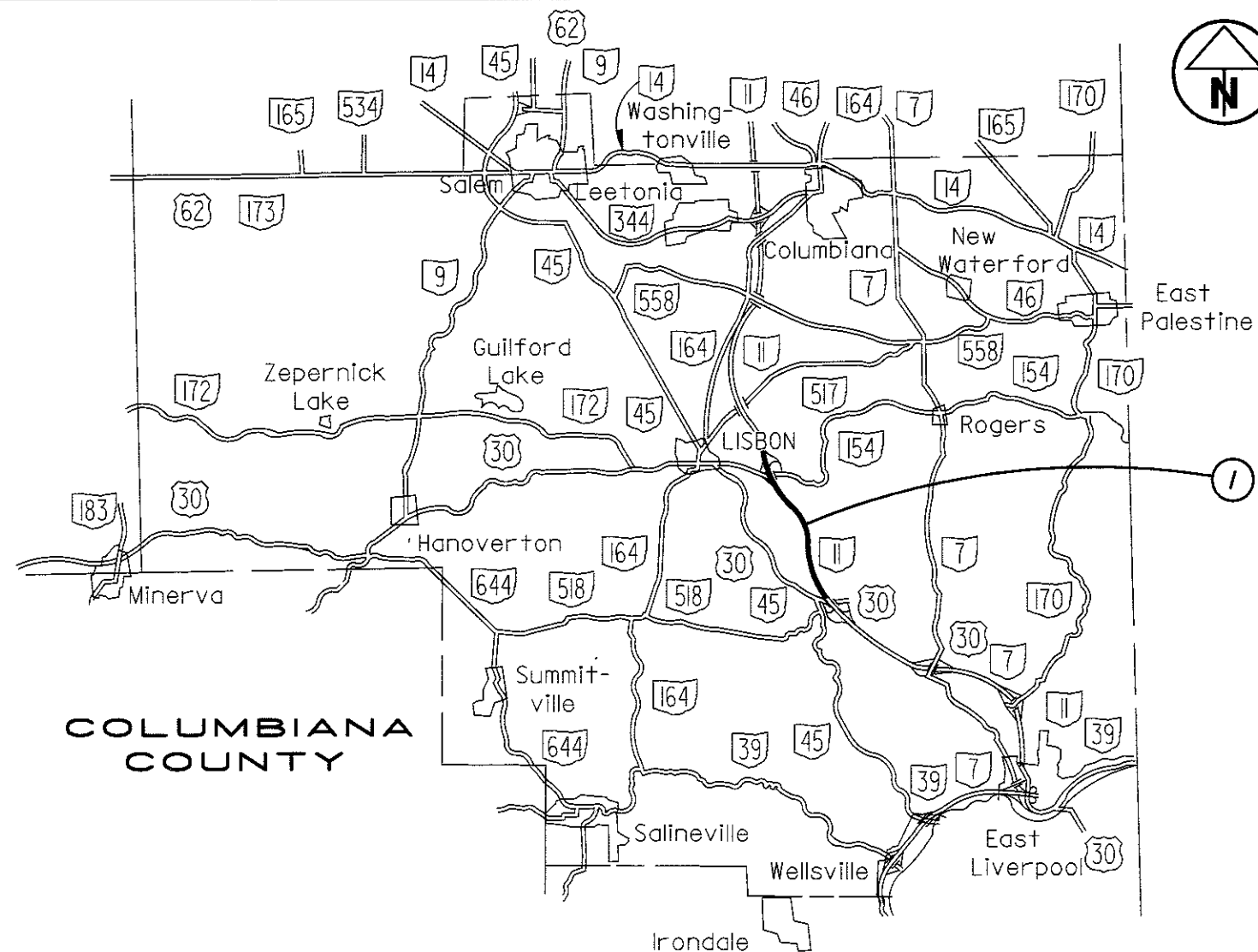


OHIO DEPARTMENT OF TRANSPORTATION

PLAN NO.



PORTIONS TO BE IMPROVED

442 RESURFACING
COL - 11 - 9.58

PART	COUNTY	ROUTE	SECTIONS	PROJECT TERMINI		NET LENGTH MILES	
				BEGIN	END		
I	COL	11	9.19	9.58	14.39	4.81	NORTHBOUND
	COL	11	9.19	9.58	14.39	4.81	SOUTHBOUND

The Standard 2002 Specifications of the State of Ohio, Department of Transportation, including changes and Supplemental Specifications listed in the plans and proposal govern these improvements.

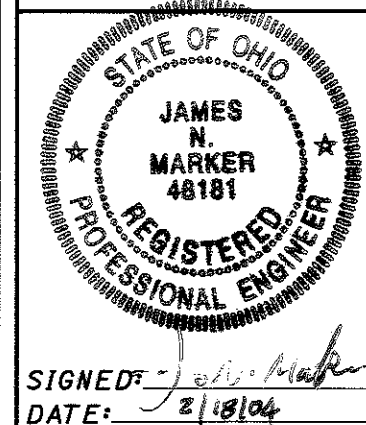
I hereby approve these plans and declare that the making of these improvements will require the closing of the highways to traffic on Parts No. NONE and that detours will be provided by State forces. The closing to traffic of the highways will not be required on Parts No. 1 and provisions for the maintenance and safety of traffic will be as indicated in the proposal.

PROJECT EARTH DISTURBED AREA = N/A (MAINTENANCE PROJECT)
ESTIMATED CONTRACTOR EARTH DISTURBED AREA = N/A (MAINTENANCE PROJECT)
NOTICE OF INTENT EARTH DISTURBED AREA = N/A (MAINTENANCE PROJECT)

INDEX OF SHEETS

TITLE SHEET	1
SCHEMATIC PLAN	2-4
TYPICAL SECTIONS	5
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PAVEMENT PLANING DETAIL	8
TYPICAL MEDIAN CROSSOVER DETAIL	9
INTERSECTION DETAIL	10
DROPOFF IN WORK ZONE	11
WORK ZONE AND PAVEMENT MARKING SUB-SUMMARY	12
RPM SUB-SUMMARY	13
GENERAL NOTES	14-15
GENERAL SUMMARY	16

ENGINEERS SEAL:

APPROVED DATE 02-19-04APPROVED DATE 3-9-04

DISTRICT DEPUTY DIRECTOR

DIRECTOR, DEPARTMENT OF TRANSPORTATION

UNDERGROUND UTILITIES

2 WORKING DAYS
BEFORE YOU DIG
CALL **800-362-2764** (TOLL FREE)
OHIO UTILITIES PROTECTION SERVICE
NON-MEMBERS
MUST BE CALLED DIRECTLY

STANDARD DRAWINGS

BP-3.1	7-28-00	MT-98.19	10-18-02
BP-9.1	10-17-03	MT-99.20M	1-30-95
DM-4.3	7-19-02	MT-105.10	10-18-02
DM-4.4	7-19-02	MT-105.11	10-18-02
MT-35.10	4-20-01	TC-41.20	1-19-01
MT-95.30	4-19-02	TC-52.10	4-20-01
MT-95.31	4-19-02	TC-52.20	4-20-01
MT-98.12	4-19-02	TC-65.10	10-19-01
MT-98.13	4-19-02	TC-65.11	10-19-01
MT-98.14	4-19-02	TC-72.20	1-19-01
MT-98.15	4-19-02	TC-73.10	1-19-01
MT-98.16	4-19-02		
MT-98.17	10-18-02		
MT-98.18	10-18-02		

SUPPLEMENTAL SPECIFICATIONS

832	2-12-03
833	2-12-03
908	4-18-03
1082	1-11-00

PLAN PREPARED BY
O.D.O.T.
DISTRICT II

COL - SR 11-9.58
040352 PID - 24744
Dist 11 6/2/2004

FEDERAL PROJECT NO.

E040(723)

PID NO.

24744

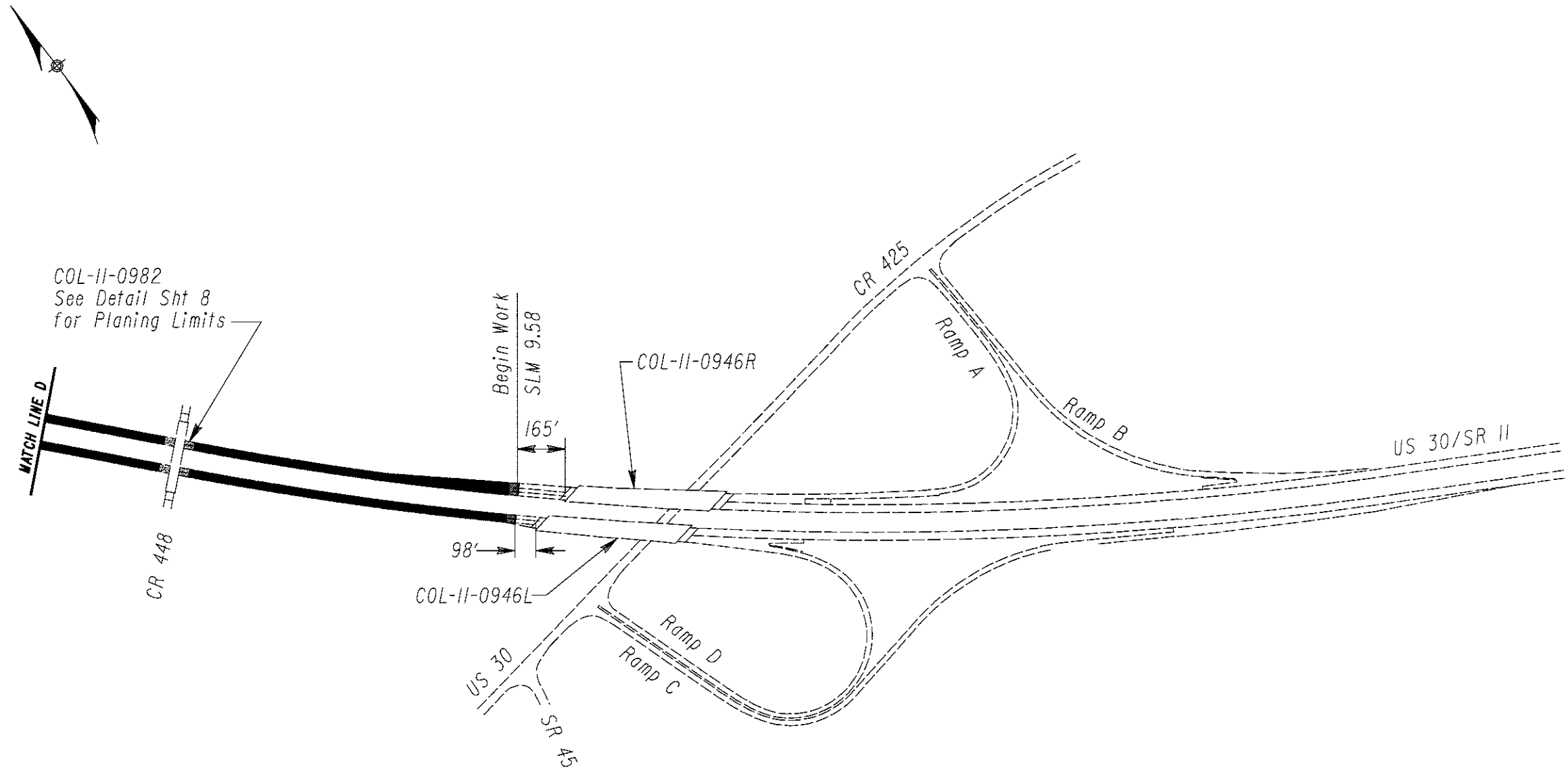
CONSTRUCTION PROJECT NO.

RAILROAD INVOLVEMENT

NONE

COL-11-9.58

1/16



COL-II-0982
See Detail Sht 8
for Planing Limits

Begin Work
SLM 9.58

COL-II-0946R

COL-II-0946L

CR 425

Ramp A

Ramp B

US 30/SR 11

CR 448

98'




165'

Ramp D

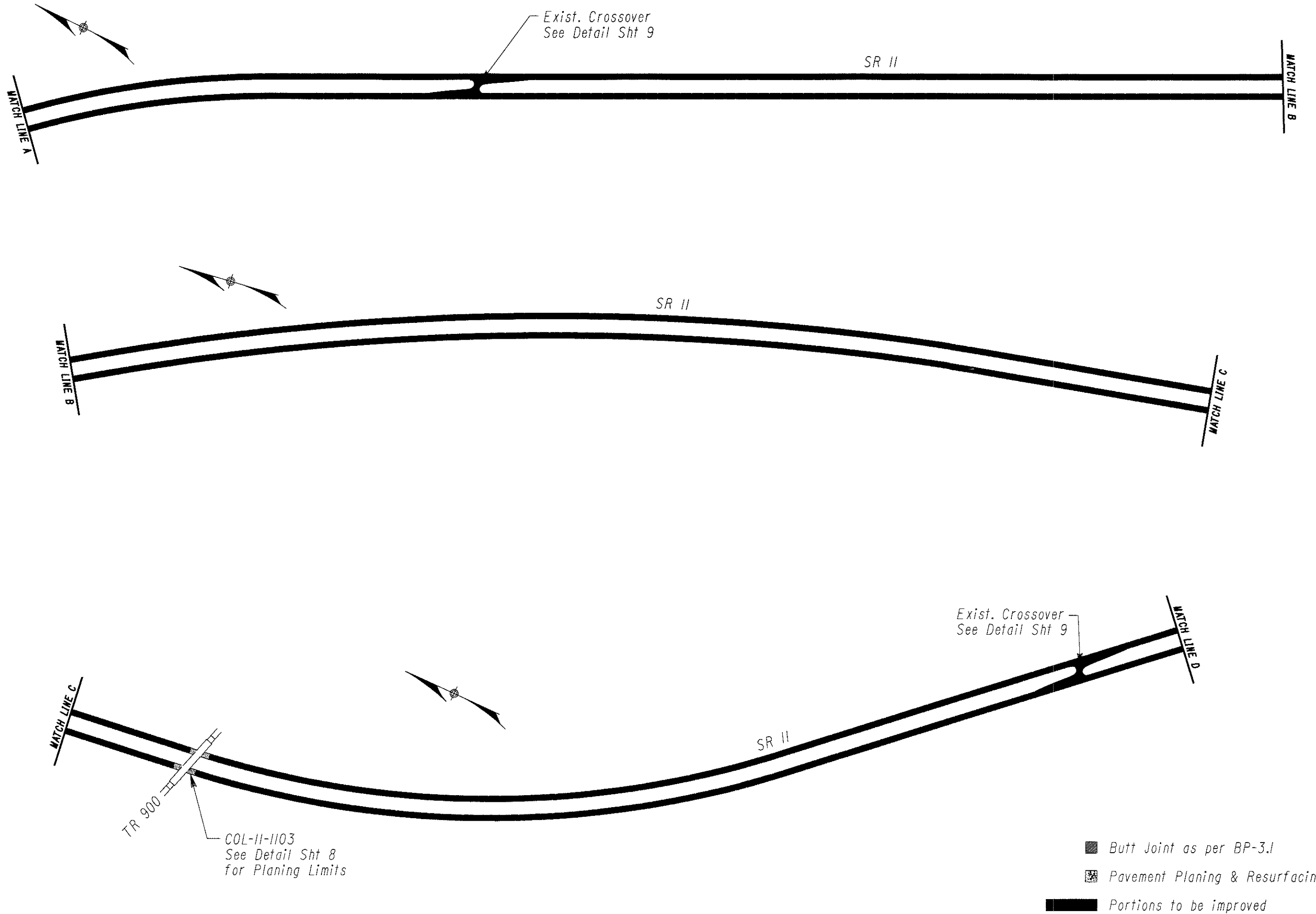
Ramp C

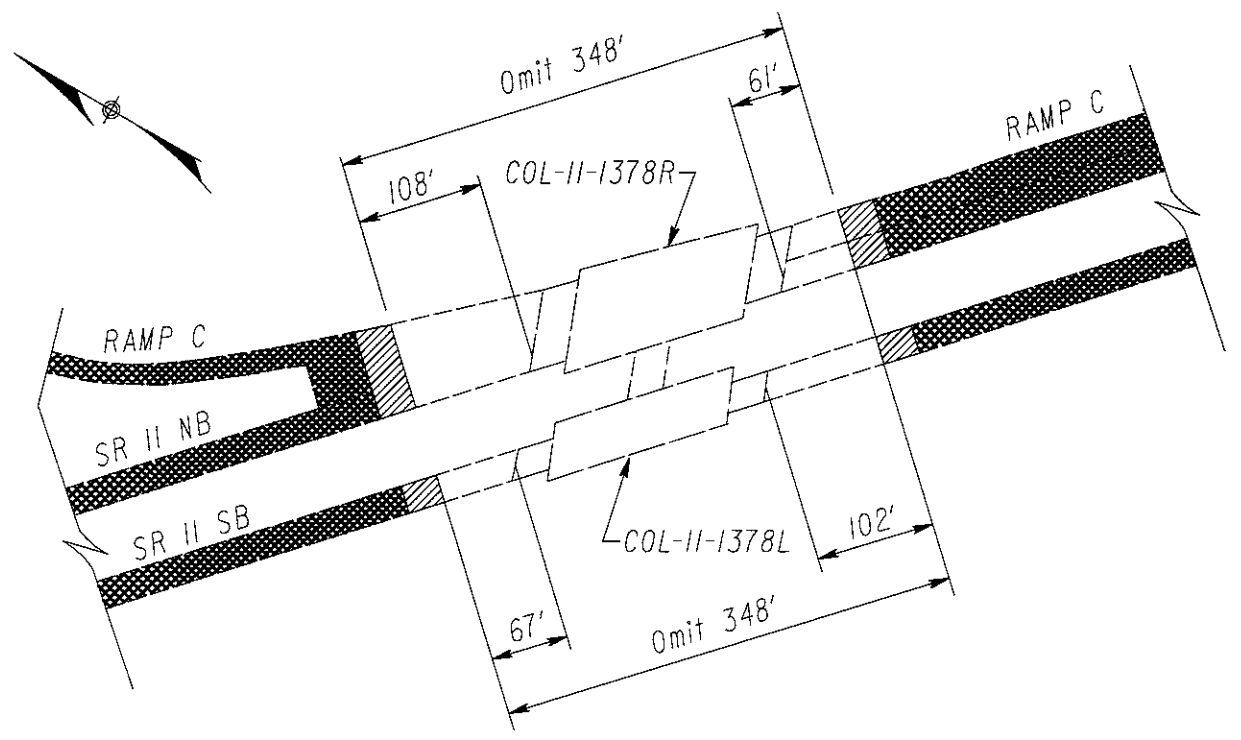
US 30

SR 45

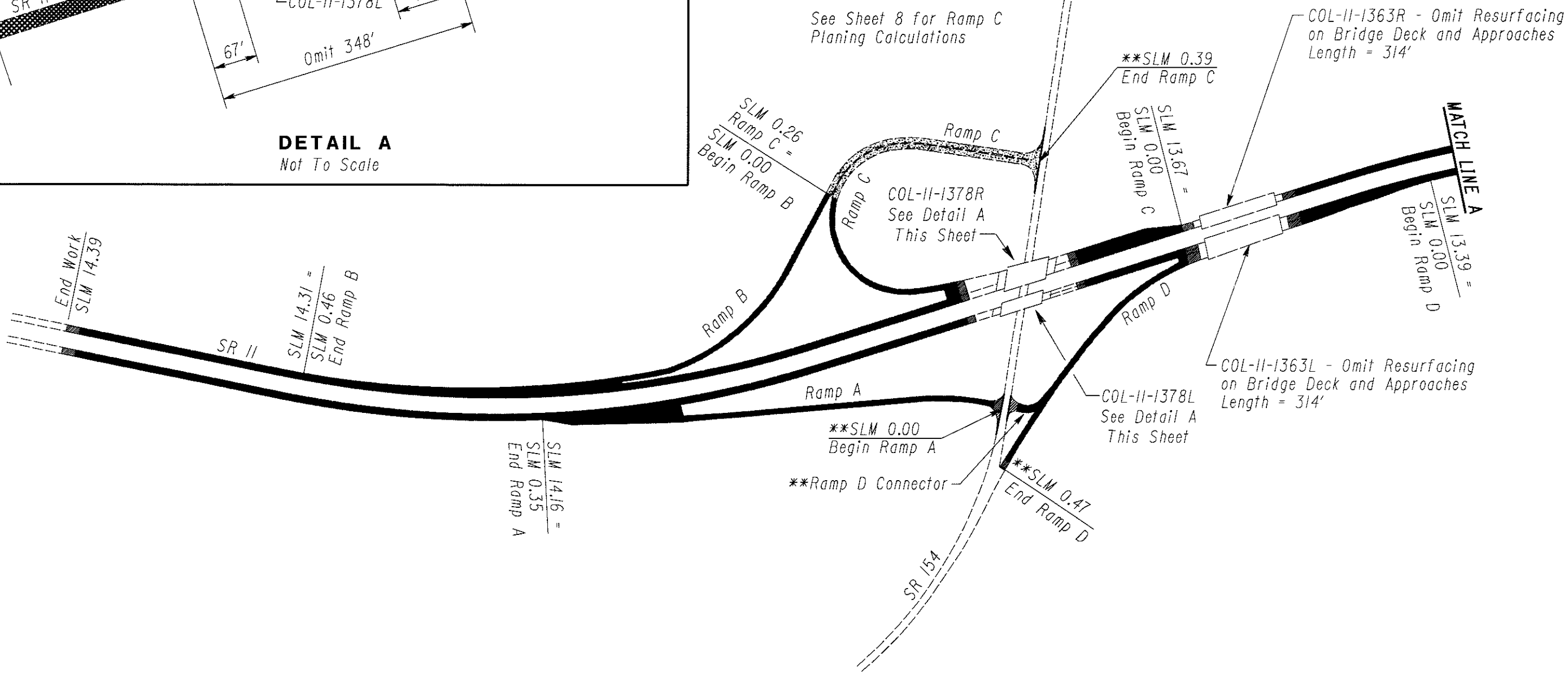
-  Butt Joint as per BP-3.1
-  Pavement Planing & Resurfacing
-  Portions to be improved

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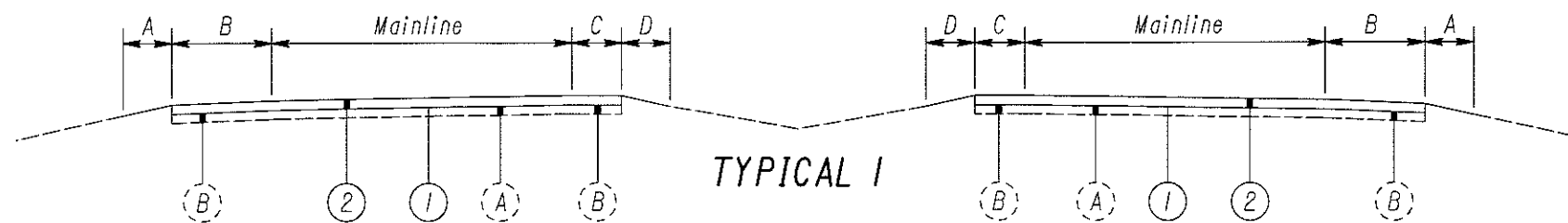




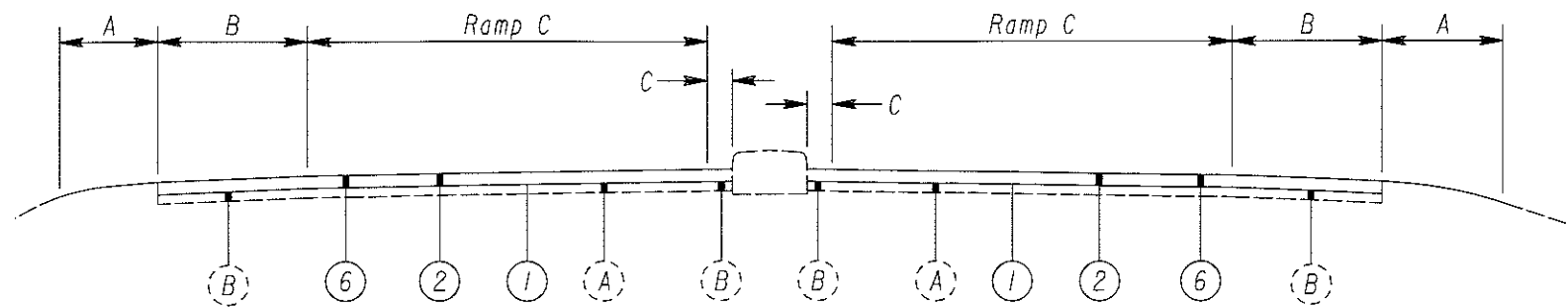
DETAIL A
Not To Scale



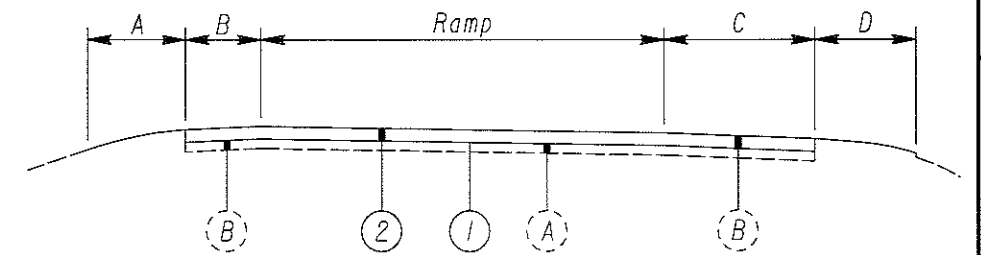
- ** See Sheet 10 for Intersection Detail
- Butt Joint as per BP-3.1
- ▨ Pavement Planing & Resurfacing
- Portions to be improved



TYPICAL 1



TYPICAL 3



TYPICAL 2

SHOULDER PREPARATION

This work will be in accordance with CMS Item 617, with special attention given to Section 617.04. The work done will be in reasonably close conformity with the lines and typical sections shown on the plans or established by the Engineer.

ITEM 408 - PRIME COAT, AS PER PLAN

The Contractor will apply "MC-70" at a rate of 0.4 gallons per square yard, or as determined by the Engineer, to the completed compacted aggregate shoulder.

SHIELD

The Contractor shall provide a shield to prevent the spraying or drifting of liquid bituminous material onto the edge of the pavement or edgeline. The attention of the Contractor is directed to 107.10 of the specifications.

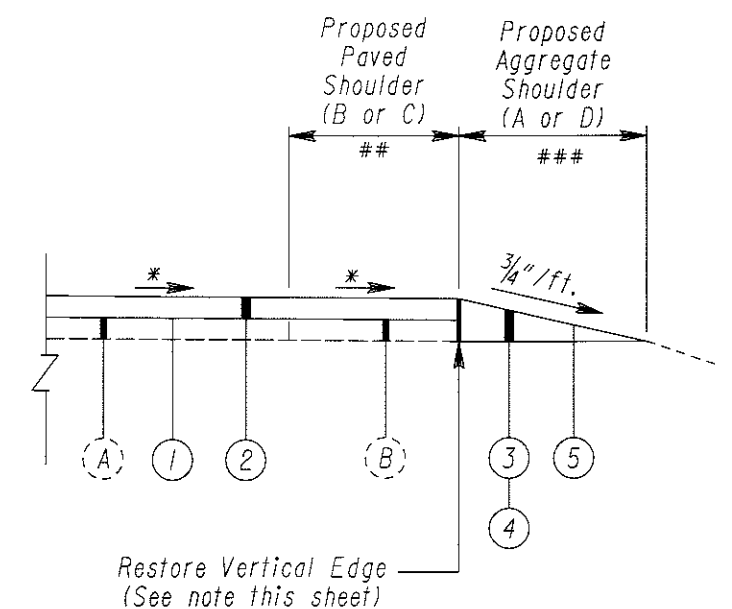
* Maintain Existing Cross-Slope

See Shoulder Data Sheet

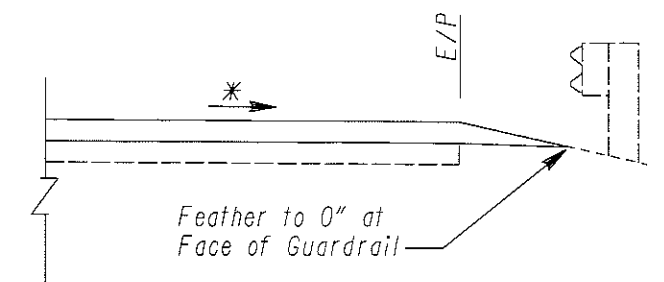
See Shoulder Data Sheet or as directed by the Engineer

LEGEND

- (1) — Item 407- Tack Coat (0.075 Gal/S.Y.)
- (2) — Item 442- 1 1/4" Asphalt Concrete Surface Course, 12.5MM, Type B (448), As Per Plan
- (3) — Item 617 - Compacted Aggregate
- (4) — Item 617 - Shoulder Preparation
- (5) — Item 408 - Prime Coat, As Per Plan
- (6) — Item 254 - Pavement Planing, Asphalt Concrete
- (A) — Existing Asphalt Concrete
- (B) — Existing Paved Shoulder



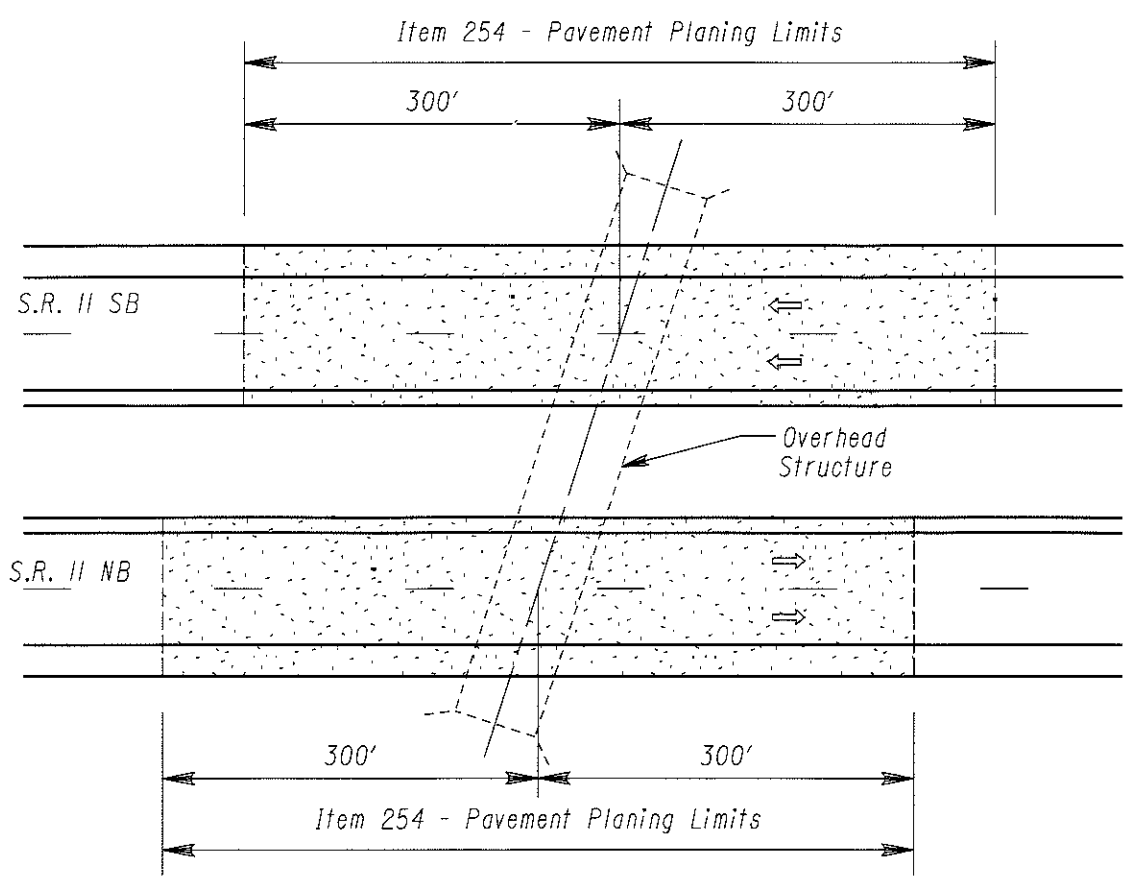
PAVED SHOULDER TYPICAL DETAIL



ALTERNATE SHOULDER TYPICAL

[illegible]

#BUTT JOINT AS PER STD DWG BP-3.1																				* - FOR TYPICAL SECTIONS, SEE SHEET 5								## - FOR SHOULDER PLANING DETAILS, SEE SHEET 8											
P A R T	ROUTE	LOG POINT TO LOG POINT		LENGTH		* T Y P I C A L	PROPOSED WIDTH				PAVED SHOULDER AREA	AGGREGATE SHOULDER AREA	202	254	407	442		617	617	618	408																		
							#WEARING COURSE REMOVED	##PAVEMENT PLANING, ASPHALT CONCRETE	TACK COAT @ 0.075 GAL/SY	ASPHALT CONCRETE SURFACE COURSE, 12.5 MM , TYPE B (448), AS PER PLAN			SHOULDER PREPARATION	COMPACTED AGGREGATE, TYPE A 1 1/4" AVG. THICKNESS	RUMBLE STRIPS, TYPE 2 (ASPHALT CONCRETE)	PRIME COAT @ 0.40 GAL/SY																							
										THICK INCHES																													
		MILE	FEET	A	B					C							D	SQ YD	SQ YD	SQ YD	SQ YD	GALLON	AVG.	CU YD	SQ YD	CU YD	FT	GALLON											
STRAIGHT LINE MILEAGE																																							
1	SR 11 NB	9.58	14.39	4.81	25397	1		8.0	4.0		33863		42	1600	2540	1 1/4	1176			50794																			
							2.0			2.0		11288						11288	392	4515																			
	BRIDGE COL-11-1363R OMISSION			(0.06)	(314)			(8.0)	(4.0)		(419)				(31)	1 1/4	(15)																						
	BRIDGE COL-11-1378R OMISSION			(0.07)	(348)			(8.0)	(4.0)		(464)				(35)	1 1/4	(16)																						
	RAMP B	0.00	0.46	0.46	2429	2		3.0	6.0		2429				182	1 1/4	84																						
							2.0			2.0		1079						1079	37	432																			
	RAMP C	0.00	0.26	0.26	1373	2		3.0	6.0		1373		31		103	1 1/4	48																						
							2.0			2.0		610						610	21	244																			
		0.26	0.37	0.11	581	3		6.0	1.0		452			452	34	1 1/4	16																						
											2.0						129		4		52																		
												2.0						129		4		52																	
			0.37	0.39	0.02	106	3		6.0	1.0		206			206	15	1 1/4	7																					
							2.0	2.0				47						47	2	19																			
	BRIDGE COL-11-1378R OMISSION			(0.07)	(348)			(3.0)	(6.0)		(348)				(26)	1 1/4	(12)																						
	SR 11 SB	9.58	14.39	4.81	25397	1		8.0	4.0		33863		42	1600	2540	1 1/4	1176			50794																			
							2.0			2.0		11288						11288	392	4515																			
	BRIDGE COL-11-1363L OMISSION			(0.06)	(314)			(8.0)	(4.0)		(419)				(31)	1 1/4	(15)																						
	BRIDGE COL-11-1378L OMISSION			(0.07)	(348)			(8.0)	(4.0)		(464)				(35)	1 1/4	(16)																						
	RAMP A	0.00	0.01	0.01	53	2		3.0	6.0		92		31		7	1 1/4	3																						
							2.0			2.0		23						23	1	9																			
		0.01	0.35	0.34	1795	2		3.0	6.0		1795		31		135	1 1/4	62																						
							2.0			2.0		798						798	28	319																			
	RAMP D	0.00	0.47	0.47	2482	2		3.0	6.0		2482		31		186	1 1/4	86																						
							2.0			2.0		1103						1103	38	441																			
	BRIDGE COL-11-1363L OMISSION			(0.06)	(314)			(3.0)	(6.0)		(314)				(24)	1 1/4	(11)																						
	RAMP D CONNECTOR	0.00	0.02	0.02	106	2		3.0	3.0		82		21		6	1 1/4	3																						
							2.0			2.0		47						47	2	19																			
	TOTALS			10.93	57731						74661	26541	229	4310	5600		2592	26541	921	101588	10617																		



MAINLINE PAVEMENT PLANING DETAIL

SR II NB

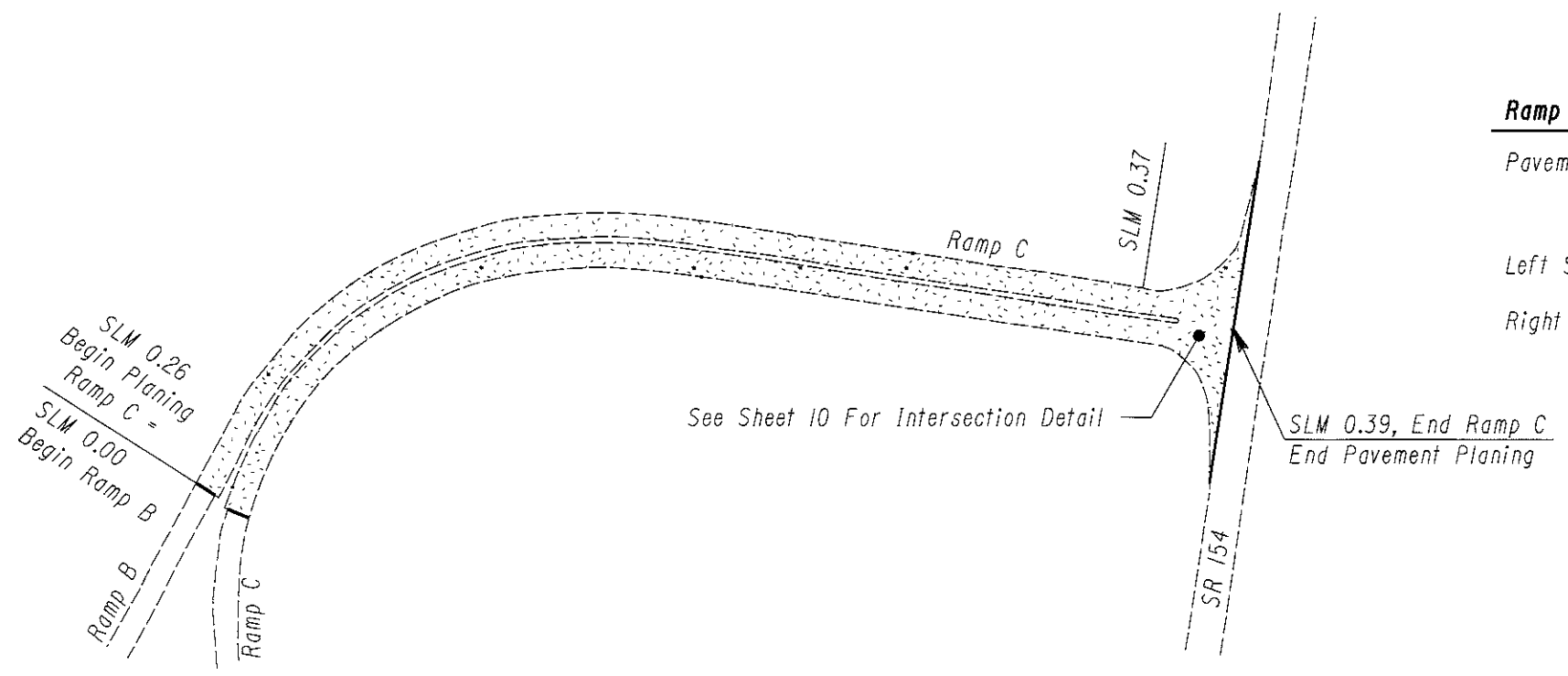
COL-II-0982 - Pavement - $(600' \times 24')/9 = 1600 \text{ Sq.Yd.}$
 COL-II-1103 - Pavement - $(600' \times 24')/9 = 1600 \text{ Sq.Yd.}$
 3200 Sq.Yd. Subtotal Carried To Pavement Data Sheet

COL-II-0982 - Shoulders - $(600' \times (8'+4'))/9 = 800 \text{ Sq.Yd.}$
 COL-II-1103 - Shoulders - $(600' \times (8'+4'))/9 = 800 \text{ Sq.Yd.}$
 1600 Sq.Yd. Subtotal Carried To Shoulder Data Sheet

SR II SB

COL-II-0982 - Pavement - $(600' \times 24')/9 = 1600 \text{ Sq.Yd.}$
 COL-II-1103 - Pavement - $(600' \times 24')/9 = 1600 \text{ Sq.Yd.}$
 3200 Sq.Yd. Subtotal Carried To Pavement Data Sheet

COL-II-0982 - Shoulders - $(600' \times (8'+4'))/9 = 800 \text{ Sq.Yd.}$
 COL-II-1103 - Shoulders - $(600' \times (8'+4'))/9 = 800 \text{ Sq.Yd.}$
 1600 Sq.Yd. Subtotal Carried To Shoulder Data Sheet



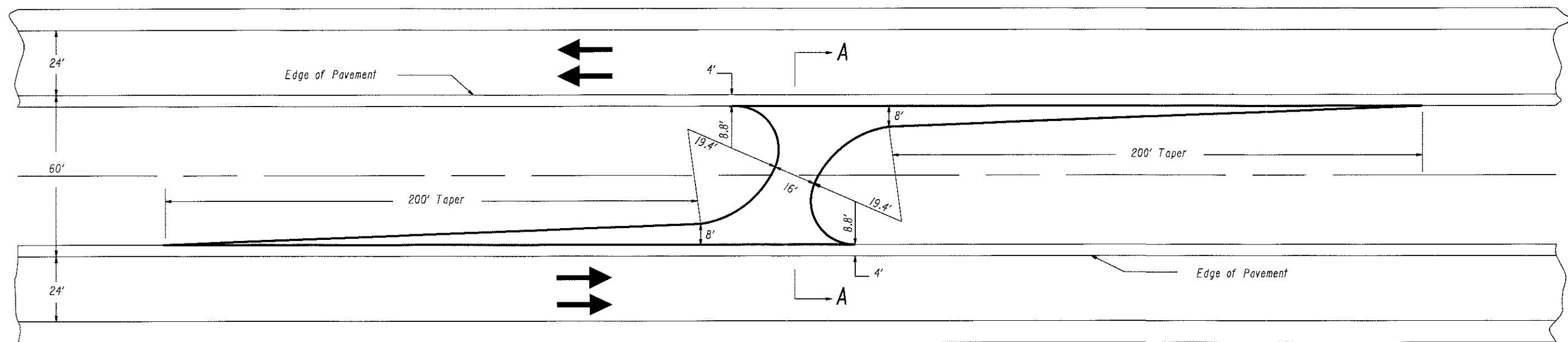
Ramp C - From SLM 0.26 to SLM 0.37 - 0.11 Mi. - 581'

Pavement - $(581' \times (16'+16'))/9 = 2066 \text{ Sq.Yd.}$
 Carried to Pavement Data Sheet

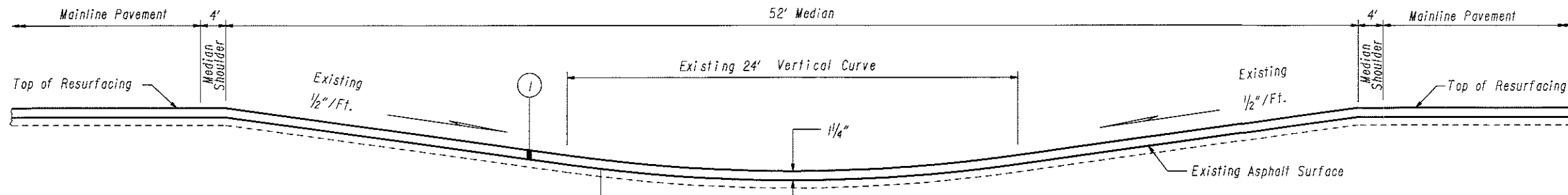
Left Shoulders - $(581' \times (6'+1'))/9 = 452 \text{ Sq.Yd.}$ Carried To Shoulder Data Sheet

Right Shoulder - $(581' \times (6'+1'))/9 = 452 \text{ Sq.Yd.}$ Carried To Shoulder Data Sheet

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PLAN
(Not to Scale)



SECTION A-A
(Not to Scale)

LEGEND

- 1 — Item 442, 1 1/4" Asphalt Concrete Surface Course, 12.5 MM, Type B (448), As Per Plan
- 2 — Item 407, Tack Coat (0.075 gal/sq.yd.)

CALCULATIONS

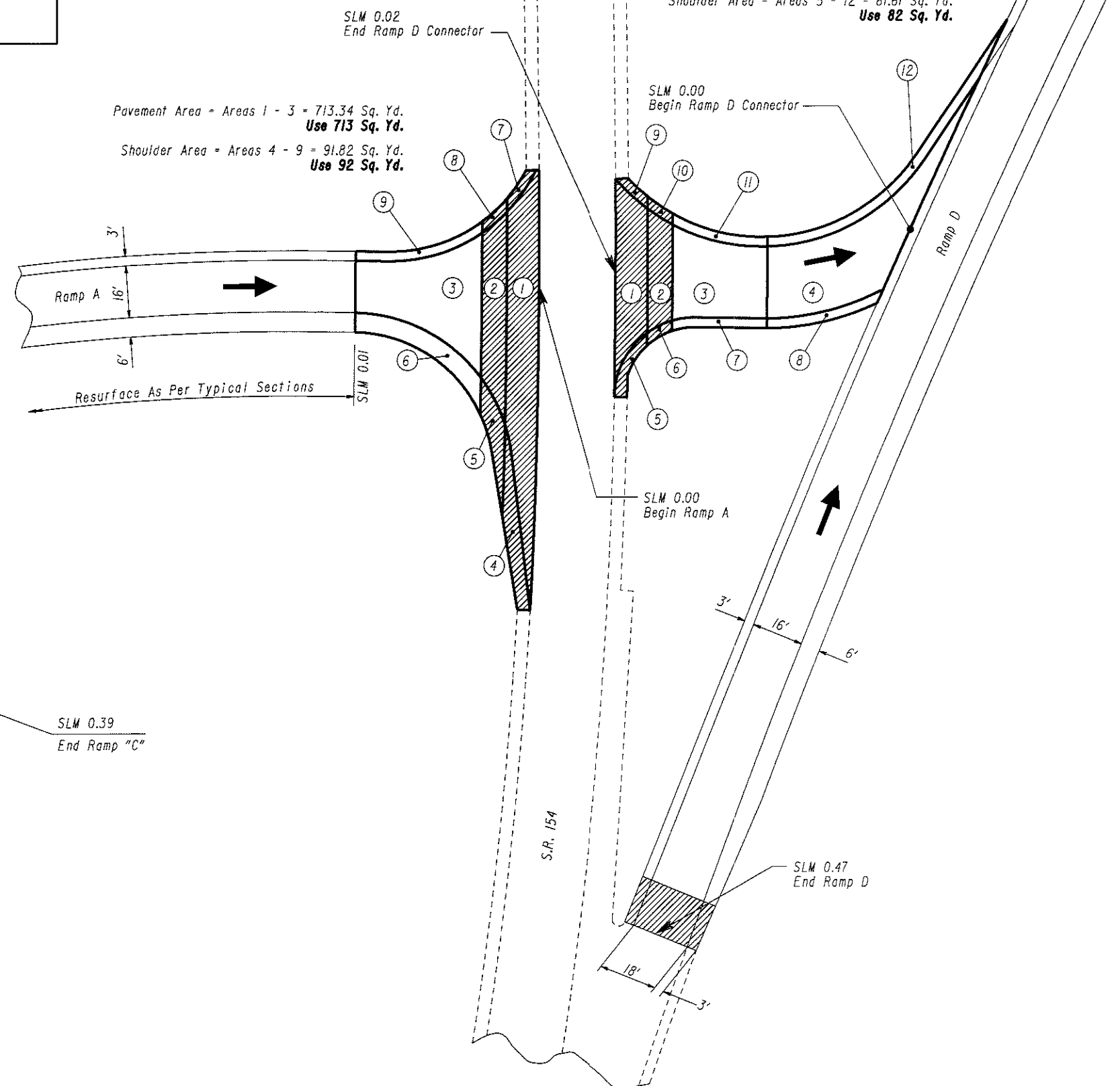
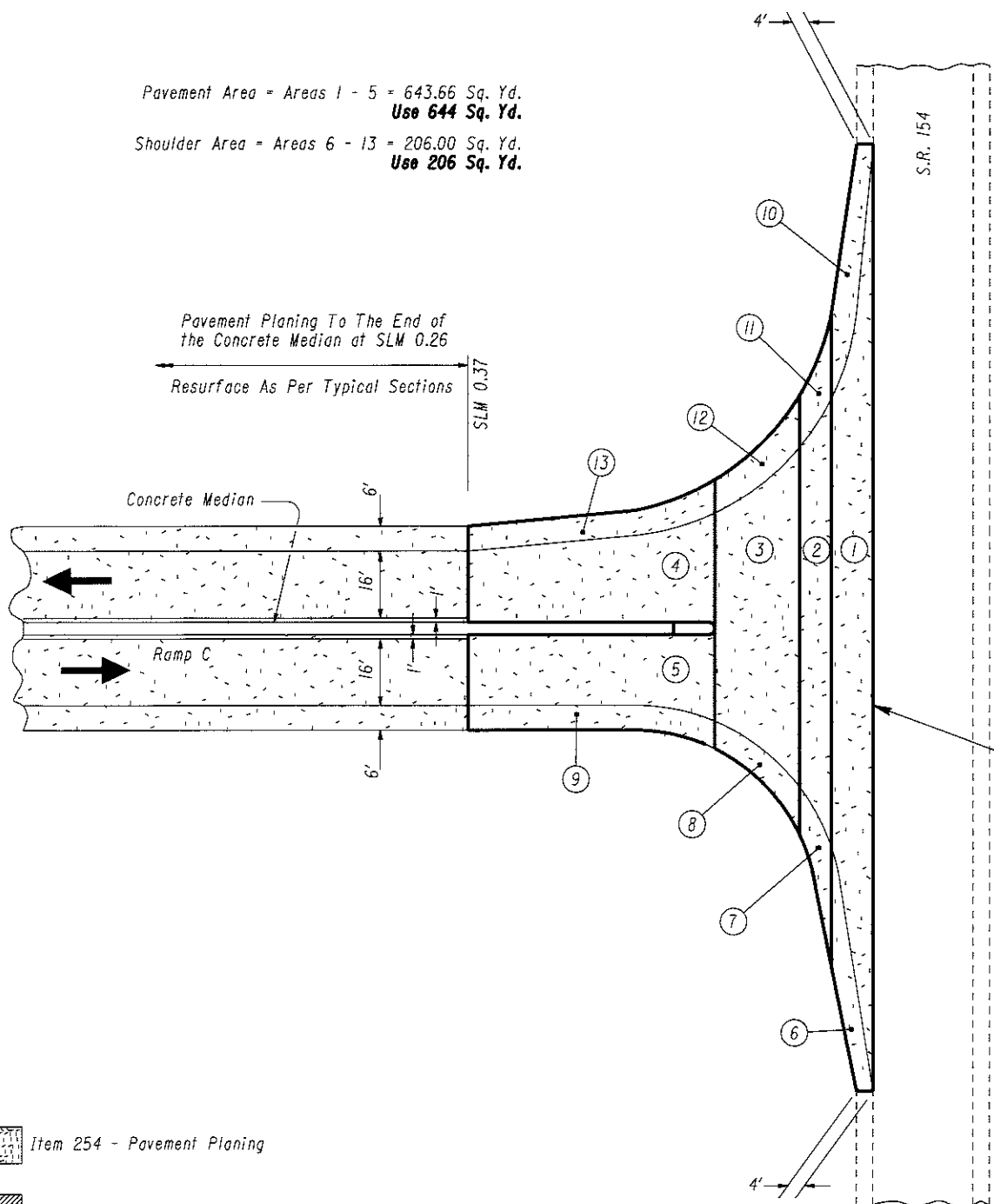
Planimetered Area = 793.21 Sq. Ft.
Item 407: 793.21 Sq. Ft. ÷ 9 x 0.075 Gal/Sq. Yd. x 2 locations = 13.2 Gal.
Use 13 Gal.
Item 442: 793.21 Sq. Ft. x 1.25" ÷ 12 ÷ 27 x 2 locations = 6.1 Cu. Yd.
Use 6 Cu. Yd.

(Quantities Carried to General Summary)

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Areas Used in Resurfacing Calculations. Totals carried to Sheets 6 & 7.

Location	Area ① Sq. Yd.	Area ② Sq. Yd.	Area ③ Sq. Yd.	Area ④ Sq. Yd.	Area ⑤ Sq. Yd.	Area ⑥ Sq. Yd.	Area ⑦ Sq. Yd.	Area ⑧ Sq. Yd.	Area ⑨ Sq. Yd.	Area ⑩ Sq. Yd.	Area ⑪ Sq. Yd.	Area ⑫ Sq. Yd.	Area ⑬ Sq. Yd.
Ramp "A"	110.63	496.76	105.95	23.87	15.75	31.40	3.96	3.24	13.60				
Ramp "C"	173.17	80.10	142.12	133.31	114.96	24.46	16.06	18.19	39.98	30.61	13.13	21.99	41.58
Ramp "D" Conn.	54.07	28.86	79.09	132.17	7.39	2.96	9.83	12.17	3.67	3.09	10.22	32.28	



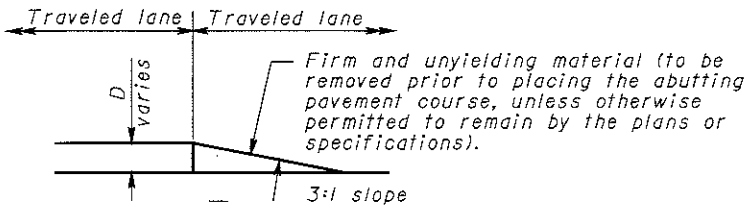
- Item 254 - Pavement Planing
- Butt Joint as per BP-3.1

GENERAL NOTES

1. It is intended that this drawing be used for treatment of drop-offs that develop during construction operations, and that are not otherwise provided for in the construction plans. The suggested treatments are intended for high volume projects that will last at least seven days and have an active work zone 1 mile [1.6 km] or less in length. For guidance on the use of this sheet, see L&D Manual Volume One, Section 500. Where the plans do not provide specific items for labor, equipment, or materials to implement the drop-off treatments specified hereon, they shall be included for payment in the lump sum bid for **Item 614 - Maintaining Traffic**.
2. While the need for certain advisory signing is noted hereon, it is not intended that this be indicative of all signing that may be required to advise or warn motorists, and all requirements of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) must be fulfilled.
3. In urban or otherwise heavily developed areas where pedestrians and/or bicyclists may be present in significant numbers, additional signing and protective measures other than those shown hereon may be required.
4. The drop-off treatment selected for use at any given location shall be as appropriate for the prevailing conditions at the site.
5. Where concrete barrier is specified, it shall be in accordance with **SCD RM-4.2** and Item 622.
6. When drums are specified for a drop-off condition, a minimum number of four drums shall be used. Spacing shall be as indicated in the plans or as specified in the OMUTCD.
7. When OW-151 (Low Shoulder) signs or OW-155 (Shoulder Drop-Off) signs or OW-171 (Uneven Lanes) signs are required, they shall be placed 750' [230 m] in advance of the condition, on all intersecting entrance ramps within the limits of the condition and immediately beyond all intersecting roadways within the limits of the condition. When the drop-off condition extends more than 0.5 mile [800 m], additional signs should be erected at intervals of 1.0 mile [1600 m] or less.
8. For locations, such as at ramps, lane shifts, lane closures, etc., where traffic is required to negotiate a difference in elevation between pavements, a 3:1 slope treatment similar to the Optional Wedge Treatment shall be provided.
9. Portable concrete barrier shall be placed on the same level as the traffic surface and shall not encroach on lane width(s) designated as the minimum required for traffic use. Where drums are used, and their presence would reduce traveled lane widths to less than 10' [3.0 m], drums may be placed on the opposite level from that of traffic provided the dropoff depth does not exceed 5" [125] and approval is granted by the Project Engineer.
10. Pavement Repairs (or similar work):
a. Lengths greater than 60' [18 m] - utilize appropriate treatment from Condition I.
b. Lengths of 60' [18 m] or less - repairs shall be effected in accordance with CMS 255.08. Drums may be used as a separator adjacent to the traveled lane.

OPTIONAL WEDGE TREATMENT
(MILLING OR RESURFACING)

1. This treatment may be used when permitted for Condition I only.
2. OW-171 sign required.



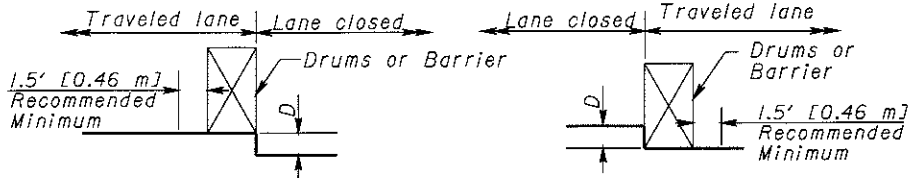
CONDITION I

DROP-OFFS BETWEEN TRAVELED LANES

1. These treatments are to be used for resurfacing, pavement planing, excavation, etc. between or within traveled lanes.

D	Treatment
≤ 1 1/2" [≤ 40]	Erect OW-171 sign.
1 1/2"-3" [40-75]	1) Lane closure utilizing drums* as shown below OR 2) Optional Wedge Treatment
> 3"-5" [75-125]	Lane closure utilizing drums as shown below.
> 5" [≥ 125]	Lane closure utilizing portable concrete barrier as shown below.

* Cones may be used for daytime only conditions.



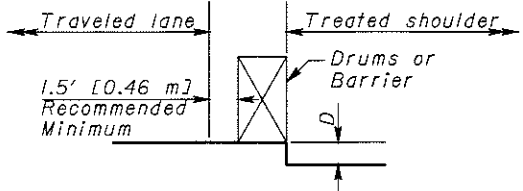
CONDITION II

DROP-OFFS WITHIN GRADED SHOULDER AREA

1. The treatments indicated below are for use in conjunction with resurfacing, planing, or excavations within the graded shoulder area.
2. The graded shoulder area is that flat or gradually sloping area between the edge of a normally traveled lane and the more steeply sloping ditch foreslope or embankment slope. Its surface may be soil or turf, and/or it may be inclusive of a "treated" area (improved with aggregates, asphaltic materials or concrete). For the purpose herein, its maximum width shall be considered to be 12' [3.6 m].

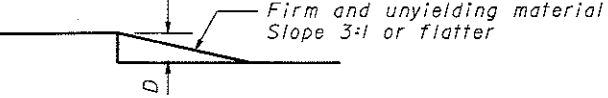
D	Treatment
≤ 1 1/2" [≤ 40]	1) Erect OW-155 signs.
> 1 1/2"-5" [40-125]	1) If minimum lane width* requirements can be met, maintain lanes utilizing drums as shown below OR 2) If minimum lane width* requirements cannot be met, close adjacent lane utilizing drums OR 3) Optional Shoulder Treatment.
> 5"-12" [125-305] Daylight only	If minimum lane width* requirements can be met, maintain lanes utilizing drums as shown below.
> 5"-24" [125-610]	1) If minimum lane width* requirements can be met, maintain lanes utilizing portable concrete barrier as shown below. OR 2) If minimum lane width* requirements cannot be met, close adjacent lane utilizing drums.
> 24" [≥ 610]	Lane closure utilizing portable concrete barrier as shown below.

* Minimum lane widths shall be 10' [3.0 m] unless otherwise specified in the plans.



OPTIONAL SHOULDER TREATMENT

1. This treatment may not be used within a bituminous shoulder where a hot longitudinal joint per CMS 401.15 is required.
2. OW-151 signs required.



CONDITION III

DROP-OFFS BEYOND GRADED SHOULDER OR BACK OF CURB

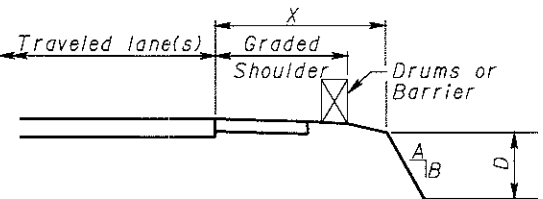
1. See Note 2 under Condition II.
2. Use Chart A or B below, as applicable.

CHART A

USE FOR: 1. Uncurbed Facilities.

2. Curbed Facilities, where:

- a. Curbs are less than 6" [150] in height.
b. Curbs are 6" [150] or greater in height and the legal speed is greater than 40 mph [70 km/h].

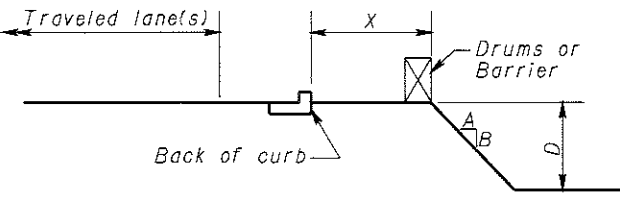


X	D	A/B	Treatment Required	
			Day	Night
0-4' [0-1.2 m]	Any	Any	(a)	(a)
4'-30' [1.2-9.1 m]	Any	3:1 or Flatter	None	None
4'-12' [1.2-3.6 m]	< 3" [≤ 75]	Steeper than 3:1	None	None
4'-12' [1.2-3.6 m]	> 3"-< 12" [75-305]	Steeper than 3:1	Drums	Drums
4'-12' [1.2-3.6 m]	> 12" [≥ 305]	Steeper than 3:1	Drums	Barrier
> 12'-20' [3.6-6.1 m]	< 12" [≤ 305]	Steeper than 3:1	None	None
> 12'-20' [3.6-6.1 m]	> 12"-< 24" [305-610]	Steeper than 3:1	Drums	Drums
> 12'-20' [3.6-6.1 m]	> 24" [≥ 610]	Steeper than 3:1	Drums	Barrier
> 20'-30' [6.1-9.1 m]	< 24" [≤ 610]	Steeper than 3:1	None	None
> 20'-30' [6.1-9.1 m]	> 24" [≥ 610]	Steeper than 3:1	Drums	Barrier
> 30' [≥ 9.1 m]	Any	Any	None	None

(a) Use treatment specified under Condition II.

CHART B

USE FOR: Curbed facilities, where the curb is 6" [150] or greater in height and the legal speed is 40 mph [70 km/h] or less.



X	D	A/B	Treatment Required	
			Day	Night
0-10' [0-3.0 m]	< 12" [≤ 305]	Any	None	Drums
0-10' [0-3.0 m]	> 12" [≥ 305]	Any	Drums	Drums
> 10' [≥ 3.0 m]	Any	Any	None	None

NOTE: All metric dimensions (in brackets []) are in millimeters unless otherwise noted.

PROFILE AND ALIGNMENT

The proposed pavement resurfacing shall follow the Alignment and Profile of the existing pavement. The proposed asphalt concrete overlay shall have a uniform surface course thickness and varying intermediate course thickness as show on the pavement data sheets.

SURFACE COURSE COMPLETION REQUIREMENTS

Any given length of work on which resurfacing operations have been started in a construction season shall have the surface course placed that same season.

CONTINGENCY QUANTITIES

The Contractor shall not order materials or perform work for items designated by plan note to be used "As Directed by the Engineer" unless authorized by the Engineer. The actual work locations and quantities used for such items shall be incorporated into the final change order governing completion of this project

CONVERSION OF METRIC STANDARD DRAWINGS

The metric standard drawings referenced on the Title Sheet shall be converted to English units using the SI (Metric) to English Conversion Factors provided in Section 109.02 of the 2002 Construction and Materials Specifications. The appendix of ASTM E 380 shall be utilized for any additional conversion factors required. Conversions shall be appropriately precise, and shall reflect standard industry English values where suitable.

ITEM 614 - MAINTAINING TRAFFIC

Traffic shall be maintained at all times as described below and in accordance with the specifications of Item 614 and the Ohio Manual of Uniform Traffic Control Devices. The length of restricted traffic zones shall be kept to a minimum. When raised pavement markers are to be installed the required lane closure shall remain in effect until the epoxy is dry and all foreign matter or debris created by the installation of the RPM casting is removed from the roadway.

A minimum of 1 lane of traffic in each direction shall be maintained at all times by use of the existing pavement or the completed pavement.

All planed surfaces shall be resurfaced prior to the lane reopening for use by traffic.

No work shall be performed and all existing lanes shall be open to traffic during the following designated holidays or events:

Memorial day Fourth of July
Labor day

The period of time that the lanes are to be open depends on the day of the week on which the holiday or event falls. The following schedule shall be used to determine this period:

Day of the Week	Time all lanes must be open to traffic
Sunday	12:00n Friday through 6:00 am Monday
Monday	12:00n Friday through 6:00 am Tuesday
Tuesday	12:00n Monday through 6:00 am Wednesday
Wednesday	12:00n Tuesday through 6:00 am Thursday
Thursday	12:00n Wednesday through 6:00am Monday
Friday	12:00n Thursday through 6:00 am Monday
Saturday	12:00n Friday through 6:00 am Monday

No extensions of time shall be granted for delays in material deliveries, unless such delays are industry-wide, or for labor strikes, unless such strikes are area wide. Should the contractor fail to meet any of these requirements, the contractor shall be assessed liquidated damages in accordance with CMS 108.07.

ITEM 614 - MAINTAINING TRAFFIC (CONT.)

All work and traffic control devices shall be in accordance with CMS 614 and other applicable portions of the specifications, as well as the Ohio Manual of Uniform Traffic Control Devices. Payment for all labor, equipment and materials shall be included in the lump sum contract price for Item 614, Maintaining Traffic, unless separately itemized in the plan.

MAINLINE

At least one lane of traffic shall be maintained in each direction at all times as per Standard Construction Drawing MT-95.30.

Construction work shall be permitted on only one side of the directional roadway at a time and any open pavement trench shall be adequately maintained and protected with barricades, drums or vertical panels. Under no circumstances shall the Contractor be permitted to have work zones that alternately close both the passing lane and the travel lane unless the distance between the lane restrictions exceeds two (2) miles.

RAMPS

Ramp traffic shall be maintained by use of portions of the existing and/or resurfaced pavement and existing shoulders.

Ramp traffic may be stopped by means of flaggers for intermittent periods not to exceed ten (10) minutes during ramp shoulder reconstruction operations.

However, in no case shall traffic be permitted to form a queue which extends beyond the limits of the ramp onto the speed change lane, mainline or crossroad pavement. The limits and duration of any traffic stoppage shall at all times be subject to the direction of the Engineer.

All work and traffic control devices shall be in accordance with CMS 614 and other applicable portions of the specifications, as well as the Ohio manual of Uniform Traffic Control Devices. Payment for all labor, equipment and materials shall be included in the lump sum contract price for item 614, maintaining traffic, unless separately itemized in the plan.

GRINDINGS FROM PLANING OPERATIONS

The grindings shall become the property of the Contractor and be disposed of at his expense outside of the limits of Right of Way, with the following exceptions; 2500 tons delivered by the Contractor to the Apples Corners Outpost, 14745 Old Lincoln Highway, East Liverpool, Ohio, phone (330) 385-9776 and 6500 tons delivered by the Contractor to the Columbiana County Garage, 33600 US 30 Route 1, Lisbon, Ohio, phone (330) 424-7253.

ITEM 442- ASPHALT CONCRETE SURFACE COURSE, 12.5 mm, TYPE B, AS PER PLAN

Materials furnished for fine and coarse aggregates used in this item shall exclude all stone and crushed carbonate stone.

ITEM 642 - TRAFFIC PAINT

The Contractor shall replace the existing pavement markings within the project limits with new pavement markings at the same locations per 641.06. See Standard Drawings TC-72.20 and TC-73.10 for pavement marking details.

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CONTRACTOR'S EQUIPMENT - OPERATION AND STORAGE

The Contractor's equipment shall be operated in the direction of traffic. A qualified Flagger shall be employed where the Contractor's equipment must merge with the traffic stream. The Contractor's equipment shall be equipped with at least one (1) amber flashing light. Pavers, rollers and other equipment may be parked in areas along the highway when pavement repair or paving operations are scheduled to occur within the next workday; otherwise the equipment shall be stored at a storage area, the location of which shall have prior approval of the Engineer. When parking along the highway, the equipment shall be parked either thirty (30) feet from the outside edge of pavement or six (6) feet behind guardrail with a minimum of 120 feet of guardrail preceding the equipment. All other equipment, including private vehicles, shall be stored at the approved Contractor's storage area.

The Contractor shall designate an individual, other than the Superintendent and subject to the approval of the Engineer, to continuously inspect all traffic control devices whenever construction work is being performed within the work limits of the project. The designated individual shall also inspect all traffic control devices at the end of each work day. The designated individual shall also be available on an around-the-clock basis to repair and/or replace damaged or missing traffic control devices. Payment for the Traffic Control Inspector shall be included in the lump sum price bid for Item 614 - Maintaining Traffic.

ITEM 614 - LAW ENFORCEMENT OFFICER WITH PATROL CAR

In addition to the requirements of CMS 614 and the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), a uniformed law enforcement officer and official patrol car with working top-mounted emergency flashing lights shall be provided for controlling traffic for the following tasks:

For lane closures: during initial set-up periods, tear down periods, substantial shifts of a closure point or when new lane closure arrangements are initiated.

Law enforcement officers (LEOs) should not be used where the OMUTCD intends that flaggers be used. The LEOs are considered to be employed by the Contractor and the contractor shall be responsible for their actions. Although they are employed by the Contractor, the Engineer shall have control over their placement. The official patrol car shall be a public safety vehicle as required by the Ohio Revised Code. The Contractor shall make arrangements for these services with:

Ohio State Highway Patrol
9423 State Route 45
Lisbon, Ohio 44432-9505
(330) 424-7783

Law enforcement officers with patrol car required by the traffic maintenance tasks above shall be paid for on a unit price (hourly) basis under Item 614, Law Enforcement Officer With Patrol Car. The following estimated quantities have been carried to the general summary.

Item 614, Law Enforcement Officer With Patrol Car - 80 hours

The hours paid shall include minimum show-up time required by the law enforcement agency involved.

If contractors wish to utilize LEOs for flagging and traffic control other than for that required in these plans, they may do so at their own expense. Payment for the excess above the contract requirements will be included under item 614, Maintaining Traffic

NOTIFICATION OF WORK ZONE LANE RESTRICTIONS

The Contractor shall notify the Engineer at least eighteen (18) days prior to implementing any work zone restrictions that will reduce the width or vertical clearance of any lane on which traffic will be maintained during construction.

The Engineer shall immediately notify the District Roadway Services Manager to advise the Office of Highway Management of the restrictions.

ITEM 614 - WORK ZONE MARKINGS AND SIGNS

The following estimated quantity has been carried to the General Summary for use as directed by the Engineer for Work Zone Marking Signs per the requirements of 614.04 and 614.11.

Item 614 - Work Zone Marking Sign 12 Each

UNDERGROUND UTILITIES

Listed below are all utilities located within the project construction limits together with their respective owners. There are no underground utilities shown on this plan. The nature of the work required by this project will not affect any known underground utilities that exist under or adjacent to the work area.

Ohio Edison
730 South Avenue
Youngstown, Ohio 44501
Phone: 330-740-7635

Time Warner Cable
755 Wick Avenue
Youngstown, Ohio 44513
Phone: 330-744-7400

Marathon Ashland Pipe Line, LLC
245 Mill Street
Lexington, Ohio 44904
Phone: 330-866-5525

AEP Ohio Power Company
47687 National Road
P. O. Box 99
St. Clairsville, Ohio 43950
Phone: 740-699-7845

AT&T Communications
908 National Road
P. O. Box 469
Bridgeport, Ohio 43912
Phone: 740-699-5635

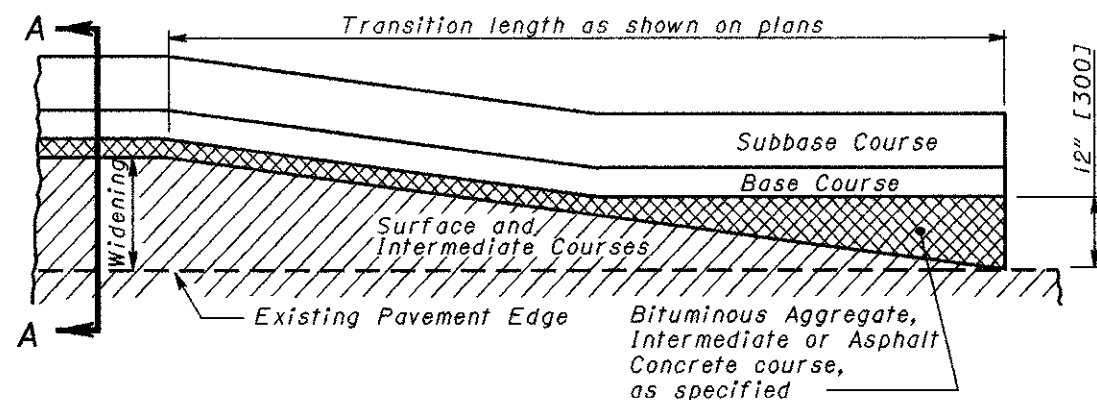
SBC
50 West Bowery Street
Akron, Ohio 44308
Phone: 330-384-8057

Columbiana County Water & Sewer District
315 South Market Street
Lisbon, Ohio 44432
Phone: 330-424-1459

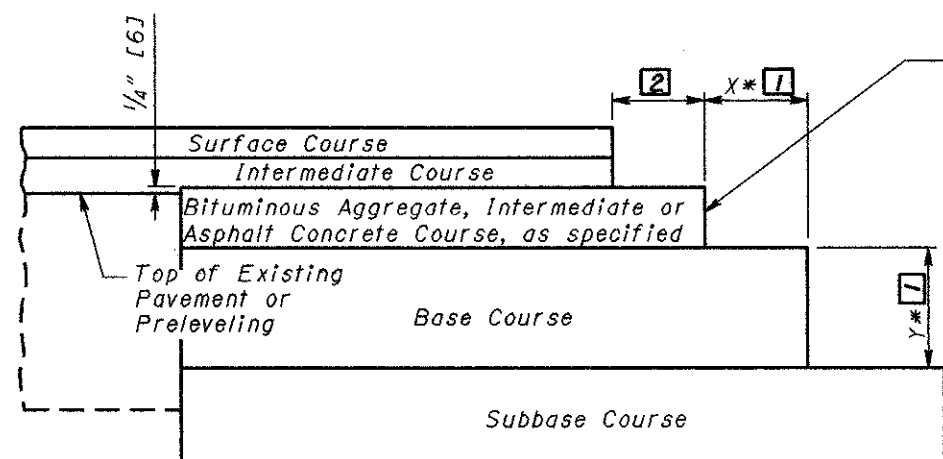
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CHK'D BY: RPT

GENERAL SUMMARY

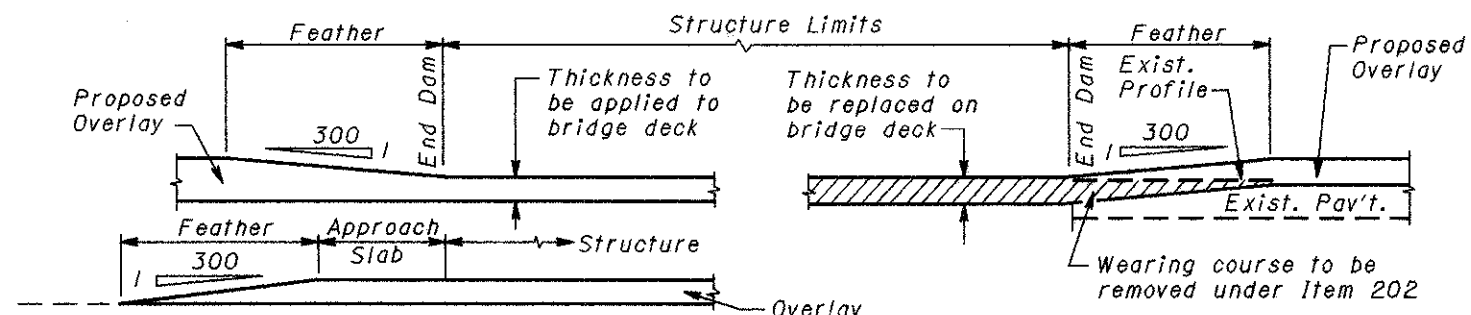
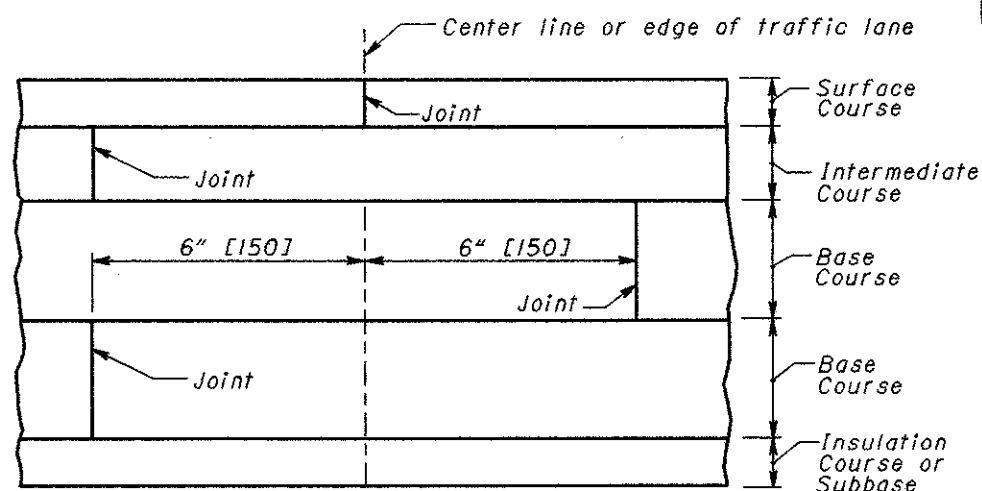
COL-11-9.58



MERGING EDGE OF PAVEMENT WIDENING
WITH EDGE OF EXISTING PAVEMENT

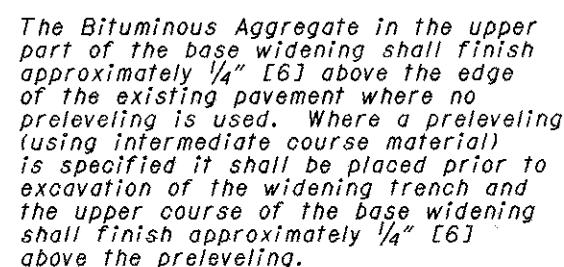


SECTION A-A
COURSE DETAIL FOR WIDENING



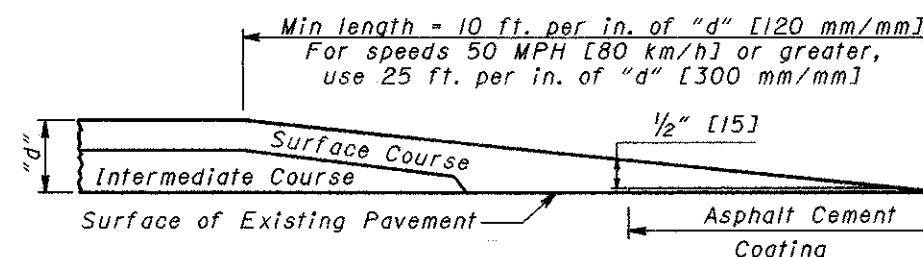
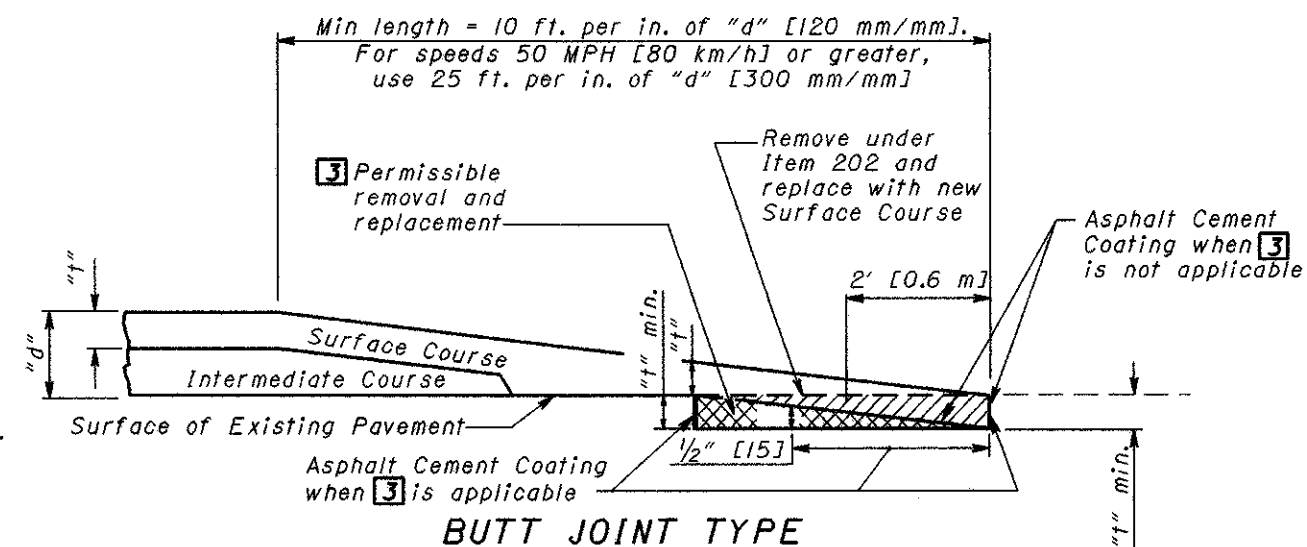
FEATHERING AT STRUCTURES

Details assume non-settled approach slabs. Smoothing of the profile for settlement is required per plan grades or as directed by the Engineer.



LEGEND

- [1]** The extended width (X) of a base or subbase course shall be equal to the depth (Y) of that particular course, unless otherwise specified in the plans.
- [2]** The extended width shall be equal to the thickness of the surface course plus the intermediate course, or 4 inches [100], whichever is greater.

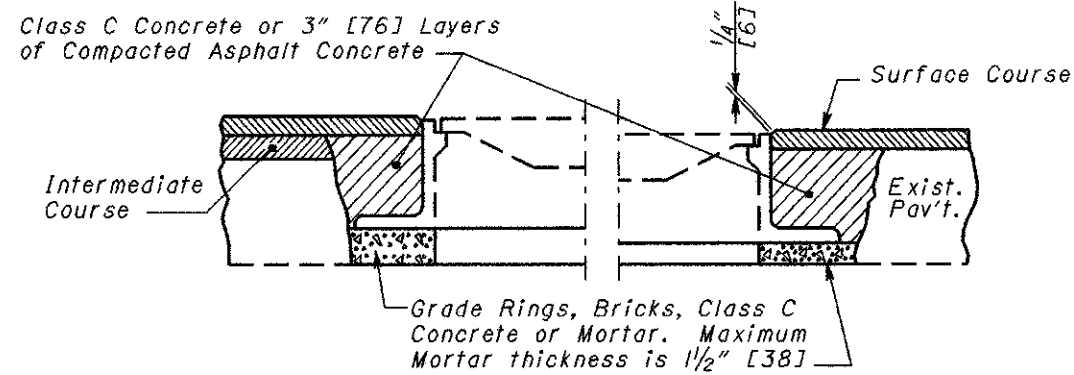


TAPER EDGE TYPE

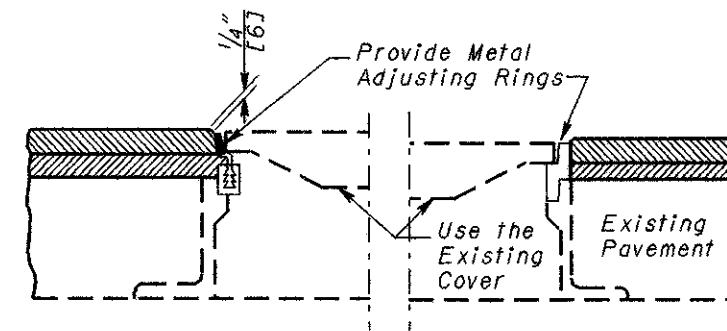
NOTE: Either butt or taper type may be used unless type is specified by the plan.

PLACING FEATHERED AREAS

Values for "t" and "d" are obtained from the plan.



USING CONCRETE OR MORTAR



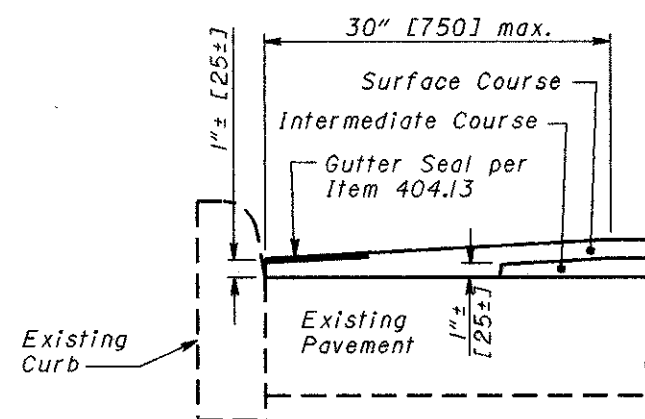
USING METAL ADJUSTING RINGS

Metal adjusting rings shall:

- (a) attach securely to the existing frame by welding or mechanical devices;
- (b) consist either of cast metal having an integral rim and seat, or be fabricated metal with a sturdy connection between the seat and rim; and
- (c) provide an even seat for the manhole cover.

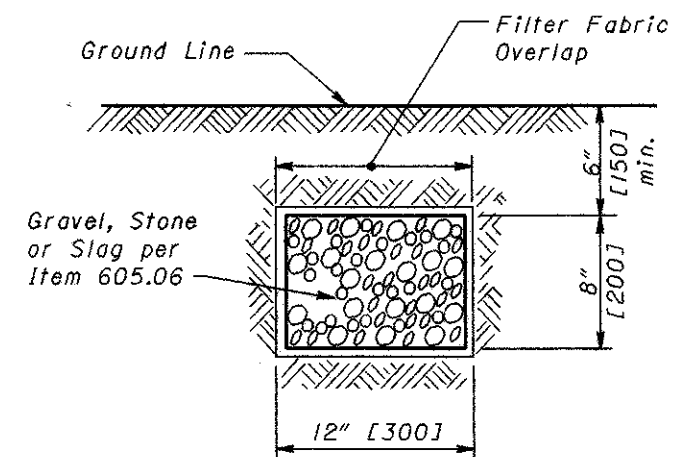
In addition, the adjusting ring type shall be a design acceptable to the local governmental agency responsible for street and sewer maintenance. Any installation unacceptable to the Engineer shall be replaced by the Contractor at his expense.

MANHOLES ADJUSTED TO GRADE



Special care shall be taken during construction to obtain maximum compaction of bituminous concrete in gutters.

GUTTER FINISH

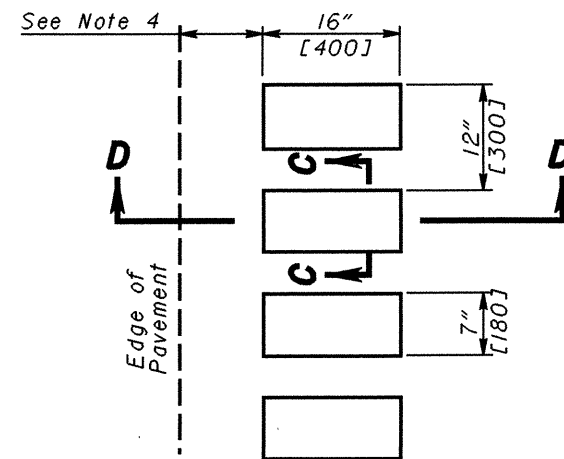


Aggregate drains to be placed where and as directed by Engineer. Provide Filter Fabric when specified as a separate pay item.

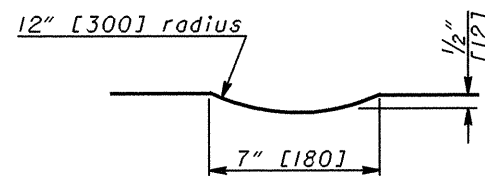
AGGREGATE DRAIN

THIS DRAWING REPLACES BP-3.1M DATED 10-28-94.

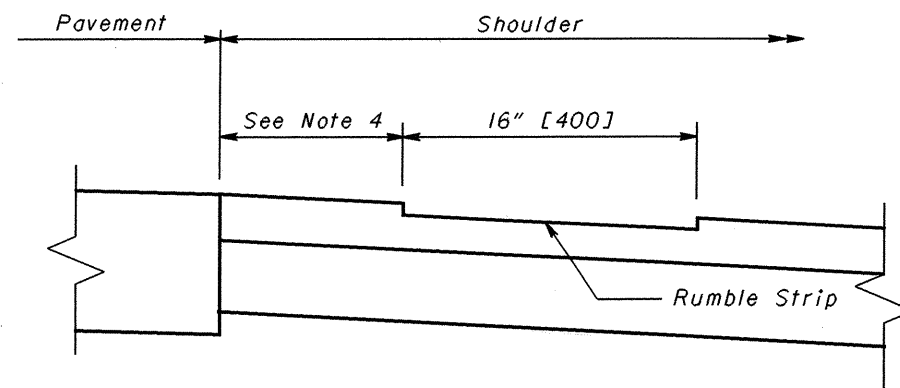
NUMBER	STANDARD ROADWAY CONSTRUCTION DRAWING	REVISIONS	DATE
BP-3.1	RESURFACING		
2			



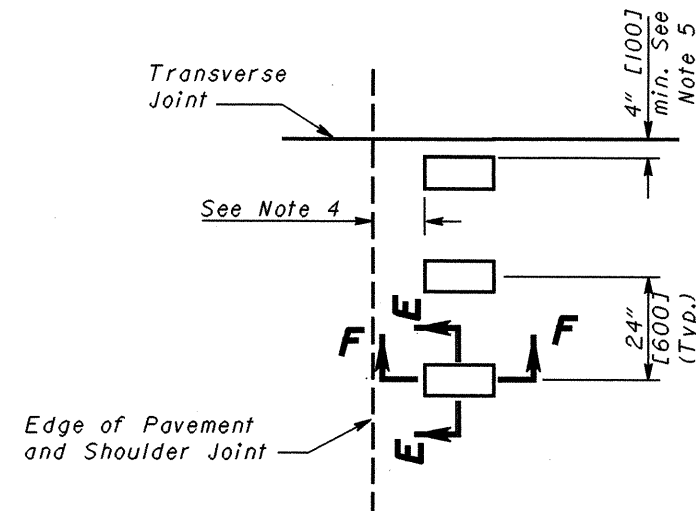
TYPICAL SPACING PLAN
TYPE 2



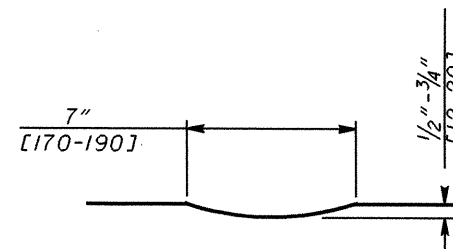
SECTION C-C



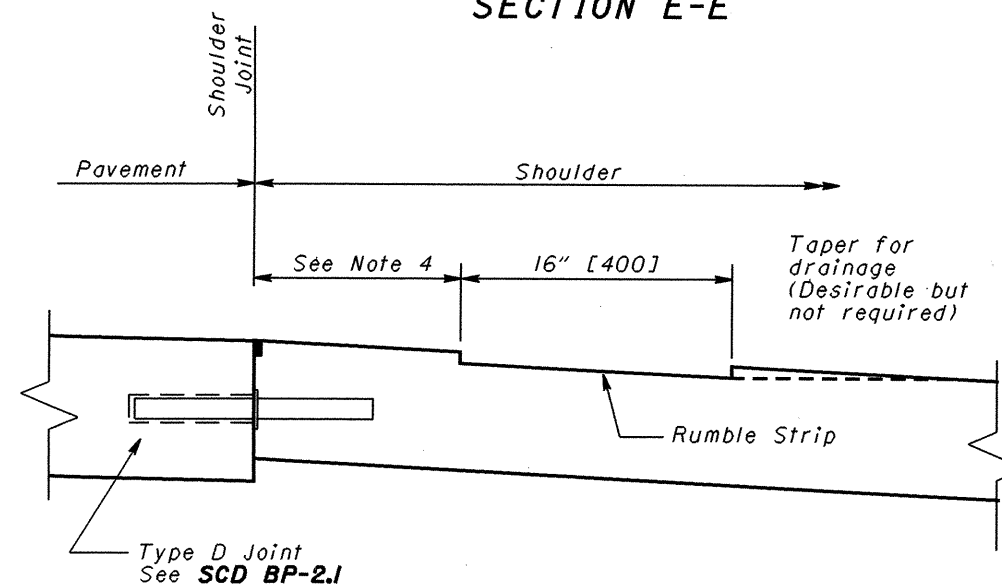
SECTION D-D



TYPICAL SPACING PLAN
TYPE 3



SECTION E-E



SECTION F-F

NOTES

1. Type 1 Rumble Strips (rolled or pressed into freshly-paved asphalt shoulders) are no longer a standard.
2. Type 2 Rumble Strips are for use on new or existing asphalt or concrete shoulders. The pattern is designed so that it can be milled or ground into the shoulder material. See specifications for details.
3. Type 3 Rumble Strips are for use on freshly-paved concrete shoulders. The pattern is designed so that it may be formed into the concrete shoulder surface prior to the material hardening. See specifications for details.
4. See Sheet 2 of 2 for Offset Dimensions.
5. A rumble strip should not be closer than 4" [100] to any joint, transverse or longitudinal, in concrete shoulders.
6. Rumble Strips are to be paid under Item 618 - Rumble Strips, Type — Lineal Feet [Meter] (Miles [Kilometers]).

THIS DRAWING REPLACES BP-9.I DATED 7-28-00.

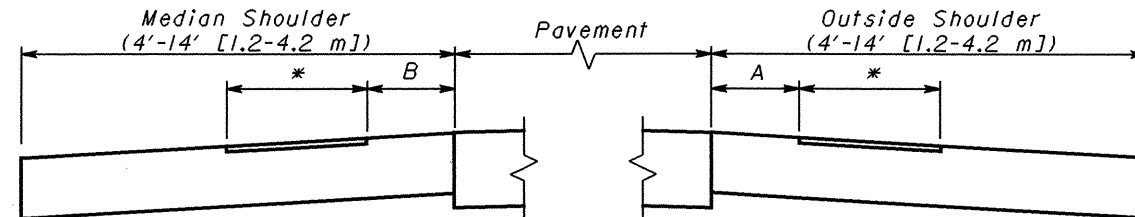
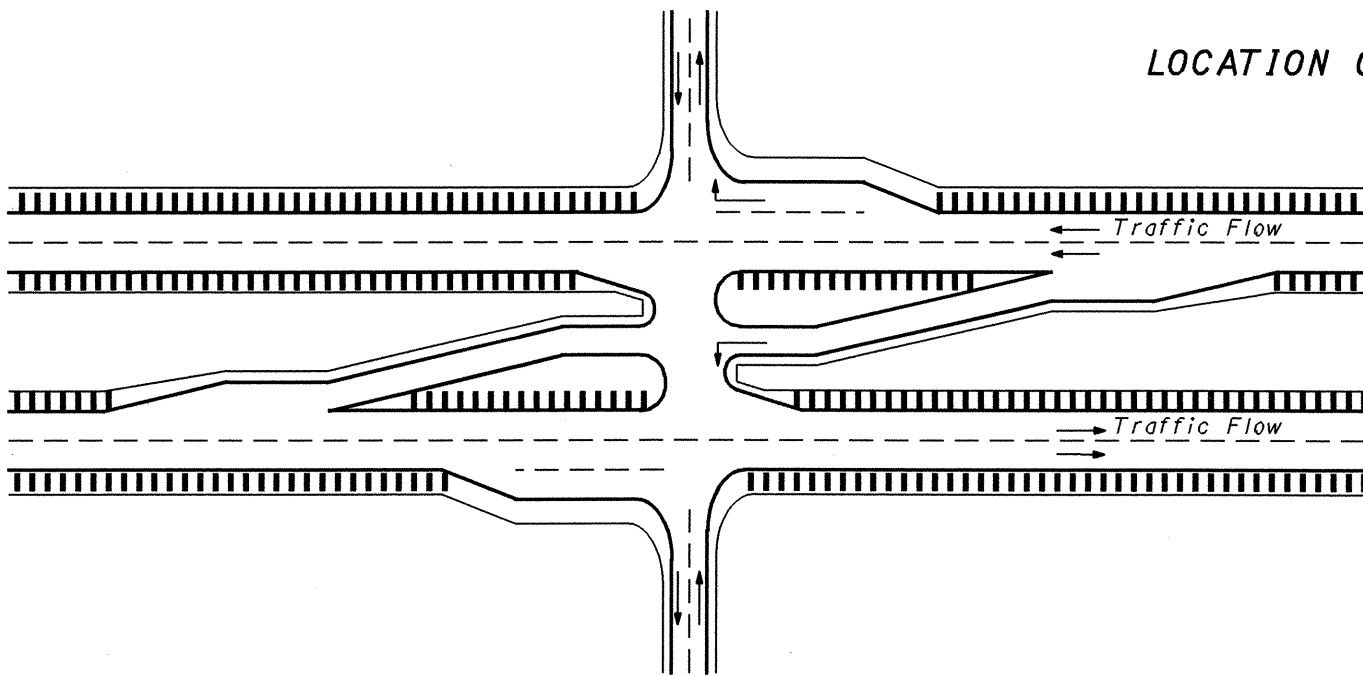
NUMBER BP-9.I 1/2	STANDARD ROADWAY CONSTRUCTION DRAWING SHOULDER RUMBLE STRIPS	ROADWAY ENGINEERING SERVICES	STDS. ENGR. D. Focke	OHIO DEPARTMENT OF TRANSPORTATION 10-17-03 ROADWAY DESIGN ENGINEER
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LOCATION OF RUMBLE STRIPS

NOTES

1. See Sheet 1 of 2 for Rumble Strip details.
2. On median shoulders 12 feet [3.6 m] or wider, where the shoulders have been designed for maintenance of traffic during construction, the pattern should be placed near the middle of the shoulder (see table at left for offsets). The purpose for this is so that traffic can be maintained on the median shoulder during a "Phase 1" traffic maintenance sequence and straddle the pattern. "Phase 2" traffic can be maintained on the newly-paved outside shoulder prior to placement of the new rumble strip pattern.
3. At entrance and exit terminals, the outside shoulder pattern should be extended toward the ramp juncture as far as possible, and then shifted over to the outside shoulder of the terminal area. The "nose" of an entrance or exit terminal is a logical reference point. On either terminal, extend the pattern 100' [30 m] into the terminal area and then transfer to the outside shoulder.
4. The AT-GRADE INTERSECTION diagram shows a typical application for divided roadways, but the patterns on the outside shoulders are also applicable to undivided roadways.
5. Where rumble strips are used on the shoulders of arterial roadways, the pattern should be interrupted across residential or commercial drives.
6. In built-up residential areas where noise may be objectionable, this dimension may be increased, but should not exceed 24" [600].
7. Rumble strips, when used in advance of critical locations, such as approaches to narrow bridges, in gore areas, and ahead of impact attenuators or other barrier end treatments, should be placed as shown.

AT-GRADE INTERSECTIONS (See Note 4.)



* See Sheet 1 of 2 for Rumble Strip details

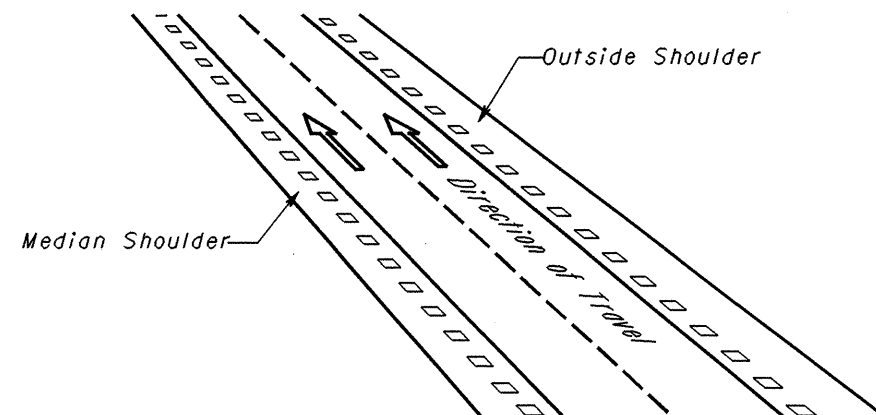
OUTSIDE SHOULDER OFFSET (See Note 6.)

A = 6" [150] for 4' to 6' [1.2 to 1.8 m] shoulders
A = 10" [250] for shoulders greater than 6' [1.8 m]

MEDIAN SHOULDER OFFSET (See Note 2.)

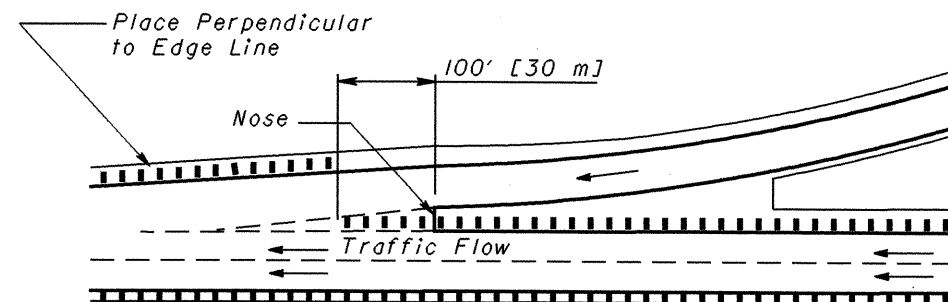
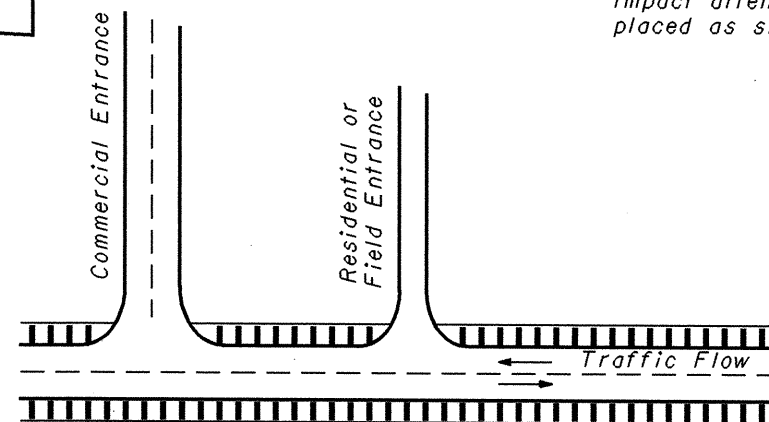
B = 6" [150] for 4' to 6' [1.2 m to 1.8 m] shoulders
B = 10" [250] for 8' to 10' [2.4 to 3.0 m] shoulders
B = 5' [1.5 m] for 12' [3.6 m] shoulders
B = 6' [1.8 m] for 14' [4.2 m] shoulders

OFFSET DIMENSIONS

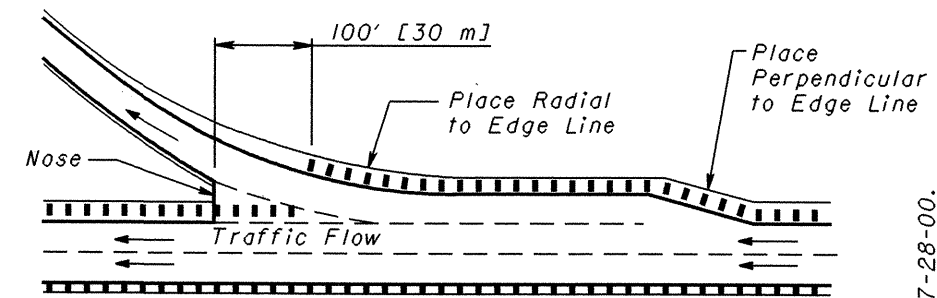


GENERAL ISOMETRIC VIEW - DIVIDED ROADWAY

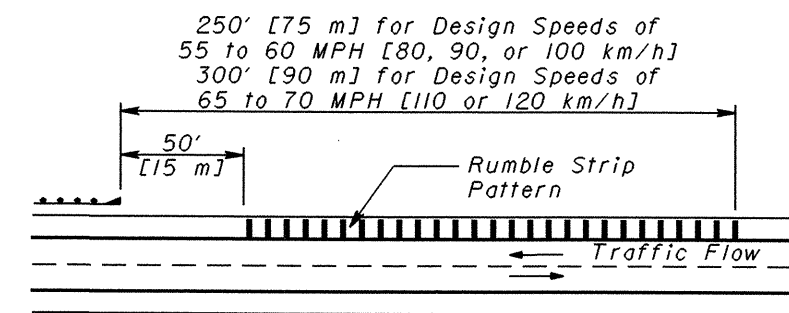
ACCESS POINTS ON ARTERIALS (See Note 5)



ENTRANCE TERMINALS (See Note 3)

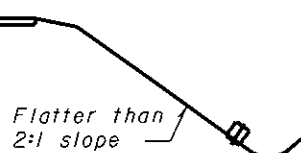
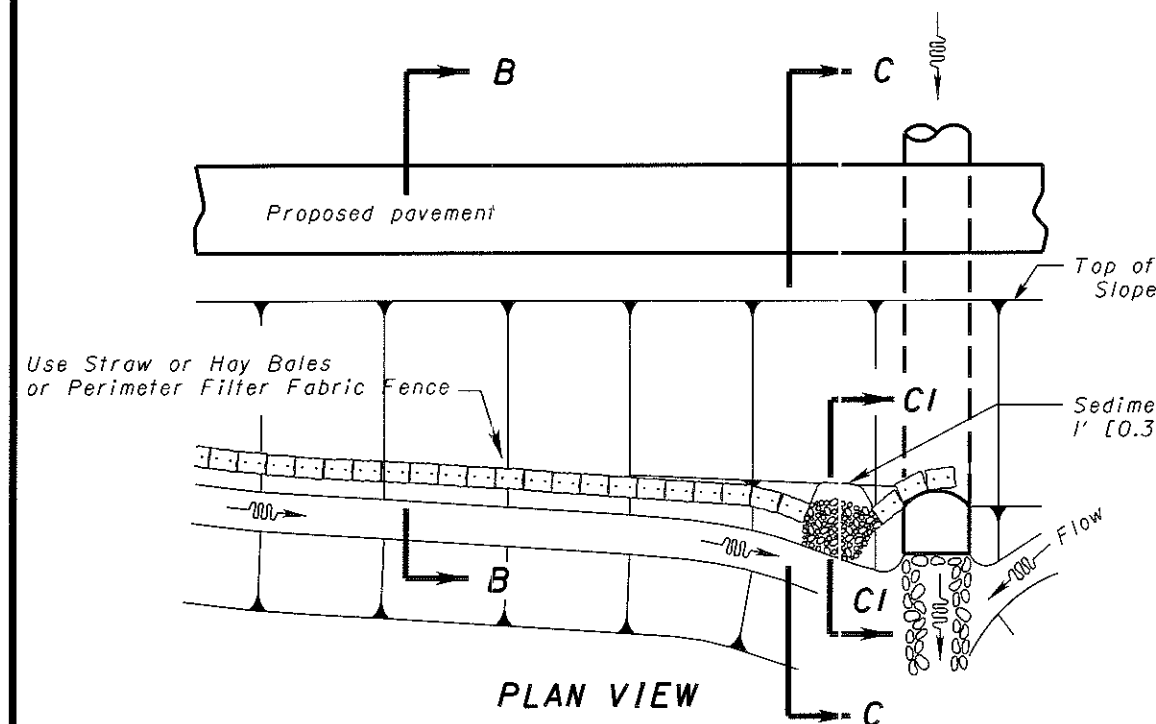


EXIT TERMINALS (See Note 3)

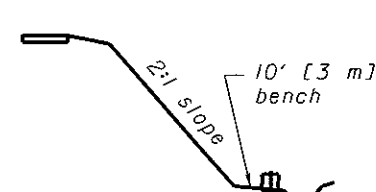


RUMBLE STRIPS LOCATIONS IN ADVANCE OF CRITICAL LOCATIONS (See Note 7)

THIS DRAWING REPLACES BP-9/I DATED 7-28-00.



SECTION B-B



SECTION C-C



SECTION CI-CI

BALE FILTER DIKE

NOTES

MATERIAL: Furnish straw or hay bales. Use 30" [0.8 m] long 2"x2" [50x50] wooden stakes, reinforcing bars or fence posts to stake the bales in place. The use of filter fabric fence in lieu of straw or hay bales will be allowed. Furnish 30" [0.8 m] wide filter fabric with sound wood supports with maximum on-center spacing of 10' [3.0m]. Use filter fabric conforming to 712.09 Type C.

Use sand and gravel for the sediment pit filter material.

CONSTRUCTION: Trench the filter fabric fence as detailed for perimeter filter fabric fence. (see DM-4.4)

When straw or hay bales are used conform to the following: Tightly place each bale adjacent to one another. Entrench 2" [50] to 3" [75] into the ground prior to staking. Firmly stake each bale with at least two stakes. Use loose hay or straw to fill the voids under and between the bales.

Construct a 3'x3'x1' [1 m x 1 m x 0.3 m] pit for the sediment pit filter material. Fill with filter material 1' [0.3 m] above ground level.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Bale Filter Dike.**

NOTES

MATERIAL: Furnish materials conforming to Item 203 Embankment and Item 601 Rock Channel Protection, Type C or D with filter. Furnish construction fence consisting of 4'-0" [1.3 m] high plastic fence with 6' [2 m] long metal fence posts.

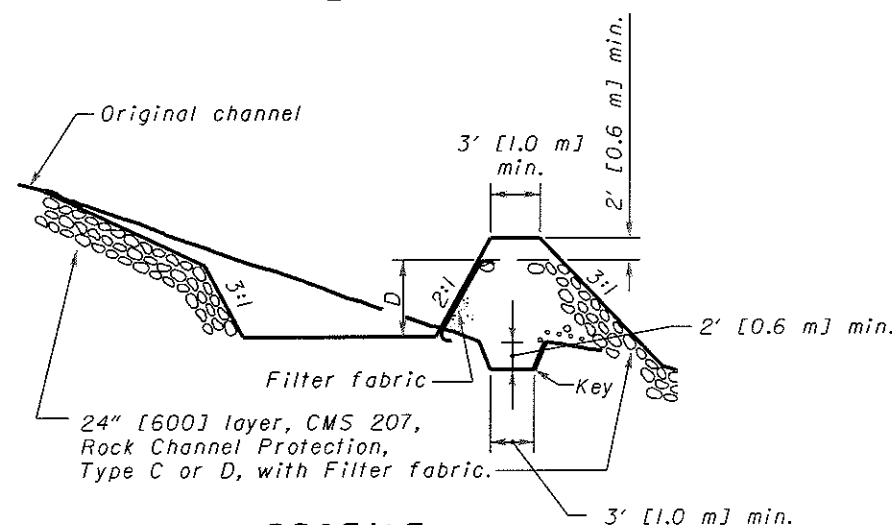
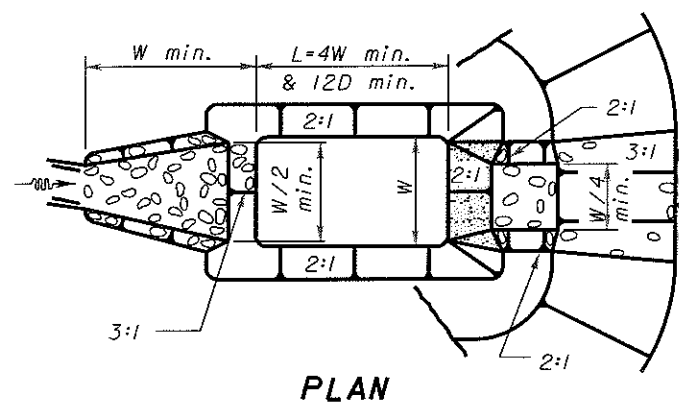
CONSTRUCTION: Construct the Basin and Dams as detailed. Construct the construction fence in urban areas or in high pedestrian traffic areas. Construct the fence to completely surround the sediment basin or dam. Place the fence post on 8' [2.6 m] centers 2' [0.6 m] deep. Securely attach the plastic construction fence to the fence post.

PAYMENT: The Department will pay for the accepted quantities at the contract prices as follows:

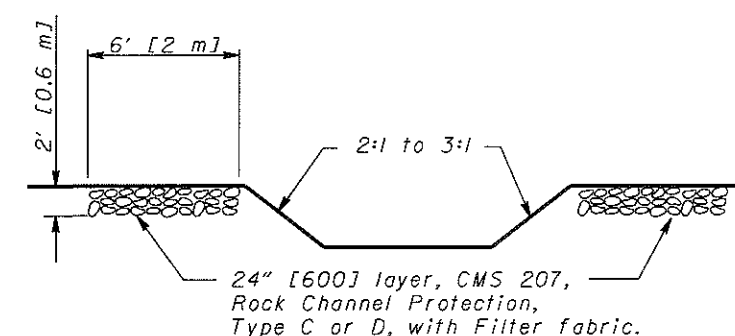
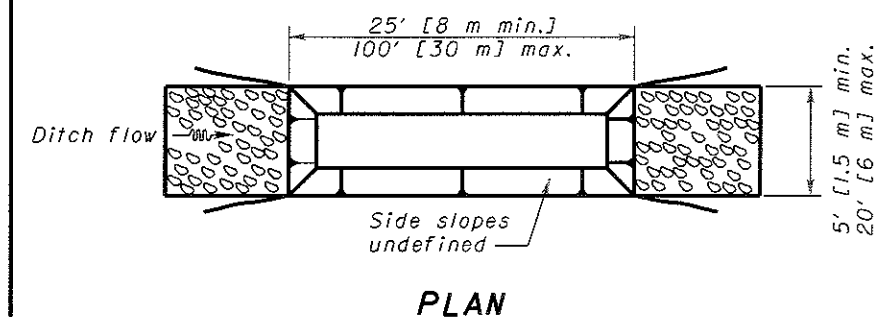
Item 207 - Sediment Basins and Dams in cubic yards [cubic meters]

Item 207 - Rock Channel Protection Type C or D with filter in cubic yards [cubic meters]

Item 207 - Construction Fence per foot [meter]

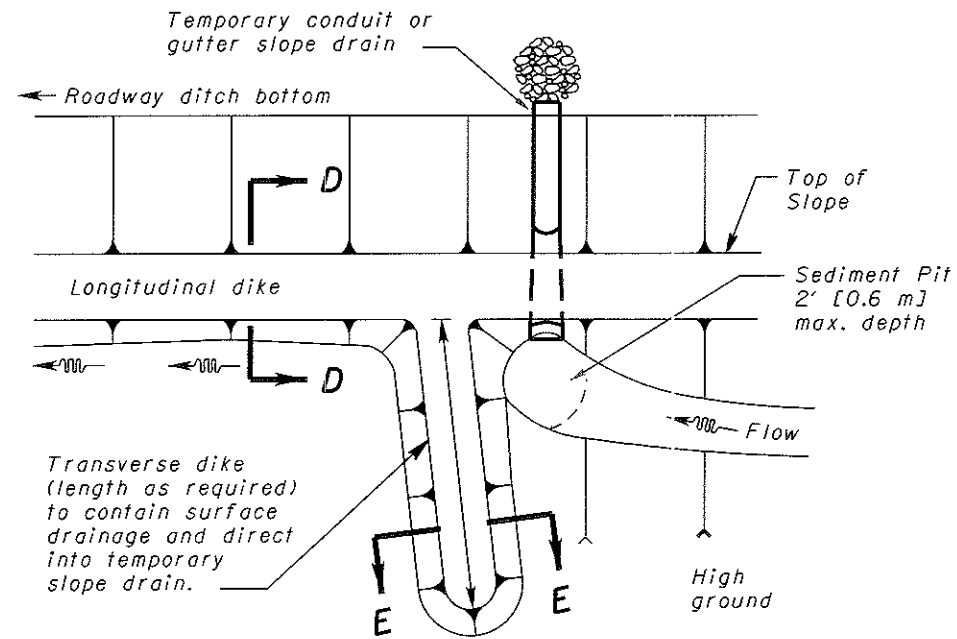


SEDIMENT DAM

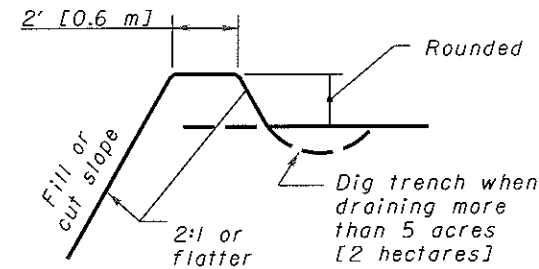


SEDIMENT BASIN

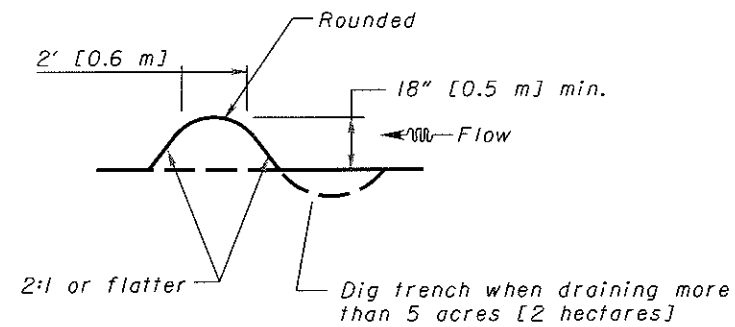
DIKES AND SLOPE PROTECTION



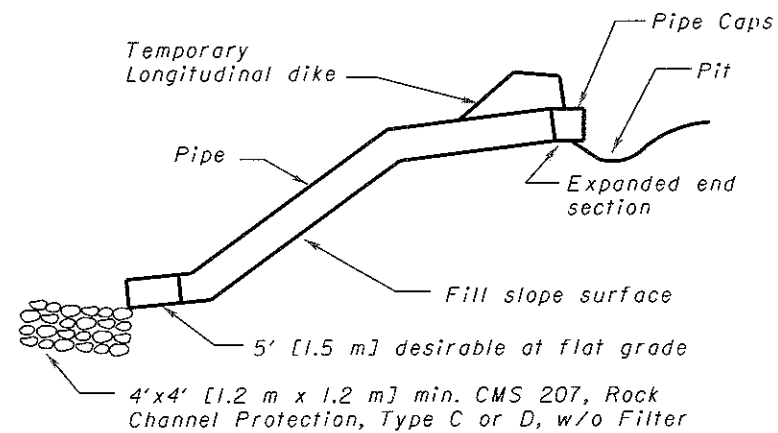
PLAN VIEW



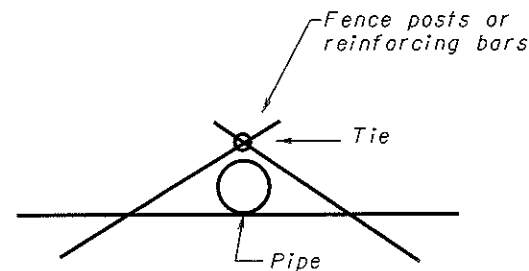
SECTION D-D



SECTION E-E



CONDUIT SLOPE DRAIN



TIE-DOWN SLOPE DRAIN

NOTES

MATERIAL: Furnish materials conforming to Item 203 Embankment and Item 601 Rock Channel Protection, Type C or D, without filter.

Furnish the following for the slope drains: corrugated steel pipe, corrugated or smooth plastic pipe, pipe caps with: holes that comprise at least 30 percent of the cross sectional area of the cap and specifically designed to connect to the pipe, reinforcing bars or fence posts and sand and gravel for the sediment pit filter material.

CONSTRUCTION: Construct as detailed. Compact the dike to 85% of the maximum density as determined by Supplement 1015.

Use reinforcing bars or fence posts to tie down the slope drains and to keep the pipe from moving.

Construct a 3'x3'x2' [1 m x 1 m x 0.6 m] pit for the sediment pit filter material. Fill with filter material to the ground level.

BASIS OF PAYMENT: The Department will pay for the accepted quantities at the contract prices as follows:

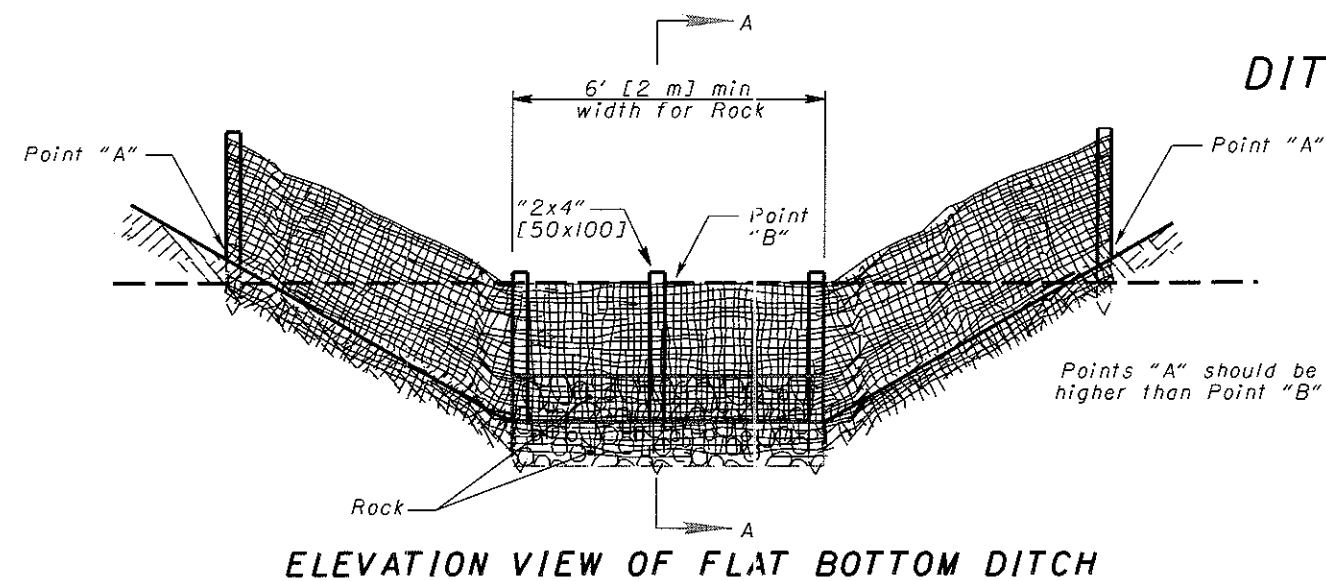
Item 207 - Dikes in cubic yards [cubic meters]

Item 207 - Slope Drains in feet [meters]

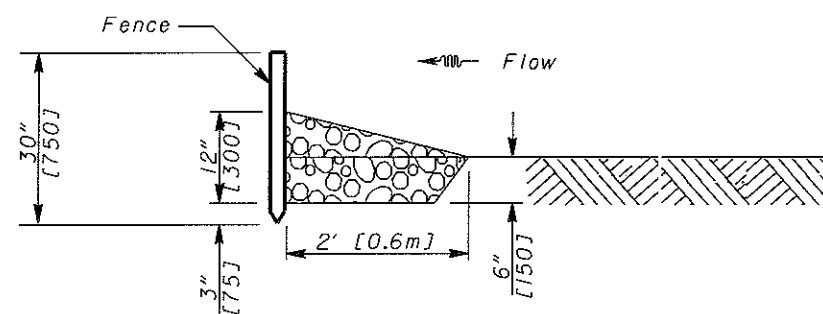
Item 207 - Rock Channel Protection Type C or D without filter in cubic yards [cubic meters]

TEMPORARY SLOPE DRAINS RECOMMENDED SIZES

AREA in acres [hectares]	PIPE SIZES	
	Smooth	Corru- gated
0-4 [0-1.6]	6" [150]	6" [150]
4-8 [1.6-3.2]	8" [200]	12" [300]
8-12 [3.2-4.9]	10" [250]	15" [375]

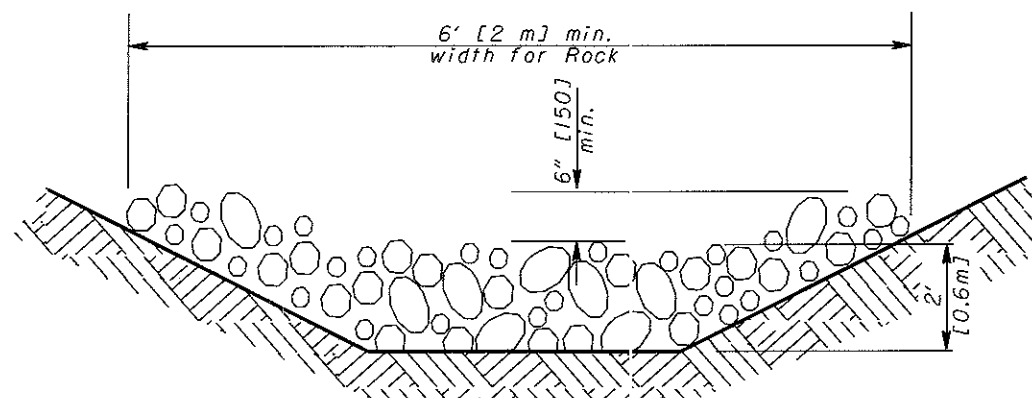


ELEVATION VIEW OF FLAT BOTTOM DITCH



SIDE VIEW OF FLAT BOTTOM AND V DITCH

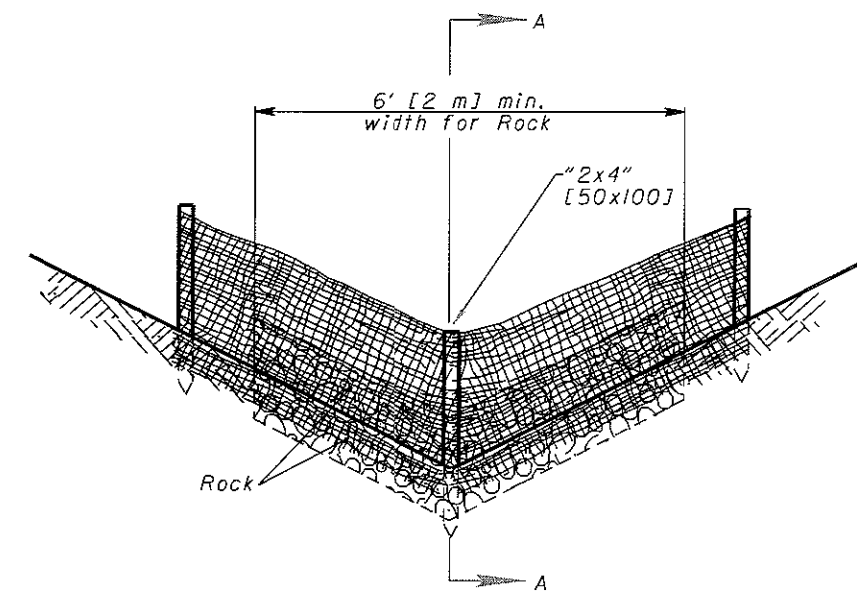
SECTION A-A



Minimum dimensions: 2' [0.6 m] high x 6' [2 m] wide x 3' [0.9 m] long

ELEVATION VIEW
ROCK CHECK

DITCH CHECKS



ELEVATION VIEW OF "V" DITCH

NOTES

FILTER FABRIC DITCH CHECKS:

MATERIALS: Furnish filter fabric ditch checks consisting of the following materials:

1. 30" [0.8 m] wide filter fabric with sound wood supports with maximum on-center spacing of 10' [3.0 m]. Use filter fabric conforming to 712.09 Type C.
2. A vertically driven "2x4" [50x100] stake in the center of the ditch
3. Gravel or limestone material conforming to one of the following gradations No. 1 through No. 4 on Table 703.01-1.

CONSTRUCTION: Trench the filter fabric fence as detailed for PERIMETER FILTER FABRIC FENCE. (see Sheet 2/2) Place a vertical "2x4" [50x100] stake in the center of the ditch with the top level to the top of the fence and at least 6" [150] below the bottom of the ditch. Excavate for and place the gravel or limestone on the upstream side of the ditch check.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Filter Fabric Ditch Check.**

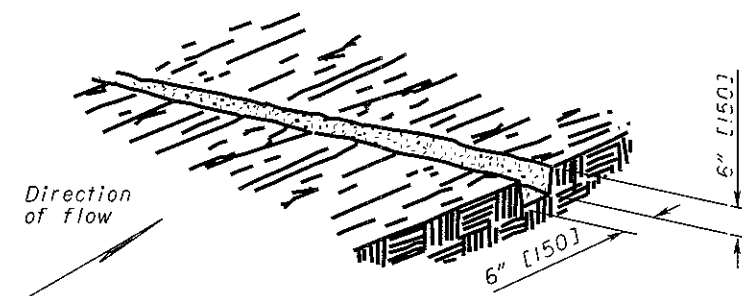
ROCK CHECKS:

MATERIALS: Furnish material conforming to Item 601 Rock Channel Protection Type C or D without filter.

CONSTRUCTION: Place the rock outside the traffic clear zone in the ditch.

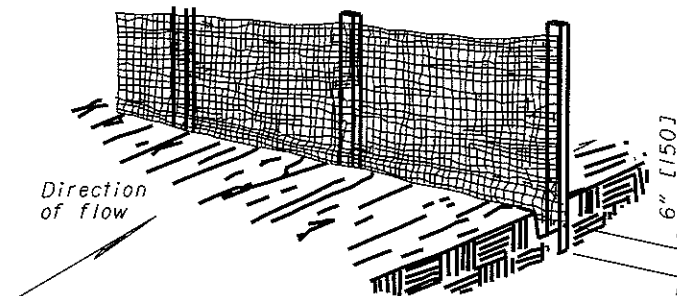
PAYMENT: The Department will pay for the accepted quantities at the contract prices in cubic yards [cubic meters] as follows: **Item 207 - Rock Channel Protection Type C or D without filter.**

PERIMETER FILTER FABRIC FENCE



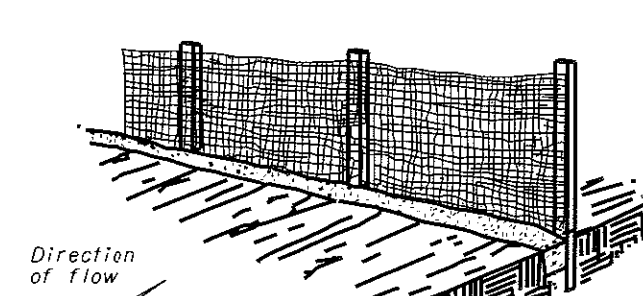
Excavate a 6"x6" [150x150] trench along the proposed fence line.

STEP 1



Place fabric and support stakes and extend fabric into the trench.

STEP 2



Backfill and compact the excavated soil.

STEP 3

NOTES

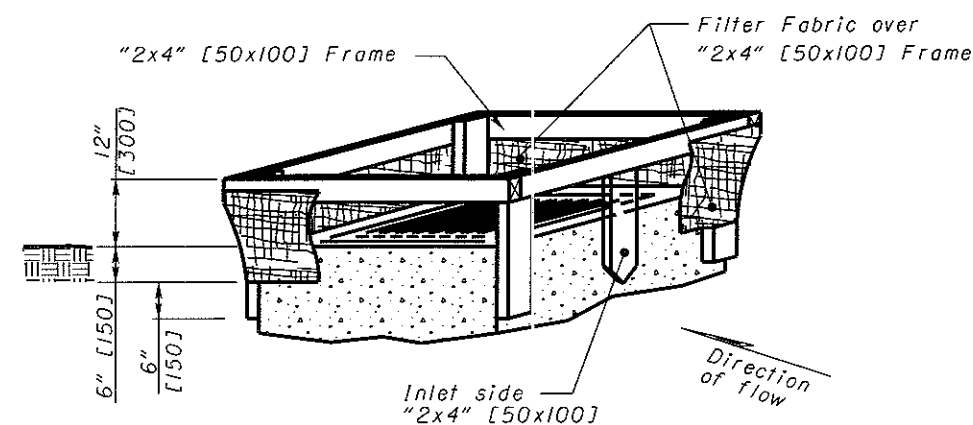
MATERIALS: Furnish 30" [0.8 m] wide filter fabric with sound wood supports with maximum on-center spacing of 10' [3.0 m]. Use filter fabric conforming to 712.09 Type C. The Contractor may elect to use straw or hay bales. Use 30" [750] long 2"x2" [50x50] wooden stakes, reinforcing bars or fence posts for the straw or hay bales.

CONSTRUCTION: Trench the filter fabric fence as detailed. The Contractor may elect to trench the fence detailed on steps 1 through 3 in one plowing operation.

When straw or hay bales are used conform to the following: Tightly place each bale adjacent to one another. Entrench 2" [50] to 3" [75] into the ground prior to staking. Firmly stake each bale with at least two stakes. Use loose hay or straw to fill the voids under or between the bales.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Perimeter Filter Fabric Fence.**

INLET PROTECTION



INLET PROTECTION

NOTES

MATERIALS: Furnish inlet protection consisting of 18" [0.5 m] wide filter fabric fence with a securely nailed "2x4" [50x100] wood frame with a vertically driven "2x4" [50x100] on the inlet or flow side of the structure. Use filter fabric conforming to 712.09 Type C.

CONSTRUCTION: Construct an 18" [0.5 m] wide filter fabric fence supported around a storm drain inlet or catch basin with a securely nailed "2x4" [50x100] wood frame. Excavate a 6" [150] trench around the inlet, and drive support posts 6" [150] below the excavated trench bottom. Stretch the fabric around the frame. Secure it tightly ensuring that 6" [150] of fabric is in the trench. Overlap the fabric on one side of the inlet so that the fabric ends are not attached to the same post. Backfill and compact the excavated soil tightly onto the fabric. Place a vertical "2x4" [50x100] in the center of the inlet so that the top is at the top of the fence and the bottom is at least 6" [150] below the bottom of the ditch.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Inlet Protection.**

TEMPORARY SIGN SUPPORT REQUIREMENTS

A. PLACEMENT OF SIGNS WHICH WILL REMAIN MORE THAN ONE DAY:

- 1) Lateral placement to nearest edge of signs shall be as follows:
- A) On the right side of the road for approaching traffic (except for dual mounted signs and signs designated in the plans for left side mounting).
 - B) Curbed roadway - minimum 2' (0.6 m) behind face of curb.
 - C) Uncurbed roadway- 12' (3.6 m) from edge of traffic lane or 6' (1.8 m) from edge of paved or useable shoulder, whichever is greater.
 - D) Behind guardrail or barrier - preferably 2' (0.6 m) behind face of guardrail (minimum 1' (0.3 m)) for signs on class a supports; 4' (1.2 m) for Class B or C supports; 1' (0.3 m) behind face of Concrete Barrier unless barrier top mounting is required by the plan.
- 2) Vertical clearance of signs, measured above roadway elevation; shall be as follows:
- A) Rural - 5' (1.5 m) when parked cars, construction equipment, etc will not obscure sign visibility.
 - B) Rural areas with parked cars or construction equipment - 7' (2.1 m)
 - C) Urban - 7' (2.1 m)
 - D) Care shall be taken to assure that signs will not be obscured by construction equipment, trees, weeds or other obstacles. Brush, weeds or grass within the right of way shall be trimmed as necessary. Signs shall normally be visible to traffic 400' (120 m) to 600' (180 m) in advance of the sign.
- 3) Supports for signs which will remain in place more than one day shall be fixed rather than portable except in situations where the sign must rest on permanent pavement or other surface which would be damaged by insertion of post type supports.

B. PLACEMENT OF SIGNS WHICH WILL REMAIN FOR ONE DAY OR LESS:

- 1) Same as A-1 above except that signs may be placed on the roadway only if they do not intrude into a traffic lane in use.
- 2) Minimum of 1' (0.3 m) above roadway

C. CLASSES OF SUPPORTS:

All temporary sign supports shall be of the following types:

1) CLASS A:

Supports shall be used for exposed locations on highways where traffic approach speeds of 40 MPH and higher are encountered. They are also suitable for use in all other locations.

2) CLASS B:

Supports may only be used where fully protected by guardrail, concrete barrier and in locations positively protected from traffic such as on retaining walls.

D. TRAFFIC APPROACH SPEEDS:

Traffic approach speeds shall be the locally posted speed (not advisory speed signs) or the measured actual (85th percentile) speed (if available) of approaching traffic, whichever is higher, adjacent to the sign location.

TABLE

APPROACH SPEED (MPH)	COMPLETELY PROTECTED BY GUARDRAIL OR BARRIER	PARTLY PROTECTED BY GUARDRAIL OR BARRIER *	GREATER THAN 30' (9 m) FROM EDGE OF PAVEMENT	WITHIN 30' (9 m) FROM EDGE OF PAVEMENT
40 AND HIGHER	A OR B	A OR B	A OR B *	A ONLY
26 TO 39	A OR B	A OR B	A OR B	A OR B
0 TO 25	A OR B	A OR B	A OR B	A OR B

* If supports are behind guardrail but not fully 5'6" (1.7 m) behind face of rail or if sign is not 1' (0.3 m) behind face of concrete barrier.

* * 30' (9 m) criterion is based upon straight roadway and a slope of 6 to 1 or flatter. Supports on the outside of curves or located down a slope (steeper than 6 : 1) will require use of class a supports.

E. BALLASTING

Ballasting of portable supports shall be with sandbags placed within 1' (0.3 m) of the ground. In no case shall hard objects be used for ballast.

F. STRENGTH OF SIGN SUPPORTS

The Contractor shall choose sign supports of adequate strength and with adequate foundations and anchorage to support the sign sizes erected. Proprietary devices shall not be loaded beyond the limits recommended by the manufacturer. Slip base type breakaway beam connections shall be at least partially embedded in concrete consisting of a 1' (0.3 m) deep by 1' (0.3 m) diameter collar. Sign supports which fail under typical wind load conditions shall be immediately modified or replaced with a support of adequate strength.

G. PROHIBITED SUPPORTS

The following support types shall not be permitted on projects:

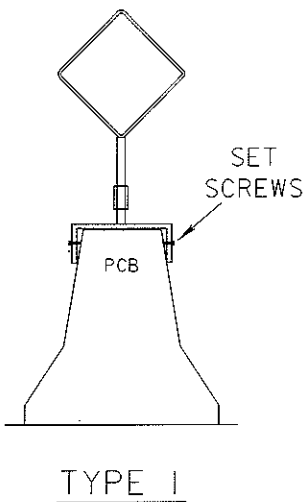
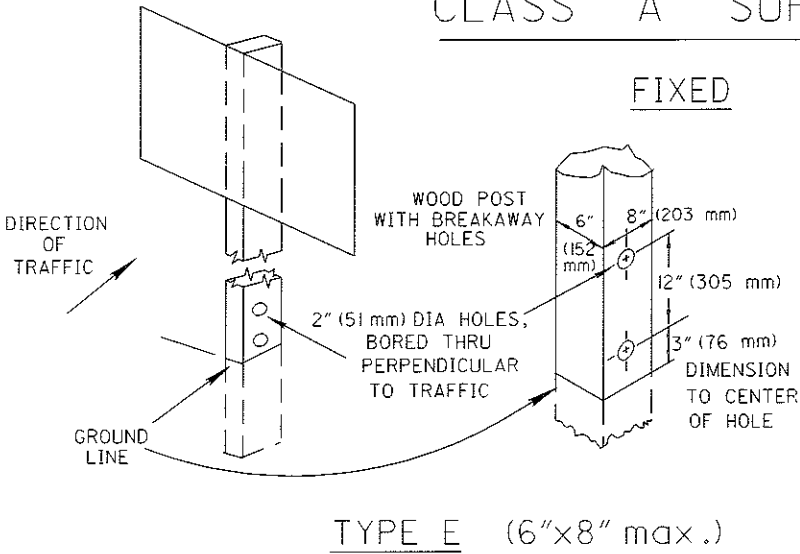
- 1) Supports fabricated from automotive axle differential assemblies and similarly heavy assemblies which cannot be considered breakaway type.
- 2) Supports consisting of vertical posts with angled braces made from drivepost or other rigid elements.
- 3) Supports that are not NCHRP 350 compliant.

CLASS A SUPPORTS FIXED SUPPORTS

- 1) All #2 and #3 posts when installed singly or in pairs (side by side) according to the details of TC-41.20. The number of supports shall be as shown on TC-52.10 and TC-52.20.
- 2) The following post types, when installed singly, by imbedment or driving into earth to a depth of about 42 inches (1.1 m).
 - A) - up to 4"x4" (102x102 mm) wood.
 - B) - up to 2" (51 mm) diameter schedule 40 steel pipe.
 - C) - up to 3" (76 mm) diameter schedule 40 aluminum pipe.
 - D) - up to 2 1/4" (56.4 mm) square, 12 gauge wall, punched steel post.
 - E) - up to 6"x8" (152x203 mm) wood with breakaway holes shown on MT-105.11.
- 3) The following post types when installed in pairs (side by side) with less than 6'-5 1/8" (2 m) between posts, by imbedment or driving into earth to a depth of about 42 inches (1.1 m):
 - A) - up to 4"x4" (102x102 mm) wood.
 - B) - up to 2" (51 mm) diameter schedule 40 steel pipe.
 - C) - up to 3" (76 mm) diameter schedule 40 aluminum pipe.
 - D) - up to 2" (51 mm) square, 14 gauge wall, punched steel post.
- 4) Fixed Type III Barricades:
- 5) All breakaway connection beam supports, when installed according to the proper details shown on TC-41.10 with a minimum clear distance between supports of 7' (2.1 m) for supports larger than w6 x 9.
- 6) Any breakaway post or post and connection which has been crash tested and approved by the FHWA as satisfying the breakaway criteria described in 630.06.

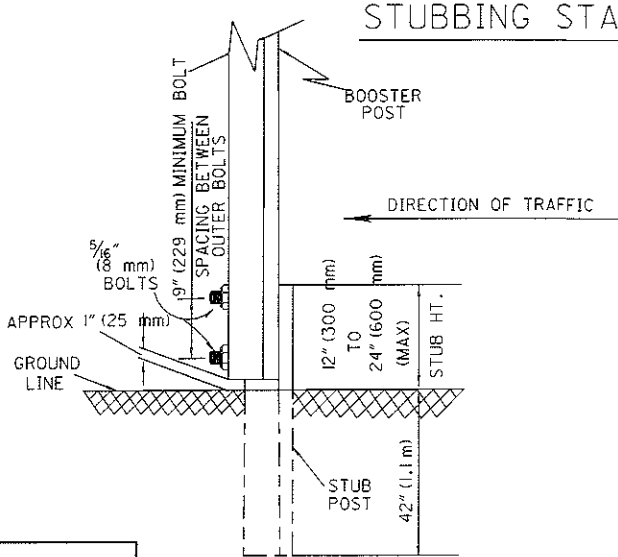
(CONTINUED ON MT-105.11)

CLASS A SUPPORTS



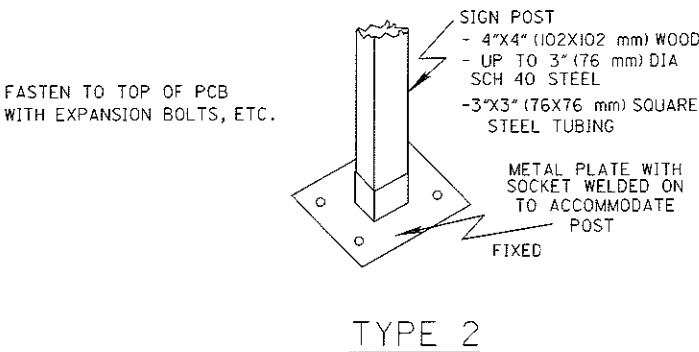
CLASS A SUPPORTS

STUBBING STANDARD



NOTES

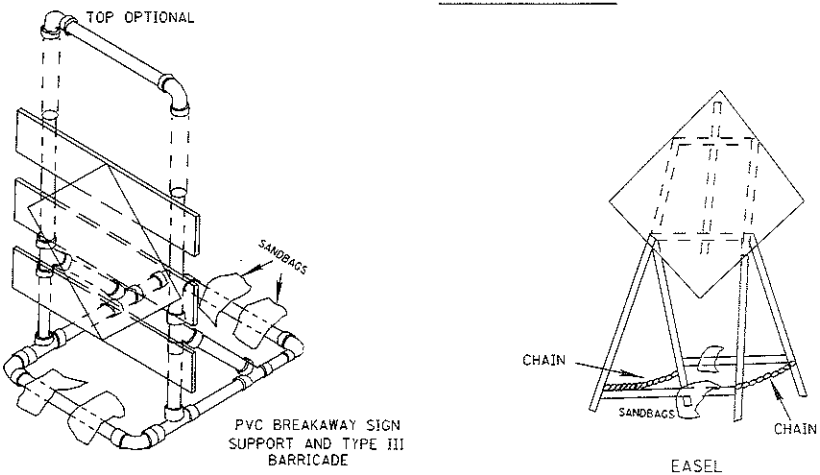
1. FOR USE WITH #3 POST OR SMALLER ONLY
2. BOLTS SHALL BE STEEL OR ALUMINUM
3. A MINIMUM OF TWO FASTENERS SHALL BE USED PER ASSEMBLY
4. BOOSTER POST SHALL BE MOUNTED BEHIND STUB POST
5. BOOSTER POST SHALL BE THE SAME OR 1LB/FT (1.5 kg/m) LESS THAN STUB POST



NOTE: SPECIFIC INFORMATION SEE MT-105.10

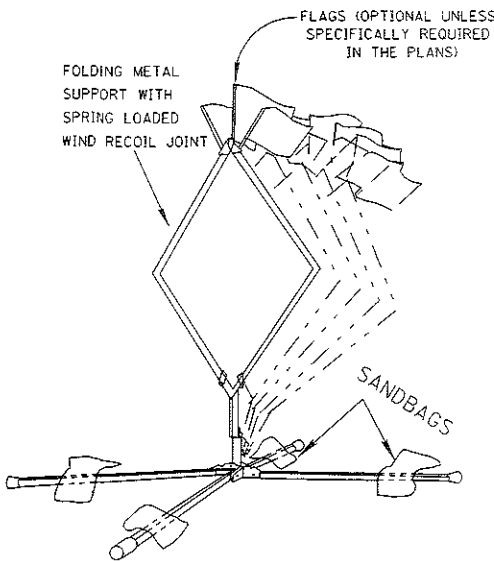
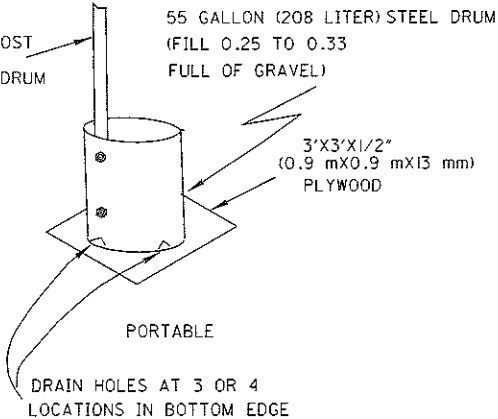
CLASS A SUPPORTS

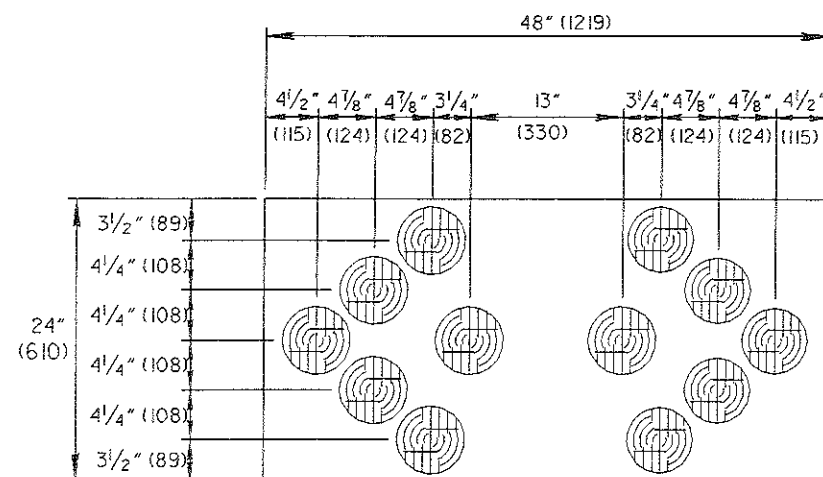
PORTABLE



CLASS B SUPPORTS

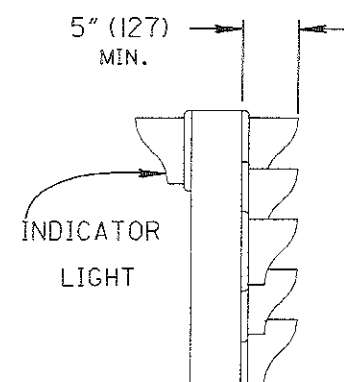
1. ALL BEAM TYPE SUPPORTS WITHOUT BREAKAWAY CONNECTIONS.
2. SUPPORTS SIMILAR TO BUT LARGER THAN PERMITTED FOR CLASS A.
3. THE STEEL DRUM(S) SHOWN BELOW MAY BE USED ONLY WHEN LOCATED BEHIND GUARDRAIL OR BARRIER.



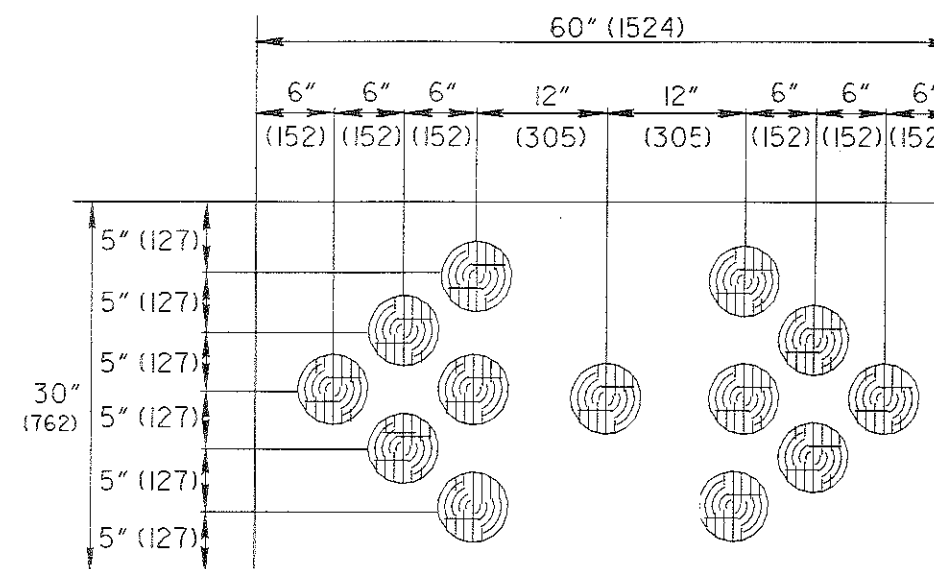


FRONT

TYPE A PANEL

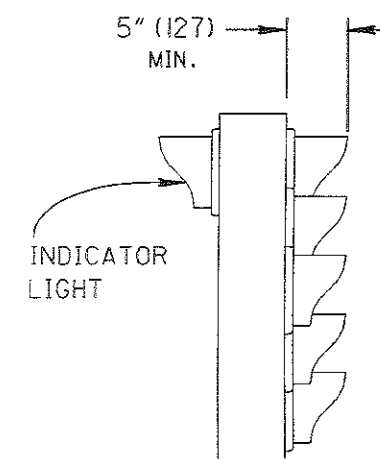


SIDE

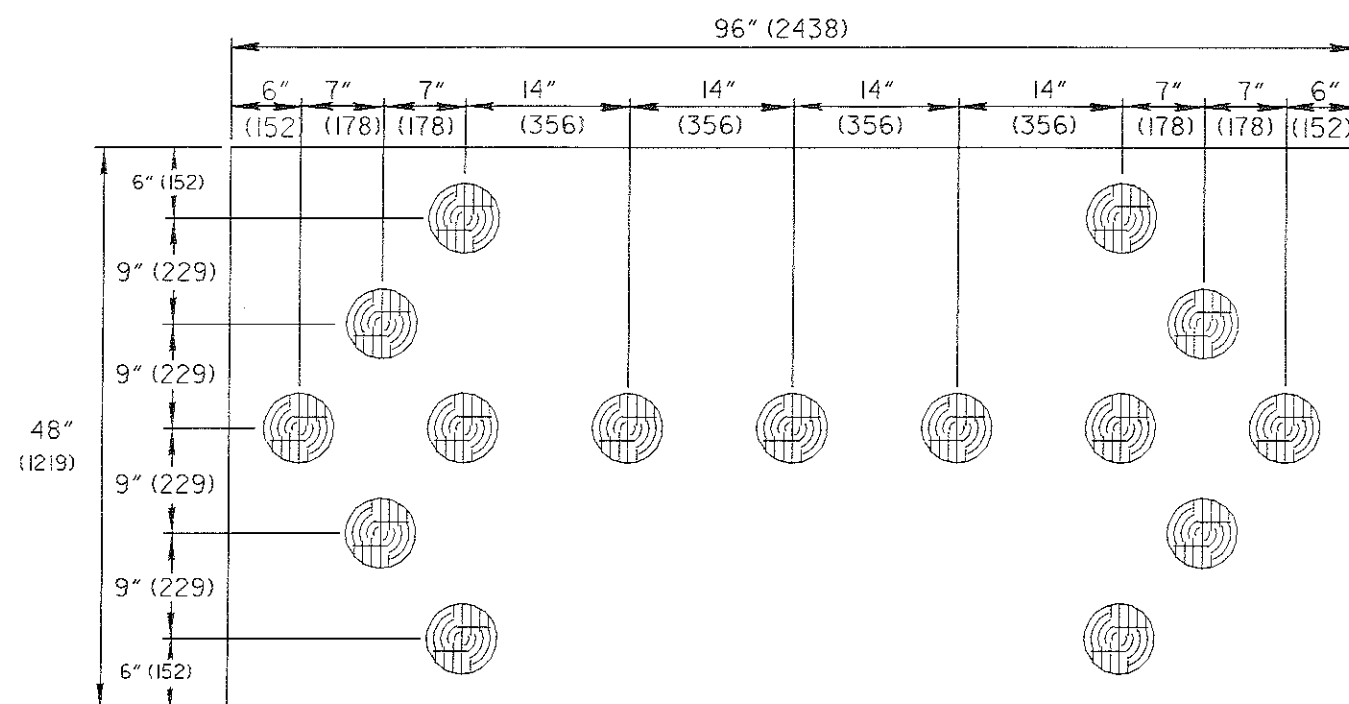


FRONT

TYPE B PANEL

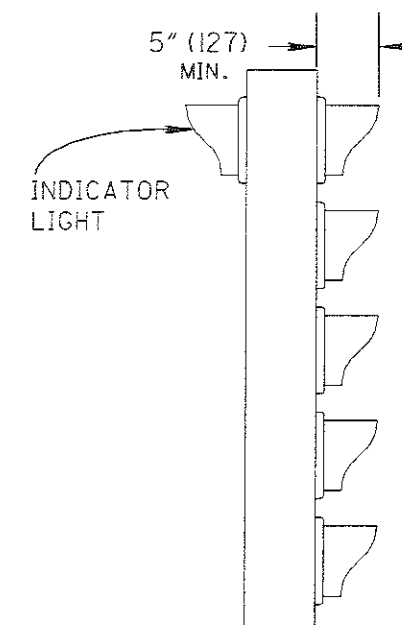


SIDE



FRONT

TYPE C PANEL



SIDE

ALL DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS, UNLESS NOTED OTHERWISE.

FLASHING ARROW PANEL

The flashing arrow panel shall consist of the following components:

- A. flasher panel
- B. lamps
- C. controls
- D. power supply
- E. mounting

A. Flasher panel

The flasher panel shall be of exterior type plywood or corrosion resistant metal construction of adequate design and strength. The panel finish shall be flat black.

A flasher panel shall be one of three sizes. The type A panel shall be a nominal 24" (610 mm) high by 48" (1219 mm) wide. Type B shall be a nominal 30" (762 mm) high by 60" (1524 mm) wide. Type C shall be a nominal 48" (1219 mm) high by 96" (2438 mm) wide.

Flashing arrow panels shall normally utilize high output (4412A and 4415A) lamps powered by an engine driven generator when permitted by the plans. The contractor may also furnish units powered by a solar array and batteries or only batteries. However, these units shall not be used where the approaching traffic would be on a horizontal curve in excess of 3 degrees. These units shall not be used if the approaching traffic, closer than 1 mile (1.6 km) [1/2 mile (.8 km) where speed limits are less than 40 MPH], is more than 5 1/2 degrees horizontally or 2 degrees vertically from the central axis of the lens units.

B. Lamps

For engine powered generator units, lamps shall be ANSI Number 4412a (PAR 46) for type B and C and 4415a (PAR 36) for type A. The lamp shall be fitted with an upper hood of not less than 180° at least 5" (127 mm) long. Arrow panels may use a lower power (wattage) lamp than the standard arrow panels. The lamps shall be approximately 5" (127 mm) diameter with a parabolic reflector. The lamp shall provide improved light distribution control by means of high quality reflectors and refractors. The light output from each lamp of the arrow shall not be less than shown in figure 1 when operating at full daytime brightness.

The lamps shall be securely mounted and positioned in the panel perpendicular to the panel face and oriented so that the lamp location lug (on back of the lamp) is on the horizontal center line through the lens. The lug will be on the right side of the lamp as viewed from the front.

The lamps shall be wired in circuits that can be switched to display any one of the following messages: left arrow, right arrow, left and right, and caution bar. A minimum of three indicator lights shall be placed on the back of the panel to indicate which message mode is in operation.

Each panel shall contain the following number of lamps as a minimum: type A-12 lamps, type B-13 lamps, type C-15 lamps.

CANDLE POWER CHART

				100					4°
		100	150	200	150	100			2°
100	150	200	250	350	250	200	150	100	0° HORIZONTAL
		100	150	200	150	100			- 2°
				100					- 4°
10°	7.5°	5°	2.5°	0°	2.5°	5°	7.5°	10°	

LEFT

CENTER

RIGHT

- (1) Measurements expressed in candela.
- (2) Color of output light shall be yellow to light yellow.

Figure 1

C. Controls

Each flashing arrow panel shall contain a flasher control and a dimmer control unit housed in a cabinet which can be locked.

1. Flasher control

The flash rate for the sign panel shall be 25 to 40 flashes per minute. The flasher shall not cause electromagnetic interference. The lamps shall have a minimum "on time" of 50% and a maximum of 66%.

2. Dimmer control

Lamp intensity shall be variable by means of a photoelectrically controlled circuit which shall reduce lamp output during low ambient light conditions. Lamp intensity shall be at the nighttime level whenever the ambient illumination is in or below the range 2 foot-candle (21 lux) to 5 foot-candle (54 lux) and shall be at daytime level when ambient illumination is in or above the range 5 foot-candle (54 lux) to 10 foot-candle (108 lux). If controls provide for continuous adjustment of lamp intensity with respect to ambient illumination, then lamp intensity shall increase linearly from nighttime intensity at 5 foot-candle (54 lux) to daytime intensity at 3250 foot-candle (35,000 lux). A time delay shall be built into the control to prevent false operation due to light flashes. The photoelectric control shall contain a switch which shall override the photoelectric control.

D. Power supply

The flashing arrow panel shall operate from power sources capable of continuously furnishing the proper voltage to the lamps a minimum of 24 hours without attendance.

D. Cont.

Motor generators, if used shall be of modern design to provide low emission of pollutants and shall be properly muffled. The motor generator shall be enclosed in a mesh enclosure which can be locked. The fuel tank shall have a cap which can be locked. Motor generators supplying power to a flashing arrow sign shall not be used to supply power to other equipment. Gasoline fueled engines shall not be used.

Battery and solar/battery units shall have a no-charge-life of not less than 15 days. No-charge-life is the number of consecutive days that the system can continue to function (double arrow mode, normal dimming during 12 hour night, full output during 12 hour day) starting with a full battery charge and with no additional charge being provided by the solar cells. The no-charge-life may be based upon calculations providing that manufacturer's ratings and efficiency calculations are furnished for each major component.

E. Mounting

The flashing arrow panel may be trailer or vehicle mounted or mounted on a rigid supporting device suitable for maintaining it in the designated position. Each of the mounting methods shall be suitably stable such as to prevent movement due to high winds or passage of large vehicles.

When a trailer is used, construction shall be such as to transport the flashing arrow panel and appurtenances adequately and legally as well as support them properly during operation. The trailer shall be equipped with devices which shall provide leveling and stability during operation.

Minimum arrow panel mounting height shall be 7 feet (2.1m) above the pavement surface (measured to the bottom of the panel).

Use and operation

The flashing arrow panel shall be located as shown in the maintenance of traffic drawings or as directed by the Engineer and operated continuously during traffic maintained periods. The Contractor shall supply all fuel, lubricants and parts necessary to obtain continuous operation and shall provide all service. The Contractor shall inspect the operation of the unit daily, including weekends and holidays. The Contractor shall arrange with the Engineer, an acceptable method of obtaining service for a malfunctioning panel within 30 minutes of a reported malfunction. Lamp intensity shall be adjusted to provide minimum legibility distances of 1/2 mile (.8 km) type A, 3/4 mile (1.21 km) type B and 1 mile (1.6 km) type C.

Type C panels shall be used for stationary operations on high speed 55 MPH or greater, high volume roadways. Type B shall be used for stationary operations on intermediate speed 40-50 MPH facilities, and type A on low speed 20-35 MPH facilities.

In addition, type B panels shall be used for moving operations on freeways and expressways and type A for moving operations on other facilities.

Battery and solar/battery units shall be fully charged when first set up. They shall have gauges to indicate approximate battery charge remaining. The Contractor shall verify daily that the unit is operating satisfactorily and the remaining battery charge is sufficient for at least 2 more days.

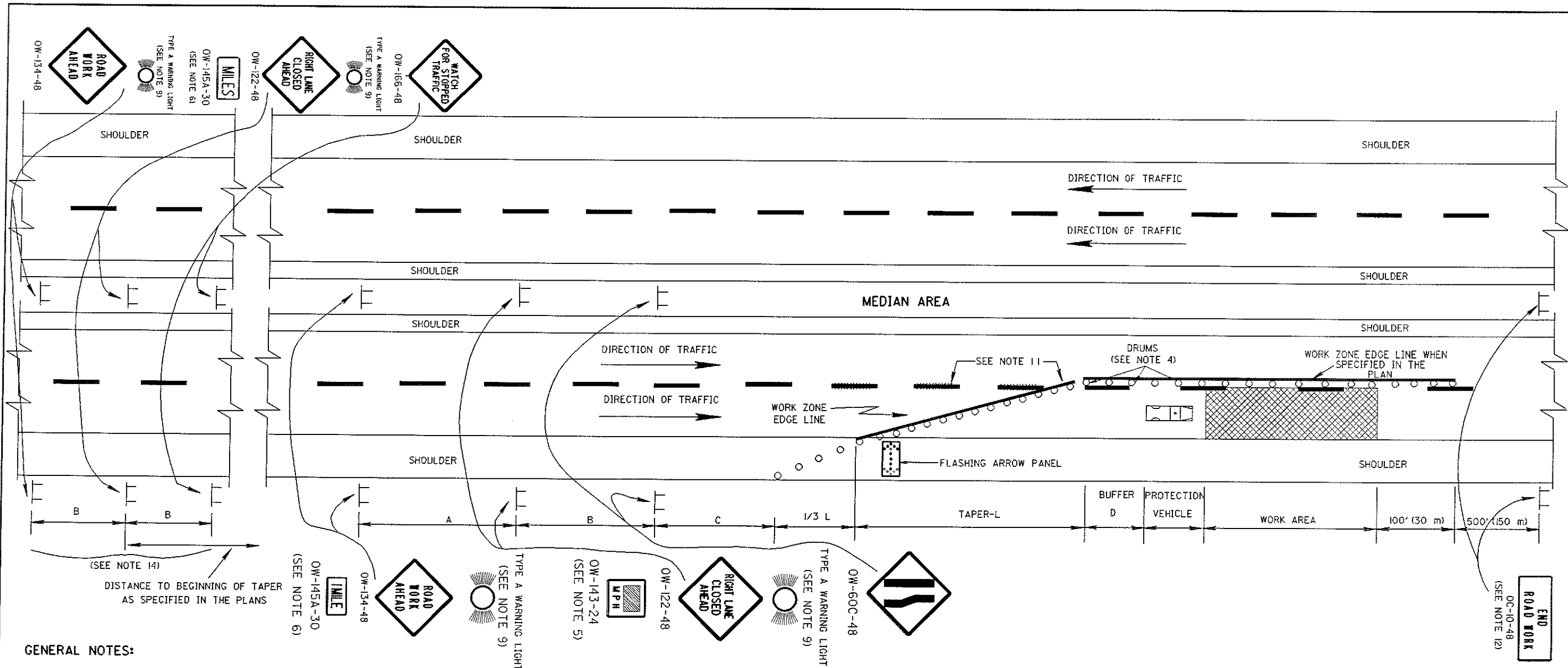
Flashing arrow panels are not to be used on two lane-two way roadways.

When left unattended the control cabinet, motor generator enclosure and fuel tank shall be locked.

Type A and type B panels used in moving operations may be powered by the vehicle's electrical system but shall not be left unattended when so powered.

When not in use, the flashing arrow panel shall be stored at a location which will not be hazardous to traffic or pedestrians.

The panels shall be designed for operation in 100% humidity and temperatures from -20 to + 130 degrees Fahrenheit (-29 to + 54 degrees Celsius).



GENERAL NOTES:

1. The location of the merging taper and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.
2. The spacing between proposed signs should be adjusted to not conflict with and to provide a minimum of 200 ft (60 m) clearance to existing signs.
3. The taper length (L) and spacing (s) of drums shall conform to table II. Drum spacing (s) shall be used for the merging taper, the buffer area and for the first 1000 ft (300 m) of the work area and at other hazardous locations as directed by the engineer. The maximum drum spacing for the balance of the work area is to be two times the spacing (s) in table II. A minimum of 5 drums shall be used to close the shoulder.
4. Cones having a minimum height of 28 inches (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.
5. The advisory speed sign OW-143 shall be used when specified in the plan.
6. The distance plate OW-145A shall indicate the distance to the beginning of the merging taper (L). Distances less than one mile may be expressed in feet. The plaque may be omitted if extra advance sign groups are not used.
7. The protection vehicle, located close to the work, shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenever workers are not in the work area. The vehicle shall be equipped with a 360 degree rotating or flashing amber beacon clearly visible a minimum of 1/4 mile (400 m). Other protective devices may be used in lieu of the protection vehicle shown when approved by the Engineer.
8. The flashing arrow panel shall meet the requirements of Standard Construction Drawing MT-35.10.
9. Type A flashing warning lights shown on the OW-134 and OW-122 (123) signs are required whenever a night lane closure is necessary.
10. When work is being performed in the lane adjacent to the median on a divided highway, OW-123 signs shall be substituted for the OW-122 signs and OW-60D signs shall be substituted for the OW-60C signs.
11. If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and the appropriate color work zone edge line shall be applied along the taper. Work zone edge lines which would conflict with final traffic lanes shall be removable (740.06 type I) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.06 type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.
12. The DC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.
13. OW-134 signs shall be provided on entrance ramps and/or side roads located within the work limits or the advance warning sign group. Within the length of closure, provision shall be made to control traffic entering from intersecting streets and driveways. Three drums shall be placed on each side across the closed lane at each intersection and driveway.
14. Extra advance warning sign groups consisting of OW-134, OW-122 and OW-166 signs plus distance plates may be specified in the plans or required to be erected at the direction of the Engineer.
15. All material and equipment shall be removed from the closure and the work area when no work is being done.
16. The speed limit chosen for design of tapers shall be the normal legal speed except where the legal speed limit is reduced due to the construction and the subject lane closure is not the first active construction area encountered by traffic within the project.
17. This drawing should be used on projects with dropoffs less than 5' in the work area. Projects with dropoffs greater than 5' in the work area should refer to MT-95.40 or MT-95.41.

TABLE I

MINIMUM DISTANCE FT (METERS)	A	B	C
MAJOR STANDARD	500 (150)	500 (150)	500 (150)
FREEWAY & EXPRESSWAY	2600 (780)	1600 (480)	1000 (300)

TABLE II

NORMAL SPEED LIMIT (MPH)	MINIMUM TAPER (L) FT (m)	MAXIMUM SPACING (S) OF DRUMS FT (m)	BUFFER (D) FT (m)
30-40	320 (98)	30 (9)	170 (52)
45-55	660 (201)	40 (12)	335 (102)
60-65	780 (238)	60 (18)	485 (148)



JAM

- JAM

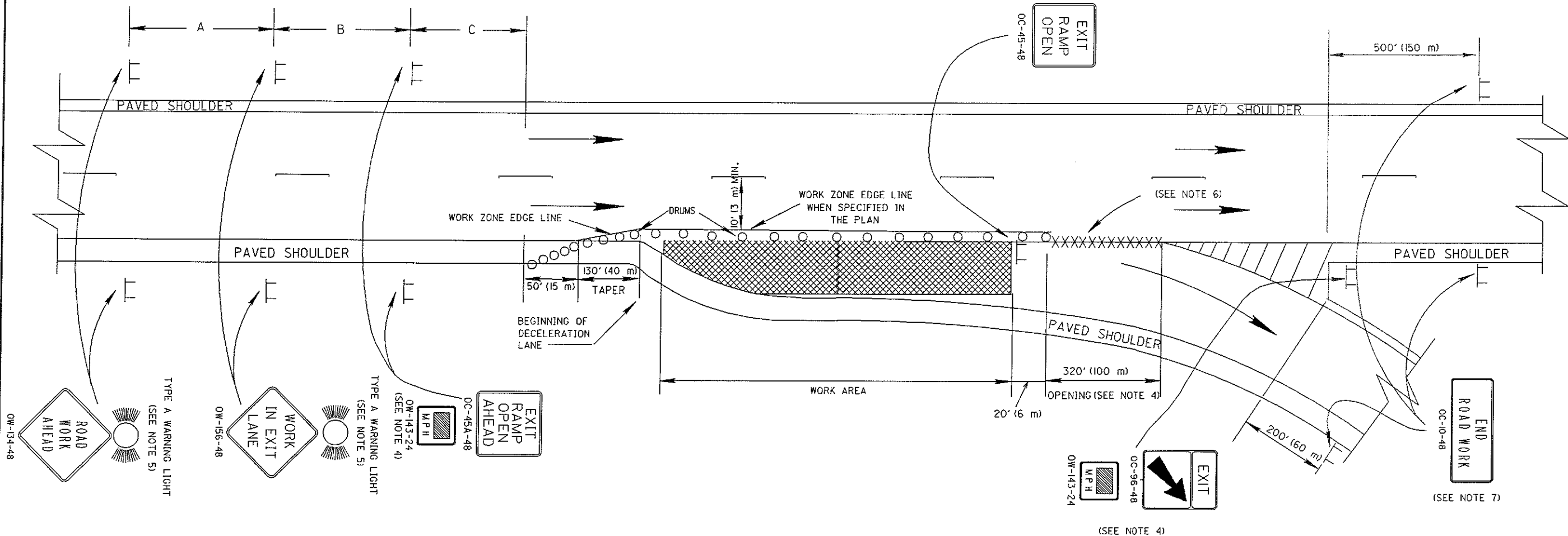
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GENERAL NOTES:

1. The location of the Advance Warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.
2. The spacing between proposed signs should be adjusted to not conflict with and to provide a minimum of 200' (60 m) clearance to existing signs, except the OW-96-48 sign which may be adjacent to the GF sign in the gore.
3. Along the closure drums shall be spaced at 20' (6 m) center to center. A minimum of 5 drums shall be used to close the shoulder. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.
4. The opening to the ramp shall be 320' (100 m) or more, whenever possible. A lesser opening may be provided if no other alternative is available. When a lesser opening is provided, Advisory Speed plaques (OW-143) shall be added to the OW-96 and OC-45A signs as follows:

Opening	Advisory speed
290' (90 m)	50 mph
260' (80 m)	45 mph
230' (70 m)	40 mph
200' (60 m)	35 mph

If a 200' (60 m) opening cannot be provided, the ramp should be closed.

4. The Advisory Speed displayed shall not be greater than would otherwise be required to accommodate the permanent ramp geometry near the exit. Advisory speeds within 10 MPH of the legal speed limit need not be displayed. If no speed reduction is required then the existing sign should be used. If a reduction is required then the existing sign should be covered and the sign configuration shown should be used.

5. Type A flashing warning lights shown on the OW-134 and OW-156 signs are required whenever a night lane closure is necessary.

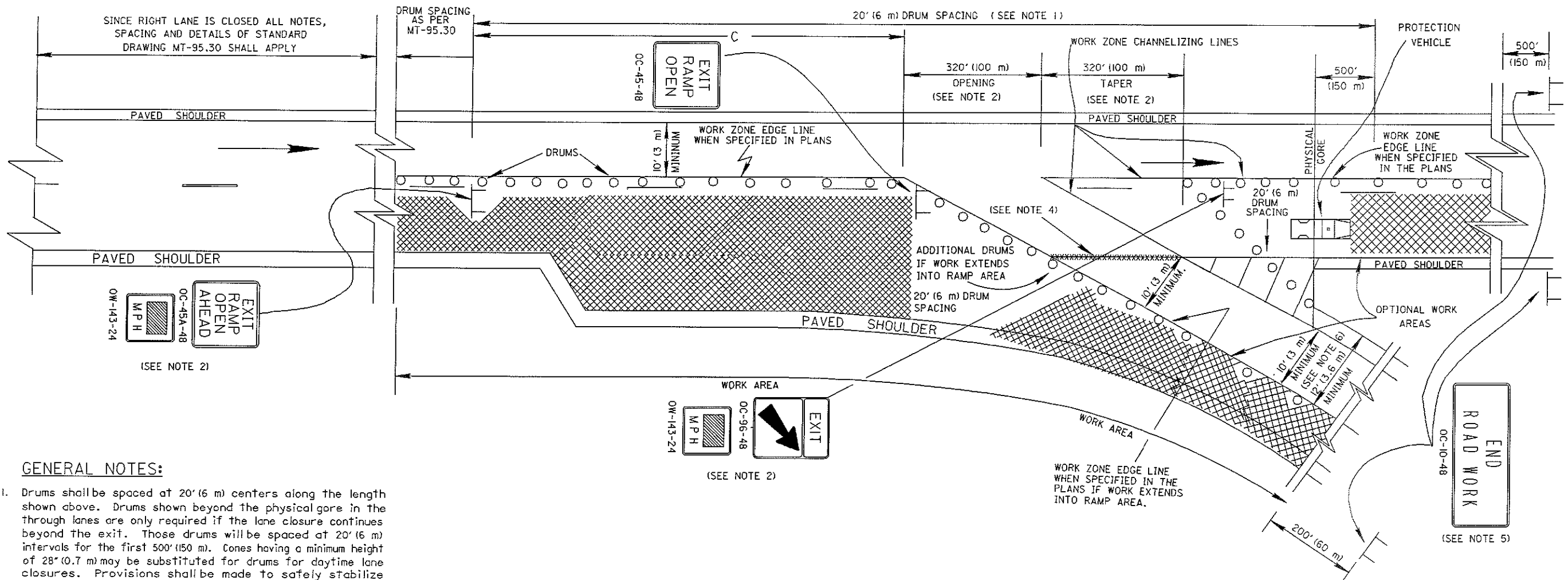
6. If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and the appropriate color work zone edge lines shall be applied along the taper. Work zone edge lines which would conflict with final traffic lanes shall be removable (740.05 Type D) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.05 Type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.

7. The OC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.

8. All material and equipment shall be removed from the closure and the work area when no work is being done.

TABLE I

	MINIMUM DISTANCE - FT (m)		
	A	B	C
FREEWAY & EXPRESSWAY	2600 (780)	1600 (480)	1000 (300)



GENERAL NOTES:

1. Drums shall be spaced at 20' (6 m) centers along the length shown above. Drums shown beyond the physical gore in the through lanes are only required if the lane closure continues beyond the exit. Those drums will be spaced at 20' (6 m) intervals for the first 500' (150 m). Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.

2. The opening to the ramp and the taper across the closed lane should each be 320' (100 m) or more whenever possible. A lesser opening and/or taper may be provided if no other alternative is available. The opening shall never be less than the taper, but may be more. When lesser opening and/or taper lengths are provided, advisory speed plaques (OW-143) shall be added to the OC-96 and OC-45A signs as follows:

Opening/taper	Advisory speed
290' (90 m)	50 mph
260' (80 m)	45 mph
230' (70 m)	40 mph
200' (60 m)	35 mph

If 200' (60 m) minimum dimensions cannot be provided, the ramp should be closed.

The advisory speed displayed shall not be greater than would otherwise be required to accommodate the permanent ramp geometry near the exit.

Advisory speeds within 10 mph of the legal speed limit need not be displayed.

3. The protection vehicle located close to the work shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenever workers are not in the work area. The vehicle shall be equipped with a 360 degree rotating or flashing amber beacon clearly visible a minimum of one quarter mile (400 m). Other protective devices may be used in lieu of the protection vehicle shown when approved by the Engineer.

4. If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and a) work zone channelizing lines shall be applied and b) the appropriate color work zone edge lines shall be applied when specified in the plans. Work zone channelizing lines and edge lines which would conflict with final traffic lanes shall be removable (740.06 Type I) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.06 Type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.

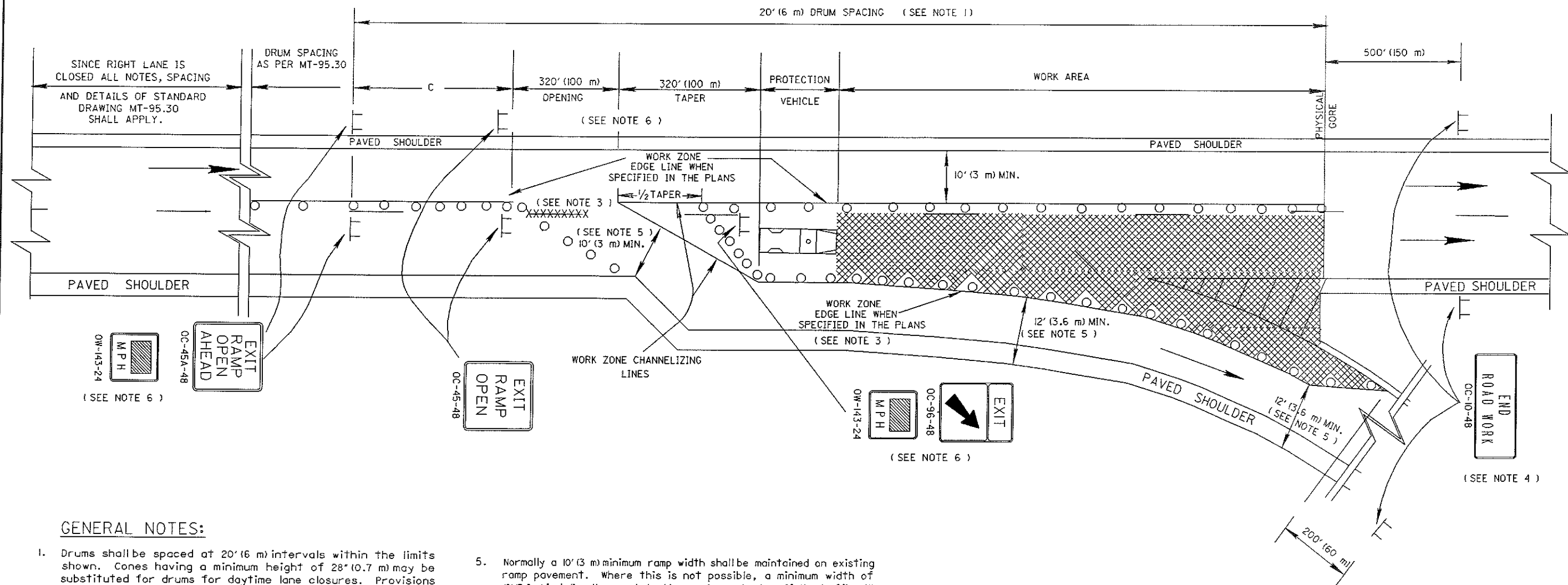
5. The OC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.

6. Normally a 10' (3 m) minimum ramp width shall be maintained on existing ramp pavement. Where this is not possible, a minimum width of 12' (3.6 m) including the paved shoulder may be used only: (1) if the traffic will be on the shoulder less than one day and the shoulder is in good condition, or (2) if the shoulder pavement is strengthened to hold the anticipated load.

7. All material and equipment shall be removed from the closure and the work area when no work is being done.

TABLE 1

MINIMUM DISTANCE - FT (m)	
	C
FREWAY & EXPRESSWAY	1000 (300)



GENERAL NOTES:

1. Drums shall be spaced at 20' (6 m) intervals within the limits shown. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.
2. The protection vehicle located close to the work shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenever workers are not in the work area. The vehicle shall be equipped with a 360 degree rotating or flashing amber beacon clearly visible a minimum of one quarter mile (400 m). Other protective devices may be used in lieu of the protection vehicle shown when approved by the Engineer.
3. If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and a) work zone channelizing lines shall be applied and b) the appropriate color work zone edge lines shall be applied when specified in the plans. Work zone channelizing lines and edge lines which would conflict with final traffic lanes shall be removable (740.06 Type I) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.06 Type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.
4. The OC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.

5. Normally a 10' (3 m) minimum ramp width shall be maintained on existing ramp pavement. Where this is not possible, a minimum width of 12' (3.6 m) including the paved shoulder may be used only: (1) if the traffic will be on the shoulder less than one day and the shoulder is in good condition, or (2) if the shoulder pavement is strengthened to hold the anticipated load.
6. The opening to the ramp and the taper in advance of the closed lane should each be 320' (100 m) or more whenever possible. A lesser opening and/or taper length may be provided if no other alternative is available. The opening shall never be less than the taper, but may be more. When lesser opening and/or taper lengths are provided, advisory speed plaques (OW-143) shall be added to the OC-96 and OC-45A signs as follows:

Opening/taper	Advisory speed
290' (90 m)	50 mph
260' (80 m)	45 mph
230' (70 m)	40 mph
200' (60 m)	35 mph

If 200' (60 m) minimum dimension cannot be provided, the ramp should be closed.

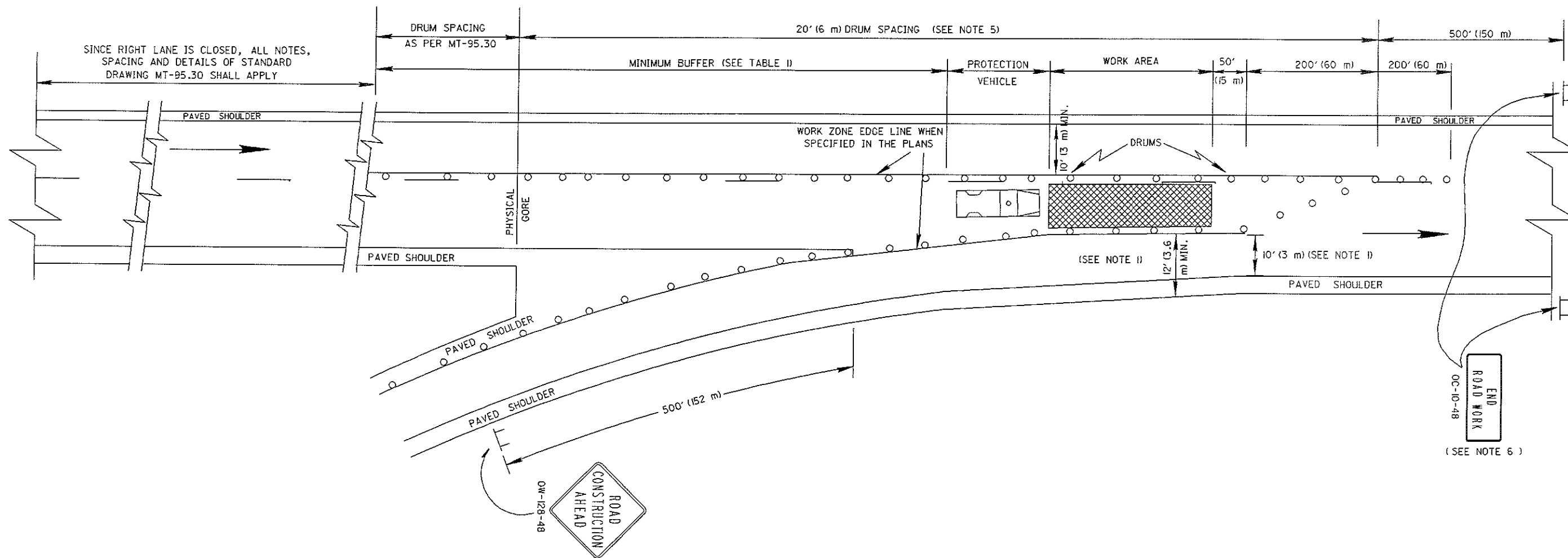
The advisory speed displayed shall not be greater than would otherwise be required to accommodate the permanent ramp geometry near the exit.

Advisory speeds within 10 mph of the legal speed limit need not be displayed.

7. All material and equipment shall be removed from the closure and the work area when no work is being done.

TABLE I

MINIMUM DISTANCE - FT (m)	
	C
FREEWAY & EXPRESSWAY	1000 (300)



GENERAL NOTES:

1. This work area traffic control application shall be employed only when the lateral clearance between the channelizing devices at the right edge of the work area and the edge of the ramp pavement is 10' (3 m) or more. Normally a 10' (3 m) minimum ramp width shall be maintained on existing ramp pavement. Where this is not possible, a minimum width of 12' (3.6 m) including the paved shoulder may be used only: (1) if the traffic will be on the shoulder less than one day and the shoulder is in good condition, or (2) if the shoulder pavement is strengthened to hold the anticipated load. When the ramp is closed appropriate detour signs shall be provided.

2. When the ramp is not long enough to allow sign placement as specified above, they may be spaced proportionately within the space available as determined by the Engineer (a 200' (60 m) minimum spacing must be maintained).

3. The protection vehicle located close to the work area shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenever workers are not in the work area. The vehicle shall be equipped with a 360 degree rotating or flashing amber beacon visible a minimum of one quarter mile (400 m). Other protective devices may be used in lieu of the protection vehicle shown when approved by the Engineer.
4. If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and the appropriate color work zone edge lines shall be applied when specified in the plans. Work zone edge lines which would conflict with final traffic lanes shall be removable (740.05 Type D) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.05 Type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.

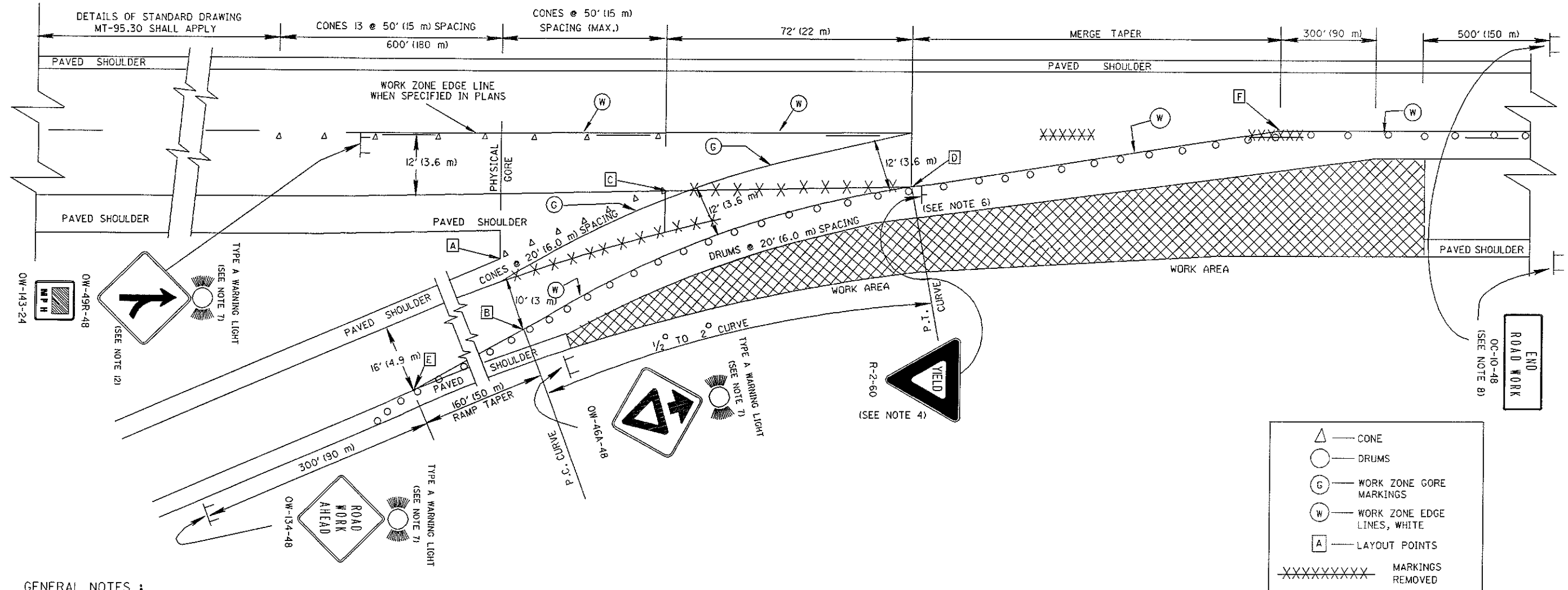
5. Drums shall be spaced at 20' (6 m) intervals on both sides of the work area within the limits shown. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.

6. The OC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.

7. All material and equipment shall be removed from the closure and the work area when no work is being done.

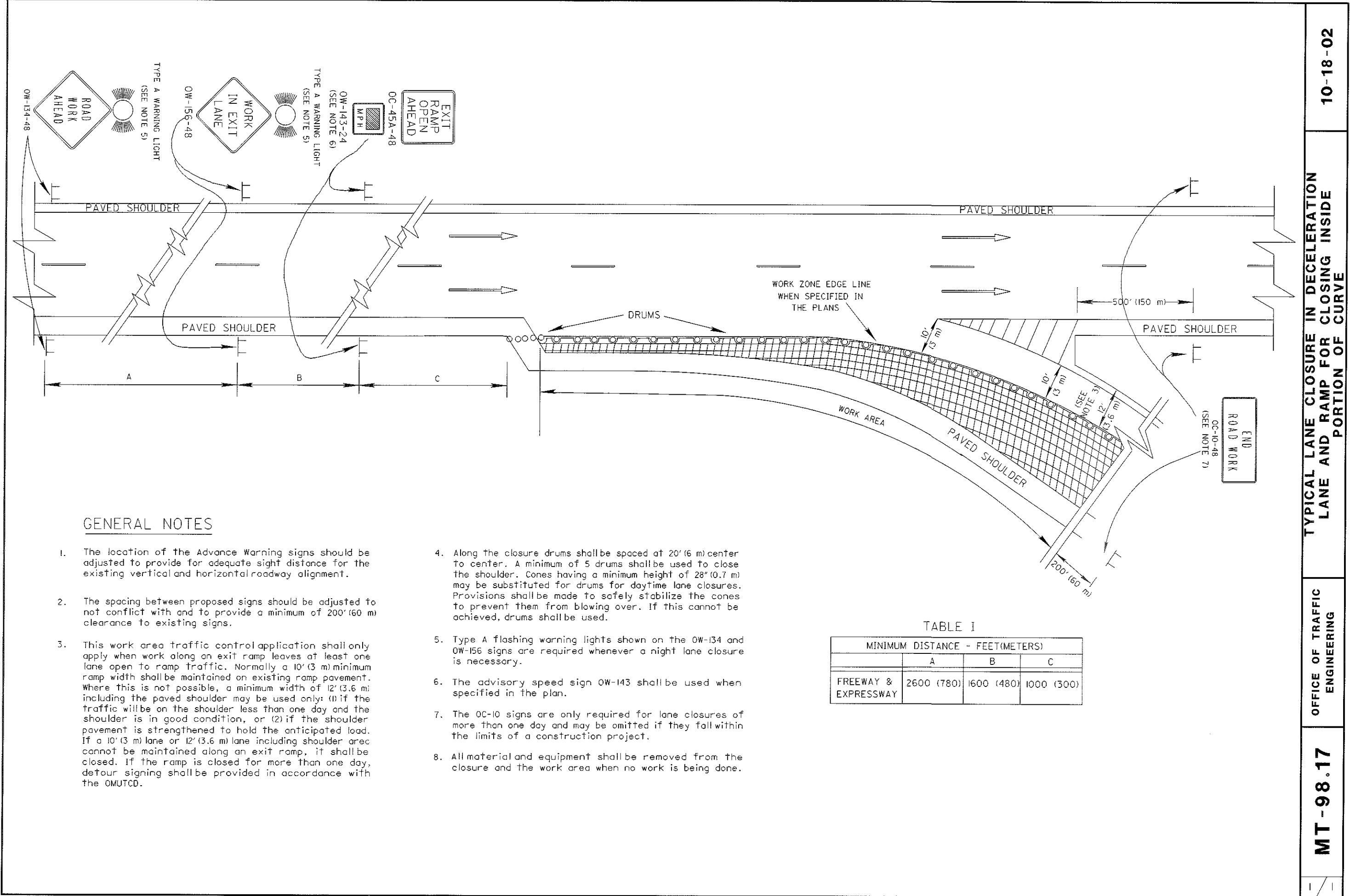
TABLE I

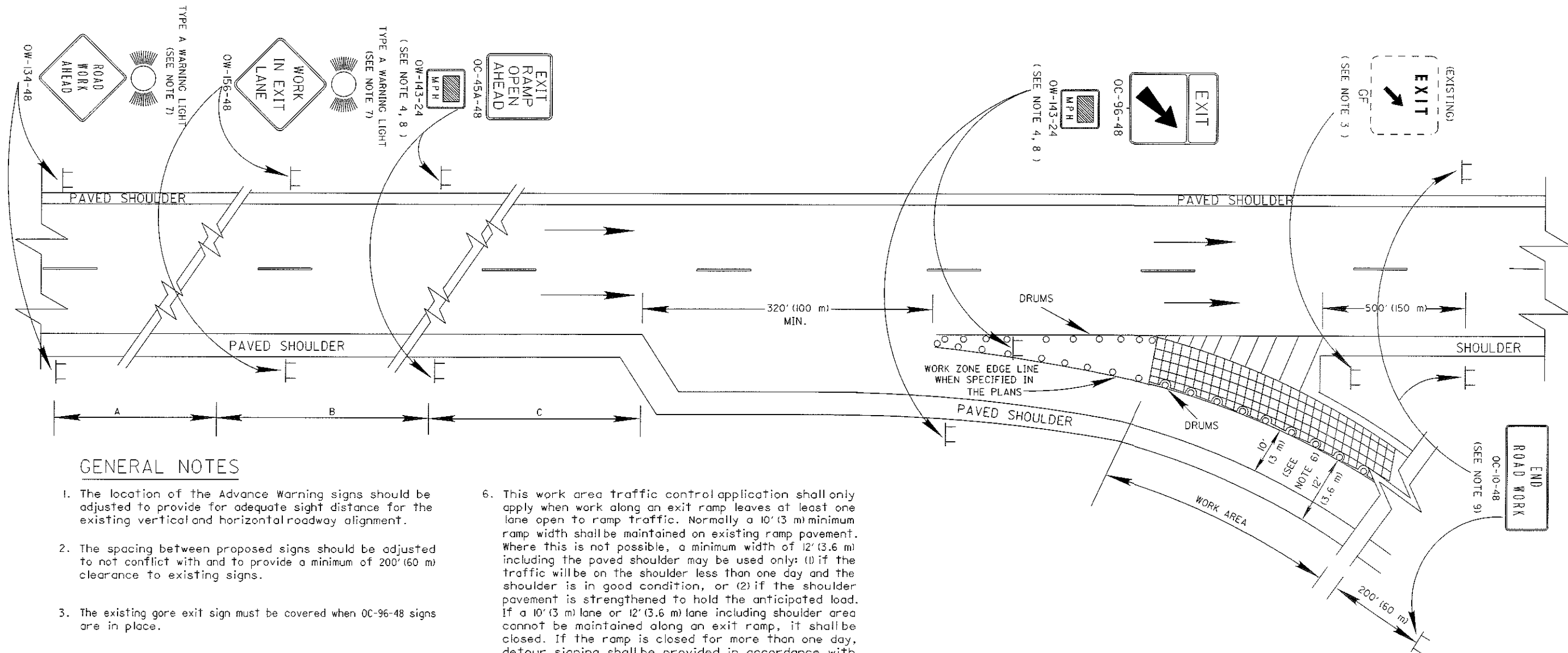
SPEED LIMIT (MPH)	BUFFER AREA FT (METERS)
45 - 50	280 (85)
60 - 65	485 (145)



GENERAL NOTES :

1. This work area traffic control application shall be employed when: (1) the lateral clearance between channelizing devices at the right edge of the work area and the edge of pavement is less than 10' (3 m) (12' (3.6 m) if the shoulder pavement is used) as shown on drawing MT-98.15, and (2) the required ramp tapers and curves can be provided as shown except as described in note 4. In the event the work zone condition would permit the use of either MT-98.15 or MT-98.16, MT-98.15 shall be used. This traffic control measure shall not be placed in effect until immediately before the Contractor is fully prepared to perform the work on the ramp or lane adjacent to it. Once this measure is placed into effect, the Contractor shall expeditiously pursue the work (working continuously with full crew in the ramp area on all normal working days) until it is completed and shall immediately open the area to normal traffic or, as a minimum, revert to the methods shown on MT-98.15. It is the intent that the longest merging taper length possible shall be chosen, commensurate with the requirements of construction.
2. The ramp taper shall desirably be located to provide a 10' (3 m) minimum path between drums and the paved shoulder in the gore. The ramp traffic may be placed on the paved gore as shown above only if: (1) the traffic will use the paved shoulder pavement less than one day and the shoulder pavement is in good condition and is level and smooth or (2) if the shoulder pavement is adequately strengthened, leveled and smoothed to carry the anticipated load. A minimum of 3 drums shall be used to close the ramp shoulder.
3. When the ramp is not long enough to allow sign placement as specified above, they may be spaced proportionately within the space available as determined by the Engineer to 200' (60 m) minimum spacing must be maintained.
4. It will be necessary to move the location of any existing yield sign. In these cases, the permanent R-2 sign installation shall be removed (and subsequently restored) and the temporary installation shall be mounted appropriately. If the required distances (ramp taper, curve and merge taper) cannot be obtained, the Engineer may approve slightly lower values for a short time, in which case the yield sign shall be removed and a 48" (1200 mm) stop sign placed appropriately to be visible to ramp traffic but not be obtrusive to mainline traffic.
5. If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed at no additional cost. The appropriate color temporary edge lines shall be applied along the taper. Work zone pavement markings which would conflict with final traffic lanes shall be removable (740.05 Type I) tape unless the area will be resurfaced in the next work phase. After completion of the work, work zone pavement markings shall be removed in accordance with 641.10 and the original markings and raised pavement marker reflectors shall be restored at no additional cost.
6. Drum spacing adjacent to the mainline and on the ramp shall be not more than 20' (6 m) C - C in the area from the physical gore to 300' (90 m) beyond the merge taper. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Cones shall be reflectorized and safely stabilized.
7. Type A flashing warning lights are required on the OW-134, OW-49R and the OW-46 signs whenever a night lane closure is necessary.
8. The OC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.
9. From the end of the gore area graded shoulder (point A), locate the PC of the curve by measuring perpendicular to the ramp centerline 10' (3 m) of ramp pavement, not including paved shoulder width (point B). From the end of the gore area paved shoulder (point C), locate the PT of the curve by measuring 72' (22 m) from point C along the edge of pavement extended (point D).
10. Placement of drums shall begin at (point E) 160' (50 m) upstream from the previously located PC (point B) and at the right edge of ramp pavement. From this point a drum taper shall be placed to the PC (point B) and then along a curve as shown to the PT (point D) where a 48" (min.) merge taper shall meet mainline traffic control (point F).
11. All material and equipment shall be removed from the closure and the work area when no work is being done.
12. It is intended that the merge sign OW-49R-48 be located to the right of the through lane as shown. However if the sign cannot be located as shown due to the activity at the location, the sign may be located to the left of the through lane as an alternate location.





GENERAL NOTES

1. The location of the Advance Warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.
2. The spacing between proposed signs should be adjusted to not conflict with and to provide a minimum of 200' (60 m) clearance to existing signs.
3. The existing gore exit sign must be covered when OC-96-48 signs are in place.
4. The opening to the ramp should be 320' (100 m) or more whenever possible. A lesser opening may be provided if no other alternative is available. When a lesser opening length is provided, advisory speed plaques (OW-143) shall be added to the OC-96 and OC-45A signs as follows:

<u>Opening</u>	<u>Advisory speed</u>
290' (90 m)	50 mph
260' (80 m)	45 mph
230' (70 m)	40 mph
200' (60 m)	35 mph

If 200' (60 m) minimum dimensions cannot be provided, the ramp should be closed.

The advisory speed displayed shall not be greater than would otherwise be required to accommodate the permanent ramp geometry near the exit.

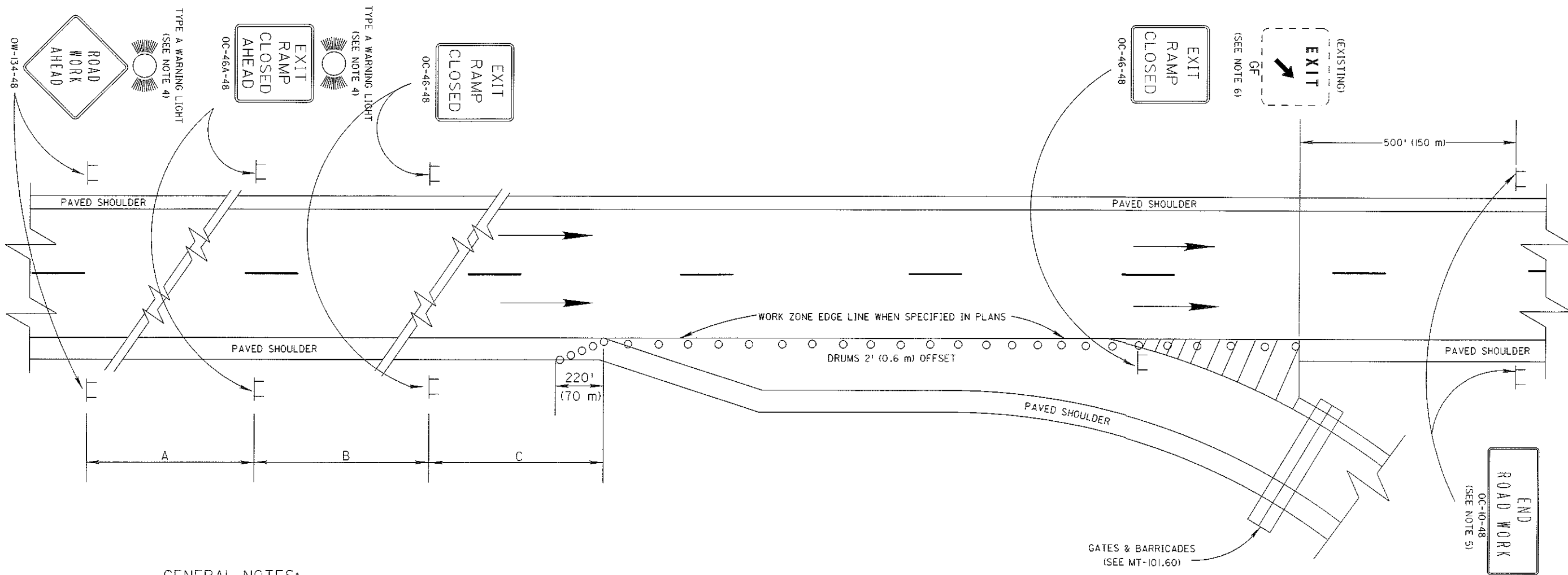
Advisory speeds within 10 mph of the legal speed limit need not be displayed.

5. Along the closure drums shall be spaced at 20' (6 m) center to center. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.

6. This work area traffic control application shall only apply when work along an exit ramp leaves at least one lane open to ramp traffic. Normally a 10' (3 m) minimum ramp width shall be maintained on existing ramp pavement. Where this is not possible, a minimum width of 12' (3.6 m) including the paved shoulder may be used only: (1) if the traffic will be on the shoulder less than one day and the shoulder is in good condition, or (2) if the shoulder pavement is strengthened to hold the anticipated load. If a 10' (3 m) lane or 12' (3.6 m) lane including shoulder area cannot be maintained along an exit ramp, it shall be closed. If the ramp is closed for more than one day, detour signing shall be provided in accordance with the OMTCD.
7. Type A flashing warning lights shown on the OW-134 and OW-156 signs are required whenever a night closure is necessary.
8. The advisory speed sign OW-143 shall be used when specified in the plan or as required in note 2.
9. The OC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.
10. All material and equipment shall be removed from the closure and the work area when no work is being done.

TABLE I

MINIMUM DISTANCE - FEET (METERS)			
	A	B	C
FREEWAY & EXPRESSWAY	2600 (780)	1600 (480)	1000 (300)



GENERAL NOTES:

1. The location of the Advance Warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.
2. The spacing between proposed signs should be adjusted to not conflict with and to provide a minimum of 200' (60 m) clearance to existing signs.
3. Along the closure, drums shall be spaced at 20' (6 m) center to center. A minimum of 5 drums shall be used to close the shoulder. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.
4. Type A flashing warning lights shown on the OW-134 and OC-46A signs are required whenever a night closure is necessary.
5. The OC-10 signs are only required for ramp closures of more than one day and may be omitted if they fall within the limits of a construction project.
6. The existing gore sign must be covered when the OC-96 signs are in place.

TABLE I

MINIMUM DISTANCE - FT (m)			
	A	B	C
FREEWAY & EXPRESSWAY	2600 (780)	1600 (480)	1000 (300)

GENERAL

IN ADDITION TO 614, TRAFFIC SHALL BE MAINTAINED IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS:

THE PURPOSE OF THE FOLLOWING REQUIREMENTS FOR TRAFFIC CONTROL FOR PAVEMENT MARKING OPERATIONS IS TO PROVIDE SAFETY FOR HIGHWAY USERS, WORKERS AND EQUIPMENT AND TO PROTECT THE MARKINGS FROM DAMAGE DURING APPLICATION. THESE REQUIREMENTS ARE THE REQUIRED MINIMUMS. IF AT ANY TIME DURING THE APPLICATION OF MARKINGS IT IS FOUND BY THE ENGINEER THAT THESE MINIMUM TRAFFIC CONTROL REQUIREMENTS ARE NOT ACHIEVING THE NECESSARY SAFETY AND MARKING PROTECTION, ADDITIONAL TRAFFIC CONTROL SHALL BE IMPLEMENTED AT NO ADDITIONAL COST.

THE ENGINEER MAY SUSPEND WORK IN ORDER TO RELIEVE TRAFFIC CONGESTION AT ANY TIME. NO WORK SHALL BE DONE DURING PEAK HOURS, AS DETERMINED BY THE ENGINEER.

VEHICLES TRANSPORTING FLAMMABLE PAVEMENT MARKING MATERIALS (MATERIAL SUPPLY VEHICLES) SHALL NOT BE UTILIZED FOR LEAD OR TRAIL VEHICLES OR FOR POWER BROOM EQUIPMENT. ALL PAVEMENT MARKING APPLICATION, PROTECTION AND SUPPORT EQUIPMENT FOLLOWING THE LINE MARKING MACHINE SHALL HAVE THE TRAFFIC CONTROL EQUIPMENT OF A TRAIL VEHICLE.

LINE MARKING MACHINES SHALL NOT BE USED FOR SIGN AND CONE PLACEMENT.

LEAD VEHICLE

A LEAD VEHICLE IS TO BE USED TO WARN OPPOSING TRAFFIC OF THE APPROACH OF CENTER LINE AND OTHER MARKING EQUIPMENT WHEN THIS EQUIPMENT EXTENDS INTO THE ADJACENT OPPOSING TRAFFIC LANE. THE LEAD VEHICLE SHALL PRECEDE THE "LEFT OF CENTER" MARKING EQUIPMENT A DISTANCE THAT WILL PROVIDE ADVANCE SAFE WARNING TO APPROACHING TRAFFIC. THE OPERATOR OF THIS UNIT SHALL DRIVE AHEAD OF THE CREST OF A VERTICAL CURVE OR AROUND A HORIZONTAL CURVE AND WAIT UNTIL THE "LEFT OF CENTER" MARKING EQUIPMENT NEARS AND THEN PROCEED, MAINTAINING AN ADVANCE LOCATION OF 122 m TO 183 m.

A LEAD VEHICLE SHALL BE EQUIPPED AND OPERATED WITH THE FOLLOWING TRAFFIC CONTROL DEVICES:

1. A 360° ROTATING OR FLASHING AMBER BEACON CLEARLY VISIBLE IN ALL DIRECTIONS A MINIMUM OF 400 m.
2. LIGHTED HEADLIGHTS AND TAILLIGHTS, AND
3. A KEEP RIGHT SIGN (OC-31R-48) AND WET PAINT SIGN (OC-52-48) MOUNTED A MINIMUM OF 1.5 m ABOVE THE ROAD SURFACE MEASURED TO THE BOTTOM OF THE SIGN, AND VISIBLE TO OPPOSING TRAFFIC.

POWER BROOM EQUIPMENT

POWER BROOM EQUIPMENT SHALL BE EQUIPPED AND OPERATED DURING PAVEMENT PREPARATIONS WITH THE FOLLOWING TRAFFIC CONTROL DEVICES:

1. A 360° ROTATING OR FLASHING AMBER BEACON CLEARLY VISIBLE IN ALL DIRECTIONS A MINIMUM OF 400 m.
2. LIGHTED HEADLIGHTS AND TAILLIGHTS, AND
- * 3. A FLASHING ARROW PANEL 1.4 X .76 m CONFORMING TO MT-35.10M (TYPE B) VISIBLE TO THE REAR MOUNTED A MINIMUM OF 2 m ABOVE THE ROAD SURFACE, MEASURED TO THE BOTTOM OF THE PANEL, AND USED ONLY ON MULTI-LANE HIGHWAYS.

LINE MARKING MACHINE

ALL TRAFFIC LINE MARKING MACHINES SHALL BE EQUIPPED AND OPERATED WITH THE FOLLOWING TRAFFIC CONTROL EQUIPMENT:

1. THREE 360° ROTATING OR FLASHING AMBER BEACONS CLEARLY VISIBLE IN ALL DIRECTIONS A MINIMUM OF 400 m, MOUNTED A MINIMUM OF 2 m ABOVE THE ROAD SURFACE, ONE FORWARD, ONE ON THE RIGHT REAR AND ONE ON THE LEFT REAR OF THE VEHICLE.
- * 2. (A) A FLASHING ARROW PANEL 1.4 X .76 m CONFORMING TO MT-35.10M (TYPE B) DISPLAYED TO THE REAR MOUNTED A MINIMUM OF 2 m ABOVE THE ROAD SURFACE, MEASURED TO BOTTOM OF THE PANEL, AND USED ONLY ON MULTI-LANE HIGHWAYS, OR
(B) A DO NOT PASS SIGN (R-33A-48) VISIBLE TO THE REAR DURING CENTER LINE MARKING ON TWO-LANE, TWO-WAY ROADWAYS AND MOUNTED A MINIMUM OF 2 m ABOVE THE ROAD SURFACE, MEASURED TO THE BOTTOM OF THE SIGN. THIS SIGN MAY BE USED TO COVER THE ARROW PANEL WHICH SHALL NOT BE USED ON TWO-LANE, TWO WAY ROADWAYS.
3. A WET PAINT WITH ARROW SIGN (OC-50-24 OR OC-51-48) SHALL FACE THE REAR. THE SIGN SHALL BE POSITIONED WITH THE ARROW POINTING TO THE WET LINE. WHEN USED, OC-50-24 SHALL BE MOUNTED ON THE SIDE OF THE VEHICLE NEAREST THE WET MARKING MATERIAL. OC-50-24 AND OC-51-48 SIGNS SHALL BE MOUNTED A MINIMUM OF 0.3 m ABOVE THE ROAD SURFACE.
4. A KEEP RIGHT SIGN (OC-31R-48) AND WET PAINT SIGN (OC-52-48) MOUNTED A MINIMUM OF 1.5 m ABOVE THE ROAD SURFACE, MEASURED TO THE BOTTOM OF THE SIGN FACING OPPOSING TRAFFIC WHEN THIS UNIT EXTENDS INTO THE ADJACENT OPPOSING TRAFFIC LANE.
5. THE GUIDE AND SIDE MOUNTED MARKING CARRIAGES SHALL EACH BE EQUIPPED WITH A CLEAN RED FLAG NOT LESS THAN 0.4 m SQUARE AND FASTENED TO A STAFF OF SUFFICIENT LENGTH SO AS TO PERMIT THE FLAG TO MOVE FREELY OF ANY OBSTRUCTION.

TRAIL VEHICLE

WHEN REQUIRED, A TRAIL VEHICLE SHALL BE POSITIONED AT THE TRACK FREE END OF THE WET LINE.

TRAIL VEHICLES SHALL BE EQUIPPED AND OPERATED WITH THE FOLLOWING TRAFFIC CONTROL EQUIPMENT:

1. A 360° ROTATING OR FLASHING AMBER BEACON CLEARLY VISIBLE IN ALL DIRECTIONS A MINIMUM OF 400 m,
- * 2. (A) A FLASHING ARROW PANEL 1.4 X .76 m CONFORMING TO MT-35.10M (TYPE B) VISIBLE TO THE REAR MOUNTED AT A MINIMUM HEIGHT OF 2 m ABOVE THE ROAD SURFACE, MEASURED TO THE BOTTOM OF THE PANEL, AND USED ONLY ON MULTI-LANE HIGHWAYS, OR
(B) A DO NOT PASS SIGN (R-33A-48) VISIBLE TO THE REAR DURING CENTER LINE MARKING ON TWO-LANE, TWO-WAY ROADWAYS AND MOUNTED A MINIMUM OF 2 m ABOVE THE ROAD SURFACE, MEASURED TO THE BOTTOM OF THE SIGN. THIS SIGN MAY BE USED TO COVER THE ARROW PANEL, WHICH SHALL NOT BE USED ON TWO-LANE, TWO-WAY ROADWAYS.
3. A WET PAINT WITH ARROW SIGN (OC-50-24 OR OC-51-48) SHALL FACE THE REAR. THE SIGN SHALL BE POSITIONED WITH THE ARROW POINTING TO THE WET LINE. WHEN USED, OC-50-24 SHALL BE MOUNTED ON THE SIDE OF THE VEHICLE NEAREST THE WET MARKING MATERIAL. OC-50-24 SHALL BE MOUNTED A MINIMUM OF 1.4 m ABOVE THE ROAD SURFACE AND OC-51-48 SHALL BE MOUNTED A MINIMUM OF 1.5 m ABOVE THE ROAD SURFACE, BOTH MEASURED TO THE BOTTOM OF THE SIGN.

*

WHEN A VEHICLE IS OPERATING ON A TWO-LANE TWO-WAY ROADWAY THE FLASHING ARROW PANEL SHALL BE TILTED HORIZONTALLY OR COVERED.

CONES AND WET PAINT-KEEP OFF SIGNS

CONES AND WET PAINT-KEEP OFF SIGNS (R-87-24) SHALL BE PLACED TO PROTECT THE LINE WHENEVER THE TRACK FREE TIME EXCEEDS 2 MINUTES. THESE DEVICES SHALL NOT BE REMOVED UNTIL THE LINE HAS DRIED TO A TRACK FREE CONDITION. RETRIEVAL EQUIPMENT SHALL HAVE THE TRAFFIC CONTROL EQUIPMENT OF A TRAIL VEHICLE. CONES SHALL HAVE A MINIMUM HEIGHT OF 0.46 m. THEY SHALL BE SPACED TO PROTECT THE WET LINE NORMALLY BETWEEN 37 m AND 61 m. IN AREAS OF TRAFFIC CONGESTION, ON CURVES AND AT OTHER LOCATIONS WHERE TRACKING OF THE WET LINE IS EXPECTED SPACINGS AS CLOSE AS 6.1 m MAY BE REQUIRED. THE WET PAINT-KEEP OFF SIGNS (R-87-24) SHALL BE PLACED FACING TRAFFIC AT:

- A. THE BEGINNING AND END OF LINE APPLICATION,
- B. ALL SIDE AND CROSS ROADS, AND
- C. MAXIMUM INTERVALS OF 1.6 km.

WHEN LANE LINE MARKINGS REQUIRE GREATER THAN A TWO MINUTE DRYING TIME, THE LANE FROM WHICH THE LINE MARKING MACHINE APPLIES LANE LINE MARKINGS SHALL BE CLOSED UNTIL THE LINE HAS DRIED TO A TOTALLY TRACK FREE CONDITION.

IMMOBILE OPERATIONS

WHEN LOADING MATERIAL, CLEANING OR PERFORMING OTHER OPERATIONS IN THE FIELD, EVERY EFFORT SHALL BE MADE TO HAVE ALL EQUIPMENT COMPLETELY OFF OF THE TRAVELED WAY. WHEN IT BECOMES NECESSARY TO ENTER UPON PRIVATE PROPERTY, PERMISSION SHALL BE OBTAINED IN ADVANCE. WHEN THE CONTRACTOR CANNOT REMOVE HIS EQUIPMENT FROM THE TRAVELED WAY ALL TRAFFIC CONTROL DEVICES ON THE VEHICLES SHALL BE IN OPERATION AND FLAGGERS AND VEHICLES SHALL BE STATIONED TO PROTECT THE WORK SITE AND THE TRAVELING PUBLIC.

TWO-WAY TRAFFIC SHALL BE MAINTAINED. FLAGGERS SHALL BE EQUIPPED IN ACCORDANCE WITH ITEM 614.03.

AUXILIARY MARKINGS

PAVEMENT PREPARATION AND PLACING OF AUXILIARY MARKINGS (SEE ③) ARE CONSIDERED TO BE STATIONARY OPERATIONS AND TRAFFIC CONTROL SHALL BE IN ACCORDANCE WITH PLAN DETAILS, STANDARD CONSTRUCTION DRAWINGS AND THE OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (OMUTCD).

LAYOUT AND PREMARKING

THE VEHICLE USED IN LAYOUT AND PREMARKING SHALL BE EQUIPPED AND OPERATED WITH THE FOLLOWING EQUIPMENT:

1. A 360° ROTATING OR FLASHING AMBER BEACON CLEARLY VISIBLE IN ALL DIRECTIONS A MINIMUM OF 400 m.
2. LIGHTED HEADLIGHTS AND TAILLIGHTS, AND
3. A KEEP RIGHT SIGN (OC-31R-48) MOUNTED A MINIMUM OF 1.5 m ABOVE THE ROAD SURFACE, MEASURED TO THE BOTTOM OF THE SIGN, AND VISIBLE TO OPPOSING TRAFFIC.

NIGHTTIME OPERATION

NIGHTTIME OPERATION IS DEFINED TO INCLUDE THE TIME FROM ONE-HALF HOUR AFTER SUNSET TO ONE-HALF HOUR BEFORE SUNRISE, AND AT ANY OTHER TIME WHEN THERE ARE UNFAVORABLE ATMOSPHERIC CONDITIONS OR WHEN THERE IS NOT SUFFICIENT NATURAL LIGHT TO RENDER DISCERNIBLE PERSONS, VEHICLES, AND SUBSTANTIAL OBJECTS ON THE HIGHWAY AT A DISTANCE OF 305 m.

DURING NIGHTTIME CONDITIONS THE FOLLOWING TRAFFIC CONTROL SHALL BE PROVIDED:

1. CONES SHALL BE REFLECTORIZED OR EQUIPPED WITH LIGHTING DEVICES FOR MAXIMUM VISIBILITY (SEE 7F-5, OMUTCD), AND
2. THE GUIDE AND SIDE-MOUNTED CARRIAGES SHALL BE ILLUMINATED.

THE PRESENCE OF HIGHWAY LIGHTING DOES NOT WAIVE THESE REQUIREMENTS.

MINIMUM PAVEMENT MARKING TRAFFIC CONTROL EQUIPMENT REQUIREMENTS

THIS TABLE INDICATES THE TRAFFIC CONTROL EQUIPMENT WHICH SHALL BE FURNISHED FOR EACH TYPE OF LONG LINE PAVEMENT MARKING OPERATION. IN ADDITION, THE TYPE OF TRAFFIC CONTROL EQUIPMENT WHICH SHALL BE FURNISHED WHEN DIRECTED BY THE ENGINEER IS INDICATED.

EQUIPMENT	PAVEMENT MARKING LINE TYPE ①					
	CENTER LINE		EDGE LINE		LANE LINE ② CHANNELIZING LINE ③	
	LONGER THAN 2 MIN. DRY	2 MIN. OR LESS DRY	LONGER THAN 2 MIN. DRY	2 MIN. OR LESS DRY	LONGER THAN 2 MIN. DRY	2 MIN. OR LESS DRY
LEAD VEHICLE	A	A	C	C	C	C
POWER BROOM EQUIPMENT	B	B	A	A	B	B
LINE MARKING MACHINE	A	A	A	A	A	A
TRAIL VEHICLE	D	A	D	A	LANE CLOSURE REQUIRED (0.7 m CONES REQUIRED)	A
TRAIL VEHICLE (ADDITIONAL)	C	B	C	B		A
TRAIL VEHICLE (SIGN & CONE RETRIEVAL)	A	C	A	C		C
TRAIL VEHICLE (SHADOW FOR RETRIEVAL)	A	C	A	C		C

① FOR EQUIPMENT REQUIREMENTS FOR AUXILIARY MARKING OPERATIONS SEE THE PLANS AND PART 7, OMUTCD.

② INCLUDES BOTH DASHED AND SOLID LANE LINES.

③ CHANNELIZING LINE SEGMENTS OF 61 m OR LESS SHALL BE CONSIDERED AUXILIARY MARKINGS, EXCEPT WHEN APPLIED AS COMPONENTS OF GORE MARKINGS SPRAYED IN MOVING OPERATIONS SEPARATE FROM THE APPLICATION OF TRANSVERSE LINES.

A	REQUIRED EQUIPMENT
B	EQUIPMENT REQUIRED WHEN DIRECTED BY THE ENGINEER
C	NOT REQUIRED
D	REQUIRED EQUIPMENT FOR SIGN & CONE PLACEMENT

METRIC

BUREAU OF DESIGN SERVICES
DIVISION OF HIGHWAYS
OHIO DEPARTMENT OF TRANSPORTATION

MAINTENANCE OF TRAFFIC

TRAFFIC CONTROL FOR LONG
LINE PAVEMENT MARKING
OPERATIONS

STANDARD
CONSTRUCTION
DRAWING
APPROVED *David C. ...* ENGR. OF DESIGN SERVICES

MT-99.20M

DATE
01/30/95

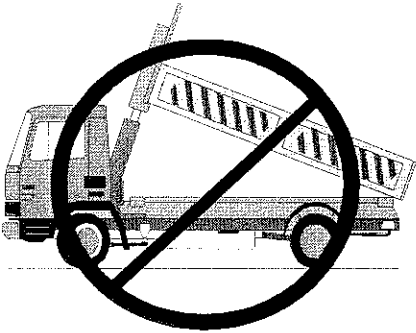
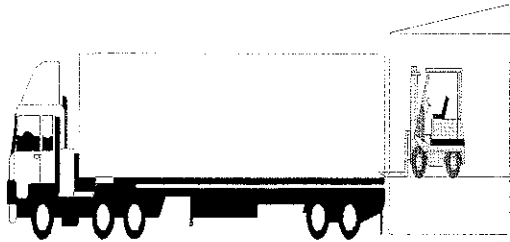
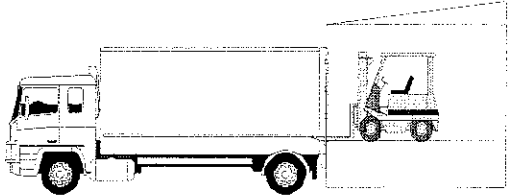
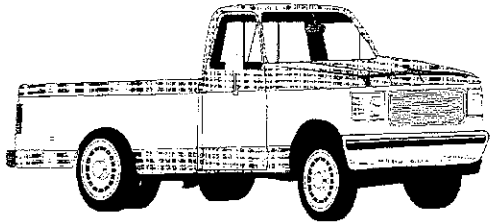
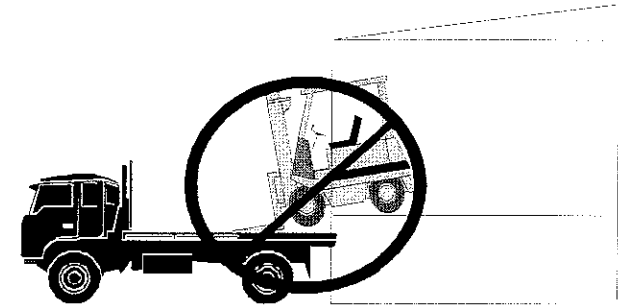
STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENT 1082
Recycled Raised Pavement Markers (RRPMs)
Authorization and Transfer Slip

This form Authorizes the Contractor to pick up Department-supplied RRPMs for the project listed below.

Project No:	Contractor:	Estimated Completion Date:	
Sale Date:	Estimated Pick-up Date:		Date Picked Up:
Authorized by _____		Telephone _____	
Print Name	Number _____	Signature _____	
ODOT District _____		Date: _____	

Type of Recycled R/Ps	OPI Catalog Number	Quantity Requested	Quantity Picked Up	No of Skids	No of Boxes
High Profile Conventional RPM with Yellow/Yellow Reflectors	RRPM 01				
Low Profile Tapered RPM with Yellow/Yellow Reflectors	RRPM 02				
High Profile Conventional Castings with no Reflectors	RRPM 03				
Low Profile Tapered Castings with no Reflectors	RRPM 04				
High Profile Conventional RPM with White/Red Reflectors	RRPM 05				
High Profile Conventional RPM with 1-Way White Reflectors	RRPM 06				
Low Profile Tapered RPM with White/Red Reflectors	RRPM 07				
Low Profile Tapered RPM with 1-Way White Reflectors	RRPM 08				
High Profile Conventional RPM with Yellow / Red Reflectors	RRPM 09				
Low Profile Tapered RPM with Yellow / Red Reflectors	RRPM 10				
High Profile Tapered RPM with 1 way Yellow Reflectors	RRPM 11				
Low Profile Tapered RPM with 1 way Yellow Reflectors	RRPM 12				
High Profile Conventional RPM with White/White Reflectors	RRPM 13				
Low Profile Tapered RPM with White/White Reflectors	RRPM 14				

Send a copy of this transfer authorization form to the Office of Traffic Engineering. Before scheduling pick up. Please call the Office of Traffic Engineering at 614-644-8179 five calendar days before the desired pickup date. OPI will not load RRPMs if it deems that the truck is inappropriate or unsafe for the load being shipped. A list of appropriate trucks can be obtained from the Office of Traffic Engineering.



The OPI Warehouse will load RPMs onto trucks similar to the ones shown on this page. The OPI dock manager has the final say in whether a truck can be safely loaded, and how it will be loaded at the dock. The driver of the truck being loaded will assure that the RPMs are loaded so they constitute a safe legal load. OPI will not load tilt bodies, dump trucks, or noncommercial moving vans; or vehicles onto which a fork lift cannot safely drive. Trucks with a less than 1.2m (48 inches) loading height or that cannot be backed up flush to the OPI docks will not be loaded unless the load is less than 500 RPMs (approximately 1-½ skids of RPMs), and then only if the OPI dock manager agrees to it. Otherwise the Contractor will be either turned away, or have to load it. An exception may be made for loads of less than 500 RPMs that can be safely loaded onto pick-up trucks. Keep in mind that one box of RPMs weighs 45 kg (100 pounds), and a skid of RPMs weigh 950 kg (2100 pounds). Trucks that cannot safely carry the required load will be turned away. If the Contractor does not follow these procedures, and OPI cannot load the RPMs, the Contractor will be responsible for loading the RPMs. Any damage during transport is the Contractor's responsibility.

**STATE OF OHIO
DEPARTMENT OF TRANSPORTATION**

SUPPLEMENTAL SPECIFICATION 908

PERFORMANCE GRADE (PG) BINDER REQUIREMENTS

April 18, 2003

- 908.01 General**
- 908.02 Materials and Manufacture**
- 908.03 Performance**
- 908.04 Storage**
- 908.050 Requirements for PGM Binder**
- 908.051 Sampling of PGM Binder**
- 908.052 Mix Design for PGM Binder**
- 908.053 Quality Control for PGM Binder**

908.01 General. The requirements of AASHTO MP1-98 shall apply, deviations from these are as follows.

PG Binders with the suffix "M" (e.g., PG 70-22M, PG 76-22M) shall meet the requirements for a PGM Binder.

For this specification, an independent laboratory shall not be owned or operated, in whole or part, by the binder supplier, Contractor, or affiliates of either.

908.02 Materials and Manufacture. The requirements of the AASHTO MP1-98 "Materials and Manufacture" Section shall be completely replaced with the following:

5.1 The PG Binder shall be an asphalt cement from the refining of crude petroleum, or combination of asphalt cements from the refining of crude petroleum, or asphalt cements and suitable liquid from the refining of crude petroleum, and possible organic modifiers for performance enhancement. Material from the crude refining stream will be considered neat. Liquid from crude refining may be used for adjustments, but shall not be used for the purpose of substitution of crude refined asphalt cement in a PG Binder. In the event of a failure investigation where binders exhibit unusual properties a supplier may be requested by the Laboratory to supply information about the makeup of a PG Binder. Failure to cooperate will mean removal from Supplement 1032 certification.

5.2 A modifier may be any organic material of suitable manufacture that is proven compatible with asphalt cement (does not separate appreciably in routine

storage), and that is dissolved, dispersed or reacted in asphalt cement to improve its performance. Performance enhancement is defined as a decrease in the temperature susceptibility of the asphalt cement while maintaining or improving desirable properties in a neat asphalt cement such as coatability, adhesiveness and cohesiveness. The use of modifiers shall be limited to 6.0 percent by PG Binder weight.

5.3 The use of previously used materials must be approved by the Department. Since no standard test procedures exist for reprocessed materials (and original tests were not developed with the use of such materials in mind), appropriate test methods may be chosen by the Department for review. Department approval does not relieve the binder supplier from full responsibility for content and use of any previously used material nor guarantee suitable performance enhancement as defined above. The detected presence in a PG Binder sample of any unapproved previously used material will mean immediate removal from Supplement 1032 certification. Approved reprocessed materials will be limited to 6.0 percent by PG Binder weight.

5.4 The PG Binder shall be homogeneous, free from water and deleterious materials, and shall not foam when heated to 350F (175C). The asphalt binder (before modification or after modification if liquid modifier used) shall be proven fully compatible with a negative result by means of the Spot Test per AASHTO T 102 using standard naphtha solvent. If standard naphtha shows a positive result, a retest using 35 percent Xylene/ 65 percent Heptane (volume) may be used.

5.5 The PG Binder shall be at least 99.0 percent soluble as determined by ASTM D 5546 or D 2042. Any insoluble component shall be substantially free of fibers and have discrete particles less than 75µm.

5.6 Flash point shall be 500F (260C) min. Mass loss on RTFO of final PG grade binder shall be 0.5 percent max.

5.7 PG 58-28 shall have a minimum Viscosity (ASTM D2171 @ 60C) of 800 poise and PG 64-22 shall have a Penetration (ASTM D5) between 55 and 75.

5.8 Direct Tension testing is not required, unless otherwise required in this specification.

908.03 Performance. Should excess fat spots, regular random areas of flushing, or excess drainage occur on a project and not be attributable to over rolling, plant operation, or mix quality compared to the JMF, the PG Binder will be rejected. This rejection includes any PGM Binders with an incompatible polymer or that have been improperly handled. The Contractor will not be allowed to use any of the rejected PG Binder. Correction of problem areas will be at the District's discretion depending on the

problem severity, but if an unsafe condition exists, the area in question will be removed and replaced. Before work is resumed, the Contractor or PG Binder supplier shall show to the Laboratory the material properties and compatibility of another PG Binder, by reporting actual test data, and that proper binder production equipment is in use.

The Contractor has a responsibility to ensure traffic is not released early on the mat, unless overridden by the Department. This Contractor responsibility includes allowing sufficient cooling time when night paving before morning rush hour release of traffic. Should traffic be on the mat in a manner leading to flushing or excess surface/tire adhesion and tracking of binder, the mat area in question shall be evaluated for removal and replacement or repair. Any removal and replacement or repair shall be at the Contractor's expense, unless the responsibility was overridden by the Department.

908.04 Storage. PG Binder storage shall be in accordance with 402, with the following additions:

A separate storage tank shall be used whenever a Contractor is providing a binder other than a PG Binder to customers other than the Department (excepting winter carryover work) or switching between different PG Binders because of alternating mix types.

When the Contractor switches between two different binder grades and is going to use the same storage tank, the storage tank shall be at least 90 percent empty by tank height. When the Contractor is switching to a PGM Binder or a PG Binder used to make a PGM Binder, the storage tank shall be at least 95 percent empty by tank height.

PGM Binder shall not be stored at the asphalt concrete mixing plant over the winter. No PG Binder to be used in producing a PGM Binder at the asphalt concrete mixing plant will be stored at the facility over the winter. SBR polymer shall be stored in a heated area over winter, but shall not exceed supplier requirements.

The Monitoring Team shall be notified before the delivery of the first load of each type of PG Binder with sufficient lead time to allow for verification of the storage tank condition and if the storage tank meets handling requirements of the binder supplier. The Monitoring Team may sample the first storage tank load or give the Contractor permission to proceed with no tank verification.

908.050 Requirements for PGM Binder. A PGM Binder shall meet the requirements of Table A and shall be obtained through modification of a non-oxidized, neat asphalt binder by using a styrene butadiene latex rubber compound (SBR polymer) or a styrene butadiene styrene polymer block copolymer (SBS polymer). The polymer supplier shall certify to the refiner and Contractor that the polymer used meets a minimum 68 percent by weight butadiene content. SBS polymer modification shall be performed prior to shipment to the asphalt concrete mixing plant (preblend). SBR polymer modification shall be performed at the asphalt concrete mixing plant (postblend) or prior to shipment to the

asphalt concrete mixing plant (preblend).

For each project, the PGM Binder supplier shall give the Contractor a handling guide specifying temperature, circulation, shelf life, and other requirements for assuring the PGM Binder will perform as desired. This handling guide will be given to the Monitoring Team and be available in the plant control room and plant laboratory. If PGM Binder is retained at the asphalt concrete mixing plant for more than two weeks before use or beyond the supplier recommended shelf life, whichever is less, a top and bottom sample test (material property difference between samples taken from the top and bottom of the storage tank) shall be performed by the Laboratory on samples retrieved by the Contractor at the District's direction and material on hand shall not be used until approved.

908.051 Sampling of PGM Binder. The Contractor shall take two 1 quart (1 liter) binder samples from the first transport truck load, before incorporation into the storage tank. The Contractor will label the samples with binder type, supplier, project number and date and retain them in the plant laboratory for future reference by the Department.

In addition to the above sampling requirements, twice during each project (once if project has less than 3000 tons (3000 metric tons) of mix), the Monitoring Team will direct the Contractor to take two 1 quart (1 liter) samples of a PGM Binder, except when SBR polymer is incorporated into batch plants. In this case the base binder and SBR polymer shall be sampled and stored independently. Samples shall be taken from the binder line between the last piping 'tee' and inlet into the plant. They shall be labeled and handled as above. All samples shall be held after project completion until the District Engineer of Tests (DET) collects or releases them.

908.052 Mix Design for PGM Binder. The PGM Binder supplier, as well as the polymer type, shall be identified on the Job Mix Formula (JMF) submittal. A change in binder or polymer source will require a redesign. The PGM Binder shall be graded, except for Direct Tension, and provide the actual pass temperatures confirming the grade requirement. All dated data shall be reported with the JMF submittal. In addition to the PG Binder grading, the dated test results for the requirements of Table A shall be reported. All data shall be neatly summarized on one page. No data shall be more than two months old. If SBR polymer is added at the asphalt concrete mixing plant, the JMF shall contain data from the SBR polymer supplier for total solids (percent) and ash (percent) according to the 702.14. As well, the submittal shall contain the target amount of SBR polymer greater than or equal to 3.5 percent to achieve the properties specified. A letter of certification from the polymer supplier verifying percent butadiene in the SBS or SBR polymer shall be included in the JMF submittal.

Each JMF submittal shall report results of temperature-viscosity testing for mixing and compaction temperatures performed according to Asphalt Institute Manual SP-2. Supplier recommended temperatures may be used in lieu of the Asphalt Institute Manual SP-2 temperatures, but the temperature-viscosity results must still be reported.

A maximum of 10 percent reclaimed asphalt concrete pavement or reclaimed bituminous aggregate base may be used in accordance with 401.04, except it shall be included in the JMF. At no time shall the amount of reclaimed asphalt concrete pavement or reclaimed bituminous aggregate base in production exceed 10 percent of the mix by dry weight.

908.053 Quality Control for PGM Binder. The Contractor's Plant Operation Quality Control Plan (403.03) shall include plans for meeting this specification and any handling requirements of the PGM Binder supplier. If the Contractor does additional testing or plant modifications, this shall be explained in the plan.

A preapproved asphalt ignition oven is required to obtain an aggregate sample from an asphalt concrete sample. The asphalt ignition oven may be used in place of hot bin or belt samples.

Some solvent testing may be performed early in a project as information in helping to verify plant operation and determining an Asphalt Content Nuclear Gauge (AC Gauge) or asphalt ignition oven calibration. However, any solvent testing shall be accompanied by an asphalt ignition oven test.

For SBR polymers added at the asphalt concrete mixing plant, the flow meter printouts shall be totaled for each day's production. The percent of polymer versus neat binder in the mix shall be calculated each day and recorded on the TE-199. Calculation worksheets and printouts shall be available in the plant laboratory for review by the Monitoring Team. A +/- 0.2 percent tolerance from the target amount of SBR polymer shall be used as a guide for an acceptable amount of SBR polymer use, but shall not be consistently low. Disposition of all data records shall be at the direction of the DET.

Table A Material Requirements for PGM Binder					
Test / Requirement	SBR Polymer		SBS Polymer		Notes
Final PG Binder Grade	70-22 (a)	70-22 (b)	70-22 (a)	76-22 (a)	c
Actual Pass Temperatures	Report		Report		i
RTFO Mass Loss, percent	≤ 0.5		≤ 0.5		d
Phase Angle, max	76		80	76	d
Elastic Recovery, min			65	75	e
Toughness, in lb	118				f, d
Tenacity, in lb	68				f, d
Elongation, in, min	20				f, d
Ductility, in, min	28				j, d
Separation, F max	10		10		g
Homogeneity			None Visible		h, d

- a. Preblended PGM Binder with a base binder of at least -22 grade or stiffer.

b. Post blended PGM Binder made from neat Supplement 1032 certified or preapproved standard PG Binder grade and rubber solids amount equal to or above 3.5 percent by weight of total binder to achieve the PG Binder grade.

c. As required by 908.052.

d. PGM Binder

e. ASTM D 6084, 10cm @ 25C, hold 5 min. before cutting, on RTFO material

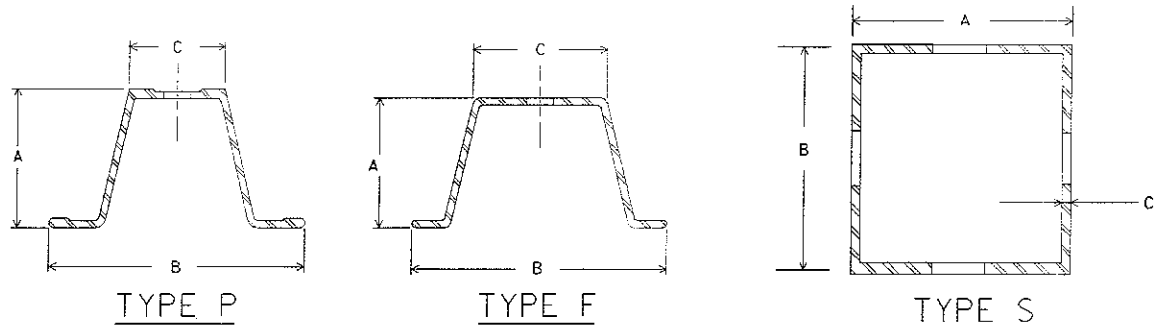
f. ASTM D 5801, 50cm/min @ 25C

g. Softening point difference of top and bottom of frozen sealed aluminum tube conditioned at 340F for 48 hours. Compatibility of polymer and neat binder is sole responsibility of supplier.
- PGM Binder shall be formulated to retain dispersion for 3 days minimum. Failure in the field to retain dispersion for this time will mean automatic removal from Supplement 1032 certification.

h. Heat a minimum 400 gram sample at 177C for 2.5-3 hours. Pour entire sample over a hot No 50 (300 μm) sieve at 340F. Look for retained polymer lumps.

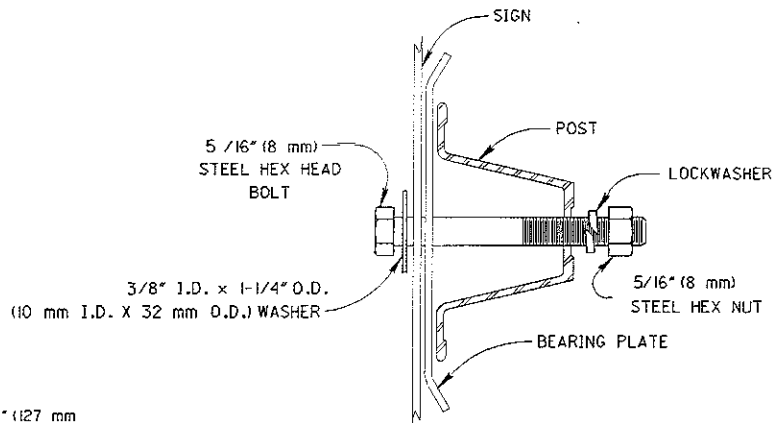
i. Actual high and low temperature achieved by PGM Binder beyond required grade, but shall not grade out to the next standard PG Binder grade for low temperature.

j. ASTM D 113, @ 4C, 1 cm/min

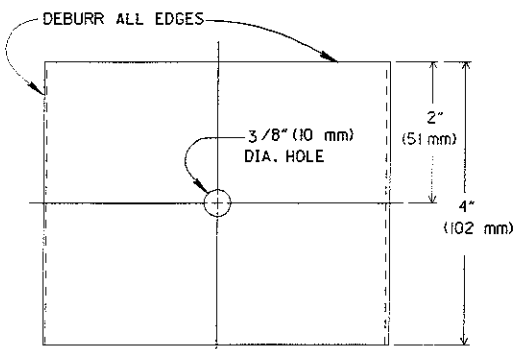
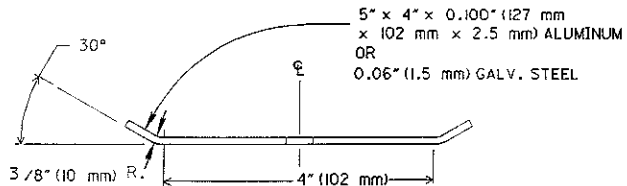


POST NO.	TYPE	LB/FT	POST DIMENSIONS (INCHES)			ANCHOR DIMENSIONS			NUMBER OF POSTS PERMITTED IN SEVEN FOOT PATH IN EXPOSED LOCATIONS
			A	B	C	A	B	C	
1	F	1.12	0.875	2.063	0.813				
	P	2.00	1.469	3.063	1.281				2
	F	2.00	1.516	3.125	1.250				2
2	S		1.750	1.750	0.083	2.000	2.000	0.105	2
	P	3.00	1.875	3.500	1.313				2
	F	3.00	1.750	3.500	1.625				2
3	S		2.00	2.00	0.083	2.250	2.250	0.105	2
	P	4.00	TWO NO.2 POST						0
	F	4.00	TWO NO.2 POST						0
4	S		2.500	2.500	0.105	3.000	3.000	0.188	1
	P	6.00	TWO NO.3 POST						0
	F	6.00	TWO NO.3 POST						0

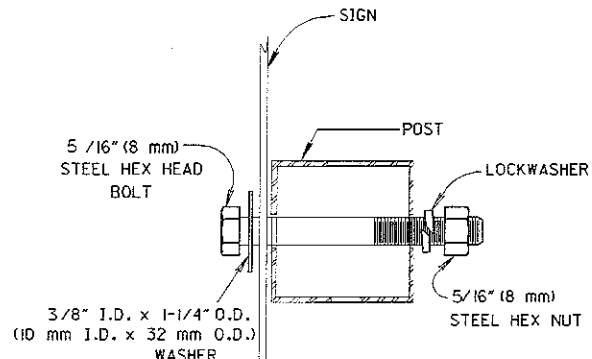
POST NO.	TYPE	Kg/m	POST DIMENSIONS (mm)			ANCHOR DIMENSIONS			NUMBER OF POSTS PERMITTED IN 2.1m PATH IN EXPOSED LOCATIONS
			A	B	C	A	B	C	
1	F	1.7	22	52	21				
	P	3.0	37	78	33				2
	F	3.0	39	79	32				2
2	S		44	44	2.1	51	51	2.7	2
	P	4.5	48	89	33				2
	F	4.5	44	89	41				2
3	S		51	51	2.1	57	57	2.7	2
	P	6.0	TWO NO.2 POST						0
	F	6.0	TWO NO.2 POST						0
4	S		63	63	2.7	76	76	4.8	1
	P	9.0	TWO NO.3 POST						0
	F	9.0	TWO NO.3 POST						0



- NOTES
1. Install number 4 type P and F posts, and number 6 type P and F posts, only in protected locations (e.g. behind guardrail). Install two post installations of number 4 type S posts within 7 foot (2.1m) path only in protected locations.
 2. Use of anchor base with No. 2 and No. 3 square post is optional. Use of anchor base with No. 4 square post is required.
 3. Square post may have die-cut knockouts or open holes.

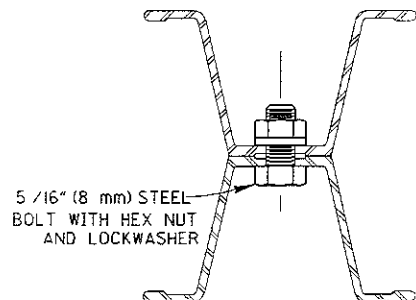


BEARING PLATE

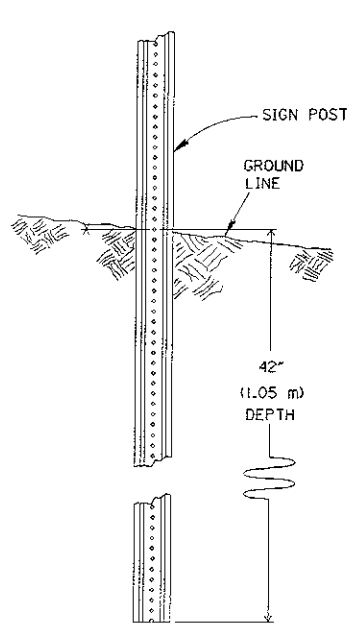


SQUARE POST

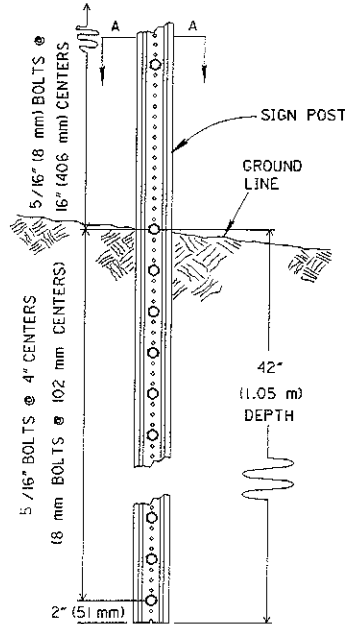
SIGN ATTACHMENT DETAIL



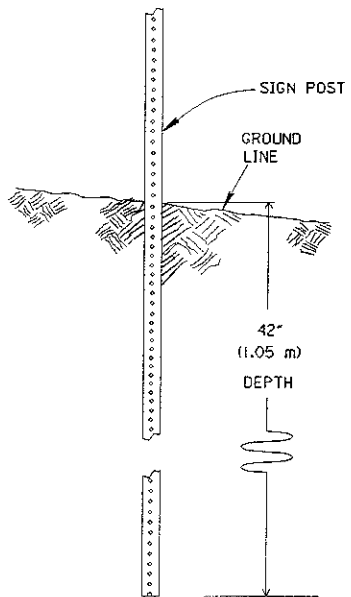
SECTION A - A



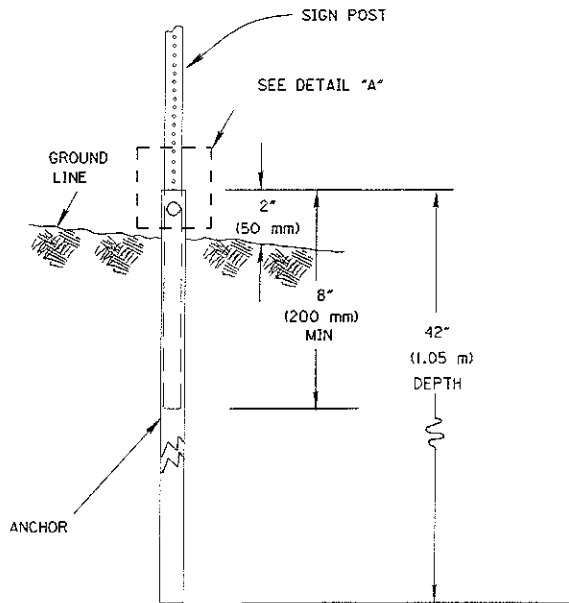
TYPICAL NO. 1, NO. 2 AND NO. 3 U - CHANNEL DRIVEN INSTALLATION



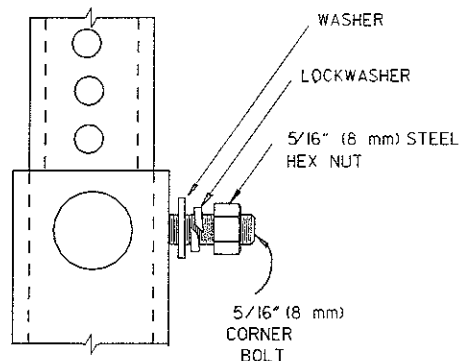
TYPICAL NO. 4 AND NO. 6 U - CHANNEL DRIVEN INSTALLATION



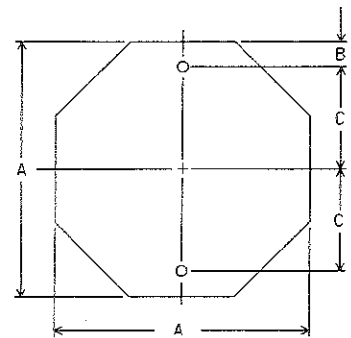
TYPICAL SQUARE POST DRIVEN INSTALLATION



TYPICAL SQUARE POST ANCHOR BASE INSTALLATION



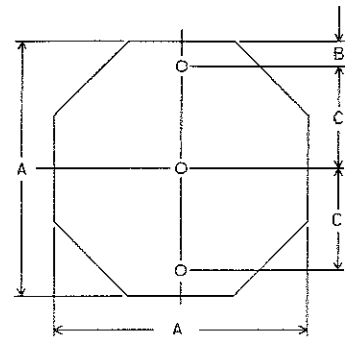
DETAIL "A"



OCTA-1-2

A	B	C	GAUGE	SQ. FT.
18	3	6	0.063	2.25
24	3	9	0.063	4.00

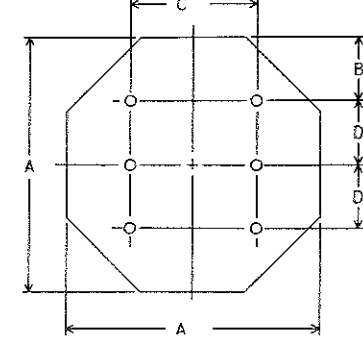
A	B	C	THICKNESS	m ²
450	75	150	1.6	0.20
600	75	225	1.6	0.36



OCTA-1-3

A	B	C	GAUGE	SQ. FT.
30	3	12	0.080	6.25
36	6	12	0.080	9.00

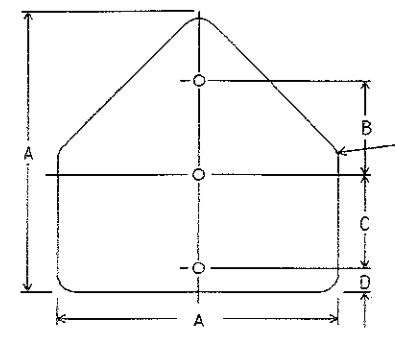
A	B	C	THICKNESS	m ²
750	75	300	2.0	0.56
900	150	300	2.0	0.81



OCTA-2-6

A	B	C	D	GAUGE	SQ. FT.
48	12	24	12	0.100	16.00

A	B	C	D	THICKNESS	m ²
1200	300	600	300	2.5	1.44



PENT-1-3

A	B	C	D	R	GAUGE	SQ. FT.
30	10	11	3	1.88	0.080	6.25
36	12	12	3	2.25	0.080	9.00
42	14	13	4	2.50	0.100	12.25

A	B	C	D	R	THICKNESS	m ²
750	250	275	75	48	2.0	0.56
900	300	300	75	57	2.0	0.81
1050	350	325	100	64	2.5	1.10

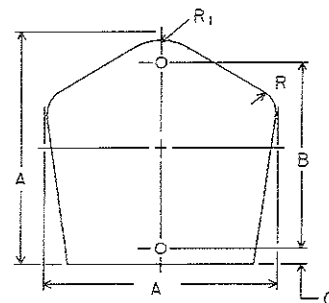
NOTES

- For each detail shown, the top table is in inches and the lower table is in millimeters unless otherwise noted.
- All bolt holes shall be 3/8" (10 mm) in diameter, and may be drilled or punched to finished size.
- Dimensions between bolt holes shall be to tolerance of $\pm 1/32"$ (± 0.8 mm).
- All route shields shall be 0.063" (1.6 mm) thick and attached to extrusheet signs with aluminum blind rivets.

SHAPE _____ NO. BOLTS REQUIRED _____

OCTA-2-6

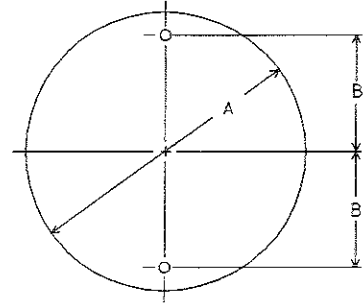
NO. SUPPORTS REQUIRED _____



CO-1-2

A	B	C	R ₁	R	GAUGE	SQ. FT.
18	15	1	5	2	0.063	2.25
24	18	2	5.31	2.69	0.063	4.00
30	24	2	6.63	3.38	0.080	6.25

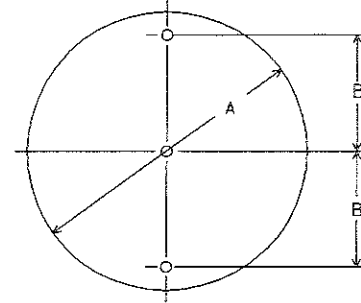
A	B	C	R ₁	R	THICKNESS	m ²
450	375	25	125	50	1.6	0.20
600	450	50	135	68	1.6	0.36
750	600	50	168	86	2.0	0.56



CIR-1-2

A	B	GAUGE	SQ. FT.
18	6	0.063	2.25
24	9	0.063	4.00

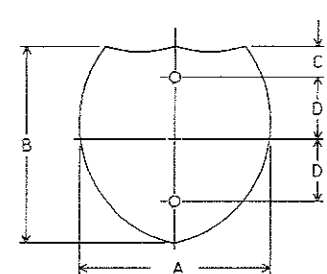
A	B	THICKNESS	m ²
450	150	1.6	0.20
600	225	2.0	0.36



CIR-1-3

A	B	GAUGE	SQ. FT.
30	12	0.080	6.25
36	15	0.080	9.00

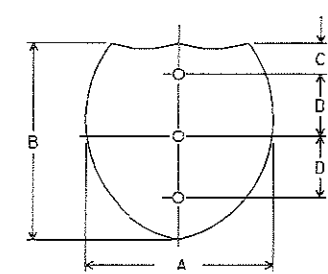
A	B	THICKNESS	m ²
750	300	2.0	0.56
900	375	2.0	0.81



I.S.-1-2

A	B	C	D	GAUGE	SQ. FT.
24	24	3	9	0.063	4.00
30	24	3	9	0.080	5.00
30	30	3	12	0.080	6.25
40	30	3	12	0.080	8.33

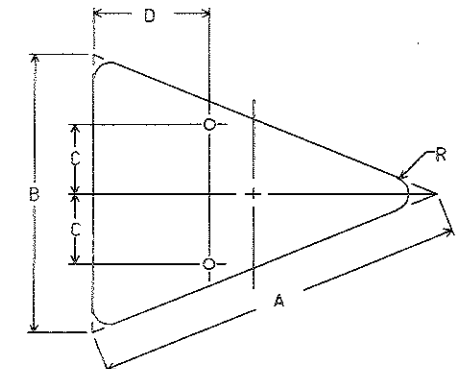
A	B	C	D	THICKNESS	m ²
600	600	75	225	1.6	0.36
750	600	75	225	2.0	0.45
750	750	75	300	2.0	0.56
1000	750	75	300	2.0	0.75



I.S.-1-3

A	B	C	D	GAUGE	SQ. FT.
36	36	6	12	0.080	9.00
48	36	6	12	0.100	12.00

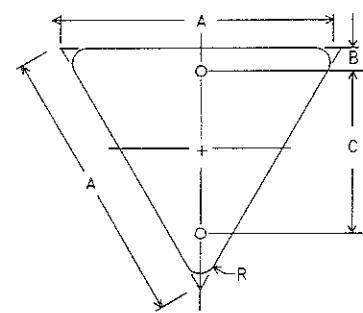
A	B	C	D	THICKNESS	m ²
900	900	150	300	2.0	0.81
1200	900	150	300	2.5	1.08



ISOS-1-2

A	B	C	D	R	GAUGE	SQ. FT.
40	30	7.50	12	1.88	0.080	3.86
48	36	9	15	2.25	0.100	5.56

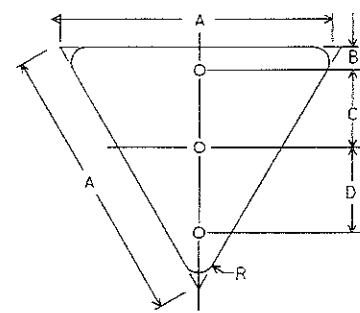
A	B	C	D	R	THICKNESS	m ²
1000	750	187	300	48	2.0	0.35
1200	900	225	375	57	2.5	0.50



TRI-1-2

A	B	C	R	GAUGE	SQ. FT.
24	2	14	1.50	0.080	1.73

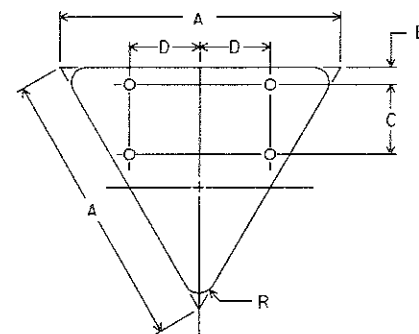
A	B	C	R	THICKNESS	m ²
600	50	350	38	2.0	0.16



TRI-1-3

A	B	C	D	R	GAUGE	SQ. FT.
36	3	10	11	2.00	0.100	3.90

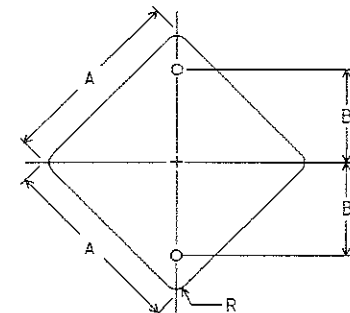
A	B	C	D	R	THICKNESS	m ²
900	75	250	275	50	2.5	0.35



TRI-2-4

A	B	C	D	R	GAUGE	SQ. FT.
48	3	12	12	3	0.100	6.93
60	3	18	15	4	0.100	10.83

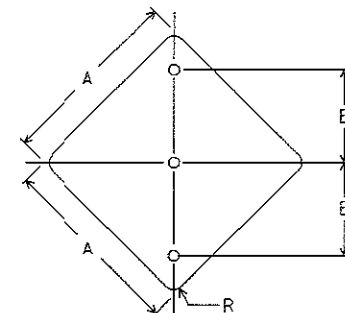
A	B	C	D	R	THICKNESS	m ²
1200	75	300	300	75	2.5	0.62
1500	75	450	375	100	2.5	0.97



DIA-1-2

A	B	R	GAUGE	SQ. FT.
18	9	1.50	0.063	2.25

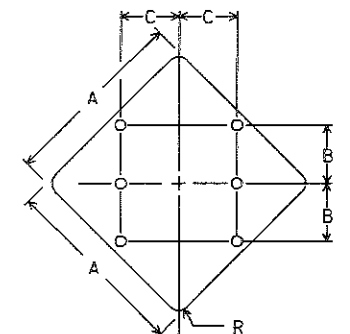
A	B	R	THICKNESS	m ²
450	225	38	1.6	0.20



DIA-1-3

A	B	R	GAUGE	SQ. FT.
24	12	1.50	0.063	4.00
30	15	1.88	0.080	6.25
36	18	2.25	0.080	9.00

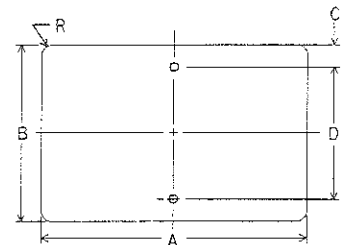
A	B	R	THICKNESS	m ²
600	300	38	1.6	0.36
750	375	48	2.0	0.56
900	450	57	2.0	0.81



DIA-2-6

A	B	C	R	GAUGE	SQ. FT.
48	15	15	3	0.100	16.00
60	18	18	3.75	0.100	25.00

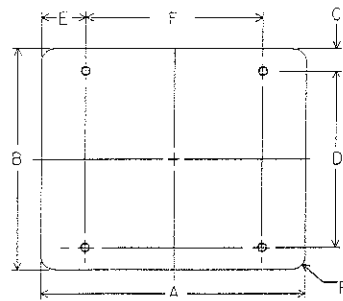
A	B	C	R	THICKNESS	m ²
1200	375	375	75	2.5	1.44
1500	450	450	95	2.5	2.25



H-REC-1-2

A	B	C	D	R	GAUGE	SQ.FT.
12	4	1.00	2	1.50	0.063	0.34
12	6	1.50	3	1.50	0.063	0.50
12	9	1.50	6	1.50	0.063	0.75
18	6	1.50	3	1.50	0.063	0.75
18	12	1.50	9	1.50	0.063	1.50
21	15	1.50	12	1.50	0.063	2.19
21	18	3	12	1.50	0.063	2.63
24	6	1.50	3	1.50	0.063	1.00
24	8	1.50	5	1.50	0.063	1.33
24	10	1.50	7	1.50	0.063	1.67
24	12	1.50	9	1.50	0.063	2.00
24	18	3	12	1.50	0.063	3.00
30	8	1.50	5	1.50	0.063	1.67
30	10	1.50	7	1.50	0.063	2.08
30	12	1.50	9	1.50	0.080	2.50
30	15	1.50	12	1.50	0.080	3.13
30	16	1.50	13	1.50	0.080	3.33
30	18	3	12	1.50	0.080	3.75
30	24	3	18	1.50	0.080	5.00
36	6	1.50	3	1.50	0.080	1.50
36	12	1.50	9	1.50	0.080	3.00
36	15	1.50	12	1.50	0.080	3.75
36	18	3	12	1.50	0.080	4.50
36	24	3	18	1.50	0.080	6.00
37.5	30	3	24	1.50	0.080	7.81
42	15	1.50	12	1.50	0.080	4.38
48	20	3	14	1.50	0.080	6.67

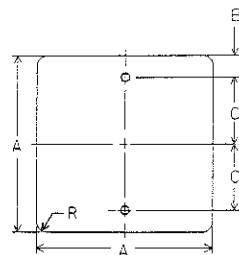
A	B	C	D	R	THICKNESS	m ²
300	100	25	50	38	1.6	0.03
300	150	37.5	75	38	1.6	0.05
300	225	37.5	150	38	1.6	0.07
450	150	37.5	75	38	1.6	0.07
450	300	37.5	225	38	1.6	0.14
525	375	37.5	300	38	1.6	0.20
525	450	75	300	38	1.6	0.24
600	150	37.5	75	38	1.6	0.09
600	200	37.5	125	38	1.6	0.12
600	250	37.5	175	38	1.6	0.15
600	300	37.5	225	38	1.6	0.18
600	450	75	300	38	1.6	0.27
750	200	37.5	125	38	1.6	0.15
750	250	37.5	175	38	1.6	0.19
750	300	37.5	225	38	2.0	0.23
750	375	37.5	300	38	2.0	0.28
750	400	37.5	325	38	2.0	0.30
750	450	75	300	38	2.0	0.34
750	600	75	450	38	2.0	0.45
900	150	37.5	75	38	2.0	0.14
900	300	37.5	225	38	2.0	0.27
900	375	37.5	300	38	2.0	0.34
900	450	75	300	38	2.0	0.41
900	600	75	450	38	2.0	0.54
937	750	75	600	38	2.0	0.70
1050	375	37.5	300	38	2.0	0.39
1200	500	75	350	38	2.0	0.60



H-REC-2-4

A	B	C	D	E	F	R	GAUGE	SQ.FT.
36	24	3	18	6	24	1.50	0.080	6.00
36	30	3	24	6	24	1.88	0.080	7.50
40	20	3	14	6	28	1.50	0.080	5.56
42	36	6	24	9	24	2.25	0.100	10.50
45	36	6	24	9	27	2.25	0.100	11.25
48	8	1.50	5	9	30	1.50	0.080	2.67
48	8.50	1.50	5.50	9	30	1.50	0.080	2.83
48	14	1.50	11	9	30	1.50	0.080	4.67
48	16	1.50	13	9	30	1.50	0.080	5.33
48	18	3	12	9	30	1.50	0.080	6.00
48	24	3	18	9	30	1.88	0.100	8.00
48	30	3	24	9	30	1.88	0.100	10.00
48	36	6	24	9	30	2.25	0.100	12.00
48	42	6	30	9	30	2.25	0.100	14.00
56	8	1.50	5	12	32	1.50	0.100	3.11
60	12	1.50	9	12	36	1.50	0.080	5.00
60	24	3	18	12	36	1.50	0.100	10.00
60	30	3	24	12	36	1.88	0.100	12.50
60	36	6	24	12	36	2.25	0.100	15.00
60	40	6	28	12	36	2.25	0.100	16.67
64	8	1.50	5	12	40	1.50	0.100	3.56
66	24	3	18	12	42	1.50	0.100	11.00
66	36	6	24	12	42	2.25	0.100	16.50
72	12	1.50	9	12	48	1.50	0.100	6.00
72	18	3	12	12	48	1.50	0.100	9.00
72	24	3	18	12	48	1.50	0.100	12.00
72	36	6	24	12	48	1.50	0.100	18.00

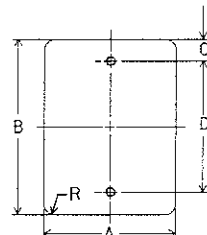
A	B	C	D	E	F	R	THICKNESS	m ²
900	600	75	450	150	600	38	2.0	0.54
900	750	75	600	150	600	48	2.0	0.68
1000	500	75	350	150	700	38	2.0	0.50
1050	900	150	600	225	600	57	2.5	0.95
1125	900	150	600	225	675	57	2.5	1.01
1200	200	37.5	125	225	750	38	2.0	0.24
1200	212	37.5	137	225	750	38	2.0	0.25
1200	350	37.5	275	225	750	38	2.0	0.42
1200	400	37.5	325	225	750	38	2.0	0.48
1200	450	75	300	225	750	38	2.0	0.54
1200	600	75	450	225	750	48	2.5	0.72
1200	750	75	600	225	750	48	2.5	0.90
1200	900	150	600	225	750	57	2.5	1.08
1200	1050	150	750	225	750	57	2.5	1.26
1400	200	37.5	125	300	800	38	2.5	0.28
1500	300	37.5	225	300	900	38	2.0	0.45
1500	600	75	450	300	900	38	2.5	0.90
1500	750	75	600	300	900	48	2.5	1.13
1500	900	150	600	300	900	57	2.5	1.35
1500	1000	150	700	300	900	57	2.5	1.50
1600	200	37.5	125	300	1000	38	2.5	0.32
1650	600	75	450	300	1050	38	2.5	0.99
1650	900	150	600	300	1050	57	2.5	1.49
1800	300	37.5	225	300	1200	38	2.5	0.54
1800	450	75	300	300	1200	38	2.5	0.81
1800	600	75	450	300	1200	38	2.5	1.08
1800	900	150	600	300	1200	38	2.5	1.62



SQ-1-2

A	B	C	R	GAUGE	SQ.FT.
15	3	4.5	1.50	0.063	1.56
18	3	6	1.50	0.063	2.25
24	3	9	1.50	0.063	4.00

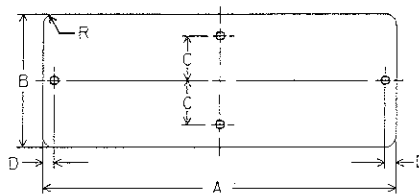
A	B	C	R	THICKNESS	m ²
375	75	112.5	38	1.6	0.14
450	75	150	38	1.6	0.20
600	75	225	38	1.6	0.36



V-REC-1-2

A	B	C	D	R	GAUGE	SQ.FT.
8	26	5	16	1.50	0.063	1.44
9	12	1.50	9	1.50	0.063	0.75
12	18	1.50	15	1.50	0.063	1.50
12	24	3	18	1.50	0.063	2.00
18	24	3	18	1.50	0.063	3.00

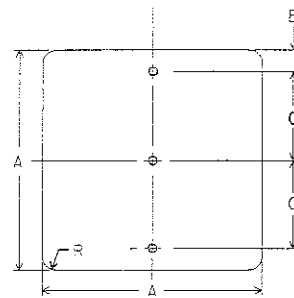
A	B	C	D	R	THICKNESS	m ²
200	650	125	400	38	1.6	0.13
225	300	37.5	225	38	1.6	0.07
300	450	37.5	375	38	1.6	0.14
300	600	75	450	38	1.6	0.18
450	600	75	450	38	1.6	0.27



H-REC-1-4 (ONE WAY)

A	B	C	D	R	GAUGE	SQ.FT.
36	12	4	1	1.50	0.080	3.00
48	18	6	1.50	1.50	0.080	6.00

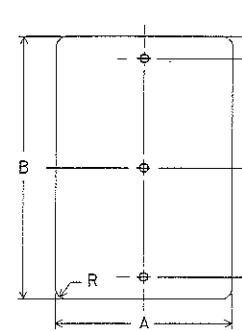
A	B	C	D	R	THICKNESS	m ²
900	300	100	25	38	2.0	0.27
1200	450	150	38	38	2.5	0.54



SQ-1-3

A	B	C	R	GAUGE	SQ.FT.
30	3	12	1.88	0.080	6.25
36	6	12	2.25	0.080	9.00

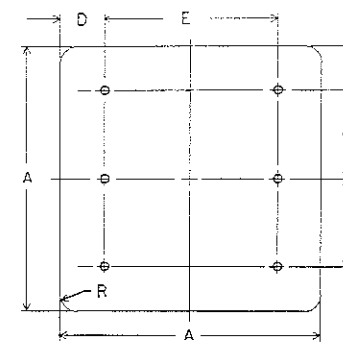
A	B	C	R	THICKNESS	m ²
750	75	300	48	2.0	0.56
900	150	300	57	2.0	0.81



V-REC-1-3

A	B	C	D	R	GAUGE	SQ.FT.
6	54	9	18	1.50	0.080	2.25
12	36	3	15	1.50	0.063	3.00
12	48	6	18	1.50	0.080	4.00
24	30	3	12	1.50	0.080	5.00
24	36	3	15	1.50	0.080	6.00
24	48	9	15	1.50	0.100	8.00
30	36	3	15	1.88	0.080	7.50
30	38	3	16	1.50	0.080	7.92
30	42	9	12	1.50	0.080	8.75
36	42	9	12	2.25	0.100	10.50

A	B	C	D	R	THICKNESS	m ²
150	1350	225	450	38	2.0	0.20
300	900	75	375	38	1.6	0.27
300	1200	150	450	38	2.0	0.36
600	750	75	300	38	2.0	0.45
600	900	75	375	38	2.0	0.54
600	1200	225	375	38	2.5	0.72
750	900	75	375	48	2.0	0.68
750	950	75	400	38	2.0	0.68
750	1050	225	300	38	2.0	0.79
900	1050	225	300	57	2.5	0.95



SQ-2-6

A	B	C	D	E	R	GAUGE	SQ.FT.
36	6	12	6	24	2.25	0.080	9.00
48	6	18	9	30	3.00	0.100	16.00
* "DO NOT ENTER" SIGN							

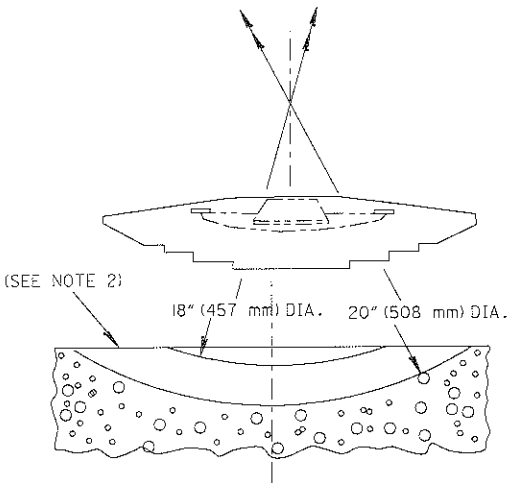
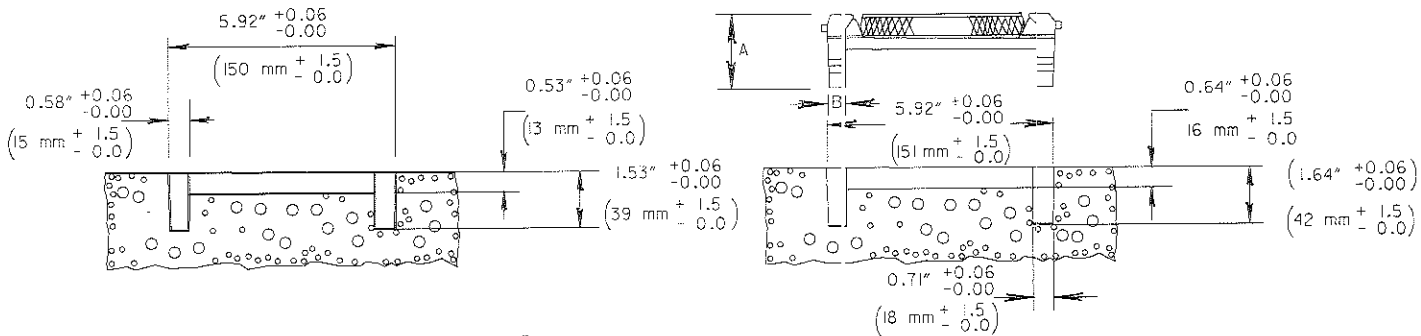
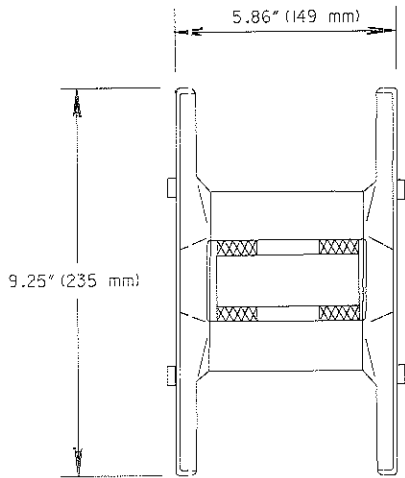
NOTES

- 1. Center line markers shall be placed between the two lines. Markers installed along an edge line or channelizing line shall be placed so that the casting is no more than 1" (25 mm) from the near edge of the line. Markers installed along a lane line or dashed yellow center line shall be placed between and in line with the dashes. Markers shall not be placed over the lines except where the lines deviate visibly from their correct alignment, and then only with the approval of the engineer.
- 2. To facilitate the cutting of the two parallel slots and intervening concaved surface simultaneously, it is recommended that an arbor and saw blade assembly be used. For additional details and tolerances of the casting and arbor-saw assembly contact the casting manufacture.
- 3. For horizontal curves of 5° or greater (radius of 380 m or less), the spacing of the center line markers shall be reduced to 40' (12 m) between P.C. or T.S. and P.T. or S.T.
- 4. For horizontal curves of 10° or greater (radius of 250 m or less) the spacing of the center line markers may be reduced to 20' (6 m) between P.C. or T.S. and P.T. or S.T. When using 20' (6 m) spacing, 12 raised pavement markers at 40' (12 m) spacing shall be installed on each end of the 20' (6 m) spacing.
- 5. When a channelizing line is less than 80' (24 m) in length, one raised pavement marker shall be placed at each end of the line, and one shall be placed in the center of the line.
- 6. Raised pavement markers on lane lines on freeways shall be one way white spaced at 120' (36 m). All other raised pavement makers on lane line on multilane or divided roadways shall be two way red/white spaced at 80' (24 m).

	CONVENTIONAL TYPE	LOW PROFILE TYPE
A	1.74"	1.69"
B	.46"	.59"

(METRIC)

	CONVENTIONAL TYPE	LOW PROFILE TYPE
A	44 mm	43 mm
B	12 mm	15 mm



CASTING AND SAW CUT DETAILS

EDGE LINE

ONE WAY (WHITE) WITH RIGHT EDGE LINE OR
ONE WAY (YELLOW) WITH LEFT EDGE LINE OR
TWO WAY (YELLOW/RED) WITH LEFT EDGE LINE ON RAMP
YELLOW SIDE FACING TRAFFIC

CHANNELIZING LINE

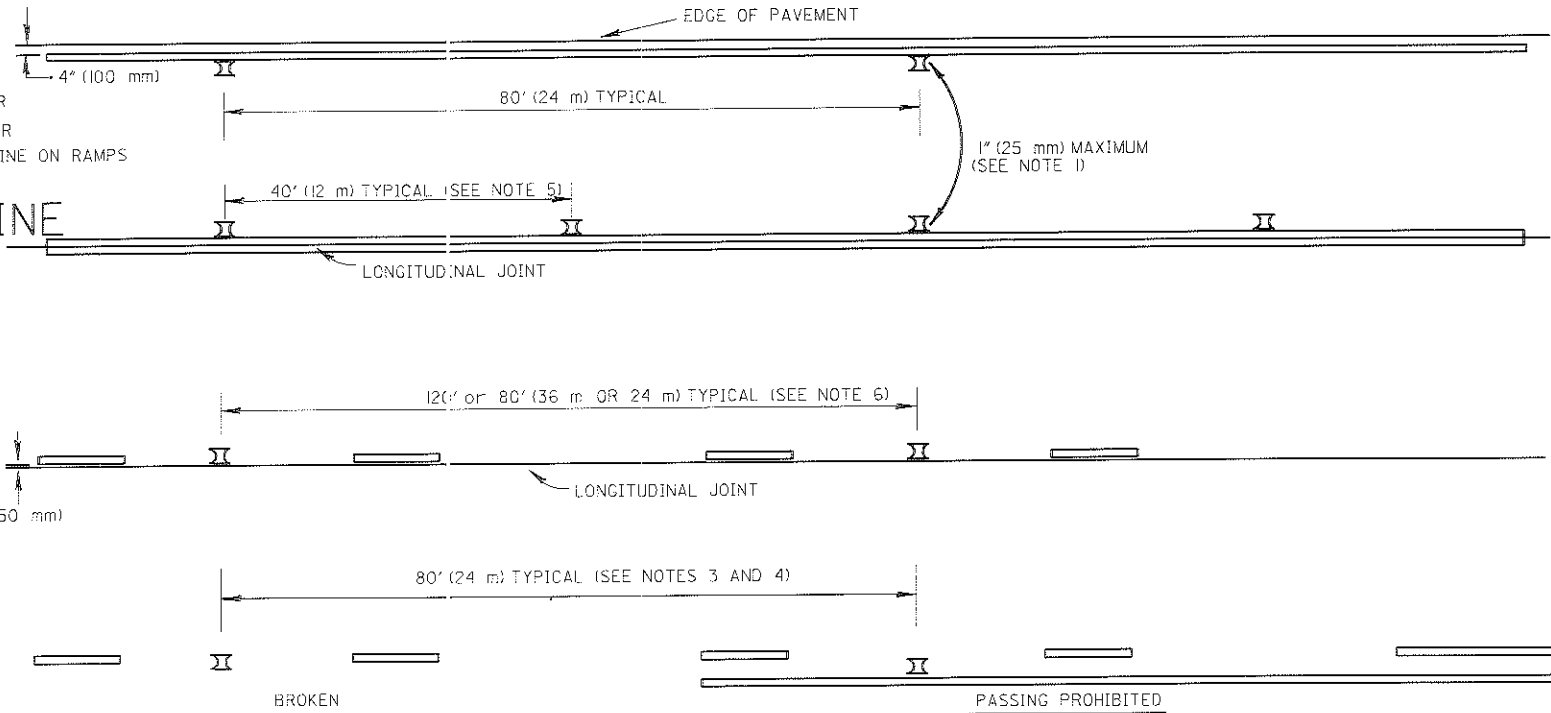
TWO WAY (WHITE/RED)
WHITE SIDE FACING TRAFFIC

LANE LINE

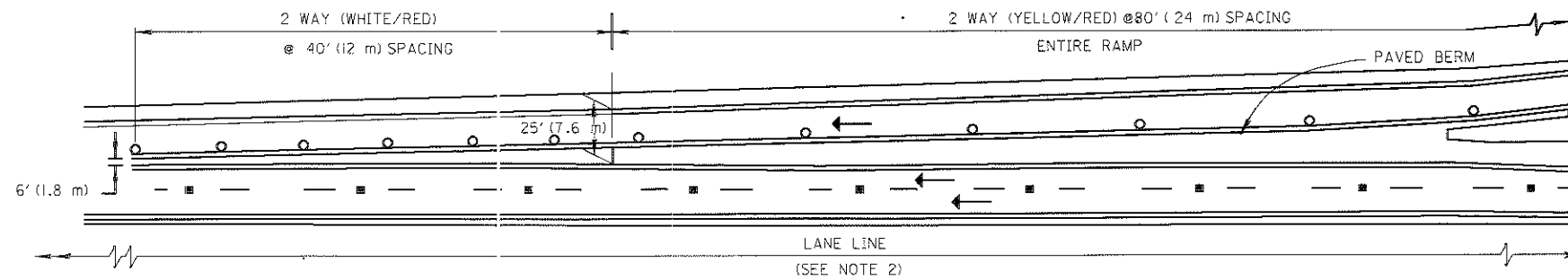
ONE WAY (WHITE) OR
TWO WAY (WHITE/RED)
WHITE SIDE FACING TRAFFIC

CENTER LINE

TWO WAY (YELLOW/YELLOW)



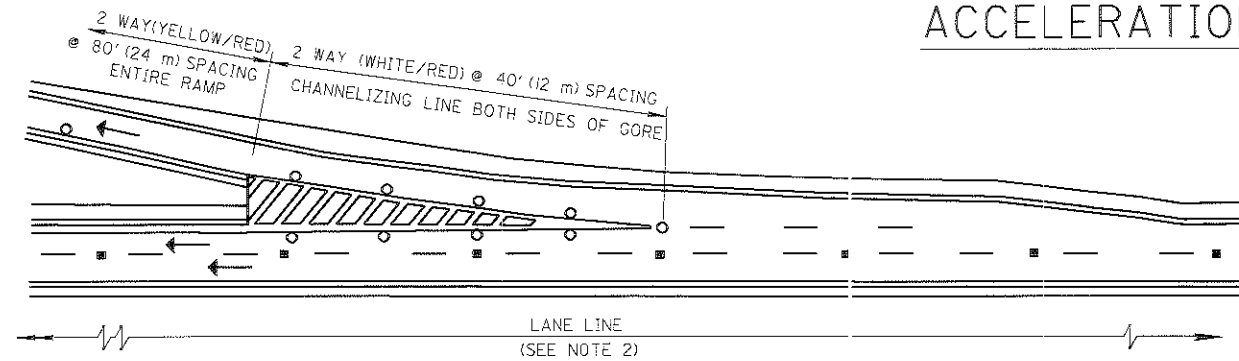
TYPICAL RAISED PAVEMENT MARKER PLACEMENT WITH LONGITUDINAL PAVEMENT MARKINGS



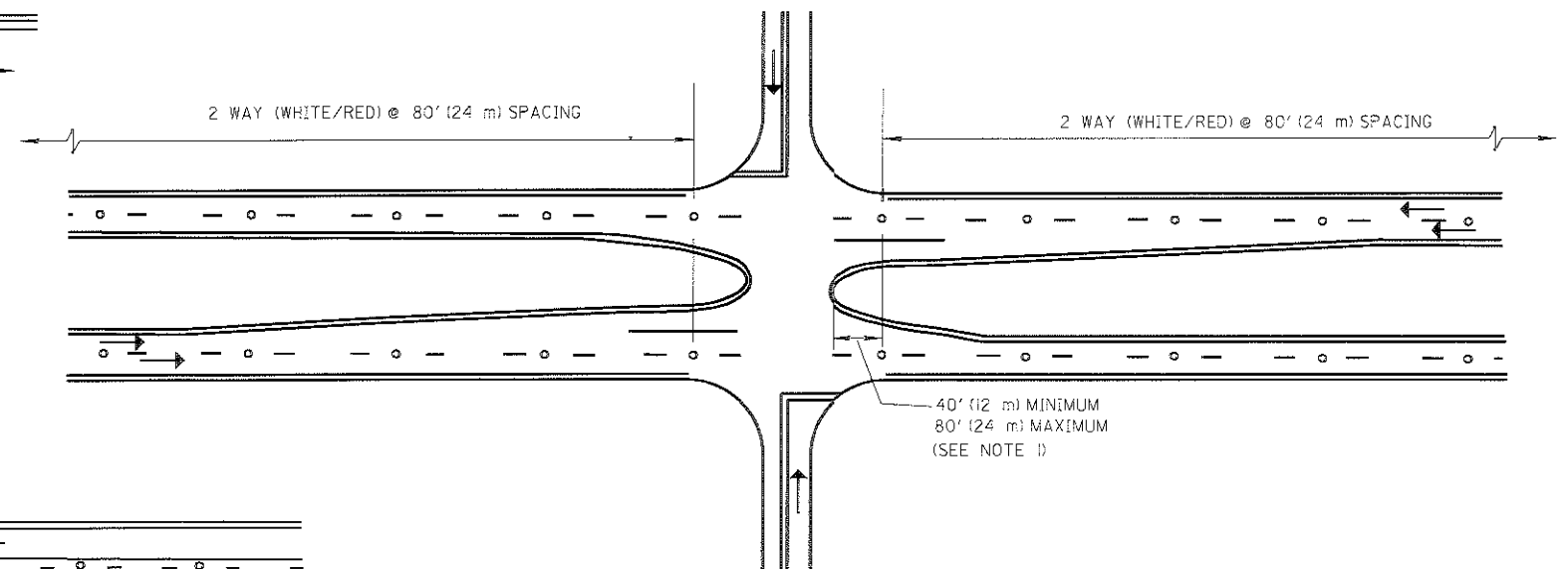
ACCELERATION LANE

NOTES

1. Raised pavement markers shall not be placed in the directional roadways within the intersection area.
2. Raised pavement markers on lane lines on freeways shall be one way white spaced at 120' (36 m). All other raised pavement markers on lane lines on multilane or divided roadways shall be two way red/white spaced at 80' (24 m).

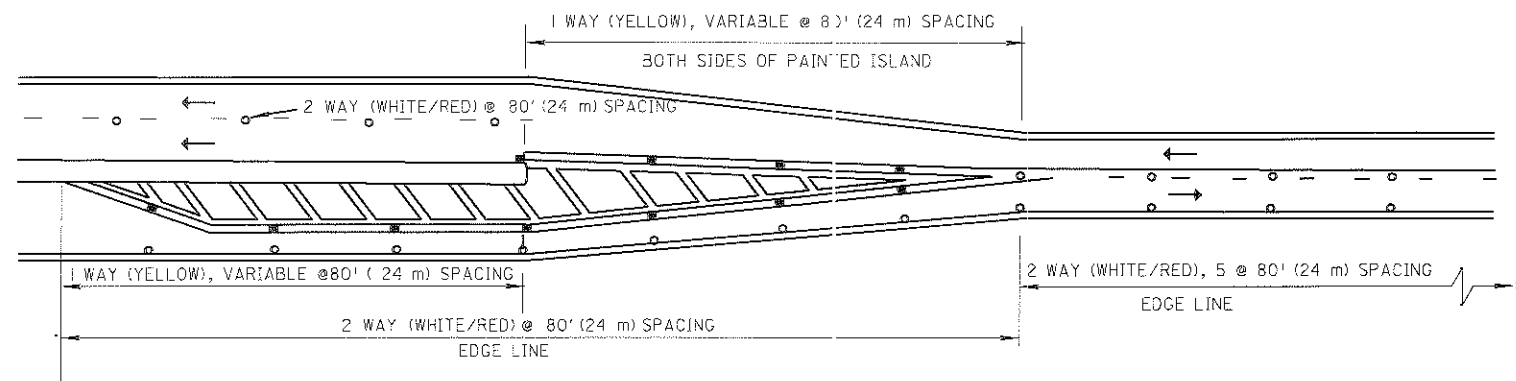


DECELERATION LANE

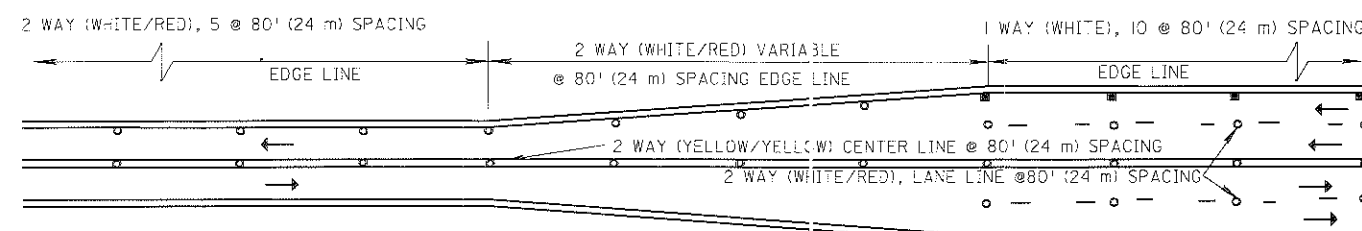


MULTILANE DIVIDED-CONTROLLED ACCESS

(SEE NOTE 2)



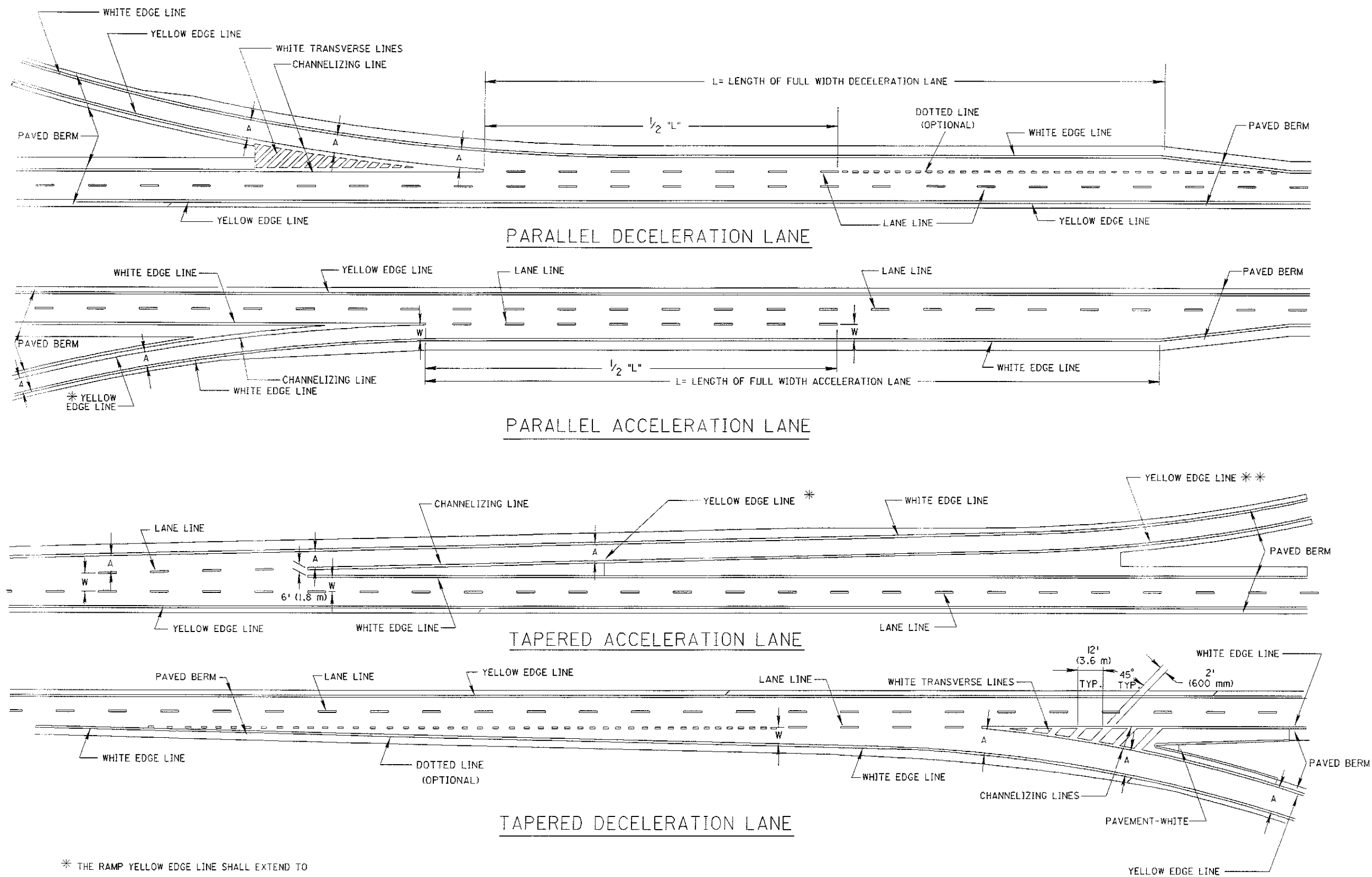
4 LANE DIVIDED TO 2 LANE TRANSITION



4 LANE UNDIVIDED TO 2 LANE TRANSITION

LEGEND

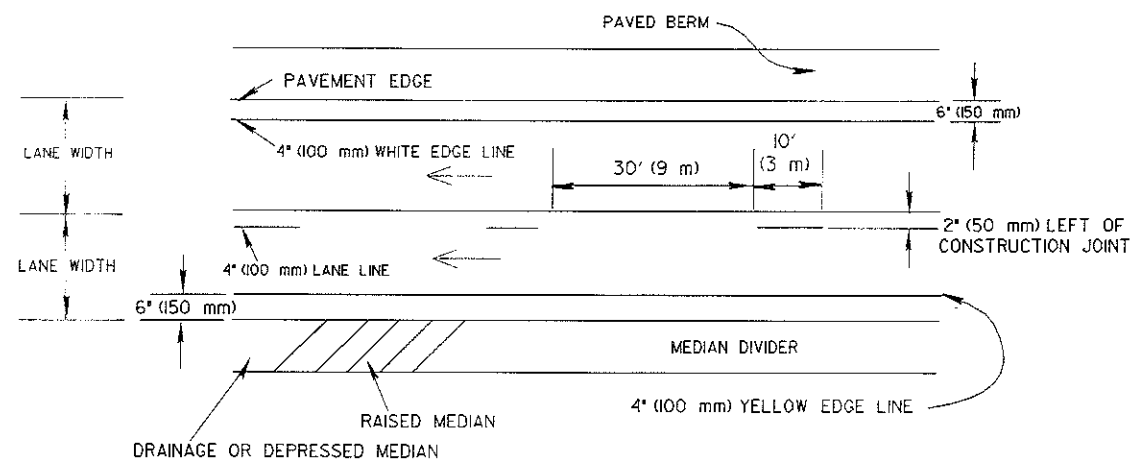
- 1 WAY REFLECTORS
- 2 WAY REFLECTORS



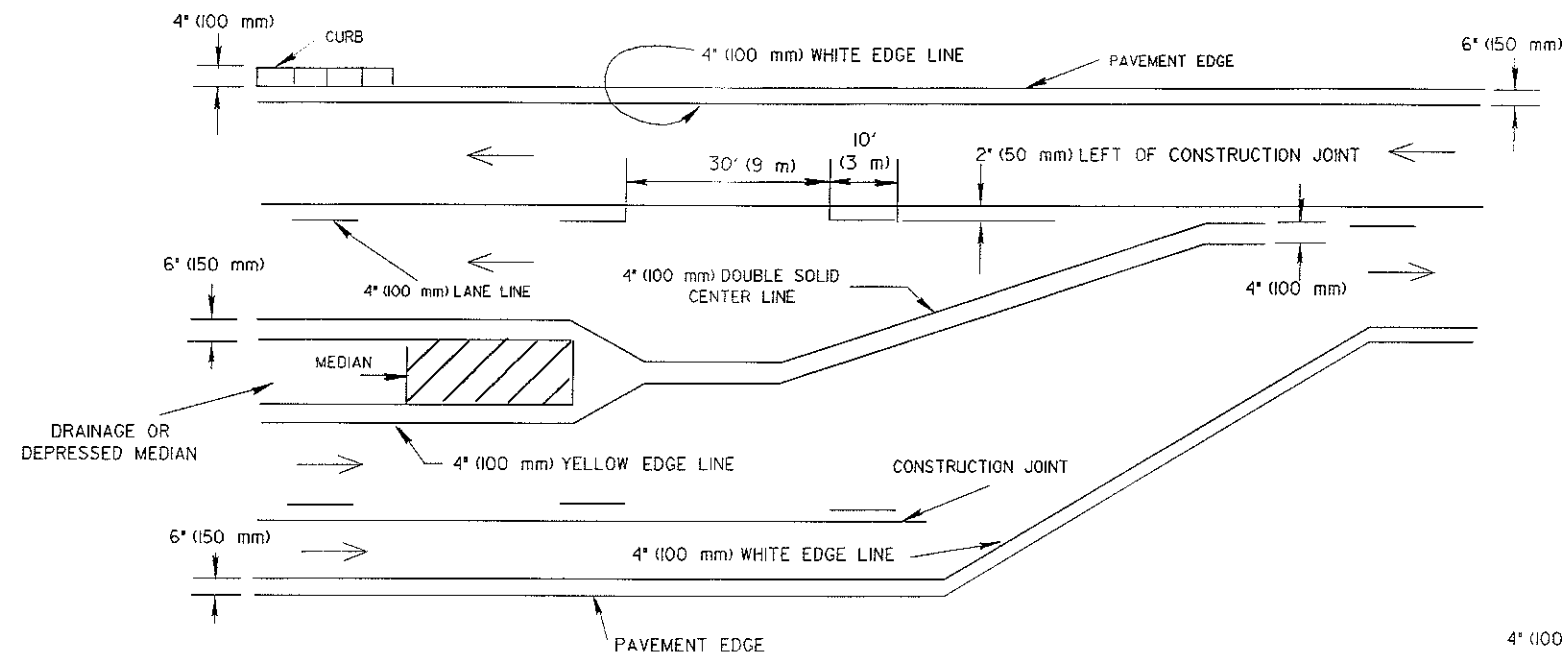
* THE RAMP YELLOW EDGE LINE SHALL EXTEND TO WHERE THE PAVED BERM ENDS.
** ANY EXISTING CURB SHALL BE PAINTED WHITE.
A = UNIFORM RAMP WIDTH
W = LANE WIDTH

NOTES

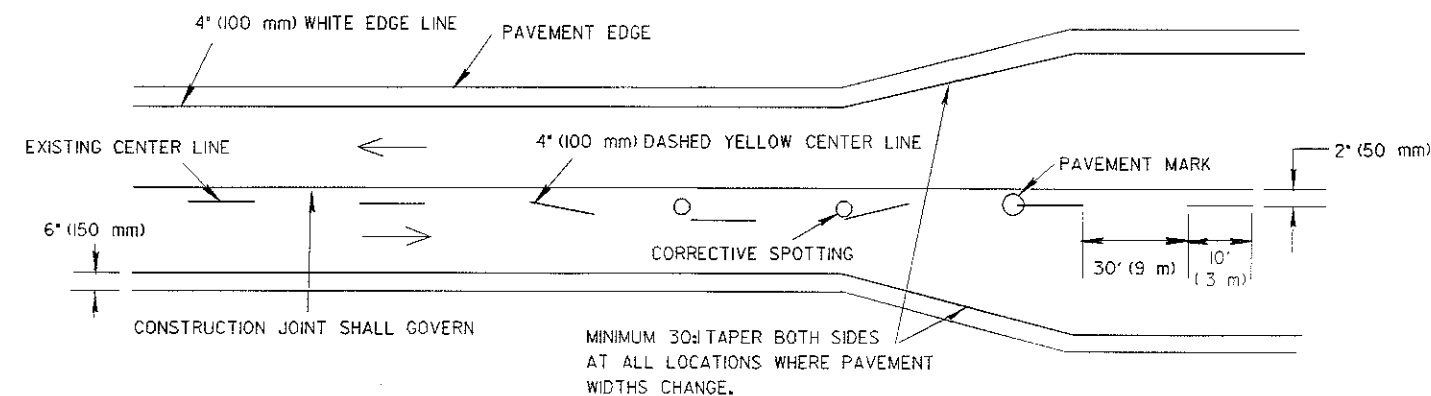
1. The distance from the pavement edge to the nearside edge of the edge line may be increased with the approval of the Engineer in order to maintain uniform lane width.
2. See TC-72.20 for entrance and exit ramp markings.
3. The cycle length for dashed lines shall be 40' (12 m) plus or minus 6" (150 mm). The minimum length of dash shall be sufficiently long to maintain a 3:1 ratio between length of gap and length of dash.
4. Edge Line transitions shall be marked at the same time as the adjoining Edge Lines.



FREEWAY & EXPRESSWAY MAINLINE MARKINGS



MULTILANE DIVIDED & UNDIVIDED HIGHWAY MARKINGS



TWO LANE MARKINGS