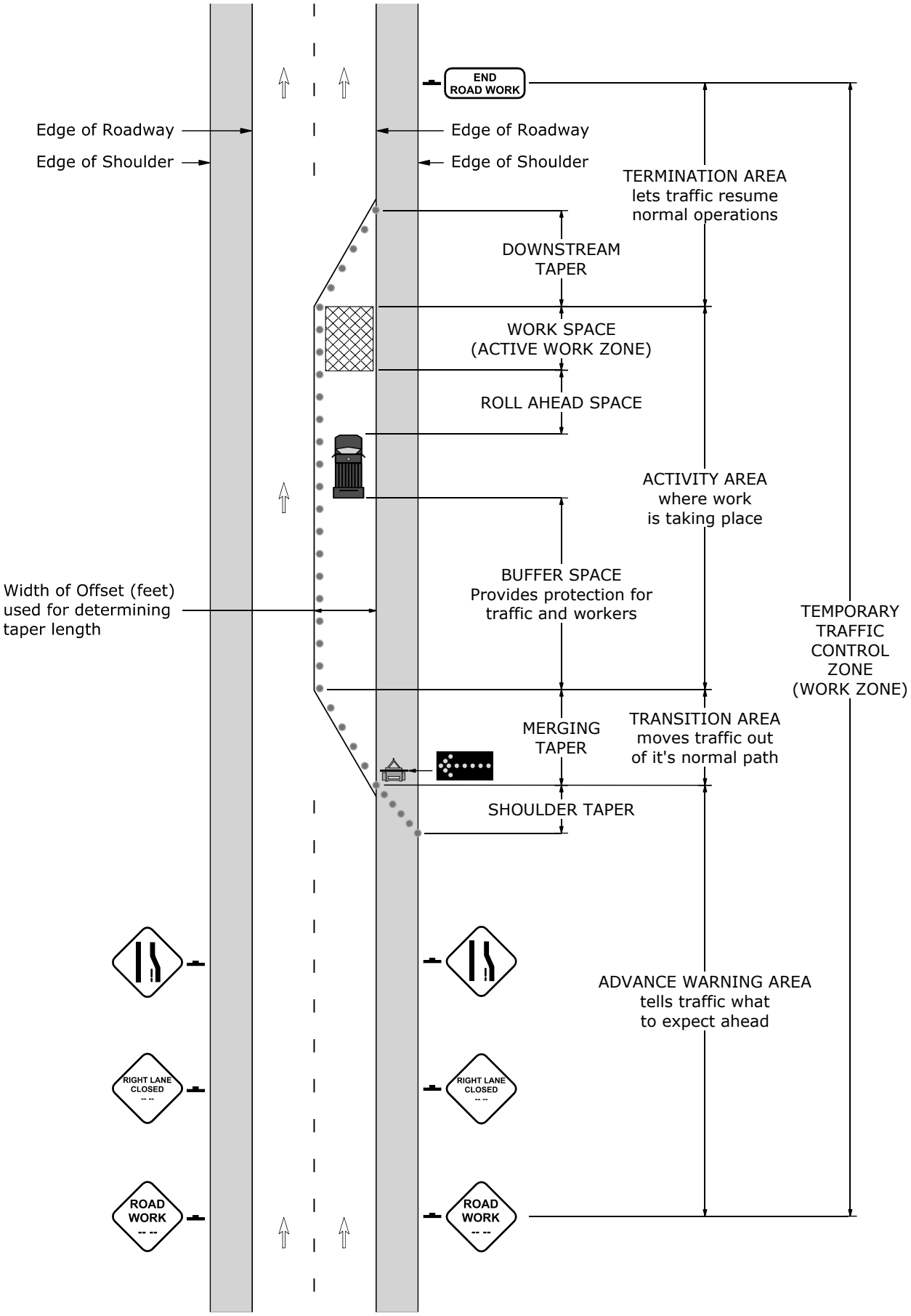
Type III Barricade

Barrier End Treatment

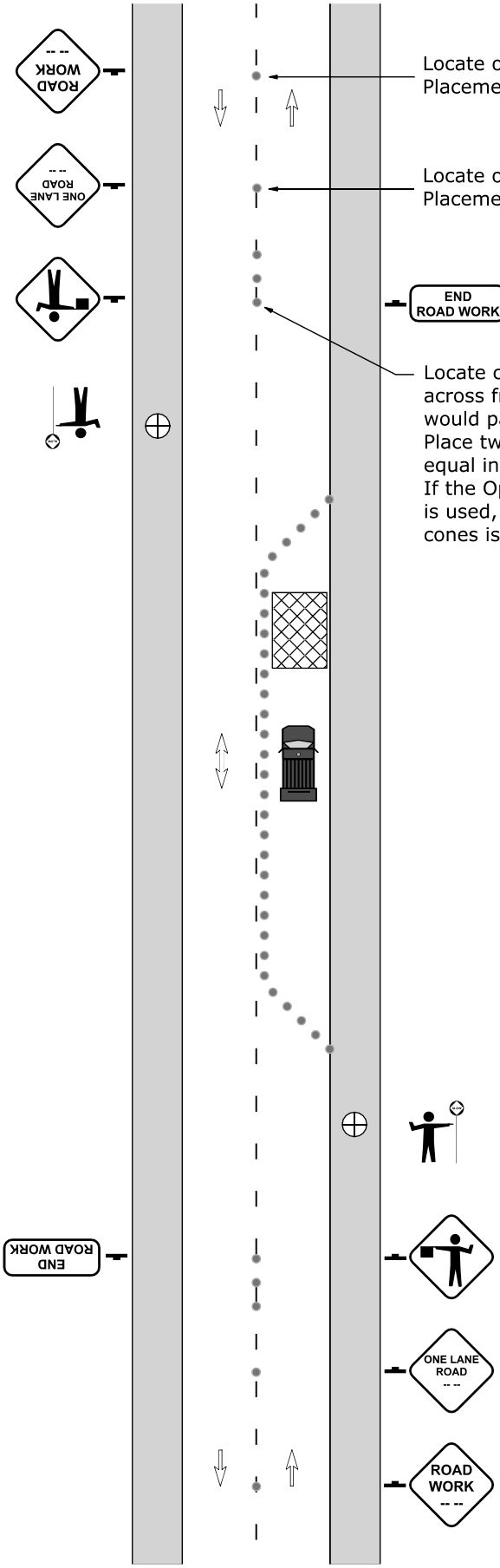
Standard Applications

(PATA 000 Series)

PATA 001
Component Parts Of A Temporary Traffic Control Zone



PATA 002
Optional Advance Cone Setup



Locate one cone across from warning sign. Placement of this cone is optional (typ.).

Locate one cone across from warning sign. Placement of this cone is optional (typ.).

Locate cone nearest to the taper directly across from final warning sign a driver would pass prior to entering the taper. Place two additional cones as shown at equal intervals of between 10' and 50'. If the Optional Advance Cone Setup is used, then placement of these three cones is mandatory (typ.).

PATA 003
Act 229 Guidelines - Notes

1. The installation of the Work Zone-Turn on Headlights (R22-1), Active Work Zone When Flashing (W21-19), and End Active Work Zone (W21-20) signs, and the flashing white lights are not required for any of the following situations:

a. Mobile operations

b. Operations 1 hour or less in duration.

c. Stationary work where the daily duration of the construction, maintenance, or utility operation is less than 12 hours and all traffic control devices are removed from the highway at the completion of the daily operation.

d. The normal speed limit is 45 MPH or less.

e. The work is in response to emergency work or conditions such as a major storm.

2. Erect the Work Zone-Turn on Headlights (R22-1) sign as the first sign on each primary approach to the work zone, generally at a distance of 250' to 1000' prior to the first warning sign.

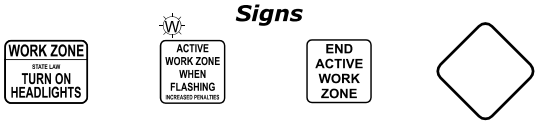
3. Erect the Active Work Zone When Flashing (W21-19) sign on each approach to an active work zone. If flaggers are present, place the signs in the advance warning area; otherwise place the signs as close as practical to the active work zone.

4. When multiple Active Work Zones are separated by a distance of more than 1 mile, erect a sign on each approach.

5. The Active Work Zone When Flashing (W21-19) light shall be activated only when workers are present, and shall be deactivated when work activity is not anticipated during the next 60 minutes.

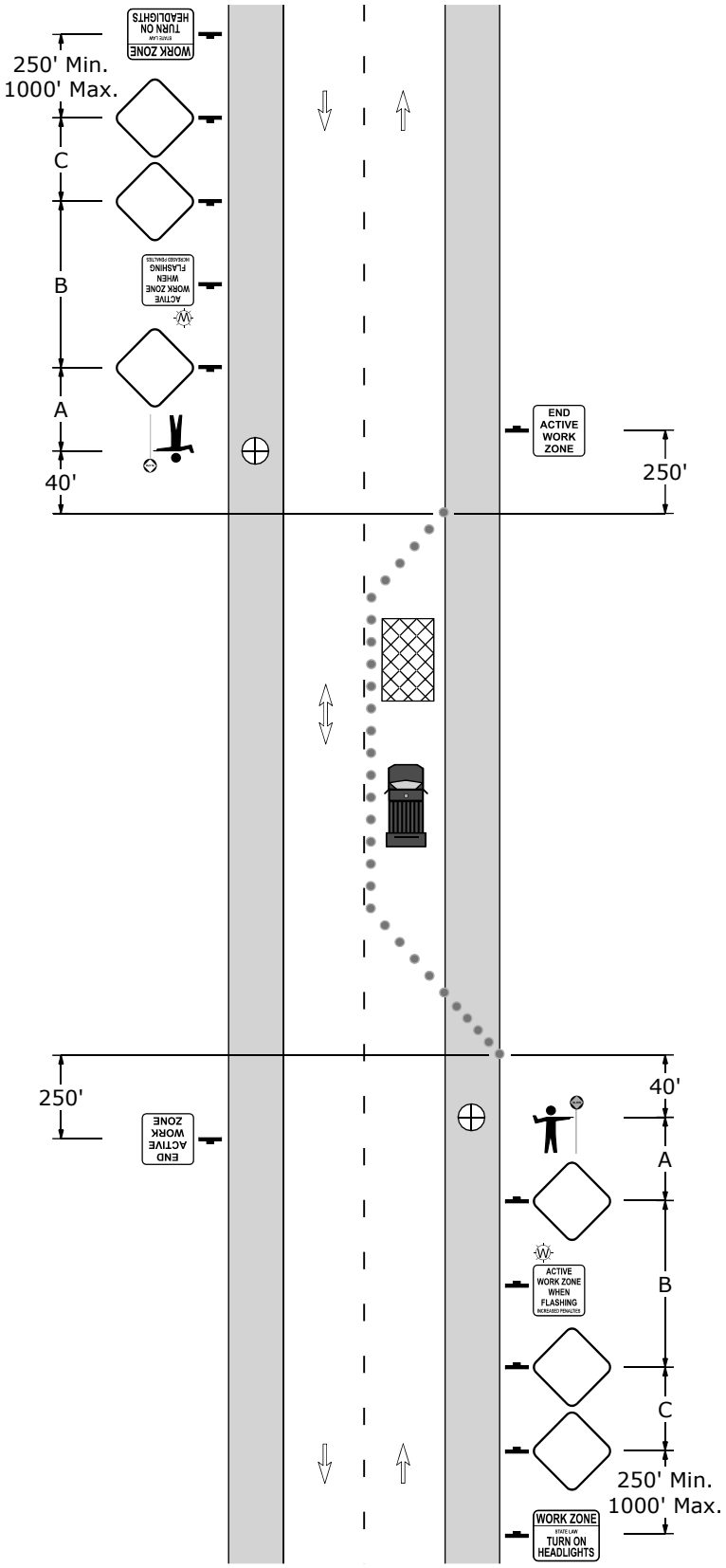
6. When the work zone is on a freeway or expressway, appropriate Act 229 signing and lights shall be installed at on-ramp approaches to the work zone.

Signs

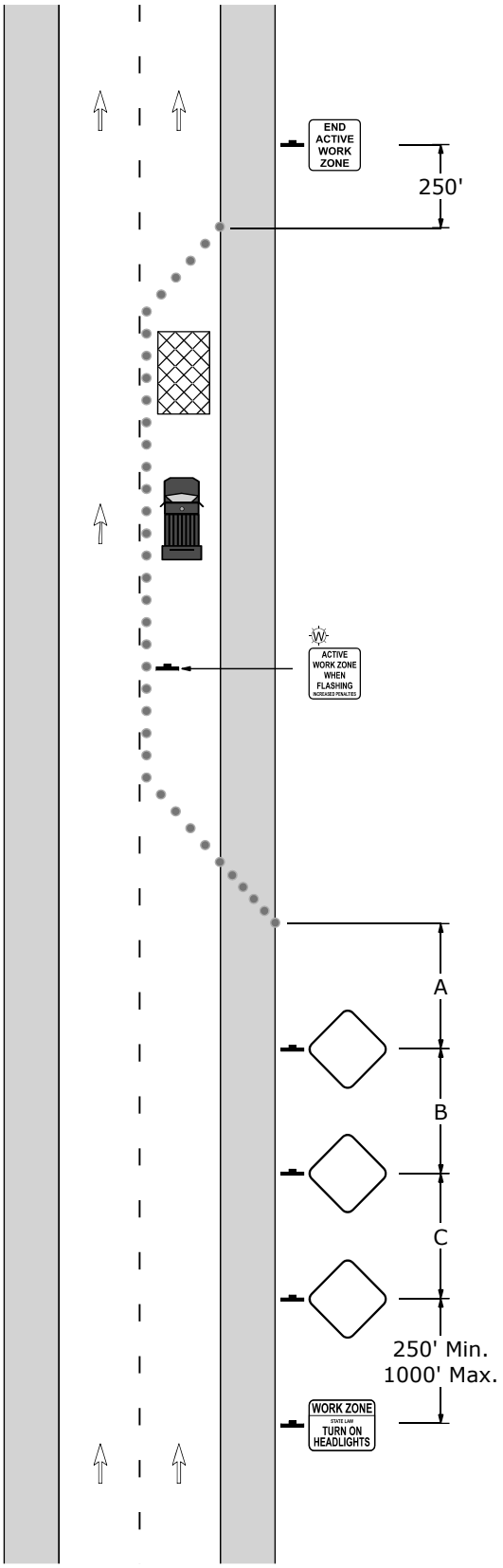


R22-1 W21-19 W21-20 W-Series

PATA 003
Act 229 Guidelines



Flagger Condition
Two Lane, Two Way



Non-Flagger Condition
One Way

PATA 004
Temporary Portable Rumble Strips - Notes

1. Temporary Portable Rumble Strips (TPRS) are authorized for use on two-lane two-way roadways.

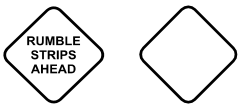
2. Do not use TPRS when the air temperature is less than 40 degrees Fahrenheit.

3. When installing TPRS, begin at the roadway centerline and continue across to the right. TPRS shall extend across the entire lane width. Any excess portion of the TPRS can be placed beyond the edgeline onto the shoulder.

4. All TPRS must be the same color. The color may be black, white, or orange.

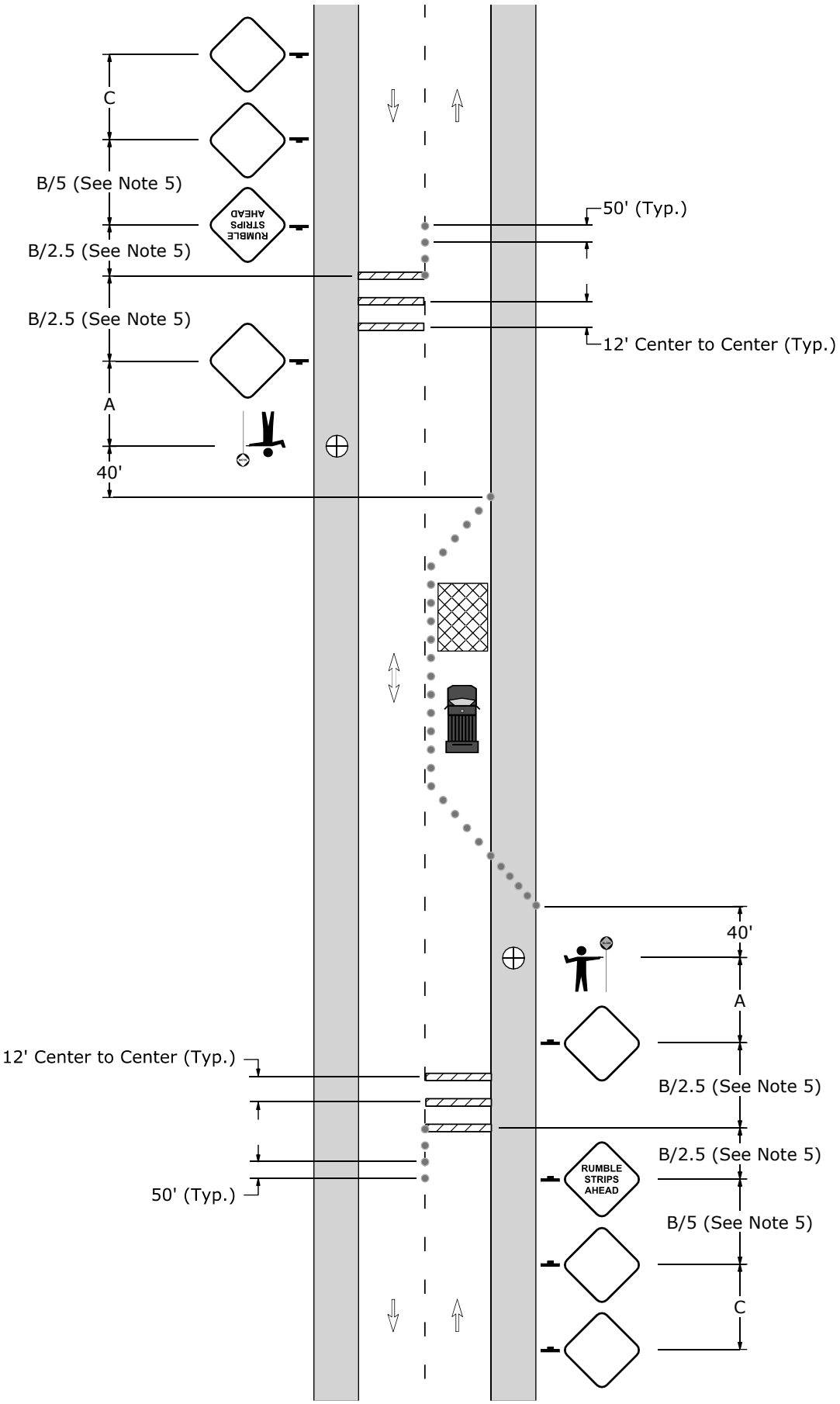
5. Maintain 100' minimum spacing between signs facing the same direction.

Signs



W8-101 W-Series

PATA 004
Temporary Portable Rumble Strips



PATA 005
Temporary Bituminous Overlay Rumble Strips - Notes

1. It is desirable to extend the rumble strip patterns past the white edge lines onto the shoulder. Amount of shoulder usage is discretionary.

2. Rumble strip patterns placed in a single direction of travel on a two-way highway shall not encroach upon the opposing travel lane.

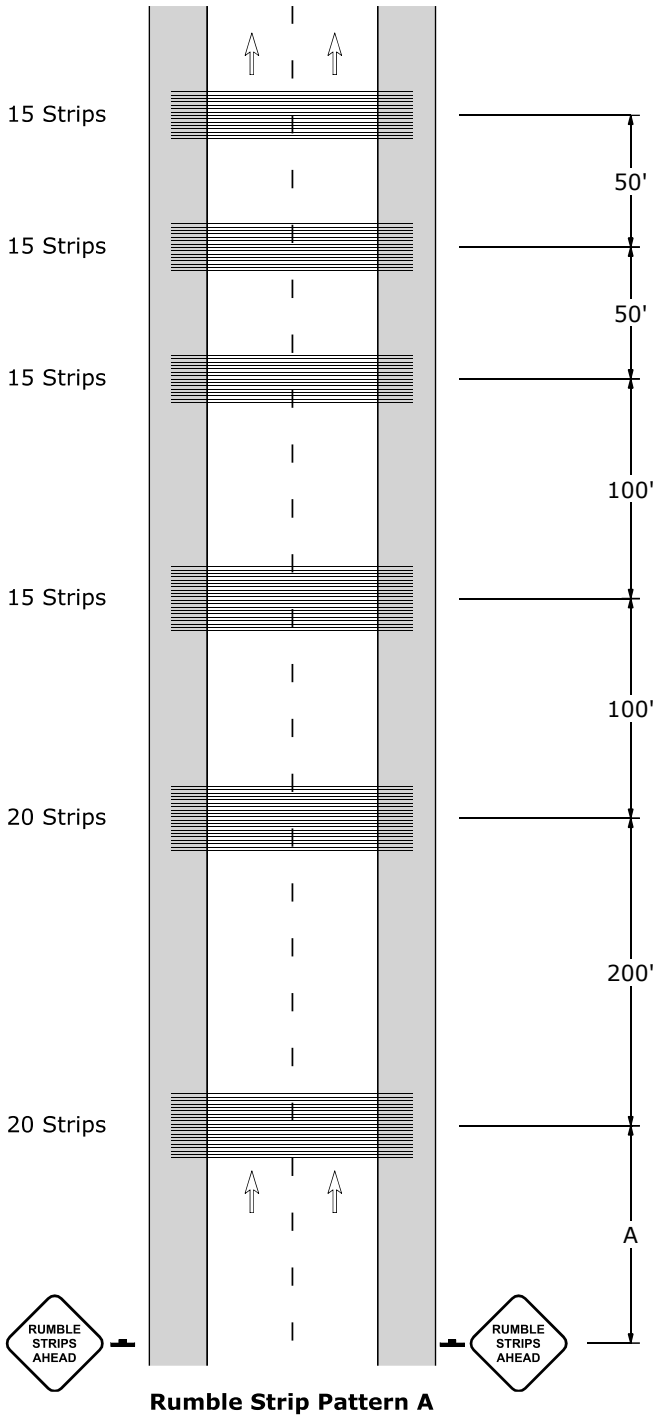
3. Rumble Strip Detail applies to Rumble Strip Pattern A and Rumble Strip Pattern B.

4. Feather both the leading and trailing ends of bituminous overlay to prevent edges from breaking down due to traffic wear.

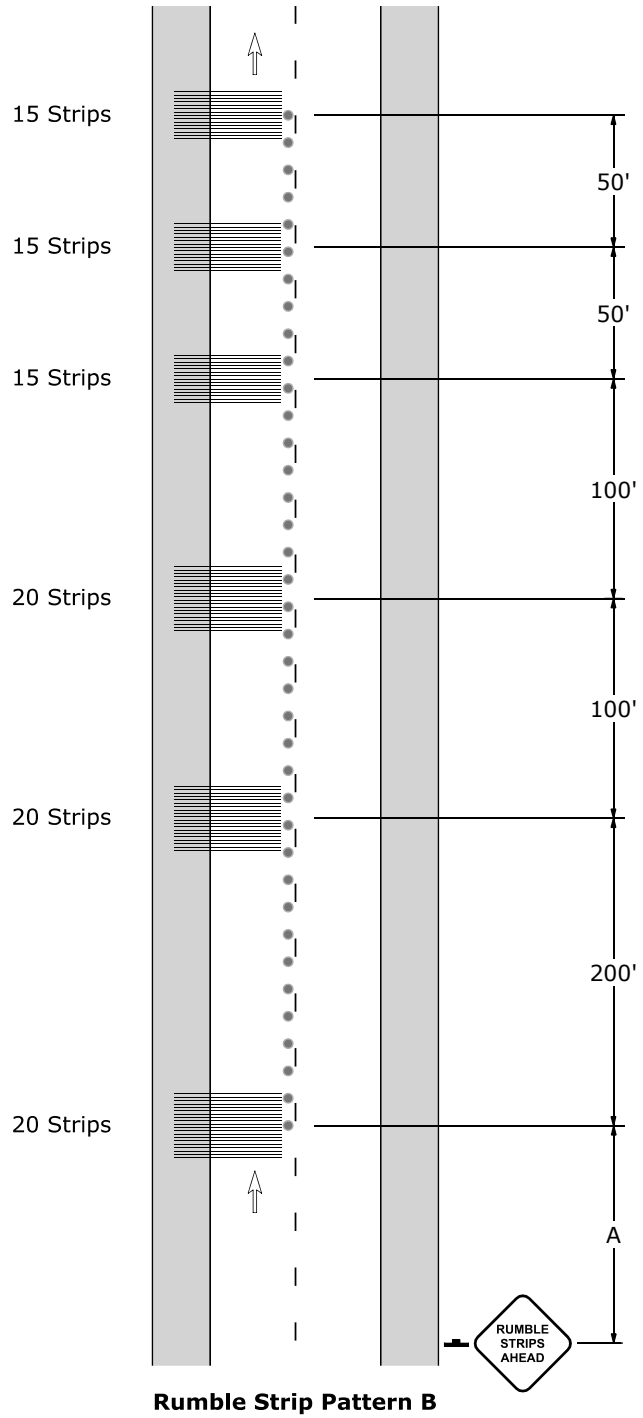
Signs

W8-101

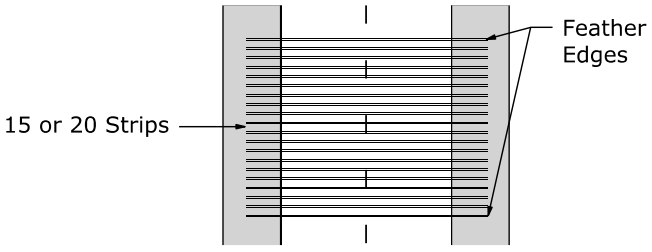
PATA 005
Temporary Bituminous Overlay Rumble Strips



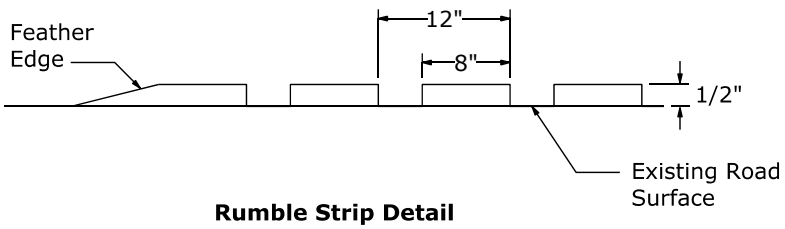
Rumble Strip Pattern A



Rumble Strip Pattern B



Rumble Strip Area (Bituminous Overlay)



Rumble Strip Detail (Longitudinal Cross Section)

PATA 006
Side Road Approach To Stationary Operations - Notes

1. Commercial and/or private driveways may be posted and controlled as shown in this PATA.

2. The Road Work (W20-1) and Flagger Symbol (W20-7) signs shall be posted on side road approaches to intersections where a flagger is controlling traffic in conjunction with a stationary operation. These signs are optional for mobile operations.

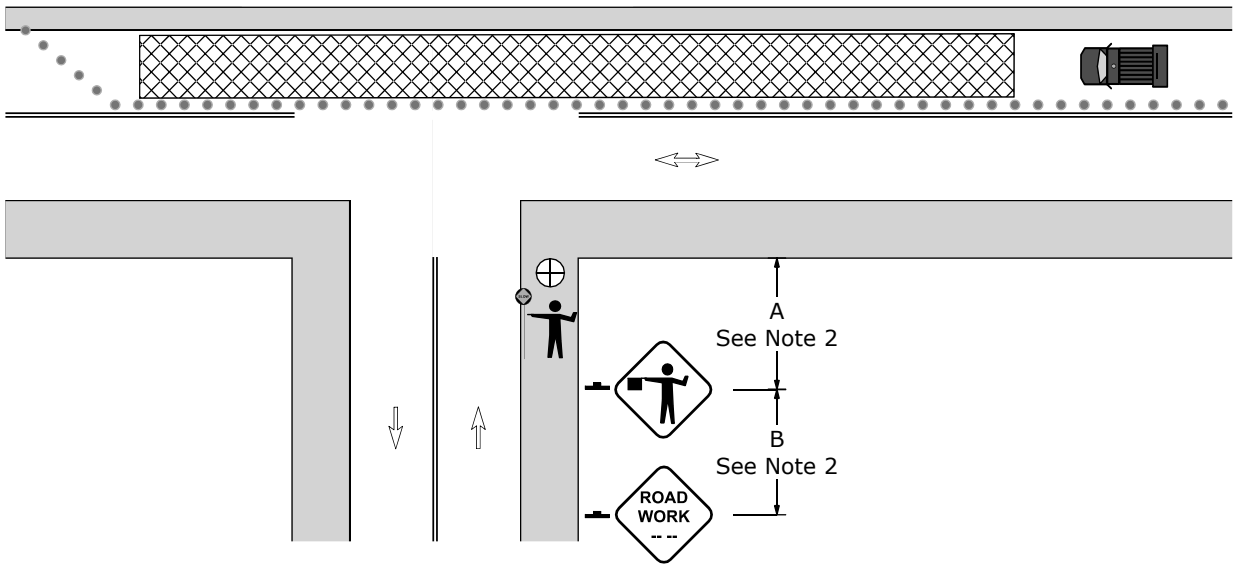
3. Drivers approaching a roadway where a stationary road work operation is taking place must pass at least one orange warning sign prior to encountering the work space. The sign may be placed on the side road approach or along the road where work is taking place. This requirement is not mandatory for mobile operations.

4. The Shoulder Work (W21-5) sign may be replaced with other appropriate signs (Low Shoulder sign, No Guide Rail sign, etc.).

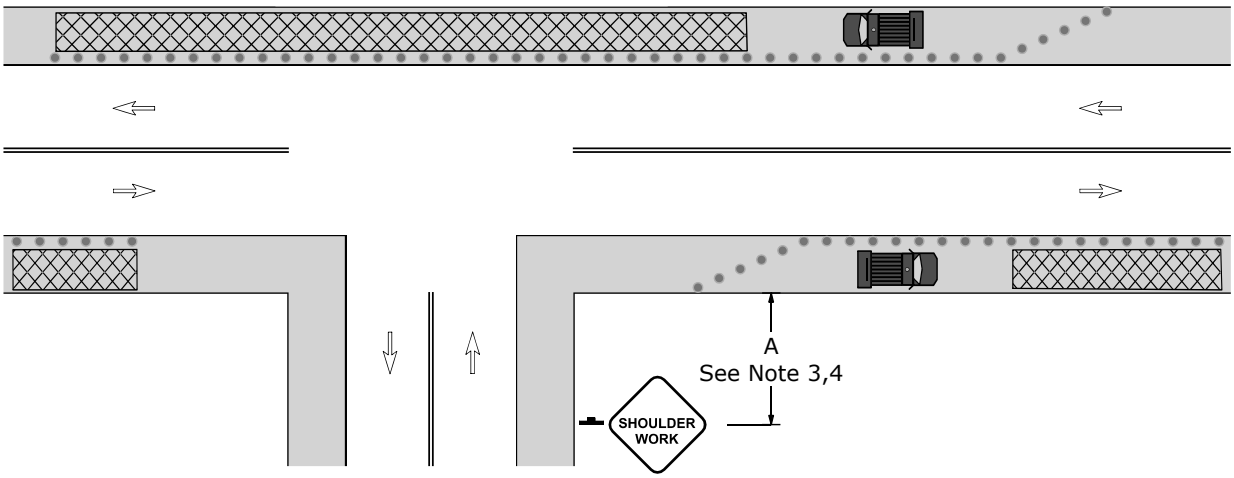
Signs

W20-1 W20-7 W21-5

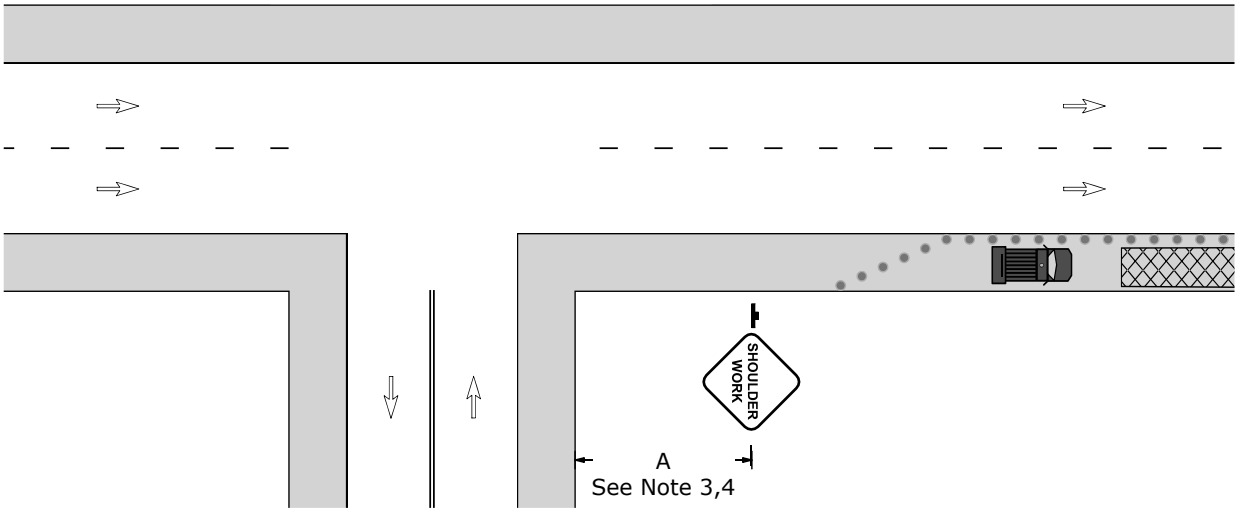
PATA 006
Side Road Approach To Stationary Operations



Side Road Approach Signing With Flagger Control at Intersection



Side Road Approach Signing Without Flagger Control at Intersection - Option 1



Side Road Approach Without Flagger Control at Intersection - Option 2

PATA 007A
Installing Advance Warning Signs For Freeways And Expressways - Notes

1. Use this PATA when there will be no roadway encroachment while installing advance warning signs along freeways and expressways.

2. Shadow vehicle 1 is required. Shadow vehicle 2 is optional.

3. Flashing arrow panels in caution mode are required for all shadow vehicles.

4. Shadow vehicles shall not straddle edge lines.

5. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

6. This operation should be done during non-peak hours of traffic or at times specified by the District Traffic Unit.

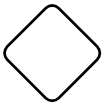
7. To remove signs, complete in reverse order in which they were installed (For example, if using a right lane closure, complete phase 2 followed by phase 1).

8. If using PATA 407 and PATA 408, distances between advanced warning signs are 1 mile and are not distances B, C, and F.

9. PATA 007A may be used in conjunction with PATA 007B if warranted by field conditions.

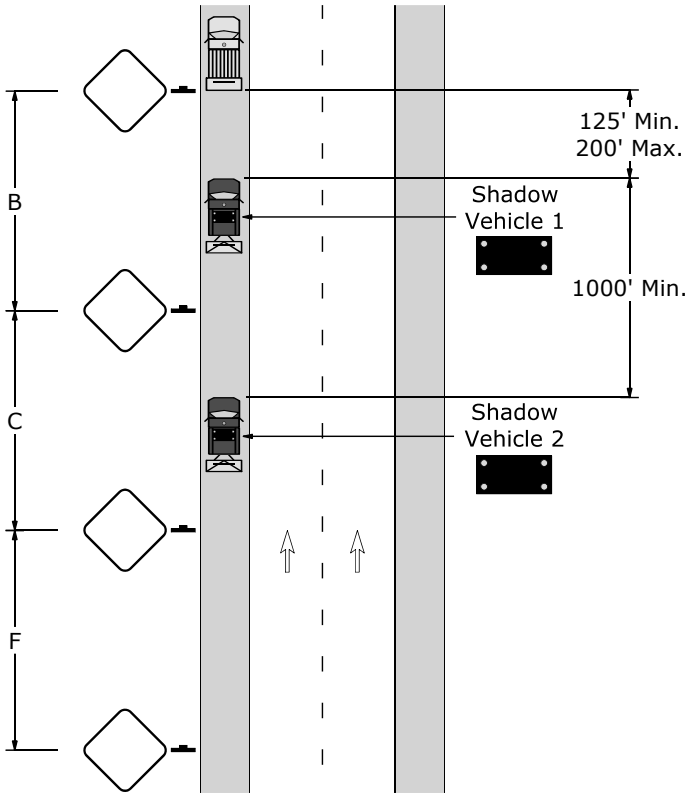
10. Refer to PATA 012 for arrow panel sizing.

Signs

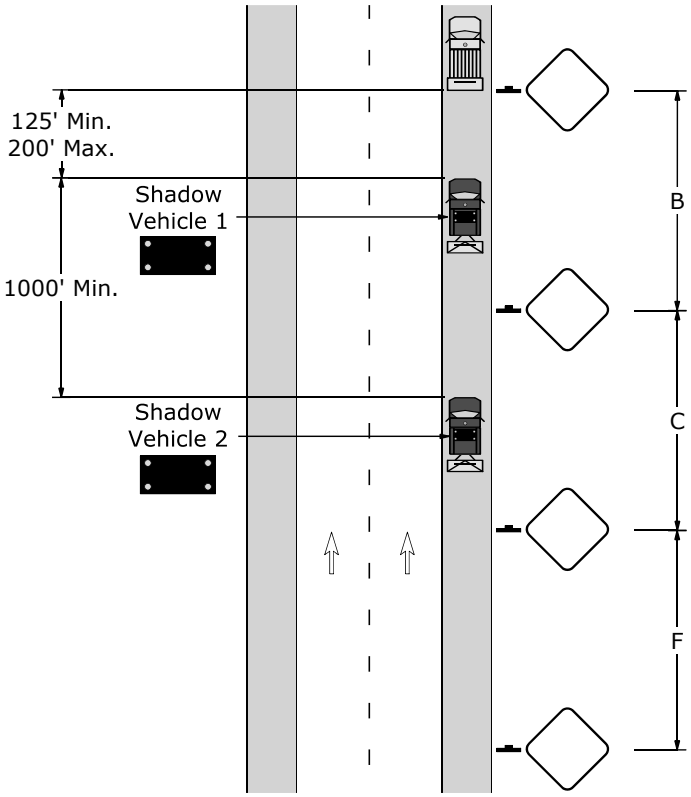


W-Series

PATA 007A
Installing Advanced Warning Signs For Freeways And Expressways

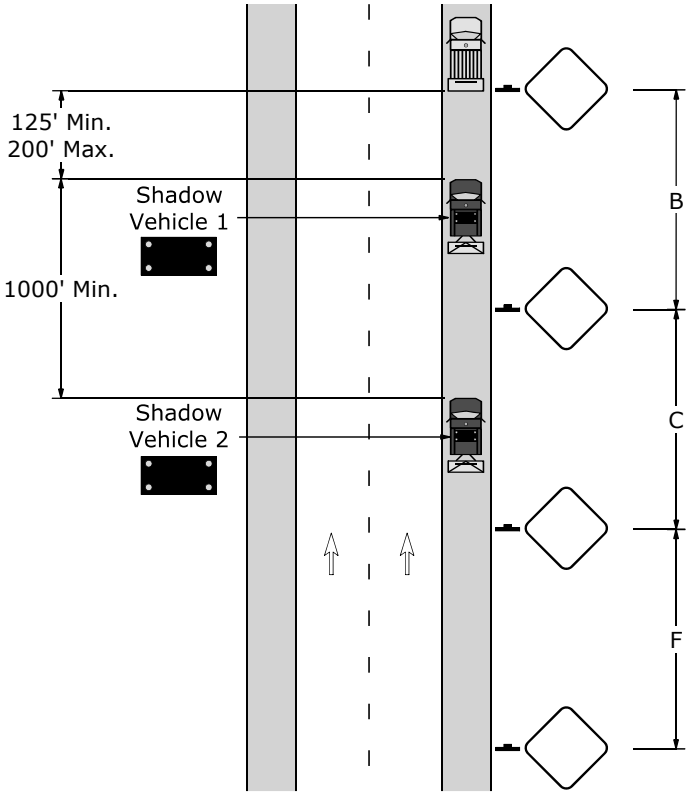


Phase 1 - Placing Signs on Left Side of Highway

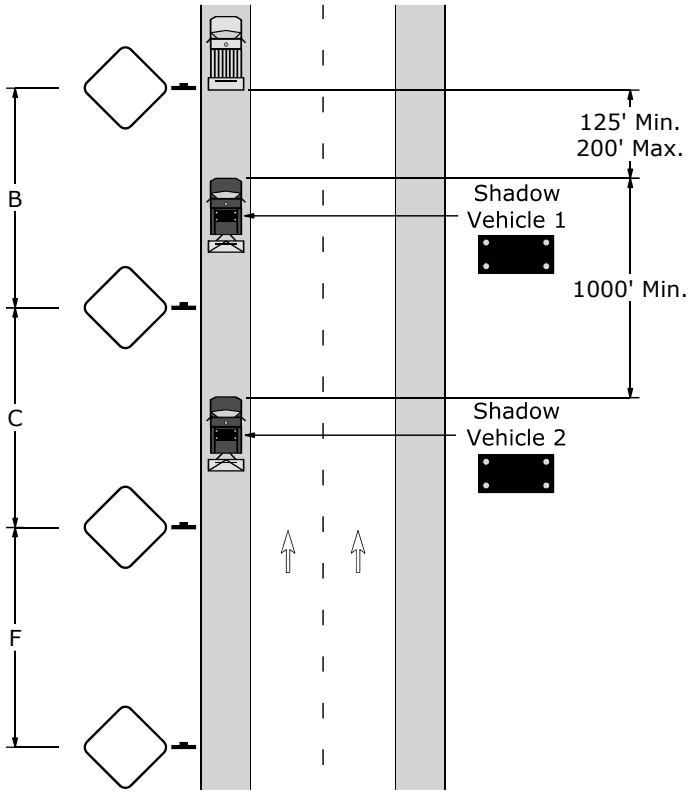


Phase 2 - Placing Signs on Right Side of Highway

Work Space Occupies Right Side Of Highway



Phase 1 - Placing Signs on Right Side of Highway



Phase 2 - Placing Signs on Left Side of Highway

Work Space Occupies Left Side Of Highway

PATA 007B
Installing Advance Warning Signs For Freeways And Expressways - Notes

1. Use this PATA when the work vehicle and/or the shadow vehicle(s) occupies the travel lane while installing advance warning signs along freeways and expressways.

2. Shadow vehicle 1 and shadow vehicle 2 are required. Shadow vehicle 3 is optional.

3. Flashing arrow panels are required for all shadow vehicles. Placement of the Lane Closed (W20-5L or W20-5R) sign on shadow vehicle 2 and shadow vehicle 3 is optional. If used, it should be placed so that it will not diminish the target value of the flashing arrow panel.

4. If sufficient shoulder width is not available for the shadow vehicles positioned on the shoulder, shadow vehicles shall be positioned as close as possible to the shoulder edge.

5. Shadow vehicles are permitted to straddle edge lines.

6. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

7. This operation should be done during non-peak hours of traffic or at times specified by the District Traffic Unit.

8. To remove signs, complete in reverse order in which they were installed (For example, if using a right lane closure, complete phase 2 followed by phase 1).

9. If using PATA 407 and PATA 408, distances between advanced warning signs are 1 mile and are not distances B, C, and F.

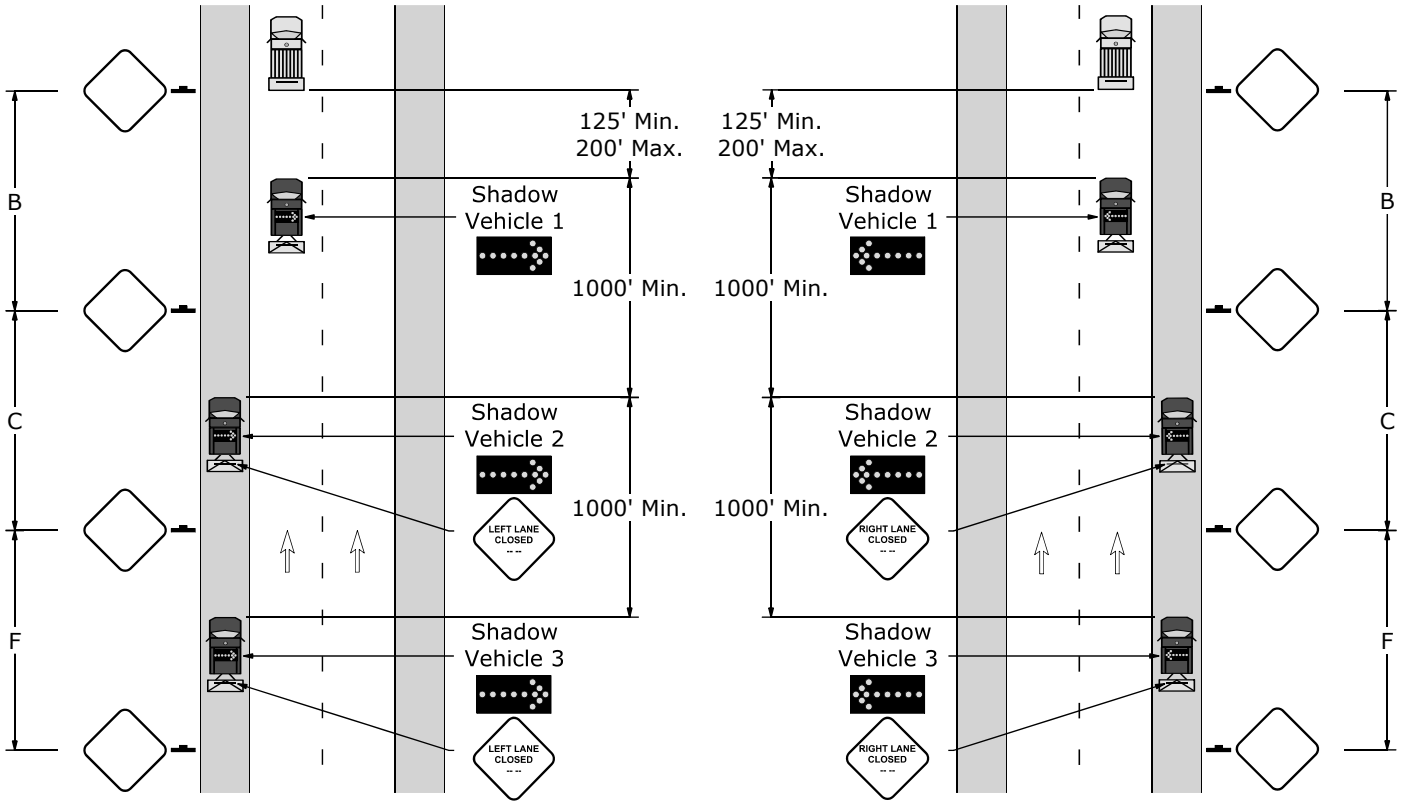
10. PATA 007B my be used in conjunction with PATA 007A if warranted by field conditions.

11. Refer to PATA 012 for arrow panel sizing.

Signs

W20-5L W20-5R W-Series

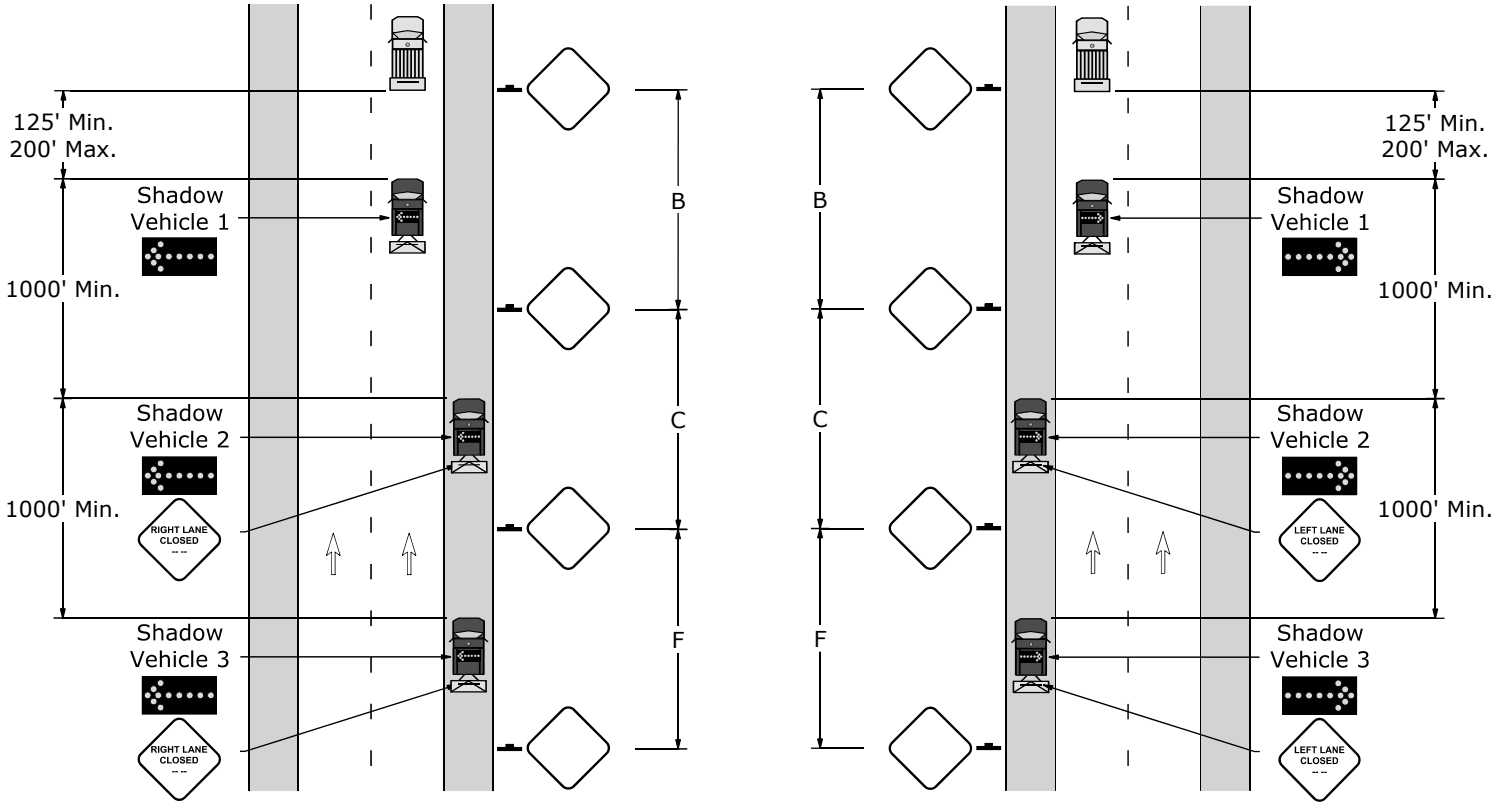
PATA 007B
Installing Advanced Warning Signs For Freeways And Expressways



Phase 1 - Placing Signs on Left Side of Highway

Phase 2 - Placing Signs on Right Side of Highway

Work Space Occupies Right Side Of Highway



Phase 1 - Placing Signs on Right Side of Highway

Phase 2 - Placing Signs on Left Side of Highway

Work Space Occupies Left Side Of Highway

PATA 008
Reverse Curve/Turn Signing - Notes

1. The Reverse Turn (W1-3L or W1-3R) sign shall be used when the tangent distance is more than 600' and the speed limit is 30 MPH or less. Place the Left Reverse Turn (W1-3L) sign in the Sign 1 and Sign 4 locations, and the Right Reverse Turn (W1-3R) sign in the Sign 2 and Sign 3 locations.

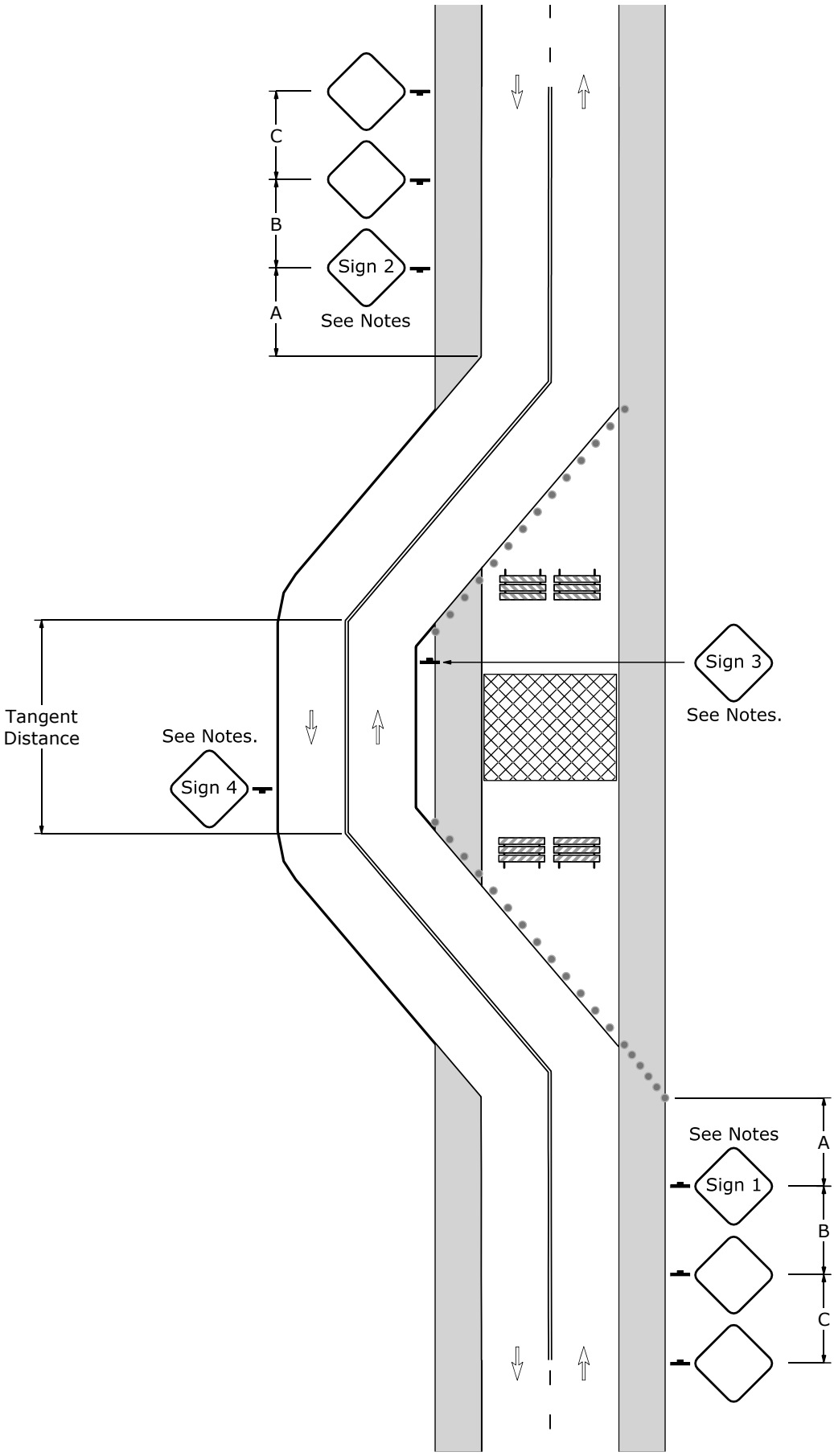
2. The Reverse Curve (W1-4L or W1-4R) sign shall be used when the tangent distance is more than 600' and the speed limit is greater than 30 MPH. Place the Left Reverse Curve (W1-4L) sign in the Sign 1 and Sign 4 locations, and the Right Reverse Curve (W1-4R) sign in the Sign 2 and Sign 3 locations.

3. The Single Lane Double Reverse Curve (W24-1L or W24-1R) sign shall be used when the tangent distance is less than 600'. Place the Left Single Lane Double Reverse Curve (W24-1L) sign in the Sign 1 location and the Right Single Lane Double Reverse Curve (W24-1R) sign in the Sign 2 location. Sign 3 and Sign 4 are not required for this scenario.

Signs

W1-3L W1-3R W1-4L W1-4R W24-1L W24-1R W-Series

PATA 008
Reverse Curve/Turn Signing



PATA 009
Trailer-Mounted Equipment Placement - Notes

1. Clear Zone width is shown on the table below. See Publication 13M, Design Manual Part 2, Chapter 12, for more information about Clear Zones.

2. Delineation is required for trailer-mounted equipment located within the clear zone, except when protected by barrier. Cones may be used if the trailer will remain in place for less than 24 hours. Drums, vertical panels or other devices authorized for long term operations shall be used when the trailer will be in place for more than 24 hours. Drums are preferred because they are highly visible, have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of road users. Also, drums are generally used in situations where they will remain in place for a prolonged period of time.

3. Place trailers in the safest location that will provide maximum performance. The trailer hitch shall be on the opposite side of traffic approaching in the nearest lane as shown on the drawings.

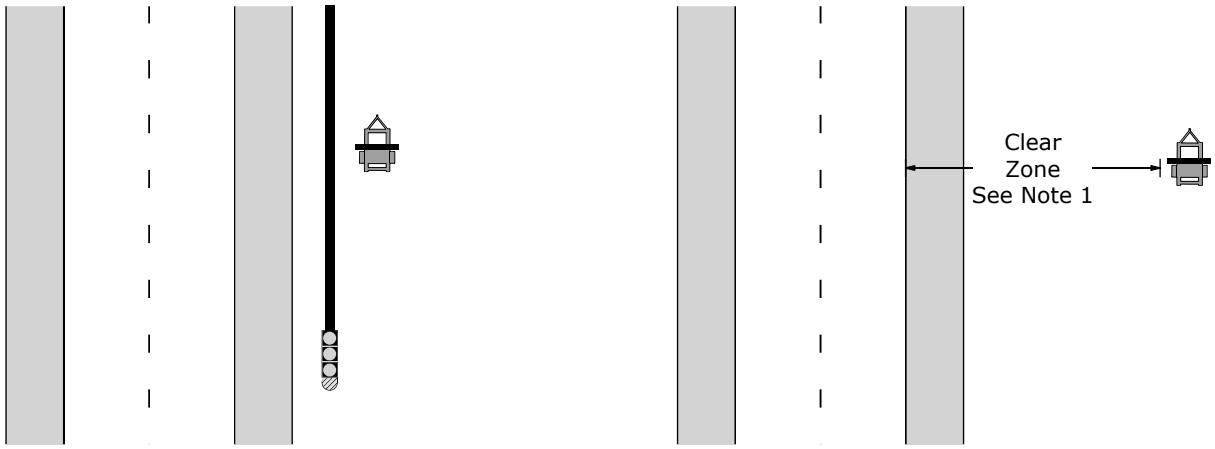
4. Placement and delineation requirements apply to all trailer-mounted equipment such as Portable Changeable Message Signs (PCMS), Speed Display Trailers, Portable Cameras, etc.

5. PCMS shown on drawings; applicable to all trailer-mounted equipment.

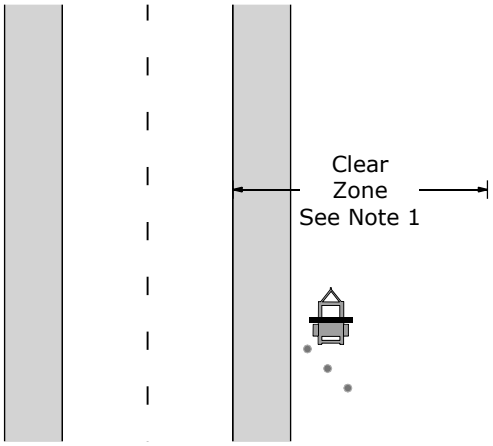
Clear Zone Width
(In feet from edge of through traveled way)

Design Speed	Design ADT	Foreslope		Backslope		
		1V:6H or Flatter	1V:5H or Steeper	1V:3H	1V:5H to 1V:4H	1V:6H or Flatter
40 MPH or less	<750	7	7	7	7	7
	750-1500	10	12	10	10	10
	1500-6000	12	14	12	12	12
	>6000	14	16	14	14	14
45-50 MPH	<750	10	12	8	8	10
	750-1500	14	16	10	12	14
	1500-6000	16	20	12	14	16
	>6000	20	24	14	18	20
55 MPH	<750	12	14	8	10	10
	750-1500	16	20	10	14	16
	1500-6000	20	24	14	16	20
	>6000	22	26	16	20	22
60 MPH	<750	16	20	10	12	14
	750-1500	20	26	12	16	20
	1500-6000	26	30	14	18	24
	>6000	30	30	20	24	26
65-70 MPH	<750	18	20	10	14	14
	750-1500	24	28	12	18	20
	1500-6000	28	30	16	22	26
	>6000	30	30	22	26	28

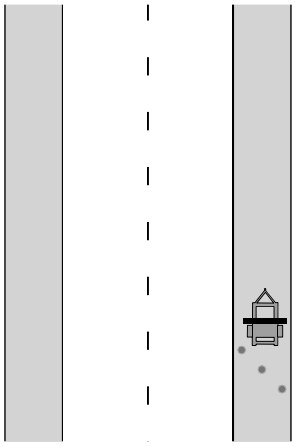
PATA 009
Trailer-Mounted Equipment Placement



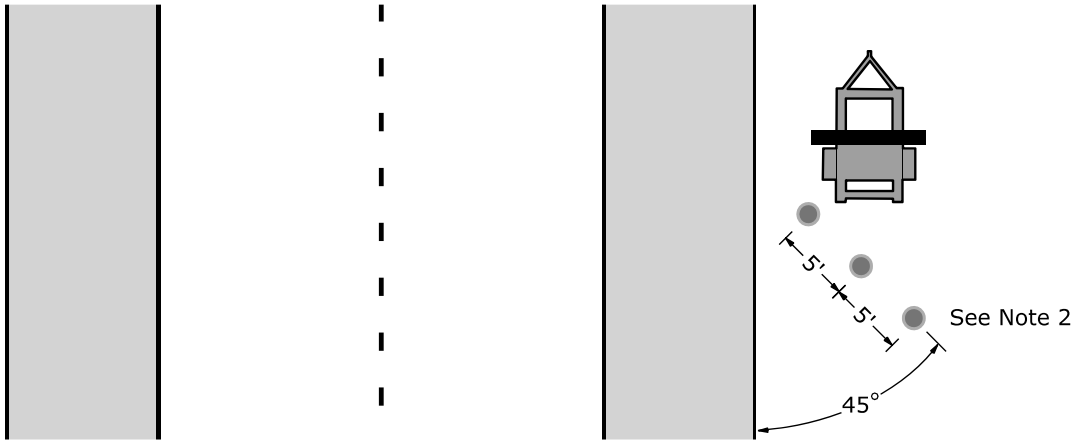
Most Perferred
Trailer Placed Behind Existing Barrier or Outside Clear Zone Where Existing Barrier Is Not Available
Delineation Not Required



Where Barrier Is Not Available
Trailer Placed Off Shoulder, But Within Clear Zone
Delineation Is Required



Least Preferred
Trailer Placed on Shoulder
Delineation Is Required



Delineation Layout Detail for Trailer Placed Within the Clear Zone

PATA 010
Guidelines For Height And Lateral Placement Of Temporary Traffic Control Signs - Notes

1. Signs located on both the left and right sides of a roadway shall conform to these guidelines.

2. Red Type B flashing lights are mandatory with temporary stop signs. Yellow Type B warning lights are mandatory with temporary yield signs and are optional with warning signs unless otherwise indicated in PATA notes. Refer to the MUTCD, Section 6F.83, for more information on flashing lights.

3. A clearance of 1' from the curb face is permissible where sidewalk width is limited or where existing utility poles are close to the curb.

4. Higher mounting heights are desirable and may be necessary where construction equipment, material or other obstructions such as parking or pedestrian activity is present.

5. All signs erected within the roadway or shoulder shall be mounted on Portable Sign Supports, Temporary Portable Sign Posts or Type III barricades.

6. The width of Type III barricade rails shall be a minimum of 48" or equal to the widest horizontal dimension of the widest sign installed on the barricade, whichever is greater.

7. Supplemental plaques may be attached to the post nearest the roadway or centered under the sign.

8. Portable sign supports should not be used for a duration greater than 3 days. They are intended to be used with warning signs and may be used with speed limit signs as described in note 9.

9. Regulatory signs such as Stop (R1-1), Yield (R1-2), Stop Here On Red (R10-6), Speed Limit (R2-1), etc. shall meet minimum mounting heights, which are 5' in rural areas and 7' in urban areas measured vertically from the edge of traveled way to bottom of sign.

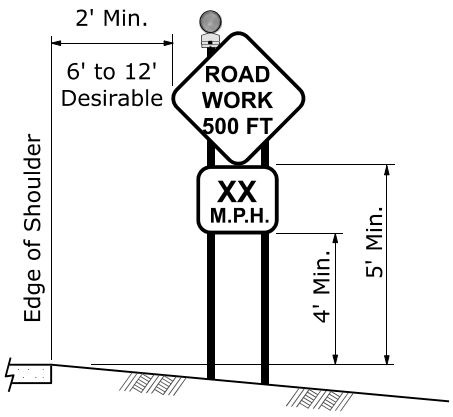
10. Mounting heights for signs posted along freeways and expressways shall conform with urban heights as shown on the next page.

11. If temporary traffic control devices are placed on a sidewalk or pedestrian pathway, a clear accessible area with a minimum width of 48" must be provided for pedestrians. This accessible area must be free from signs, materials and other obstructions which may inhibit wheelchair usage. See General Note A-4 for more information.

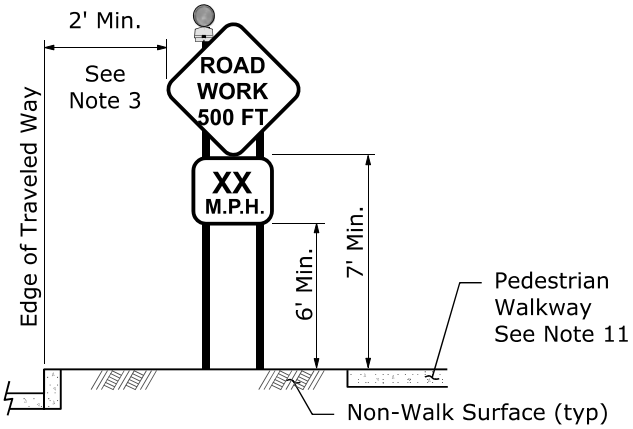
12. Sign edge should align with curb face, however sidewalk overhang is permissible if a 48" minimum accessible path is provided.

13. Type III Barricades and Portable Sign Posts ("H" base or "X" base) shall utilize sandbag ballast on each leg to provide stability.

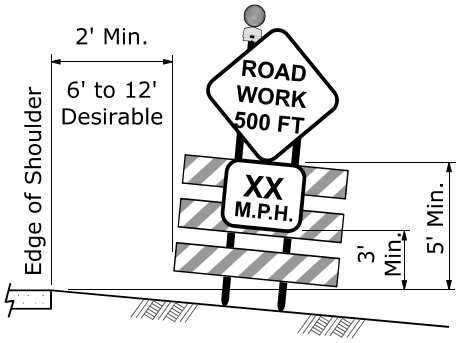
PATA 010
Guidelines For Height And Lateral Placement Of Temporary Traffic Control Signs



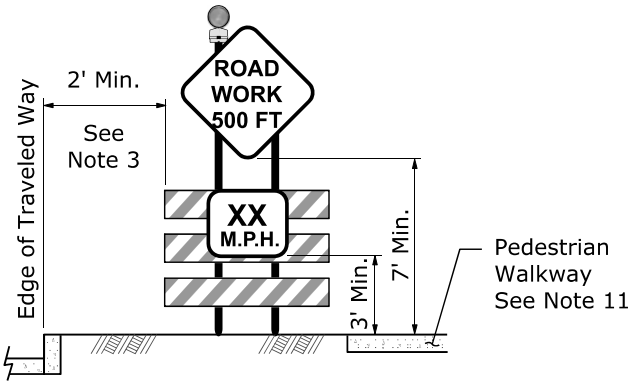
Rural Post Mounted Sign



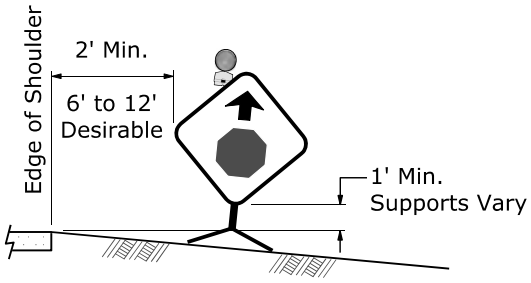
Urban Post Mounted Sign



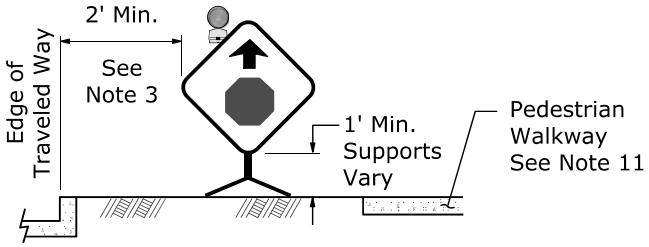
Rural Type III Barricade



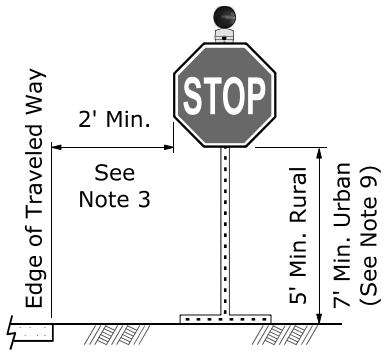
Urban Type III Barricade



Rural Portable Sign Supports

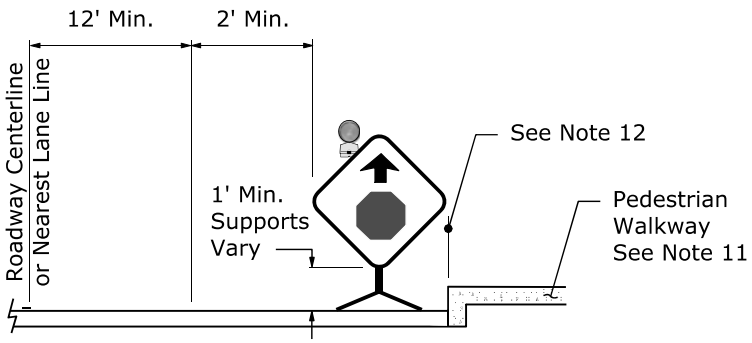


Urban Portable Sign Supports



Portable Sign Post
"H" Base or "X" Base

See Publication 111 Traffic Control - Pavement Markings and Signing Standards TC-8717 for Base Detail



Urban Portable Sign Supports

PATA 011
Channelizing Device Details - Notes

1. Cones may be used as channelizing devices in short term operations where work is active.

2. Direction Indicator Barricades may be used for all tapers approaching a work zone. Utilization is recommended on tapers approaching work zones on freeways and expressways.

3. Use drums as channelizing devices when these devices are expected to remain in the same location for more than 24 hours.

4. Cones used at nighttime and/or on highways with speed limits greater than 40 MPH shall have a minimum height of 28". Retroreflective white bands are required as shown on the adjacent diagram.

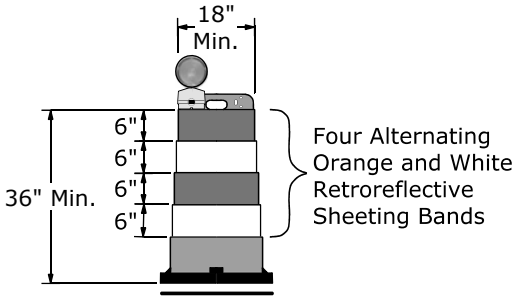
5. Tubular markers should be used only where space restrictions do not allow for placement of other more visible devices. 18" tubular markers may only be used on conventional highways with a speed limit of 40 MPH or less. Retroreflective bands are required and shown as white on the adjacent diagram.

6. Rail stripe widths shall be 4" wide on Type 1 and Type 2 Barricades and Direction Indicator Barricades; Rail stripe widths shall be 6" wide on Type 3 Barricades.

7. Warning lights are shown for purpose of displaying proper mounting positions. Lights are optional on these devices, however consistency in application should be observed. For example, if lights will be used in a taper, then all channelizing devices in the taper should be mounted with lights.

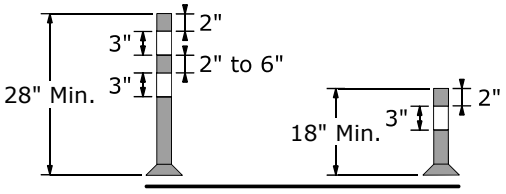
8. Refer to the MUTCD, Section 6F.62 through 6F.74, for more information

PATA 011
Channelizing Device Details



Daytime or Nighttime
Any Highway
Any Speed

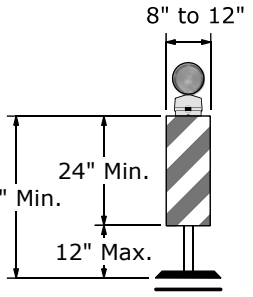
DRUM



Daytime or Nighttime
Any Highway
Any Speed

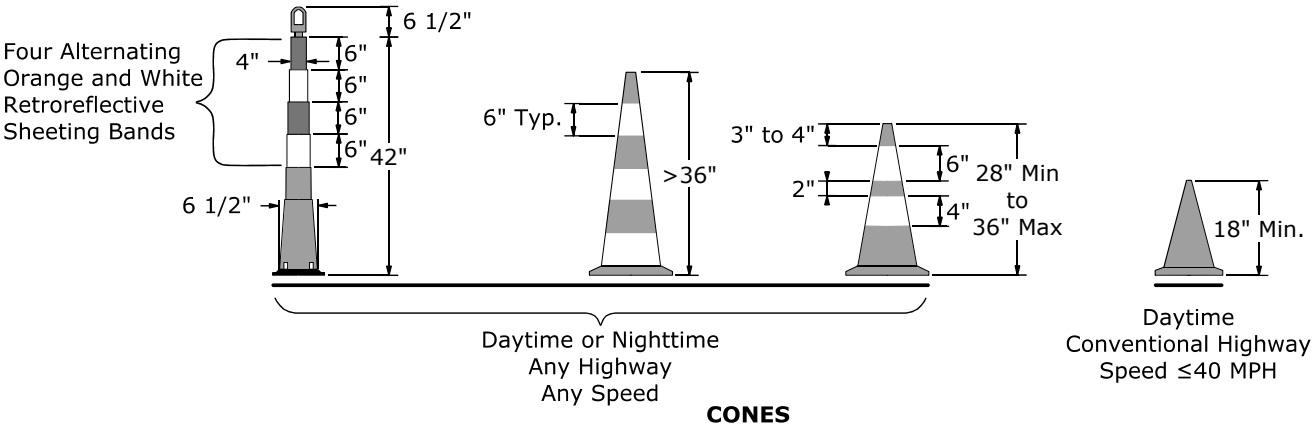
Daytime or Nighttime
Conventional Highway
Speed ≤40 MPH

TUBULAR MARKERS



Daytime or Nighttime
Any Highway
Any Speed

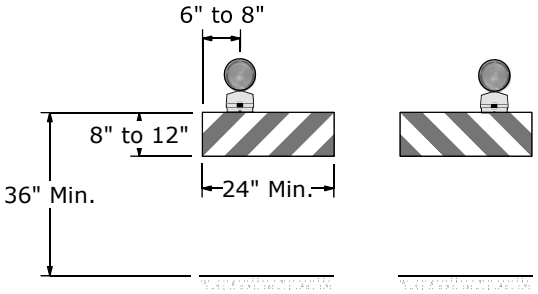
VERTICAL PANEL



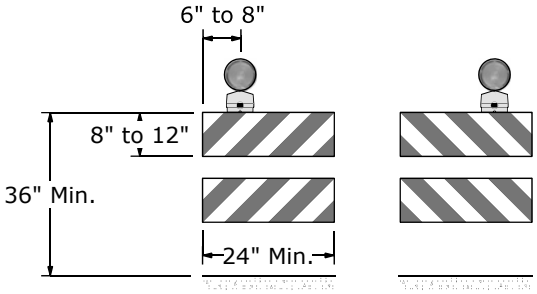
Daytime or Nighttime
Any Highway
Any Speed

Daytime
Conventional Highway
Speed ≤40 MPH

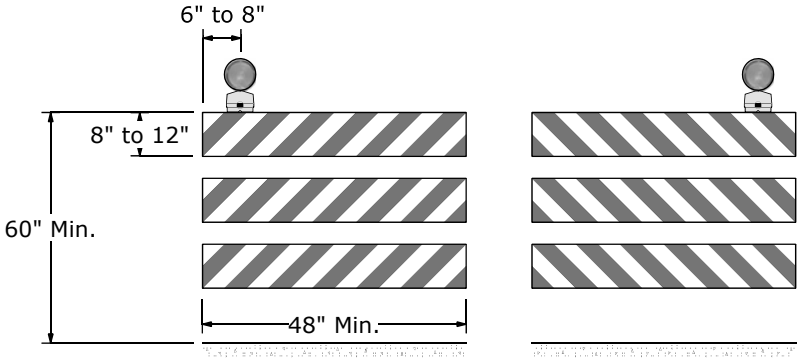
CONES



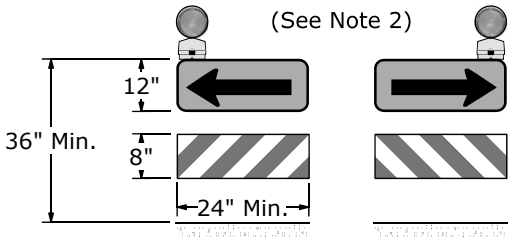
TYPE I BARRICADES



TYPE II BARRICADES



TYPE III BARRICADES



DIRECTION INDICATOR BARRICADES

PATA 012
Flashing Arrow Panel Guidelines - Notes

1. The color presented by the elements shall be yellow.

2. The minimum element on-time shall be 50 percent for the flashing mode, with equal intervals of 25 percent for each sequential phase. The flashing rate shall be not less than 25 or more than 40 flashes per minute.

3. Full matrix message boards may be utilized in the same manner as the flashing arrow panels if the minimum size and legibility requirements are satisfied.

4. Arrow panels display a flashing arrow in Merge Mode. Use this mode for conditions where traffic must merge in lane-drop situations. Merge mode is not to be used for lane shifts or other scenarios not shown in a PATA drawing.

5. Type D Arrow Panels shall only be used on vehicles during short term and/or mobile operations.

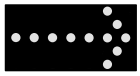
6. See the MUTCD, Section 6F.61, and Publication 46, Section 6.10, for additional information.

PATA 012
Flashing Arrow Panel Guidelines

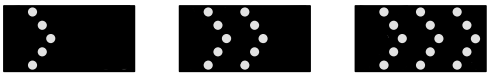
Operating Modes | **Display**

Merge Mode

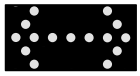
Flashing Arrow
(right arrow shown; left is similar)



Sequential Chevron
(right arrow shown; left is similar)



Flashing Double Arrow



Caution Mode

Flashing Corners

Flashing Bar

Alternating Diamond

Flashing Arrow Panel Sizing and Utilization Chart

Arrow Panel Type	Minimum Size (inches)	Minimum Legibility Distance	Minimum Number of Elements	Type of Operation	Type of Highway	Maximum Speed Limit MPH
A	48x24	1/2 mile	12	Stationary	Conventional	30
B	60x30	3/4 mile	13	Stationary	Conventional	40
				Mobile	Conventional	55
C	96x48	1 mile	15	Any	Freeways & Expressways	65
				Stationary	Conventional	45
D	None*	1/2 mile	12	Stationary (Daylight only)	Conventional	30

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

PATA 013
Advisory Speed Posting Guide

Regulatory Speed Limit	Work Zone Speed Limit	Advisory Speed ** In Advance of the Activity Area — Signs from Beginning of Work Zone			
MPH	MPH	4th	3rd	2nd	1st
70	60	-	60	60	60
70	55	60	60	55	55
70	50	60	55	50	50
65	55	-	55	55	55
65	50 *	55	55	50	50
65	45 *	55	50	45	45
55	45	50	50	45	45
55	40 *	50	45	40	40
55	35 *	65	45	40	35
50	40	65	45	40	40
50	35 *	50	40	35	35
50	30 *	45	40	35	30
45	35	45	35	35	35
45	30 *	45	35	35	30
45	25 *	-	35	30	25
40	30	-	-	30	30
40	25 *	-	-	30	25
35	30	-	-	30	30
35	25	-	-	25	25
30	25	-	-	-	25

* A regulatory speed limit up to 10 MPH below the normal speed limit may be established without an engineering and traffic study, provided the reduced regulatory speed limit is at least 25 MPH. Regulatory speed limits less than 25 MPH or more than 10 MPH below the normal speed limit require an engineering and traffic study and the prior approval of the District Traffic Engineer for state designated highways and approval of a Traffic Engineer as determined by local authorities for local highways. To qualify for an additional speed limit reduction, the engineering and traffic study must indicate that traffic queues, erratic maneuvers, high vehicle crash rates, or undesirable working conditions exist on the project or have existed on similar projects.

** Use of advisory speed plaques is optional.

Conventional Highways

Short-Term Stationary Operations
(PATA 100 Series)

PATA 101 (Old PATA 5) - Notes

1. The shadow vehicle and traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2’ behind curb, or 15’ or more from the edge of any roadway.

2. For operations of 60 minutes or less, all traffic control devices may be eliminated if a shadow vehicle is present.

3. For divided highways and one-way highways where it is physically possible, advance warning signs should also be placed on the left-hand side of the roadway.

4. When a shadow vehicle is not used, distance A is measured from the Road Work (W20-1) sign location to beginning of work space.

Signs

W20-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

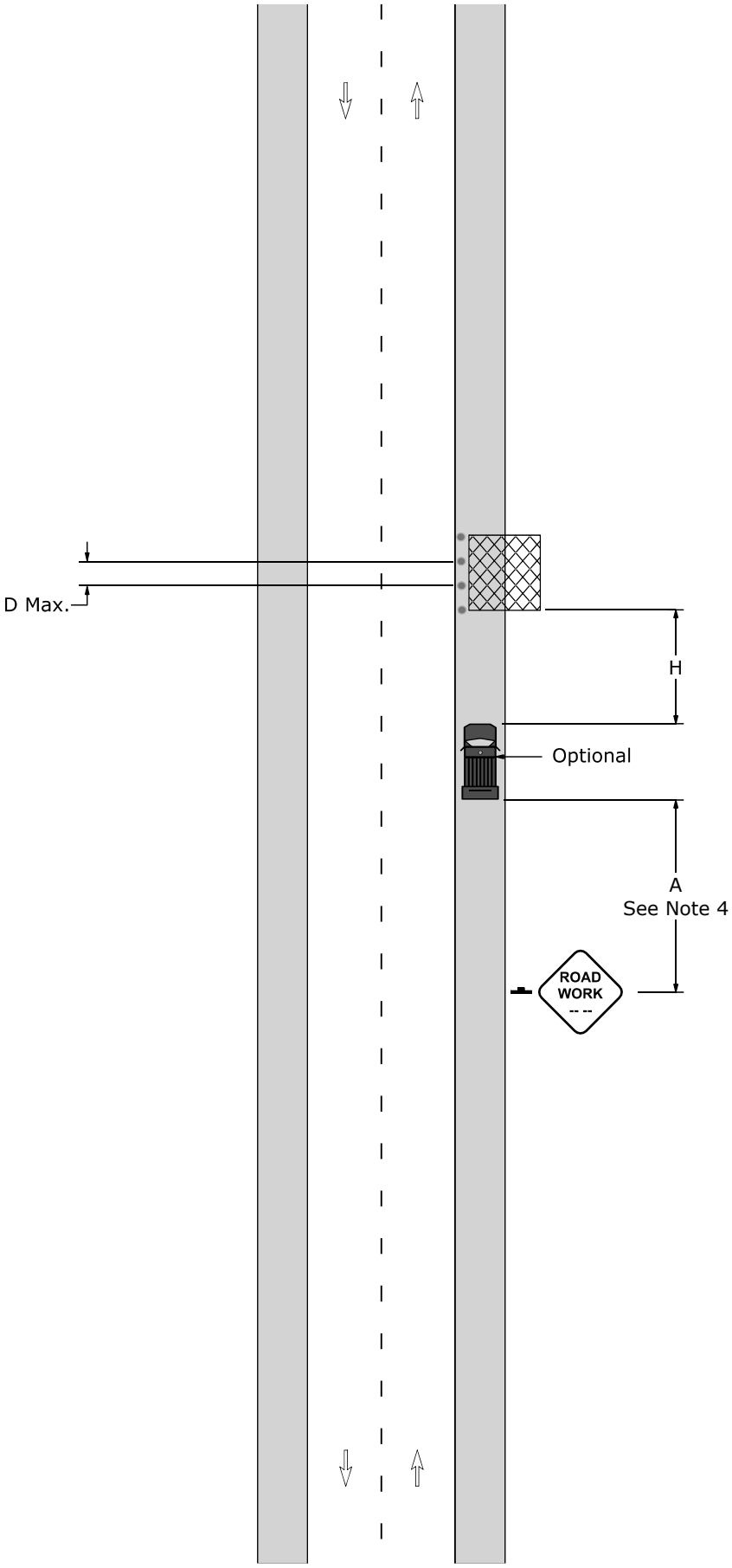
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 101 (Old PATA 5)
Work Space On Or Beyond The Shoulder (No Roadway Encroachment)



PATA 102 (Old PATA 7) - Notes

1. If the work space is completely within a parking lane and parking is present, the taper or shadow vehicle is not required.

2. For operations of 15 minutes or less:

   a. The Road Work (W20-1) sign is not required.

   b. All channelizing devices may be eliminated if a shadow vehicle is present.

3. For divided highways and one-way highways where it is physically possible, advance warning signs should also be placed on the left-hand side of the roadway.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs

W20-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

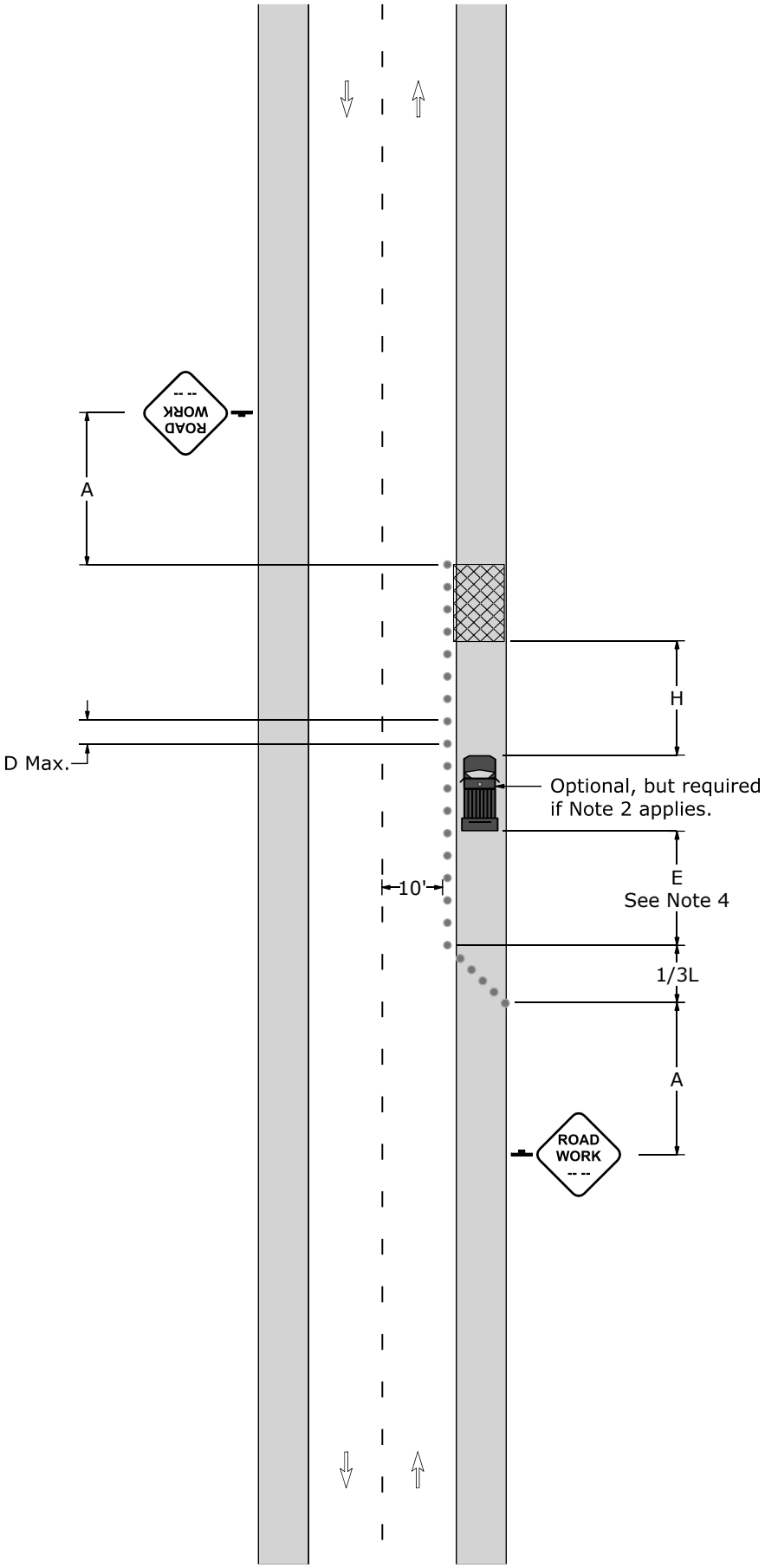
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 102 (Old PATA 7)
Work Space On Or Beyond The Shoulder (Minor Roadway Encroachment)



PATA 103 (Old PATA 08) - Notes

1. Right Reverse Curve (W1-4R) sign shall only be used when lane shifts onto shoulder.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. Refer to PATA 008 for reverse curve/turn signing.

Signs

W20-1 W1-4L W1-4R

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

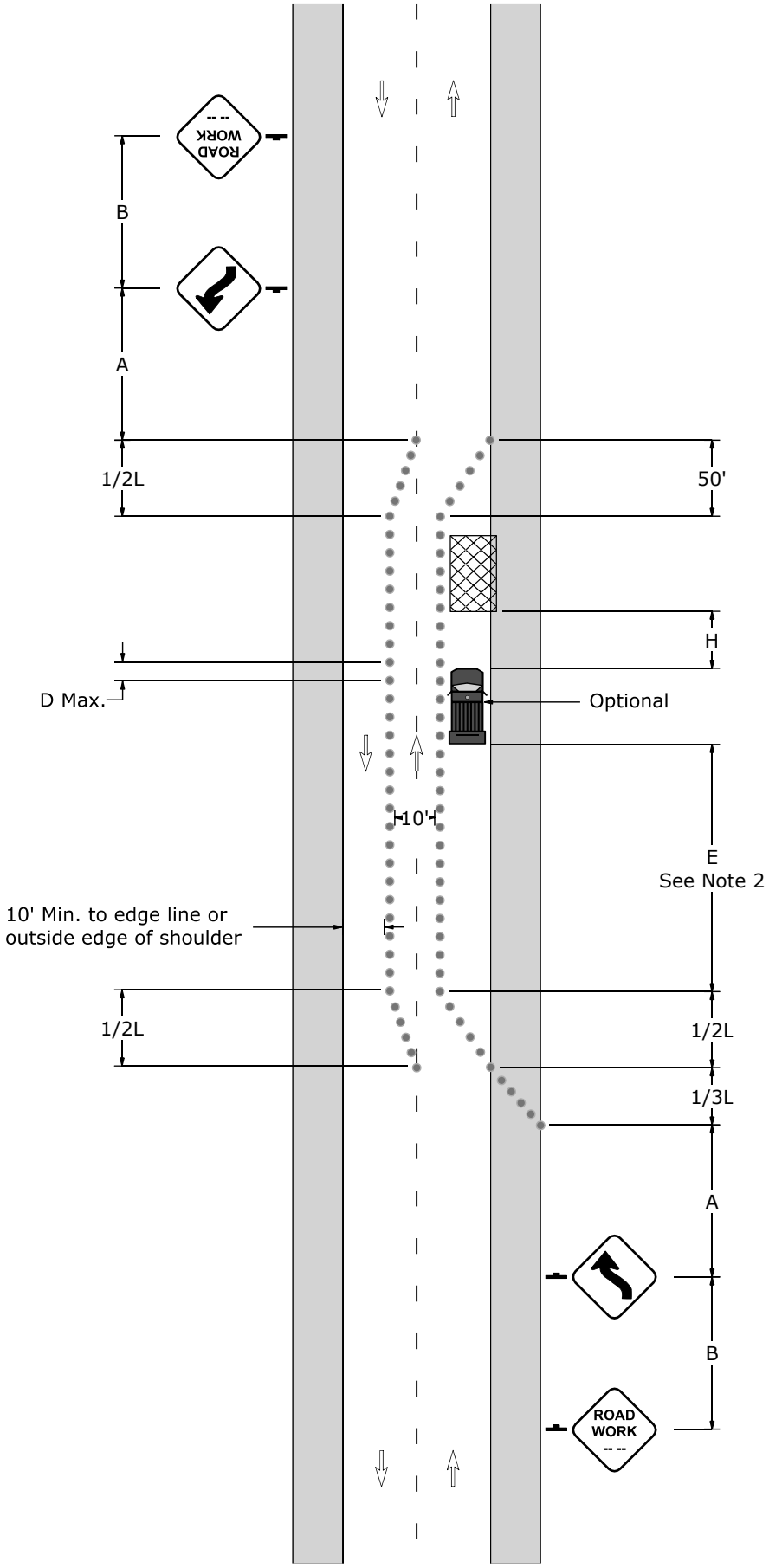
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 103 (Old PATA 8)
Work Space Has A Major Encroachment On The Roadway



PATA 104 (Old PATA 9a S) - Notes

1. Right Reverse Curve (W1-4R) sign shall only be used when lane shifts onto shoulder.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. Refer to PATA 008 for reverse curve/turn signing.

Signs

W20-1 W1-4R R4-7

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

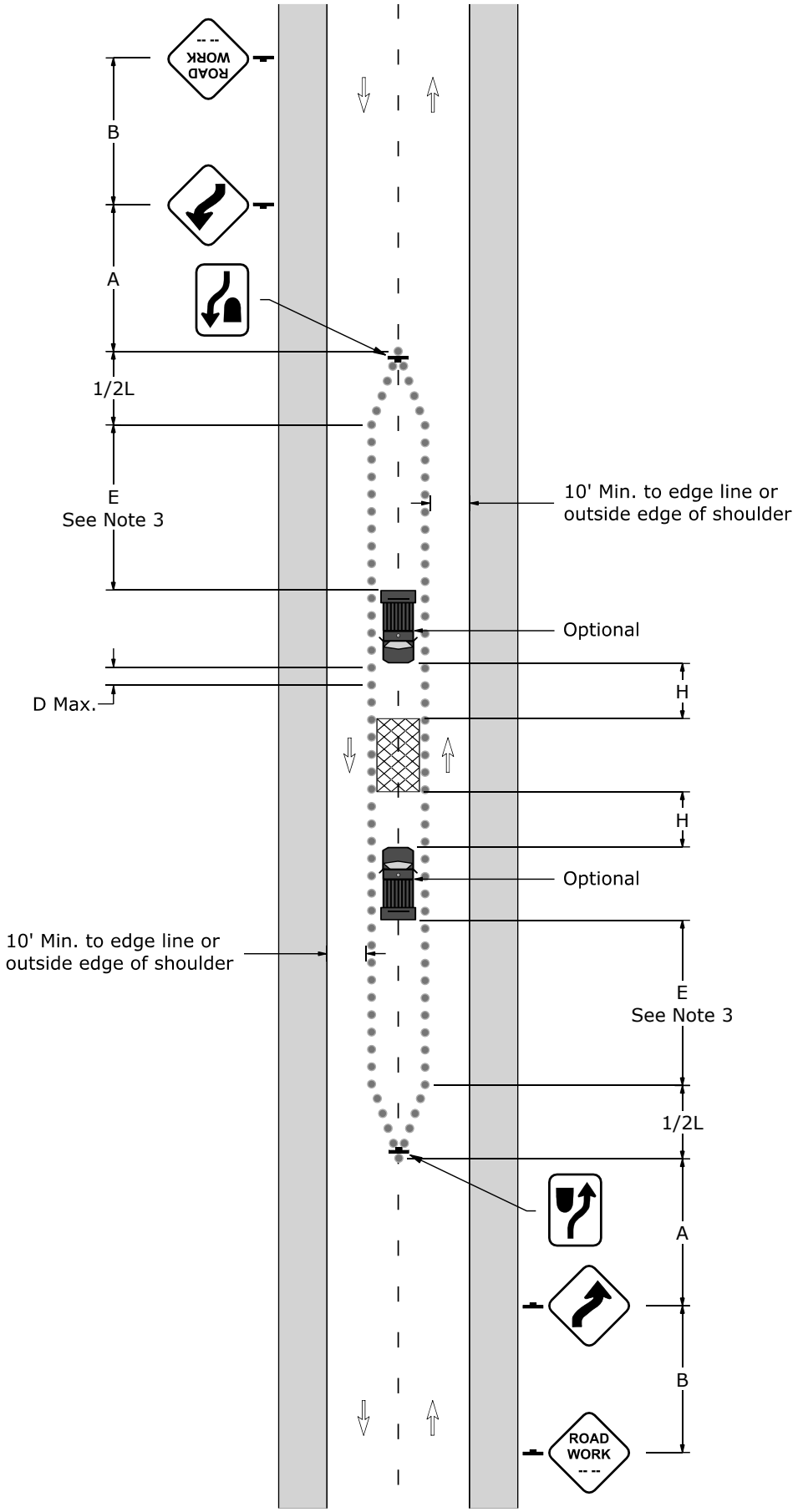
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 104 (Old PATA 9a S)
Work Space In Center Of Roadway



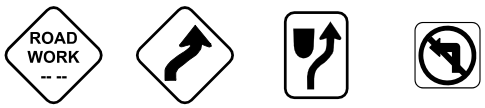
PATA 105 (Old PATA 9b) - Notes

1. Left turns may be prohibited as required by geometric conditions. When the No Left Turn (R3-2) sign is used on undivided streets, one sign should be placed at the near right-hand corner and one at the far left-hand corner. On divided streets the No Left Turn (R3-2) sign should be placed on both the near side and the far side ends of the medians. Refer to Publication 236 for additional guidance.

2. Right Reverse Curve (W1-4R) sign shall only be used when lane shifts onto shoulder.

3. Refer to PATA 008 for reverse curve/turn signing.

Signs



W20-1 W1-4R R4-7 R3-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

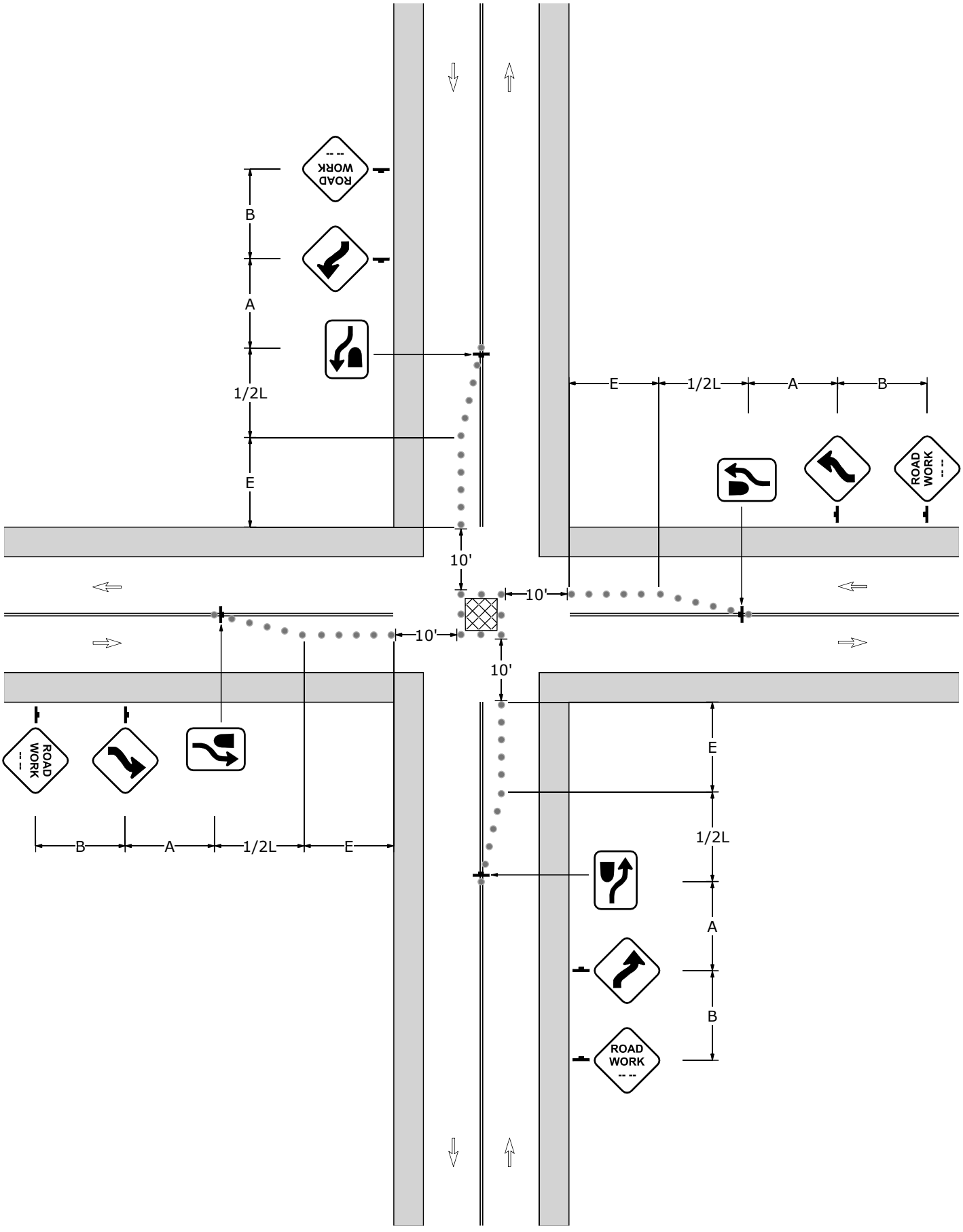
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 105 (Old PATA 9b)
Work Space In Center of Intersection



PATA 106 (Old PATA 9c) - Notes

1. Place 50' taper in closed lane as shown. Continue taper angle and spacing as needed on the opposite side of the roadway centerline while maintaining a 10' minimum lane width for traffic.

2. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

3. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs

W20-1 W20-4 W20-7

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

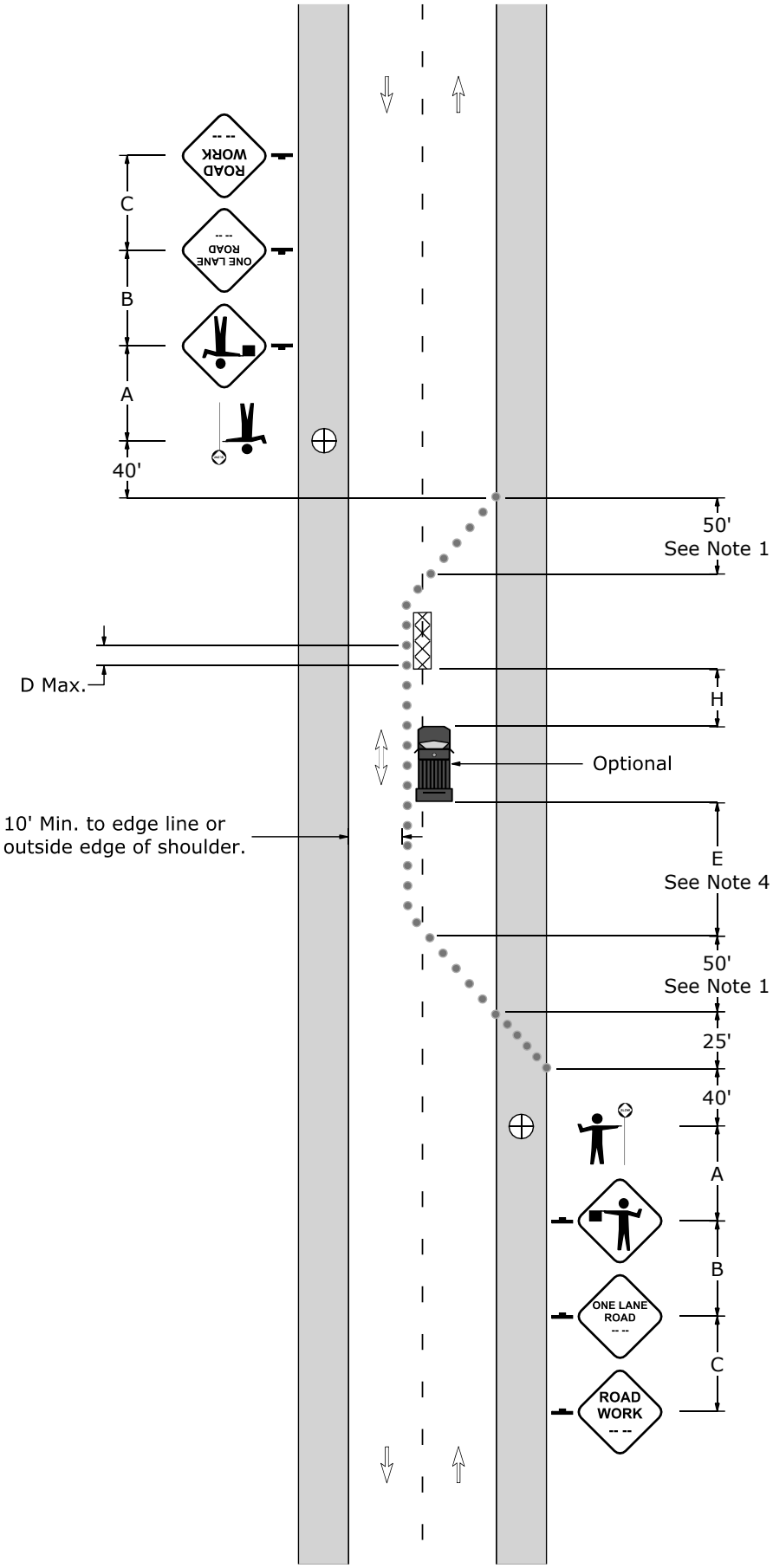
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 106 (Old PATA 9c)
Work Along Roadway Centerline



PATA 107 (Old PATA 10a) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. For operations of 15 minutes or less:

   a. The Road Work (W20-1), One Lane Road (W20-4), and Flagger Symbol (W20-7) signs are not required.

   b. All channelizing devices may be eliminated if a shadow vehicle is present.

3. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs

W20-1 W20-4 W20-7

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

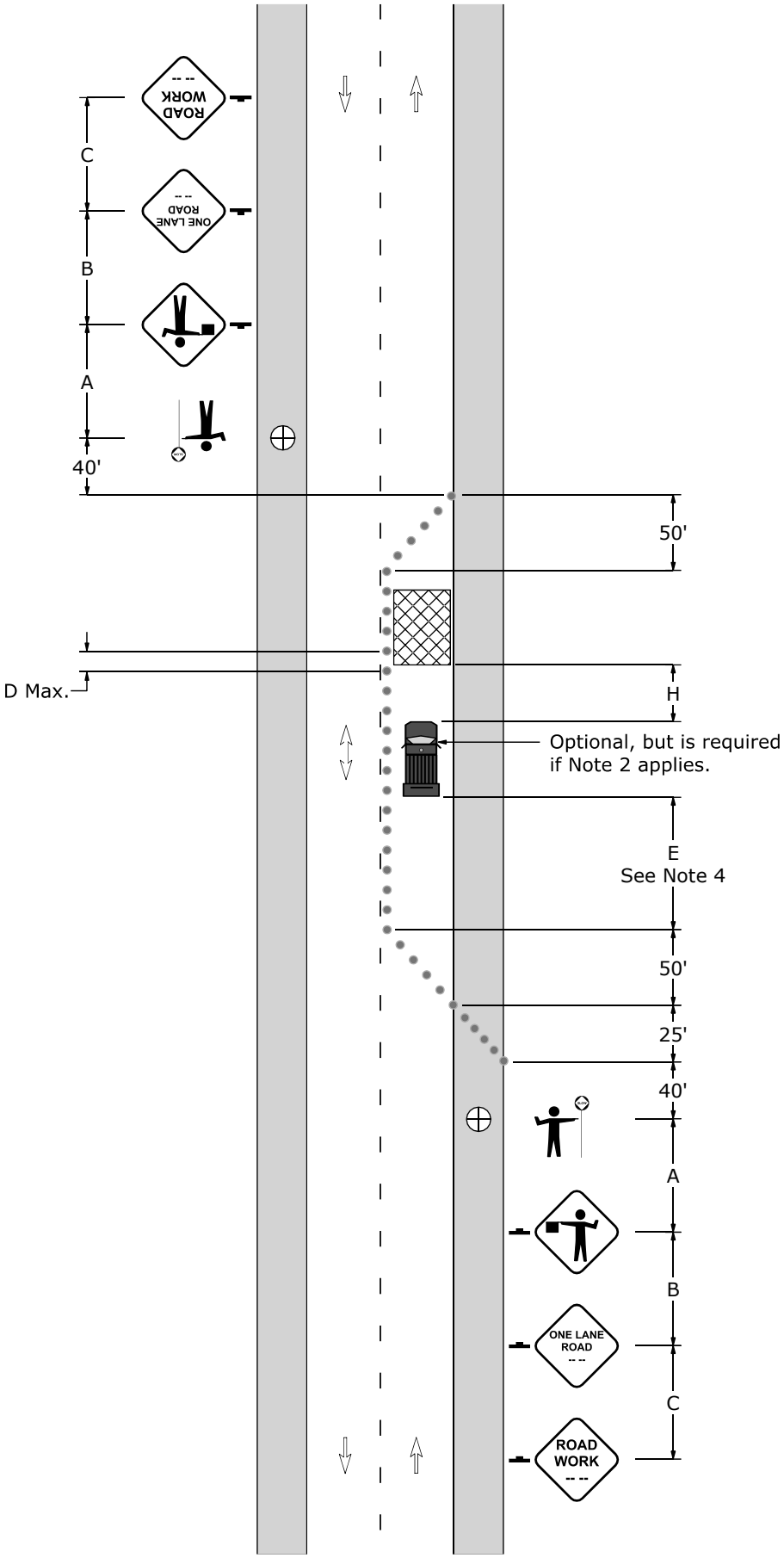
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 107 (Old PATA 10a)
Work In One Lane; Two Flaggers



PATA 108 (Old PATA 10c) - Notes

1. This drawing applies when all of the following conditions are satisfied:
   a. Roadway is two-lane, two-way.
   b. Sight distance between the flagger and any vehicle between Points X and Y will be unobstructed.
   c. The ADT is not greater than approximately 1500.
2. The flagger shall be clearly visible to traffic for a minimum distance of E.
3. For operations of 15 minutes or less:
   a. The Road Work (W20-1), One Lane Road (W20-4), and Flagger Symbol (W20-7) signs are not required.
   b. All channelizing devices may be eliminated if a shadow vehicle is present.
4. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.
5. When a shadow vehicle is not used, 50' is measured from end of taper to beginning of work space.

Signs

W20-1 W20-4 W20-7

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

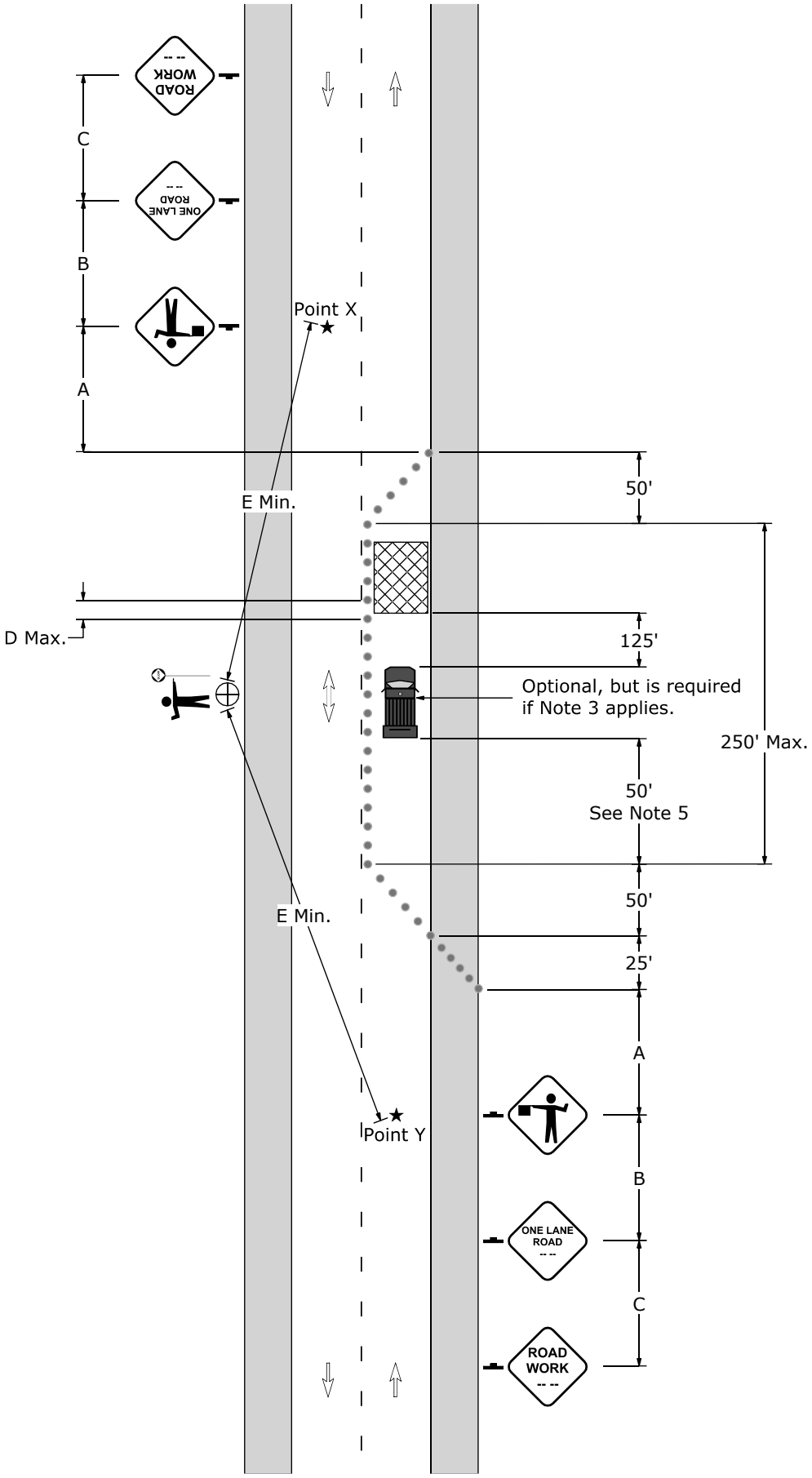
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 108 (Old PATA 10c)
Single Flagger



PATA 109 (New PATA) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. For operations of 15 minutes or less:

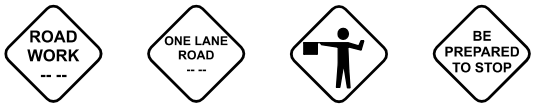
   a. The Road Work (W20-1), One Lane Road (W20-4), Be Prepared To Stop (W3-4), and Flagger Symbol (W20-7) signs are not required.

   b. All channelizing devices may be eliminated if a shadow vehicle is present.

3. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs



W20-1 W20-4 W20-7 W3-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

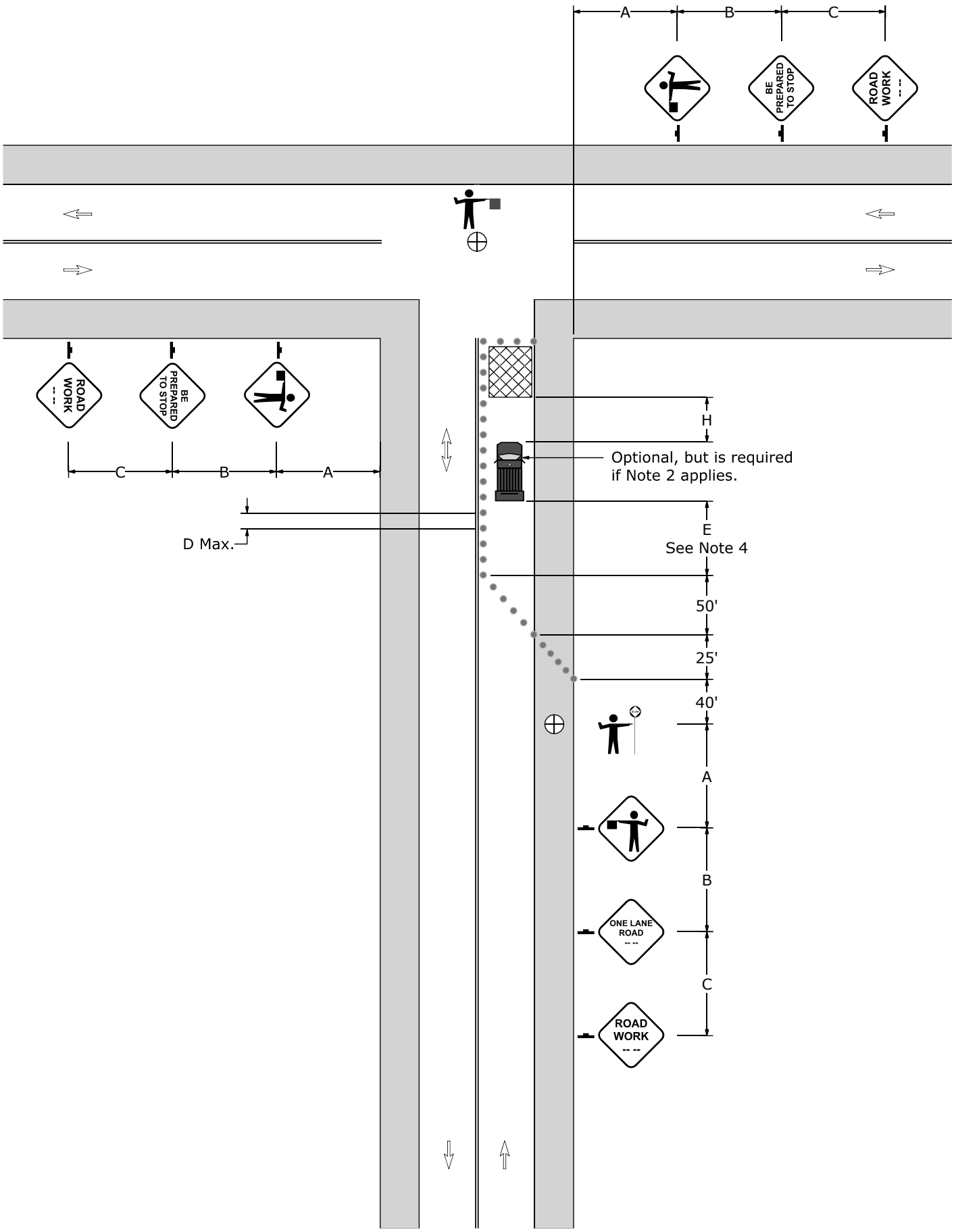
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 109 (New PATA)
Three-Leg Intersection Flagging



PATA 110 (Old PATA 10b) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. For operations of 15 minutes or less:

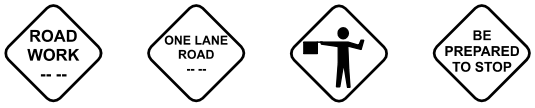
   a. The Road Work (W20-1), One Lane Road (W20-4), Be Prepared To Stop (W3-4), and Flagger Symbol (W20-7) signs are not required.

   b. All channelizing devices may be eliminated if a shadow vehicle is present.

3. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs



W20-1 W20-4 W20-7 W3-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

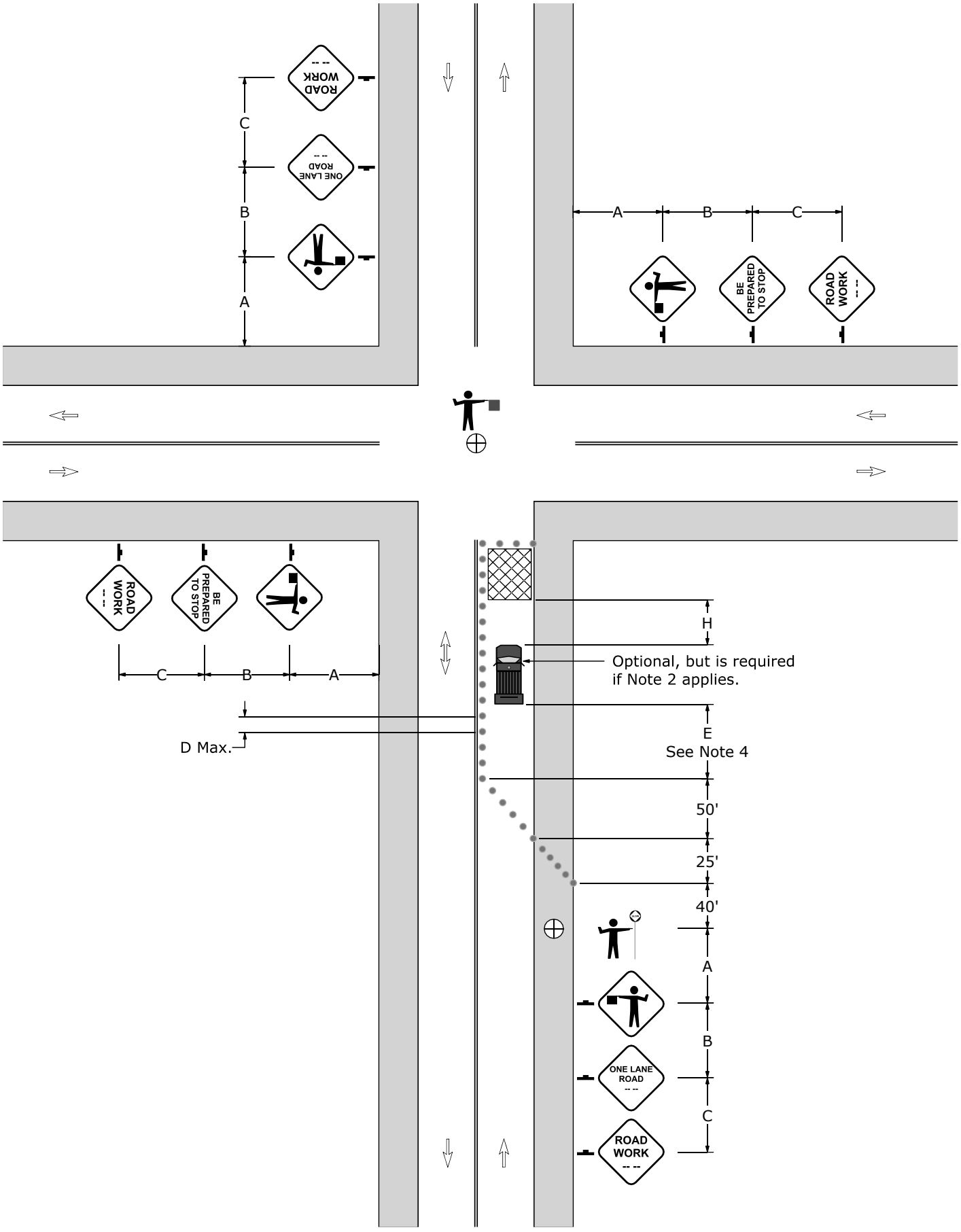
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 110 (Old PATA 10b)
Four-Leg Intersection Flagging



PATA 111 (Old PATA 10d) - Notes

1. This figure applies when all of the following conditions are satisfied:
   a. Sight distance between the Stop (R1-1) signs is unobstructed.
   b. The ADT is not greater than approximately 1500.
2. The Stop (R1-1) sign shall be clearly visible to traffic for a minimum distance of E.
3. Attach red Type B flashing lights on stop signs as shown.
4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.
5. Refer to PATA 008 for reverse curve/turn signing.
6. Refer to PATA 010 for additional information regarding the temporary portable sign posts for the Stop (R1-1) signs.

Signs

W20-1 W20-4 W1-4R W3-1 R1-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

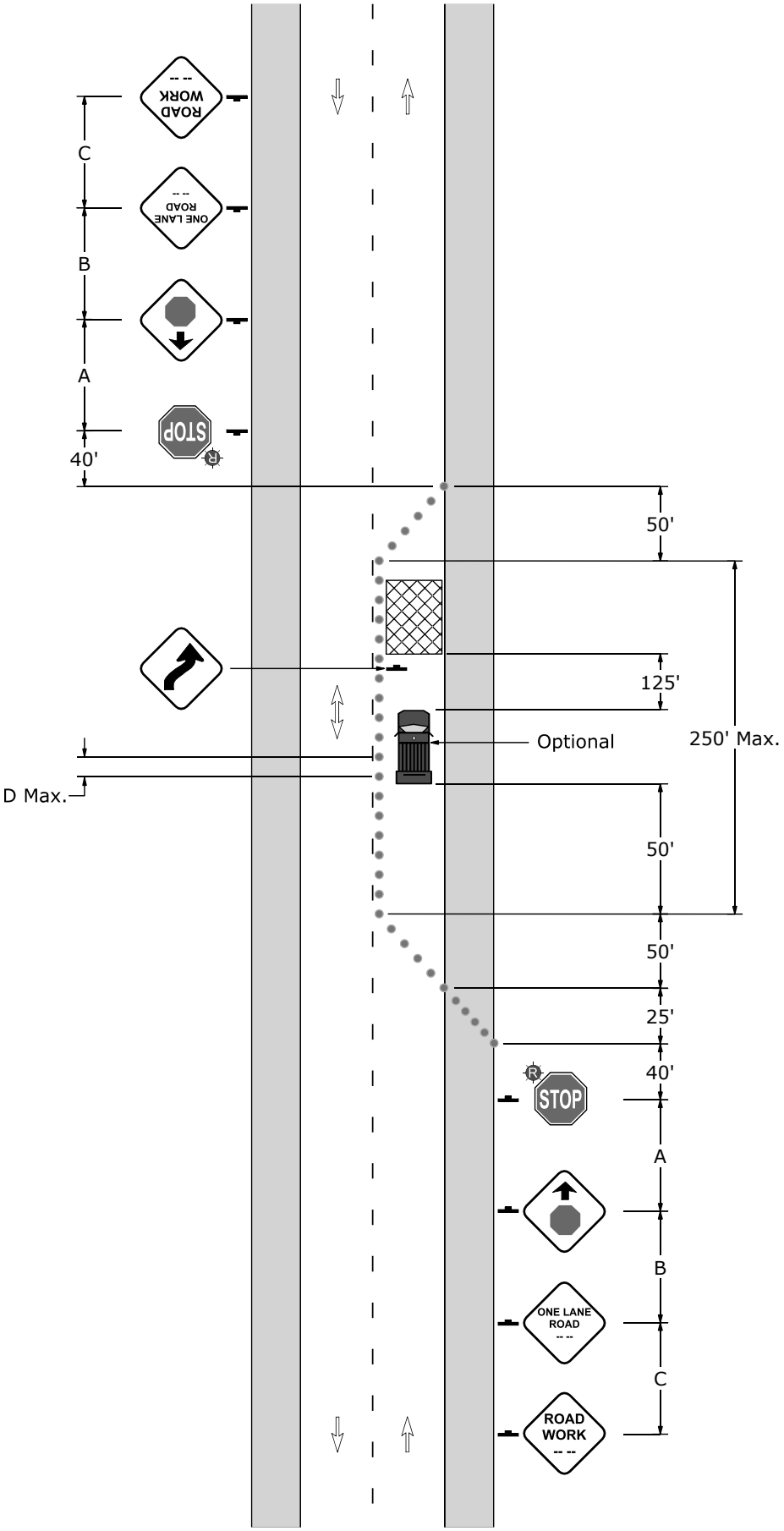
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 111 (Old PATA 10d)
Self-Regulating Stop Sign-Controlled Lane Closure



PATA 112 (Old PATA 10AFAD-1) - Notes

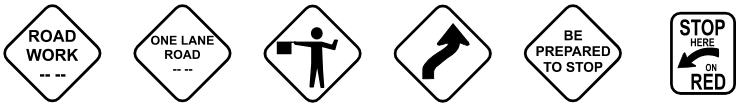
1. The flagger and Automated Flagger Assistance Device (AFAD) shall be clearly visible to traffic for a minimum distance of E. The flagger must be able to see the AFAD and approaching traffic.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. Refer to PATA 008 for reverse curve/turn signing.

4. Refer to PATA 010 for additional information regarding the temporary portable sign posts for the Stop Here On Red (R10-6AL) signs.

Signs



W20-1 W20-4 W20-7 W1-4R W3-4 R10-6AL

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

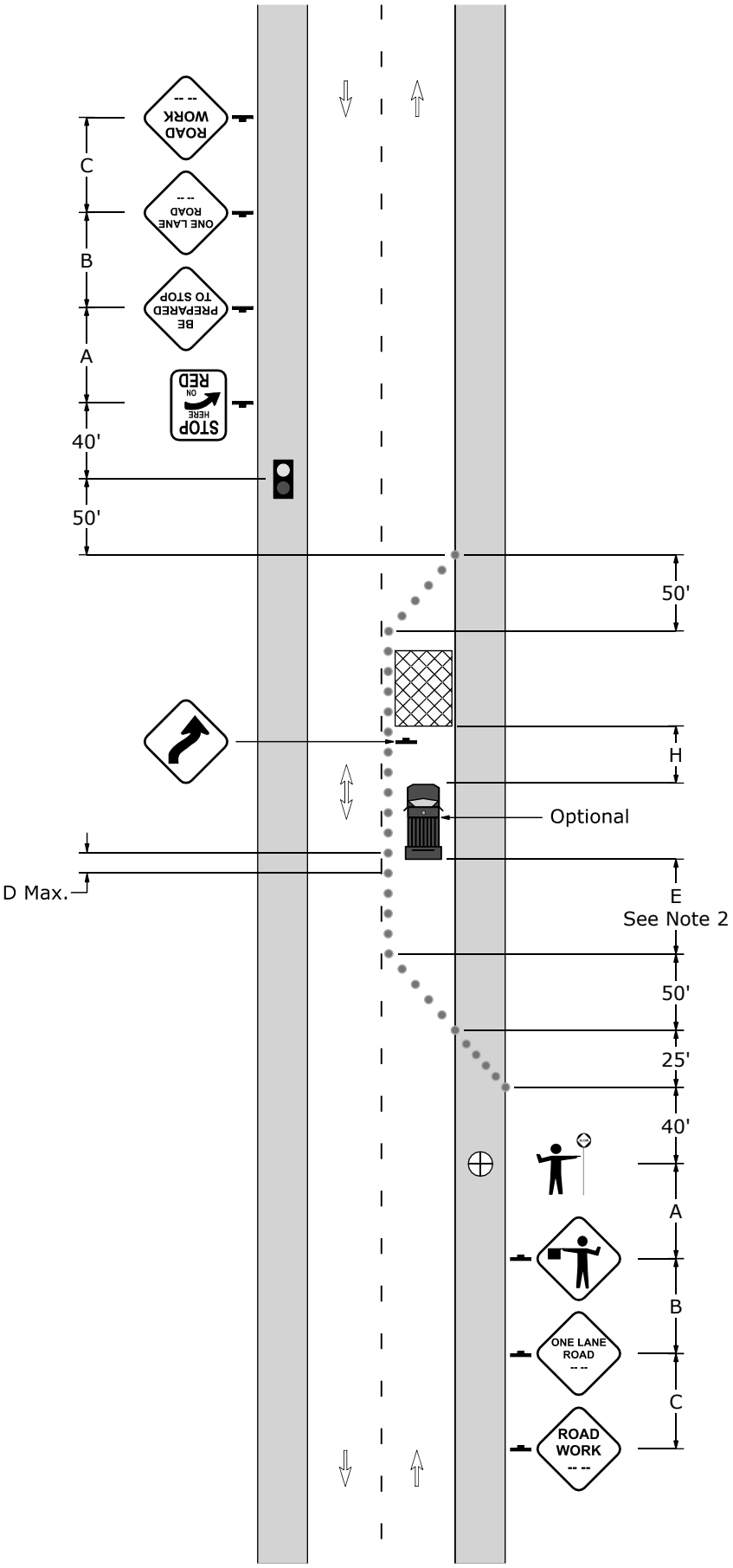
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 112 (Old PATA 10AFAD-1)
Flagger On Closed Lane Approach, AFAD At The Other End



PATA 113 (Old PATA 10AFAD-1) - Notes

1. The flagger and Automated Flagger Assistance Device (AFAD) shall be clearly visible to traffic for a minimum distance of E. The flagger must be able to see the AFAD and approaching traffic.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. Refer to PATA 010 for additional information regarding the temporary portable sign posts for the Stop Here On Red (R10-6AL) signs.

Signs

W20-1 W20-4 W20-7 W3-4 R10-6AL

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

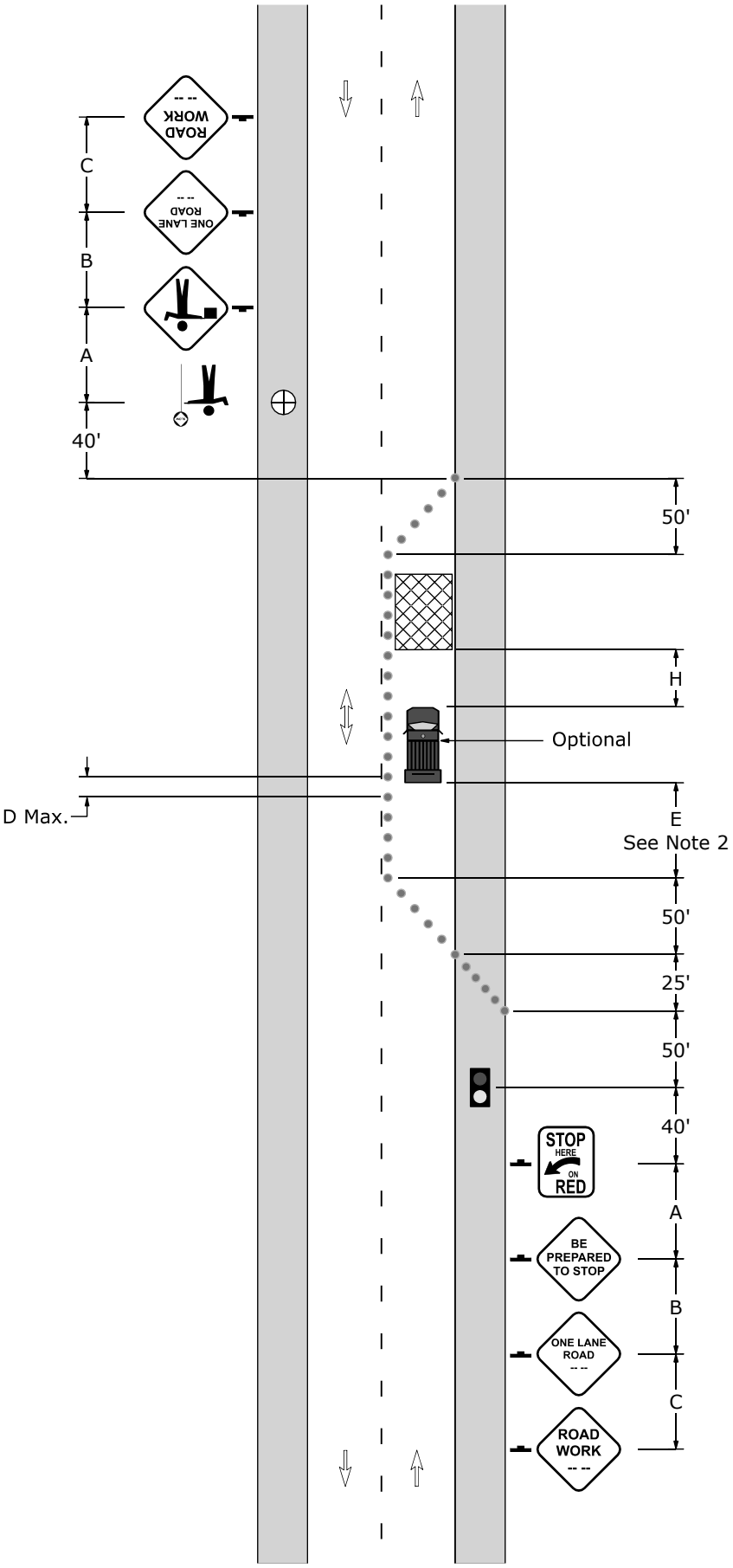
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 113 (Old PATA 10AFAD-1)
AFAD On Closed Lane Approach, Flagger At The Other End



PATA 114 (Old PATA 10AFAD-2) - Notes

1. Each Automated Flagger Assistance Device (AFAD) shall be clearly visible to traffic for a minimum distance of E. The flagger must be able to see the AFAD and approaching traffic and shall be in constant communication with all other flaggers.

2. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

3. While operating the AFAD, a flagger should position themselves beside the AFAD and away from traffic so not to block an escape route.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

5. Refer to PATA 010 for additional information regarding the temporary portable sign posts for the Stop Here On Red (R10-6AL) signs.

Signs

W20-1

W20-4


W1-4R

W3-4

R10-6AL

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

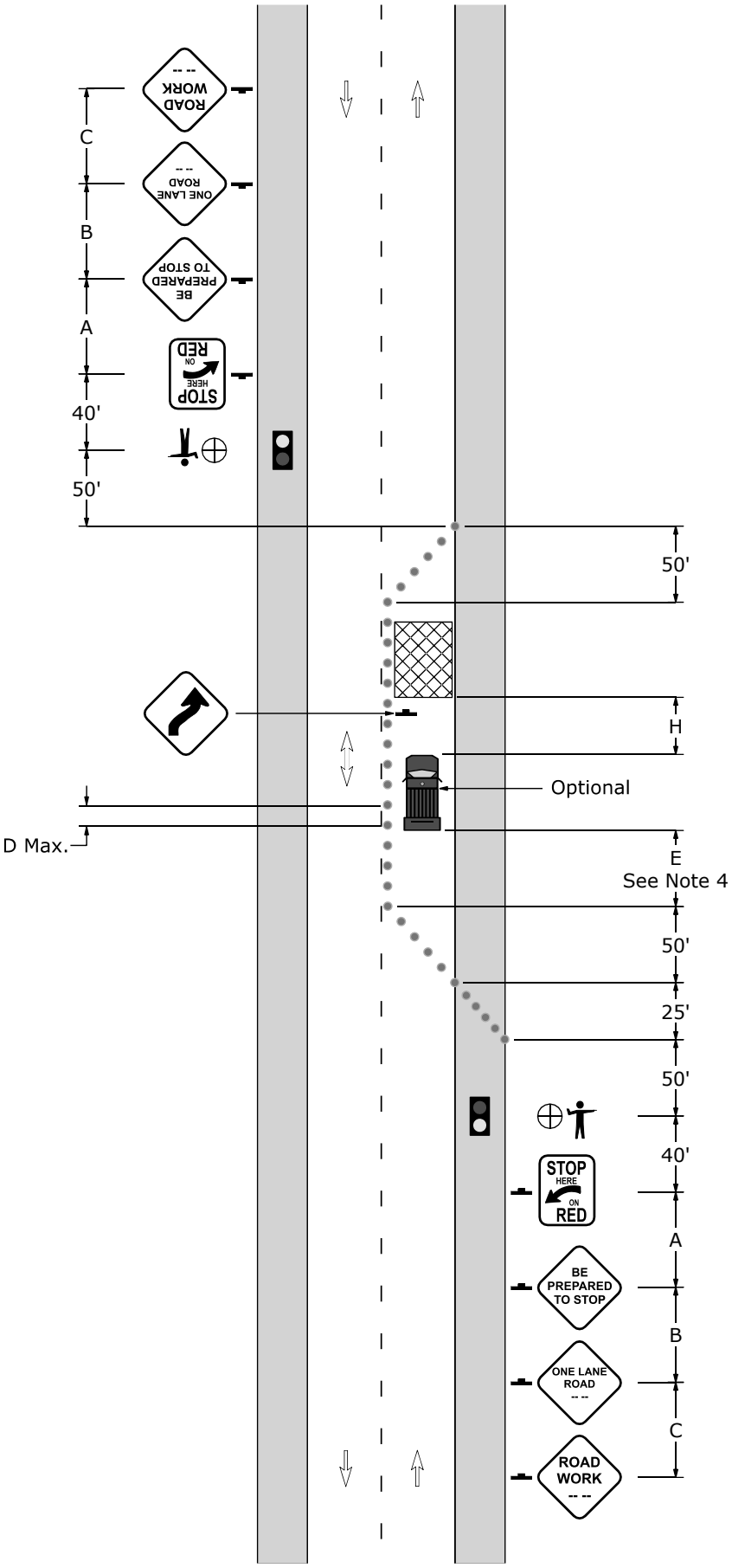
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 114 (Old PATA 10AFAD-2)
AFAD With Operator At Both Ends



PATA 115 (Old PATA 10AFAD-3) - Notes

1. Each Automated Flagger Assistance Device (AFAD) shall be clearly visible to traffic for a minimum distance of E. The flagger must be able to see both AFAD and approaching traffic.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. Refer to PATA 008 for reverse curve/turn signing.

4. Refer to PATA 010 for additional information regarding the temporary portable sign posts for the Stop Here On Red (R10-6AL) signs.

Signs

W20-1

W20-4


W1-4R

W3-4

R10-6AL

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

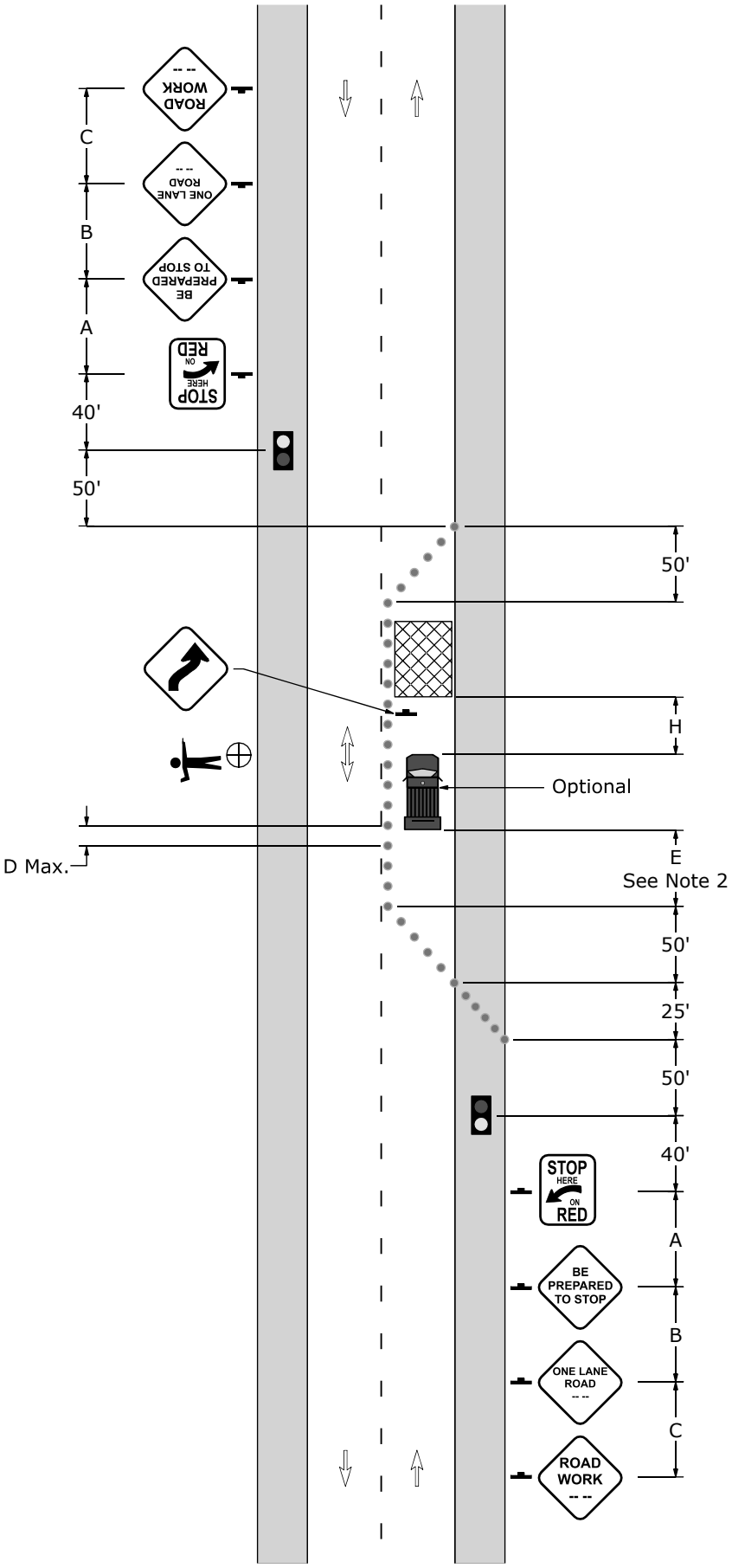
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 115 (Old PATA 10AFAD-3)
AFAD At Both Ends, Single Operator Centrally Located



PATA 116 (Old PATA 11e) - Notes

1. This figure applies for stationary operations where it is not feasible to maintain alternate one direction traffic flow.

2. This setup is to be used during daylight hours only and only on roadways with an ADT of 1500 or less. The PATA may be approved by the District Traffic Engineer for use on other roads.

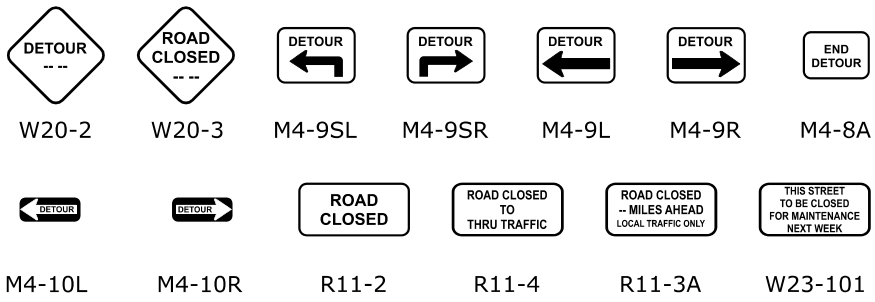
3. Hours of work should not interfere with rush hour (6:00-9:00 AM and 3:00-6:00 PM) or school bus schedules and the work site must be capable of accommodating emergency vehicles with as little delay as possible.

4. At locations where there are overlapping detours or several detours within the same area, street names may be added to the M4-9 series signs, or signs with different colored arrows may be used to designate different detour routes. The design and application of signs displaying colored arrows shall comply with PennDOT Publication 236.

5. The Road Closed-Local Traffic Only (R11-3A) sign may be used in place of the Road Closed To Thru Traffic (R11-4) sign.

6. This Street To Be Closed For Maintenance Next Week (W23-101) signs should be installed for scheduled work. Install the signs at most appropriate locations.

Signs



W20-2 W20-3 M4-9SL M4-9SR M4-9L M4-9R M4-8A

M4-10L M4-10R R11-2 R11-4 R11-3A W23-101

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

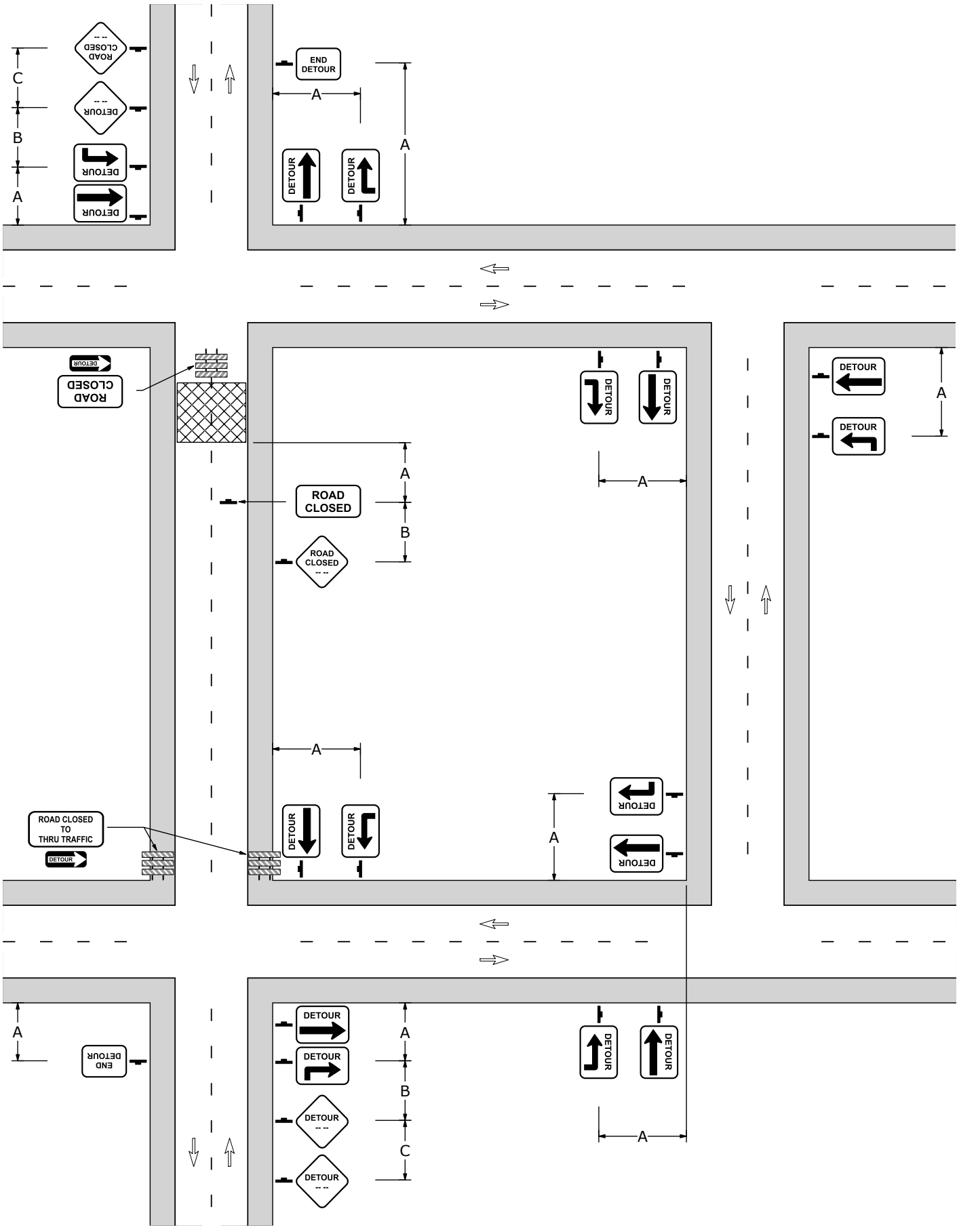
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 116 (Old PATA 11e)
Road Closure With Detour



PATA 117 (New PATA) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers. Additional flaggers are required to control traffic from side road intersections that exist between Flaggers.

2. A Pilot Vehicle with an activated flashing or revolving yellow light shall be used at all times to lead stopped vehicles through the work zone.

3. This PATA applies to roads with an ADT of 5000 or less. The PATA may be approved by the District Traffic Engineer for use on other roads.

4. The Turning Vehicles - Wait For Pilot Car (G20-4-1) sign is authorized for use on side road approaches. When used, the sign shall be positioned in the vicinity of the stop sign, or if none, immediately in advance of the intersection and facing the traffic on the side road.

5. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

6. Longitudinal channelizing devices are optional.

7. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs

W20-1 W20-4 W20-7 G20-4 G20-4-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

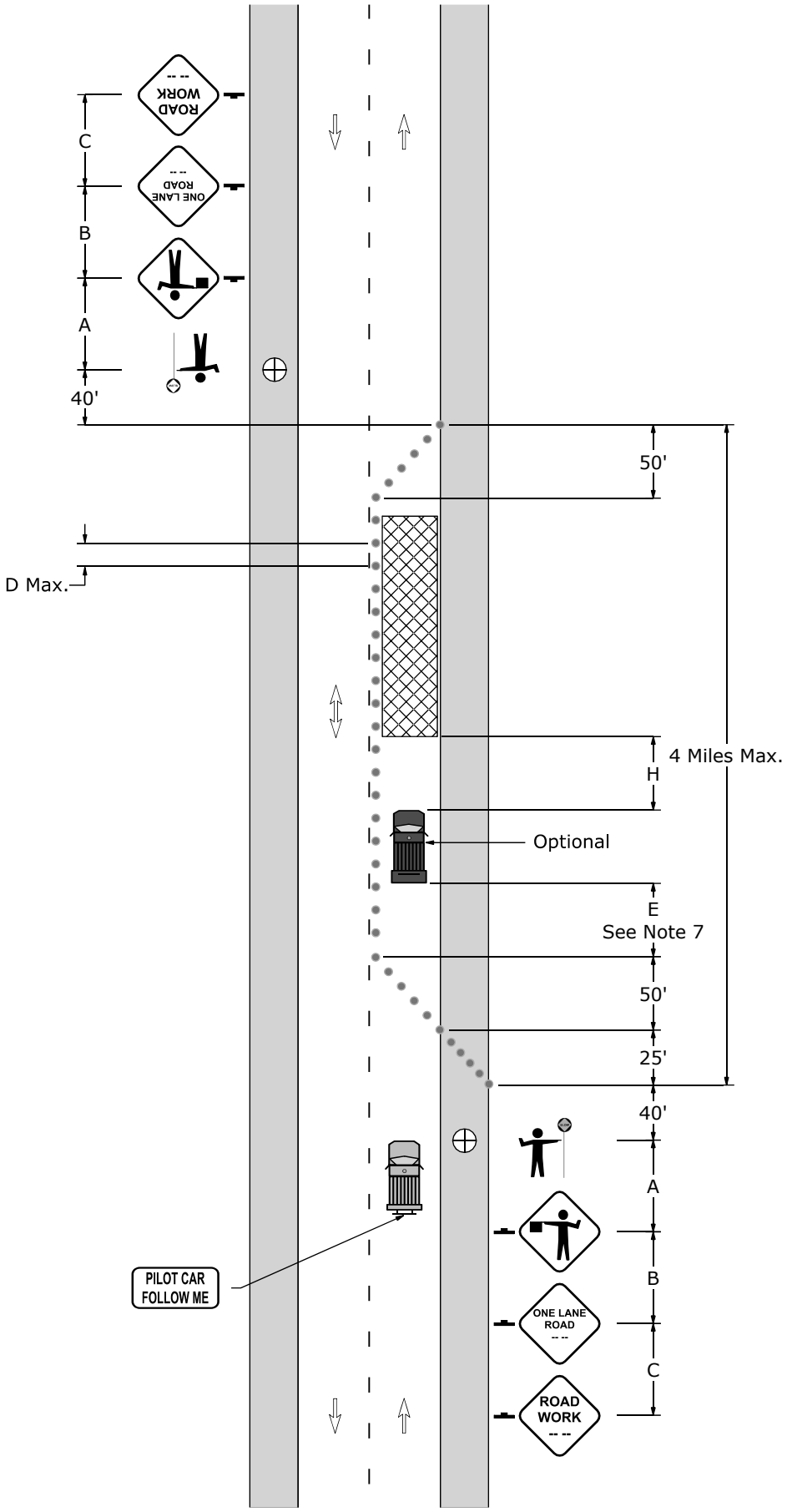
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 117 (New PATA)
Flagging With Pilot Vehicle



PATA 118 (Old PATA 13a) - Notes

1. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

2. Refer to PATA 008 for reverse curve/turn signing.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5L W1-4L W1-4R W4-2L

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

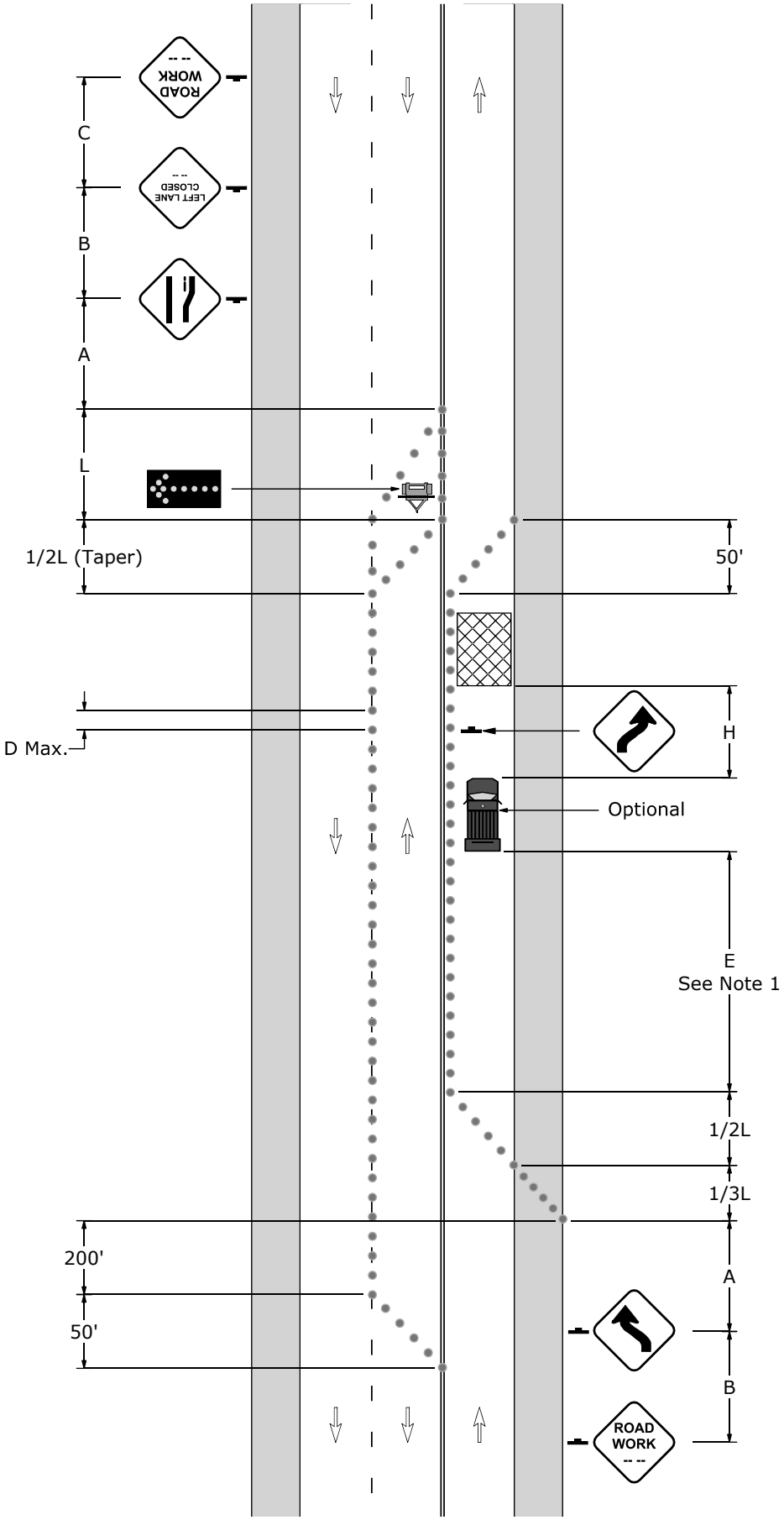
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 118 (Old PATA 13a)
Work Space In The Single-Lane Approach



PATA 119 (Old PATA 13b) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

4. If shadow vehicles are used, use two as shown on the PATA drawing.

5. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-4 W4-2R W20-7 W20-5R

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

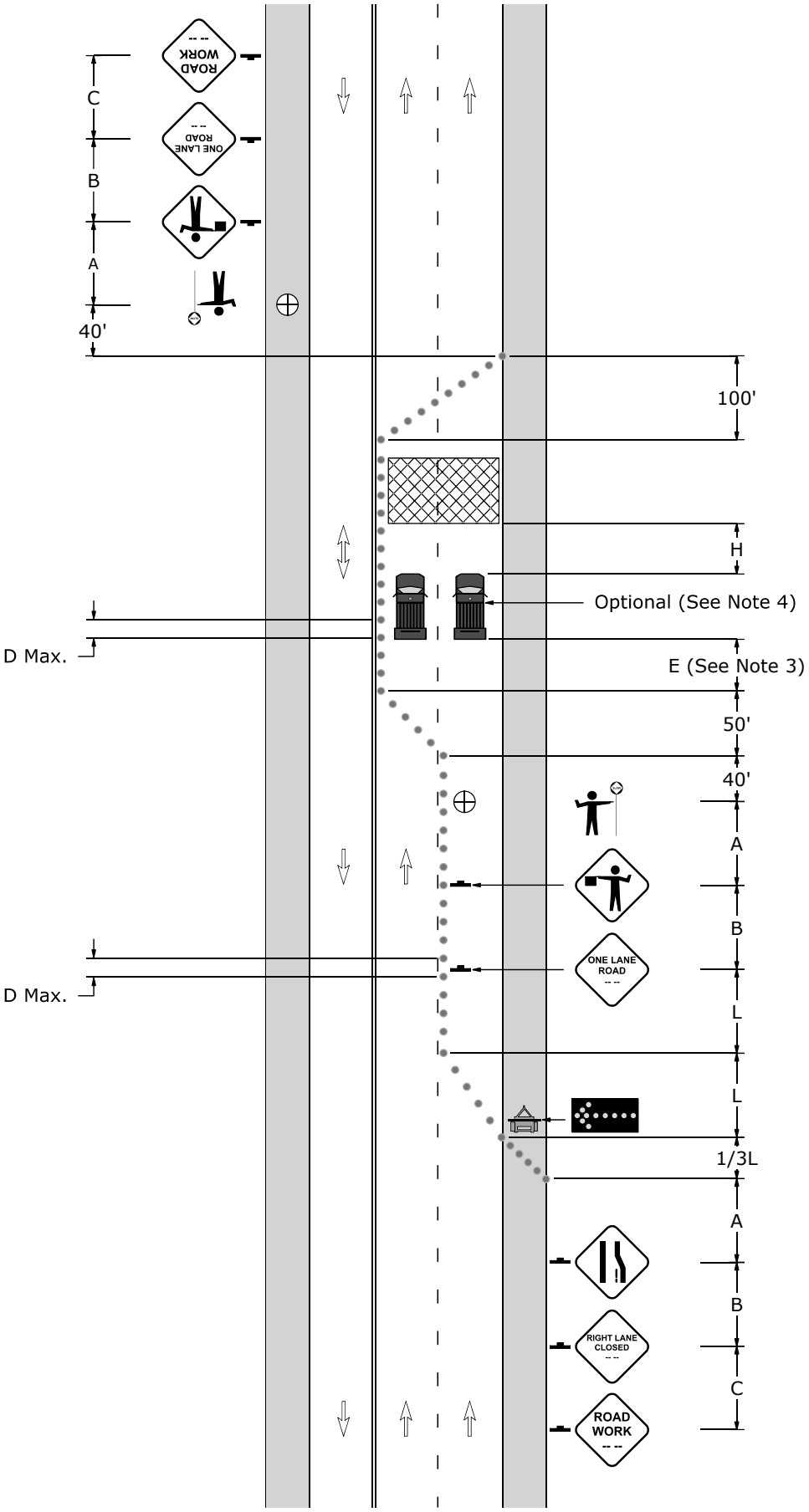
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 119 (Old PATA 13b)
Work Space In Both Lanes Of The Two-Lane Approach



PATA 120 (Old PATA 13c) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

4. If shadow vehicles are used, use two as shown on the PATA drawing.

5. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-4 W20-7 W20-5L W4-2L

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

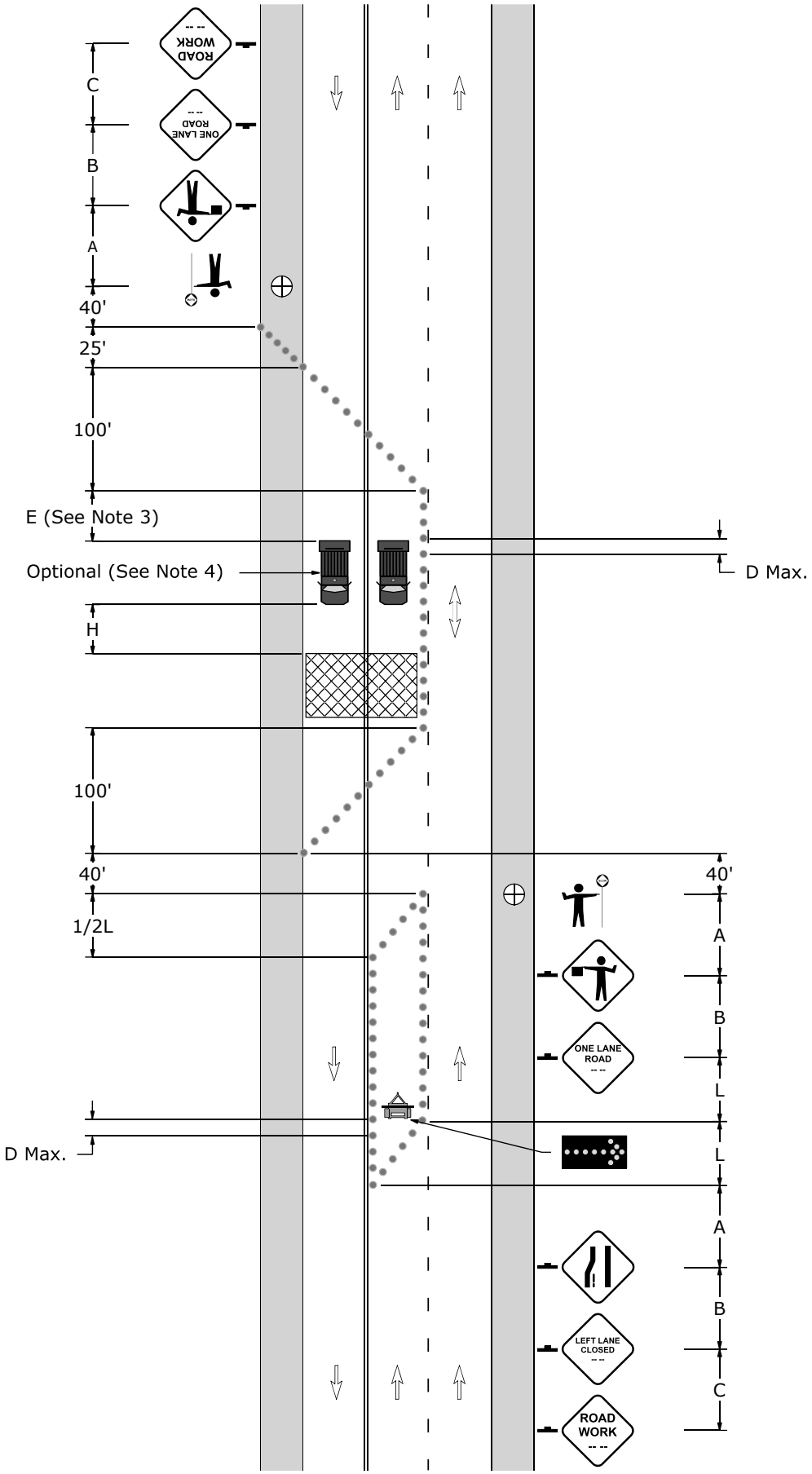
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 120 (Old PATA 13c)
Work Space In One-Lane Approach And Left Lane Of Two-Lane Approach

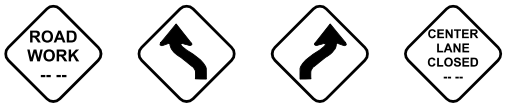


PATA 121 (Old PATA 14) - Notes

1. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

2. Refer to PATA 008 for reverse curve/turn signing.

Signs



W20-1 W1-4L W1-4R W9-3

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

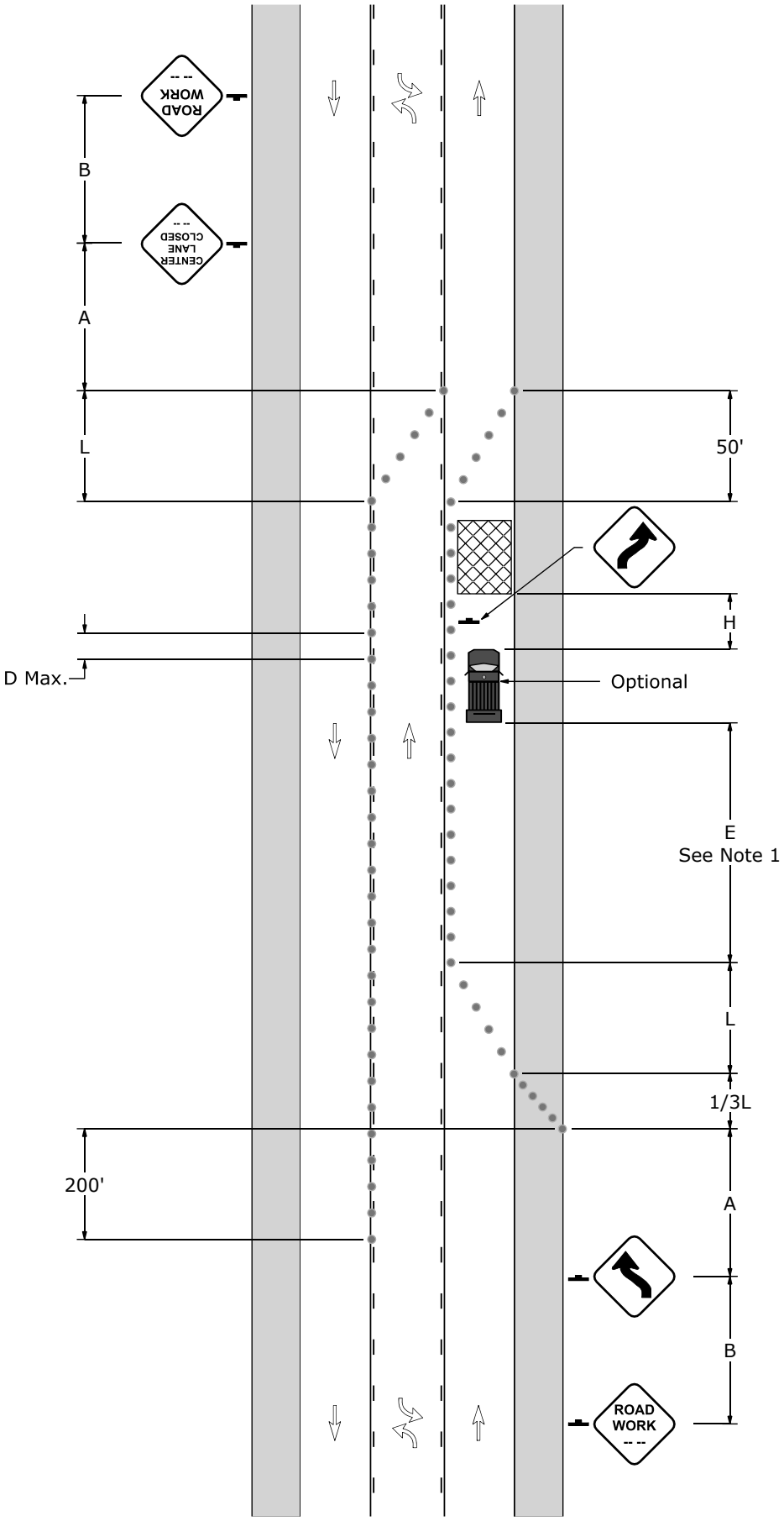
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

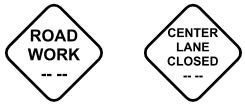
PATA 121 (Old PATA 14)
Single Lane Closure; Traffic Shifted Into Two-Way Left Turn Lane



PATA 122 (Old PATA 15) - Notes

1. For operations of 15 minutes of less:
   a. The Road Work (W20-1) and Center Lane Closed (W9-3) signs are not required.
   b. All channelizing devices may be eliminated if both shadow vehicles are present.
2. When shadow vehicles are not used, distance E is measured from end of taper to beginning of work space.

Signs



W20-1 W9-3

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

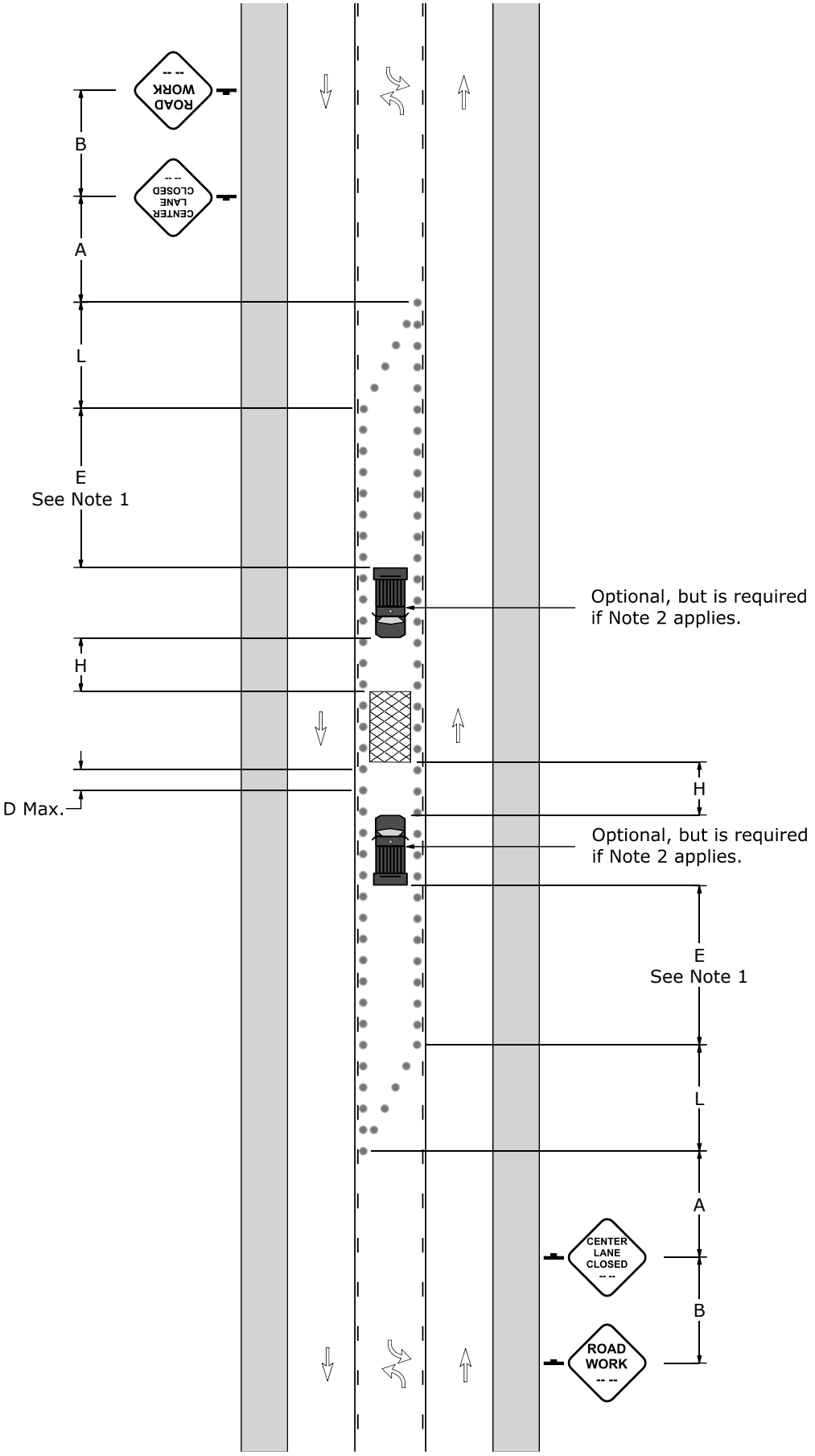
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 122 (Old PATA 15)
Work Space In The Two-Way Left Turn Lane



PATA 123 (New PATA) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. The buffer space shall be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

4. If shadow vehicles are used, use two as shown on the PATA drawing.

5. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-4 W20-7

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

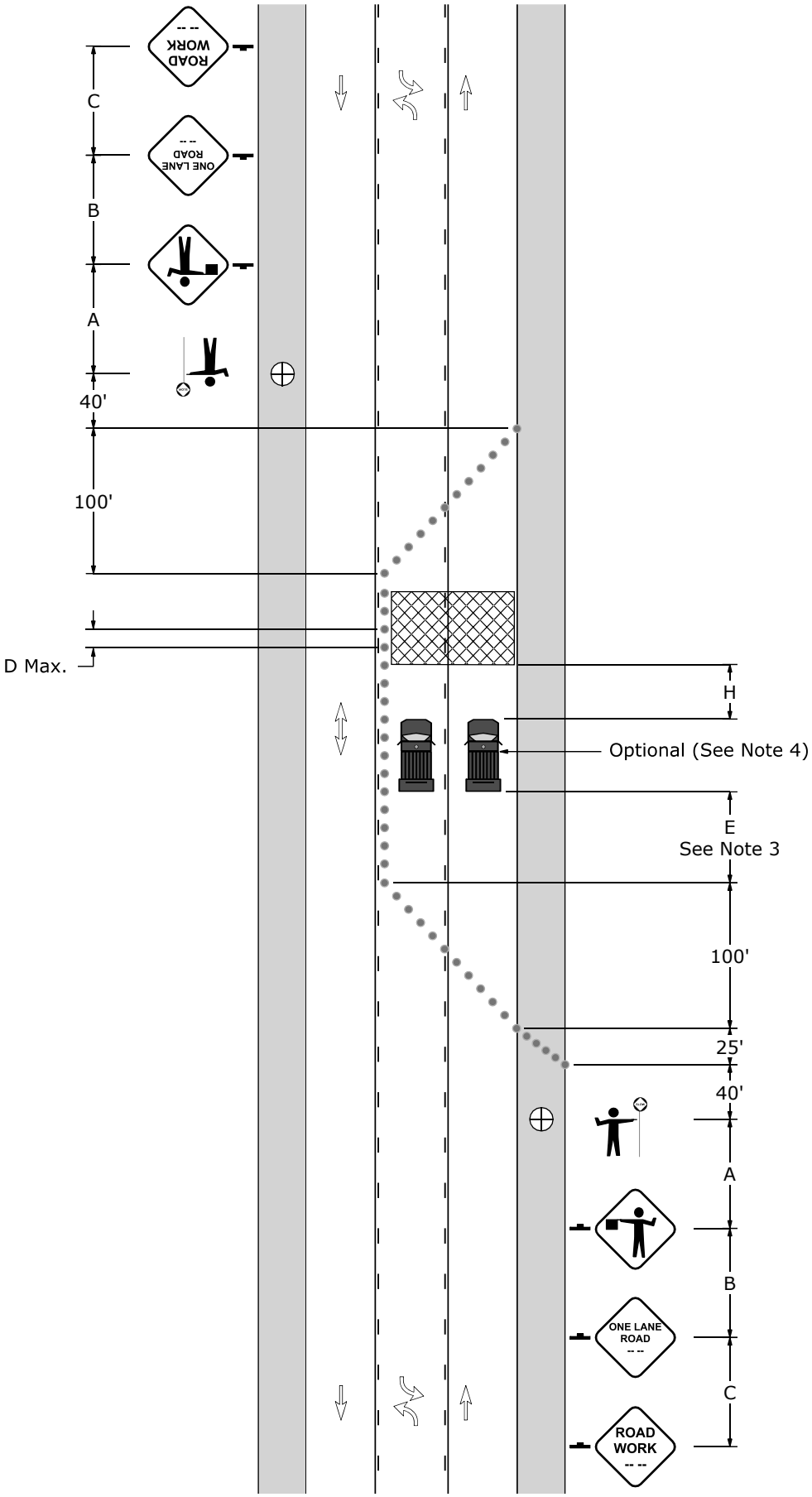
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 123 (New PATA)
Work Space In Two Adjacent Lanes



PATA 124 (Old PATA 16) - Notes

1. For right lane closures, the Right Lane Ends (W4-2R) sign shall be used instead of the Left Lane Ends (W4-2L) sign and the Right Lane Closed (W20-5R) sign shall be used instead of the Left Lane Closed (W20-5L) sign.

2. For right lane closure, signs in the opposite direction are not required.

3. For operations of 15 minutes or less:

   a. The Road Work (W20-1), Lane Closed (W20-5L or W20-5R), and Lane Ends (W4-2L or W4-2R) signs are not required.

   b. All channelizing devices may be eliminated if shadow vehicles are present. A second shadow vehicle (equipped with a flashing arrow panel) shall be located where the trailer-mounted flashing arrow panel is shown on this PATA drawing.

4. For operations of 60 minutes or less in duration, the Road Work (W20-1) sign in the opposite direction of travel is not required.

5. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

6. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W4-2L W4-2R W20-5L W20-5R

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

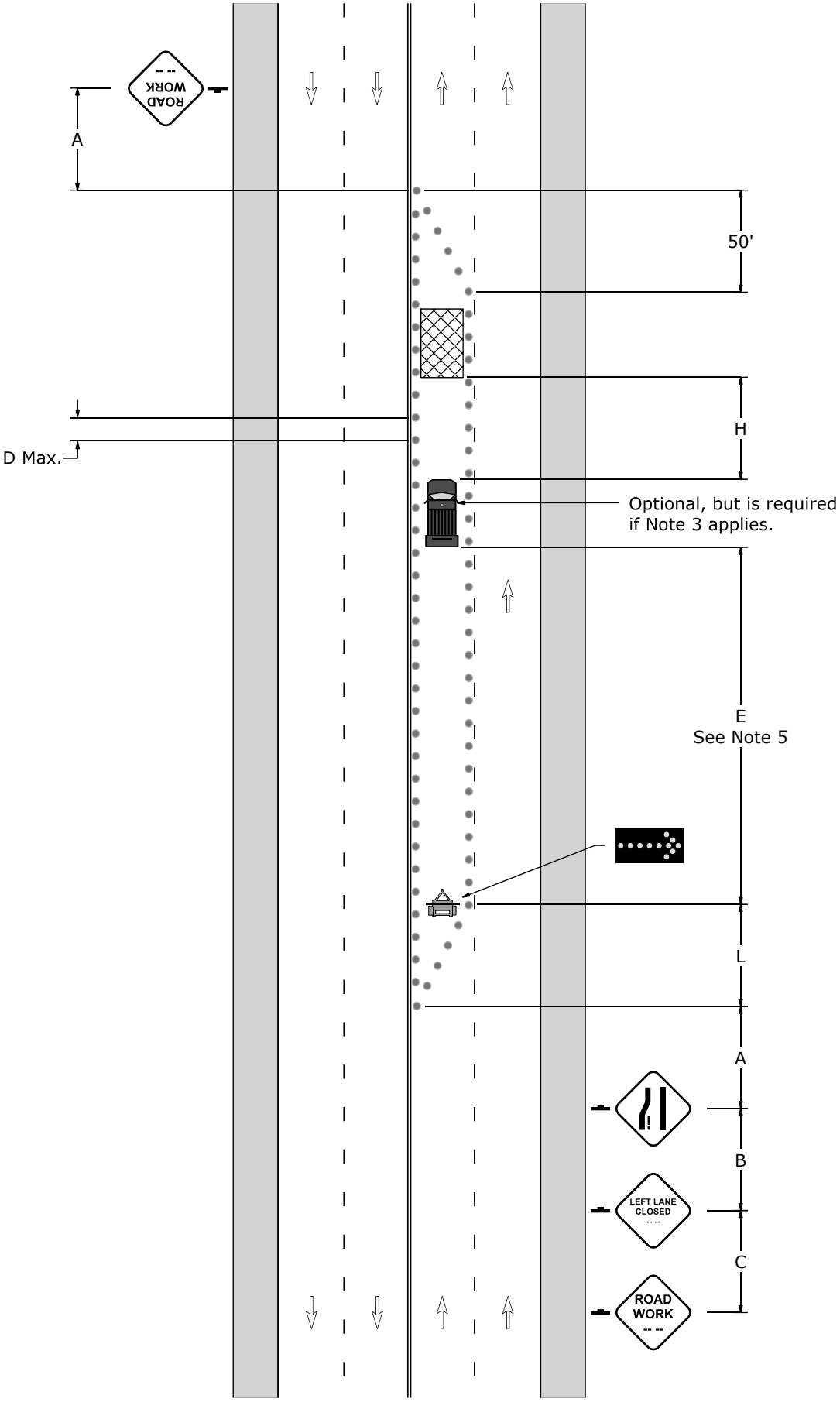
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 124 (Old PATA 16)
Work Space In The Left Or Right Lane Of A Two-Lane Approach



PATA 125 (Old PATA 17) - Notes

1. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.
2. If shadow vehicles are used, use two as shown on the PATA drawing.
3. Refer to PATA 008 for reverse curve/turn signing.
4. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5R W20-5L W4-2R W4-2L W1-4L W1-4R

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

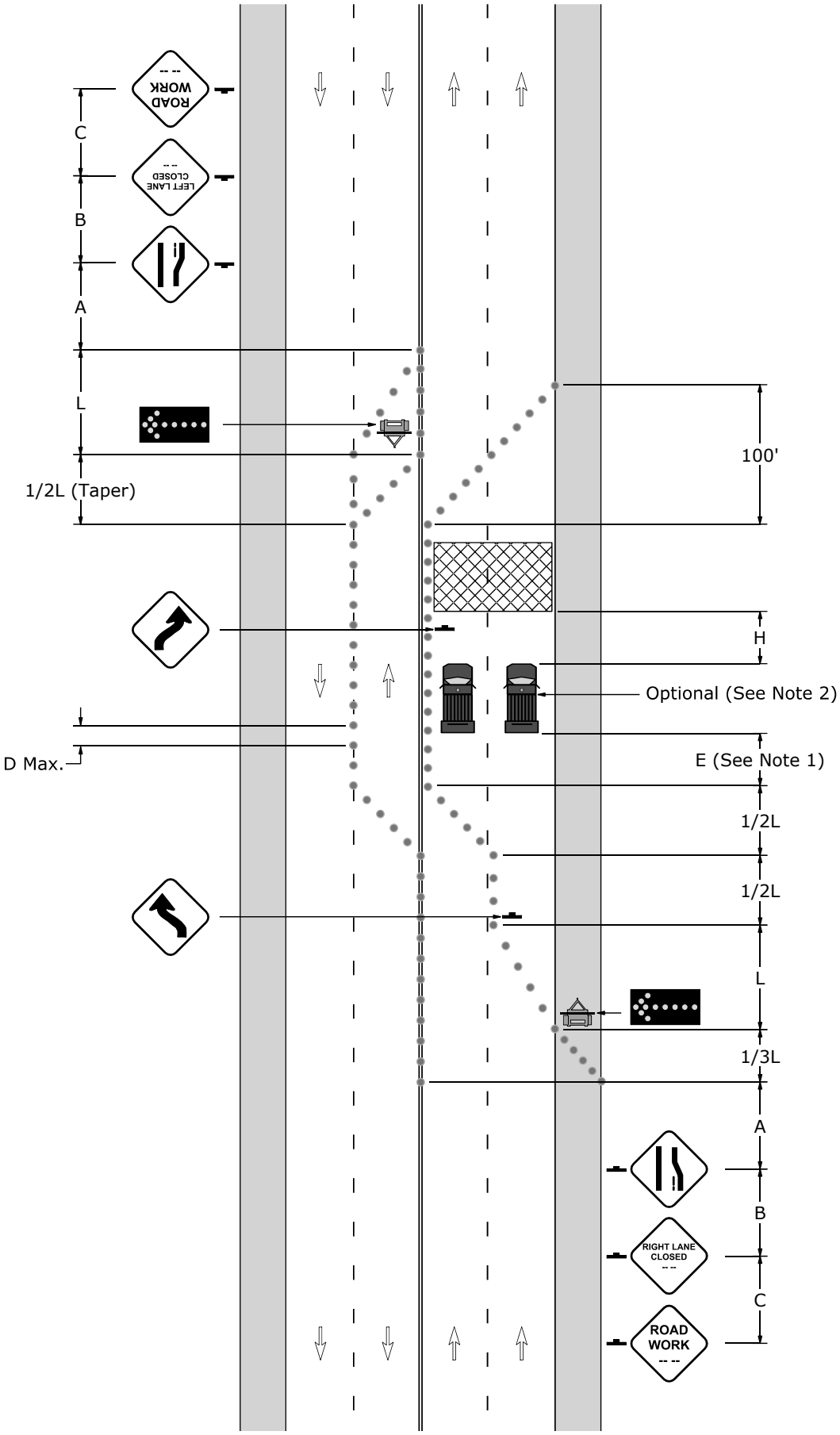
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 125 (Old PATA 17)
Work Space Requiring Closure Of One Side Of A Four-Lane Undivided Highway



PATA 126 (Old PATA 18) - Notes

1. For left lane closures, the Left Lane Closed (W20-5L) sign shall be used instead of the Right Lane Closed (W20-5R) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5R W20-5L W4-2R W4-2L

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

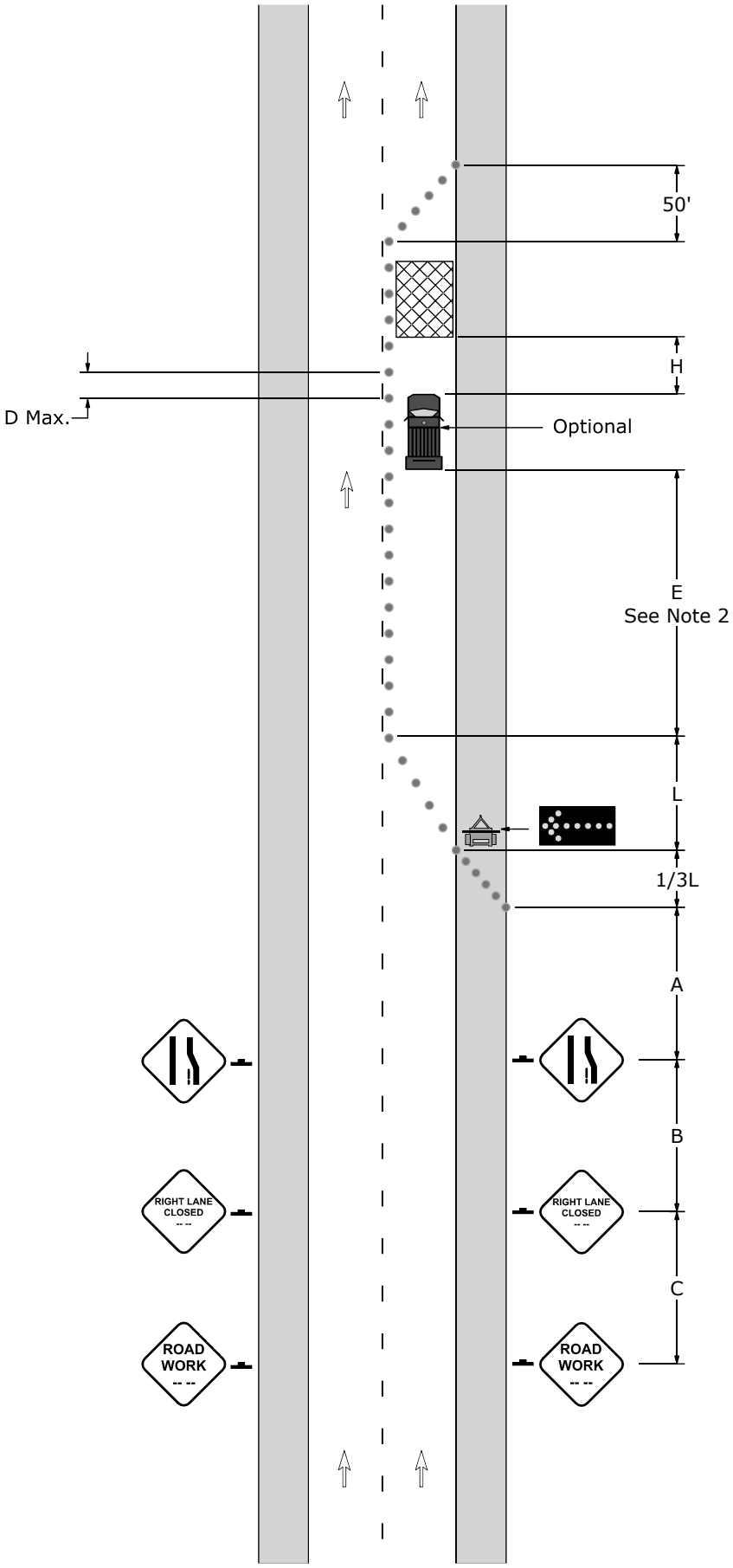
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 126 (Old PATA 18)
Work Space In The Left Or Right Lane



PATA 127 (Old PATA 20) - Notes

1. For two left lane closures, the Left Two Lanes Closed (W20-5AL) sign shall be used instead of the Right Two Lanes Closed (W20-5AR) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Placement of two consecutive Two Lanes Closed (W20-5AL or W20-5AR) signs is required for all roads with a speed limit of 45 MPH or greater and is optional for roadways with a speed limit of 40 MPH or less.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

4. If shadow vehicles are used, use two as shown on the PATA drawing.

5. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5AR W20-5AL W4-2R W4-2L

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

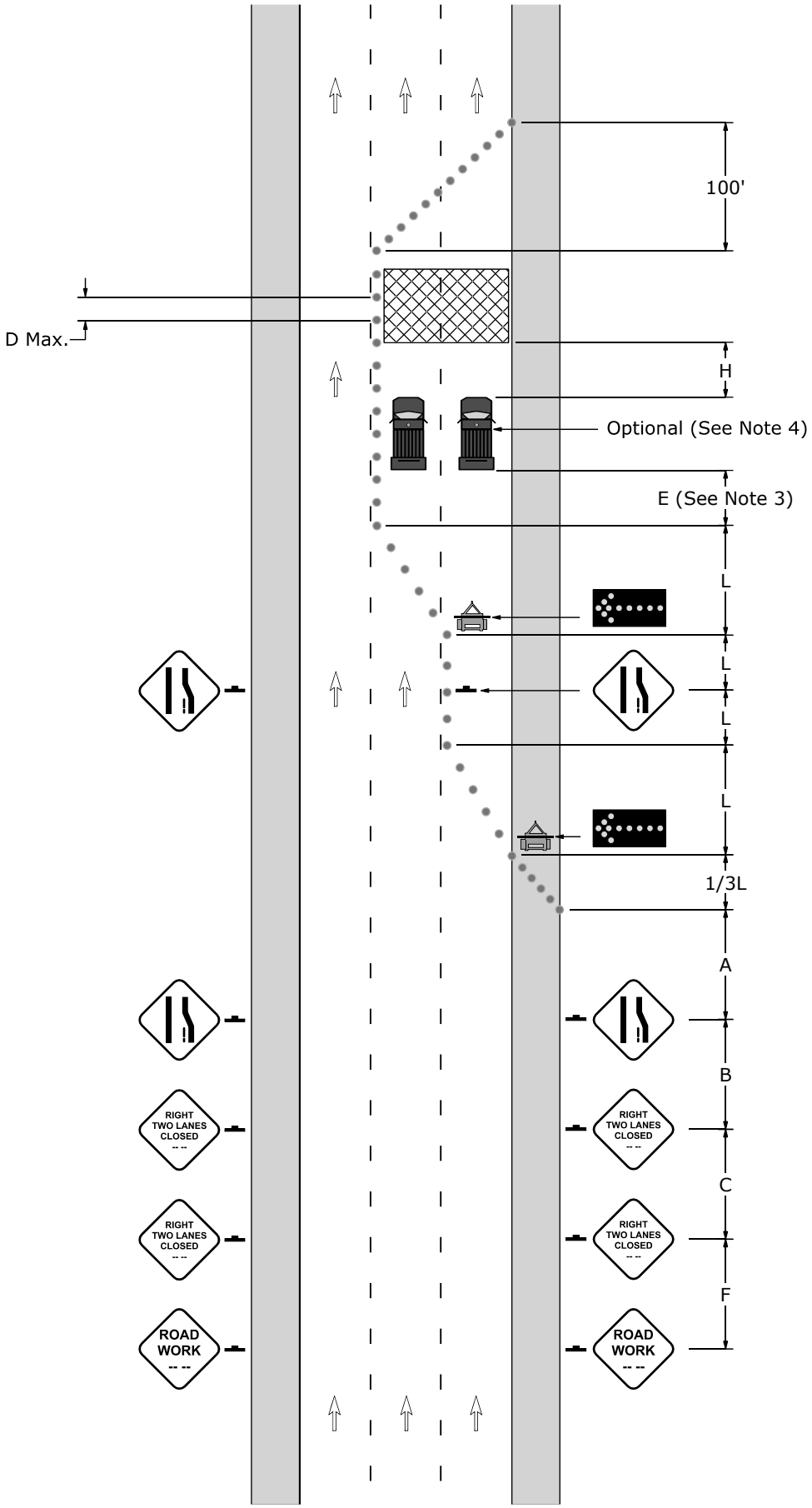
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 127 (Old PATA 20)
Work Space In Two Adjacent Lanes

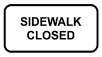


PATA 128 (Old PATA 40) - Notes

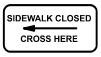
1. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

Signs

W20-1



R9-9



R9-11a

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

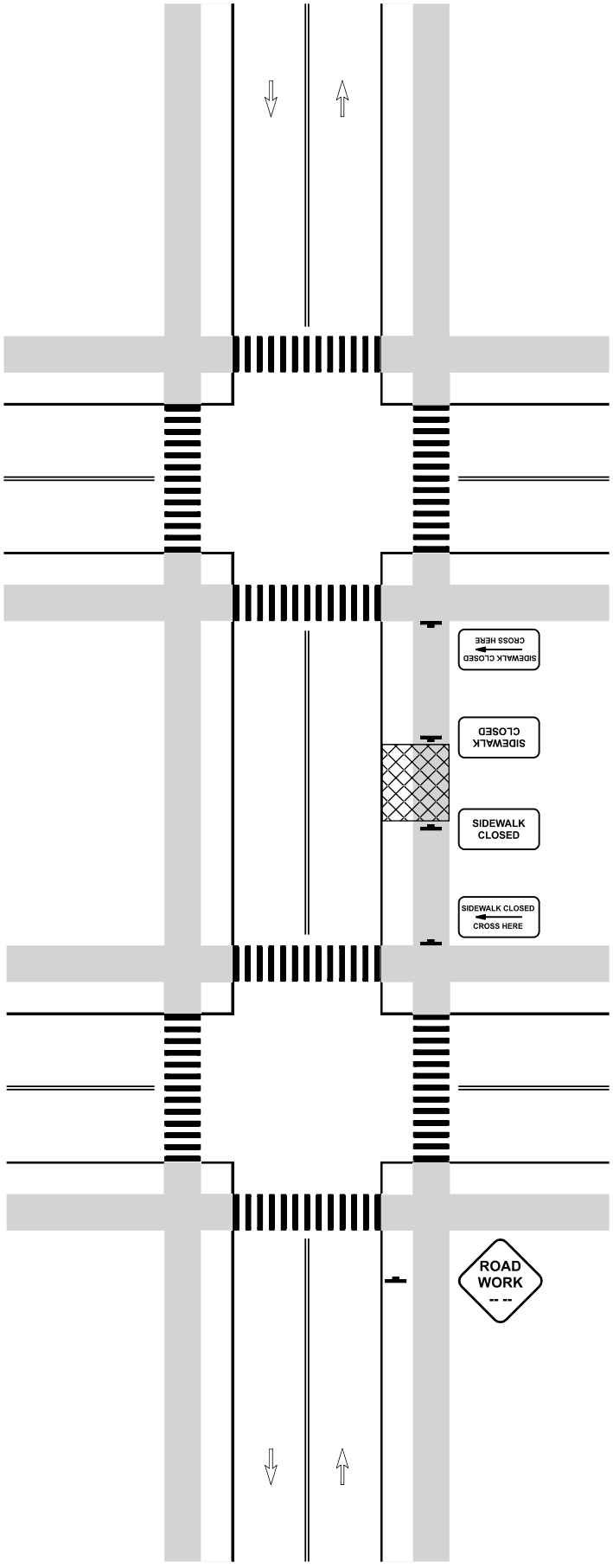
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 128 (Old PATA 40)
Sidewalk Closure; Pedestrian Detour



PATA 129 (Old PATA 40) - Notes

1. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

2. Use channelizing devices to separate and maintain temporary pedestrian walkway while sidewalk is closed. Where high speeds are anticipated, a temporary traffic barrier with appropriate end treatments should be used to separate the temporary walkways from vehicular traffic.

3. Other devices, such as lane closure signing or Road Narrows (W5-1) signs, may be used to control vehicular traffic.

4. When it is not possible to maintain a minimum width of 60" throughout the entire length of the pedestrian pathway, a 60"x60" passing space should be provided at least every 200' to allow individuals in wheelchairs to pass. A minimum 48" wide accessible path shall be maintained for the length of sidewalk diversion.

Signs

W20-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

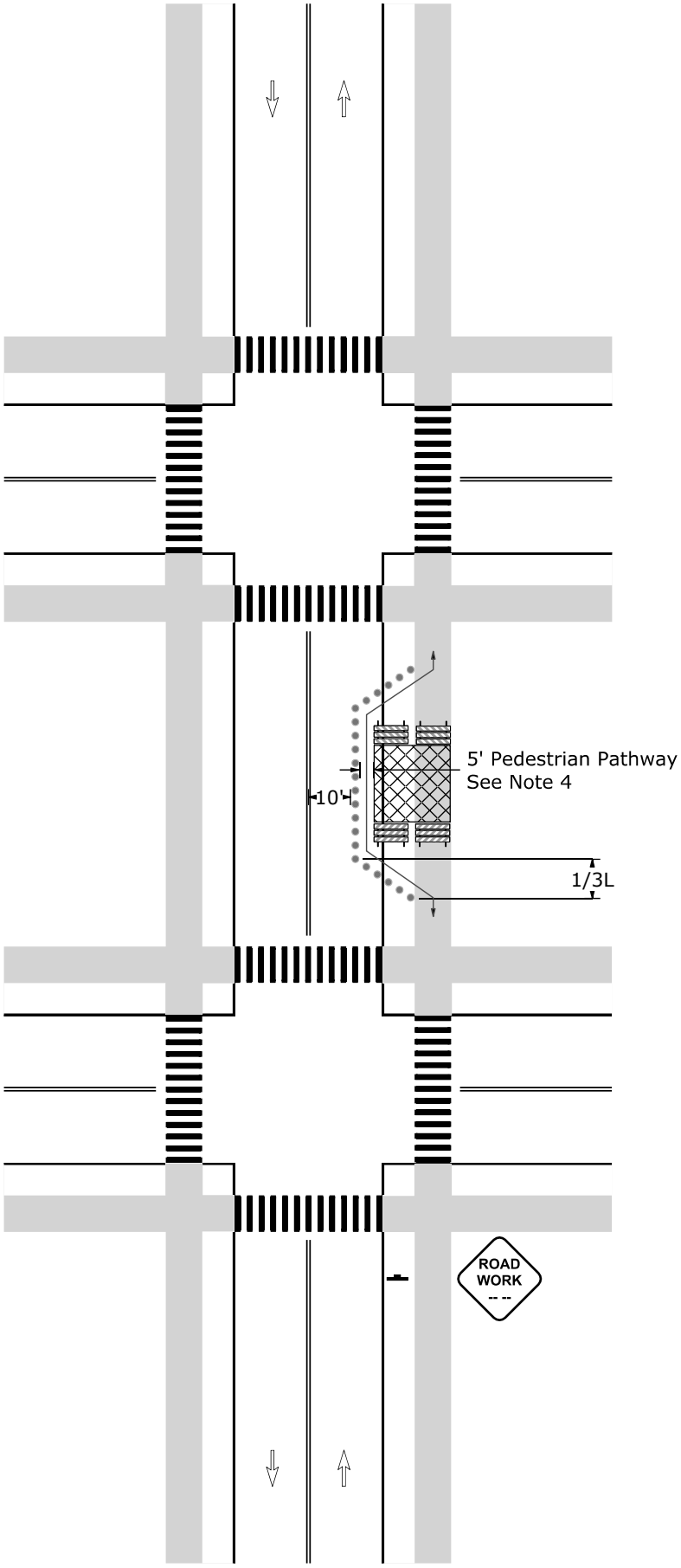
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 129 (Old PATA 40)
Sidewalk Closure; Pedestrian Diversion



PATA 130 (Old PATA 41) - Notes

1. When crosswalks or other pedestrian facilities are closed or relocated and there is not an alternate marked crossing within 300', an engineering and traffic study is required to determine the appropriate location of a temporary pedestrian crossing. PennDOT approval shall be obtained prior to installing a midblock crosswalk. Every temporary crossing shall be detectable and include accessibility features (curb ramps, landing areas, etc.) consistent with the features present in the existing pedestrian facility.

2. Parking is not permitted within 75' of a midblock crosswalk, unless a 6' to 8' curb extension is in place to improve pedestrian visibility.

3. Pedestrian traffic signal displays controlling closed crosswalks shall be covered and deactivated.

4. The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway or other pedestrian facility. When it is not possible to maintain a minimum width of 60" throughout the entire length of the pedestrian pathway, a 60"x60" passing space should be provided at least every 200' to allow individuals in wheelchairs to pass.

5. Any approved channelizing devices may be used for closing the sidewalk.

Signs

W20-1 W11-2 W16-7P W16-9P R9-9 R9-10 R9-11a

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

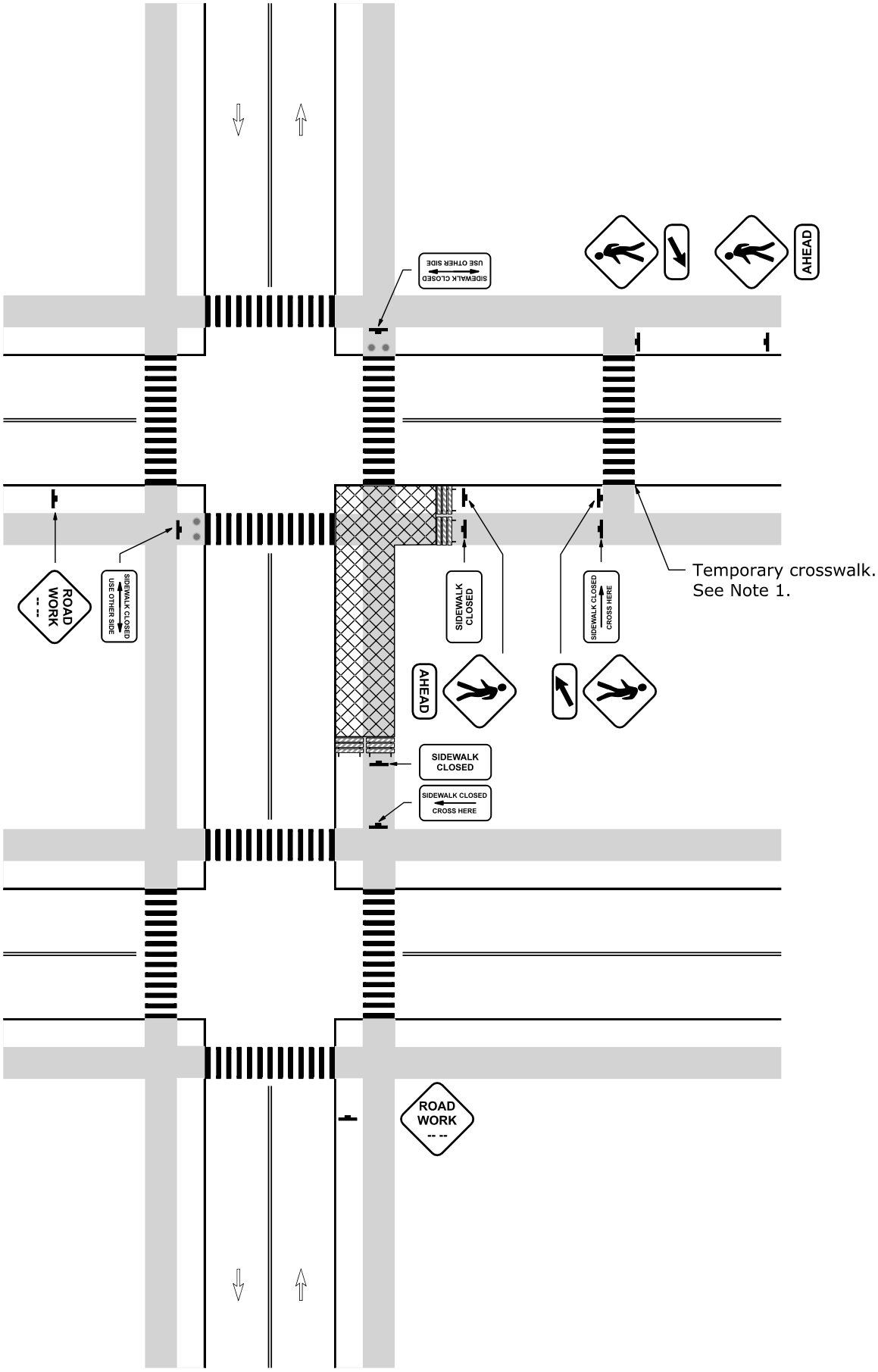
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 130 (Old PATA 41)
Sidewalk and Crosswalk Closure; Pedestrian Detour



PATA 131 (New PATA) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

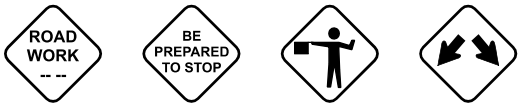
2. This PATA shall be used when the work space prohibits traffic from making a complete circle in a roundabout or traffic circle. It is applicable to every roundabout or traffic circle regardless of the number of roadways entering or exiting the roundabout or traffic circle.

3. Traffic must be controlled from all approaches prior to commencement of work.

4. Flaggers must control traffic flow so that vehicles from only one approach are permitted to utilize the roundabout or traffic circle at a time. Traffic from all other approaches must be held until traffic is cleared from the work zone. The desired traffic flow is depicted on the PATA with a distinct color line for each approach. Flaggers on site must work as a team to create the most safe and efficient traffic flow.

5. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work.

Signs



W20-1 W3-4 W20-7 W12-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

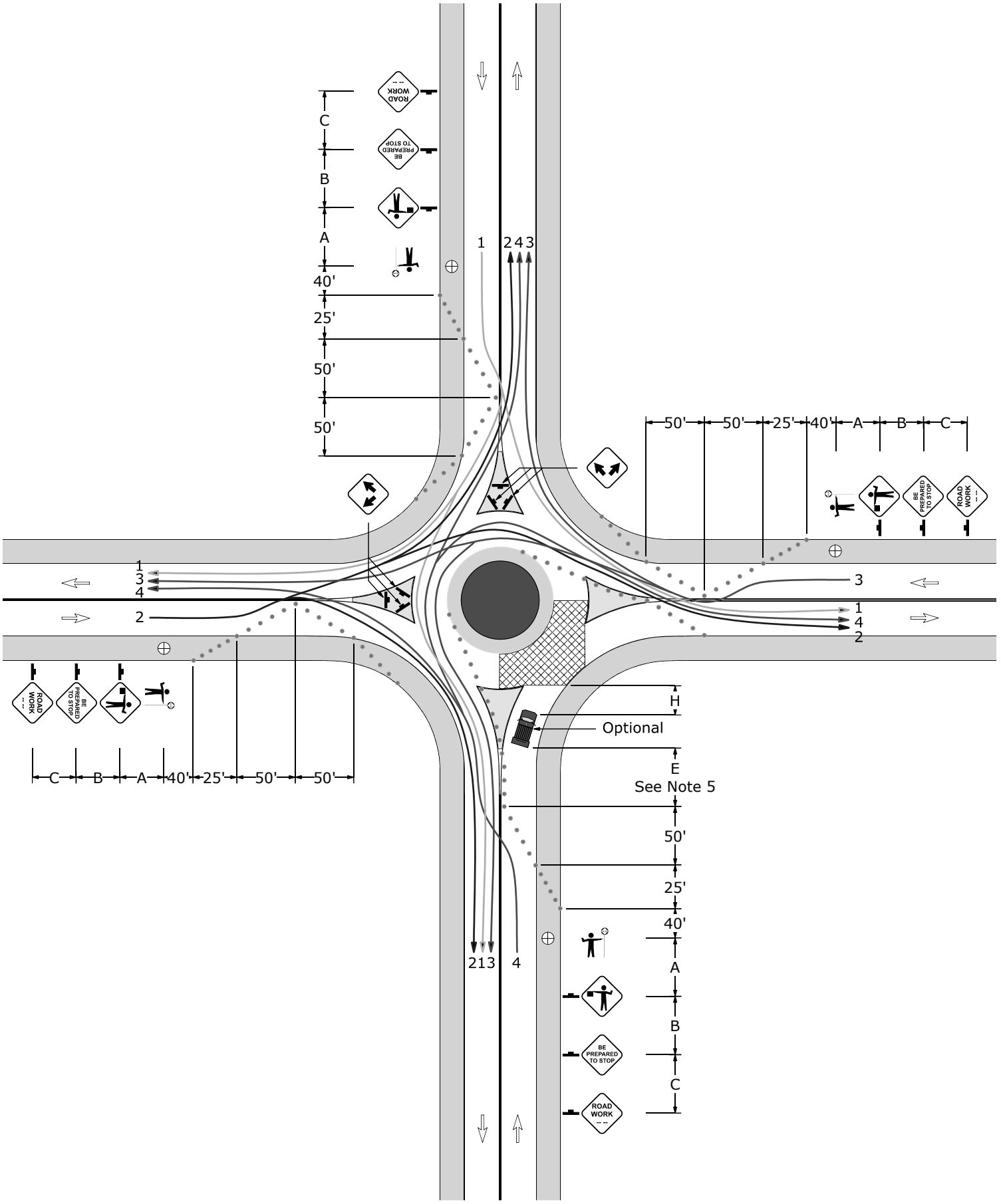
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 131 (New PATA)
Work Space On One Quadrant Of A Roundabout Or Traffic Circle



PATA 132 (New PATA) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. This PATA shall be used when the work space prohibits traffic from making a complete circle in a roundabout or traffic circle. It is applicable to every roundabout or traffic circle regardless of the number of roadways entering or exiting the roundabout or traffic circle.

3. Traffic must be controlled from all approaches prior to commencement of work.

4. Flaggers must control traffic flow so that vehicles from only one approach are permitted to utilize the roundabout or traffic circle at a time. Traffic from all other approaches must be held until traffic is cleared from the work zone. The desired traffic flow is depicted on the PATA with a distinct color line for each approach. Flaggers on site must work as a team to create the most safe and efficient traffic flow.

5. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work.

Signs

W20-1 W3-4 W20-7 W12-1 R4-7

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

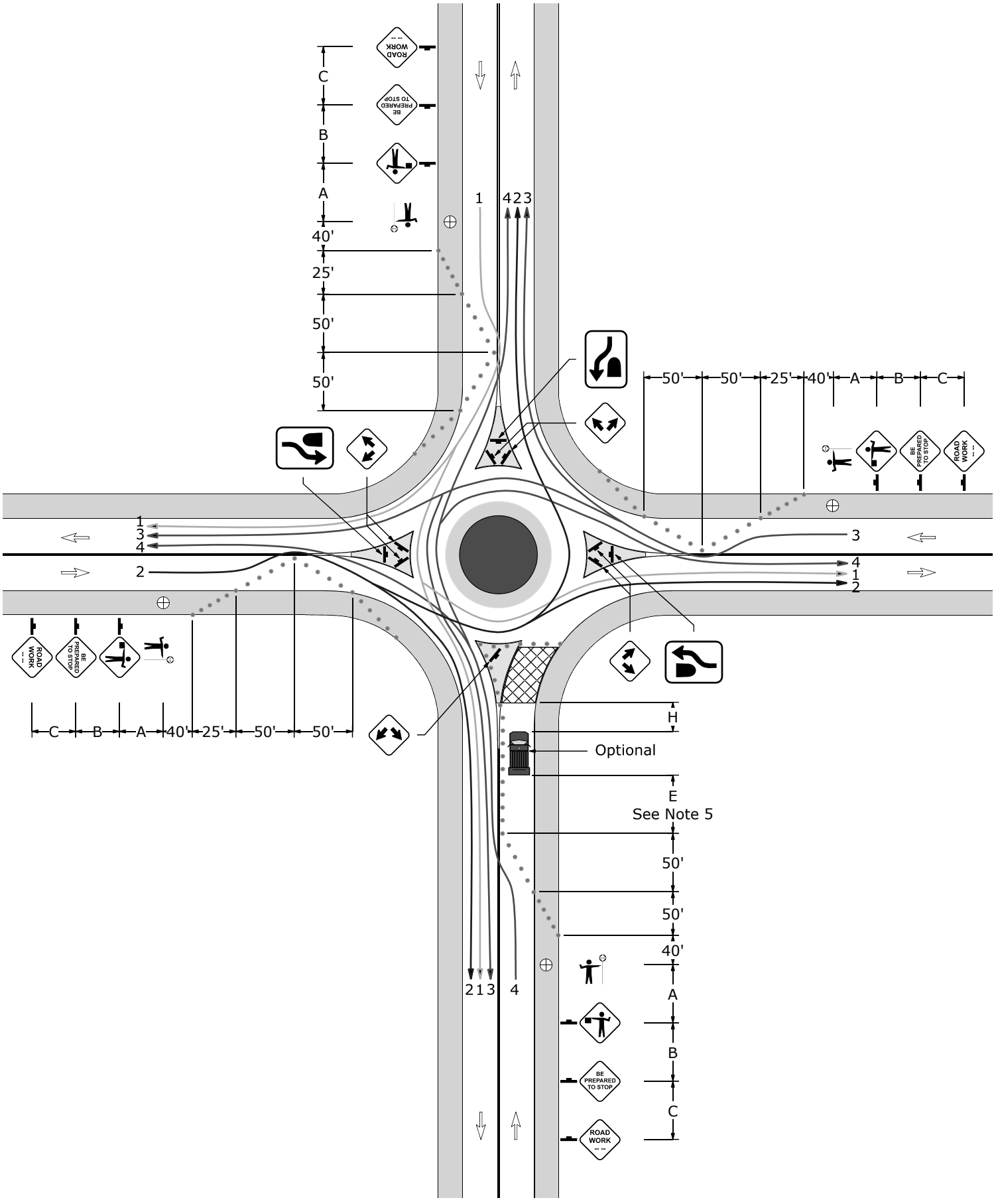
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 132 (New PATA)
Work Space On One Entrance Of A Roundabout Or Traffic Circle



PATA 133 (New PATA) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers.

2. This PATA shall be used when the work space prohibits traffic from making a complete circle in a roundabout or traffic circle. It is applicable to every roundabout or traffic circle regardless of the number of roadways entering or exiting the roundabout or traffic circle.

3. Traffic must be controlled from all approaches prior to commencement of work.

4. Flaggers must control traffic flow so that vehicles from only one approach are permitted to utilize the roundabout or traffic circle at a time. Traffic from all other approaches must be held until traffic is cleared from the work zone. The desired traffic flow is depicted on the PATA with a distinct color line for each approach. Flaggers on site must work as a team to create the most safe and efficient traffic flow.

5. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work.

Signs

W20-1 W3-4 W20-7 W12-1 R4-8

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

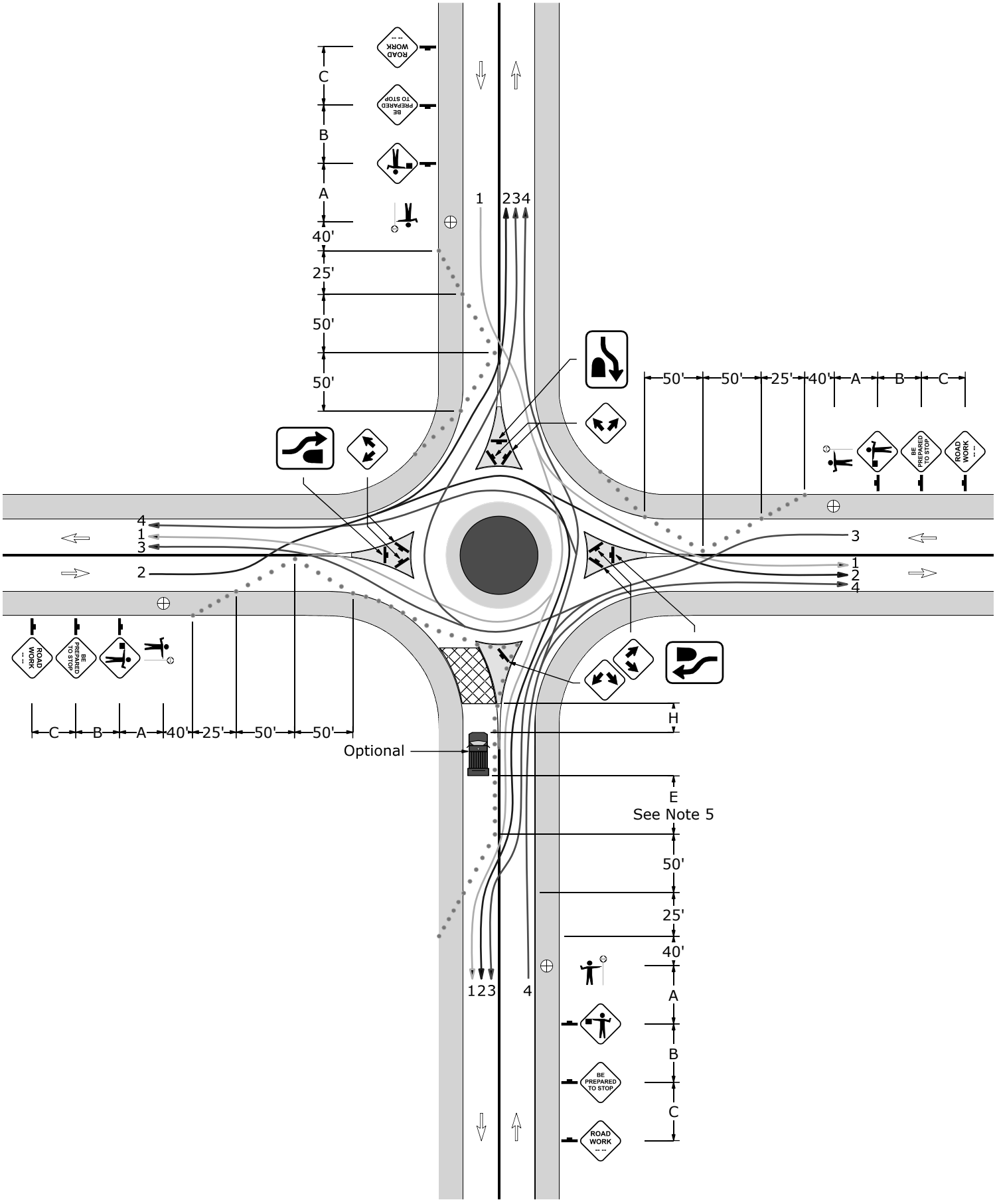
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 133 (New PATA)
Work Space On One Exit Of A Roundabout Or Traffic Circle



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Conventional Highways

Long-Term Stationary Operations
(PATA 200 Series)

PATA 201 (Old PATA 24) - Notes

1. Traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2'-0" behind curb, or 15' or more from the edge of the roadway.

2. For divided highways and one-way highways where it is physically possible, advance warning signs should also be placed on the left-hand side of the roadway.

3. When a shadow vehicle is not used, distance A is measured from sign to beginning of work space.

Signs

W20-1

G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

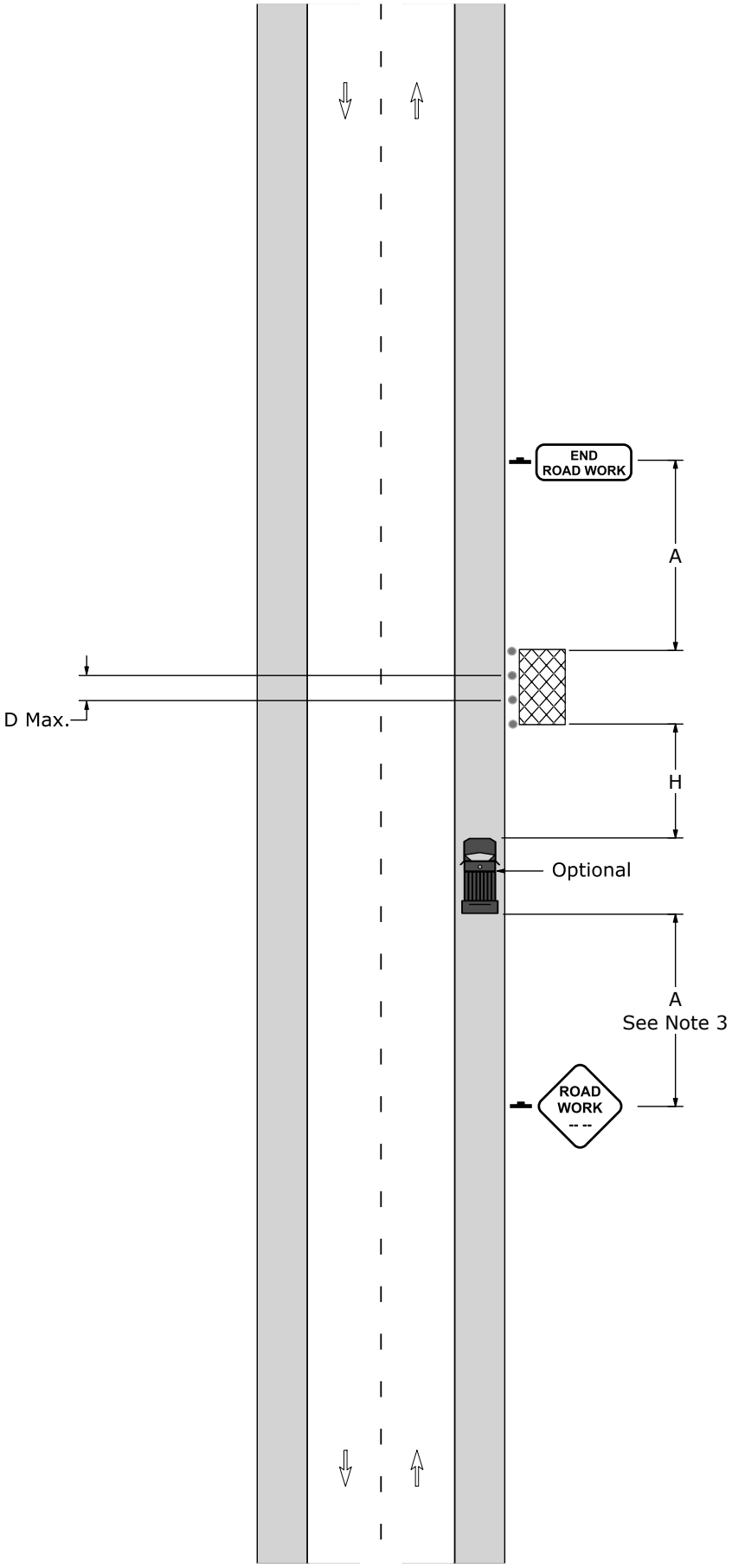
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 201 (Old PATA 24)
Work Space Beyond Shoulder



PATA 202 (Old PATA 25) - Notes

1. Traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2'-0" behind curb, or 15' or more from the edge of the roadway.

2. For divided highways and one-way highways where it is physically possible, advance warning signs should also be placed on the left-hand side of the roadway.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs

W20-1 W21-5 W21-5BR W21-5BL G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

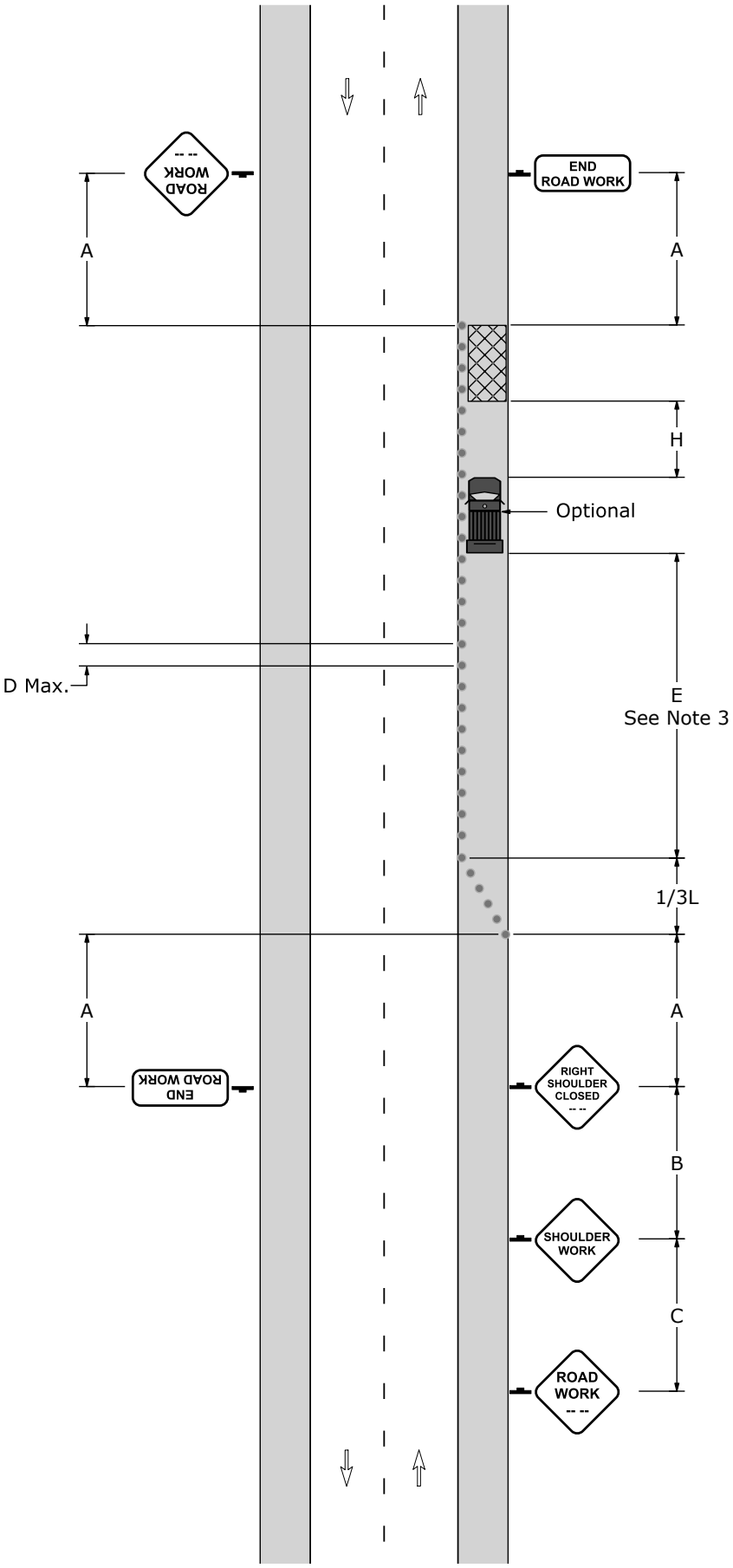
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 202 (Old PATA 25)
Work Space On Shoulder



PATA 203 (Old PATA 9a L1) - Notes

1. Where traffic is required to use a shoulder, it must be a paved shoulder that is in good condition both during the period it is being used by traffic and also after the work is complete.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. A no passing zone shall be established when an existing passing zone is present. A temporary double yellow pavement marking line shall be installed throughout the entire length of the work zone. Place a No Passing Zone (W14-3) sign at the start of the temporary double yellow pavement marking line (Across from the Road Work (W20-1) sign).

4. Refer to PATA 008 for reverse curve/turn signing.

Signs

W20-1 W5-5 W1-4R W1-4L W14-3 R4-7 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

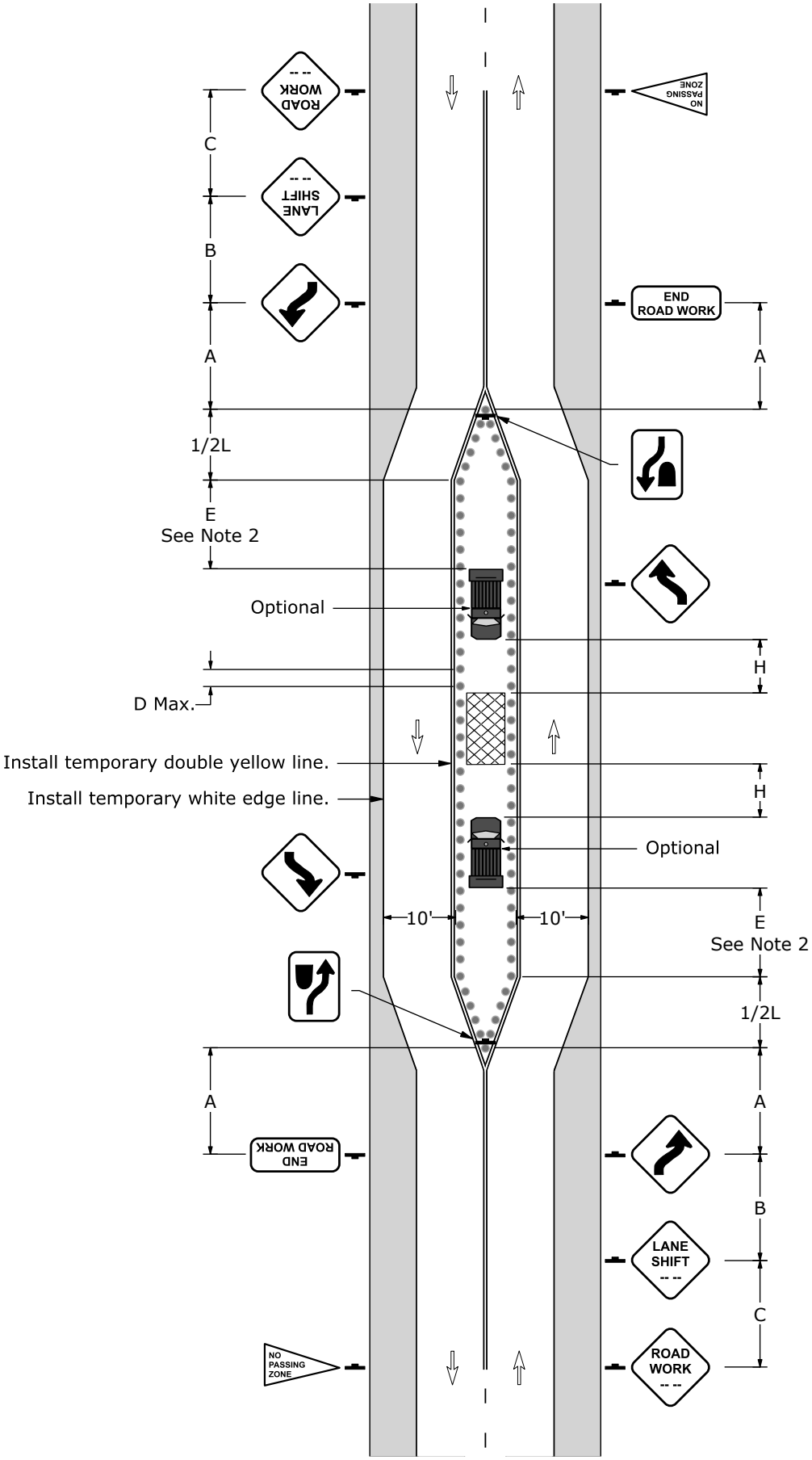
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 203 (Old PATA 9a L1)
Work Space In Center Of Roadway



PATA 204 (Old PATA 9a L2) - Notes

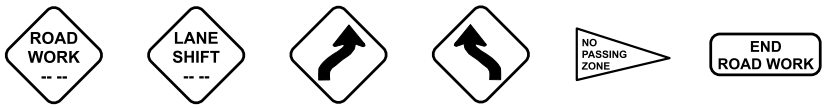
1. Where traffic is required to use a shoulder, it must be a paved shoulder that is in good condition both during the period it is being used by traffic and also after the work is complete.

2. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

3. A no passing zone shall be established when an existing passing zone is present. A temporary double yellow pavement marking line shall be installed throughout the entire length of the work zone. Place a No Passing Zone (W14-3) sign at the start of the temporary double yellow pavement marking line (Across from the Road Work (W20-1) sign).

4. Refer to PATA 008 for reverse curve/turn signing.

Signs



W20-1 W5-5 W1-4R W1-4L W14-3 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

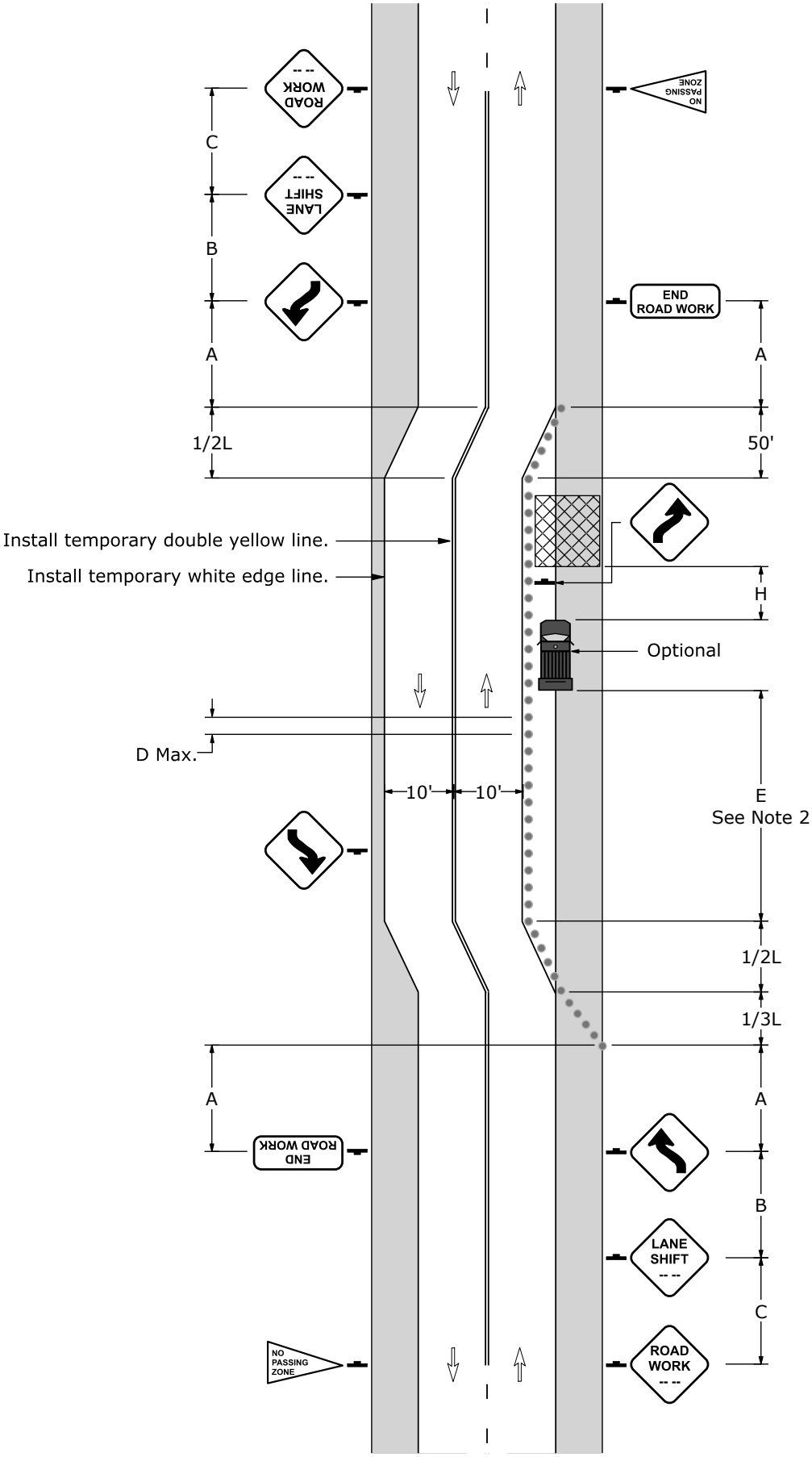
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 204 (Old PATA 9a L2)
Work Space On The Side Of Roadway



PATA 205 (Old PATA 26c) - Notes

1. This figure applies when all of the following conditions are satisfied:
   a. Sight distance between the Stop (R1-1) signs is unobstructed.

   b. The ADT is not greater than approximately 1500.

2. The Stop (R1-1) sign shall be clearly visible to traffic for a minimum distance of E.

3. Attach red Type B flashing lights on stop signs as shown.

4. When a shadow vehicle is not used, 50' is measured from end of taper to beginning of work space.

5. A no passing zone shall be established when an existing passing zone is present. A temporary double yellow pavement marking line shall be installed throughout the entire length of the work zone. Place a No Passing Zone (W14-3) sign at the start of the temporary double yellow pavement marking line (Across from the Road Work (W20-1) sign).

6. Refer to PATA 008 for reverse curve/turn signing.

7. Refer to PATA 010 for additional information regarding the temporary portable sign posts for the Stop (R1-1) signs.

Signs

W20-1 W20-4 W1-4R W3-1 W14-3 R1-1 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

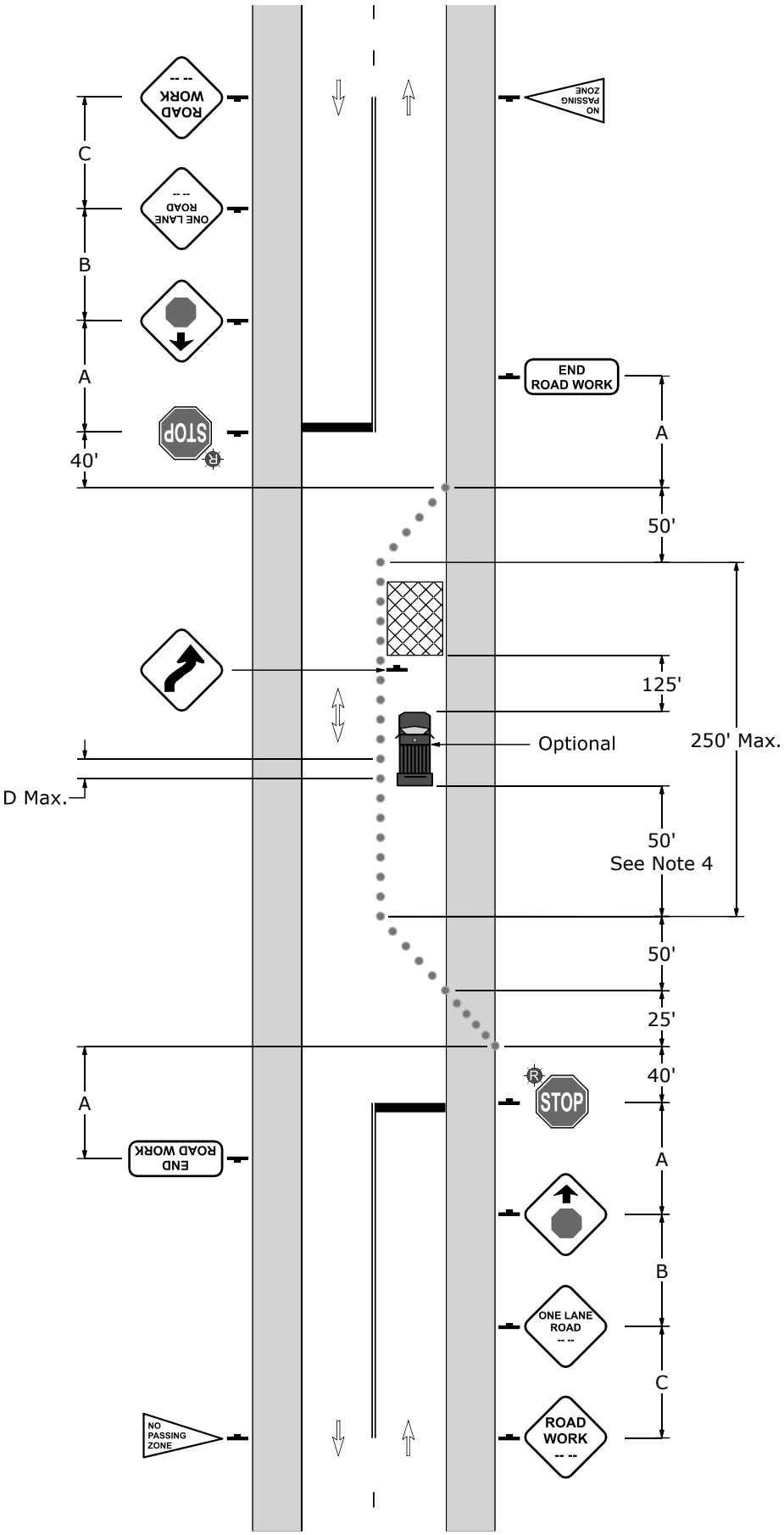
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 205 (Old PATA 26c)
Self-Regulating Stop Sign-Controlled Lane Closure



PATA 206 (Old PATA 27) - Notes

1. Delineators should be placed along the temporary roadway where needed.

2. A no passing zone shall be established when an existing passing zone is present. A temporary double yellow pavement marking line shall be installed throughout the entire length of the work zone. Place a No Passing Zone (W14-3) sign at the start of the temporary double yellow pavement marking line (Across from the Road Work (W20-1) sign).

3. Refer to PATA 008 for reverse curve/turn signing.

Signs

W20-1 W5-5 W1-4L W1-4R W14-3 R11-2 W1-6 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

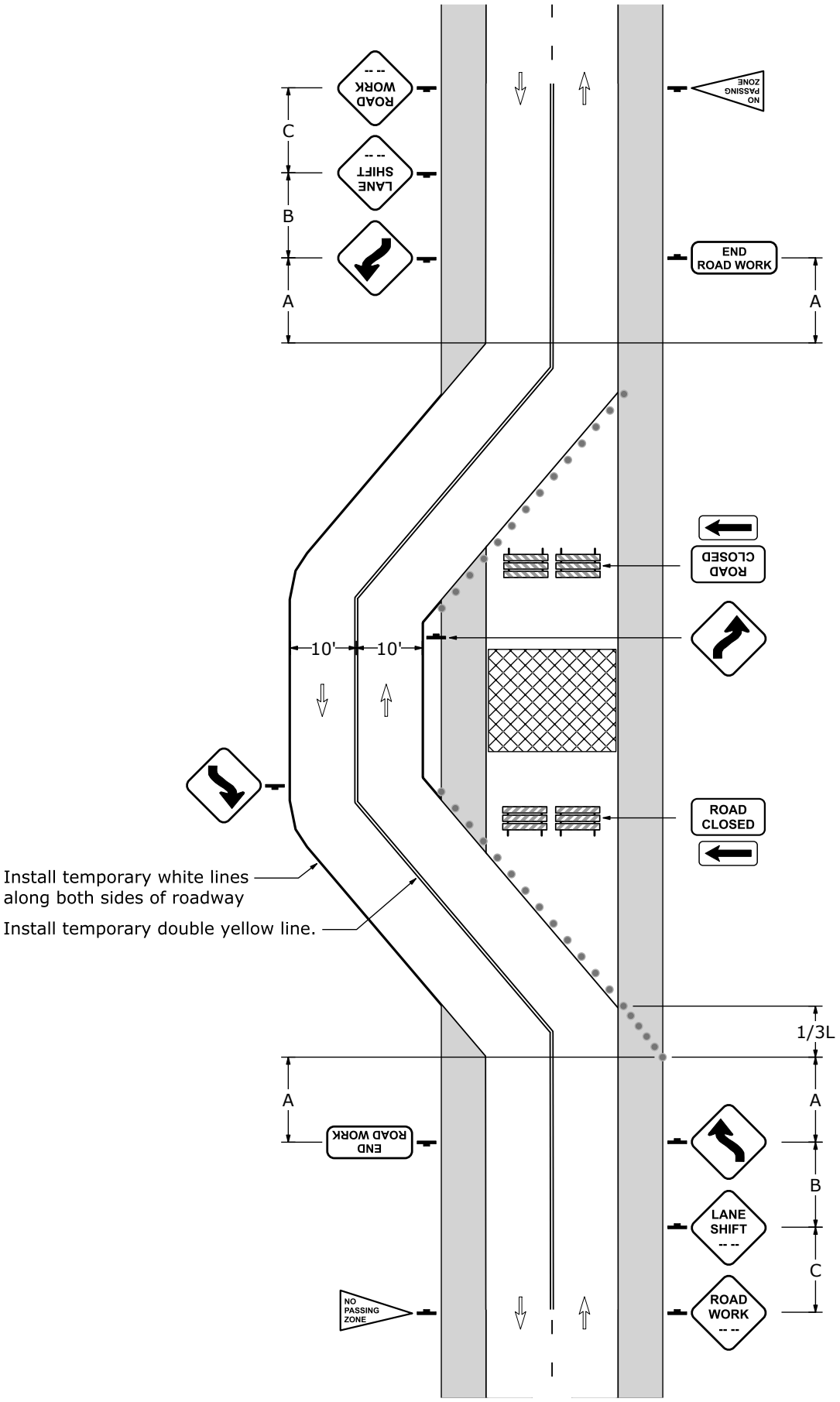
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 206 (Old PATA 27)
Temporary Roadway



PATA 207 (Old PATA 28) - Notes

1. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

2. Refer to PATA 008 for reverse curve/turn signing.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W5-5 W20-5L W4-2L W1-4L W1-4R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

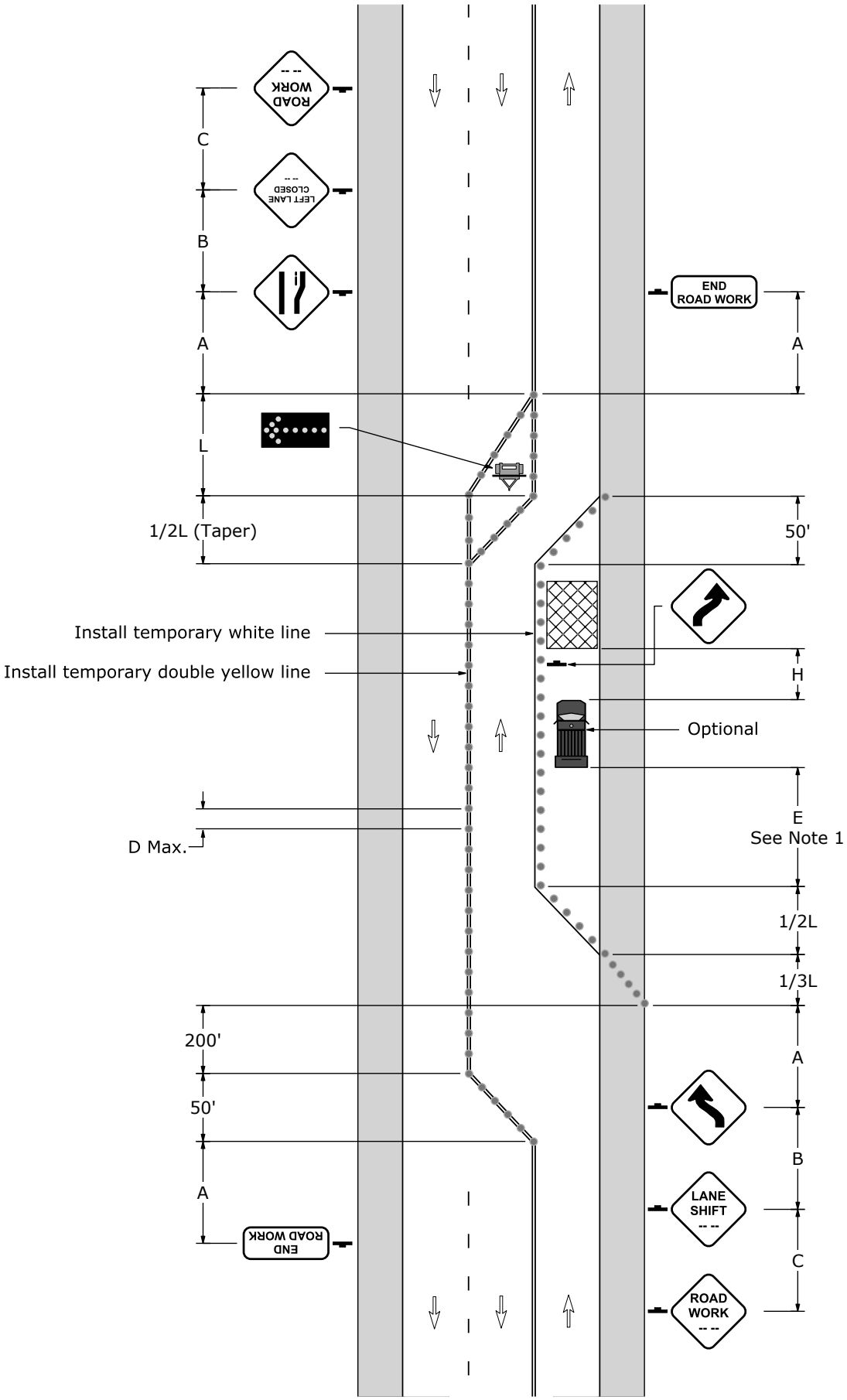
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 207 (Old PATA 28)
Work Space In The Single-Lane Approach



PATA 208 (Old PATA 29) - Notes

1. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

2. Refer to PATA 008 for reverse curve/turn signing.

Signs

W20-1 W5-5 W9-3 W1-4L W1-4R M4-14-1 M4-12 R3-9B G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

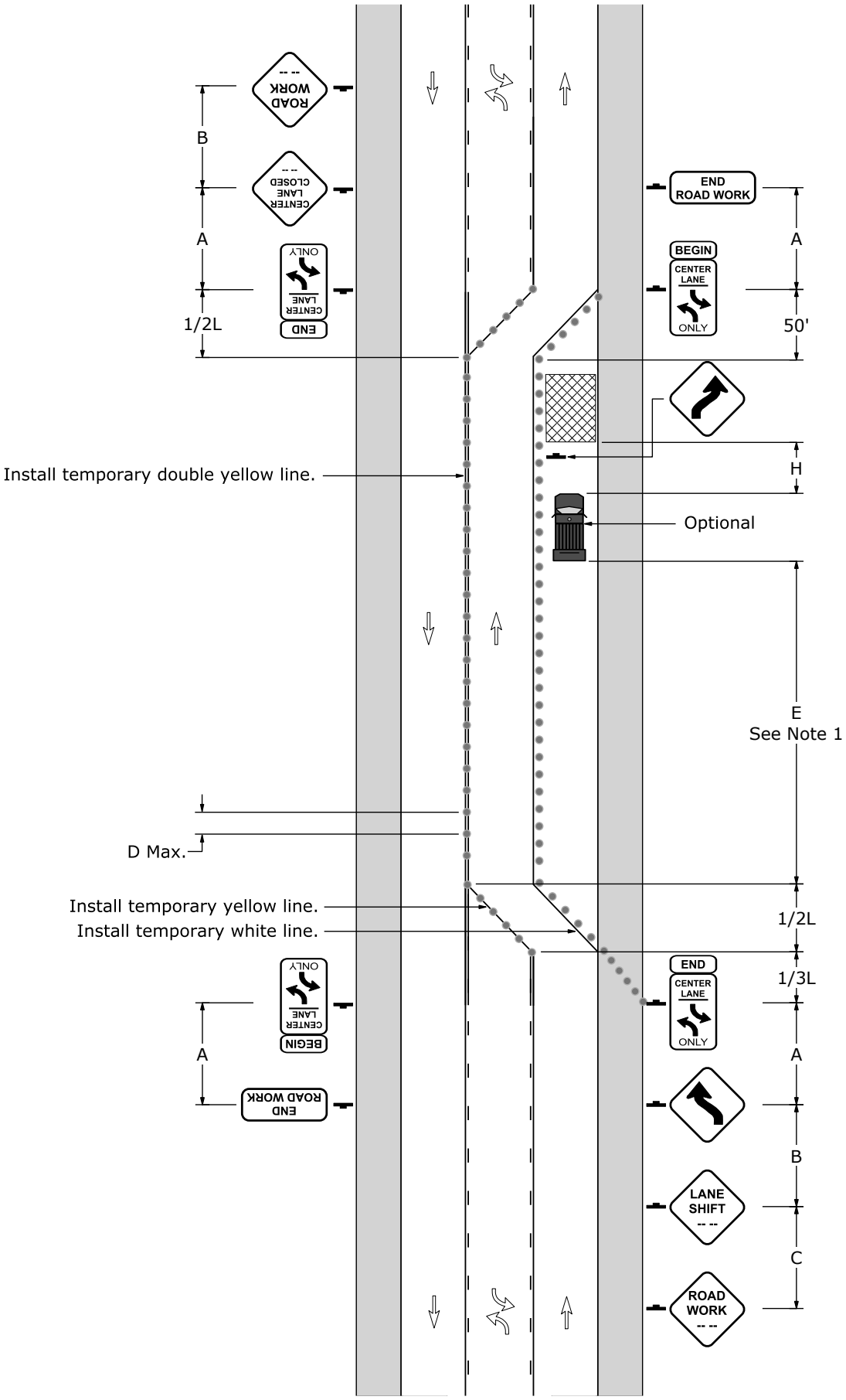
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 208 (Old PATA 29)
Single Lane Closure; Traffic Shifted Into Two-Way Left Turn Lane



PATA 209 (Old PATA 30) - Notes

1. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

Signs

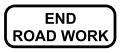
W20-1

W9-3

M4-14-1

M4-12

R3-9B



G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

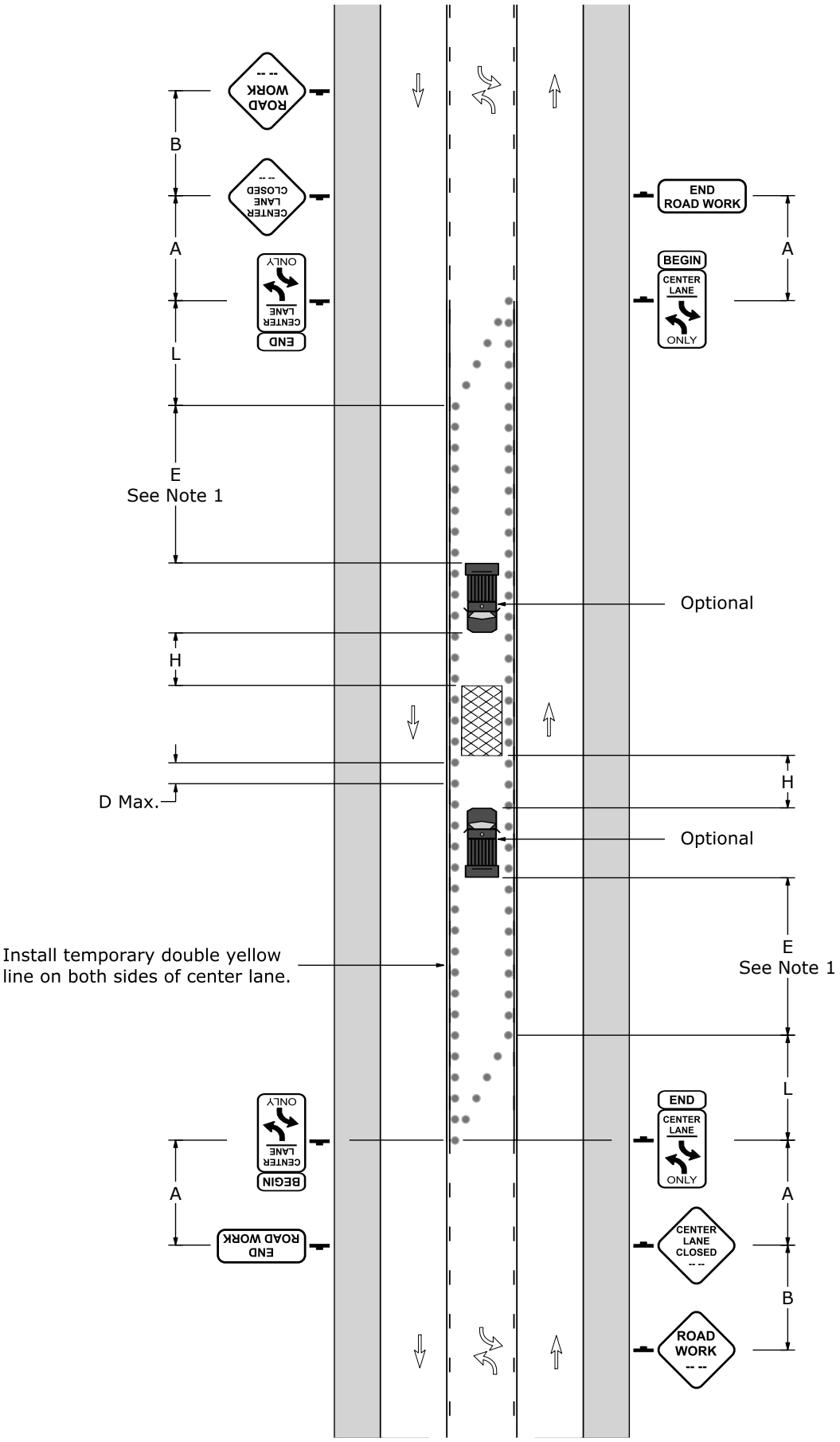
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 209 (Old PATA 30)
Work Space In The Two-Way Left Turn Lane



PATA 210 (Old PATA 31) - Notes

1. For right lane closures, signing is not required on the opposite approach.

2. For right lane closures, Right Lane Closed (W20-5R) signs shall be used instead of the Left Lane Closed (W20-5L) signs and Right Lane Ends (W4-2R) signs shall be used instead of Left Lane Ends (W4-2L) signs.

3. For right lane closures, a temporary white edge line will need to be installed.

4. Placement of two consecutive Lane Closed (W20-5L or W20-5R) signs is required for roadways with a speed limit of 45 MPH or greater and is optional for roadways with a speed limit of 40 MPH or less.

5. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

6. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5L W20-5R W4-2L W4-2R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

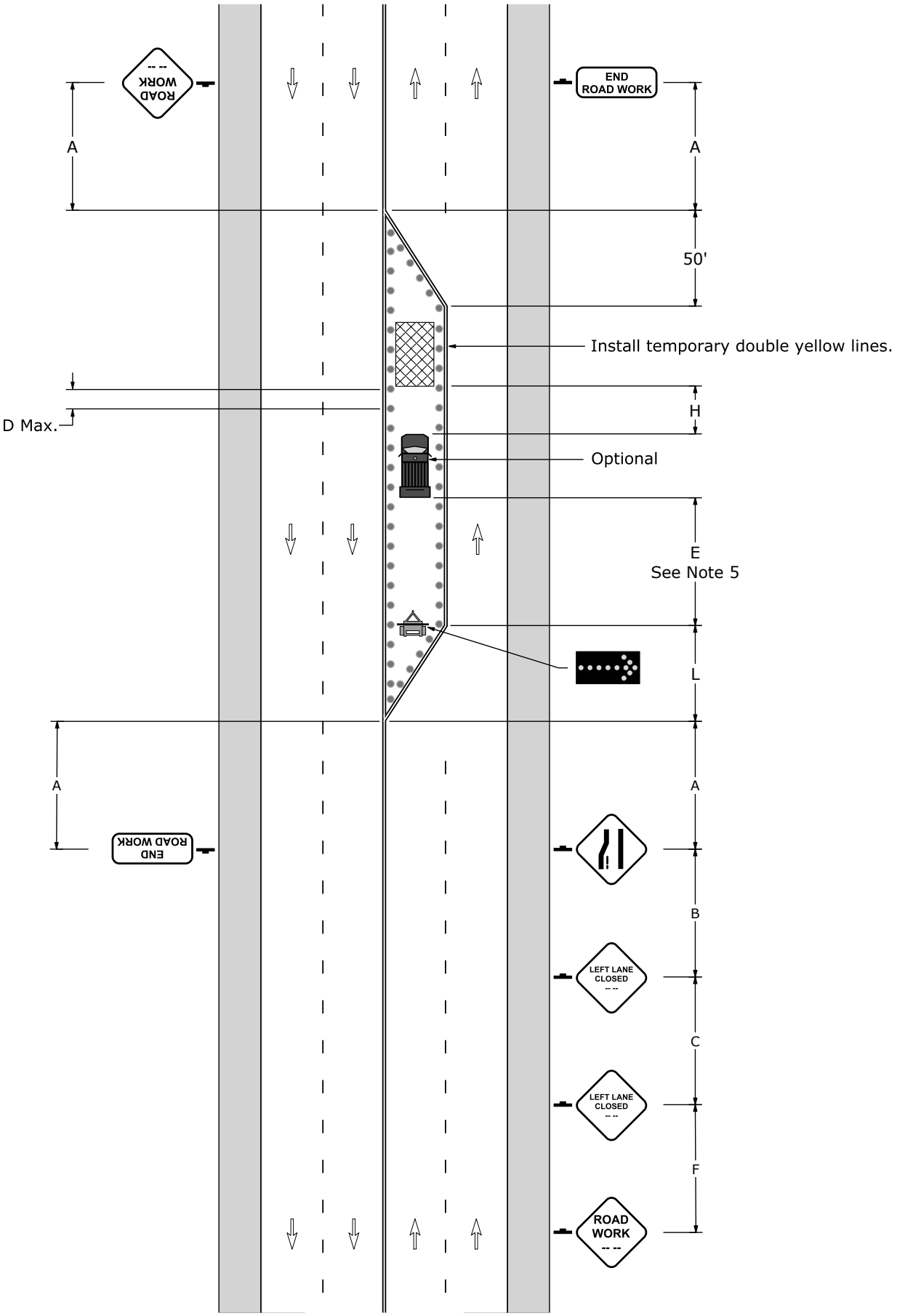
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 210 (Old PATA 31)
Work Space In The Left Or Right Lane Of A Two-Lane Approach



PATA 211 (Old PATA 32) - Notes

1. Placement of two consecutive Lane Closed (W20-5L or W20-5R) signs is required for roadways with a speed limit of 45 MPH or greater and is optional for roadways with a speed limit of 40 MPH or less.

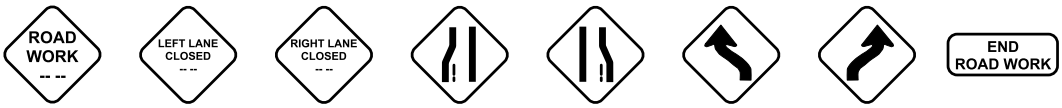
2. If shadow vehicles are used, use two as shown on the PATA drawing.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

4. Refer to PATA 008 for reverse curve/turn signing.

5. Refer to PATA 012 for arrow panel sizing.

Signs



W20-1 W20-5L W20-5R W4-2L W4-2R W1-4L W1-4R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

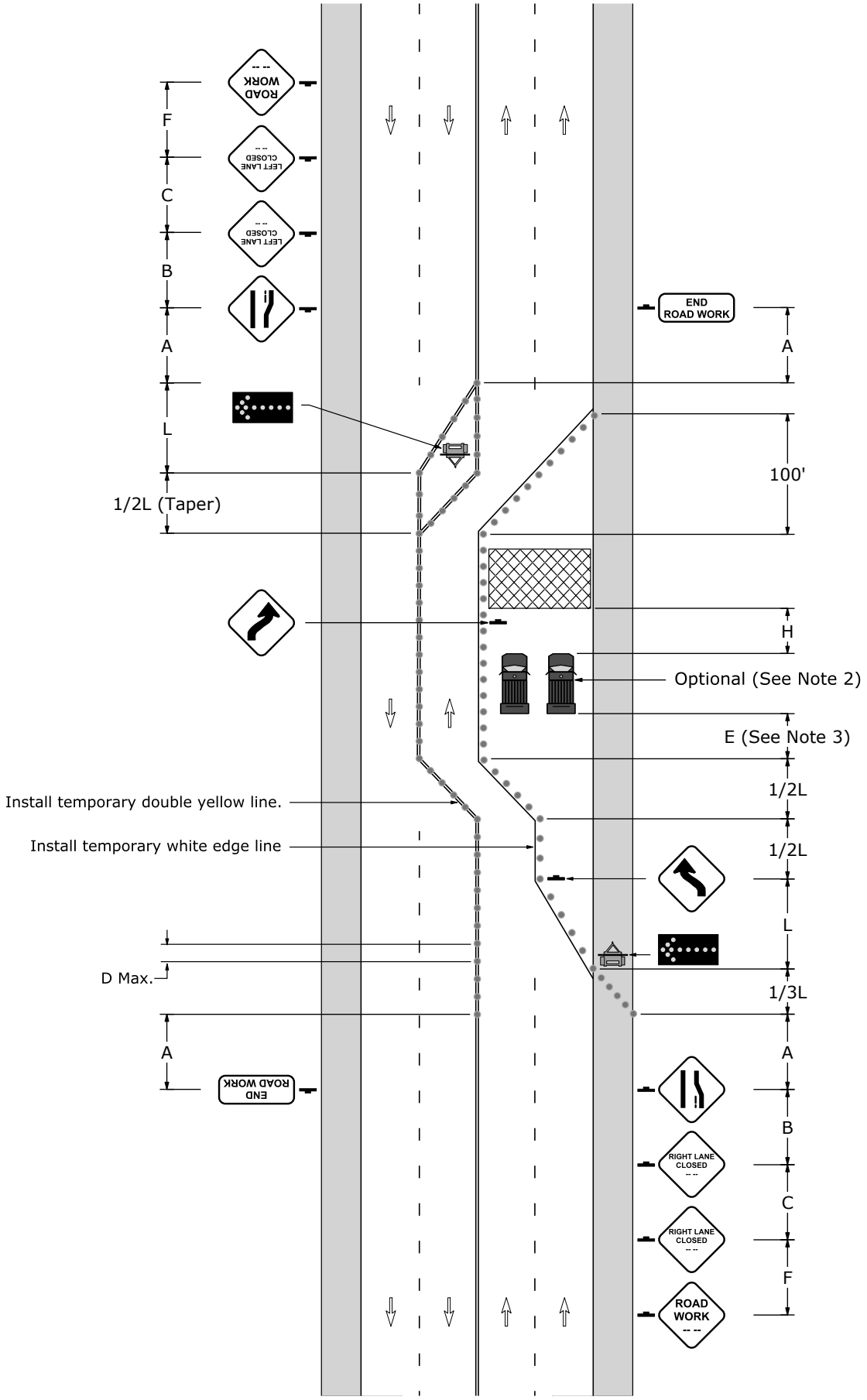
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 211 (Old PATA 32)
Work Space Requiring Closure Of One Side Of A Four-Lane Undivided Highway



PATA 212 (Old PATA 33) - Notes

1. For left lane closures, the Left Lane Closed (W20-5L) sign shall be used instead of the Right Lane Closed (W20-5R) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Placement of two consecutive Lane Closed (W20-5L or W20-5R) signs is required for roadways with a speed limit of 45 MPH or greater and is optional for roadways with a speed limit of 40 MPH of less.

3. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

4. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5L W20-5R W4-2L W4-2R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

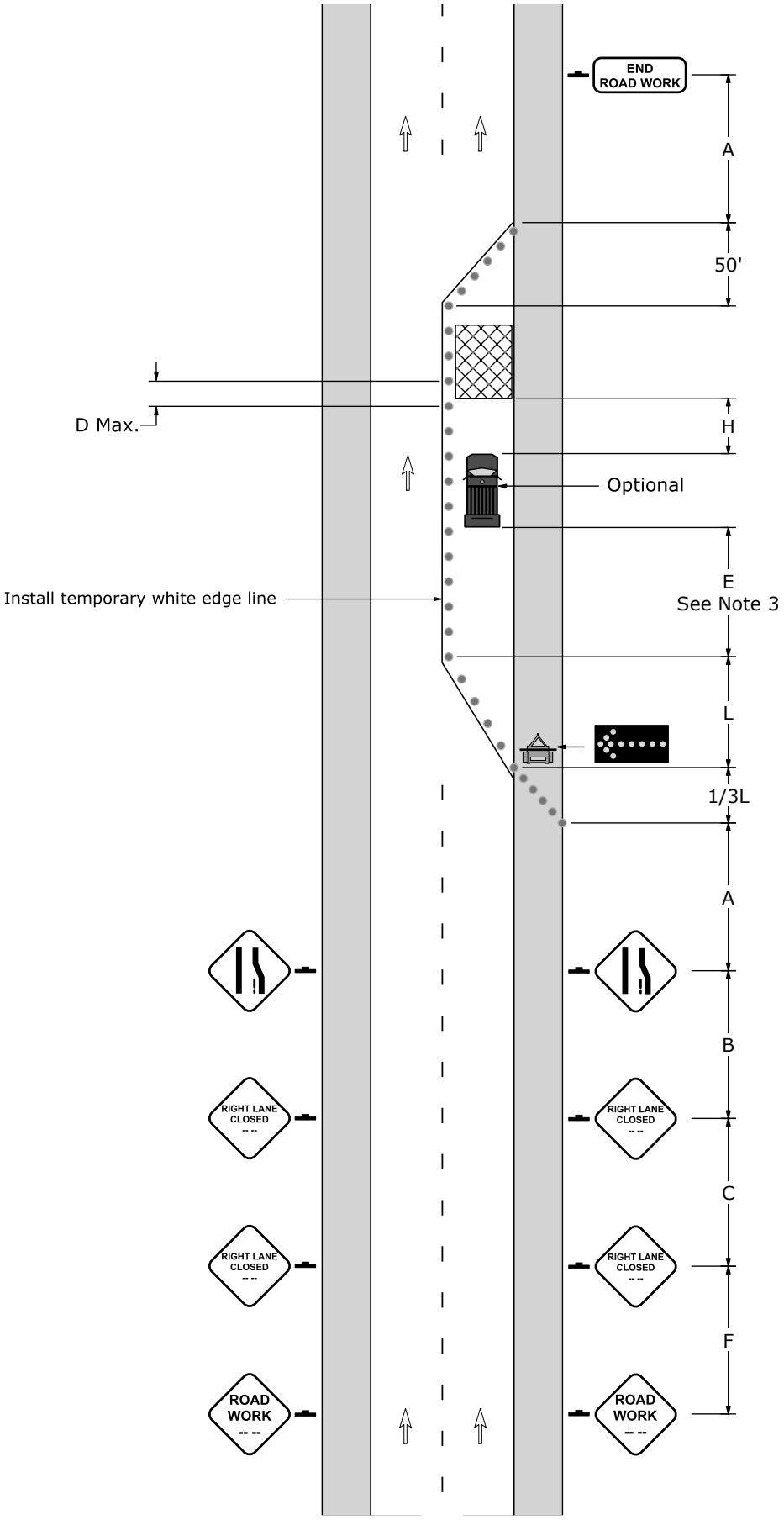
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 212 (Old PATA 33)
Work Space In The Left Or Right Lane



PATA 213 (Old PATA 35) - Notes

1. If the left two lanes are closed, the Left Two Lanes Closed (W20-5AL) sign shall be used instead of the Right Two Lanes Closed (W20-5AR) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Placement of two consecutive Two Lanes Closed (W20-5AL or W20-5AR) signs is required for roadways with a speed limit of 45 MPH or greater and is optional for roadways with a speed limit of 40 MPH of less.

3. If shadow vehicles are used, use two as shown on the PATA drawing.

4. When a shadow vehicle is not used, distance E is measured from end of taper to beginning of work space.

5. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5AL W20-5AR W4-2L W4-2R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

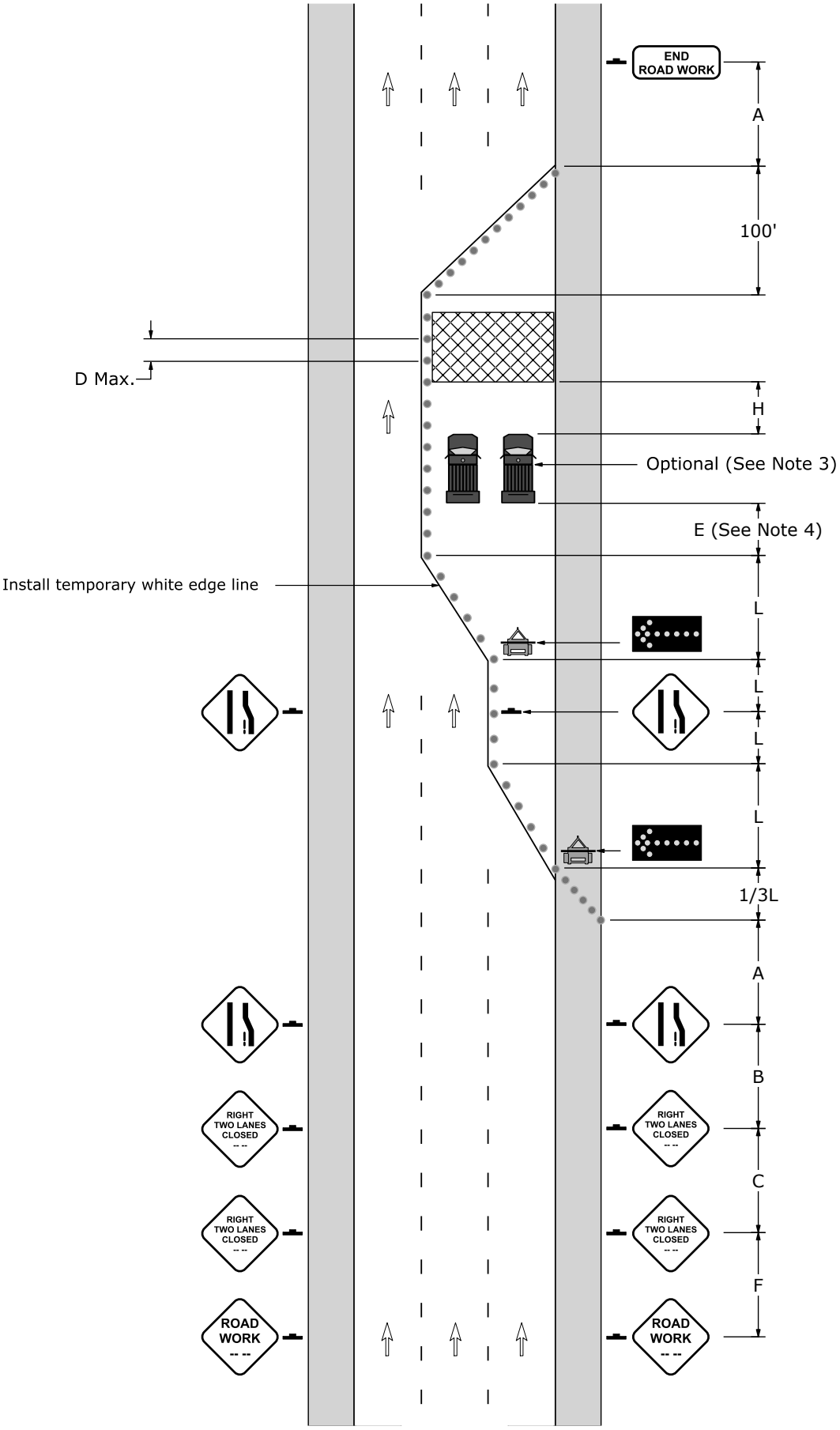
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 213 (Old PATA 35)
Work Space In Two Adjacent Lanes



PATA 214 (Old PATA 38) - Notes

1. The maximum length of temporary one-lane operation, excluding transitions, should not exceed approximately 3 miles. Temporary one-lane operations longer than approximately 3 miles shall only be permitted if justified by an engineering analysis of crossover locations, traffic operations, safety, and other related factors.

2. The alignment of the crossover may be designed as a reverse curve. When the crossover follows a curved alignment, the design criteria contained in Publication 13M (Design Manual Part 2 - Highway Design) should be used.

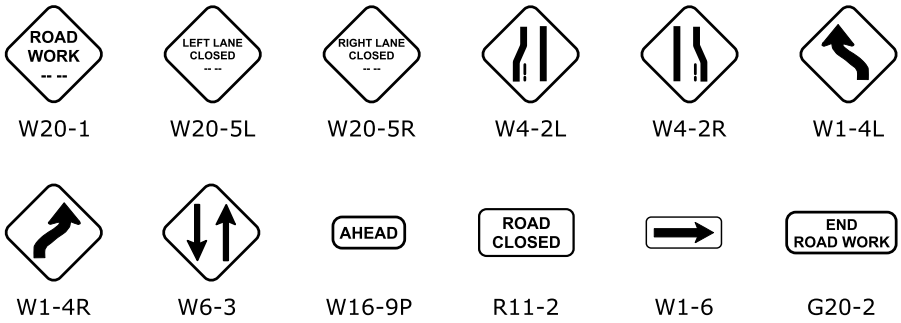
3. Placement of two consecutive Lane Closed (W20-5L or W20-5R) signs is required for all roadways with a speed limit of 45 MPH or greater and is optional for roadways with a speed limit of 40 MPH or less.

4. Refer to PATA 008 for reverse curve/turn signing.

5. Refer to PATA 012 for arrow panel sizing.

6. Refer to PATA 507 for use of barrier.

Signs



W20-1 W20-5L W20-5R W4-2L W4-2R W1-4L

W1-4R W6-3 W16-9P R11-2 W1-6 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

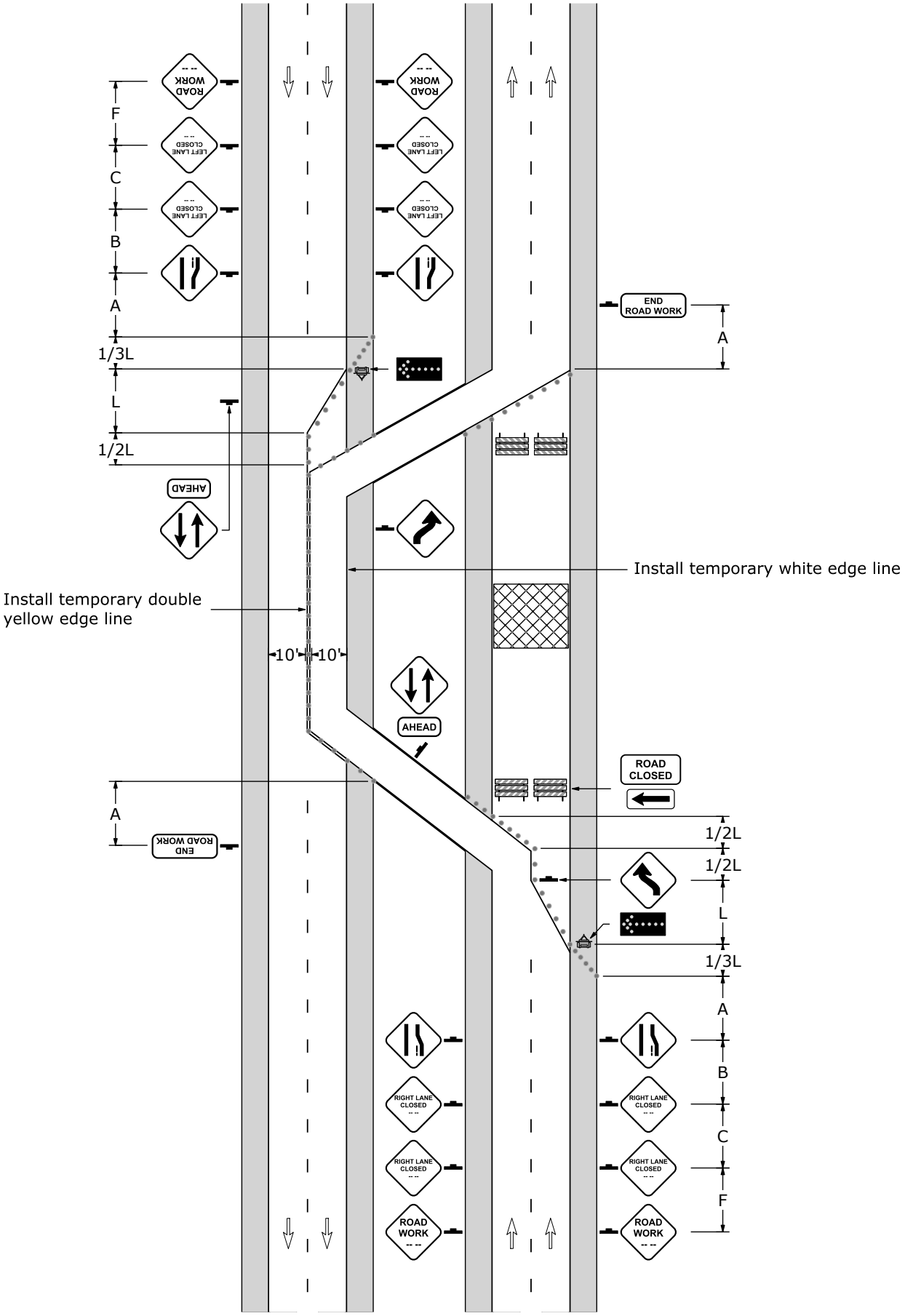
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 214 (Old PATA 38)
Two-Way Traffic On One Roadway Of A Normally Divided Highway



PATA 215 (Old PATA 39a) - Notes

1. Regulatory traffic control devices should be modified as needed for the duration of the detour.

2. If the road is opened for some distance beyond the intersection and/or there are significant origin/ destination points beyond the intersection, the Road Closed (R11-3A) and Detour Arrow (M4-10L or M4-10R) signs on the Type III Barricades may be located at the edge of the traveled way.

3. Unless otherwise specified, all traffic control devices for the detour shall be furnished, erected, modified, maintained, and subsequently removed by the contractor for contract operations or by the permittee for permit operations.

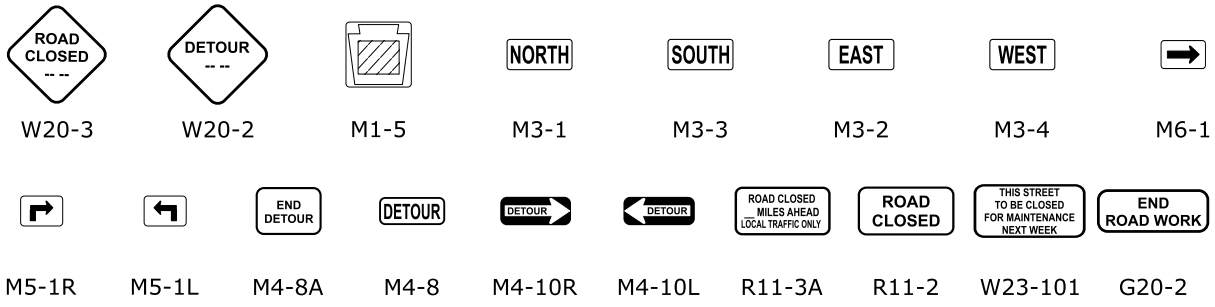
4. The size of the route marker assemblies shall comply with Publication 236 (Handbook of Approved Signs).

5. For scheduled or emergency closures of 7 consecutive days or less, PATA 216 may be used.

6. On multi-lane streets, additional detour signs with Advance Turn Arrow (M5-1L or M5-1R) signs should be posted prior to the detour signs with Turn Arrow (M6-1) signs.

7. This Street To Be Closed For Maintenance Next Week (W23-101) signs should be installed for scheduled work. Install the signs at most appropriate locations.

Signs



W20-3 W20-2 M1-5 M3-1 M3-3 M3-2 M3-4 M6-1

M5-1R M5-1L M4-8A M4-8 M4-10R M4-10L R11-3A R11-2 W23-101 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

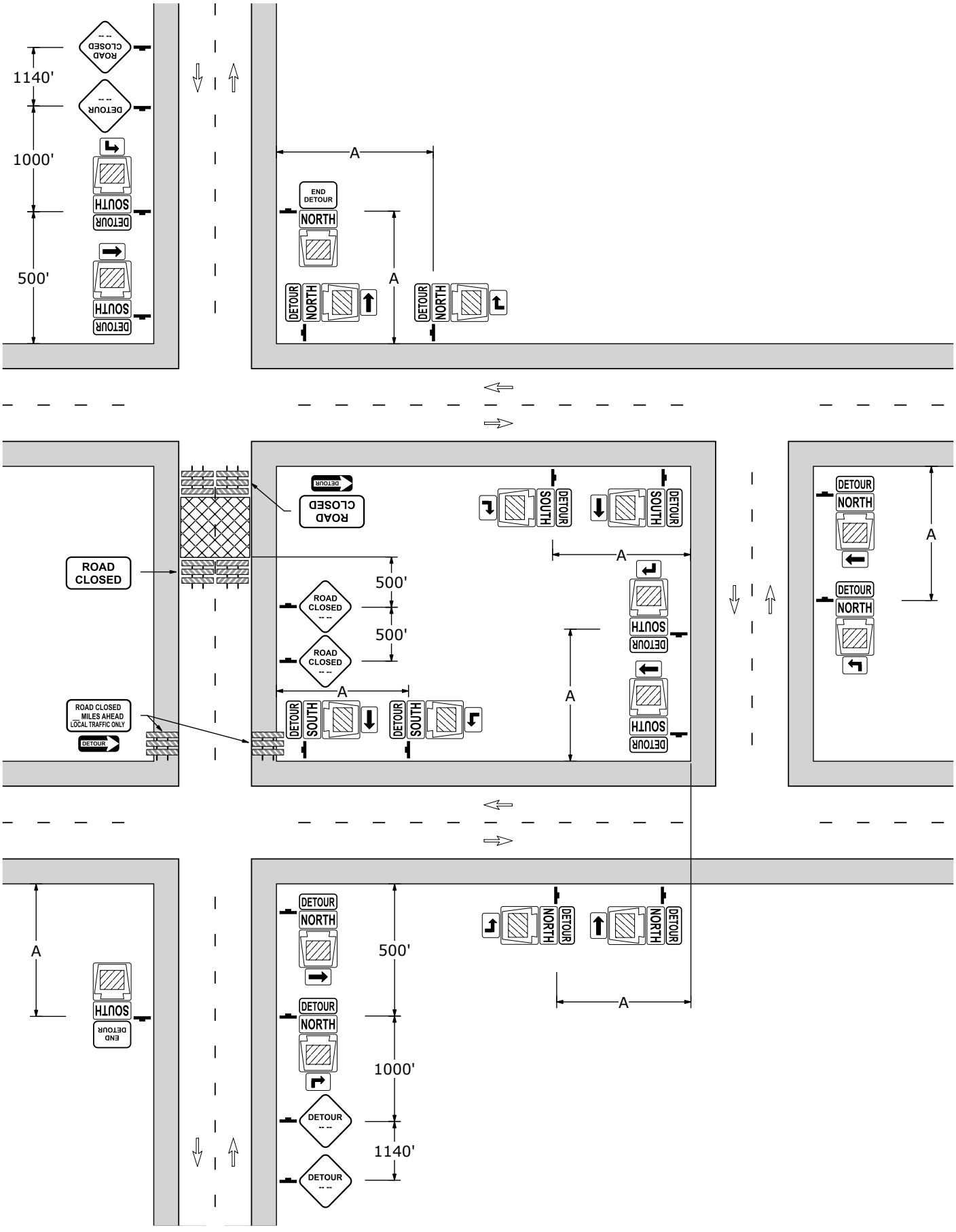
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 215 (Old PATA 39a)
Detour Of A Numbered Traffic Route



PATA 216 (Old PATA 39b) - Notes

1. Regulatory traffic control devices should be modified as needed for the duration of the detour.

2. If the road is opened for some distance beyond the intersection and/or there are significant origin/ destination points beyond the intersection, the Road Closed (R11-3A) and Detour Arrow (M4-10L or M4-10R) signs on the Type III Barricades may be located at the edge of the traveled way.

3. Unless otherwise specified, all traffic control devices for the detour shall be furnished, erected, modified, maintained, and subsequently removed by the contractor for contract operations or by the permittee for permit operations.

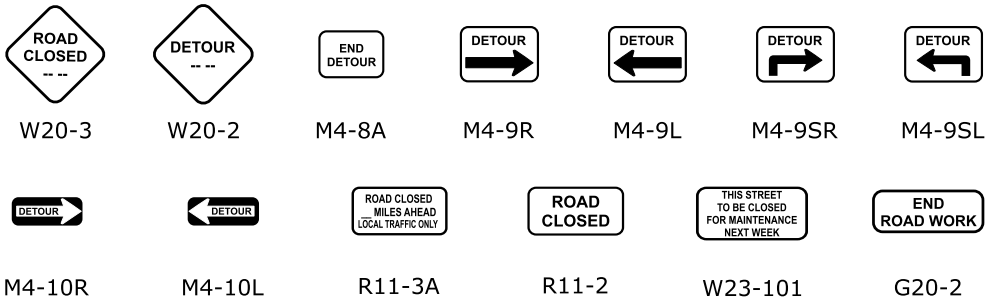
4. The size of the route marker assemblies shall comply with Publication 236 (Handbook of Approved Signs).

5. At locations where there are overlapping detours or several detours within the same area, street names may be added above the Detour (M4-9L or M4-9R) signs, or signs with different colored arrows may be used to designate the different detour routes. The design and application of signs displaying colored arrows shall comply with Publication 236 (Handbook of Approved Signs).

6. On multi-lane streets, additional detour signs with Advance Turn Arrow (M5-1L or M5-1R) signs should be used in advance of a turn

7. This Street To Be Closed For Maintenance Next Week (W23-101) signs should be installed for scheduled work. Install the signs at most appropriate locations.

Signs



W20-3 W20-2 M4-8A M4-9R M4-9L M4-9SR M4-9SL

M4-10R M4-10L R11-3A R11-2 W23-101 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

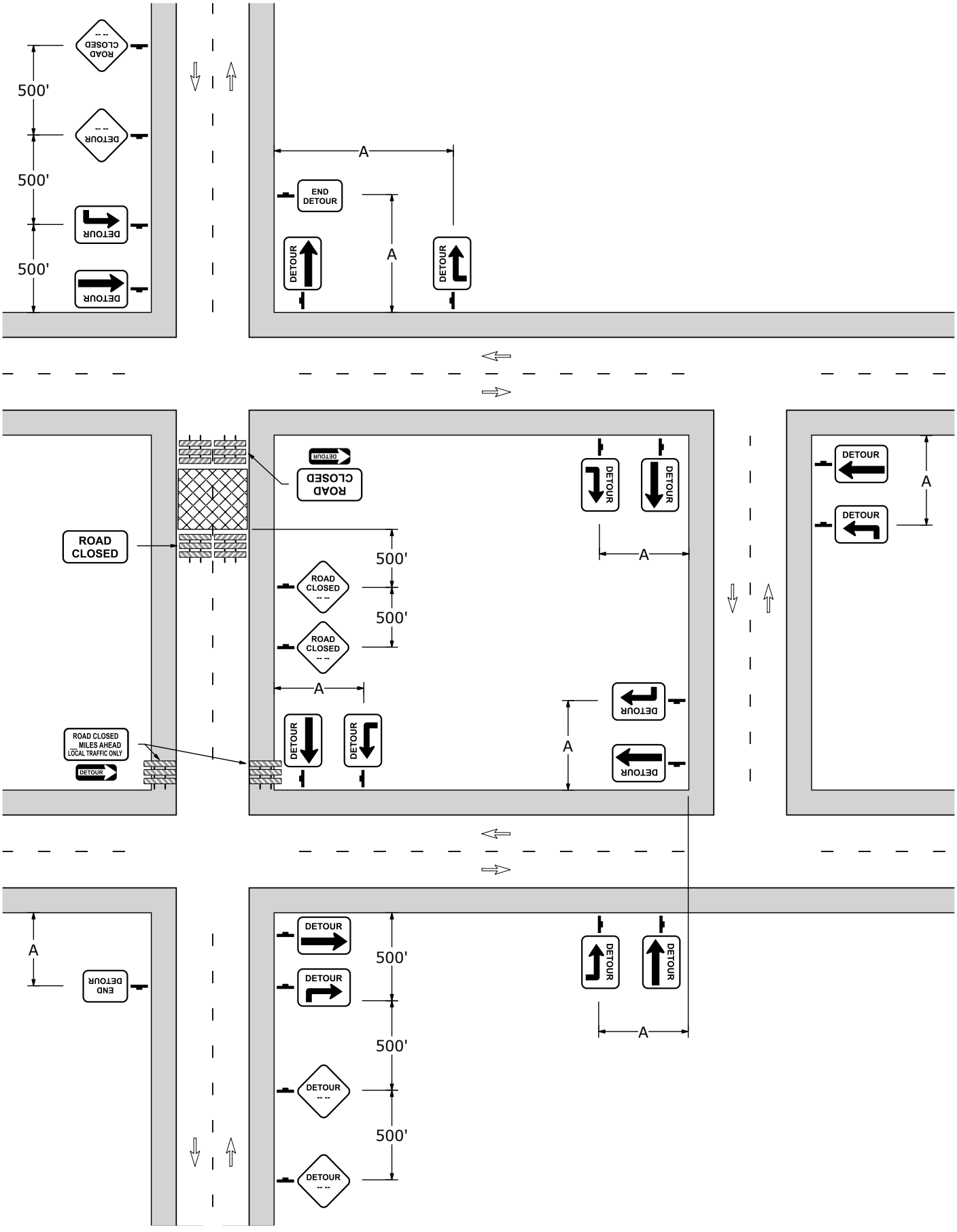
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 216 (Old PATA 39b)
Detour Of A Quadrant Route (4 Digit State Road)



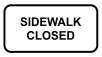
PATA 217 (Old PATA 40) - Notes

1. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

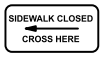
2. Only the temporary traffic control devices related to pedestrians are shown. Other devices may be used to control vehicular traffic.

Signs

W20-1



R9-9



R9-11a

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

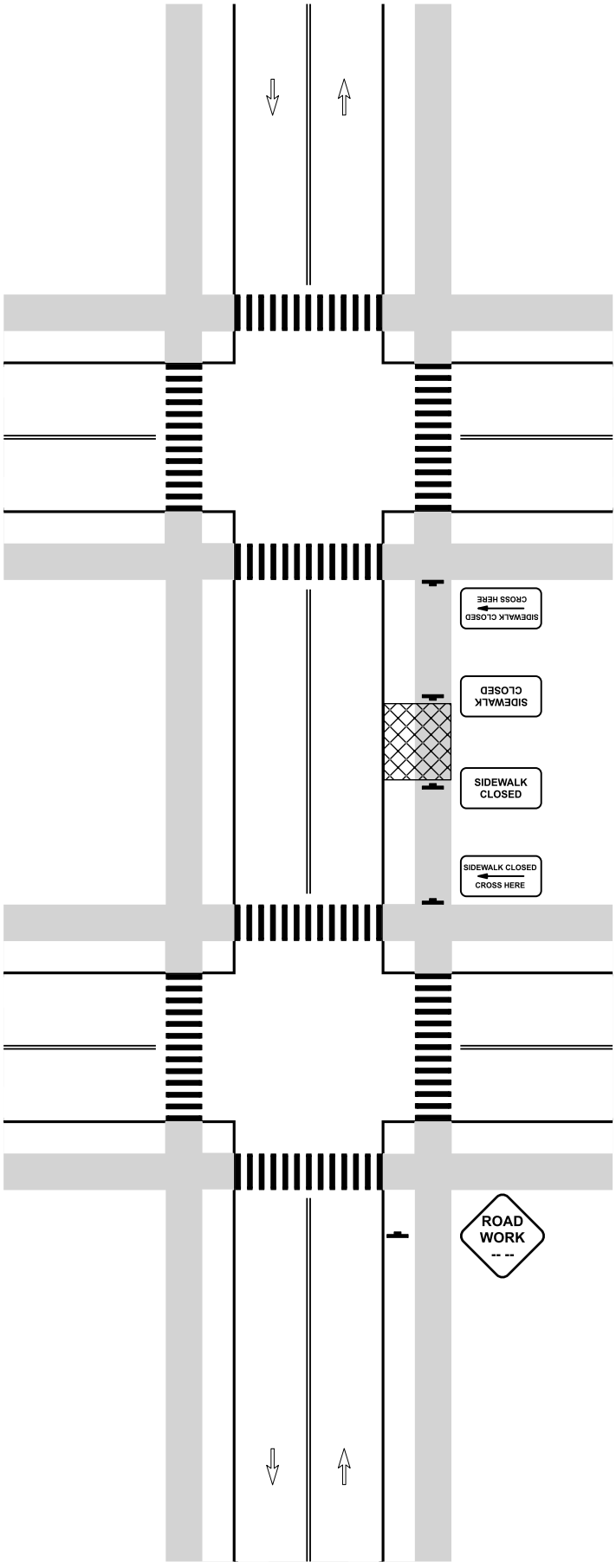
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 217 (Old PATA 40)
Sidewalk Closure; Pedestrian Detour



PATA 218 (Old PATA 40) - Notes

1. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

2. Use channelizing devices to separate and maintain temporary pedestrian walkway while sidewalk is closed. Where high speeds are anticipated, a temporary traffic barrier with appropriate end treatments should be used to separate the temporary walkways from vehicular traffic.

3. Only the temporary traffic control devices related to pedestrians are shown. Other devices may be used to control vehicular traffic.

4. When it is not possible to maintain a minimum width of 60" throughout the entire length of the pedestrian pathway, a 60"x60" passing space should be provided at least every 200' to allow individuals in wheelchairs to pass. A minimum 48" wide accessible path shall be maintained for the length of sidewalk diversion.

Signs

W20-1 R9-9 R9-11a

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

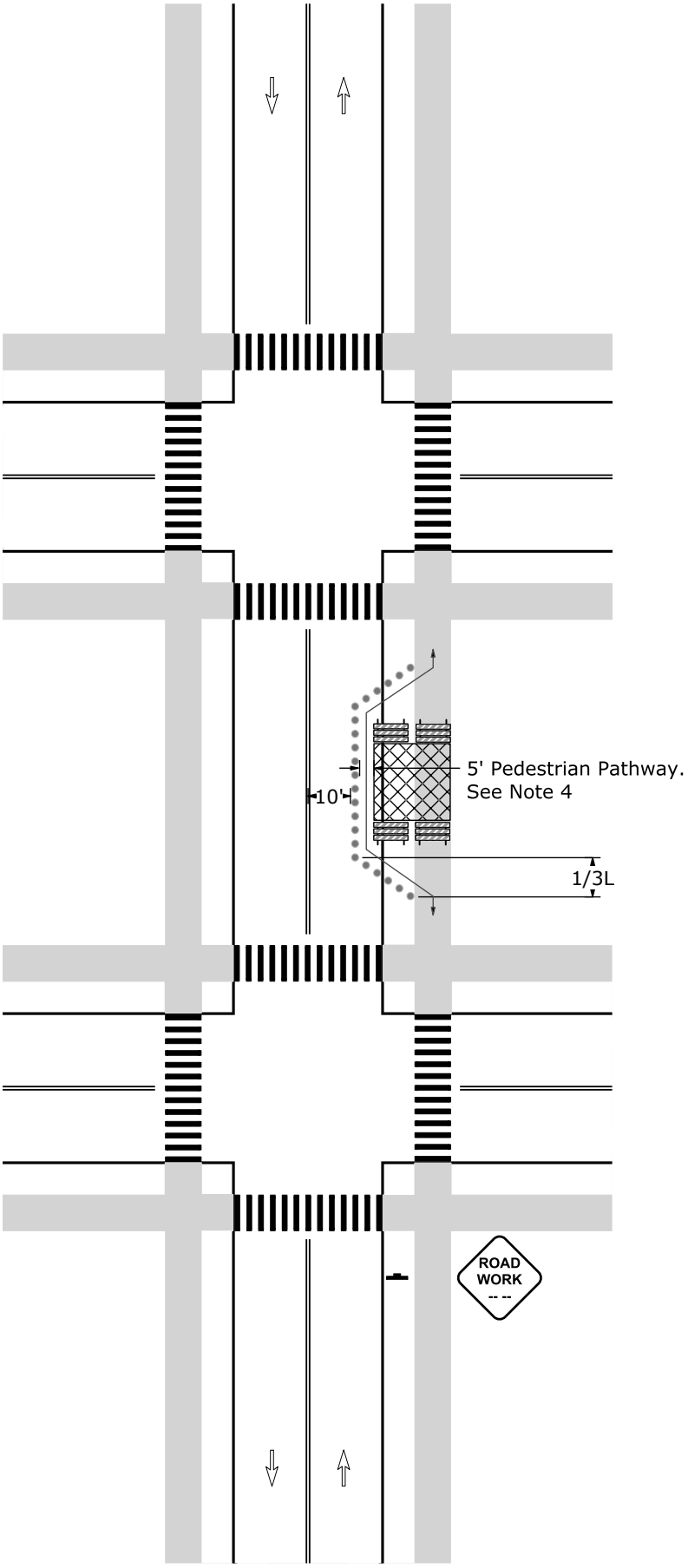
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 218 (Old PATA 40)
Sidewalk Closure; Pedestrian Diversion



PATA 219 (Old PATA 41) - Notes

1. When crosswalks or other pedestrian facilities are closed or relocated and there is not an alternate marked crossing within 300', an engineering and traffic study is required to determine the appropriate location of a temporary pedestrian crossing. PennDOT approval shall be obtained prior to installing a midblock crosswalk. Every temporary crossing shall be detectable and include accessibility features (curb ramps, landing areas, etc.) consistent with the features present in the existing pedestrian facility.

2. Parking is not permitted within 75' of a midblock crosswalk, unless a 6' to 8' curb extension is in place to improve pedestrian visibility.

3. Pedestrian traffic signal displays controlling closed crosswalks shall be covered and deactivated.

4. Only temporary traffic control devices related to pedestrians are shown. Other devices may be used to control vehicular traffic.

5. The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway or other pedestrian facility. When it is not possible to maintain a minimum width of 60" throughout the entire length of the pedestrian pathway, a 60"x60" passing space should be provided at least every 200' to allow individuals in wheelchairs to pass.

6. Any channelizing devices approved for long term operations may be used for closing the sidewalk.

Signs

W20-1 W11-2 W16-7P W16-9P R9-9 R9-10 R9-11a

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

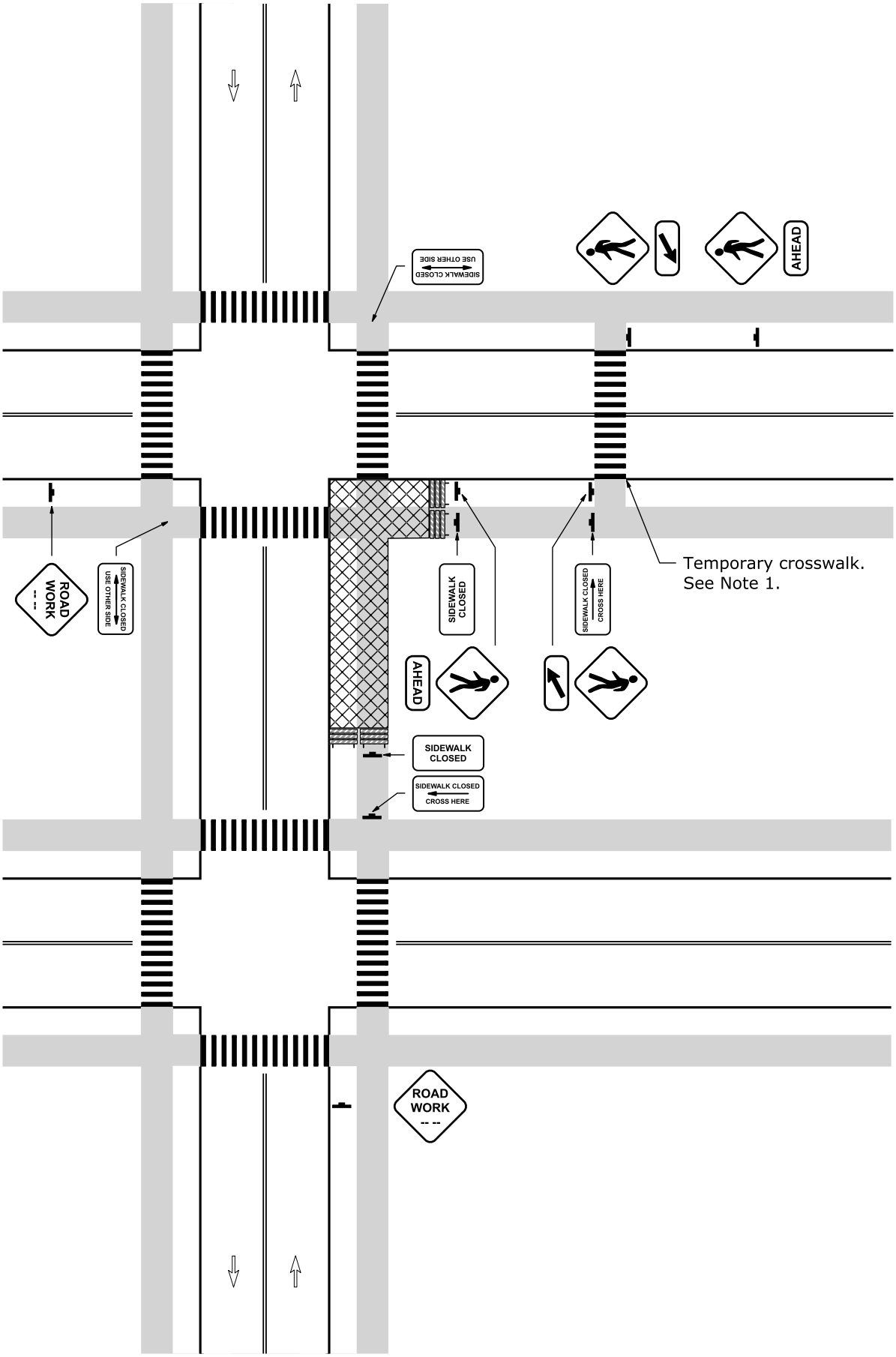
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 219 (Old PATA 41)
Sidewalk and Crosswalk Closure; Pedestrian Detour



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Conventional Highways

Mobile Operations
(PATA 300 Series)

PATA 301 (Old PATA 6) - Notes

1. Traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2’ behind curb, or 15’ or more from the edge of any roadway.

2. For operations 60 minutes or less, the Length of Work (G20-1) sign may be eliminated if both the shadow vehicle and work vehicle have an activated flashing or revolving yellow light.

3. For a work area greater than 3 miles, a second Length Of Work (G20-1) sign may be installed at the end of the first 3 mile segment.

4. When a shadow vehicle is not used, distance A is measured from the Length Of Work (G20-1) sign location to beginning of work space.

Signs

G20-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

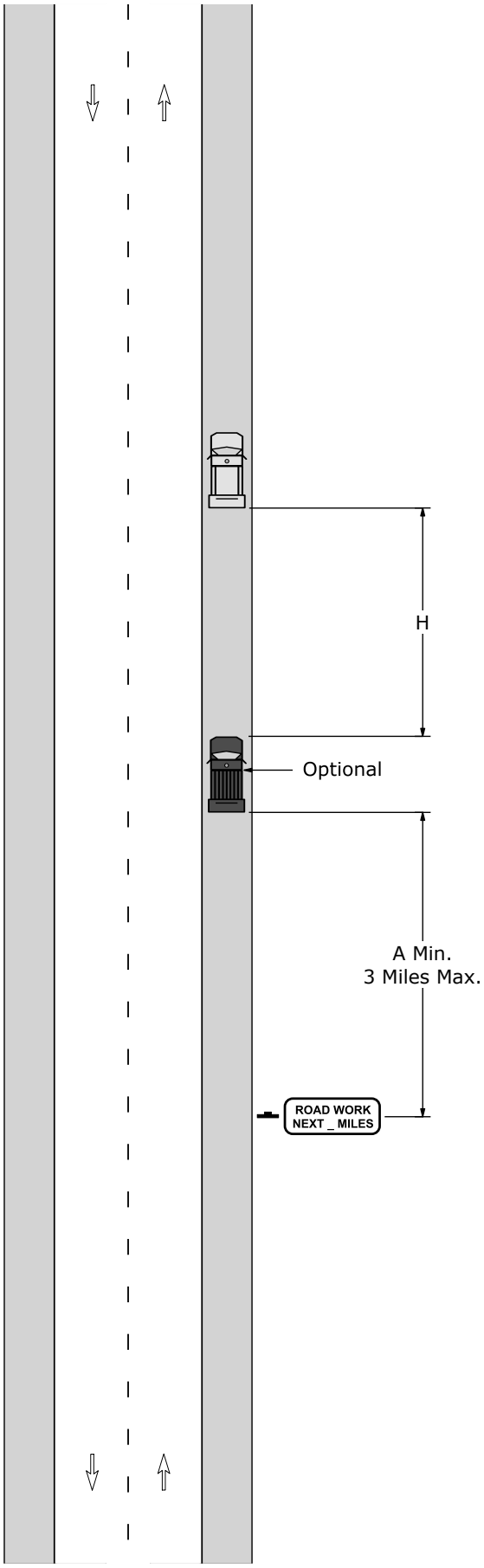
When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 301 (Old PATA 6)
Work Space On Or Beyond The Shoulder (No Roadway Encroachment)



PATA 302 (Old PATA 11a) - Notes

1. Each flagger shall be clearly visible to traffic for a minimum distance of E and shall be in constant communication with all other flaggers. Additional flaggers are required to control traffic from side road intersections that exist between Flagger A and Flagger B.

2. Place the Be Prepared To Stop Next XX Miles (W20-10a) sign after the One Lane Road (W20-4) sign on each approach as shown. The length of the work zone must be displayed on each of the Be Prepared To Stop Next XX Miles (W20-10a) signs. Interim Be Prepared To Stop (W3-4) signs are required for any project over 1 mile in length and shall be spaced at intervals not exceeding one mile throughout the work zone.

3. The signing for intersecting roads is optional but when signed, a Be Prepared To Stop (W3-4) sign shall be installed on the roadway where work is taking place in the direction of the work being performed.

4. The distance between the flagger and the Be Prepared To Stop Next XX Miles (W20-10a) sign or the Be Prepared To Stop (W3-4) sign shall be a minimum A and maximum of 1 mile. The minimum A distance is not required between the flagger and the interim Be Prepared To Stop (W3-4) signs.

5. If there will be no flaggers after a Be Prepared To Stop (W3-4) sign, the Be Prepared To Stop (W3-4) sign should be removed or turned away from traffic.

6. Flagger A and Flagger B can continuously move if there is proper sight distance. If there is not proper sight distance, the appropriate flagger relocation option shall be utilized. (See PATA 302A)

Signs

W20-1 W20-4 W20-10A W3-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

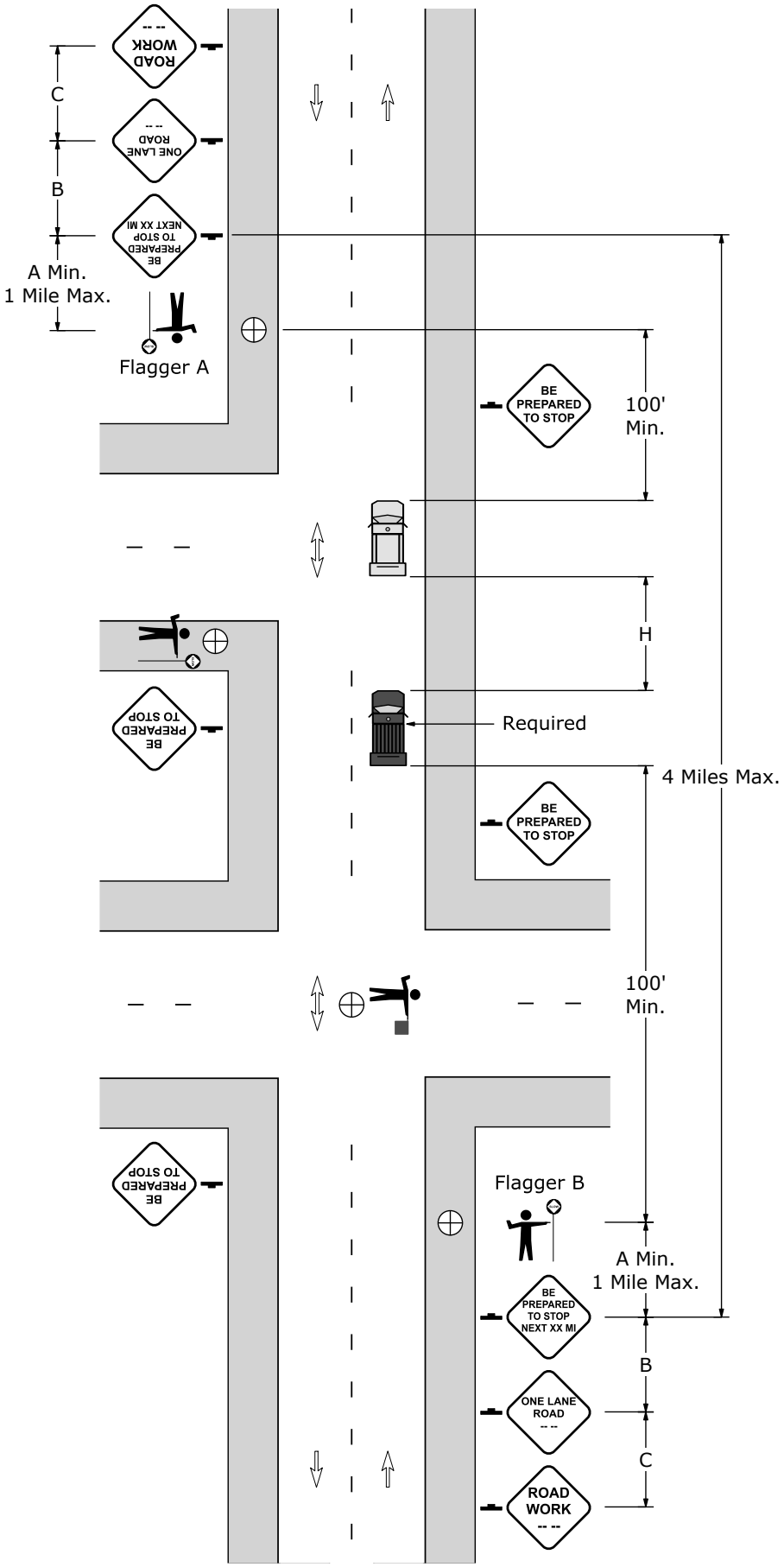
When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 302 (Old PATA 11a)
Mobile Flaggers



PATA 302A (Old PATA 11a) - Notes
Flagger Relocation

Option A

(Walking)

1. To relocate Flagger A:

   a. While Flagger B has traffic stopped, Flagger A will release traffic and walk downstream to new position, with proper sight distance, while displaying slow side of stop/slow paddle to traffic.

   b. Do not attempt to relocate flagger A while flagger A is holding stopped traffic.

2. To relocate Flagger B:

   a. Station Flagger C (Temporary) at the transition position while Flagger A and Flagger B have traffic stopped.

   b. When Flagger C (Temporary) is in position, Flagger B releases traffic and walks towards the transition position while holding stop/slow paddle at side.

   c. When Flagger B arrives at the Flagger C position, Flagger B will resume flagging duties.

Option B

(Work Vehicle)

1. To relocate Flagger A:

   a. While Flagger B has traffic stopped, Flagger A will release traffic and walk downstream to new position, with proper sight distance, while displaying slow side of stop/slow paddle to traffic.

   b. Do not attempt to relocate flagger A while flagger A is holding stopped traffic.

2. To relocate Flagger B:

   a. Station Flagger C (Temporary) at the transition position while Flagger A and Flagger B have traffic stopped.

   b. When Flagger C (Temporary) is in position, Flagger B releases traffic.

   c. Flagger B enters work vehicle for transportation to the new transition position.

   d. When Flagger B arrives at the Flagger C position, Flagger B will resume flagging duties.

Option C

(Pilot Vehicle)

1. To relocate Flagger A:

   a. While Flagger B has traffic stopped, Flagger A will release traffic and walk downstream to new position, with proper sight distance, while displaying slow side of stop/slow paddle to traffic.

   b. Do not attempt to relocate flagger A while flagger A is holding stopped traffic.

2. To relocate Flagger B:

   a. Flagger A and Flagger B will stop traffic.

   b. Pilot vehicle will move into position by Flagger B.

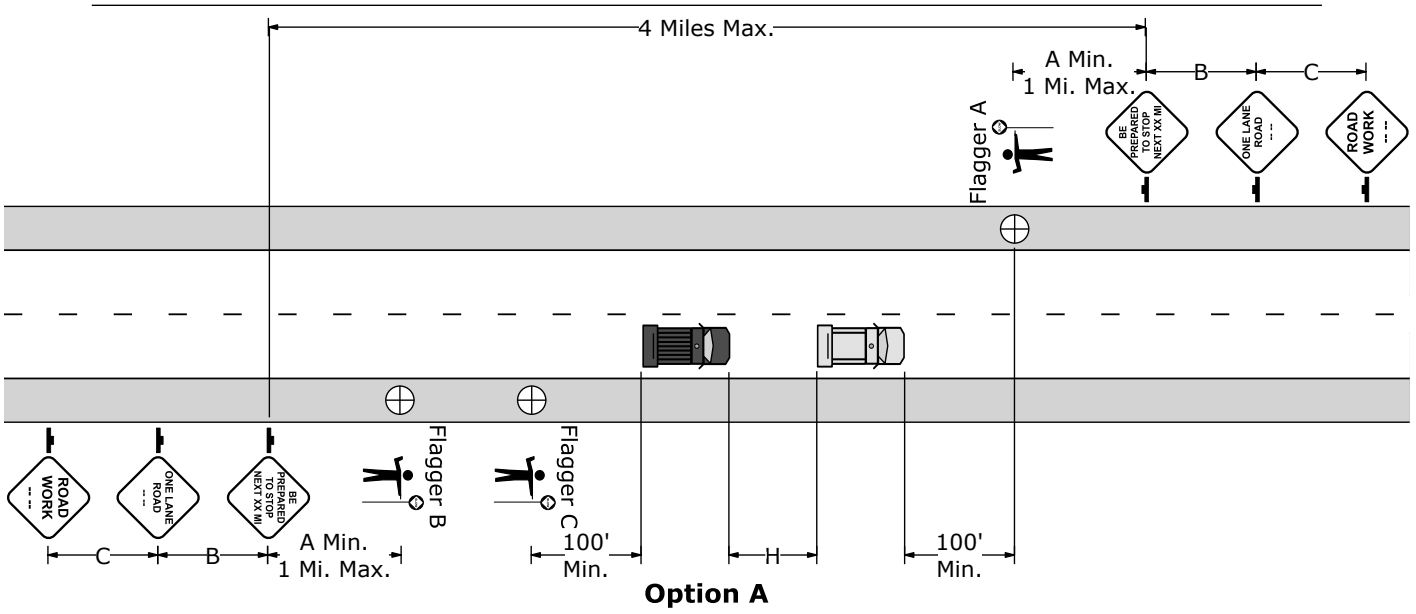
   c. Before pilot vehicle proceeds through work zone, Flagger B will enter pilot vehicle for transportation to new transition position.

   d. Flagger B will resume flagging duties at new transition position.

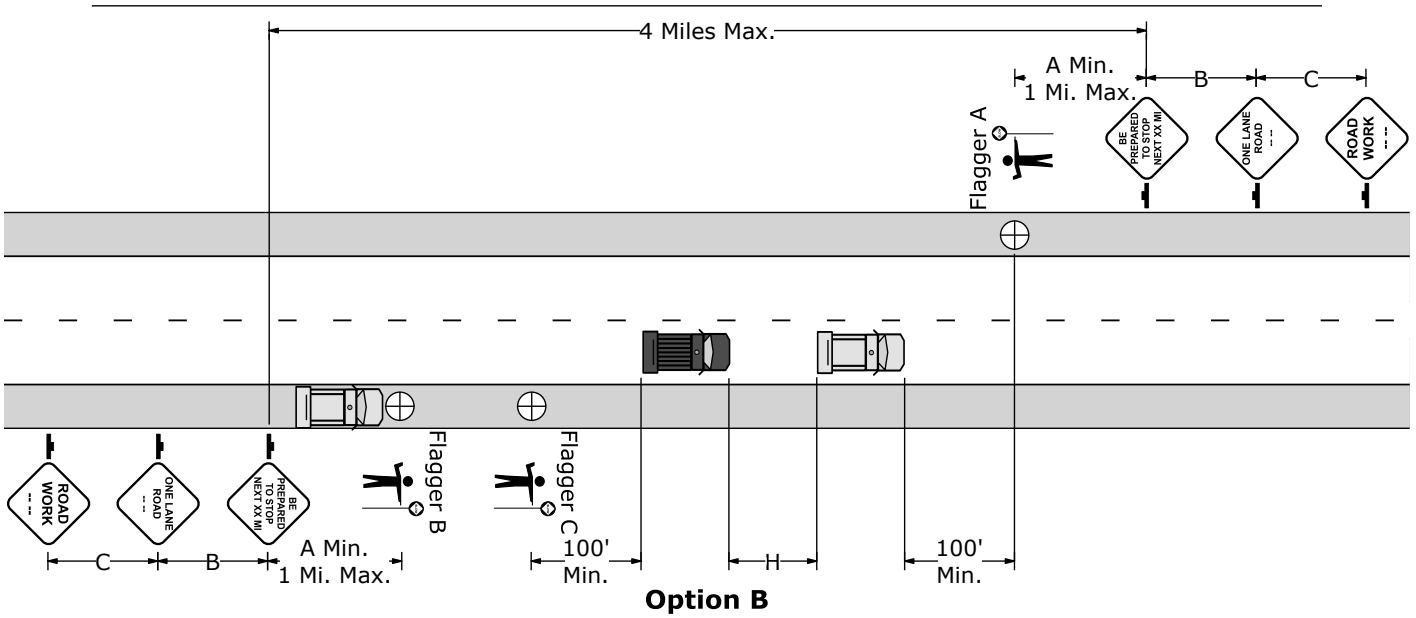
Note (All Options):

Flagger A shall only utilize walking when establishing a new flagging position. If the distance is too far to walk to the new flagging position (For a reason such as sight distance availability), all equipment shall be removed from the road and Flagger A shall be transported.

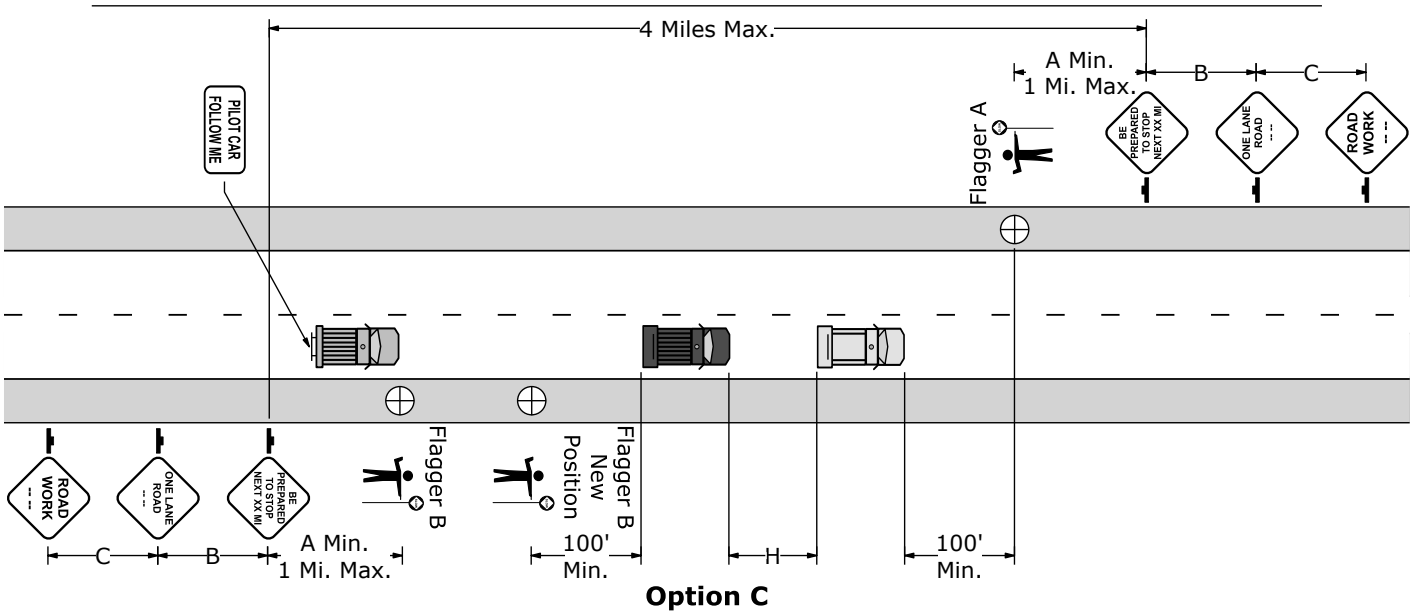
PATA 302A (Old PATA 11a)
Flagger Relocation



Option A



Option B



Option C

PATA 303 (Old PATA 12) - Notes

1. The shadow vehicle shall be positioned so that it is visible from behind the work vehicle for a minimum distance of A. The shadow vehicle should slow down in advance of vertical or horizontal curves that restrict sight distance.

2. Where passing is not permitted for extended lengths, the shadow and work vehicles should pull over periodically, when it is reasonable and safe, in order to allow traffic to resume normal speeds.

3. The shadow vehicle should be equipped with two high-intensity flashing lights mounted on the rear and located adjacent to the sign.

4. The shadow vehicle may be equipped with a flashing arrow panel in caution mode.

5. A "W Series" (W14-12, W21-14, W21-11, etc) sign or message board on the rear of the shadow vehicle is required.

6. Refer to PATA 012 for arrow panel sizing.

Signs

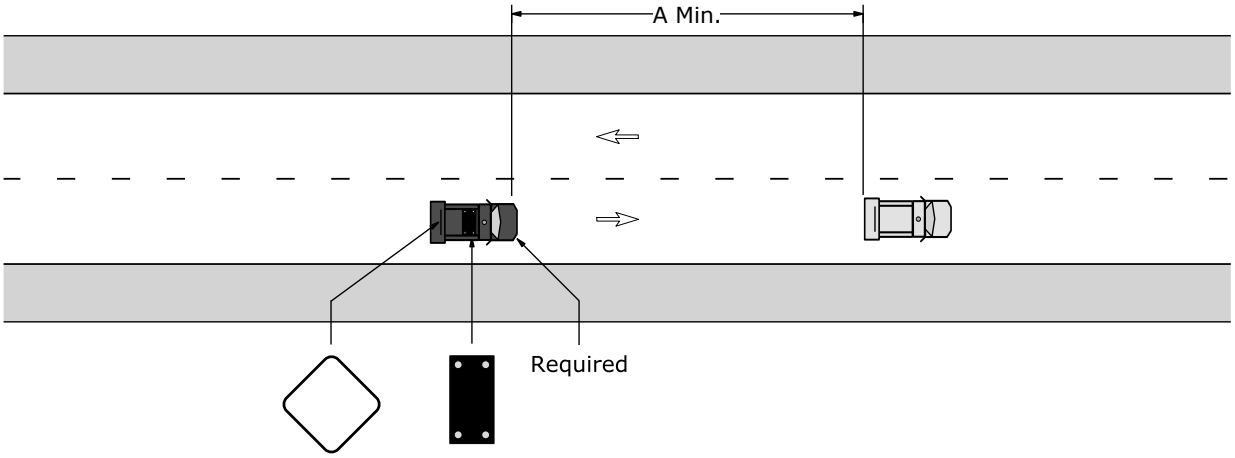
W20-1 W21-14 W21-11 W14-12

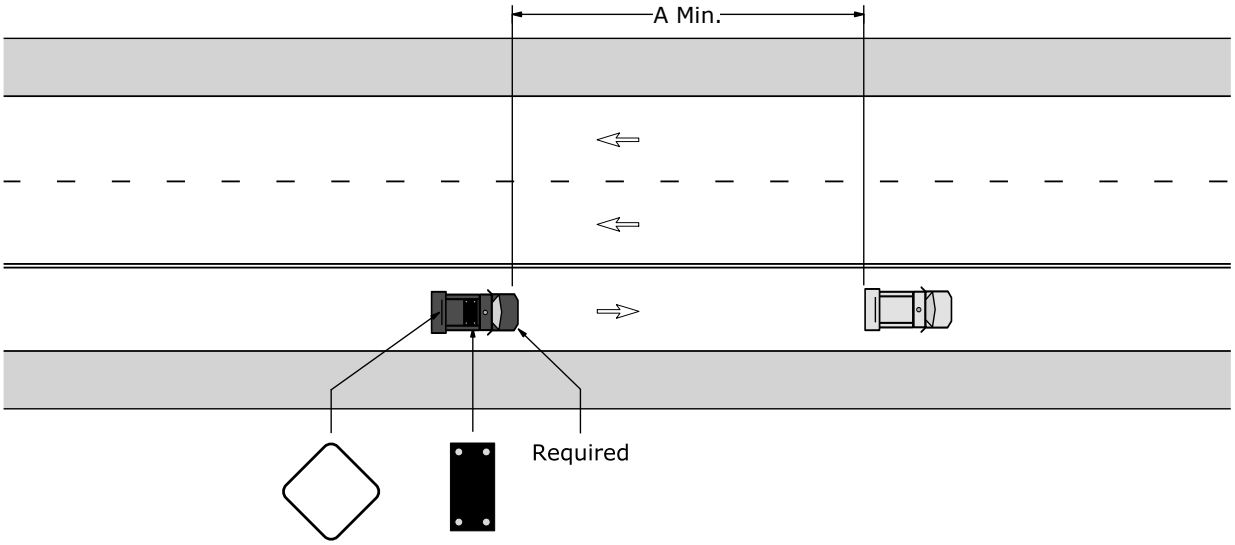
Sign Spacing Chart

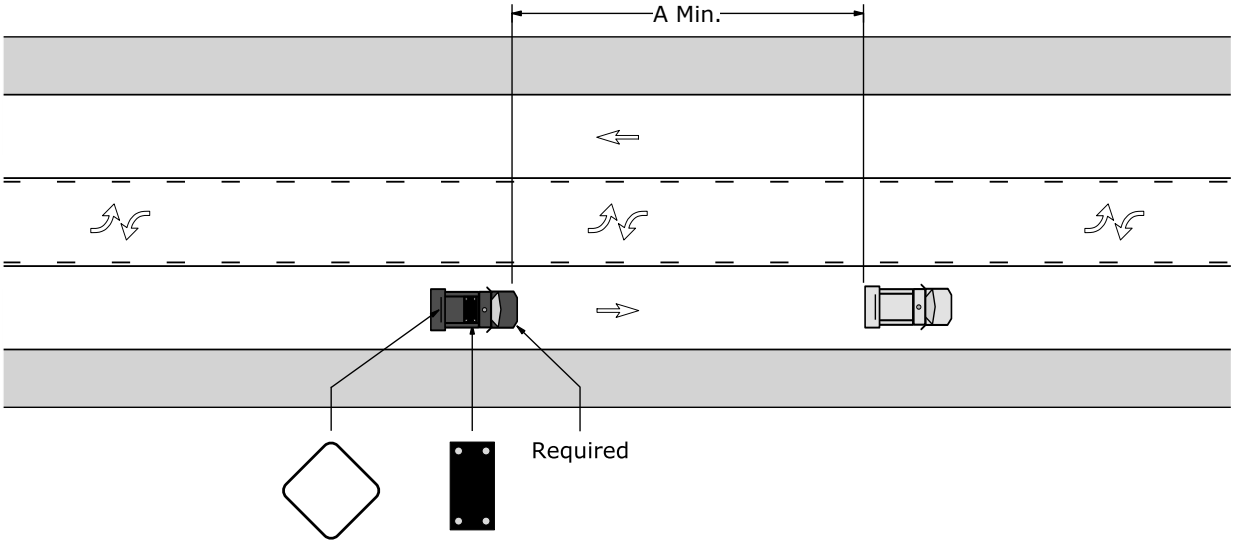
Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

PATA 303 (Old PATA 12)
Moving Lane Closure







PATA 304 (Old PATA 16) - Notes

1. Shadow vehicles are required unless otherwise stated on the PATA drawings.

2. Flashing arrow panels are required for all shadow vehicles. Placement of the Lane Closed (W20-5L or W20-5R) sign on shadow vehicle 2 and shadow vehicle 3 is optional. If used, it should be placed so that it will not diminish the target value of the flashing arrow panel.

3. If sufficient shoulder width is not available for the shadow vehicles positioned on the shoulder, shadow vehicles shall be positioned as close as possible to the shoulder edge.

4. Shadow vehicles are permitted to straddle edge lines.

5. Whenever adequate stopping sight distance exists to the rear, the shadow vehicle 1 should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

6. This operation should be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

7. Refer to PATA 012 for arrow panel sizing.

Signs

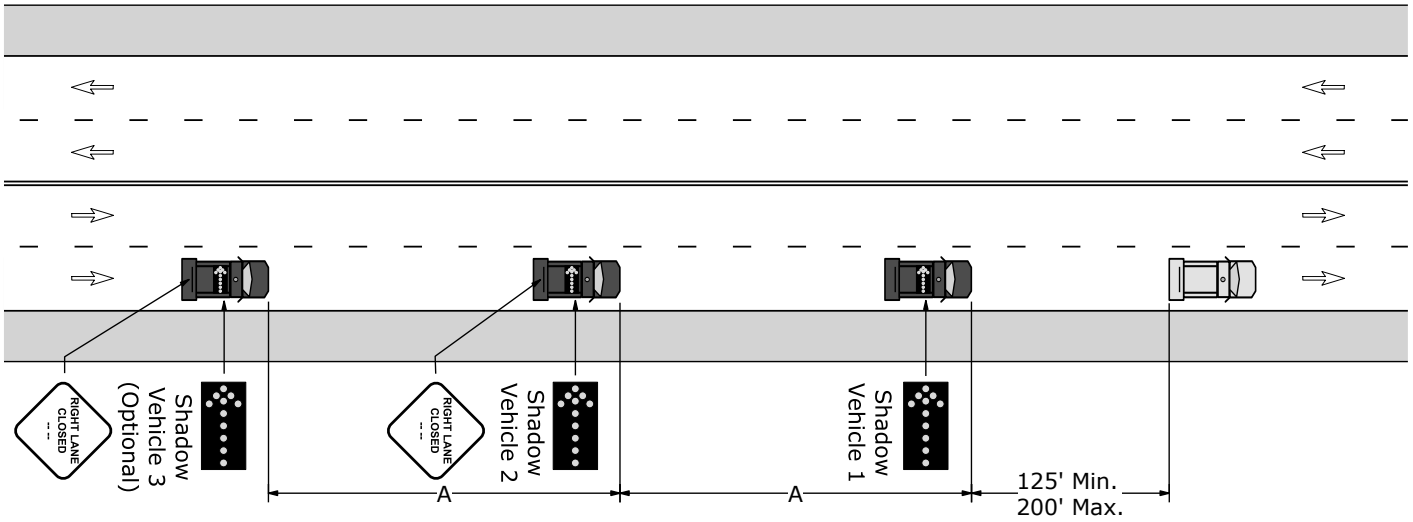
W20-1 W20-5L W20-5R

Sign Spacing Chart

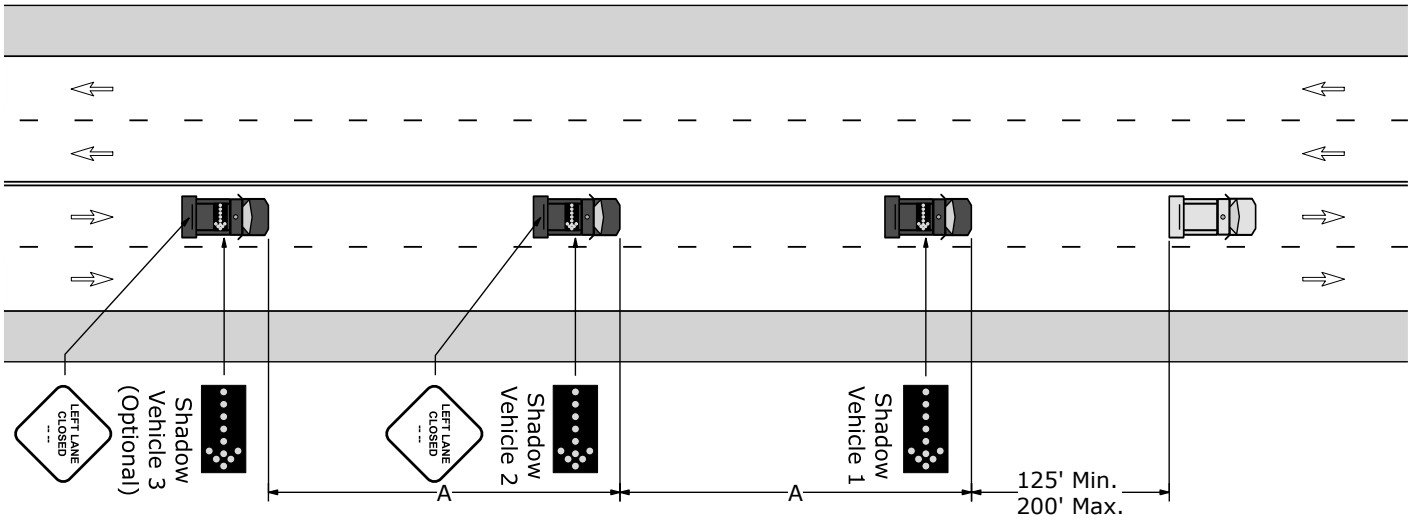
Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

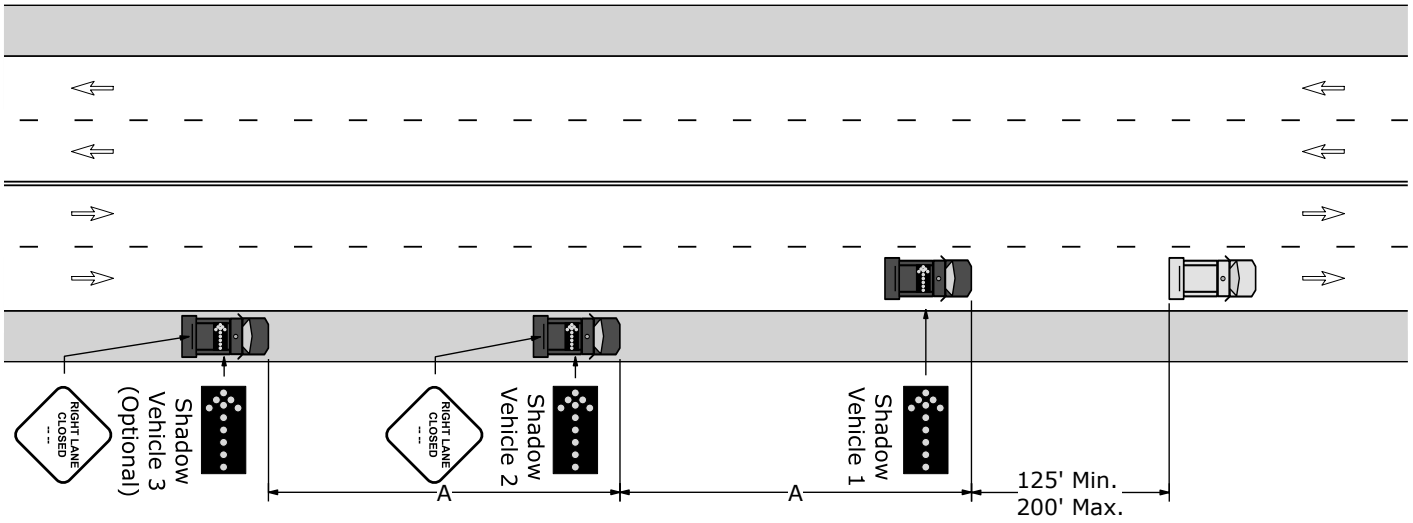
PATA 304 (Old PATA 16)
Work Space In The Left Or Right Lane Of A Two-Lane Approach



Continuously Moving Right Lane Operation - Traffic Merges To The Left



Continuously And Intermittently Moving Left Lane Operation - Traffic Merges To The Right



Intermittently Moving Right Lane Operation - Traffic Merges To The Left

PATA 305 (Old PATA 18) - Notes

1. Shadow vehicles are required unless otherwise stated on the PATA drawings.

2. Flashing arrow panels are required for all shadow vehicles. Placement of the Lane Closed (W20-5L or W20-5R) sign on shadow vehicle 2 and shadow vehicle 3 is optional. If used, it should be placed so that it will not diminish the target value of the flashing arrow panel.

3. If sufficient shoulder width is not available for the shadow vehicles positioned on the shoulder, shadow vehicles shall be positioned as close as possible to the shoulder edge.

4. Shadow vehicle are permitted to straddle edge lines.

5. Whenever adequate stopping sight distance exists to the rear, shadow vehicle 1 should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

6. This operation should be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

7. Refer to PATA 012 for arrow panel sizing.

Signs

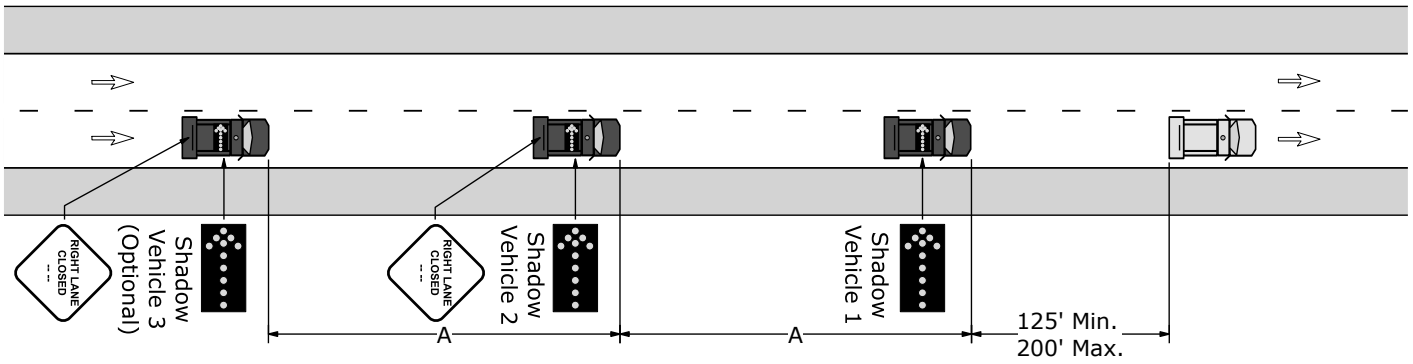
W20-5R W20-5L

Sign Spacing Chart

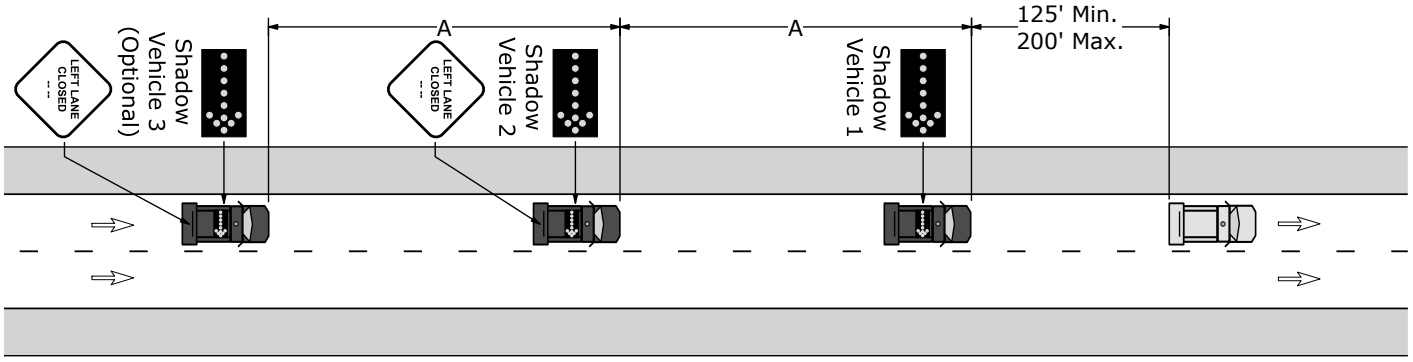
Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

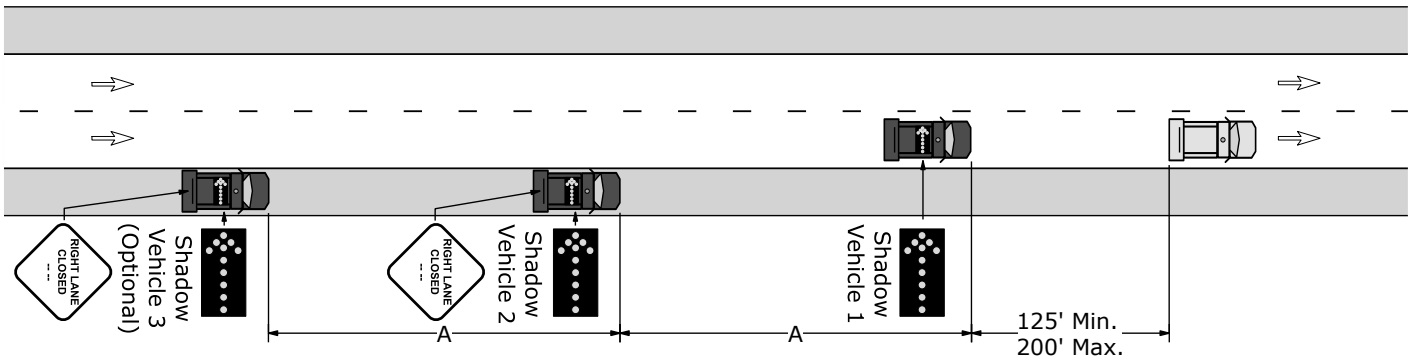
PATA 305 (Old PATA 18)
Work Space In The Left Or Right Lane



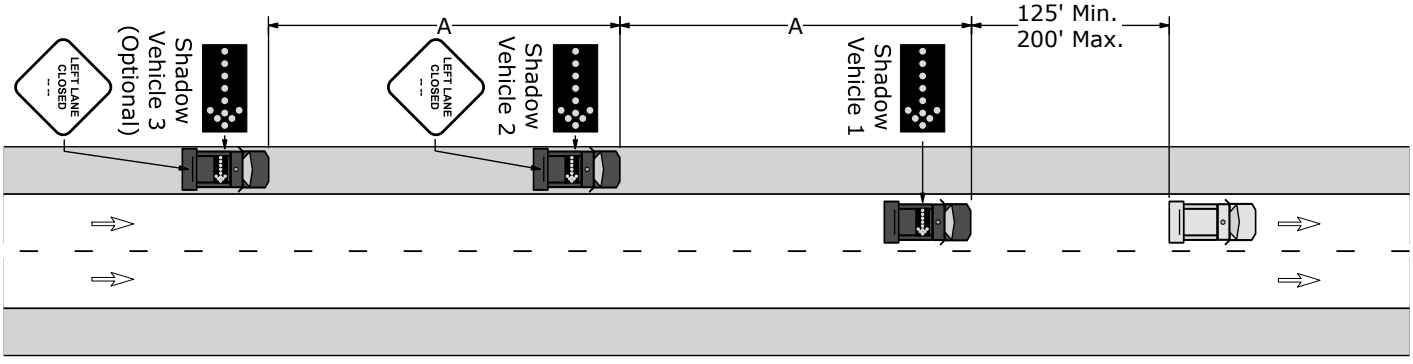
Continuously Moving Right Lane Operation - Traffic Merges To The Left



Continuously Moving Left Lane Operation - Traffic Merges To The Right



Intermittently Moving Right Lane Operation - Traffic Merges To The Left



Intermittently Moving Left Lane Operation - Traffic Merges To The Right

PATA 306 (Old PATA 23) - Notes

1. Shadow vehicles are required unless otherwise stated on the PATA drawings.

2. Flashing arrow panels are required for all shadow vehicles. Placement of the Lane Closed (W20-5L, W20-5R, or W9-3) sign on shadow vehicle 2 and shadow vehicle 3 is optional. If used, it should be placed so that it will not diminish the target value of the flashing arrow panel.

3. If sufficient shoulder width is not available for the shadow vehicles positioned on the shoulder, shadow vehicles shall be positioned as close as possible to the shoulder edge.

4. Shadow vehicle are permitted to straddle edge lines.

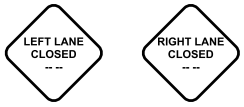
5. If shadow vehicle 3 is not used during continuously moving center lane operations, shadow vehicle 2 will display a flashing arrow panel pointing to the left and right.

6. Whenever adequate stopping sight distance exists to the rear, shadow vehicle 1 should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

7. This operation should be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

8. Refer to PATA 012 for arrow panel sizing.

Signs



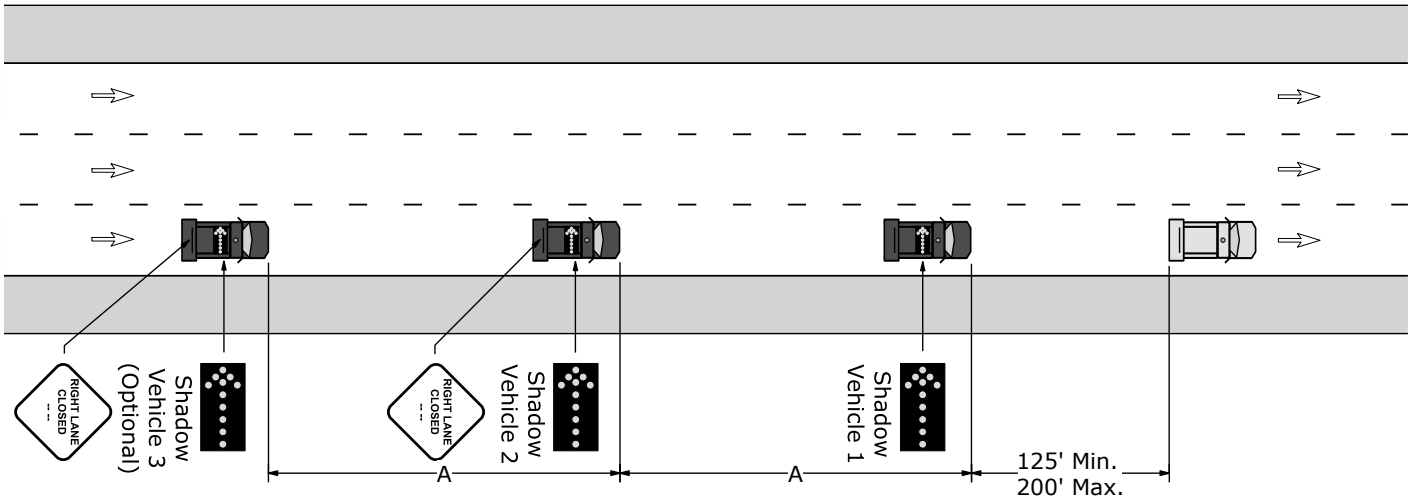
W20-5L W20-5R

Sign Spacing Chart

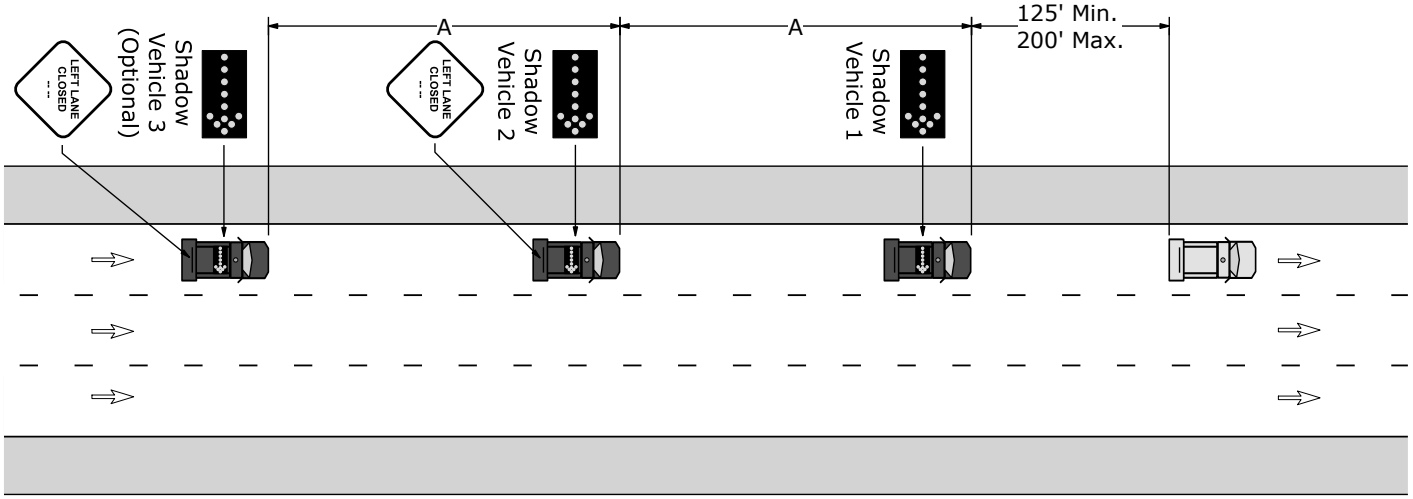
Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

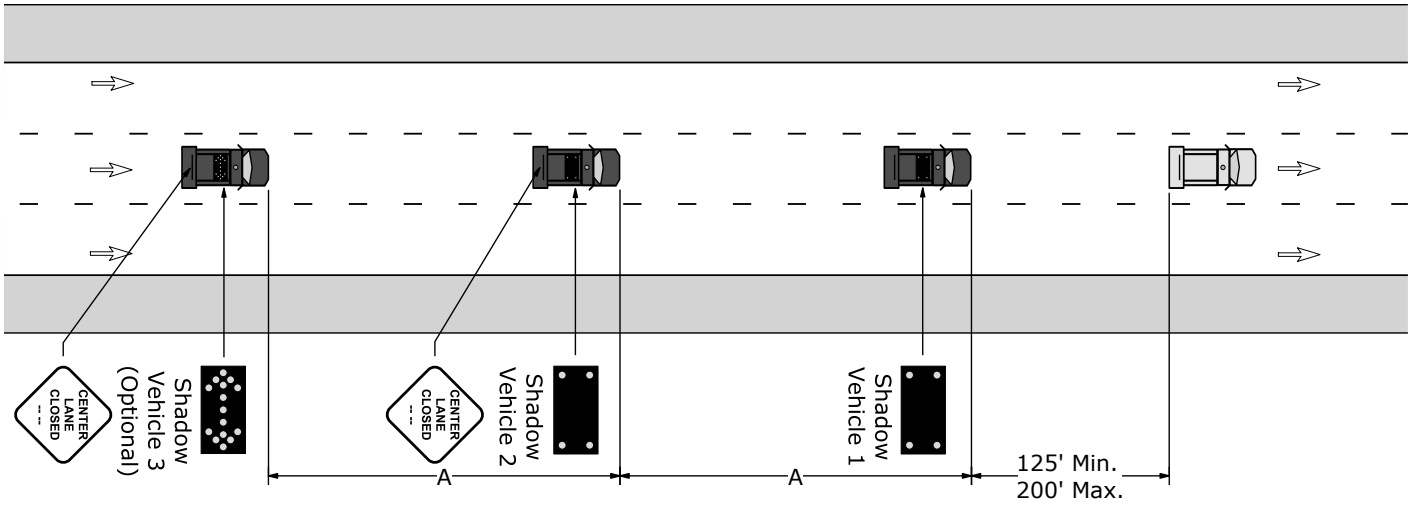
PATA 306 (Old PATA 23)
Work Space In Any Lane Of A Three Or More-Lane Approach (Drawing 1 of 3)



Continuously Moving Right Lane Operation - Traffic Merges To The Left

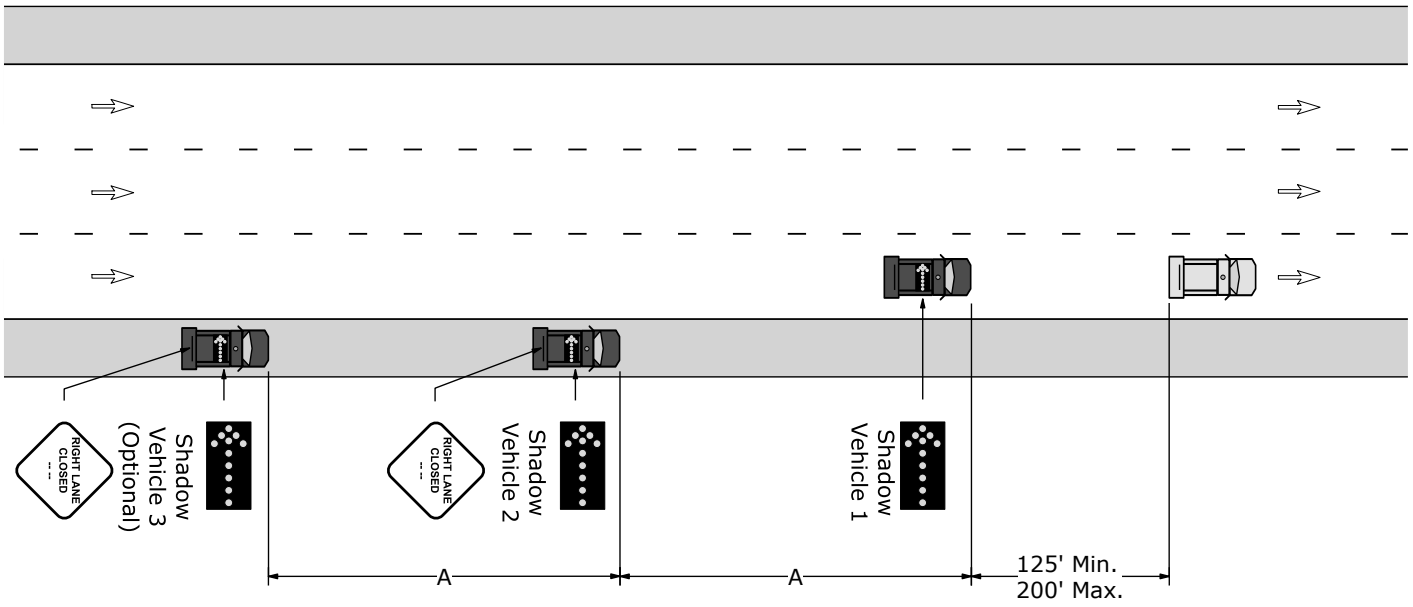


Continuously Moving Left Lane Operation - Traffic Merges To The Right

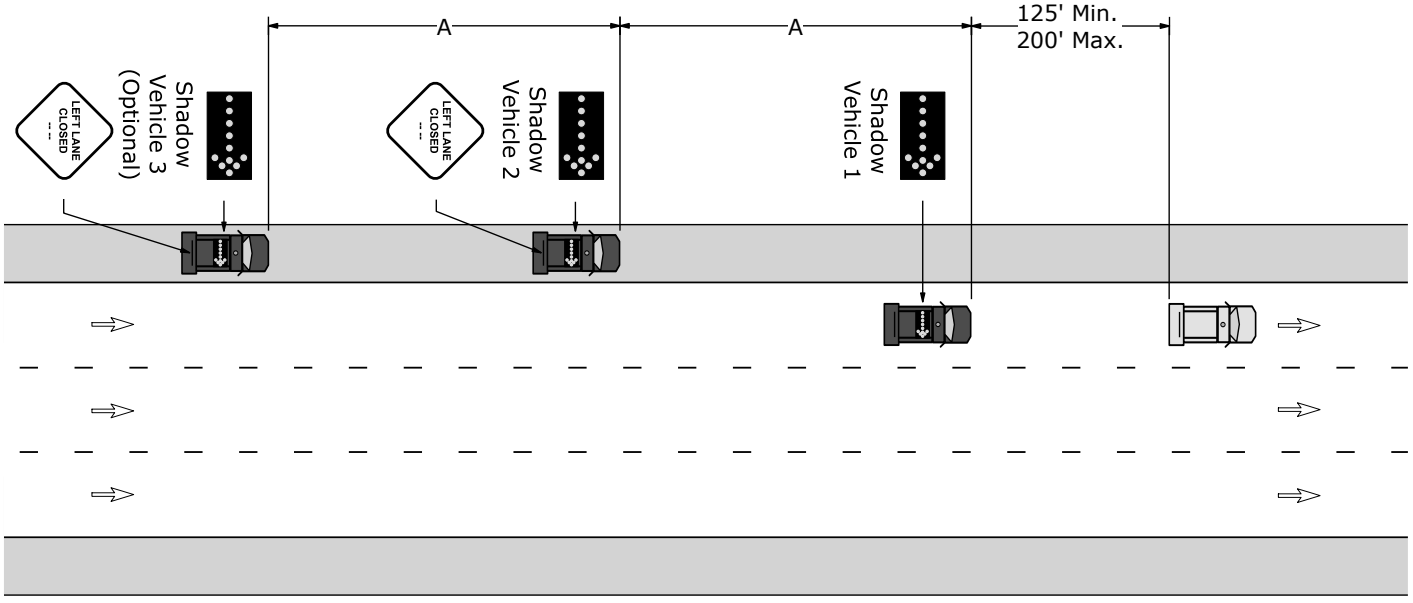


Continuously Moving Center Lane Operation - Traffic Merges To The Left Or Right

PATA 306 (Old PATA 23)
Work Space In Any Lane Of A Three Or More-Lane Approach (Drawing 2 of 3)

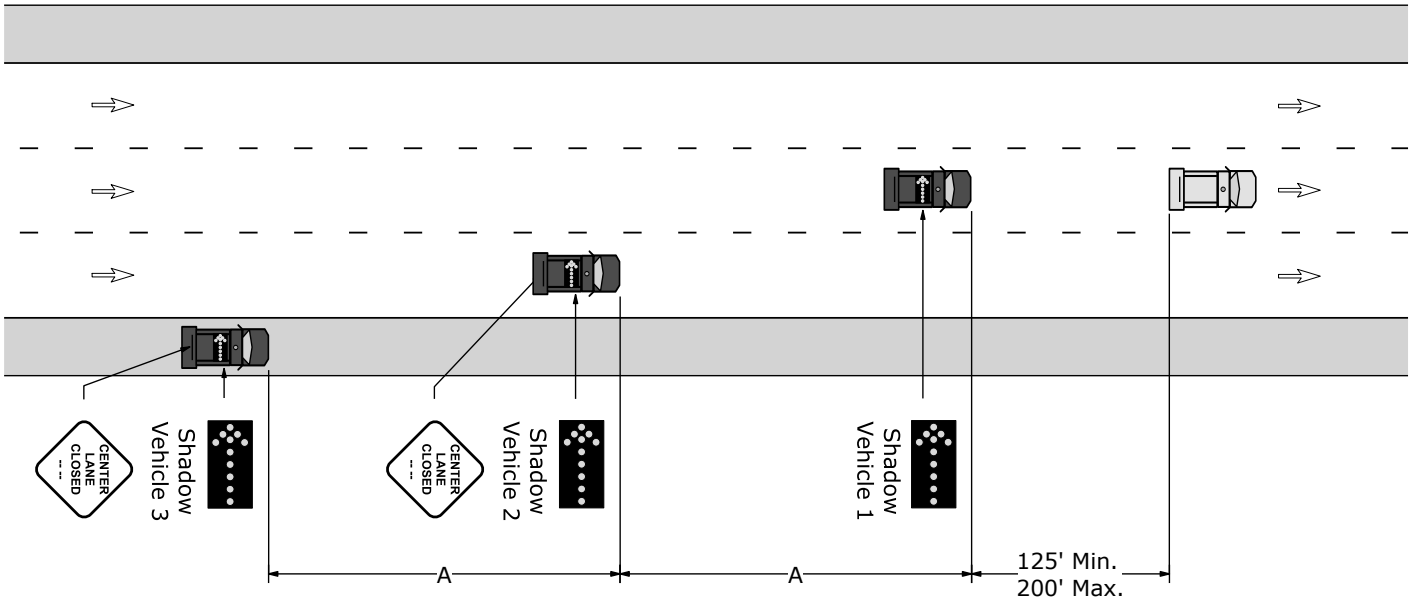


Intermittently Moving Right Lane Operation - Traffic Merges To The Left

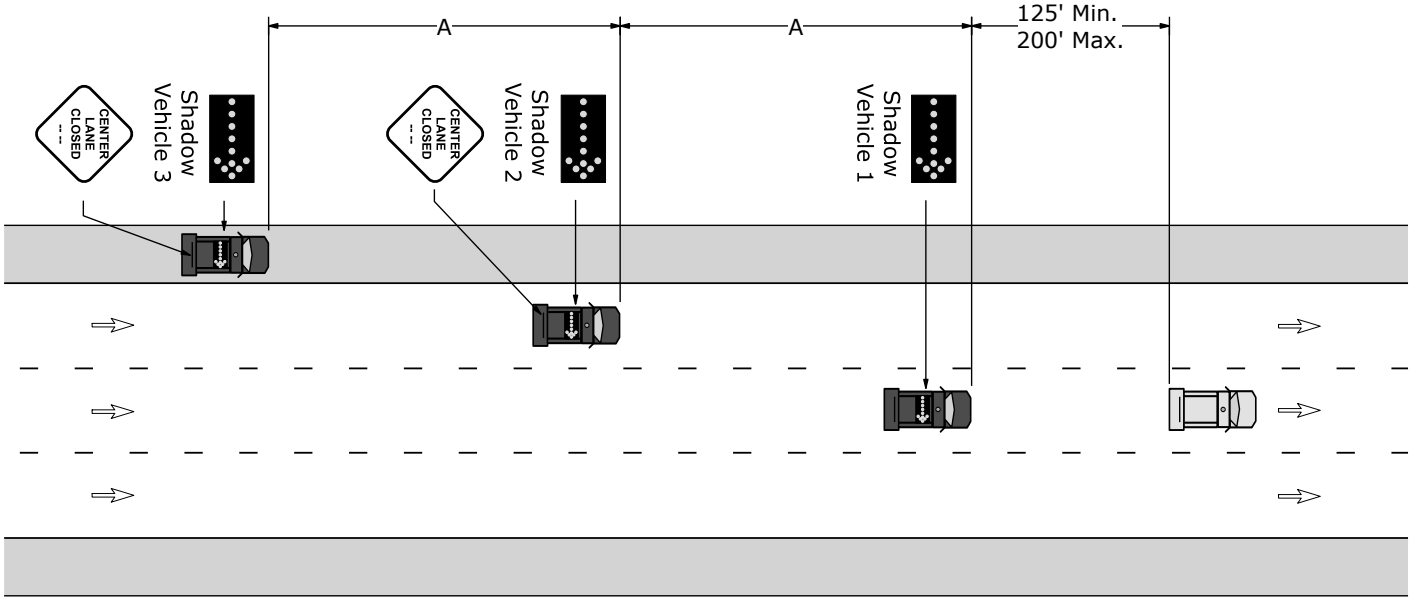


Intermittently Moving Left Lane Operation - Traffic Merges To The Right

PATA 306 (Old PATA 23)
Work Space In Any Lane Of A Three Or More-Lane Approach (Drawing 3 of 3)



Intermittently Moving Center Lane Operation - Traffic Merges To The Left



Intermittently Moving Center Lane Operation - Traffic Merges To The Right

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Freeways & Expressways

Short-Term Stationary Operations
(PATA 400 Series)

PATA 401 (Old PATA 5) - Notes

1. The shadow vehicle and traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2’ behind curb, or 15’ or more from the edge of any roadway.

2. For operations of 60 minutes or less, all traffic control devices are not required.

3. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs

W20-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

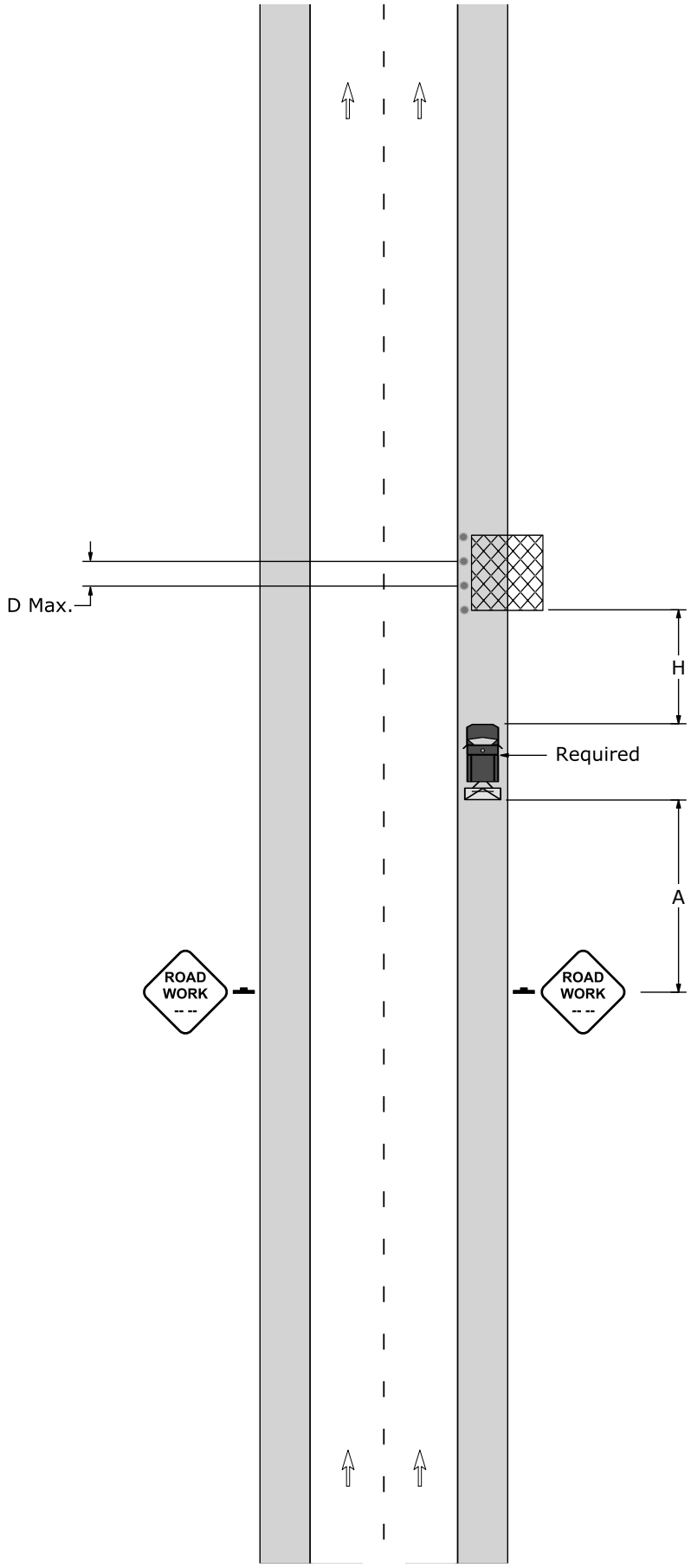
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 401 (Old PATA 5)
Work Space On Or Beyond The Shoulder (No Roadway Encroachment)



PATA 402 (Old PATA 18) - Notes

1. For left lane closures, the Left Lane Closed (W20-5L) sign shall be used instead of the Right Lane Closed (W20-5R) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5R W20-5L W4-2R W4-2L

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

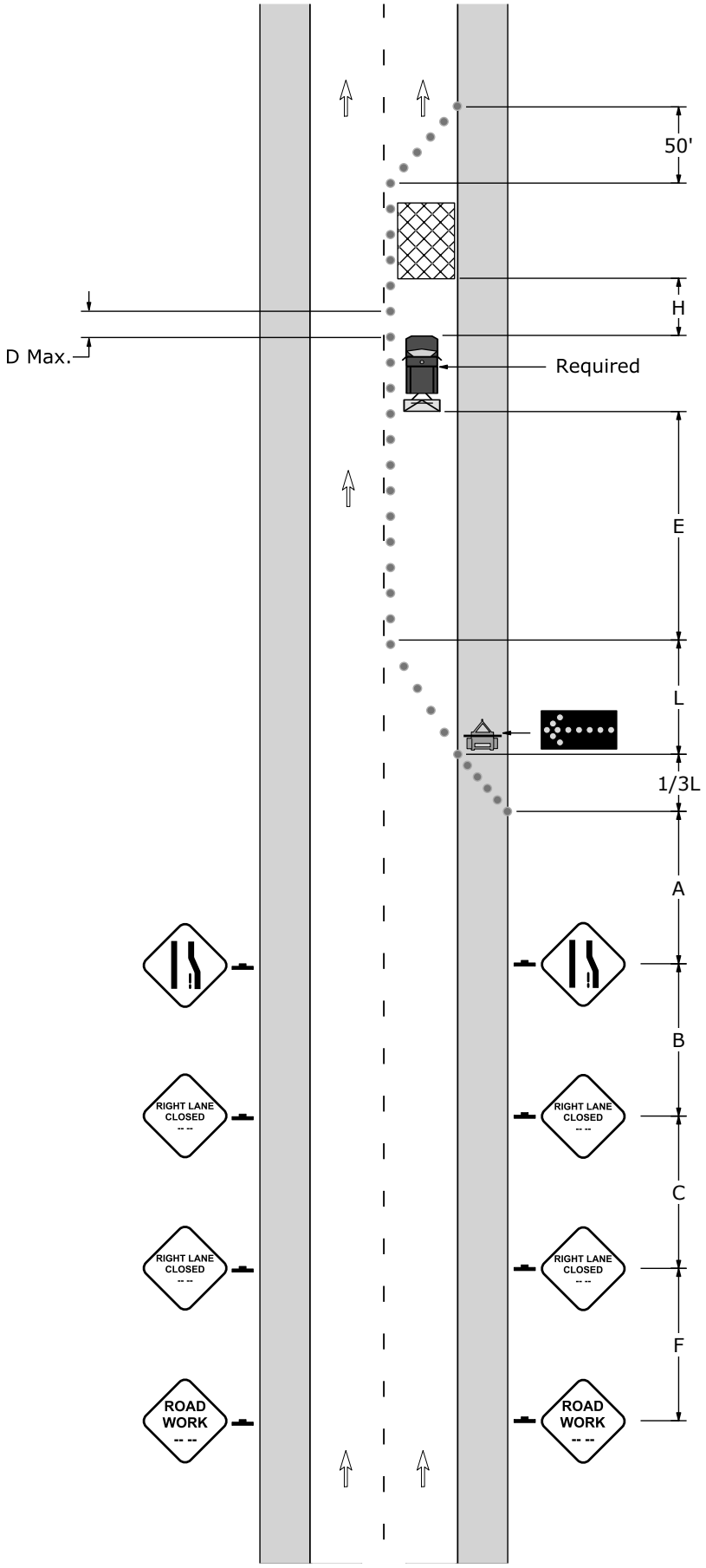
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 402 (Old PATA 18)
Work Space In The Left Or Right Lane



PATA 403 (Old PATA 20) - Notes

1. For two left lane closures, the Left Two Lanes Closed (W20-5AL) sign shall be used instead of the Right Two Lanes Closed (W20-5AR) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5AR W20-5AL W4-2R W4-2L

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

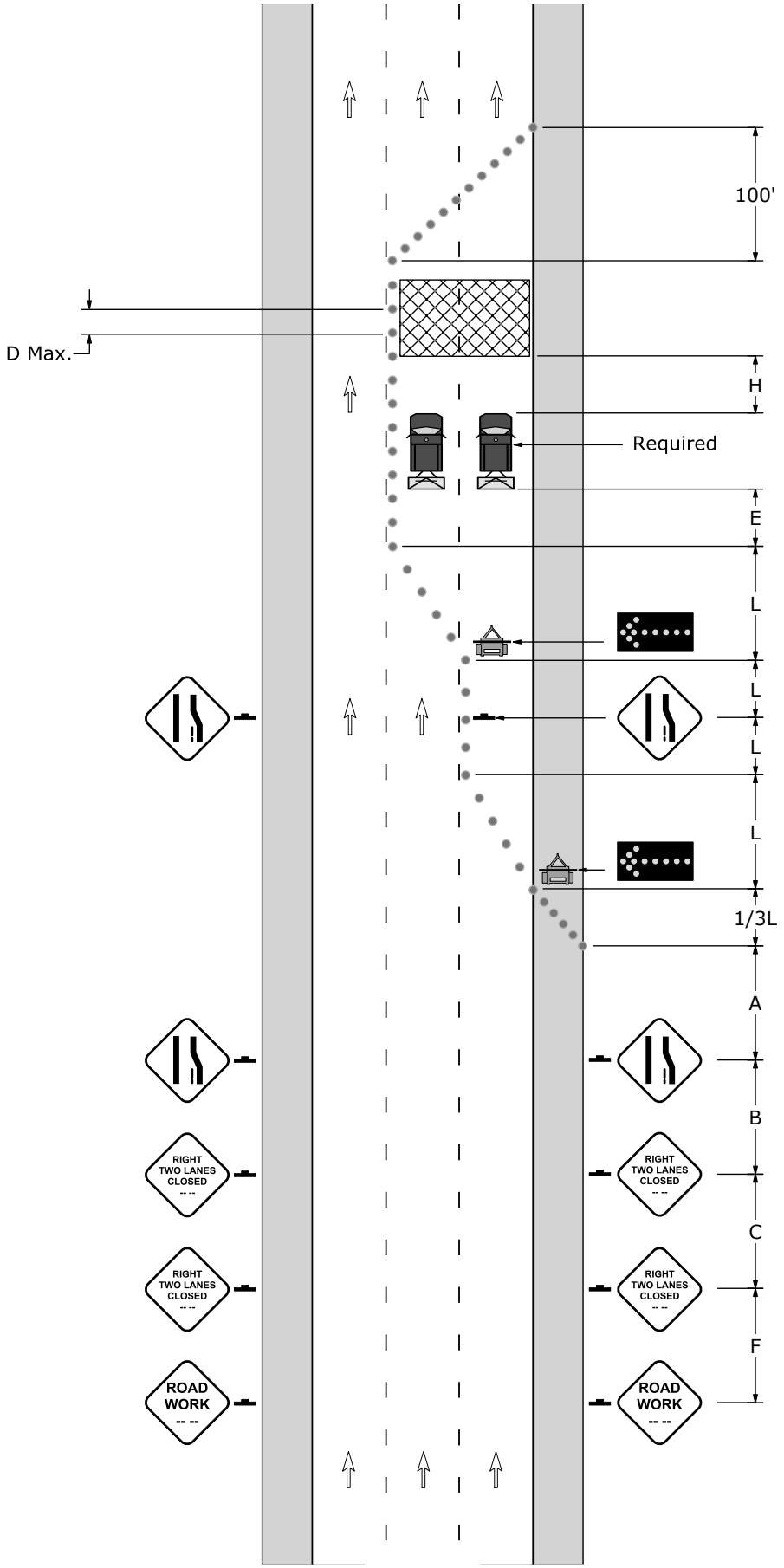
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 403 (Old PATA 20)
Work Space In Two Adjacent Lanes



PATA 404 (Old PATA 21) - Notes

1. Channelizing devices placed near the off ramp will be spaced more closely together. Spacing requirements (D Max., 1/2D Max., 1/4D Max.) are shown in parenthesis next to the length dimension.

2. In locations with heavy ramp traffic, the channelizing devices in advance of the ramp may be eliminated if special advance signing is erected to indicate that the right lane is a mandatory exit only lane.

3. The temporary Exit (W25-4) sign shall be located in the temporary gore. It shall be mounted a minimum 7' from the pavement surface to the bottom of the sign.

4. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

5. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5R W4-2R W25-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

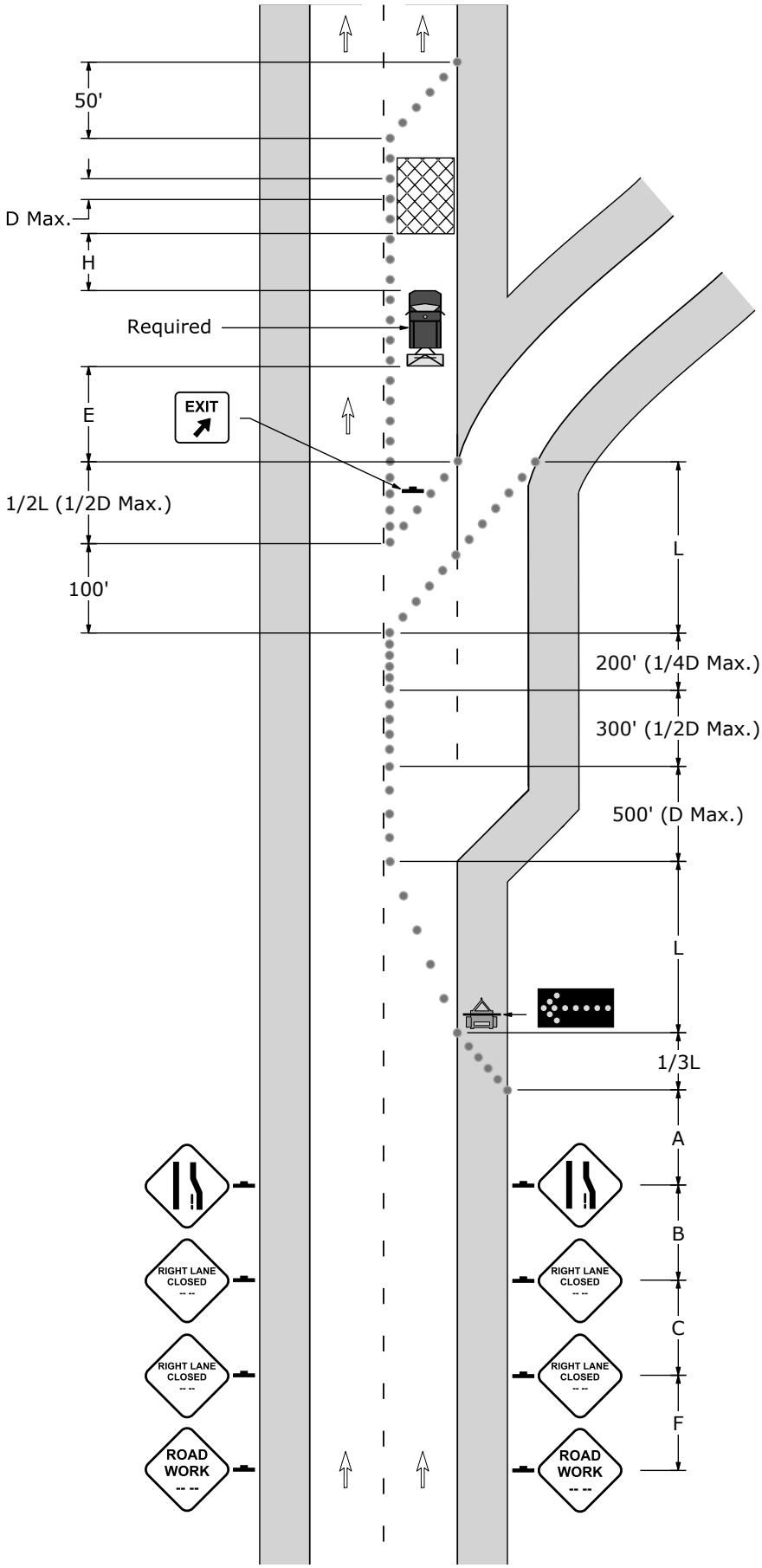
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 404 (Old PATA 21)
Lane Closure Near A Freeway Or Expressway Exit Ramp



PATA 405 (Old PATA 22) - Notes

1. The acceleration lane should be maintained at the longest length that will accommodate adjacent tapers .

2. If a ramp entering a freeway or expressway is normally controlled with a yield sign, then the yield condition should remain during temporary traffic control if both a and b are true:

   a. Available sight distance for traffic emerging from the ramp is greater than the minimum stopping sight distance shown in the MUTCD Table 6C-2.

   b. An acceleration distance of at least 200' is provided.

   If a or b are not satisfied or if an engineering and traffic study has been approved with the recommendation for a stop condition, than implement a stop condition.

3. When Stop (R1-1) signs are used to control ramp traffic , Stop Ahead (W3-1) signs shall be placed along the ramp. When Yield signs (R1-2) are used to control ramp traffic, Yield Ahead (W3-2) signs shall be placed along the ramp.

4. Placement of the temporary Merge Right (W4-1R) sign is optional if the permanent Merge Right (W4-1R) sign is clearly visible and is within 500' of the location shown in this PATA.

5. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

6. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5R W4-2R W4-1R W3-2 W3-1 R1-2 R1-1 R1-1-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

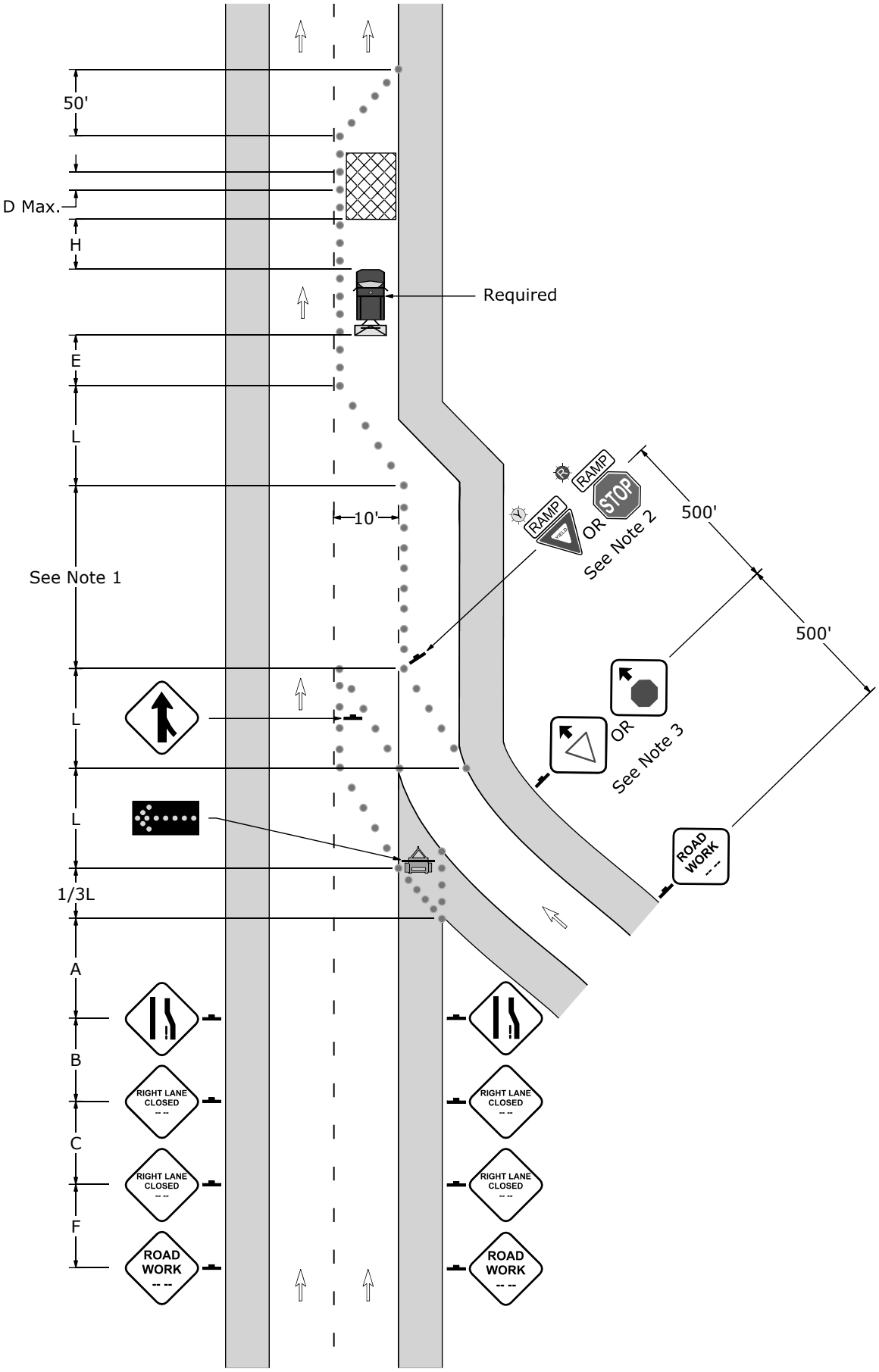
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 405 (Old PATA 22)
Lane Closure Near A Freeway Or Expressway Entrance Ramp



PATA 406 (Old PATA 21 Ramp) - Notes

1. If the shoulder is to be used for vehicular traffic, insure the shoulder is in good condition and free of debris prior to its use.

2. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs

W21-101

W5-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

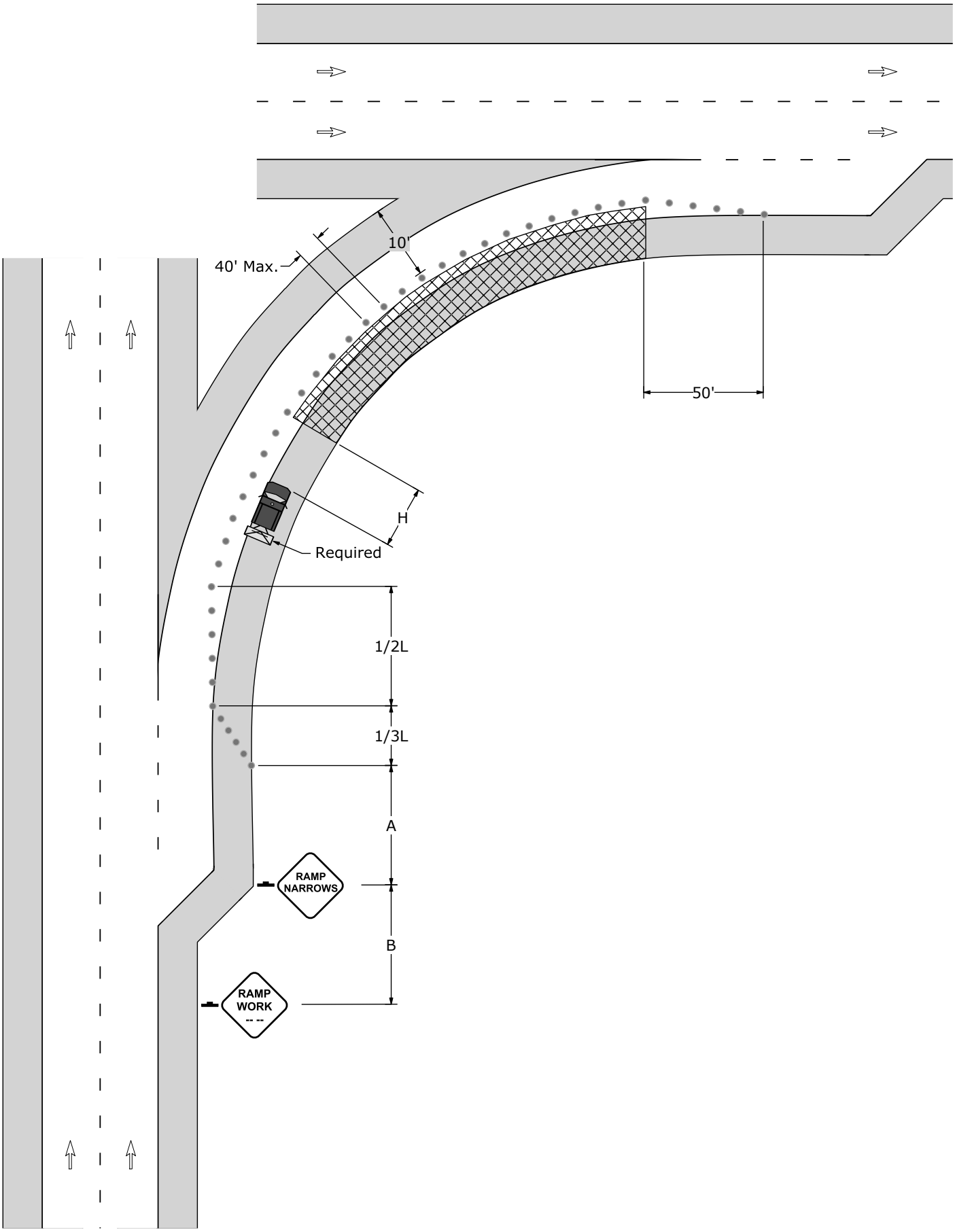
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 406 (Old PATA 21 Ramp)
Work Space On A Ramp



PATA 407 (Old PATA 43) - Notes

1. This operation shall be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

2. Use one shadow vehicle per lane; each equipped with a Truck Mounted Attenuator (TMA). These vehicles should start side by side at least one mile in advance of the point of stoppage and drive towards the work area to gradually slow traffic down. Once traffic is stopped one of the shadow vehicles shall block the roadway while the other is used in blocking the closed lane to discourage motorists from driving around. Drivers should be in communication with each other and one person at the work area.

3. Traffic utilizing the on-ramps must be stopped until the shadow vehicles pass beyond the end of the ramp. Channelizing devices shown on the ramp which are placed behind a shadow or work vehicle are optional and may be useful in closing the ramp and shoulders.

4. After this operation has been active for 15 minutes, all queued traffic shall be cleared and any succeeding 15 minute stoppage shall not occur until traffic flow has returned to normal pre-stoppage conditions.

5. A Portable Changeable Message Sign (PCMS) may be placed along the highway to provide advance notice to drivers. If used, the PCMS should be placed approximately 1 mile in advance of the first Lanes Blocked Ahead (W20-101) sign.

6. All PCMS should be placed off the shoulder and behind a traffic barrier, if practical. Where barrier is not available to shield the PCMS, it should be placed off the shoulder and outside of the clear zone. If a PCMS must be placed on the shoulder or within the clear zone, it shall be delineated with retroreflective temporary traffic control devices. PCMS should not be located within the limits of a highway interchange. Refer to PATA 008 for further guidance.

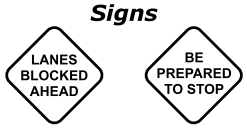
7. If multiple PCMS are utilized then additional signs may be placed in advance of the initial PCMS. A minimum spacing of at least 1000' shall be maintained between PCMS facing the same direction and shall be located on the same side of the roadway.

8. Contact the District or Regional Traffic Management Center (TMC) two weeks in advance to provide information regarding this operation and to request guidance for PCMS message content and timing. Notify the same TMC one hour prior to beginning this operation.

9. Additional PCMS may be used in lieu of the static signs.

10. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs



W20-101 W3-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

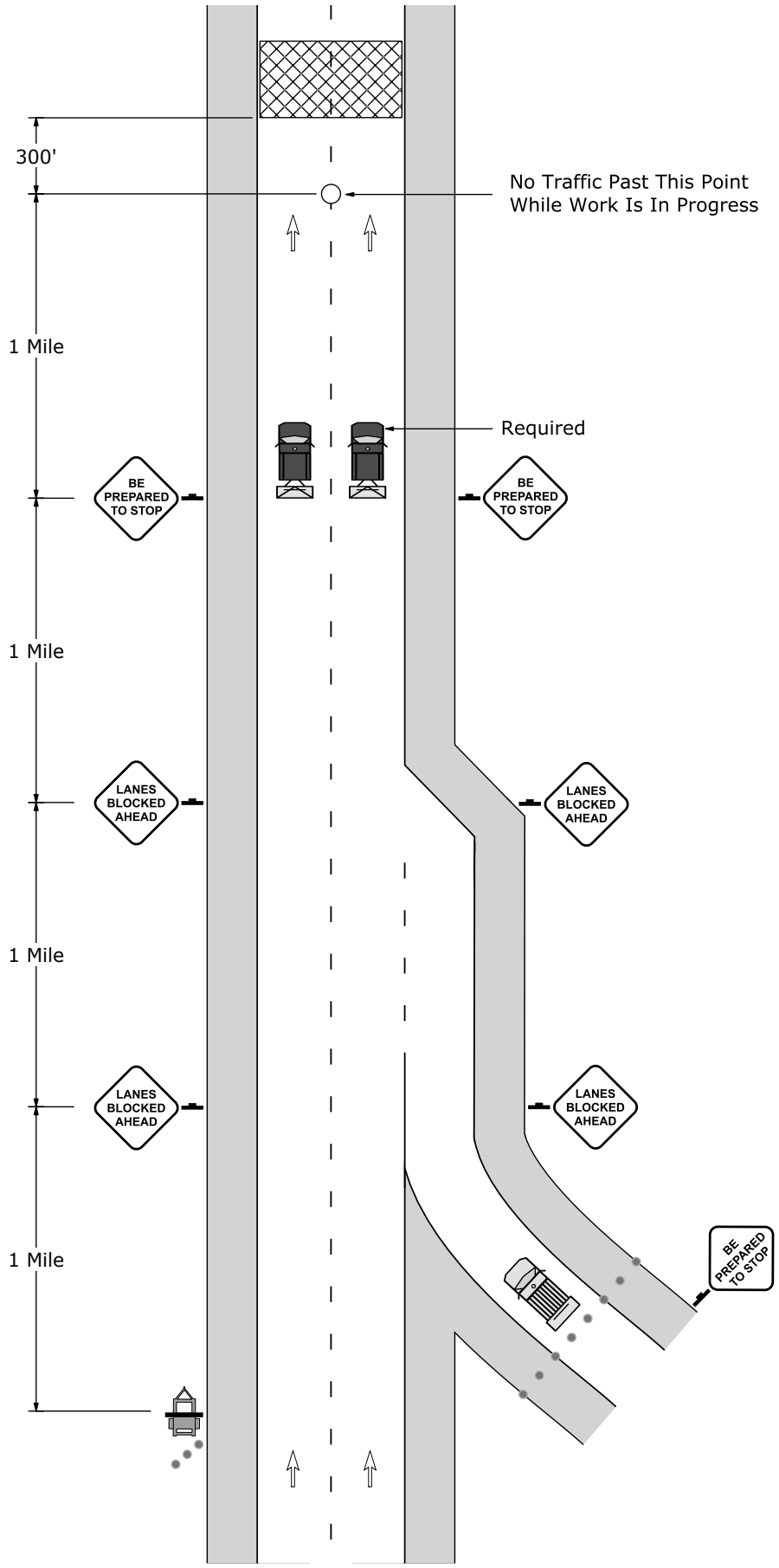
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 407 (Old PATA 43)
Rolling Slow Down Or Stoppage



PATA 408 (Old PATA 44) - Notes

1. This operation shall be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

2. Use one shadow vehicle per lane; each equipped with a Truck Mounted Attenuator (TMA). These vehicles should start side by side at least one mile in advance of the point of stoppage and drive towards the work area to gradually slow traffic down. Once traffic is stopped one of the shadow vehicles shall block the roadway while the other is used in blocking the closed lane to discourage motorists from driving around. Drivers should be in communication with each other and one person at the work area.

3. Traffic utilizing the on-ramps must be stopped until the shadow vehicles pass beyond the end of the ramp. Channelizing devices shown on the ramp which are placed behind a shadow or work vehicle are optional and may be useful in closing the ramp and shoulders.

4. After this operation has been active for 15 minutes, all queued traffic shall be cleared and any succeeding 15 minute stoppage shall not occur until traffic flow has returned to normal pre-stoppage conditions.

5. A Portable Changeable Message Sign (PCMS) may be placed along the highway to provide advance notice to drivers. If used, the PCMS should be placed approximately 1 mile in advance of the first Lanes Blocked Ahead (W20-101) sign.

6. All PCMS should be placed off the shoulder and behind a traffic barrier, if practical. Where barrier is not available to shield the PCMS, it should be placed off the shoulder and outside of the clear zone. If a PCMS must be placed on the shoulder or within the clear zone, it shall be delineated with retroreflective temporary traffic control devices. PCMS should not be located within the limits of a highway interchange. Refer to PATA 009 for further guidance.

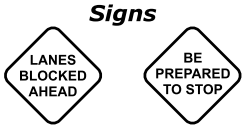
7. If multiple PCMS are utilized then additional signs may be placed in advance of the initial PCMS. A minimum spacing of at least 1000' shall be maintained between PCMS facing the same direction and shall be located on the same side of the roadway.

8. Contact the District or Regional Traffic Management Center (TMC) two weeks in advance to provide information regarding this operation and to request guidance for PCMS message content and timing. Notify the same TMC one hour prior to beginning this operation.

9. Additional PCMS may be used in lieu of the static signs.

10. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs



W20-101 W3-4

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

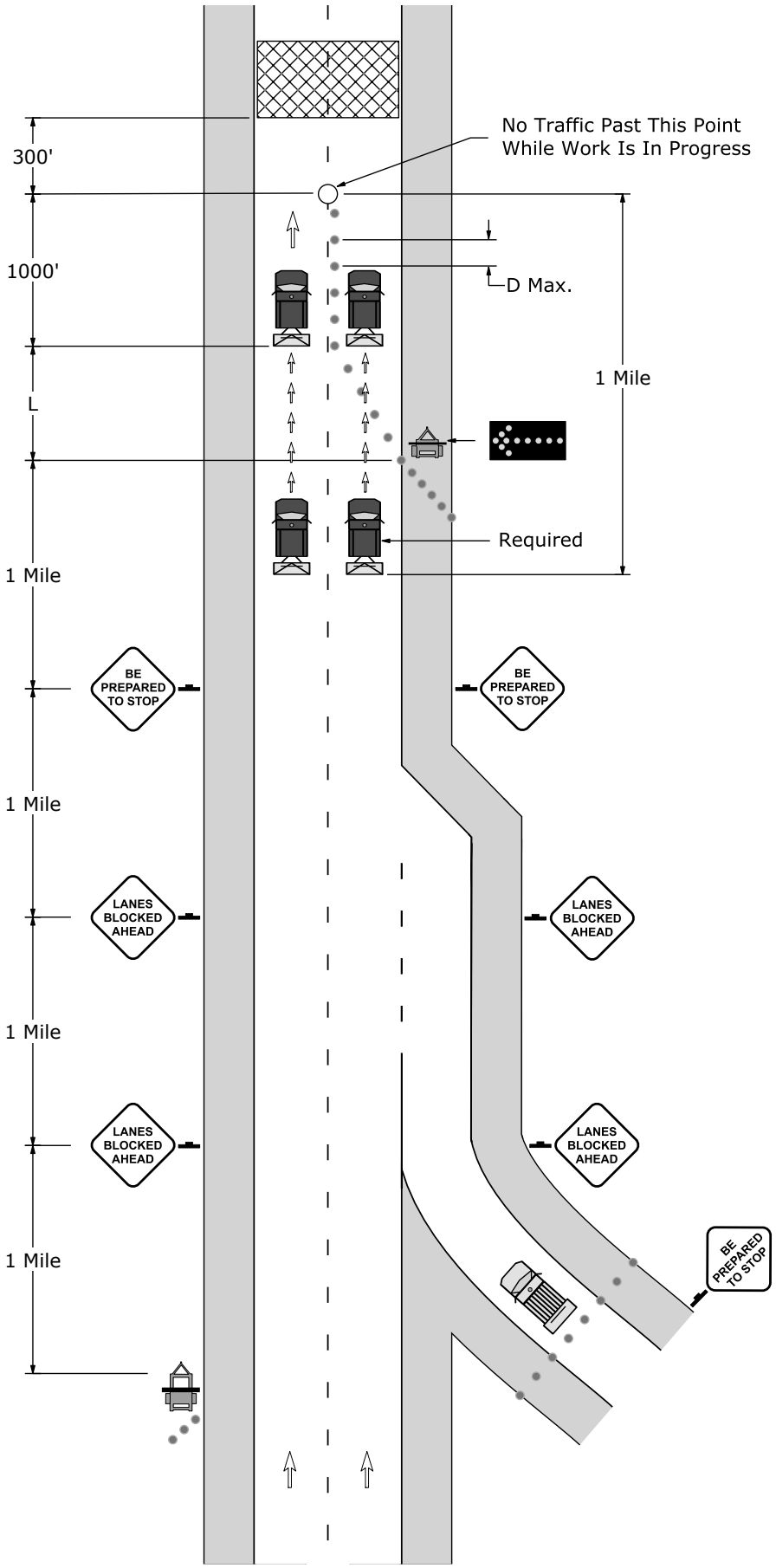
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 408 (Old PATA 44)
Rolling Slow Down Or Stoppage With Existing Lane Closure



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Freeways & Expressways

Long-Term Stationary Operations
(PATA 500 Series)

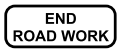
PATA 501 (Old PATA 24) - Notes

1. The shadow vehicle and traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2'-0" behind curb, or 15' or more from the edge of the roadway.

2. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs

W20-1



G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

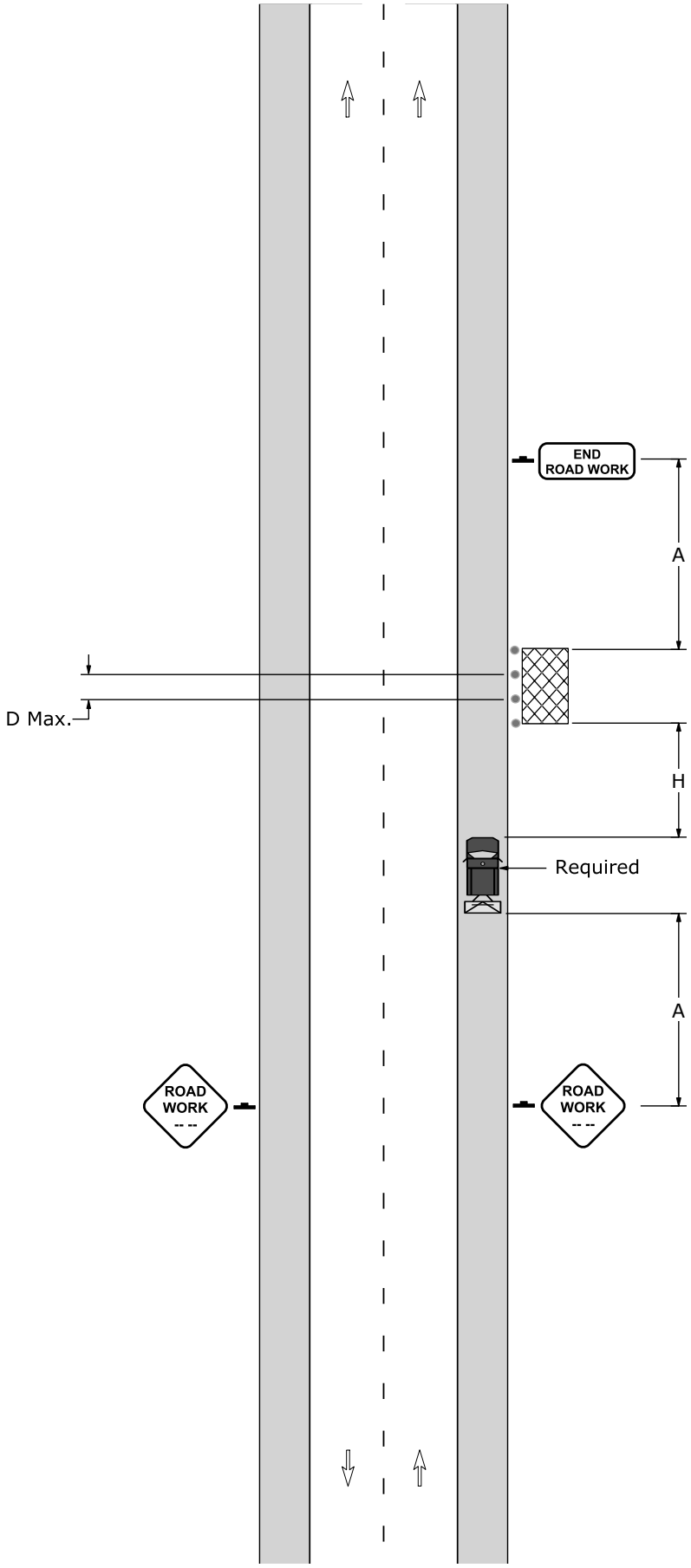
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 501 (Old PATA 24)
Work Space Beyond Shoulder



PATA 502 (Old PATA 25) - Notes

1. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs

W20-1 W21-5 W21-5BR W21-5BL G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

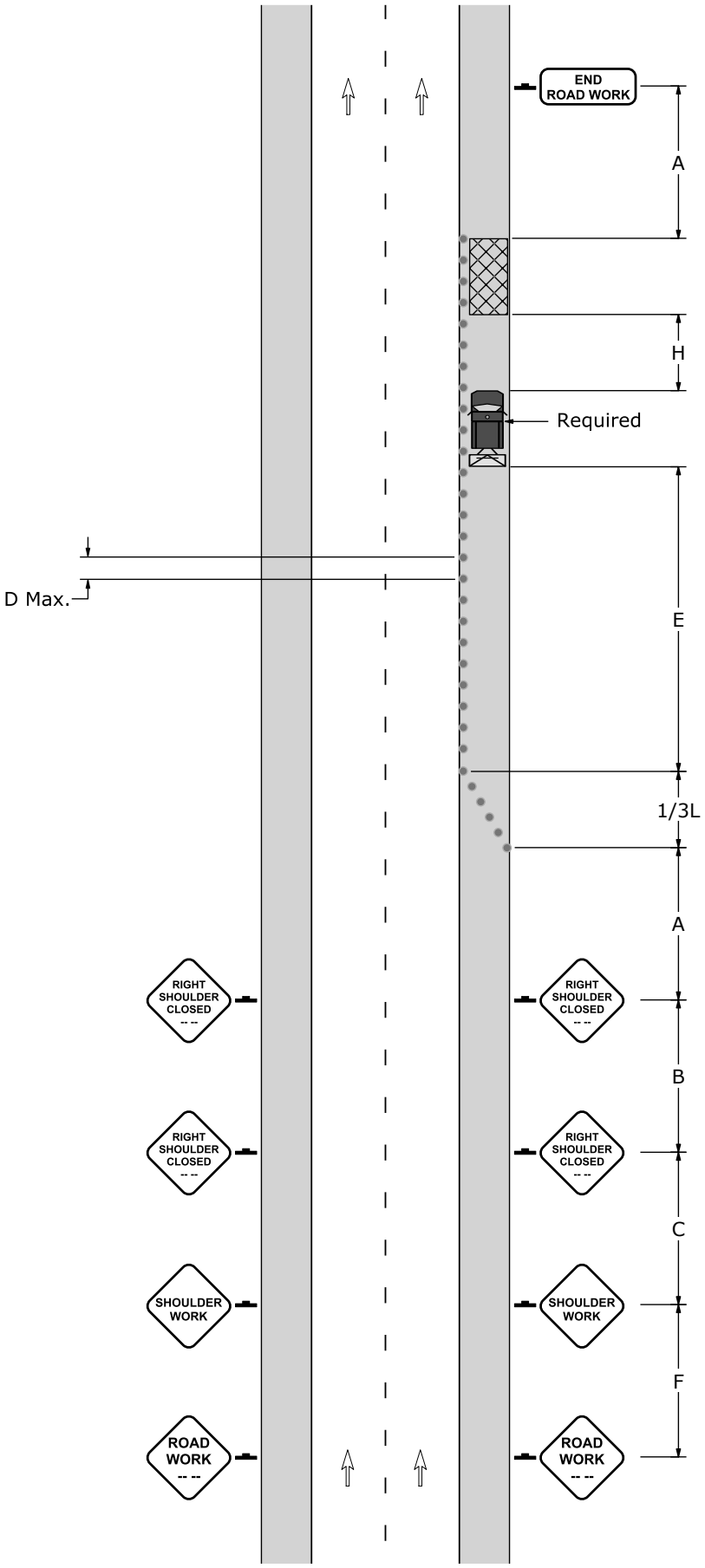
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 502 (Old PATA 25)
Work Space On Shoulder



PATA 503 (Old PATA 33) - Notes

1. For left lane closures, the Left Lane Closed (W20-5L) sign shall be used instead of the Right Lane Closed (W20-5R) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5L W20-5R W4-2L W4-2R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

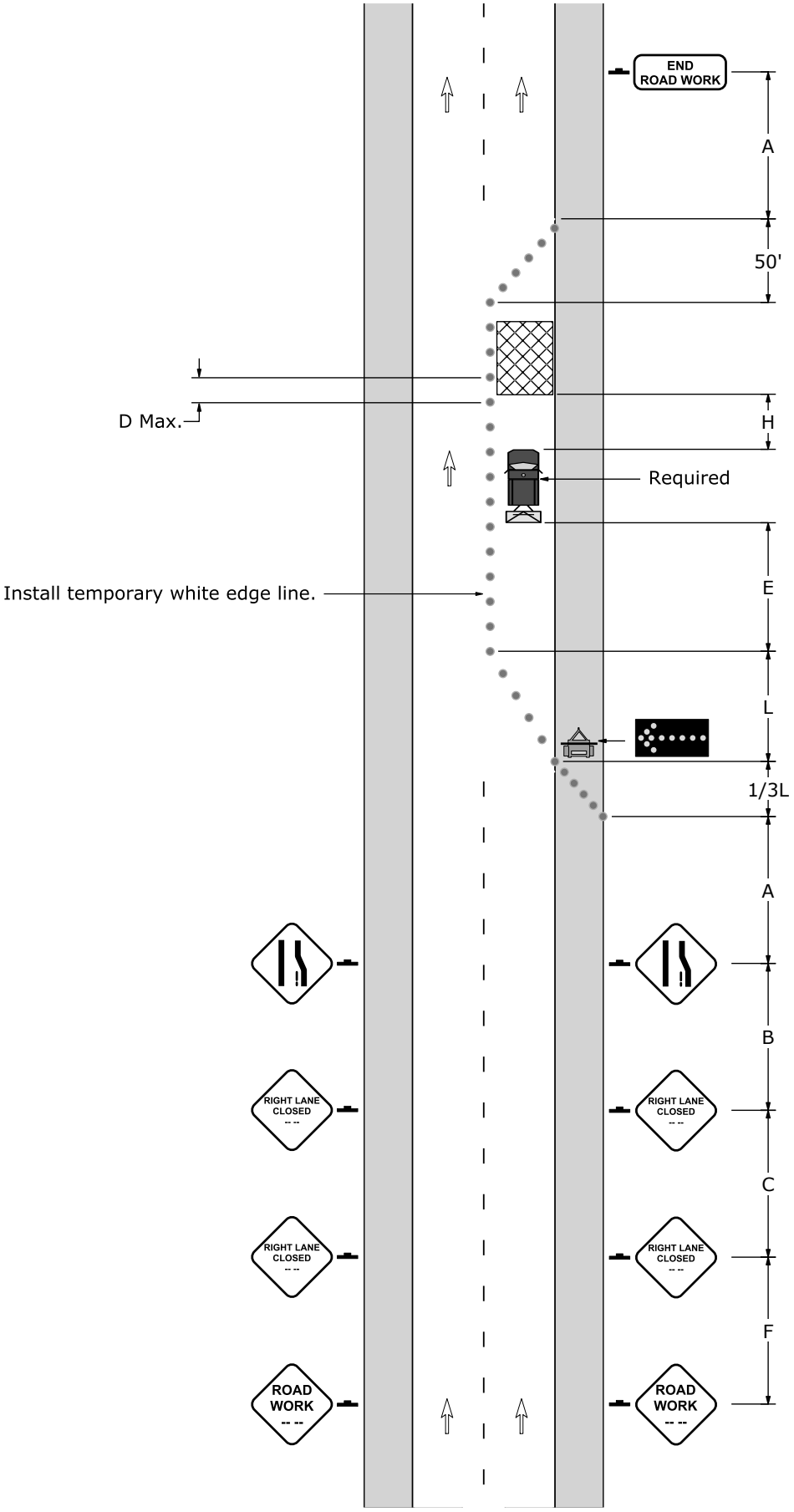
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 503 (Old PATA 33)
Work Space In The Left Or Right Lane



PATA 504 (Old PATA 35) - Notes

1. For left lane closures, the Left Two Lanes Closed (W20-5AL) sign shall be used instead of the Right Two Lanes Closed (W20-5AR) sign and the Left Lane Ends (W4-2L) sign shall be used instead of the Right Lane Ends (W4-2R) sign.

2. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

3. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5AL W20-5AR W4-2L W4-2R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

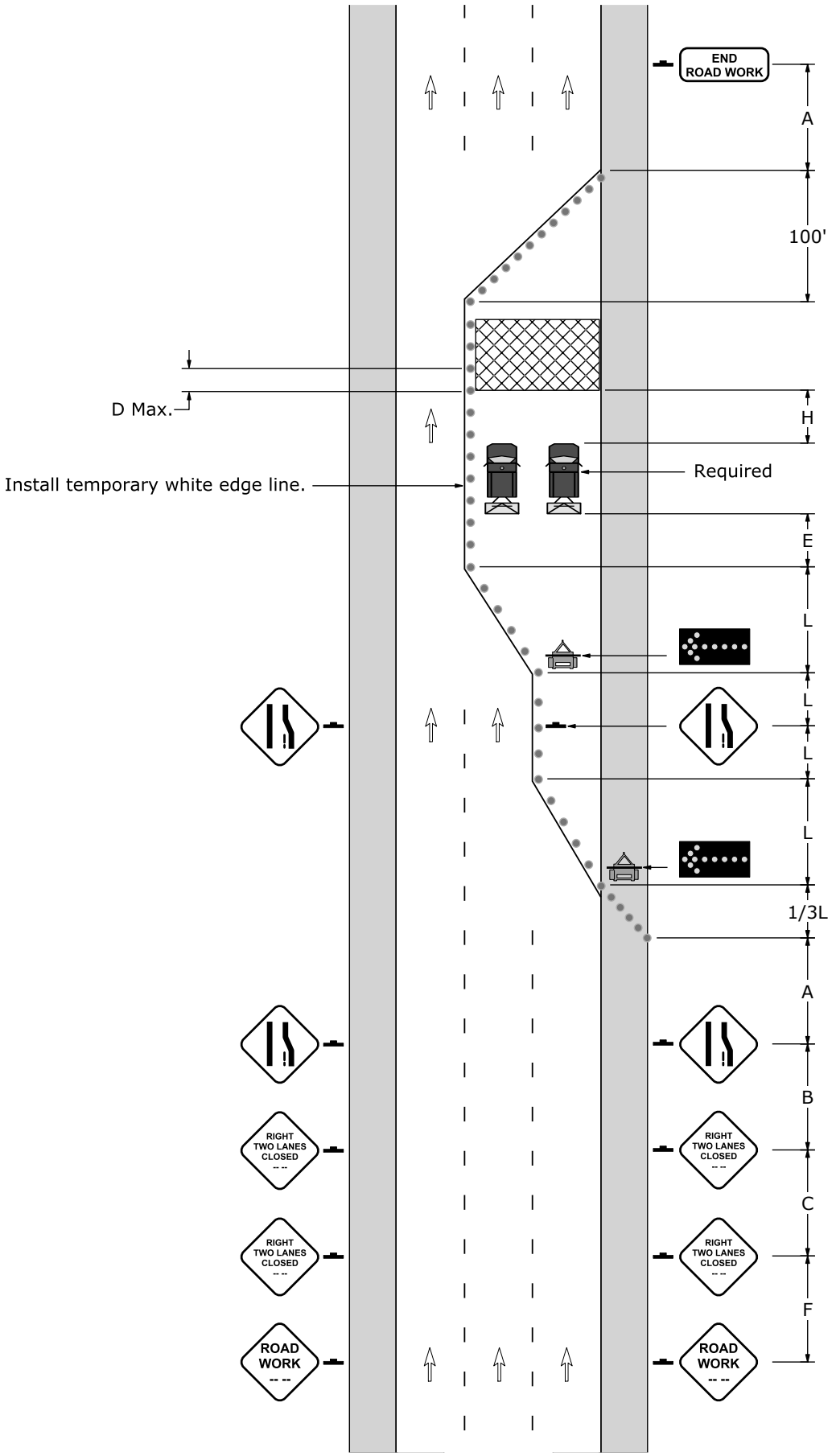
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 504 (Old PATA 35)
Work Space In Two Adjacent Lanes



PATA 505 (Old PATA 36) - Notes

1. Channelizing devices placed near the off ramp will be spaced more closely together. Spacing requirements (D Max., 1/2D Max., 1/4D Max.) are shown in parenthesis next to the length dimension.

2. The design criteria contained in Publication 13M (Design Manual Part 2 - Highway Design) should be used for determining the alignment.

3. In locations with heavy ramp traffic, the channelizing devices in advance of the ramp may be eliminated if special advance signing is erected to indicate that the right lane is a mandatory exit only lane.

4. The temporary Exit (W25-4) sign shall be located in the temporary gore. It shall be mounted at a minimum height of 7' from the pavement surface to the bottom of the sign. This sign may be either black on orange or white on green. This sign may be the Exit Gore (W25-4) sign or a Type I through IV sign as shown on TC-8701D sheet 8 in Publication 111, Traffic Control-Pavement Markings and Signing Standards.

5. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

6. Refer to PATA 012 for arrow panel sizing.

Signs

W20-1 W20-5R W25-4 W4-2R G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

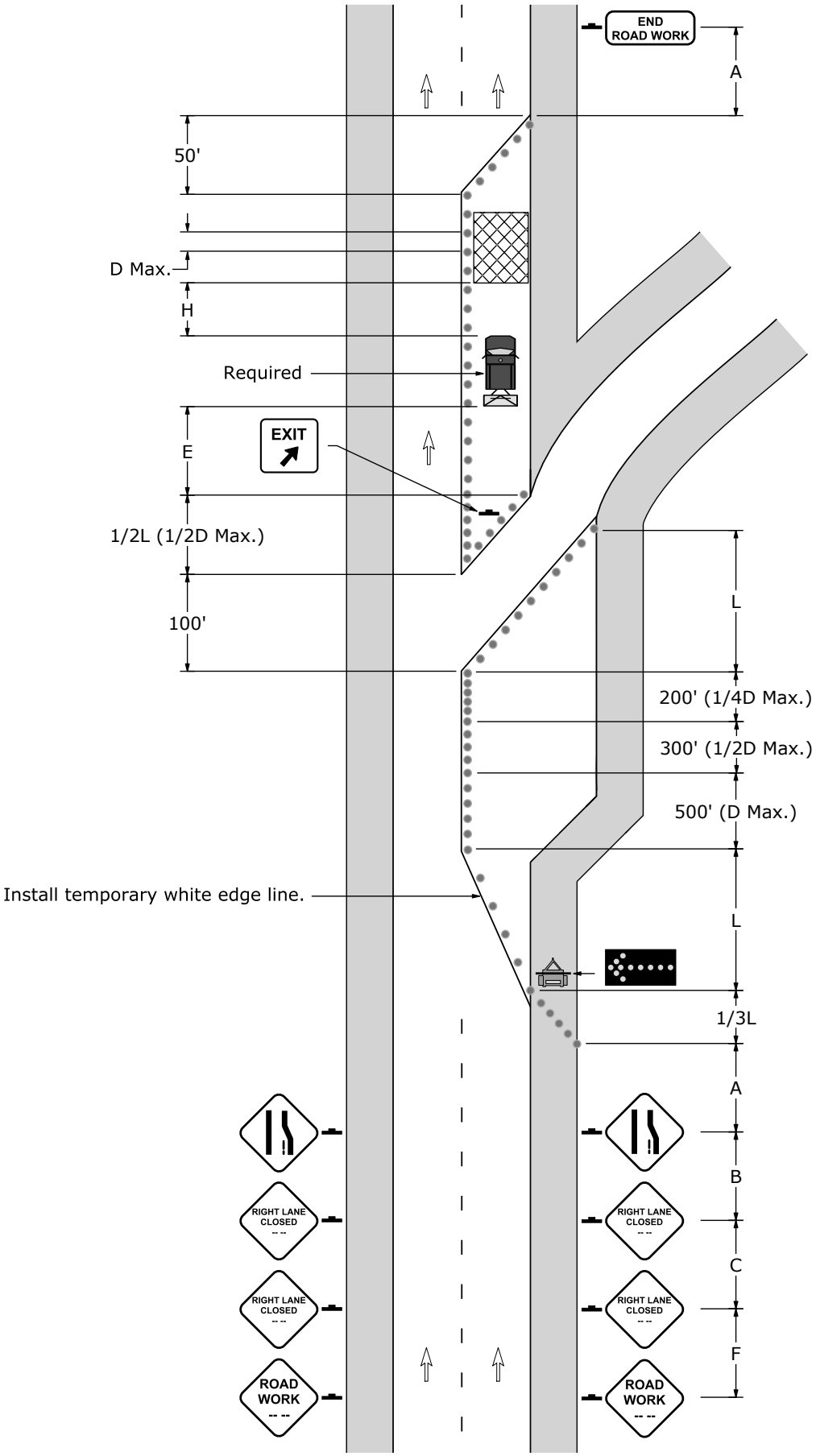
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 505 (Old PATA 36)
Lane Closure Near A Freeway Or Expressway Exit Ramp



PATA 506 (Old PATA 37) - Notes

1. The acceleration lane should be maintained at the longest length that will accommodate adjacent tapers .

2. If a ramp entering a freeway or expressway is normally controlled with a yield sign, then the yield condition should remain during temporary traffic control if both a and b are true:

   a. Available sight distance for traffic emerging from the ramp is greater than the minimum stopping sight distance shown in the MUTCD Table 6C-2.

   b. An acceleration distance of at least 200' is provided.

   If either a or b are not satisfied or if an engineering and traffic study has been approved with the recommendation for a stop condition, than implement a stop condition.

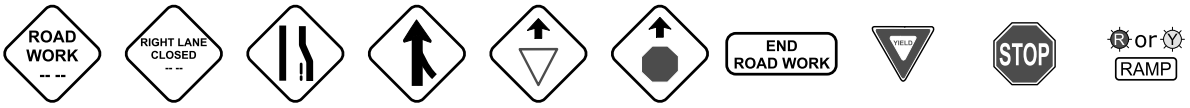
3. When Stop (R1-1) signs are used to control ramp traffic , Stop Ahead (W3-1) signs shall be placed along the ramp. When Yield signs (R1-2) are used to control ramp traffic, Yield Ahead (W3-2) signs shall be placed along the ramp.

4. Placement of the temporary Merge Right (W4-1R) sign is optional if the permanent Merge Right (W4-1R) sign is clearly visible and is within 500' of the location shown in this PATA.

5. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

6. Refer to PATA 012 for arrow panel sizing.

Signs



W20-1 W20-5R W4-2R W4-1R W3-2 W3-1 G20-2 R1-2 R1-1 R1-1-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

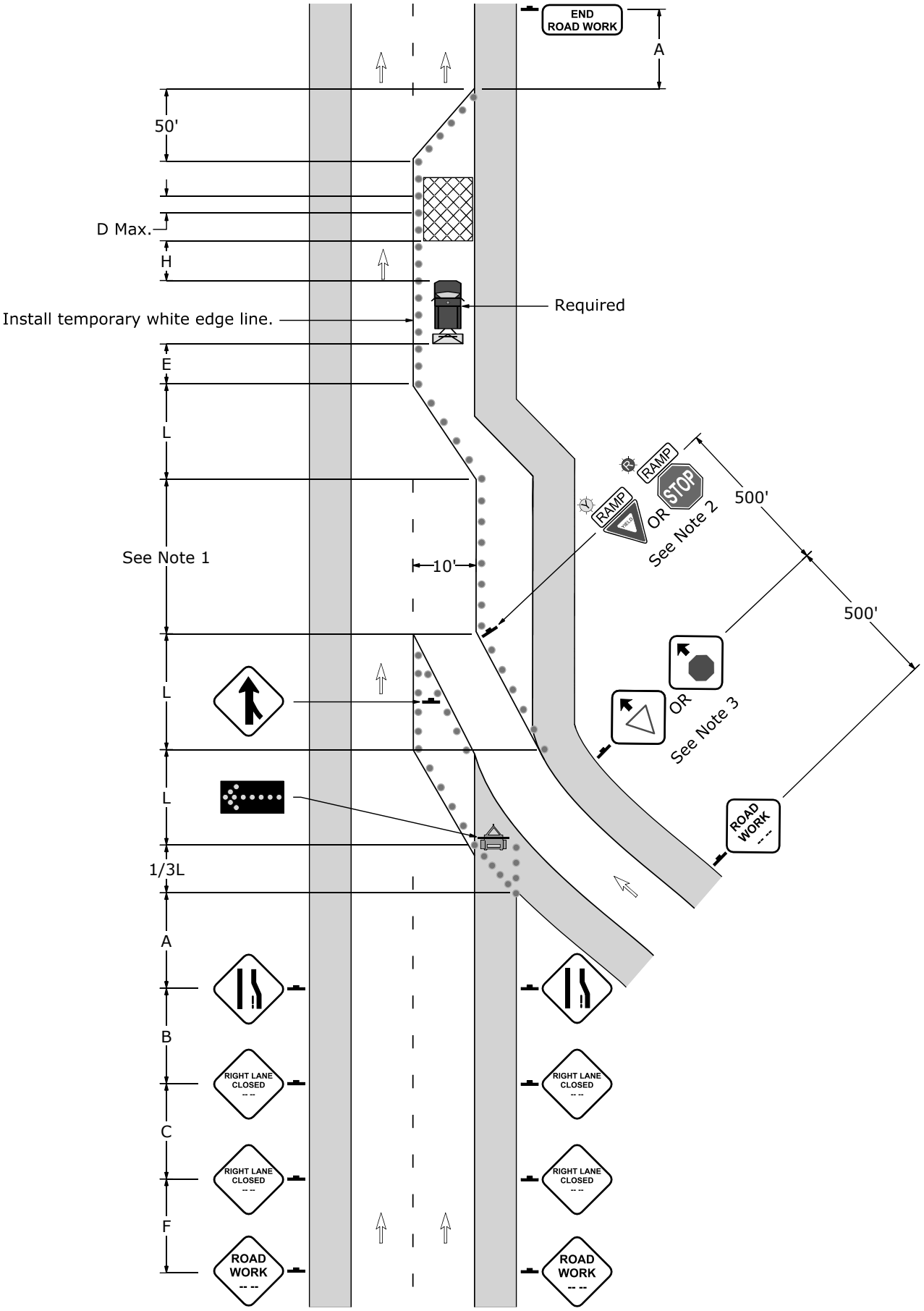
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 506 (Old PATA 37)
Lane Closure Near A Freeway Or Expressway Entrance Ramp



PATA 507 (Old PATA 38) - Notes

1. The maximum length of temporary one-lane operation, excluding transitions, should not exceed approximately 3 miles. Temporary one-lane operations longer than approximately 3 miles shall only be permitted if justified by an engineering analysis of crossover locations, traffic operations, safety, and other related factors.

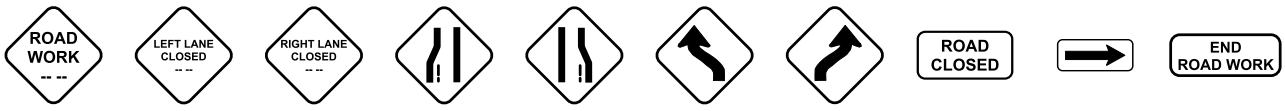
2. The alignment of the crossover may be designed as a reverse curve. When the crossover follows a curved alignment, the design criteria contained in Publication 13M (Design Manual Part 2 - Highway Design) should be used.

3. For existing concrete pavements, temporary bituminous overlays should be used as shown to cover misleading pavement joints.

4. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

5. Refer to PATA 012 for arrow panel sizing.

Signs



W20-1 W20-5L W20-5R W4-2L W4-2R W1-4L W1-4R R11-2 W1-6 G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

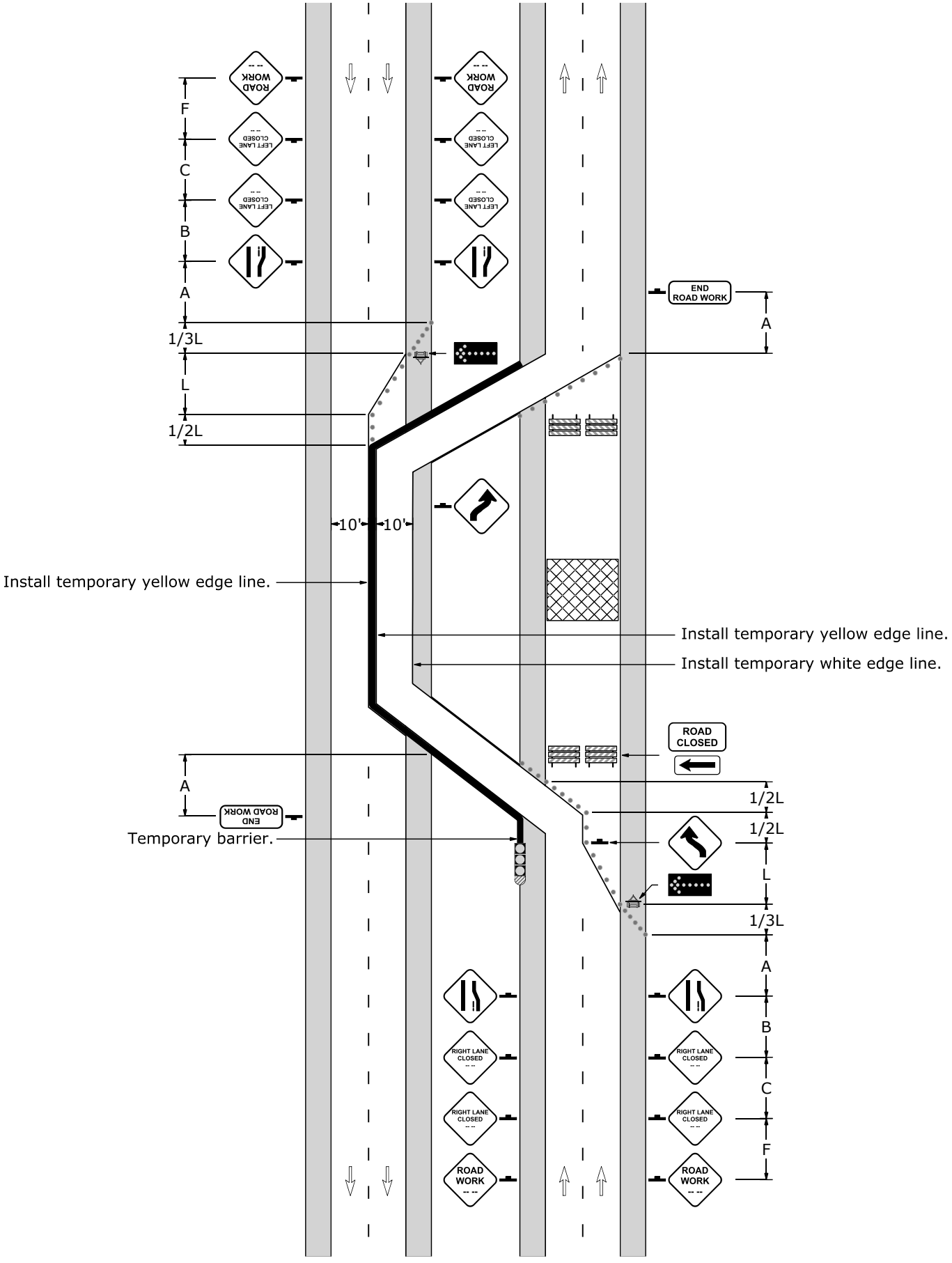
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 507 (Old PATA 38)
Two-Way Traffic On One Roadway Of A Normally Divided Highway



PATA 508 (New PATA) - Notes

1. The maximum length of temporary one-lane operation, excluding transitions, should not exceed approximately 3 miles. Temporary one-lane operations longer than approximately 3 miles shall only be permitted if justified by an engineering analysis of crossover locations, traffic operations, safety, and other related factors.

2. The width of existing lanes should be maintained throughout the temporary traffic control zone.

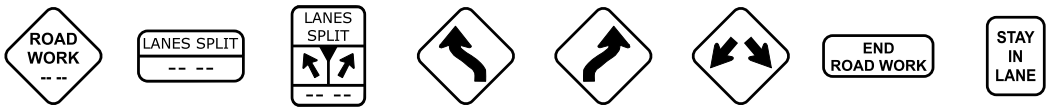
3. Temporary barriers, including end treatments must be crashworthy.

4. Temporary traffic barriers shall be supplemented with standard delineation, pavement markings, and channelizing devices for improved daytime and nighttime visibility.

5. The Lanes Split (W99-1) sign is a custom sign with dimensions that may vary based upon site conditions. Requests for creation of these signs shall be submitted to the District Traffic Unit prior to sign installation.

6. Refer to PATA 007 for installing advance warning signs for freeways and expressways.

Signs



W20-1 W99-1 W99-1 W1-4L W1-4R W12-1 G20-2 R4-9

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

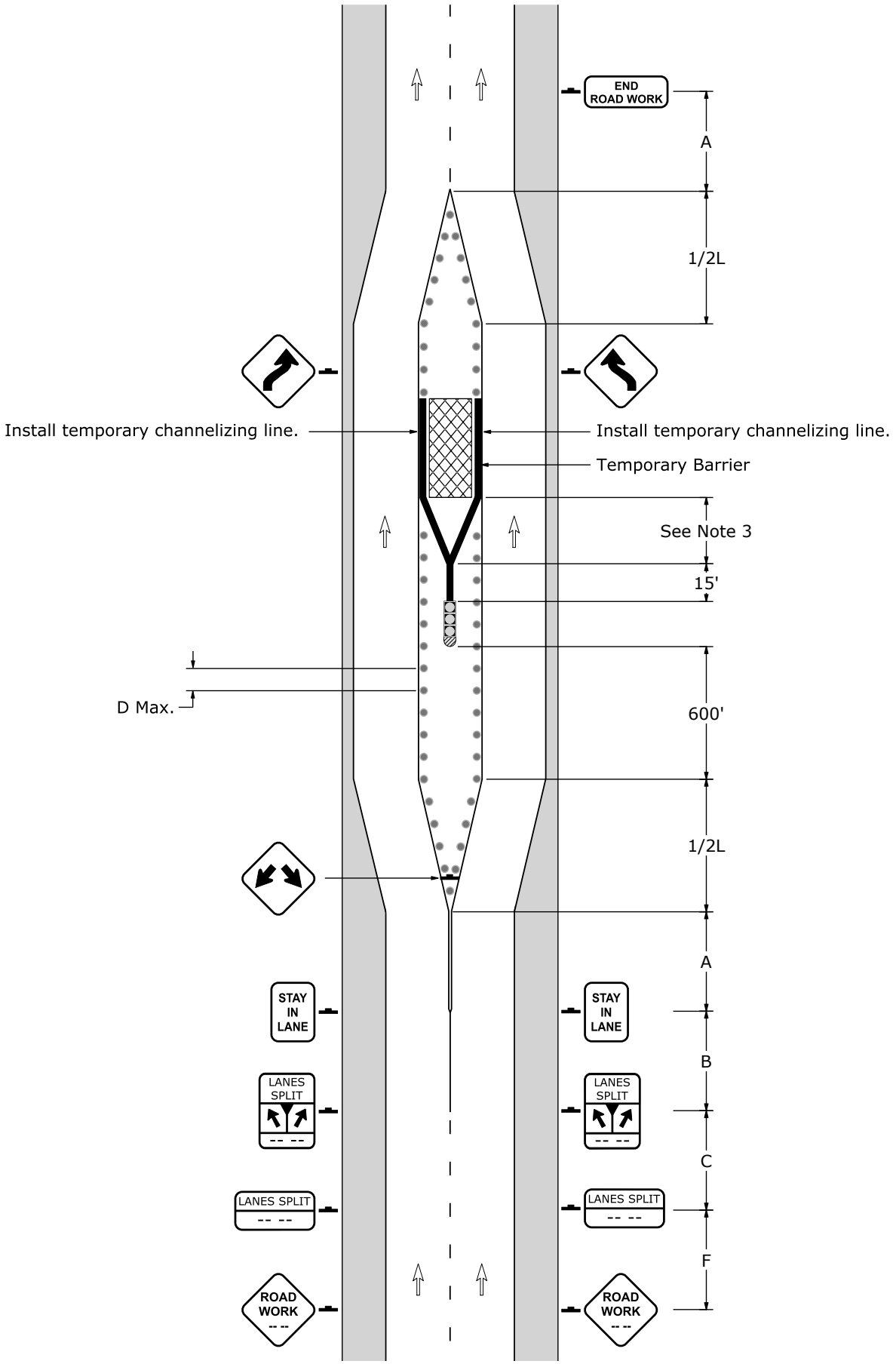
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 508 (New PATA)
Work Space In Center Of Roadway



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Freeways & Expressways

Mobile Operations
(PATA 600 Series)

PATA 601 (Old PATA 6) - Notes

1. The shadow vehicle and traffic control devices are not required if the work space is outside the highway right-of-way, behind barrier, more than 2’ behind curb, or 15’ or more from the edge of any roadway.

2. The Road Work (W20-1) sign on the shadow vehicle is optional.

Signs

W20-1

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

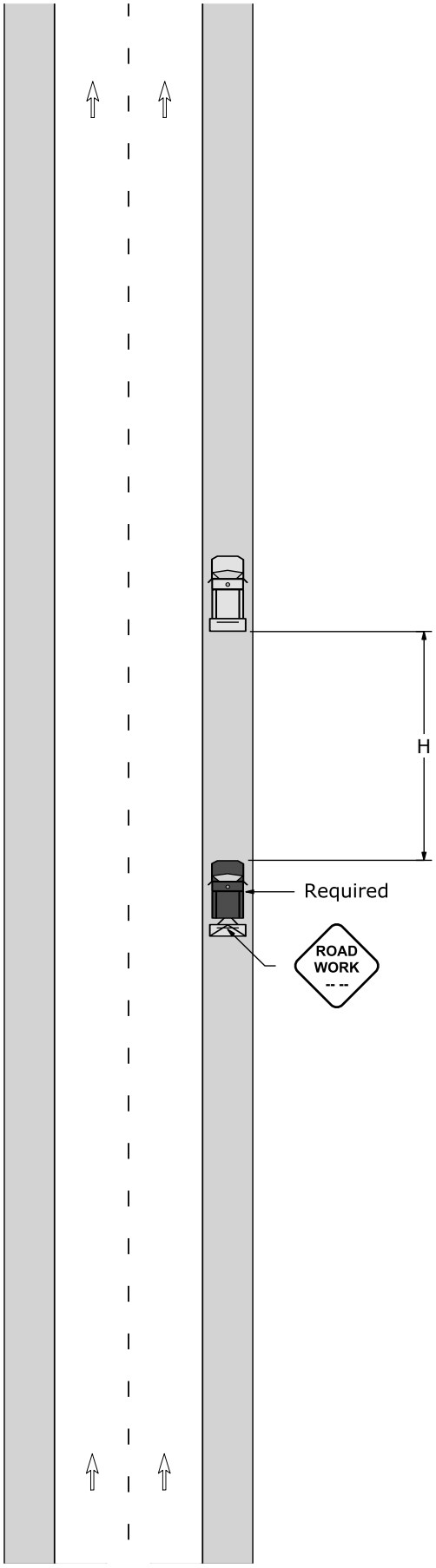
When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
40	12	320	160	110	9	6	6	6	80	305	150
45	12	540	270	180	13	7	6	6	90	360	150
50	12	600	300	200	13	7	6	6	100	425	250
55	12	660	330	220	13	7	6	6	110	495	250
60	12	720	360	240	13	7	6	6	120	570	250
65	12	780	390	260	13	7	6	6	130	645	250
70	12	840	420	280	13	7	6	6	140	730	250

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 601 (Old PATA 6)
Work Space On Or Beyond The Shoulder (No Roadway Encroachment)



PATA 602 (Old PATA 18) - Notes

1. Workers performing duties within the work lane shall not remain outside of the work vehicle for more than 60 minutes during the operation.

2. Shadow vehicles are required unless otherwise stated on the PATA drawings.

3. Flashing arrow panels are required for all shadow vehicles. Placement of the Lane Closed (W20-5L or W20-5R) sign on shadow vehicle 2 and shadow vehicle 3 is optional. If used, it should be placed so that it will not diminish the target value of the flashing arrow panel.

4. If sufficient shoulder width is not available for the shadow vehicles positioned on the shoulder, shadow vehicles shall be positioned as close as possible to the shoulder edge.

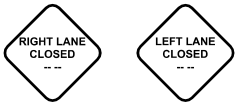
5. Shadow vehicle are permitted to straddle edge lines.

6. Whenever adequate stopping sight distance exists to the rear, shadow vehicle 1 should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

7. This operation should be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

8. Refer to PATA 012 for arrow panel sizing.

Signs



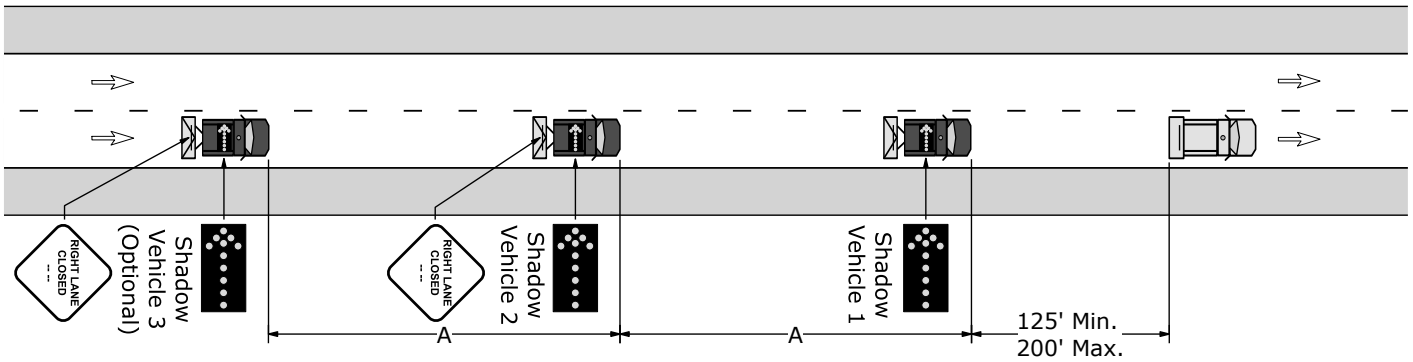
W20-5R W20-5L

Sign Spacing Chart

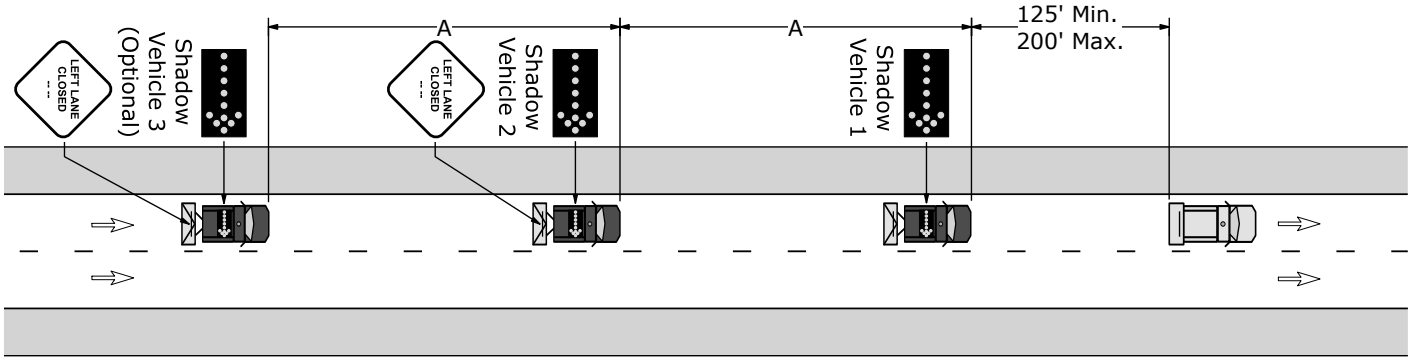
Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

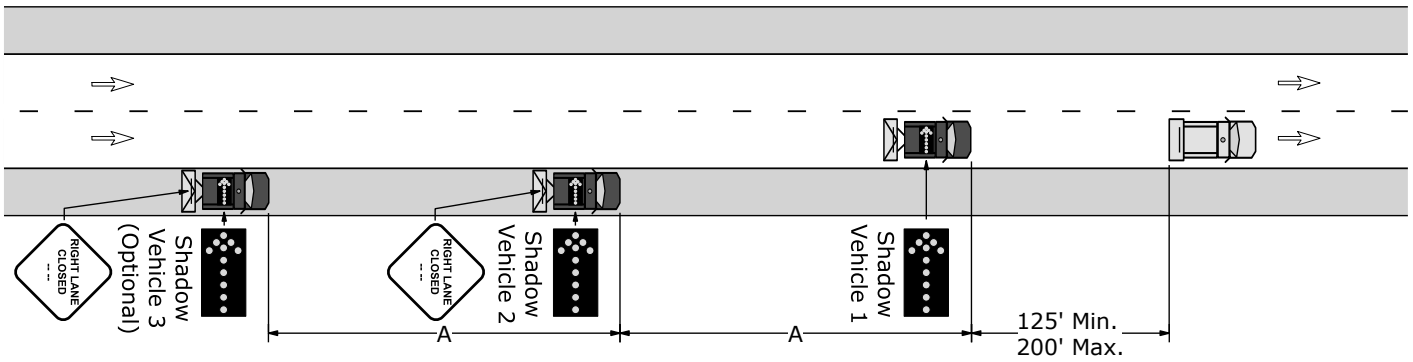
PATA 602 (Old PATA 18)
Work Space In The Left Or Right Lane



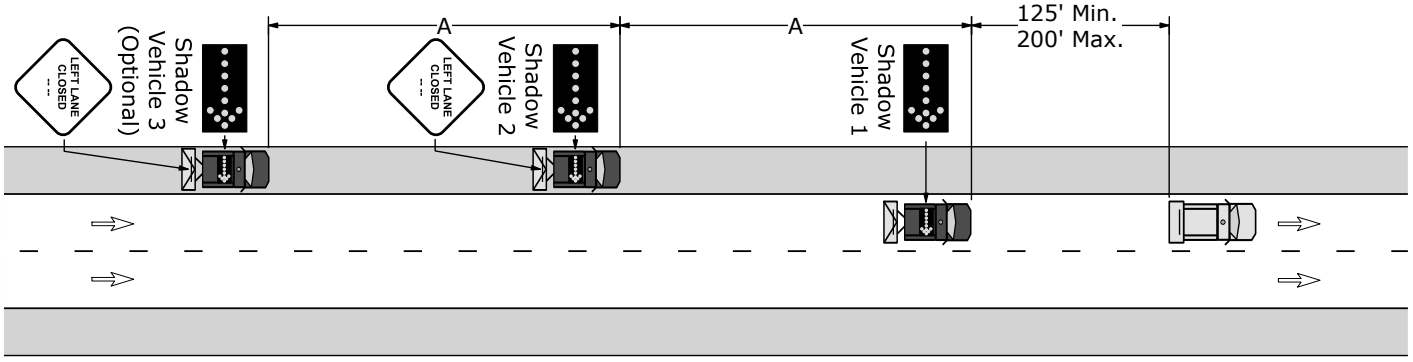
Continuously Moving Right Lane Operation - Traffic Merges To The Left



Continuously Moving Left Lane Operation - Traffic Merges To The Right



Intermittently Moving Right Lane Operation - Traffic Merges To The Left



Intermittently Moving Left Lane Operation - Traffic Merges To The Right

PATA 603 (Old PATA 23) - Notes

1. Workers performing duties within the work lane shall not remain outside of the work vehicle for more than 60 minutes during the operation.

2. Shadow vehicles are required unless otherwise stated on the PATA drawings.

3. Flashing arrow panels are required for all shadow vehicles. Placement of the Lane Closed (W20-5L, W20-5R, or W9-3) sign on shadow vehicle 2 and shadow vehicle 3 is optional. If used, it should be placed so that it will not diminish the target value of the flashing arrow panel.

4. If sufficient shoulder width is not available for the shadow vehicles positioned on the shoulder, shadow vehicles shall be positioned as close as possible to the shoulder edge.

5. Shadow vehicle are permitted to straddle edge lines.

6. During center lane operations, shadow vehicle 4 shall be utilized if workers are outside of the work vehicle and positioned in the travel lane.

7. If shadow vehicle 3 is not used during continuously moving center lane operations, shadow vehicle 2 will display a flashing arrow panel pointing to the left and right.

8. Whenever adequate stopping sight distance exists to the rear, shadow vehicle 1 should maintain the minimum distance from the work vehicle and proceed at the same speed. The shadow vehicle should slow down in advance of vertical or horizontal curves.

9. This operation should be done during non-peak hours of traffic, to be determined by the District Traffic Unit.

10. Refer to PATA 012 for arrow panel sizing.

Signs

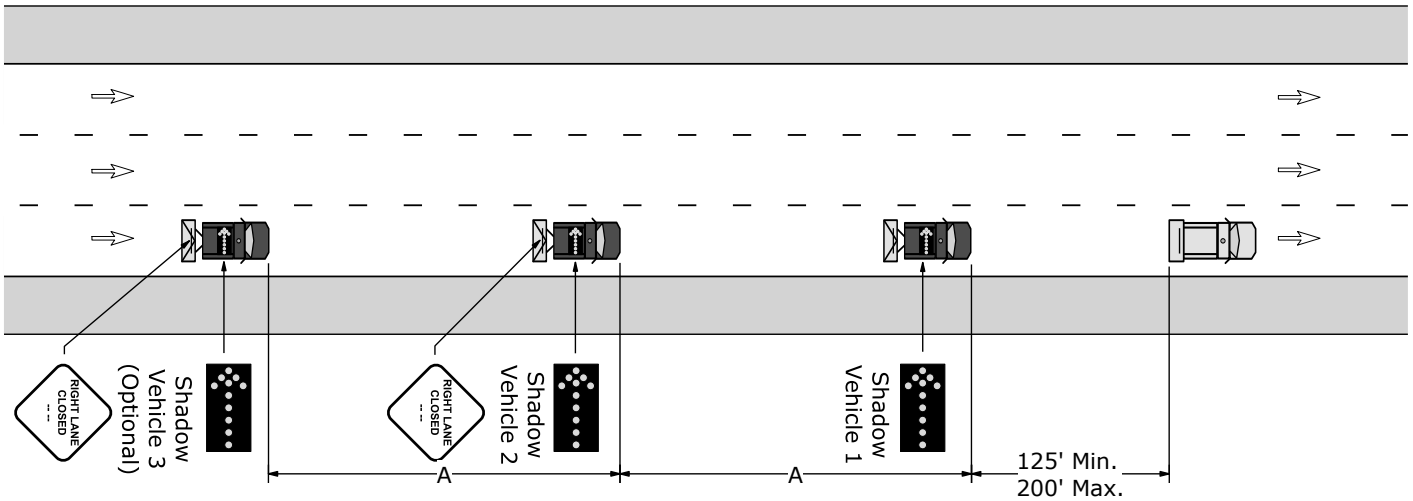
W20-5L W20-5R W9-3

Sign Spacing Chart

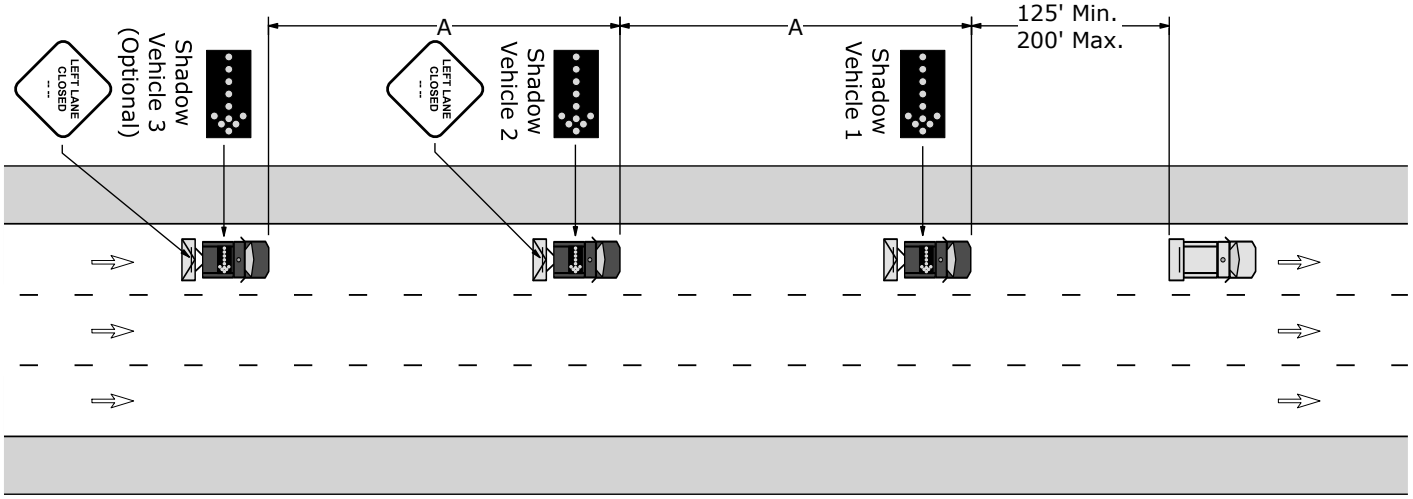
Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Freeways & Expressways	1000	1640	2640	5280

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

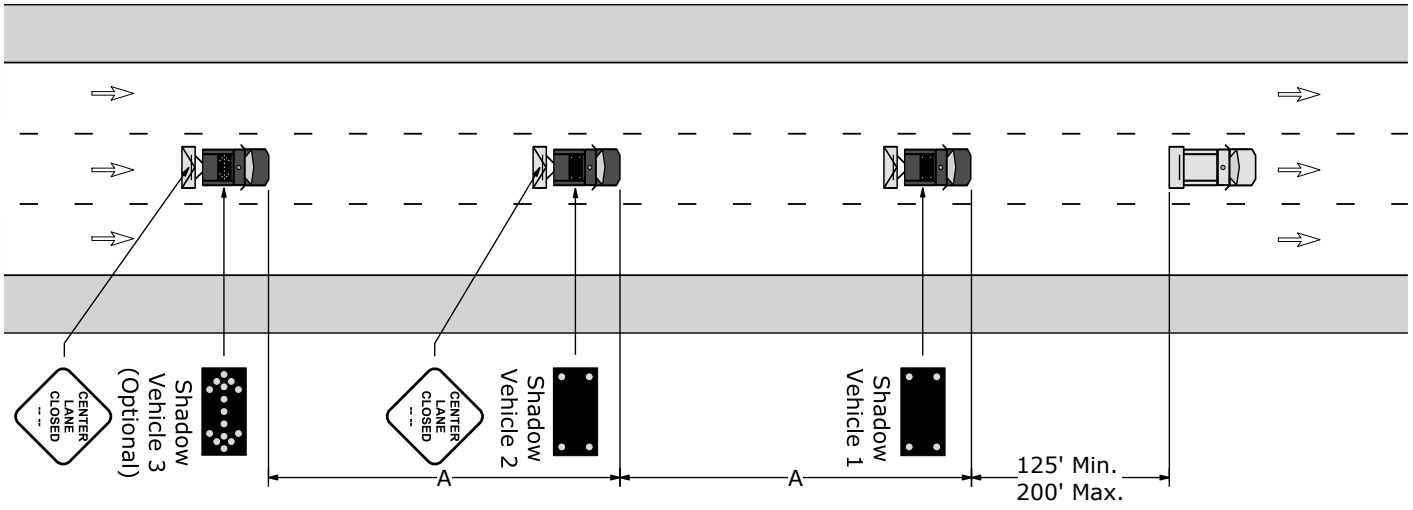
PATA 603 (Old PATA 23)
Work Space In Any Lane Of A Three Or More-Lane Approach (Drawing 1 of 3)



Continuously Moving Right Lane Operation - Traffic Merges To The Left

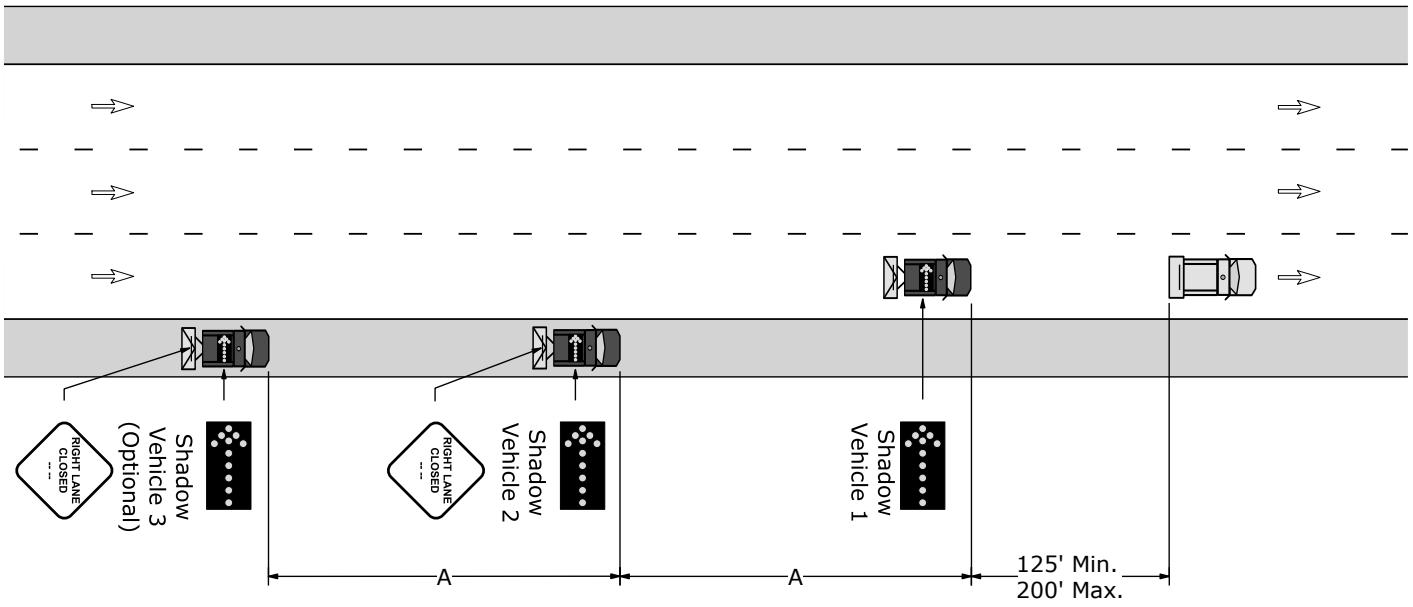


Continuously Moving Left Lane Operation - Traffic Merges To The Right

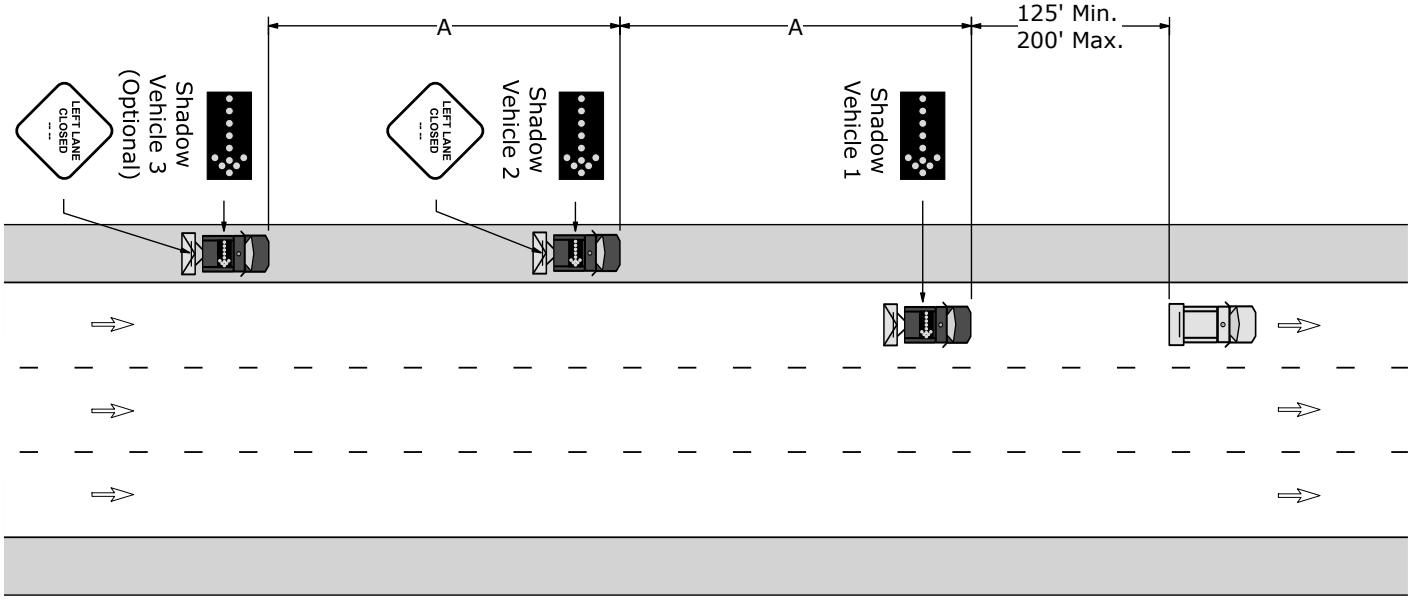


Continuously Moving Center Lane Operation - Traffic Merges To The Left Or Right

PATA 603 (Old PATA 23)
Work Space In Any Lane Of A Three Or More-Lane Approach (Drawing 2 of 3)

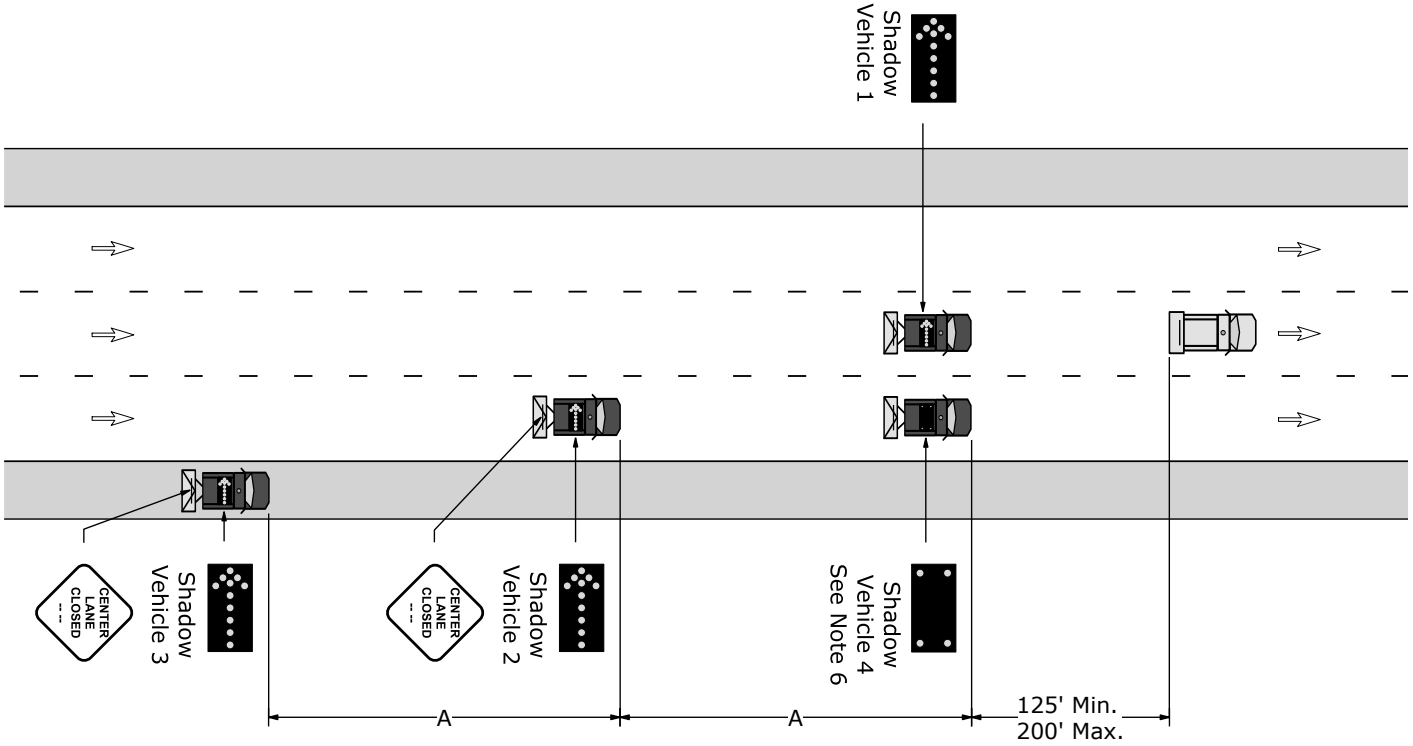


Intermittently Moving Right Lane Operation - Traffic Merges To The Left

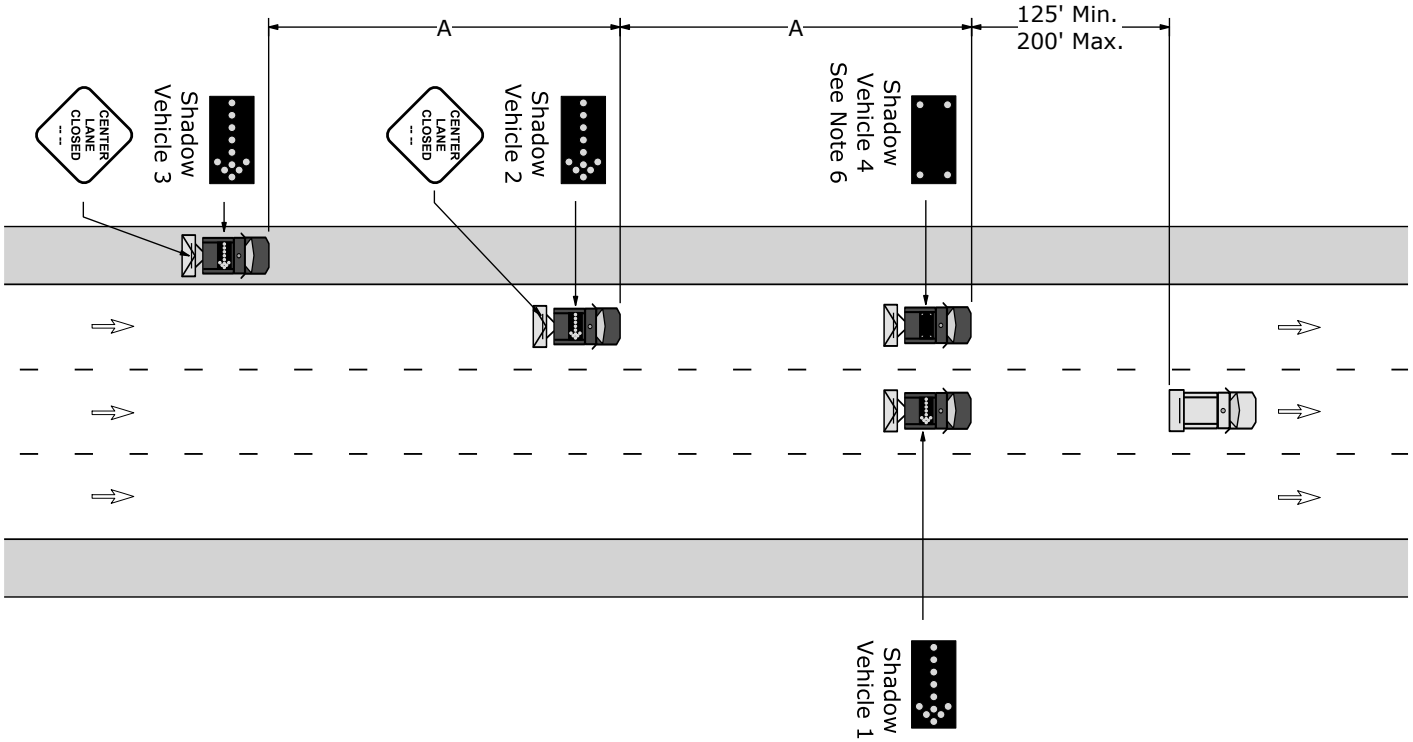


Intermittently Moving Left Lane Operation - Traffic Merges To The Right

PATA 603 (Old PATA 23)
Work Space In Any Lane Of A Three Or More-Lane Approach (Drawing 3 of 3)



Intermittently Moving Center Lane Operation - Traffic Merges To The Left



Intermittently Moving Center Lane Operation - Traffic Merges To The Right

Temporary Traffic Signal Operations

(PATA 700 Series)

Signal Reference Guide

Reference Guide for Temporary Traffic Control Signal Figures				
Type of Highway	Condition	Figure Number		
		Using Fixed Supports	Using Pedestal-Mounted Portable Traffic Control Signals	Using Trailer-Mounted Portable Traffic Control Signals
Two-Lane, Two Way Highway With One-Lane, Two-Way Traffic	Short-Term Manually-Controlled Complex or Non-Complex		PATA 701	PATA 702
	Short-Term Non-Complex			
	Short-Term Complex		PATA 703	PATA 704
	Long-Term Complex or Non-Complex	PATA 705		PATA 706

Appendix D Index: Temporary Traffic Control Signal Documentation
Document Type
Temporary Traffic Control Signal Requirements And Timeframes
Process For Obtaining PennDOT Approval To Use Temporary Traffic Control Signals
Blanket Permits
Application For Permit To Operate Temporary Traffic Control Signals
Temporary Traffic Control Signal Permit
Application Instructions For Permit To Operate Termporary Traffic Control Signals
Example Problem: Application For Permit To Operate Termporary Traffic Control Signals
Guidelines For The Selection Of Temporary Traffic Control Signals In Work Zones
Temporary Traffic Control Signals Non-Compliance Documentation Form
Temporary Traffic Control Signals User Comment Form
TE-161: Notice of Commencement for Pedestal-Mounted Portable Traffic Signals

PATA 701 (Old PATA 26e NC-1 and 26e M-1) - Notes (Page 1 of 3)

1. The use of pedestal-mounted portable traffic control signals in Pennsylvania for short-term stationary operations with non-complex conditions shall comply with provisions of this figure.

2. This figure may be used if all of the following field conditions are satisfied:

a. The operation is a stationary, short-term operation as defined in PennDOT Publication 212 and 213.

b. The portable traffic control signals are used to control one-lane, two-way traffic, and no more than two approaches to the work zone will be controlled by the portable traffic control signals.

c. There is no at-grade railroad crossing within the one-lane, two-way traffic section (between STOP HERE ON RED SIGNS) and within 300 feet of a portable traffic control signal.

d. No roadway approach to the portable traffic control signal is on a downgrade of 5% or more, if the normal speed limit is greater than 35 miles per hour.

e. There are no intersections or uncontrolled driveways within the one-lane, two-way traffic section.

3. For manual control, a single operator may be used if the operator is located within the activity area and has an unobstructed view of both traffic traveling through the one-lane section and traffic on the approach to each portable traffic control signal unit. Otherwise, a separate operator is required at each portable traffic control signal unit and communications must be maintained between operators.

4. Electronically submit a completed Notice of Commencement form (TE-161) to the appropriate PennDOT District Traffic Engineer so that it is received at least 3 business hours before the desired beginning time of the portable traffic control signal usage, except for emergency work as defined in PennDOT Publication 212. The Traffic Engineer may authorize commencement of work immediately on a case-by-case basis and shall provide information regarding the temporary traffic control zone to the appropriate District or Regional Traffic Management Center.

5. The design and application of the portable traffic control signals shall comply with the most current version of PennDOT Publications 149, 212, & 213.

6. Signal supports should be a minimum of 2 feet off the edge of travel way. If this is not possible, the supports shall be adequately delineated by channelizing devices.

7. The pedestal-mounted portable traffic control signals shall have two signal faces on each approach.

8. The length of yellow change intervals is normally in the range from about 3 seconds to 6 seconds. Use a 5-second yellow change interval, or an appropriate alternative value from PennDOT Publication 149 based on actual site conditions.

9. An all-red clearance interval must be used in accordance with all-red clearance interval calculations unless otherwise indicated by PennDOT. If the distance between the opposing Stop Here On Red (R10-6) signs is greater than 1000 ft. then the District Traffic Unit must be contacted to provide guidance as to the appropriate timing for all red clearance intervals when applicable.

10. For fixed time and actuated operations, the minimum green interval provided for each approach shall be 10 seconds, unless otherwise indicated by PennDOT. The length of green intervals should be such as to provide for safe and efficient traffic operations. For green intervals, monitor traffic operations as traffic volumes change throughout the period of portable traffic control signal usage and adjust green intervals to provide for safe and efficient traffic operations.

11. When not in operation, signal heads shall be removed from the view of traffic or hooded with a material that covers the signal indications from the view of traffic. All inappropriate signs shall also be removed, covered, folded, or turned so that they are not readable by oncoming traffic when the portable traffic control signal is not in operation.

12. Signal modules must be replaced in accordance with the manufacturers' recommendations, and a record of the change must be maintained by the user.

13. PennDOT reserves the right to inspect each portable traffic control signal usage. PennDOT also reserves the right to suspend the operation of the portable traffic control signal if the user shall at any time willfully or negligently fail to comply with the conditions contained or those contained in Publication 213, or fail to make any changes in the operation of the signal, or remove it, when so ordered by PennDOT.

14. All deficiencies will be subject to work zone liquidated damages as referenced in Publication 408, Section 108.07.

15. When signals are operated in actuation mode, the detection zone for vehicles approaching the signals should be limited to between 30' and 100' from the signal head.

16. In the event of signal failure, adequate manpower and equipment must be present at the work site.

PATA 701 (Old PATA 26e NC-1 and 26e M-1) - Notes (Page 3 of 3)

Signal Phases

	Phase 1			Phase 2			Emergency Flashing
	Intervals			Intervals			
Signal	1	2	3	1	2	3	
① ②	G	Y	R	R	R	R	R
③ ④	R	R	R	G	Y	R	R
Fixed	**	5	*	**	5	*	
Minimum***	10			10			
Passage****	3			3			
Maximum ^	45			45			
Memory	L			L			

Any field adjustment of "STOP HERE ON RED SIGNS" requires new calculation of clearance intervals in accordance with PennDOT specifications.

* See Table and Note 9.

** For manual operations, interval determined by operator.

*** See note 13. Minimum intervals not applicable for manual operations.

**** Passage interval not applicable for manual or fixed operations.

^ Field verify necessary green time. 45 seconds is maximum unless otherwise directed by the appropriate engineering District.

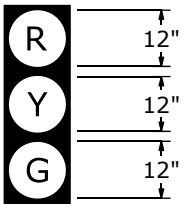
All-Red Clearance Interval (See Note 9)

Length of One-Lane Two-Way Traffic Section between STOP HERE ON RED SIGN signs (FT)	Require Minimum Length of All-Red Clearance Interval (Seconds)		
	15 MPH	20 MPH	25 MPH
1000	45	34	27
950	43	32	26
900	41	31	25
850	39	29	23
800	36	27	22
750	34	26	20
700	32	24	19
650	30	22	18
600	27	20	16
550	25	19	15
500	23	17	14
450	20	15	12

Signal Face Visibility (See Note 7)

Normal Speed Limit (MPH)	Minimum Visibility Distance (FT)
25	215
30	270
35	325
40	390
45	460
50	540
55	625

Signal Requirements



Signal Number's: 1-2-3-4

Note: All signals to be equipped with backplates

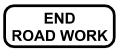
Signs

W20-1

W20-4

W3-3

R10-6AL



G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

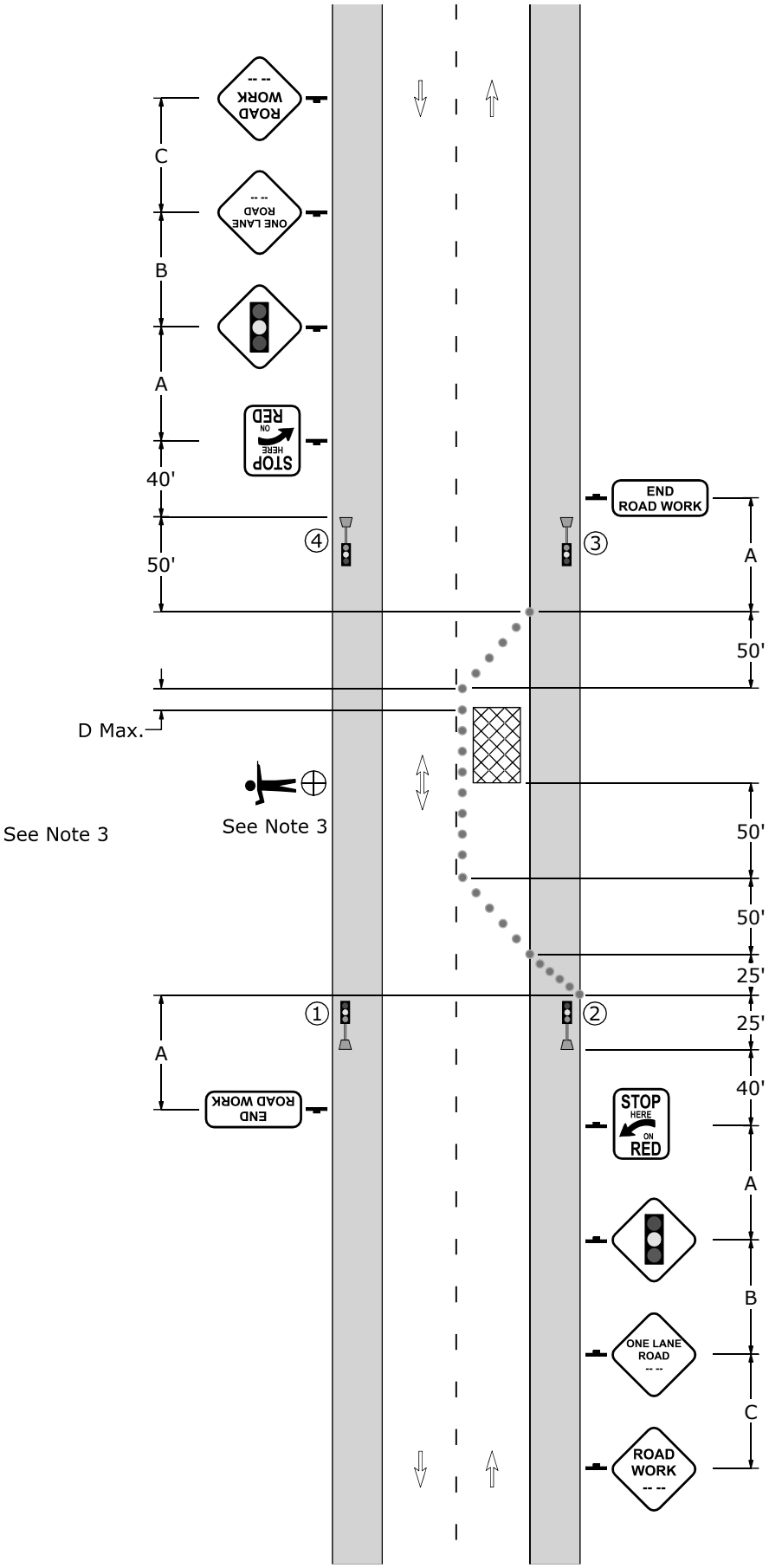
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 701 (Old PATA 26e NC-1 and 26e M-1)
Short-Term Non-Complex (Pedestal-Mounted)



PATA 702 (Old PATA 26e NC-2 and 26e M-2) - Notes (Page 1 of 3)

1. The use of trailer-mounted portable traffic control signals in Pennsylvania for short-term stationary operations with non-complex conditions shall comply with provisions of this figure.

2. This figure may be used if all of the following conditions are satisfied:

a. The operation is a stationary, short-term operation as defined in PennDOT Publication 212 and 213.

b. The portable traffic control signals are used to control one-lane, two-way traffic, and no more than two approaches to the work zone will be controlled by the portable traffic control signals.

c. There is no at-grade railroad crossing within the one-lane, two-way traffic section (between STOP HERE ON RED SIGNS) and within 300 feet of a portable traffic control signal.

d. No roadway approach to the portable traffic control signal is on a downgrade of 5% or more, if the normal speed limit is greater than 35 miles per hour.

e. There are no intersections or uncontrolled commercial driveways within the one-lane, two-way traffic section. The proposed method of traffic control for non-commercial driveways shall be acceptable to PennDOT.

f. The roadway ADT (average daily traffic) is 10,000 vehicles per day or less, and thelength of the one-lane, two-way traffic section (between "Stop Here On Red Signs") is 1000 feet or less.

3. For manual control, a single operator may be used if the operator is located within the activity area and has an unobstructed view of both traffic traveling through the one-lane section and traffic on the approach to each portable traffic control signal unit. Otherwise, a separate operator is required at each portable traffic control signal unit and communications must be maintained between operations.

4. For manual control, supplemental signal indicator lamps are required to show the operator(s) the status of signal indications.

5. For manual control, portable traffic control signal operations should remain in a manually-controlled mode and should not be changed unless directed by PennDOT.

6. Advance written approval must be obtained from PennDOT prior to using portable traffic signals for short-term operations on any public highway. A PennDOT temporary traffic control signal permit is required for short-term operations, and a copy must be maintained on-site during the period of portable traffic control signal usage.

7. Submit a completed application for a permit to operate temporary traffic signals to the appropriate PennDOT engineering district office so that it is received at least 3 full working days before the desired beginning time of the portable traffic signal usage, except for emergency work as defined in PennDOT Publication 212.

8. Refer to appendix D of this Publication for additional guidance and acceptance procedures pertaining to portable traffic control signals.

9. The design and application of the portable traffic control signals shall comply with the most current version of PennDOT Publications 149, 212, & 213.

10. Signal supports should be a minimum of 2 feet off the edge of travel way. If this is not possible, the supports shall be adequately delineated by channelizing devices.

11. The bottom of the housing of a signal face suspended over the roadway shall be a minimum of 15 feet, but not more than 19 feet above the pavement. The bottom of the housing of a signal face that is not mounted over the roadway shall be at least 8 feet, but not more than 15 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

12. A minimum of two signal faces on each approach should be continuously visible to approaching traffic from a point meeting the signal visibility distances specified in the table on Notes Page 3 of 3.

13. The length of yellow change intervals is normally in the range from about 3 seconds to 6 seconds. Use a 5-second yellow change interval, or an appropriate alternative value from PennDOT Publication 149 based on actual site conditions.

14. An all-red clearance interval must be used. The length of the all-red clearance interval is based on the length of the one-lane, two-way traffic section controlled by the portable traffic control signals and the speed of traffic through that section. Monitor traffic operations during the period of portable traffic control signal usage and adjust the length of the all-red clearance interval to account for site conditions and to provide for safe and efficient traffic operations. Unless otherwise indicated by PennDOT, the minimum length of all-red clearance intervals shall be as indicated on the table on Notes Page 3 of 3.

15. For fixed time and actuated non-complex operations, the minimum green interval provided for each approach shall be 10 seconds, unless otherwise indicated by PennDOT. The length of green intervals should be such as to provide for safe and efficient traffic operations. Use green intervals as indicated on the permit drawing. If there is not permit drawing, monitor traffic operations as traffic volumes change throughout the period of portable traffic control signal usage and adjust green intervals to provide for safe and efficient traffic operations.

16. When not in operation, signal heads shall be removed from the view of traffic or hooded with a material that covers the signal indications from the view of traffic. All inappropriate signs shall also be removed, covered, folded, or turned so that they are not readable by oncoming traffic when the portable traffic control signal is not in operation.

17. Signal modules must be replaced in accordance with the manufacturers' recommendations, and a record of the change must be maintained by the user.

18. Additional signs and devices shall be installed as required in PennDOT Publications 212 and 213, and as required based on actual site conditions.

19. PennDOT reserves the right to inspect each portable traffic control signal usage. PennDOT also reserves the right to revoke a temporary traffic control signal permit or to suspend the operation of the portable traffic control signal if the user shall at any time willfully or negligently fail to comply with the conditions contained in the permit or Publication 213, or fail to make any changes in the operation of the signal, or remove it, when so ordered by PennDOT. The user shall not make any change in the operation of the portable traffic control signal as defined in the permit drawings without prior written approval of PennDOT.

20. Optional signal configurations shall only be used when physical obstructions make it unreasonable to use the primary configuration.

21. In the event of signal failure, adequate manpower and equipment must be present at the work site.

PATA 702 (Old PATA 26e NC-2 and 26e M-2) - Notes (Page 3 of 3)

Signal Phases

	Phase 1			Phase 2			Emergency Flashing
	Intervals			Intervals			
Signal	1	2	3	1	2	3	
① ②	G	Y	R	R	R	R	R
③ ④	R	R	R	G	Y	R	R
Fixed	**	5	*	**	5	*	
Minimum***	10			10			
Passage****	3			3			
Maximum							
Memory	NL			NL			

Any field adjustment of "STOP HERE ON RED SIGNS" requires new calculation of clearance intervals in accordance with PennDOT specifications.

* See Table and Note 14.

** For manual operations, interval determined by operator.

*** See note 15. Minimum intervals not applicable for manual operations.

**** Passage interval not applicable for manual operations.

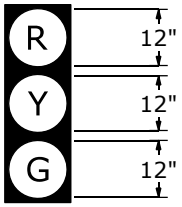
All-Red Clearance Interval (See Note 14)

Length of One-Lane Two-Way Traffic Section between STOP HERE ON RED SIGN signs (FT)	Require Minimum Length of All-Red Clearance Interval (Seconds)		
	15 MPH	20 MPH	25 MPH
1000	45	34	27
950	43	32	26
900	41	31	25
850	39	29	23
800	36	27	22
750	34	26	20
700	32	24	19
650	30	22	18
600	27	20	16
550	25	19	15
500	23	17	14
450	20	15	12

Signal Face Visibility (See Note 12)

Normal Speed Limit (MPH)	Minimum Visibility Distance (FT)
25	215
30	270
35	325
40	390
45	460
50	540
55	625

Signal Requirements



Signal Number's: 1-2-3-4

Note: All signals to be equipped with backplates

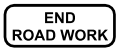
Signs

W20-1

W20-4


W3-3

R10-6AL



G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

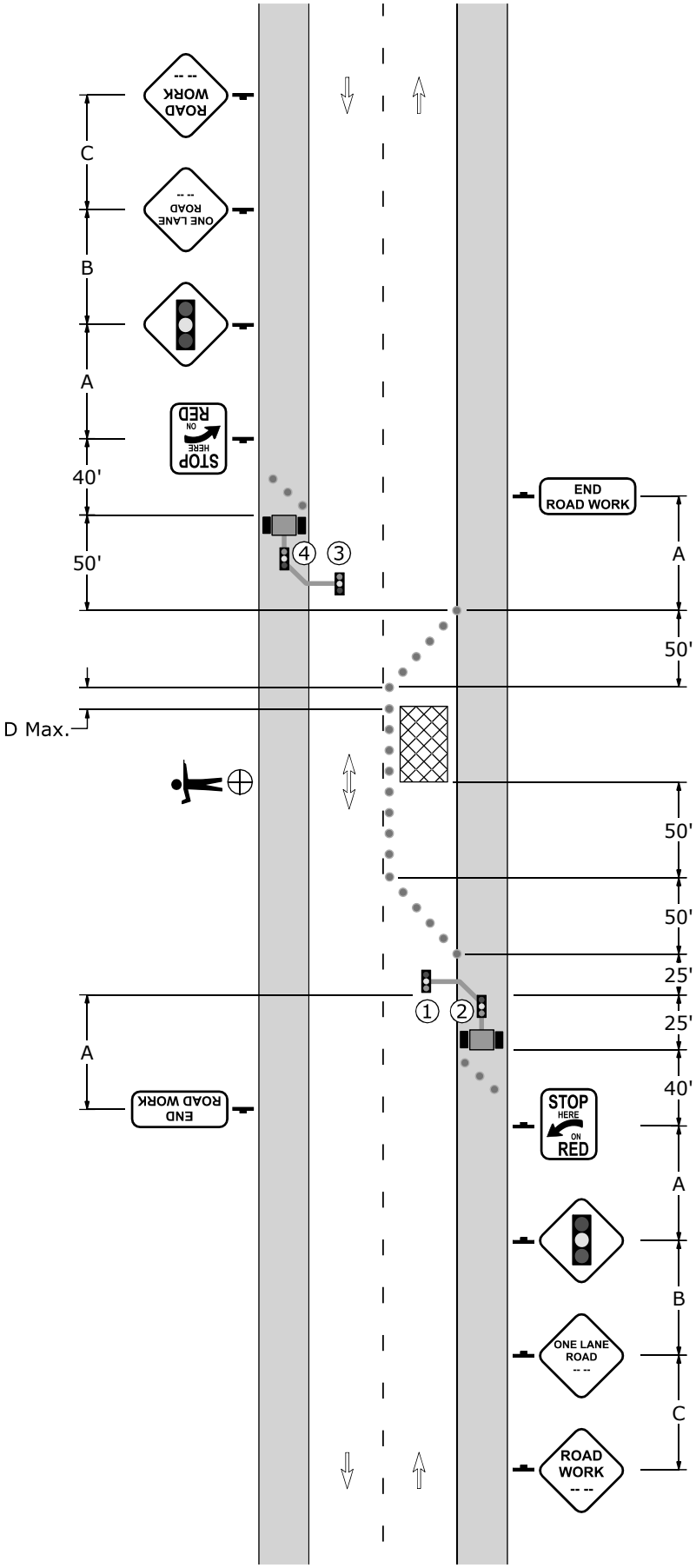
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

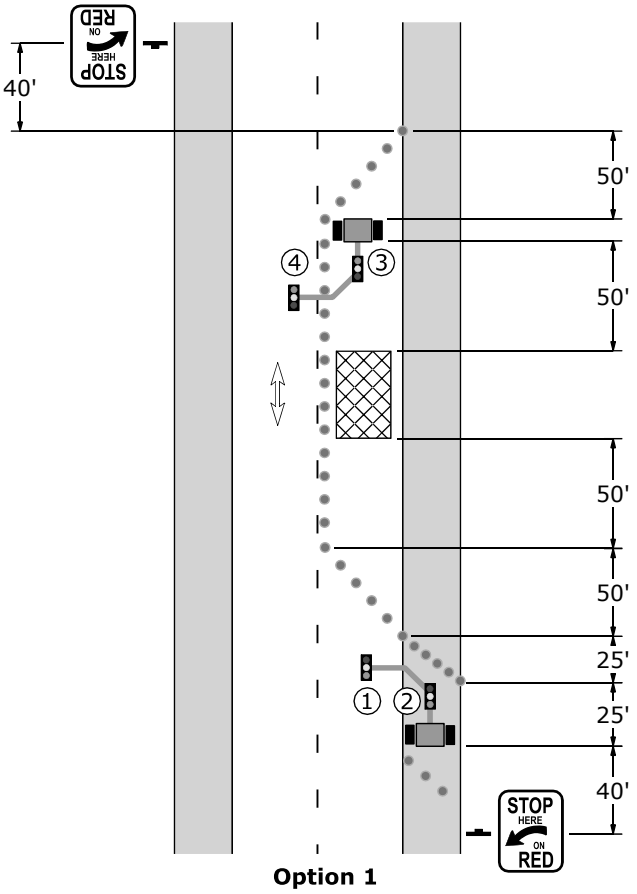
Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

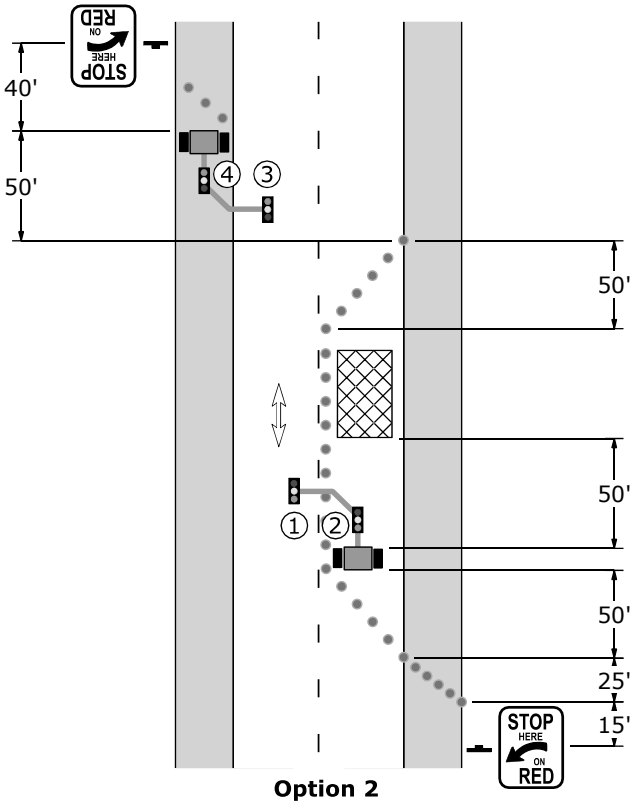
PATA 702 (Old PATA 26e M-2 and PATA 26e NC-2)
Short-Term Non-Complex (Trailer-Mounted) (Drawing 1 of 2)



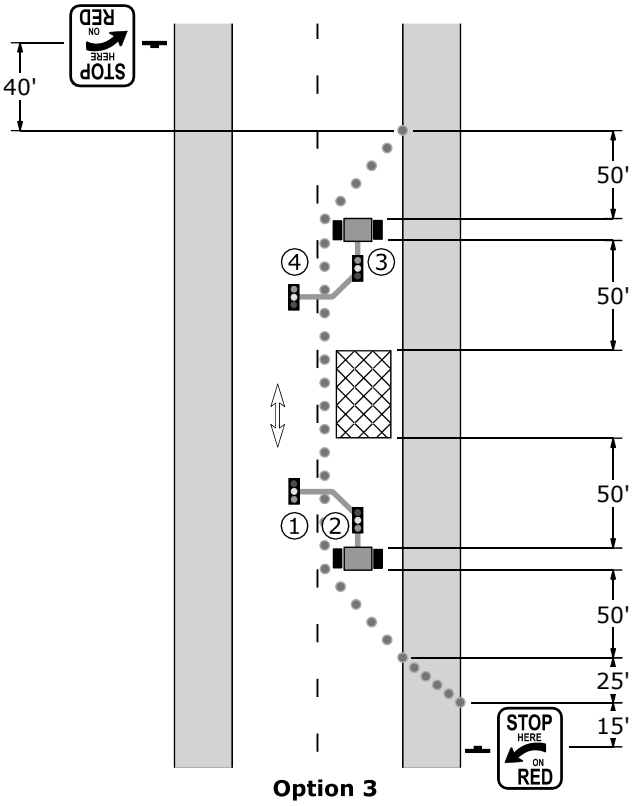
PATA 702 (Old PATA 26e M-2 and PATA 26e NC-2)
Alternate Trailer-Mounted Portable Traffic Signal Placements (Drawing 2 of 2)



Option 1



Option 2



Option 3

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PATA 703 (Old PATA 26e C-1) - Notes (Page 1 of 2)

1. The use of manually-controlled, pedestal-mounted portable traffic control signals in Pennsylvania for short-term stationary operations with complex conditions shall comply with provisions of this figure.

2. Advance written approval must be obtained from PennDOT prior to using portable traffic signals for short-term operations on any public highway. A PennDOT temporary traffic control signal permit is required for short-term operations, and a copy must be maintained on-site during the period of portable traffic control signal usage.

3. Refer to appendix D of this Publication for additional guidance and acceptance procedures pertaining to portable traffic control signals.

4. The design and application of the portable traffic control signals shall comply with the most current version of PennDOT Publications 149, 212, & 213.

5. Signal supports should be a minimum of 2 feet off the edge of the travel way. If this is not possible, the supports shall be adequately protected by barrier, guiderail, or channelizing devices.

6. The bottom of the housing of a signal face that is not mounted over the roadway shall be at least 8 feet, but not more than 15 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

7. A minimum of two signal faces on each approach should be continuously visible to approaching traffic from a point meeting the signal visibility distances specified in the table on notes page 2 of 2.

8. All signal lenses shall be 12 inches in diameter.

9. The length of yellow change intervals is normally in the range from about 3 seconds to 6 seconds. Use a 5-second yellow change interval, or an appropriate alternative value from PennDOT Publication 149 based on actual site conditions.

10. An all-red clearance interval must be used. The length of the all-red clearance interval is based on the length of the one-lane, two-way traffic section controlled by the portable traffic control signals and the speed of traffic through that section. Monitor traffic operations during the period of portable traffic control signal usage and adjust the length of the all-red clearance interval to account for site conditions and to provide for safe and efficient traffic operations. Unless otherwise indicated by PennDOT, the minimum length of all-red clearance intervals shall be as indicated on the table on Notes Page 2 of 2.

11. For fixed time and actuated operations, the minimum green interval provided for each approach shall be 10 seconds, unless otherwise indicated by PennDOT. The length of green intervals should be such as to provide for safe and efficient traffic operations. Use green intervals as indicated on the permit drawing. Monitor traffic operations as traffic volumes change throughout the period of portable traffic control signal usage and adjust green intervals to provide for safe and efficient traffic operations.

12. When not in operation, signal heads shall be removed from the view of traffic or hooded with a material that covers the signal indications from the view of traffic. All inappropriate signs shall also be removed, covered, folded, or turned so that they are not readable by oncoming traffic when the portable traffic control signal is not in operation.

13. When the temporary traffic control signal is changed to flashing mode, either manually or automatically, red signal indications shall be flashed to both approaches.

14. Signal modules must be replaced in accordance with the manufacturers' recommendations, and a record of the change must be maintained by the user.

15. Additional signs and devices shall be installed as required in PennDOT Publications 212 and 213, and as required based on actual site conditions.

16. PennDOT reserves the right to inspect each portable traffic control signal usage. PennDOT also reserves the right to revoke a temporary traffic control signal permit or to suspend the operation of the portable traffic control signal if the user shall at any time willfully or negligently fail to comply with the conditions contained in the permit or Publication 213, or fail to make any changes in the operation of the signal, or remove it, when so ordered by PennDOT. The user shall not make any change in the operation of the portable traffic control signal as defined in the permit drawings without prior written approval of PennDOT.

17. In the event of signal failure, adequate manpower and equipment must be present at the work site.

PATA 703 (Old PATA 26e C-1) - Notes (Page 2 of 2)

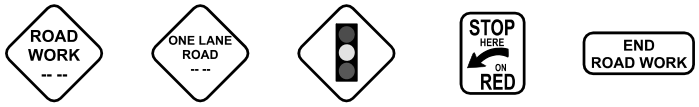
All-Red Clearance Interval (See Note 10)

Length of One-Lane Two-Way Traffic Section between STOP HERE ON RED SIGN signs (FT)	Require Minimum Length of All-Red Clearance Interval (Seconds)		
	15 MPH	20 MPH	25 MPH
1000	45	34	27
950	43	32	26
900	41	31	25
850	39	29	23
800	36	27	22
750	34	26	20
700	32	24	19
650	30	22	18
600	27	20	16
550	25	19	15
500	23	17	14
450	20	15	12

Signal Face Visibility (See Note 7)

Normal Speed Limit (MPH)	Minimum Visibility Distance (FT)
25	215
30	270
35	325
40	390
45	460
50	540
55	625

Signs



W20-1 W20-4 W3-3 R10-6AL G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

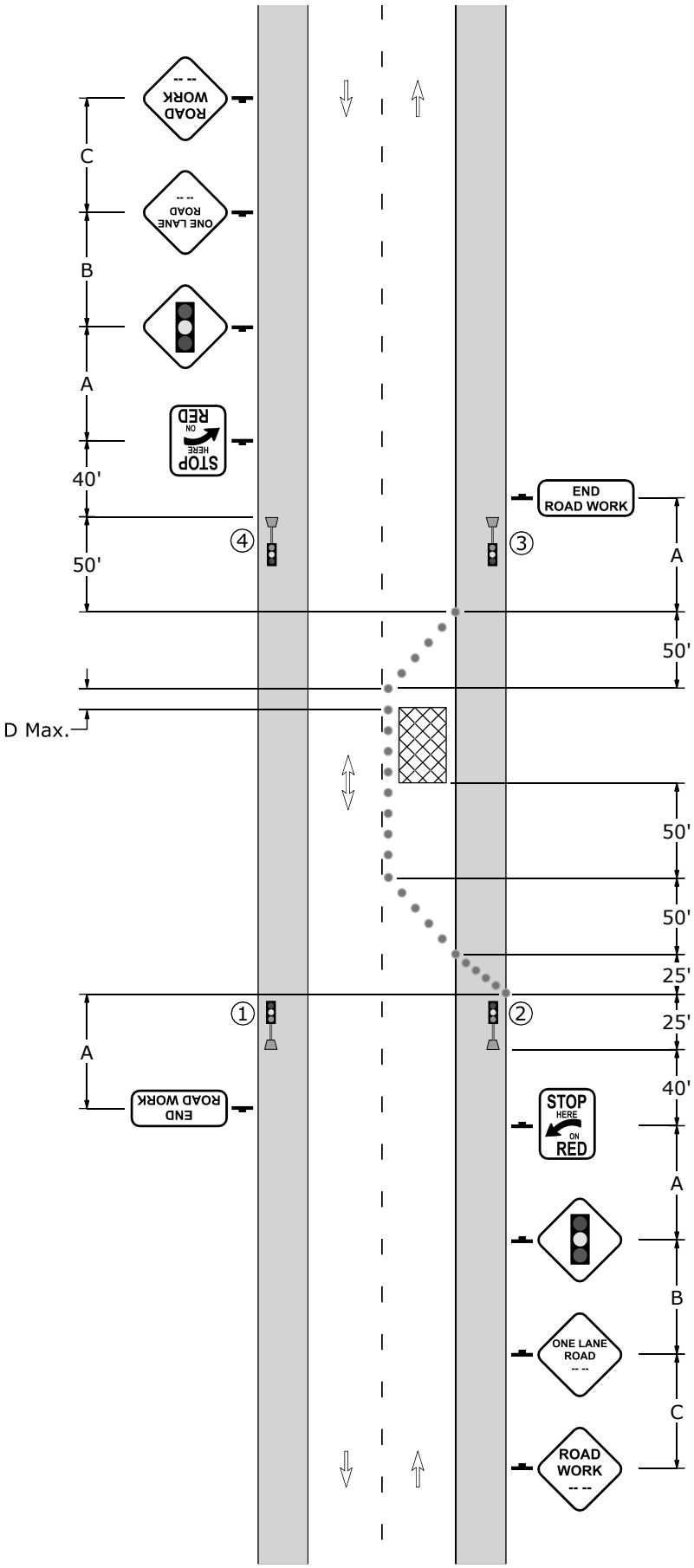
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 703 (Old PATA 26e C-1)
Short-Term Complex (Pedestal-Mounted)



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PATA 704 (Old PATA 26e C-2) - Notes (Page 1 of 2)

1. The use of manually-controlled, trailer-mounted portable traffic control signals in Pennsylvania for short-term stationary operations with complex conditions shall comply with provisions of this figure.

2. Advance written approval must be obtained from PennDOT prior to using portable traffic signals for short-term operations on any public highway. A PennDOT temporary traffic control signal permit is required for short-term operations, and a copy must be maintained on-site during the period of portable traffic control signal usage.

3. Refer to appendix D of this Publication for additional guidance and acceptance procedures pertaining to portable traffic control signals.

4. The design and application of the portable traffic control signals shall comply with the most current version of PennDOT Publications 149, 212, & 213.

5. Signal supports should be a minimum of 2 feet off the edge of the travel way. If this is not possible, the supports shall be adequately protected by barrier, guiderail, or channelizing devices.

6. The bottom of the housing of a signal face suspended over the roadway shall be a minimum of 15 feet, but not more than 19 feet above the pavement. The bottom of the housing of a signal face that is not mounted over the roadway shall be at least 8 feet, but not more than 15 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

7. A minimum of two signal faces on each approach should be continuously visible to approaching traffic from a point meeting the signal visibility distances specified in the table on notes page 2 of 2.

8. All signal lenses shall be 12 inches in diameter.

9. The length of yellow change intervals is normally in the range from about 3 seconds to 6 seconds. Use a 5-second yellow change interval, or an appropriate alternative value from PennDOT Publication 149 based on actual site conditions.

10. An all-red clearance interval must be used. The length of the all-red clearance interval is based on the length of the one-lane, two-way traffic section controlled by the portable traffic control signals and the speed of traffic through that section. Monitor traffic operations during the period of portable traffic control signal usage and adjust the length of the all-red clearance interval to account for site conditions and to provide for safe and efficient traffic operations. Unless otherwise indicated by PennDOT, the minimum length of all-red clearance intervals shall be as indicated on the table on Notes Page 2 of 2.

11. For fixed time and actuated operations, the minimum green interval provided for each approach shall be 10 seconds, unless otherwise indicated by PennDOT. The length of green intervals should be such as to provide for safe and efficient traffic operations. Use green intervals as indicated on the permit drawing. Monitor traffic operations as traffic volumes change throughout the period of portable traffic control signal usage and adjust green intervals to provide for safe and efficient traffic operations.

12. When not in operation, signal heads shall be removed from the view of traffic or hooded with a material that covers the signal indications from the view of traffic. All inappropriate signs shall also be removed, covered, folded, or turned so that they are not readable by oncoming traffic when the portable traffic control signal is not in operation.

13. When the temporary traffic control signal is changed to flashing mode, either manually or automatically, red signal indications shall be flashed to both approaches.

14. Signal modules must be replaced in accordance with the manufacturers' recommendations, and a record of the change must be maintained by the user.

15. Additional signs and devices shall be installed as required in PennDOT Publications 212 and 213, and as required based on actual site conditions.

16. PennDOT reserves the right to inspect each portable traffic control signal usage. PennDOT also reserves the right to revoke a temporary traffic control signal permit or to suspend the operation of the portable traffic control signal if the user shall at any time willfully or negligently fail to comply with the conditions contained in the permit or Publication 213, or fail to make any changes in the operation of the signal, or remove it, when so ordered by PennDOT. The user shall not make any change in the operation of the portable traffic control signal as defined in the permit drawings without prior written approval of PennDOT.

17. Optional signal configurations shall only be used when physical obstructions make it unreasonable to use the primary configuration.

18. In the event of signal failure, adequate manpower and equipment must be present at the work site.

PATA 704 (Old PATA 26e C-2) - Notes (Page 2 of 2)

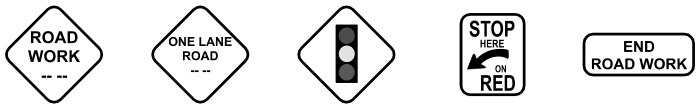
All-Red Clearance Interval (See Note 10)

Length of One-Lane Two-Way Traffic Section between STOP HERE ON RED SIGN signs (FT)	Require Minimum Length of All-Red Clearance Interval (Seconds)		
	15 MPH	20 MPH	25 MPH
1000	45	34	27
950	43	32	26
900	41	31	25
850	39	29	23
800	36	27	22
750	34	26	20
700	32	24	19
650	30	22	18
600	27	20	16
550	25	19	15
500	23	17	14
450	20	15	12

Signal Face Visibility (See Note 7)

Normal Speed Limit (MPH)	Minimum Visibility Distance (FT)
25	215
30	270
35	325
40	390
45	460
50	540
55	625

Signs



W20-1 W20-4 W3-3 R10-6AL G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

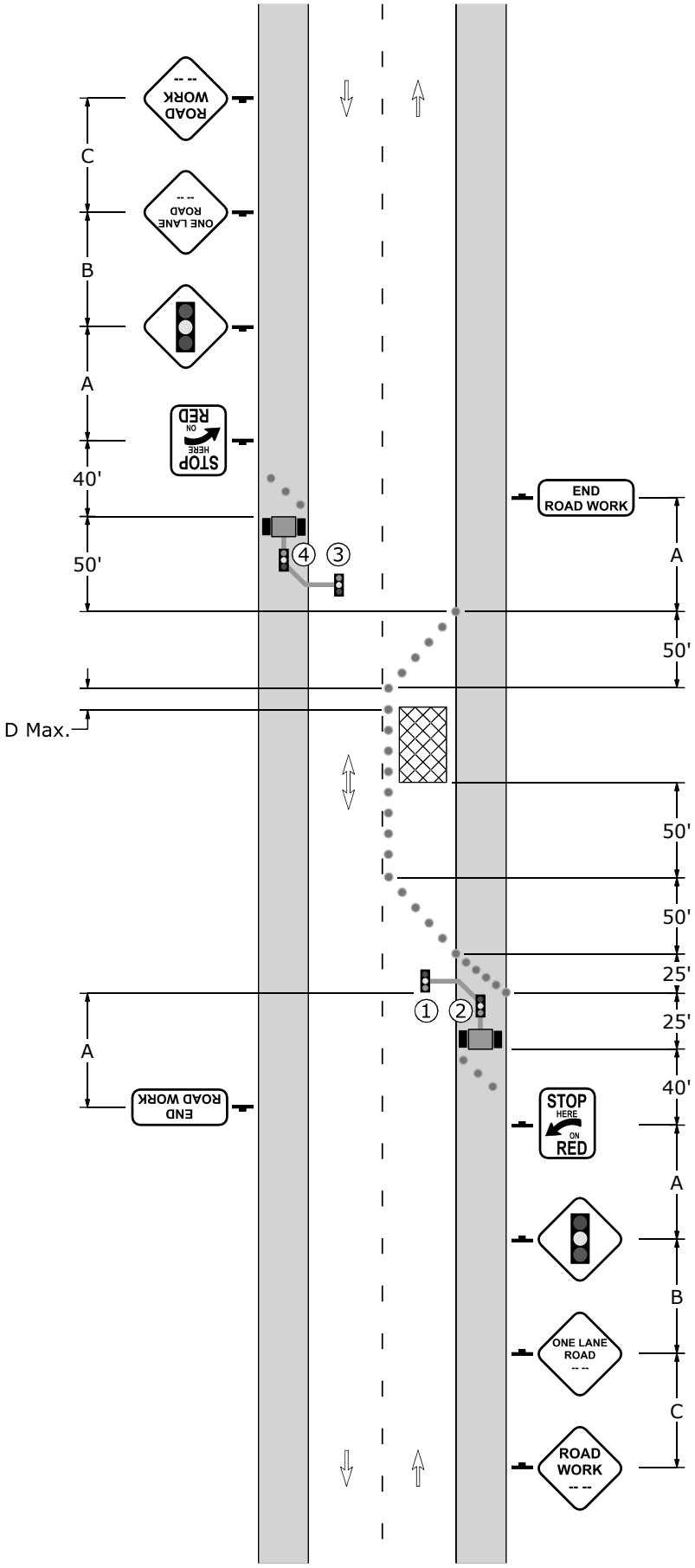
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

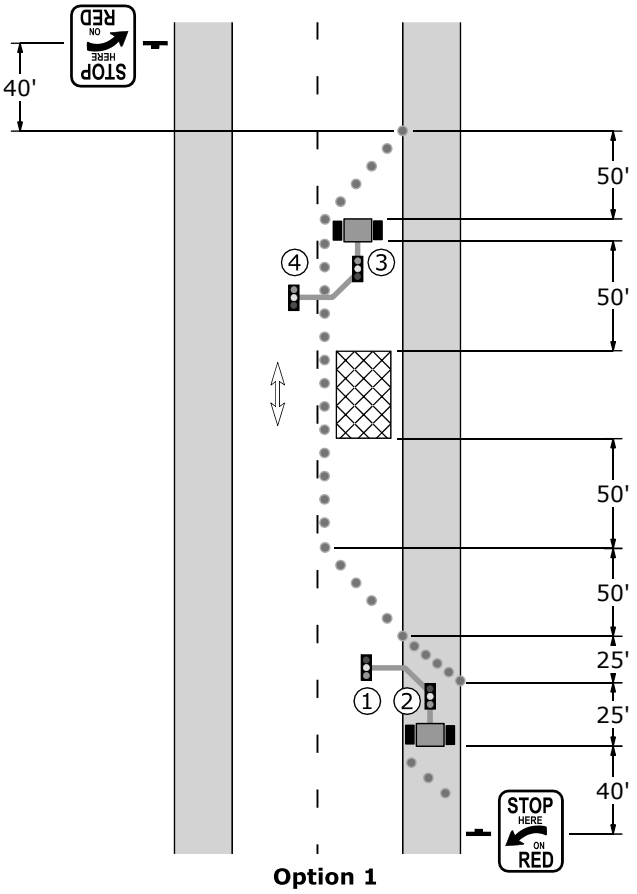
Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

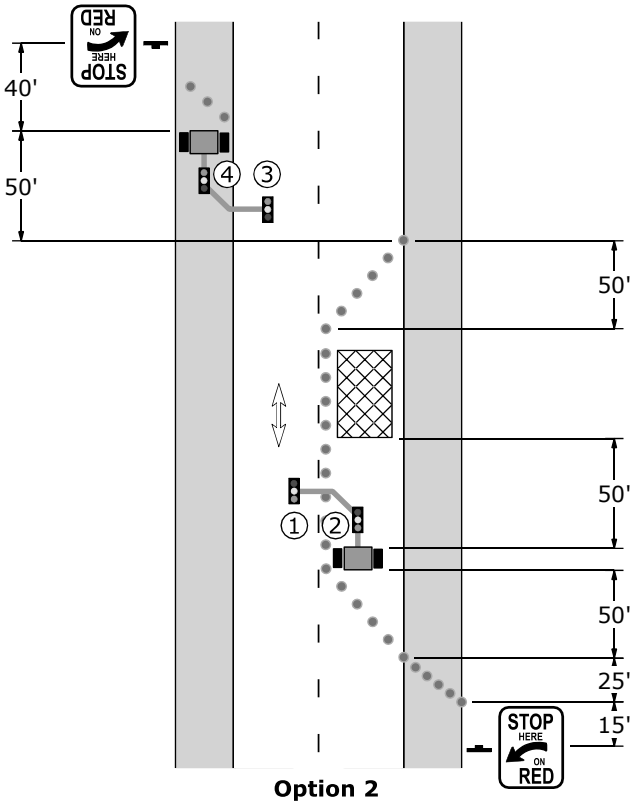
PATA 704 (Old PATA 26e C-2)
Short-Term Complex (Trailer-Mounted) (Drawing 1 of 2)



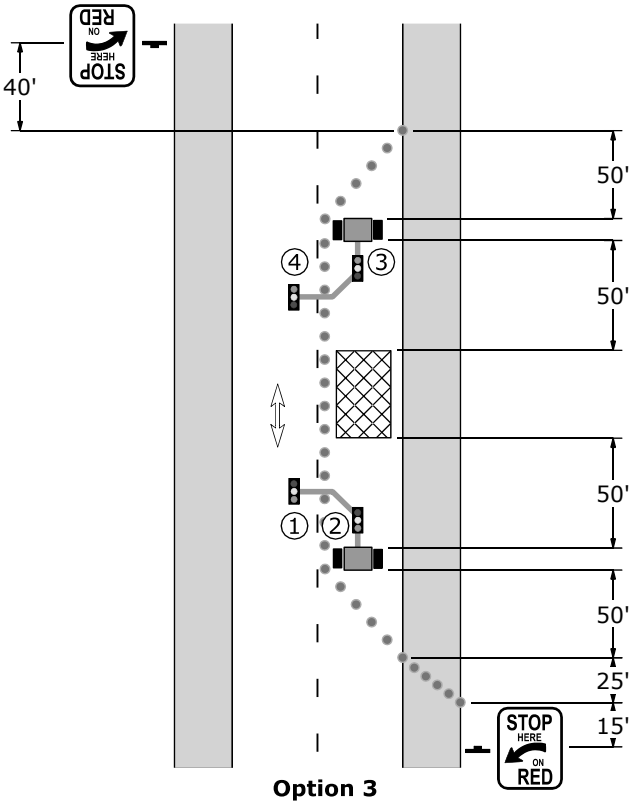
PATA 704 (Old PATA 26e C-2)
Alternate Trailer-Mounted Portable Traffic Signal Placements (Drawing 2 of 2)



Option 1



Option 2



Option 3

PATA 705 (Old PATA 26e L) - Notes (Page 1 of 2)

1. The use of temporary traffic control signals on fixed supports in Pennsylvania for long-term stationary operations shall comply with the provisions of this guide.

2. Refer to appendix D of this Publication for additional guidance and acceptance procedures pertaining to temporary traffic control signals on fixed supports.

3. The design and application of the temporary traffic control signals on fixed supports shall comply with the most current version of PennDOT Publications 149, 212, & 213.

4. Remove conflicting pavement markings.

5. Stop bars shall be installed with temporary traffic control signals on fixed supports for long-term stationary operations. Existing conflicting pavement markings and raised pavement markers between stop bars shall be removed. After temporary traffic control signals are removed, the stop bars shall be removed and the permanent pavement markings restored.

6. All signal lenses shall be 12 inches in diameter.

7. The servicing police department must be provided with the name and telephone number of an emergency contact person who is available 24 hours per day, 7 days a week during the period of temporary traffic control signal usage.

8. A minimum of two signal faces on each approach should be continuously visible to approaching traffic from a point meeting the signal visibility distances specified in the table on notes page 2 of 2.

9. Signal supports should be a minimum of 2 feet off the edge of the travel way. If this is not possible, the supports shall be adequately protected by barrier, guiderail, or channelizing devices.

10. The bottom of the housing of a signal face suspended over the roadway shall be a minimum of 15 feet, but not more than 19 feet above the pavement.

11. Additional signs and devices shall be installed as required in PennDOT Publications 212 and 213, and as required based on actual site conditions.

12. Signal modules must be replaced in accordance with the manufacturers' recommendations, and a record of the change must be maintained by the user.

13. When not in operation, signal heads shall be removed from the view of traffic or hooded with a material that covers the signal indications from the view of traffic. All inappropriate signs shall also be removed, covered, folded, or turned so that they are not readable by oncoming traffic when the portable traffic control signal is not in operation.

14. PennDOT reserves the right to inspect each temporary traffic control signal usage. PennDOT also reserves the right to revoke a temporary traffic control signal permit or to suspend the operation of the traffic control signal if the user shall at any time willfully or negligently fail to comply with the conditions contained in the permit or Publication 213, or fail to make any changes in the operation of the signal, or remove it, when so ordered by PennDOT. The user shall not make any change in the operation of the temporary traffic control signal as defined in the permit drawings without prior written approval of PennDOT.

15. When the temporary traffic control signal is changed to flashing mode, either manually or automatically, red signal indications shall be flashed to both approaches.

16. In the event of signal failure, adequate manpower and equipment must be present at the work site.

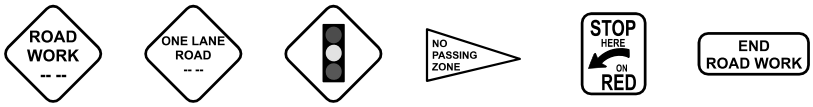
17. A no passing zone shall be established when an existing passing zone is present. A temporary double yellow pavement marking line shall be installed throughout the entire length of the work zone. Place a No Passing Zone (W14-3) sign at the start of the temporary double yellow pavement marking line (Across from the Road Work (W20-1) sign).

PATA 705 (Old PATA 26e L) - Notes (Page 2 of 2)

Signal Face Visibility (See Note 8)

Normal Speed Limit (MPH)	Minimum Visibility Distance (FT)
25	215
30	270
35	325
40	390
45	460
50	540
55	625

Signs



W20-1 W20-4 W3-3 W14-3 R10-6AL G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

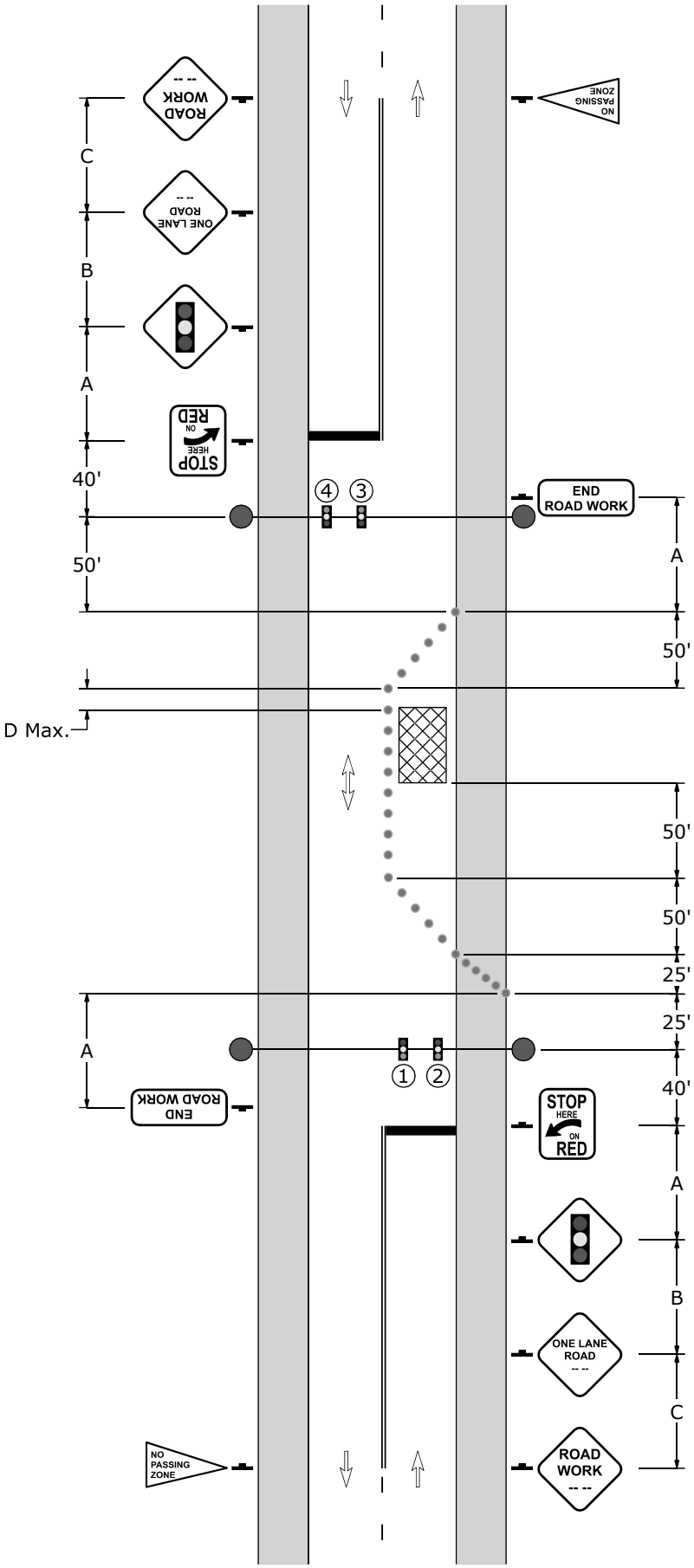
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

PATA 705 (Old PATA 26e L)
Long-Term (Fixed Supports)



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1. The use of portable temporary traffic control signals in Pennsylvania for long-term stationary operations shall comply with the provisions of this guide.

2. Refer to appendix A of this Publication for additional guidance and acceptance procedures pertaining to portable traffic control signals.

3. The design and application of the portable traffic control signals shall comply with the most current version of PennDOT Publications 149, 212, & 213.

4. Remove conflicting pavement markings.

5. Stop bars shall be installed with portable temporary traffic control signals for long-term stationary operations. Existing conflicting pavement markings and raised pavement markers between stop bars shall be removed. After portable traffic control signals are removed, the stop bars shall be removed and the permanent pavement markings restored.

6. Advance written approval must be obtained from PennDOT prior to using portable traffic signals for long-term operations on any public highway. A PennDOT temporary traffic control signal permit is required for short-term operations, and a copy must be maintained on-site during the period of portable traffic control signal usage.

7. Portable traffic control signals used for long-term stationary operations shall be trailer-mounted units having at least one signal head on a mast arm over the roadway. Pedestal-mounted portable traffic control signal units are not permitted for long-term operations.

8. All signal lenses shall be 12 inches in diameter.

9. The local police department must be provided with the name and telephone number of an emergency contact person who is available 24 hours per day, 7 days a week during the period of temporary traffic control signal usage.

10. All portable traffic control signal units used for long-term stationary operations must be interconnected via radio or hard wire to ensure fail-safe operation and proper functioning.

11. A minimum of two signal faces on each approach should be continuously visible to approaching traffic from a point meeting the signal visibility distances specified in the table on notes page 2 of 2.

12. Signal supports should be a minimum of 2 feet off the edge of the travel way. If this is not possible, the supports shall be adequately protected by barrier, guiderail, or channelizing devices.

13. The bottom of the housing of a signal face suspended over the roadway shall be a minimum of 15 feet, but not more than 19 feet above the pavement. The bottom of the housing of a signal face that is not mounted over the roadway shall be at least 8 feet, but not more than 15 feet above the sidewalk or, if there is no sidewalk, above the pavement grade at the center of the roadway.

14. Additional signs and devices shall be installed as required in PennDOT Publications 212 and 213, and as required based on actual site conditions.

15. Signal modules must be replaced in accordance with the manufacturers' recommendations, and a record of the change must be maintained by the user.

16. When not in operation, signal heads shall be removed from the view of traffic or hooded with a material that covers the signal indications from the view of traffic. All inappropriate signs shall also be removed, covered, folded, or turned so that they are not readable by oncoming traffic when the portable traffic control signal is not in operation.

17. PennDOT reserves the right to inspect each temporary traffic control signal usage. PennDOT also reserves the right to revoke a temporary traffic control signal permit or to suspend the operation of the portable traffic control signal if the user shall at any time willfully or negligently fail to comply with the conditions contained in the permit or Publication 213, or fail to make any changes in the operation of the signal, or remove it, when so ordered by PennDOT. The user shall not make any change in the operation of the temporary traffic control signal as defined in the permit drawings without prior written approval of PennDOT.

18. Steps must be taken to ensure continued proper placement and to forestall possible vandalism of the portable traffic control signal units. tires and the "hitch" must be removed from the trailer, and battery enclosures, crank mechanisms for horizontal arms, and other mechanisms to adjust placement or operation must be locked to eliminate any tampering by unauthorized personnel.

19. When the temporary traffic control signal is changed to flashing mode, either manually or automatically, red signal indications shall be flashed to both approaches.

20. Optional signal configurations shall only be used when physical obstructions make it unreasonable to use the primary configuration.

21. In the event of signal failure, adequate manpower and equipment must be present at the work site.

22. A no passing zone shall be established when an existing passing zone is present. A temporary double yellow pavement marking line shall be installed throughout the entire length of the work zone. Place a No Passing Zone (W14-3) sign at the start of the temporary double yellow pavement marking line (Across from the Road Work (W20-1) sign).

PATA 706 (Old PATA 26e PL) - Notes (Page 3 of 3)

Signal Face Visibility (See Note 11)

Normal Speed Limit (MPH)	Minimum Visibility Distance (FT)
25	215
30	270
35	325
40	390
45	460
50	540
55	625

Signs

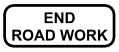
W20-1

W20-4


W3-3

W14-3

R10-6AL



G20-2

Sign Spacing Chart

Condition	Distance			
	A	B	C	F
	Feet	Feet	Feet	Feet
Urban 35 MPH or less	100	100	100	100
Urban Greater than 35 MPH	350	350	350	350
Rural	500	500	500	500

When multiple distance plaques are used on advance warning signs, they shall all be of the same series type.
Example: either all "AHEAD" or XXX FEET.

Taper Length Formulas

S	L
40 MPH or less	$L = \frac{WS^2}{60}$
45 MPH or more	L = WS

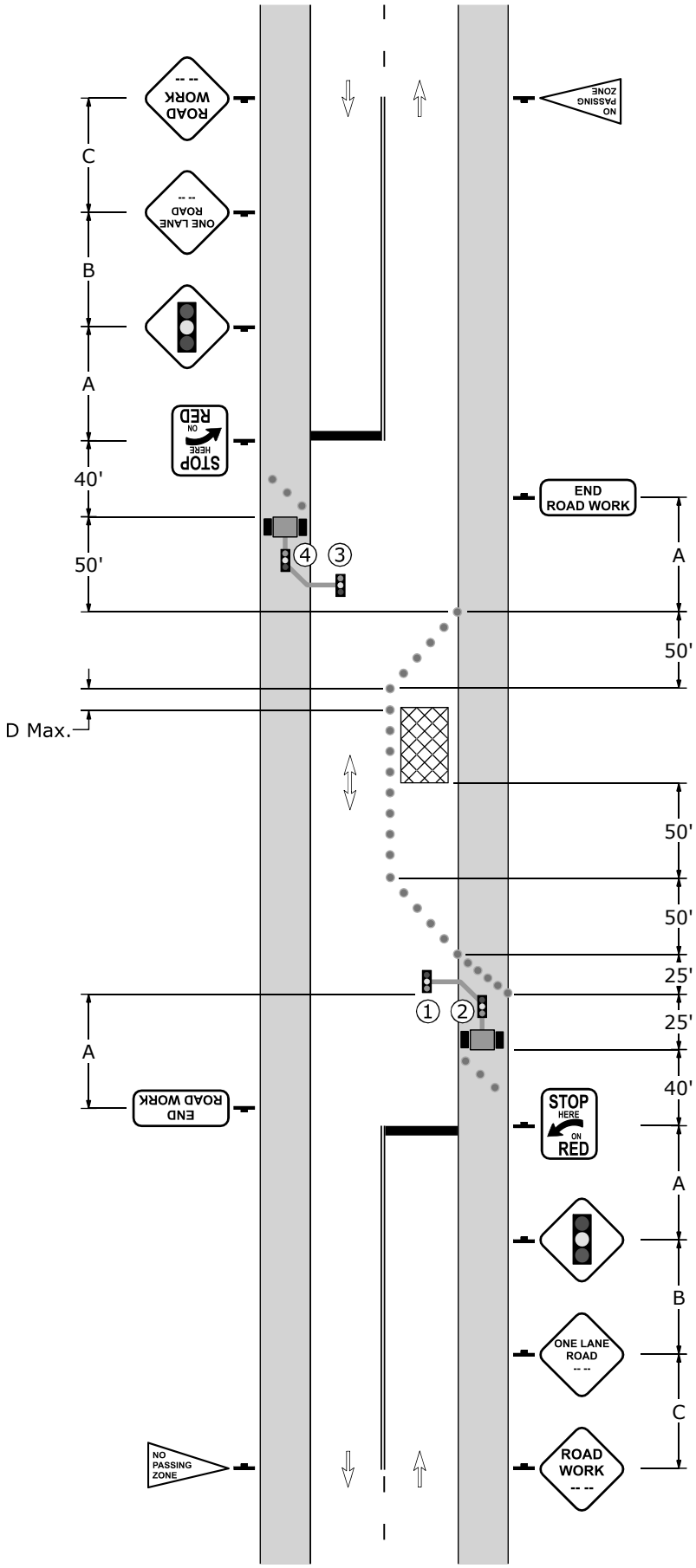
S = Regulatory Speed Limit
W = Width of Offset
L = Length

Distance and Spacing Quick Reference Chart

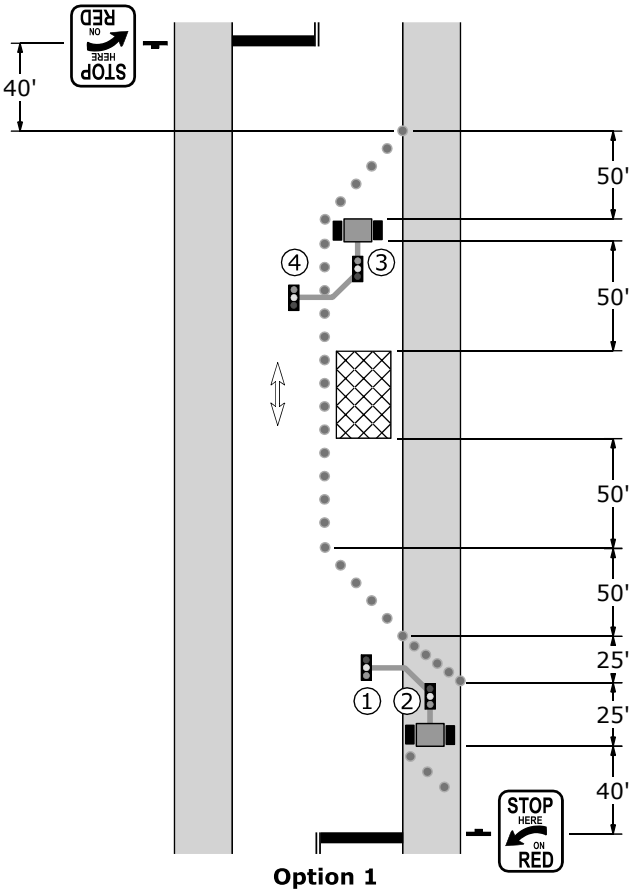
Speed	W	L	1/2L	1/3L	Min. Channelizing Devices Per Taper Type (Length)				D	E	H
MPH	Feet	Feet	Feet	Feet	L	1/2L	1/3L	50'	Feet	Feet	Feet
25	10	105	55	35	6	6	6	6	50	155	150
	11	115	60	40							
	12	125	65	45							
30	10	150	75	50	6	6	6	6	60	200	150
	11	165	85	55	7						
	12	180	90	60	7						
35	10	205	105	70	7	6	6	6	70	250	150
	11	225	115	75	8						
	12	245	125	85	8						
40	10	270	135	90	8	6	6	6	80	305	150
	11	295	150	100	9						
	12	320	160	110	9						
45	10	450	225	150	11	6	6	6	90	360	150
	11	495	250	165	12	7					
	12	540	270	180	13	7					
50	10	500	250	170	11	6	6	6	100	425	250
	11	550	275	185	12	7					
	12	600	300	200	13	7					
55	10	550	275	185	11	6	6	6	110	495	250
	11	605	305	205	12	7					
	12	660	330	220	13	7					

Note: Channelizing devices used in taper shall be equally spaced at ½ D Max.

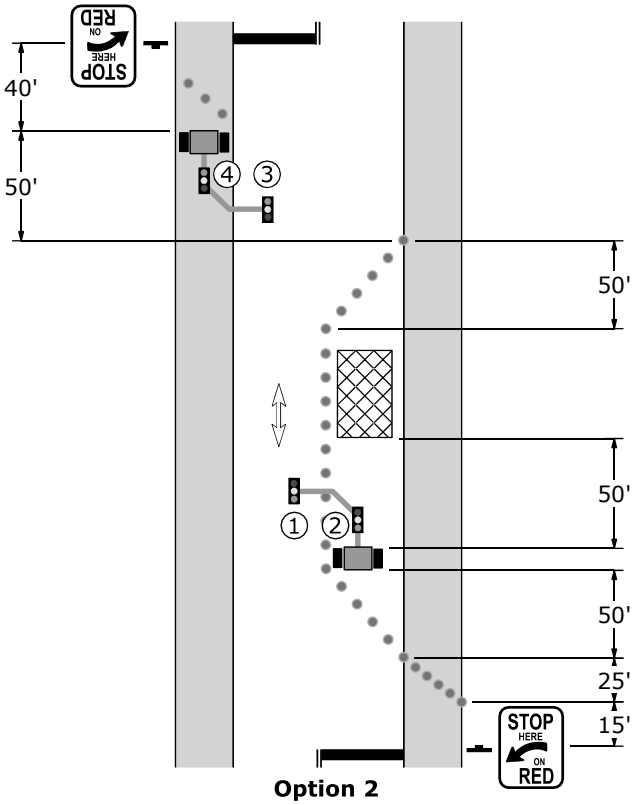
PATA 706 (Old PATA 26e PL)
Long-Term (Trailer-Mounted) (Drawing 1 of 2)



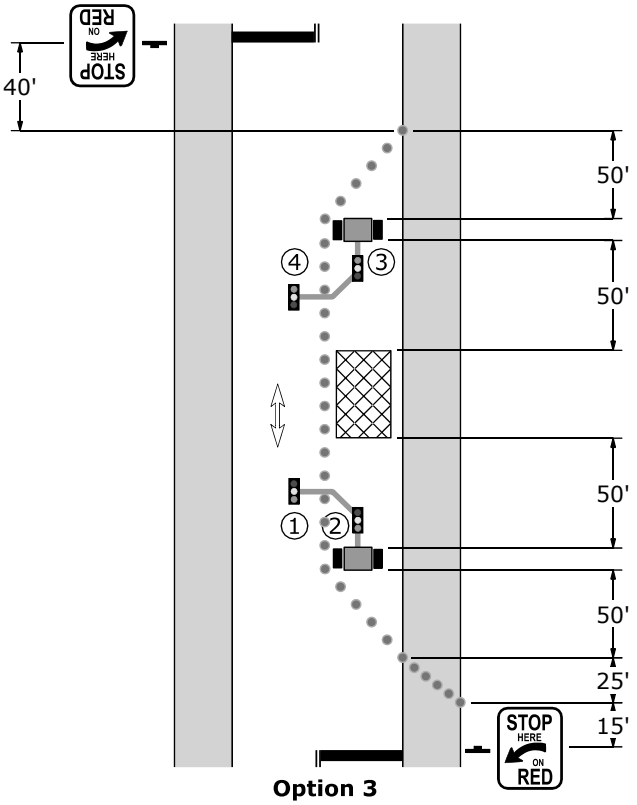
PATA 706 (Old PATA 26e PL)
Long-Term (Trailer-Mounted) (Drawing 2 of 2)



Option 1



Option 2



Option 3

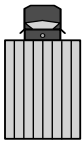
Hauling Operations

(PATA 800 Series)

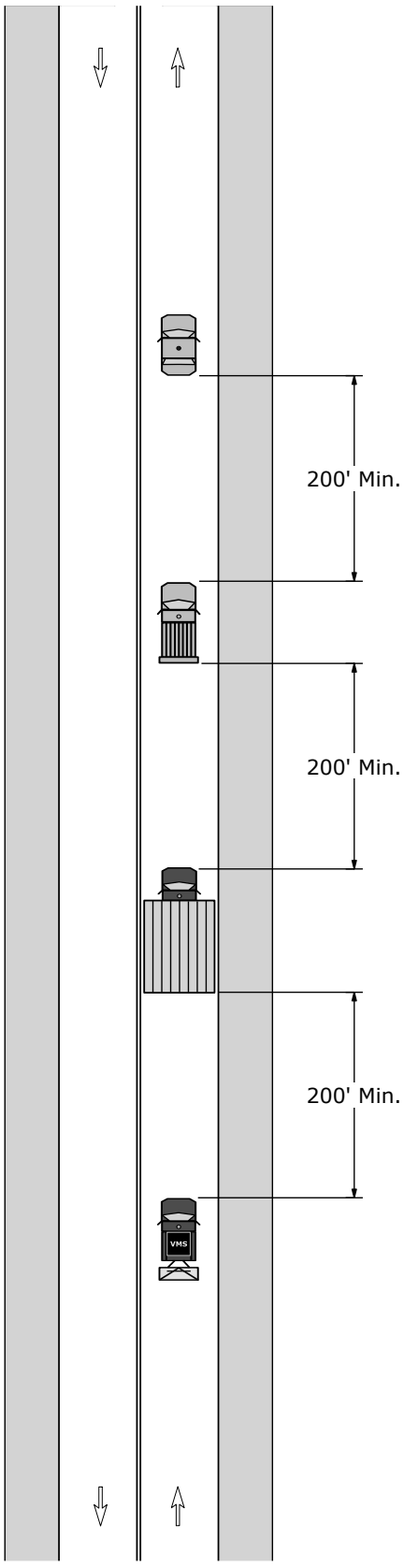
PATA 801 (New PATA) - Notes Page

1. If a static sign is used, it shall use minimum 12-inch, black legend on a fluorescent yellow retroreflective sheeting material. If a Variable Message Sign (VMS) is used, it shall be of a type approved by the Department and listed in Publication 35 (Approved Constriction Materials - Bulletin 15), and it shall be capable of displaying two lines of message with minimum 14-inch legend.

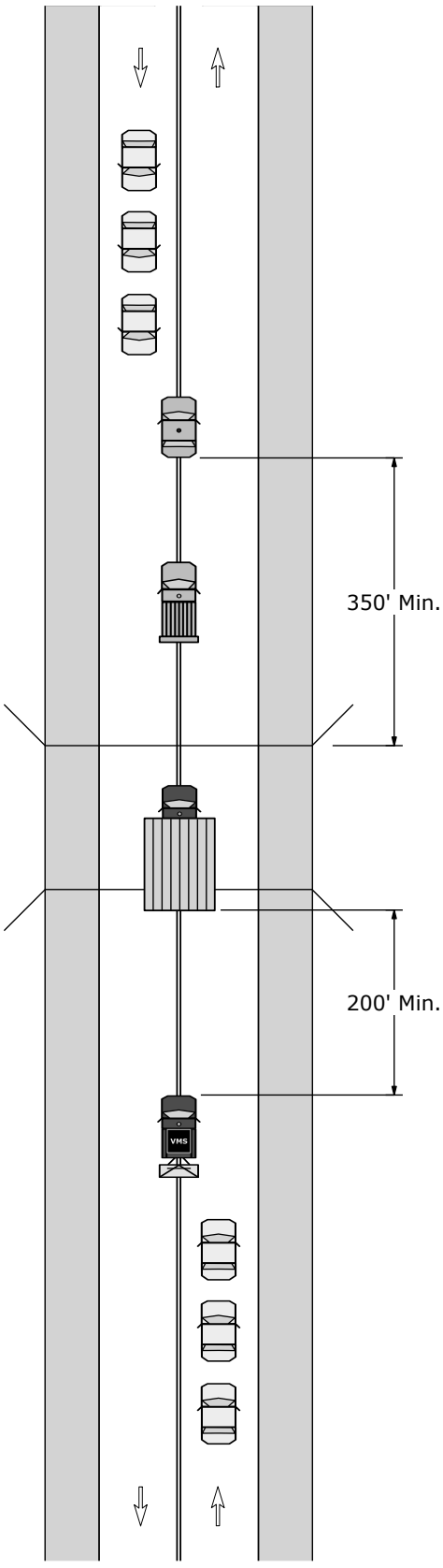
2. The hauler shall have CB radios in all vehicles for communication, including one in the State Police Vehicle. One of the operators shall also have a cellular telephone for emergency purposes.

Symbol	***Description***
	PRIVATE ESCORT VEHICLE - This vehicle is provided by the hauler and shall be equipped with a flashing or revolving yellow light. When the State Police Vehicle is not used, this vehicle shall be used to stop the approaching traffic at a distance of at least 350' before the bridge, and then release the approaching traffic only after Superload or Non-Superload Vehicle has cleared the bridge and is in the normal travel lane. In order to stop traffic, it may be necessary to have someone use a red flag.
	SUPERLOAD OR NON-SUPERLOAD - This vehicle shall be equipped with two flashing or revolving yellow lights, one on the front and one on the back. This vehicle should be positioned either in the center or the right side of the roadway in accordance with the permit. When the State Police Vehicle is used, this vehicle should maintain a minimum distance behind Vehicle A of 200' or one bridge span in length, whichever is greater.
	SHADOW VEHICLE - The shadow vehicle shall be supplied and operated by the hauler. It shall be equipped with a flashing or revolving yellow light and a sign with the message "DO NOT PASS". The sign may be either a static sign or a VMS, see Note 1. If a VMS is used, it should flash the message, when applicable. If a static sign is used, the sign shall be removed when it is not applicable. This vehicle should be positioned either in the center or on the right side of the roadway similar to the Superload or Non-Superload Vehicle. When on the bridge, the vehicle should maintain a minimum following distance behind the Superload or Non-Superload Vehicle of 200' or on the bridge span length, whichever is greater.
	STATE POLICE VEHICLE - This vehicle is only required for superloads. When used, the vehicle shall be a marked vehicle with activated revolving or flashing lights. The trooper in this vehicle should stop approaching traffic at a distance of at least 350' before the bridge. The trooper should release the approaching traffic only after the Superload or Non-Superload Vehicle has cleared the bridge and is in the normal travel lane.
	TRAFFIC UNRELATED TO OPERATIONS - This represents local traffic that may be impacted by the superload movement operations.

PATA 801 (New PATA)
Any Highway Except Freeways and Expressways
Mobile or Short-Term



Moving Operation
Along Highway



Rolling Roadblock when
Crossing over a Bridge

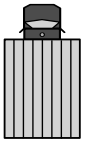
PATA 802 (New PATA) - Notes Page

1. The Truck Mounted Attenuator (TMA) and Variable Message Sign (VMS) shall be of a type approved by the Department and listed in Publication 35 (Approved Construction Materials - Bulletin 15).

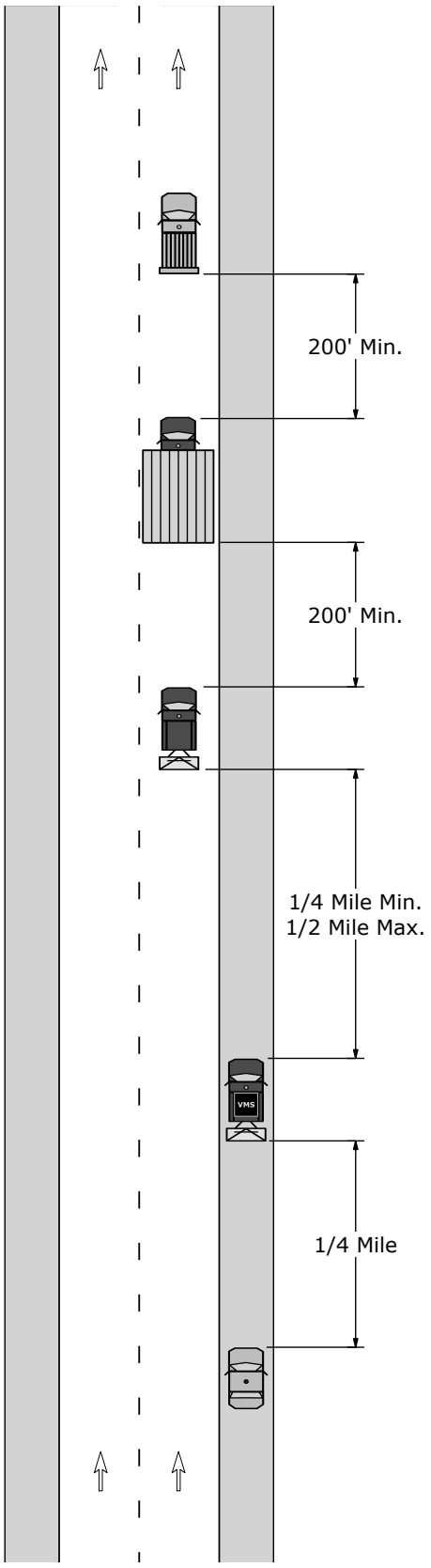
2. The VMS on the Queue Monitoring Vehicle shall be capable of displaying a minimum of two lines of message with minimum 14" legend.

3. The hauler shall have CB radios in all vehicles for communication, including one in the State Police Vehicle. One of the operators shall also have a cellular telephone for emergency purposes.

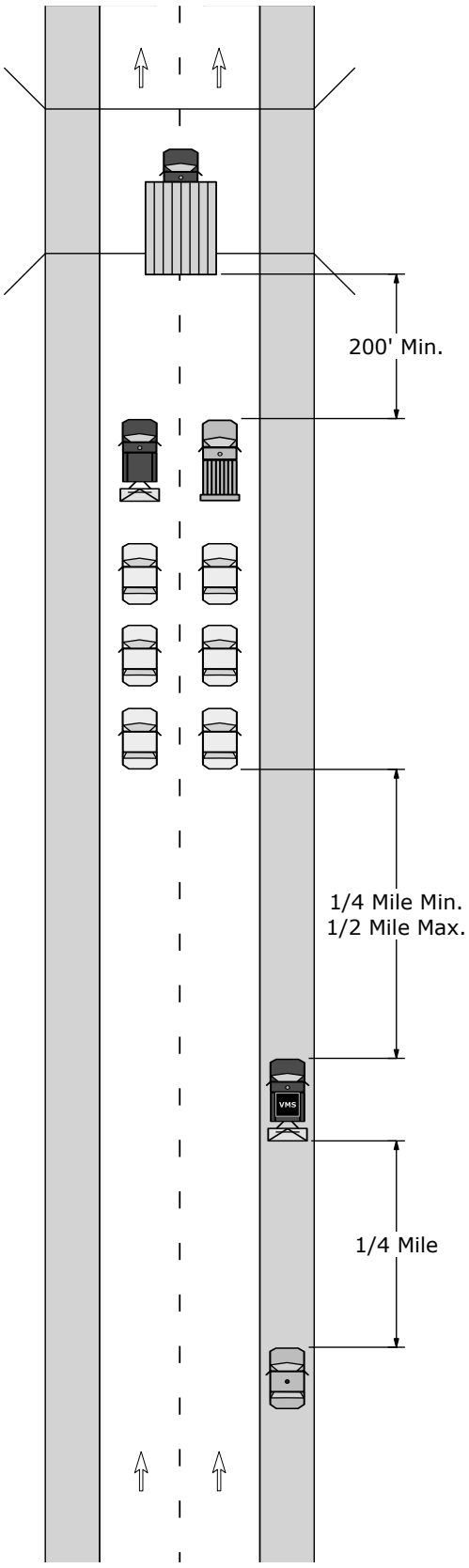
4. When operating between locations with crawl speeds, all vehicles should normally be in the right lane. The VMS should display messages such as "OVERSIZE LOAD" and "PASS WITH CARE" and/or "USE LEFT LANE".

Symbol	***Description***
	STATE POLICE VEHICLE - This vehicle is only required for superloads. When used, the vehicle shall be a marked vehicle with activated revolving or flashing lights. Whenever possible, the vehicle should be positioned on the shoulder
	PRIVATE ESCORT VEHICLE - This vehicle is provided by the hauler and shall be equipped with a flashing or revolving yellow light. The vehicle should normally be positioned on the right side of the roadway in advance of the Superload or Non-Superload Vehicle. However, prior to reaching the bridge, this vehicle may allow the Superload or Non-Superload Vehicle to pass in order to run parallel with the Shadow Vehicle and form a rolling roadblock.
	SUPERLOAD OR NON-SUPERLOAD - This vehicle shall be equipped with two flashing or revolving yellow lights, one on the front and one on the back. This vehicle should maintain a minimum distance behind the Private Escort Vehicle of 200' or one bridge span length, whichever is greater.
	SHADOW VEHICLE - The shadow vehicle shall be supplied and operated by the hauler. It shall be equipped with a flashing or revolving yellow light. A TMA is strongly recommended and if used shall be of a type approved by the Department (see Note 1). The Shadow Vehicle should maintain a minimum distance behind the Superload or Non-Superload of 200' or one bridge span length, whichever is greater.
	QUEUE MONITORING VEHICLE - This vehicle is supplied by the hauler and positioned on the shoulder whenever possible. It shall be equipped with a flashing or revolving yellow light and a Variable Message Sign (VMS), see Note 1, alternately displaying preprogrammed messages "PREPARE TO STOP" and "SLOW DOWN".
	TRAFFIC UNRELATED TO OPERATIONS - This represents local traffic that may be impacted by the superload movement operations.

PATA 802 (New PATA)
Any Highway
Mobile or Short-Term (2 Lanes)



Moving Operation
Along Highway



Rolling Roadblock Prior
to Bridge Along Highway

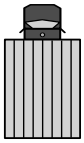
PATA 803 (New PATA) - Notes Page

1. The Truck Mounted Attenuator (TMA) and Variable Message Sign (VMS) shall be of a type approved by the Department and listed in Publication 35 (Approved Construction Materials - Bulletin 15).

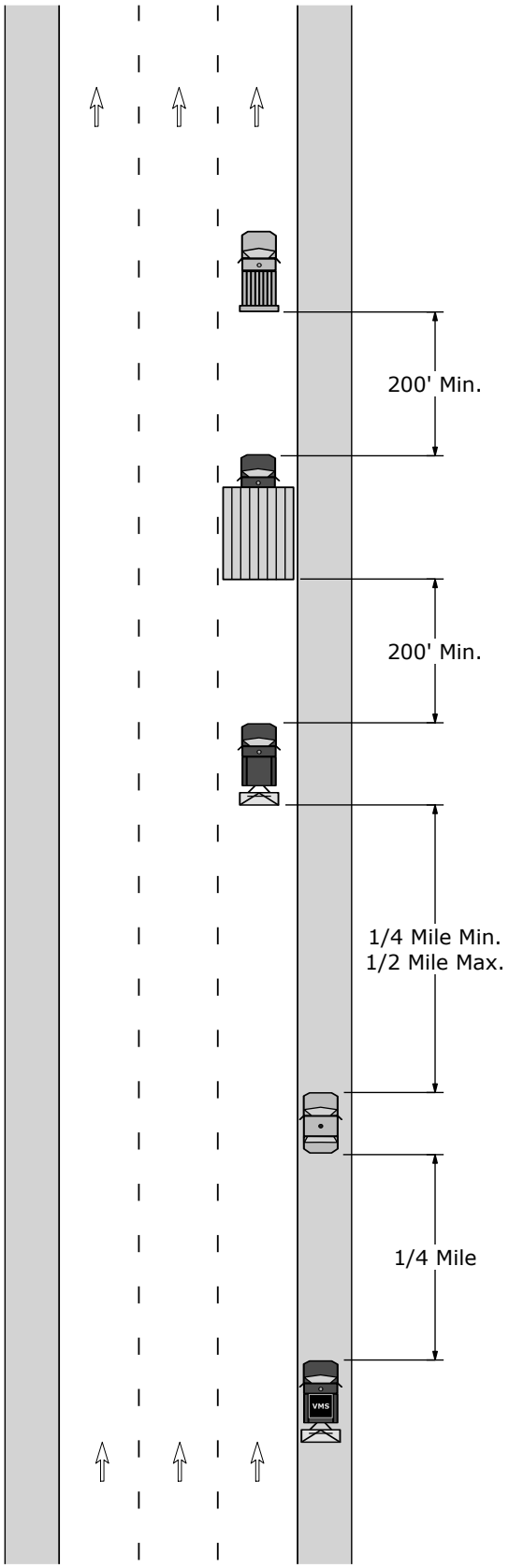
2. The VMS on the Queue Monitoring Vehicle shall be capable of displaying a minimum of two lines of message with minimum 14" legend.

3. The hauler shall have CB radios in all vehicles for communication, including one in the State Police Vehicle. One of the operators shall also have a cellular telephone for emergency purposes.

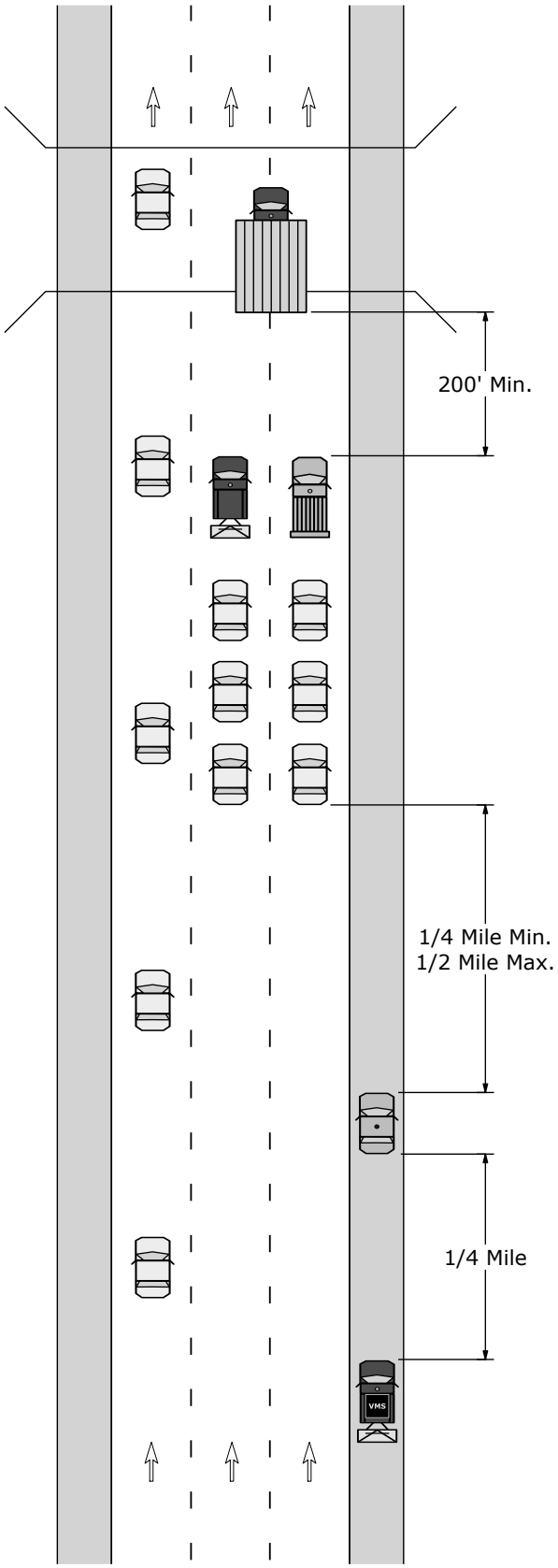
4. When operating between locations with crawl speeds, all vehicles should normally be in the right lane unless superload width restricts the center lane then the Shadow Vehicle and Queue Monitoring Vehicle shall be in the center lane. The VMS should display messages such as "OVERSIZE LOAD" and "PASS WITH CARE" and/or "USE LEFT LANE".

Symbol	***Description***
	STATE POLICE VEHICLE - This vehicle is only required for superloads. When used, the vehicle shall be a marked vehicle with activated revolving or flashing lights. Whenever possible, the vehicle should be positioned on the shoulder
	PRIVATE ESCORT VEHICLE - This vehicle is provided by the hauler and shall be equipped with a flashing or revolving yellow light. The vehicle should normally be positioned on the right side of the roadway in advance of the Superload or Non-Superload Vehicle. However, prior to reaching the bridge, this vehicle may allow the Superload or Non-Superload Vehicle to pass in order to run parallel with the Shadow Vehicle and form a rolling roadblock.
	SUPERLOAD OR NON-SUPERLOAD - This vehicle shall be equipped with two flashing or revolving yellow lights, one on the front and one on the back. This vehicle should maintain a minimum distance behind the Private Escort Vehicle of 200' or one bridge span length, whichever is greater.
	SHADOW VEHICLE - The shadow vehicle shall be supplied and operated by the hauler. It shall be equipped with a flashing or revolving yellow light. A TMA is strongly recommended and if used shall be of a type approved by the Department (see Note 1). The Shadow Vehicle should maintain a minimum distance behind the Superload or Non-Superload of 200' or one bridge span length, whichever is greater.
	QUEUE MONITORING VEHICLE - This vehicle is supplied by the hauler and positioned on the shoulder whenever possible. It shall be equipped with a flashing or revolving yellow light and a Variable Message Sign (VMS), see Note 1, alternately displaying preprogrammed messages "PREPARE TO STOP" and "USE LEFT LANE" or "DO NOT PASS".
	TRAFFIC UNRELATED TO OPERATIONS - This represents local traffic that may be impacted by the superload movement operations.

PATA 803 (New PATA)
Any Highway
Mobile or Short-Term (3 Lanes)



Moving Operation
Along Highway



Rolling Roadblock Prior
to Bridge Along Highway

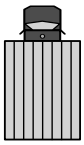
PATA 804 (New PATA) - Notes Page

1. The Truck Mounted Attenuator (TMA) and Variable Message Sign (VMS) shall be of a type approved by the Department and listed in Publication 35 (Approved Construction Materials - Bulletin 15).

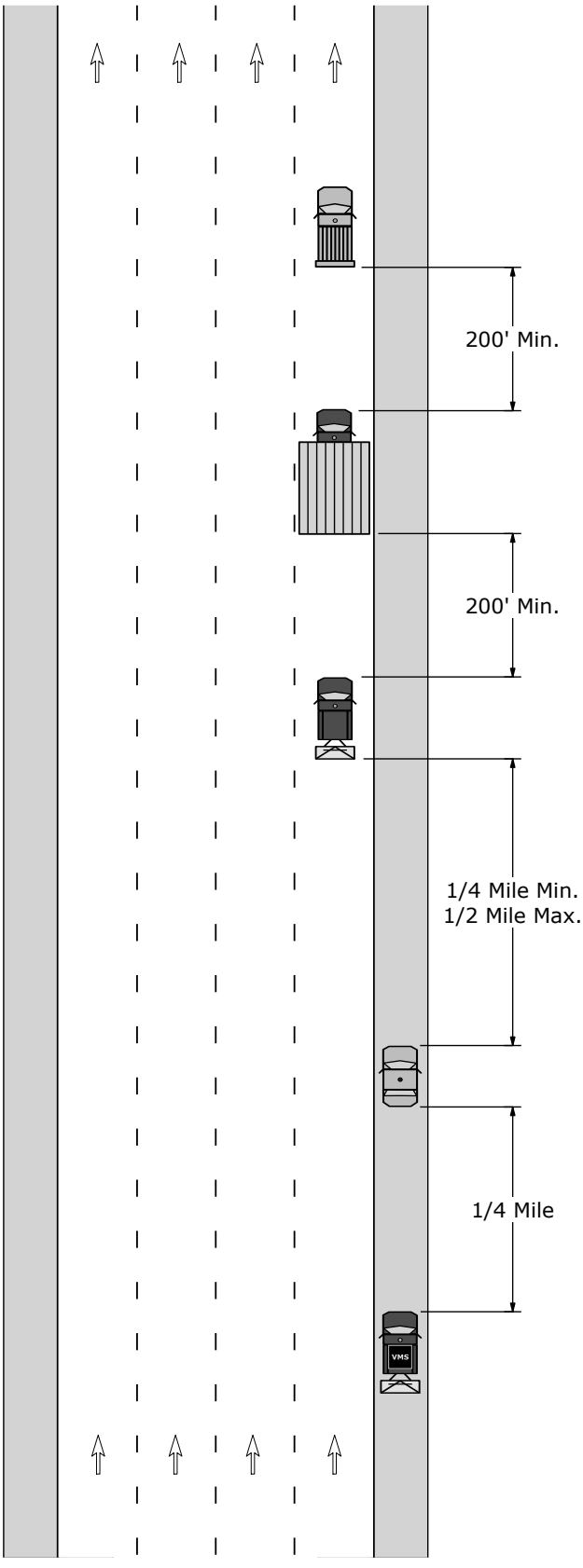
2. The VMS on the Queue Monitoring Vehicle shall be capable of displaying a minimum of two lines of message with minimum 14" legend.

3. The hauler shall have CB radios in all vehicles for communication, including one in the State Police Vehicle. One of the operators shall also have a cellular telephone for emergency purposes.

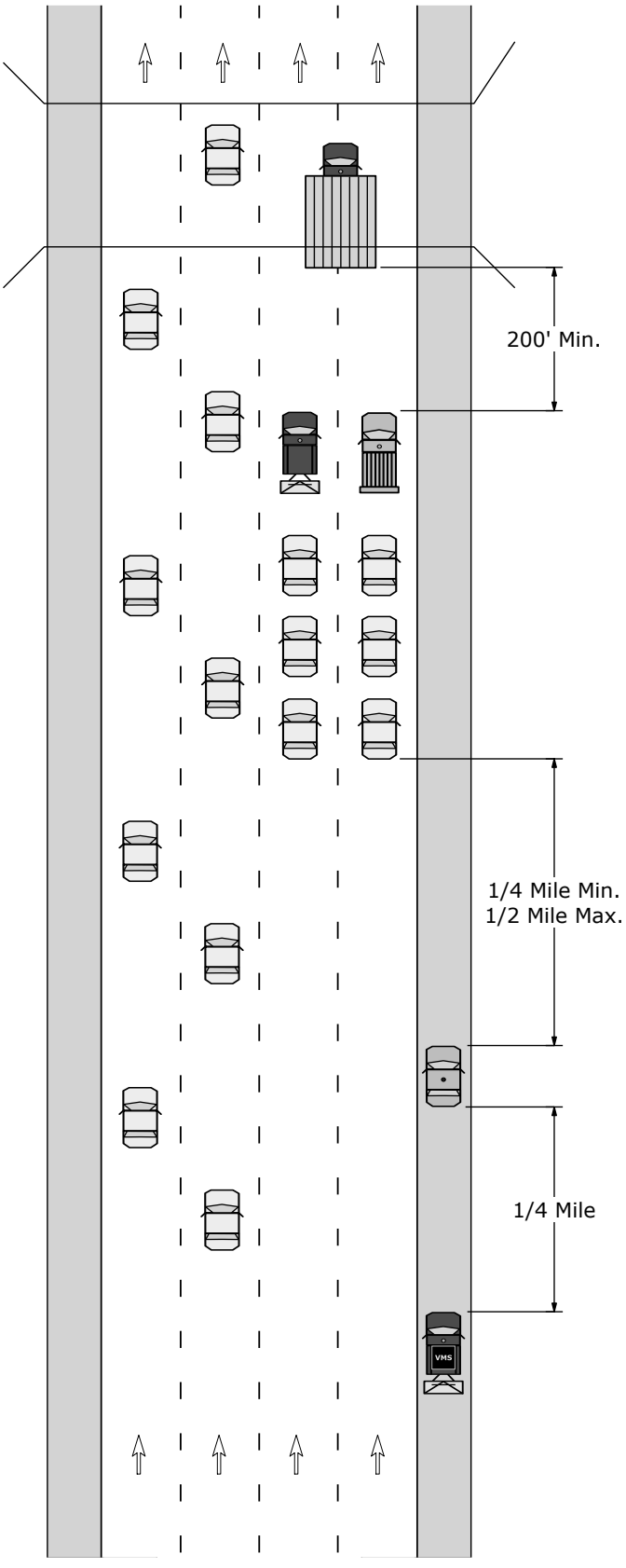
4. When operating between locations with crawl speeds, all vehicles should normally be in the right lane unless superload width restricts the center lane then the Shadow Vehicle and Queue Monitoring Vehicle shall be in the center lane. The VMS should display messages such as "OVERSIZE LOAD" and "PASS WITH CARE" and/or "USE LEFT LANES".

Symbol	***Description***
	STATE POLICE VEHICLE - This vehicle is only required for superloads. When used, the vehicle shall be a marked vehicle with activated revolving or flashing lights. Whenever possible, the vehicle should be positioned on the shoulder
	PRIVATE ESCORT VEHICLE - This vehicle is provided by the hauler and shall be equipped with a flashing or revolving yellow light. The vehicle should normally be positioned on the right side of the roadway in advance of the Superload or Non-Superload Vehicle. However, prior to reaching the bridge, this vehicle may allow the Superload or Non-Superload Vehicle to pass in order to run parallel with the Shadow Vehicle and form a rolling roadblock.
	SUPERLOAD OR NON-SUPERLOAD - This vehicle shall be equipped with two flashing or revolving yellow lights, one on the front and one on the back. This vehicle should maintain a minimum distance behind the Private Escort Vehicle of 200' or one bridge span length, whichever is greater.
	SHADOW VEHICLE - The shadow vehicle shall be supplied and operated by the hauler. It shall be equipped with a flashing or revolving yellow light. A TMA is strongly recommended and if used shall be of a type approved by the Department (see Note 1). The Shadow Vehicle should maintain a minimum distance behind the Superload or Non-Superload of 200' or one bridge span length, whichever is greater.
	QUEUE MONITORING VEHICLE - This vehicle is supplied by the hauler and positioned on the shoulder whenever possible. It shall be equipped with a flashing or revolving yellow light and a Variable Message Sign (VMS), see Note 1, alternately displaying preprogrammed messages "PREPARE TO STOP" and "USE LEFT 2 LANES" or "DO NOT PASS".
	TRAFFIC UNRELATED TO OPERATIONS - This represents local traffic that may be impacted by the superload movement operations.

PATA 804 (New PATA)
Any Highway
Mobile or Short-Term (4 Lanes)



Moving Operation Along Highway



Rolling Roadblock Prior to Bridge Along Highway

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Appendix A

Publication 236
Sign Index In Nomenclature Order

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
R 1-1	STOP		30" x 30"	36" x 36"	48" x 48"		24" x 24"
R 1-1A	RIGHT LANE KEEP MOVING		24" x 30"	30" x 36"			
R 1-1-2	RAMP		36" x 18"		48" x 24"		
R 1-1-3	RAMP STOP		36" x 48"		48" x 60"		
R 1-1-4	RAMP YIELD		36" x 48"		48" x 60"		
R 1-2	YIELD		36" x 36"	48" x 48"	60" x 60"		
R 1-2AP	TO ONCOMING TRAFFIC PLAQUE (for R 1-2)		24" x 18"				
R 1-3P	ALLWAY PLAQUE		18" x 6"				
R 1-4-1	STOP SIGN REMOVED FROM SIDE STREET		18" x 24"				
R 1-5L	YIELD HERE TO PEDESTRIAN WITH LEFT ARROW		36" x 36"				
R 1-5R	YIELD HERE TO PEDESTRIAN WITH RIGHT ARROW		36" x 36"				
R 1-6	IN - STREET PEDESTRIAN CROSSING		12" x 36"				
R1-9	OVERHEAD PEDESTRIAN CROSSING		90" x 24"				
R 1-10P	EXCEPT RIGHT TURN PLAQUE		24" x 18"				
R 2-1	SPEED LIMIT		24" x 30"	30" x 36"	48" x 60"		
R 2-2-1	TRUCKS OVER (____) LBS. SPEED		30" x 36"		36" x 48"		
R2-6P	FINES HIGHER PLAQUE		24" x 18"		48" x 36"		36" x 24"
R2-6AP	FINES DOUBLE PLAQUE		24" x 18"		48" x 36"		36" x 24"
R 2-9	NEXT (___)		30" x 18" / 36" x 24" / 48" x 30" *				
R2-10	BEGIN HIGHER FINES ZONE		24" x 30"		48" x 60"		36" x 48"
R2-11	END HIGHER FINES ZONE		24" x 30"		48" x 60"		36" x 48"
R 2-15	MAINTAIN SPEED THRU TUNNELS				60" x 60"		
R 2-101	TRUCK & BUS PLAQUE	24" x 24" / 36" x 24" / 48" x 36"					
R 3-1	NO RIGHT TURN		24" x 24"	36" x 36"		48" x 48"	30" x 30"
R 3-2	NO LEFT TURN		24" x 24"	36" x 36"		48" x 48"	30" x 30"
R 3-3	NO TURNS		24" x 24"	36" x 36"		48" x 48"	
R 3-3-3	NO TURNS FROM SHOULDER		24" x 30"				
R 3-4	NO U-TURN		24" x 24"	36" x 36"		48" x 48"	30" x 30"
R3-5A	STRAIGHT-THROUGH		30" x 36"				
R 3-5L	LEFT TURN		30" x 36"				
R 3-5R	RIGHT TURN		30" x 36"				
R 3-5-1	U-TURN OK		24" x 24"	36" x 36"	48" x 48"		
R 3-6LR	OPTIONAL LEFT OR RIGHT TURN		30" x 36"				
R 3-6LS	OPTIONAL LEFT TURN		30" x 36"				
R 3-6LSR	OPTIONAL LEFT, STRAIGHT & RIGHT TURN		30" x 36"				
R 3-6SR	OPTIONAL RIGHT TURN		30" x 36"				
R 3-7C	CENTER LANE MUST TURN LEFT		30" x 30"	36" x 36"		48" x 48"	
R 3-7L	LEFT LANE MUST TURN LEFT		30" x 30"	36" x 36"		48" x 48"	
R 3-7LA	LEFT LANE MUST TURN LEFT (narrow)		24" x 48"				
R 3-7R	RIGHT LANE MUST TURN RIGHT		30" x 30"	36" x 36"		48" x 48"	
R 3-7RA	RIGHT LANE MUST TURN RIGHT (narrow)		24" x 48"				
R 3-7-1L	ALL TRAFFIC MUST TURN LEFT		30" x 30"	36" x 36"		48" x 48"	
R 3-7-1R	ALL TRAFFIC MUST TURN RIGHT		30" x 30"	36" x 36"		48" x 48"	
R 3-7-2	LANE MUST TURN SUPPLEMENTARY PLAQUE		30" x 30"				
R 3-8A	LANE USE CONTROL (TWO LANES) (Two Sheets)		Varies x 30"				
R 3-8B	LANE USE CONTROL (THREE LANES)		48" x 30"				
R 3-9A	TWO-WAY LEFT TURN ONLY		30" x 36"				
R 3-9B	CENTER LANE - LEFT TURN ONLY		24" x 36"			36" x 48"	
R 3-9CP	BEGIN PLAQUE		24" x 12" / 30" x 15" / 36" x 18"				
R 3-9DP	END PLAQUE		24" x 12" / 30" x 15" / 36" x 18"				

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
R 3-10	HOV RESTRICTED LANE		30" x 42"		78" x 96"		36" x 60"
R 3-11A	HOV PREFERENTIAL LANE		30" x 42"		78" x 96"		42" x 60"
R 3-12	HOV PREFERENTIAL LANE AHEAD		30" x 42"		48" x 84"		36" x 60"
R 3-12A	HOV PREFERENTIAL LANE ENDS		30" x 42"		48" x 84"		36" x 60"
R 3-15	HOV PREFERENTIAL LANE AHEAD OVERHEAD		66" x 36"		102" x 60"		84" x 48"
R 3-15B	HOV PREFERENTIAL LANE ENDS OVERHEAD		66" x 36"		102" x 60"		84" x 48"
R 3-17	BIKE LANE		30" x 24"				
R3-20L	BEGIN LEFT TURN LANE		24" x 36"				
R3-20R	BEGIN RIGHT TURN LANE		24" x 36"				
R 3-23	ALL TURNS FROM RIGHT LANE		60" x 48"			96" x 48"	
R3-23A	U TURN FROM RIGHT LANE		60" x 36"				
R 3-24	ALL TURNS (45° ARROW)		72" x 18"				
R3-24A	U AND LEFT TURNS (45° ARROW)		60" x 24"				
R3-24B	U TURN (45° ARROW)		72" x 18"				
R3-25	ALL TURNS (RIGHT ARROW)		72" x 18"				
R3-25A	U AND LEFT TURNS (RIGHT ARROW)		60" x 24"				
R3-25B	U TURN (RIGHT ARROW)		72" x 18"				
R3-26	U AND LEFT TURNS (STRAIGHT ARROW)		60" x 24"				
R3-26A	U TURN (STRAIGHT ARROW)		72" x 18"				
R 3-101P	EXCEPT BUSES PLAQUE		24" x 18" / 30" x 24"				
R 3-102P	TRUCKS OVER (____) FEET LONG PLAQUE		24" x 18" / 30" x 24"				
R 3-103	PREFERENTIAL LANE		72" x 60"		108" x 84"		96" x 72"
R 4-1	DO NOT PASS		24" x 30"		48" x 60"		36" x 48"
R 4-1A	NO PASSING ZONE AHEAD		36" x 48"				
R 4-2	PASS WITH CARE		24" x 30"		48" x 60"		36" x 48"
R 4-4	RIGHT TURN LANE / BIKES		36" x 30"				
R 4-5	TRUCKS USE RIGHT LANE		24" x 30"		48" x 60"		36" x 48"
R 4-6	TRUCK LANE (____) FEET		24" x 30"		48" x 60"		36" x 48"
R 4-7	KEEP RIGHT		24" x 30"		48" x 60"		36" x 48"
R 4-7B	KEEP RIGHT WITH 30° ARROW		24" x 30"		48" x 60"		36" x 48"
R4-7C	KEEP RIGHT (NARROW)		18" x 30"				
R 4-8	KEEP LEFT		24" x 30"		48" x 60"		36" x 48"
R 4-8B	KEEP LEFT WITH 30° ARROW		24" x 30"		48" x 60"		36" x 48"
R4-8C	KEEP LEFT (NARROW)		18" x 30"				
R 4-9	STAY IN LANE		24" x 30"		48" x 60"		36" x 48"
R 4-10	RUNAWAY VEHICLES ONLY		48" x 48"				
R 4-10-1	FORM SINGLE LANE			24" x 30"	36" x 48"		
R 4-11	BICYCLES MAY USE FULL LANE		30" x 30"				
R 4-16	KEEP RIGHT EXCEPT TO PASS	18" x 24"	24" x 30"		48" x 60"		36" x 48"
R 4-20	THRU TRAFFIC STAY LEFT				60" x 60"		
R 4-101	LEFT LANE NO BUSES			48" x 60"			
R 4-102	LEFT LANE NO TRUCKS	24" x 30"		30" x 36"	48" x 60"		
R 4-103	NO TRUCKS BUSES TRAILERS LEFT LANE			48" x 60"			
R 4-104	TRUCKS BUSES RIGHT LANE ONLY			48" x 60"			
R 4-105	TRUCK MINIMUM SPEED LIMIT			84" x 78"	102" x 96"		
R 4-106	ENTER HERE		24" x 30"			36" x 48"	
R 4-107	KEEP OFF SHOULDER		30" x 30"				
R 5-1	DO NOT ENTER		30" x 30"	36" x 36"	48" x 48"		
R 5-1A	WRONG WAY		36" x 24"	48" x 30"			
R 5-2	NO TRUCK		24" x 24"		36" x 36"	48" x 48"	30" x 30"

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
R 5-2-3	EXCEPT LOCAL DELIVERIES (for R5-2, R12-1, R12-5A)		24" x 18" / 36" x 30" / 48" x 36"				
R 5-2-4	TRUCK WEIGHT(LENGTH) RESTRICTION PANEL (for R5-2)		24" x 12"				
R 5-2-5	EXCEPT LOCAL TRAFFIC		30" x 30"				
R 5-3	NO MOTOR VEHICLES		24" x 24"				
R 5-3-1	MOTOR VEHICLES ONLY		24" x 30"				
R 5-3-1A	MOTOR VEHICLES AND BICYCLES ONLY				36" x 48"		
R 5-3-1B	BICYCLES MUST USE SHOULDER				48" x 48"		
R 5-3-1C	ALL BICYCLES MUST EXIT				48" x 48"		
R 5-3-1D	BICYCLE RESTRICTIONS				36" x 24"		
R 5-3-2	PEDESTRIANS ONLY		24" x 12"				
R 5-3-4	NO TRUCKS OR BUSES		30" x 24"				
R 5-3-5	NO RV'S BEYOND THIS POINT		30" x 30"	36" x 36"			
R 5-6	NO BICYCLES		24" x 24"				30" x 30"
R 5-10C	NO PEDESTRIANS		24" x 12"				
R 5-20	FLAM LIQ & EXP LOADS PROHIBITED IN TUNNEL				48" x 72"		
R 5-20-1	FLAM LIQ & EXP LOADS MUST USE NEXT EXIT				48" x 72"		
R 5-21	HAZARDOUS LOADS WITH PLACARDS PROHIBITED				48" x 60"		
R 5-21-1	HAZARDOUS MATERIALS MUST FOLLOW DETOUR				48" x 60"		
R 5-101	EMERGENCY AND AUTHORIZED VEHICLES ONLY				24" x 30"		
R 5-102	SEMITRAILER MINIMUM UNDERCLEARANCE		60" x 60"				
R 5-103	VEHICLES OVER (____) (____) FOLLOW		36" x 48"				
R 5-104	VEHICLES OVER (____) TONS NO TURNS		36" x 48"				
R 5-105	SNOW EMERGENCY ROUTE		36" x 48"				
R 6-1L	HORIZONTAL LEFT ONE-WAY		36" x 12"	54" x 18"			
R 6-1R	HORIZONTAL RIGHT ONE-WAY		36" x 12"	54" x 18"			
R 6-2L	VERTICAL LEFT ONE-WAY	18" x 24"	24" x 30"	30" x 36"			
R 6-2R	VERTICAL RIGHT ONE-WAY	18" x 24"	24" x 30"	30" x 36"			
R 6-3	DIVIDED HIGHWAY CROSSING		30" x 24"		36" x 30"		
R 6-3A	DIVIDED HIGHWAY SIDEROAD CROSSING		30" x 24"		36" x 30"		
R 6-4	ROUNDABOUT DIRECTIONAL (2 CHEVRONS)		30" x 24"				
R 6-4A	ROUNDABOUT DIRECTIONAL (3 CHEVRONS)		48" x 24"				
R 6-4B	ROUNDABOUT DIRECTIONAL (4 CHEVRONS)		60" x 24"				
R 6-6	BEGIN ONE-WAY		24" x 30"	30" x 36"		36" x 48"	
R 6-7	END ONE-WAY		24" x 30"	30" x 36"		36" x 48"	
R 7-2	NO PARKING RESTRICTED HOURS		12" x 18"				
R 7-3-1	NO PARKING RESTRICTED DAYS		12" x 18"				
R 7-4	NO STANDING ANY TIME		12" x 18"				
R 7-4A	NO STOPPING OR STANDING		12" x 18"			24" x 36"	
R 7-5	LIMITED TIME PARKING		12" x 18"				
R 7-6-1	NO PARKING LOADING ZONE		12" x 18"				
R 7-8	RESERVED PARKING		12" x 18"				
R 7-8F	RESERVED PARKING PENALTIES		12" x 18"				
R 7-8P	VAN ACCESSIBLE PLAQUE		12" x 6"				
R 7-8-1	RESERVED PARKING-STATE POLICE ONLY		12" x 18"				
R 7-8-2	RESERVED PARKING EDUCATIONAL PLAQUE (for R7-8)		12" x 10"				
R 7-8-3	PERMIT PARKING FOR GOVERNOR'S RESIDENCE		12" x 18"				
R 7-9	ONE HOUR PARKING EXCEPT TURNPIKE EMPLOYEES		12" x 18"				
R 7-10	TEMPORARY NO PARKING		12" x 18"				
R7-100	NO IDLING		24" x 24"			48" x 48"	
R 7-107A	NO PARKING BUS STOP		12" x 30"				

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
R 7-201AP	TOW-AWAY ZONE PLAQUE		12" x 6"				
R 7-203-1	SNOW EMERGENCY ROUTE NO PARKING		18" x 24"				
R 7-203-2	NO PARKING UNTIL SNOW IS REMOVED		12" x 18"				
R 7-301	NO PARKING ARROW PLAQUE (for R8-3)	12" x 6"	24" x 12"	36" x 18"			
R 7-302	NO PARKING SYMBOL / ARROW		12" x 18"				
R 8-3	NO PARKING SYMBOL		12" x 12" / 24" x 24"		48" x 48"		36" x 36"
R 8-3CP	NO PARKING ON PAVEMENT PLAQUE	12" x 12"	24" x 18"				
R 8-3GP-1	NO PARKING LOADING ZONE PLAQUE	12" x 12"	24" x 18"				
R 8-3HP-1	NO PARKING RESTRICTED HOURS PLAQUE (for R8-3)	12" x 12"	24" x 18"				
R 8-4	EMERGENCY PARKING ONLY		30" x 24"		48" x 36"		
R 8-5	NO STOPPING ON PAVEMENT		24" x 30"		48" x 60"		36" x 48"
R 8-7	EMERGENCY STOPPING ONLY		30" x 24"		48" x 36"		
R 8-8	DO NOT STOP ON TRACKS		24" x 30"				36" x 48"
R 8-9	TRACKS OUT OF SERVICE		36" x 36"				
R 8-10A	STOP HERE WHEN FLASHING		24" x 30"			36" x 42"	
R 8-20	NO STOPPING ON BRIDGE		18" x 24"				24" x 30"
R 9-1	WALK ON LEFT FACING TRAFFIC		18" x 24"				
R 9-2	CROSS ONLY AT CROSSWALKS		12" x 18"				
R 9-3	NO PEDESTRIAN CROSSING		18" x 18"				24" x 24"
R 9-3BPL	USE CROSSWALK LEFT PLAQUE (for R9-3)		18" x 12"				
R 9-3BPR	USE CROSSWALK RIGHT PLAQUE (for R9-3)		18" x 12"				
R 9-4B	DO NOT PICK UP HITCHHIKERS		24" x 30"				
R 9-7	SHARED-USE PATH RESTRICTION						
R 9-9	SIDEWALK CLOSED		24" x 12"			30" x 18"	
R 9-10	SIDEWALK CLOSED USE OTHER SIDE		24" x 12"			48" x 24"	
R 9-11A	SIDEWALK CLOSED CROSS HERE		24" x 12"			48" x 24"	
R10-2	CROSS ON WALK SYMBOL ONLY		9" x 12"				
R10-3	PUSH BUTTON FOR WALKING PERSON SIGNAL		9" x 12"				
R10-3B	EDUCATIONAL PUSH BUTTON FOR WALKING PERSON SIGNAL		9" x 12"				
R10-3E	EDUC. PUSH BUTTON FOR WALK SIGNAL W/ COUNTDOWN TIMER		9" x 15"				
R10-4	PUSH BUTTON FOR GREEN SIGNAL		9" x 12"				
R10-5	LEFT ON GREEN ARROW ONLY	24" x 30"	30" x 36"				
R10-6AL	STOP HERE ON RED, (LEFT)		24" x 30"				
R10-6AR	STOP HERE ON RED, (RIGHT)		24" x 30"				
R10-6-1	LEFT LANE PLAQUE		24" x 18"				
R10-7	DO NOT BLOCK INTERSECTION		24" x 30"				
R10-10L	LEFT TURN SIGNAL		30" x 36"				
R10-10R	RIGHT TURN SIGNAL		30" x 36"				
R10-11	NO TURN ON RED SYMBOL		24" x 30"	36" x 48"			
R10-11B	NO TURN ON RED SQUARE-SHAPED		36" x 36"				
R10-11C	NO TURN ON RED EXCEPT FROM RIGHT LANE		30" x 42"				
R10-11D	NO TURN ON RED FROM THIS LANE		30" x 42"				
R10-12	LEFT TURN YIELD ON GREEN		30" x 36"				
R10-13	EMERGENCY SIGNAL		36" x 24"				
R10-15L	TURNING TRAFFIC MUST YIELD TO PEDESTRIANS (LEFT)		30" x 30"				
R10-15R	TURNING TRAFFIC MUST YIELD TO PEDESTRIANS (RIGHT)		30" x 30"				
R10-16	U-TURN YIELD TO RIGHT TURN		30" x 36"				
R10-18	TRAFFIC LAWS PHOTO ENFORCED		36" x 24"		54" x 36"		
R10-19AP	PHOTO ENFORCED PLAQUE		24" x 18"		48" x 36"		36" x 30"
R10-20AP	RESTRICTED HOURS PLAQUE - 24" WIDTH		12" / 18" / 24" / 30" HEIGHT				

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
	RESTRICTED HOURS PLAQUE - 30" WIDTH		15" / 24" / 30" / 36" HEIGHT				
R10-25	PUSH BUTTON TO TURN ON WARNING LIGHTS		9" x 12"				
R10-28	ONE VEHICLE PER GREEN		30" x 36"				
R10-29	ONE VEHICLE PER GREEN EACH LANE		36" x 24"				
R10-101	NO TURN ON RED WITH ONE-LINE RESTRICTION		24" x 30"	30" x 36"			
R10-102	FORM TWO LANES WHEN METERED		84" x 42"				
R10-103	RAMP METER ON WHEN FLASHING		84" x 42"				
R 11-1	KEEP OFF MEDIAN		24" x 30"			36" x 48"	
R11-2	ROAD CLOSED		48" x 30"				
R11-2-1	BRIDGE CLOSED		48" x 30"				
R11-3A	ROAD CLOSED - LOCAL TRAFFIC ONLY		60" x 30"				
R11-3B	BRIDGE OUT - LOCAL TRAFFIC ONLY		48" x 12"				
R11-4	ROAD CLOSED TO THRU TRAFFIC		60" x 30"				
R11-6	CLOSED FOR THE SEASON		36" x 30"				
R11-7	TRUCKS KEEP OFF SHOULDER		30" x 30"				
R11-10	STREET CLOSED (____) TO (____)		18" x 24"				
R11-11	SNOWMOBILE ROAD - CLOSED TO ALL OTHER VEHICLES		36" x 24"				
R11-11-1	ATV ROAD - CLOSED TO ALL OTHER VEHICLES		36" x 24"				
R11-11-2	SNOWMOBILE - ATV ROAD/CLOSED TO ALL OTHER VEHICLES		48" x 24"				
R12-1	WEIGHT LIMIT (____) TONS		24" x 30"			36" x 48"	
R12-1A	BRIDGE LIMITED TO ONE TRUCK		36" x 30"				
R12-1-2	BRIDGE (for R12-1 & W16-103P)		24" x 12"			36" x 12"	
R12-1-3	WEIGHT LIMIT FOR SAFETY PLAQUE (for R5-2, R12-1, R12-5A)		10" x 6"				
R12-1-4	SEASONAL WEIGHT LIMIT (for R12-1)		24" x 18"			36" x 24"	
R12-5A	EXCEPT COMBINATIONS (____) TONS (for R12-1)		24" x 18"			36" x 24"	
R12-6	102-INCH WIDE TRAILER ADVANCE PROHIBITED		24" x 36" / 36" x 48" / 60" x 72" **				
R12-6A	102-INCH WIDE TRAILER PROHIBITED		24" x 24" / 36" x 36" / 60" x 48" **				
R13-1-1	ALL TRUCKS & BUSES MUST ENTER WEIGH STATION		72" x 48"		120" x 84"		96" x 66"
R13-2	ALL TRUCKS MUST ENTER REST AREA		48" x 48"				
R14-1	TRUCK ROUTE		24" x 18"				
R14-2	HAZARDOUS MATERIAL ROUTE		24" x 24"		36" x 36"	48" x 48"	30" x 30"
R14-3	HAZARDOUS MATERIAL PROHIBITED		24" x 24"		36" x 36"	48" x 48"	30" x 30"
R14-6	WASTE TRUCKS PROHIBITED		36" x 36"				
R14-9	BRAKE RETARDERS PROHIBITED		30" x 36"				
R14-9A	END BRAKE RETARDER PROHIBITION		36" x 30"				
R14-10	TRUCKS REDUCE GEAR		48" x 36"				
R14-11	TRUCKS OVER (____) LBS GROSS WEIGHT REDUCE GEAR		36" x 48"				
R14-12	REDUCED GEAR ZONE		30" x 30"			48" x 48"	
R14-12-1	STAY IN REDUCED GEAR		30" x 30"		36" x 36"		
R14-13	END REDUCED GEAR ZONE		30" x 30"			48" x 48"	
R14-14	TRUCKS OVER (____) LBS STOP (____) FEET		48" x 60"			72" x 96"	
R14-15	TRUCKS OVER (____) LBS WITH ARROW		72" x 36"			96" x 48"	
R14-16-1	VEHICLES OVER (____) FT WIDE PROHIBITED		60" x 60"			96" x 96"	
R14-16(1)	BEYOND EXIT (for R14-16-1)		60" x 12"			96" x 24"	
R14-16(2)	BEYOND NEXT EXIT (for R14-16-1)		60" x 12"			96" x 24"	
R14-16(3)	BEYOND NEXT INTERSECTION (for R14-16-1)		60" x 18"			96" x 30"	
R14-17	TRUCKS OVER 10,000 GVWR RIGHT LANE		48" x 36"				
R14-17-1	VEHICLES OVER (____) FT IN HEIGHT PROHIBITED		60" x 60"			96" x 96"	
R14-18	TRUCKS OVER 10,000 GVWR ENTER		48" x 36"				
R14-19	BUSES RIGHT LANE		48" x 36"				

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
R14-20	BUSES ENTER HERE		48" x 36"				
R15-1	RAILROAD CROSSBUCK		48" x 9"				
R15-2P	TRACKS PLAQUE (for R15-1)		27" x 9"				
R15-3P	EXEMPT RAILROAD CROSSING PLAQUE		24" x 12"				
R15-101	HIGH SPEED TRAINS		24" x 24"				
R16-1	SCHOOL BUS LAW		36" x 36"				
R16-4	FENDER BENDER?		162" x 72"				
R16-8	TURN ON HEADLIGHTS		30" x 15"		60" x 30"		78" x 36"
R16-9	CHECK HEADLIGHTS		30" x 15"		60" x 30"		78" x 36"
R16-101	NO CRUISING		36" x 48"				
R16-102	WET PAINT		24" x 24"				
R16-103	NO FISHING, DIVING OR LOITERING		18" x 18"				
R16-104	USE FLASHERS BELOW (____) MPH				48" x 60"		
R20-4	THREE OR MORE AXLE TRUCKS		24 x 18"				
R22-1	WORK ZONE-TURN ON HEADLIGHTS		48" x 36"		72" x 48"		
W 1-1L	LEFT TURN		30" x 30"	36" x 36"	48" x 48"		
W 1-1R	RIGHT TURN		30" x 30"	36" x 36"	48" x 48"		
W 1-1LR	LEFT TURN WITH SIDE ROAD RIGHT (symbol)		30" x 30"	36" x 36"	48" x 48"		
W 1-1LS	LEFT TURN WITH SIDE ROAD STRAIGHT AHEAD (symbol)		30" x 30"	36" x 36"	48" x 48"		
W 1-1RL	RIGHT TURN WITH SIDE ROAD LEFT (symbol)		30" x 30"	36" x 36"	48" x 48"		
W 1-1RS	RIGHT TURN WITH SIDE ROAD STRAIGHT AHEAD (symbol)		30" x 30"	36" x 36"	48" x 48"		
W 1-2L	LEFT CURVE		30" x 30"	36" x 36"	48" x 48"		
W 1-2R	RIGHT CURVE		30" x 30"	36" x 36"	48" x 48"		
W 1-3L	LEFT REVERSE TURN		30" x 30"	36" x 36"	48" x 48"		
W 1-3R	RIGHT REVERSE TURN		30" x 30"	36" x 36"	48" x 48"		
W 1-4L	LEFT REVERSE CURVE		30" x 30"	36" x 36"	48" x 48"		
W 1-4R	RIGHT REVERSE CURVE		30" x 30"	36" x 36"	48" x 48"		
W 1-4BL	TWO-LANE LEFT REVERSE CURVE		36" x 36"		48" x 48"		
W 1-4BR	TWO-LANE RIGHT REVERSE CURVE		36" x 36"		48" x 48"		
W 1-5L	LEFT WINDING ROAD		30" x 30"	36" x 36"	48" x 48"		
W 1-5R	RIGHT WINDING ROAD		30" x 30"	36" x 36"	48" x 48"		
W 1-5-1	WINDING ROAD NEXT (____) MILES		36" x 36"				
W 1-6	LARGE SINGLE ARROW		48" x 24"		96" x 48"	120" x 60"	
W 1-7	LARGE DOUBLE ARROW		48" x 24"		96" x 48"	120" x 60"	
W 1-8	CHEVRON ALIGNMENT	18" x 24"	24" x 30"	30" x 36"	36" x 48"		
W 1-10L	LEFT CURVE RIGHT SIDE ROAD		36" x 36"		48" x 48"		
W 1-10R	RIGHT CURVE LEFT SIDE ROAD		36" x 36"		48" x 48"		
W 1-10BL	LEFT CURVE -- DIVERGING MINOR RIGHT SIDE ROAD		30" x 30"	36" x 36"	48" x 48"		
W 1-10CL	LEFT CURVE -- CONVERGING MINOR RIGHT SIDE ROAD		30" x 30"	36" x 36"	48" x 48"		
W 1-10BR	RIGHT CURVE -- DIVERGING MINOR LEFT SIDE ROAD		30" x 30"	36" x 36"	48" x 48"		
W 1-10CR	RIGHT CURVE -- CONVERGING MINOR LEFT SIDE ROAD		30" x 30"	36" x 36"	48" x 48"		
W 1-11L	LEFT HORSESHOE CURVE		30" x 30"	36" x 36"	48" x 48"		
W 1-11R	RIGHT HORSESHOE CURVE		30" x 30"	36" x 36"	48" x 48"		
W 1-13L	TRUCK ROLLOVER LEFT CURVE				48" x 48"		
W 1-13R	TRUCK ROLLOVER RIGHT CURVE				48" x 48"		
W 2-1	CROSS ROAD		30" x 30"	36" x 36"	48" x 48"		
W 2-2	SIDE ROAD		30" x 30"	36" x 36"	48" x 48"		
W 2-3L	45° SIDE ROAD LEFT		30" x 30"	36" x 36"	48" x 48"		
W 2-3R	45° SIDE ROAD RIGHT		30" x 30"	36" x 36"	48" x 48"		
W 2-3-1L	CURVE - SIDE ROAD LEFT		30" x 30"	36" x 36"	48" x 48"		

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
W 2-3-1R	CURVE - SIDE ROAD RIGHT		30" x 30"	36" x 36"	48" x 48"		
W 2-4	T SYMBOL		30" x 30"	36" x 36"	48" x 48"		
W 2-5	Y SYMBOL		30" x 30"	36" x 36"	48" x 48"		
W 2-5-1L	Y SYMBOL SECONDARY LEFT		30" x 30"	36" x 36"	48" x 48"		
W 2-5-1R	Y SYMBOL SECONDARY RIGHT		30" x 30"	36" x 36"	48" x 48"		
W 2-6	CIRCULAR INTERSECTION	24" x 24"	30" x 30"	36" x 36"	48" x 48"		
W 2-7L	OFFSET SIDE ROADS LEFT		30" x 30"	36" x 36"	48" x 48"		
W 2-7R	OFFSET SIDE ROADS RIGHT		30" x 30"	36" x 36"	48" x 48"		
W 2-8	DOUBLE SIDE ROAD		30" x 30"	36" x 36"	48" x 48"		
W 3-1	STOP AHEAD		36" x 36"		48" x 48"		
W 3-2	YIELD AHEAD		36" x 36"		48" x 48"		
W 3-3	SIGNAL AHEAD		36" x 36"		48" x 48"		
W 3-3-3	SIGNAL OUT OF SERVICE		36" x 36"		48" x 48"		
W 3-4	BE PREPARED TO STOP		36" x 36"		48" x 48"		
W 3-4A	POLICE CONTROL AHEAD		36" x 36"		48" x 48"		
W 3-5	SPEED REDUCTION SIGN		36" x 36"		48" x 48"		
W 4-1L	MERGE LEFT		36" x 36"		48" x 48"		
W 4-1R	MERGE RIGHT		36" x 36"		48" x 48"		
W 4-2L	PAVEMENT WIDTH TRANSITION - LEFT LANE ENDS		36" x 36"		48" x 48"		
W 4-2R	PAVEMENT WIDTH TRANSITION - RIGHT LANE ENDS		36" x 36"		48" x 48"		
W 4-3L	LEFT ADDED LANE				48" x 48"		
W 4-3R	RIGHT ADDED LANE				48" x 48"		
W 4-4P	CROSS TRAFFIC DOES NOT STOP PLAQUE		30" x 15"		36" x 18"		
W 4-4APL	TRAFFIC FROM LEFT DOES NOT STOP PLAQUE		30" x 15"		36" x 18"		
W 4-4APR	TRAFFIC FROM RIGHT DOES NOT STOP PLAQUE		30" x 15"		36" x 18"		
W 4-4BP	ONCOMING TRAFFIC DOES NOT STOP PLAQUE		30" x 15"		36" x 18"		
W 4-5	ENTERING ROADWAY MERGE	30" x 30"	36" x 36"		48" x 48"		
W 4-5P	NO MERGE AREA PLAQUE		18" x 24"		24" x 30"		
W 4-13	WEAVE AREA		36" x 36"				
W 5-1	ROAD NARROWS		36" x 36"				
W 5-1-1	NARROW ROAD NEXT (____) MILES		36" x 36"				
W 5-2	NARROW BRIDGE		36" x 36"		48" x 48"		
W 5-2A	NARROW UNDERPASS		30" x 30"	36" x 36"			
W 5-3	ONE LANE BRIDGE		36" x 36"		48" x 48"		
W 5-3A	ONE LANE UNDERPASS		36" x 36"		48" x 48"		
W 5-3B	TWO ONE LANE BRIDGES		36" x 36"		48" x 48"		
W 5-4	RAMP NARROWS		36" x 36"		48" x 48"		
W 5-4-1	LANES NARROW		36" x 36"		48" x 48"		
W 5-5	LANES SHIFT		36" x 36"		48" x 48"		
W 6-1	DIVIDED HIGHWAY - DIVIDED HIGHWAY ENDS		36" x 36"		48" x 48"		
W 6-3	TWO - WAY TRAFFIC		36" x 36"		48" x 48"		
W 7-1	HILL		30" x 30"	36" x 36"	48" x 48"		
W 7-3P	GRADE PLAQUE (for W7-1)		24" x 18"		30" x 24"		
W 7-3AP	NEXT (____) MILES PLAQUE (for W7-1)		24" x 18"		30" x 24"		
W 7-3BP	(____) GRADE / (____) MILES PLAQUE (for W7-1)		24" x 18"		30" x 24"		
W 7-4	ADVANCE RUNAWAY TRUCK RAMP		78" x 48"			144" x 72"	
W 7-4B	RUNAWAY TRUCK RAMP EXIT (right diag. arrow)		78" x 60"			114" x 72"	
W 7-4DP	SAND PLAQUE		78" x 18"			144" x 24"	
W 7-4EP	GRAVEL PLAQUE		78" x 18"			144" x 24"	
W 7-4FP	PAVED PLAQUE		78" x 18"			144" x 24"	

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
W 7-6	HILL BLOCKS VIEW		30" x 30"	36" x 36"			
W 8-1	BUMP		30" x 30"	36" x 36"			
W 8-2	DIP		30" x 30"	36" x 36"			
W 8-3	PAVEMENT ENDS		36" x 36"				
W 8-4	SOFT SHOULDER	30" x 30"	36" x 36"				
W 8-5	SLIPPERY WHEN WET		30" x 30"	36" x 36"	48" x 48"		
W 8-5P	SLIPPERY WHEN WET PLAQUE		24" x 18"		30" x 24"		
W 8-7	LOOSE GRAVEL	30" x 30"	36" x 36"				
W 8-8	ROUGH ROAD	30" x 30"	36" x 36"				
W 8-9	LOW SHOULDER	30" x 30"	36" x 36"				
W 8-11	UNEVEN LANES		36" x 36"		48" x 48"		
W 8-13	BRIDGE ICES BEFORE ROAD		36" x 36"		48" x 48"		
W 8-13B	BRIDGE MAY BE SLIPPERY		36" x 36"		48" x 48"		
W 8-14	FALLEN ROCKS		30" x 30"	36" x 36"	48" x 48"		
W 8-15	GROOVED PAVEMENT		36" x 36"		48" x 48"		
W8-17L	SHOULDER DROP OFF LEFT	24" x 24"	30" x 30"	36" x 36"	48" x 48"		
W8-17R	SHOULDER DROP OFF RIGHT	24" x 24"	30" x 30"	36" x 36"	48" x 48"		
W8-17P	SHOULDER DROP-OFF PLAQUE		24" x 18"		36" x 30"		30" x 24"
W 8-18	ROAD MAY FLOOD		36" x 36"				
W 8-21	GUSTY WINDS AREA		36" x 36"		48" x 48"		
W 8-22	FOG AREA				48" x 48"		
W 8-101	RUMBLE STRIPS AHEAD		36" x 36"		48" x 48"		
W 8-102	CENTER LINE RUMBLE STRIPS		36" x 36"		48" x 48"		
W 8-103	OPEN GRATE BRIDGE		36" x 36"				
W 8-104	WATCH FOR ICE		36" x 36"		48" x 48"		
W 8-105	WATCH FOR MUD		36" x 36"		48" x 48"		
W 8-106	MUD SLIDE AREA		36" x 36"				
W 8-107	SLIPPERY WINTER CONDITIONS				48" x 48"		
W 8-108 & W 8-108P	ANTI-ICING IN PROGRESS AND WHEN FLASHING		36" x 36"		48" x 48"		
W 9-1L	LEFT LANE ENDS	30" x 30"	36" x 36"		48" x 48"		
W 9-1R	RIGHT LANE ENDS	30" x 30"	36" x 36"		48" x 48"		
W 9-2L	LANE ENDS MERGE LEFT	30" x 30"	36" x 36"		48" x 48"		
W 9-2R	LANE ENDS MERGE RIGHT	30" x 30"	36" x 36"		48" x 48"		
W 9-3	CENTER LANE CLOSED		36" x 36"		48" x 48"		
W 9-3A	CENTER LANE MUST SHIFT LEFT		30" x 30"	36" x 36"	48" x 48"		
W10-1	RAILROAD WARNING		36" DIA.		48" DIA.		
W10-1AP	EXEMPT RAILROAD WARNING PLAQUE (for W10-1)		24" x 12"				
W10-1B	BICYCLISTS DISMOUNT		18" x 18"		24" x 24"		
W10-2	RAILROAD CROSSING AT CROSS ROAD		36" x 36"		48" x 48"		
W10-3	RAILROAD CROSSING ON SIDE ROAD		36" x 36"		48" x 48"		
W10-4	RR CROSSING ON STEM OF "T" INTERSECTION (RIGHT)		36" x 36"		48" x 48"		
W10-4A	RR CROSSING ON STEM OF "T" INTERSECTION (LEFT)		36" x 36"		48" x 48"		
W10-5	LOW GROUND CLEARANCE HIGHWAY-RAIL GRADE CROSSING		36" x 36"				
W10-5P	LOW GROUND CLEARANCE HIGHWAY-RAIL GRADE CROSSING PLAQUE		24" x 18"				
W10-9P	NO TRAIN HORN PLAQUE		24" x 18"				
W11-1	BICYCLE WARNING		30" x 30"	36" x 36"			
W11-2	PEDESTRIAN		30" x 30"	36" x 36"			
W11-2A	RAISED PEDESTRIAN CROSSING		30" x 30"	36" x 36"			
W11-2B	HIKER CROSSING		30" x 30"	36" x 36"			
W11-3	DEER CROSSING		30" x 30"	36" x 36"	48" x 48"		

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
W11-4	CATTLE CROSSING		30" x 30"	36" x 36"			
W11-5	FARM MACHINERY		30" x 30"	36" x 36"			
W11-6	SNOWMOBILE CROSSING		30" x 30"	36" x 36"			
W11-6-1	ATV CROSSING		30" x 30"	36" x 36"			
W11-7	EQUESTRIAN CROSSING		30" x 30"	36" x 36"			
W11-8	FIRE STATION		30" x 30"	36" x 36"			
W11-8-2	EMERGENCY VEHICLE ENTRANCE		30" x 30"	36" x 36"			
W11-9	HANDICAPPED AREA		30" x 30"	36" x 36"			
W11-10	TRUCK CROSSING		30" x 30"	36" x 36"	48" x 48"		
W11-10-1	HEAVY EQUIPMENT CROSSING		30" x 30"	36" x 36"			
W11-11	GOLF CART CROSSING		30" x 30"	36" x 36"			
W11-12	PLANT ENTRANCE		30" x 30"	36" x 36"			
W11-12P	EMERGENCY SIGNAL AHEAD PLAQUE		36" x 30"				
W11-13	PARK ENTRANCE		30" x 30"	36" x 36"			
W11-14	HORSEDRAWN VEHICLE		30" x 30"	36" x 36"			
W11-15	COMBINED BICYCLE / PEDESTRIAN	24" x 24"	30" x 30"	36" x 36"	48" x 48"		
W11-15P	TRAIL X-ING PLAQUE		24" x 18"		30" x 24"	36" x 30"	
W11-20	ELK CROSSING		30" x 30"	36" x 36"			
W11-25	BLIND PEDESTRIAN CROSSING		30" x 30"	36" x 36"			
W11-26	DUCK CROSSING		30" x 30"	36" x 36"			
W11-27	TANK CROSSING		30" x 30"	36" x 36"			
W11-28	CEMETERY ENTRANCE		30" x 30"	36" x 36"			
W11-101	HOSPITAL		30" x 30"	36" x 36"			
W11-102	CHURCH		30" x 30"	36" x 36"			
W11-103	HIDDEN DRIVEWAY		30" x 30"	36" x 36"			
W11-104	BRIDLE PATH		30" x 30"	36" x 36"			
W11-105	LEFT TURNS AND CROSS TRAFFIC				48" x 48"	60" x 60"	
W11-106	LEFT TURNS		30" x 30"	36" x 36"			
W11-107	WATCH FOR TURNS		30" x 30"	36" x 36"			
W11-108	IMPAIRED CHILD		30" x 30"	36" x 36"			
W12-1	DOUBLE ARROW		36" x 36"				
W12-2	LOW CLEARANCE		36" x 36"		48" x 48"		
W12-2-3	ON SHOULDER		36" x 18"		48" x 24"		
W12-2A	LOW CLEARANCE (overhead)		78" x 24"				
W13-1P	ADVISORY SPEED PLAQUE		18" x 18" / 24" x 24" / 30" x 30" **				
W13-2	ADVISORY EXIT SPEED				48" x 60"		
W13-3	ADVISORY RAMP SPEED				48" x 60"		
W14-2	NO OUTLET		30" x 30"	36" x 36"			
W14-2-1	NO THRU STREEET		36" x 36"				
W14-2AL	NO OUTLET (LEFT ARROW)		36" x 8"				
W14-2AR	NO OUTLET (RIGHT ARROW)		36" x 8"				
W14-3	NO PASSING ZONE (pennant)		48" x 36"				
W14-5	NO WINTER MAINTENANCE		30" x 30"	36" x 36"			
W14-6	CONGESTED AREA NEXT (____) MILE(S)				60" x 60"		
W14-7	WATCH FOR STOPPED VEHICLES		36" x 36"		48" x 48"	60" x 60"	
W14-9	TRUCK WEIGHING AHEAD		36" x 36"		48" x 48"		
W14-11	VEHICLES ARE CLOSER THAN THEY APPEAR		18" x 18"				
W14-12	SLOW MOVING VEHICLES				48" x 48"	60" x 60"	
W14-13	LOW FLYING AIRCRAFT				48" x 48"		
W14-15	TRAFFIC SURVEY		36" x 36"		48" x 48"		

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
W14-16	BALLOON LAUNCH AREA		36" x 36"		48" x 48"		
W14-20	EFFECTIVE HOURS (panel) - 24" WIDTH		12" / 18" / 24" HEIGHTS				
	EFFECTIVE HOURS (panel) - 30" WIDTH		15" / 24" / 30" HEIGHTS				
W14-22	ARE YOUR TURN SIGNALS ON ?		48" x 24"				
W15-1	PLAYGROUND		30" x 30"	36" x 36"			
W 15-2	WATCH CHILDREN		30" x 30"	36" x 36"			
W16-4P	NEXT (___) FEET (black-on-yellow) PLAQUE		30" x 24"				
W16-5PL	90° TURN - LEFT ARROW PLAQUE		24" x 18"				
W 16-5PR	90° TURN - RIGHT ARROW PLAQUE		24" x 18"				
W16-6PL	ADVANCE 90° TURN - LEFT ARROW PLAQUE		24" x 18"				
W16-6PR	ADVANCE 90° TURN - RIGHT ARROW PLAQUE		24" x 18"				
W16-7P	DIAGONAL DOWNWARD POINTING ARROW PLAQUE		24" x 12"			30" x 18"	
W16-8P	SINGLE-LINE ADVANCE STREET NAME PLAQUE		VAR x 8"	VAR. x 12"			
W16-8AP	DOUBLE-LINE ADVANCE STREET NAME PLAQUE		48" x 16"	72" x 24"			
W16-9P	AHEAD PLAQUE		24" x 12"	36" x 24"			48" x 30"
W16-10AP	PHOTO ENFORCED PLAQUE		24" x 18"				36" x 30"
W16-10-1	RED LIGHT PHOTO ENFORCED		30" x 30"				48" x 48"
W16-12P	TRAFFIC CIRCLE PLAQUE		24" x 18"				
W16-17P	ROUNDABOUT PLAQUE		24" x 12"				
W16-101	SHARE THE ROAD		30" x 30"	36" x 36"			
W16-102P	CONSPICUITY PLAQUE		18" x 18"				
W16-103P	DISTANCE AHEAD PLAQUE		24" x 18"			36" x 24"	
W17-1	SPEED HUMP		30" x 30"	36" x 36"			
W19-1	FREEWAY ENDS XX MILE(S)				144" x 48"		
W19-2	EXPRESSWAY ENDS XX MILE(S)				144" x 48"		
W19-3	FREEWAY ENDS				48" x 48"	60" x 60"	
W19-4	EXPRESSWAY ENDS				48" x 48"	60" x 60"	
W20-1	ROAD WORK		36" x 36"		48" x 48"	60" x 60"	
W20-1S	RECTANGULAR ROAD WORK		36" x 36"				
W20-2	ADVANCE DETOUR		36" x 36"		48" x 48"		
W20-3	ROAD CLOSED		36" x 36"		48" x 48"		
W20-3A	ROAD OPEN		48" x 36"				
W20-4	ONE LANE ROAD		36" x 36"		48" x 48"		
W20-5AL	LEFT TWO LANES CLOSED				48" x 48"		
W20-5AR	RIGHT TWO LANES CLOSED				48" x 48"		
W20-5L	LEFT LANE CLOSED		36" x 36"		48" x 48"		
W20-5R	RIGHT LANE CLOSED		36" x 36"		48" x 48"		
W20-5-3	RECTANGULAR LEFT LANE CLOSED		36" x 48"				
W20-5-4	RECTANGULAR RIGHT LANE CLOSED		36" x 48"				
W20-7	FLAGGER SYMBOL		36" x 36"		48" x 48"		
W20-9	TEMPORARY ROADWAY		36" x 36"		48" x 48"		
W20-10A	BE PREPARED TO STOP NEXT (__) MI		36" x 36"		48" x 48"		
W20-11	SOBRIETY CHECK POINT AHEAD				48" x 48"		
W20-12	SAFETY CHECK POINT AHEAD				48" x 48"		
W20-13	TUNNEL TEMPORARILY CLOSED		30" x 30"	36" x 36"			
W20-15	EXPECT DELAYS		36" x 36"		48" x 48"		
W20-16	ROAD SURVEY NEXT (____) MILE		36" x 36"		48" x 48"		
W20-17	END ROADWAY SURVEY		30" x 30"				
W20-99	TUNNEL LANE CLOSED		36" x 36"		48" x 48"		
W20-101	LANES BLOCKED AHEAD		36" x 36"		48" x 48"		

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
W20-102	TRAFFIC ENFORCEMENT ZONE				48" x 48"		
W20-103	ARROW		30" x 30"	36" x 36"			
W21-2	FRESH OIL		30" x 30"	36" x 36"			
W21-2-1	TRAVEL AT YOUR OWN RISK		30" x 30"				
W21-5	SHOULDER WORK		30" x 30"	36" x 36"	48" x 48"		
W21-5BL	LEFT SHOULDER CLOSED (_)		30" x 30"	36" x 36"	48" x 48"		
W21-5BR	RIGHT SHOULDER CLOSED (_)		30" x 30"	36" x 36"	48" x 48"		
W21-5-1	FRESH OIL AND CHIPS		36" x 36"				
W21-5-2	OIL AND CHIPPING AHEAD		36" x 36"				
W21-6	SURVEY CREW		36" x 36"		48" x 48"		
W21-7	UTILITY WORK AHEAD		36" x 36"				
W21-9A	NO GUIDE RAIL		30" x 30"	36" x 36"	48" x 48"		
W21-10	STOP AND SLOW (paddle)	18" x 18"	24" x 24"				
W21-11	BRIDGE INSPECTION AHEAD		36" x 36"		48" x 48"		
W21-12	SAND BLASTING AHEAD CLOSE WINDOWS		60" x 36"				
W21-14	MOWING NEXT (____) MI		36" x 36"		48" x 48"		
W21-15	COUNTER INSTALLATION AHEAD		36" x 36"		48" x 48"		
W21-16	NO PAVEMENT MARKINGS		36" x 36"		48" x 48"		
W21-18	LITTER CREW AHEAD		36" x 36"		48" x 48"		
W21-18A	LITTER CREW AHEAD (Square)		36" x 36"		48" x 48"		
W21-19	ACTIVE WORK ZONE WHEN FLASHING		36" x 36"		48" x 48"		
W21-20	END ACTIVE WORK ZONE		36" x 36"		48" x 48"		
W21-101	RAMP WORK AHEAD				48" x 48"		
W21-102	WORK AREA AHEAD		36" x 36"		48" x 48"		
W21-103	RECTANGULAR WORK AREA AHEAD		36" x 48"				
W22-1	BLASTING ZONE AHEAD				48" x 48"		
W22-2	TURN OFF 2-WAY RADIOS AND CELL PHONES				48" x 36"		
W22-3	END BLASTING ZONE				42" x 36"		
W23-2	NEW TRAFFIC PATTERN AHEAD		36" x 36"				
W23-101	THIS BRIDGE TO BE CLOSED FOR MAINTENANCE		96" x 48"				
W23-102	ROAD TO BE OILED NEXT WEEK		36" x 36"				
W23-103	END OF PROPOSED OILING		36" x 36"				
W24-1L & W24-1R	SINGLE LANE DOUBLE REVERSE CURVE		30" x 30"	36" x 36"	48" x 48"		
W24-1AL & W24-1AR	TWO LANE DOUBLE REVERSE CURVE		30" x 30"	36" x 36"	48" x 48"		
W24-1BL & W24-1BR	THREE LANE DOUBLE REVERSE CURVE		30" x 30"	36" x 36"	48" x 48"		
W25-1	ONCOMING TRAFFIC HAS EXTENDED GREEN		24" x 30"				
W25-2	ONCOMING TRAFFIC MAY HAVE EXTENDED GREEN		24" x 30"				
W25-3	BUS INSPECTION AHEAD		36" x 36"		48" x 48"		
W25-4	EXIT GORE				48" x 48"		
W25-5	CONSTRUCTION ENTRANCE AHEAD		36" x 36"		48" x 48"		
W25-101	INCIDENT AHEAD		36" x 36"		48" x 48"		
W25-102	TRUCK INSPECTION AHEAD		36" x 36"		48" x 48"		
W30-1-1	DISTANCE (500 FT) (panel)		20" x 6"		30" x 10"		
W30-1-2	DISTANCE (1000 FT) (panel)		20" x 6"		30" x 10"		
W30-1-3	DISTANCE (1500 FT) (panel)		20" x 6"		30" x 10"		
W30-1-4	DISTANCE (1/2 MILE) (panel)		20" x 6"		30" x 10"		
W30-1-5	DISTANCE (1 MILE) (panel)		20" x 6"		30" x 10"		
W30-1-6	DISTANCE (AHEAD) (panel)		20" x 6"		30" x 10"		
W35-1	SAFETY CORRIDOR - FINES DOUBLED NEXT XX MILES		60" X 36"		120" X 54"		
W35-2	END FINES DOUBLED CORRIDOR		60" X 36"		108" X 54"		

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
G20-1	LENGTH OF WORK		60" x 30"			72" x 36"	
G20-1-2	ROAD WORK TO BEGIN NEXT WEEK		48" x 36"				
G20-2	END ROAD WORK		36" x 18"		60" x 24"		
G20-4	PILOT CAR		36" x 18"				
G20-4-1	TURNING VEHICLES -- WAIT FOR PILOT CAR		36" x 48"				
G20-5AP	WORK ZONE PLAQUE		24" x 18" / 36" x 24" / 48" x 36" *				
G20-6	DETOUR FOLLOW RED ARROW		48" x 30"				
G20-6-1	RED ARROW		24" x 12"				
G20-15	CROSSOVER (____) FEET		72" x 36"				
G20-16	MAINTAIN SAFE DISTANCE BETWEEN VEHICLES		60" x 60"				
G20-17	SINGLE LANE NEXT (__) MILES		60" x 60"				
G30-1	EMERGENCY PULL-OFF (__)		96" x 60"				
G30-2	EMERGENCY PULL-OFF ENTRANCE		96" x 60"				
G40-1	TEMPORARY ARROW	72" x 36"	96" x 48"				
G40-2	STRIPED (panel) (for G40-1)	72" x 36"	96" x 48"				
G60-1	ROAD WORK INFO TUNE RADIO TO (____) AM			132" x 60"			120" x 48"
G60-1A	URGENT MESSAGE WHEN FLASHING			132" x 36"			120" x 24"
G70-1	USE BOTH LANES TO MERGE POINT			132" x 42"			
G70-2	MERGE HERE TAKE YOUR TURN			132" x 42"			
M 1-1	INTERSTATE ROUTE (marker) - 1 OR 2 DIGITS		24" x 24"		36" x 36"		
	INTERSTATE ROUTE (marker) - 3 DIGITS		30" x 24"		45" x 36"		
M 1-2	INTERSTATE BUSINESS LOOP - 1 OR 2 DIGITS		24" x 24"		36" x 36"		
	INTERSTATE BUSINESS LOOP - 3 DIGITS		30" x 24"		45" x 36"		
M 1-3	INTERSTATE BUSINESS SPUR - 1 OR 2 DIGITS		24" x 24"		36" x 36"		
	INTERSTATE BUSINESS SPUR - 3 DIGITS		30" x 24"		45" x 36"		
M 1-4	U.S. ROUTE (marker) - 1 OR 2 DIGITS		24" x 24"		36" x 36"		
	U.S. ROUTE (marker) - 3 DIGITS		30" x 24"		45" x 36"		
M 1-5	PENNSYLVANIA ROUTE (marker) - 1 OR 2 DIGITS		24" x 24"		36" x 36"		
	PENNSYLVANIA ROUTE (marker) - 3 DIGITS		30" x 24"		45" x 36"		
M 1-5A	PENNSYLVANIA TURNPIKE (marker)		36" x 36"		45" x 36"		
M1-8	BICYCLEPA ROUTE (marker)		12" x 30"				
M1-8A	BICYCLEPA ROUTE MARKER TURN ASSEMBLY		12" x 30"				
M1-10	EISENHOWER INTERSTATE SYSTEM (2 pages)				36" x 36"		
M 2-1	JUNCTION (marker)		21" x 15"		30" x 18"		
M 2-1-1	INTERSTATE JUNCTION (marker)		21" x 15"		30" x 18"		
M 3-1	NORTH (marker)		24" x 12"		30" x 15"		
M 3-1-1	INTERSTATE NORTH (marker)		24" x 12"		30" x 15"		
M 3-1-2	INTERSTATE BUSINESS NORTH (marker)		24" x 12"		30" x 15"		
M 3-2	EAST (marker)		24" x 12"		30" x 15"		
M 3-2-1	INTERSTATE EAST (marker)		24" x 12"		30" x 15"		
M 3-3	SOUTH (marker)		24" x 12"		30" x 15"		
M 3-3-1	INTERSTATE SOUTH (marker)		24" x 12"		30" x 15"		
M 3-3-2	INTERSTATE BUSINESS SOUTH (marker)		24" x 12"		30" x 15"		
M 3-4	WEST (marker)		24" x 12"		30" x 15"		
M 3-4-1	INTERSTATE WEST (marker)		24" x 12"		30" x 15"		
M 4-1	ALTERNATE MARKER		24" x 12"		30" x 15"		
M 4-2	BY- PASS (marker)		24" x 12"		30" x 15"		
M 4-3	BUSINESS (marker)		24" x 12"		30" x 15"		
M 4-4	TRUCK (marker)		24" x 12"		30" x 15"		
M 4-5	TO (marker)		24" x 12"		30" x 15"		

NOMEN-CLATURE	DESCRIPTION	SIZE					
		Minimum	Conventional Road		Freeway	Oversized	Additional Sizes
			Single Lane	Multi-Lane			
M 4-5-1	INTERSTATE TO (marker)		24" x 12"		30" x 15"		
M 4-6	END (marker)		24" x 12"		30" x 15"		
M 4-8	DETOUR (marker)		24" x 12"		30" x 15"		
M 4-8A	END DETOUR		24" x 18"		36" x 30"		
M 4-8-1	CAR DETOUR (marker)		24" x 24"				
M 4-8-2	TRUCK DETOUR (marker)		24" x 24"				
M4-9A	BICYCLE / PEDESTRIAN DETOUR		30" x 24"				
M4-9B	PEDESTRIAN DETOUR		30" x 24"				
M4-9C	BICYCLE DETOUR		30" x 24"				
M4-9L	DETOUR, LEFT		30" x 24"		48" x 36"		
M4-9R	DETOUR, RIGHT		30" x 24"		48" x 36"		
M4-9S	DETOUR, STRAIGHT		30" x 24"		48" x 36"		
M4-9SL	LEFT ADVANCE DETOUR		30" x 24"		48" x 36"		
M4-9SR	RIGHT ADVANCE DETOUR		30" x 24"		48" x 36"		
M4-9-1AL	LEFT ADVANCE 45° DETOUR		30" x 24"		48" x 36"		
M4-9-1AR	RIGHT ADVANCE 45° DETOUR		30" x 24"		48" x 36"		
M4-9-1BL	45° LEFT TURN DETOUR		30" x 24"		48" x 36"		
M4-9-1BR	45° RIGHT TURN DETOUR		30" x 24"		48" x 36"		
M4-10L	DETOUR ARROW, LEFT		48" x 18"				
M4-10R	DETOUR ARROW, RIGHT		48" x 18"				
M4-10S	DETOUR ARROW, STRAIGHT		48" x 18"				
M 4-12	END (for D11-1)		24" x 6"				
M 4-13	TO (for D11-1)		24" x 6"				
M 4-14-1	BEGIN (for D11-1)		24" x 6"				
M 5-1L	ADVANCE 90° LEFT TURN (marker)		21" x 15"		30" x 18"		
M 5-1-1L	INTERSTATE ADVANCE 90° LEFT TURN (marker)		21" x 15"		30" x 18"		
M 5-1R	ADVANCE 90° RIGHT TURN (marker)		21" x 15"		30" x 18"		
M 5-1-1R	INTERSTATE ADVANCE 90° RIGHT TURN (marker)		21" x 15"		30" x 18"		
M 5-2L	ADVANCE 45° LEFT TURN (marker)		21" x 15"		30" x 18"		
M 5-2-1L	INTERSTATE ADVANCE 45° LEFT TURN (marker)		21" x 15"		30" x 18"		
M 5-2R	ADVANCE 45° RIGHT TURN (marker)		21" x 15"		30" x 18"		
M 5-2-1R	INTERSTATE ADVANCE 45° RIGHT TURN (marker)		21" x 15"		30" x 18"		
M5-3	CURVED-STEM ADVANCE TURN ARROW		21" x 15"		30" x 21"		
M 6-1	90° TURN (marker)		21" x 15"		30" x 18"		
M 6-1-1	INTERSTATE 90° TURN (marker)		21" x 15"		30" x 18"		
M 6-2L	45° LEFT TURN (marker)		21" x 15"		30" x 18"		
M 6-2-1L	INTERSTATE 45° LEFT TURN (marker)		21" x 15"		30" x 18"		
M 6-2R	45° RIGHT TURN (marker)		21" x 15"		30" x 18"		
M 6-2-1R	INTERSTATE 45° RIGHT TURN (marker)		21" x 15"		30" x 18"		
M 6-3	STRAIGHT THROUGH (marker)		21" x 15"		30" x 18"		
M 6-3-1	INTERSTATE STRAIGHT THROUGH (marker)		21" x 15"		30" x 18"		
M 6-4	90° RIGHT AND LEFT TURN (marker)		21" x 15"		30" x 18"		
M 7-1	HORIZONTAL ARROW (for D11-1)		12" x 9"				
M 7-2	VERTICAL ARROW (for D11-1)		12" x 9"				
M 7-3	DOUBLE HEADED DIAGONAL ARROW (for D11-1)		12" x 9"				
M 7-4	DIAGONAL ARROW (for D11-1)		12" x 9"				
M 7-5	DOUBLE HEADED HORIZONTAL ARROW (for D11-1)		12" x 9"				
M 7-6	HORIZONTAL AND VERTICAL ARROW (for D11-1)		12" x 9"				
M 7-7	VERTICAL AND DIAGONAL ARROW (for D11-1)		12" x 9"				

Appendix B

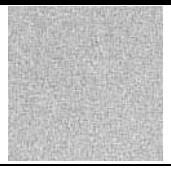
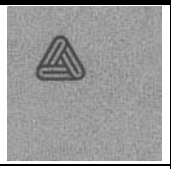
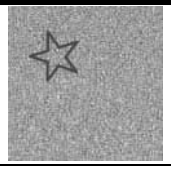
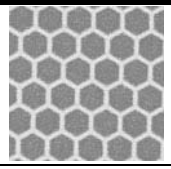
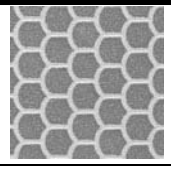
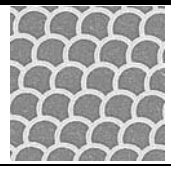
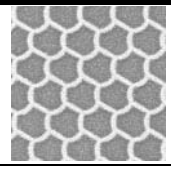
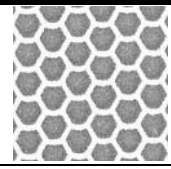
Traffic Sign Retroreflective Sheeting Identification Guide

2011 Traffic Sign Retroreflective Sheeting Identification Guide

U.S. Department of Transportation
Federal Highway Administration

This document is intended to help identify sign sheeting materials for rigid signs and their common specification designations. It is not a qualified product list. FHWA does not endorse or approve sign sheeting materials. Many other sheeting materials not listed here are available for delineation

Retroreflective Sheeting Materials Made with Glass Beads

Example of Sheeting (Shown to scale)								
ASTM D4956-04	I	II	II	III	III	III	III	III
ASTM D4956-09	I	II	II	III	III	III	III	III
AASHTO M268-10	(1)	(1)	(1)	A	A	A	A	A
Manufacturer	Several companies	Avery Dennison®	Nippon Carbide	3M™	ATSM, Inc.	Avery Dennison®	Nippon Carbide	Oracal
Brand Name	Engineer Grade	Super Engr Grade	Super Engr Grade	High Intensity	High Intensity	High Intensity	High Intensity	High Intensity
Series	Several	T-2000	15000	2800 3800	ATSM HI	T-5500	N500	5800
NOTES:	(2)	(3) (4)	(4)	(3) (4)	(4)	(4)	(4)	(4)

(1) – Sheeting material does not meet minimum AASHTO classification criteria.
(2) – Glass Bead Engineer Grade sheeting is uniform without any patterns or identifying marks. Section 2A.08 of the 2009 MUTCD (http://mutcd.fhwa.dot.gov) does not allow this sheeting type to be used for new yellow or orange signs, or new legends on green signs.
(3) – Material no longer sold in the United States as of the date of this publication.
(4) – Section 2A.08 of the 2009 MUTCD (http://mutcd.fhwa.dot.gov) does not allow this sheeting type to be used for new legends on green overhead signs.

- ASTM D4956-04 is referenced in Table 2A-3 of the 2009 MUTCD.
- ASTM D4956-09 is the most current ASTM sign sheeting specification (the 2009 version is designated by "-09").
- AASHTO M268-10 Types for this Guide are based only on retroreflective properties and not other unique AASHTO requirements such as color.

Manufacturer Contact Information

3M - http://www.3M.com/tss
Avery Dennison - http://www.reflectives.averydennison.com
Oracal - http://www.oracal.com
ATSM, Inc. - http://www.atsminc.com
Nippon Carbide - http://www.nikkalite.com
Reflexite - http://www.reflexite.com

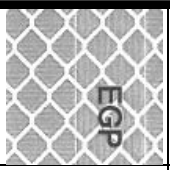
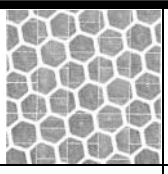
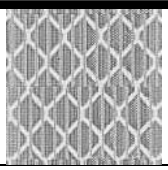
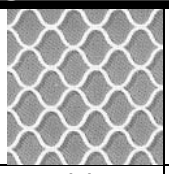
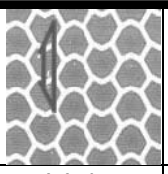
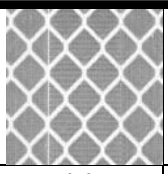
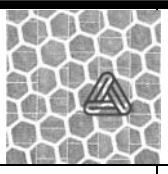
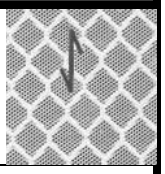
FHWA Publication Number: FHWA-SA-11-14. For additional copies of this document, please send request to report.center@dot.gov

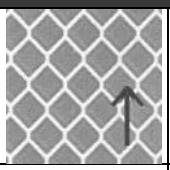
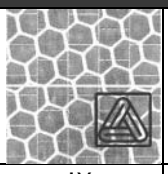
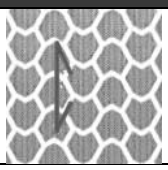
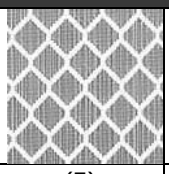
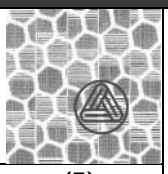
2011 Traffic Sign Retroreflective Sheeting Identification Guide

U.S. Department of Transportation
Federal Highway Administration

This document is intended to help identify sign sheeting materials for rigid signs and their common specification designations. It is not a qualified product list. FHWA does not endorse or approve sign sheeting materials. Many other sheeting materials not listed here are available for delineation and construction/work zone uses.

Retroreflective Sheeting Materials Made with Prisms

Example of Sheeting (Shown to scale)								
D4956-04	(5)	III, IV	III, IV, X	(5)	(5) / X	(5)	VIII	VII, VIII, X
D4956-09	I	III, IV	III, IV	IV	IV / VIII	VIII	VIII	VIII
M268-10	(6)	B	B	B	B	B	B	(9)
Manufacturer	3M™	Avery Dennison®	3M™	Reflexite®	Nippon Carbide	3M™	Avery Dennison®	3M™
Brand Name	Engr Grade Prismatic	High Intensity Prismatic	High Intensity Prismatic	High Intensity Prismatic	Crystal Grade	Reflective Sheeting	MVP Prismatic	Diamond Grade™ LDP
Series	3430	T-6500	3930	IC400	94000 / 92000	3940	T-7500	3970
NOTES:	(7)				(8)			(10)

Example of Sheeting (Shown to scale)					
D4956-04	IX	IX	(5)	(5)	(5)
D4956-09	IX	IX	IX	XI	XI
M268-10	B	B	B	D	D
Manufacturer	3M™	Avery Dennison®	Nippon Carbide	3M™	Avery Dennison®
Brand Name	Diamond Grade™ VIP	OmniView™	Crystal Grade	Diamond Grade™ DG3	OmniCube™
Series	3990	T-9500	95000	4000	T-11500
NOTES:					

NOTE: The watermarks have been enhanced in this ID Guide. They are shown to scale but are not as visible on actual sheeting materials. It helps to view the sheeting materials at different angles to see the watermarks. The spacing of the watermarks varies and therefore watermarks may not be present on small pieces of sheeting.

(5) – Material was either unavailable in 2005 (previous version of this Guide) or unassigned in the 2004 version of ASTM D4956.
(6) – Sheeting material does not meet minimum AASHTO classification criteria.
(7) – Section 2A.08 of the 2009 MUTCD (http://mutcd.fhwa.dot.gov) does not allow this sheeting type to be used for new yellow or orange signs, or new legends on green signs.
(8) – These two materials (94000 and 92000) are visually indistinguishable from one another.
(9) – Material has been discontinued prior to AASHTO M268-10.
(10) – Material no longer sold in the United States as of the date of this publication.

Resources

Federal Highway Administration – http://www.fhwa.dot.gov/retro
Manual on Uniform Traffic Control Devices (MUTCD) – http://mutcd.fhwa.dot.gov
ASTM – http://www.astm.org AASHTO – http://www.transportation.org
Texas Transportation Institute – http://tti.tamu.edu/visibility

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Appendix C

Quality Guidelines For Temporary Traffic Control Devices

Evaluation Guide For Work Zone Signs

ACCEPTABLE

There are several abrasions on the surface but very little loss of lettering. There has been no touch-up of the lettering. This message is legible per the design criteria of the MUTCD and PennDOT Publication 236.

MARGINAL

Of the many surface abrasions throughout the sign face, many are within the individual letters of the message. The sign surface is free of any residue. Although some color fading is evident,the background color and reflectivity are still apparent at night. This message is legible per the design criteria of the MUTCD and PennDOT Publication 236.

UNACCEPTABLE

Signs with asphalt splatter or cement slurry of an amount similar to the abrasions that are evident throughout the face of this signs are unacceptable. Some letters have a loss of more than 50 percent. There is noticeable color-fading. The message is illegible per the design criteria of the MUTCD and PennDOT Publication 236.

Evaluation Guide For Barricade Panels or Vertical Panels

ACCEPTABLE

Panels not deformed to an extent so as to decrease the panels target value. There are several abrasions on the surface but very little loss of reflective sheeting. The orange is vivid and the stripes provide contrast.

MARGINAL

There are numerous surface abrasions through the panel surface. Some color fading is evident; however, it is free of large areas of residue or missing reflective material. The orange is vivid and the stripes provide contrast.

UNACCEPTABLE

The surface is marred over a high percentage of the panel area. There is noticeable loss of reflectivity and obvious color fading . Panels with asphalt splatter and/or cement slurry, or any combination of missing and covered re- flective material similar in area to that shown here would also make a panel unacceptable.

Evaluation Guide For Drums

ACCEPTABLE
The sheeting has only minor tears and scratches. The dent shown does not seriously reduce the reflectivity. The drum maintains its intended original shape.

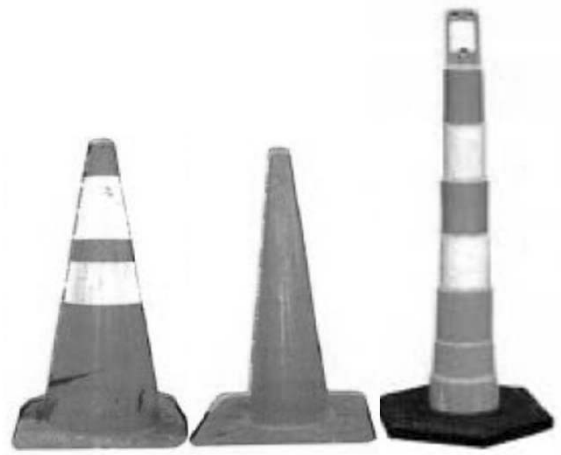
MARGINAL
The sheeting has numerous tears and scratches; however, it is free of large areas of residue or missing reflective material. The large dent shown reduces the effectiveness of the upper reflective band; however, the drum strength is not reduced. The drum maintains its original shape.

UNACCEPTABLE
The large areas of missing reflective material on the fractured upper area make this drum unacceptable. Drums with asphalt splatter and/or cement slurry, or any combination of missing and covered reflective material would also make a drum unacceptable. Substantial deformation of a drum which reduces the original dimensions may cause the drum to be considered as "unacceptable" even if other parameters are still "acceptable'.

Evaluation Guide For Cones

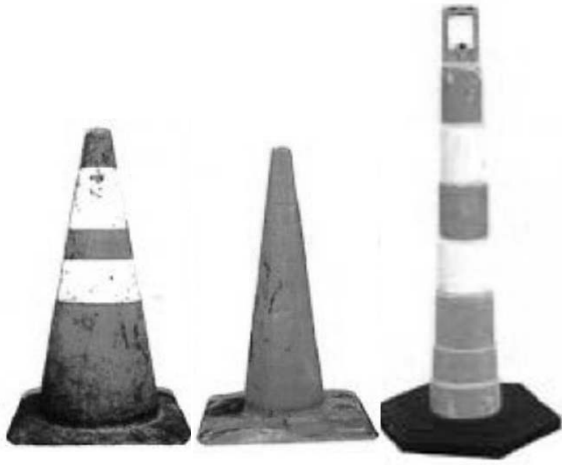
ACCEPTABLE

The conical shape should remain clearly identifiable with no significant distortion and must be free standing in its normal position. The surface is free of punctures and abrasions. The surface is free of asphalt splatter, cement slurry or other material and will readily respond to washing. The reflective bands, if required, have little or no loss of reflectivity, with only minor tears and scratches.



MARGINAL

The surface has some asphalt splatterings or cement slurry and may not be readily cleaned due to abrasion and discoloration. The reflective bands, if required, have numerous tears and scratches, but are free of large areas of residue or missing material.



UNACCEPTABLE

Punctures and large areas of straining asphalt splatter and cement slurry make these an unlikely candidate for improvement. Large areas of missing or stained reflective material make the cone unacceptable.

Evaluation Guide For High Visibility Work Zone Safety Apparel

ACCEPTABLE

New high-visibility safety aparel is characterized by having vivid color contrast and high reflectivity. Apparel that is used but is in like-new condition is characterized as having excellent color contrast, excellent reflectivity and is not faded or soiled.

MARGINAL

Good reflectivity although the vest has some soiling and light fading. Note: The second picture was taken with a flash and simulates nighttime conditions.

UNACCEPTABLE

Little or no refelctivity, and soiled and faded material. Poor color contrast, low or no reflectivity, significant fading or soiling, and deteriorated reflective strips.

Evaluation Guide For Tubular Markers

ACCEPTABLE
The surface is free of punctures and abrasions, asphalt splatter, cement slurry, or other material and will readily respond to washing . The reflective bands, if required, have little or no loss of reflectivity, with only minor tears and scratches

MARGINAL
The surface has some asphalt splattering or cement slurry and may not be readily cleaned due to abrasion or discoloration. The reflective bands, if required, have numerous tears and scratches, but are free of large areas of residue or missing material.

UNACCEPTABLE
Punctures and large areas of staining, asphalt splatter or cement slurry make these unlikely candidates for improvement. Large areas of missing or stained reflective material also make the markers unacceptable.

ACCEPTABLE

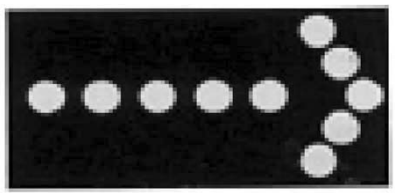
90% or more of the pixels per character module are operating properly. The text should be legible from a minimum of 650' to 900' as required in the material specifications.

UNACCEPTABLE

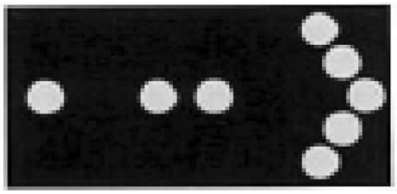
Less than 90% of the pixels per character module are operating properly or not performing within the criteria of the MUTCD or text is not legible from the specified acceptable distances.

Evaluation Guide For Flashing Arrow Panels (Merge Mode)

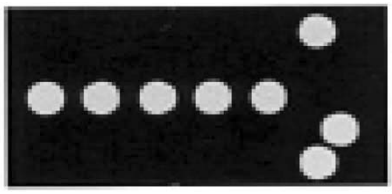
ACCEPTABLE
No more than one (1) lamp out in stem and none out in arrowhead.
Lights dim properly.



MARGINAL
Two (2) or fewer lamps in stem out. No lamps out in head.
Lights dim properly.



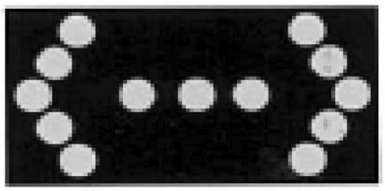
UNACCEPTABLE
Any lamp out in the arrowhead, or more than two (2) lamps out in the stem or lights do not dim properly.



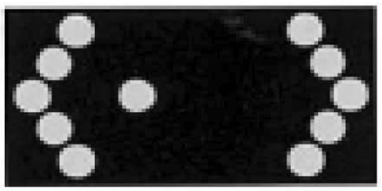
Note: Any operating lamp which is out of alignment will be considered "not functioning".

Evaluation Guide For Flashing Arrow Panels (Double Arrow Mode)

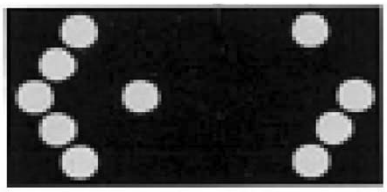
ACCEPTABLE
No more than one (1) lamp out in stem and none out in arrowhead.
Lights dim properly.



MARGINAL
Two (2) or fewer lamps in stem out. Both arrowheads completely functional with no lamps out. Lights dim properly.



UNACCEPTABLE
Any lamps in arrowheads out or more than two(2) lamps out in the stem or lights do not dim properly.



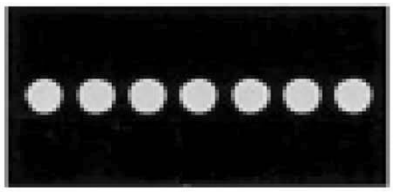
Note: Any operating lamp which is out of alignment will be considered "not functioning".

Evaluation Guide For Flashing Arrow Panels (Caution Mode)

(Bar or Corners)

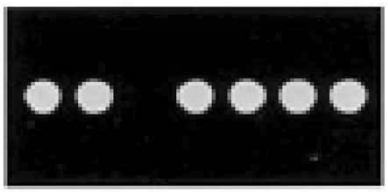
ACCEPTABLE

Four (4) or more lamps operating. Lights dim properly.



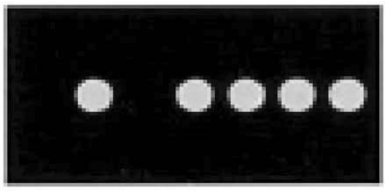
MARGINAL

Minimum of four (4) lamps functioning. Lights dim properly.



UNACCEPTABLE

Less than four (4) lamps functioning or lights do not dim properly.



Note: Any operating lamp which is out of alignment will be considered "not functioning".

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Appendix D

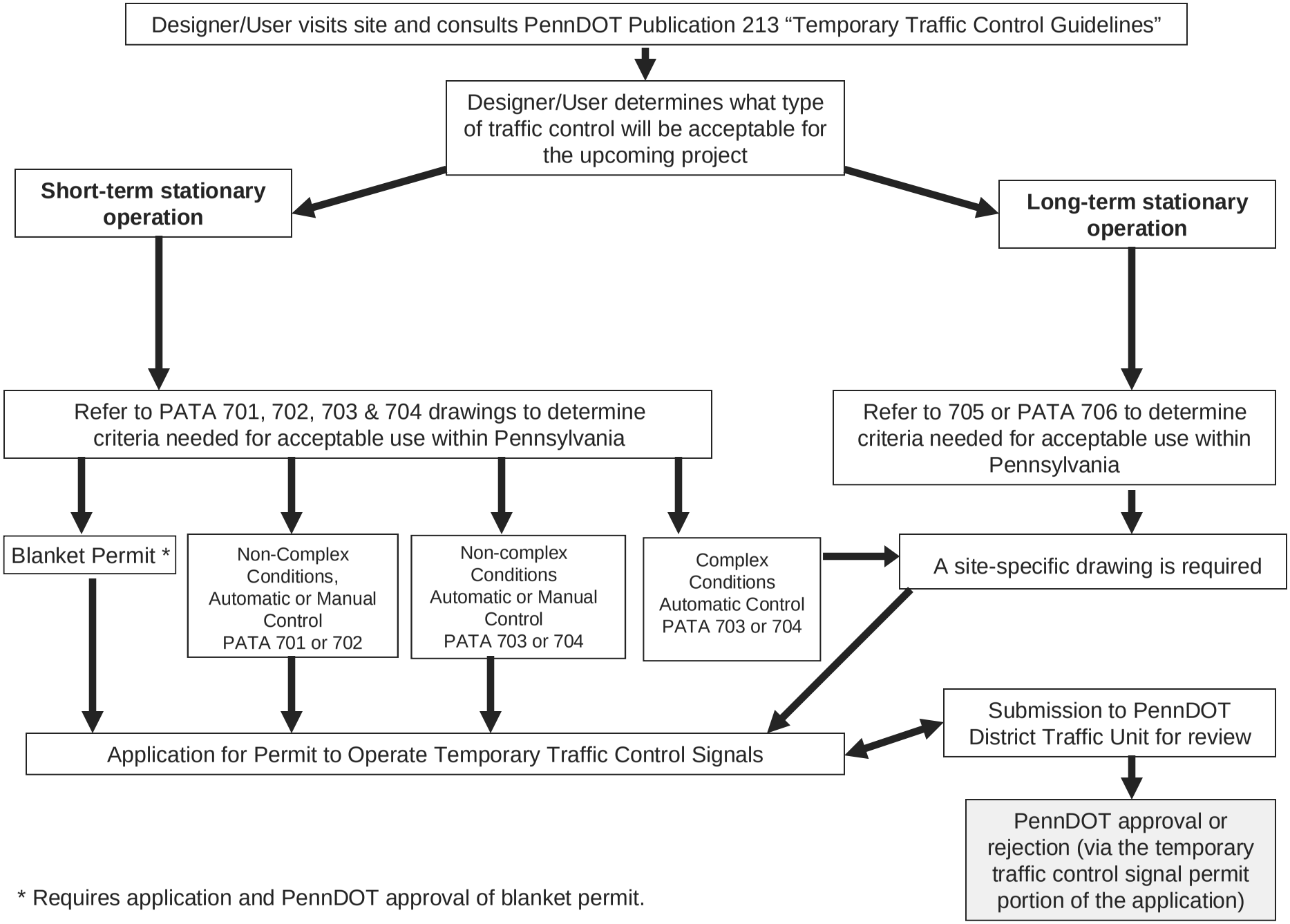
Temporary Traffic Control Signal Documentation

Documentation Type Index
Temporary Traffic Control Signal Requirements and Timeframes
Process for Obtaining PennDOT Approval to Use Temporary Traffic Control Signals
Blanket Permits
Application for Permit to Operate Temporary Traffic Control Signals
Temporary Traffic Control Signal Permit
Application Instructions for Permit to Operate Temporary Traffic Control Signals
Example Problem: Application for Permit to Operate Temporary Traffic Control Signals
Guidelines for the Selection of Temporary Traffic Control Signals in Work Zones
Temporary Traffic Control Signals Non-Compliance Documentation Form
Temporary Traffic Control Signals User Comment Form
TE 161: Notice of Commencement for Pedestal-Mounted Portable Traffic Signals

Temporary Traffic Control Signal Requirements and Timeframes

Type of Application	*Publication 213 Figure*	*PennDOT Approval Required Prior to Use*	*Advance Site Visit Required by User*	*Application Required*	*Site-Specific Drawing Required*	*Deadline for District Receipt of All Required Materials*
Long-Term Stationary Operation Fixed Supports	PATA 705	X	X	X	X	At least 15 working days prior to desired usage
Long-Term Stationary Operation Trailer-Mounted Portable Traffic Control Signals	PATA 706	X	X	X	X	At least 15 working days prior to desired usage
Short-Term Stationary Operation Pedestal-Mounted, Non-complex Condition Automatic or Manually Controlled	PATA 701	X	X	X		At least 3 full working days prior to desired usage
Short-Term Stationary Operation Trailer-Mounted, Non-complex Condition Automatic or Manually Controlled	PATA 702	X	X	X		At least 3 full working days prior to desired usage
Short-Term Stationary Operation Pedestal-Mounted Portable Traffic Control Signals Complex Conditions	PATA 703	X	X	X	X	At least 15 working days prior to desired usage
Short-Term Stationary Operation Trailer-Mounted Portable Traffic Control Signals Complex Conditions	PATA 704	X	X	X	X	At least 15 working days prior to desired usage
Short-Term Stationary Operation Pedestal-Mounted Portable Traffic Control Signals Blanket Permit	PATA 701	X	X	X		At least 15 working days for initial blanket permit request; at least 3 full working days prior to each usage under the blanket permit
Short-Term Stationary Operation Trailer-Mounted Portable Traffic Control Signals Blanket Permit	PATA 702	X	X	X		At least 15 working days for initial blanket permit request; at least 3 full working days prior to each usage under the blanket permit

Process for Obtaining PennDOT Approval to Use Temporary Traffic Control Signals



* Requires application and PennDOT approval of blanket permit.

Blanket Permits

The following information below will provide you with the requirements when considering a blanket permit for temporary traffic control signals.

What is a blanket permit?

- For repeat users of portable traffic control signals, PennDOT's appropriate Engineering District Office may issue a blanket temporary traffic control signal permit covering multiple locations and dates of operation for up to a one-year period. This action will only be considered by PennDOT if that user has properly used portable traffic control signals in a safe and efficient manner on three or more past deployments without problems and in compliance with PennDOT requirements.
- PennDOT's Bureau of Maintenance and Operations (BOMO) will be involved in the blanket process. Although permits are issued by the appropriate Engineering District Office, BOMO will participate in the evaluation process to determine whether a particular portable traffic control signal user can be issued their initial blanket permit in each Engineering District. BOMO will provide the overall blanket permit approval number, participate in any blanket permit revocation proceedings, and will keep track of users who have been issued blanket permits statewide.

What types of operations can be covered by a blanket permit?

- Blanket permits can only be issued for short-term stationary operations (manual control, non-complex conditions) that satisfy the criteria and provisions of PATA 701 or PATA 702, except for emergency work as defined in Chapter 212. See Note 2 of each figure.
- Blanket permits **cannot** be used for portable traffic control signal usage involving either long-term operations or short-term operations with complex conditions that are governed by PATA 703, 704, 705 or 706.

Who can apply for a blanket permit?

- Any repeat user of portable traffic control signals who agrees to the responsibilities, terms, and conditions as outlined herein.
- The blanket permit will be issued to up to two specific individuals (representing a company), and not to companies in general.

What are the roles and responsibilities of the blanket permittee?

- Responsible for the proper installation, maintenance, and operation of the portable traffic control signal system as specified in PennDOT Publication 213 and the temporary traffic control signal permit.
- Work closely with the work crew to provide safe and proper operations as specified in PennDOT Publication 213 and the temporary traffic control signal permit. Safety will be strictly enforced, and will not be compromised when using the devices.
- Assist the work crew with PennDOT Publication 213 and temporary traffic control signal permit requirements for portable traffic control signal usage.
- Provide technical and expert assistance on the use of the devices before, during, and after deployments to the contractors' personnel.

- Take responsibility to ensure that the devices are working properly.
- Approved products as specified in PennDOT Publication 35 (Bulletin 15) must be used.
- Ensure the upkeep of the devices to PennDOT specifications and requirements maintained by the Bureau of Operations and Maintenance (BOMO).
- Provide documentation, satisfactory to PennDOT, showing that the individual successfully completed a training course given by the manufacturer on the operation of the portable traffic control signal system that is being deployed under the blanket permit.
- Ensure proper all-red clearance intervals and yellow change intervals are used as specified in PennDOT Publication 213 and the temporary traffic control signal permit.
- Ensure appropriate green intervals are used based on traffic conditions. Ensure this is evaluated several times a day, and all changes should be documented.
- Ensure that good records are kept of any changes during the operation of the devices.
- Ensure that proper documentation is maintained on-site (including the temporary traffic control signal permit, PennDOT Publication 213, etc.).
- Develop and document a contingency plan by the permitte prior to the deployment of the devices to establish procedures in the event of device failure or malfunction, or in the event of changing conditions or unforeseen circumstances.
- Establish a designated on-site liaison from work crew. Topics to be covered with the on-site liaison include a contingency plan, basic programming and operation, take-down procedures, traffic monitoring responsibilities, driveway control, etc.
- Provide the initial programming and the initial monitoring of the portable traffic control signals each day. All changes during the day should be made under the direction of the permittee and documented.
- Be on-site at the start of signal usage each day. Provide emergency protocols and a contingency plan to address situations involving device malfunctions or changing conditions. Also, provide a direct number whereby the blanket permittee can be contacted at all times during signal usage.
- Provide instructions to the work crew about proper removal procedures and how to place devices into a flash mode before going dark.
- Visit the site in advance to ensure that proper usage can be achieved at the location of the upcoming deployment.
- Continue to follow the appropriate processes outlined in PennDOT Publication 213 for obtaining PennDOT approval to use portable traffic control signals. The deadline for PennDOT District Office receipt of all required materials for the blanket permit request is at least 15 working days prior to the first desired usage date. Thereafter, required materials must be received by the appropriate District Office at least 3 full working days prior to each usage under an established blanket permit.
- Coordinate yearly with PennDOT's Central Office and District Offices to ensure proper installations are occurring. Also, this will allow for a working relationship where the blanket permittee will be up-to-date with respect to the latest requirements and guidance documents.

What is the process/procedure to follow if an individual wants to be considered as a future blanket permittee?

- Submit a written request to BOMO and the appropriate Engineering District(s) identifying the individuals seeking to be evaluated for future blanket permit consideration. Indicate the Engineering Districts where blanket permit consideration is being sought. Clearly indicate acceptance of the blanket permittee roles and responsibilities as outlined herein. Provide written documentation from the manufacturer of each portable traffic control signal system that will be deployed indicating that each individual seeking a blanket permit has successfully completed a training course given by the manufacturer on the operation of that signal system.
- After receipt of the written request, PennDOT will contact the applicant to discuss the evaluation process and associated expectations. A series of successful trial deployments will need to be completed.
- The appropriate processes outlined in PennDOT Publication 213 for obtaining PennDOT approval to use portable traffic control signals must be followed for the trial deployments. Failure to do so may result in rejection of the trial deployment.

How many successful trial deployments must be completed before obtaining a blanket permit?

- The initial application will begin the evaluation of the trial deployments. Previous deployments will not be considered during the blanket permit evaluation.
- A minimum of three proper deployments by the individual desiring to be a future blanket permittee, with at least one proper deployment in each Engineering District where a blanket permit is desired.
- PennDOT will allow a maximum of two individuals from the same company to be evaluated on each trial deployment for the purposes of being considered as a future blanket permittee.
- BHSTE will be actively involved in monitoring the trial deployments, and feedback received from District Office personnel, the work crew, the supplier/manufacturer, and others will be considered.

Upon successful completion of the trial deployments, what are the next steps?

- PennDOT will document all comments and advise the applicant of successful completion of the trial deployments.
- BOMO will work with District Office personnel to ensure that a blanket permit is issued to applicants that fulfill requirements.

What about blanket permit revocation?

- A blanket permit must be renewed each year.
- A blanket permit can be revoked at any time for poor performance by the Engineering District. BOMO will be involved in any revocation proceedings.
- If a blanket permit is revoked, that individual will not be allowed to submit for a blanket permit application for at least one year. Future submissions should follow the same procedures as a first-time applicant.

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DEPARTMENT OF TRANSPORTATION

APPLICATION FOR PERMIT TO OPERATE TEMPORARY TRAFFIC CONTROL SIGNALS

Applicant's Contact Information

Applicant's Name: _____

Applicant's Company:_____

Company Address:_____

Company Phone No.: _____Company Fax No.:_____

Cellular Phone No.: _____E-mail Address:_____

Name of Emergency Contact Person: _____ Cellular Phone No.: _____
(Must be available 24 hrs./day, 7 days/week during period of usage.)

Description of Traffic Control Device

Type of Device		Mounted on Fixed Supports		Trailer-Mounted		Pedestal-Mounted		Automated Flagger Assistance Device (AFAD)		Other (explain)
(check one)										

Traffic Control Device Manufacturer: _____ Manufacturer's Model No.: _____

PennDOT Approval No.: _____

Work Zone Information

Was a site visit performed prior to submitting this application? Yes ___ No ___

Date of Traffic Control Device Usage: Begin _____ End_____

Engineering District: _____County: _____Municipality:_____

On State Route (SR): _____ Direction: _____

From: Segment: _____ Offset: _____

To: Segment: _____ Offset: _____

On Local Road: _____ Direction: _____

From: _____

To: _____

Normal Speed Limit: _____mph ADT: _____ veh/day

Maximum Length of One-Lane, Two-Way Traffic Section _____ feet
(Between *STOP HERE ON RED* Signs)

Type of Operation: Long-Term Stationary _____ Short-Term Stationary _____

Other (please describe): _____

The traffic control device will be used to control: One-Lane, Two-Way Traffic _____
(Check all that apply) No More than Two Approaches _____
Other (please describe): _____

Will all signal faces exceed the thresholds for signal face visibility specified on the Publication 213 figure? Yes ___ No ___

Does the site contain an intersection within the one-lane, two-way traffic section? Yes ___ No ___

Does the site contain an uncontrolled commercial driveway within the one-lane, two-way traffic section? Yes ___ No ___

Is any roadway approach to the traffic control device on a steep downgrade (5% or more)? Yes ___ No ___

Does the site contain an at-grade railroad crossing within 300 feet of the work zone? Yes ___ No ___

Proposed work description:

Traffic Control Device Operational Information

Mode of Operation	Manually-Controlled	Pre-Timed	Actuated	Other (explain)
(please check one)				

PennDOT Publication 213 PATA _____ will be followed.

All-red clearance time is _____ seconds based on

assumed traffic speed of _____ mph within one-lane, two-way section.

The proposed minimum green time shall be at least 10 seconds.

The proposed maximum green time shall be determined based on field conditions.

The proposed yellow change interval shall be five (5) seconds unless otherwise indicated by PennDOT.

Applicant Certification

The applicant certifies that the information provided on this application and accompanying documents is true and correct.

The applicant certifies that, if approved, the traffic control devices will be operated and maintained in compliance with PennDOT Publications 212 and 213, and the provisions of the temporary traffic control signal permit as issued by PennDOT.

The applicant agrees that it will indemnify, save harmless and defend (if requested) the Commonwealth of Pennsylvania, its agents, representatives and employees, from all suits, actions or claims of any character, name or description, damages, judgments, expenses, attorneys' fees and compensation arising out of personal injury, death or property damage, sustained or alleged to have been sustained in whole or in part by any and all persons whatsoever as a result of or arising out of any act, omission, neglect or misconduct of the applicant, its officers, agents, contractors or employees, during the period of temporary traffic control signal usage.

BY: _____ _____

Signature of Applicant Date

Sworn before me this _____ day of _____, 20_____

Notary: _____

PennDOT Acknowledgement

This application is: Accepted: _____ Temporary Traffic Signal Permit Attached: _____

Rejected: _____ Application was rejected because:

If rejected, please correct immediately and submit to PennDOT. Temporary traffic control device usage cannot begin without prior approval.

TE-964P (8- 08)

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Permit No. _____
Sheet 1 of _____

TEMPORARY TRAFFIC CONTROL SIGNAL PERMIT

In accordance with the Vehicle Code, the Pennsylvania Department of Transportation (PennDOT) hereby approves the operation of a temporary traffic control signal as follows:

Location:

Date(s) of Operation:

This permit is issued to, and accepted by, _____, hereinafter known as the Permittee, as follows:

The operation and maintenance of this temporary traffic control signal by the Permittee shall be in accordance with requirements contained on the attached sheets and application, PennDOT's figures governing the use of temporary traffic control signals as contained in PennDOT Publication 213, and the following special requirements:

All work performed by the Permittee with respect to the operation and maintenance of this temporary traffic control signal shall be under and subject to the direction of PennDOT. The said Permittee shall use due diligence in the execution of the work authorized under this permit and shall not obstruct or endanger travel along the said road. All operations must be conducted so as to permit safe and reasonable free travel at all times over the road within the limits of the work herein permitted.

The Permittee agrees to indemnify, save harmless and defend (if requested) the Commonwealth of Pennsylvania, its agents, representatives and employees, from all suits, actions or claims of any character, name or description, damages, judgments, expenses, attorneys' fees and compensation arising out of personal injury, death or property damage, sustained or alleged to have been sustained in whole or in part by any and all persons whatsoever as a result of or arising out of any act, omission, neglect or misconduct of the Permittee, its officers, agents, contractors or employees, during the period of temporary traffic control signal usage.

PennDOT reserves the right to revoke this permit or to suspend the operation of the temporary traffic control signal if the Permittee shall at any time willfully or negligently fail to comply with the conditions contained in this permit or PennDOT Publication 213, or fail to make any changes in the operation of this signal, or to remove it, when so ordered by PennDOT. The Permittee shall maintain the signal in a safe condition at all times. The Permittee shall not make any change in the operation of the temporary traffic control signal as defined in the permit drawings without prior written approval of PennDOT. PennDOT reserves the right to inspect this temporary traffic control signal usage at any time.

Date:_____

Approved:_____
Secretary of Transportation
Commonwealth of Pennsylvania

By: _____
District Executive
Pennsylvania Department of Transportation

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DEPARTMENT OF TRANSPORTATION

APPLICATION INSTRUCTIONS FOR PERMIT TO OPERATE TEMPORARY TRAFFIC CONTROL SIGNALS

Applicant's Contact Information

- **Applicant's Name:** is the individual who will be responsible for the proper placement of the work zone traffic control devices.
- **Applicant's Company:** the Company the Applicant represents.
- **Company Address:** the official mailing address of the Applicant's company.
- **Company Phone No.**: the phone number of the Applicant's company.
- **Company Fax No.:** the fax number of the Applicant's company.
- **Cellular Phone No.:** the Applicant's cellular phone number.
- **Email Address:** the Applicant's e-mail address.
- **Name of Emergency Contact Person:** the person that will be available 24 hrs./day, 7 days/week during the period of usage and who will be responsible for the continued proper usage of the device.
- **Cellular Phone No.:** the emergency contact person's cellular phone number.

Description of Traffic Control Device

Type of Device		Mounted on Fixed Supports		Trailer-Mounted		Pedestal-Mounted		Automated Flagger Assistance Device (AFAD)		Other (explain)
(check one)										

Descriptions of the devices are as follow:

- **Mounted on Fixed Supports**: As defined in the Manual on Uniform Traffic Control Devices (MUTCD), it is a temporary traffic control signal that is temporarily mounted on fixed supports. The fixed supports are typically span wires mounted on temporarily-installed poles. These devices are normally used for long-term stationary applications where appropriate field conditions exist.
- **Trailer-Mounted:** Trailer-mounted portable traffic control signal systems consist of two trailers, with each trailer having a vertical upright and a horizontal arm to accommodate the mounting of at least two signal heads. These devices may be used for short-term stationary and long-term stationary applications where the appropriate conditions exist.
- **Pedestal-Mounted:** Pedestal-mounted portable traffic control signal systems consist of four units, with a pedestal-mounted signal head on each unit. These devices may be used for short-term stationary applications where appropriate field conditions exist.
- **Automated Flagger Assistance Device (AFAD)**: A manually-controlled device operated by one or more individuals to safely stop and control traffic through a

work zone. These devices may be used for short-term stationary applications where appropriate field conditions exist.

- **Other (explain):** Other applications which do not fall into the criteria listed above. Please give a detailed description so that proper evaluation may be made.
- **Traffic Control Device Manufacturer:** the manufacturer of the device that will be used for work zone traffic control.
- **PennDOT Approval No.:** the PennDOT device approval number as indicated in PennDOT Publication 35 "Approved Construction Materials (Bulletin 15)". This number can be accessed through the internet at the listing below:

  ftp://ftp.dot.state.pa.us/public/pdf/BOCM_MTD_LAB/PUBLICATIONS/PUB_35/BULLETIN_15.pdf

  If problems exist with finding an approval number, please contact either the appropriate PennDOT Engineering District Office or PennDOT Central Office at (717) 783-0333.

Work Zone Location Information

- **Was a site visit performed prior to this application request?:**
  - **Yes:** A proper field visit was made prior to the submission of this application to determine if the device was acceptable and met all of the criteria specified in Publication 213 to safely and efficiently operate the device.
  - **No:** A proper field visit was not made prior to the submission of this application.
- **Date (s) of Traffic Control Device Usage:** Please specify the approximate date and/or dates and times that you would like to use this device. Upon approval of this application, if dates are modified, please contact the appropriate Engineering District representative.
- **Engineering District:** The Engineering District that will be reviewing the completed application.

- **County:** the county where the traffic control device would be used.
- **Municipality:** the municipality where the traffic control device would be used.
- **On State Route (SR):** the state highway where the traffic control device would be deployed. For further guidance, please refer to the following link and select the appropriate county map:

  http://www.dot.state.pa.us/Internet/Bureaus/pdPlanRes.nsf/infoBPRCartoCountyType3

- **Direction:** the direction of travel which may be either North/Southbound or East/Westbound. The link above may help you with the determination of the travel direction.
- **From Segment:** the roadway segment on the State Route the device will be deployed. These segment numbers may be found either on small markers posted along the roadway or from straight-line diagrams.
- **Offset:** the roadway location from the beginning of the segment to the approximate location of the device in feet.
- **From Segment:** the roadway segment on the State Route the device will be deployed. These segment numbers may be found either on small markers posted along the roadway or from straight-line diagrams.
- **Offset:** the roadway location from the beginning of the segment to the approximate location of the device in feet.
- **On Local Road:** Use the local road name. Identify the nearest intersecting roadways when determining the local roadway location.
- **Normal Speed Limit:** this is the legal speed limit on the roadway prior to the beginning of the work. If no speed limit is posted on the roadway, please mark unposted.
- **ADT:** This is also known as Average Daily Traffic. This number can be found by accessing the following link below and selecting the appropriate county map:

http://www.dot.state.pa.us/Internet/Bureaus/pdPlanRes.nsf/infoBPRTrafficInfoTrafficVolumeMap

If problems exist with finding an ADT number, please contact either the appropriate PennDOT Engineering District Office or PennDOT Central Office at (717) 783-0333.

- **Maximum Length of One-Lane, Two-Way Traffic Section:** this is the approximate distance between "STOP HERE ON RED" signs in feet. This is very important for determining the proper all-red clearance interval needed to safely and efficiently move traffic through the work zone.
- **Does the sight distance requirement exceed the thresholds specified in the drawing?:**
  - **Yes:** The sight distance requirements have been met as indicated on the correct Publication 213 drawing.
  - **No:** The sight distance requirements could not be met as indicated on the correct Publication 213 drawing.
- **Does the site contain intersections within the work zone?:**
  - **Yes:** The site contains an intersection within the work zone.
  - **No:** The site does not contain an intersection within the work zone.
- **Does the site contain uncontrolled commercial driveways within the work zone?:**
  - **Yes:** The site contains uncontrolled commercial driveways within the work zone.
  - **No:** The site does not contain uncontrolled commercial driveways within the work zone.
- **Is any roadway approach to the traffic control device on a steep downgrade (5% or more)?**
  - **Yes:** the site contains a steep downgrade of 5% or more.
  - **No:** the site does not contain a steep downgrade of 5% or more.

- **Does the site contain at-grade railroad crossings within 300 feet of the work zone?**
  - **Yes:** the site contains an at-grade railroad crossing within 300 feet of the work zone.
  - **No:** the site does not contain an at-grade railroad crossing within 300 feet of the work zone.
- **Provide a Brief Description of the Construction Operation:** Please provide a description of the work being performed in the work zone.

Traffic Control Device Operation Information

Type of Operation	Manually-Controlled	Pre-Timed	Actuated	Other (explain)
(please check one)				

- **Manually-Controlled**: The traffic control device will be operated at all times by an individual who will ensure the safe and efficient travel through the work zone.
- **Pre-Timed:** The traffic control device will operate automatically in a pre-determined timing pattern(s) based on time of day, and will continue to operate that way throughout the day.
- **Actuated:** The traffic control device will operate using sensors and will change green time as traffic demand warrants.
- **AFAD:** The traffic control device will be operated at all times by an individual(s) who will ensure the safe and efficient travel through the work zone.
- **Other (explain):** Other applications that do not fall into the criteria listed above. Please give a detailed description so that proper evaluation may be made.
- **PennDOT Publication Figure:** the determination of the correct figure to be followed from PennDOT Publication 213.
- **All-red clearance time:** This is to ensure that the proper clearance time is being used when using a temporary traffic signal. This should be determined by using the charts specified on the appropriate Publication 213 figure.

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EXAMPLE PROBLEM

APPLICATION FOR PERMIT TO OPERATE TEMPORARY TRAFFIC CONTROL SIGNALS

Applicant's Contact Information

Applicant's Name: John Smith

Applicant's Company: Smith Contracting Company, Inc.

Company Address: 400 North Street Harrisburg, PA 17120

Company Phone No.: (717) 783-0333 Company Fax No.: (717) 705-0686

Cellular Phone No.: (717) 783-0555 E-mail Address: jsmith@smithcontracting.com

Name of Emergency Contact Person: James Smith Cellular Phone No.: (717) 777-5555

(Must be available 24 hrs./day, 7 days/week during period of usage.)

Description of Traffic Control Device

Type of Device		Mounted on Fixed Supports		Trailer-Mounted		Pedestal-Mounted		Automated Flagger Assistance Device (AFAD)		Other (explain)
(check one)										

Traffic Control Device Manufacturer: Traffic Control Signals, Inc. Manufacturer's Model No.: TCS1

PennDOT Approval No.: TCS-001P

Work Zone Information

Was a site visit performed prior to submitting this application? Yes X No

Date of Traffic Control Device Usage: Begin 06/10/2008 End 6/12/2008

Engineering District: 8-0 County: Dauphin Municipality: Lower Paxton Twp.

On State Route (SR): 1023 Direction: North/Southbound

From: Segment: 40 Offset: 1000

To: Segment: 40 Offset: 1500

On Local Road: ____N/A_____ Direction: _____N/A_____

From: __N/A_____

To: ____N/A_____

Normal Speed Limit: __35____mph ADT: ___3,500_____ veh/day

Maximum Length of One-Lane, Two-Way Traffic Section ___500_____ feet
(Between *STOP HERE ON RED* Signs)

Type of Operation: Long-Term Stationary _____ Short Term Stationary __Non-Complex____

Other (please describe): _____

The traffic control device will be used to control: One-Lane, Two-Way Traffic ___X_____
(Check all that apply) No More than Two approaches ___X_____
Other (please describe): _____

Will all signal faces exceed the thresholds for signal face visibility specified on the Publication 213 figure? Yes _X_ No ___

Does the site contain an intersection within the one-lane, two-way traffic section? Yes ___ No _X_

Does the site contain an uncontrolled commercial driveway within the one-lane, two-way traffic section? Yes ___ No _X_

Is any roadway approach to the traffic control device on a steep downgrade (5% or more)? Yes ___ No _X__

Does the site contain an at-grade railroad crossing within 300 feet of the work zone? Yes ___ No _X__

Proposed work description:
Bridge patching project which consists of daylight operations. Upon completion of the day, two-lane, two-way operation will be restored.

Traffic Control Device Operational Information

Mode of Operation	Manually-Controlled	Pre-Timed	Actuated	Other (explain)
(please check one)			X	

PennDOT Publication Figure: PATA ___702____ will be followed.

All-red clearance time is ___23_____ seconds based on
assumed traffic speed of __15____ mph within one-lane, two-way section.

The proposed minimum green time shall be at least 10 seconds.

The proposed maximum green time shall be determined based on field conditions.

The proposed yellow change interval shall be five (5) seconds unless otherwise indicated by PennDOT.

Applicant Certification

The applicant certifies that the information provided on this application and accompanying documents is true and correct.

The applicant certifies that, if approved, the traffic control devices will be operated and maintained in compliance with PennDOT Publications 212 and 213, and the provisions of the temporary traffic control signal permit as issued by PennDOT.

The applicant agrees that it will indemnify, save harmless and defend (if requested) the Commonwealth of Pennsylvania, its agents, representatives and employees, from all suits, actions or claims of any character, name or description, damages, judgments, expenses, attorneys' fees and compensation arising out of personal injury, death or property damage, sustained or alleged to have been sustained in whole or in part by any and all persons whatsoever as a result of or arising out of any act, omission, neglect or misconduct of the applicant, its officers, agents, contractors or employees, during the period of temporary traffic control signal usage.

BY: _____ _____
Signature of Applicant Date

Sworn before me this _____ day of _____, 20_____

Notary: _____

PennDOT Acknowledgement

This application is: Accepted: _____ Temporary Traffic Signal Permit Attached: _____

Rejected: _____ Application was rejected because:

If rejected, please correct immediately and submit to PennDOT. Temporary traffic control device usage cannot begin without prior approval.

Guidelines for the Selection of Temporary Traffic Control Signals in Work Zones

Background

It is common for construction, maintenance, and utility operations to require the closing of a traffic lane during the course of their work. For the duration of the lane closure, traffic must be either diverted to another route via a detour, or merged into other lanes. When the lane closure is located on two-lane, two-way roadways and detour routes are not practical, then alternating traffic on the remaining open lane is the typical operational choice.

Purpose

The purpose of these guidelines and the accompanying selection chart are to provide guidance for selecting the appropriate temporary traffic signal control for short-term and long-term lane closures on two-lane, two-way roadways. These guidelines supplement PennDOT Publication 213 and assist in the determination of the minimum requirements for work zone traffic control for various traffic and roadway parameters. Definitions of terminology and distance charts for various parameters are also available in this document.

MUTCD Guidance on Temporary Traffic Control Signals

"Section 4D.20 Temporary Traffic Control Signals

Standard:
A temporary traffic control signal shall be defined as a traffic control signal that is installed for a limited time period. A portable traffic control signal shall be defined as a temporary traffic control signal that is designed so that it can be easily transported and reused at different locations.

Support:
A temporary traffic control signal is generally installed using methods that minimize the costs of installation, relocation, and/or removal. Typical temporary traffic control signals are for specific purposes, such as for one-lane, two-way facilities in temporary traffic control zones (see Chapter 4G), for a haul-road intersection, or for access to a site that will have a permanent access point developed at another location in the near future.

Standard:
Advance signing shall be used when employing a temporary traffic control signal.

A temporary traffic control signal shall:

A. *Meet the physical display and operational requirements of a conventional traffic control signal.*
B. *Be removed when no longer needed.*

C. Be placed in the flashing mode when not being used if it will be operated in the steady mode within 5 working days; otherwise, it shall be removed.

D. Be placed in the flashing mode during periods when it is not desirable to operate the signal, or the signal heads shall be covered, turned, or taken down to indicate that the signal is not in operation.

Guidance:
A temporary traffic control signal should be used only if engineering judgment indicates that installing the signal will improve the overall safety and/or operation of the location. The use of temporary traffic control signals by a work crew on a regular basis in their work area should be subject to the approval of the jurisdiction having authority over the roadway.

A temporary traffic control signal should not operate longer than 30 days unless associated with a longer-term temporary traffic control zone project.

For use of temporary traffic control signals in temporary traffic control zones, reference should be made to Section 6F.80."

"Section 6F.80 Temporary Traffic Control Signals

Standard:
Temporary traffic control signals (see Section 4D.20) used to control road user movements through TTC zones and in other TTC situations shall meet the applicable provisions of Part 4.

Support:
Temporary traffic control signals are typically used in TTC zones such as temporary haul road crossings; temporary one-way operations along a one-lane, two-way highway; temporary one-way operations on bridges, reversible lanes, and intersections.

Standard:
One-lane, two-way vehicular traffic flow (see Chapter 4G) requires an all-red interval of sufficient duration for road users to clear the portion of the TTC zone controlled by the traffic control signals. Safeguards shall be incorporated to avoid the possibility of conflicting signal indications at each end of the TTC zone.

Guidance:
Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals (see Section 4E.06) are needed for crossing along an alternate route.

When temporary traffic control signals are used, conflict monitors typical of traditional traffic control signal operations should be used.

Option:
Temporary traffic control signals may be portable or temporarily mounted on fixed supports.

Standard:
The supports for temporary traffic control signals shall not encroach into the minimum required width of a "pedestrian access route" of 1200 mm (48 in) or an "alternate circulation path" of 900 mm (36 in).

Guidance:
Temporary traffic control signals should only be used in situations where temporary traffic control signals are preferable to other means of traffic control, such as changing the work staging or work zone size to eliminate one-way vehicular traffic movements, using flaggers to control one-way or crossing movements, using STOP or YIELD signs, and using warning devices alone.

Support:
Factors related to the design and application of temporary traffic control signals include the following:

A. *Safety and road user needs;*
B. *Work staging and operations;*
C. *The feasibility of using other TTC strategies (for example, flaggers, providing space for two lanes, or detouring road users, including bicyclists and pedestrians);*
D. *Sight distance restrictions;*
E. *Human factors considerations (for example, lack of driver familiarity with temporary traffic control signals);*
F. *Road-user volumes including roadway and intersection capacity;*
G. *Affected side streets and driveways;*
H. *Vehicle speeds;*
I. *The placement of other TTC devices;*
J. *Parking;*
K. *Turning restrictions;*
L. *Pedestrians;*
M. *The nature of adjacent land uses (such as residential or commercial);*
N. *Legal authority;*
O. *Signal phasing and timing requirements;*
P. *Full-time or part-time operation;*
Q. *Actuated, fixed-time, or manual operation;*
R. *Power failures or other emergencies;*
S. *Inspection and maintenance needs;*

T. Need for detailed placement, timing, and operation records; and

U. Operation by contractors or by others.

Although temporary traffic control signals can be mounted on trailers or lightweight portable supports, fixed supports offer superior resistance to displacement or damage by severe weather, vehicle impact, and vandalism.

Guidance:
Other TTC devices should be used to supplement temporary traffic control signals, including warning and regulatory signs, pavement markings, and channelizing devices.

The design and placement of temporary traffic control signals should include interconnection to other traffic control signals along the subject roadway.

Temporary traffic control signals not in use should be covered or removed."

Key Terms and Definitions

Portable Traffic Control Signal- as defined in the MUTCD is a temporary traffic control signal that is designed so that it can be easily transported and reused at different locations. Types of portable signals are trailer-mounted and pedestal-mounted.

Temporary Traffic Control Signal on Fixed Supports – as defined in the MUTCD is a temporary traffic control signal that is temporarily mounted on fixed supports. They are typically constructed with span wires mounted on temporarily-installed poles.

Trailer-Mounted Portable Traffic Control Signal System – The system consists of two trailers, with each trailer having a vertical upright and a horizontal arm to accommodate the mounting of at least two signal heads.

Pedestal-Mounted Portable Traffic Control Signal System – The system consists of four units, with a pedestral-mounted signal head on each unit.

Automated Flagger Assistance Device (AFAD) – is a manually-controlled device operated by one or more individuals to safely stop and control traffic through a work zone.

Long-Term Stationary Operation – As defined in PennDOT Publication 213 is work that occupies a location more than 24 hours.

Short-Term Stationary Operation – As defined in PennDOT Publication 213 is work that occupies a location up to 24 hours.

Short-Term Stationary Operation for Temporary Traffic Control Signals – is defined as daylight work areas with work in active progress, emergency nighttime work areas with

work in active progress, or work areas of relatively short duration where work begins during daylight and continues in active progress during hours of darkness.

Long-Term Stationary Operation for Temporary Traffic Control Signals - is defined as all other stationary operations that do not meet the short-term stationary operation for temporary traffic control signals criteria.

Signal Phase – the right-of-way, yellow change, and red clearance intervals in a cycle that are assigned to an independent traffic movement or combination of movements.

Two-Phase Traffic Signal Operation – is defined as an operation when two different vehicle movements occur during the signal cycle. One-lane, two-way traffic control is often a two-phase operation assuming that additional phases are not needed for driveways and intersecting roads.

Multiple Phase Traffic Signal Operation – is defined as an operation when more than two vehicle movements occur during the signal cycle.

Traffic Signal Timing – the amount of time allocated for the display of a signal indication.

Yellow Change Interval – is the first interval following the green interval during which the yellow signal indication is displayed. It is used to warn traffic of an impending change in the right-of-way assignment. The duration of a yellow change interval shall be predetermined.

Red Clearance Interval – is an interval that follows a yellow change interval and proceeds the next conflicting green interval. It provides additional time before conflicting traffic movements, including pedestrians, are released. The duration of a red clearance interval shall be predetermined.

Temporary Traffic Control Signal Permit – is the PennDOT Engineering District Office acceptance that the proper documentation was received to ensure safe and effective use of temporary traffic control signals. This permit will allow proper use of the device in accordance with the provisions of the permit and PennDOT Publication 213.

Temporary Traffic Control Signal Application – is an application that allows the PennDOT Engineering District Office to obtain the minimum required information to ensure safe and efficient operation of the temporary traffic control signal.

Site-Specific Drawing – A drawing that clearly depicts the work zone and the anticipated operations. Typically, this is part of the Traffic Control Plan (TCP).

Performance Specification – Is the required product performance, which may include but is not limited to equipment, physical requirements, operational requirements, etc..

Manually-Controlled Portable Traffic Control Signal Operation – when a portable traffic control signal is being controlled manually.

Short-Term Portable Traffic Control Signal Operation under Blanket Permit – this allows a successful past user of portable signals to obtain agreement with PennDOT to provide notice of the placement of the portable signals with minimal documentation. Verification of the agreement between the user and PennDOT will be evaluated prior to approval of a blanket permit request.

Short-Term Stationary Portable Traffic Control Signal Operation for Non-Complex Conditions– the "non-complex" application will be verified through a number of physical and operational requirements that the site must meet to be considered. These checks allow PennDOT to verify safe and efficient use if installed properly.

Short-Term Stationary Portable Traffic Control Signal Operation for Complex Conditions– the "complex" application would be any short-term portable signal installation that does not met the requirements for "non-complex" applications.

Short-Term Emergency Operation – An emergency application defined in PennDOT Publication 212.

Long-Term Portable Traffic Control Signal Operation – All physical and operational requirements should be part of the Traffic Control Plan.

Temporary Traffic Control Signal – as defined in the MUTCD is a traffic control signal that is installed for a limited time period. Temporary traffic control signals may be portable or temporarily mounted on fixed supports. Common types of temporary traffic control signals are signals mounted on span wire with temporary supports and trailer-mounted portable signals.

Work in Active Progress – Workers, other than flaggers, are present and are actively engaged in performing the necessary work.

Temporary Traffic Control Signals for Long-Term Stationary Operations

In the design phase of every project that will have temporary traffic signals, it is required that both installations on fixed supports and trailer-mounted portable traffic control signals always be considered before completing the design of the Traffic Control Plan (TCP). In some instances, trailer-mounted portable signals or installations on fixed supports can be used. On the other hand, in certain instances, installations on fixed supports may be preferable to trailer-mounted signals, or vice-versa, depending on the nature of the project, site conditions, traffic conditions, and other specific factors.

Before developing a TCP with temporary traffic signals, it is absolutely essential that the designer visit the proposed worksite beforehand. The site visit will enable the designer to evaluate various factors that will help in the determination of whether the TCP should permit both temporary signal design options, or one or the other. These factors include lateral clearance, trailer or pole placement, signal operation (phasing and timing), and

others. Please also note that pedestal-mounted portable traffic control signals will not be considered for long-term stationary operations.

To establish the proper and acceptable temporary traffic control signal within a work zone, the following criteria should be considered:

Long-Term Stationary Operation Using Trailer-Mounted Portable Traffic Control Signals:

Pros:

- Systems can be deployed quickly.
- Especially conducive to deployments for emergencies.
- Systems can be easily set up and taken down each day, or for multiple construction phases.
- Equipment can be reused on future projects.
- Equipment capable of being leased.
- Cost savings potential.
- Capable of wireless radio or hardwire interconnect.
- Commonly equipped with monitoring system for location, low battery status, and conflicts using website and/or cell phone paging.
- Commonly equipped with batteries that are solar recharging.
- Commonly equipped with solar panels, rechargeable batteries, and ability to run via commercial power.
- Wireless remote commonly available.

Cons:

- Arm length can sometimes affect signal head placement.
- Arm length affects number of signal heads that can be placed overhead.
- Trailer size and/or arm length in conjunction with physical features can sometimes limit adequate placement.
- Manufacturers have different operating systems.
- More susceptible to vandalism.
- Less appropriate for long-duration jobs on multilane, high-speed roadways.

Long-Term Stationary Operation Using Temporary Traffic Control Signals on Fixed Supports:

Pros:

- Desirable signal head placement can be achieved.
- More than two overhead signals can be erected.
- Less susceptible to vandalism.
- Pole placement sometimes may be easier to accommodate than trailers due to physical features.
- Fixed supports may be more desirable for long duration deployments.

- More appropriate for multilane approaches.
- Employs common traffic signal control equipment and operational features.

Cons:

- Inability to set up and take down each day.
- Less appealing for short-duration jobs or jobs with short-duration, multiple set-ups.
- Equipment and material availability is sometimes an issue.
- Less cost savings potential.

If the designer determines that only one temporary signal design option is justified for a particular project, then the TCP shall be prepared accordingly, and written documentation shall be maintained in the project file outlining the reasons for this determination. It would also be desirable to clearly indicate on the TCP that the other option will not be permitted for the project.

If the designer determines that trailer-mounted portable signals or installations on fixed supports would be acceptable, then the TCP should clearly show the exact design and operation of both alternatives so that additional plans from the contractor would not be necessary. The TCP should include the design of all anticipated needed features. For example, if platforms or other special features will be needed, their design and placement should be in the TCP. Engineering judgment should be used and documented to determine the safest and most efficient operation for the work zone.

Temporary Traffic Control Signals for Short-Term Stationary Operations

Before developing and/or determining your traffic control plan (TCP) using PennDOT Publication 213, it is absolutely essential that the user visit the proposed worksite beforehand. The site visit will enable the user to evaluate various factors that will help in the determination of whether the TCP should permit temporary signal (portable signal) options, or other traffic control methods such as flaggers. These factors include lateral clearance, trailer or pedestal placement, signal operation (phasing and timing), and others. Please also note that installations on fixed supports are not considered viable for short-term stationary operations because of the amount of time and materials needed for installation.

If the user determines that portable traffic control signals will be an option and would like to pursue that option, then a completed application shall be submitted to PennDOT's appropriate Engineering District Office. If the Engineering District Office agrees with the proposed usage, they will issue a temporary traffic control signal permit.

Non-Compliance Reference No. _____

pennsylvania
DEPARTMENT OF TRANSPORTATION

TEMPORARY TRAFFIC CONTROL SIGNALS
Non-Compliance Documentation Form

The purpose of this form is to provide a means for the Districts to document non-compliant installations of temporary traffic control signals. Supply necessary and pertinent information and photos when submitting a non-compliance form. Please be advised that Central Office will review non-compliance documentation to determine possible future action regarding the individual temporary signal user. This will also provide a means of documenting District-wide and statewide issues with temporary traffic control signals.

Engineering District: _____ Non-Compliance Form Submittee:_____

Temporary Signal User: _____

Date of Non-Compliance:_____

County: _____ Municipality: _____

SR: _____Segment _____ Offset:_____

Please attach supporting documentation (e.g., application, permit, TCP, etc.). Provide a description of the nature of the non-compliance:

Please submit completed form to:

Pennsylvania Department of Transportation
Bureau of Operations and Maintenance
ATTN: TEMPORARY TRAFFIC SIGNALS
400 North Street- 6th Floor
Harrisburg, PA 17120-0064

Comment Reference No. _____

pennsylvania
DEPARTMENT OF TRANSPORTATION

TEMPORARY TRAFFIC CONTROL SIGNALS
User Comment Form

The purpose of this form is to provide the user of temporary traffic control signals the means to comment on both positive and negative feedback received from PennDOT's Engineering District Offices. Please supply all supporting documentation when submitting a comment form. PennDOT's Central Office will review all comments and will work with District Offices to resolve immediate issues, to improve future practices, and to seek uniformity among PennDOT's eleven Engineering District Offices.

User Name: _____Date Submitted: _____

Company: _____

Company Address: _____

Company Phone No.: _____Company Fax No.: _____

Cellular Phone No.: _____E-mail Address: _____

Please attach supporting documentation. Please use the space below to provide your comments:

Please submit completed form to: Pennsylvania Department of Transportation

Bureau of Operations and Maintenance
ATTN: TEMPORARY TRAFFIC SIGNALS
400 North Street- 6th Floor
Harrisburg, PA 17120-0064

TE-161 (06-13)

Notice of Commencement for Pedestal-Mounted Portable Traffic Signals

pennsylvania
DEPARTMENT OF TRANSPORTATION

DEPARTMENT USE ONLY

County :

Engineering District :

Notification Date :

Notification Time :

The purpose of this notice of commencement form is to allow manufacturer certified pedestal-mounted portable traffic signal operators to submit the following traffic engineering form in accordance with Publication 213, PATA 701. The manufacturer's training certification requires Department approval prior to implementation. NOTE: A copy of this form is required on the work site.

A - Operator Information

Operator's Name: Field Phone #:

Company:

Operator's Certification #: Alternative Phone Number:

Pedestal-Mounted Portable Traffic Signal Manufacturer:

Manufacturer Model Number:

B - Location Information

County: PennDOT Engineering District:

Date of Deployment: Operating Times:

State Route (SR) or Local Roadway Name:

Beginning Location (Segment/Offset, Intersection, etc...):

Ending Location (Segment/Offset, Intersection, etc...):

Description of Proposed Work:

C - Terms and Conditions

By checking the boxes below, as a certified Pedestal-Mounted Portable Signal Operator, I and my associates, understand and accept the following:

- ☐ The operator certifies that they have previously field reviewed the deployed location prior to issuing this Notice of Commencement.
- ☐ The operator certifies that they have a valid certification provided by the manufacturer and the work zone complies to the conditions established within Publication 213, PATA 701.
- ☐ The operator certifies that all pedestal-mounted portable signal conditions and settings are in accordance with Publication 213, PATA 701 or otherwise written approval is provided by the District Traffic Engineer or designee which complies to the conditions established within Publication 213, PATA 701.
- ☐ The operator agrees that it will indemnify, save harmless and defend (if requested) the Commonwealth of Pennsylvania, its agents, representatives and employees, from all suits, actions or claims of any character, name or description, damages, judgments, expenses, attorneys' fees and compensation arising out of personal injury, death or property damage, sustained or alleged to have been sustained in whole or in part by any and all persons whatsoever as a result of or arising out of any act, omission, neglect or misconduct of the applicant, its officers, agents, contractors or employees, during the period of temporary traffic control signal usage.
- ☐ I will submit this Notice of Commencement to the appropriate District Traffic Engineer at least 3 business hours prior to deployment unless otherwise specified by the District Traffic Engineer.
- ☐ I AGREE TO THESE TERMS AND CONDITIONS SPECIFIED ABOVE.

Responsible Person: Submit Date

Appendix C: Section 901 – Maintenance and Protection of Traffic during Construction

Instructions for Use: These are changes to Section 901

HEADER:
a07039 Changes to Specifications: Section 901

Provision Body:

SECTION 901—MAINTENANCE AND PROTECTION OF TRAFFIC DURING CONSTRUCITON

- **Section 901.3(j) Dropoffs. Revise to read as follows:**

(j) Drop-offs. The following conditions and treatments apply only to continuous and intermittent drop-offs created by construction, maintenance, or permit/utility operations. If the treatments in this Section cannot be met due to constructability-related issues, obtain approval of an alternate drop-off treatment method, in writing, from the Bureau of Project Delivery before implementation.

The following are not considered drop-offs:

1. Drainage ditches.
2. Compacted earthen embankments tapered at 3:1 or flatter.
3. Any area ≤ 2 inches below grade AND > 12 feet away from active travel lane.
4. Any area behind guide rail, barrier, or curb.
5. Any area outside right-of-way.

General Conditions:

1. The duration of the drop-off condition starts at the end of the shift in which the drop-off condition was created.
2. Place all channelizing devices at the same grade as the travel lane as close to the edge line as possible.
3. As an option, an approved Type C steady burn light may be placed on each channelizing device throughout the drop-off condition unless otherwise specified in Condition 2.
4. For intermittent drop-off conditions, place at least 3 channelizing devices or a Type III barricade transversely in front of each drop-off condition.
5. When applicable, install Uneven Lane Signs (W8-11), Low Shoulder Signs (W8-9), or No Guide Rail Signs (W21-9A) at intervals not to exceed 1/2 mile throughout the drop-off condition.

Condition 1 – Drop-offs ≤ 2 inches below grade AND ≤ 12 feet away from active travel lane

Drop-off Location	Treatment
Between Active Travel Lane & Non-Active Travel Lane or Shoulder	• Place channelizing devices throughout drop-off condition. Space all channelizing devices at a maximum distance in feet, equal to two times the posted speed limit in miles per hour throughout a continuous or intermittent drop-off condition, unless otherwise directed.

Between Two Active Travel Lanes	• Install Longitudinal Notched Wedge Joint during paving operations in accordance with RC-28M and during milling operations mill a 12:1 wedge. For Temporary Overlay Transitions during paving and milling operations follow RC-28M except for the paving notch, feather transition edge as much as mix will allow. **OR** • End all lanes at the same grade longitudinally, install Temporary Overlay Transitions during paving and milling operations in accordance with RC-28M except for the paving notch, and feather transition edge as much as mix will allow.

Condition 2 – Drop-offs > 2 inches below grade

Distance From Active Travel Lane	**Duration Condition Exists**	**Drop-off Height**		
		> 2 inches to ≤ 4 inches	**> 4 inches to ≤ 2 feet**	**> 2 feet**
		Treatment		
≤ 4 feet Away	**≤ 48 Hours**	(A) OR (B)(D)	(A) OR (B)(E) OR (C)	(A) OR (C)
	> 48 Hours			
> 4 feet to ≤ 12 feet Away	**≤ 48 Hours**	(D)	(E)	(A) OR (B)(E)(F) OR (C)
	> 48 Hours	(A) OR (B)(D)	(A) OR (B)(E)	
> 12 feet	**≤ 48 Hours**	(D)	(E)	(E)(F)
	> 48 Hours			

Footnotes:

A. Place suitable material to grade and compact to non-movement.
B. Install a 3:1 slope with suitable material and compact to non-movement.
C. Install temporary barrier.
D. Place channelizing devices starting at 120 feet in advance of the drop-off condition. Space all channelizing devices at a maximum distance in feet, equal to two times the posted speed limit in miles per hour throughout a continuous or intermittent drop-off condition, unless otherwise directed.
E. Place channelizing devices starting at 120 feet in advance of the drop-off condition. Space all channelizing devices at a maximum distance in feet, equal to the posted speed limit in miles per hour throughout a continuous or intermittent drop-off condition, unless otherwise directed.
F. Place an approved Type C steady burn light on each channelizing device throughout drop-off condition.

Appendix D: Transportation Management Plan #99251 (“Significant Project”)

Transportation Management Plan

PennDOT District 3-0
ECMS #99251
SR 80 Section M33
Northumberland County

TRANSPORTATION MANAGEMENT PLAN

OUTLINE OF CONTENTS

1. EXECUTIVE SUMMARY

This Transportation Management Plan (TMP) was prepared in accordance with PennDOT Publication 46. The TMP lays out a set of coordinated transportation management strategies and describes how they will be used to manage the work zone impacts of a road project. Transportation management strategies for a work zone include temporary traffic control measures and devices, public information/outreach, and operational strategies such as travel demand management and traffic incident management.

2. ROLES AND RESPONSIBILITIES

The Pennsylvania Department of Transportation (PennDOT) is responsible for the creation, implementation, and enforcement of this plan. The following individuals are responsible for specific activities to carry out the plan:

- Inspector-in-Charge—monitors activities being carried out under the TMP and provides feedback to the District Traffic Unit
- Community Relations Coordinator —coordinates activities included in the Public Information Plan
- District Traffic Unit —reviews the activities of the TMP and compiles work zone performance data in conjunction with construction personnel/contractor
- Contractor—performs specific activities provided by the provisions included in the contract in accordance with the TMP. These activities will typically be carried out by the Contractor's Traffic Control Coordinator.

Any changes to the TMP must be approved, in writing, by the District Traffic Engineer.

3. PROJECT DESCRIPTION

The SR 80 Section M33 project is located in Northumberland County. The project limits are listed below. The following is a summary of the proposed work:

The project will consist of replacing a portion of the existing concrete parapet and deck on the right side of the bridge in span 1 of the existing structure looking segments ahead. Also approx. 250 LF of approach guide rail will be replaced at the near left approach looking segments ahead.

Beginning Segment/Offset: Segment 2144 Offset 2085 Eastbound

Ending Segment/Offset: Segment 2150 Offset 1300 Eastbound

Functional Classification: Rural Interstate

This section of roadway is not within the boundary of a Transportation Management Area.

4. TRAFFIC CONDITIONS

Roadway traffic data is as follows:

SR 80 Section 114 Northumberland Co. (Eastbound)

Current A.D.T.:	16,414 (2014)
Design Year A.D.T.:	24,390 (2034)
DHV:	1806 (11%)
Trucks:	33%

SR 80 Design Information is as follows:

Highway Classification:	Rural Interstate
Design Speed:	70 mph (65 mph posted)
Pavement Width:	24’
Shoulder Width:	8’ Lt, 12’ Rt.

5. WORK ZONE IMPACT ASSESSMENT

Due to the nature of the work being performed, it is anticipated that lane restrictions will be implemented using long-term traffic control figures as shown in PennDOT Publication 213 and the Traffic Control Plan (TCP).

There is an interchange with SR 254 within the project limits of Northumberland County SR 80 Section M33. Additional traffic from the entrance ramp of this interchange could generate unwanted congestion. In the event that queuing occurs outside of the advance signing along interstate 80, the contractor may be required to close the entrance ramp and install a signed detour route along SR 254 and SR 54 using Publication 213 PATA figures. Additionally, the contractor may be required to implement additional measures such as Changeable Message Signs (CMS) for motorist’s information.

6. WORK ZONE IMPACT MANAGEMENT STRATEGIES

A. Traffic Control Plan (TCP) – This project will be managed in accordance with the approved Traffic Control Plans. Any modifications of these plans must be approved by the Department before implementation.

B. Transportation Operations Plan (TOP)

i. Traffic Control Supervisor – The Contractor’s Project Traffic Control Supervisor is required to be adequately trained in accordance with PennDOT requirements. The Traffic Control Supervisor is responsible for the following:

- Coordinate all traffic control installations, pattern changes, and removals.
- Inspect long term traffic control devices and patterns each working day.
- Inspect each short term traffic control pattern that is set up.
- Document the details of these inspections (items inspected, deficiencies discovered, and action taken to correct the deficiencies).
- Program changeable message signs.
- Notify immediately the Inspector-in-Charge of any highway incidents within the limits of the work zone.
- Perform duties related to data collection, sharing, and performance monitoring.

ii. **Changeable Message Signs (CMS) –** CMS will be used in the following manner:
- Notify motorists of the start dates of any detours, any major changes to the traffic control patterns, or any lane closures.
- Provide messages specifically related to slowing traffic down or being prepared to stop during any lane closures or anticipated traffic queues.
- Provide messages for use during incident management.

iii. **Lane Closure Requirements –** Lane closures will not be permitted on the following dates and times:

- Permit no lane restrictions during the following events/holidays:
  A. Easter — April 18, 2014 at 5 a.m. until April 21, 2014 at 10 p.m.
  B. Memorial Day — May 23, 2014 at 5 a.m. until May 26, 2014 at 10:00 p.m.
  C. Independence Day — July 3, 2014 at 5 a.m. until July 6, 2014 at 10 p.m.
  D. Labor Day — Aug 29, 2014 at 5 a.m. until Sept. 1, 2014 at 10 p.m.

Any traffic stoppages (emergencies excluded) or "rolling" road closures, regardless of their duration, must be approved by the District Traffic Unit.

iv. **Incident Management Plan –** An Incident Management Plan will be developed in accordance with the special provision in the contract (see Appendix A). In Appendix B of this plan, a list of 24-hour emergency phone numbers (emergency services and organizations, Contractor's representatives, Department representatives, County Maintenance Manager, etc.) are provided. The Incident Management Plan also requires that the Contractor immediately notify the Inspector-in-Charge of all lane closures and major incidents so that information may be provided to motorists and other stakeholders via District variable message signs and the statewide road closure reporting and traveler information systems.

The Contractor is required to submit an "Emergency Response Plan" at the pre-construction conference. The Emergency Response Plan should include contact individuals for incidents that occur during non-working periods and alternate contact individuals.

Following an incident, the Contractor will conduct an After Action Review with the Department and emergency service organizations to evaluate the plan. The Contractor will modify the plan as directed.

C. **Public Information Plan (PIP) –** The Contractor shall maintain ongoing communication with the Inspector-in-Charge regarding phasing of operations that will impact traffic control and transportation operations in the project area. The Contractor shall maintain lists of phone and fax numbers for school district, media

outlets, emergency services, major businesses in the area, transit companies, nearby trucking firms, and other prominent traffic generators in the project vicinity. The Contractor is responsible for notifying these groups of changes in the traffic control phasing at least 48 hours in advance of the phase change as directed by the Inspector-in-charge. The Inspector-in-Charge shall coordinate with the Community Relations Coordinator to develop and issue press releases related to traffic control and transportation operations on this project.

7. TMP PERFORMANCE – The performance of the Transportation Management Plan will be regularly assessed from two standpoints:

- Monitoring the overall work zone performance.
- Evaluating individual TMP strategies.

Crash data, travel time data, and queue length will be the primary sources of information used to determine the overall effectiveness of the work zone traffic management strategies. This project is characterized as "significant" with respect to PennDOT's Work Zone Safety and Mobility Policy; therefore travel delay monitoring and recording is a requirement.

The Contractor's Traffic Control Supervisor shall maintain a daily record of crashes, work zone incidents, and maximum daily queue lengths due to the construction using the MPT Daily Record form included in the contract. The Contractor's Traffic Control Supervisor shall perform and record queue lengths and travel times through and approaching the work zone on a daily basis at the start of shift, middle of shift, and end of shift in each direction. This information will be obtained by driving through the work zone, starting at the exit prior to the queue. The queue length will be determined by odometer readings and travel time by stop watch. This information shall be coordinated daily with PennDOT's Inspector-in-Charge. Feedback from the public through phone calls, in person, or in writing will also be captured.

The Department will regularly inspect the manner in which traffic control installations, pattern changes, and removals are conducted and check to ensure that the portable changeable message signs are operational and being used appropriately. All of this monitoring information will be documented in the project diary.

PennDOT's inspector will share this information monthly with the District Traffic Engineer (DTE). The DTE will also arrange for periodic floating car runs through the project work limits to validate/corroborate work zone performance and actual queues and travel delays.

The Inspector-in-Charge, DTE (or their representative), and TMC Manager will participate in partnering meetings or conduct bi-monthly conference calls to discuss how well the TMP is performing and to verify that the PennDOT Project Manager, TMC Manager, and Public Safety Stakeholders have been receiving timely notifications of incidents as required by the Incident Management Plan.

8. CONTINGENCY PLANS – Only required for high-impact significant projects.

Appendix E: Transportation Management Plan #82309 (“Non-Significant Project”)

Transportation Management Plan

PennDOT District 3-0
ECMS #82309
SR 80 Section M15
Columbia County

TRANSPORTATION MANAGEMENT PLAN

OUTLINE OF CONTENTS

1. EXECUTIVE SUMMARY

This Transportation Management Plan (TMP) was prepared in accordance with PennDOT Publication 46. The TMP lays out a set of coordinated transportation management strategies and describes how they will be used to manage the work zone impacts of a road project. Transportation management strategies for a work zone include temporary traffic control measures and devices, public information/outreach, and operational strategies such as travel demand management and traffic incident management.

2. ROLES AND RESPONSIBILITIES

The Pennsylvania Department of Transportation (PennDOT) is responsible for the creation, implementation, and enforcement of this plan. The following individuals are responsible for specific activities to carry out the plan:

- Inspector-in-Charge—monitors activities being carried out under the TMP and provides feedback to the District Traffic Unit
- Community Relations Coordinator —coordinates activities included in the Public Information Plan
- District Traffic Unit —reviews the activities of the TMP and compiles work zone performance data in conjunction with construction personnel/contractor
- Contractor—performs specific activities provided by the provisions included in the contract in accordance with the TMP. These activities will typically be carried out by the Contractor's Traffic Control Coordinator.

Any changes to the TMP must be approved, in writing, by the District Traffic Engineer.

3. PROJECT DESCRIPTION

The SR 80 Section M15 project is located in Columbia County. The project limits extend from the Montour county line to east of the Buckhorn Interchange (No. 232) in the westbound lanes. The following is a summary of the proposed work:

The project will consist of milling off 2¼" in the driving lane, passing lane, and bituminous shoulders and replacing with ¾" scratch course and 1½" of SMA wearing course. In rutted areas of Segment 2311, Offset 1491 to Segment 2325, Offset 2110, all bituminous material will be milled off at a depth of 4¾" and replaced with 2½" binder course, ¾" scratch course, and 1½" of SMA wearing course. Pavement markings and rumble strips will be included on this project. Raised pavement markers will be removed on this contract but not replaced. In addition, the near and far approach concrete slabs will be removed and reconstructed with full-depth bituminous pavement at the westbound Hemlock creek structure.

Beginning Segment/Offset: Segment 2283 Offset 0000 Westbound

Ending Segment/Offset: Segment 2325 Offset 2149 Westbound

Functional Classification: Rural Interstate

This section of roadway is not within the boundary of a Transportation Management Area.

This project is anticipated to be constructed over 1 construction season. The anticipated Notice to Proceed date is June 9, 2014 and the completion date is anticipated by August 22, 2014.

Two lanes of traffic will be maintained in each direction from noon on Fridays through 7 am on Mondays. There will be an allowance for long term single-lane closures from 7 am Mondays through noon Fridays after the 4th of July weekend to August 1, 2014 with the contractor required to work two 12-hour shifts.

The acceleration/deceleration ramps that serve the westbound direction will be required to be closed between 10 pm and 7 am (low peak period) in order for milling and resurfacing.

The Contractor is responsible for coordinating with the District Traffic Unit and the Community Relations Coordinator to implement a substantial public notification program in advance of the weekday lane closures.

Construction Staging:

Stage 1 and 2: Consists of reconstructing the bridge approach slabs over Hemlock creek.

Stages 3A thru 5B: Consists of the mill and overlay of westbound SR 80 and the interchange acceleration/ decleration lanes that serve the westbound direction.

4. TRAFFIC CONDITIONS

Roadway traffic data is as follows:

SR 80 WESTBOUND	
Current A.D.T.:	21,507 (2014)
Design Year A.D.T.:	26,314 (2024)
DHV:	2368 (9%)
Trucks:	24%

SR 80 Design Information is as follows:

Highway Classification:	Rural Interstate
Design Speed:	70 mph (65 mph posted)
Pavement Width:	24'
Shoulder Width:	8' Lt, 12' Rt.

This project is in close proximity to the Bloomsburg Fairgrounds. It is anticipated that there will be one special event, the Monster Truck Jamboree, which occurs Friday, July 11, 2014 (4:00 pm) through Sunday, July 13, 2014. The project will not affect traffic to this event as two-lanes will be restored on Fridays, Noon to Mondays, 7 am. Even though no events are anticipated to be impacted, it is imperative that a public information

campaign be in place for the duration of the construction to give current, real-time information regarding lane closures.

5. WORK ZONE IMPACT ASSESSMENT

Multiple options for controlling traffic in the work zone were considered and analyzed:

- Long term lane closures
- Night work with short term lane closures
- Full Interstate closure with detour

A. Long Term Lane Closures – Long term lane closures for the construction of the approach slabs to the SR 80 bridge over Hemlock Creek were not selected due to adequate bridge and pavement width to maintain two travel lanes during construction.

Long term lane closures for the milling and overlay of the westbound travel lanes were selected even though anticipated delays may exceed the 20 minute threshold as defined in Publication 46 based on past experience from previous projects. Delay calculations were performed for the determination of delay and queue lengths, using the "Delay Analysis Workbook" developed by French Engineering. The results of these delay calculations indicate a delay not exceeding 11 minutes. The above analysis was performed at the Buckhorn Interchange vicinity, due to the volumes of traffic entering the work zone at the approach to the bridge over Hemlock Creek. Because the estimated delays for this project are based off an ADT value and statewide averages, the most reliable estimate of delay and queue length is from projects that were previously under construction on SR 80 in the area of this project.

On SR 80-M01 (resurfacing from Buckhorn to Montour/Columbia County line westbound, constructed in 2007), the longest queue lengths were 8 miles, with two instances occurring on Friday in the afternoon. One was not attributed to anything specific and the other was attributed to an accident. There were five other instances that queues were over three miles long. All of these queues were 4 miles in length. They all occurred in the afternoons on Mondays and Thursdays. One was not attributed to anything specific; two were for backlog of traffic; one for an accident; and the other for a switch in lane closures.

On SR 80-M05 (widening of Fishing Creek bridges, reconstruction of SR 80 near the bridges and resurfacing from Buckhorn to Lime Ridge area; constructed in 2010), the longest queue lengths were 5.0 miles to 6.6 miles, with six instances occurring on Friday afternoons at 2:00 pm, two instances occurring on Wednesdays in the afternoon, and two instances occurring on Thursday afternoon. The majority of these occurrences happened near the peak time of travel at 2:00 pm. There were seven more instances where the queue lengths exceeded three miles, which ranged from 3.2 miles to 4.7 miles. Again these occurred during peak times (1:00 pm to 3:00 pm) on various weekdays.

Observations from the queues on the above projects were:

- Queues developed predominantly in the afternoons.
- Queue lengths were excessive on Fridays when one lane was kept closed. When opening both lanes to traffic over the weekends was an effective method to reduce the impact.

- There were numerous times when traffic volume was relatively light and queues developed for no apparent reason.

In an effort to reduce queues by having traffic traveling through the one-lane restricted work zones quicker, there will be a restriction in the contract to limit the work zone length to be 2 ½ miles long maximum.

On the previous SR 80 projects with single-lane closures, weekend queues resulted in longer delays than on weekdays. Weekend queues in the westbound direction typically occur on Friday afternoons.

Construction restrictions have been placed to allow two lanes of traffic to be restored through the project on weekends from Fridays noon to Mondays at 7 am.

B. Night Work with Short Term Lane Closures – Due to the reconstruction of the approach slabs to the bridge over Hemlock Creek and the depth of milling and overlay required, this project cannot be constructed under nighttime operations with short-term lane closures. It was also determined that when milling and resurfacing, that working at night and restoring to two lanes was not feasible due to low production for only milling and paving in short lengths, paving would go beyond the Labor Day weekend, and numerous transverse joints would be located at where the contractor had to stop each night.

C. Full Interstate Closure with Detour – This alternative was not analyzed or selected because there is no suitable detour route for SR 80.

6. WORK ZONE IMPACT MANAGEMENT STRATEGIES

A. Traffic Control Plan (TCP) – This project will be managed in accordance with the approved Traffic Control Plans. Any modifications of these plans must be approved by the Department before implementation.

B. Transportation Operations Plan (TOP)

i. Traffic Control Supervisor – The Contractor's Project Traffic Control Supervisor is required to be adequately trained in accordance with PennDOT requirements. The Traffic Control Supervisor is responsible for the following:

- Coordinate all traffic control installations, pattern changes, and removals.
- Inspect long term traffic control devices and patterns each working day.
- Inspect each short term traffic control pattern that is set up.
- Document the details of these inspections (items inspected, deficiencies discovered, and action taken to correct the deficiencies).
- Program changeable message signs.
- Notify immediately the Inspector-in-Charge of any highway incidents within the limits of the work zone.
- Perform duties related to data collection, sharing, and performance monitoring.

ii. Changeable Message Signs (CMS) – CMS on SR 80 leading into the project site will be used in the following manner:

- Notify motorists of the start date of the project, any changes to the traffic control patterns, or any short term road closures.
- Provide messages specifically related to slowing traffic down or being prepared to stop during any short term road closures or anticipated traffic queues.
- Notify of closure of off-ramp at SR 42 (Buckhorn interchange).
- Provide messages for use during incident management.

CMS will be used at SR 42 (EB) north of SR 80; SR 11 (SB) east of SR 42; SR 42 (NB) south of SR 11; and SR 11 NB west of SR 42 in order to:

- Notify traffic that SR 80 WB ramps are closed at the Buckhorn Interchange, and to follow "Red" detour (SR 11 South to SR 54 West) during times of milling and resurfacing of acceleration ramps serving SR 80 WB.

iii. Lane Closure Requirements – Lane closures will not be permitted on the following dates and times:

- Permit no lane restrictions during the following events/holidays:

Independence Day: July 3, 2014 at 5 a.m. until July 7, 2014 at 7 a.m..

Any traffic stoppages (emergencies excluded) or "rolling" road closures, regardless of their duration, must be approved by the District Traffic Unit.

iv. Incident Management Plan – An Incident Management Plan will be developed in accordance with the special provision in the contract (see Appendix A). In Appendix B of this plan, a list of 24-hour emergency phone numbers (emergency services and organizations, Contractor's representatives, Department representatives, County Maintenance Manager, etc.) are provided. The Incident Management Plan also requires that the Contractor immediately notify the Inspector-in-Charge of all lane closures and major incidents so that information may be provided to motorists and other stakeholders via District variable message signs and the statewide road closure reporting and traveler information systems.

The Contractor is required to submit an "Emergency Response Plan" at the pre-construction conference. The Emergency Response Plan should include contact individuals for incidents that occur during non-working periods and alternate contact individuals.

Following an incident, the Contractor will conduct an After Action Review with the Department and emergency service organizations to evaluate the plan. The Contractor will modify the plan as directed.

C. Public Information Plan (PIP) – The Contractor shall maintain ongoing communication with the Inspector-in-Charge regarding phasing of operations that will impact traffic control and transportation operations in the project area. The

Contractor shall maintain lists of phone and fax numbers for school district, media outlets, emergency services, major businesses in the area, transit companies, nearby trucking firms, and other prominent traffic generators in the project vicinity. The Contractor is responsible for notifying these groups of changes in the traffic control phasing at least 48 hours in advance of the phase change as directed by the Inspector-in-charge. The Inspector-in-Charge shall coordinate with the Community Relations Coordinator to develop and issue press releases related to traffic control and transportation operations on this project.

7. TMP PERFORMANCE – The performance of the Transportation Management Plan will be regularly assessed from two standpoints:

- Monitoring the overall work zone performance.
- Evaluating individual TMP strategies.

Crash data, travel time data, and queue length will be the primary sources of information used to determine the overall effectiveness of the work zone traffic management strategies. This project is characterized as "non-significant" with respect to PennDOT's Work Zone Safety and Mobility Policy; but due to district policy for projects located on SR 80 east of SR 15, travel delay monitoring and recording is a requirement.

The Contractor's Traffic Control Supervisor shall maintain a daily record of crashes, work zone incidents, and maximum daily queue lengths due to the construction using the MPT Daily Record form included in the contract. The Contractor's Traffic Control Supervisor shall perform and record queue lengths and travel times through and approaching the work zone on a daily basis at the start of shift, middle of shift, and end of shift in each direction. This information will be obtained by driving through the work zone, starting at the exit prior to the queue. The queue length will be determined by odometer readings and travel time by stop watch. This information shall be coordinated daily with PennDOT's Inspector-in-Charge. Feedback from the public through phone calls, in person, or in writing will also be captured.

The Department will regularly inspect the manner in which traffic control installations, pattern changes, and removals are conducted and check to ensure that the portable changeable message signs are operational and being used appropriately. All of this monitoring information will be documented in the project diary.

PennDOT's inspector will share this information monthly with the District Traffic Engineer (DTE). The DTE will also arrange for periodic floating car runs through the project work limits to validate/corroborate work zone performance and actual queues and travel delays.

The Inspector-in-Charge, DTE (or their representative), and TMC Manager will participate in partnering meetings or conduct bi-monthly conference calls to discuss how well the TMP is performing and to verify that the PennDOT Project Manager, TMC Manager, and Public Safety Stakeholders have been receiving timely notifications of incidents as required by the Incident Management Plan.

8. CONTINGENCY PLANS

In the event that traffic queues begin to develop beyond the approach signing, the contractor will close any entrance ramps to SR 80 WB.

The contractor will utilize the CMS at the following locations in order to notify that SR 80 WB ramps are closed and to follow the "Red" detour (SR 11 South to SR 54 West):

- SR 42 EB north of SR 80.
- SR 11 SB west of SR 42.
- SR 42 NB south of SR 11.
- SR 11 NB east of SR 42.

Also, the Traffic Control Plan will include signs to be uncovered to show direction to SR 80 WB to the Danville Interchange.

APPENDIX A

Incident Management Special Provision

ITEM 9999-9980 INCIDENT MANAGEMENT

DESCRIPTION - This work is the furnishing, installing and maintaining of traffic Control Devices and other services requested by the incident commander for incidents occurring within the work zone or as directed by the Project Manager. This will be performed in conjunction with Contract Item 0901-0001 Maintenance and Protection of Traffic during Construction.

CONSTRUCTION -

(a) Contractor Response Time - During working hours, the contractors designee required in pub 408, section 901.3p will respond to an incident within 15 minutes. To respond to an incident, the contractor's designee will contact the Project Manager and assist the incident commander upon arrival by coordinating any requests for support for material and resources. Equip the designee with a cellular phone and provide the phone number to the Project Manager.

At all other times, the Contractor's designee must respond to an incident within 30 minutes.

MEASUREMENT AND PAYMENT - Dollar -

The proposal will include an item and a predetermined amount of money for the implementation of an Incident Management Plan. The contract item will have a unit of measure of Dollar, a unit price of $1.00, and a quantity equal to the predetermined amount.

Due to the contingent or unpredictable nature of the work being performed, the provisions of Section 110.02(d) are not applicable to this item.

Measured and paid for, under the Incident Management item as follows:

(a) Contract Items. The Department will pay for performance of work, identified as having similar items listed in the contract, at the contract unit price.

(b) Non-Contract Items. The Department will pay for items of work not identified in the contract as follows:

1. Negotiated Price. At price agreed upon with the Department before performing the work. If applicable, agreement is also required with FHWA.

2. Force Account Basis. Section 110.03(d)

Payment for the contractor's designee will be incidental to 0901-0001.

The Department will charge the Contractor $750 for each ¼ hour, or any portion thereof, that the Contractor fails to meet the time specified above under Contractor Response Time.

APPENDIX B

List of 24-hour Emergency and District Contacts

SR 80-M15 Municipality Contacts

Town of Bloomsburg
Town Hall
301 E. Second Street
Bloomsburg, PA 17815-1870
Phone: 570-784-7703

Mayor
Dan Knorr
401 Wirt Street, Apt. 1
570-441-9618

Fire
911 Market Street
Bloomsburg, PA 17815
Phone: 570-784-1951

Police
Chief Leo V Sokoloski
301 E. 2nd Street
Bloomsburg, PA 17815
Phone: 570-784-4155

Columbia County
Courthouse
35 West Main Street
Bloomsburg, PA 17815
Phone: 570-389-5608
Fax: 570-784-0257

Commissioners
Chris E. Young
Rich Ridgway
David Kovach

County Emergency Services Dispatch
570-784-6300

Sheriff
Timothy T. Chamberlain
35 W. Main Street
PO Box 380
Bloomsburg, PA 17815
Phone: 570-389-5622

Mount Pleasant Township
Mount Pleasant Township
230 McWilliams Road
Bloomsburg, PA 17815
Phone: 570-784-3515
Fax: 570-784-3547

Contact Person, Secretary
Coralee Kindt
230 McWilliams Road
Bloomsburg, PA 17815
570-784-3515

Supervisor, Chairman
John R. Gordner (2010)
164 McWilliams Road
Bloomsburg, PA 17815
570-784-2603

Supervisor
Albert E. Wagner (2008)
189 Kindt Road
Bloomsburg, PA 17815
570-784-4416

Fire
Millville Community Fire Company
Chief Rob Bower
PO Box 80
28 West Main Street
Millville, PA 17846-0080
Phone: 570-458-5783

Hemlock Township
26 Firehall Road
Bloomsburg, PA 17815
Phone: 570-784-6178
Fax: 570-784-3288

Supervisors
Albert L. Hunsinger, Jr. Board Chair
Robert B. Snyder, Vice Chair
David E. Bardo
Frederick J. Klinger
Mark E. Morrow

Police
Chief Michael D. VanDine
Phone: 570-784-6543

Fire
Buckhorn Volunteer Fire Co.
Chief Ken Wenner
19 Firehall Road
Bloomsburg, PA 17815
Phone: 570-387-1119

Manager
Stephanie Haney

Pennsylvania State Police
6850 Hidlay Church Road
Bloomsburg, PA
Phone: 570-387-4701

Pennsylvania Department of Transportation
715 Jordan Avenue
Montoursville, Pennsylvania 17754
Phone: 570-368-4299

Assistant Construction Engineer
Kevin S. Smith
Phone: 570-369-4231

Construction Project Manager
David Serra
Phone: 570-971-0304

County Maintenance Manager
Shawn Hill
Phone: 570-387-4250

Appendix F: Work Zone Mobility and Safety Self-Assessment Summary Report, 2012

2012 Work Zone Mobility and Safety Self Assessment

PENNSYLVANIA

Summary Report

Federal Highway Administration
Office of Operations

January 2013

1. Background and Methodology

To help agencies evaluate their work zone practices and to help assess work zone practices nationally, the Federal Highway Administration (FHWA) developed the Work Zone Mobility and Safety Self Assessment (WZ SA) tool. The WZ SA tool consists of a set of 46 questions designed to assist those with work zone management responsibilities in assessing their programs, policies, and procedures against many of the good work zone practices in use today. The questions are scored on a 0 to 15 scale. Beginning in 2003, FHWA Division Offices have worked in partnership with their respective States to complete a WZ SA each year to assess their own work zone practices and program. The goal of the 2012 WZ SA was to evaluate the progress made since the last WZ SA in 2011 and to reassess program initiatives both at the local and national levels. In 2012, each FHWA Division Office was asked to re-examine and update their scores from 2011 to reflect any changes in their practices related to the 46 WZ SA questions. This report presents the WZ SA results for Pennsylvania in 2012, with data from 2011 included as a reference.

For a description of the structure of the WZSA and scoring guidelines, please refer to Appendix A. Along with providing a score for each of the 46 questions, respondents had the option of providing comments related to their response. Comments submitted by Pennsylvania are included in Appendix B.

To support efforts to meet the ongoing process review requirement, the WZ SA includes a two-part question on process reviews. This question was not used in calculating an agency's WZ SA score. This question is intended to gauge progress by agencies in performing work zone process reviews in accordance with 23 CFR 630 Subpart J.

Agencies are encouraged to use their WZ SA results to identify actions and priority areas for improvement in their State, and as part of their inputs when they perform the process reviews that are required by the Work Zone Safety and Mobility Rule (http://www.ops.fhwa.dot.gov/wz/resources/final_rule.htm).

2. Summary of Results

Section 2.1 presents the overall 2012 WZ SA results for Pennsylvania. The 2011 results for Pennsylvania, as well as the national results for both years, are included for reference. Section 2.2 displays the 2012 results for Pennsylvania on both a section-by-section and question-by-question basis, with 2011 results for reference.

2.1 Overall Results

Table 1 presents the overall score for Pennsylvania on the WZ SA. In calculating the overall score on the WZ SA, a weighting scheme has been applied to reflect the relative importance of each section on the overall score. This scheme assigns the following weights to each section:

1. Leadership and Policy - 10%
2. Project Planning and Programming - 15%
3. Project Design - 25%
4. Project Construction and Operation - 25%
5. Communications and Education - 15%
6. Program Evaluation - 10%

After applying the weighting scheme, the Pennsylvania overall score on the WZ SA is 9.1 for 2012. The national average score for 2012 is 10.6.

Table 1. Overall Self Assessment Score (0 to 15 scale)

	2011 Weighted Score	2012 Weighted Score	Percent Change from 2011 to 2012
Pennsylvania	8.8	9.1	3.4%
National Average	10.3	10.6	2.9%

Unweighted scores are also provided, in Table 2, since these values indicate the average score for each section on the 0 to15 WZ SA scoring scale. The individual section weights are applied to each of the unweighted section scores and the resulting six values are added to obtain the final overall/weighted score.

Table 2. Mean Scores for Each Section

Section	2011 Pennsylvania Unweighted Score	2012 Pennsylvania Unweighted Score	Percent Change from 2011 to 2012	2012 National Unweighted Average
Section 1 – Leadership and Policy	8.8	9.2	4.5%	10.3
Section 2 – Project Planning and Programming	5.0	5.5	10.0%	9.3
Section 3 – Project Design	9.5	9.8	3.2%	10.9
Section 4 – Project Construction and Operation	9.9	10.2	3.0%	11.1
Section 5 – Communications and Education	12.4	13.0	4.8%	12.8
Section 6 – Program Evaluation	4.5	4.3	-4.4%	7.7

Note: Individual section averages and overall scores have been rounded for presentation purposes.

2.2. Section-by-Section Results

2.2.1 Leadership and Policy

Table 3 presents the Pennsylvania scores for the questions in the Leadership and Policy section. Leadership support should drive overall policy making in an agency. The direction provided by this support fosters an environment that is conducive to developing an effective work zone program. Consideration and management of work zone mobility and safety impacts should be part of project planning, design, and construction and maintenance activities. Agency management should facilitate and encourage a multidisciplinary approach to traffic management throughout all phases in the life of a project. Senior managers should be personally, visibly, and proactively involved in efforts to minimize work zone delay and enhance the safety of motorists and workers in work zones.

Table 3. Leadership and Policy Scores

Item	Question	2011 Pennsylvania Score	2012 Pennsylvania Score	2012 National Average
4.1.1	Has the agency developed a process to determine whether a project is impact type I, II, III, or IV?	8	8	11.1
4.1.2	Has the agency established strategic goals specifically to reduce congestion and delays in work zones?	7	9	9.5
4.1.3	Has the agency established strategic goals specifically to reduce crashes in work zones?	10	11	10.0
4.1.4	Has the agency established measures (e.g., vehicle throughput or queue length) to track work zone congestion and delay?	7	7	8.4
4.1.5	Has the agency established measures (e.g., crash rates) to track work zone crashes?	13	13	10.5
4.1.6	Has the agency established a policy for the development of Transportation Management Plans to reduce work zone congestion and crashes?	10	12	11.5
4.1.7	Has the agency established work zone performance guidance that addresses maximum queue lengths, number of open lanes, maximum traveler delay, etc.?	11	11	10.6
4.1.8	Has the agency established criteria to support the use of project execution strategies (e.g., night work and full closure) to reduce public exposure to work zones and reduce the duration of work zones?	12	12	12.2
4.1.9	Has the agency developed policies to support the use of innovative contracting strategies to reduce contract performance periods?	9	8	12.0
4.1.10	Has the agency established formal agreements, such as Memoranda of Understanding (MOU), with utility suppliers to promote the proactive coordination of long-range transportation plans with long-range utility plans, with the goal of reducing project delays and minimizing the number of work zones on the highway?	1	1	6.9

2.2.2 Project Planning and Programming

Table 4 presents the Pennsylvania scores for the questions in the Project Planning and Programming section. While transportation planning and implementation processes differ significantly from State to State, they all focus on developing increased capacity and efficiency in the transportation system. They do this with the development of long-range transportation plans (LRTPs), transportation improvement program plans (TIPs), unified planning work programs (UPWPs), and in some cases congestion management system (CMS) plans. Although the role of the planner in the development of project-specific criteria has not been universally defined, it is clear that the complexity of our transportation systems and the impact of congestion on our nation necessitate input from planners during the project development process in order to better assess and manage work zone impacts.

Table 4. Project Planning and Programming Scores

Item	Question	2011 Pennsylvania Score	2012 Pennsylvania Score	2012 National Average
4.2.1	Does the agency's planning process actively use analytical traffic modeling programs to determine the impact of future type I and II road construction and maintenance activities on network performance?	3	3	9.1
4.2.2	Does the agency's regular planning process analyze the network to develop adequate alternate options for routing traffic in anticipation of various needs for future road construction and maintenance?	3	5	8.9
4.2.3	Does the agency's planning process manage the transportation improvement program to eliminate network congestion caused by poorly prioritized and uncoordinated execution of projects?	6	6	9.2
4.2.4	Does the agency's transportation planning process include a planning cost estimate review for work types I, II, and III that accounts for traffic management costs (e.g., incident management, public information campaigns, positive separation elements, uniformed law enforcement, and Intelligent Transportation Systems [ITS])?	2	2	9.7
4.2.5	Does the agency's transportation planning process include active involvement of planners during the project design stage to assist in the development of congestion mitigation strategies for type I and II projects?	8	9	9.4
4.2.6	Does the agency's transportation planning process engage planners as part of a multidisciplinary/multiagency team in the development of Transportation Management Plans involving major corridor improvements?	8	8	9.4

2.2.3 Project Design

Table 5 presents the Pennsylvania scores for the questions in the Project Design section. Project designers, working in concert with other functional experts, should consider work zone maintenance of traffic issues early in the design process. Designers should examine the use of different project execution strategies that can accelerate construction, thereby reducing construction time and minimizing the exposure of travelers to work zones and workers to traffic. In addition, designers should actively lead the preparation of Transportation Management Plans, including Traffic Control Plans, that will mitigate the impact of work zone activities.

Table 5. Project Design Scores

Item	Question	2011 Pennsyl-vania Score	2012 Pennsyl-vania Score	2012 National Average
4.3.1	Does the agency have a process to estimate road user costs and use them to evaluate and select project strategies (full closure, night work, traffic management alternatives, detours, etc.) for type I and II projects?	11	11	11.1
4.3.2	Does the agency develop a Transportation Management Plan that addresses all operational impacts focused on project congestion for type I and II projects?	12	12	11.8
4.3.3	Does the agency use multidisciplinary teams consisting of agency staff to develop Transportation Management Plans for type I and II projects?	12	12	12.0
4.3.4	Does the agency perform constructability reviews that include project strategies to reduce congestion and traveler delays during construction and maintenance for type I and II projects?	12	13	12.4
4.3.5	Does the agency use independent contractors or contractor associations to provide construction process input to expedite project contract times for type I and II projects?	1	1	9.7
4.3.6	Does the agency use scheduling techniques that are based on time and performance, such as the critical path method or parametric models, to determine contract performance times for type I and II projects?	13	13	11.3
4.3.7	Does the agency have a process to evaluate the appropriate use of ITS technologies to minimize congestion in and around work zones for type I, II, and III projects?	9	8	9.7
4.3.8	Does the agency use life-cycle costing when selecting materials to reduce the frequency and duration of work zones for type I, II, and III projects?	11	11	10.9
4.3.9	Does the agency have a process to assess projects for the use of positive separation devices for type I and II projects?	14	14	12.7
4.3.10	Does the agency anticipate and design projects to mitigate future congestion impacts of repair and maintenance for type I, II, and III projects?	7	8	10.5
4.3.11	When developing the Traffic Control Plan for a project, does the agency involve contractors on type I and II projects?	2	3	8.4
4.3.12	When developing the Traffic Control Plan for a project, does the agency use computer modeling to assess Traffic Control Plan impacts on traffic flow characteristics such as speed, delay, and capacity for type I and II projects?	10	12	9.9

2.2.4 Project Construction and Operation

Table 6 presents the Pennsylvania scores for the questions in the Project Construction and Operation section. A roadway construction or maintenance site can be a very complex orchestration of activities impacting the public in many ways. There are many pieces to the project delivery process and everyone has a critical role, but what the public mostly sees and experiences is the construction end of the process. The use of letting strategies, quality-based contractor selection, time-sensitive bidding, efficient operations, traffic management, aggressive contract management, and good public information can help transportation agencies improve the execution and public perception of transportation improvements.

Table 6. Project Construction and Operation Scores

Item	Question	2011 Pennsylvania Score	2012 Pennsylvania Score	2012 National Average
4.4.1	Is the letting schedule altered or optimized to reflect the available resources and capabilities of the construction industry?	7	7	10.5
4.4.2	Is the letting schedule altered or optimized to minimize disruptions to major traffic corridors?	9	8	11.3
4.4.3	When bidding type I and II projects, does the agency include road user costs in establishing incentives or disincentives (e.g., I/D, A+B, or lane rental) to minimize road user delay caused by work zones?	13	13	12.1
4.4.4	When bidding type I, II, and III projects, does the agency use performance-based criteria to eliminate contractors who consistently demonstrate their inability to complete a quality job within the contract time?	9	9	8.3
4.4.5	When bidding type I and II project contracts, does the agency use incident management services (e.g., wrecker, push vehicles, and service patrols)?	14	14	11.3
4.4.6	When bidding contracts, does the agency use flexible starting provisions after the Notice to Proceed is issued?	7	9	11.3
4.4.7	During type I, II, and III projects, does the agency use uniformed law enforcement?	13	13	13.3
4.4.8	Does the agency provide/require training of contractor staff on the proper layout and use of traffic control devices?	8	9	12.8
4.4.9	Does the agency provide training to uniformed law enforcement personnel on work zone devices and layouts or ensure law enforcement personnel receive proper training elsewhere?	9	10	8.8

2.2.5 Communications and Education

Table 7 presents the Pennsylvania scores for the questions in the Communications and Education section. To reduce public anxiety and frustration regarding work zones, it is important to sustain effective communications and outreach with the public regarding road construction and maintenance activity, and the potential impacts of the activities. This also increases the public's awareness of such activities. The lack of information is often cited as a key cause of frustration for the traveling public. Agencies should identify and consider key issues from a public information and outreach perspective.

Table 7. Communications and Education Scores

Item	Question	2011 Pennsylvania Score	2012 Pennsylvania Score	2012 National Average
4.5.1	Does the agency maintain and update a work zone website providing timely and relevant traveler impact information for type I, II and III projects to allow travelers to make effective travel plans?	12	12	13.1
4.5.2	Does the agency sponsor National Work Zone Awareness week?	13	14	12.6
4.5.3	Does the agency assume a proactive role in work zone educational efforts?	13	13	12.9
4.5.4	During type I, II, and III project construction, does the agency use a public information plan that provides specific and timely project information to the traveling public through a variety of outreach techniques, (e.g., agency website, newsletters, public meetings, radio, and other media outlets)?	13	13	13.8
4.5.5	During type I, II, and III projects, does the agency use ITS technologies to collect and disseminate information to motorists and agency personnel on work zone conditions?	11	13	11.6

2.2.6 Program Evaluation

Table 8 presents the Pennsylvania scores for the questions in the Program Evaluation section. Evaluation is necessary to identify successes and analyze failures. Work zone performance monitoring and reporting at a nationwide level can increase the knowledge base on work zones and help lead to the development of better tools to help agencies better plan, design, and implement road construction and maintenance projects. At the local level, performance monitoring and reporting provides an agency with valuable information on the effectiveness of congestion mitigation strategies, contractor performance, and work zone safety.

Table 8. Program Evaluation Scores

Item	Question	2011 Pennsylvania Score	2012 Pennsylvania Score	2012 National Average
4.6.1	Does the agency collect data to track work zone congestion and delay performance in accordance with agency-established measures? (See Section 1, item 4.1.4)	4	3	6.9
4.6.2	Does the agency collect data to track work zone safety performance in accordance with agency-established measures? (See Section 1, item 4.1.5)	8	8	9.2
4.6.3	Does the agency conduct customer surveys to evaluate work zone traffic management practices and policies on a statewide/area-wide basis?	3	3	6.9
4.6.4	Does the agency develop strategies to improve work zone performance on the basis of work zone performance data and customer surveys?	3	3	7.8

2.2.7 Work Zone Process Reviews

23 CFR 630 Subpart J requires that an agency perform a comprehensive work zone process review at least every 2 years. In order to gauge progress by agencies in performing work zone process reviews in accordance with 23 CFR 630 Subpart J, agencies were asked to respond to the following two-part supplemental question. The 2012 Pennsylvania responses to the supplemental question are shown below.

1a. Has the agency performed a comprehensive work zone process review in the last two years in accordance with 23 CFR 630 Subpart J? Yes

1b. Please provide the date when your last process review was <u>completed</u>.

Month: June
Year: 2012

1c. Comments (optional):

Appendix A

2012 Work Zone Self Assessment

WZ SA Structure and Scoring Guidelines

The WZ SA asked respondents to rate the extent to which a particular policy, strategy, process, or tool, has been adopted into an agency's way of doing business. The adoption process consisted of five progressive levels based on the quality improvement process model used by industry: 1) initiation, 2) development, 3) execution, 4) assessment, and 5) integration. Respondents were asked to rate each question using a 0 to 15 scale following the guidance contained in Table 1.

Table A1. Scoring Guidelines

Adoption Phase	Scoring Range	Description
Initiation	(0-3)	Agency has acknowledged the need for this item
Development	(4-6)	Agency has developed a plan or approach to address this item
Execution	(7-9)	Agency is executing or has executed an approach to address this item
Assessment	(10-12)	Agency has assessed this item's performance and its success in achieving agency goals and objectives
Integration	(13-15)	Agency has integrated this item into its project execution process and culture

The 46 questions are grouped into six sections: Leadership and Policy, Project Planning and Programming, Project Design, Project Construction and Operation, Communications and Education, and Program Evaluation. For each question, respondents had the option of providing comments related to their response.

For the WZ SA, four project types were defined to reflect the magnitude of impact a work zone may have on travelers:

- **Type I** represents the most complex and costly projects that an agency may undertake. These projects impact the traveling public at the metropolitan, regional, intrastate, and possibly at the interstate level.
- **Type II** projects are less complex projects that impact the traveling public predominately at the metropolitan and regional level and have a moderate to high level of public interest and user cost/impacts.
- **Type III** projects impact the traveling public at the metropolitan or regional level and have a moderate to low level of public interest and impacts.
- **Type IV** projects impact the traveling public to a small degree.

The larger and more complex a project, the greater the likelihood it will cause greater impacts and the higher the level of attention and resources an agency generally needs to invest in mitigating work zone congestion and crashes. Therefore, some items in the WZ SA were limited to particular project types (e.g., types I and II) since it was unlikely they would apply to all project types. These work zone impact levels were intended to be an assistance tool and may not encompass all possible combinations or degree of work zone categories. States were encouraged to use their own categories provided that they could align their categories to the four categories defined in the WZ SA.

Appendix B

2012 Work Zone Self Assessment

Comments Submitted

Pennsylvania

No comments were submitted.

Appendix G: State of the Practice Survey – Work Zone Programs, Practices and Policies, 2014

State of the Practice: Work Zone Programs, Practices, and Policies

The purpose of this survey is to document current practices and policies within your organization related to work zones. This information will be used in conjunction with work zone crash data to determine strategies and countermeasures that may help reduce severe and fatal injuries in active work zones.

Policies Related to Work Zones

In your agency, what is the role of enforcement in work zones?

Enforcement is conducted with construction and permit inspection staff. Enforcement is also conducted by Central and District Office quality assurance team members.

Does your agency or State law allow for the use of automated enforcement?

No. It was recently proposed, but has been held up by the Pennsylvania State Police trooper union. PSP participates in our work zones for queue protection **only**.

What is your agency's policy related to the use of experimental temporary traffic control devices (TTCD)?

We are open to using devices that are functional and improve the safety and mobility of our workers and motorists. Most pilot projects are conducted with our maintenance crews to help get devices deployed in a timely manner. The federal experimental process is very time consuming for a pilot.

What is your agency's policy on night and weekend work?

Night and weekend is typically used when site-specific conditions dictate it. Night work is required on most Interstate operations to avoid queuing issues, and business districts to limit the local business impacts.

Are revisions to TTC plans allowed by the contractor? If so, what process is used to vet the recommendations and who approves?

Yes, by Value Engineering. As a general rule to everyone, ALL changes to the TTC shall be approved by the District Engineer. There are no exceptions.

What is your agency's policy for allowable edge drop-off, i.e., how long and under what conditions the situation may exist and the height of the drop-off?

Our drop-off policy is located in Publication 408, Section 901 (j).
ftp://ftp.dot.state.pa.us/public/bureaus/design/Pub408/pdf%20for%20printing%202011%205/901.pdf

Programs and Practices Related to Work Zones

Do you have a crash data collection and/or analysis training program? If so, briefly describe the content, how often these trainings are given, and who is required to attend.

To be answered by Bob Ranieri at a later date.

Do you have a work zone safety training program – flagger, TTDC, moving operations, etc? How often are these trainings given and who is required to attend?

Flagger training is an in-house flagger training course for our own employees. Our training material may be used by an external customer upon request. Most external customers attend ATSSA, APC or LTAP training courses.

Do you perform work zone inspections for each active work zone? How often are inspections performed, what elements are inspected, and is the information documented? Are work zone inspections conducted by agency staff or by contract? How are the results of the inspection used?

Inspections are required twice a day on construction projects (and are performed by Dept. as well as contracted inspectors). All elements are inspected. We have a standard form used by construction. Maintenance projects are maintained daily by our foremen. Annually reported and evaluated by all.

Do you perform work zone reviews at the agency level (e.g. agency work zone policies and/or review of statewide work zone data)? If so, how often are reviews conducted, what elements are reviewed, and is the information documented? How are the results of the review used?

Yes. We have an annual report that looks at all aspects of our work zones, and focuses on the fatalities and those items we can remedy quickly.

Do you perform work zone road safety audits (WZRSA)? If so, please explain your WZRSA program and process.

Not currently. Some Districts may, but that decision is on their own. We do not have a current statewide policy beyond our QA reviews.

What types of data are collected in work zones? Speed, volume, location, travel time, injury type/severity, etc.

Our data that is collected remains project specific. Our Safety & Mobility Policy performance measurements have not been identified.

How does your agency determine which safety and mobility strategies to use in an active work zone?

Through the Pre-design and Design field reviews conducted during the pre-bid phase of the project. This is all coordinated thru the District's traffic units.

Who is responsible for providing input on development of a project's transportation management plan, including the traffic control plan and construction staging plan?

The District Traffic Engineer and his/her staff.

If lighting is used in work zones, what guidance do you have for its use and placement?

The only lighting we have guidance on is the flagger's station. We do not have any other statewide policy. The Districts may have project specific details, but nothing is use statewide.

How are work zone locations, progress, and alternate routes communicated?

Message boards and static signs, and thru public information officers (media outlets) and 511PA.com.

Are work zones coordinated across district or regional boundaries? How is this achieved?

Yes. Group (project) meetings, emails and phone calls.

Are motor carriers, emergency responders, emergency medical services, transit operators, and law enforcement partners consulted and/or informed of work zones? If so, in what manner?

Yes. They are invited in at the pre-planning (design) phase of the project.

Are incentives/disincentives used to reduce construction/active work zone duration?

Yes.

When is traffic modeling used to simulate work zone conditions and inform strategies and staging selection?

This is easiest to explaining in our Safety and Mobility policy in Publication 46, Section 6.3. ftp://ftp.dot.state.pa.us/public/PubsForms/Publications/PUB%2046.pdf

What is your agency's standard practice for setting speed limits in work zones?

No standard, but would like to establish a policy thru this effort.

Appendix H: Roundtable Attendees, Harrisburg, PA, June 19–20, 2014

Attendee	Agency
Matt Briggs	PennDOT
Mark Grabusnik	PennDOT
Lou Ferretti	PennDOT
Lt. Jeff Hopkins	PSP
Sgt. Todd Witalec	PSP
Ken Campbell	PennDOT
Joe Oswald	PennDOT
Brian Crossley	PennDOT
Michael Castellano	FHWA
James Paral	FHWA
John Ambrosini	PennDOT
Dan Storm	PennDOT
Ryan Palman	PennDOT
Larry Fagan	PennDOT
Jay Ruit	Jacobs
Mark Hood	Pennoni Associates
Matt Craley	Flagger Force
J. Smyser	PennDOT
Dan Farley	PennDOT
Tony Dellafiora	PennDOT
John Copeland	PennDOT
Keith Johnson	URS
William Miller	PennDOT
Brian Moore	Baker
Randy King	PennDOT
Ross Buchan	Gannett Fleming
Cory Greene	Baker
Steve Grimme	PennDOT
Glenn Rowe	PennDOT
Doug Nury	Beth's Barricades
Gary Modi	PennDOT
Manny Anastasiadis	PennDOT
Wayne Shappell	Pennsylvania Turnpike
Jennifer Atkinson	Leidos
Kelly Donoughe	Leidos

Appendix I: Additional Resources

This appendix presents additional resources to aid in understanding and/or implementation of the recommendations made in this report.

Topic	Source	Resource Location
Work Zone Speed Limits	North Carolina DOT – Guidelines for Implementation of the Work Zone Safety and Mobility Policy	https://connect.ncdot.gov/projects/WZTC/Documents/WZSafetyAndMobilityDraftGuidelines07_23_2007.pdf
	Minnesota DOT – Speed Limits in Work Zones Guidelines	http://www.dot.state.mn.us/speed/pdf/WZSpeedLimitGuideline.pdf
	Oregon DOT – Work Zones Designed at the Posted Speed	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=35&from=crossref&Category_ID=2&subCat1=&subCat2=
	NCHRP Report 746: Traffic Enforcement Strategies for Work Zones	http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_746.pdf
	Florida DOT – Active Law Enforcement to Manage Speed in Work Zones	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=99&from=topindex&Category_ID=96
Queuing Policy	North Carolina DOT – Work Zone ITS	http://ops.fhwa.dot.gov/wz/p2p/itswkshop052113/kite/kite.pdf
	Missouri DOT's Work Zone Capacity, Queue and Travel Delay Policies	http://epg.modot.org/index.php?title=616.30_Work_Zone_Capacity%2C_Queue_and_Travel_Delay
	Missouri DOT's Queue Length Detector	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=313&from=crossref&Category_ID=11&subCat1=&subCat2=
	Indiana DOT's Policies, Processes & Procedures on Work Zone Safety & Mobility	http://www.in.gov/dot/div/contracts/standards/INDOT_Work_Zone_Safety_Mobility_Policy_web.pdf
Work Zone Performance Measures	Michigan DOT – I-94 Work Zone Performance Measures	http://www.ops.fhwa.dot.gov/wz/p2p/pmwkshop053013/doyle/doyle.htm
	FHWA Case Studies – Work Zone Performance Measurement Using Probe Data	http://www.ops.fhwa.dot.gov/wz/resources/publications/fhwahop13043/ch3.htm
	FHWA Resources on Work Zone Safety and Mobility Performance Monitoring and Measurement	http://www.ops.fhwa.dot.gov/wz/resources/publications/fhwahop13014/index.htm

Topic	Source	Resource Location
	Missouri DOT – Work Zone Safety and Mobility Policy	http://epg.modot.mo.gov/index.php?title=616.14_Work_Zone_Safety_and_Mobility_Policy
	Developing and Implementing Transportation Management Plans for Work Zones	http://www.ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/trans_mgmt_plans.pdf
Work Zone Data	Quick Zone: A New Work Zone Delay Estimation Tool	http://www.fhwa.dot.gov/research/topics/operations/travelanalysis/quickzone/
	Wyoming DOT – Work Zone Crash Data Analysis	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=233&from=crossref&Category_ID=12&subCat1=&subCat2=
	Kansas DOT – Analysis of Work Zone Crash Data	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=203&from=crossref&Category_ID=12&subCat1=&subCat2=
	Montana DOT – Analysis of Work Zone Crash Data	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=203&from=crossref&Category_ID=12&subCat1=&subCat2=
	Ohio DOT – Analysis of Work Zone Crash Trends	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=368&from=crossref&Category_ID=12&subCat1=&subCat2=
	The Use of Operational Models to Evaluate Construction Staging Plans, A Case Study	http://www.workzonesafety.org/files/documents/database_documents/01135.pdf
Pedestrian Safety in Work Zones	FHWA – Maintaining Pedestrian Pathways in TTC Zones	http://www.atssa.com/galleries/default-file/WZ%20Guidance%20Sheet%20FINAL%20LAYOUT%20TO%20FHWA.pdf
	ATSSA Guidance Sheet – Temporary Traffic Control Zone: Pedestrian Access Considerations	http://www.atssa.com/galleries/default-file/WZ%20Guidance%20Sheet%20FINAL%20LAYOUT%20TO%20FHWA.pdf
	Minnesota DOT – Temporary Pedestrian Access Routes	http://ops.fhwa.dot.gov/wz/practices/best/view_document.asp?ID=155&from=crossref&Category_ID=2&subCat1=&subCat2=