City of Phoenix

September 18, 2007

To: All Traffic Barricade Manual Users

Re: OFFICIAL NEW RELEASE: 2007 City of Phoenix Traffic Barricade Manual

Enclosed is the 2007 City of Phoenix Traffic Barricade Manual (TBM) which has been updated to reflect new, proven and effective practices. This TBM is compatible with the 2003 Arizona Manual on Uniform Traffic Control Devices. Changes are intended to help you complete street betterments and special events efficiently, while assuring added safety for both workers and the public. This TBM gives substantially increased emphasis to:

- Policies/procedures governing the enhanced Phoenix Right-of-Way Management Program;
- Better accommodation of pedestrians and worker safety, including, but not limited to, Americans with Disabilities Act (ADA) requirements;
- Enhanced sign sheeting and clarifying language regarding "crash-worthiness" of devices;
- Enforcing American Traffic Safety Services Association (ATSSA) quality standards for work zone traffic control devices;
- Expectations regarding use of off-duty police/flaggers in temporary traffic control zones; and
- Minimizing the duration and number of restrictions near traffic signals. Signals "meter" traffic, so taking away lanes on either street can impose **severe** impacts on both streets.

While the TBM suggests specifics (i.e., the number of devices to be used in a taper), it is important to recognize that these numbers are simply used for guidance. In reality, each situation is different so this TBM should only be considered a guide. It is not a substitute for engineering judgment.

This TBM is effective **immediately**, as is the requirement for W12-1 series "splitter" signs to have the fluorescent orange sheeting. Other compliance dates for temporary traffic control are:

(a) January 1, 2008 for requiring fluorescent orange sheeting as the initial warning sign; and

(b) July 1, 2008 for "high-intensity" sheeting on signs, barricades, and vertical panels.

While we encourage early conversion, no citations (except warning) for sheeting will be issued until the compliance date passes.

Manuals will be available at the Right-of-Way Management Section counter (Phoenix City Hall, 200 W. Washington Street, sixth floor). Your continued support and assistance in providing safe and efficient temporary traffic control in construction and maintenance areas are greatly appreciated.

Sincerely,

Ross D. Blakley, Jr., P.E.
Acting Street Transportation Department Director

RB:JWS:TG:APAS
Enclosure

City of Phoenix

2007 Traffic Barricade Manual

STREET TRANSPORTATION DEPARTMENT

KEY REFERENCE MATERIAL

Table 1
TAPER LENGTH CALCULATIONS

SPEED LIMIT	FORMULA
40 mph or under	$L = \frac{WS^2}{60}$
45 mph or over	L = WS

L = Taper Length (ft)

W = Width of Lane (ft)

S = Posted Speed Limit

Table 2
TYPICAL TAPER LENGTH & SPACING BETWEEN DEVICES

SPEED LIMIT (mph)	**TAPER LENGTH (L)** (Feet)**			**SPACING BETWEEN DEVICES** (Feet)	**NUMBER OF DEVICES NEEDED**
	Lane Width:				
	10’	**11’**	**12’**		
25	104	115	125	25*	6
30	150	165	185	30	7
35	204	225	245	35	8
40	267	293	320	40	9
45	450	495	540	45	13
50	500	550	600	50	13
55	550	605	660	55	13

*	Distance between traffic cones used for tapers should not exceed 25 feet regardless of speed
**	Advance warning signs should be placed at distance (L) in advance of taper

NOTE: Values shown in Table 2 are for merging tapers only. Other taper lengths should be approximately L/2 and number of devices needed appropriately halved.

FOREWORD

This *Traffic Barricade Manual* (*TBM*) was prepared to guide people working in and near streets or planning events.

The *TBM* is intended to help:

- ❒ Expedite projects and keep workers safe, while;
- ❒ Minimizing inconvenience and interference to the public.

The primary reason streets exist is to provide safe and efficient mobility. To fulfill that purpose, streets must remain unrestricted and functional as much as possible.

The *TBM* augments and complements the *Manual on Uniform Traffic Control Devices (MUTCD)* and the Arizona Supplement to the *MUTCD*. The *TBM* was written to share the City's professional staff's experience as to what techniques have proven to work best on busy city streets. This is in full agreement with the *MUTCD* which specifies in Section 1A.09 (Engineering Study and Engineering Judgment), that the *MUTCD* should not be considered "a substitute for engineering judgment". That premise is important as no single written book could possibly cope with the diverse conditions a practitioner faces in controlling traffic on city streets.

Differences exist between urban streets and higher speed rural highways as a result of characteristics unique to these facilities. While urban engineers must deal with the same roadway curvature, grades, and traffic control issues that rural engineers face, they also are confronted on a daily basis with the following additional issues:

- ❒ Pedestrians with and without disabilities;
- ❒ Bicyclists;
- ❒ Access demands every 50 feet and intersections every 300 feet;
- ❒ Bus, Light Rail, and other forms of public transit;
- ❒ Economic impacts on abutting commercial properties.

Remember:
Providing effective temporary traffic control not only protects your workers but simultaneously protects the traveling public.

The City of Phoenix *TBM* was first published in 1961, with subsequent editions published in 1970, 1974, 1976, 1980, 1982, 1989, and 1998. To enable the *TBM* to be as helpful a guide as practical, the City of Phoenix may periodically update portions of the *TBM* using instructional addendums.

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Traffic Operations Division
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ACKNOWLEDGEMENTS

This 2007 edition of the *Traffic Barricade Manual* was developed based on the field experience of the city's most experienced traffic control inspectors and professional traffic engineers. Final content was determined by an evaluation of what additional guidance was necessary to best complement the *Arizona Manual on Uniform Traffic Control Devices*.

The primary goal of the *TBM* is to provide guidance for implementing the most effective temporary traffic control in our urban public streets. This goal was achieved through various inputs received from staff, contractors and the public. The City expresses its appreciation to all those who contributed data and ideas towards this effort.

The City is particularly appreciative of the general guidance and inputs provided by the following groups towards the completion of this *TBM*:

- City of Phoenix Mayor's Commission on Disability Issues
- American Traffic Safety Services Association (ATSSA), Arizona Chapter
- American Traffic Safety Services Association (ATSSA)
- Associated General Contractors of America (AGC), Arizona Chapter
- Utility companies serving Phoenix

The Street Transportation Department sincerely appreciates and wants to give credit to:

- CK Group, Inc. of Phoenix, Arizona for their creative formatting and effort to make this 2007 Traffic Barricade Manual print-ready;
- Trafficade Service, Inc. for both preparing the barricading illustrations throughout and for providing the setup used on the front cover.

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INTRODUCTION

The ***primary*** function of city street Right-of-Way (ROW) is to provide safe and efficient movement of people and goods, while its secondary function is to provide access for public utilities. To successfully accommodate both functions, city streets must be built with forethought as to how streets can be improved and/or repaired in a practical manner. Because the functions of a street are vitally important, essential construction and maintenance activities within city street ROW must be planned to minimize the disruption of traffic service and maximize access to adjacent land-use.

Definitions for specific terms used throughout this TBM are provided in Appendix A-2. Additionally, a few key definitions are provided below for user clarity:

- ❒ RMP: The Right of Way Management Program;
- ❒ RMP Administrator: The Administrator of RMP;
- ❒ RMP Agent: Any authorized agent working for the RMP Administrator
- ❒ RMP Client: Contractors, utility companies, city crews, or any other person authorized to work in city ROW.

Need for Traffic Barricade Manual (TBM)

In 1960, the City of Phoenix recognized the need for an official manual to provide positive and effective guidance for traffic control in construction and maintenance areas. City of Phoenix published the first *TBM*[1] in 1961, a full decade before the U.S. Department of Transportation added guidance for work zone traffic control in the *MUTCD*[2]. Since that time, the City of Phoenix Manual has become a common reference for urban work zones throughout the country. This edition is the ninth revision, with each being published as needed to share new ideas, while remaining in substantial conformance with the *MUTCD.*

This 2007 edition of the *TBM* adds new practices and introduces the basic precepts of the City's new and improved procedures for managing its street right-of-way more effectively. This *TBM* includes improved mechanisms for:

- ❒ Better ROW management
- ❒ Respecting and accommodating those with disabilities
- ❒ Gaining authorization to reserve and occupy public ROW
- ❒ Becoming certified for working in ROW
- ❒ Maintaining traffic signal visibility
- ❒ Improving both pedestrian and worker safety
- ❒ Coordinating project work with transit and schools

[1] Phoenix City Code, Section 36-300: Official *Traffic Barricade Manual*. Contractors, utilities and other agencies are to abide by applicable Phoenix Ordinances when working in public ROW.

[2] *Manual on Uniform Traffic Control Devices*, published by the U.S. Department of Transportation, Federal Highway Administration, as modified by the Arizona Supplement (Arizona law).

New features emphasized in this 9th Edition include the importance of:

Agency Self-Training: Effective management of street ROW can ONLY be sustained by a concerted effort of managers, superintendents, foremen, or lead personnel of all agencies. The *TBM* has been prepared to help managers properly train their staff as to which temporary traffic control methods work best on busy urban streets. It is incumbent upon agencies and contractors to familiarize and train those who supervise field crews to assure that crews are intimately familiar with practices contained in both the *TBM* and the *MUTCD*.

Phoenix Helping to Facilitate Training: The City of Phoenix has produced not only this *TBM*, but also video training programs that complement the *TBM*. Both are available to assist Contractors, barricade companies, utilities, and government agencies training their employees on proper temporary traffic control procedures.

Requesting Approval of New Devices: Given the constantly changing technology, the City encourages all participants to suggest new practices and products for consideration. However, new devices may not be used before approval. Requests for new product approval are to be sent to:

City of Phoenix

Attn: ROW Administrator
Street Transportation Department
200 West Washington, 6th Floor
Phoenix, AZ 85003

The City's ROW Administrator will evaluate products as soon as practical and will respond in writing within 90 days. ***The submittal needs to include:***

- ❒ Product to be used, including specifications;
- ❒ Specific application they wish to use the device for;
- ❒ Crashworthy test information;
- ❒ Any previous field testing of the device;
- ❒ Documentation of other jurisdictions that have approved the device.

This edition of the Traffic Barricade Manual will be effective at the time of publication, superseding all previous versions.

Purpose of the Traffic Barricade Manual

The purpose of the (*TBM*) is to help assure that during construction, maintenance and event activities on City streets, reasonably safe conditions are sustained for motorists, bicyclists, pedestrians, and workers. This 9th edition of the *TBM* augments the *MUTCD* with proven procedures that work well on different types of urban streets, including Major, Collector, and Local streets. If temporary traffic control is done properly, it will significantly reduce congestion and confusion by providing uniform applications of temporary traffic control. Each updated edition is written using the national *MUTCD* pertinent at the time as a base, and adding to it both national and local procedures that will work best on our urban streets.

The key purpose of the *TBM* is to gain uniformity in implementing temporary traffic control zones, and to get persons who restrict street and/or sidewalk functions to use the most effective and the least disruptive methodology.

This *TBM* establishes uniform procedures to be used in temporary traffic control zones for construction, maintenance, utility work, incident management, or events. The City of Phoenix has the responsibility to do so, and provisions contained in this *TBM* are all in substantial compliance with the *MUTCD* Section 1A.07 and 1A.08, which reads as follows:

"The responsibility and authority for the design, placement, operation, maintenance, and uniformity of traffic control devices shall rest with the public agency or the official having jurisdiction."

The key prerequisite for optimizing traffic control involves applying techniques described in this *TBM*, including applying engineering judgment to tailor traffic control to best fit a given situation. Typical applications of approved devices and procedures are illustrated in the *TBM*. Application of these devices to other situations are to be handled consistently with the methods illustrated.

The provisions established in this *TBM* ***apply to all*** persons occupying space otherwise used for transportation and utilities within Phoenix public ROW. For events, the provisions apply to the event sponsor.

Emergencies and incidents overseen by Police and Fire personnel such as vehicle crashes, hazardous waste emergencies, or other major occurrences often require immediate work without the opportunity to get temporary traffic control resources established. Nevertheless, even these incidents require use of innovative and effective temporary traffic control strategies including police power, use of emergency vehicles with flashing lights, manual control of traffic, and/or flaggers. Flares and roll-up emergency signs are also commonly used. The longer the duration of the incident, the more consideration should be given to using established traffic control techniques, such as those prescribed in this *TBM*.

RMP Client Notes:

POLICIES AND REGULATIONS

- Chapter 1
- Chapter 2

RMP Client Notes:

Chapter 1
RIGHT-OF-WAY MANAGEMENT

The following abbreviations will be used throughout this chapter:

- ❒ Right-of-Way - ROW
- ❒ Right-of-Way Management Staff/ Program - RMP
- ❒ Temporary Restriction and Closure System permit – TRACS
- ❒ Temporary Traffic Control devices – TTC devices

Improved management of public ROW will enhance traffic safety and mobility by minimizing unauthorized and improper street and sidewalk restrictions, and should they occur, minimize their duration. The **goal** is to gain high levels of compliance with temporary traffic control rules to ensure that their impact upon the traveling public is minimized without delaying projects.

What is Right-of-Way (ROW)?

ROW is land that has been dedicated or purchased for use of the traveling public at large. The land is essentially in trust, and is to be used for the public good rather than private gain. The City of Phoenix Street Transportation Department is the administrating custodian of the ROW, and is charged with the responsibility of making sure it is operated in a manner that optimizes its safe use for the public.

Why Are Right-of-Way Management Procedures Necessary?

Improved management of right-of-way is essential. When compliance with the *TBM* declines, rabid violations of the *TBM* result in imposing unfair delay, cost, inconvenience, and danger to the health, safety, and welfare of our citizens and visitors. Even though the *TBM* has always been thorough as to when and how to restrict the ROW, there unfortunately existed no effective enforcement mechanism other than to shut down jobs (which benefits nobody).

Improved management also offers benefits, including safety, to persons working in streets and sidewalks. Prior to September 1, 2004, persons needing to work in the ROW would request to do so, but the City had no way of assuring them their work would not be interrupted by competing events.

This new emphasis on better managing public ROW for everybody's benefit was unanimously approved by City Council on April 16, 2004 and added to City Code as Article XV on September 1, 2004.

Components of ROW Management

Four key components of ROW Management have been identified:

1. *Certification/ Training* - Agencies wanting to set and/or remove temporary traffic control must learn proper procedures in an annual training program and become certified.
2. *Penalties for Non-performance (Civil Sanctions)* – Fines can be assessed for misuse of the privilege of taking portions of the public ROW out of service.
3. *Parking Meter Bagging Fees* – Encourage keeping parking meters in-service.
4. *Authority to Impound Improper Devices* – The City may remove/store unauthorized or improper traffic control devices in emergency situations, or as a last resort, if the owner will not pick them up.

Training and certification of all agencies desiring to set up and/or take down TTC devices **shall** obtain **certification** from the City on an annual basis. This annual refresher course is designed to train new agency facilitators and share lessons learned from the prior year.

Two types of certification require annual training classes offered by the City**:**

Blanket Certification: The City "Blanket Certification" is available for any agency desiring to set **AND** remove signs and barricades in the ROW. It costs $750 annually (per agency not per trainee) to acquire the training and Blanket Certification. Blanket certification also requires successful completion of the American Traffic Safety Services Association (ATSSA) Certification at the Supervisory Level, or equivalent training as approved by the Phoenix RMP Administrator. To complete this three-part ATSSA Certification, contact ATSSA at 1-800-272-8772.

Take-Down Certification: "Take-Down Certification" is available for any agency that **ONLY** wants to remove signs and barricades from the ROW (not set them up). At times, authority to simply remove signs/barricades is desirable because it can be done immediately following work completion, eliminating service calls by barricade attendants. Take-Down certification is required annually and costs $250.

To register for training, call the RMP Administrative Aide at 602-534-5369. **Certifications MUST be renewed annually.**

The City Code authorizes taking measures necessary to preserve and protect use of the public ROW. This includes issuing civil sanctions for violating the *TBM or the TRACS Permit*. The civil sanctions for violations are shown in Table 3.

In the event of serious violations of the TRACS permit in the eyes of the RMP Administrator, additional penalties beyond the base civil sanctions are authorized including:

- ❒ Suspension of the TRACS permit up to five business days.
- ❒ Doubling sanctions up to $2500 for continued violations in a 24-hour period.

Table 3
SUMMARY OF VIOLATIONS AND PENALTIES

VIOLATION	DESCRIPTION	CIVIL SANCTION
#1	Creates imminent risk of injury to the public within ROW.	$1,500
#2	Restricting ROW without proper certification or TRACS permit.	$1,000
#3	Restricting traffic during peak hours as described in the *TBM* without authorization.	$1,000
#4	Failing to correct a violation, as listed, within the time period stated on the warning notice.	$1,000
#5	Restricting traffic at signal with no work occurring.	$1,000
#6	Closing sidewalk improperly, or without certification, or a TRACS permit.	$500
#7	Violating the restrictions, limits, times, and locations of the TRACS permit.	$500
#8	Missing or improper use of advance warning signs.	$500
#9	Missing or improper barricades/channelizing devices	$500
#10	Leaving advance warning signs facing traffic after restriction has been removed – per one traffic direction.	$250
#11	Leaving TTC devices in the ROW 24-hours after TRACS permit expires, unless a request for a permit extension is received prior to the expiration of permit	$250
#12	Use of "unacceptable" quality traffic control devices as described in the *TBM*	$250
#13	Rendering a bus stop inaccessible without relocating it or making other accommodations	$250

CLARIFICATIONS

- ❒ Repetitive sanctions: Each calendar day may be considered a separate violation.
- ❒ Impoundment of devices: ROW is not generally appropriate for storing TTC devices. Non-applicable devices are **not** to be left "active". Misused devices may be impounded by the City if:
  - ❖ Devices present a hazard/nuisance to the public, and:
  - ❖ Device owners ignore requests to remove them in a timely manner.

TTC devices that are impounded will be stored by the City, and owners may retrieve the devices subject to a fee that equitably recoups City costs.

Chapter 2

TEMPORARY RESTRICTION AND CLOSURE SYSTEM (TRACS) PERMIT

Public streets and sidewalks are public assets and as such, can only be taken out of service when deemed appropriate by the City. Individuals or agencies needing to use the ROW temporarily are required to seek a Temporary Restrictions and Closure (TRACS) Permit, which will authorize them to perform their work. The permit process enables the City to:

- ❒ **Ensure** the ROW is reserved (barring emergencies) for the permitted party's sole use, and take that loss of functionality into consideration when assessing other nearby permit requests.
- ❒ **Provide** appropriate advance notification to those who may be adversely affected by the TRACS restrictions.
- ❒ **Monitor** the quality of all ROW restrictions and spot check barricading/ safety precautions and their impacts on street operations.

The TRACS permit process, while designed to protect the service of public ROW, also takes the convenience of the contractor into consideration. For example, the TRACS permit system was designed so that:

- ❒ Permits can be efficiently requested electronically, contingent upon the applicant complying with ALL provisions of the *TBM* & any other special requirements that apply.
- ❒ Local streets and "short-duration" (less than one-hour) restrictions on any streets during non-peak hours are typically exempt from the TRACS permitting process. Exceptions include complete closures, downtown restrictions, and in other rare circumstances. Some projects, even on Local streets, may require a TRACS permit at the discretion of the RMP Administrator, such as when a partial closure may impose an undue hardship on a neighborhood, school, or public facility such as a fire station. Additionally, a TRACS permit may be required when prior agency performance indicates a need for special oversight.

Who Needs a TRACS Permit?

All persons, contractors, utilities, and other agencies including City departments (RMP Clients) ***must*** obtain a TRACS permit if they are to restrict access (partial or complete closures) on Major/Collector public streets, or complete closures of Local streets, sidewalks, bike lanes and alleys except as noted earlier in this chapter. The permit authorizes work to be performed within the public ROW, but

does *not completely* guarantee the requester exclusive rights to occupy a particular portion of the public ROW. Weather, emergencies, incidents, or other projects and special events might require temporary restriction of activities, but the City will try hard to reserve the space for efficient work.

Requests for TRACS permits must conform to regulations outlined in this manual, as well as "Special Traffic Regulations" or "Downtown District Special Provisions" listed in the City Project Specifications or Permit. Deviation (other than emergencies) from regulations must have prior approval of the RMP Administrator.

TRACS permits are typically not required for restrictions on Local streets, moving operations, and "short duration" restrictions (less than one hour). However, the City reserves the right to require a TRACS permit if determined beneficial.

How To Obtain a TRACS Permit

TRACS permits may be obtained through the following channels:

- ❒ **Special Events -** The assigned Event Coordinator
- ❒ **City Projects -** The assigned City Inspector
- ❒ **County Projects -** The County Project Supervisor
- ❒ **ADOT Projects -** The ADOT Resident Engineer

Other types of work may require a TRACS permit that don't fit into the above categories. Examples are work by city forces, work by railroads, work that results in construction materials being placed in streets, sidewalks or alleys. Another example is when temporary walkways or fences are built. Still another example is where building demolition results in restricting streets/sidewalks. TRACS permits may be obtained by contacting RMP Agents at: Phone: 602-262-6235; Fax: 602-256-3154; E-Mail: RMP@phoenix.gov.

Regulations That Govern TRACS Permits

TRACS permits carry with them up to four different types of regulations. The four include:

1. Advance Notice Regulations,
2. Citywide General Regulations,
3. Downtown Special Regulations,
4. Contractual Special Regulations

Advance Notice Regulations

Providing advance notice of restricting a public ROW is not just a courtesy, but is required to enable effective notification of emergency personnel and others affected. Permits will NOT be issued without the minimum required advance notice, except under emergency conditions. Emergency repair work requires urgent action, which

eliminates the opportunity to comply with advance notice requirements. Even in emergencies though, it is imperative that the restriction be called in to RMP Agents as soon as possible. The following telephone numbers should be used in case of emergency to report street, sidewalk, or alley closures:

- ❒ Business hours: (602) 262-6235 (7:30 a.m. to 5:00 p.m.)
- ❒ Non-business hours: (602) 262-6000 (Nights and Weekends)

The amount of advance notice needed is contingent upon the functional classification of the street(s) and the positioning within the streets. All restrictions/closures require coordination with the controlling authority. The type of restriction, the amount of advance notice, and the contact number, are shown below:

Type of Closure	Advance Notice Required	Contact Number
Full: Major/Collector street	72 hours	(602) 262-6235
Partial: Major/Collector street	48 hours	(602) 262-6235
Work near a traffic signal	48 hours	(602) 262-6021
Work affecting transit stops	48 hours	(602) 462-5741
Work affecting rail stops	48 hours	(602) 253-5000
Work affecting residential alleys	72 hours	(602) 262-7251
Work affecting commercial alleys		
Out of Downtown	24 hours	(602) 262-7251
Downtown	48 hours	(602) 262-7251

Work near a traffic signal **must** be coordinated with the Traffic Signal Shop. Work near a transit stop should be coordinated with Valley Metro Bus or Rail. Work in alleys should be coordinated with the Public Works/Sanitation Division.

The entities cited above should always be contacted to determine if the proposed work activity would adversely impact facilities prior to seeking a TRACS permit. Additionally, applicants seeking permits for commercial alley closures are required to coordinate with tenants adjacent to the alley prior to applying for the permit.

RMP reserves the right to deny any TRACS permit requests that is not in the best interest of the public.

Citywide General Regulations

Except during emergencies or when pre-approved in the contract, or by the RMP office, there are ten (10) general traffic regulations that apply during traffic restrictions.

1. Traffic restrictions ***are not*** permitted on Major/Collector streets during peak traffic hours (***6:00 a.m. to 8:30 a.m.*** and ***4:00 p.m. to 7:00 p.m***. weekdays).
2. RMP Clients **must** keep at least the following number of through lanes open:
   - ❒ If more than four lanes exist: Four lanes (two each way);

- ❒ If four or fewer lanes exist: Two lanes (one each way);
- ❒ On one-way streets: Two lanes open

3. **Special requirements for work near signals:** Special care is required when restricting traffic in the influence area of signals, because signals represent "pinch points" where road users only receive a portion of the "go" time. It is imperative that restrictions within 300' of traffic signals be minimized, and work planned to minimize the duration of such restrictions. At multi-lane signals, restrictions typically result in left-turn lanes being converted to a through lane in the direction needing the most help. (See Figures 16, 21 and 22).

   Whenever traffic in one direction at a multi-lane signalized intersection is restricted to only one through lane, the RMP Client are to provide a uniformed police officer to manually allocate available "green time" unless otherwise approved by the RMP Agents (See Chapter 7).

4. **Quality requirements for traffic lanes:** No lane (vehicle or bike) adjacent to pavement shall be considered "satisfactory," unless paved with hot or cold mix asphalt.

5. **Local access requirements:** Local access shall be maintained to all properties on all streets (Major, Collector and Local) at all possible times. When local access cannot be maintained, it is the responsibility of the RMP Client to notify the affected property owners, residents, or tenants a minimum of **72-*hours*** in advance. The reasons for the closures shall be fully explained to the affected people. Alternative access accommodations shall also be explained. Full, unimpeded access needs to be restored as soon as possible.

6. **Special access requirements to protect public facilities:** Access to fire stations, police stations, hospitals, transit facilities, bus stops, and schools shall be maintained at all times. When restrictions are necessary, the RMP Client shall coordinate such access restrictions with the responsible person in charge of the affected facility.

7. **Special pedestrian accommodations:** Access to sidewalks (paved or unpaved), marked and unmarked crosswalks (especially school crosswalks), and bus stops shall be maintained in a safe, usable condition as detailed in Chapter 3 of this TBM, and/or in the American with Disabilities Act (ADA) Accessibility Handbook. In the rare event when their function cannot be retained, it is the responsibility of the applicant to first prove that closure is necessary, and secondly to locate a safe and reasonable alternative walkway that is fully accessible to a pedestrian in a wheelchair. Generally, this requires the contractor to repair, cleanup, and prepare a detour route before the day of the restriction to provide continuous, safe, and accessible conditions for the duration of the work.

8. **Special Event Coordination Requirements:** Extraordinary coordination efforts are required for the Fiesta Bowl Parade, Fabulous Phoenix 4th of July, and other major special events when they conflict with construction and maintenance activities.

9. **Holiday Season Requirements:** (November 15 through January 1) creates congestion to the point that construction/ maintenance activities are minimized on Major/Collector Streets, which serve as primary access to large retail shopping centers citywide. Proposed restrictions that would interfere with decent traffic flow near retail shopping areas and on busy Major/Collector streets are normally denied, but when important, requires pre-approval by the RMP Agents. RMP Clients are encouraged to plan around this predictable, congested time period, as restrictions will rarely be approved.

Coordination with other Contractors **must** occur between projects to ensure compatibility of temporary traffic control systems, and to ensure that duplicate signing is not being used.

Downtown Special Regulations

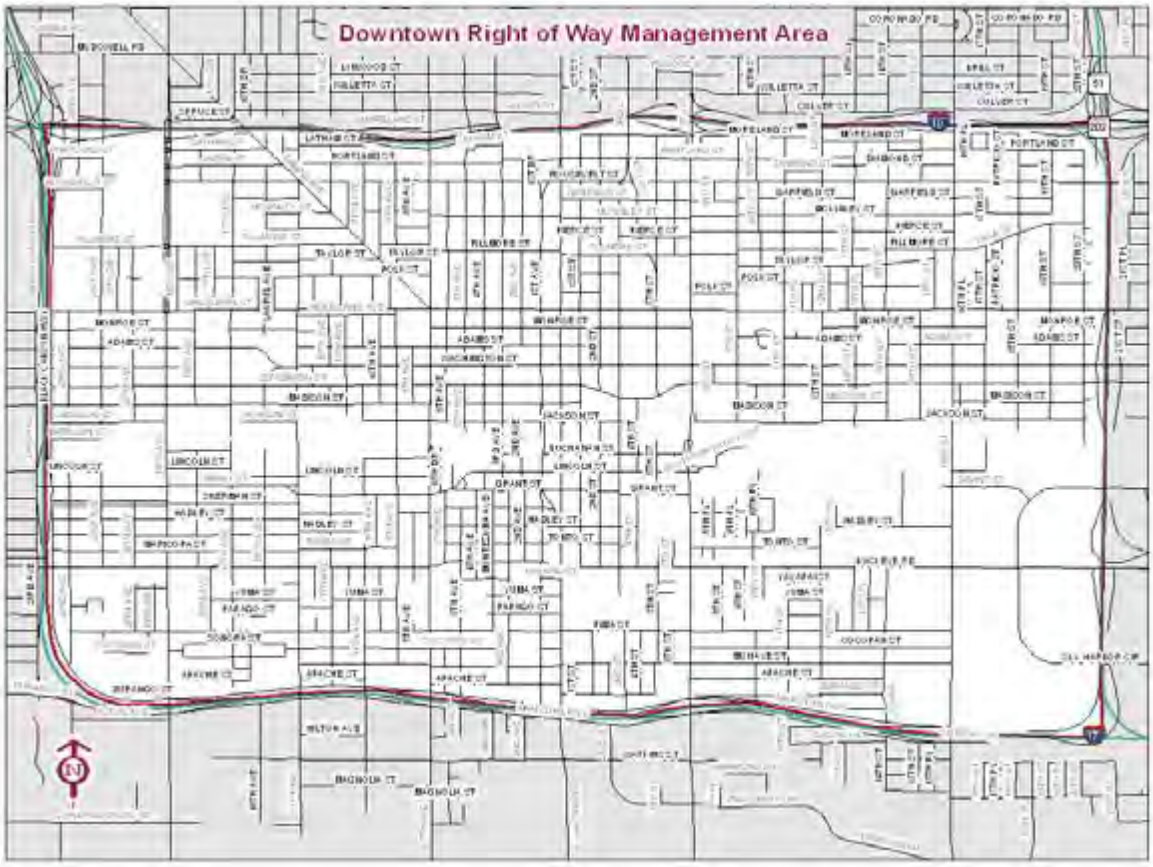
Given the intensity of activity occurring in Downtown Phoenix, there are unique additional protective requirements that apply to ensure coordination with businesses, residents, events, and other projects. The Downtown area is bounded by Maricopa Freeway (I-17) to the South; Papago Freeway (I-10) to the North; Black Canyon Freeway (I-17) to the West; and Papago Freeway (I-10) to the East. The Map on the following page illustrates the general limits of Downtown.

Except during emergency or when provided for either in the "General Traffic Regulations" or when given prior approval from a RMP Agent, the following ***minimum*** requirements are to prevail Downtown:

1. Traffic restrictions are not permitted on Major/Collector Streets during slightly modified hours from citywide, extending later during the morning peak hour and ending sooner during the evening peak hours (*6:00 a.m. to 9:00 a.m.* and *4:00 p.m. to 6:00* p.m.).
2. Even Local street restrictions/closures in downtown areas **require** TRACS permits.
3. A minimum of forty-eight (48) hours notice is required for partial closure of commercial alleys Downtown. These facilities are the lifeline to provide services to the adjacent land-uses. Eliminating access cannot be taken lightly, as the impact of poor coordination will be felt immediately. Prior to the restriction, the RMP Client **shall** coordinate with adjacent tenants. Suitable arrangements for alley service shall be made and coordinated with the Downtown Phoenix Partnership at 602-254-8696 and the Downtown Police Unit at 602-534-6432.
4. A minimum of seventy-two (72) hours notice is required for complete closure of commercial alleys.

Contractual Special Regulations

Other special regulations may be imposed either through the contract, or as part of the TRACS process, when deemed in the best interest of the public.



Temporary Traffic Control Plans: When are they required?

Good, effective traffic control planning requires forethought. It is for that reason that Traffic Control Plans (TCPs), prepared ahead of time can make construction/ maintenance work progress more efficiently and offer a higher degree of safety. Depending on the complexity of the temporary traffic control needed, the type of restriction requested, the type of traffic that exists, and the overall impact on adjacent land use, a TCP may be required.

On most minor projects, the typical graphics contained in this *TBM* can be applied, and constitute a pre-approved TCP. In some cases, Special Traffic Regulations or Provisions may be incorporated into bid documents that empower RMP Clients to develop alternative TCPs. Alternative TCPs may be approved if the RMP Administrator finds the alternative TCP yields superior results.

The primary purpose of a *TCP* is to encourage proper planning as to the time of day, sequence of construction, degree of restriction required, and temporary traffic control needed. Good, advance planning can provide not only for efficient work, but simultaneously minimizes interference to traffic service. The following addresses when *TCPs* may be required:

- ❒ *TCPs* may range in complexity from use of typical illustrations depicted in this *TBM* to a detailed site plan showing signing, striping, barricading, detours, pedestrian walkways, bike lanes, construction fences and project phasing. In all cases, the required *TCP* needs to satisfactorily, and responsibly address requirements of this *TBM*. For large or unusual projects, advance consultation and review during the planning/ design phase is ***strongly encouraged*** to preclude avoidable delays. Pre-consultation also ensures that projects become a truly cooperative and partnered effort between those needing to work in the ROW, and those needing to use the public ROW.
- ❒ A *TCP* is usually required for long-term or complex projects such as detours and channelization for bridge construction, street restrictions for building construction walkways and fences, major utility construction, special events, and Major street closures.
- ❒ *TCPs* may be required for other projects and permits, as needed, at the discretion of the Project Inspector, RMP, and/ or other City department officials.
- ❒ *TCPs* showing temporary striping and signing are required to be drawn to scale and at the discretion of the RMP Administrator, sealed by a Professional Engineer. Temporary striping in work zones is the responsibility of the RMP Client.

Due to the nature of traffic operations along frontage roads and at or near freeway traffic interchanges, a *TCP* should be prepared for traffic restrictions on those facilities. **Prior approval from the Arizona Department of Transportation is typically required.**

ACCOMMODATING PEDESTRIANS AND WORKER SAFETY

- Chapter 3
- Chapter 4

RMP Client Notes:

Chapter 3

PEDESTRIAN SAFETY AND SERVICE CONSIDERATIONS

Proper advanced planning for pedestrians near temporary work zones is **every bit** as important as planning for vehicular traffic. It is particularly important that anytime pedestrian service will be affected (transit stops, access, or sidewalks) by a project, RMP Clients doing the project give full consideration to the adverse impacts their work may cause. A goal of the City is to minimize adverse impacts anytime normal pedestrian service is threatened. This requires proper forethought to preserving as much service as possible. When service needs disrupting, alternative but practical service needs to be provided. Cognitive or visually impaired pedestrians should not have to face unnecessary inconvenience or be subjected to consequences, simply because those working in the street failed to consider them.

Special Pedestrian Considerations

Except during emergencies, pedestrian service/safety needs to be fully preserved at crosswalks (marked/ unmarked) and other facilities used by pedestrians. Facilities must be kept safe and usable by the RMP Client at all times, unless the RMP Administrator gives ***prior*** approval. If temporary disruptions of pedestrians are required, RMP Clients need to accommodate pedestrians to the satisfaction of the RMP Administrator.

Those whose work will influence pedestrians need to give forethought to the most effective ways of maintaining access to bus stops, local merchants, facilities, and crosswalks. The provisions for protection of pedestrian service outlined in this *TBM* are applicable to all persons doing work that influences pedestrian facilities (sidewalks or marked/unmarked crosswalks). The six fundamental principles for successfully accommodating pedestrians through work zones are:

1. Traffic and pedestrian safety must be an integral and high-priority element in every project, from planning through design and construction.
2. Pedestrian and traffic movements should be inhibited as little as practical, and planned to reduce exposure to potential hazards.
3. Pedestrians and motorists should be guided in a clear and positive manner while approaching, traversing, and leaving work sites.
4. Routine inspection of traffic control devices must be performed.
5. Personnel must be adequately trained in the proper management of pedestrian and traffic control, so they are qualified to make work zone safety decisions in the selection, placement, and maintenance of traffic control devices.
6. Pedestrian paths through the work zones should replicate as nearly as possible the elements of the existing path and be accessible to people in wheelchairs.

Full utility of a pedestrian facility is achieved by keeping it entirely clear. Where the full facility cannot be kept functional, it is essential that a clear path be provided that is a minimum of 36-inches in width (ADA). Accordingly, special care is important in

placing traffic control devices and other equipment/ material. If a 36-inch clear walkable surface cannot be kept clear, it is not considered functional. On the rare occasion when it is required to take sidewalks out of service, alternative and accessible provisions must be made. The only exception to this is on the very rare occasion when a walkway has to be ***totally*** closed for safety reasons (this can only be done if no businesses or bus stops require access beyond the closure).

When a temporary work zone requires the closing of pedestrian facilities such as marked or unmarked crosswalks, or walkways, provisions shall be made in advance by the contractor to provide fully accessible, alternate temporary walkways that direct pedestrians through a reasonably safe, usable, and convenient route. RMP Clients requesting a complete or partial walkway closure on one side of the street must first diligently accommodate pedestrians on accessible alternative paths on the same side of the street to prevent:

- ❒ Pedestrians from having to cross streets twice
- ❒ Disruption of transit services
- ❒ Interference with business accesses

Temporary walkways can be designated using portions of the existing sidewalk, or on rare occasions, in the adjacent parking lane if conditions and capacity permit. If a moving traffic lane is authorized, extraordinary care must be taken to properly shield and protect the walkway from errant vehicles.

If after due deliberation, walkway closures are necessary, the alternative provisions must make sure that pedestrians are provided with a suitable path consistent with ADA regulations and the facilities should only be taken out of service for the minimum time necessary.

Additionally, the following actions need to be taken:

- ❒ Walkways shall always be clearly identified, wheelchair usable, shielded from motor vehicle traffic, and free of pedestrian hazards such as holes, debris, gravel, mud, etc.
- ❒ Unless a covered walkway or construction fence is required, barricades, cones and signs may be used, as deemed appropriate. For temporary walkways see Figures 1 & 2.
- ❒ When pedestrian paths are redirected on the same side of the street, the “PEDESTRIAN” sign, with an appropriate direction arrow, shall be used to direct pedestrians to the alternate walkway.

When pedestrian paths are being maintained in advance of a full closure, the “SIDEWALK CLOSED AHEAD” sign should be placed at the appropriate end(s) of the block where pedestrians have the last opportunity to use a crosswalk to cross the street. Special care needs to be taken to place the sign so it is prominently visible, yet leaves the required *36*-inch minimum width. Additionally, reasonable care needs to be

taken to assure that sign placement leaves adequate maneuvering room for disabled users to be able to cross to the other side of the street, or continue on the accessible path to their regular destination. (See Figures 1 and 2).

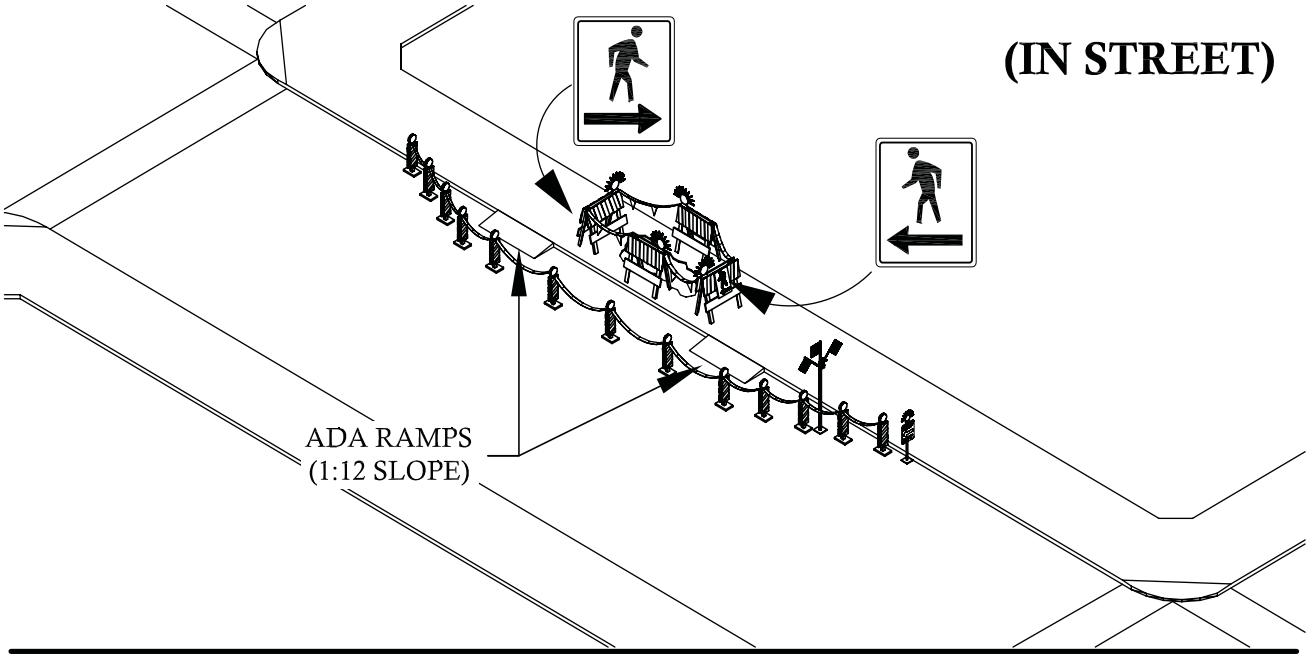
For complete sidewalk closures, “SIDEWALK CLOSED CROSS HERE” signs shall be provided at the crosswalk nearest each end of the closure. Where there is no pedestrian landing area on the far side of an intersection, “near-side” signs with the same message supplemented with additional standard barricades, should be placed to clarify the sidewalk on the far side is inaccessible. “SIDEWALK CLOSED” signs shall also be placed adjacent to the actual sidewalk closure.

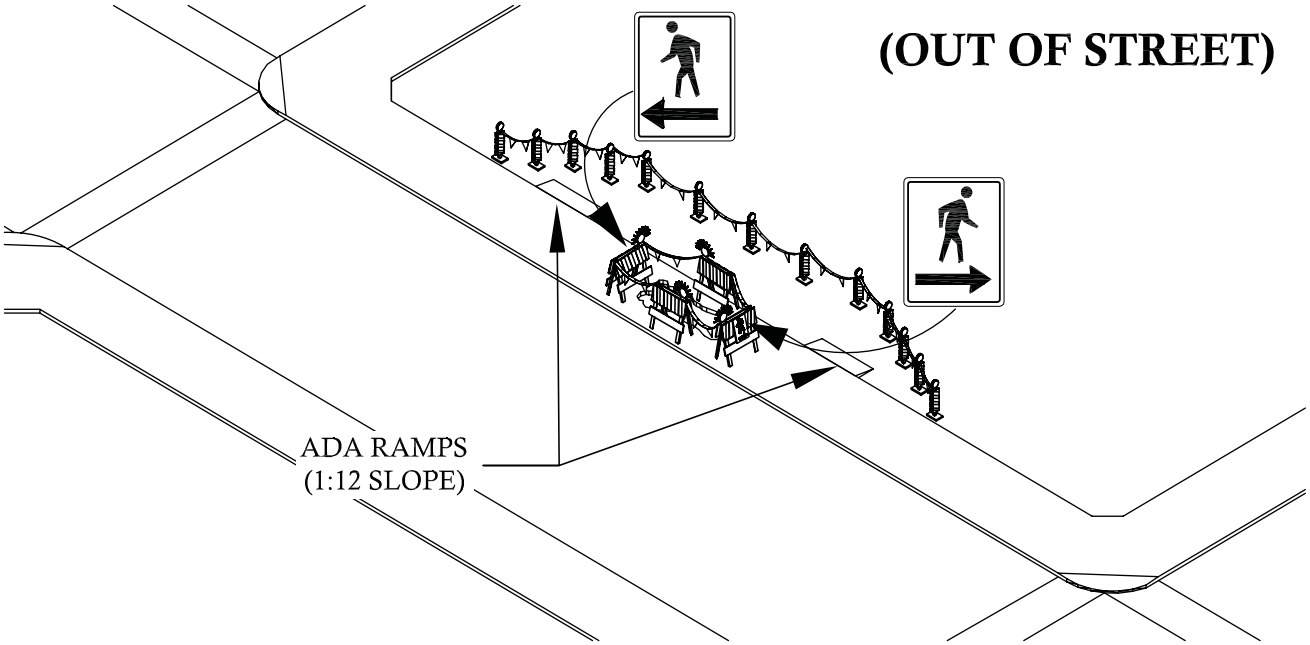
Special Pedestrian Requirements for Demolition and Construction of Buildings

Downtown, where demolition or construction of buildings near sidewalks is common, special provisions need to be made to protect pedestrians by separating them from construction activity. Gates and/or temporary fencing serving as access to the construction site shall not open out into the street or impede pedestrian walkways (See Figure 3). If the activity has the potential for dropping loads or creating hazards for pedestrians on the sidewalk, a covered walkway shall be provided for pedestrian protection. This is commonly necessary when the building wall is within six feet of the walkway, or when the distance of the walkway from the building is less than one-half the height of the exterior wall. Engineering judgment will determine when a covered walkway is necessary, but is generally not required if the walkway is a greater distance than one-half of the height of the exterior wall from the building. In that case, a construction fence is typically required to be installed prior to beginning either construction or demolition sites. Access to fire hydrants, traffic signal control boxes, manholes, and other utilities shall be maintained at all times

A contractor intending to demolish or construct buildings in the influence area of pedestrian facilities must submit a professionally prepared temporary work zone traffic control and/or walkway plans to the RMP Administrator for prior approval. No loading or unloading of material, staging or stopping of vehicles, will be allowed on the street side of walkways and fences without approval from RMP Agents.

Figure 1





Walkway Design Features:

- 36"min. width, w/5' passing opportunities every 200'.
- All-weather, compacted, smooth surface w/dust control.
- 5% slope max either direction.
- No abrupt change in grade height > ½".

NOTE: Circumstances may require ped guards, or curb control changes.

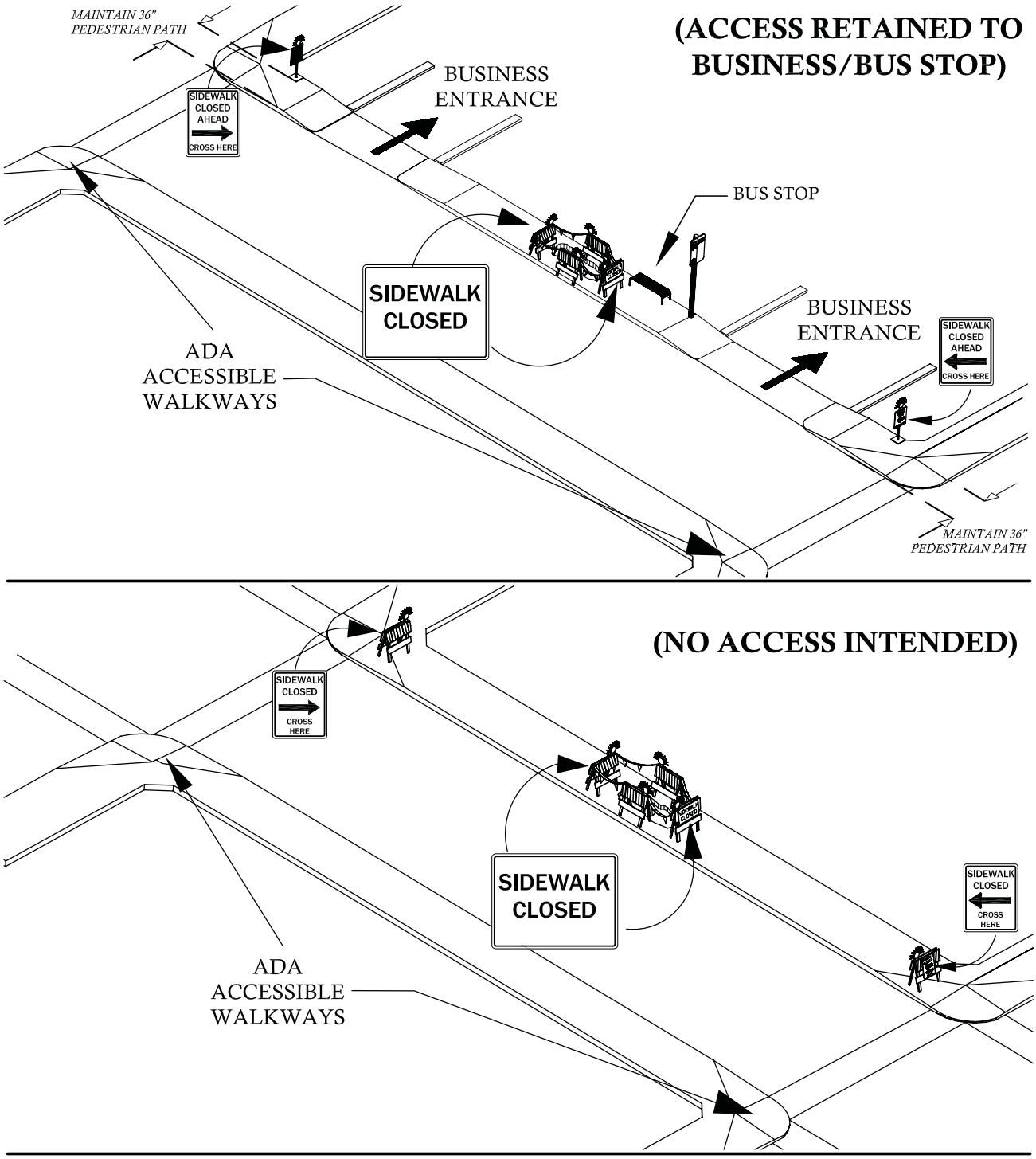
24 HOUR
CHANNELIZATION SHOWN

Steady Burn Lights

Flashing Lights

SIDEWALK DIVERSIONS

Figure 2



24 HOUR CHANNELIZATION SHOWN

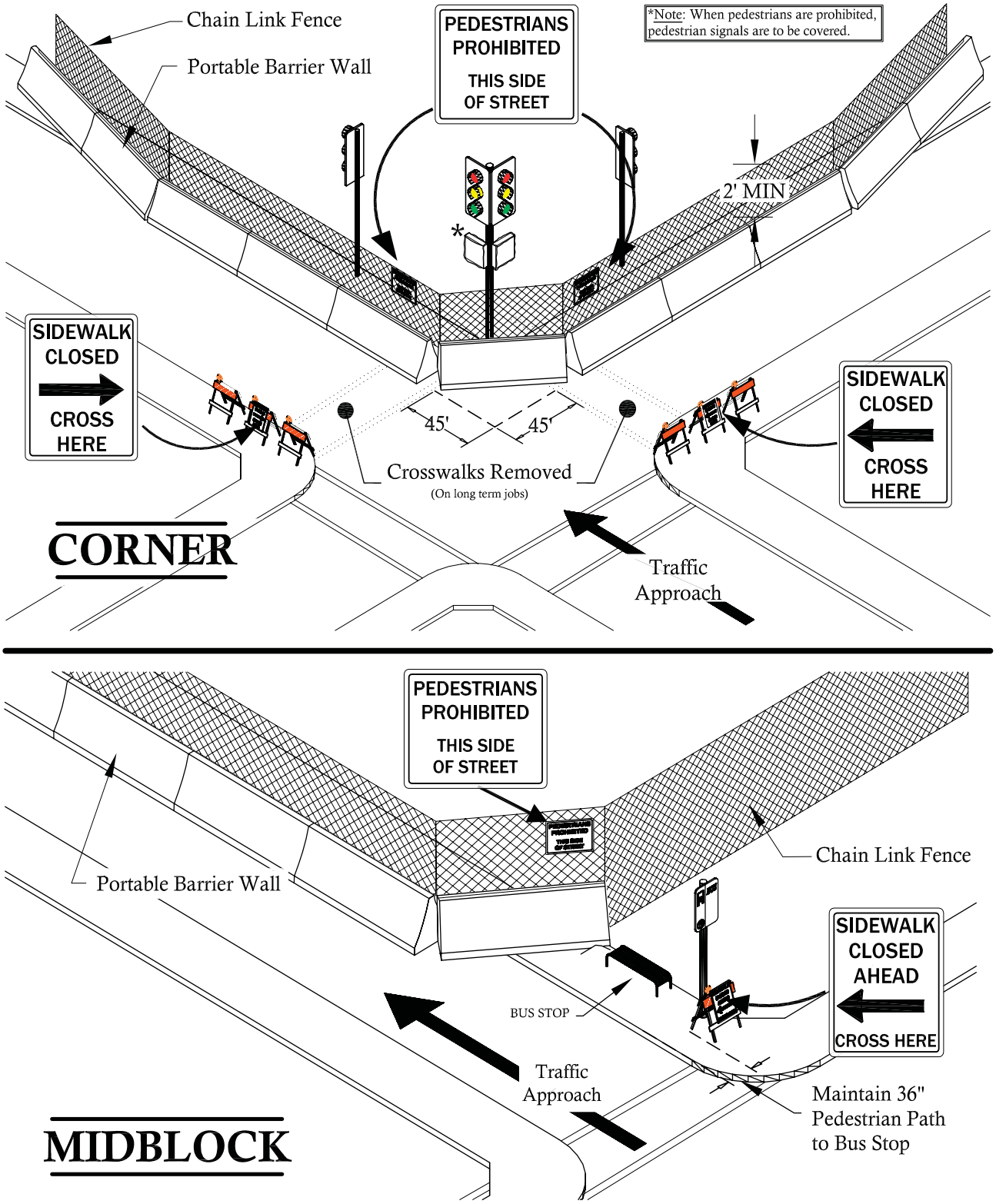
Steady Burn Lights

Flashing Lights

MANDATORY: All complete sidewalk closures shall require prior approval from Right-of-Way Management.

SIDEWALK CLOSURES

Figure 3



CONSTRUCTION FENCES

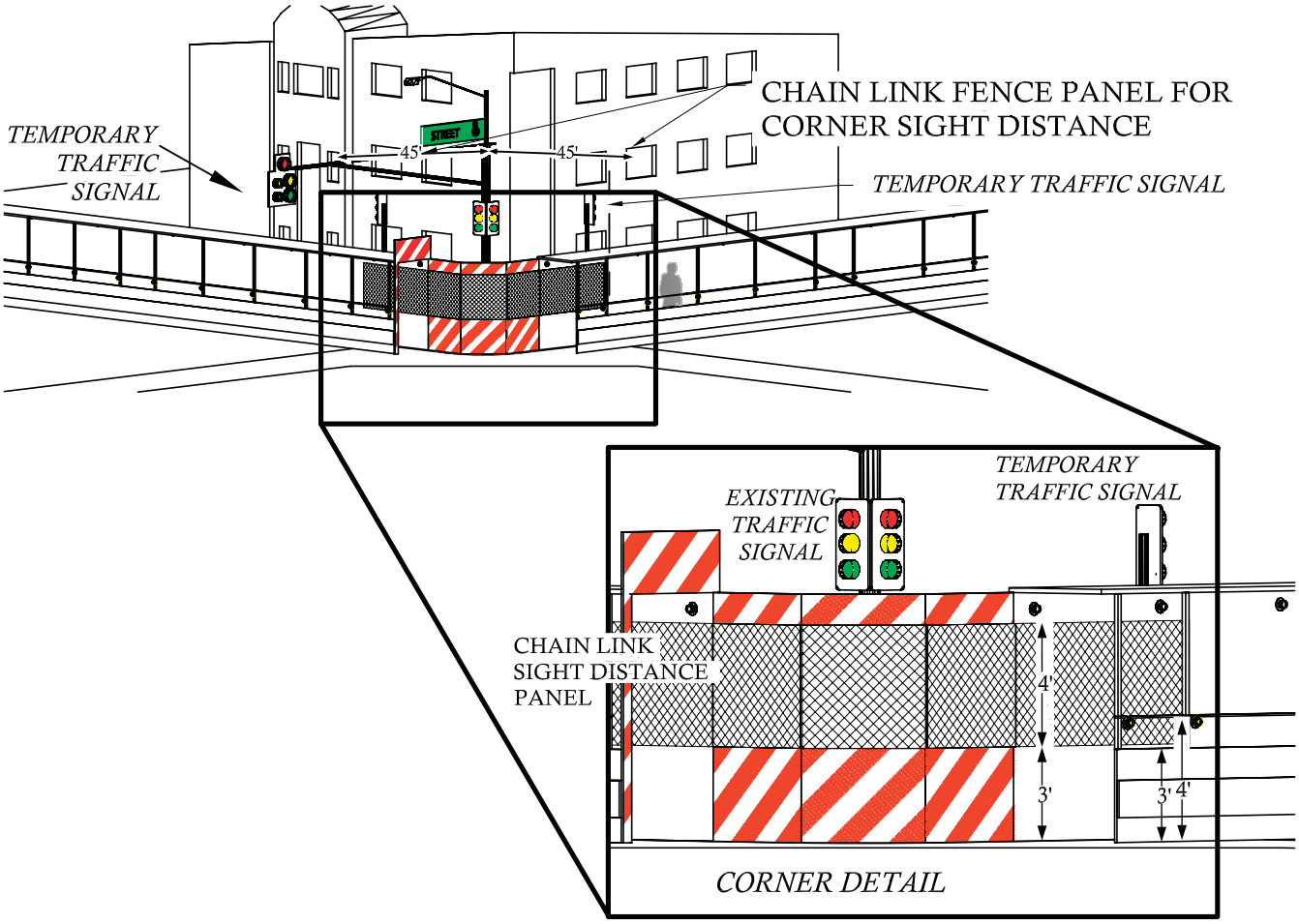
Covered Pedestrian Walkways

Constructing a covered walkway in the ROW requires a separate construction-building permit from the City of Phoenix, Development Services Department (See Figure 4).

Covered walkway requirements include:

- ❒ Constructed of suitable material to support the loads to be imposed upon the structure. Minimum design requirements for the floor and roof shall be 150 pounds per square foot live load uniformly loaded.
- ❒ Maintaining the walkway in good, clean condition, free of any debris, and fresh in appearance at all times.
- ❒ Repair damaged walkways and fences immediately.

Figure 4



COVERED PEDESTRIAN WALKWAYS

Chapter 4

WORKER SAFETY

Everybody benefits when workers are able to complete their work in a safe environment. The unexpected nature of work zones, and the constantly changing conditions that exist within work zones make workers particularly vulnerable to errant drivers. This chapter provides guidance as to the three key components of promoting worker safety:

- ❒ Training: Workers should be trained by employers as to ways in which worker vulnerability is minimized
- ❒ Safety Apparel: Workers exposed to risks of moving roadway traffic or work equipment should wear high-visibility safety apparel
- ❒ Work Areas: Should be planned so as to minimize worker exposure to risk from roadway traffic and work equipment

The proper set up of TTC devices is a key procedure for promoting worker safety, but this chapter additionally addresses how service vehicles of workers can help promote worker safety. This chapter augments the national *MUTCD* with regard to surveyors who have the difficult job of working within roadways, often for short enough periods of time where it is not practical to set up a full array of devices.

How Service Vehicles Can Best Be Used to Promote Safety

Worker safety can be enhanced with proper use of service vehicles. Service vehicles covered in this section are those required by the nature of their work to travel slowly, or stop for brief periods on City streets. Some large vehicles that routinely stop in streets, like sanitation trucks and busses, are not considered service vehicles. They are exempt from the requirements spelled out in this chapter due to their sheer size, design, and/or their alternative provisions for safety. Service vehicle operations are the backbone of the fleet, which allow effective maintenance of utilities, traffic control, pavement, and other roadway infrastructure.

The City of Phoenix recognized many years ago (long before Part 6 of the *MUTCD* was written) that service vehicles supporting short-term or mobile work warrant special procedures to complete their work safely and efficiently. If the full array of traffic control required for intermediate or long-term activity was required for service vehicles, the result could be counter-productive to both safety and functionality of the street system. The set-up and take-down time, effort, and cost would typically take longer than the time needed to complete the task at hand. If required, it would result in the general public being the overall loser, as not only would road closures lose functionality of streets for longer than necessary, but workers would be exposed to a greater risk longer than necessary.

Instead, this section outlines special equipment that service vehicles may use in place of the full array of devices specified throughout this *TBM* when performing short-

term/ mobile activities. This special equipment is dominant and has been found to provide at least equal overall safety, as if the full array of devices were used. Arizona Revised Statutes already require vehicles to be equipped with warning devices deemed adequate for normal stops while driving in traffic. The special equipment described in this chapter is specifically for service vehicles that stop frequently in traffic, or need to be positioned unusually in the traveled way.

Service vehicle operations **are prohibited** on Major/Collector streets during peak traffic hours, except when authorized by RMP Agents or under emergency/disaster conditions governed by Police and Fire personnel. During all other times, service vehicle operators need to apply forethought to minimize the extent of restrictions.

When service vehicles must travel slowly or stop for brief periods, they are to display one of the following operating high level warning light systems. (See Figure 5).

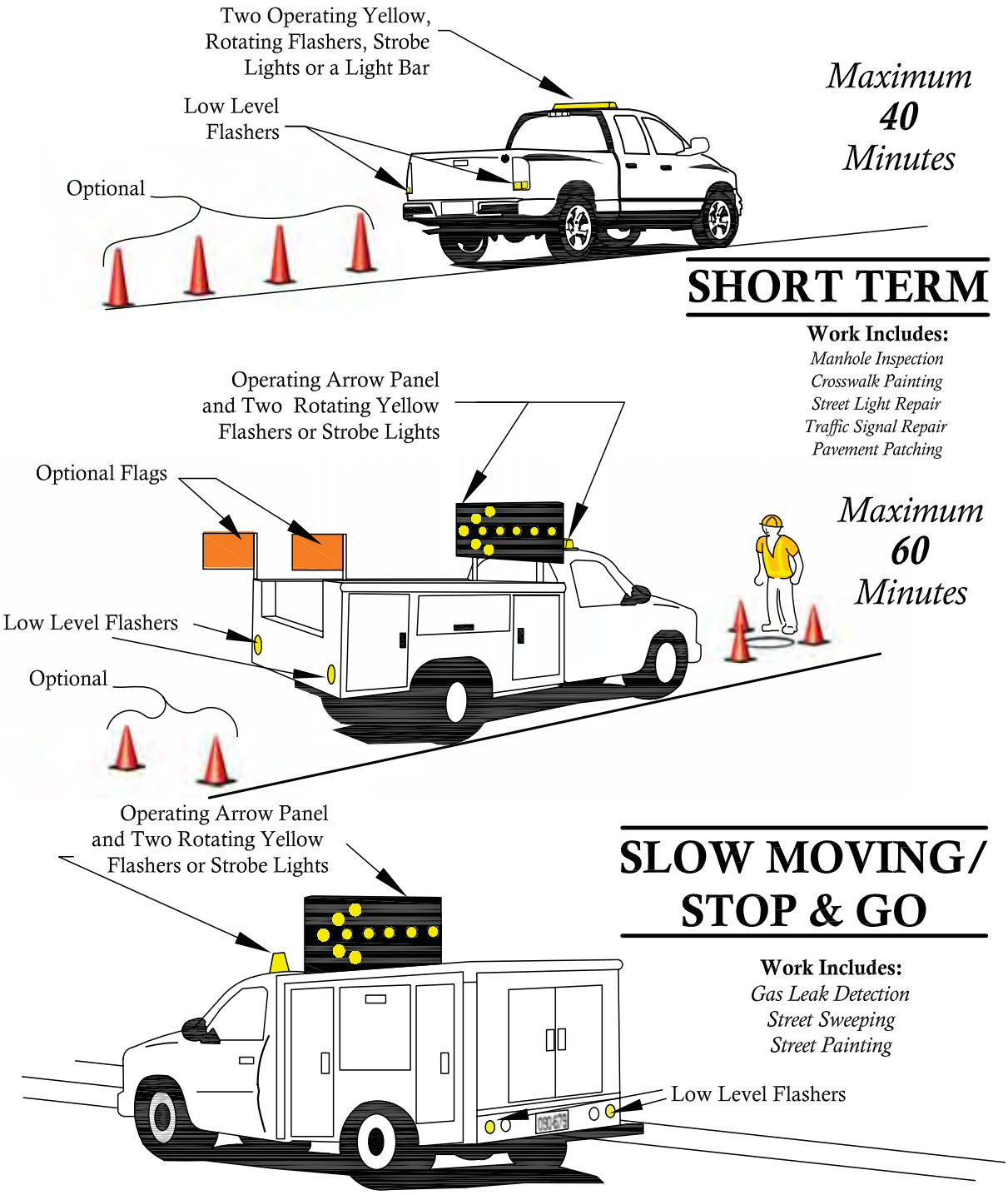
- ❒ **Two Rotating Flashers or Strobe Light High Level Warning Light Devices** These devices are designed to provide 360-degree visibility and may be used in combination with, or incorporated into a "light bar" for added visibility.
- ❒ **One Arrow Panel** - Approved arrow panels shall be used in combination with rotating flashers, or strobe lights to highlight service vehicles, and warn motorists of lane shifts or work activities.

Flashing lights on service vehicles need to be located so that they remain in full view, front and rear, and are not obscured by dump beds, vehicle-mounted equipment, or work activities. Minimum mounting height should be 8 feet. The arrow panel shall be mounted on a vehicle, a trailer, or other suitable support should be provided with remote controls. Minimum-mounting height should be 8 feet from the roadway to the bottom of the panel, except on vehicle-mounted panels, which should be as high as practicable.

When service vehicles stop for brief periods, standard operating procedure will be to display the special warning devices and the vehicle's four-way hazard warning flashers. Optionally, in busy traffic areas, and if sufficient distance exists to do so, traffic cones may be helpful when placed a minimum of 10 feet from the rear of the vehicle or in a short taper (using six cones spread out about 50 feet). Placing flags on the upper rear corners of the vehicle has been found to be a relatively inexpensive way to further enhance visibility.

Arrow panels are powerful because they provide both warning and directional information ahead of time to motorists when the restriction causes traffic to change lanes. Because they are more effective than flashing lights, arrow panels are certainly preferable and in some cases, mandatory to support work zones.

Figure 5



SERVICE VEHICLE OPERATION

With the special equipment specified below, service vehicles are authorized to conduct short-term/mobile work without setting up the normal array of TTC devices for up to:

- ❒ **40 minutes if equipped** with two rotating flashing or strobe light high level warning devices.
- ❒ **60 minutes if equipped** with approved arrow panels.

The more extensive signing, barricading, and channelization specified elsewhere in this *TBM* are necessary even for service vehicles if they will be stopped for more than one hour. Similarly, signs, barricades, and channelizing devices should be considered for use in slow-moving or intermittent stop and go operations, such as pavement crack sealing and tree trimming on Major/Collector streets. These devices normally can be set-up in short sections and moved as work progresses.

Special Information for Surveyor Workers

Pedestrian fatalities account for one of every three traffic fatalities. The very nature of urban survey work is potentially hazardous, not only for the survey workers themselves, but also for the traveling public. The surveyor enters the street as a pedestrian, but becomes a worker once he/she ceases crossing the street. Workers are responsible for making sure appropriate traffic control is in place, exercising due diligence, and wearing protective clothing/ apparel with high visibility markings, designed to clearly identify the wearer as a person.

For safety and efficiency reasons, **surveying is not permitted on Major/Collector streets during peak traffic hours,** except when such work is being performed in areas that are already under construction, and the contract special provisions allow restrictions, or with the prior approval of the RMP Administrator.

When surveyors need to temporarily work in the street, surveyors must have:

- ❒ Class 3 type *MUTCD* recommended vests.
- ❒ Traffic cones or standard barricade devices.
- ❒ A flagger or a police officer whenever unable to see oncoming traffic.

When surveyors are working in areas under construction, the approved temporary traffic regulations applying to the RMP Client apply to the surveyor as well. All traffic restrictions shall be coordinated in advance through the assigned inspection group or other authorized agency. “SURVEY CREW” warning signs properly placed in advance of the working area is valuable in alerting motorists of the surveyor’s presence in traffic. The flag type-high level warning device is extremely valuable for survey work, as it may be seen over the top of preceding vehicles. Accordingly, the ***use of high level warning devices is mandatory*** any time an instrument is set up in the street.

When survey work requires restricting a full traffic lane, or when restricting traffic during hours of darkness, temporary traffic control devices (advance warning signs, barricades, and channelization) shall be provided, and placed properly as required elsewhere in this ***TBM*** for those particular conditions.

TRAFFIC CONTROL

- Chapter 5
- Chapter 6
- Chapter 7

RMP Client Notes:

Chapter 5

EXISTING TRAFFIC CONTROL DEVICES

RMP Clients are responsible for maintaining all traffic signs and pavement markings in their construction zones and for restoring the permanent traffic signs and pavement markings upon completion of their work.

During temporary traffic control operations, it is important to make sure that existing traffic control devices remain compatible with temporary traffic control being imposed. This includes, but is not limited to, signs, parking meters, traffic signals, and pavement markings. The devices that remain applicable to the affected traffic must be maintained, while other devices must be covered, relocated, or in rare cases, completely removed. Requirements for each group of devices are detailed in this section.

Traffic Signs

All post mounted signs shall be maintained upright, clean, and in full view of the intended traffic by RMP Clients at all times. If these signs interfere with construction, the RMP Clients shall temporarily relocate the signs to permit construction. However, the devices must be kept in full effective view of intended traffic. Portable signs may be helpful to augment other signs, which temporarily cannot be placed in their optimum position.

Existing signs that are no longer applicable shall be removed by the RMP Client, taking care not to damage the signs. The signs are to be salvaged by carefully storing them out of the way on the adjacent property line. ***The Street Transportation Department, Sign Shop shall be notified immediately of all sign removals by calling (602) 262-6449.*** When construction nears completion, the assigned inspector shall notify the Sign Shop to reset all needed signs at permanent locations.

Traffic Signals

The RMP Client shall notify the ***Traffic Signal Shop (602-262-6021)*** a minimum of 48-hours prior to the start of any underground construction in the vicinity of signalized intersections.

Procedures to be Used Near Traffic Signals

The RMP Clients shall keep existing signal equipment fully operational, and in full view of the intended traffic at all times. The only exception is when pre-approved by the City Signal Engineer (602-262-4693) or when reflected in City Project/ Permit/Plans and Specifications. When necessary, vehicle detector sensing devices (typically inductive loops) and pedestrian push buttons may be deactivated with PRIOR approval. However, they shall be reactivated or replaced by the contractor expeditiously when work is completed. The request must be accompanied by a full explanation of why it is necessary to do so, what alternative procedures shall be used to accommodate traffic, and what efforts are being made to minimize the time the detectors will be out of service. Left-turn arrows shall be de-activated when left-turn prohibitions are in effect. If traffic conditions are such that traffic signals cannot efficiently operate without sensor loops, the contractor may have to

employ, at their cost, alternative detection devices. Twenty-four hour advance notice to the Signal Shop is required for this type of work.

The Signal Shop will, upon request, provide the approximate locations of all underground signal equipment (conduits, junction boxes, vehicle detector sensing devices, etc.). The exact location of underground equipment shall be determined by the RMP Clients prior to excavation. During all work, the RMP Clients shall exercise due care to prevent damage to existing traffic signal equipment. Should damage occur, the Signal Shop must be notified immediately so that they can restore traffic signal operations.

Responsibility for permanent repair/replacement of damaged equipment shall be:

- ❒ **At the RMP Clients expense IF** the damage done was not preceded by a request for City blue stake/identification of equipment prior to the start of work.

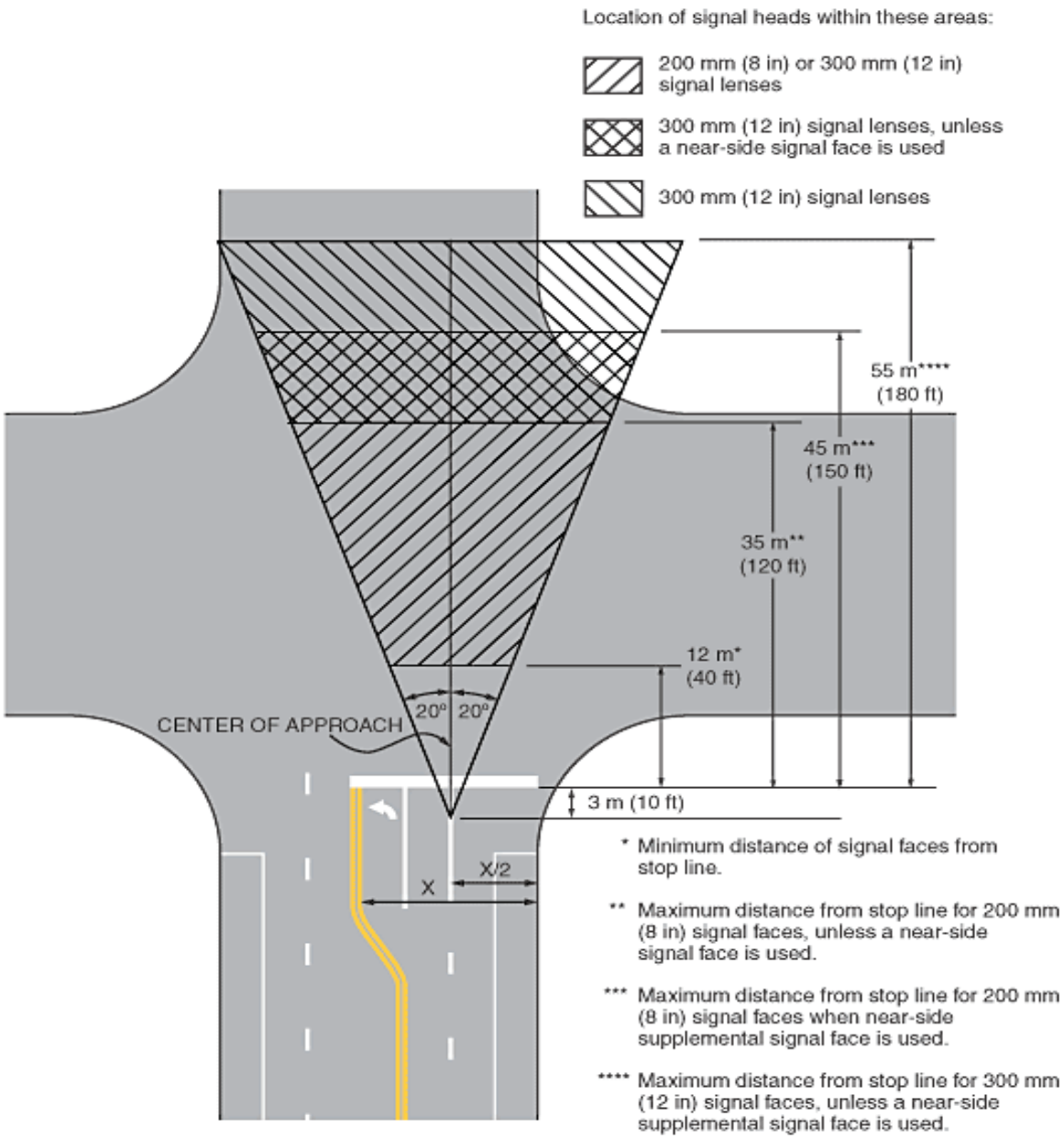
- ❒ **At the City's expense, IF** the damage dome was preceded by a City blue stake/identification and appropriate time given for the City to do so. When existing signal equipment cannot be maintained, the RMP Client **shall, at their expense**, have a qualified electrical contractor move the equipment to a temporary location. Another option is to provide temporary equipment capable of ensuring continuity of all signal functions (except vehicle detector sensing devices). The location and type of temporary signal equipment must be pre-approved by the City Signal Engineer.

Signal equipment modifications shall be coordinated with the Signal Shop by the RMP Client a minimum of **24-hours** in advance of work. When temporary or new equipment is installed to replace existing equipment, it shall be fully operational before the existing equipment is removed. The RMP Client shall restore signal equipment to its proper location, as soon as possible after all the work in the immediate area is completed. Traffic signal pedestrian push buttons must remain operational and accessible to pedestrians at all times unless provisions are made for manual control, or fixed-time operation of the signal.

Traffic Signal Head Requirements

It is important that drivers be provided with at least two signal indications within the 40-degree cone of vision approaching the signal. If traffic is to be repositioned in such a manner that two signal heads will **not** be within the driver's 40 degree cone of vision, the City Signal Engineer shall be contacted immediately at 602-262-4693.

DRIVER'S CONE OF VISION AT TRAFFIC SIGNALS



Pavement Markings and Other Delineations

Existing pavement markings that cause driver confusion by seriously conflicting with the intended vehicle path (indicated by barricades and channelization devices) shall be removed or obliterated by the RMP Clients, as directed by the RMP Agent. The City purposefully requires use of portable traffic control devices to substitute for pavement markings within work zones because these large, three-dimensional devices dominate surface pavement markings to the point that they typically eliminate confusion. This usually means that substantial pavement marking obliteration is only required on long term or high-speed projects such as detours, special channelization for bridge construction, realignment for building construction, and similar fixed location projects. However, using engineering judgment, the City reserves the right to require the removal or obliteration of existing pavement markings anywhere that driver confusion exists due to pavement markings.

If pavement-marking obliteration is needed, a method should be used which leaves a minimum of pavement scars and effectively removes existing markings. Sandblasting, high-pressure washing, grinding, or other methods may be used to remove existing markings. Slurry seal (MAG Specification, Section 332) may also be used to obliterate markings.

When used, slurry seal shall be applied over existing markings in strips at least 24-inches wide. Markings that become exposed shall be recovered with slurry seal. Painting over existing markings with black paint or asphalt material is not typically acceptable, except for short durations with pre-approval from the RMP Agent.

Parking Meters

The RMP Client shall keep metered parking spaces functional and open for parking at all possible times. When parking meters must be hooded or removed, the RMP Client shall notify the appropriate City Project Inspector who in turn, will notify the RMP Agent. The Parking Meter staff will responsively hood/remove meters when warranted.

To minimize potential damage/theft to meters, there are times when meter heads may need to be removed. Any posts damaged during construction shall be the responsibility of the RMP Client to repair or replace at his/her expense. Other parking meter post removals, relocations, or installations shall be done by the RMP Client as provided for in the plans, or as directed by the Parking Meter Supervisor. Where required, the Sign Shop will provide parking meter posts.

To request taking parking meters out of service, a minimum of 48-hour advance notice is required to the RMP Administration at (602) 262-6235. A RMP Client seeking to take a parking meter out of service to reserve curb space shall request a TRACS permit. This request is to include justification to the **RMP Administrator** stating the designated purpose, time requested, and paying an application fee. Currently the fee is $35 per city block of meters, with an additional charge of $10 per meter, per day for the duration of the project meters will be taken out of service.

School Zones

Work zone signing near school zones can dilute driver attention to the fact the school zone exists. Accordingly, depending on the situation, some school zones may benefit from strategic use of additional signs or flagging of signs to emphasize the school zone. This should be taken into consideration when laying out the temporary traffic control near school zones. Normally, the additional signs should be installed on the right side of the traffic lane. However, unusual detour arrangements might require them to be installed elsewhere for best target value. Additional signing is intended to help compensate for the distraction caused by construction, and should not result in the use of too many signs.

In some cases where the roadway is very wide and striped with a temporary centerline causing traffic to drive two abreast, it may be desirable to place the portable school signs close to the center of the approach pavement. To properly align vehicles approaching the signs, temporary lane lines may be advantageous approximately 12 feet away from the centerline for about 300 feet in advance of the 15 mile per hour portable signs and continuing to the crosswalk.

RMP Client Notes:

Chapter 6

TEMPORARY TRAFFIC CONTROL DEVICES

Temporary traffic control can be provided by using physical devices, or alternatively by employing manual control using police officers and, to a limited degree, flaggers. Physical devices will be discussed in this chapter, while manual control of traffic using police or flaggers will be discussed in Chapter 7.

Why Use Temporary Traffic Control Devices?

Temporary traffic control devices are used to alert and guide road users through locations where roadways have been temporarily reconfigured for maintenance, construction, special events, or due to incidents. Temporary traffic control devices fall into five basic categories:

- ❒ Signs
- ❒ Barricades and Channelizing Devices
- ❒ High-Level Warning Devices
- ❒ Pavement Markings
- ❒ Portable Barriers

Removal of Temporary Traffic Control Devices When Not Applicable

The *TBM* **requires** that advance warning signs and barricade devices be immediately removed from drivers' sight lines when no longer applicable. This has traditionally been a recurring problem, particularity with regard to advance warning signs, resulting in the subject being emphasized in this *TBM*. For this reason, the City now has added substantial fines for non-compliance.

It is the responsibility of the RMP Client to provide and maintain temporary traffic control devices. All TTC devices shall be stabilized with sandbags, or other approved material (ballast), when necessary. Ballast shall be placed on lower parts of the frame, or on the base, and not be placed on top of any striped rail. The use of rocks, concrete blocks, concrete, or asphalt chunks, etc. as ballast is not permissible.

Channelization devices work as a system. Periodic reminder signing (such as "KEEP RIGHT/LEFT" signs) may need to be placed at frequent enough intervals that the proper message is self-evident to drivers. Channelization signs and devices must be provided whenever:

- ❒ Traffic is moved across the street center line;
- ❒ The existing center line is obliterated, or;
- ❒ Traffic is maintained in other than the normal traffic lanes.

Sign Applications

Signs are a very important part of TTC. They are to be placed in advance, and at applicable points throughout traffic restrictions to provide navigational guidance to drivers. It is especially important to use initial warning signs in advance of traffic restrictions, to prepare drivers for conditions ahead.

TTC signs in Phoenix follow the same, basic standards for signs specified in the *MUTCD* regarding size, color, and shape. However, based on engineering judgment and experience, there are a few variations used taken simply because of minor modifications which have found to do a better job than nationally prescribed suggestions. Two notables include the size of the split lane (arrow warning) sign, and the "open for business" blue sign color used in temporary traffic control zones. Otherwise, warning and guide signs in temporary traffic control areas shall have a black legend on an orange background.

Most, but not all, signs used in Phoenix temporary traffic control zones are included in this *TBM*. However, other signs included in the *MUTCD* or alternative signs pre-approved by the RMP Administrator may be used. Each sign shall be displayed only for the specific purpose envisioned in this *TBM*. Uniformity of signs used contributes to effectiveness so that similar conditions will be similarly marked with the same type of signs. Hopefully, doing so will help enable motorists to become conditioned to the required action indicated by signs. The less variation in signs, the fewer responses the motorist will have to learn.

Sign Sizes: Guidelines for sign sizes, colors, and shapes are shown in following illustrations and in the *MUTCD*. The size of sign needed is dependent on the size and speed of the road in question, and how much out of the direct line-of-sight of the driver the signs are placed. Signs placed within roadways offer optimum line-of-sight visibility to drivers, which mean they work well at a smaller size sign than would normally be used if mounted at the side of the road. Larger signs are important on higher speed, rural highways where signs are mounted well away from the edge of roadways. Accordingly, the sign sizes shown reflect the suggested sizes for signs installed within roadways (warning and regulatory signs). The size of sign used may need to be increased for emphasis and where unusual conditions exist, making larger signs desirable. For signs mounted on posts along the side of the street (street-side supports), signs typically will be larger than shown in the illustration. There are some sizes where the size of legend/stroke width on the sign controls the final sign size, as it is important the final product offer good legibility.

Sign Sheeting Requirements: Historically, engineer grade retroreflective material has successfully been used in temporary traffic control zones throughout the world, and specifically in Phoenix. Newer products have emerged, however, which are substantially brighter. Additionally, the good news is the cost of higher-grade materials has come down. Combining that with the fact that competition in the sign industry has resulted in the quality level of engineer grade material being reduced has resulted in national practitioners gradually upgrading to newer types of sheeting. Except for signs where colors offer substantial contrast (i.e., black on white). This conversion by many agencies nationally has been spurred by those eager to achieve the advantages offered by brighter, longer lasting signs. Furthermore, the addition of fluorescent characteristics to warning signs has

strengthened "noticeability" of signs, particularly during twilight hours.

Nighttime visibility of signs is important enough that with this edition of the *TBM*, the City is calling for use of brighter and more attention grabbing sign sheeting Changes included in this *TBM* include:

- ❒ Fluorescent Orange Prismatic (ASTM Type VII) or better is to be used for the first advance warning sign(s) in a temporary traffic control zone. This includes, but may not be limited to, "Road Work Ahead", "Shoulder Work Ahead", and "Special Event Ahead" signs.
- ❒ Fluorescent Orange Prismatic (ASTM Type VII) or better is to be used for the double arrow or "splitter" signs (W12-1 and W12-1a) to compensate for their small size.
- ❒ High intensity prismatic sheeting, or better, is required for all other orange signs/barricades (ASTM Type IV).

The industry is encouraged to upgrade promptly, but the fluorescent orange prismatic sheeting will not required until January 1, 2008 to enable an efficient phase-out of current inventory. Similarly, the upgrade to high intensity prismatic sheeting will be required after July 1, 2008 (FY 08-09).

The above changes were based on research which has shown that the engineer grade black on orange signs do not provide the needed brightness and contrast. This 2007 *TBM* requires that **all other black on orange sheeting for signs and barricades be high-intensity, reflective sheeting (ASTM Type IV) or higher. A more liberal phase–out deadline of July 1, 2008 (FY 08-09) is required for this conversion**.

Signs used for temporary traffic control during hours of darkness must:

- ❒ Be equipped with operating Type-A flashing barricade warning lights when mounted on portable supports.
- ❒ Be equipped with operating Type-B flashing warning lights when authorized to be mounted on street-side supports for advance warning at major street construction projects.
- ❒ Have a **minimum** of 150 square inches of orange, weather-proof, high intensity retroreflective sheeting on the back of signs exposed to opposing traffic. The retroreflectorized sheeting is to be placed in strips not less than 5-inches wide along the outer edge of the sign. Signs placed in two-way left-turn lanes will have at least one Type I barricade (or Type II with approved ballast) placed a **maximum** of 10 feet behind the sign to alert opposing traffic.

Sign Mounting Heights

All portable signs are to be mounted on standard vertical supports with minimum heights to the bottom of signs as follows:

- ❒ ***Regulatory:*** 36-inches, except KEEP RIGHT/LEFT (R4-7a and 8a), SIDEWALK CLOSED/ PEDESTRIANS (R11-7, 8 and 11) and SIDEWALK CLOSED AHEAD CROSS HERE (R11-7A) should be mounted at 12-inches..
- ❒ ***Warning:*** 12-inches, except for W1-6 which should be mounted at 36-inches.
- ❒ **Guide:** 24-inches.
- ❒ ***Combination Regulatory and/or Warning:*** 12-inches.

All post mounted signs are to be mounted on standard vertical supports with a minimum height to the bottom of signs at seven feet (6-feet for a secondary sign).

Sign Mounting Procedures and Placement

Standard vertical supports used for barricades, vertical panels, and flag trees are also acceptable for mounting portable signs. When flag trees are used as sign supports, they shall be provided in addition to those required in Chapter 6 of this TBM. Suitable ballast should be placed on the base of all portable signs that are unattended.

Metal and wood signposts, such as those commonly used to mount permanent traffic signs and steel streetlight poles, are acceptable sign supports. However, signs shall not be typically mounted on wood Utility poles or placed in areas intended for pedestrians. Where necessary to do so, care shall be taken to minimize interference with pedestrians and wheelchair accessibility.

As a general rule, portable signs are to be located on the right side of the street when right-lane traffic is restricted, and additionally on the centerline or median, when left-lane traffic is restricted. Post-mounted signs shall be located on the right side of the street and in protected medians. Where special emphasis is required, and where more than one lane of traffic in any one direction is affected, dual signs should be provided approximately opposite each other. Care ***shall*** be taken when signs are placed in the two-way left-turn lane, to not obstruct access to or from driveways or intersecting streets.

Portable supports should be used for short-term and moving operations. Street side supports may be used when authorized for construction speed limit and advance warning signs on long-term, fixed construction operations, such as major street reconstruction.

For maximum mobility on certain types of construction and maintenance operations, signs may be mounted on a vehicle stationed in advance of the work, or moving along with it. This may be the working vehicle, pavement marking equipment, crack-sealing equipment, or a vehicle provided expressly for this purpose.

Work Zone Speed Limits

Speed limit signs are regulatory signs, and procedures for establishing work zones speed reductions may be appropriate. Procedures to be used for determining if work zone speed reductions may be helpful are outlined here. Speed reduction in work zones may be considered when the following conditions exist:

- ❒ Roadway grade differential;
- ❒ Roadway geometric challenge;
- ❒ Insufficient lighting for driver visibility;
- ❒ Major traffic shift;
- ❒ Flagging operation.

Research has shown that achieving substantial speed reductions in work zones is difficult. When necessary, speed limits are not to be reduced by more than 10 mile per hour increments.

In Phoenix, speed limit signs are posted in an unusual manner. It has been found effective to co-mount work zone and speed limit signs in order to gain motorist understanding of reduced speed limits. Accordingly, "SPEED LIMIT" signs are to be co-mounted with "WORK ZONE" signs when reducing speed limits within construction areas. Typically, there are to be a minimum of one in advance of construction, and three signs per one-half mile for each direction of traffic. Existing, conflicting "SPEED LIMIT" signs shall be covered or removed.

The "SPEED LIMIT *25*" sign is typically used where the existing pavement has been removed, or where traffic is being maintained on temporary detour roads, on unpaved shoulders, or on traffic lanes that are severely restricted.

The "SPEED LIMIT *35*" is commonly also used where traffic is being maintained on new asphalt paving during the completion of street paving projects, and in most construction zones, on improved streets where restricted traffic is maintained on a reduced number of lanes.

Types of Signs

Temporary traffic control signs fall into the following three major categories:

- ❒ Regulatory Signs
- ❒ Warning Signs
- ❒ Guide Signs

Regulatory Signs: Impose legal obligations or restrictions and are enforceable by the Police Department (City Code 36-300). To be enforced, their use must be approved by the RMP Administrator. Special care must be used to insure proper placement, use, maintenance, and ***removal*** of all temporary regulatory signs in a timely fashion. Conflicting existing regulatory signs shall be covered or removed.

The RMP Client provides all regulatory signs. Commonly used signs are illustrated in Figures 6 and 7.

Regulatory signs used in construction and maintenance areas shall be the shape and color shown in the illustrations. They shall be used as follows:

- **Turn Restriction** signs**:** NO LEFT (RIGHT) TURN signs are used whenever turns may cause excessive congestion. There is to be a minimum of two signs (one near side, and one far side). When buses can safely turn, "EXCEPT BUSES" panels should be considered..
- **Mandatory Turn** signs are used to require turns from specific lanes. There shall be a minimum of two signs (one in advance and one at the intersection). These are always used with the "splitter" sign to clearly differentiate the turn lane from the through lane.
- **Street Closed to Through Traffic** signs are used for closures of Major streets where only local access is permitted. Where used, the proper detour arrow and detour instructions shall be displayed. "STREET CLOSED AHEAD" and "DETOUR AHEAD" signs are used approximately 300 feet and 600 feet, respectively in advance of Major/Collector street closures Mandatory turn lanes approaching street closures shall be closed.
- **Street Closed** signs are used for all Collector/Local street closures when only local access is allowed. A "LOCAL TRAFFIC ONLY" panel shall be displayed unless approved by the RMP Administrator.
- **Alley Closed** signs are used for alley closures.
- **Detour** signs with arrow are used to mark detour routes when required.
- **Business Access** signs are used where access becomes a problem on Major/ Collector streets closed for construction. Signs are installed on a barricade adjacent to the "STREET CLOSED" sign when required.
- **Keep Right/Left** signs are used at, or near, the start of all channelization, except where the "splitter" sign is used. Additional signs are to be placed as needed. Also, this sign is used on both sides of intersections where temporary center line channelization is required.
- **Sidewalk Closed and Pedestrians Prohibited** signs are used for walkway closures as provided for in Chapter 3 of this *TBM*. **Special attention shall be given when contemplating the closure of pedestrian paths**, to assure that safe, reasonable, and accessible alternative walkways exist. Closures will only be approved when absolutely necessary for safe operation. Even then, maintaining access to businesses and transit stops must be taken into consideration. When used, advance warning should be provided with a "SIDEWALK CLOSED AHEAD" sign.

Figure 6

R1-1
30" x 30"

R1-2
30" x 30" x 30"

R5-1
24" x 24"

R8-8
12" x 18"

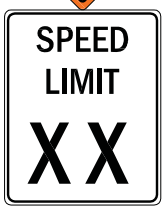
R3-7
(R) (L)
24" x 24"

R3-5
(R) (L)
18" x 24"

R3-2
24" x 24"
PANEL
4" x 24"

R3-1
24" x 24"

R3-8
(R) (L)
24" x 24"



W20-6
R2-1(XX)

R6-2
(R) (L)
18" x 24"

R2-5a
24" x 30"

R6-1
(R) (L)
36" x 12"

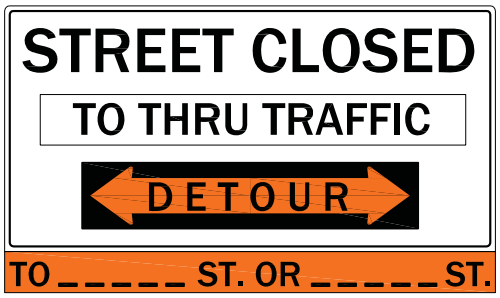
COMBINATION WORK ZONE/
SPEED LIMIT SIGN SIZES

Sign	Post Mounted	Portable
W20-6	36" x 36"	24"x 24"
R2-1	24" x 30"	18" x 24"

REGULATORY SIGNS

Figure 7

M 4-9
(Double Arrow) (R) (L)
30" x 24"



R11-4 (Arterials)
("To Thru Traffic" For Soft Closure)
M4-10
(Double Arrow) (R) (L)
96" x 48" With 8" Bottom Panel

M 4-9
(Ahead)
30" x 24"

R4-8a
18" x 24"

R11-2 (Collectors & Locals)
48" x 30"
8" Bottom Panel

24" x 30"

NOTE: R11-4 (arterials) & R11-2 (collector & locals) are used to partially or fully close streets. For partial closures, the TO THRU TRAFFIC is added to the R11-4, while LOCAL TRAFFIC ONLY is added to the R11-2 (slower speed collector & local streets).

R4-7a
18" x 24"

R11-2a
48" x 30"

24" x 30"

R11-11b
(RIGHT)
24" x 30"

R11-11a
(LEFT)
24" x 30"

R11-9
30" x 24"

R11-7a
(R) (L)
24" x 30"

R5-9a
(R) (L)
24" x 30"

REGULATORY SIGNS AND GUIDE SIGNS

Warning Signs: Warning signs are used to notify unfamiliar motorists of specific hazards or restrictions in temporary traffic control zones. Within construction zones there may be a variety of temporary roadway conditions, such as reduced width, open excavations, or pavement removal. Motorists must be properly alerted well in advance to provide adequate time to react safely.

All warning signs are provided by the RMP Client. Commonly used signs are illustrated in Figures 8 and 9.

Warning signs used in temporary traffic control zones shall be diamond shaped, except as shown in the warning sign illustrations. They shall have a black legend and/or symbol on an orange or fluorescent orange background. The warning signs illustrated shall be used for only those situations indicated by their legend or symbol.

The "ROAD WORK AHEAD" sign is to be used in advance of all construction and maintenance areas, except for slow moving or short duration work in service vehicles. Minimum spacing for advance warning signs in advance of channelization should be equal to the taper lengths shown on the inside of the front cover.

Guide and Miscellaneous Other Helpful Signs: Few guide signs are used in work zones because of the need for so many regulatory and warning signs. Guide signs that are used for directing motorists on detour routes and to advise motorists of business access. Guide signs used in temporary traffic control areas are generally rectangular, and have a black legend on an orange background. To assist businesses, Phoenix has successfully pioneered using white legend on a blue background to highlight business access and bus stops (see Figure 10).

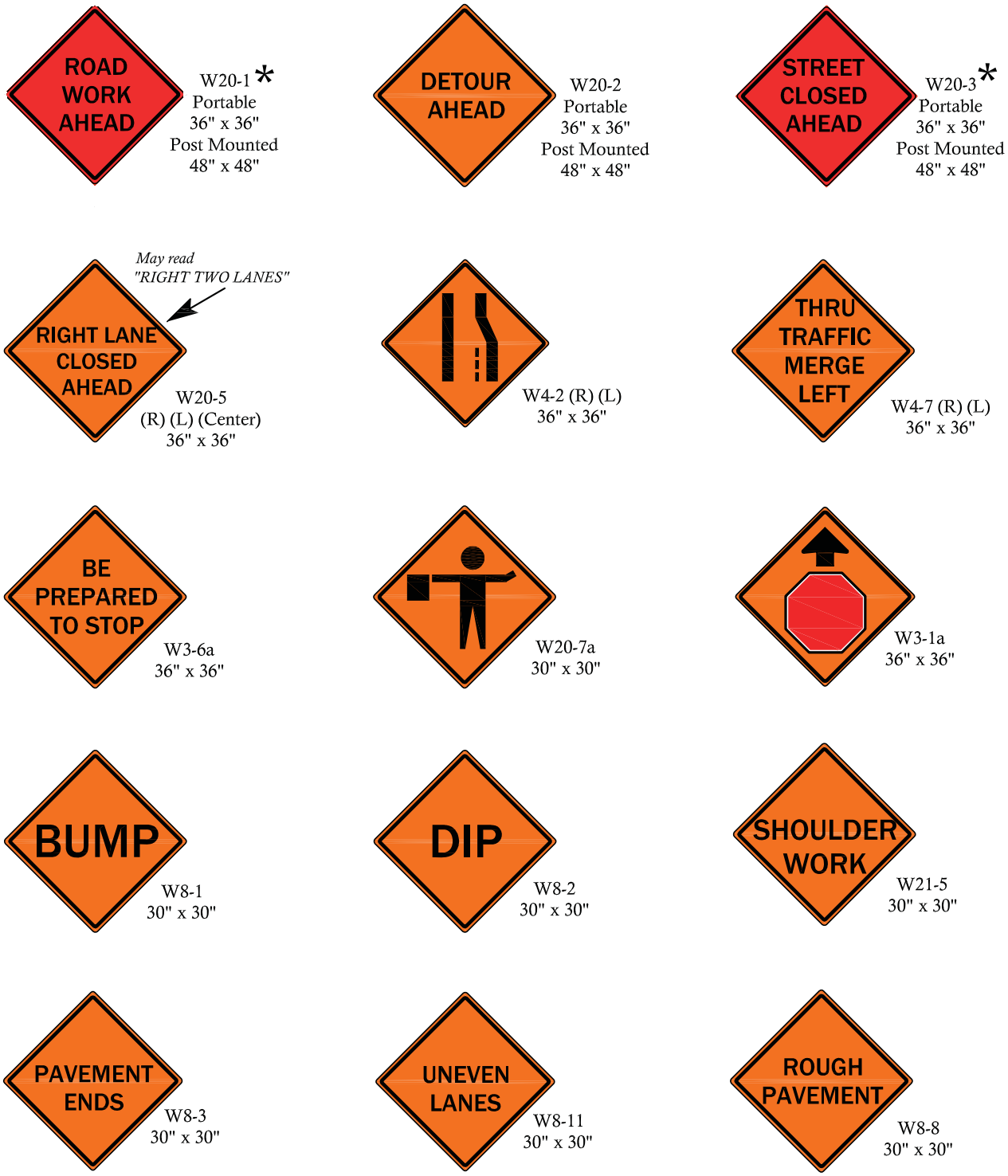
Guide signs most frequently used are "DETOUR" signs with arrows, as shown with the "STREET CLOSED" signs in Figure 7. "DETOUR" sign and detour instructions are incorporated into the design of the STREET CLOSED TO THROUGH TRAFFIC" sign.

When required, the RMP Clients shall provide separate "DETOUR" signs, with the appropriate arrow, at locations along a specific detour route as directed by RMP. When required, detailed detour route instructions and/or State and Federal route symbols shall also be provided and attached to the detour signs.

At times, when alternate detour routes for street closures are offset or points of closure are at locations where detours are not available, it is necessary to provide additional guide information signs. These signs generally have a legend similar to "SR-51 TO MCDOWELL EB CLOSED-USE 24TH ST" or "GREENWAY SB TO 1-17 CLOSED - USE 19TH AVE", with appropriate detour arrows. These signs shall be rectangular with a minimum size of 48-inches by 48-inches. The legend shall be black on an orange or fluorescent orange background.

The RMP Clients are to provide these guide signs, as specified in the City project or permit "Special Traffic Regulations," or as directed by the RMP Agents.

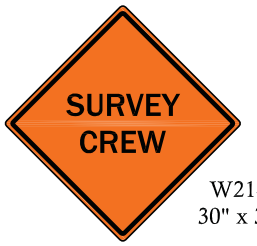
Figure 8



* *Fluorescent orange prismatic sheeting by January 1, 2008 for initial warning sign in temporary traffic control zones.*

WARNING SIGNS

Figure 9



W21-6
30" x 30"

W21-2
30" x 30"

W21-8
30" x 30"

W8-10
30" x 30"

W8-6
30" x 30"

W1-1 (R) (L)
30" x 30"

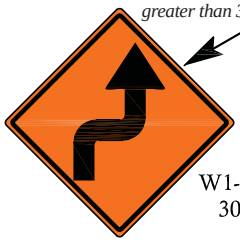
To be used on shifts at speed greater than 30 MPH

W1-4 a
(R) (L)
30" x 30"

W1-2 (R) (L)
30" x 30"

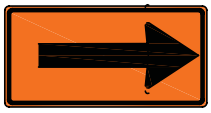
W13-1
18" x 18"

To be used on shifts at speed greater than 30 MPH and less



W1-3 (R) (L)
30" x 30"

W1-4 b (c)
(R) (L)
30" x 30"



W1-6(D) (R) (L)
48" x 24"

W6-3
30" x 30"

W12-1**
18" x 18"

May read "BOTH LANES" or "THREE LANES"

SPECIAL WARNING
36" x 36"

W12-1a**
18" x 18"

*** Fluorescent orange prismatic sheeting to be required on all W12-1 series signs effective immediately.*

WARNING SIGNS

Figure 10

R11-10
(R) (L)
30" x 24"

(R) (L) (Ahead)
18" x 24"

(R) (L) (Ahead)
18" x 24"

12" x 18"

(R) (L) (Ahead)
24" x 24"

MISCELLANEOUS OTHER HELPFUL SIGNS

Barricades and Channelizing Devices and Their Applications

Barricades and channelizing devices are the most important part of temporary traffic control in temporary traffic control areas. They are used to warn and alert motorists of upcoming temporary restrictions, and to guide motorists and pedestrians through restricted areas. They are also used to separate vehicular traffic from the workspace, pavement drop-offs, pedestrians, and opposing traffic. They are not intended to be physical barriers. Barricades and channelizing devices should always be used in groups to warn and guide traffic.

Flag, rope, and plastic caution tape may be used between barricades and channelizing devices to provide additional guidance and security. In some major construction areas, and in areas with substantial pedestrian traffic, the use of fencing may be necessary for maximum safety.

New and improved guidance is evolving to better design for those with low vision. Increasingly, in long-term work zones, the techniques listed in this paragraph may no longer be appropriate depending upon the alignment of newly defined pedestrian paths. Designers should take evolving technology into consideration, and where practical, design for pedestrians with low vision. The key to doing so is to provide detectable bottom and top rails on channelization devices without gaps.

Barricades and channelizing devices used to guide motorists must provide a smooth, gradual transition, when moving traffic from one lane to another, onto a bypass detour, or when reducing the width of the street. This smooth, gradual transition is referred to as the "taper length." ***The minimum desirable taper length formulas, calculated taper lengths, and spacing of devices for tapers are shown in Tables 1 and 2.***

KEY REFERENCE MATERIAL

Table 1
TAPER LENGTH CALCULATIONS

SPEED LIMIT	FORMULA
40 mph or under	$L = \frac{WS^2}{60}$
45 mph or over	L = WS

L = Taper Length (ft)
W = Width of Lane (ft)
S = Posted Speed Limit

Table 2
TYPICAL TAPER LENGTH & SPACING BETWEEN DEVICES

SPEED LIMIT (mph)	TAPER LENGTH (L) (Feet)** Lane Width:			SPACING BETWEEN DEVICES (Feet)	NUMBER OF DEVICES NEEDED
	10’	11’	12’		
25	104	115	125	25*	6
30	150	165	185	30	7
35	204	225	245	35	8
40	267	293	320	40	9
45	450	495	540	45	13
50	500	550	600	50	13
55	550	605	660	55	13

*	Distance between traffic cones used for tapers should not exceed 25 feet regardless of speed
**	Advance warning signs should be placed at distance (L) in advance of taper

NOTE: Values shown in Table 2 are for merging tapers only. Other taper lengths should be approximately L/2 and number of devices needed appropriately halved.

Minimum desirable taper lengths apply to streets of relatively flat grade and straight alignment. Adjustments may be desirable to provide adequate sight distance on the approach to channelization, and to accommodate cross streets and adjacent driveways. In urban areas characterized by short block lengths and driveways, longer tapers have not proven to be better than shorter ones. The reason for that is that extended tapers tend to encourage sluggish operation and encourage drivers to delay lane changes unnecessarily to the last moment, which creates friction.

When more than one lane is closed, a tangent length of channelization between the two closed lanes of no more than about twice the taper length is desirable to distinguish between the two separate lane closures. Experience has shown that on busy streets with short block lengths, other factors make it imprudent to use that much distance. However, having some tangent clearly operates better than having none. (See Figure 25).

When lanes are not merged together, but rather simply re-directed, a more moderate shifting taper (½ L) is used. This is particularly applicable in Phoenix, which typically uses three-dimensional channelizing devices to overpower existing pavement markings.

Barricades and channelizing devices are also used to protect workers in the street and to guide and protect pedestrians. Consequently, it is important that the design of barricades and channelizing devices be substantial enough to provide protection, yet not pose a threat to road users should a collision occur. The good news is that because of typical urban operating speeds, there have been no reported incidents in Phoenix over the past four decades where a metal or traditional traffic control device became a projectile and penetrated a vehicle's windshield.

Typical uniform applications of barricades and channelizing devices are shown in the barricade illustrations included in this *TBM*. Situations not illustrated shall be handled in conformance with the general methods set forth.

Barricades:

Barricades used in Phoenix shall be three types: Type I, II, and III. (See Figure 11). Markings for all barricade panels shall be alternate orange and white stripes sloping down at a *45*-degree angle to the side on which traffic is to pass. Both stripes (orange and white) shall be retroreflective with type IV (minimum) sheeting. **Use of high intensity sheeting is recommended for immediate use, and required on July 1, 2008 (FY 08-09).**

All barricades shall be constructed of suitable materials to the dimensions shown in Figure 11. Barricade supports shall be substantial enough to support what they hold.

Type I and II barricades are intended for use to channelize traffic through temporary traffic control areas. Type I and II barricades are also used to delineate hazards in or near the street or sidewalk, or to close Collector/Local streets or sidewalks and alleys. When used to ***delineate hazards*** parallel to traffic, spacing should not exceed ***75 feet.*** Usually, vertical panels are used to channelize traffic, but Type I and II barricades provide more target value and are more effective when roadside hazards exist. When used to close streets, sidewalks, and alleys, spacing should be close enough together to make it clear access is closed.

Type III barricades are used for complete street closures of Major streets. One is to be placed on each side of the "STREET CLOSED TO THROUGH TRAFFIC" sign, and one centered on the back of the sign. Additional Type III barricades are to be used as required to close the street to through traffic.

Barricades used during hours of darkness are to have an approved barricade warning light attached, and operational. The warning light is to be mounted above the top panel and on the end of the barricade closest to traffic. Type A flashing warning lights are be used to delineate hazards and close streets, sidewalks, and alleys. Type C steady burn warning lights are used in a series to channelize traffic and to guide traffic through construction areas.

Type I, II, and III barricades are to have the responsible party's (RMP Clients) name and phone number placed near the bottom of the lowest panel as illustrated in Figure 11**.** The letters are to be clearly legible, and not less than one inch or more than two inches in height.

Barricade Warning Lights

Barricade warning lights are yellow, mounted atop appropriate traffic control devices to call attention to the device, and to provide alignment information to motorists. They shall be mounted on all signs, barricades, and channelizing devices, as specified in this ***TBM.*** Barricade warning lights shall be in operation during hours of darkness.

Warning lights are portable, battery, or solar powered, lens directed enclosed light, which must be maintained so that the light provides proper illumination during hours of darkness.

Warning lights are to have a minimum seven-inch diameter lenses that emit a yellow light and comply with the current Institute of Transportation Engineers Purchase Specifications for Flashing and Steady-Burn Warning Lights.

There are four types of warning lights: Type A, low intensity flashing warning lights, Type B, high intensity flashing warning lights, Type C, steady burn warning lights, and Type D, 360-degree steady burn warning lights.

1. ***Type A, Low Intensity Flashing Warning Lights*** are used to help warn drivers during nighttime hours. In Phoenix, they shall be used on all signs mounted on portable supports, and on all channelizing devices (except cones and tubular markers) used to mark hazards and close streets. Type A warning lights are not intended to guide traffic.
2. ***Type B, High Intensity Flashing Warning Lights*** are used to help warn drivers both daytime and nighttime, and shall be used on advance warning signs that are street mounted for major street construction and on "Flag Type" High Level warning devices when used at night.
3. ***Type C, Steady Burn Warning Lights*** are to be used on barricades and vertical panel channelizing devices when used to guide traffic, form tapers, and delineate centerlines, lane lines, and the edge of the traveled way. Type C warning lights

may be used on devices to mark hazards, but they are generally less effective than flashing lights for this purpose.

4. ***Type D, 360-degree Steady Burn Warning Lights*** may be used during nighttime hours to delineate the edge of the traveled way, or on the outside of a curve.

Channelizing Devices:

Channelizing devices used in the City of Phoenix include the following three types:

1. **Traffic Cones:** Are effective for **daytime** channelization of traffic and to delineate minor maintenance areas. Traffic cones are versatile because they are portable and if struck, they will not damage vehicles. They can be set up and removed quickly. When traffic cones are used, it is necessary to check them often because vehicles frequently move them. 18" cones are acceptable for daytime use only, but use of 28" cones is encouraged given the improved conspicuity offered. Cones are normally not considered suitable for nighttime use, except under emergency conditions, or special circumstances approved by RMP Administrator. When used at night, cones must have reflective sleeves as called for in the *MUTCD* and have a minimum height of 28-inches. A good example of where 28-inch cones (with sleeves) have been approved for night use is in downtown Phoenix, where the cones are under direct police supervision, the lighting is excellent, and traffic speeds are low.

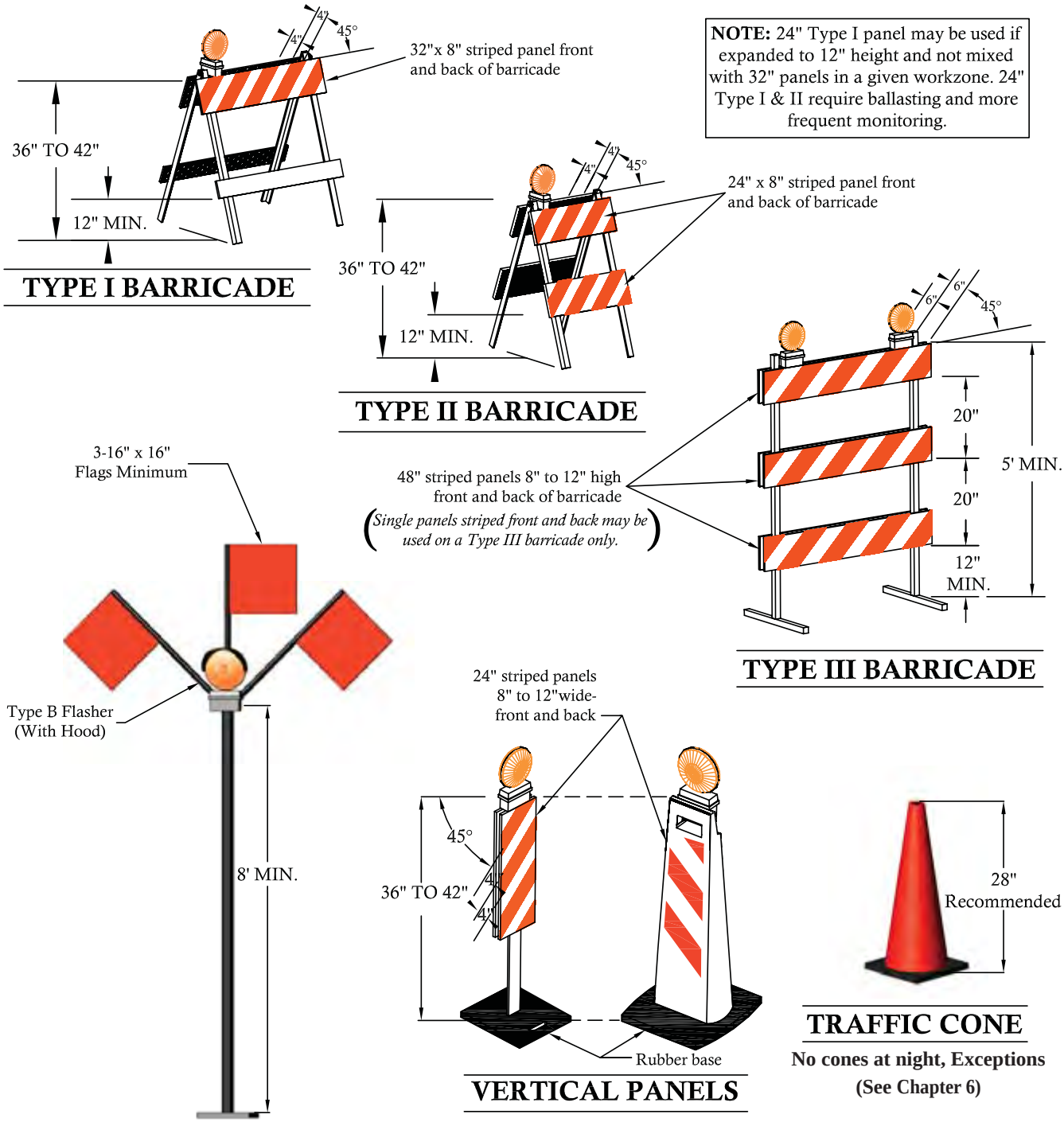
   Traffic cones are used to channelize traffic, divide opposing traffic lanes, divide traffic lanes when two or more lanes are open in the same direction, and delineate minor maintenance operations. When traffic cones are used to divide traffic lanes or delineate minor maintenance operations, spacing should not exceed 50 feet.

   When traffic cones are used to channelize traffic, they shall be placed using an appropriate taper where applicable. Taper lengths should be as shown in Table 2 (inside front cover). Because cones are smaller and less visible than standard barricades, ***spacing between cones used to channelize traffic should not exceed 25 feet, regardless of speed.***

2. **Vertical Panel Channelizing Devices:** Vertical panels are devices to enable 24-hour channelization. They are used in place of traffic cones when channelization is needed, during hours of darkness. They are versatile because their height and amount of retroreflective sheeting makes them substantially more visible than normal pavement markings. They are portable, lightweight, and use less street width than standard barricades. Professional experience indicates that at city speeds, vertical panels when properly placed, overwhelm any existing pavement markings, to the point that positive guidance prevails to the point that existing pavement markings can remain, as they do not induce driver confusion.

   Markings on vertical panel channelizing devices shall be alternate orange and white stripes, sloping down at a *45*-degree angle to the side on which traffic must pass. When used to divide two traffic lanes in the same direction, the stripes shall slope down to the side on which traffic is being diverted. (See Figure 11). Both stripes

Figure 11



NOTE: 24" Type I panel may be used if expanded to 12" height and not mixed with 32" panels in a given workzone. 24" Type I & II require ballasting and more frequent monitoring.

Type IV high intensity sheeting to be required in (FY08-09) July 1,2008.

BARRICADES AND CHANNELIZING DEVICES

(orange and white) shall be reflectorized with **Type IV** retroreflective sheeting. **The requirement for Type IV sheeting is recommended for immediate use and required on July 1, 2008 (FY 08-09).**

Vertical panels shall be constructed of suitable material to the dimensions shown in Figure 11. The base and panel support should be substantial, designed to prevent overturning, and yet sturdy enough to ensure they do not become a projectile. Because the base can be an obstacle to traffic when overturned, the base and support should be designed to minimize damage to a vehicle if struck. The base and panel support shall be galvanized, aluminum, or white in color, except rubber bases, which may be black.

Vertical panels are used to channelize traffic, divide opposing lanes of traffic, divide traffic lanes when two or more lanes are maintained open in the same direction, and in place of standard barricades where space is limited. When vertical panels are used to channelize traffic, they shall be placed appropriately to guide motorists past hazards. Taper lengths and vertical panel spacing should be as shown in Table 2 (inside front cover).

When vertical panels are used in place of standard barricades to ***delineate hazards*** parallel to traffic, spacing should not exceed ***50 feet.*** When used to divide opposing lanes of traffic or divide two or more lanes traveling in the same direction, spacing should not exceed ***80 feet*** for short distances and ***160 feet*** for extended distances.

Vertical panels used during hours of darkness, shall have an approved and operating barricade warning light mounted on top. Type C, steady burn warning lights shall be used in a series to channelize or guide traffic, While Type A, flashing warning lights shall be used to delineate hazards at night.

3. **Drums as channelizing devices** are rarely used on urban streets in the Phoenix area due to space constraints. If drums are proposed for use, refer to the *MUTCD* for proper specifications and applications.

High Level Warning Devices:

High level warning devices are powerful traffic control devices, particularly helpful in cities with busy streets because they are designed to be seen over the top of preceding vehicles. This height is particularly effective in providing drivers with advance notification of the need to divert. Use of a high level warning device is required for advance warning of all closures. Phoenix allows four different types of high level devices as follows:

1. Flag Type High Level
2. Rotating Flasher and Strobe Light
3. Arrow Panels
4. Changeable Message Sign

Along with being required for advance warning of all lane closures, high level devices can be helpful in other circumstances such as new construction, pavement patching, manhole

work, surveying, cranes, excavations, etc. High level warning devices may be attached to a vehicle located at, or in advance of, the obstruction. On fixed location projects, high level warning devices should be placed within or behind the channelization near the center of the area closed.

Flag Type Devices and Applications

Flag type high level warning devices (flag trees) shall display two or more flags supported so that the lowest point of the flags is 8 feet or more above the street. (See Figure 11). The flags shall be orange or fluorescent orange in color, and 16 inches square or larger. The flag support and base shall be substantial, to resist overturning by wind. The flag support shall be galvanized, aluminum, or white in color.

During hours of darkness, each flag tree must be equipped with a minimum of one Type B High Intensity Flashing Warning Light mounted more than 8 feet above the street. If equipped with a remote battery, the battery shall be mounted at the base, at ground level, to provide additional stability.

One flag tree is required for each direction of traffic affected. The devices shall be placed within, or behind the channelization, near the center of the area closed. Additional flag trees may be used to support signs.

Flashing Devices and Applications

Rotating flasher and strobe light type high level warning devices are typically vehicle mounted. Electrically operated, rotating Sealed Beam or halogen lamp flashers, or strobe light flashers, may be used instead of, or in addition to, flag type high level warning devices. Rotating Sealed Beam flashers shall consist of one or more Sealed Beam units at least four inches in diameter, rated at a minimum of 30,000 candlepower each. They shall emit a yellow light with a flash rate of 70 to 110 flashes per minute.

Halogen lamp flashers shall consist of one or more halogen lamps with a minimum rating of 50 watts, generating 50,000 candlepower each, reflected in a rotating or alternating pattern by high quality parabolic reflectors. They shall emit a yellow light with a flash rate of 70 to 120 flashes per minute. Strobe light flashers shall be rated at a minimum of one million candlepower at the bulb. They shall emit a yellow light with a flash rate of 80 to 120 flashes per minute.

Rotating flashers or strobe lights shall be mounted on a vehicle or other substantial support. When possible, they shall be mounted at a minimum height of 8 feet above the street. The vehicle or other support with flashers in operation shall be positioned behind the required channelization, and near the center of the area closed, except when used on a moving service vehicle.

Use of rotating flashers or strobe light type high level warning devices is particularly desirable during hours of darkness. They should be used instead of the flag type high level warning device, with flasher attached, whenever possible.

Arrow Panels

Arrow panels provide additional advance warning and directional information to assist in diverting traffic, which is especially effective under high volume traffic conditions and at night. Arrow panels, where possible, should be placed in the parking lane at the beginning of the merging taper. If no parking lane or room exists, arrow panels may be placed in the closed lane behind the channelization used to transition traffic.

An arrow panels' primary function is to provide advance warning of traffic lanes being closed. Arrow panels are designed to flash directional arrows or chevrons, are as dominant as control devices that they may be used instead of other types of high level warning devices. Arrow panels are powerful devices that can be seen far ahead of time and are required for use on Major streets when lanes are fully closed at night. If two lanes are closed sequentially, an arrow panel is required for the first one to get driver's attention, and may be required for the subsequent lane closure depending upon engineering judgment of conditions. The only exceptions will be emergencies, or when service vehicles are used instead. A common example of when arrow boards may be required is when geometric conditions prevent the normal advance warning and taper/tangent distances from being achieved.

Arrow panels shall be rectangular (except type D, which are intended for use on service vehicles and have no panel). In the case of type D, the arrow length is 48", with an arrowhead width of 24". Arrow panels should meet the following specifications:

Minimum mounting height should be 7-feet from the roadway surface to the bottom of the panel, except on vehicle-mounted panels which should be as high as practicable. Arrow panels are to be in compliance with the specifications provided in the latest *MUTCD.*

Arrow panels should be positioned on the shoulder, or in the parking lane, and at the beginning of the taper, where possible. When width is restricted, the arrow panel should be positioned behind the required channelization near the start of the merging taper. When arrow panels are used to close multiple lanes during nighttime hours, a separate arrow panel shall be used for each closed lane.

Since use of arrow boards can cause unnecessary lane changing, their best use is for closed lanes and generally they should not be used for shoulder or roadside work activities.

Changeable Message Signs

Mobile, electronic sign displays, such as changeable message signs may be mounted on a trailer. Experience has proven the effectiveness of providing advance notice of projects though the use of dynamic message signs. This notice is typically given fourteen days in advance of the work. Careful attention needs to be given in the placement of these signs so they do not impede pedestrians, block driveways, or create visibility obstructions. A Changeable Message Sign may be used to simulate an arrow panel display.

Pavement Markings

Temporary markings may be used to guide traffic in temporary traffic control areas when clean, hard surfaced street or detour roadway surfaces exist. Temporary pavement

Types of Arrow Panels

Operating Mode	**Panel Display** *
I. At least one of the following two modes shall be provided.	**(Right Shown; left is similar)**
Flashing Arrow	**Move / Merge Right**
Sequential Chevron	**Move / Merge Right**
II. The following mode shall be provided: Flashing Double Arrow.	**Move / Merge Right or Left**
III. The following mode shall be provided: Flashing Double Arrow	**or** **Caution**
* Element layout for Type C panel shown	

Type	Minimum Size	Minimum Number of Elements	Minimum Legibility Distance
A	24” x 48”	12	½ Mile
B	30” x 60”	13	¾ Mile
C	48” x 96”	15	1 Mile
D	Arrow Shape	12	½ Mile

NOTES:

Type A arrow panels are appropriate for use on low speed urban streets.

Type B arrow panels are intended for use on intermediate speed facilities and for moving operations on high-speed roadways.

Type C arrow panels are intended for use on high-speed, high-volume facilities such as freeways and expressways; however, they may be used on City streets when additional warning is desirable.

Type D arrow panels are to conform to the shape of an arrow.

markings must be kept clean at all times. Normally, they should be used in combination with signs, barricades, and channelizing devices. Existing pavements markings that conflict with the vehicle path indicated by temporary markings shall be removed or obliterated, unless the potential for driver confusion can be eliminated using vertical three dimensional channelization devices. Upon project completion , temporary markings shall be removed and permanent markings replaced.

Reflective paint lines, pavement marking tape, or raised pavement markers may be used for temporary traffic control when approved by the Street Transportation Department, Traffic Operations Division. They are generally used on paved detours and on Major street construction between the completion of asphalt layers.

Reflective paint lines shall be applied with a suitable paint striping machine using Phoenix specifications for traffic paint and reflective glass beads, or an approved substitute. Paint lines shall have a minimum wet film thickness of 15 mils with 6 pounds of glass beads applied per gallon of paint.

Reflective pavement marking tape, specifically manufactured for pavement marking, may be used in place of paint lines. Pavement marking tape shall be durable and have the appearance and reflectivity of paint lines. Application of short pieces of pavement marking tape to form dashed lines instead of pavement striping is not acceptable.

- ❒ Centerline markings are to be two 4-inch wide yellow lines with a 5-inch space between.
- ❒ Lane line markings are to be 4-inch wide white lines, placed with 15 lineal feet of marking and 25 lineal feet of space between markings. ***When approaching marked crosswalks at unsignalized locations, the lane markings shall be 6 inches wide and solid, rather than dashed to inhibit lane changing and speed, and to enhance notification that a crosswalk exists.*** Edge lines are to be 4-inch wide, continuous, white lines.
- ❒ Barrier lines for mandatory turn lanes, pavement edge tapers, and lane transitions are to be 10-inch wide white lines.
- ❒ Normal crosswalk lines are to be white and 10-inches wide while school zone 15 mph crosswalks are to be yellow.

Raised reflective pavement markers may be used instead of paint or tape markings. They are most helpful on unlit curves, unlighted areas, and on detours. Centerline markers shall be yellow, while lane line and edge line markers shall be white. Spacing between markers, when used instead of centerlines, shall not exceed 10 lineal feet on straight alignments, and 5 lineal feet on curves. Lane lines shall be in groups of three markers, spaced 5 lineal feet apart, with 15 lineal feet space between groups on straight alignments, and 10 lineal feet of space between groups on curves.

Where reflective markers are used to supplement edge lines, their spacing should be at least twice as frequent as the adjacent lane lines to eliminate driver misinterpretation of these as lane lines.

Without this close spacing, some drivers may believe another lane exists beyond the markers. Spacing between markers used to supplement centerlines, lane lines, and edge lines shall not exceed 40 feet on straight alignments and 20 feet on curves.

Temporary Traffic Signals

A temporary traffic signal system may be used to control vehicular traffic movements at construction or maintenance work areas, when a traffic engineering study indicates it is necessary. The Traffic Operations Division must specifically approve each use.

All traffic signal control equipment shall meet the applicable standards and specifications prescribed in Parts IV and VI of the ***MUTCD.*** "TRAFFIC SIGNAL AHEAD" signs shall be placed in advance of all approaches to temporary traffic control signals.

If it is desired to use temporary traffic signals, RMP Clients shall prepare a detailed TCP showing the location, use, timing, and hours of operation at each location for approval prior to implementation. Signal controller phasing and timing must be pre-approved by the Street Transportation Department. Only police officers or properly trained police assistants under the direct on-site supervision of a police officer, may manually control permanent or temporary traffic signals, unless otherwise approved by the RMP Administrator.

Barriers

Portable barriers are usually precast, reinforced concrete units, commonly referred to as Temporary Traffic Barrier Wall (TBW) or Jersey Barriers. These devices are approximately 36 inches high, vary in length, and taper from a wide base to a narrow top. They are designed to be physical barriers placed parallel to traffic lanes to help prevent penetration by vehicles leaving the traveled way, thereby minimizing injuries to vehicle occupants, and to protect workers, bicyclists, and pedestrians.

The four primary functions of TBWs are:

1. To keep vehicular traffic from entering work areas, such as excavations or material storage sites;
2. To separate workers, bicyclists, and pedestrians from motor vehicle traffic;
3. To separate opposing directions of vehicular traffic; and
4. To separate vehicular traffic, bicyclists, and pedestrians from the work area as false work for bridges and other exposed objects.

Portable barriers shall only be used in combination with the required signs, and supplemented with standard barricades, and channelizing devices for improved daytime and nighttime visibility. Barriers may serve the additional function of channelizing traffic. When serving this function, barriers shall be light in color and equipped with vertical panel markings and barricade warning lights. The first two warning lights at the start of a continuous barrier shall be Type B, flashing warning lights. All other warning lights shall be Type C, steady burn warning lights. Spacing for barricade warning lights and vertical panel markings shall be as required for vertical panel channelizing devices in this *TBM*.

The traffic approach ends of all portable barriers shall be protected from vehicle impact by the use of impact attenuators or flaring the ends away from the traveled way. When space permits, approach ends shall be flared at a 45-degree angle to a minimum of 10 feet from the traveled way. When space does not permit, barrier ends shall be protected with impact attenuators, as required in the ***MUTCD.***

Standard "water-filled" barriers are suitable for use with the following stipulations:

- ❒ Water-filled barriers are to be placed parallel to the direction of traffic flow.
- ❒ The traffic approach or angled "flared-ends" are to be standard precast reinforced concrete units, commonly referred to as "Jersey Barriers".
- ❒ The devices may only be placed on Phoenix streets after proper review of the entire work zone and approval of the specific TCP.

Chapter 7

MANUAL TRAFFIC CONTROL

(Police and Flaggers)

Use of police officers for manual control of traffic is expensive, but important during some forms of temporary traffic control work. The primary time when police control is required is at traffic signals, when less than the usual numbers of lanes exist due to construction/ maintenance work. The reason signals are installed in the first place is because of high traffic on both streets. When those lanes are removed, it is important that manual control replace electrical control to allocate green time equitably and to best move traffic.

Manual control of traffic is essential at times. Using police officers and flaggers can accomplish things that no physical traffic control device can do. Police officers and flaggers can visually assess traffic conditions and respond accordingly.

Only uniformed Phoenix, Maricopa County Sheriffs Department, or Department of Public Safety law enforcement officers are allowed to control traffic in Phoenix in order to expedite enforcement (citation writing), empower ready communication, enable performance feedback, and insure reliability.

Police Control

On-duty Police Officers (see Definition) are only available for use during emergency conditions and for traffic control during restrictions by City departments when traffic conditions warrant. On-duty police officer use is coordinated by the Police Department Information Desk. Call 602-262-7626 Monday through Friday from 7:30 a.m. to 3:00 p.m.

Off-duty Police Officers, when needed, are to be hired by the RMP Clients. Off-duty police officers can be arranged for contractually. Phoenix officers are the first choice to be used because of radio communications with on-duty officers, accountability, and citation writing ability. Additionally, history has shown that Phoenix officers show more allegiance to making Phoenix streets operate efficiently than others less familiar with Phoenix.

Police officers that are alert, visible, and accommodating can be a valuable public relations asset for both the city and RMP Clients. Conversely, they **can create** a poor image for the city if they are not contributing to the efficient and safe movement of traffic. Since officers wear an official uniform, their performance reflects powerfully upon Phoenix. **Expectations of the City and employers of police officers** hired to provide manual traffic control are set high. When police officers are hired to support construction/maintenance/ special event efforts, expectations are that officers will:

- ❒ Perform in a manner that favorably reflects on Phoenix,
- ❒ Manually operate signals in such a manner so as to benefit pedestrians, public vehicular traffic, as well as the RMP Clients.
- ❒ Position themselves in such a manner as to have access to the traffic signal cabinet, yet maintain a full view (360-degree vision) of ALL traffic movements,

- ❒ Station their vehicle in a manner that does not block sidewalks, or block traffic.

Upon arrival at the job site, the off-duty police officer shall:

- ❒ Contact the RMP Client or assigned City inspector to receive detailed instructions on how the movement of the displaced traffic is to be sequenced through the signalized intersection,
- ❒ Be equipped with the proper equipment (i.e., highly visible safety vest, signal cabinet access key, two-way radio, etc.) as required to perform this vital temporary traffic function,
- ❒ Assure that physical obstructions (i.e., no vehicles parked on sidewalks and/or near the signal controller cabinet) preventing access for pedestrians with disabilities,
- ❒ "Stand-their-post" at all times except for during planned breaks (i.e., not simply watching work being performed, etc.). As with any employer, breaks need to be coordinated with the RMP Client. This includes work shift changes for continuous operation of the intersection.

Off-duty police officers duties include, but are not limited to the following:

- ❒ Assisting pedestrians as well as vehicles when needed or when requested.
- ❒ Keeping traffic lanes functional, and free of illegally parked or workers vehicles by arranging for their removal.
- ❒ Insisting the RMP Client restrict turns at intersections, if necessary to achieve the specified number of through lanes.
- ❒ Confirming RMP Client set-up has proper advance warning signs posted.
- ❒ Doing what is necessary to facilitate manual traffic control when needed to cope with unforeseen traffic pattern changes, such as during blasting operations.
- ❒ Observing, and immediately reporting traffic problems to the appropriate RMP Client and assigned inspection staff.
- ❒ Enforcing speed limits/other restrictions in or near the work zone.
- ❒ Assisting as needed with temporary traffic control setup and takedown activities.
- ❒ Assist troubled flagging operations by providing a more authoritative presence to motorists.

Flagger Control

Flaggers are limited by the ***MUTCD*** to flagging operations that can be accomplished from the edge of the traveled way, but police officers are authorized by City Code to direct traffic as required. They can operate traffic signals, control multiple lanes of traffic, complete intersections, and even permit/prohibit specialized lane movements. They can also assist pedestrians and enforce traffic restrictions.

Flaggers (see definition) should be alert, courteous, neat, and possess a sense of responsibility for the safety of the public and work crews.

For daytime and nighttime activity, flaggers shall wear highly visible safety apparel meeting the standards provided in the latest edition of the ***MUTCD***. Flaggers shall also wear an approved hard hat and incorporate the use of an authorized STOP/SLOW sign to manually control traffic. The STOP/SLOW sign shall be 18 inches wide and octagonal shape with 6 inch Series C letters. The STOP face shall have a red background with white letters and border. The SLOW face shall have an orange background with black letters and border. The sign shall be mounted on a suitable staff to support the sign a minimum of 5 feet from the ground when in use.

The use of flags for controlling traffic is limited to emergency use only. Flagging procedures are illustrated in Figure 12.

Flaggers shall be stationed at a readily visible location on the shoulder, or behind channelization, in advance of the restriction. Flagger stations shall be marked with a high level warning device. "FLAGGER AHEAD" and "BE PREPARED TO STOP" signs shall be used in advance of each station. At no time should a flagger be allowed to stand in the traveled portion of the roadway, or cross a traffic lane to stop more than one lane of traffic.

Each flagger station shall be illuminated during the hours of darkness. All traffic control devices, including the STOP/SLOW sign and the flagger's vest, shall be reflectorized. Signs, barricades and channelization in advance of each flagger station shall have barricade warning lights attached and in operation.

Police Officer and Flagger Functions

Police officers or flaggers, depending on the situation, are required at locations where equipment is intermittently blocking or crossing a traffic lane, or where ***only one traffic lane*** is available for two directions of travel.

Police officers carry with them the broad authority under State Law to control traffic, and also possess special training. These characteristics make police officers important to use at multiple lane, signalized intersections, when traffic is restricted to one through traffic lane in any one direction. Additionally, police officers may be required at signalized intersections when restricted to less than the normal number of lanes.

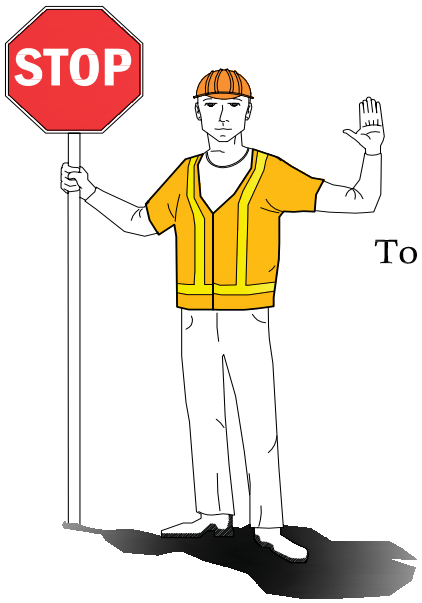
Police officers or flaggers, depending on the situation, are required at times when a large number of trucks enter and leave construction sites. Use of police officers is mandatory whenever manual control of more than one lane traffic is necessary, as such control cannot be done by flaggers from the edge of the roadway. Police officers or flaggers are to be provided in other situations when required by RMP Agents.

Figure 12

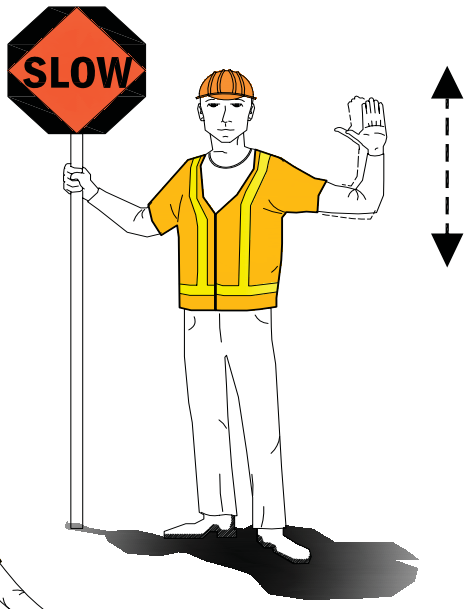
Flaggers shall use a Stop/Slow paddle on a 5' staff and a high level warning device (flag tree) at all times.

Daytime: Flagger must wear ANSI Class II or better vest with a hard hat.

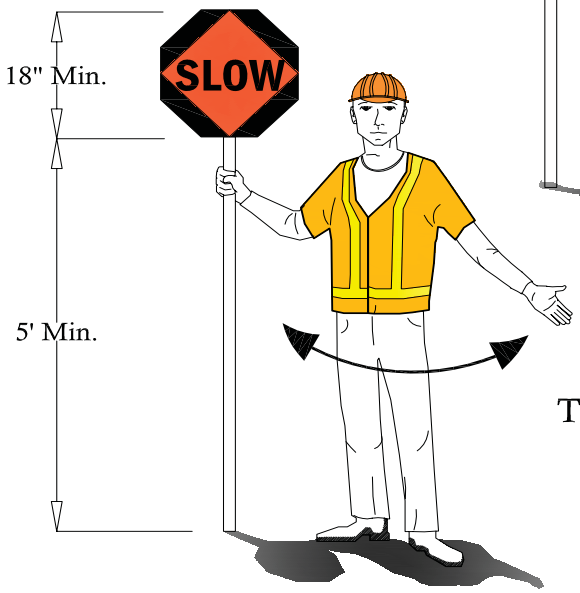
Nighttime: Flagger must weat ANSI Class III apparel with a hard hat and be visible by use of a light tower or other direct lighting.



To Stop Traffic



To Alert and Slow Traffic



Traffic May Proceed

FLAGGING PROCEDURES

QUALITY REQUIREMENTS FOR TRAFFIC CONTROL DEVICES

CHAPTER 8

RMP Client Notes:

Chapter 8

QUALITY OF TEMPORARY TRAFFIC CONTROL DEVICES AND SAFETY EQUIPMENT

To be effective, a traffic control device (permanent or temporary) must be of high quality and:

- ❒ Fulfill a need;
- ❒ Command attention;
- ❒ Convey a clear, simple meaning;
- ❒ Command respect from road users;
- ❒ Give adequate time for proper response.

Phoenix believes in the importance of the above to the point our staff helped develop, and fully supports the ***Quality Standards for Work Zone Traffic Control Devices, 2006*** published by the American Traffic Safety Services Association (ATSSA). Phoenix staff worked with ATSSA in creating photographs, which depicted signs and barricades in clear stages of degradation. The intent was to define what varying quality levels of signs and barricades were necessary to command respect from road users. The ATSSA results demonstrate the differences in appearance of devices that are rated Acceptable, Marginal, and Unacceptable. Inspectors and RMP Clients who are responsible for making sure high quality devices are provided are urged to familiarize themselves with these ATSSA condition ratings. It is important to remember that these "condition" standards are what are to be used as the basis for writing citations in an effort to improve safety and motorist understanding.

The *2003 Manual on Uniform Traffic Control Devices* (*MUTCD*) provides the following support guidance in Section 1A.01 on Temporary Traffic Control (TTC) devices.

"The purpose of traffic control devices, as well as the principles for their use, is to promote highway safety and efficiency by providing for the orderly movement of all road users on streets and highways throughout the Nation."

"Traffic control devices notify road users of regulations and provide warning and guidance needed for the reasonably safe, uniform, and efficient operation of all elements of the traffic stream."

Traffic controls are a necessary part of TTC zones to warn motorists of hazards, advise them of the proper path through the zone, delineate areas where they may not operate, and to separate them from the workers. This is accomplished by the deployment of a system of devices. The success of this system depends on the visibility of each device at the time of a project's initial installation as well as throughout the life of the project. Since it is not practical to require new devices at all times, guidelines are needed to evaluate condition of used devices to assure continued effectiveness. The guidelines in this publication should aid in the determination of the quality of used devices.

The use of TTC zone devices subjects them to wear that does not occur with permanent devices. Much of this wear occurs during the storage, shipment, installation, relocation, and removal of devices causing deterioration in appearance. Whenever a high number of these worn and damaged devices appear on the same project, the general appearance of the TTC zone deteriorates, reducing the level of safety provided to the workers, pedestrians, and traveling public.

These guidelines have been developed in an effort to offset the deterioration in appearance of TTC zone devices. A determination of the condition of device quality should be made at several stages: while in storage, during preparation for delivery to the TTC zone, during initial set up and periodically during the course of the work. Suppliers and Contractors are encouraged to apply this guideline prior to delivery of devices to the jobsite. Doing so will minimize agency involvement and reduce costs related to on-site replacement.

These guidelines are intended to address the day-to-day operations of traffic control within a TTC zone and are not meant to cover the needs of emergency situations. Crashworthy is a term used by the Federal Highway Administration to refer to devices acceptable for use on the National Highway System (high speed roadways). Devices used on those highways must meet performance criteria contained in the National Cooperative Highway Research Program (NCHRP Report 350) entitled "Recommended Procedures for the Safety Performance Evaluation of Highway Features". That testing was done exclusively on high-speed highways and results are appropriate for those highways. On city streets however, devices that have proven to not present the same problems as they do on higher speed highways may be deemed acceptable by the agency. During the past four decades there have been no reported collisions in Phoenix where a metal traffic control device became a projectile and penetrated a vehicles windshield.

High Visibility Apparel Quality Requirements

All workers exposed to the risks of moving roadway traffic or construction equipment should wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Safety Apparel" (see Section 1A.11), or equivalent revisions, and labeled as ANSI 107-2004 (or current edition) standard performance for Class 1, 2, or 3 risk exposure. A competent person designated by the employer to be responsible for the worker safety plan within the activity area of the job site should make the selection of the appropriate class of garment.

For daytime and nighttime activity, flaggers shall wear safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel" (see Section 1A.11) and labeled as meeting the ANSI 107-2004 (or current edition) standard performance for Class 2 risk exposure. The apparel background (outer) material color shall be either fluorescent orange-red or fluorescent yellow-green as defined in the standard. The retroreflective material shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 300 m (1,000 ft). The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

ATTSA Quality Classifications

The quality of the TTC zone devices in this guideline has been divided into three categories: acceptable, marginal, and unacceptable.

At the time of the initial set up or at the time of major stage changes, one hundred percent (100%) of each type of device (cones, tubular markers, drums, barricades, vertical panels, signs, warning lights, arrow panels, changeable message signs, pavement tape and raised pavement markers) shall be classified as "acceptable". Throughout the duration of the project, the number of acceptable devices may decrease to seventy-five percent (75%) of the initial quantity, as a result of damage and/or deterioration during the course of the work, with the remainder of the devices in the marginal category. Unacceptable devices or situations that are found on the jobsite shall be replaced or the situation corrected within twelve (12) hours of notification or as specified in the contract specifications.

Acceptable: Devices that meet the quality requirements in this *TBM* for this classification and all other requirements such as design, size, color, weight, etc. in the plans and specifications shall be considered to be acceptable for use on highway construction or contract maintenance projects.

Marginal: The term "Marginal" for the purpose of this *TBM* means "marginally acceptable", reaching the lower end of acceptability. Devices that meet the quality criteria for marginal as described in this *TBM* may remain in the TTC zone until their number exceeds the specified percentage of that type of device or until it is determined that they have become unacceptable. Should the percentage of devices in the marginal category exceed the specified percentage, the proper number of those devices shall be replaced so as to bring the percent of marginal devices to the specified percentage or less.

Unacceptable: Devices in this category shall not be delivered to the jobsite. When found in the TTC zone, they shall be replaced or repaired within 12 hours of notification or as contained in the contract specifications. **Temporary traffic control devices found in City of Phoenix ROW rated as Unacceptable shall cause the project/permit owner, or temporary device provider to be susceptible to fines per City Code Article XV, G-4599; 36-304. Temporary traffic control devices found that rate in the "Marginal" category will not cause fines to be initiated.**

The following photographs, together with the accompanying description, should be used as a guide to determine if the device is acceptable, marginal or unacceptable. A direct comparison of each device to this guideline is not required for rejection of devices; however, this guideline should be used to resolve disputes. One aid in avoiding potential disputes is to retain samples of devices in each category to supplement the photographs shown in the evaluation guides that follow.

Quality Guidelines For Channelizing Devices and Signs

Application of this guideline provides the means to meet the requirements of Section 1A.05 of the *MUTCD* which states:

"Physical maintenance of traffic control devices should be performed to retain legibility and visibility of the device, and to retain the proper functioning of the device. Clean, legible, properly mounted devices in good working condition command the respect of road users."

This guideline applies to all channelizing devices and signs that are furnished by the agency, supplier, Subcontractor or Contractor and used for traffic control in TTC zones.

All channelizing devices and signs shall conform to the requirements of the Manual on Uniform Traffic Control Devices (*MUTCD*) and the contract documents with regard to size, shape, color, placement and legend. Special signs, if required, are normally detailed in the plans. All devices required to be tested to NCHRP-350 standards shall be approved by the FHWA.

Signs shall be substantially plumb to the pavement. Sign positioning at the work site should be determined based on site conditions. Usually the sign spacing may be increased if a design location proves to be unsuitable. Signs mounted on temporary mounts that are not vertical by design, (A-Frame barricade for example), should be as near vertical as practicable.

For barricades or vertical panels to be used in TTC Zones, all requirements shall be met to the satisfaction of the contracting agency. Vertical panels shall be erected and maintained in a vertical position. Barricades shall be considered unacceptable if they have bent or twisted legs (see photo, this page), unfinished or excessively rusty metal parts, unfinished wooden rails, or deformation of the support assembly to the extent that the barricade panel is not reasonably parallel to the roadway surface.

Acceptable channelizing devices and signs should be constructed and ballasted to perform in a predictable manner when inadvertently struck by a vehicle. Channelizing devices and signs should be crashworthy. Fragments or other debris from the device or the ballast should not pose a significant hazard to road users or workers.

Any situation where there are more than two adjacent channelizing devices missing or substantially out of alignment will cause an unacceptable situation.

The evaluation guide that follows is to be used to evaluate the quality of the reflective face and general appearance of signs, barricades, vertical panels, and cones. The City of Phoenix staff is grateful to ATSSA for allowing the Phoenix to use their copy written graphics and text.

Evaluation Guide

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*

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*.

Unacceptable:
Signs with asphalt splatter or cement slurry of an amount similar to the abrasions that are evident throughout the face of this sign are unacceptable. Some letters have a loss of more than 50 percent (50%). There is noticeable color fading, and the message is illegible per the design criteria of the *MUTCD*.

Type I, II, or III Barricade or Vertical Panels

Acceptable:
Panel is not deformed to an extent so as to decrease the panel's 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 reflective material similar in area to that shown here would also make a panel unacceptable.

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 staining asphalt splatter or cement slurry make these an unlikely candidate for improvement. Large areas of missing or stained reflective material make the cone unacceptable.

Warning Lights, Type A, B, & C

Acceptable: This standard applies to all Type A, B & C warning lights, advance warning arrow panels, and changeable message signs that are furnished by the agency, supplier, Subcontractor, or Contractor and used for traffic control in work zones.

The use and placement of Type A, B & C warning lights, advance warning arrow panels, and changeable message signs are specified in the contract documents. All Type A, B & C warning lights, advance warning arrow panels, and changeable message signs shall be in accordance with the most current version of the *Manual on Uniform Traffic Control Devices (MUTCD).*

For Type A, B & C warning lights to be functioning properly, they must meet the *MUTCD* criteria which states: "Type A low intensity flashing warning lights and Type C steady burn warning lights shall be maintained so as to be capable of being visible on a clear night from a distance of 3,000 feet. Type B high intensity flashing warning lights shall be maintained so as to be capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1,000 feet".

The evaluation guide that follows is to be used to evaluate the appearance and function of Type A, B & C warning lights, advance warning arrow panels, and changeable message signs. Because of the different types of advance warning arrow panels approved for use, the evaluation guide will address each type (mode) of panel separately.

Any warning light, arrow panel, or changeable message sign, which is out of alignment from the intended driver's line of vision, shall be considered to be "unacceptable".

Warning Lights

Acceptable: One hundred percent (100%) of all warning lights must be properly operating and meeting the *MUTCD* specifications.

Marginal: Not less than ninety percent (90%) of the warning lights must be properly operating and meeting the *MUTCD* specifications with no more than three (3) adjacent lights failing.

Unacceptable: Less than ninety percent (90%) of the warning lights properly operating and meeting the *MUTCD* specifications, or more than three (3) adjacent lights failing, or more than one (1) Type B warning light failing for more than twelve (12) consecutive hours or as specified in the contract document.

Arrow Panel (Flashing Arrow Mode, or Sequential Arrow)

Acceptable: Not more than one (1) lamp out in stem and none out in arrowhead, and dimming properly.

Marginal: Two (2) or fewer lamps in stem out. No lamps out in the head. Dimming properly.

Unacceptable: Any lamp out in the head, or more than two (2) lamps out in the stem or arrow panel not dimming properly.

Note: Any operating lamp that is out of alignment will be considered "not functioning."

Arrow Panel (Chevron Mode)

Acceptable: No lamps out in any chevron segment.

Marginal: Not more than one (1) lamp out in any one chevron segment, and dimming properly.

Unacceptable: Two (2) or more lamps out in any one chevron segment, or not dimming properly.

Note: Any operating lamp that is out of alignment will be considered "not functioning".

Arrow Panel (Caution Mode – Bar or Corners)

Acceptable: Four (4) or more lamps operating and dimming properly.

Marginal: Minimum of four (4) lamps functioning, dimming properly.

Unacceptable: Less than four (4) lamps functioning or not dimming.

Note: Any operating lamp that is out of alignment will be considered "not functioning".

Arrow Panel (Double Arrow Mode)

Acceptable: Not more than one (1) lamp out in stem and none out in arrow heads, and dimming properly.

Marginal: Two (2) lamps out in stem, but both heads completely functional with no lamps out dimming properly.

Unacceptable: Any lamps in heads out or more than two (2) lamps out in the stem, or arrow panel not dimming properly.

Changeable Message Signs

Acceptable: Ninety percent (90%) or more of the pixels per character module are operating properly.

Marginal: No less than ninety percent (90%) of the pixels per character module are operating properly.

Unacceptable: Less than ninety (90%) of the pixels per character module are operating properly or not performing within the criteria of the *MUTCD*.

Storage of Temporary Traffic Control Devices

Property dedicated for public roadways and walkways belong to the public and need to be kept clear for public travel rather than used for private benefit, such as storage of signs and barricades. Too often, inconsiderate street/sidewalk workers leave barricades/signs sloppily across sidewalks or where they virtually preclude access to buildings, crosswalks, sidewalks or bus stops. When this happens, it imposes two adverse impacts (either impeding accessibility, or selfishly forces users to take lengthy alternate routes). This creates a tort liability risk for both the public entity and the company/individual responsible for using the ROW to store the devices.

Temporary devices cannot be stored in the ROW for extended periods of time because of appearance, vandalism, and the main fact that the ROW belongs to the general public. When temporary traffic control devices are allowed to be stored in the ROW, the "cluster" method shall apply to minimize problems. Certified temporary traffic control providers are expected to strategically place, "cluster", the devices in a professional manner, which will not impose physical obstructions to a pedestrian, bicyclists, motorist, or person in a wheelchair, and will minimize the probability of drawing public complaints.

APPENDIX A-1

Appendix A-1

BARRICADING ILLUSTRATIONS

Traffic channelization and barricading illustrations on the following pages show typical applications of signs, barricades, and channelizing devices. They illustrate strategies that have proven to be both effective and efficient throughout Phoenix, and represent the most common methods required for the uniform application and placement of standard traffic control devices. Specific situations, not specifically illustrated, need to be addressed making best use of the general principles described in this *TBM*, the *MUTCD*, and these illustrations. The illustrations are "typical" situations, and where applicable, differentiate between daytime and 24-hour channelization.

Notes About the Illustrations:

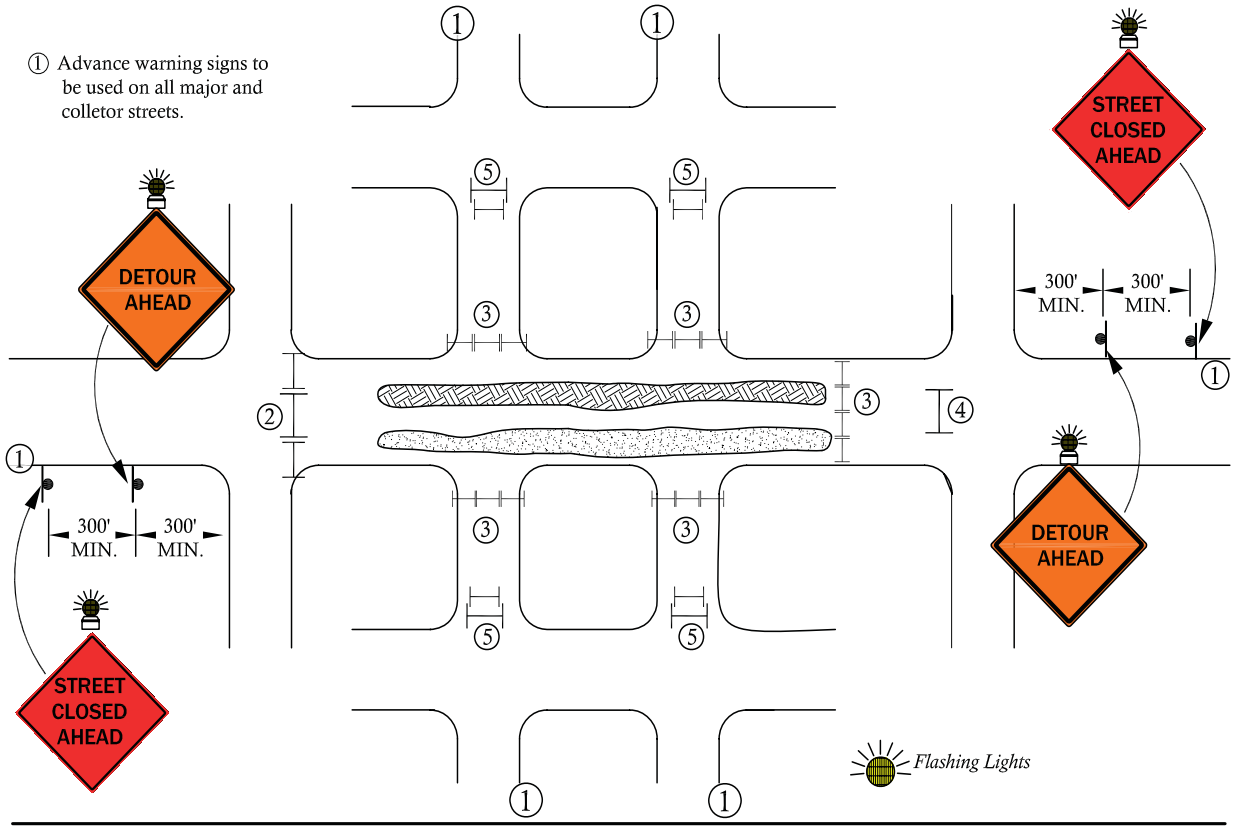
The "ROAD WORK AHEAD" sign is the key "lead" sign used to advise of an upcoming temporary traffic control work zone. Barricades, vertical panels, and channelizing devices are normally used to:

- ❒ Mark hazards (holes, equipment, materials, & drop-off's);
- ❒ Close streets;
- ❒ Shield workers and pedestrians in the public ROW.

Traffic cones are shown for daylight hours only. During the hours of darkness, they must be replaced with standard channelizing devices. Exceptions are rarely granted and approved by the ROW Administrator.

Devices used during darkness must be equipped with fully operating barricade warning lights, as specified. Only Type C steady burn warning lights are to be used on devices placed to guide traffic (tapers, centerlines, lane lines, or edge lines) Only Type A or Type B flashing warning lights are to be used on signs and flag type high level warning devices as specified. Type A flashing warning lights should be used on devices marking hazards because they have proven to be the most effective for this purpose.

Figure 13

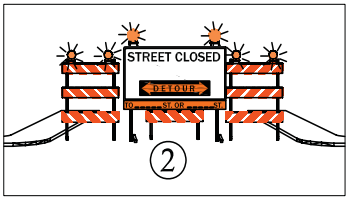


HARD CLOSURES

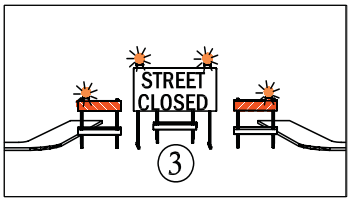
② R11-4 sign (without **To Thru Traffic** phrase) with Type III barricades to cover the full width of the roadway. To be used for all major and collector hard closures.*

③ R11-2 sign (without **Local Traffic Only** panel) with Type I barricades to cover the full width of the roadway, to be used for all local hard closures. *

MAJOR / COLLECTOR STREETS
Use R11-4



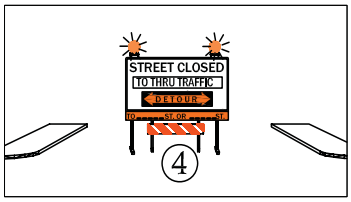
LOCAL STREETS
Use R11-2

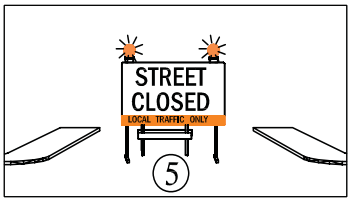


SOFT CLOSURES

④ R11-4 sign (with **To Thru Traffic** phrase), with Type III barricade. To be used for all major soft closures. *

⑤ R11-2 sign (with **Local Traffic Only** panel) with Type I barricade, to be used for collector and local soft closures. *





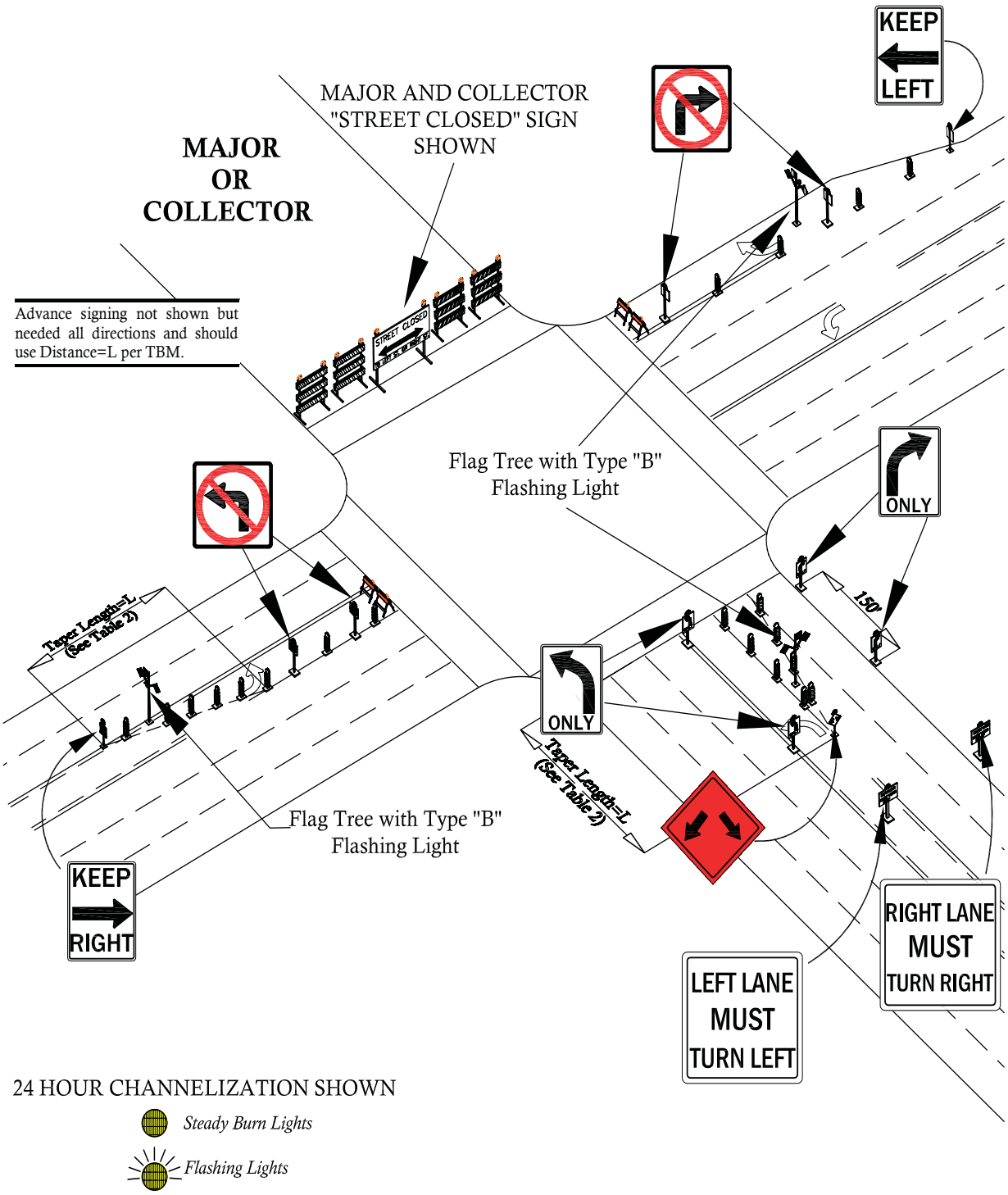
NOTE: Existing mandatory turn lanes approaching hard closures shall be closed. (See Figure 14)

****Reference Figure 7 for signage, Figure 8 for equipment***

STREET CLOSURE SIGNING

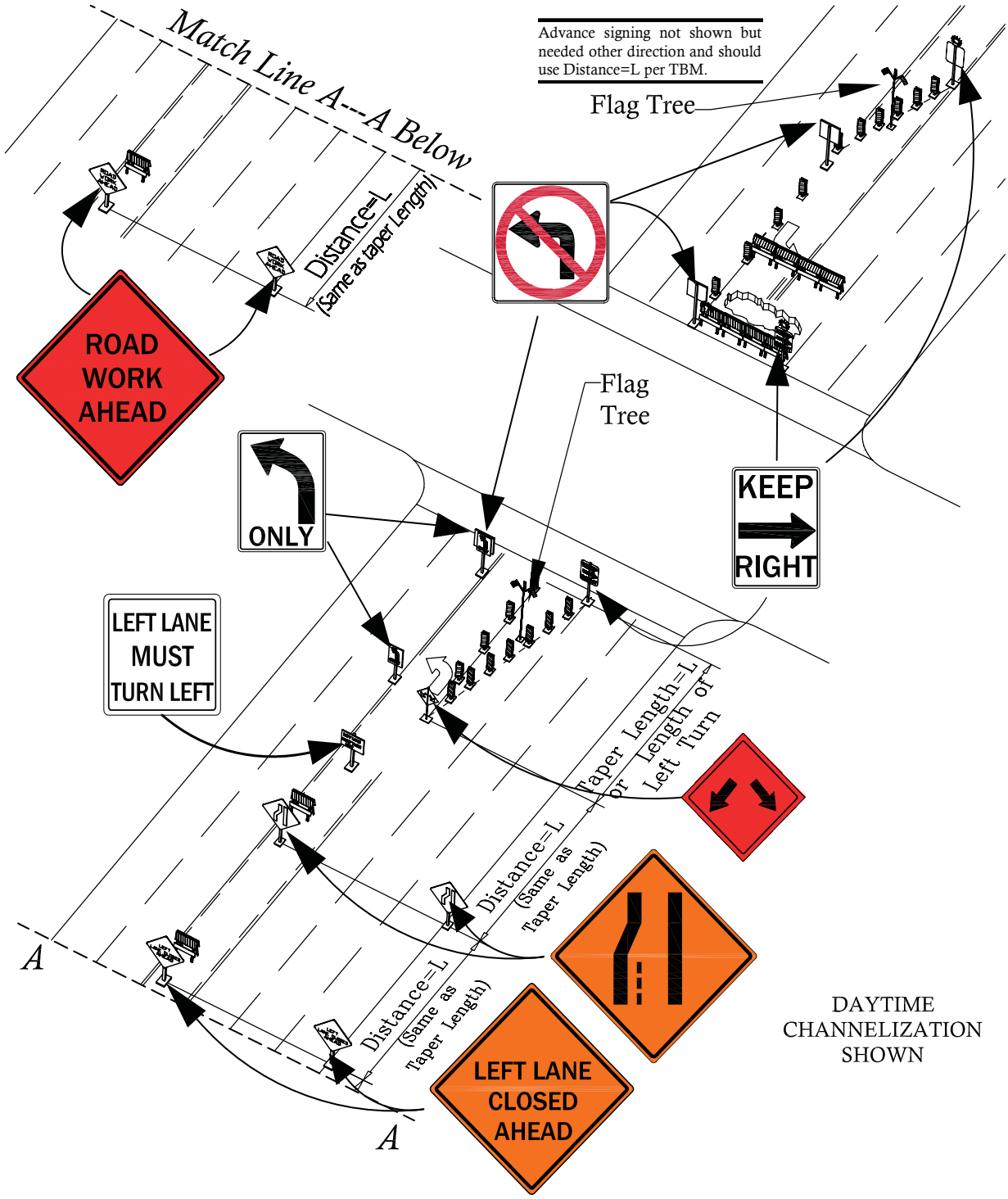
(Hard and soft)

Figure 14



TURN LANE TREATMENTS FOR HARD CLOSURES

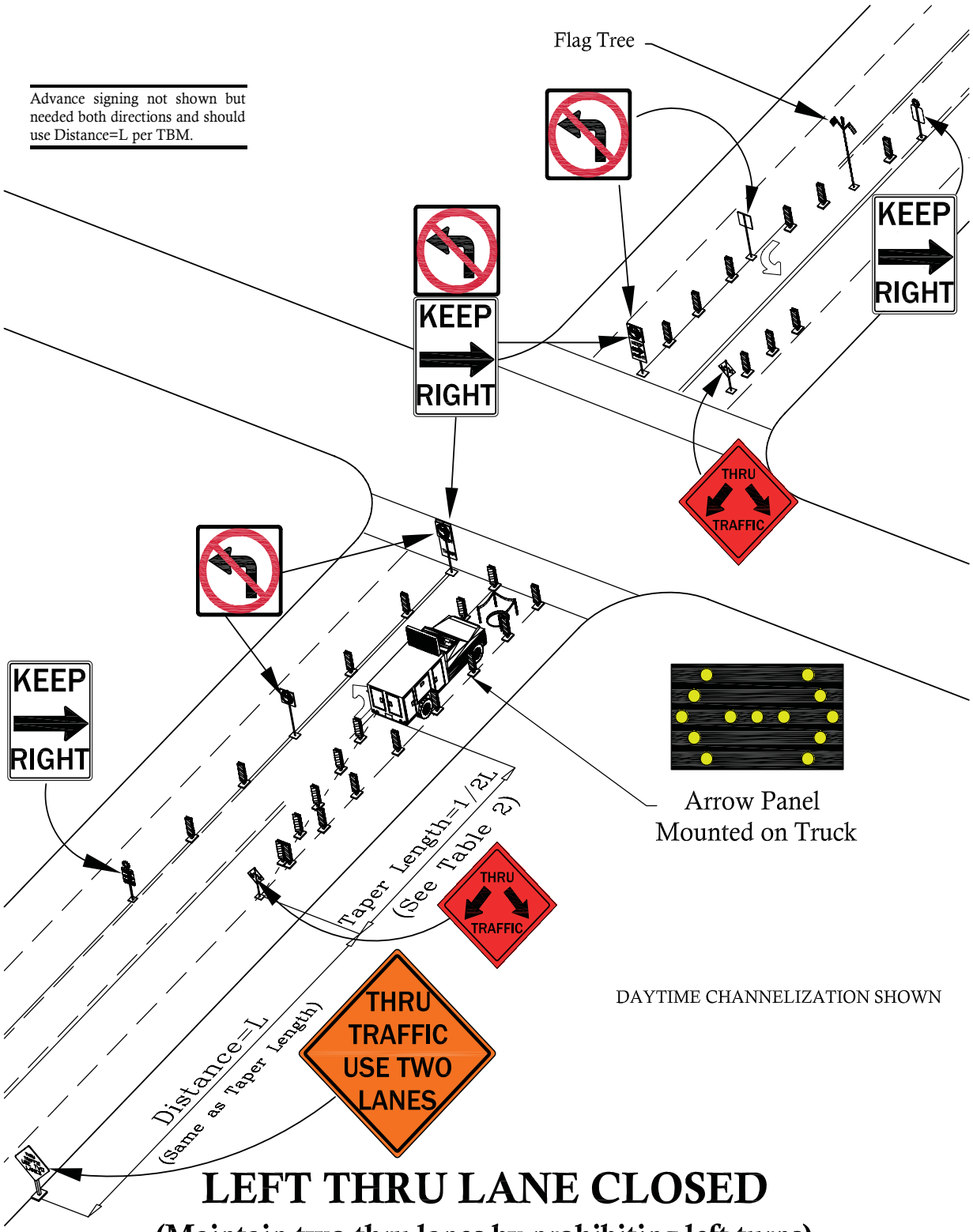
Figure 15



LEFT THRU LANE CLOSED

(Maintain two lanes)

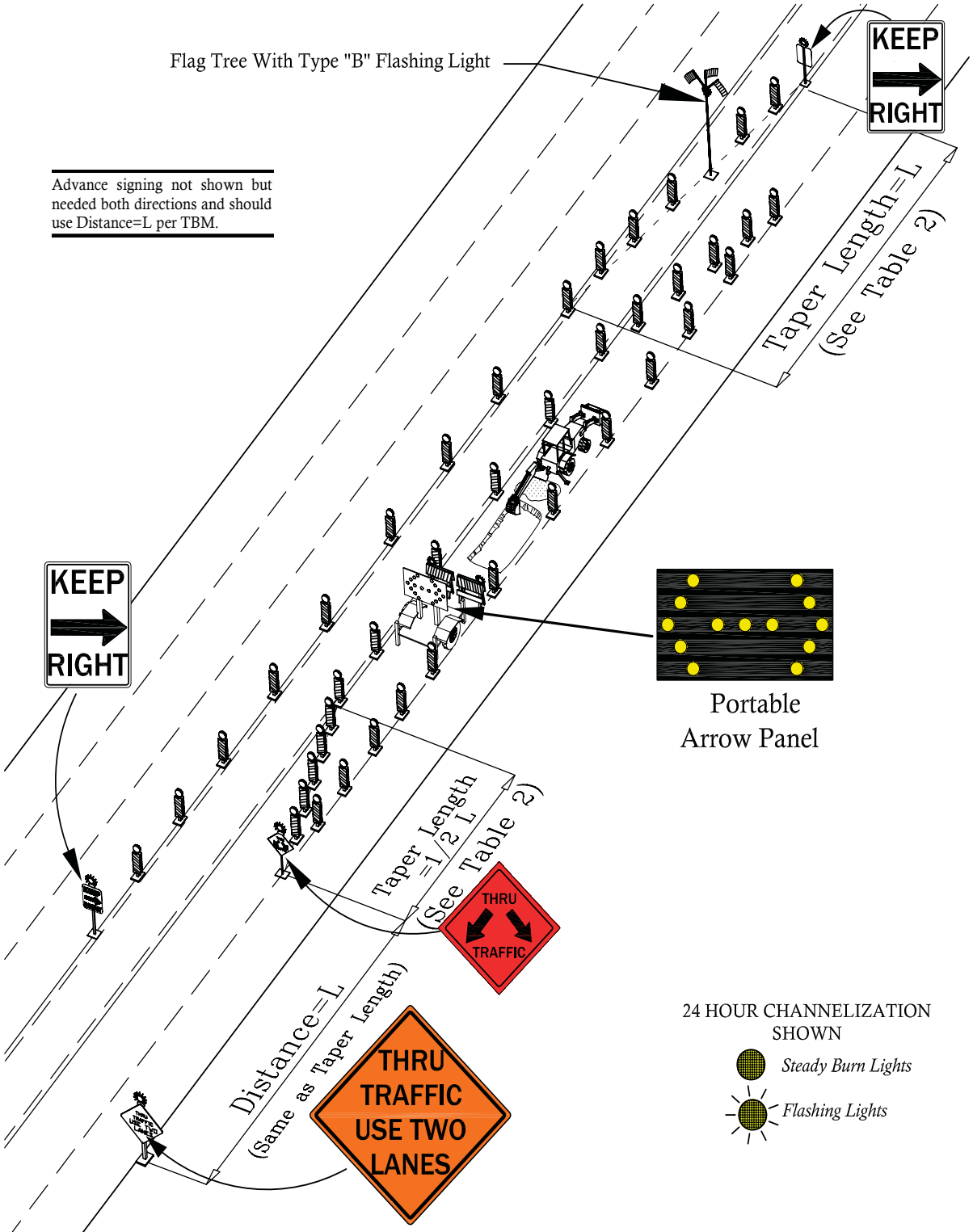
Figure 16



LEFT THRU LANE CLOSED

(Maintain two thru lanes by prohibiting left turns)

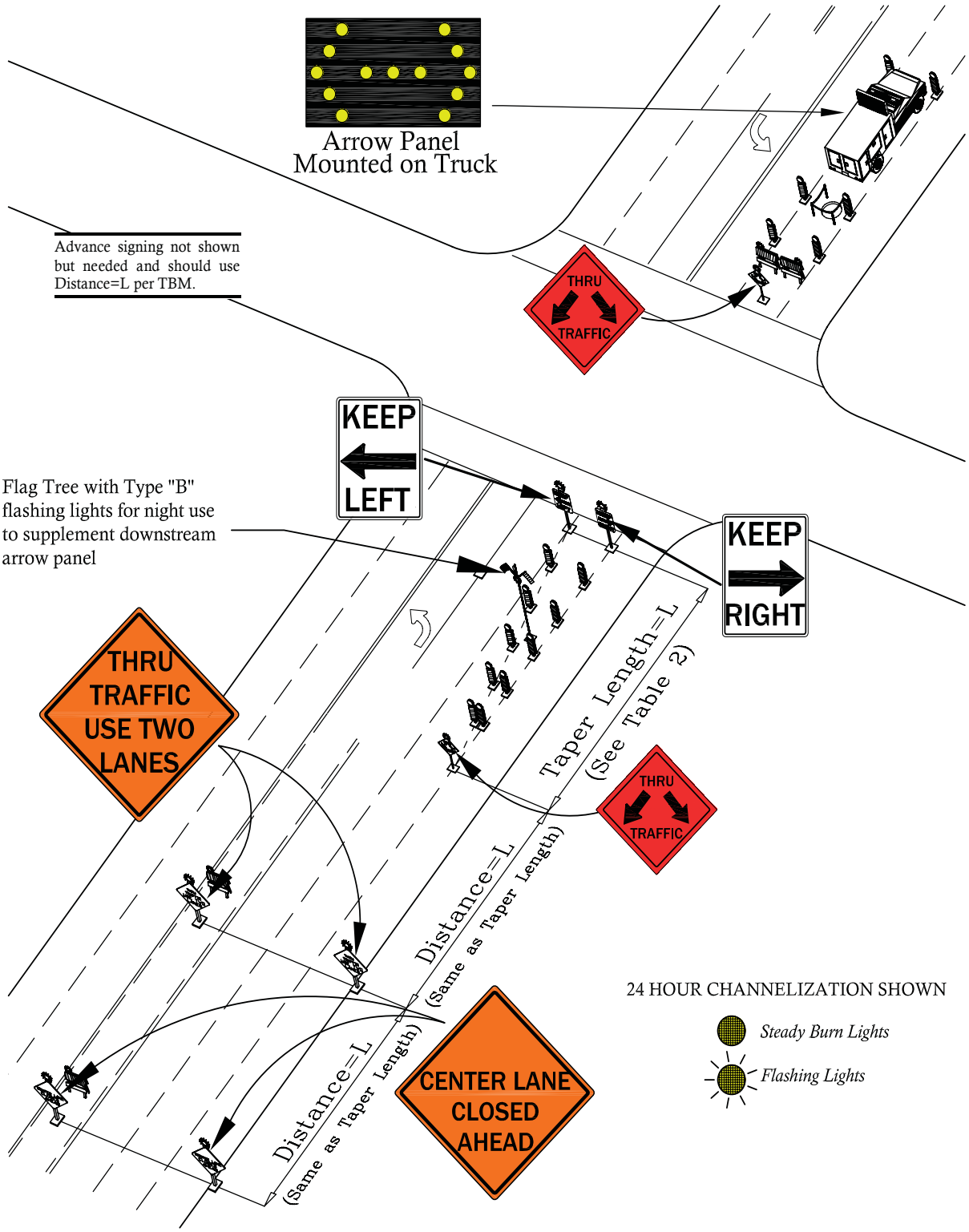
Figure 17



MIDBLOCK LEFT LANE CLOSED

(Maintain two lanes using left turn lane)

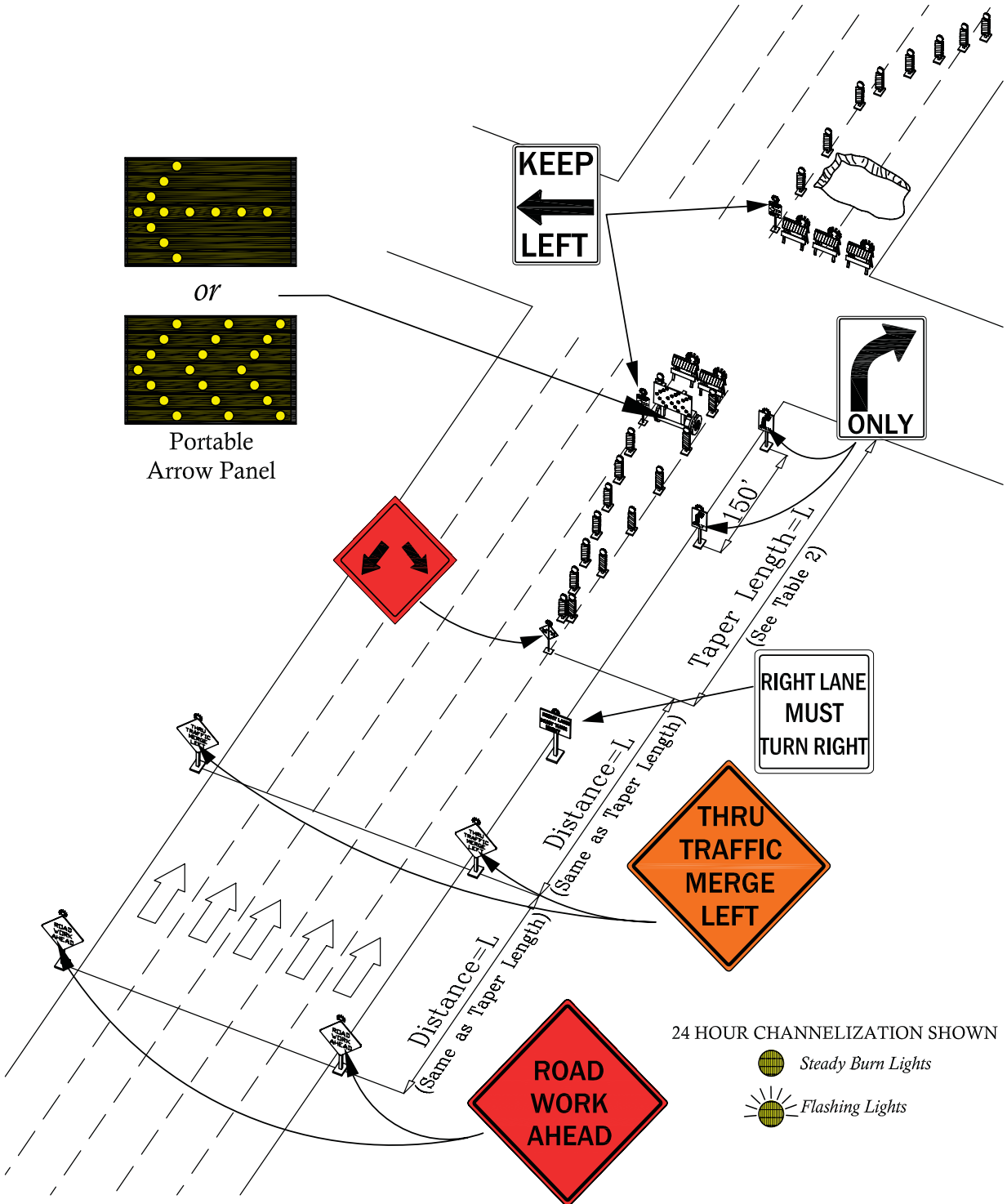
Figure 18



CENTER THRU LANE CLOSED

(Maintain two thru lanes)

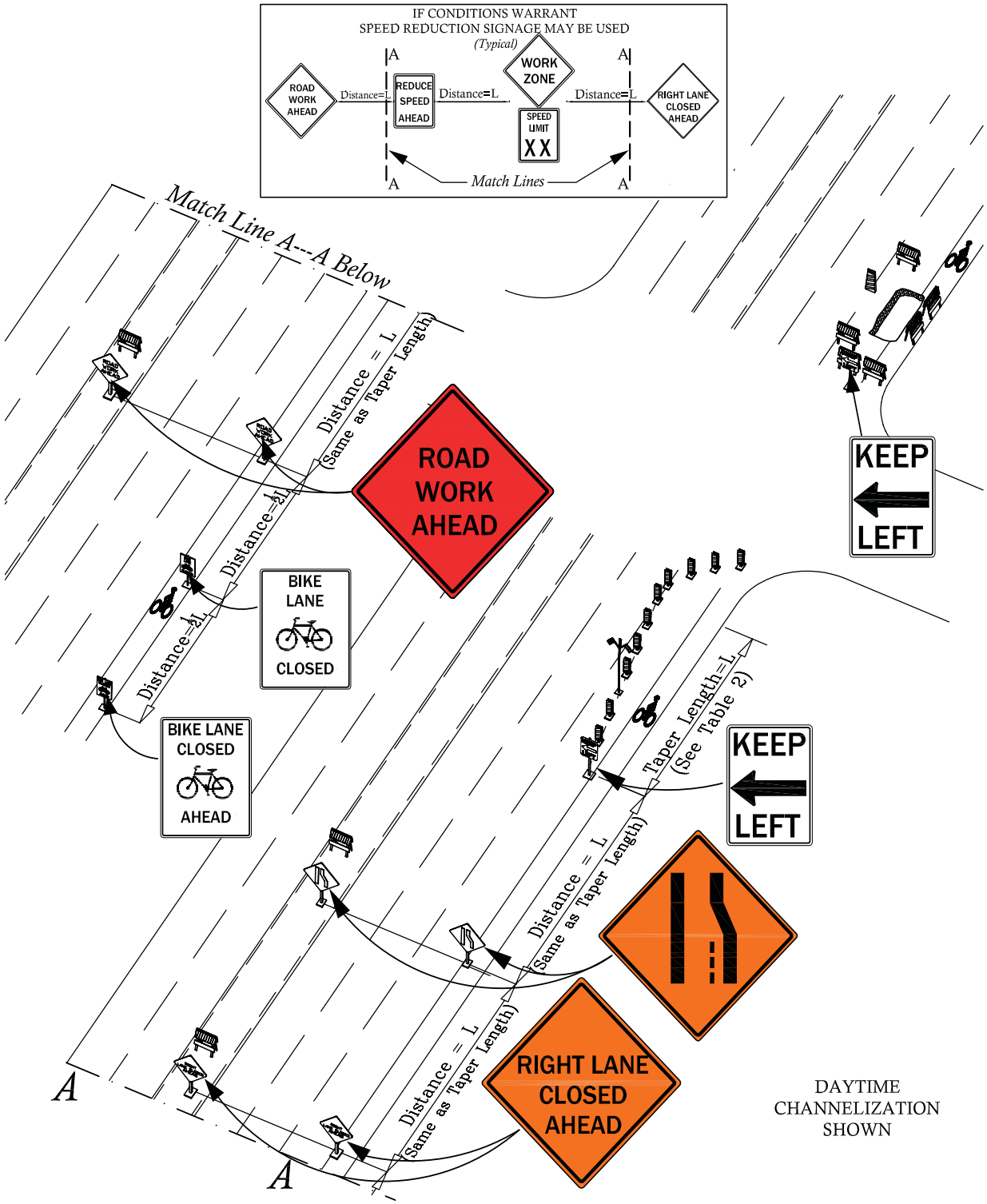
Figure 19



ONE WAY STREET-RIGHT 2 LANES CLOSED

(Create right turn lane)

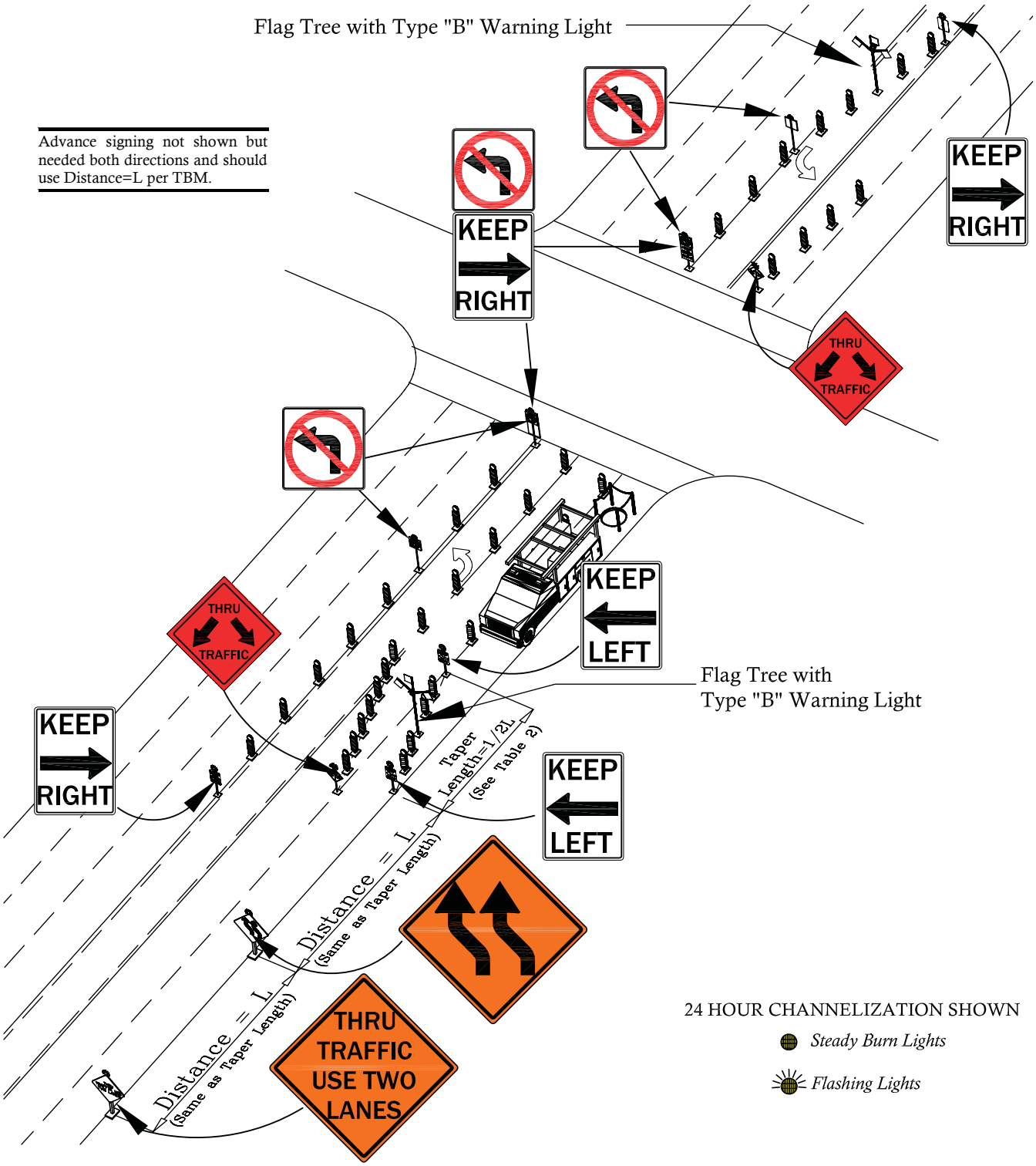
Figure 20



FARSIDE RIGHT/BIKE LANE CLOSED

(Maintain two thru lanes; end bike lane)

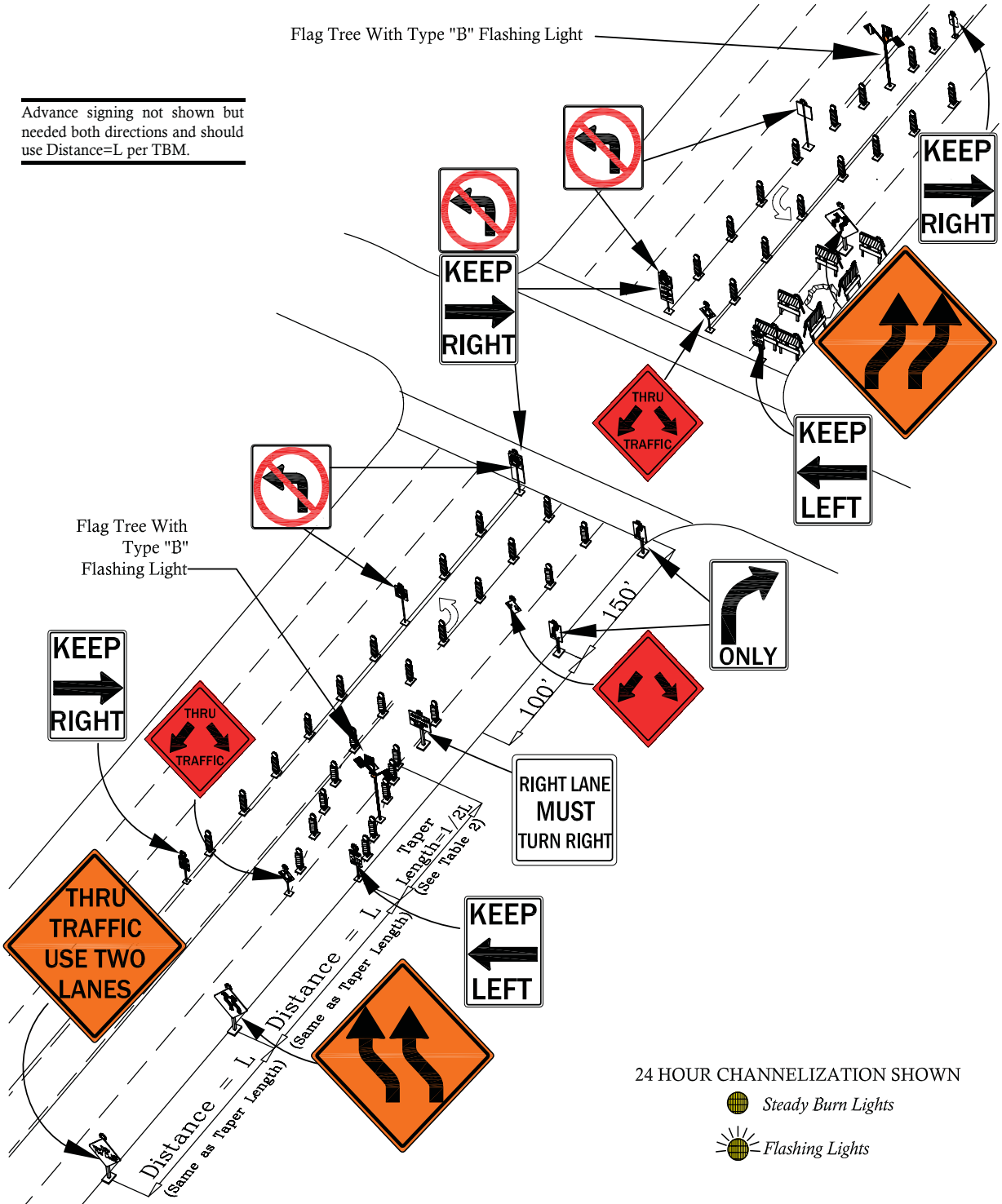
Figure 21



NEARSIDE RIGHT / THRU LANE CLOSED

(Maintain two thru lanes by prohibiting left turns)

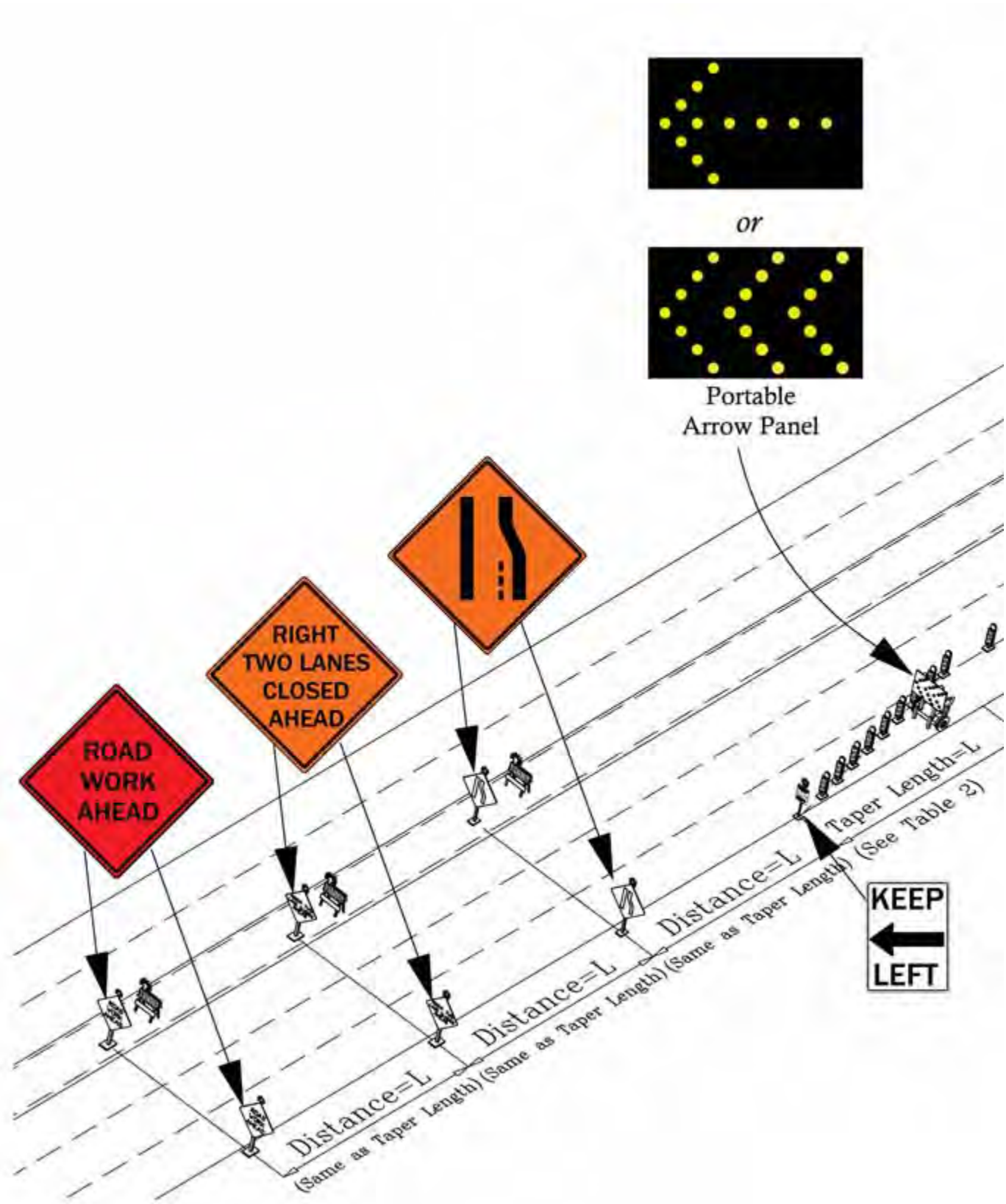
Figure 22

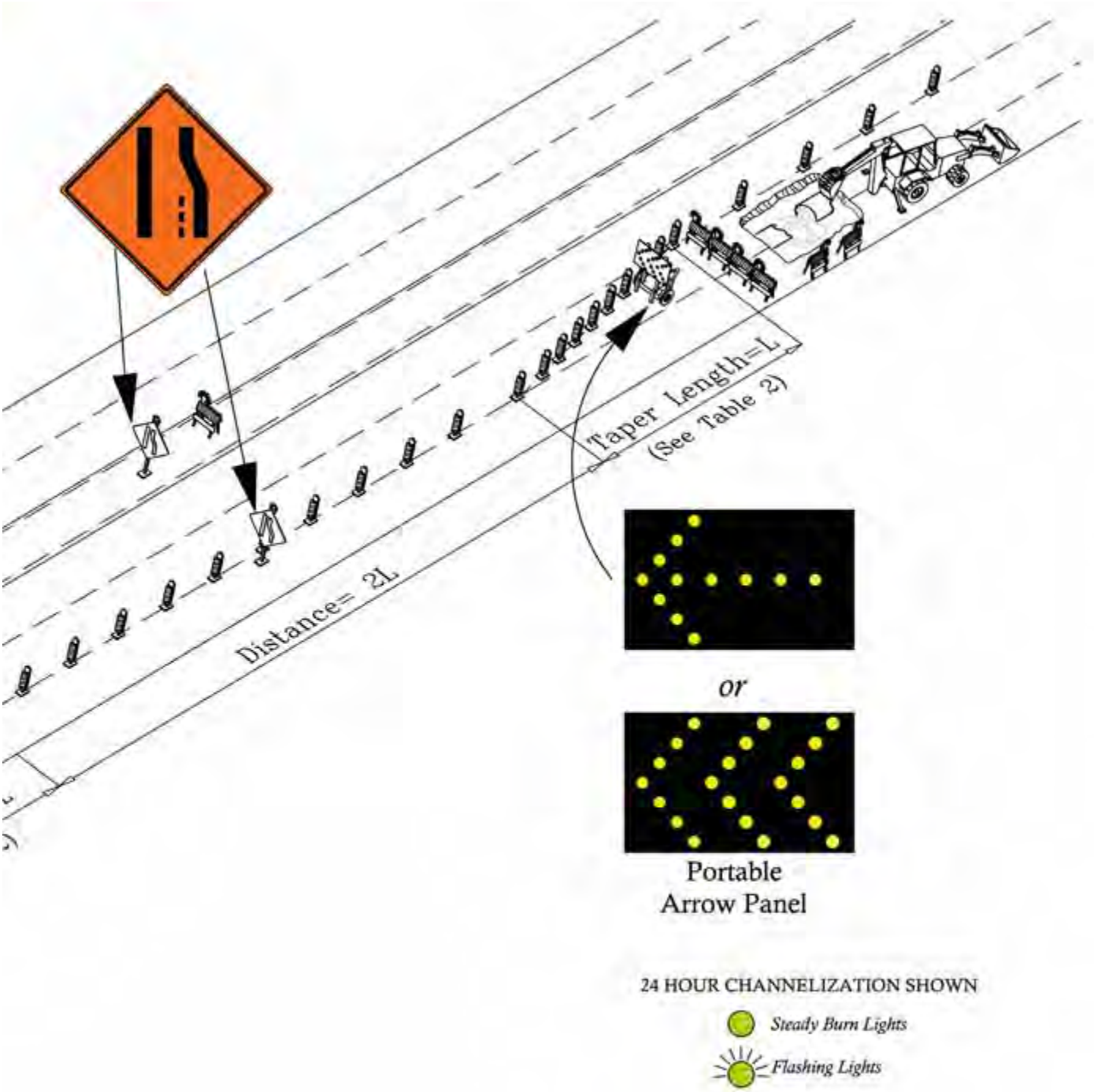


FARSIDE RIGHT LANE CLOSED

(Maintain two thru lanes by prohibiting left turns and create right turn lane)

Figure 23


or
Portable
Arrow Panel
ROAD
WORK
AHEAD
RIGHT
TWO LANES
CLOSED
AHEAD
KEEP
LEFT
Distance=L
(Same as Taper Length)
Distance=L
(Same as Taper Length)
Distance=L
(Same as Taper Length)
Taper Length=L
(See Table 2)

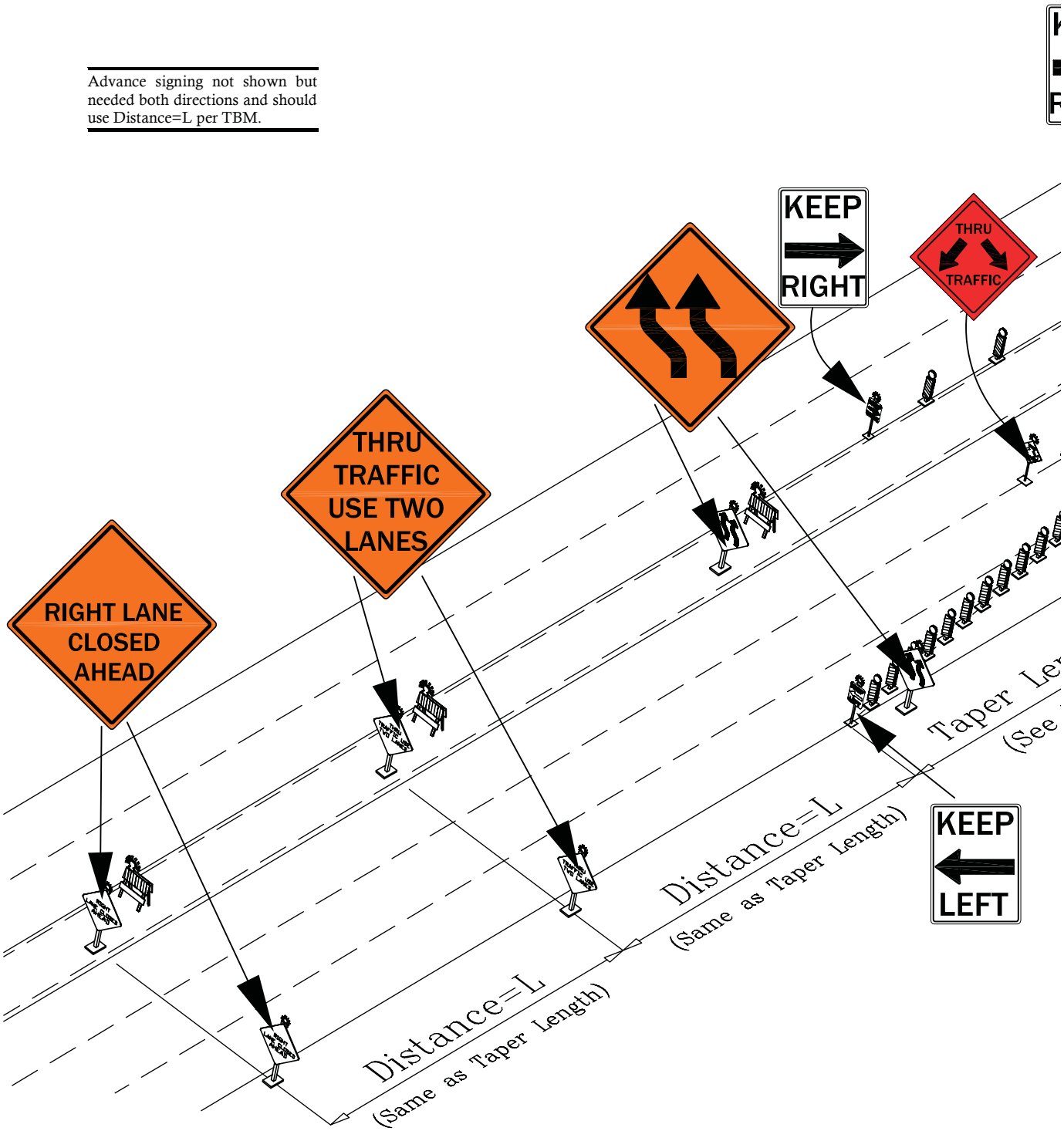


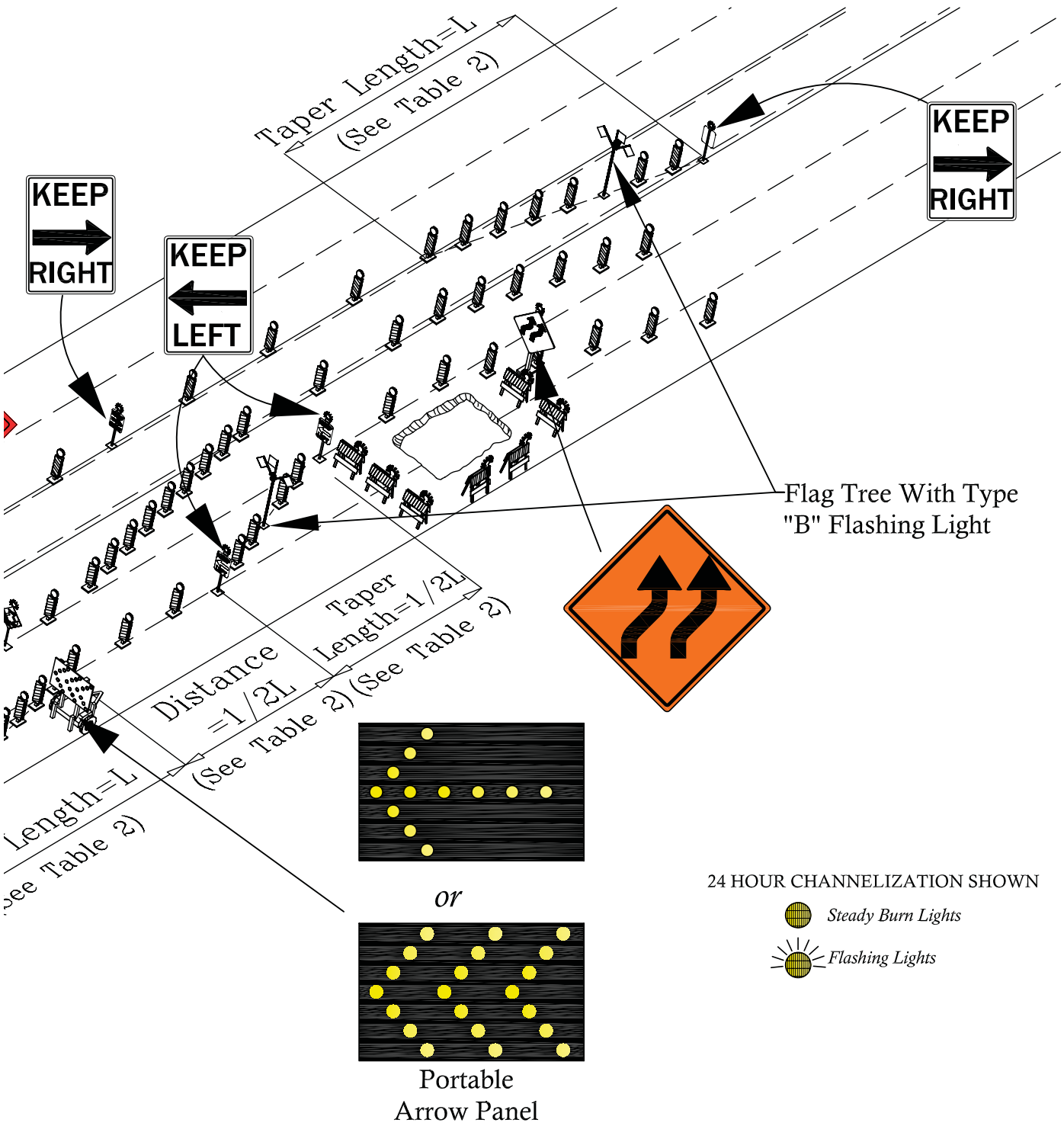
MIDBLOCK TWO RIGHT LANES CLOSED

(Maintain one thru lane)

Figure 24

Advance signing not shown but needed both directions and should use Distance=L per TBM.

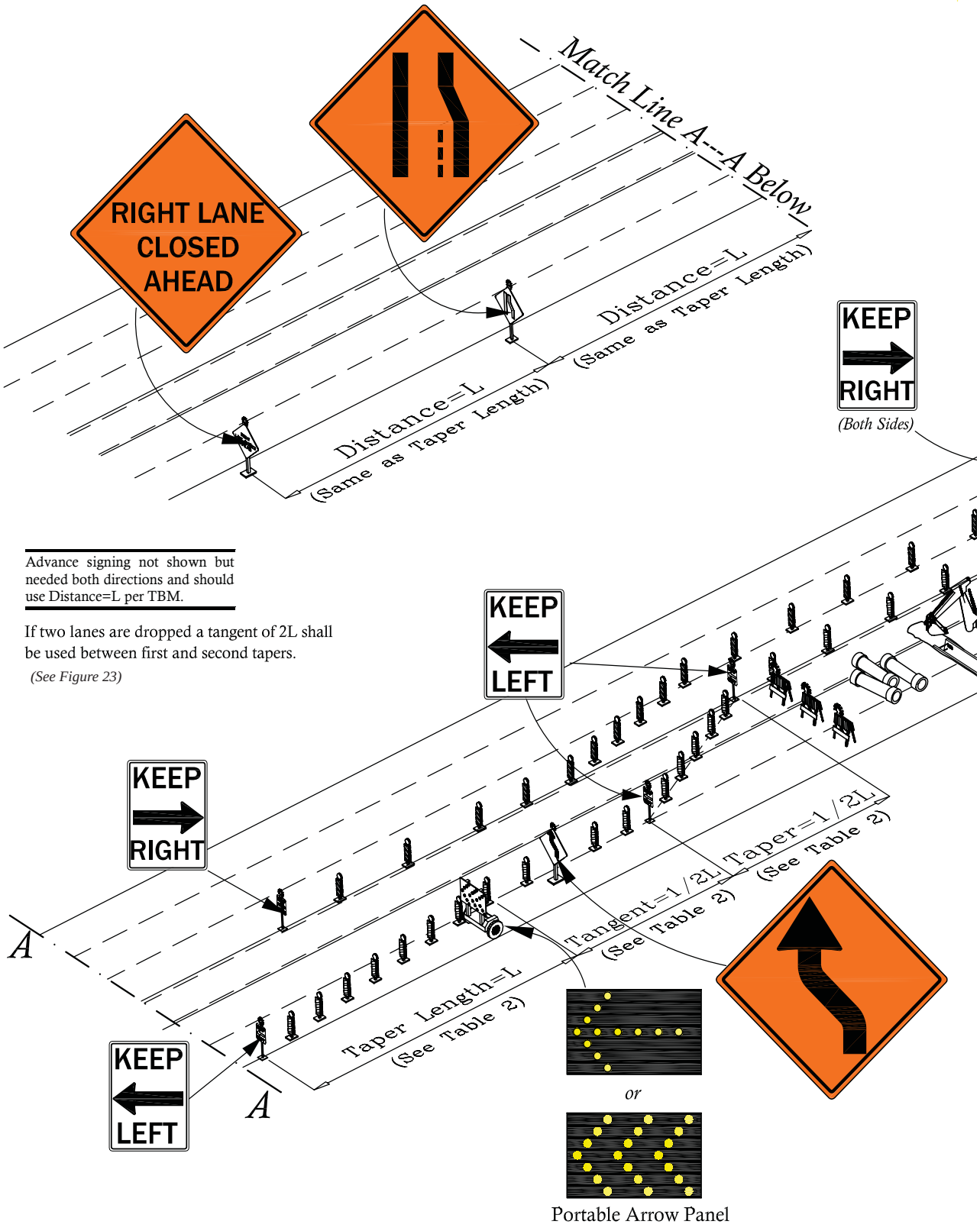




MIDBLOCK TWO RIGHT LANES CLOSED

(Maintain two lanes using left turn lane)

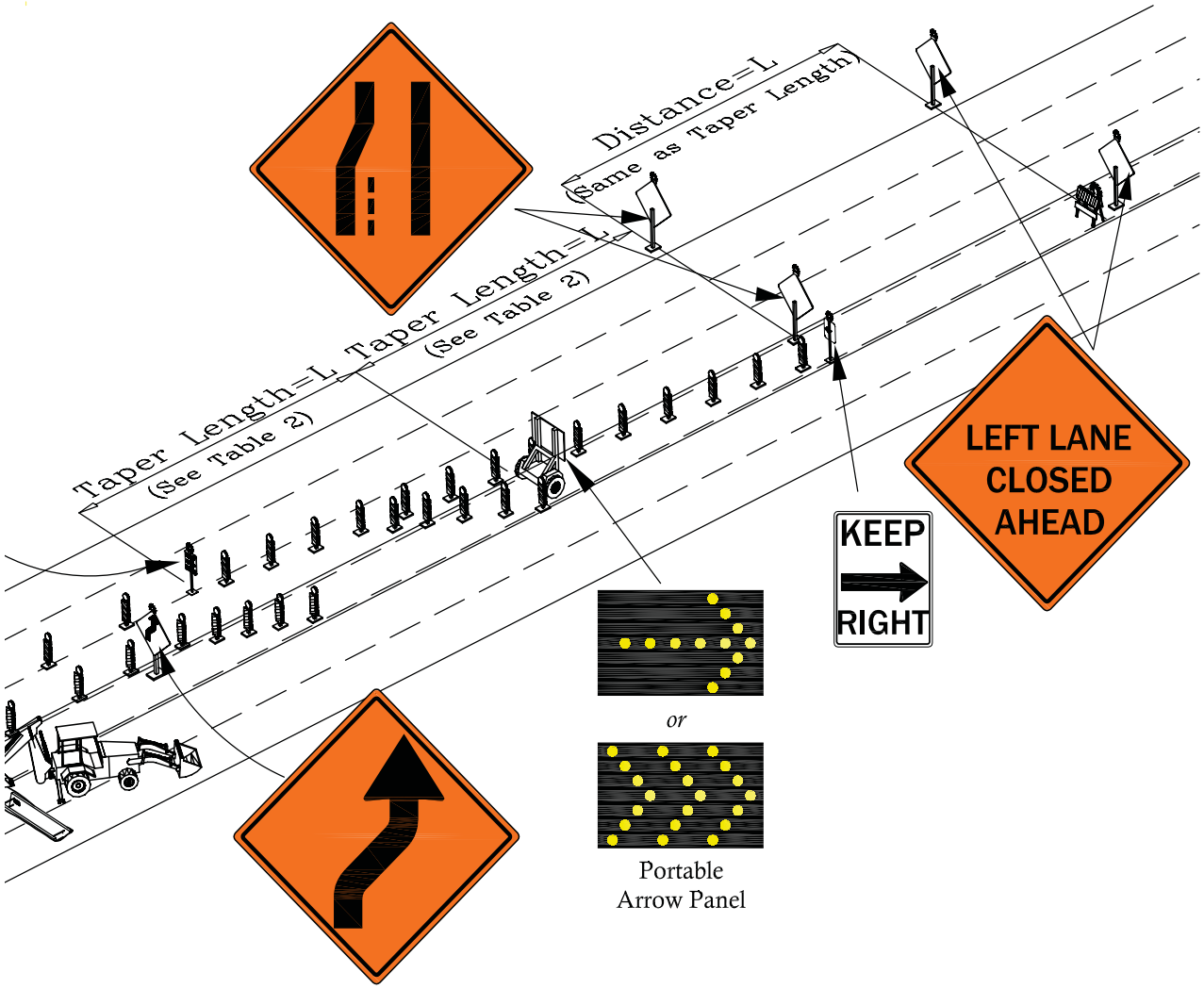
Figure 25



Advance signing not shown but needed both directions and should use Distance=L per TBM.

If two lanes are dropped a tangent of 2L shall be used between first and second tapers.

(See Figure 23)



24 HOUR CHANNELIZATION SHOWN

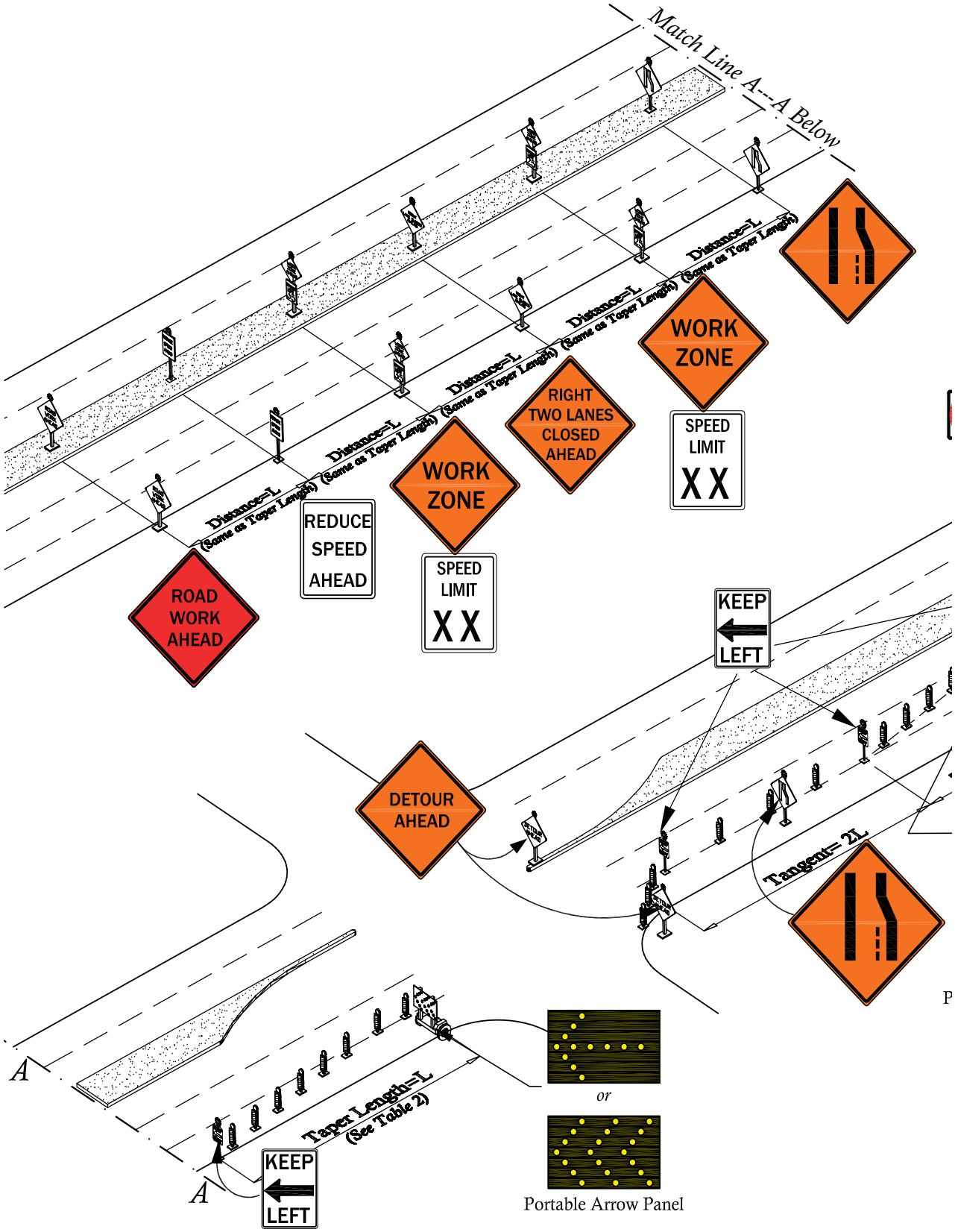
Steady Burn Lights

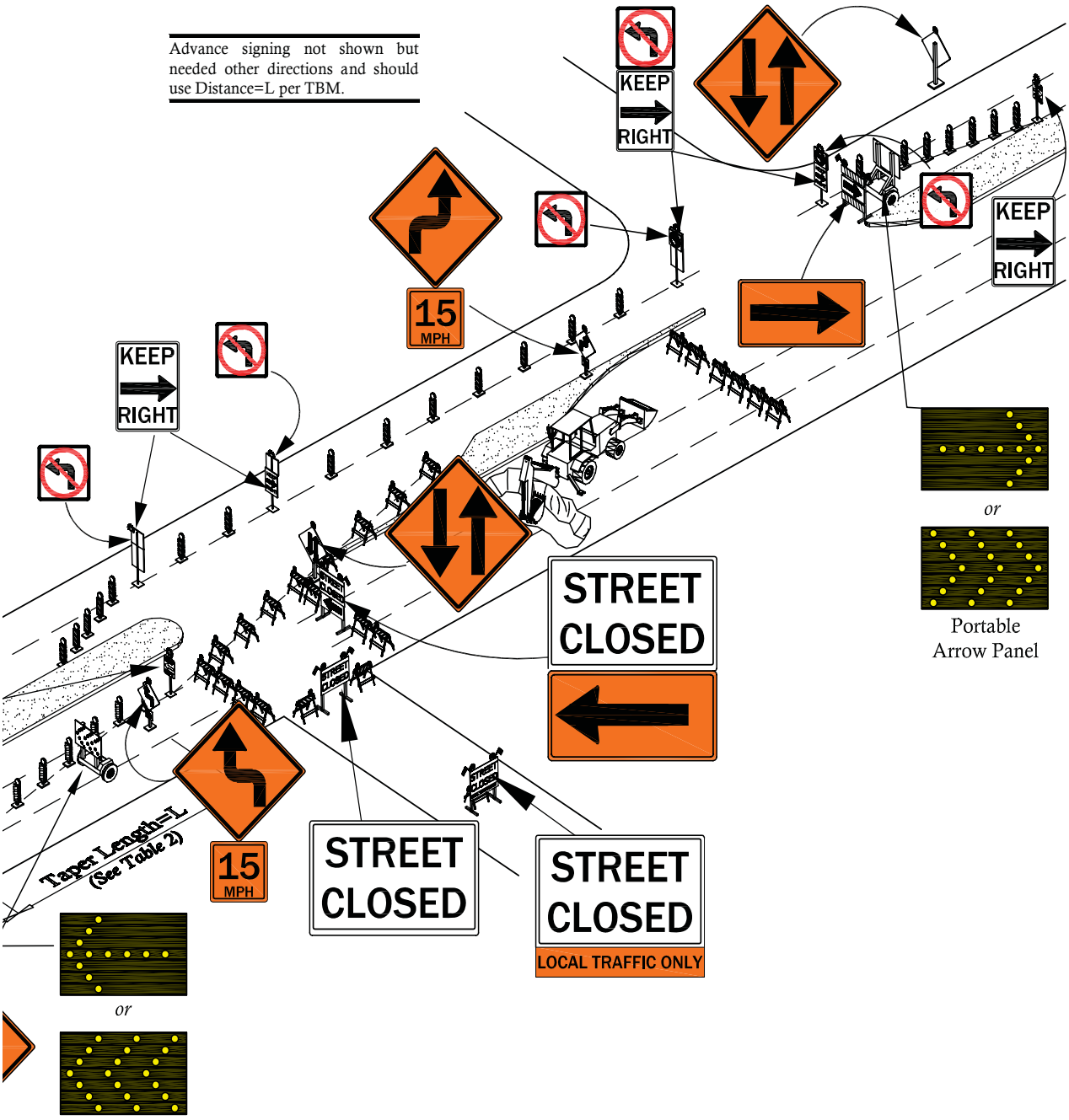
Flashing Lights

ENTIRE DIRECTION CLOSED

(Maintain one thru lane across centerline)

Figure 26


Match Line A--A Below
Distance=L
(Same as Taper Length)
ROAD WORK AHEAD
REDUCE SPEED AHEAD
WORK ZONE
SPEED LIMIT
X X
RIGHT TWO LANES CLOSED AHEAD
WORK ZONE
SPEED LIMIT
X X
KEEP
LEFT
DETOUR AHEAD
Tangent= 2L
A
A
Taper Length=L
(See Table 2)
KEEP
LEFT
or
Portable Arrow Panel



24 HOUR CHANNELIZATION SHOWN

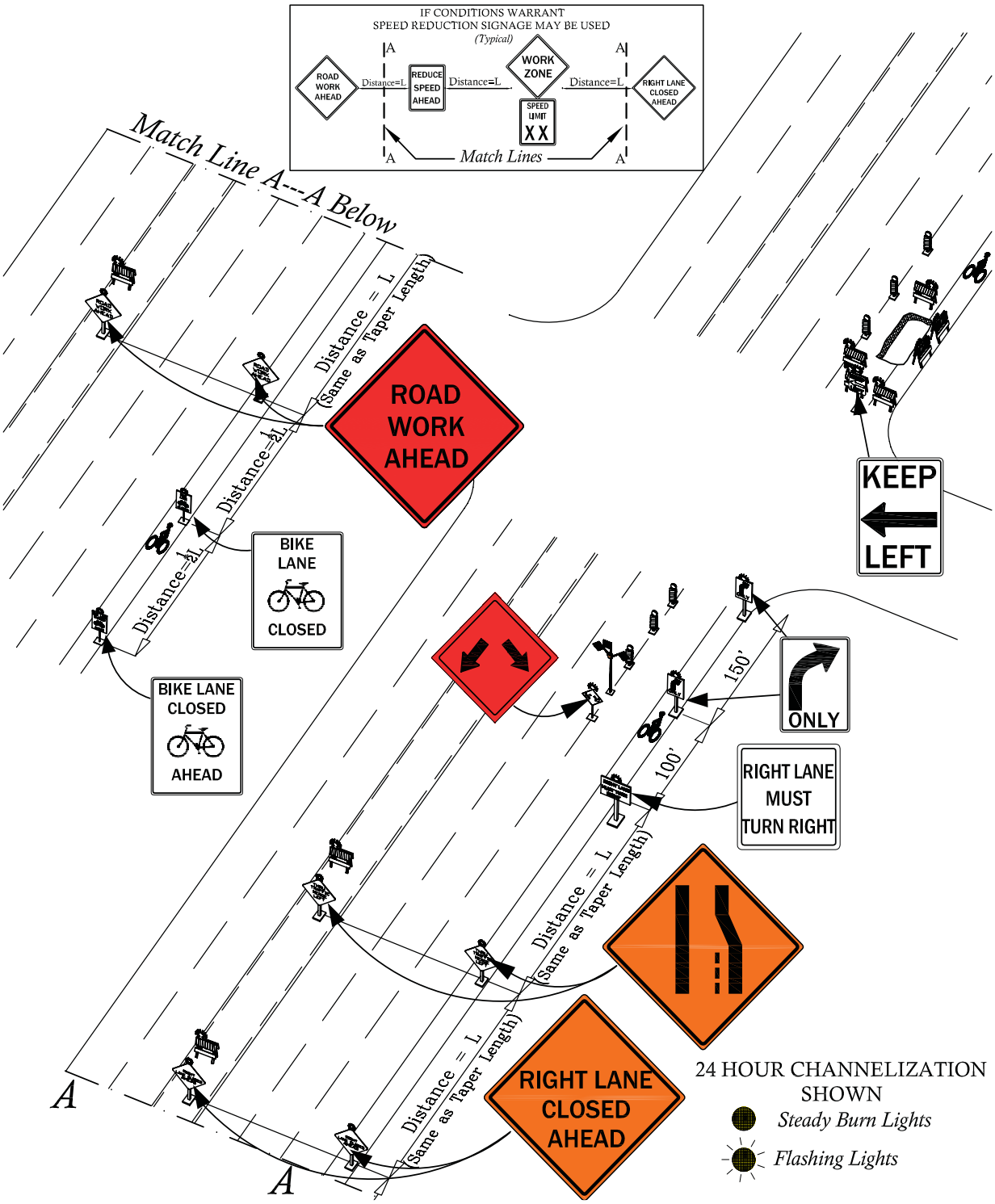
Steady Burn Lights

Flashing Lights

ENTIRE DIRECTION CLOSED (RAISED MEDIANS)

(Maintain one lane thru raised median)

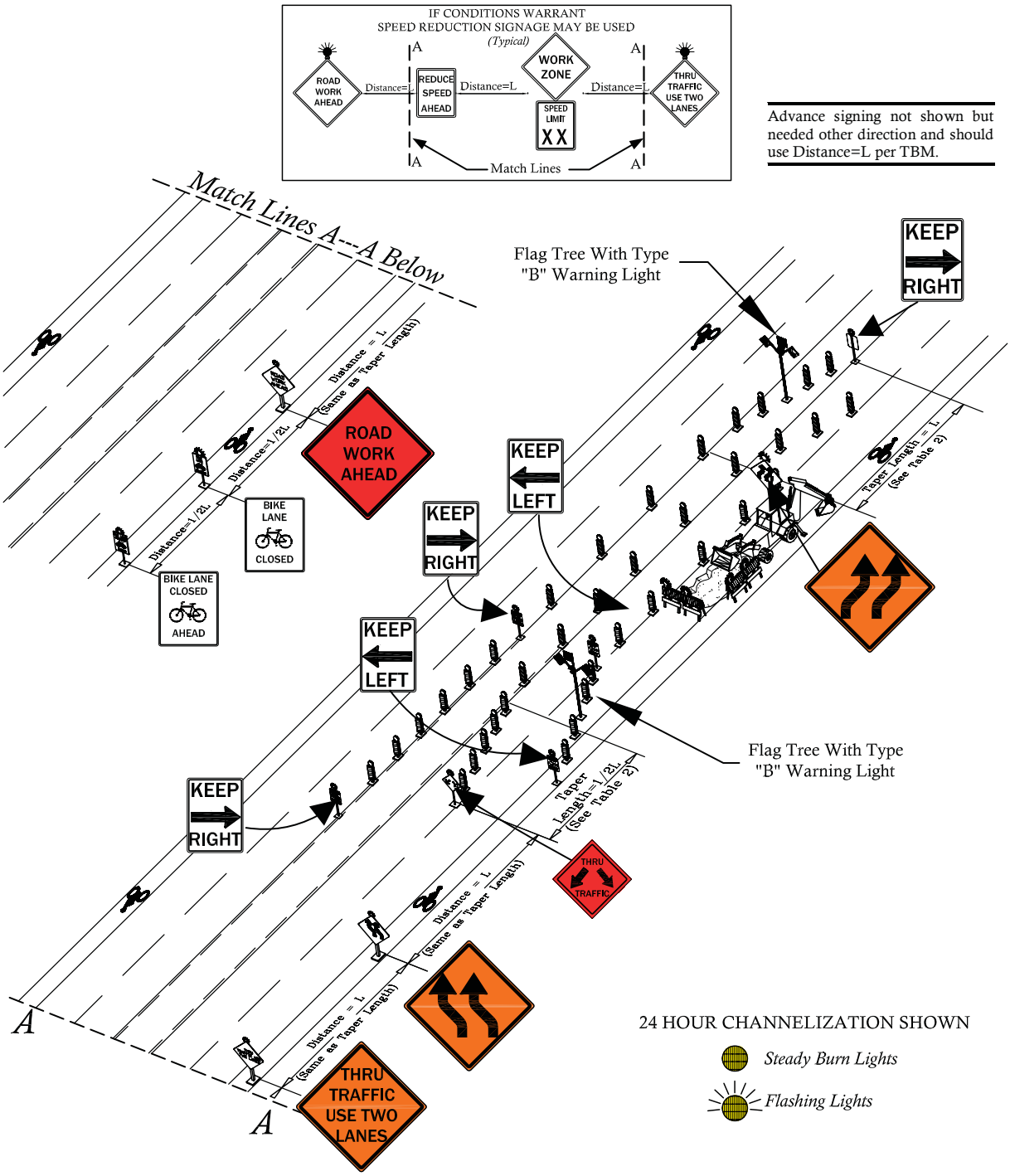
Figure 27



FARSIDE BIKE / RIGHT LANE CLOSED

(Create right turn lane)

Figure 28



MIDBLOCK BIKE / RIGHT LANE CLOSED

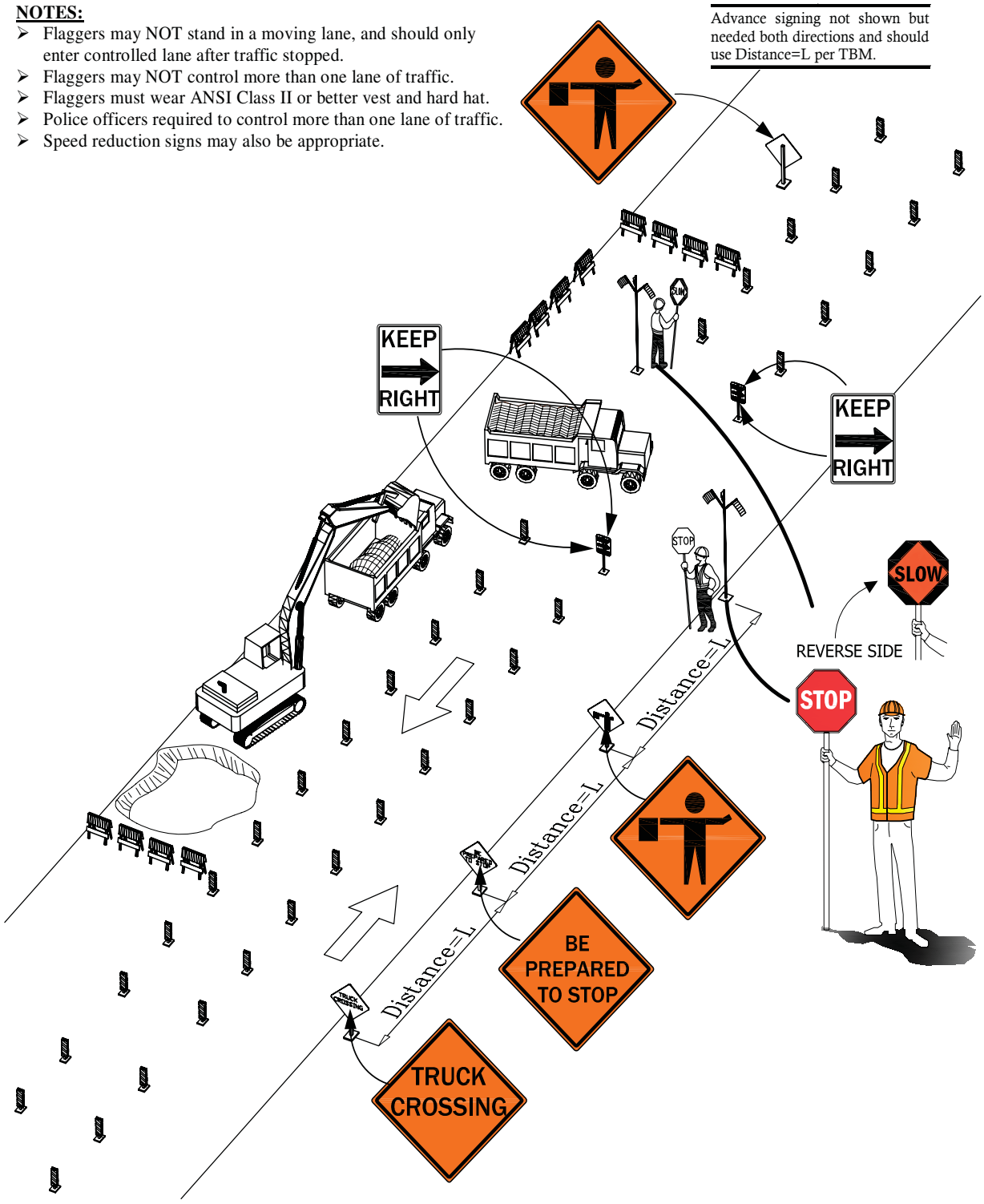
(Maintain two thru lanes making left turn lane)

Figure 29

NOTES:

- Flaggers may NOT stand in a moving lane, and should only enter controlled lane after traffic stopped.
- Flaggers may NOT control more than one lane of traffic.
- Flaggers must wear ANSI Class II or better vest and hard hat.
- Police officers required to control more than one lane of traffic.
- Speed reduction signs may also be appropriate.

Advance signing not shown but needed both directions and should use Distance=L per TBM.



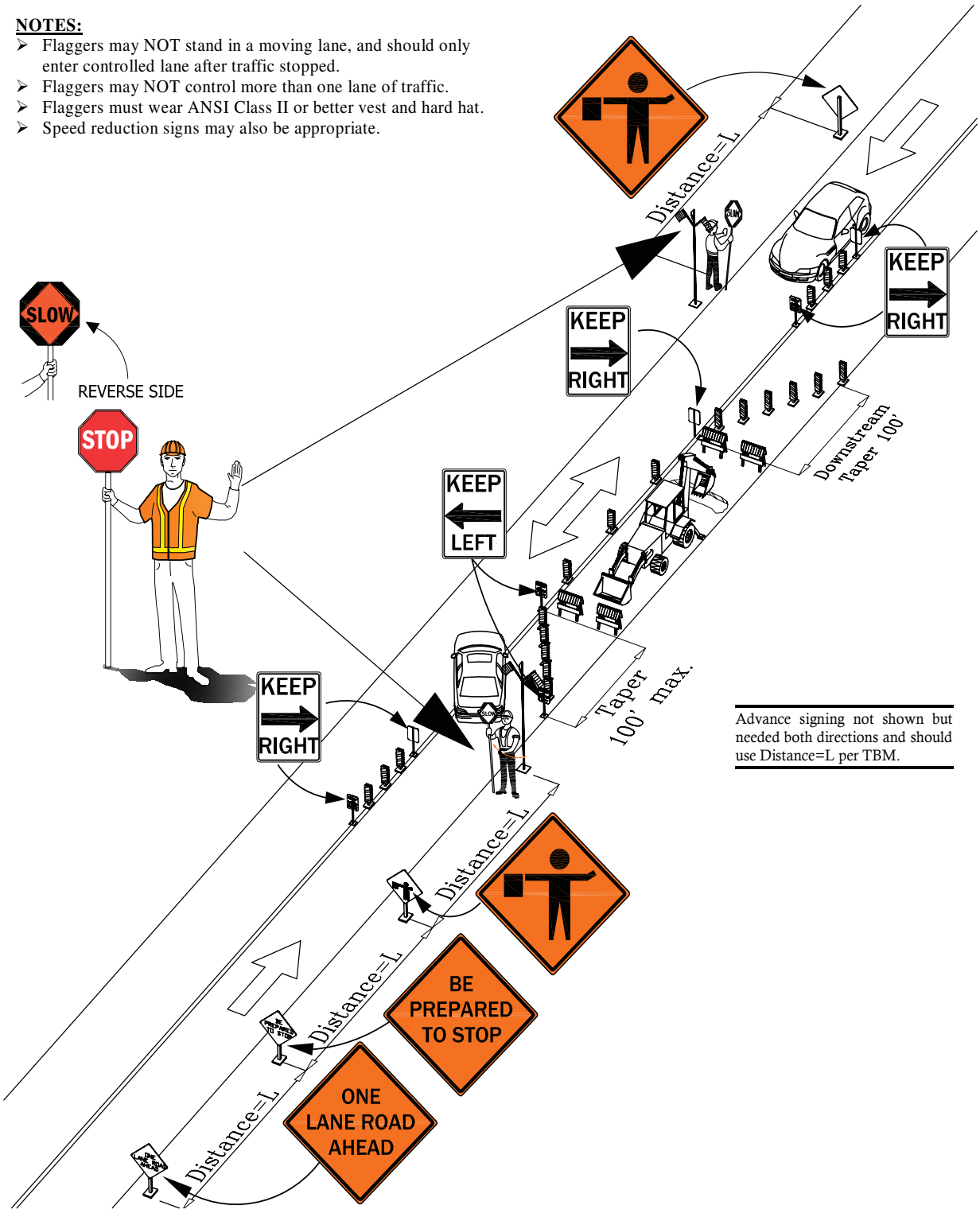
FLAGGING TO FACILITATE CONSTRUCTION

(To stop traffic as needed)

Figure 30

NOTES:

- Flaggers may NOT stand in a moving lane, and should only enter controlled lane after traffic stopped.
- Flaggers may NOT control more than one lane of traffic.
- Flaggers must wear ANSI Class II or better vest and hard hat.
- Speed reduction signs may also be appropriate.



Advance signing not shown but needed both directions and should use Distance=L per TBM.

ONE LANE TWO-WAY TRAFFIC USING FLAGGERS
(To control traffic with flaggers)

APPENDIX A-2

Appendix A-2
DEFINITIONS

ADVANCE NOTICE: Represents the minimum number of business days in advance of the work, excepting Saturdays, Sundays, and City of Phoenix Holidays.

ALLEY (Commercial): Passageways for local access to the rear of lots or buildings in commercial areas. Alleys are not streets or highways, and are **not** intended for use by through traffic. The junction of an alley with a street does not constitute and intersection.

ALLEY (Residential): Same as above, only for local access to residential land uses.

BARRICADE: A device used for channelizing or shielding depending on application. These may include Type I, II, or III barricades (which reflects the number of horizontal panels each has), drums, cones, or vertical panels. More and larger panels are used on faster and wider roadways (more to scale) to provide the appropriate level of visibility.

BICYCLE: A device, including a racing wheelchair, that is propelled by human power and on which a person may ride that has either: **(a)** Two tandem wheels, either of which is more than 16 inches in diameter, or **(b)** Three wheels in contact with the ground, any of which is more than 16 inches in Diameter

BICYCLE LANE: A portion of a roadway designated by signs and/or pavement markings for preferential or exclusive use by bicyclists.

BICYCLE ROUTE: A bikeway designated for use by bicyclists by an authorized agency using appropriate directional guide signs.

CHANGEABLE MESSAGE SIGN: A sign that is capable of displaying more than one message, changeable manually, remote control, or by automatic control.

CHANNELIZATION DEVICES: Temporary traffic control devices used in conjunction with one another to guide and warn road users of conditions created by road work activities in or very near the roadway. They may be used to divert traffic around temporary obstructions and to guide traffic along their intended path.

CIRCULAR INTERSECTION: Includes roundabouts and traffic circles, with a marked or raised circular center island where through traffic passes to the right of the island. Roundabouts are circular intersections where traffic in the circle has the right of way over those entering (controlled by YIELD signs). Traffic circles are circular intersections in low volume, residential areas with smaller islands, where state right of way laws apply (typically unsigned). Depending on the design, left turners may either go around the circle in a counter-clockwise direction or turn short of it.

CITY: The City of Phoenix, Arizona.

CITY FORCES: Employees, work crews of Phoenix working in the ROW.

CITY PERMIT: There are two common types of permits associated with working in streets and sidewalks. They are the: **(1) ROW permit:** This is a fee based permit issued by the Development Services Department required before working in City ROW. This permit enables the City to be aware of and to inspect jobs within the ROW. **(2) TRACS permit:** This is a no fee permit issued by the Street Transportation Department to restrict traffic in the public ROW. The purpose is to enable monitoring of projects by trained traffic staff to ensure public service/safety of streets and sidewalks remains protected. The acronym stands for Traffic Restriction and Closure System (TRACS) permit.

CITY PROJECT: A project performed under contract with the City of Phoenix.

CITY STREETS: Major, Collector, and Local streets in Phoenix. Not Freeways or Expressways.

COLLECTOR STREETS: Streets designated as "Collector" Streets on the latest Phoenix Street Classification Map on file with the City Clerk. They are generally located at half-mile intervals.

CRASHWORTHY: A characteristic describing traffic control devices that have proven by experience to an agency, to NOT constitute a threat to road users when struck at typical operating speeds prevalent on their facilities. On high speed rural highways or freeways, traffic control devices will only be considered crashworthy if the devices have successfully passed crash tests consistent with NCHRP Report #350. This report was entitled Recommended Procedures for the Safety Performance Evaluation of Highway Features, which was predicated entirely on high speed crash data.

CROSSWALK: (a) that part of a roadway at an intersection included within the prolongations or connections of the sidewalks on opposite sides of streets. The length of a crosswalk is determined by measuring the distance at which the pedestrians are exposed to traffic, normally considered to be defined by the prolongation of curbs or the edge of the traveled way. **(b)** any portion of a roadway at an intersection or elsewhere distinctly indicated as a pedestrian crossing by white or yellow lines which may be supplemented by contrasting pavement texture, style, or color.

DAYLIGHT HOURS (DAYTIME): Hours from sunrise to sunset.

DELINEATORS: Retroreflective devices mounted at the side of a roadway in a series, or on the roadway surface to delineate the alignment of the roadway during hours of darkness. Delineators are for guidance, and are not considered warning devices.

DETOUR: A temporary rerouting of road users onto an existing street in order to avoid a temporary traffic control zone. When traffic is routed onto a new, alternate route.

DIVERSION: A temporary rerouting of road users onto a temporary street or alignment placed around the work area. When traffic is routed along or through the work zone.

EMERGENCY: An event that requires urgent response. It may be addressed without a TRACS permit, but the location, type of emergency, and expected duration needs to be communicated as soon as practical. Call 602-262-6000 to report emergency restrictions.

ENGINEERING ASSESSMENTS: There are two types; engineering judgment and engineering studies. Both involve evaluation of pertinent information and application of appropriate principles and practices by trained personnel familiar with local conditions to decide the applicability, design, operation, or installation of a traffic control device. Engineering assessments shall be exercised by an engineer, or an individual working under the supervision of an engineer using procedures established by the engineer. Application of engineering judgment does not require documentation. An engineering study needs documentation at the time the study is conducted, but need not be retained forever.

FLAGGER: A person wearing an orange or fluorescent red-orange vest and hard hat, using a STOP/SLOW paddle, stationed to assist with traffic control in restricted areas. Flaggers are limited to controlling traffic in one traffic lane only and should position themselves outside of the traveled lane until traffic is stopped.

HOURS OF DARKNESS (NIGHT): Hours from sunset to sunrise.

INTERSECTION: The area embraced within the prolongation or connection of the lateral curb lines, or if none, the lateral boundary lines of the roadways of two streets that join one another, or the area within which vehicles traveling on different streets might come into conflict within the ROW of intersecting streets, and the area 150’ from the center of the intersection along all legs of the intersection. The junction of an alley with a public street does not constitute an intersection.

INTERSECTION INFLUENCE AREA: Traffic is strongly influenced by intersections for at least 300’ in all directions approaching the intersection. This is particularly true at signalized intersections. Accordingly, it is vital that special care be taken in planning temporary traffic control work within the influence area of a signalized intersection to minimize both disruption and duration.

LOCAL STREETS: All streets designated as Local streets (generally known as residential streets) on the latest Phoenix Street Classification Map, which is on file at the office of the City Clerk.

MAJOR SHOPPING CENTER: A large, regional, high-volume retail indoor or outdoor mall.

MAJOR STREETS: Streets designated as Major Streets on the latest City of Phoenix Street Classification Map on file with the City Clerk. They are generally located at one mile intervals.

MULTIPLE LANES: Two or more through traffic lanes in any one cardinal direction.

OFF-PEAK TRAFFIC HOURS: Times not defined as “peak traffic hours”

PAVED: A mixed, bituminous concrete, or Portland cement concrete roadway surface that provides both structural strength (weight bearing) and a seal.

PEAK TRAFFIC HOURS: Hours between 6:00 a.m. to 8:30 am. (extended to 9:00 a.m. on Reverse Lane streets) and 4:00 p.m. to 7:00 p.m., Monday through Friday.

PEDESTRIAN: A person afoot or in a wheelchair.

PEDESTRIAN CROSSING GUARD: A person wearing a fluorescent vest and hat, using a flag and/or STOP paddle to gain motorist attention, and stationed to assist with pedestrian traffic control in restricted areas.

PEDESTRIAN FACILITIES: A general term denoting improvements and provisions made to accommodate or encourage walking.

POLICE DEPARTMENT: The City of Phoenix Police Department.

POLICE OFFICER: A uniformed City of Phoenix, Maricopa County Sheriffs Department, or Department of Public Safety law enforcement officer, on-duty or off-duty, duly authorized to enforce the *Arizona Revised Statutes* and the *Phoenix City Code* in the City of Phoenix. The City seeks officers equipped with portable radio/phone to enable prompt contact with appropriate Phoenix police, and those who display empathy for public traffic.

PUBLIC RIGHTS-OF-WAY (ROW): All land in the City of Phoenix dedicated and/or expressly reserved for the use of vehicular and pedestrian traffic and/or utilities.

RAISED PAVEMENT MARKER: A device about 10 mm (0.4 in) in height mounted on a road surface that is intended to guide, supplement, or substitute for pavement markings or to mark a fire hydrant.

REGULATORY SIGN: A sign giving notice to road users of traffic laws or regulations.
RESTRICTION (STREET): Any induced reduction to the normal flow/access of vehicular or pedestrian traffic in the public ROW

RETROREFLECTIVITY: A surface property that allows a large portion of the light coming from a point source to be returned back to that source.

REVERSE LANE: A traffic lane marked by double dashed yellow lines, usually at or near the center of a street, used during certain hours for through traffic in opposing directions and other hours as a two-way left-turn lane (e.g., 7th Avenue and 7th Street).

RIGHT-OF-WAY MANAGEMENT: Phoenix's program and team established in 2004 to enhance traffic safety and mobility by minimizing unauthorized/improper street and sidewalk restrictions without delaying projects.

RIGHT-OF-WAY MANAGEMENT AGENT: Members of the Street Transportation Department authorized to carry out the intent of RMP.

RMP: The Right of Way Management Program.

RMP Administrator: The Administrator of RMP.

RMP Agent: Any authorized agent working for the RMP Administrator.

RMP Client: Contractors, utility companies, city crews, or any other person authorized to work in city ROW.

ROADWAY (traveled way): That portion of street improved, designed, or ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder even though such sidewalk, berm, or shoulder is used by persons riding bicycles or other human-powered vehicles.

ROUNDABOUT INTERSECTION: A circular intersection with yield control for all entering traffic, channelized approaches, and appropriate geometric curvature such that travel speeds on the circulatory roadway are typically less than 30 mph.

SANITATION DIVISION: The Sanitation Division for Phoenix

SIDEWALK: That portion of a street between the curb line, or the lateral line of a roadway, and the adjacent property line or on easements of private property intended for use by pedestrians. In temporary traffic control zones, accessible temporary sidewalk detours/ diversions are to be constructed and maintained similar to the sidewalk it replaced.

SIGN: Any traffic control device intended to communicate specific information to road users through a word or symbol legend. Signs do not include traffic control signals, pavement markings, delineators, or channelization devices.

SPECIAL TRAFFIC REGULATIONS: "Special Traffic Regulations" included in the City Project specifications, or attached to City Permits, prepared by the Street Transportation Department for the specific traffic situations detailed therein.

STATE: State of Arizona.

STREET: A general term for denoting a public way for the purpose of vehicular travel, including the entire area within the ROW.

STREET TRANSPORTATION DEPARTMENT: The Phoenix Street Transportation Department.

TRAFFIC: Pedestrians, bicyclists, ridden or herded animals, vehicles, streetcars, and other conveyances either singularly or together while using any street for purposes of travel.

TRAFFIC SIGNAL: Any traffic control device by which traffic is alternately directed to stop and permitted to proceed.

TRAFFIC CONTROL DEVICES: Signs, parking meters, traffic signals, markings, barricades, and channelizing devices used to regulate, warn, or guide traffic by the authority of a public agency having jurisdiction. Traffic control devices are to be in substantial conformance with those illustrated in this *TBM* or in the *Manual on Uniform Traffic Control Devices*.

TRAFFIC SIGNAL SHOP: The Traffic Signal Shop of the Street Transportation Department, Operations Division 602-262-6021.

WARNING SIGN: Intended for unfamiliar road users to provide notice of a situation that might not be readily apparent.

WEEKDAYS: Days of the week, starting at 5:00 am. on Monday, and ending at 10:00 p.m. on Friday.

WEEKENDS: Days of the week starting at 10:00 p.m. Friday and ending at 5:00 a.m. on Monday.

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Appendix A-4

EMERGENCY TELEPHONE NUMBERS

(All numbers, unless indicated otherwise, have a "602" prefix)

To report temporary traffic control signs or barricades in poor condition or inappropriately positioned, call the RMP Hotline at

(602) 262-6000 or e-mail: *RMP*@phoenix.gov.

When an emergency occurs, such as a street cave in, water line or gas line break, damaged sewer, telephone, or electric lines, the RMP Client causing such emergency shall notify the affected agencies immediately.

During the normal workweek, the following shall also be notified:

City of Phoenix City Operator. 262-6200/6300

Street Transportation Department:

Design & Construction Management 495-2050

RMP 262-6235

Utility Inspection Section 534-1400

During weekends, holidays, and nights when the above offices are closed, the following shall also be notified.

City of Phoenix:

Police Department 262-6151

Street Maintenance Emergency 262-6011

The following telephone numbers may be useful:

City of Phoenix:

Development Services Department Construction Permits 262-7811

Fire Department ..... 911 or 253-1191

Police Department ..... 911 or 262-6151

Police Department, (Off-Duty Officers) 262-7323

Public Works Department..... 262-7251

Sanitation Division 262-7251

City of Phoenix Continued:

Street Transportation Department..... 262-6284

Street Closures 262-6235

Street Maintenance..... 262-6441

Traffic Signal Shop 262-6021

Traffic Signal Underground Location 262-6204

Water Services Department 262-6251

Water Distribution..... 262-6509

Wastewater Collections..... 262-6691

Arizona Department of Transportation..... 712-7316

District 1 Office Engineer..... 712-8274

Arizona Department of Public Safety..... 223-2000

Arizona Public Service Company..... 371-7171

Emergency Service 258-5483

Blue Stake, Underground Utility Locations 263-1100

Maricopa County Highway Department..... 506-8600

Maricopa County Sheriffs Department..... 876-1000

Public Transit..... 462-5741

Rural Metro Fire Department 480-945-6311

Salt River Project..... 236-8888

Irrigation Water..... 236-3333

Southwest Gas Company..... 271-4277

Qwest Communications..... 800-244-1111

City of Phoenix
Street Transportation Department
Traffic Operations Division

2007 TRAFFIC BARRICADE MANUAL

This document is a key component of the
City Street Transportation Department's Right-of-Way Management Program.

AMERICANS WITH DISABILITIES ACT (ADA) INFORMATION

Upon request, this publication can be made available in Braille, large print, or audiocassette tape by contacting the Street Transportation Department at

(602) 262-6284 or at TTY (602) 256-4286