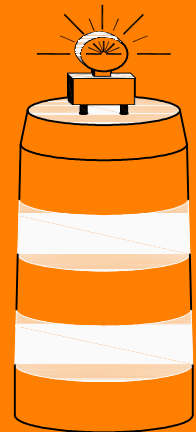
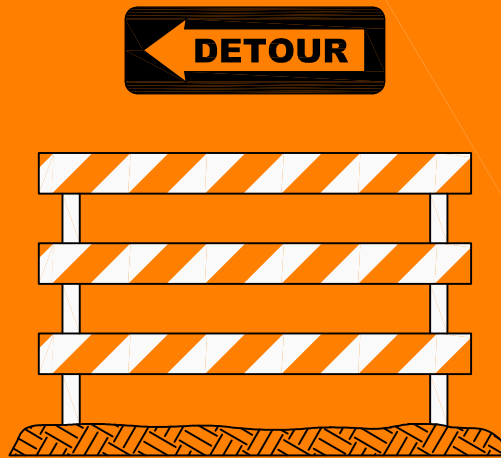


***WORK
AREA
TRAFFIC
CONTROL
HANDBOOK***



**CITY OF GREENSBORO, NC
DEPARTMENT OF TRANSPORTATION
OFFICE: (336)-373-GDOT
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I. PURPOSE OF HANDBOOK

The purpose of this handbook is to set forth the basic principles and standards to be observed by **all agencies** (private or public) who perform work in or adjacent to public streets in Greensboro, North Carolina; for safe and effective temporary traffic control zones.

The need for standard controls is especially acute during roadway construction, maintenance, and utility operations. Abnormal conditions are the rule, and therefore, drivers and pedestrians are particularly dependent on design, placement, and uniformity of traffic control devices to direct and guide them safely and efficiently through what would otherwise be hazardous areas.

The purpose of traffic control devices and warrants for their use is to help insure highway safety by providing for the orderly and predictable movement of all traffic, motorized and non-motorized, throughout the national highway transportation system. Also, to provide such guidance and warnings as needed to insure the safe and uniform operation of individual elements of the traffic stream.

Traffic control devices are used to direct and assist vehicle operators in the guidance and navigation tasks required to traverse safely any facility open to public travel. Guide and information signs are solely for the purpose of traffic control and are not an advertising medium.

Proper traffic control techniques can provide the following benefits:

1. Reduce accidents
2. Reduce confusion for motorists
3. Expedite traffic flow
4. Minimize injury to workmen and the public
5. Reduce property damage
6. Minimize the possibility of claims and litigation arising from accidents in work zone
7. Improve public relations

II. GENERAL RESPONSIBILITY

All persons or agencies doing work in the public streets, highways, or public rights-of-way are responsible for obtaining all necessary permits, coordinating the work with all affected government agencies and utilities, and informing occupants of adjacent properties of access impacts due to the work.

Responsibility for the installation and maintenance of adequate safety devices for the protection of the public, the workers and general protection of the work shall rest with the contractor, utility company, or public agency doing the work.

All traffic control devices and procedures shall conform to the requirements of this handbook, the current FHWA edition of the Manual on Uniform Traffic Control Devices, the current edition of the North Carolina Department of Transportation (NCDOT) Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways, the NCDOT Policies and Procedures for Utilities on Highway Rights of Way, the NCDOT Roadway Standard Drawings, and the current edition of the NCDOT Standard Specifications for Roads and Structures.

The Director of the Department of Transportation or his representative is authorized to stop any construction or maintenance activity in the public right-of-way that has not been approved and/or is not properly signed and barricaded, as required by this handbook, until such requirements are met.

III. APPROVAL PROCEDURE FOR WORK IN THE PUBLIC RIGHT-OF-WAY

It is necessary for both public and private agencies to obtain approval from the Greensboro Department of Transportation (GDOT) before scheduling work that will affect the flow of traffic in the City of Greensboro. This is necessary to ensure proper coordination between the many activities, which take place in the right-of-way. Proper coordination is necessary to ensure the safest and most efficient flow of traffic throughout the City.

Major utility companies, sub-contractors and other agencies that operate and maintain facilities in the rights-of-way may obtain a general right-of-way permit that can be renewed annually.

Both public and private agencies are also required to obtain an encroachment agreement from the North Carolina Department of Transportation (NCDOT) to work in the rights-of-way of State maintained streets. An encroachment agreement can be obtained through the district office of the NCDOT. The encroachment agreement is required in addition to the right-of-way use permit or lease agreement.

IV. NOTIFICATION REQUIREMENTS

The contractor, utility company, or public agency constructing a project in the public right-of-way is responsible for notifying the Transportation Engineering Division of GDOT of any work where the number of travel lanes is reduced from normal conditions or the street is required to be closed. Except in emergencies, the following notification period is required:

1. Closing 1 or more travel lanes: five (5) working days prior to the scheduled work;
2. Closing a street: fifteen (15) working days prior to the scheduled work

In emergency situations during normal business hours, GDOT (373-GDOT) should be notified of all control procedures as soon as possible after the site is secured.

In emergency situations, after hours and on weekends/holidays, the Police Department should be contacted (373-2222) as soon as the site is secured. The Police Department will be responsible for approving traffic control at the site and will notify appropriate GDOT staff as necessary.

V. ROAD CLOSURE NOTIFICATIONS

When a road closure has been approved (see sections III & IV), the agency requesting the closure is required to notify the following agencies at least one week prior to the expected closure:

Police-Fire-EMS	373-2222
Greensboro Transit	332-6440
School Transportation	370-8920

Each of the above agencies shall also be contacted upon the reopening of the roadway.

VI. PEAK FLOW HOURS

The peak flows of traffic in Greensboro occur between the hours of **7:00-9:00 a.m. and 4:00-6:00 p.m.** During these hours, construction or maintenance work, which involves closure of a lane of traffic, will not be allowed on thoroughfare streets except for emergency situations and with approval from GDOT. In addition, any work activity that requires the closure of more than one travel lane on a thoroughfare in a particular direction shall not be allowed during the hours of 7 AM to 6 PM Monday through Friday without prior coordination with the GDOT Engineering Division. As a general rule, all multi-lane roads or two-lane roads that are separated by a marked double yellow centerline should be considered to be thoroughfare streets.

VII. PROJECT PLANNING

All work shall be planned well in advance to keep traffic obstructions, public inconvenience, and lost work time to minimum. The responsible agency should visit the site before starting the project to assess the following:

1. Traffic conditions
2. Existing traffic controls
3. Traffic lane requirements
4. Physical features
5. Access to adjacent properties

6. The type, number, and location of signs, barricades, lights, and other traffic control devices required

During the design phase of a project, the agency responsible for the construction activity shall coordinate the development of a traffic control plan (TCP) with GDOT. The details regarding the necessary traffic control devices and the placement of such devices shall be approved by GDOT prior to advertising for bids and/or scheduling the construction activity.

Where appropriate, it may be acceptable to simply refer to specific sections and/or diagrams of this handbook and other such documents rather than prepare a TCP.

This handbook applies to all emergency situations where there is not adequate time to prepare a TCP.

VIII. PEDESTRIAN CONSIDERATIONS

There are three threshold considerations in planning for pedestrian safety in temporary traffic control zones:

- Pedestrians should not be led into conflict with work site vehicles, equipment or operations.
- Pedestrians should not be led into direct conflicts with traffic moving through or around the work site.
- Pedestrians should be provided with a safe, convenient travel path that replicates, as nearly as possible, the existing pedestrian facility through the work site.

The needs of all pedestrians, including the visually impaired, the hearing impaired, and those with other physical disabilities, must be accommodated at work sites.

Every effort should be made to separate pedestrian traffic from both work site activity and adjacent vehicular traffic. Protective barricades, fencing, handrails, and bridges, together with warning and guidance devices and signs, should be utilized so that the passageway for pedestrians is safe and well defined. Where it is necessary to divert pedestrians into the parking lane of a street, approved barricading, and delineation shall be provided to separate the pedestrian walkway from

the adjacent traffic lane. At no time shall pedestrians be diverted into a portion of the street that is open to vehicular traffic.

When a safe passageway can be provided around a work site, signing should be used to direct pedestrians to safe street crossings in advance of the work area. Signs should be placed at the intersections nearest to the work so that pedestrians, particularly in high traffic-volume areas, are not confronted with mid-block work sites that will encourage them to walk along or through the work zone or to make a mid-block crossing. It should be recognized that pedestrians generally will not retrace their steps to make a safe crossing. Consequently, ample advance notification of sidewalk closures is important.

In areas where overhead construction is taking place adjacent to a public pedestrian area, a covered walkway shall be constructed in accordance with **Chapter 33 and in compliance accessibility requirements of the North Carolina State Building Code and ICC/ANSI A117.1-2003.**

Where pedestrian access is to be maintained across an excavation, a bridge designed to support a load of not less than 150-lbs/square foot shall be constructed. Suitable ramps shall be provided at each end and fences and handrails shall be provided along each side. **(See Chapter 16 of the North Carolina State Building Code.)**

IX. WORKER SAFETY CONSIDERATIONS

Of equal importance to the safety of the public traveling through the work zone is the safety of the personnel performing the work. The constantly changing and unexpected conditions, which are often experienced in a work zone, tend to confuse drivers thus creating a high level of vulnerability for the personnel working on or near the roadway.

Following the fundamental principles of this handbook and the other referenced materials will usually provide the degree of control and traffic operation that will bring about safe conditions for the workers. Of particular importance is maintaining work areas where traffic flow is inhibited as little as possible, providing standard and clear traffic devices that get the driver's attention and provide positive direction.

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

- **TRAINING** - All workers should be trained in how to work next to traffic in a way that minimizes their vulnerability. In addition, personnel with specific traffic control responsibilities should be trained in traffic control techniques, device usage, and placement.
- **WORKER CLOTHING** - Workers exposed to traffic should be attired in bright, highly visible clothing similar to that of flaggers (see section XVI-B).
- **BARRIERS** - Barriers should be placed along the work space depending on such factors as lateral clearance of workers from adjacent traffic, speed of traffic, duration of operations, time of day, and volume of traffic.
- **LIGHTING** - For nighttime work, lighting the area and approaches may allow the driver better comprehension of the requirements being imposed. Care should be taken to ensure that the lighting does not blind drivers approaching the work site.
- **SPECIAL DEVICES** - Judicious use of special warning and control devices may be helpful for certain difficult work area situations. These include changeable message signs, hazard identification beacons, flags, and warning lights. Misuse and overuse of special devices/techniques can greatly lessen their effectiveness.
- **PUBLIC INFORMATION** - Improved driver performance may be realized through a well-prepared and complete public relations effort that covers the nature of the work, the time and duration of its execution, and its anticipated effects upon traffic and possible alternate routes and modes of travel. Such programs have been found to result in a significant drop in traffic, which reduces the possible number of conflicts.
- **ROAD CLOSURE** - If acceptable alternate routes are available, the road may be closed temporarily during times of greatest worker hazard, which, in addition to offering

maximum worker safety, may facilitate quicker project completion and thus further reduce worker vulnerability. Road closures will only be allowed with prior approval from GDOT or in emergency situations (see sections III, IV and V).

X. TRANSIT CONSIDERATIONS

Provisions for effective continuity of transit service needs to be incorporated into the temporary traffic control planning process. Oftentimes, public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). On transit routes, the TCP should provide for features, such as temporary bus stops, pull-outs, and waiting areas for transit patrons.

Transit operations are particularly affected by lane and road closures in the central business district. Additional work time restrictions may be included in the right-of-way for work zones in the vicinity of the Greensboro Transportation Center on Washington Street, Church Street, and Davie Street.

XI. MISCELLANEOUS CONSIDERATIONS

A. UNEVEN AND ROUGH PAVEMENT

The following signs may be used for circumstances described for the specific sign:

1. "BUMP" (W8-1): For paving or other maintenance operations, this sign should be placed at the point of change in elevation exceeding one inch.

2. "ROUGH ROAD" (W8-8): This sign should be placed in advance of any milled areas of an open travel lane.

3. "UNEVEN LANES" (W8-11): This sign should be placed in advance of a condition where the difference in pavement elevation between adjacent lanes exceeds one inch.

B. INGRESS AND EGRESS

Reasonable ingress and egress shall be maintained to all businesses and dwellings affected by the work activity. Access to driveways shall

not be blocked unless reasonable alternative access is available or unless the affected property owner and/or tenant grant permission to block the driveway. Special attention shall be paid to maintaining easy access to fire hydrants.

C. STORAGE OF EQUIPMENT AND MATERIALS

During periods of construction inactivity, all construction equipment and materials may be stored in the right-of-way or temporary project easement, but must be placed ten or more feet away from any open travel lane and not obstruct sight distance. It is recommended that all construction equipment and materials be stored on private property. It is the responsibility of the organization performing the work to obtain the permission to use property for this purpose.

D. LANE WIDTHS

The minimum acceptable width of temporary travel lanes is 10 feet; however, a 12 foot wide lane is preferred and should be used wherever possible. A lane width of less than 10 feet will be accepted only where the existing permanent lanes are already less than 10 feet. In such cases, no additional narrowing of the lanes will be permitted.

E. WORKING BOTH SIDES OF ROADWAY

Work shall not be allowed on both sides of the road simultaneously within the same area, except where the roadway is divided by a median. It will be acceptable to construct bore pits on each side of a roadway for boring utilities under the roadway.

XII. TEMPORARY TRAFFIC CONTROL WORK ZONE COMPONENTS

The temporary traffic control zone includes the entire section of roadway between the first advance warning sign through the last traffic control device, where traffic returns to its normal path and conditions. Most temporary traffic control zones can be divided into four areas: the advance warning area, the transition area, the activity area (includes the work area and the buffer area) and the termination area. Figure 1 (page 11) illustrates these four areas.

A. ADVANCE WARNING AREA

In the advance warning area, drivers are informed of what to expect. The advance warning may vary from a single sign or flashing lights on a vehicle to a series of signs in advance of the temporary traffic control zone transition area.

The number and spacing of advance warning devices is dependent on the type of activity in the work zone, the speed and volume of traffic and the visibility of the work zone to approaching traffic. Where construction is on or near a hill or in a horizontal curve, the advance warning area shall be extended so that there is adequate site distance of the temporary traffic control zone.

Advance warning is normally not needed when the activity is sufficiently removed from the driver's path such that it does not interfere with traffic flow.





B. TRANSITION AREA

When redirection of the driver's normal path is required, traffic must be channelized from the normal path to a new path. This redirection is intended to occur at the beginning of the transition area. In mobile operations, this transition area moves with the work space. Transition areas usually involve strategic use of tapers, which are discussed in detail in section XIII. The length of the transition area is dependent on the speed of approaching traffic and the lateral distance which traffic is being diverted.

C. ACTIVITY AREA

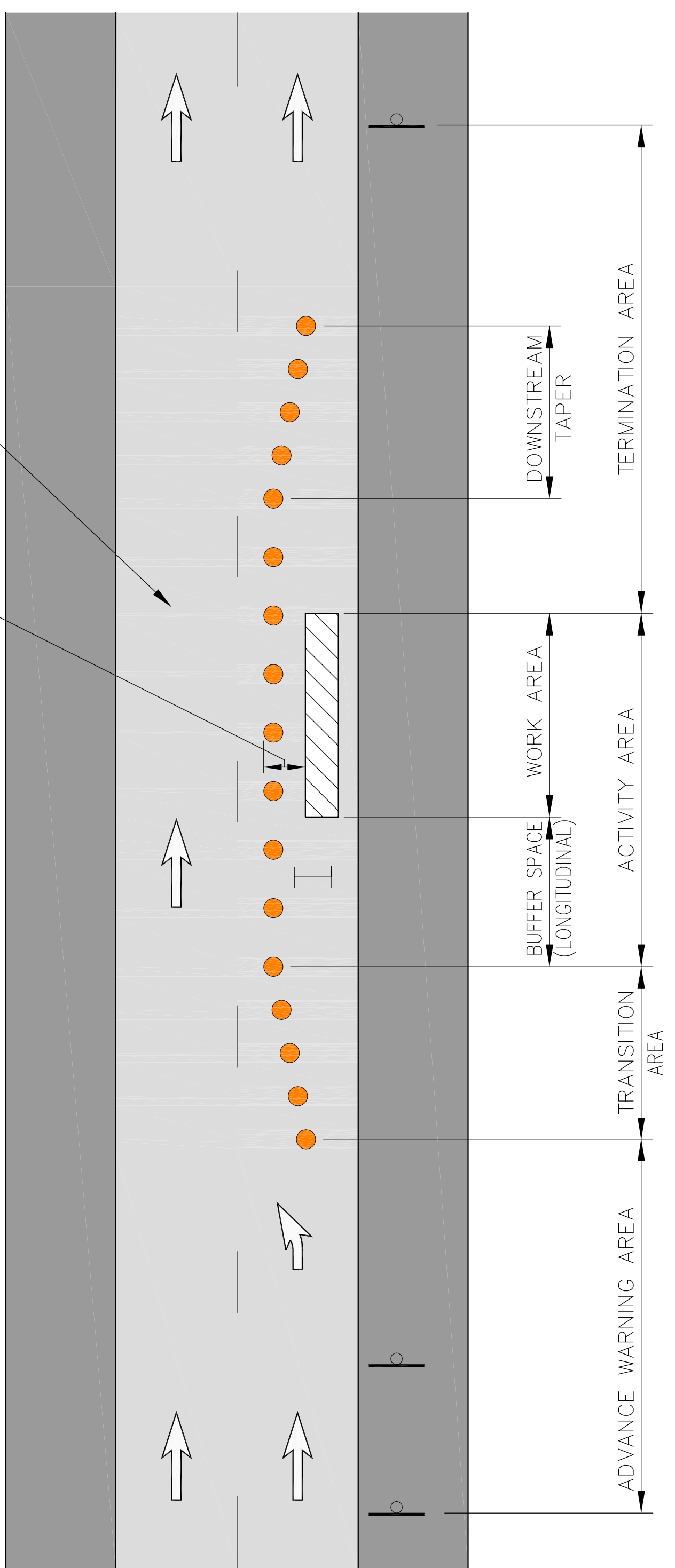
The activity area is the area of roadway where the work takes place. It is composed of the workspace, the traffic space, and one or more buffer spaces.

The workspace is that portion of the roadway closed to traffic and set-aside for workers, equipment and materials. Work space may be fixed or may move as work progresses. Long-term workspaces should be delineated by channelizing devices or may be shielded by barriers to exclude vehicular and pedestrian traffic.

LEGEND	
	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE
	WORK AREA

TRAFFIC SPACE

BUFFER SPACE (LATERAL)



NOT TO SCALE

FIGURE 1
TEMPORARY TRAFFIC CONTROL ZONES

The traffic space is the portion of the roadway in which traffic is routed through the activity area. **The pedestrian traffic space must be separated from the vehicular traffic space either by adequate buffer space or by barrier.**

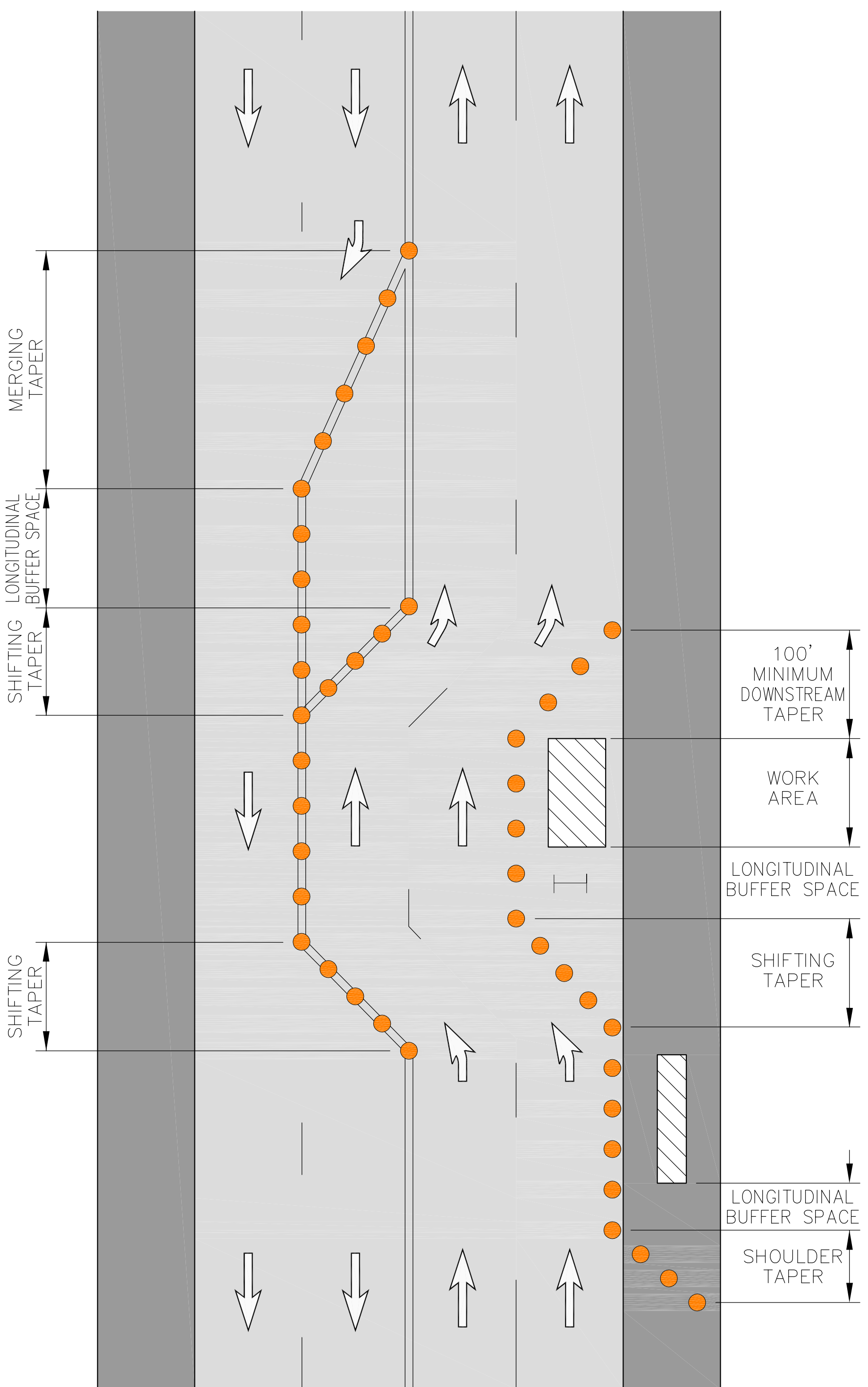
The buffer space separates the traffic flow from the work activity or a potential hazardous area and provides recovery space for an errant vehicle. Buffer spaces may also be used to separate opposing traffic flows or to separate pedestrian traffic areas from vehicular traffic areas. **Neither work activity nor storage of equipment, vehicles or materials shall occur in the buffer area.**

Except where space limitations prohibit it, a longitudinal buffer shall be placed in the initial portion of a closed lane in advance of the workspace, as shown in figure 1 (page 11). The longitudinal buffer in figure 2 (page 13) should be used where a closed portion separates opposing traffic flows. Typically, it is formed as a traffic island and defined by channelizing devices such as cones or drums. The standard diagrams in this handbook include longitudinal buffer spaces of appropriate length, see chart inside back cover for most urban conditions. **Where construction is on or near a hill or in a horizontal curve, the standard buffer space should be extended so that there is adequate sight distance of the advance warning area and the transition area.**

A lateral buffer space may be used to separate the traffic space from the work space, as shown in figure 1 (page 11) or a potential hazardous area, such as an excavation or pavement drop-off. A lateral buffer space may be used between two travel lanes, especially those carrying opposing flows. The width of the lateral buffer space should be determined by engineering judgement; however **a minimum lateral buffer space of 2 feet is required between the space and the nearest travel lane.** Appropriate channelizing devices, such as cones or drums, may be placed inside lateral buffer space.

D. TERMINATION AREA (OPTIONAL)

The termination area is used to return traffic to the normal traffic path. The termination area extends from the down stream end of the work area to the “END ROAD WORK” signs, if posted.



NOT TO SCALE

FIGURE 2
TAPERS AND BUFFER SPACE

XIII. TAPERS

An important element of a temporary traffic control zone is a roadway taper. Tapers may be used in both the transition and termination areas. Tapers are created using a series of channelizing devices or pavement markings placed to move traffic out of or into its normal path. The standard diagrams in this handbook show tapers of adequate length for most urban conditions. Whenever tapers are to be used near interchange ramps, crossroads, curves, or other influencing factors, it may be desirable to adjust the length of the tapers. Longer tapers are not necessarily better than shorter tapers (particularly in urban areas characterized by short block lengths, frequent driveways, etc.), because extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily. The real test of taper length involves observation of driver's performance after traffic controls are in place. The maximum space between devices in a taper normally approximates the distance in feet of the speed limit in miles per hour. (i.e. a 35-mph street should normally have devices spaced about 35 feet apart).

Taper length criteria for temporary traffic control areas.

<u>Type of taper</u>	<u>Taper length</u>
Merging taper	L minimum
Shifting taper	1/2 L minimum
Shoulder taper	1/3 L minimum
Termination Downstream	100 feet/lane minimum
Two-way traffic taper	100 feet maximum

Formulas for L*

<u>Speed</u>	<u>Formula</u>
40 mph or less	$L = WS^2/60$
45 mph or greater	$L = W \times S$

*L = Taper length in feet

W = Width of offset in feet

S = Posted speed or operating speed in mph.

There are five different types of tapers, each of which are described below:

A. MERGING TAPER

A merging taper (L) requires the longest distance because drivers are required to merge with an adjacent lane of traffic at the prevailing speed. The taper should be long enough to enable merging drivers to adjust their speeds and merge into a single lane before the end of the transition. The appropriate series of lane reduction/merge signs shall be erected in the advance warning area before a merging taper. **The “ONE LANE ROAD AHEAD” sign shall not be used in lieu of proper lane reduction/merge signs.**

B. SHIFTING TAPER

A shifting taper (L/2) is used when merging is not required, but lateral shift is needed. Where more space is available, it may be beneficial to use longer distances. Guidance for changes in alignment may also be accomplished by using horizontal curves designed for normal roadway speeds. If a shifting taper is shorter than the desired length for the roadway speed, then appropriate curve or turn warning signs with the appropriate advisory speed plates shall be erected in the advance warning area. No special signing is needed to warn of a shifting taper of adequate length.

C. SHOULDER TAPER

When work is occurring on the paved shoulder of a high-speed roadway, a shoulder taper (L/3) may be beneficial. If a shoulder is used as a travel lane either through practice or during a temporary traffic activity, a normal merging taper and proper advance warning signing should be used.

D. DOWNSTREAM TAPER

The downstream taper may be useful in termination areas to provide a visual cue to the driver that access is available to the original lane/path that was closed. When a downstream taper is used, it should have a minimum length of 100 feet per lane, with devices spaced about 20 feet apart.

E. ONE –LANE, TWO-WAY TAPER

The one-lane, two-way taper is used in advance of an activity area that requires the space to be used alternately by traffic flowing in opposing directions. Typically, traffic is controlled by a flagger. A short taper having a maximum length of 100 feet with channelizing devices at approximately 20 feet spacing should be used to guide traffic into the one-lane section. A **“ONE LANE ROAD AHEAD”** sign shall be placed in each direction in advance of a one-lane, two-way taper. **The "RIGHT/LEFT LANE CLOSED AHEAD" signs shall not be used in lieu of the "ONE LANE ROAD AHEAD" signs.**

XIV. DETOURS AND DIVERSIONS

At detours, traffic is directed onto another roadway to bypass the work zone. Detours should be signed clearly over their entire length so motorists can easily determine how to return to the original roadway.

At diversions, traffic is directed along a different path than normal on the same roadway as the work zone (lane shifts, median crossovers, etc.). Use appropriate warning signs as needed but detour signing should not be used to direct traffic through a diversion.

XV. ONE LANE, TWO WAY TRAFFIC CONTROL

Where traffic in both directions must, for a limited distance, use a single lane, provision should be made for alternate one-way movement through the constricted area. Some means of coordinating movements at each end shall be used to avoid head-on conflicts and to minimize delays.

Alternate one-way traffic controls may be accomplished by either single flagger control, multiple flagger control, flag transfer, a pilot car, or by stop or yield control. At “spot” obstructions (such as an isolated pavement patch or pipe crossing) on minor roadways with low speeds and very low volume and with adequate site distance, the movement may be self-regulating.

All flaggers shall be properly trained, attired and equipped (see section XVI). “Flagger Ahead” signs shall be included in the advance warning area wherever flaggers are present. “One Lane Road” signs shall be placed in the advance warning area of all one lane, two way traffic zones.

A. SINGLE FLAGGER METHOD

Where a one-lane, two-way temporary traffic zone is short enough to allow visibility from one end to the other, and traffic volumes and speeds are moderate to low, traffic may be controlled by a single flagger. The flagger should be stationed on the shoulder opposite the work space, or in position where good visibility and traffic control can be maintained at all times.

B. MULTIPLE FLAGGERS

When there is not good visibility and traffic control cannot be maintained safely by a single flagger, traffic should be controlled by a flagger on each end of the work area. One of the flaggers should be designated as the coordinator. The flaggers should be able to communicate with each other orally or with signals. Signals should not be able to be mistaken with flagging signals for traffic. The use of radios is recommended even when there is visual contact between the flaggers.

Multiple flaggers may be needed on streets with higher traffic volumes and higher speeds, and where the site conditions limit the visibility of a single flagger to approaching traffic. In work zones at intersections it may be necessary to post flaggers on the intersecting streets to avoid conflicts with vehicles approaching the site from these streets.

C. FLAG TRANSFER METHOD

The flag transfer method can be very effective for long one-lane, two-way traffic control zone; especially when flaggers are not able to see one another. This method requires proper flagging at each end of the constricted area. Flaggers must also be stationed at each intersecting street or the intersecting street must be closed.

D. PILOT CAR METHOD

A pilot car may be used to guide a queue of vehicles through a complex or very long one-lane two-way traffic control zone. Its operation must be coordinated with flagging operations at each end of the one-lane section. Flaggers must also be stationed at the end of each intersecting street or the intersecting streets must be closed.

The pilot car shall have the PILOT CAR sign conspicuously mounted on the rear of the vehicle.

The pilot car method will not generally be used under the urban conditions to which this handbook applies. This method is offered as an acceptable alternative and may be useful in helping to control speeds through the temporary traffic control zone, even when two-way traffic is maintained.

E. STOP OR YIELD CONTROL

On low volume, low speed streets, where the constriction is very short and there is excellent visibility of the entire work zone to approaching traffic, a yield or stop sign may be posted for traffic approaching for the side of the closure. This traffic will stop and /or yield to traffic approaching from the opposite direction. A standard “STOP” (R1-1) or “YIELD” (R1-2) sign shall be used and the sign shall be adequately secured in the proper position. A site using this method of traffic control may be left unattended; however, it is recommended that the sign be checked several times each day to ensure that it remains in proper position.

XVI. FLAGGING PROCEDURES

A. QUALIFICATIONS FOR FLAGGERS

Because flaggers are responsible for public safety and make the greatest number of public contacts of all construction/maintenance workers, they should have the following minimum qualifications:

- Sense of responsibility for the safety of the public and the other workers,
- Training in safe traffic control procedures (certification),
- Average intelligence,
- Good physical condition, including sight and hearing,
- Mental alertness and the ability to react in an emergency,
- Courteous but firm manner,
- Neat appearance.

B. HIGH VISIBILITY CLOTHING

For daytime work, the flagger's apparel shall meet the Performance Class 2 or 3, and for nighttime work apparel shall meet the Performance Class 3 of the ANSI/ISEA 107-2004 standard. These garments shall be visible at minimum distance of 1,000 feet and shall be designed to clearly identify the wearer as a person.

C. HAND SIGNALING EQUIPMENT

Except in emergency situations, flaggers shall use standard STOP/SLOW paddles to direct traffic through a work zone. The faces of the standard STOP/SLOW paddle are shown in figure 3. The paddles shall be retroreflective for nighttime use.

In emergency situations, red flags may be used in lieu of the standard STOP/SLOW paddles. Such flags will be a minimum of 24 inches square and shall be fastened to a staff about 3 feet long. The free edge shall be weighted so the flag will hang vertically, even in heavy winds. When used at night flags shall be retroreflective red.

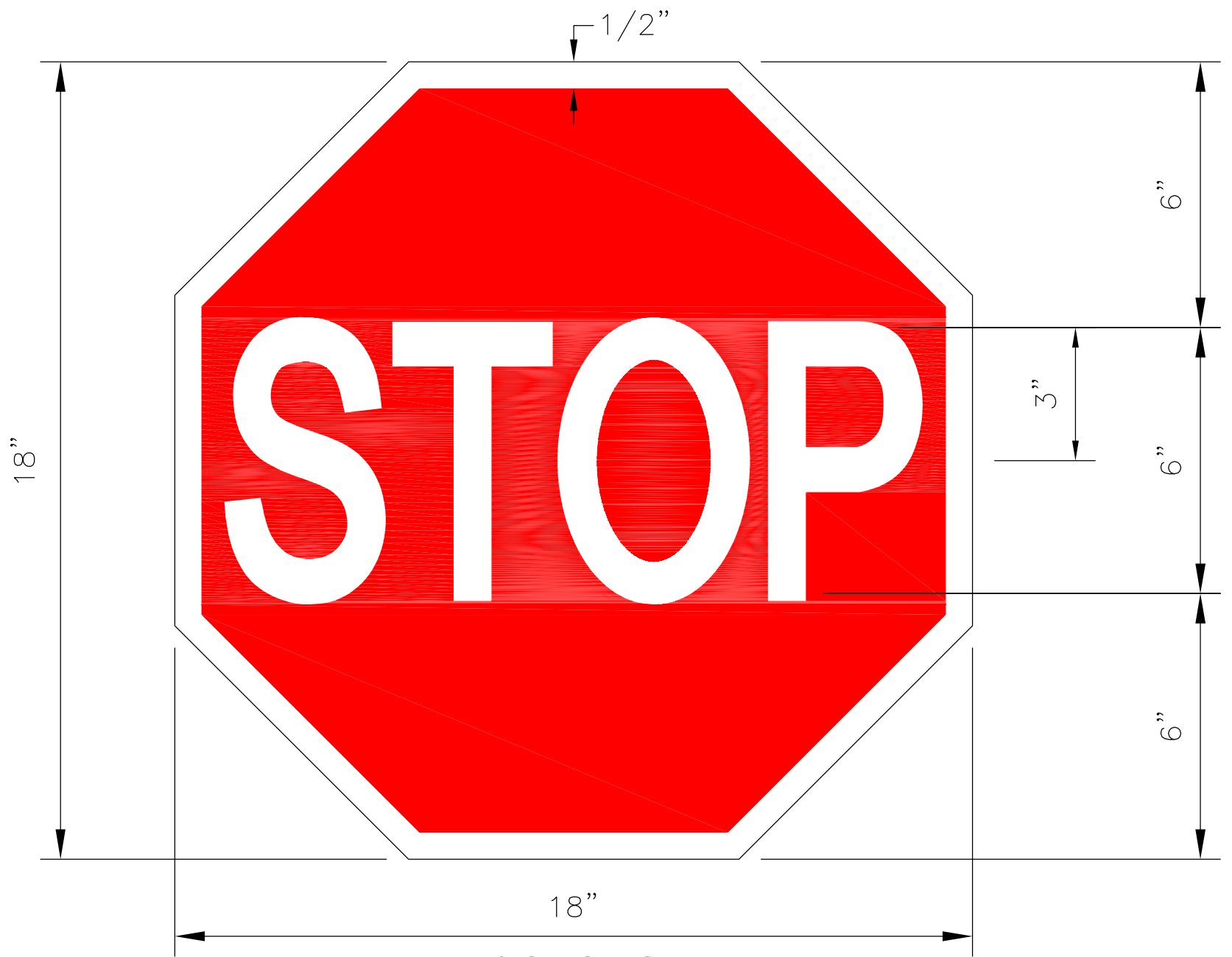
D. HAND SIGNALING PROCEDURES

Flaggers are permitted to stop traffic intermittently as required by the work process or to maintain continuous traffic past a work site at reduced speeds to help protect the work crew. This is to be accomplished following the procedures shown in figures 4 and 5 (pages 22 and 23). Traffic shall not be stopped for more than five minutes at a time in any direction.

E. FLAGGER STATIONS

The flagger must, at all times, be clearly visible to approaching traffic for a distance in advance of the work zone sufficient to permit proper response by the motorist to the flagging instructions.

Flaggers should stand on the shoulder adjacent to the traffic being controlled. A single flagger stationed in the center of the work zone should stand on the shoulder opposite the work space. A flagger should stand in an open travel lane only after traffic in that lane has been stopped.



COLORS

LEGEND -WHITE (REFL)
 BACKGROUND - RED (REFL)



COLORS

LEGEND -BLACK (NO REFL)
 BACKGROUND - ORANGE (REFL)

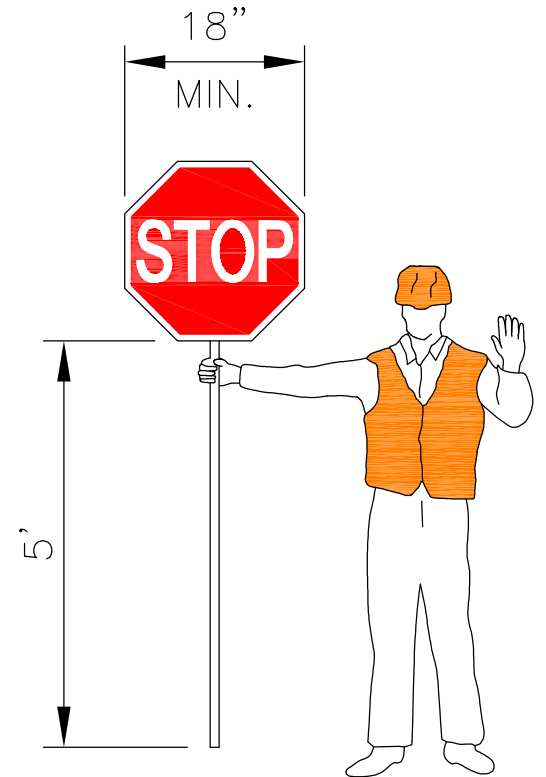
FIGURE 3
 STANDARD STOP/SLOW PADDLE

NOTES

PADDLE

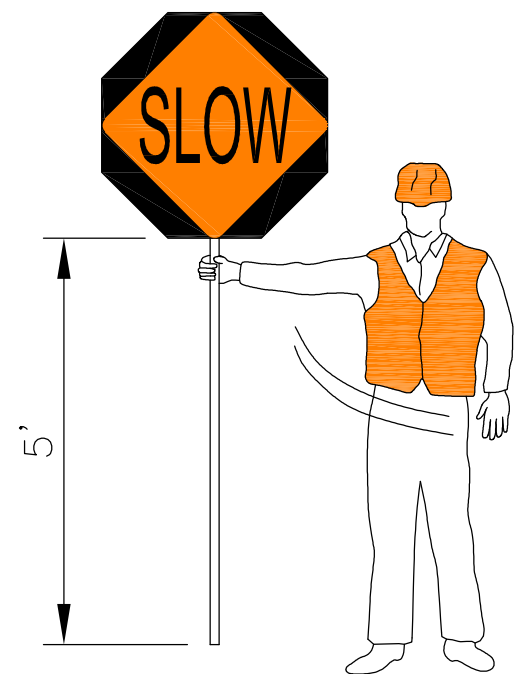
TO STOP TRAFFIC

1. **TO STOP TRAFFIC:** The flagger shall face traffic and display the STOP sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm should be raised with the palm towards approaching traffic.



TRAFFIC PROCEED

2. **TO DIRECT STOPPED TRAFFIC TO PROCEED:** The flagger shall face traffic with the SLOW paddle held in a stationary position with the arm extended horizontally away from the body. The flagger should motion with the free hand for traffic to proceed.



TO ALERT AND SLOW TRAFFIC

3. **TO ALERT OR SLOW TRAFFIC:** The flagger shall face traffic with the SLOW paddle held in a stationary position with the arm extended horizontally away from the body. The flagger may motion up and down with the free hand, palm down, indicating that the vehicle should slow down.

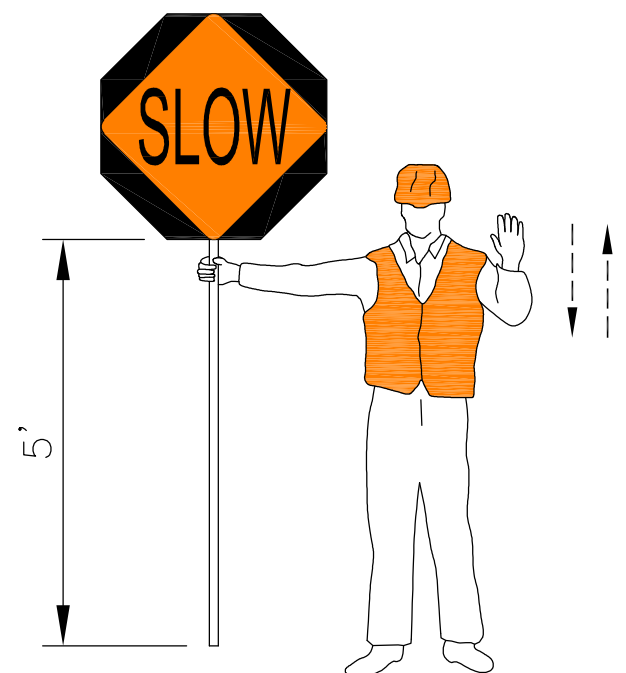
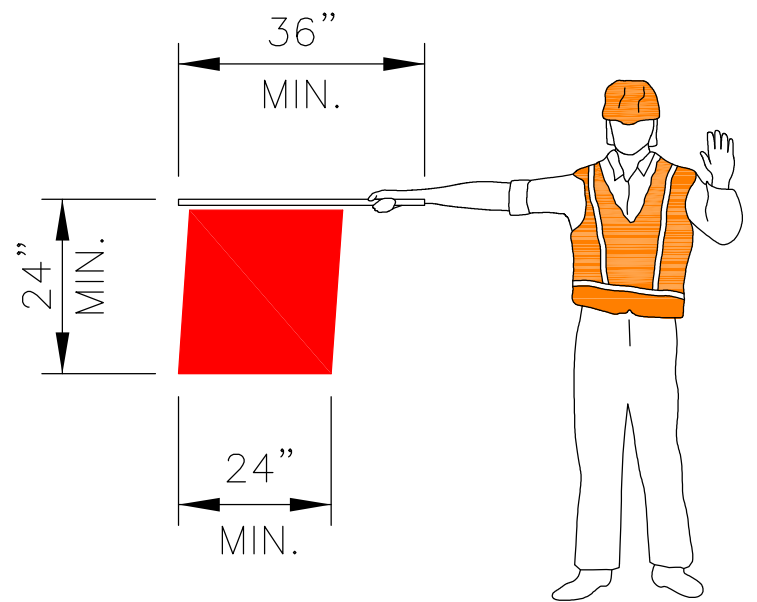


FIGURE 4
HAND SIGNALING PROCEDURES

FLAG

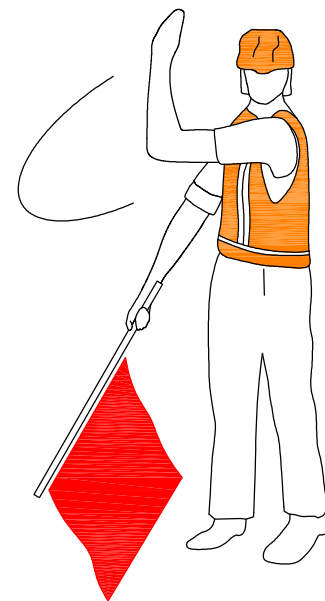
TO STOP TRAFFIC

1. **TO STOP TRAFFIC:** The flagger shall face traffic and extend the flag staff horizontally across the traffic lane in a stationary position, so that the full area of the flag is visible hanging below the staff. The free arm should be raised with the palm towards approaching traffic.



TRAFFIC PROCEED

2. **TO DIRECT STOPPED TRAFFIC TO PROCEED:** The flagger shall face traffic with the flag and arm lowered from view of the driver. With the free hand, the flagger should motion traffic to proceed. Flags shall not be used to signal traffic to proceed.



TO ALERT AND SLOW TRAFFIC

3. **TO ALERT OR SLOW TRAFFIC:** The flagger shall face traffic and slowly wave the flag in a sweeping motion of the extended arm from the shoulder level to straight down, without raising the arm above a horizontal position. The flagger may motion up and down with the free hand, palm down, indicating that the vehicle should slow down.

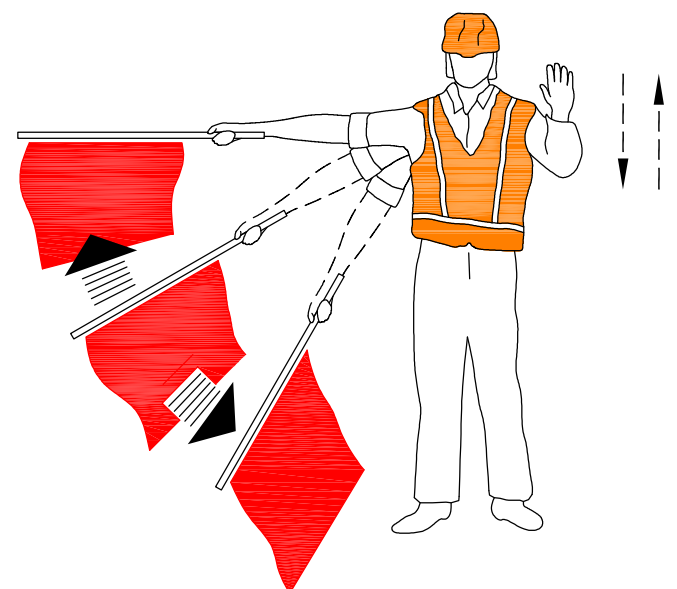


FIGURE 5
FLAGGING PROCEDURES
(EMERGENCIES ONLY)

It is critical that the flaggers are clearly visible to approaching traffic. For this reason the flagger should stand alone. No other traffic control devices should be placed around the flagger station nor should other workers congregate around the flagger station.

F. POLICE OFFICERS

It is recognized that certain types of construction/maintenance activity, especially those in or near intersections, require extensive traffic control, which can be effectively accomplished only by a uniformed police officer. Public and private agencies shall acquire the services of a uniformed police officer when the situation so dictates for the safety of the public and the workers.

Only uniformed police officers shall direct traffic through signalized intersections. The traffic signal may be put into flashing operation or may remain in normal operation at the discretion of the officer.

Officers shall be properly attired and shall direct traffic with hand motions. Flashlights with red cones should be used at night. Officers may also use a whistle to signal when they are changing the direction of the right of way.

XVII. DURATION OF WORK

The duration of the work zone is a major factor in determining the number and types of devices used in temporary traffic control zones. The five categories of work duration are as follows:

Long-term stationary - Work that occupies a location continuously for more than 3 days.

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

Short-term stationary - Daytime work that occupies an area for 1 hour to 12 hours.

Short-duration - Active work zone that occupies a location for up to 1 hour.

Mobile - Work that moves intermittently or continuously.

At LONG-TERM STATIONARY work zones, there is ample time to install and realize benefits from the full range of traffic control procedures and devices that are available for use. Since these types of work zones extend overnight, all traffic control devices used shall be made with retroreflective material. Drums shall be used to channel vehicular traffic. Drums or an approved barrier shall be used to separate the activity space from the traffic space. Appropriate temporary pavement markings shall be installed and all conflicting pavement markings shall be removed. **Portable channelizing devices (cones, tubular markers, etc.) shall not be used to separate opposing flows of traffic.** High-level warning devices such as changeable message signs or flashing arrow panels should be used whenever possible.

During INTERMEDIATE-TERM STATIONARY work, it may not be feasible or practical to use procedures or devices that are desirable for long-term stationary work zones, such as altered pavement markings, barriers or changeable message signs. The increased time to place and remove these devices in some cases could significantly lengthen the project, thus increasing exposure time. Since these projects extend overnight, all traffic control devices used shall be made with retroreflective material. Cones may be used in lieu of drums but must be 28 inches high with white retroreflective bands. Drums or tubular markers affixed to the pavement shall be used if the site is left unattended and traffic is being diverted across conflicting pavement markings or if channelizing devices are to be used in lieu of double yellow centerline to separate opposing traffic flows.

Most maintenance and utility operations are SHORT-TERM STATIONARY. The work crew is present to maintain and monitor the temporary traffic control zone. A temporary traffic control zone in compliance with the figures of this handbook is required. For nighttime operations, the traffic control devices shall either be made of retroreflective materials or shall be externally illuminated.

Work zones that continue more than one day but are abandoned and cleared such that all travel lanes and shoulders are open during periods of inactivity can be considered short-term stationary. In such cases, all temporary traffic control devices shall be removed or covered during periods of inactivity.

For SHORT-DURATION activities, it generally takes longer to set up and remove the temporary traffic control zone than to perform the work. Typically, such operations can be accomplished in 60 minutes or less. There are hazards involved for the crew in setting up and taking down a traffic control zone. Also, as the work time is short, the time during which the motorist is affected is significantly increased when additional devices are installed and removed. Considering these factors, it is generally held that simplified control procedures are warranted for short duration projects. Such shortcomings may be offset by the use of other, more dominant devices, such as special lighting units on work vehicles or larger, more visible signs. Mobility is essential, the crew is always on site. Safety is not compromised as numerous small devices are merely replaced by fewer, more dominant and effective devices.

MOBILE operations include activities that stop intermittently and then move on (e.g. pothole patching) and those that move continuously (e.g. pavement stripping). With operations that move slowly (less than 3 mph), it may be feasible to use stationary signing that is periodically retrieved and repositioned in the advance warning area. At higher speeds, trucks are typically used as components of the traffic control zones. Appropriately colored and marked vehicles with signs, flashing or rotating lights, and special lighting panels move as part of a train behind the work vehicles.

Mobile operations that move at speeds greater than 20 mph, such as snow plowing operations, shall have appropriate devices on the equipment, (i.e., rotating lights, signs, or special lighting), or shall use a protection vehicle with appropriate warning devices.

Safety should not be compromised by using fewer devices simply because the operation will frequently change its location. Portable devices should be used. Flaggers may be used, but caution must be exercised so they are not exposed to unnecessary hazards. The control devices should be moved periodically to keep them near the work area. If mobile operations are in effect in a travel lane of high-speed (45 mph or greater), multi-lane roadway, flashing arrow panels mounted on the back of each vehicle should be used.

XVIII. TEMPORARY TRAFFIC CONTROL DEVICES

The contractor, Utility Company or Public Agency performing the work shall furnish and install all necessary traffic control devices prior

to the start of construction or maintenance operations. This same organization shall continuously patrol the work zone throughout the duration of construction to ensure that all traffic control devices are in place, clean, visible, and are operating properly.

Temporary traffic control devices, which are not required at any time, shall be removed, covered, or otherwise shielded from traffic. **All temporary traffic control devices shall be removed or relocated as the work is finished or as work conditions change.**

Temporary traffic control devices include signs, channeling devices (barricades, traffic cones, drums, etc.), temporary pavement markings, warning lights, and arrow panels. The use of each of these devices is described below.

Portable changeable message signs are also very useful as temporary traffic control devices for complicated temporary traffic control zones, which may be required by GDOT/NCDOT.

A. SIGNS

Temporary traffic control signs convey both general and specific messages by means of words or symbols. As with other traffic signs, there are three categories of temporary traffic control signs: regulatory signs, warning signs, and guide signs. Regulatory signs, such as "KEEP RIGHT" and "ROAD CLOSED," are to be black on white. Warning signs for temporary traffic control in construction/maintenance zones are to be black on orange. Temporary guide signs in construction/maintenance zones, such as detour route signs, should also be black on orange.

All signs used at night shall be retroreflective to show similar shape and color both day and night. The retroreflective material shall be equal to or better than Type I, Level A reflective sheeting requirements in section 633 of the **Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects (FP-74)**. Illumination may be either internal or external. Standard street lighting does not meet the requirements for sign illumination.

Standard orange flags and/or flashing warning lights (see section XVIII-D) may be used in conjunction with signs to form high level warning devices (see figure 6, page 28). The flags and/or flashers must not block the sign legend.

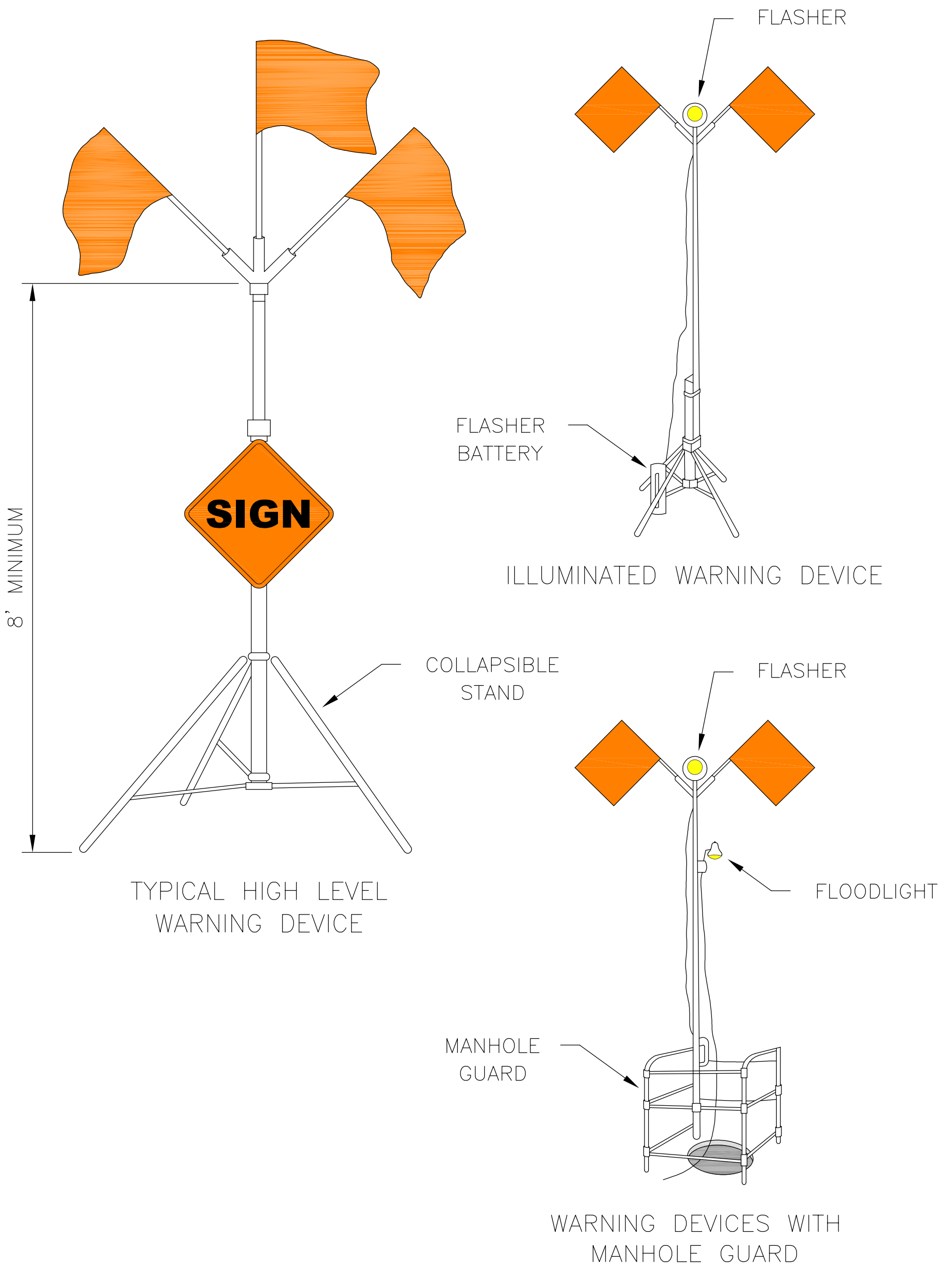
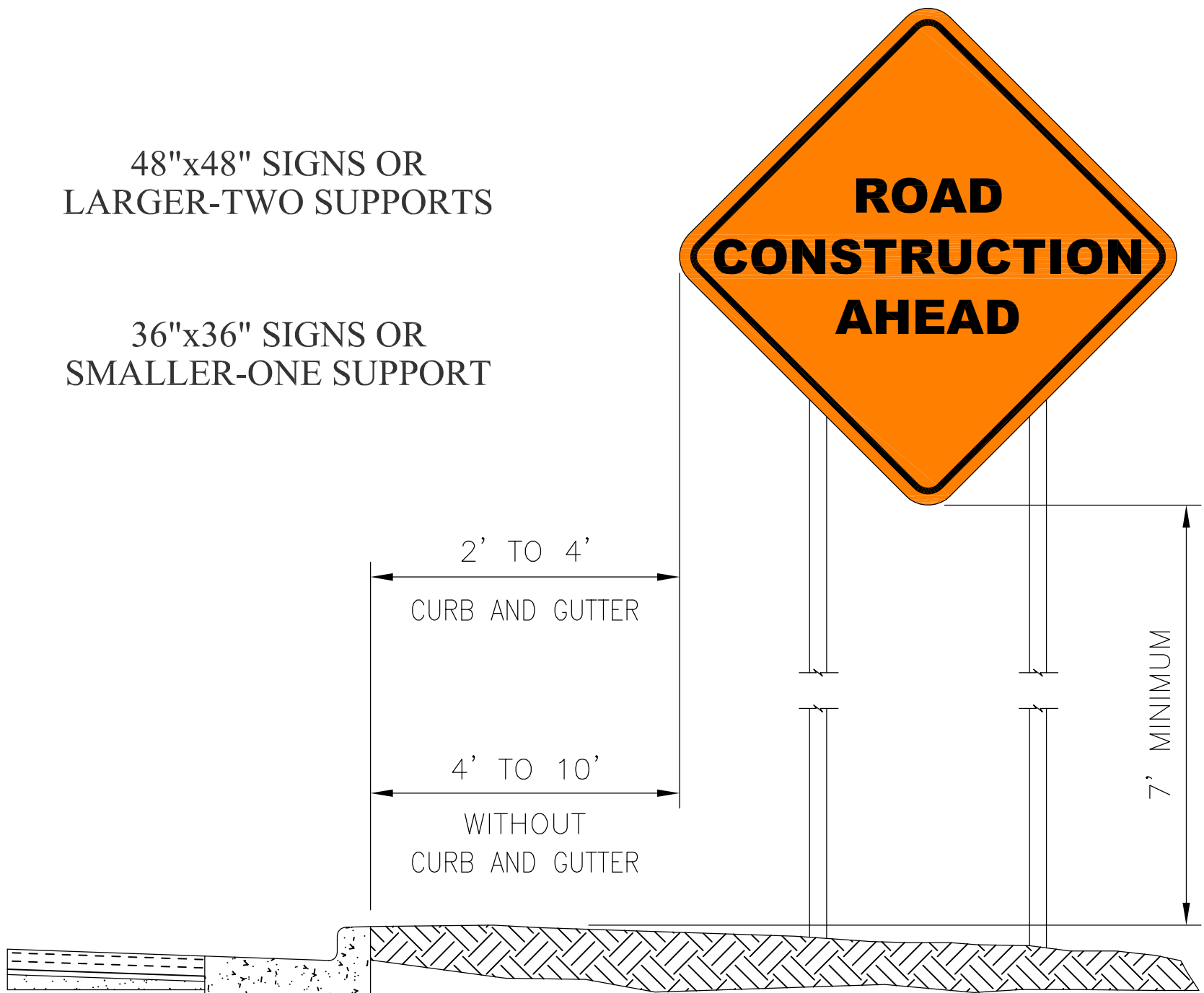


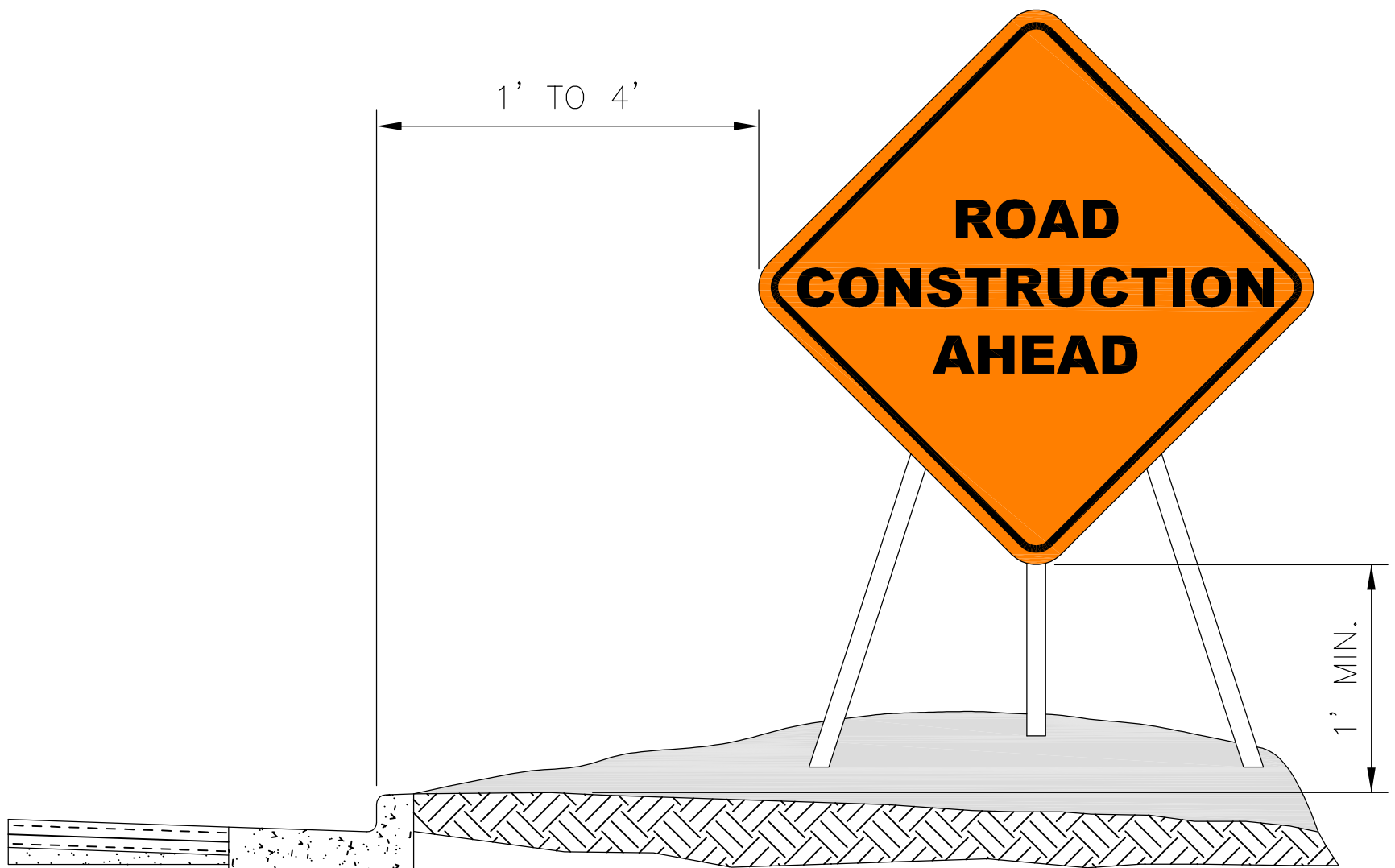
FIGURE 6
 HIGH LEVEL WARNING DEVICES
 (RECOMMENDED IN CONGESTED AREAS)

48"x48" SIGNS OR
LARGER-TWO SUPPORTS

36"x36" SIGNS OR
SMALLER-ONE SUPPORT



FIXED MOUNTING



PORTABLE MOUNTING

FIGURE 7
HEIGHT AND LATERAL LOCATION OF SIGNS

Advance warning signs should be placed on the shoulder on the right side of the road, and shall face and be visible to approaching traffic. On one-way and median-divided streets, supplemental advancement warning signs shall also be placed on the shoulder on the left side of the road. Such supplemental signs are required when closing the left lane of a one-way or median-divided street. Sign supports should not be located on sidewalks or areas designated for pedestrian or bicycle traffic. **Advance warning signs shall not be placed in a travel lane.**

Advance warning signs on long-term stationary projects shall be mounted on posts. On shorter term projects, advance warning signs may be mounted on portable supports. Figure 7 (page 29) shows the height and lateral clearance requirements for both of these types of mountings. Where appropriate, signs may be mounted on or above barricades. For mobile operations, a large sign may be mounted on a maintenance vehicle stationed in advance of the work area or moving along with it.

Signs, which are typically used in temporary traffic control zones, are shown on pages 40 through 47. The sizes shown are standard for most urban conditions. Larger signs are recommended for highways. Smaller signs may be used on low volume, local streets, but not less than 24" by 24".

The Contractor, Utility Company, or Public Agency performing the work shall furnish, install, and maintain all temporary signs. **Only GDOT forces shall install, remove, or relocate any permanent signs within the right of way.** Notification of conflicting signs may be made directly to GDOT. Any conflicts will usually be corrected within 24-hours of notification during the workweek.

B. CHANNELIZING DEVICES

The purpose of channelizing devices is to guide drivers and pedestrians through a temporary traffic control zone and to protect the workers inside the work area. Channelizing devices include drums, cones, tubular markers, and barricades. Each of these devices has a similar function and can be interchanged for most applications. The best device to use will be dependent on the duration of the work, the type of work, the time of day, and level of safety desired.

Channelizing devices are elements of a temporary traffic control system and shall not be used without appropriate warning signs and/or other devices. To effectively guide traffic, channelizing devices must be placed in series to form tapers or to separate traffic from hazards. The spacing of the devices to provide good guidance is dependent on the speed of the approaching traffic. To provide good guidance, the type of channelizing device used should be consistent throughout a temporary traffic control zone. Types of devices in a series should not be mixed. A single channelizing device shall not be placed alone in a travel lane.

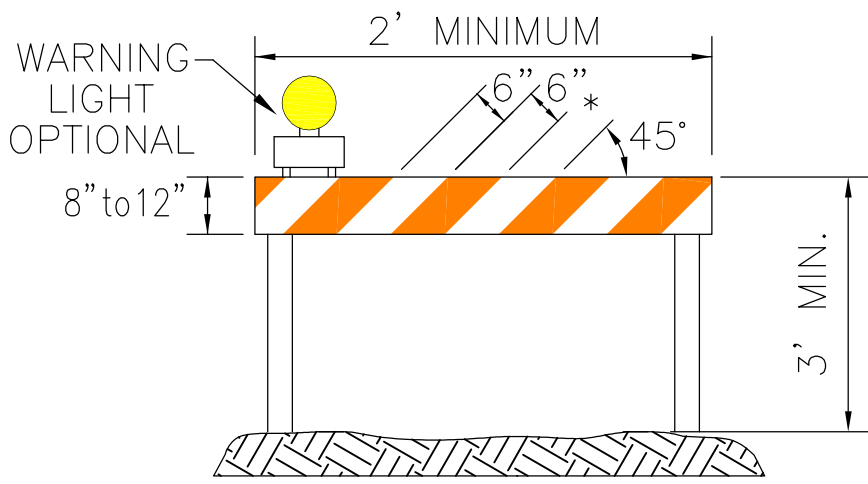
The standard design and typical application of each type of channelizing device follows.

DRUMS - Drums used for traffic warning or channelization shall be constructed of lightweight, flexible, and deformable materials. Also, shall have a minimum height of 36 inches and the outside upper diameter shall be at least 18 inches, not to exceed the outside base diameter. The base shall be designed to accommodate a sandbag of 40 pounds to 60 pounds in weight as ballast. **Ballast shall not be placed on top of the drum.** Drums shall have closed tops to prevent water and debris from accumulating in the bottom of the drums.

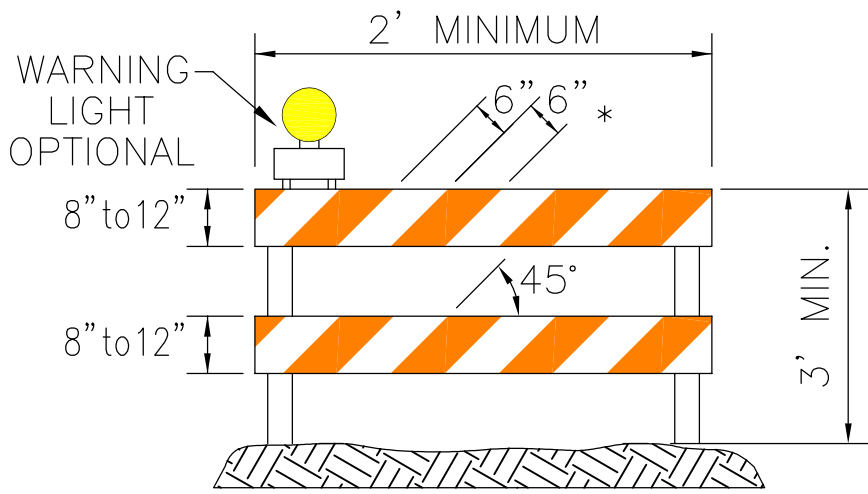
The markings on the drums shall have alternating orange and white horizontal, circumferential, retroreflective stripes 4 to 6 inches wide. There shall be at least 2 orange and 2 white stripes on each drum. Any non-retroreflective stripes between the horizontal orange and white stripes shall not exceed 3 inches wide (see figure 8, page 32).

Drums are most commonly used to delineate the flow of traffic but may also be used to mark specific hazards. Drums have the appearance of being formidable obstacles and, therefore, command the respect of drivers. They are portable enough to be shifted from place to place in a temporary traffic control zone to accommodate changing conditions, but are generally used in places where they will remain in place for a prolonged period of time. Drums are the recommended channelizing device for long-term and intermediate-term stationary projects.

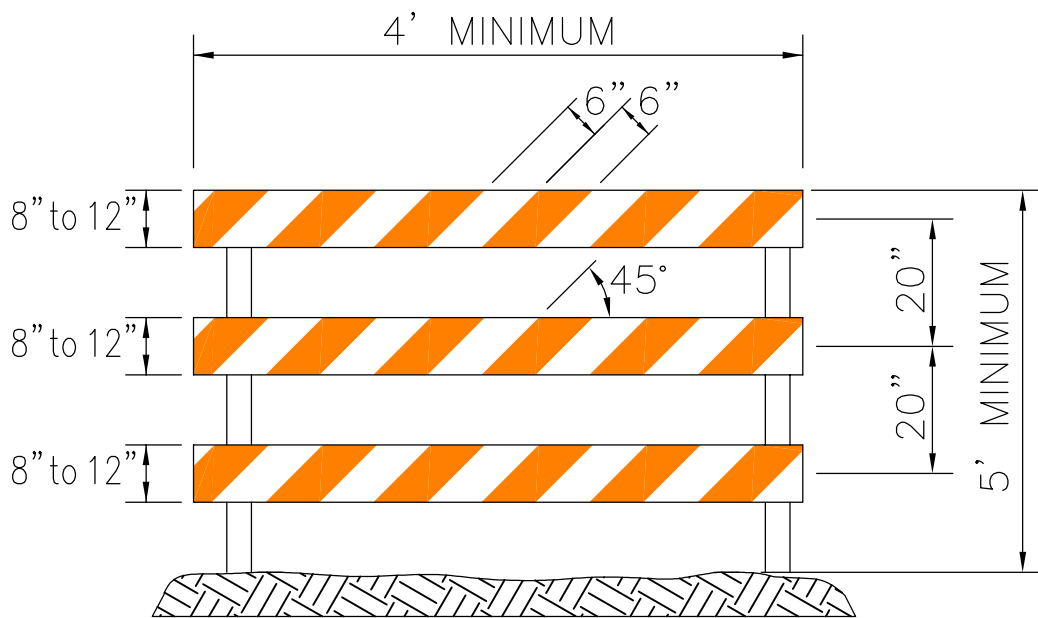
CONES AND TUBULAR MARKERS - All cones and tubular markers shall be predominately orange and made of material that can be struck without damaging vehicles on impact. Cones and tubular markers shall be at least 18 inches high when used on low speed, low volume roads. A minimum height of 28 inches is required on



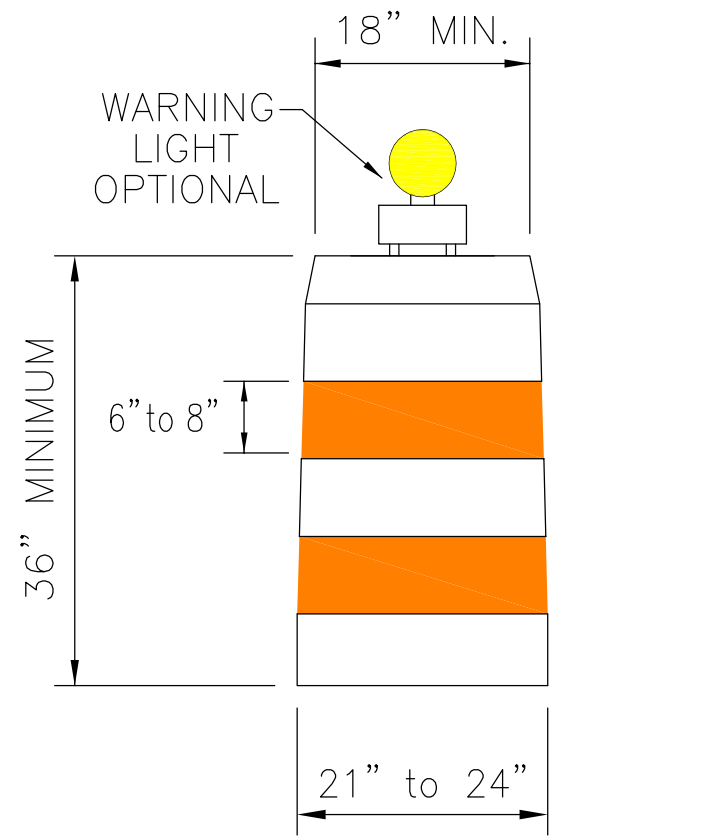
TYPE I BARRICADE



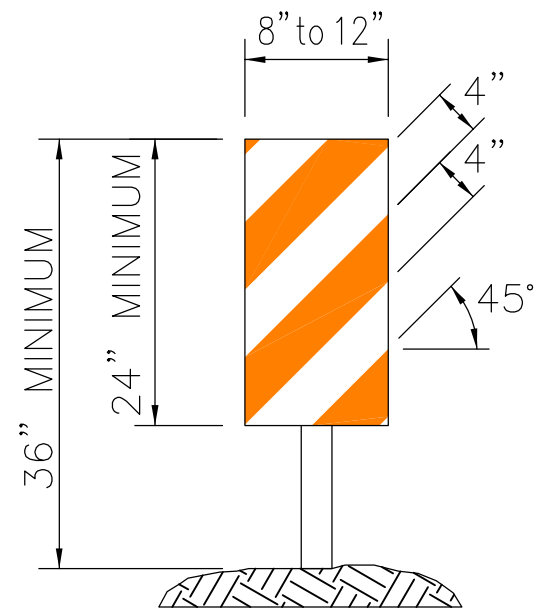
TYPE II BARRICADE



TYPE III BARRICADE



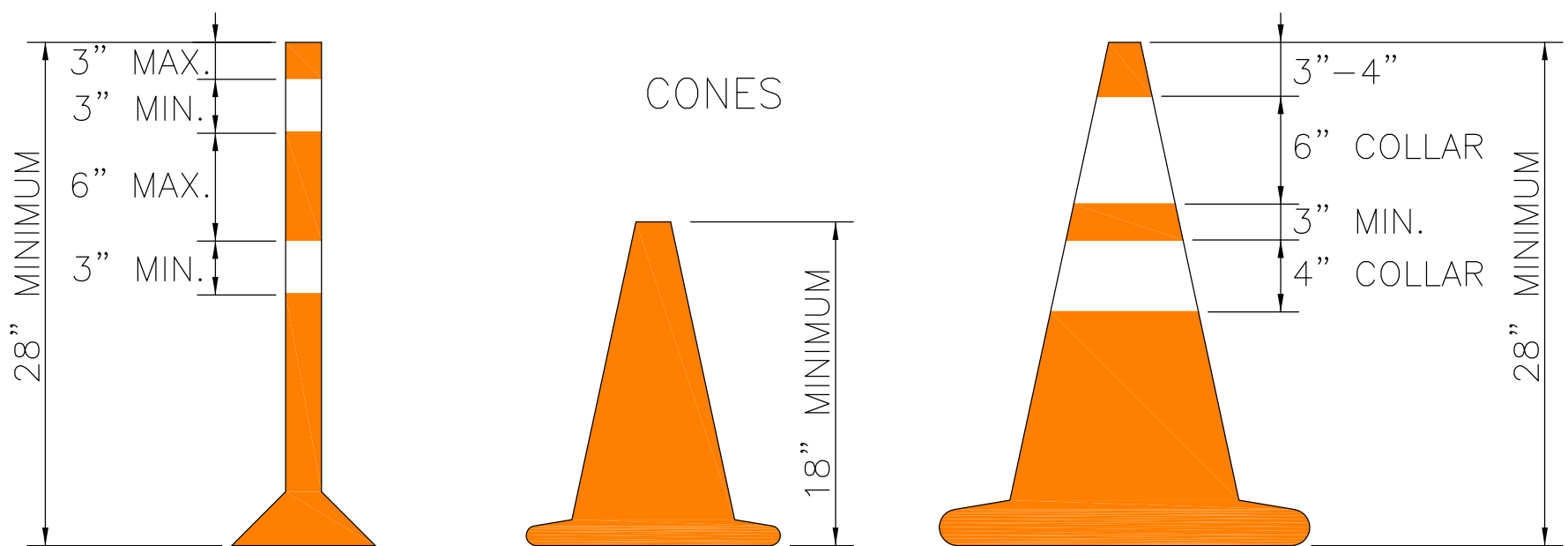
NON-METALLIC DRUM



VERTICAL PANEL

* RAIL STRIPES MAY BE 4 INCHES WIDE WHERE RAIL LENGTH ARE LESS THAN 3 FEET.

THE SIDES OF BARRICADES FACING TRAFFIC SHALL HAVE RETROREFLECTIVE RAIL FACES.



CONES

FIGURE 8
CHANNELIZING DEVICES

thoroughfares and for night use. Tubular markers shall be at least 2 inches wide. Cones and tubular markers used at night shall have reflectorized bands as shown in figure 8, page 32.

Like drums, traffic cones are most commonly used to delineate the flow of traffic but may also be used to mark specific hazards. Cones are lightweight, very portable, and are typically used on projects with very short duration that will not be left unattended. Care must be taken when placing cones to insure that they will not be blown over or displaced by wind or moving traffic. If a site is to be left unattended, cones should be double stacked to increase their weight and stability.

Tubular markers have less visibility than most channelizing devices but may be used where space limitations do not allow for the use of larger, more visible devices. A typical application of tubular markers is to separate opposing flows of traffic. If a site is to be left unattended the tubular markers should be affixed to the pavement with adhesive.

BARRICADES - A barricade is a portable device having 1 to 3 horizontal rails with alternating orange and white retroreflective stripes. The stripes slope downward at an angle of 45 degrees in the direction traffic is to pass the barricade (see figure 8, page 32).

Barricade rails should be supported in a manner that allows them to be clearly seen by motorist and provide stable support. Because barricades are often located adjacent to traffic and are subject to impact from errant vehicles they should be constructed of lightweight materials and should not have rigid bracing. Barricades may be ballasted with sandbags on the lower parts of the frame to prevent being blown over by wind or traffic. As with drums, solid objects such as rocks or chunks of concrete shall not be used as a ballast.

There are three types of barricades: Type I, Type II, and Type III. The type of barricade is determined by the number of horizontal rails with reflective striping (Type I barricades often include a second unstriped rail, which is necessary for stability).

Type I and Type II barricades are intended for use in situations where traffic is maintained throughout the temporary traffic control zone. As with drums or cones, Type I or Type II barricades may be used to delineate the flow of traffic but may also be used to mark specific hazards. A single drum or barricade shall not be placed in an open travel lane.

Like drums, barricades have the appearance of being formidable obstacles and, therefore, command the respect of drivers. They should be portable enough to be shifted from place to place within a temporary traffic control zone to accommodate changing conditions, but are generally used in situations where they will remain in place for a prolonged period. Type I or II barricades are adequate for all such applications in the city. Type II barricades are recommended for highways.

Type III barricades are used for the closure of all or a portion of the roadway. When used to close the entire roadway to traffic a sufficient number of Type III barricades shall be used to completely close the roadway. If access by construction vehicles is required, the contractor, utility company or agency doing the work is responsible for properly replacing the barricades at the end of the work day. If access to local dwellings and businesses is to be maintained beyond the point of the closure then an adequate opening shall be provided between the barricades to allow safe ingress and egress through the closure. A single Type III barricade may be used at the beginning of the activity area to help delineate the closed portion of the roadway.

C. TEMPORARY PAVEMENT MARKINGS

Properly maintained pavement markings can provide the best delineation around long-term stationary work zones. Pavement markings are not susceptible to being blown down or being moved by wind or traffic and are not easily changed by vandals. This “permanence” makes temporary pavement markings ideal for long-term stationary projects, but also makes it inappropriate for shorter duration projects.

On long-term stationary projects, the contractor, utility company or agency doing the work shall remove any existing pavement markings that conflict with temporary traffic flow. New temporary markings, which direct traffic through the temporary traffic zone, shall be installed and maintained for the duration of the project. Appropriate permanent markings shall be re-installed upon the completion of the project.

Existing conflicting markings shall be obliterated so as to be unidentifiable as pavement markings under day or night, wet or dry conditions.

All temporary pavement markings shall meet the specification for size, placement and color of Part 3 (pavement markings) of the Manual on Uniform Traffic Control Devices and the current GDOT standards. Temporary pavement markings may either be painted or be formed using temporary tape. Paint is recommended for any application which is intended to remain longer than two weeks. All temporary markings should be retroreflective. The temporary markings shall be checked each day and night to ensure good visibility. Proper maintenance is critical for temporary markings to be effective.

D. WARNING LIGHTS

Temporary traffic control activities often create conditions along the traveled way that are particularly unexpected at night, when the drivers' visibility is sharply reduced. It is often desirable and necessary to supplement retroreflectorized signs and channelizing devices with warning lights. There are three types of warning lights:

TYPE A: low-intensity flashing warning lights are most commonly mounted on barricades, drums or advance warning signs, and are intended to continually warn drivers that they are approaching or are adjacent to a hazardous area.

TYPE B: high-intensity flashing warning lights are normally mounted on advance warning signs or on independent supports. Since these lights are effective in daylight, as well as darkness, they are designed to work 24 hours a day.

TYPE C: steady-burn lights are usually mounted on drums and barricades and are intended to delineate the edge of the travel path, lane closures, or similar situations.

TYPE A and TYPE B flashers shall not be used in a longitudinal display to delineate a travel path or in random pattern that may confuse the motorist. They shall not be used in an attempt to "guide" traffic, but only as a device to alert motorists. Where lights are needed to delineate the travel path through and around obstructions in a construction or maintenance area, the delineation shall be accomplished by use of TYPE C steady burn lights.

As used herein, warning lights are portable, lens directed, enclosed lights. The color of the light emitted shall be yellow. They may be used in either a steady burn or flashing mode as noted above. Warning lights shall be in accordance with the requirements of **ITE Standard for Flashing and Steady Burn Barricade Warning Lights**.

E. ARROW PANELS

The Director of the Department of Transportation or his representative may require the use of arrow panels or portable changeable message signs on projects that may need additional warning for the motorists.

An arrow panel is a sign with a matrix of elements capable of either flashing or sequential displays. It is intended to provide additional warning and provide positive guidance to assist in merging and controlling traffic through a temporary traffic zone. Arrow panels should be used in combination with, not in lieu of, appropriate signs, barricades, and other traffic control devices.

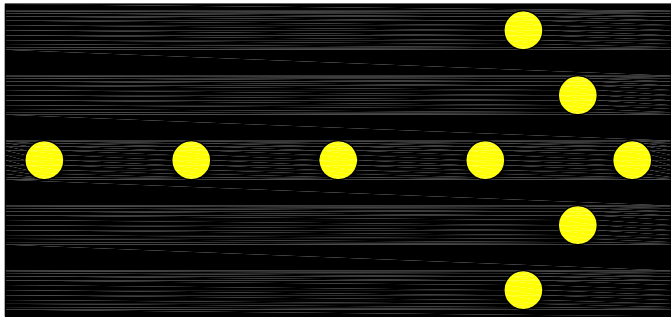
For stationary lane closing, the arrow display should be located on the shoulder at the beginning of the taper. Where the shoulder is too narrow for the arrow board, it should be located behind the channelization at the end of the buffer area or the beginning of the work area.

Arrow panels should have the capability of the following mode selections (see figure 9, page 37); (1) left or right flashing or sequential arrows; (2) left or right sequential chevrons; and (3) flashing double arrow; or (4) caution. The caution mode consists of four or more lamps arranged in a square or horizontal pattern.

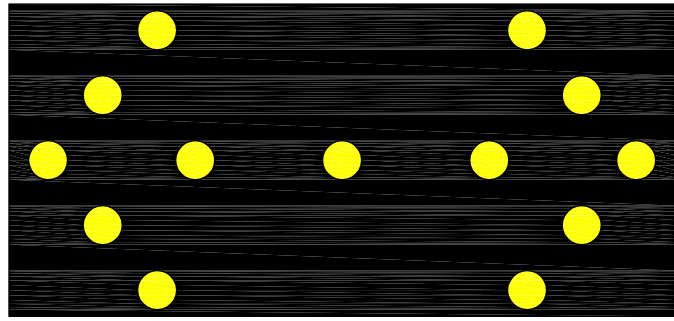
Arrow display elements shall be capable of a minimum of 50% dimming from their full lamp voltage. Full lamp voltage should be used for day and the dimmed mode shall be used for night.

Care must be taken to avoid driver confusion in the placement of arrow panels in the vicinity of ramps, median crossovers, and side-road intersections.

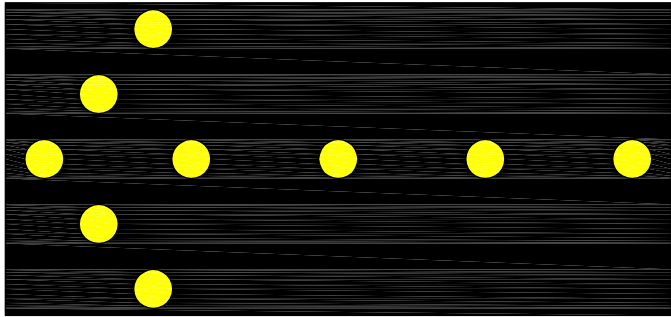
Arrow panels are intended to assist with merging traffic. Arrow panels should not be used for work activities on the shoulder of the roadway except in the "CAUTION" mode because the panels can cause unnecessary lane changing. **An arrow panel shall not be used on a two-lane, two-way temporary one-lane operation.** An arrow panel **shall not** be used on a multi-lane roadway to laterally shift all lanes of traffic.



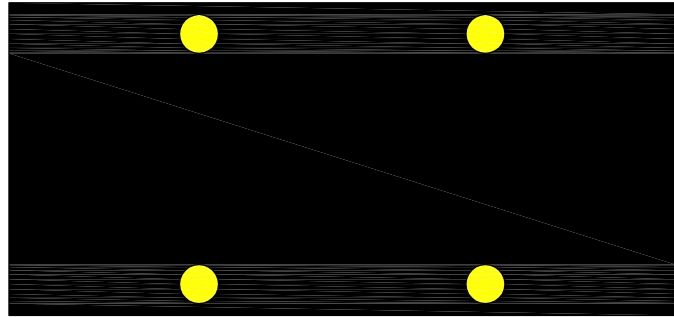
MOVE/MERGE RIGHT



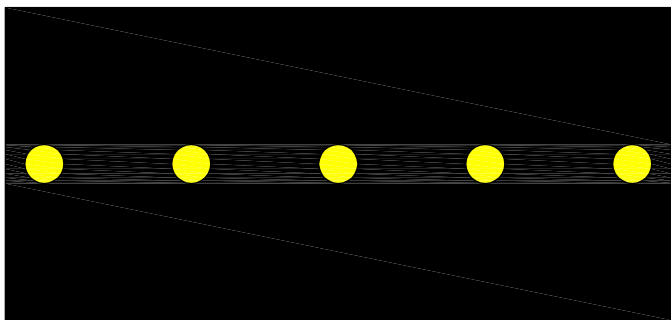
MOVE/MERGE EITHER SIDE



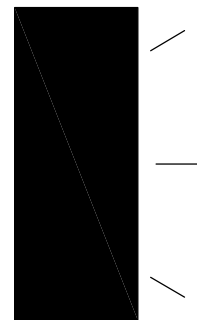
MOVE/MERGE LEFT



CAUTION



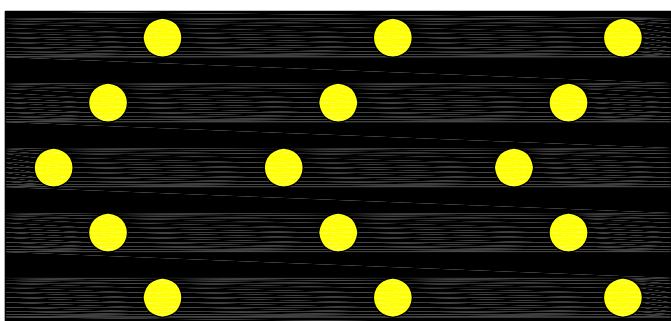
CAUTION



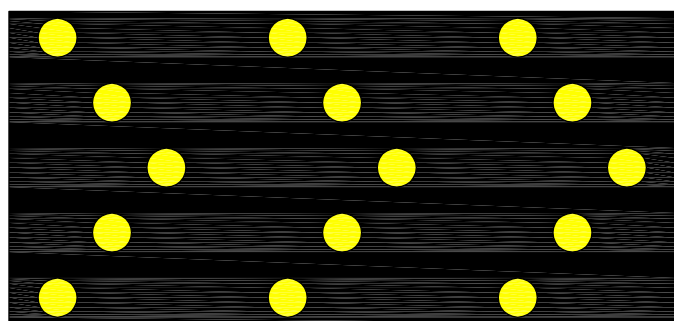
CAUTION

FLASHING ARROW PANELS MAY BE USED FOR DAY AND NIGHT LANE CLOSURES. AS A MINIMUM, THE FLASHING ARROW PANELS SHALL BE CAPABLE OF THE DISPLAYS SHOWN.

FLASHING ARROW PANELS - OPERATING MODES



MOVE/MERGE LEFT



MOVE/MERGE RIGHT

SEQUENTIAL CHEVRON DISPLAYS (AS SHOWN ABOVE) MAY BE USED IN LIEU OF THE FLASHING ARROWS.

FIGURE 9
FLASHING ARROW PANEL DISPLAYS

F. TRUCK MOUNTED ATTENUATOR (TMA)

Trucks are often used as a protective vehicle to protect workers or work equipment from errant vehicles. These protective vehicles are normally equipped with flashing arrows, changeable message signs and/or flashers, and must be located properly in advance of the workers and/or equipment they are protecting. However, these protective vehicles are objects that may cause injuries to occupants of the errant vehicles if they are not equipped with truck mounted attenuators (TMA).

A TMA capable of absorbing the impact of errant vehicles can be attached to the rear of these protective vehicles to reduce the severity of rear-end crashes. There are a variety of TMA that use energy absorbing cartridges filled with foam or honeycomb materials that telescope and compress upon impact to absorb the impact safely.

The TMA must be positioned a sufficient distance in advance of the workers or equipment being protected to allow for appropriate vehicle roll ahead, but not so far that errant vehicles will travel around the vehicle and strike the protected workers/equipment. The attenuator should be in the full down-and-locked position. For stationary operations, the parking brake should be set, the transmission in second gear, and when possible, the front wheels turned away from the work site. Turning the front wheels should be based on specific conditions at the work site such that the after-impact trajectory is into a safe area. See NCDOT specs for further details on TMA.

XIX. EXCAVATIONS AND TRENCHES

Trenches or excavations that cannot be properly backfilled and patched prior to the end of the workday shall be bridged to permit an unobstructed flow of traffic. Trench walls and adjacent soils shall be sufficiently stabilized prior to the use of steel plates used for bridging.

1. Bridging must be secured against displacement by using adjustable cleats, angles, bolts, or other devices to prevent movement by traffic.
2. The trench must be adequately shored to support the bridging and traffic.

3. Steel plates used for bridging must extend one foot beyond the edges of the trench. Temporary paving materials (premix) should be used to feather the edges of the plate to minimize wheel impact.

All excavations in the public right-of-way shall be in compliance with all current Occupational Safety and Health Act (O.S.H.A.) requirements. All individuals in an excavation not in compliance with O.S.H.A. regulations will be ordered out of the excavation until it is brought into compliance. O.S.H.A.-N.C. inspectors may be notified of any excavation not brought into compliance when ordered out or if a contractor or utility company repeatedly violates O.S.H.A. regulations.

All excavations or trenches made in the street or sidewalk shall be backfilled and patched in accordance with current GDOT and/or NCDOT specifications. **Engineering and Inspections and GDOT shall be notified prior to making an excavation or cutting a trench in the pavement or sidewalk.**

XX. DIAGRAMS

The following pages contain several diagrams that depict typical temporary traffic control zones. The diagrams include all the requirements for the type of closure shown. Some diagrams also include devices, which are not required or are optional. It should be noted that the diagrams are typical and that construction procedures may require that two or more diagrams be used in one area of construction. Channelizing devices associated with these typical diagrams shall be moved, supplemented, changed or removed as required to ensure that the motorist does not receive false information. If a project requires that typical diagrams be combined or altered numerous times throughout the duration of the project, it is recommended that a specific traffic control plan (TCP) be prepared for the project following the standards presented in the previous sections of this hand book.

The standards presented in the previous sections of this handbook and the diagrams, which follow, are the minimums required. Additional signs, cones, barricades, and warning devices may be used, but at no time will less than what is specified herein be acceptable. Since public safety is involved, a high degree of conformity to the presented standards is necessary. Other traffic control devices or applications may be used, but only with the approval of GDOT.

CONSTRUCTION SIGNS



C2
36" x 36"
(W21-4)



C2a
36" x 36"
(W21-7)



C2b
36" x 36"



C2c
36" x 36"



C3
36" x 36"
(W21-5)

SIGNS C2a, C2b, AND C2c MAY BE USED IN PLACE OF THE STANDARD C2 SIGN WHERE APPROPRIATE

(MUTCD SIGN IDENTIFICATION CODE IN PARENTHESIS)

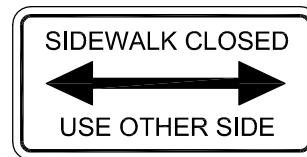
CONSTRUCTION SIGNS



C4
36"x36"
(W21-1a)



C5a
24"x12"
(R9-9)



C5b
24"x12"
(R9-10)

ROAD NARROWS



C6
36"x36"
(W5-1)



C7
36"x36"
(W20-7b)



C8
36"x36"
(W20-4)



C9
36"x36"
(W20-7a)

Use where two-way traffic must use the same lane.

CONSTRUCTION SIGNS



C10L
36"x36"
(W20-5L)



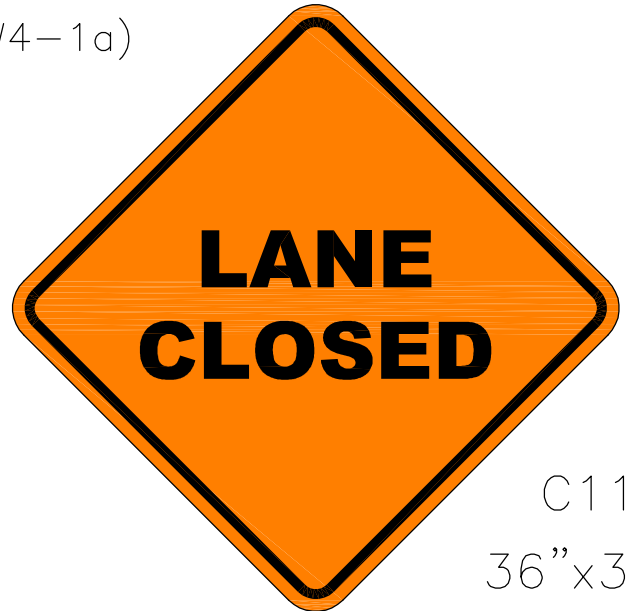
C10R
36"x36"
(W20-5R)



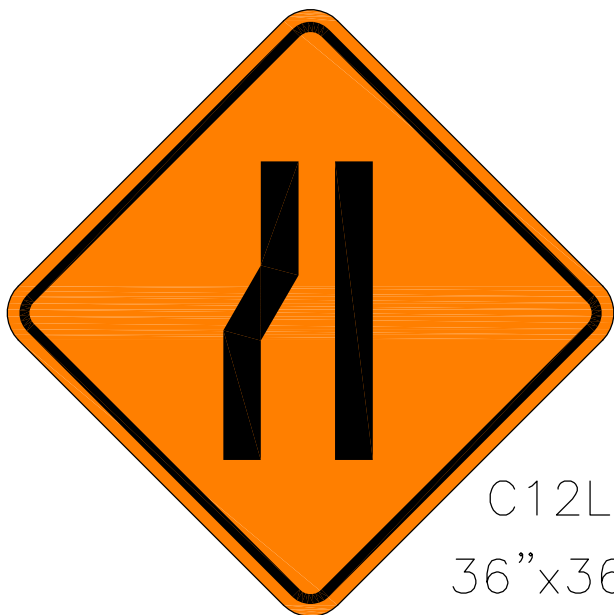
C10T
36"x36"
(W4-1a)



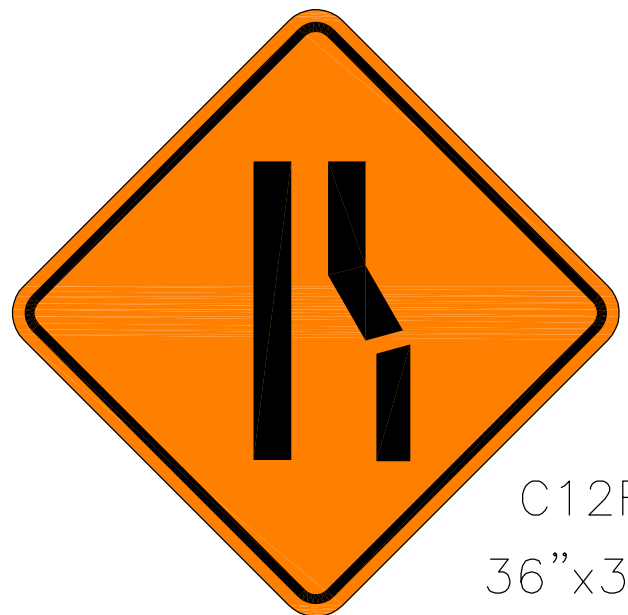
C10C
36"x36"
(W9-3)



C11
36"x36"



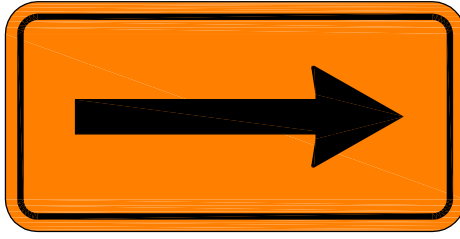
C12L
36"x36"
(W4-2L)



C12R
36"x36"
(W4-2R)

(MUTCD SIGN IDENTIFICATION CODE IN PARENTHESIS)

CONSTRUCTION SIGNS

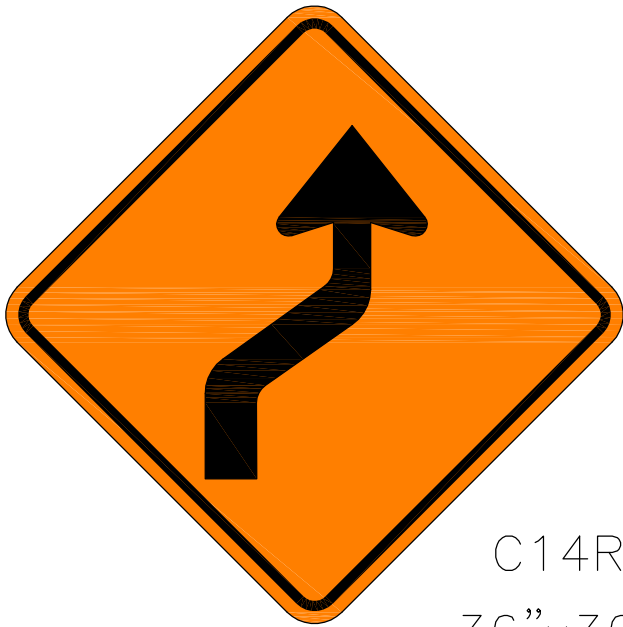


C13

36"x18"

(W1-6)

(ARROW MAY POINT LEFT OR RIGHT)



C14R

36"x36"

(W1-4R)



C14L

36"x36"

(W1-4L)



C15R

36"x36"

(W1-3R)



C15L

36"x36"

(W1-3L)

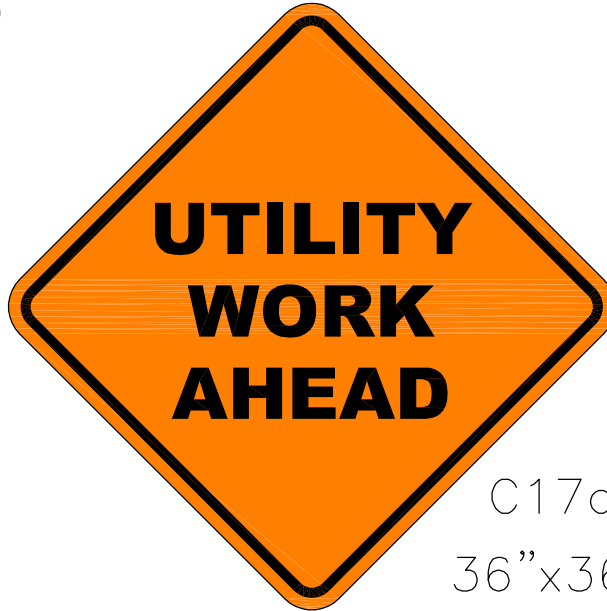
CONSTRUCTION SIGNS



C16
36"x36"
(W20-3)



C17
36"x36"
(W20-2)



C17a
36"x36"
(W21-7)



C18
48"x30"
(R11-2)



C18a
48"x30"
(R11-4)



C19
48"x36"
(E5-2)



C19a
48"x36"
(E5-2a)

(MUTCD SIGN IDENTIFICATION CODE IN PARENTHESIS)

CONSTRUCTION SIGNS



C20R
36"x12"
(M4-10R)



C20L
36"x12"
(M4-10L)



C21L
30"x24"
(M4-9L)



C21R
30"x24"
(M4-9R)



C22L
30"x24"
(M4-9La)

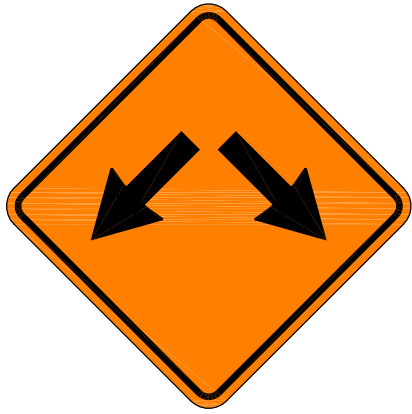


C22R
30"x24"
(M4-9Ra)

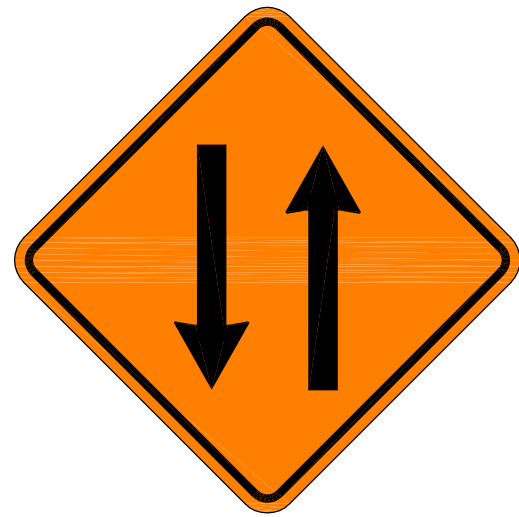


C23
24"x18"
(M4-8a)

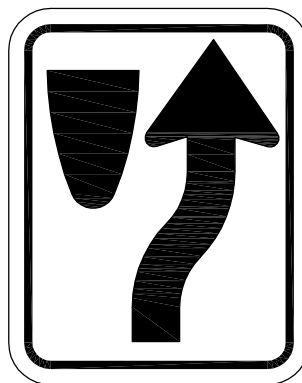
CONSTRUCTION SIGNS



C24
24"x24"
(W12-1)



C25
30"x30"
(W6-3)



C26
24"x30"
(R4-7)

(MUTCD SIGN IDENTIFICATION CODE IN PARENTHESIS)

CONSTRUCTION SIGNS



C28
30"x30"
(W8-1)



C29
30"x30"
(W8-4)



C30
30"x30"
(W8-8)

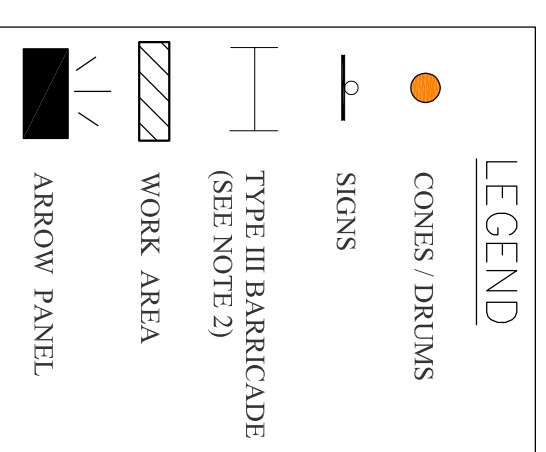
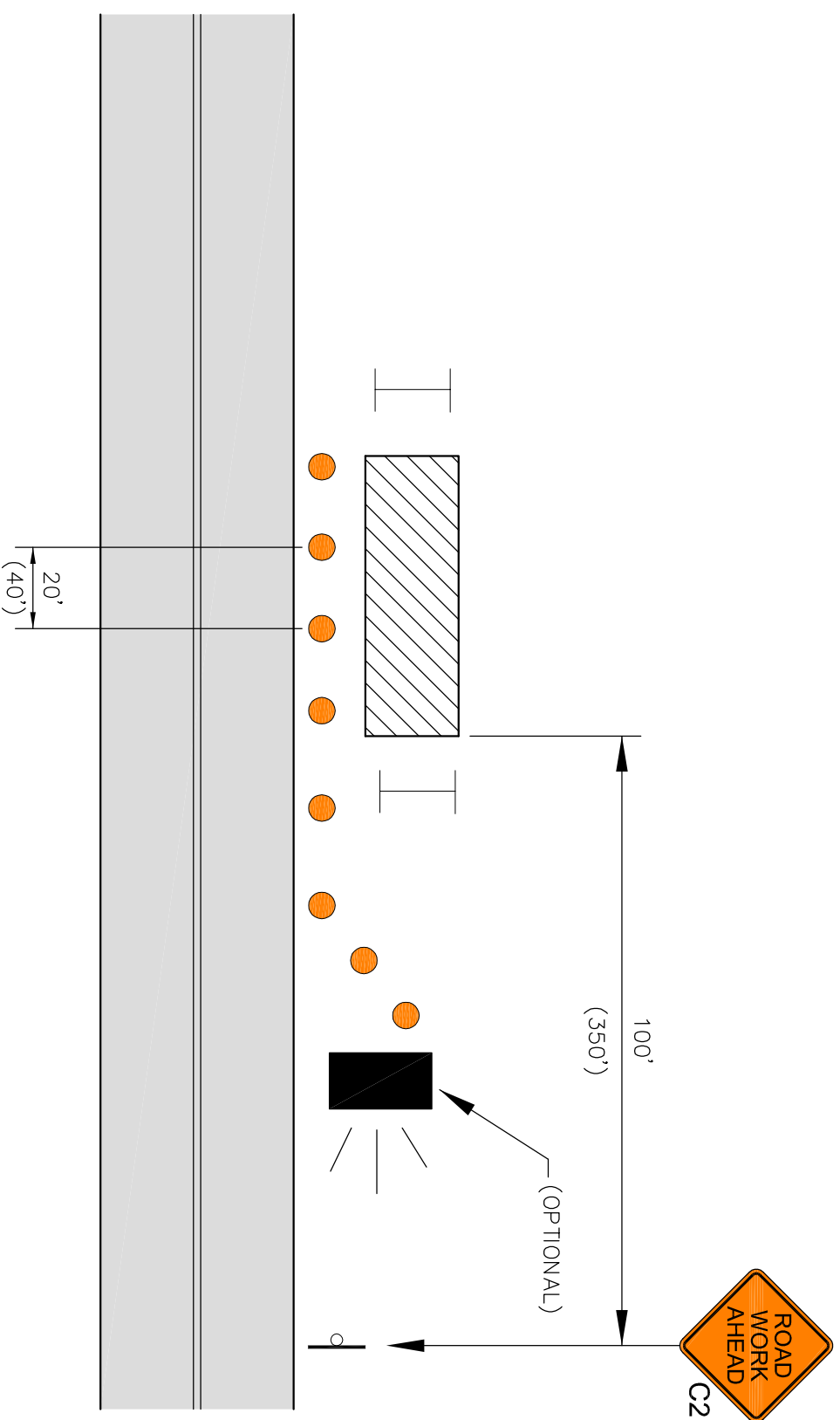


C31
30"x30"
(W8-9)



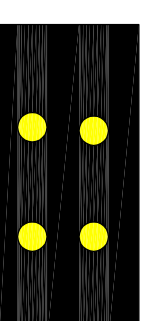
C32
30"x30"
(W8-11)

DIAGRAM 1 WORK AREA BEYOND SHOULDER



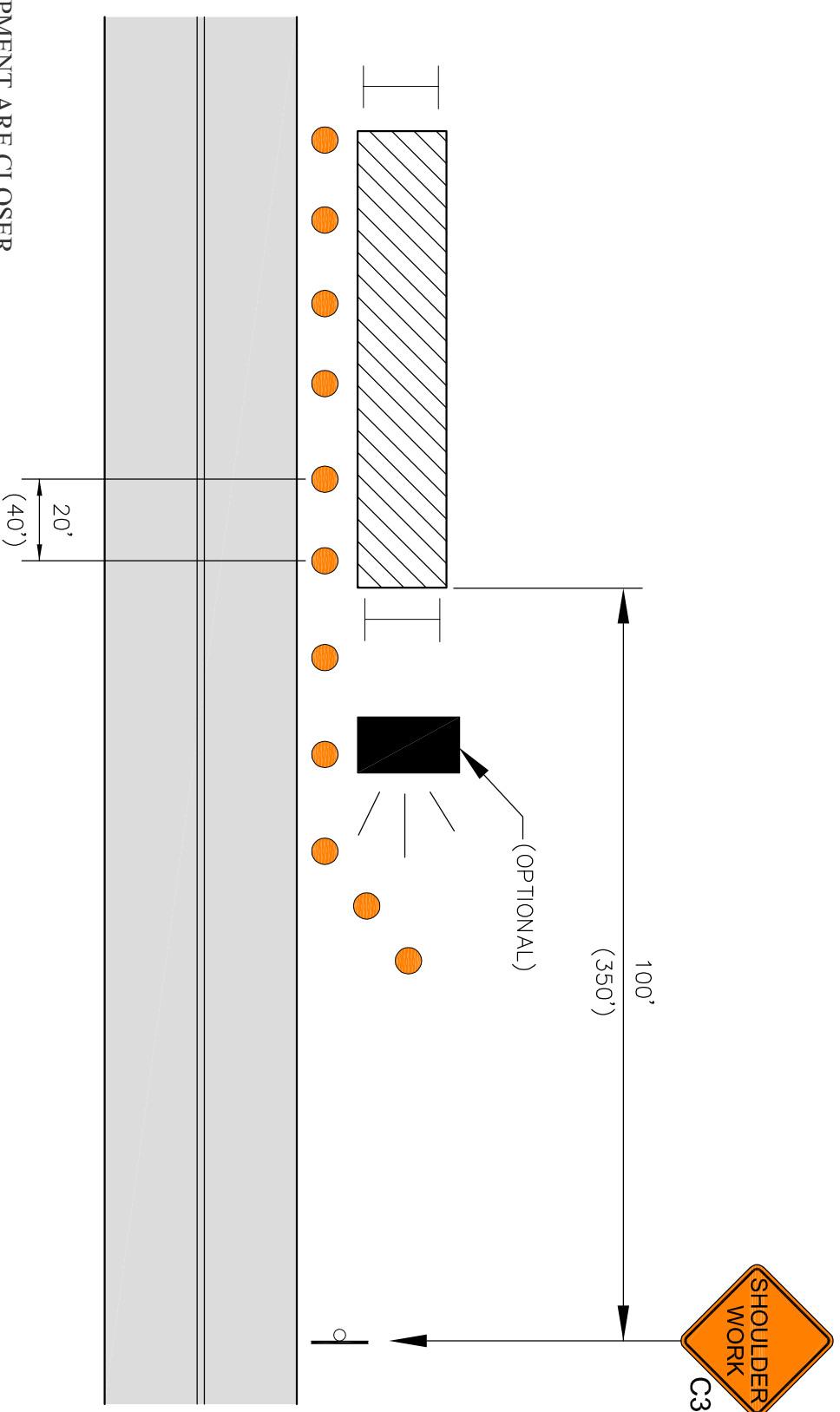
NOTES:

1. NO ADVANCE SIGNING REQUIRED IF 15' OR MORE OF CLEARANCE IS MAINTAINED FROM EDGE OF PAVEMENT.
2. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.
3. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
4. FOR SHORT DURATION OPERATIONS OF 60 MIN. OR LESS, ALL SIGNS AND CHANNELIZING DEVICES MAY BE ELIMINATED IF A VEHICLE WITH ACTIVATED ROTATING LIGHTS OR STROBE LIGHTS IS USED. VEHICLE HAZARD WARNING SIGNALS SHALL NOT BE USED INSTEAD OF ROTATING LIGHTS OR STROBE LIGHTS.



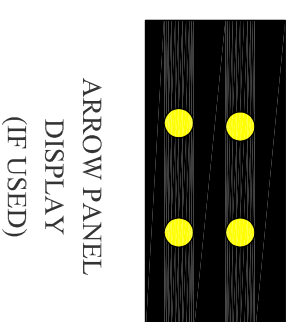
ARROW PANEL
DISPLAY
(IF USED)

DIAGRAM 2 WORK AREA ON SHOULDER



NOTES:

1. IF WORK AREA AND EQUIPMENT ARE CLOSER THAN 2' TO THE EDGE OF THE PAVEMENT, THEN USE OTHER APPLICABLE DIAGRAMS.
2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
3. IF AN EXCAVATION IS TO BE MADE WITHIN 4' OF THE EDGE OF THE PAVEMENT THE LANE ADJACENT TO THE EXCAVATION SHOULD BE CLOSED USING OTHER APPLICABLE DIAGRAMS.
4. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.
5. FOR SHORT DURATION OPERATIONS OF 60 MIN. OR LESS, ALL SIGNS AND CHANNELIZING DEVICES MAY BE ELIMINATED IF A VEHICLE WITH ACTIVATED ROTATING LIGHTS OR STROBE LIGHTS IS USED. VEHICLE HAZARD WARNING SIGNALS SHALL NOT BE USED INSTEAD OF ROTATING LIGHTS OR STROBE LIGHTS.








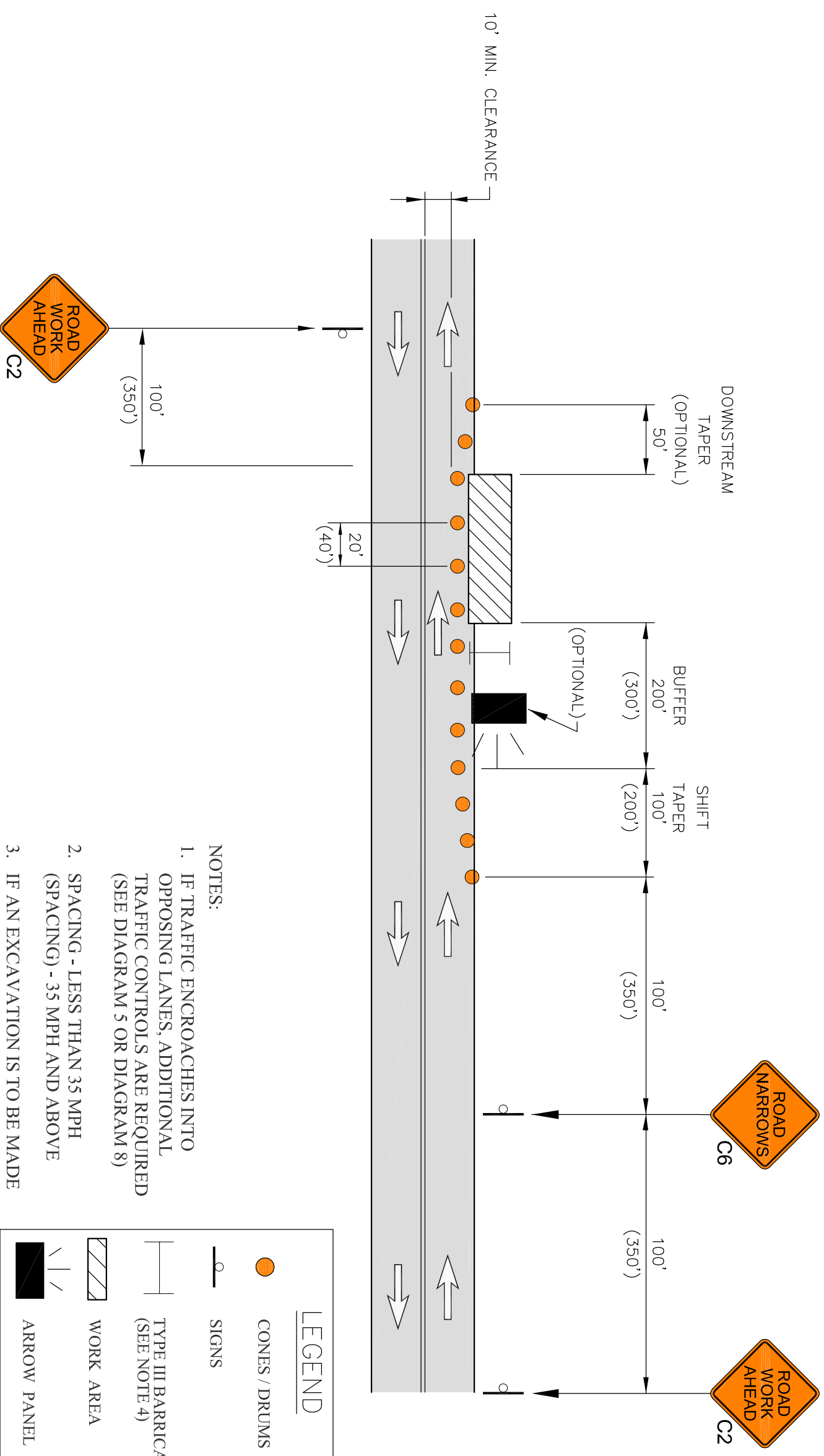
LEGEND	
	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE (SEE NOTE 4)
	WORK AREA
	ARROW PANEL

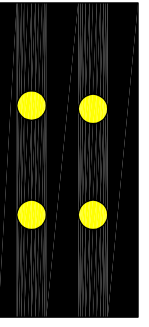
DIAGRAM 3 WORK AREA ON SHOULDER (MINOR ENCROACHMENT ON PAVEMENT)



NOTES:

1. IF TRAFFIC ENCROACHES INTO OPPOSING LANES, ADDITIONAL TRAFFIC CONTROLS ARE REQUIRED (SEE DIAGRAM 5 OR DIAGRAM 8)
2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
3. IF AN EXCAVATION IS TO BE MADE WITHIN 4' OF THE EDGE OF THE PAVEMENT, THE LANE ADJACENT TO THE EXCAVATION SHOULD BE CLOSED USING OTHER APPLICABLE DIAGRAMS.
4. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.

LEGEND	
	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE (SEE NOTE 4)
	WORK AREA
	ARROW PANEL



ARROW PANEL
DISPLAY
(IF USED)

DIAGRAM 4
WORK AREA ON SHOULDER
(MINOR ENCROACHMENT NEAR INTERSECTION)

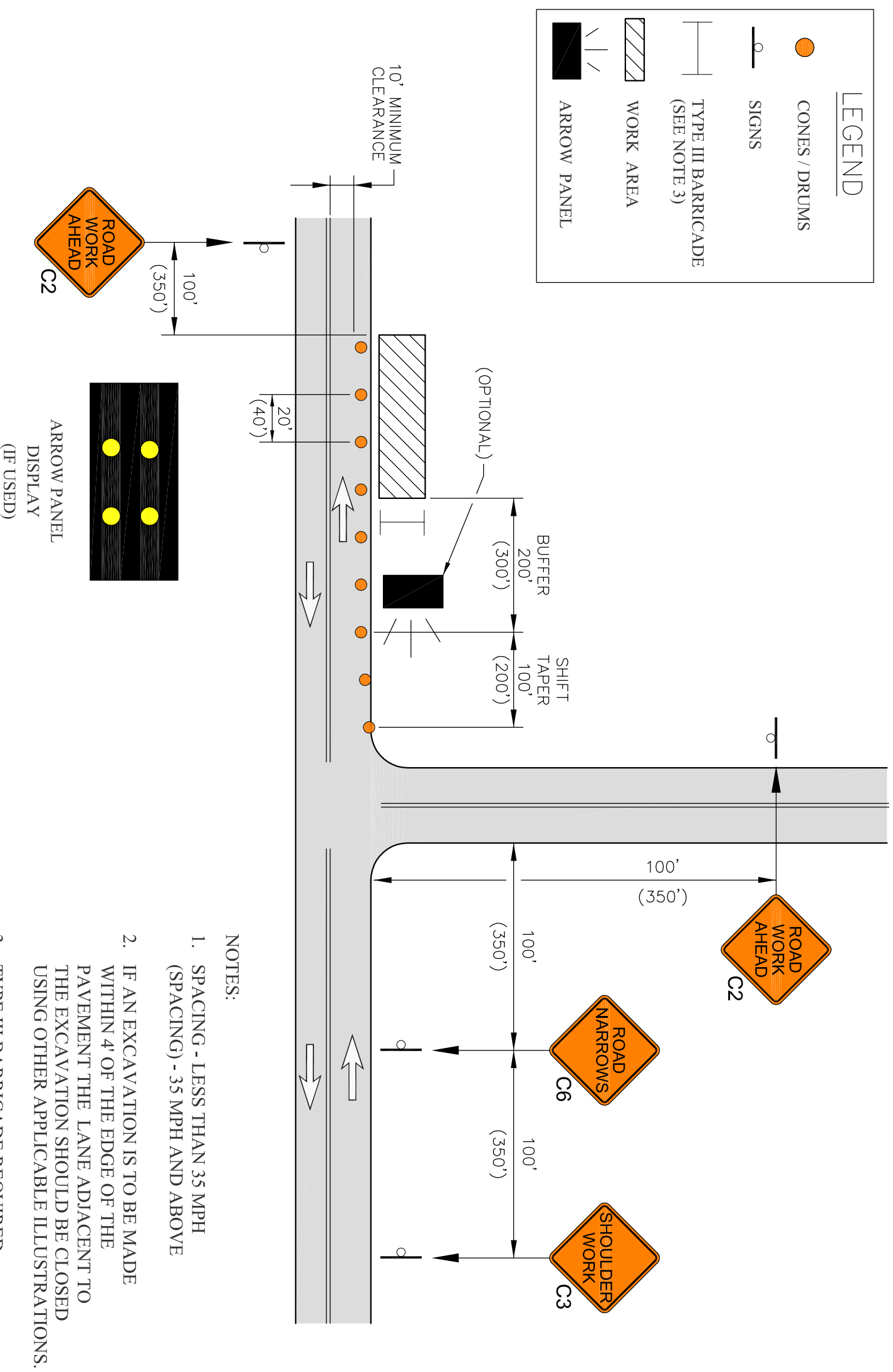


DIAGRAM 5
WORK AREA IN TRAVEL LANE
(MAINAINING 2-WAY TRAFFIC)

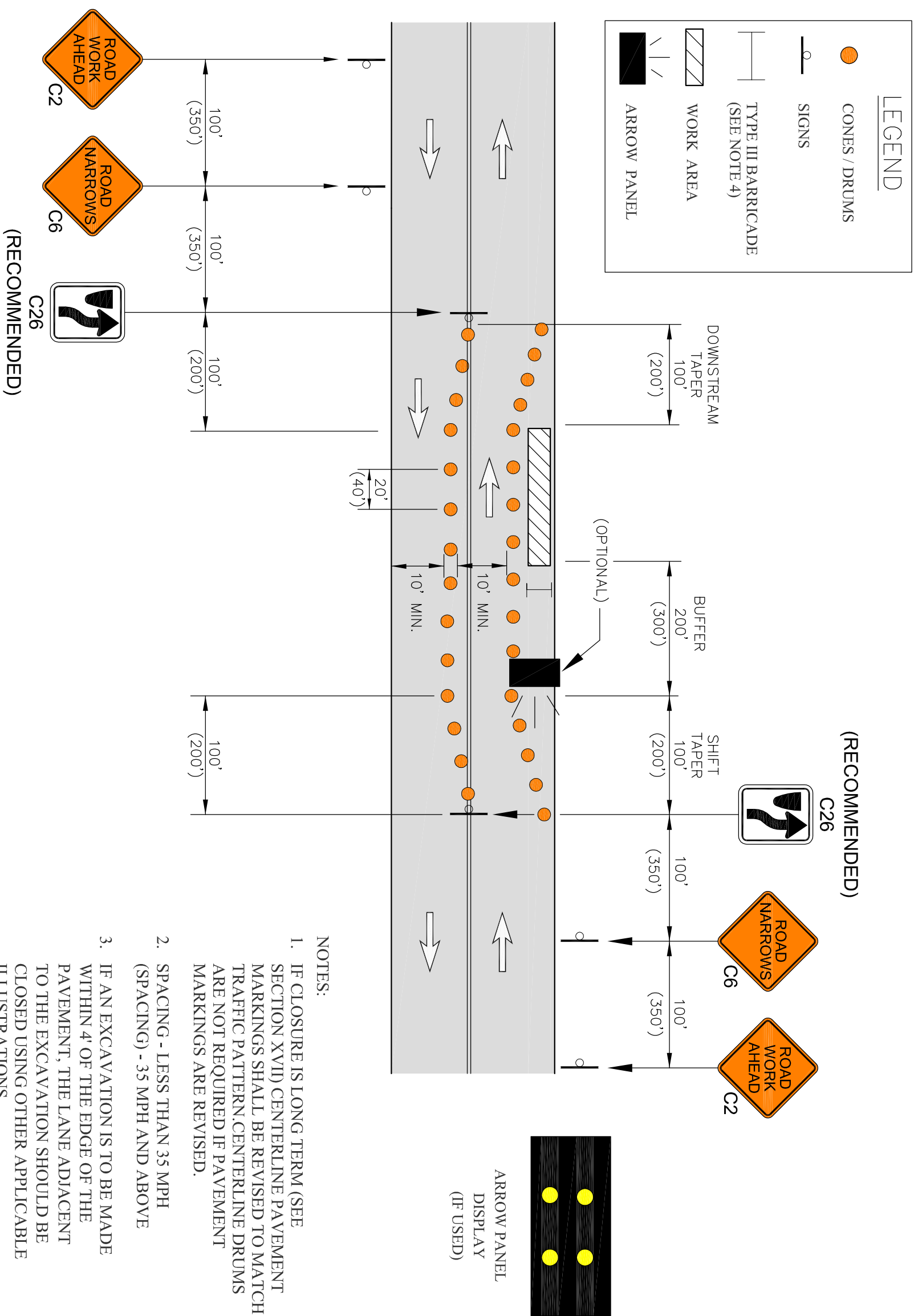


DIAGRAM 6
WORK AREA IN CENTER OF STREET
(MAINAINING 2-WAY TRAFFIC)

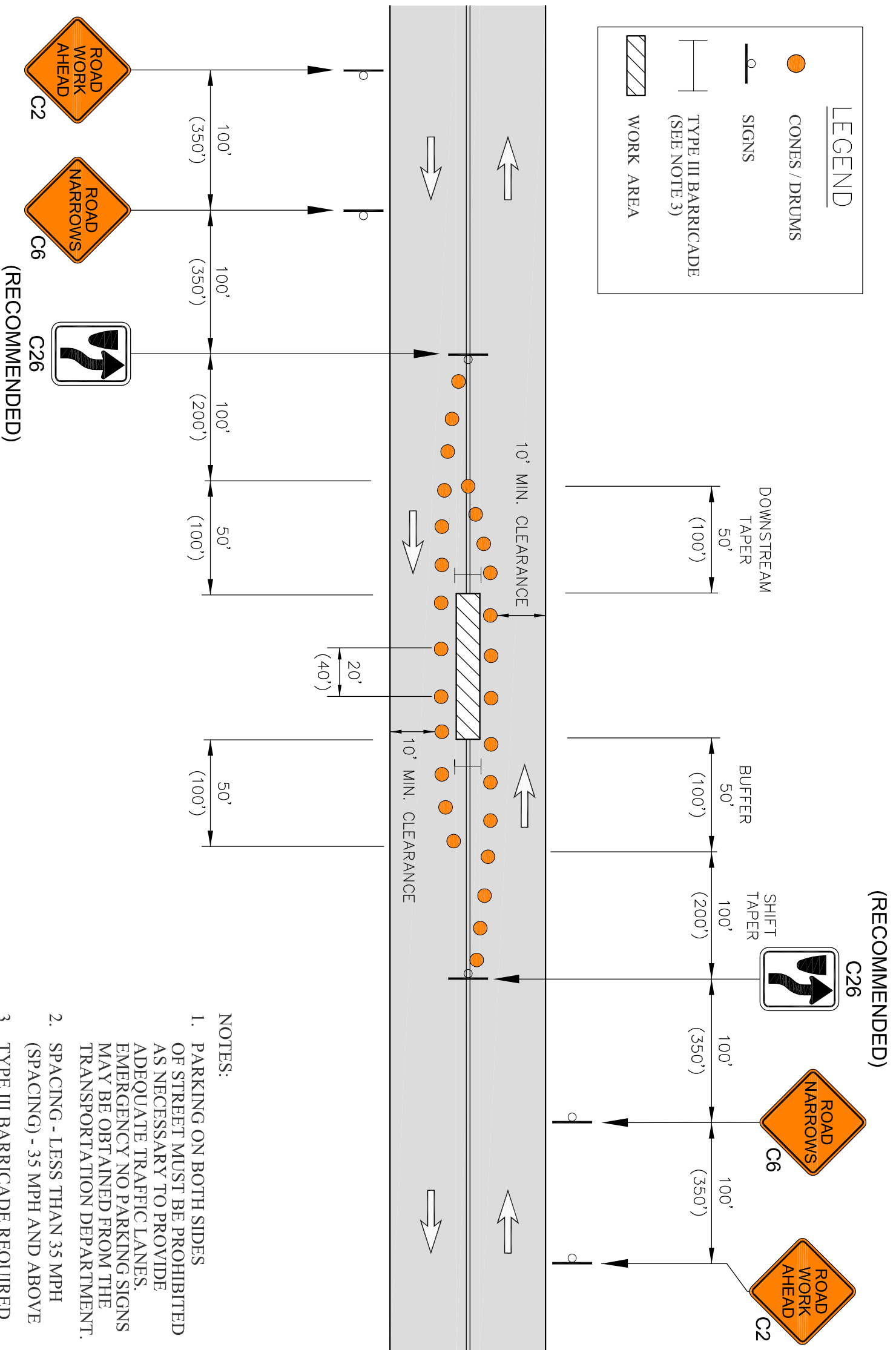
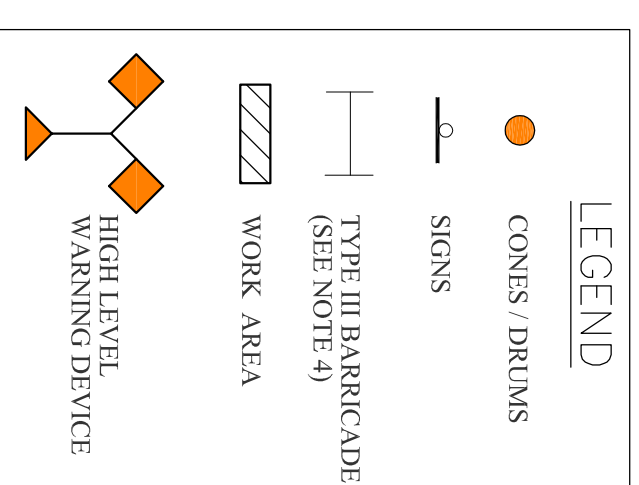
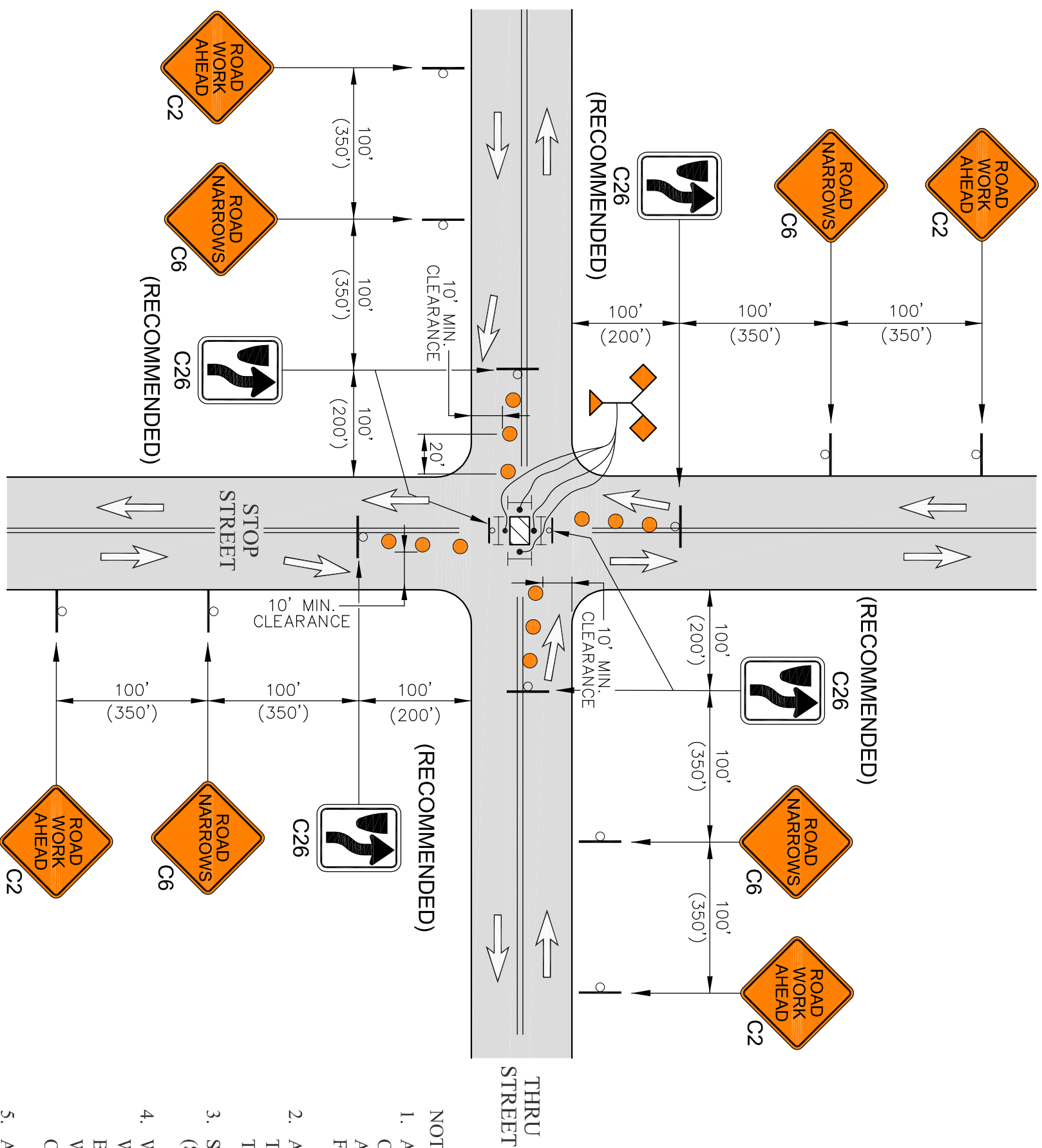


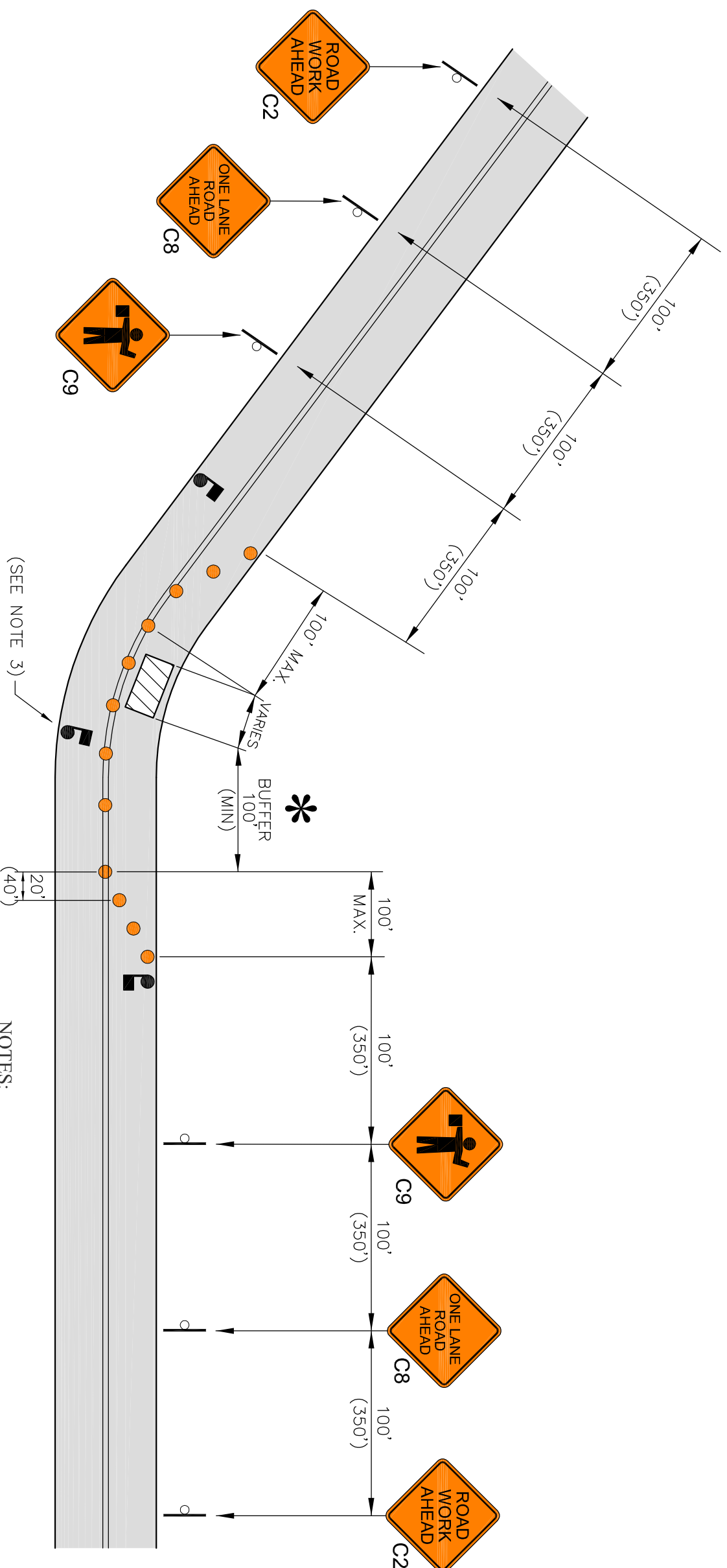
DIAGRAM 7 WORK AREA IN INTERSECTION







NOTES:

1. ADDITIONAL SIGNING, AND/OR TRAFFIC CONTROLS SUCH AS TURN PROHIBITIONS AND FLAGGERS MAY BE NECESSARY.
2. AT SIGNALIZED INTERSECTIONS TREAT ALL APPROACHES AS THRU STREETS.
3. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
4. WORK AREA MAY BE ENCLOSED WITH CONES/DRUMS. TYPE III BARRICADES ARE REQUIRED IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.
5. A HIGH LEVEL WARNING DEVICE SHOULD BE PLACED IN THE WORK SPACE IF THERE IS SUFFICIENT ROOM.

DIAGRAM 8
TWO-WAY, ONE LANE TRAFFIC
 (FLAGGER CONTROL)

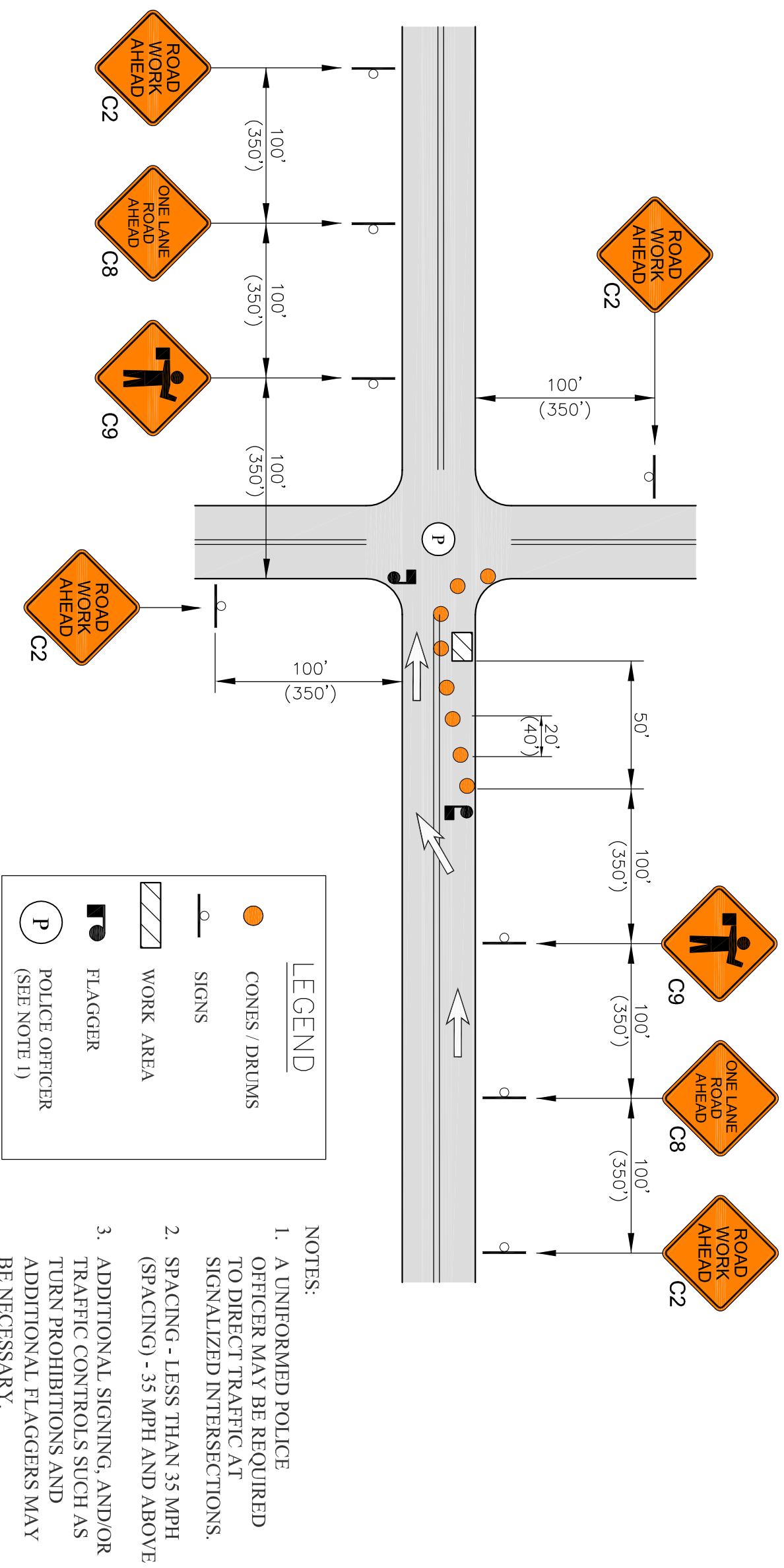


LEGEND

	CONES / DRUMS
	SIGNS
	WORK AREA
	FLAGGER

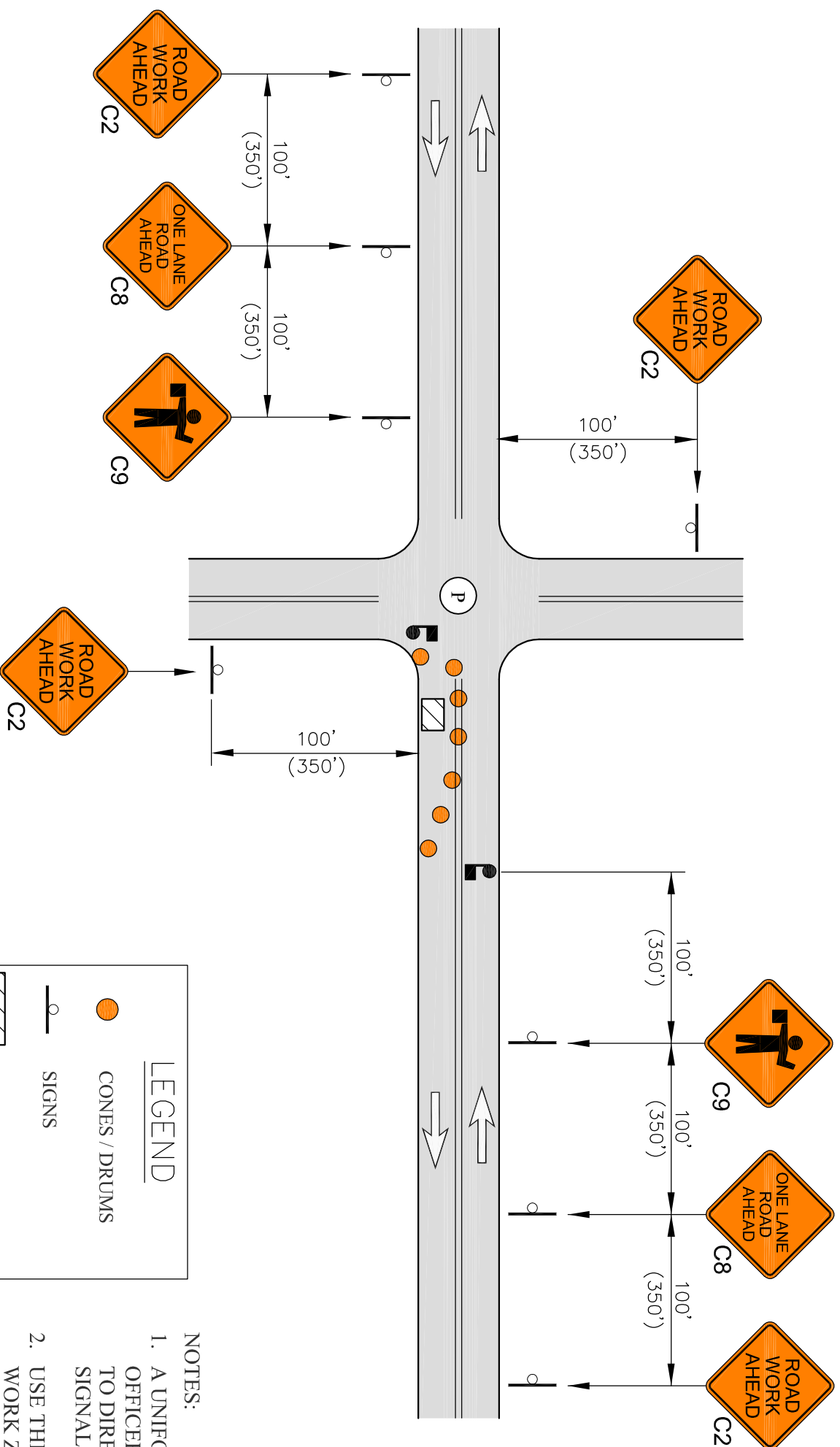
- NOTES:**
- 1.  BUFFER SHALL EXTEND BACK TO THE BEGINNING OF THE CURVE OR HILL TO PROVIDE ADEQUATE SIGHT DISTANCE FOR APPROACHING TRAFFIC.
 - 2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
 - 3. ON LOW VOLUME, RESIDENTIAL STREETS WHERE THERE IS ADEQUATE VISIBILITY, A SINGLE FLAGGER POSITIONED AS SHOWN MAY BE ACCEPTABLE.
 - 4. IF WORK ZONE IS WITHIN 50' OF AN INTERSECTION SEE DIAGRAM 9 AND DIAGRAM 10.

DIAGRAM 9
WORK AREA BEFORE AN INTERSECTION
 (FLAGGER CONTROL)



- LEGEND**
- CONES / DRUMS
 - SIGNS
 - WORK AREA
 - FLAGGER
 - POLICE OFFICER (SEE NOTE 1)
- NOTES:**
1. A UNIFORMED POLICE OFFICER MAY BE REQUIRED TO DIRECT TRAFFIC AT SIGNALIZED INTERSECTIONS.
 2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
 3. ADDITIONAL SIGNING, AND/OR TRAFFIC CONTROLS SUCH AS TURN PROHIBITIONS AND ADDITIONAL FLAGGERS MAY BE NECESSARY.
 4. USE THIS APPLICATION WHEN WORK ZONE IS WITHIN 50' OF INTERSECTION

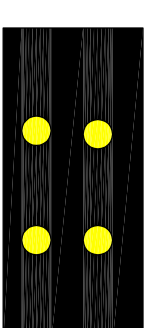
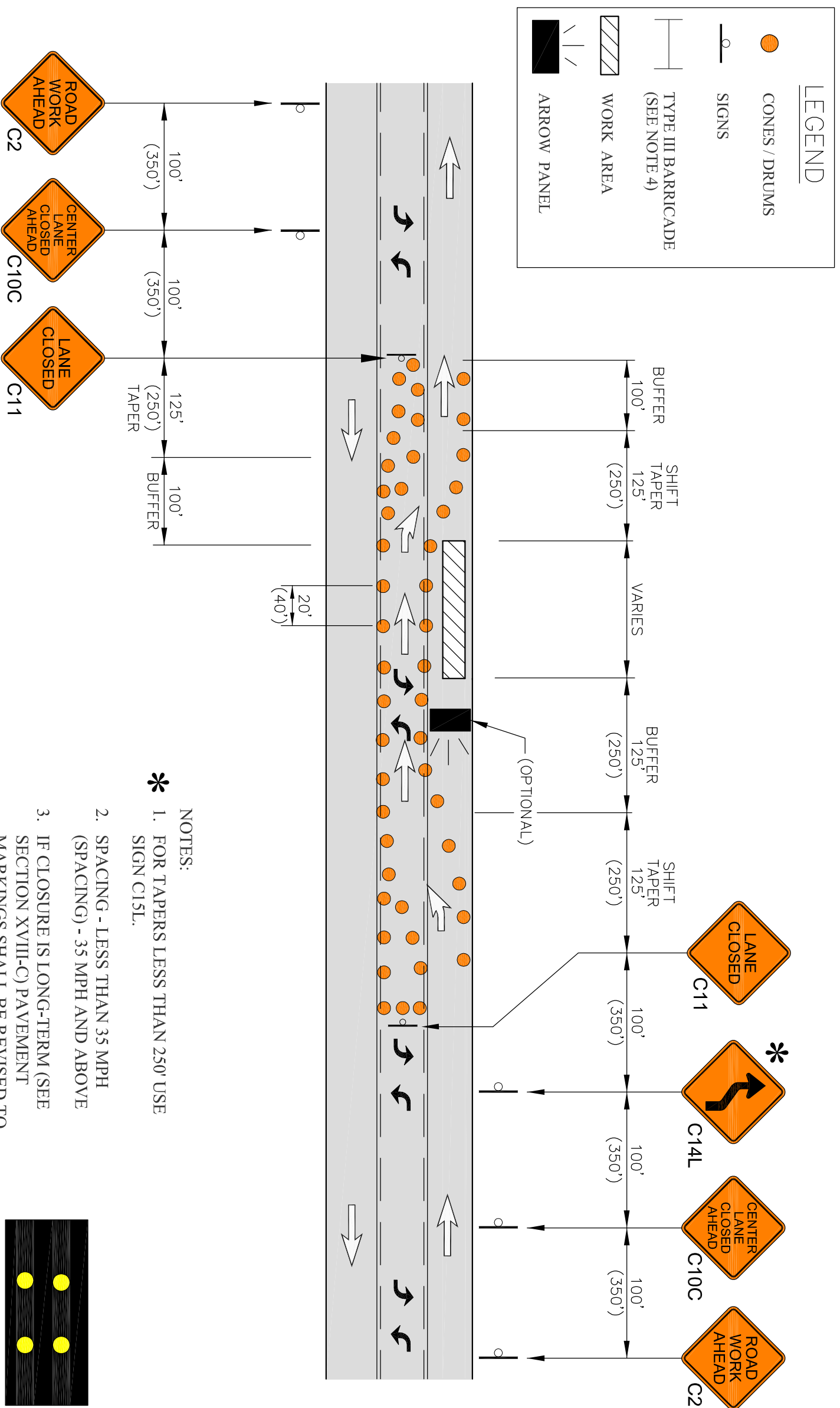
DIAGRAM 10
WORK AREA BEYOND AN INTERSECTION
 (FLAGGER CONTROL)



LEGEND	
	CONES / DRUMS
	SIGNS
	WORK AREA
	FLAGGER
	POLICE OFFICER (SEE NOTE 1)

- NOTES:
1. A UNIFORMED POLICE OFFICER MAY BE REQUIRED TO DIRECT TRAFFIC AT SIGNALIZED INTERSECTIONS.
 2. USE THIS APPLICATION WHEN WORK ZONE IS WITHIN 50' OF INTERSECTION
 3. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
 4. ADDITIONAL SIGNING, AND/OR TRAFFIC CONTROLS SUCH AS TURN PROHIBITIONS AND ADDITIONAL FLAGGERS MAY BE NECESSARY.

DIAGRAM 11 WORK AREA IN THRU LANE (STREET WITH 3 LANES)



ARROW PANEL
DISPLAY
(IF USED)

DIAGRAM 12
WORK AREA IN RIGHT LANE
(MULTI-LANE ROADWAY)

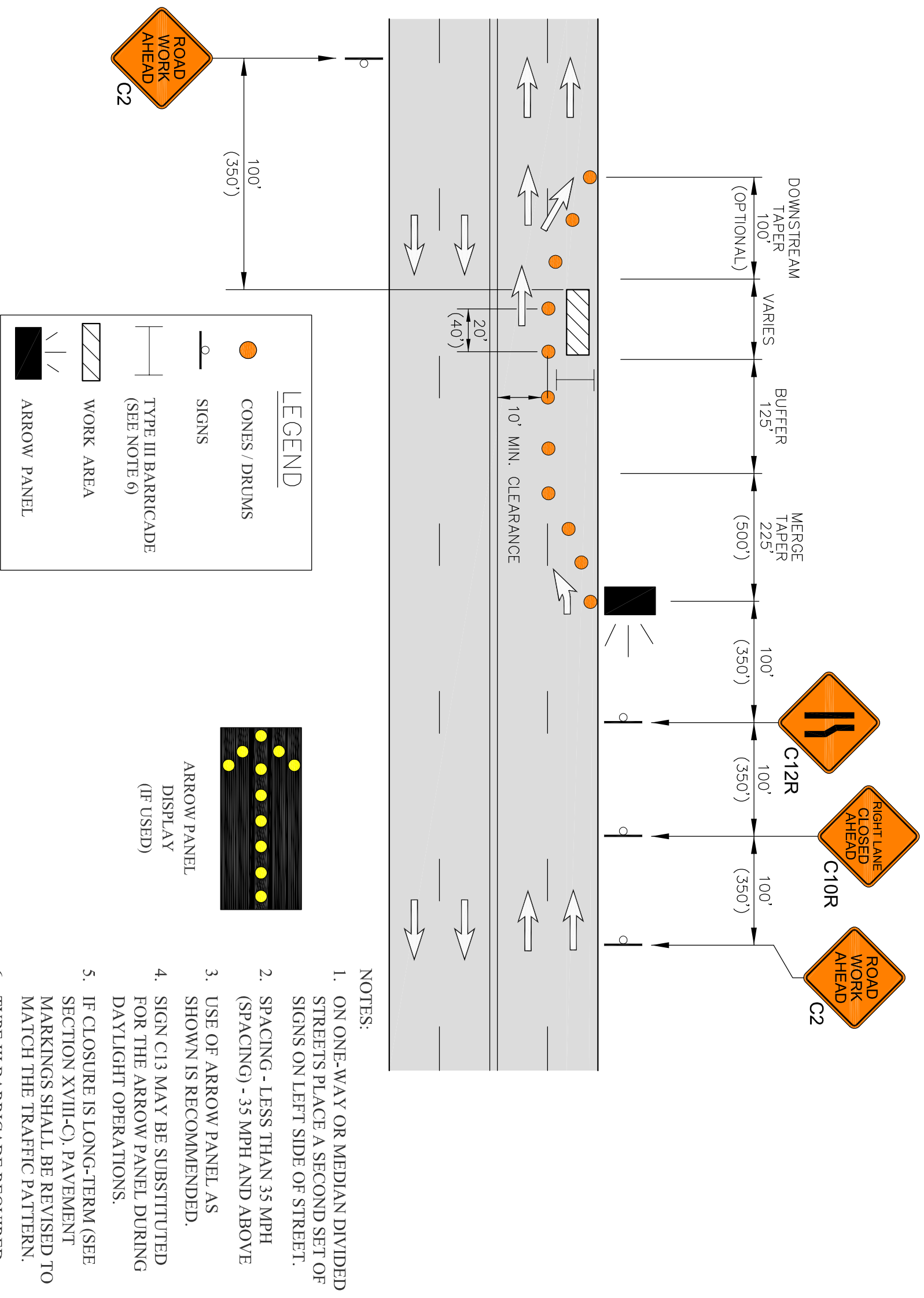
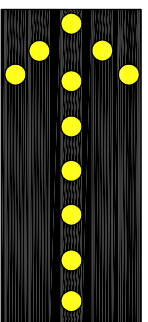
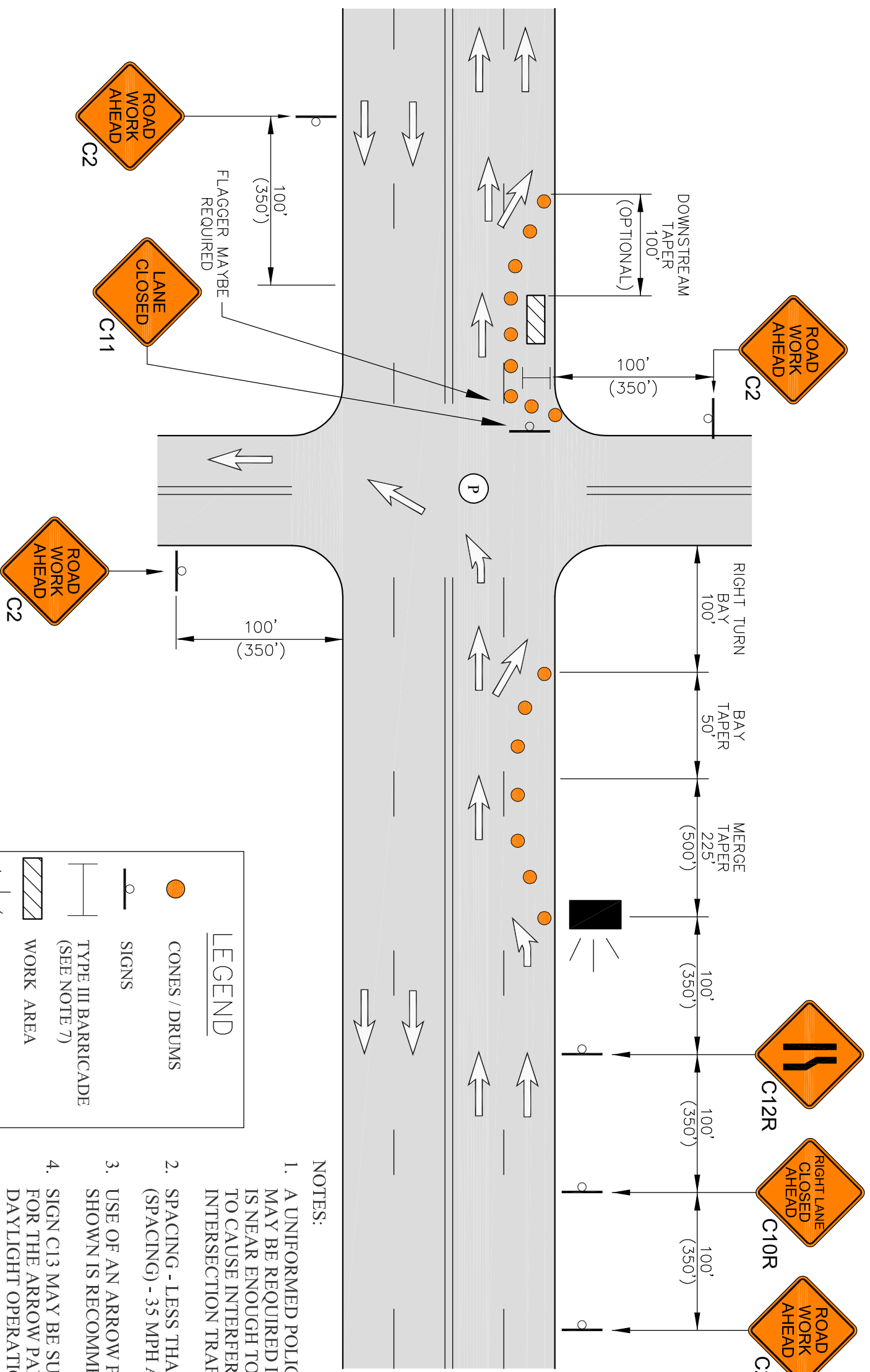


DIAGRAM 13
WORK AREA IN RIGHT LANE
(BEYOND INTERSECTION)

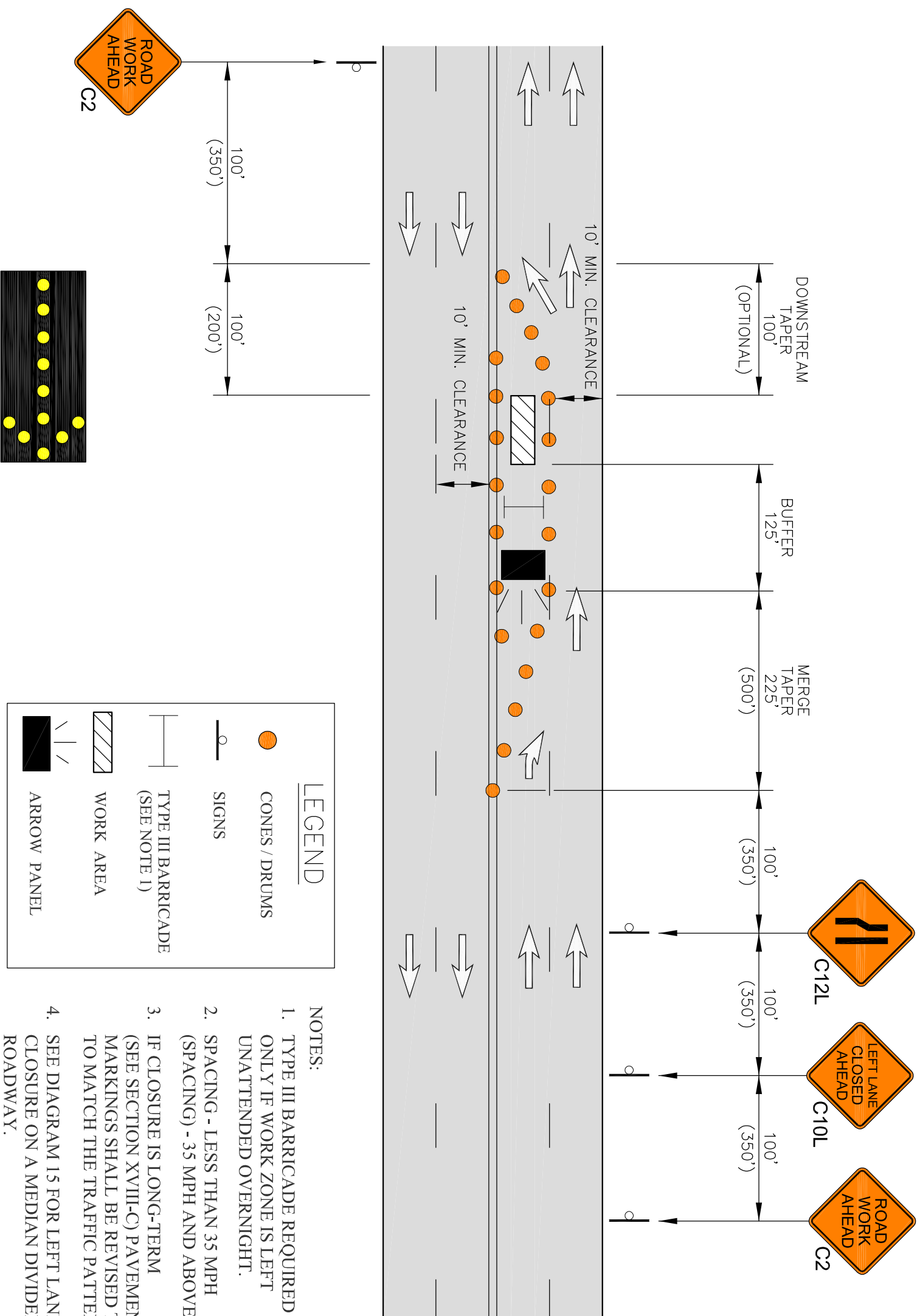


ARROW PANEL
 DISPLAY
 (IF USED)

LEGEND	
	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE (SEE NOTE 7)
	WORK AREA
	ARROW PANEL
	POLICE OFFICER (SEE NOTE 1)

- NOTES:**
1. A UNIFORMED POLICE OFFICER MAY BE REQUIRED IF WORK AREA IS NEAR ENOUGH TO INTERSECTION TO CAUSE INTERFERENCE WITH INTERSECTION TRAFFIC.
 2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
 3. USE OF AN ARROW PANEL AS SHOWN IS RECOMMENDED.
 4. SIGN C13 MAY BE SUBSTITUTED FOR THE ARROW PANEL DURING DAYLIGHT OPERATIONS.
 5. IF CLOSURE IS LONG-TERM (SEE SECTION XVIII-C), PAVEMENT MARKINGS SHALL BE REVISED TO MATCH THE TRAFFIC PATTERN.

DIAGRAM 14
WORK AREA IN LEFT LANE
(MULTI-LANE ROADWAY)



LEGEND

	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE (SEE NOTE 1)
	WORK AREA
	ARROW PANEL

NOTES:

1. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.
2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
3. IF CLOSURE IS LONG-TERM (SEE SECTION XVIII-C) PAVEMENT MARKINGS SHALL BE REVISED TO MATCH THE TRAFFIC PATTERN.
4. SEE DIAGRAM 15 FOR LEFT LANE CLOSURE ON A MEDIAN DIVIDED ROADWAY.

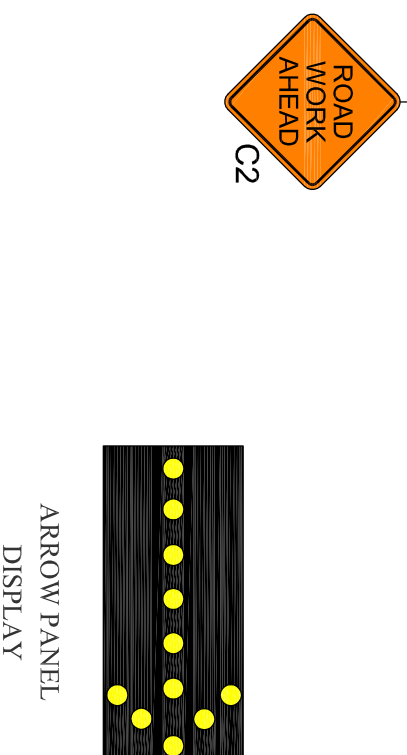
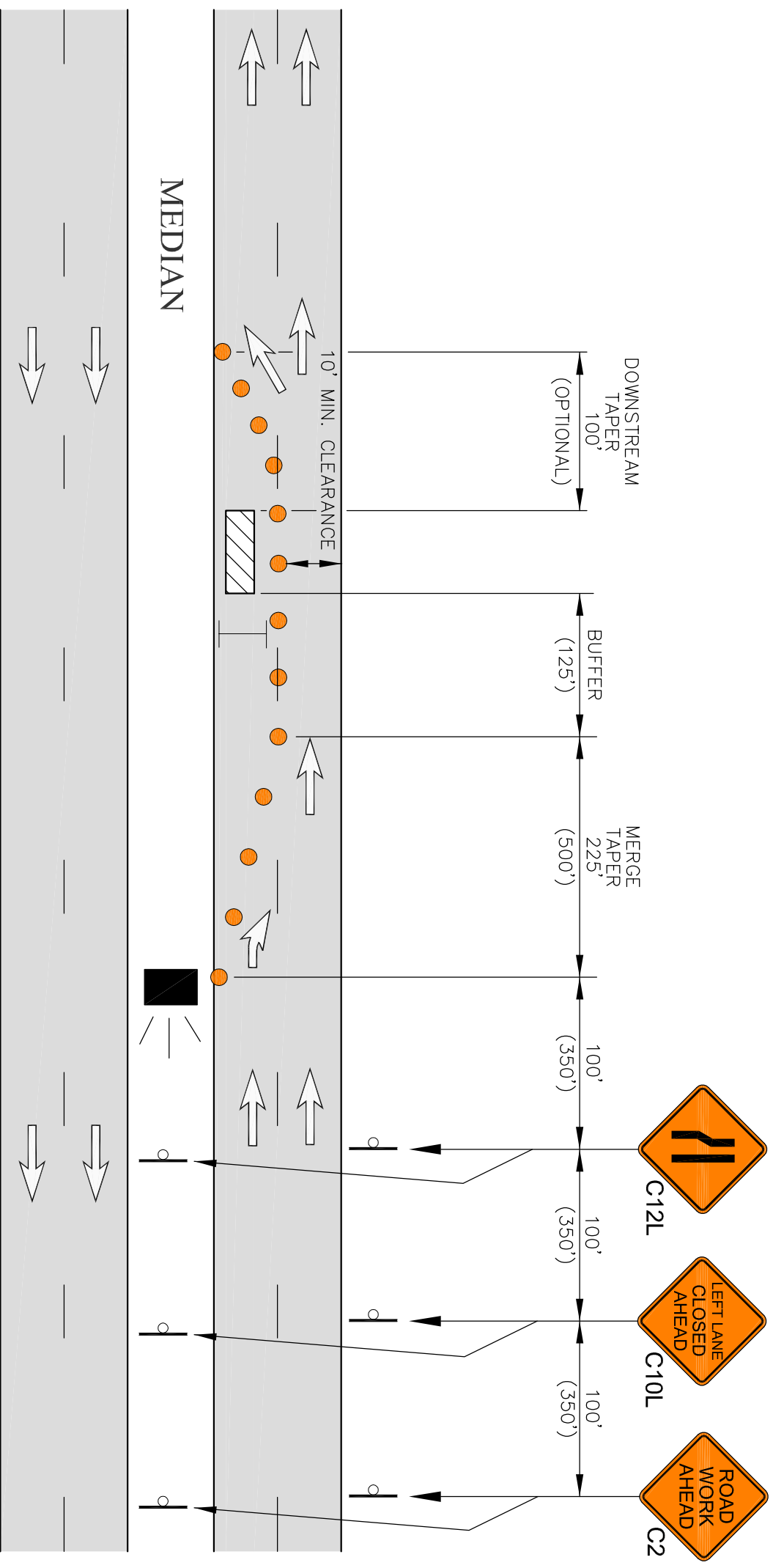
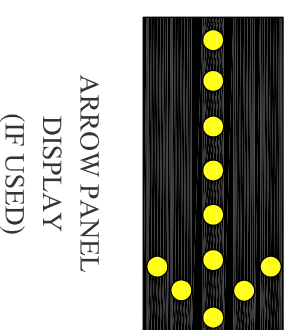


DIAGRAM 15 WORK AREA IN LEFT LANE (STREET WITH MEDIAN)



NOTES:

1. USE ALSO ON ONE-WAY STREETS OF 2 OR MORE LANES.
2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
3. IF MEDIAN IS NOT SUFFICIENT WIDTH FOR PLACEMENT OF ADVANCED CONSTRUCTION WARNING SIGNS, THEN USE DIAGRAM 14.
"WORK AREA IN LEFT LANE (MULTI-LANE ROADWAY)"
4. USE OF AN ARROW PANEL AS SHOWN IS RECOMMENDED.
5. SIGN C13 MAY BE SUBSTITUTED FOR THE ARROW PANEL DURING DAYLIGHT OPERATIONS.
6. IF CLOSURE IS LONG-TERM (SEE SECTION XVIII-C), PAVEMENT MARKINGS SHALL BE REVISED TO MATCH THE TRAFFIC PATTERN.
7. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.



ARROW PANEL
DISPLAY
(IF USED)






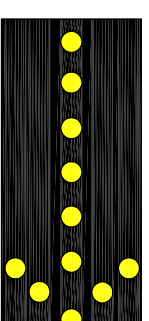
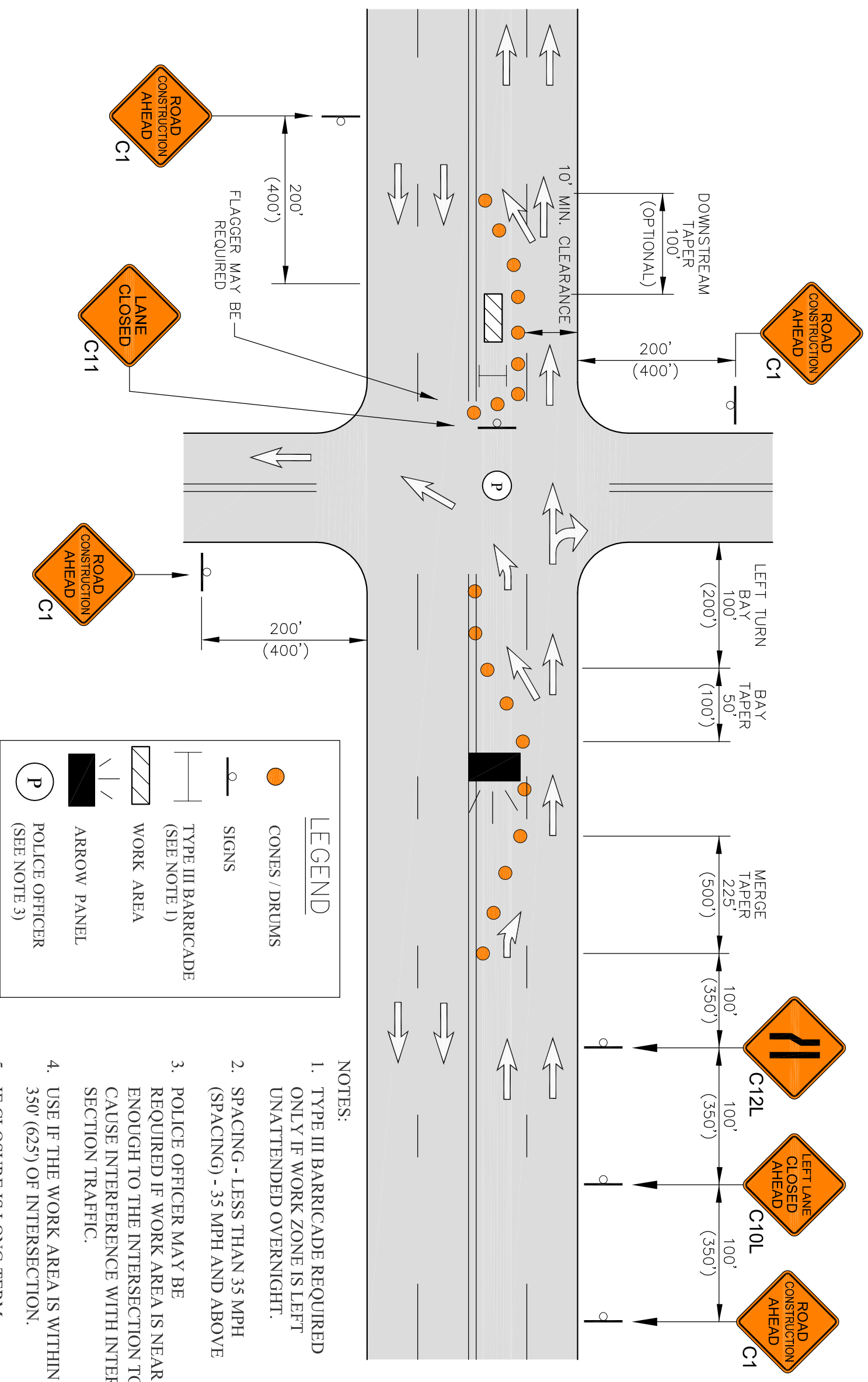
LEGEND	
	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE (SEE NOTE 7)
	WORK AREA
	ARROW PANEL

DIAGRAM 16 WORK AREA IN LEFT LANE (BEYOND INTERSECTION)



ARROW PANEL
DISPLAY

DIAGRAM 17
WORK AREA IN CENTER OF STREET
(MULTI-LANE ROADWAY)

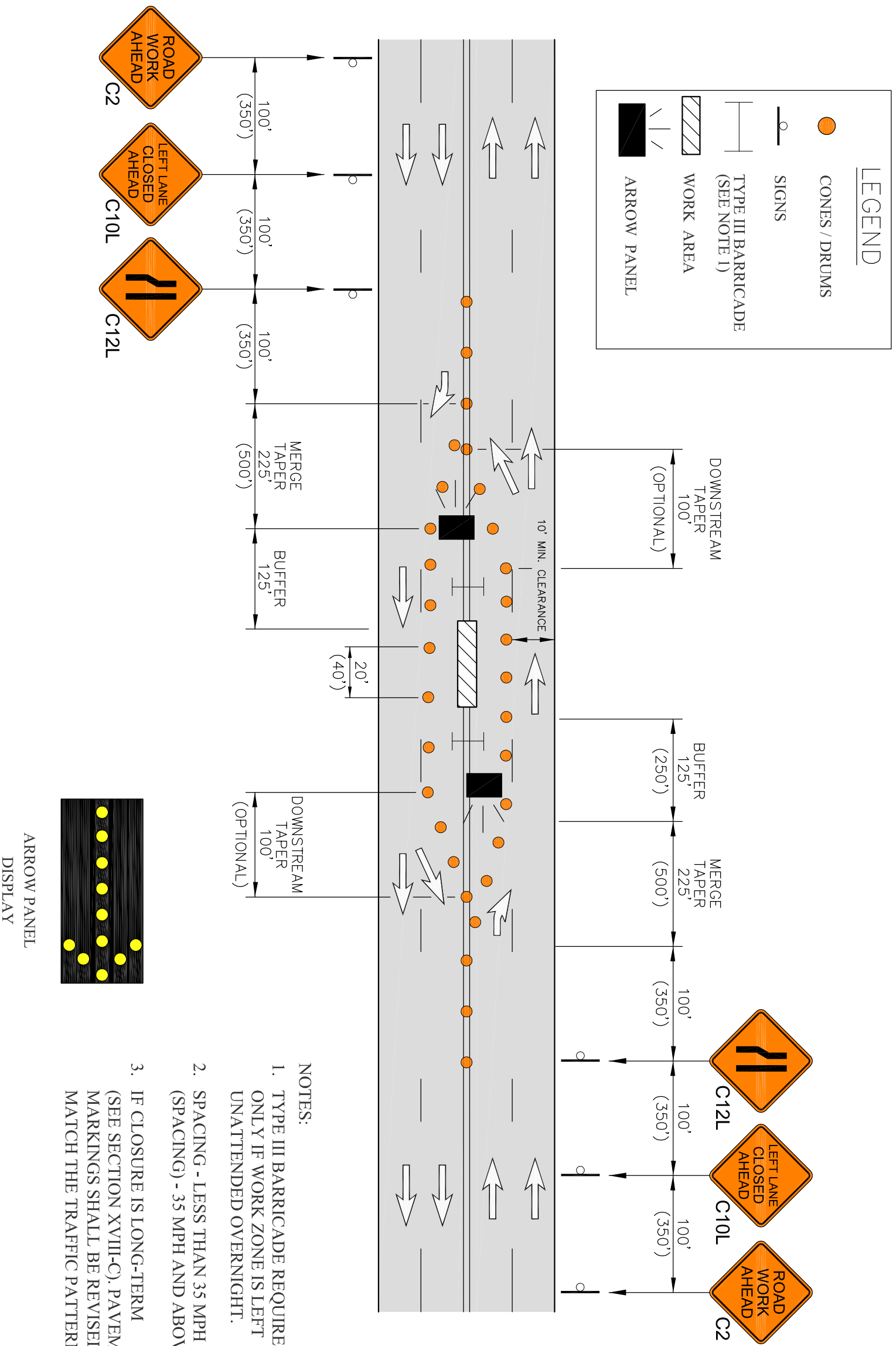


DIAGRAM 18 WORK AREA IN HALF OF STREET (FOUR LANES, TWO-WAY TRAFFIC)

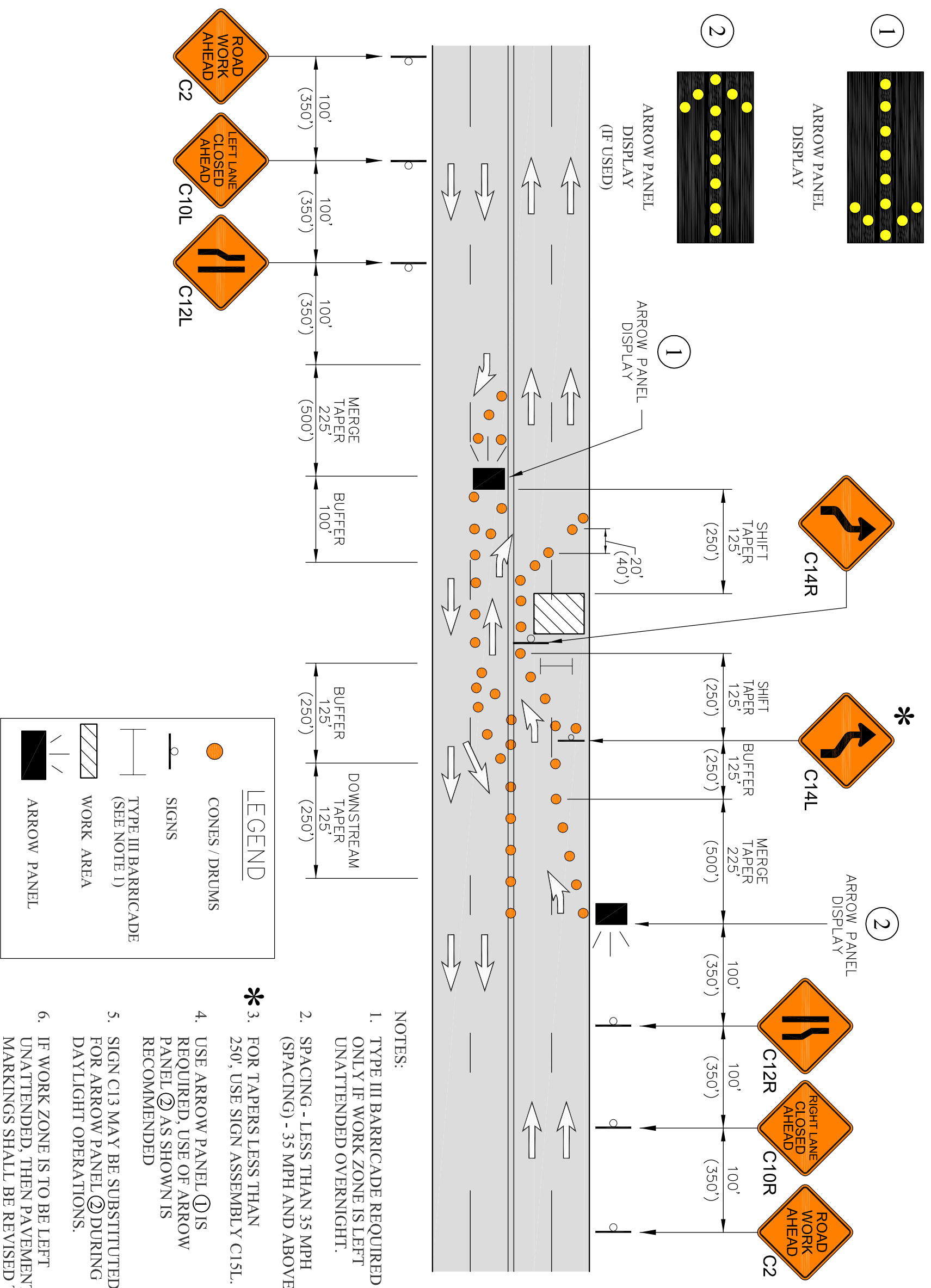
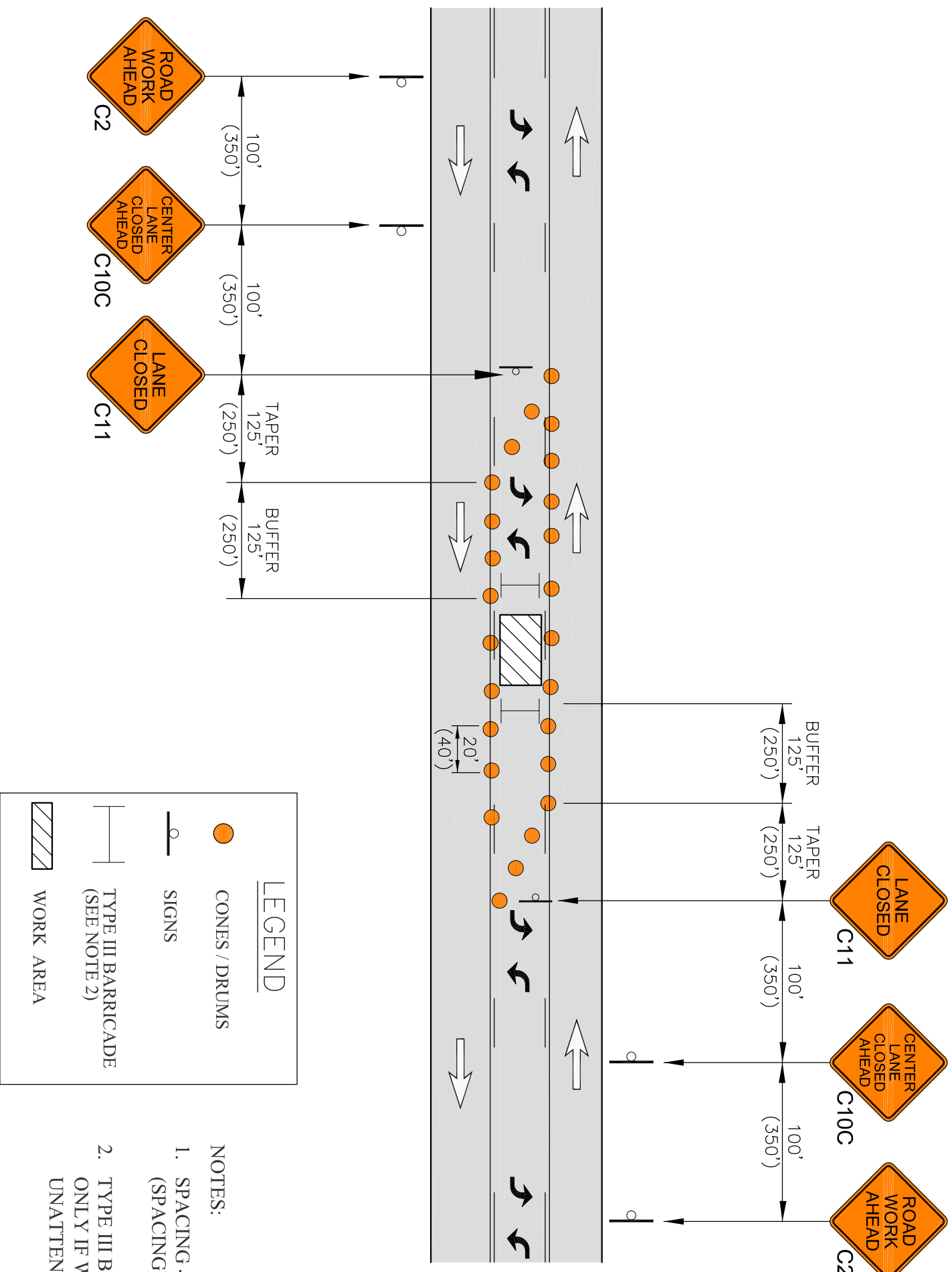


DIAGRAM 19
WORK AREA IN A TWO-WAY
LEFT TURN LANE
 (ALL THRU LANES OPEN)



- LEGEND
- CONES / DRUMS
 - SIGNS
 - |— TYPE III BARRICADE (SEE NOTE 2)
 - ▨ WORK AREA
- NOTES:
1. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
 2. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.

DIAGRAM 20 WORK AREA BOTH THRU LANES (STREET WITH 5 LANES)

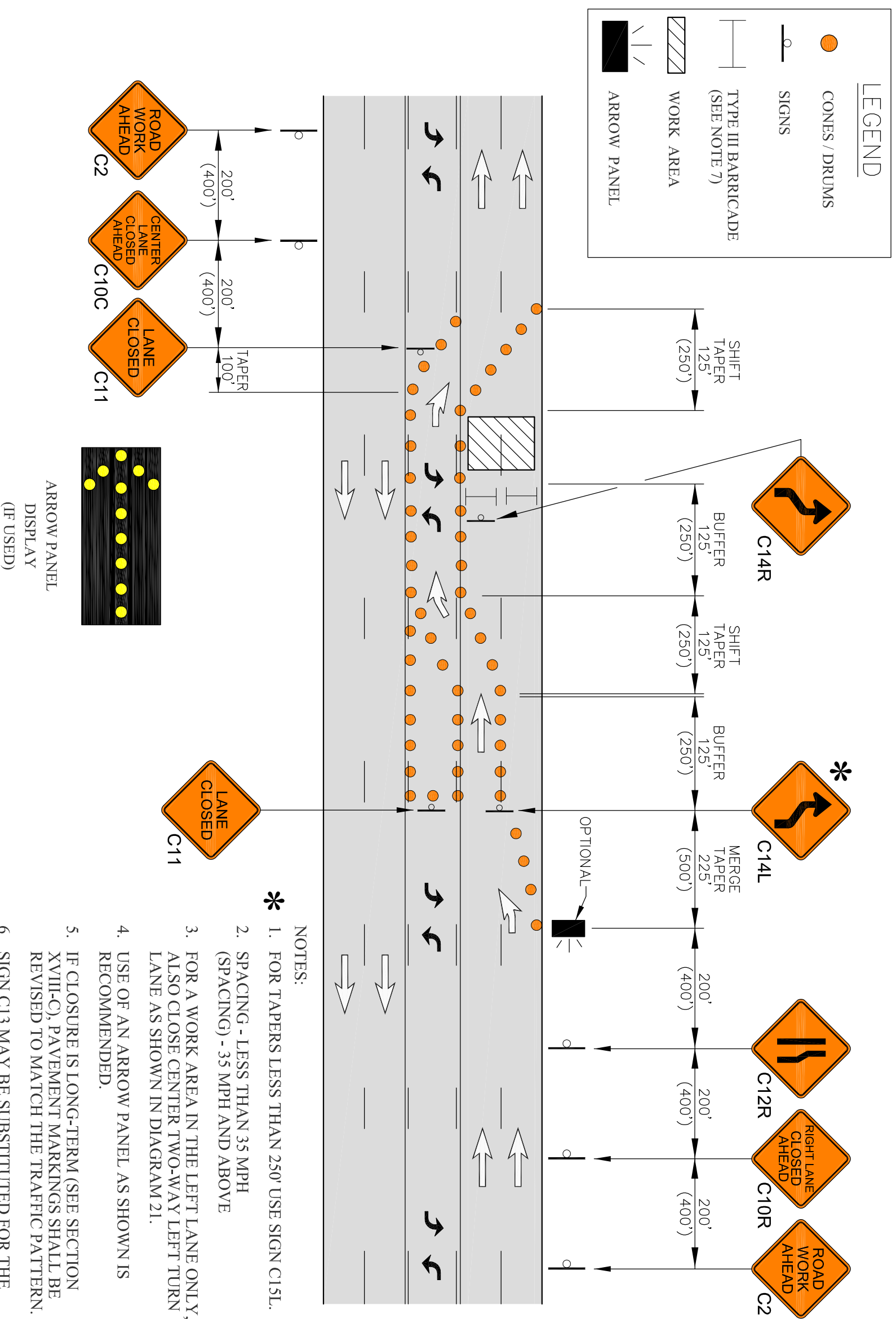
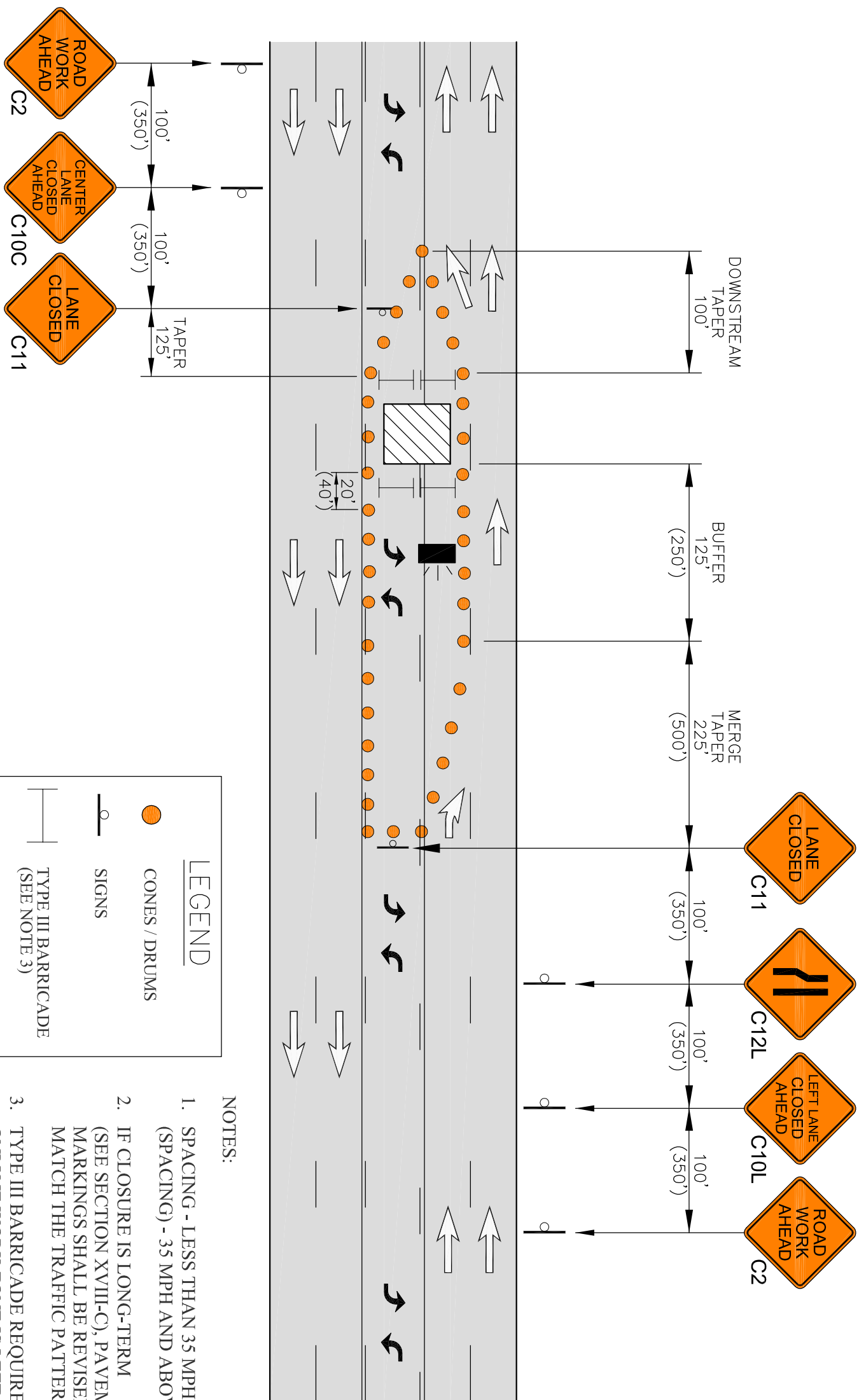
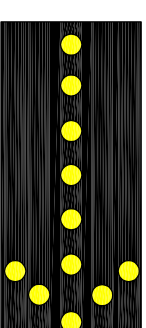


DIAGRAM 21
WORK AREA IN LEFT THRU AND
CENTER TWO-WAY LEFT TURN LANE
(STREET WITH 5 LANES)



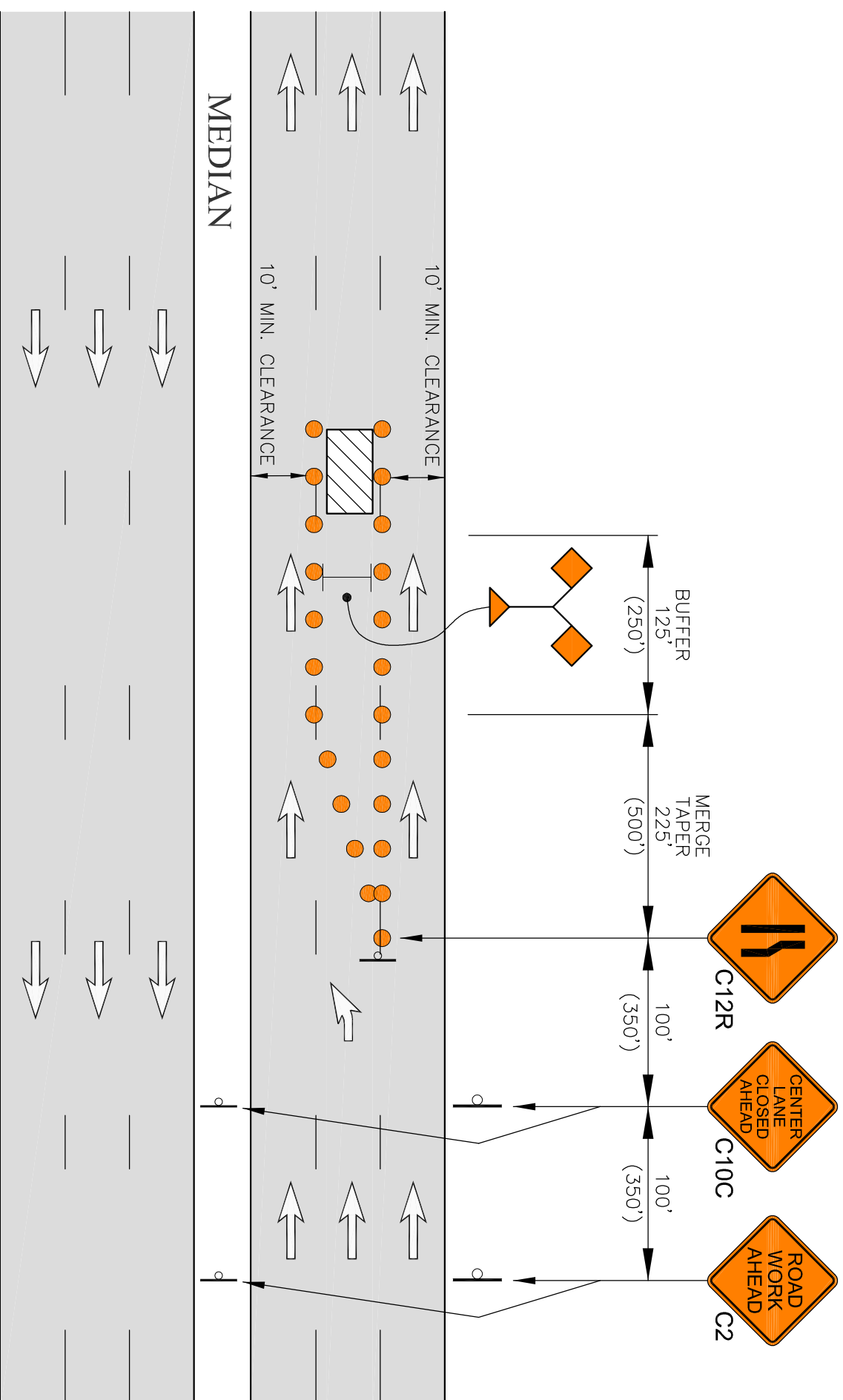
LEGEND	
	CONES / DRUMS
	SIGNS
	TYPE III BARRICADE (SEE NOTE 3)
	WORK AREA
	ARROW PANEL

- NOTES:
1. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
 2. IF CLOSURE IS LONG-TERM (SEE SECTION XVIII-C), PAVEMENT MARKINGS SHALL BE REVISED TO MATCH THE TRAFFIC PATTERN.
 3. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.

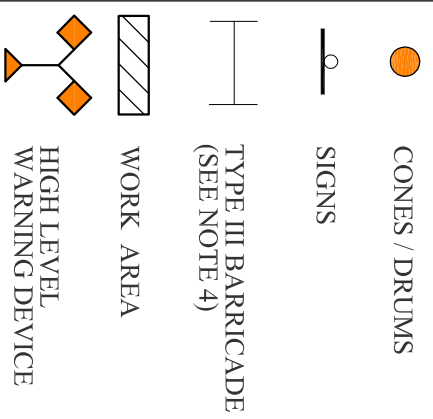


ARROW PANEL
 DISPLAY

DIAGRAM 22
WORK AREA IN CENTER LANE
 (3 OR MORE LANES IN ONE DIRECTION)



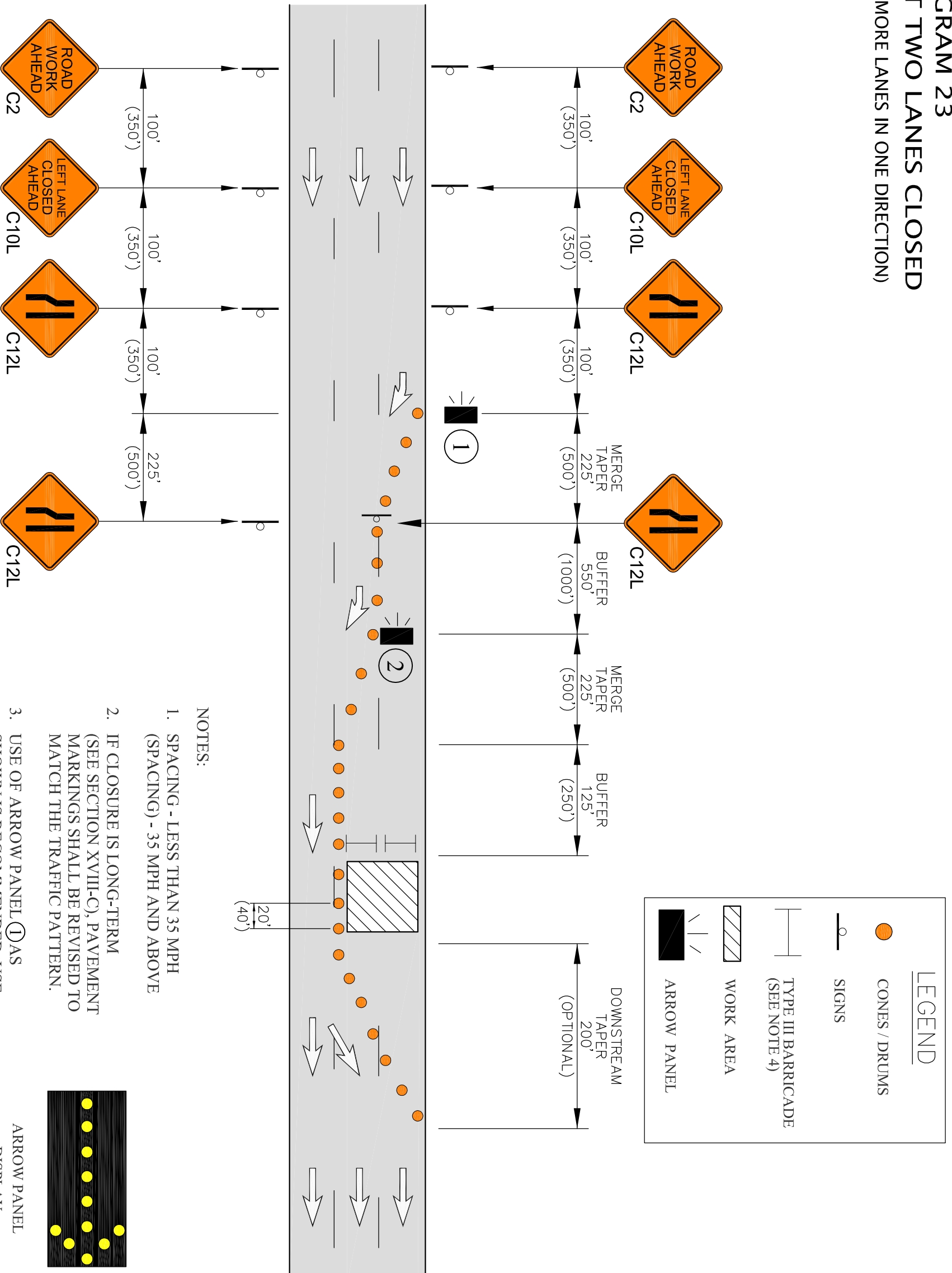
LEGEND



NOTES:

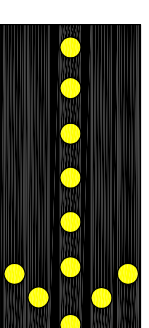
1. USE ALSO ON ONE-WAY STREETS OF 3 OR MORE LANES.
2. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
3. IF CLOSURE IS LONG-TERM (SEE SECTION XVIII-C), PAVEMENT MARKINGS SHALL BE REVISED TO MATCH THE TRAFFIC PATTERN.
4. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.
5. THE MERGING TAPER SHALL DIRECT MOTOR VEHICLE TRAFFIC INTO EITHER THE RIGHT OR LEFT LANE, BUT NOT BOTH.

DIAGRAM 23
LEFT TWO LANES CLOSED
 (3 OR MORE LANES IN ONE DIRECTION)



NOTES:

1. SPACING - LESS THAN 35 MPH (SPACING) - 35 MPH AND ABOVE
2. IF CLOSURE IS LONG-TERM (SEE SECTION XVIII-C), PAVEMENT MARKINGS SHALL BE REVISED TO MATCH THE TRAFFIC PATTERN.
3. USE OF ARROW PANEL ① AS SHOWN IS RECOMMENDED, USE OF ARROW PANEL ② IS REQUIRED.
4. TYPE III BARRICADE REQUIRED ONLY IF WORK ZONE IS LEFT UNATTENDED OVERNIGHT.



ARROW PANEL
DISPLAY

DIAGRAM 24
RIGHT TWO LANES CLOSED
 (3 OR MORE LANES IN ONE DIRECTION)

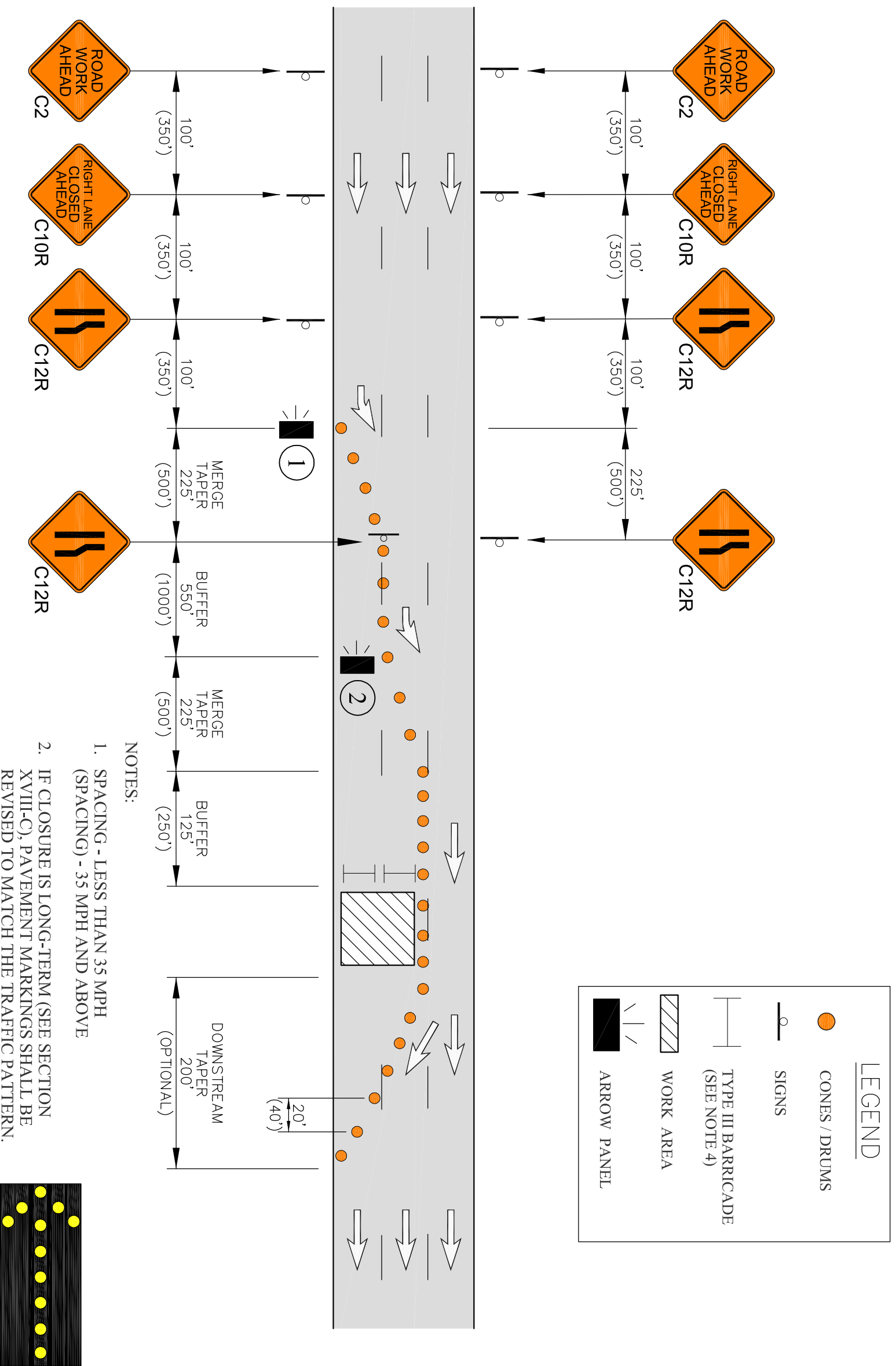


DIAGRAM 25 DETOUR PLAN FOR CLOSED ROAD (USE FOR MINOR STREETS ONLY)

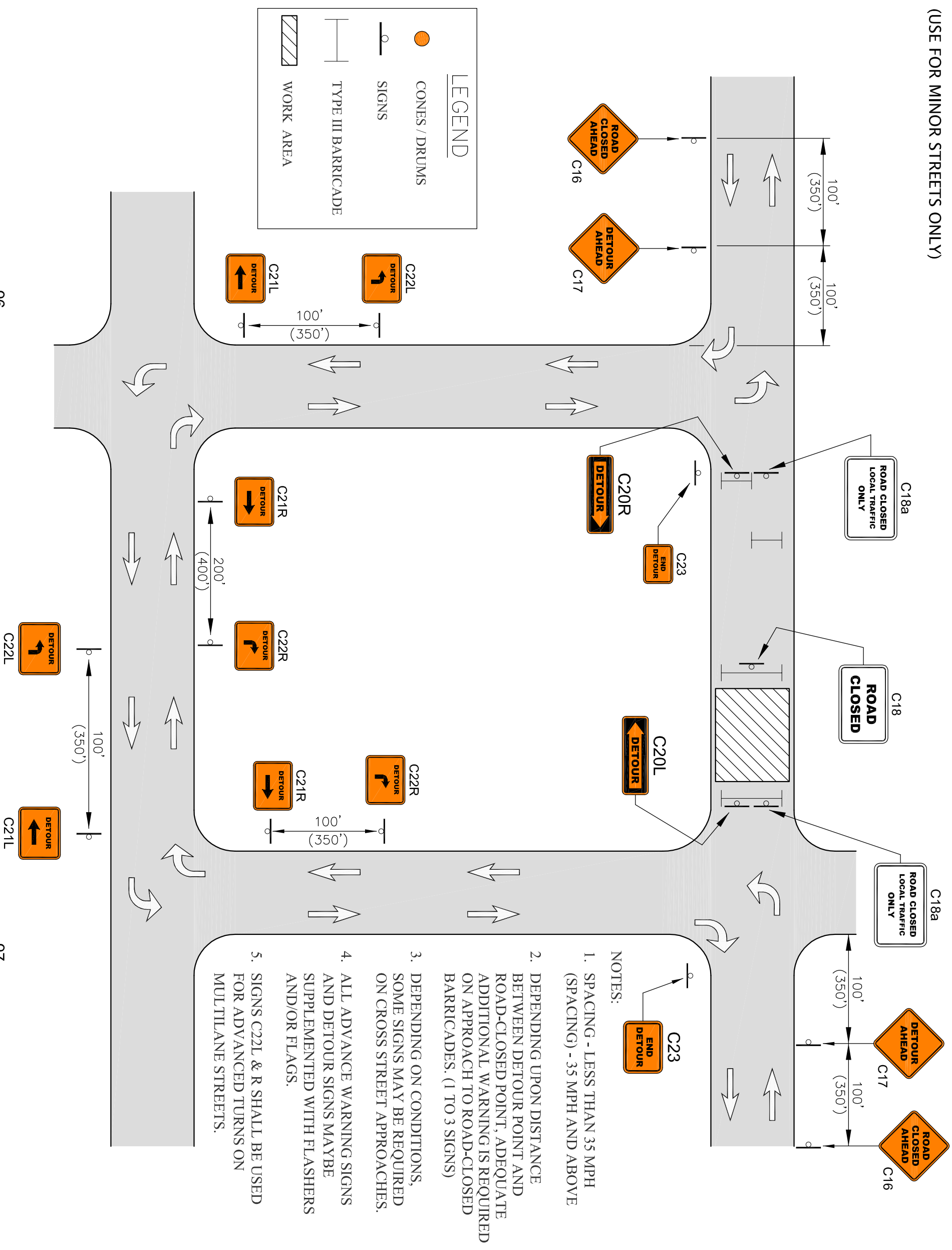
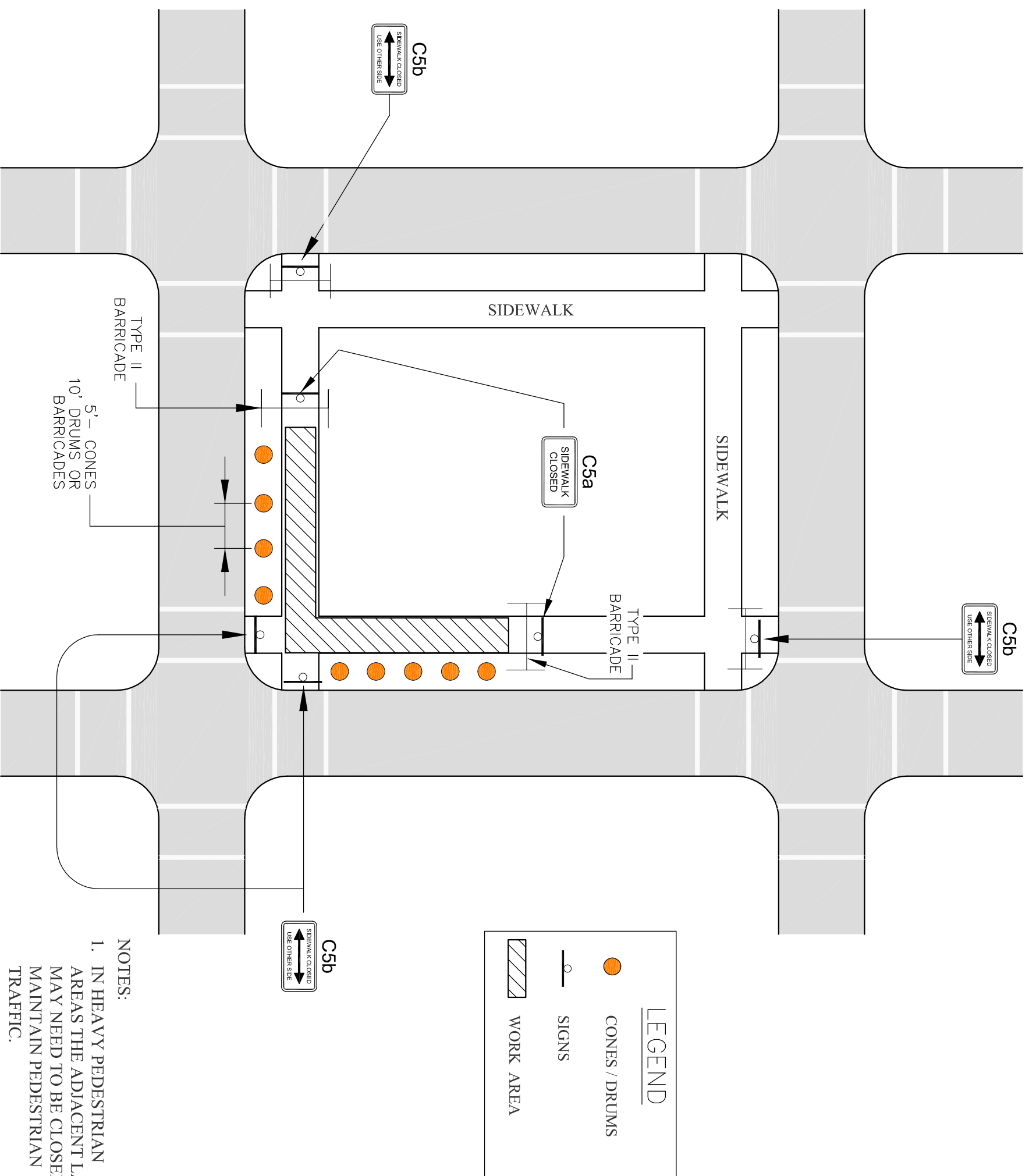


DIAGRAM 26 SIDEWALK CLOSURE



NOTES:
 1. IN HEAVY PEDESTRIAN AREAS THE ADJACENT LANE MAY NEED TO BE CLOSED TO MAINTAIN PEDESTRIAN TRAFFIC.

MINIMUM TAPER LENGTHS

The following chart may be used to determine minimum taper lengths for typical work zones.

Speed Limit	Width of Closed Portion of Street						
	8 ft.	9 ft.	10 ft.	11 ft.	12 ft.	13 ft.	14 ft.
25	85	95	105	115	125	135	145
30	120	135	150	165	180	195	210
35	165	185	205	225	245	265	285
40	215	240	270	295	320	345	375
45	360	405	450	500	550	585	630
50	400	450	500	550	600	650	700
55	440	495	550	605	660	715	770

The **maximum space** between channelizing devices **should not exceed** the legal or posted speed limit in miles per hour. For example, if the speed limit is 40 mph, the maximum permitted spacing between these devices is 40 feet. However, some conditions may require reduced spacing for the safety of the public and the workers.

BUFFER LENGTHS

The buffer area serves to separate traffic flow from the work area or a potentially hazardous area and provides a recovery space for an errant vehicle. **Neither work activity nor storage of equipment, vehicle or material should be in the buffer space.**

Speed-mph	Length-ft	Speed-mph	Length-ft
20	35	45	220
25	55	50	280
30	85	55	335
35	120	60	415
40	170	65	485