

III-19.01 General

One of the critical parts of the design of highway construction projects is ensuring that effective provisions for proper control of traffic within the construction work zone is provided for on the project. Highway construction generally results in heavy equipment working in close proximity to highway traffic, many times with restricted roadway widths, alignment shifts, and/or temporary driving surfaces. These conditions not only have a direct impact upon public safety, but also present a significant hazard to contractor equipment and personnel working on the project. It is vital that every construction project have an appropriate traffic control plan that will properly guide traffic through the work zone, at appropriate travel speeds, in both daytime and nighttime periods, for the duration of the construction activity. In addition, if there are pedestrians in the project area, the plans must provide for their safe passage through the project. Access to adjacent properties is also an important consideration that must be provided for in the traffic control plan. The work zone traffic control for a project should be planned early in the design phase. Final work zone traffic control plans should be reviewed by the Design Division – Traffic Safety Section.

This section reviews applicable policies and procedures governing work zone traffic control and the resources available for use in the design process.

III-19.02 Design of Work Zone Traffic Control

Design of work zone traffic control should comply with the requirements of the “Manual on Uniform Traffic Control Devices” (MUTCD), Part VI, published by FHWA, and comply with NDDOT Standard Drawings.

III-19.03 Work Zone Traffic Control Plan

A work zone traffic control plan should be prepared for all projects, as no single set of signs or other traffic control devices can satisfy all conditions on a project. The traffic control plan should be in sufficient detail, appropriate to the complexity of the project, to clearly identify and convey the concepts of project traffic control and the types of traffic control devices necessary to achieve the desired control. The selection of traffic control devices should be based on the highway type, traffic conditions, duration of operations, physical constraints, and the proximity of the work area to the highway traffic.

The traffic control plan may range in scope from simply identifying Standard Drawings and layouts, to preparing extensive detailed project specific plan drawings and notes. The Standard Drawings show typical applications and layouts for traffic control devices for various common work situations, but do not include all conceivable work situations, especially those with complicated signing or other traffic control needs.

Typical applications shown by the Standard Drawings should be altered, when necessary, to fit

the conditions of the proposed work situation. Detail drawings and plan notes may be required to clarify device locations and quantities. The designer should review the Standard Drawings and Standard Notes to determine what drawings, layouts, and notes may apply to the proposed project. If special conditions exist that cannot be conveyed by the Standard Drawings and Standard Notes, or the Standard Drawings require modification, additional plan drawings or details and notes should be developed to indicate the necessary traffic control requirements. Project notes should identify the necessary Standard Drawings, application, and other special conditions. On complex projects, the work zone traffic control details and quantities should be developed for all construction phases anticipated on the project.

The traffic control plan should include a “Traffic Control Devices List”, indicating the quantities for each type of traffic control device required. The “Traffic Control Devices List” should be included in the plans for every project. The quantities should be developed from the Standard Drawings and other work zone details that may be included. The signing indicated should be applied in both directions for two-lane and four-lane roadways, and be applied to both sides of the roadway for freeway and expressway projects. The plans should address quantities for multiple installations, intersections, limitations, etc. The quantities shown on the “Traffic Control Devices List” are for bidding purposes. The “Traffic Control Devices List” program can be found on the web at www.state.nd.us/dot/designmanual.html, click on “Plan Preparation Guide”, “Plan Sheets”, “Section 700”, “704.2 Traffic Control Devices List”, or on the web at www.dot.state.nd.us/, click on “Manuals”, “Design Manual”, “Plan Prep. Guide”, “Plan Sheets”, “Section 700”, “704.2 Traffic Control Devices List.”

It is preferred that traffic control devices be bid and paid for on the basis of unit prices for each type of device shown on the Traffic Control Devices List in accordance with Sections 704.04A and 704.05A of the Standard Specifications. This method of payment is preferred over lump sum payment for the following reasons:

- It provides for a more complete set of plans and better defines the traffic control work item.
- It provides for a method to account for project variations that develop during construction.
- It provides for contract bid prices that may be used as a basis for negotiation when adding traffic control devices.

When using unit payment, devices required in addition to the quantities provided on the Traffic Control Devices List should be added at the unit prices in the contract. If the added devices do not have a contract unit price, then payment should be negotiated or be paid at the prices listed in the “Rental Rates for Equipment and Traffic Control Devices,” provided by Construction Services.

Traffic control devices may be bid and paid for on a lump sum basis if the traffic control plan provides fixed quantities, is clearly defined, and requires a single set-up without modification.

When using lump sum payment, the following should be added to the traffic control plan note:
AThe devices listed on the Traffic Control Devices List shall not be bid separately, but shall be included in the lump sum price bid for@Traffic Control@. When using lump sum payment, devices required in addition to the quantities provided on the Traffic Control Devices List should be added and paid for in accordance with Section 704.05B of the Standard Specifications.

Devices added to accommodate the Contractor's operation are the Contractor's responsibility.

III-19.04 Traffic Control Devices List

The "Traffic Control Devices List" program can be found on the web at www.state.nd.us/dot/designmanual.html, click on "Plan Preparation Guide", "Plan Sheets", "Section 700", "704.2 Traffic Control Devices List", or on the web at www.dot.state.nd.us/, click on "Manuals", "Design Manual", "Plan Prep. Guide", "Plan Sheets", "Section 700", "704.2 Traffic Control Devices List." The plan sheet table contains all signs and other devices shown in the Standard Drawings. The program file may be copied to the appropriate project file, and the sheet summary edited as necessary to add or delete traffic control devices.

III-19.05 Special Signs

Occasionally, signs will be needed that are not provided in the Standard Drawings. These signs may be special detour signs, distance and destination signs, etc. The designer should contact the Design Division – Traffic Safety Section for the proper sign legend, dimensions, and post configuration. The designer should time the request to provide a minimum two week lead time for the Traffic Section.

III-19.06 Computation of Sign Units

Material Costs Per Project

Signs	\$4.00/ S.F.
Posts	\$10.00 ea.

Install Sign and Post(s):

Sign and 1 post	\$22.00
Sign and 2 post	\$36.00
Sign and 3 post	\$48.00
Sign and 4 post	\$60.00

Install sign on existing installed post(s):

Sign and 1 post	\$14.00
Sign and 2 post	\$22.00

Sign and 3 post	\$28.00
Sign and 4 post	\$32.00

Installation costs include hardware, removal, maintenance, profit and overhead.

Units = (Cost of material and installation) :- \$3.50

EXAMPLES

Sign mounted on post(s)		Sign mounted on existing installed post(s)	
<u>48" x 48" sign and 2 posts</u>		21' x 15" Arrow sign	
4' x 4' = 16 sq. ft. x \$4 =	\$64.00	1.75' x 1.25' = 2.2 sq. ft. x \$4 =	\$ 8.75
2 posts x \$10 =	\$20.00	1 post =	<u>\$14.00</u>
Install sign and 2 posts =	<u>\$36.00</u>	Total	\$22.75
Total	\$120.00		
Units = \$120/ 3.50 = 34.3	Use 35	Units = \$22.75/ 3.50 = 6.5	Use 7

NOTE: All units are rounded up to the next even number. Most signs 30 inch in length have units calculated using 1 post and sign over 30 inches to 60 inches in length have units calculated using 2 post. Sign over 60 inches to 96 inches in length have units calculated using 3 posts. Sign over 96 inches in length should have 4 posts but the 4th post must be outside 8 feet from the first post.

III-19.07 Guidelines for Using Standard Drawings for Construction Signing

Table III-19-1, at the end of this section, has been developed to summarize the application of Standard Drawings for work zone traffic control signing. The table is intended to serve as a guide only, and is not all inclusive. The designer should select the appropriate standard drawings and include them in the project plans. In instances where the standard drawings do not adequately cover the specific type of work proposed, the designer should consult with the Design Division – Traffic Safety Section for assistance in developing appropriate project traffic control.

III-19.08 Traffic Control Supervisor

Some major projects, with extensive traffic control, high traffic volumes, and/or complicated construction, may warrant the use of a Traffic Control Supervisor. Guidelines for the use of the project Traffic Control Supervisor are as follows:

The Traffic Control Supervisor should be used only on projects that meet one or more of the requirements listed below.

- Projects that include complex construction phasing.
- Projects that have traffic volumes over 750 ADT in rural areas and over 2000 ADT in urban areas.
- Projects that have traffic control devices proposed to cost over \$50,000.
- Projects listed above must have live traffic traveling through the construction area.

The designer should use the above guidelines to determine if a Traffic Control Supervisor is to be recommended. The District Engineer should review the recommendation and make the decision. The guidelines should be adhered to unless special circumstances require the use of a Traffic Control Supervisor.

Standard Note 704-016, as follows, should be included in the plans when the District Engineer determines the Traffic Control Supervisor is required. A plan note further detailing the Traffic Control Supervisor may also be included in the plans.

704-016 **TRAFFIC CONTROL SUPERVISOR:** A Traffic Control Supervisor shall be provided on the project.

The standard and plan notes can be found on the web at www.state.nd.us/dot/designmanual.html, click on “Plan Preparation Guide”, “Standard Notes” (and “Plan Notes”), “Section 700”, “704 – Traffic Control.”

III-19.09 Reflective Sheeting for Work Zone Traffic Control Devices

It is the policy of NDDOT that certain traffic control devices in work zones have Micro-cube Corner Prismatic (Diamond Grade) and Micro-cube Corner Prismatic (Fluorescent Diamond Grade) Sheeting.

Generally, the use of Micro-cube Corner Prismatic (Diamond Grade) and Micro-cube Corner Prismatic (Fluorescent Diamond Grade) wide angle retroreflective sheeting on work zone traffic control signs will improve daytime and nighttime visibility, daytime color, handling characteristics, and long-term durability.

Specifically, all work zone traffic control signs should be constructed of Micro-cube Corner Prismatic (Diamond Grade) for white background signs and Fluorescent Diamond Grade for orange background signs.

This should include all detour signs, black on orange work zone traffic control signs, and all other rigid signs installed to control and direct traffic during construction operations.

Orange and white Type I, II, and III barricades, and orange and white vertical panels should be Micro-cube Corner Prismatic (Diamond Grade) Retroreflective Sheeting.

Sheeting requirements for retroreflective bands on cones and drums should be high intensity material or Micro-cube Corner Prismatic Sheeting.

All construction contracts should include the provisions for Micro-cube Corner Prismatic Sheeting.

III-19.10 Work Zone Speed Limits

NDDOT's Traffic Control Review Team has adopted Work Zone Speed Limit Reduction Procedures. A summary of these procedures follows.

III-19.10.01 Seal Coat Projects

The speed limit on seal coat projects should be reduced as shown on the Standard Drawings.

III-19.10.02 Interstate, Four-Lane Divided and Two-Lane Highways

This procedure provides a method for considering engineering factors in selecting a work zone speed limit. It is intended to establish speed zones based on actual conditions.

Based on present guidance in the Manual on Uniform Traffic Control Devices (MUTCD), the procedure starts with speed limits of the work site prior to the beginning of the construction activities.

The procedure is based on consideration of speed limits for the work zones on a site by site basis.

The need for a speed reduction is determined through consideration of a number of factors related to the actual condition in a specific work zone.

Where a work zone speed limit reduction may be appropriate, the recommended procedure indicates the maximum speed limit reduction that should be considered 10 mph. A work zone speed limit reduction of greater than 10 mph is not recommended unless the design speed of the geometric element is more than 10 mph below the normal speed limit.

Reduced speed limits are generally for projects that last at least 24 hours, but there is no constrain to using reduced work zone speed limits for shorter projects.

Reduced work zone speed limits should be used only during specific time periods and only for specific portions of the work zone where the engineering factors identified in the work zone

speed limit procedure are present.

III-19.10.02.01 Work Zone Speed Limit Procedure

The appropriate speed limit for any highway work zone can be determined from the procedure presented in this section. The procedure is applicable to stationary construction zones, maintenance zones and utility operations; intermittent moving or mobile operations; and continuous moving operations. The recommended procedure has four steps:

Step 1 - Determine the existing speed limit.

Step 2 - Determine the work zone condition that applies.

Step 3 - Determine which factors for the appropriate condition apply to the specific site.

Step 4 - Select the work zone speed limit.

Each step is discussed below. This procedure is illustrated by the flow chart in Figure III-19.01. Table G-1 explains the seven work zone conditions that are addressed in Step 2.

Step 1 - Determine the existing speed limit.

The first step in the procedure is to determine the existing (pre-construction) speed limit for the work zone.

Step 2 - Determine the work zone condition that applies.

The work zone condition is determined by the location of the work activities in relation to the traveled way.

Step 3 - Determine which factors for the appropriate condition apply to the specific site.

The third step in the procedure is to review the conditions that are applicable to the condition that is present in the work zone.

Step 4 - Select the work zone speed limit

The work zone speed limit should be selected considering the factors presented in the conditions.

Project engineers responsible for each work zone should monitor the conditions in the work zone and make sure that the posted speed limit is appropriate for the actual conditions at any given time.

All work zone traffic control should be evaluated at the beginning of the project and periodically through the life of the project to determine if the traffic controls are operating as intended.

Figure III-19.01 – Work Zone Speed Limit Procedure

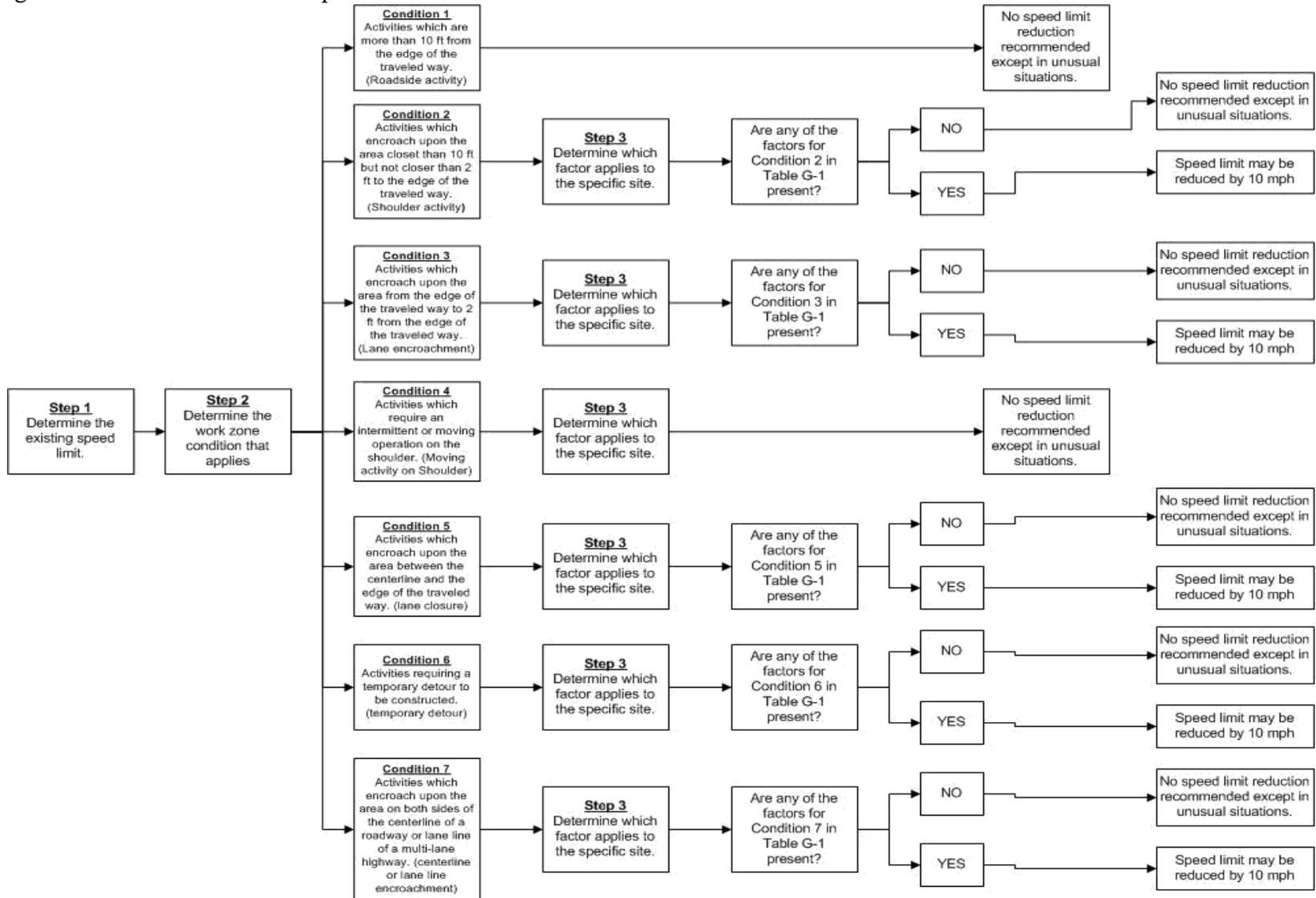


TABLE G-1

Condition 1

Activities that are more than 10 ft from the edge of the traveled way (roadside activity).

Typical applications

- Roadway constriction
- Cleaning drainage
- Landscaping work
- Structural work
- Utility work
- Reworking ditches
- Fencing work

Reduction to Existing Regulatory Speed Limit

Should not be used.*

Suggested Maximum Amount of Speed Reduction

None

Factors:

None

The regulatory speed limit shall meet all requirements of the MUTCD.

*There should not be a reduction of the existing regulatory speed limit unless unusual situations create hazardous conditions for motorists, pedestrians, or workers.

Condition 2

Activities that encroach on the area closer than 10 ft but not closer than 2 ft to the edge of the traveled way (shoulder activity).

Typical Applications

- Roadway construction
- Culvert extension
- Guardrail installation
- Cleaning drainage
- Reworking ditches
- Shoulder work
- Utility work
- Side slope work
- Landscaping work
- Structural work
- Sign installation

Reduction to Existing Regulatory Speed Limit

May be used where factors exist.

Suggested Maximum Amount of Speed Reduction

10 mph

Factors:

Workers present for extended periods within 10 ft of the traveled way unprotected by barrier.

Horizontal curvature that might increase vehicle encroachment rate (could include mainline curves, ramps, and turning roadways).

The regulatory speed limit shall meet all requirements of the MUTCD.

Conditions 3

Activities that encroach on the area from the edge of the traveled way to 2 ft from the edge of the traveled way (lane encroach).

Typical Application

Roadway construction
Utility work
Guardrail installation
Shoulder work

Reduction to Existing Regulatory Speed Limit

May be used where factors exist.

Suggested Maximum Amount of Speed Reduction

10 mph

Factors:

Workers present for extended periods within 2 ft of the traveled way unprotected by barrier.

Horizontal curvature that might increase vehicle encroachment rate (could include mainline curves, ramps, and turning roadways).

Barriers or pavement edge drop-off within 2 ft of the traveled way.

Reduced design speed for stopping sight distance.

Unexpected conditions

The regulatory speed limit shall meet all requirements of the MUTCD. Where work zone geometric with reduced design speeds cannot be avoided, the work zone speed limit should not exceed the design speed, even if this requires a work zone speed limit reduction greater than 10 mph.

Condition 4

Activities that require an intermittent or moving operation on the shoulder (moving activity on shoulder).

Typical Applications

- Roadway construction
- Widening
- Delineator installation
- Shoulder and slope work
- Utility work
- Guardrail installation
- Landscaping work

Reduction to Existing Regulatory Speed Limit

Should not be used.*

Suggested Maximum Amount of Speed Reduction

None

Factors:

None

The regulatory speed limit shall meet all requirements of the MUTCD.

*There should not be a reduction of the existing regulatory speed limit unless unusual situations create hazardous conditions for motorists, pedestrians, or workers.

Condition 5

Activities that encroach on the area between the centerline and the edge of traveled way (lane closure).

Typical Applications

- Roadway construction
- Pavement repair
- Utility work
- Widening

Pavement resurfacing
Pavement marking
Bridge repair

Reduction to Existing Regulatory Speed Limit

May be used where factors exist.

Suggested Maximum Amount of Speed Reduction

10 mph

Factors:

Workers present for extended periods in the closed lane unprotected by barrier.

Lane width reduction of 1 ft or more with a resulting lane width less than 11 feet.

Traffic control devices encroaching on a lane open to traffic or within a closed lane but within 2 ft of the edge of the open lane.

Reduced design speed for taper length or speed change lane length.

Barriers or pavement edge drop-off within 2 ft of the traveled way.

Reduced design speed of horizontal curve.

Reduced design speed for stopping sight distance.

Traffic congestion created by a lane closure.

Unexpected conditions.

The regulatory speed limit shall meet all requirements of the MUTCD. Where work zone geometric with reduced design speeds cannot be avoided, the work zone speed limit should not exceed the design speed, even if this requires a work zone speed limit reduction greater than 10 mph.

Condition 6

Activities require a temporary detour to be constructed (temporary detour).**

Typical Applications

Roadway construction
Subgrade restoration
Bridge construction
Culvert repair

Reduction to Existing Regulatory Speed Limit

May be used where factors exist.

Suggested Maximum Amount of Speed Reduction

10 mph

Factors:

Lane width reduction of 1 ft or more with a resulting lane width less than 11 feet.

Reduced design speed for detour roadway or transition (radius of curvature, superelevation, and sight distance).

Unexpected conditions.

The regulatory speed limit shall meet all requirements of the MUTCD. Where work zone geometric with reduced design speeds cannot be avoided, the work zone speed limit should not exceed the design speed, even if this requires a work zone speed limit reduction greater than 10 mph.

**Detour and transition geometry with a design speed equal to or greater than the existing regulatory speed limit should be provided whenever possible.

Condition 7

Activities that encroach on the area on both sides of the centerline of a roadway or lane lines of a multilane highway (centerline or lane line encroachment).

Typical Applications

Roadway construction
Widening
Pavement marking
Crack sealing
Pavement resurfacing
Bridge repair
Pavement repair

Reduction to Existing Regulatory Speed Limit

May be used where factors exist.

Suggested Maximum Amount of Speed Reduction

10 mph

Factors:

Workers present on foot in the traveled way or in the closed lane unprotected by barrier

for extended periods.

Remaining lane plus shoulder width is less than 11 ft.

Reduced design speed for taper length or speed change lane length.

Barriers or pavement edge drop-off within 2 ft of the traveled way.

Reduced design speed of horizontal curve.

Reduced design speed for stopping sight distance.

Traffic congestion created by a lane closure.

Unexpected conditions.

The regulatory speed limit shall meet all requirements of the MUTCD. Where work zone geometrics with reduced design speeds cannot be avoided, the work zone speed limit should not exceed the design speed, even if this requires a work zone speed limit reduction greater than 10 mph.

III-19.11 Longitudinal Edge Drop-off Guidelines

These guidelines are intended to increase traffic safety by identifying techniques for the treatment of uneven lanes and edge drop-offs that occur along the centerline, edgeline, and shoulders in highway work areas. One of the best ways to increase traffic safety is to minimize exposure to uneven lanes and edge drop-offs. The following guidelines incorporating traffic control devices and construction methods may be applied to enhance traffic safety. See Figure III-19.02, Longitudinal Edge Drop-Off Guidelines, at the end of this section for a graphical representation of these techniques.

GENERAL:

- At no time should there be more than one uneven lane condition between the traffic carrying lanes, which include auxiliary lanes, turn lanes, and ramp access or egress areas. Weather permitting, all exposed uneven lane conditions within the traffic carrying lanes should be Amatched@ within 24 hours.
- Traffic control signs, as shown, should be repeated after major intersections. A major intersection is defined as an intersection between a state highway and another state highway, an Interstate ramp, or a County Major Collector (CMC).
- The maximum sign spacing should be 1 mile when the speed limit is greater than 30 mph.

- The maximum sign spacing should be 1/4 mile when the speed limit is 30 mph or less.
- The maximum spacing of channelizing devices used to close the shoulder is 100 feet.
- The maximum spacing of Type III Barricades used to close a lane is 1000 feet.

UNEVEN LANES – PAVING OPERATIONS:

Note: The following paragraph and subparagraph numbers correspond to drawings on Figure III-19.02, which follows this section.

1. Two Lane Highways

- A. For drop-offs of 1-1/2 inches or less, appropriate traffic control signs should be provided as indicated in Standard Note 704-250. Traffic can be permitted to cross the drop-off.
- B. For drop-offs of 1-1/2 to 2-1/2 inches, appropriate traffic control signs and devices should be provided as indicated in Standard Note 704-251 for ADT of 750 or less, or Standard Note 704-252 for ADT greater than 750. Traffic should not be permitted to cross the drop-off as shown.
- C. For drop-offs of 2-1/2 to 4 inches, appropriate traffic control signs and devices should be provided as indicated in Standard Note 704-253. Traffic should not be permitted to cross the drop-off.

2. Four Lane Divided and Interstate Highways

For drop-offs of 2 inches or less, appropriate traffic control signs and a lane closure should be provided as indicated in Standard Note 704-254. Traffic should not be permitted to cross the drop-off.

3. Shoulders – All Highways

For drop-offs of various depths, appropriate traffic control signs and an edge slough should be provided as indicated in Standard Note 704-255. Traffic may cross the drop-off.

UNEVEN LANES – MILLING OPERATIONS:

Milling operations should use the guidelines shown for paving operations. The plan notes, etc., will require modifications in terminology for the milling operations.

EDGE DROP-OFFS – ADJACENT TO TRAFFIC CARRYING LANE:

1. For drop-offs of 1-1/2 inches or less, appropriate traffic control signs should be provided as shown in Figure III-19.02 at the end of this section.
2. For drop-offs greater than 1-1/2 inches up to 4 inches:
 - A. The edge should be tapered and compacted at a slope of 4:1 and appropriate traffic control signs should be provided; or
 - B. If the taper is not provided, traffic should not be permitted to cross the drop-off, and that portion of the roadway should be closed to traffic with appropriate traffic control signs and devices.
3. For drop-offs greater than 4 inches up to 12 inches:
 - A. The edge should be tapered and compacted at a slope of 4:1. Traffic should not be allowed to cross the drop-off, and that portion of the roadway should be closed to traffic with appropriate traffic control signs and devices; Vertical Panels shall be placed at the top of the slope or Stackable Vertical Panels placed at the edge of the driving lane; or
 - B. If a taper is not provided, the traffic should not be allowed to cross the drop-off, and that portion of the roadway should be closed to traffic with appropriate traffic control signs, devices, and a positive barrier, such as a portable precast concrete barrier; or
 - C. If a taper is not provided, the traffic or auxiliary lane adjacent to the drop-off should be closed to traffic with the appropriate traffic control signs and devices.

Note: Tapers or positive barriers are not required if:

- 1) The drop-off is within an urban area and the speed limit is 30 mph or less; Stackable Vertical Panels placed at the edge of the driving lane; or
 - 2) The drop-off is short term (7 calendar days or less) and less than 50 feet in length and the speed limit is higher than 30 mph. Vertical Panels shall be placed at the top of the slope or Stackable Vertical Panels placed at the edge of the driving lane.
4. For drop-offs greater than 12 inches:

The traffic or auxiliary lane adjacent to the drop-off should be closed to traffic with the appropriate traffic control signs and devices, and a positive barrier, such as a portable precast concrete barrier.

Positive barriers are not required if the drop-off is a short term condition (7 calendar days or less) and is located 16 feet or more from the traffic carrying lane.

EDGE DROP-OFFS – INSIDE EDGE OF SHOULDER:

1. For drop-offs of 1-1/2 inches or less, appropriate traffic control signs should be provided.
2. For drop-offs greater than 1-1/2 inches up to 4 inches:
 - A. The edge should be tapered and compacted at a slope of 4:1 and appropriate traffic control signs should be provided; or
 - B. If the taper is not provided, traffic should not be permitted to cross the drop-off, and that portion of the roadway should be closed to traffic with the appropriate traffic control signs and devices.
3. For drop-offs greater than 4 inches up to 12 inches:
 - A. The edge should be tapered and compacted at a slope of 6:1, and appropriate traffic control signs should be provided (6:1 taper should not be used as a traffic carrying lane). This treatment should not be permitted unless the 6:1 slope is compacted so that a vehicle may safely drive onto it without losing control, and there are no other hazardous conditions; Vertical Panels shall be placed at the top of the slope or Stackable Vertical Panels placed at the edge of the driving lane; or
 - B. The edge should be tapered and compacted at a slope of 4:1, traffic should not be allowed to cross the drop-off, and that portion of the roadway should be closed to traffic with appropriate traffic control signs and devices; or
 - C. If a taper is not provided, the traffic or auxiliary lane adjacent to the drop-off should be closed to traffic with the appropriate traffic control signs and channelizing devices.
4. For drop-offs greater than 12 inches:

The traffic or auxiliary lane adjacent to the drop-off should be closed to traffic with the appropriate traffic control signs and devices, and a positive barrier, such as a portable precast concrete barrier.

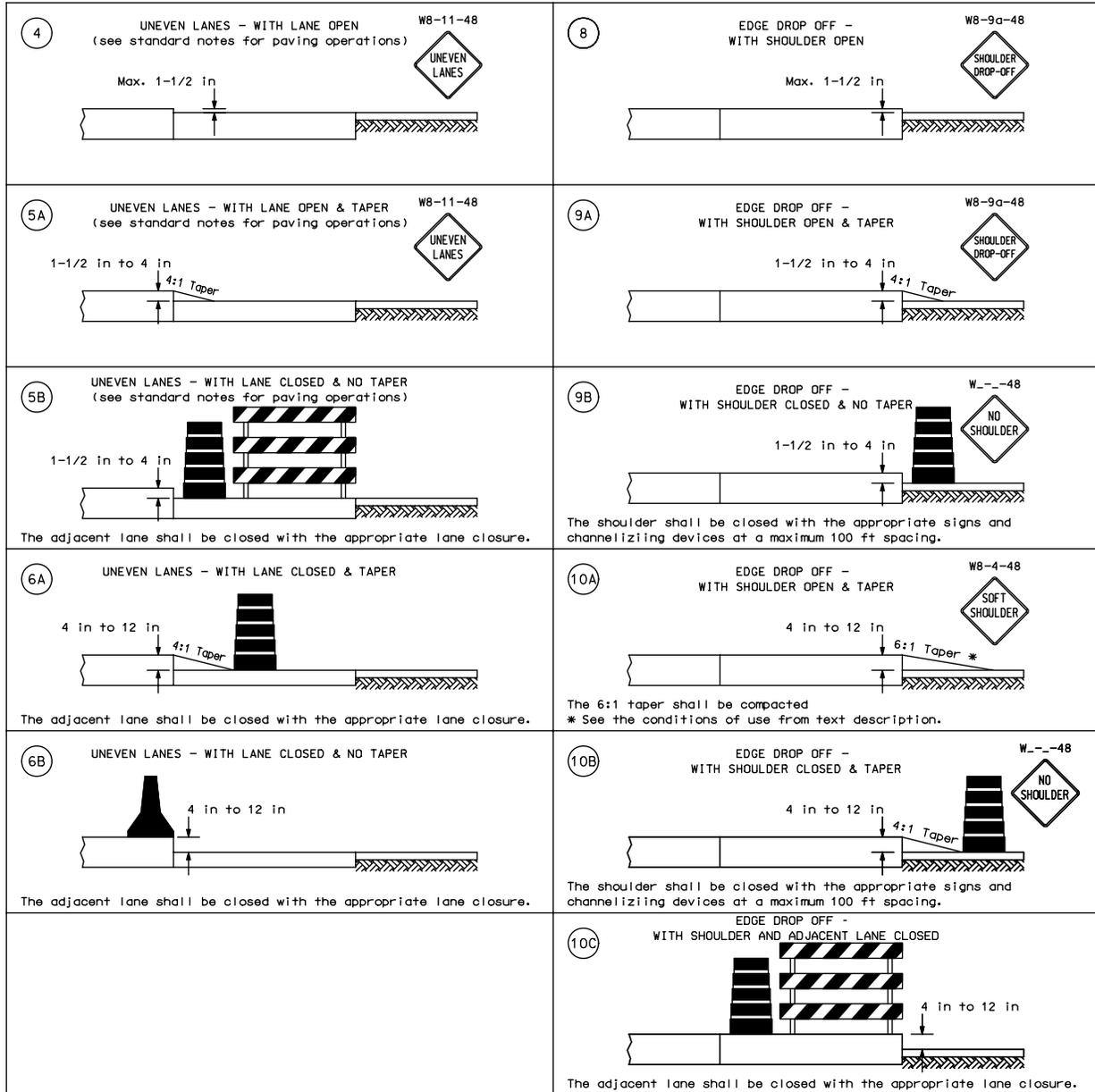
Positive barriers are not required if the drop-off is a short term condition (7 calendar days or less) and located 16 feet or more from the traffic carrying lane.

EDGE DROP-OFFS - OUTSIDE EDGE OF SHOULDER:

1. Shoulder width 0 to 2 feet and a 0 to 12 inch drop-off; use appropriate guideline above. Stackable Vertical Panels placed at the edge of the Shoulder.
2. Shoulder width 2 to 8 feet and a 0 to 4 inch drop-off; install edgeline, or use appropriate guideline above.
3. Shoulder width 8 feet or greater and a 0 to 4 inch drop-off; no traffic control required.
4. Shoulder width 2 to 8 feet and a 4 to 12 inch drop-off; use appropriate guideline above.

Figure III-19.02, which follows, has been developed to summarize longitudinal edge drop-off guidelines for work zones. Vertical Panels shall be placed at the top of the slope or Stackable Vertical Panels placed at the edge of the driving lane. The figure is intended to serve as a guide only and is not all inclusive.

Figure III-19.02 Longitudinal Edge Drop-Off Guidelines



III-19.12 Warrants for Portable Changeable Message Signs

Portable changeable message signs (PCMS) have a wide variety of applications in work zone traffic control, including roadway or ramp closures, crash or emergency incident management with restrictions information, advisories on road work scheduling, traffic management and diversion, warning of adverse conditions, and operation controls.

The primary purpose of PCMS in work zone traffic control is to advise the driver of unexpected traffic and routing situations. Some typical applications include the following:

- Where speed of traffic is to drop substantially.
- Where queuing and delays are possible.
- Where adverse environmental conditions are present.
- To provide advance notice of ramp, lane, or roadway closure.
- For crash or incident management.

Some typical criteria include:

- The speed limit in the work zone is above 50 mph, and the speed reduction is more than 20 mph.
- When queuing traffic is more than 20 vehicles and delays are greater than 5 minutes.
- Adverse environmental conditions – any chemical spills or other hazardous materials.
- It is assumed that ramp, lane, or roadway closures are normally less than 2 weeks.
- Crash or incidents are hard to quantify.

The designer should use the guidelines to determine if the project meets all of these requirements and then recommends to the District Engineer if the PCMS are to be provided. The District Engineer should consider the recommendation and make the decision. The guidelines should be adhered to unless special circumstances require the use of a PCMS.

A Special Provision covering PCMS has been prepared and should be used on all projects that specify the use of this traffic control device. Contact the Maintenance and Engineering Services Division for the Special Provision.

Table III-19-1 Traffic Control Devices List

The “Traffic Control Devices List” program can be found on the web at www.dot.state.nd.us/, click on “Manuals”, “Design Manual”, “Plan Prep. Guide”, “Plan Sheets”, “Section 700”, “704.2 Traffic Control Devices List”, or on the web at www.state.nd.us/dot/designmanual.html, click on “Plan Preparation Guide”, “Plan Sheets”, “Section 700”, “704.2 Traffic Control Devices List”. ~~This table is a sample Traffic Control Devices List.~~ Download XLS, open and follow instructions and the traffic control devices list will provide the quantities for each sign used and a total amount for the bid items. The chart can be printed for plans. The table contains all signs and devices shown in the Standard Drawings. The table may be copied and edited as necessary and unused signs and devices removed to minimize the size of the table.

Special Signs:

Occasionally signs will be needed that are not provided in the Standard Drawings. These signs may be special detour signs, distance and destination signs, etc. The designer should contact the Design Division - Traffic Section for the proper sign message, dimensions, and post configuration. The designer should coordinate the request to provide a minimum two week lead time for the Design Division.

TABLE III-19-2 Application of Standard Drawings for Construction Signing

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
D-704-01	na	Attenuation device	All	na	
D-704-03	na	Lane markers for seal jobs only (spotting tab)	All	na	1) Use on all seal coat projects in accordance to Section 762.04 D.1.e. 2) See example note 762 - P01, to revise method of payment, when short-term pavement markings are not provided. 3) See example note 762 - P01, when using plastic and preformed patterned pavement markings, and it is desired to recess the pavement markings.
D-704-08	na	Breakaway system for construction zone signs	All	na	1) Use on all projects.
D-704-09	na	Construction sign details	All	na	1) Use on all projects.
D-704-10	na	Construction sign details	All	na	1) Use on all projects.
D-704-11	na	Construction sign details	All	na	1) Use on all projects.
D-704-12	na	Construction sign details	All	na	1) Use on all projects.
D-704-13	na	Barricade details	All	na	1) Use on all projects.
D-704-14	na	Construction signs and barricade assembly details	All	na	1) Use on all projects.
D-704-22	K	Truck traffic entering thru highway	All	L,I,S	1) Signs should be covered or taken down at night
D-704-22	L	Truck traffic crossing thru highway	All	L,I,S	1) Signs should be covered or taken down at night
D-704-24	R	Bridge painting below roadway	All	L,I,S	
D-704-24	S	Bridge painting above roadway	All	L,I,S	
D-704-24	T	Work area outside roadway	All	S	1) Use in daylight with good visibility only and outside major work area.
D-704-24	U	Equipment parked on right shoulder	All	S	
D-704-26	Y	Haul road crossing thru highway	All	L,I,S	1) Use when condition exist outside the major work area. 2) Signs should be covered or taken down at night
D-704-26	Z	Speed zone	All	L,I,S	1) Use when condition exist.
D-704-26	AA	Survey crew	All	S	1) Use when condition exist.
D-704-26	BB	Shoulder work or shoulder drop-off	All	L,I,S	1) Use when condition exist within the major work area.
D-704-26	CC	Fresh oil	All	L,I,S	1) Use when condition exist.

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
D-704-26	DD	Road narrows	All	L,I,S	1) Use when condition exist.
D-704-26	EE	Bump	All	L,I,S	1) Use when condition exist.
D-704-26	FF	End of pavement	All	L,I,S	1) Use when condition exist.
D-704-26	GG	Uneven lanes	All	L,I,S	1) Use when condition exist.
D-704-30	na	Windrow marking	All	L,I,S	1) Use when condition exist.
D-704-42	na	Road construction guide sign	All	L	1) Use on projects that may have a suspension(s) greater than 3 days or through the winter months.
D-704-15	A	Temporary roadway closure with flagger control	2L	SD	1) Use in daylight with good visibility only. The closure should be limited to 15 to 20 minutes only. 2) The layout may be referenced to indicate flagging station layout and signing. 3) Applications include HBP paving operations on two-lane two-way roadways in conjunction with pilot cars, and other operations that require temporary closure of a roadway.
D-704-15	B	Roadway closure with temporary detour (diversion)	2L	L,I	1) Use when condition exist > 1 day or outside major work area. 2) Applications include box culverts and structures. Work areas are typically short in length (<1000 ft). 3) "Sharp" curve signs (W1-3-48 & W13-1-24) should be used on cures with design speeds of 30 mph or less.
D-704-16	na	Lane closure with temporary traffic signal control and barriers	2L	L	1) Use when hazardous conditions exist next to the driving lane and traffic is controlled by signals. Work areas are typically short in length (<1000 ft). Work area geometry should be reviewed for suitability. The signal are typically used on long term projects in-place of flagging. 2) Applications: generally used for structural repair. 3) The contractor should have the option of using this layout or Std. Dwg. D-704-17. Include plan note 704-450 to address the option and method of payment. 4) The attenuation devices and barrier may be deleted by plan note pending engineering analysis. Engineering analysis should include closure time less than 4 weeks.
D-704-17	na	Lane closure with flagger control and barriers	2L	L,I	1) Use when hazardous conditions exist next to the driving lane and traffic is controlled by flagging. 2) Applications include structural repair, pipe installation, excavation, etc. with conditions remaining overnight. Work

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
					<p>areas are typically short in length (<1000 ft).</p> <p>3) For long term projects the contractor should have the option of using this layout or Std. Dwg. D-704-16. Include plan note 704-450 to address the option and method of payment.</p> <p>4) The attenuation devices and barrier may be deleted by plan note pending engineering analysis. Engineering analysis should include closure time less than 4 weeks.</p>
D-704-19	E	Detour signing - roadway closure beyond detour point	2L	L,I	1) Use when condition exist > 1 day and outside major work area.
D-704-19	F	Lane closure with flagger control (depicts obstructed visibility)	2L	L,I	<p>1) Use when condition exist > 1 day and outside major work area.</p> <p>2) Application: generally used when traffic must be restricted from the work area. Typically the traffic control devices and flagging would remain in-place overnight, if the operation requires daily set-up consideration should be given to an alternative channelizing device. A pilot car may be used to supplement the flagging control.</p> <p>3) Tubular Markers or Traffic Cones may be substituted for Delineator Drums by plan note, pending engineering analysis. Cones shall not be used when conditions exist over night time.</p>
D-704-21	J	Lane closure with widened section to maintain two-way traffic	2L	L,I	1) Use when condition exist > 1 day and outside major work area.
D-704-22	M	Temporary detour for culvert installation	2L	S	<p>1) Use when condition exist < 1 day and within the major work area. Use in daylight with good visibility only.</p> <p>2) "Sharp" curve signs (W1-3-48 & W13-1-24) should be used on curves with design speeds of 30 mph or less.</p>
D-704-22	N	Temporary lane closure with flaggers to maintain traffic	2L	S	1) Use when condition exist < 1 day and within the major work area.
D-704-31	na	Lane closure with stop sign control	2L	L,I	<p>1) Use when condition exist > 1 day and outside major work area.</p> <p>2) Application: use on structures only, when the roadway has an ADT <750. Work areas are typically short in length (<1000 ft).</p> <p>3) Work area geometry should be reviewed for adequate sight distance and visibility.</p>
D-704-27	na	Pavement Marking - moving operation	2L & 4L	M	<p>1) Applications: TCP (3-1a), Undivided Multilane Roadway. TCP (3-1b), Two-Way Roadway With Paved Shoulders. TCP (3-1c), Two-Way Roadway Without Paved</p>

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
					Shoulders.
D-704-20	H	Construction signing - for seal coats with traffic maintained (includes signing for intersecting routes)	2L & 4L	L,I	<ol style="list-style-type: none"> 1) Construction signing is installed to delineate the construction zone (project boundaries) outside of the work area. The purpose is to inform the motorist that construction activities should be anticipated. 2) The designer should review the roadway ADT and intersection locations. A plan note or detailed drawing should be included to address intersection locations and short-term markings.. 2) Use spotting tabs on all seal coat projects in accordance to Section 704.04 D.1.e and Std. Dwg. D-704-3. 3) See example note 762 - P01, to revise method of payment, when short-term pavement markings are not provided.
D-704-20	G	Construction signing - with traffic maintained (includes signing for intersecting routes)	2L, 4L, & 4LD	L	<ol style="list-style-type: none"> 1) Construction signing is installed to delineate the construction zone (project boundaries) outside of the work area. The purpose is to inform the motorist that construction activities should be anticipated. As a rule of thumb, construction signing should be provided if the anticipated duration is > 2 weeks. 2) The designer should review the intersection locations. A plan note or detailed drawing should be included to address intersection locations. 3) The designer should review the need for sign no. G20-1b-60 and address by plan note.
D-704-21	I	Detour signing - roadway closure	2L, 4L, & 4LD	L,I	<ol style="list-style-type: none"> 1) The advance warning sign sequence should be revised to show a lane closure for 4L and 4LD application.
D-704-22	O	Construction signing - tee-intersection with traffic maintained	2L, 4L, & 4LD	L,I	<ol style="list-style-type: none"> 1) Construction signing is installed to delineate the construction zone (project boundaries) outside of the work area. The purpose is to inform the motorist that construction activities should be anticipated. 2) The designer should review the intersection locations. A plan note or detailed drawing should be included to address intersection locations. 3) The designer should review the need for sign no. G20-1b-60 and address by plan note.
D-704-29	na	Pavement Marking - individual unit operation	2L, 4L & 4LD	M	<ol style="list-style-type: none"> 1) Applications: Two-Way Roadway With Paved Shoulders. Two-Way Roadway Without Paved Shoulders.

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
					Divided Multi-Lane Highway. Undivided Multi-Lane Highway.
D-704-02	na	Coring for hot bituminous pavement	2L, 4L, 4LD & Int	M	1) Use on HBP projects when cores for specified density are required. 2) Use in daylight with good visibility only.
D-704-15	C	2 Roadway closure with traffic maintained	4L	L,I	1) Use when condition exist > 1 day or outside major work area. 2) The work area should be returned to a non-hazardous or traversable condition at the end on the work day. 3) Tubular Markers may be substituted for Traffic Cones by plan note.
D-704-19	D	Roadway closure with traffic maintained by temporary crossover and detour to other roadway	4LD	L,I	1) Use when condition exist > 1 day and outside major work area. 2) The use of positive barriers should be based on need determined by engineering analysis and duration of project. Use Std. Dwg. for Interstate crossovers if barriers are required. 3) The alignment may be designed using standard tapers or AASHTO design criteria for curves.
D-704-23	P	Lane closure	4LD	L,I,S	1) Use on stationary operations that do encroach the driving lane (L or R), and flagging is not required. 2) Applications include guardrail, etc. Projects are generally shorter in length (begin and end of project visible), but may extend to approx. 3 miles in length. 3) The lane closure may remain in-place overnight or be removed. If used overnight, Tubular Markers shall be substituted for Traffic Cones.
D-704-33	na	Lane closure, with inside approach shown	4LD	L,I	1) Use on operations that encroach the driving lane and require flagging. 2) Applications include HBP overlays, seal coats, CPR, grinding, etc. The daily construction area is generally limited to <6 miles in length (by plan note). 3) The lane closure may remain in place overnight or be removed depending on roadway hazard condition. 4) Excavation should be <1 ft and hazardous conditions should be removed or traversable at night. 5) The designer should verify the approach location. 6) The designer may limit length and quantities by providing a plan note and detailing quantities provided.

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
D-704-34	na	Lane closure, with outside approach shown	4LD	L,I	<ol style="list-style-type: none"> 1) Use on operations that encroach the driving lane and require flagging. 2) Applications include HBP overlays, seal coats, CPR, grinding, etc. The daily construction area is generally limited to <6 miles in length (by plan note). 3) The lane closure may remain in place overnight or be removed depending on roadway hazard condition. 4) Excavation should be <1 ft and hazardous conditions should be removed or traversable at night. 5) The designer should verify the approach location. 6) The designer may limit length and quantities by providing a plan note and detailing quantities provided.
D-704-28	na	Pavement Marking - moving operation	4LD, Int	M	<ol style="list-style-type: none"> 1) Applications: Divided Highways or Interstate with 3 or more lanes.
D-704-32	na	Lane closure, moving operation	4LD, Int	M	
D-704-18	na	Lane closure with portable barriers	Int	L,I	<ol style="list-style-type: none"> 1) Use when hazardous conditions exist next to the driving lane 2) Applications include structural repair, pipe installation, excavation, etc. The project length is generally limited. 3) The use of barriers and attenuation devices (hazardous conditions) should be based on need determined by engineering analysis. If hazardous conditions are not present use Std. Dwg. D-704-35.
D-704-35	na	Lane closure	Int	L,I	<ol style="list-style-type: none"> 1) Use on operations that encroach the driving lane and require flagging. 2) Applications include HBP overlays, seal coats, CPR, grinding, etc. The daily construction area is generally limited to <6 miles in length (by plan note). 3) The lane closure may remain in place overnight or be removed depending on roadway hazard condition. 4) Excavation should be <1 ft and hazardous conditions should be removed or traversable at night. 5) The designer may limit length or quantities by providing a plan note and detailing quantities provided.
D-704-38	na	TCS - Median crossover (begin), 55 mph	Int	L	
D-704-39	na	TCS - Median crossover (end), 55 mph	Int	L	

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING					
Std Dwg No.	CSL Type	Description	Roadway Type	Duration	Comments
D-704-40	na	TCS - Median crossover (begin), 65 mph	Int	L	
D-704-41	na	TCS - Median crossover (end), 65 mph	Int	L	
D-704-43	na	TCS - Median crossover (begin), 70 mph	Int	L	
D-704-44	na	TCS - Median crossover (end), 70 mph	Int	L	
D-704-25	V	Partial roadway closure (mid-block)	MS	S	1) Use in daylight with good visibility only.
D-704-25	W	Work area outside roadway, no partial closure	MS	S	1) Use in daylight with good visibility only.
D-704-25	X	Partial roadway closure (end-block)	MS	S	1) Use in daylight with good visibility only.
D-704-23	Q	Detour signing - city street closure	MS & U	L,I,S	

APPLICATION OF STANDARD DRAWINGS FOR CONSTRUCTION SIGNING	
<p>Roadway Type Definitions:</p> <p>All = All roadways. 2L = 2 Lane Roadways. 4L = 4 Lane Roadways. 4LD = 4 Lane Divided Roadways. Int = Interstate Roadways. MS = Major Streets. U = Urban Streets.</p>	<p>Duration Definitions:</p> <p>na = Not applicable. L = Long term stationary - > 3 days. I = Intermediate term stationary - overnight #3 days. S = Short term stationary - anytime > 60 minutes. SD = Short Duration - anytime # 60 minutes. M = Mobile - Intermittent and continuously moving.</p>
<p>Other Definitions:</p> <p>1) Outside the Major Work Area. Advance construction signing is not provided with shown signing. 2) Within the Major Work Area. Advance construction signing is provided with shown signing. 3) Major Intersection. A major intersection is defined as intersecting a County Major Collector (CMC), State Highway, U.S. Highway, or Interstate ramp. Intersections with other County Roads and Local Roads may be considered major based on traffic volumes. 4) High volume local road. A high volume local road has an ADT greater than 750. 5) Low volume local road. A low volume local road has an ADT less than 750. 6) Approach. An approach is any entrance onto a roadway or access to a roadway, including other roadways. Typically an existing approach controlled by an existing yield or stop condition should be considered in the Traffic Control Plan.</p>	