VIRGINIA DEPARTMENT OF TRANSPORTATION

LOCATION AND DESIGN DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: CONCRETE MEDIAN BARRIER TRAFFIC BARRIER SERVICE	NUMBER: IIM-LD-184.5
SPECIFIC SUBJECT: NEW SHAPE; CONCRETE BARRIER DESIGNED FOR TRUCKS/BUSES; CONCRETE BARRIER FOR GRADE DIFFERENTIALS	DATE: OCTOBER 5, 2006
	SUPERSEDES: IIM-LD-184.4
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, P.E. State Location and Design Engineer Approved October 5, 2006	

Changes are shaded.

CURRENT REVISION

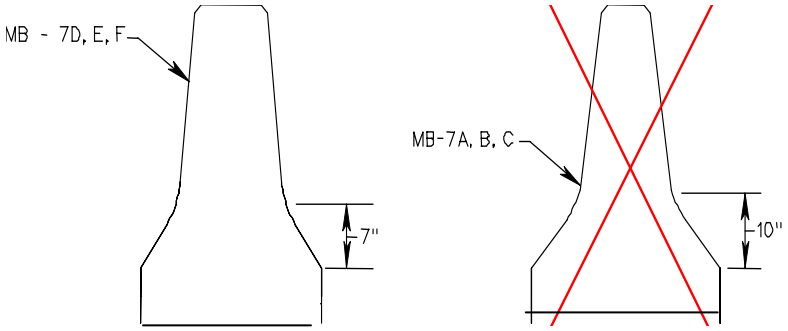
- Revised to add requirement for showing grade profiles for MB-7 series and MB-12 series median barriers.

EFFECTIVE DATE

- This memorandum is effective upon receipt for all applicable projects.

POLICY

- The “F” shape of St’d. MB-7D, E, F Concrete Median barrier will be the only configuration allowed. Testing conducted using small cars proved that reducing the height of the break between the upper and lower slopes from 10” (old St’d. MB-7A, B, C Jersey shape) to 7” decreases the probability of a vehicle overturning.



- Only Traffic Barrier Service with a positive connection and “F” shape will be allowed. See St’d MB-INS for positive connection details.

- St’d. MB-12A, B, C 50” (1270 mm) Concrete Median Barrier (Tall Wall) is for use with high volumes of truck traffic or for glare control. This barrier is designed with the same shape as St’d. MB-7D, E, F and extended to the 50” (1270 mm) height.

- When a double-faced median barrier is used to separate roadways with minimal width medians and the barrier faces are at different elevations due to the roadway elevations, superelevation, etc., the designer can specify Concrete Median Barrier MB-8A, Type I, II, or III for grade differentials varying from zero to 3’0” (0.9 m) maximum.

- Grade differences exceeding the 3’0” (0.9 m) maximum will be submitted to the Engineering Services Section for design.

- Concrete Median barrier (Tall Wall), St’d. MB-13 (TYPE. I, II, or III) is for use with the same conditions that govern the use of ST’d. MB-12A, B, C, 50” (1270 mm) St’d. MB-13 is designed with the same shape as St’d. MB-8A and extended to the 50” (1270 mm) height on the roadway with the highest elevation.

- Traffic Barrier Service Concrete Parapet (Single Face) St’d. MB-10A is for temporary installation on bridge decks. St’d. MB-10A shall be anchored to the bridge deck with four (4) bolts to prevent movement. The safety shaped side is to face traffic.

- Traffic Barrier Service Concrete Parapet (Double Face) St’d. MB-11A is for temporary installation on bridge decks. St’d MB-11A shall be anchored to the bridge deck with four (4) bolts to prevent movement. If the traffic is only on one side of the barrier, then that side will have the four (4) bolts. If traffic is on both sides of barrier, then both sides will have four (4) bolts.

CONCRETE BARRIER DESIGNED FOR TRUCKS/BUSES

- In most cases, the standard height 32" (810 mm) concrete median barrier will capably redirect passenger cars and light vans and trucks. However, some locations with poor geometrics, high volumes and speeds, or high volume of heavy trucks and buses may warrant consideration of the tall 50" (1270 mm) barrier to prevent top-heavy vehicles from tipping over the top of the barrier. The tall barrier may also serve a secondary function as an opaque glare screen where needed. Tables 2 and 3 have been developed to assist in the process of determining whether 50" (1270 mm) tall barrier would be warranted for safety purposes. The following examples should help the designer to understand how to use the tables:

Metric Example 1:

Given - 100 km/h 6 lane facility
Construction year ADT = 40,000*
10% Trucks
3.0 m barrier offset
Average horizontal curvature = 850 m
Average grade = 4%

*** NOTE: THE CONSTRUCTION YEAR ADT USED IN DETERMINING WARRANTS SHOULD BE LIMITED TO A MAXIMUM 10,000 PER DAY PER LANE FOR DESIGN SPEEDS GREATER THAN 80 km/h (50 MPH). FOR EXAMPLE, IF THE ADT FOR A 100 km/h (60 MPH) 4 LANE ROAD WAS 55,000, 40,000 WOULD BE USED IN DETERMINING BARRIER WARRANTS.**

Step 1. From Table 2, select "Total ADT Adjustment Factor (K)" by going down the grade column to 4% and across the row to intersect with the 850 m curve column. K = 1.5

Multiply Construction year ADT times K.
40,000 x 1.5 = 60,000 Adjusted ADT

Step 2. Using Table 3, go down the "percent trucks" column to 10% trucks and across on the "2.2-3.6 m barrier offset row" to intersect with the column for 100 km/h design speed. Maximum Adjusted ADT for 810 mm standard barrier
= 51,000

Conclusion – Since 51,000 is the maximum adjusted ADT that warrants a standard 810 mm barrier and the adjusted ADT computed for this example is 60,000 (higher than the maximum), consideration should be given to using a 1270 mm barrier instead of the standard 810 mm design.

Imperial Example 2:

Given - 70 mph 6 lane facility
Construction year ADT = 80,000*
5% Trucks
14’ barrier offset
Average horizontal curvature = 2°
Average grade = 5%

NOTE: THE CONSTRUCTION YEAR ADT USED IN DETERMINING WARRANTS SHOULD BE LIMITED TO A MAXIMUM 10,000 PER DAY PER LANE FOR DESIGN SPEEDS GREATER THAN 80 km/h (50 MPH). FOR EXAMPLE, IF THE ADT FOR A 100 km/h (60) MPH 6 LANE ROAD WAS 80,000, 60,000 WOULD BE USED IN DETERMINING BARRIER WARRANTS.

Step 1. From Table 2, select “Total ADT Adjustments Factor (K) by going down the grade column to 5% and across the row to intersect with the 2° curve column.
K=1.75

Multiply Construction year ADT (using maximum 10,000 per **day** per lane) times K.
60,000 x 1.75 = 105,000

Step 2. Using Table 3, go down the “percent trucks” column to 5% trucks and across on the “>12 foot barrier offset row” to intersect with the column for 70 mph design speed. Maximum Adjusted ADT for 32” standard barrier = 127,600.

Conclusion – Since 127,600 is the maximum adjusted ADT that warrants a standard 32” barrier and the adjusted ADT computed for this example is 105,000, a standard 32” barrier should be an adequate design.

		CURVATURE						
		1° (2000 m) (K=1)	2° (850 m) (K=1)	3° (600 m) (K=1)	4° (450 m) (K=1)	5° (350 m) (K=3)	6° (300 m) (K=4)	7° (250 m) (K=4)
GRADE	1% (K=1)	1.0	1.0	1.0	2.0	3.0	4.0	4.0
	2% (K=1)	1.0	1.0	1.0	2.0	3.0	4.0	4.0
	3% (K=1.25)	1.25	1.25	1.25	2.5	3.75	5.0	5.0
	4% (K=1.5)	1.5	1.5	1.5	3.0	4.5	6.0	6.0
	5% (K=1.75)	1.75	1.75	1.75	3.5	5.25	7.0	7.0
	6% (K=2)	2.0	2.0	2.0	4.0	6.0	8.0	8.0
	7% (K=2)	2.0	2.0	2.0	4.0	6.0	8.0	8.0

TOTAL ADT ADJUSTMENT FACTOR (K)
TABLE 2

METRIC
MAXIMUM ADJUSTED ADT (IN THOUSANDS) FOR 810 mm BARRIER
TABLE 3

PERCENT TRUCKS	*BARRIER OFFSET (m)*	*DESIGN SPEED (km/h)*						
		50	*60*	*70*	*80*	*90*	*100*	*110*
0%	0-0.9							
	1.0-2.1							
	2.2-3.6							
	>3.6							
5%	0-0.9				162	127	98	70
	1.0-2.1				189	152	117	88
	2.2-3.6				315	185	143	105
	>3.6						181	135
10%	0-0.9	170	106	64	50	44	38	33
	1.0-2.1	241	125	78	61	53	46	40
	2.2-3.6			97	71	58	51	44
	>3.6			127	90	73	64	55
15%	0-0.9	90	54	38	30	26	23	22
	1.0-2.1	125	59	46	37	32	28	26
	2.2-3.6	212	118	55	41	34	30	29
	>3.6			67	52	43	39	35
20%	0-0.9	65	38	28	21	19	17	16
	1.0-2.1	72	43	32	26	23	20	19
	2.2-3.6	149	84	41	29	24	22	20
	>3.6			48	36	31	28	25
25%	0-0.9	48	30	21	16	14	13	13
	1.0-2.1	53	33	25	20	18	17	15
	2.2-3.6	114	64	31	23	19	17	16
	>3.6		105	38	29	24	21	20
30%	0-0.9	40	24	17	13	12	11	11
	1.0-2.1	47	27	20	17	15	13	13
	2.2-3.6	84	42	27	18	15	14	13
	>3.6	186	84	32	23	20	18	16
35%	0-0.9	34	21	15	11	10	9	9
	1.0-2.1	43	23	17	14	12	11	11
	2.2-3.6	74	37	22	16	13	12	11
	>3.6	157	72	27	19	16	15	14
40%	0-0.9	30	18	12	10	9	8	8
	1.0-2.1	35	20	15	12	11	10	9
	2.2-3.6	62	32	20	13	11	10	10
	>3.6	125	42	23	17	14	13	12

IMPERIAL
MAXIMUM ADJUSTED ADT (IN THOUSANDS) FOR 32" BARRIER
TABLE 3

PERCENT TRUCKS	*BARRIER OFFSET (FT.)*	DESIGN SPEED (MPH)				
		30	*40*	*50*	*60*	*70*
0%	0.3					191.4
	3.1-7					379.1
	7.1-12					
	>12					
5%	0-3		280.7	162.2	107.3	63.1
	3.1-7		335.1	188.6	126.3	80.0
	7.1-12		452.0	247.3	158.4	96.4
	>12			314.7	203.8	127.6
10%	0-3	179.8	79.7	50.0	39.6	32.1
	3.1-7	258.3	89.8	61.4	47.5	38.5
	7.1-12	404.4	132.4	70.6	53.1	42.2
	>12		183.6	88.5	67.6	53.0
15%	0-3	102.9	46.4	29.6	24.3	21.5
	3.1-7	146.6	51.9	36.7	29.3	25.3
	7.1-12	228.5	77.6	41.2	31.9	27.0
	>12	472.0	105.1	51.5	40.5	33.5
20%	0-3	72.0	32.8	21.0	17.5	16.2
	3.1-7	102.4	36.5	26.1	21.1	18.9
	7.1-12	159.2	54.9	29.1	22.8	19.9
	>12	329.1	73.6	36.3	28.9	24.4
25%	0-3	55.4	25.3	16.3	13.7	13.0
	3.1-7	78.6	28.1	20.3	16.5	15.1
	7.1-12	122.2	42.4	22.5	17.7	15.7
	>12	252.6	56.7	28.1	22.5	19.2
30%	0-3	45.0	20.6	13.3	11.2	10.8
	3.1-7	63.8	22.9	16.6	13.6	12.5
	7.1-12	99.1	34.6	18.3	14.5	13.0
	>12	205.0	46.1	22.9	18.4	15.9
35%	0-3	37.9	17.4	11.2	9.5	9.3
	3.1-7	53.7	19.3	14.0	11.5	10.7
	7.1-12	83.4	29.2	15.5	12.3	11.1
	>12	172.5	38.8	19.3	15.6	13.5
40%	0-3	32.8	15.0	9.7	8.3	8.1
	3.1-7	46.4	16.7	12.2	10.0	9.4
	7.1-12	72.0	25.3	13.4	10.6	9.6
	>12	148.9	33.5	16.7	13.5	11.8

HORIZONTAL SIGHT DISTANCE AT CROSSOVERS

Crossovers should only be provided in conjunction with concrete median barrier after careful study to determine the essential need and optimum locations.

The following charts show the maximum degree of horizontal curvature allowable to achieve a safe-stopping distance at various design speeds when 50" (1270 mm) concrete barrier is utilized at crossover locations:

METRIC

MAXIMUM RADUIS OF HORIZONTAL CURVATURE FOR SAFE-STOPPING SIGHT DISTANCE

	Design Speed			
TOTAL MEDIAN WIDTH E.P. to E.P.	60 km/h	80 km/h	100 km/h	110 km/h
3.0 m Median	275 m	500 m	850 m	1500 m
3.0 m Median (Barrier Offset 0.9 m)		375 m	650 m	1000 m
6.0 m Median		325 m	600 m	950 m
6.0 m Median (Barrier Offset 0.6 m)		275 m	550 m	825 m

Note: Offsetting barrier reduces shoulder width on inside of curve

IMPERIAL

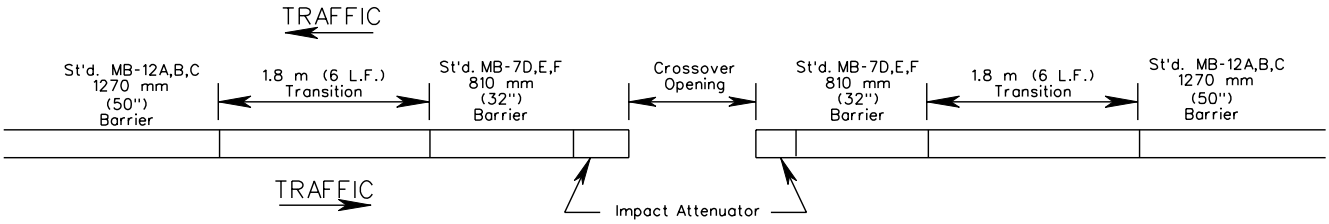
MAXIMUM DEGREE OF HORIZONTAL CURVATURE FOR SAFE-STOPPING SIGHT DISTANCE

	Design Speed			
TOTAL MEDIAN WIDTH E.P. TO E.P.	40 mph	50 mph	60mph	70°mph
10' Median	6°15'	3°45'	2°	1°15'
10' Median (Barrier Offset 3')		4°45'	2°45'	1°45'
20' Median		5°30'	3°	1°45'
20' Median (Barrier Offset 2')		6°15'	3°15'	2°15'

Note: Offsetting barrier reduces shoulder width on inside of curve

The diagram below illustrates the details of transitioning from 50" (1270 mm) tall concrete median barrier to 32" (810 mm) concrete median barrier at crossover

locations to improve sight distance. The minimum sight distances required at crossovers are indicated in the Road Design manual (Appendix C).



CONCRETE BARRIER FOR GLARE CONTROL

There may be locations in which the 50” (1270 mm) concrete median barrier can be used for glare control.

Conditions to keep in mind when considering concrete median barrier for glare control are median width, vertical grades and horizontal curvature (especially to the left).

Since warrants are not available for determining the need for glare screens, a recommendation from the District Traffic Engineer based on existing accident data would be the typical factor determining a need.

PLAN

Plan Sheet

All Concrete Median Barrier is to be drawn on the plans the same as St’d. MB-7D, E, F and designated accordingly.

Due to space limitations, the designation could be shown by symbol and noted elsewhere.

Profile Sheet

Flow line finished grade elevations for each side of the median barrier (St’d. MB-7D, E, F, MB- 8A, MB-12A, B, C and MB-13, etc.) will be furnished at the beginning and the end of the median barrier as well as at each contraction and expansion joint.

All concrete median barriers located on horizontal curves will require an alignment along the wall to determine the median barrier length and panel joint locations.

When the ending concrete median barrier panel will be less than 6’ (1.8 m) in length it is to be set at 6’ (1.8 m) and the preceding panel length reduced.

Contraction joints are required at intervals of approximately 20’ (6 m) with an expansion joint at intervals of 80’ (24 m). .

DRAINGE

Each side of the median barrier shall be closely reviewed for drainage requirements and drop inlets provided where necessary.

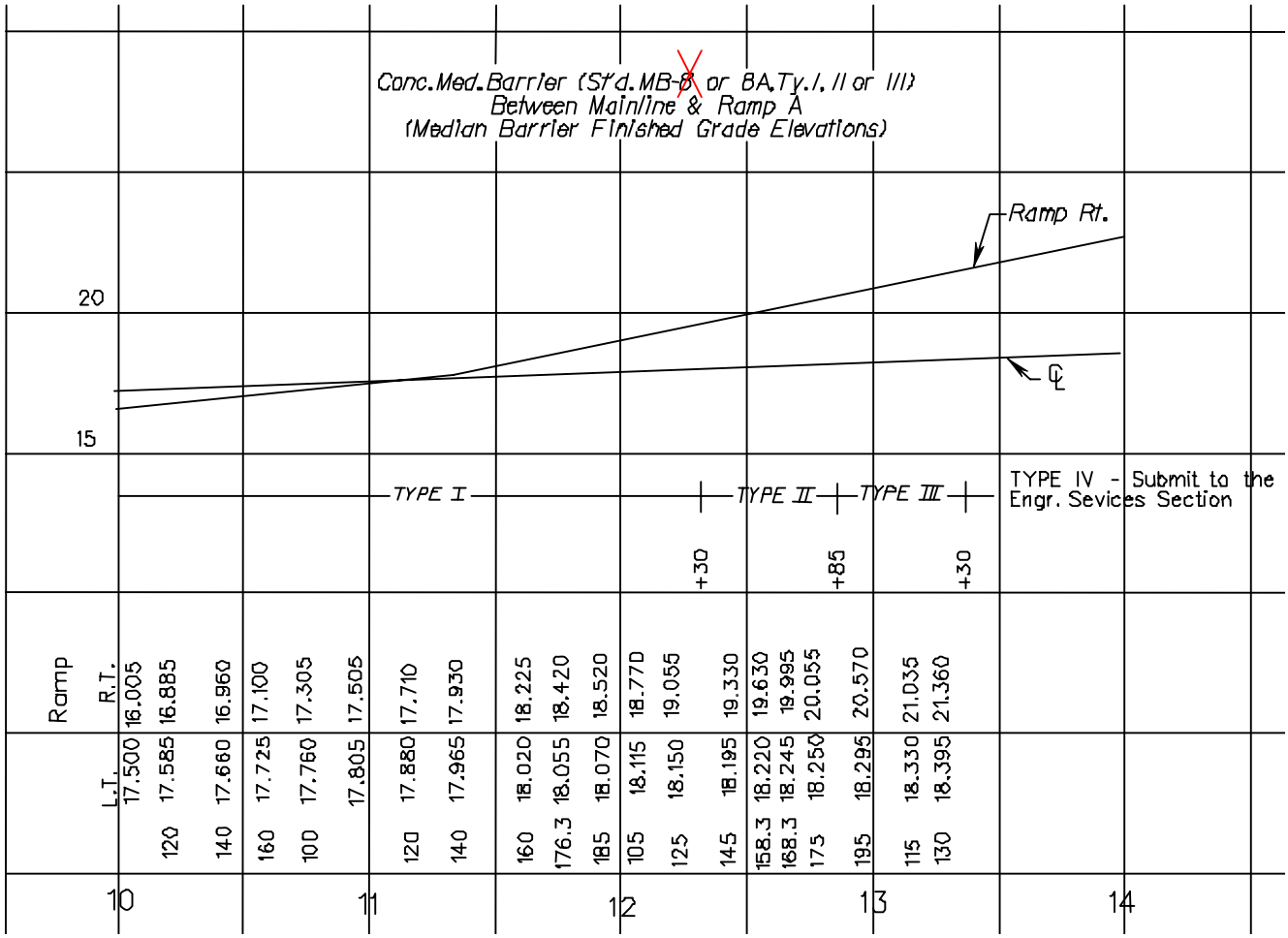
Summaries

Summarize quantities as indicated in the example below or by the individual sheet total format.

INCIDENTAL SUMMARY										
STA. TO STA.	LOCATION	CONCRETE MEDIAN BARRIER STD. 8A			Special Design Median Barrier Type IV				BEDDING MATERIAL AGGR. NO. 25 OR 26	REMARKS
		TYPE			CLASS A3 CONC.	REINF. STEEL	POROUS BACKFILL	MINOR STR. EXCAV.		
		I	II	III						
		L.F. (m)	L.F. (m)	L.F. (m).	C.Y. (m³)	Lb. (kg)	C.Y. (m³)	C.Y. (m³)	TON (M TON)	

EXAMPLE

Profile Sheet



INSERTABLE SHEETS

Current insertable sheets are available on Falcon DMS, under the PPMS# eng_ser, Division of insert and minsert for insertion into applicable plan assemblies.