U.S. Department
of Transportation
Federal Highway Administration

AUG 29 1996

400 Seventh St., S.W.
Washington, D.C. 20590

Refer to: HNG-14

Charles E. Dougan, Ph.D., P.E.
Manager of Research and Materials
Bureau of Engineering and Highway Operations
Connecticut Department of Transportation
P.O. Box 317546
Newington, Connecticut 06131-7546

Dear Dr. Dougan:

Your August 21 letter to Mr. Gerald L. Eller, Director, Office of Engineering requested the Federal Highway Administration's (FHWA) acceptance of an aesthetic steel post supported timber guardrail developed for use on the Merritt Parkway in Connecticut. Included with your letter were plan sheets and specifications for the Merritt Parkway Guardrail (MPG), an April 1996 test report by Bullard, Menges, and Alberson of the Texas Transportation Institute entitled "Testing and Evaluation of the Merritt Parkway Guiderail," and a composite videotape showing each of the tests that were run.

The MPG consists of a 152-mm x 305-mm timber rail element backed by a steel strap and splice plates. This rail is supported by W150 x 22.5 steel posts at a 2896-mm spacing and set with the top of the rail at a height of 762 mm above the pavement surface. Wood blockouts measuring 100 mm x 200 mm x 280 mm separate the rail from the steel posts. Details of the design are shown in Enclosure 1. A transition design, shown in Enclosure 2 was also tested.

Enclosure 3 is a summary of the National Cooperative Highway Research Program (NCHRP) Report 350 testing that was done. We note that the basic design was successfully tested with both the 820-kg car and the 2000-kg pickup truck (tests 3-10 and 3-11, respectively). Test 3-11 was also run on the basic design set 300 mm behind a slope-face, 100-mm high curb, and test 3-21 was run on the transition design. We concur that the pickup truck test is the critical one in these last two cases, and that tests 3-10 and 3-20 with the 820-kg car are not necessary. However, in the case of the transition design, a note should be added to the plan requiring that the granite transition curbing be backfilled

to its top to minimize the likelihood of a small car's wheel becoming jammed between the back of this curb and the bottom of the timber rail element.

Based on our review of the test results, we find that the MPG meets the appropriate evaluation criteria for an NCHRP Report 350 Test Level 3(TL-3) traffic barrier and may be used on the National Highway System (NHS) when such use is requested by a highway agency. We understand that the MPG is a non-proprietary product and that interested agencies may contact the Connecticut Department of Transportation to obtain copies of specifications and full size drawings.

We note that you intend to conduct an in-service evaluation of the MPG as recommended in the NCHRP Report 350. Two items of particular interest, in addition to crash performance and repair costs, are the initial cost of the system and the long-term durability of the weathering steel used for the backing plates, splices, and posts.

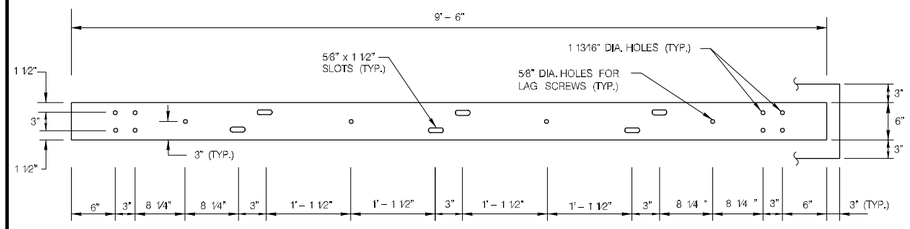
You also asked our opinion on the possible effect on performance of horizontal grooves on the upper sloped face of an F-shape concrete safety barrier. Tests conducted several years ago have led some research engineers to conclude that a "rough" faced barrier allows an impacting vehicle to climb higher up the wall, possibly leading to a rollover in the case of shorter wheelbase, front-wheel drive vehicles. Horizontal grooves in the barrier could produce the same undesirable results in relatively shallow-angle impacts. Thus, we recommend that this seemingly minor design modification be tested prior to use, or that a vertical-faced barrier be considered instead.

Sincerely yours,

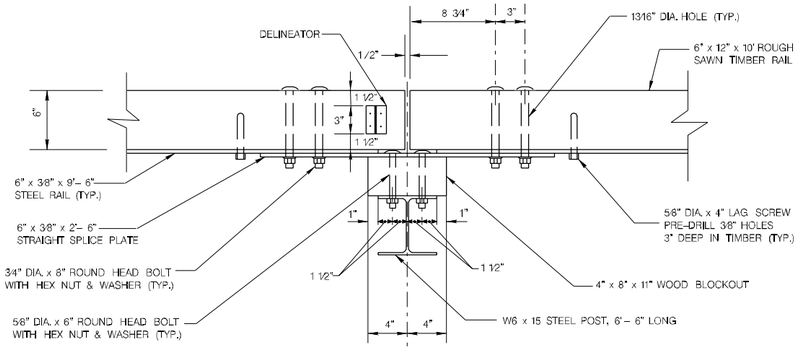
James A. Hatton Jr.

for Seppo I. Sillan, Acting Chief
Federal-Aid and Design Division

3 Enclosures



STANDARD STEEL RAIL DETAIL
6" x 3/8" x 9' – 6"



POST CONNECTION FOR STRAIGHT SECTIONS

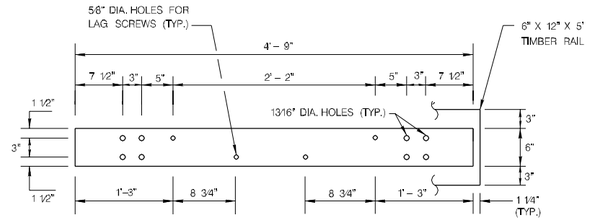
NOTES:

1. MATERIALS AND CONSTRUCTION OF THE MERRITT PARKWAY GUIDERAIL SHALL CONFORM TO SPECIAL PROVISION PROVIDED WITH THE PROJECT.

2. DELINEATOR REFLECTORS SHALL BE BROWN PLASTIC INVERTED T-SECTIONS CONFORMING TO DURAFLEX CORP. SLEXX 2020, OR APPROVED EQUAL. REFLECTIVE SHEETING SHALL BE SQUARE, AND A MINIMUM OF 19 SQ. IN., AND CONFORM TO SECTION M.18.09. DELINEATORS SHALL BE ATTACHED WITH FOUR (4) 1" – LONG, GALVANIZED WOOD SCREWS. REFLECTORS SHALL BE SPACED IN ACCORDANCE WITH THE TABLE, AND POSITIONED PERPENDICULAR TO THE ADJACENT EDGE OF LANE. DO NOT ATTACH REFLECTORS ON FLAIR OR TERMINAL SECTIONS. REFLECTIVE SHEETING SHALL BE SILVER-WHITE ON ALL RAIL SECTIONS ADJACENT TO THE RIGHT SHOULDER, AND YELLOW ON RAIL SECTIONS ADJACENT TO THE LEFT SHOULDER OF TRAVEL LANES.

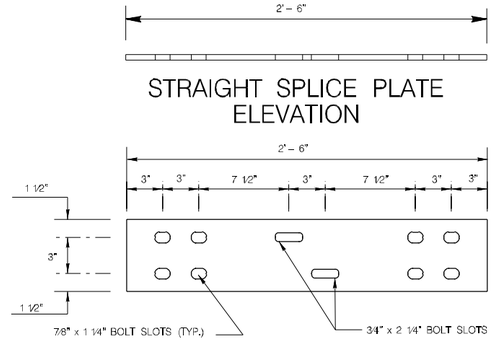
3. TWO ADDITIONAL 5/8" DIA. X 4" LONG LAG SCREWS AND WASHERS SHALL BE INSTALLED AT ALL MID-SPAN POINTS FOR STANDARD SYSTEMS.

4. ALL CONNECTION HARDWARE SHALL BE SUFFICIENTLY TIGHTENED TO ACCOMMODATE FOR SHRINKAGE OF THE WOOD ELEMENTS.



FOR USE WITH R ≤ 70'

STEEL RAIL DETAIL
6" x 3/8" x 4'–9"



SPLICE PLATE DETAIL
6" x 3/8" x 2'– 6"

BENT SPLICE PLATE ELEVATION

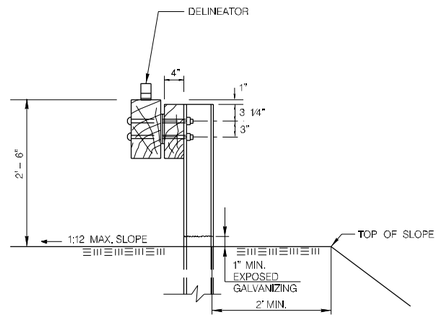
NOTES:

1. WHEN FURNISHING THE SHOP BENT SPLICE PLATES, USE THE MINIMUM BEND ANGLE AS SHOWN IN TABLE 2.

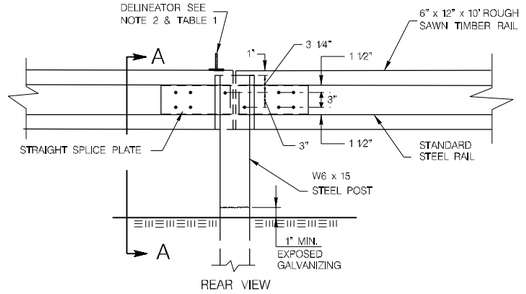
2. FOR RAILING SET ON A CURVE WITH RADII ≤ 70' SPACE POSTS AT 5'.

TABLE 2

Radius R (ft.)	ϕ /2 (Degrees)	d (In.)
35 Min.	4.10	5/8
40	3.58	9/16
45	3.18	1/2
50	2.86	7/16
55	2.60	7/16
60	2.40	3/8
65	2.20	3/8
70	2.05	5/16
Over 70	Flat	0

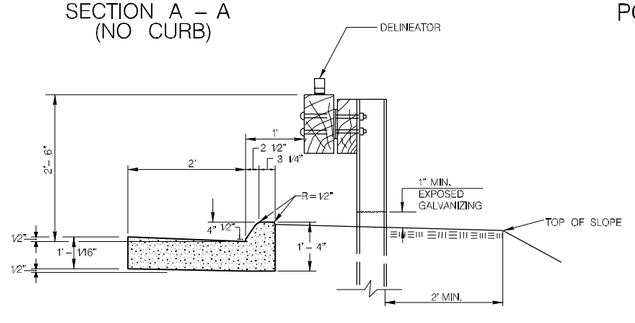


SECTION A – A
(NO CURB)



REAR VIEW

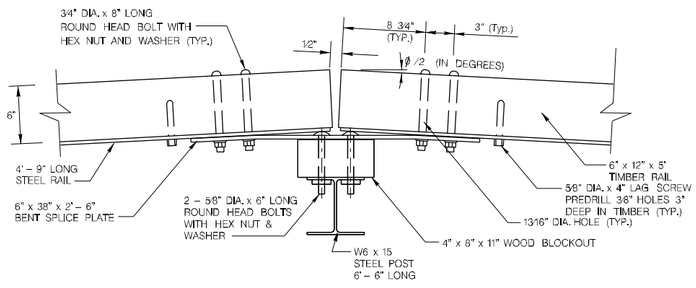
POST CONNECTION ELEVATION



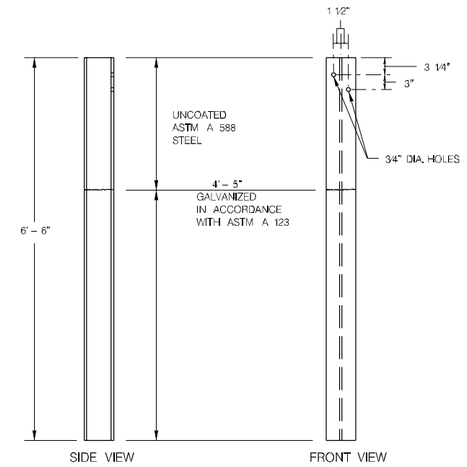
STANDARD SECTION WITH MOUNTABLE CURB

TABLE 1

DELINEATOR SPACING	
CURVE RADIUS	SPACE
< 300'	20'
≥ 300'	50'



POST CONNECTION
FOR CURVES WITH R ≤ 70'



POST DETAIL
W6 x 15

REVISED: 040505

REV.	DATE	DESCRIPTION	SHEET NO.
		REVISIONS	

NOT TO SCALE

DESIGNER:
DRAFTER:
CHECKED BY:
DATE CHECKED:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

ENGINEER: OFFICE OF ENGINEERING
APPROVED BY: DATE:

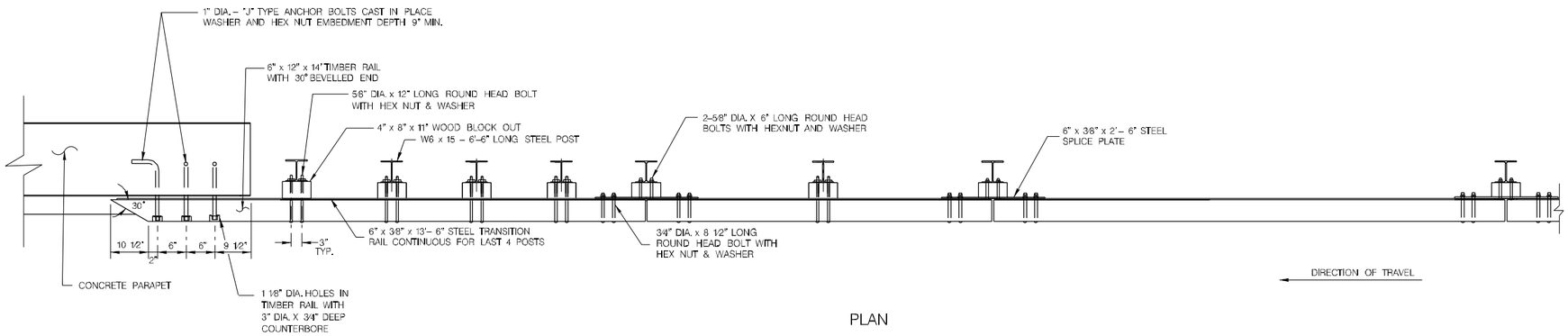
OFFICE OF ENGINEERING

PROJECT TITLE:
PLOTTED

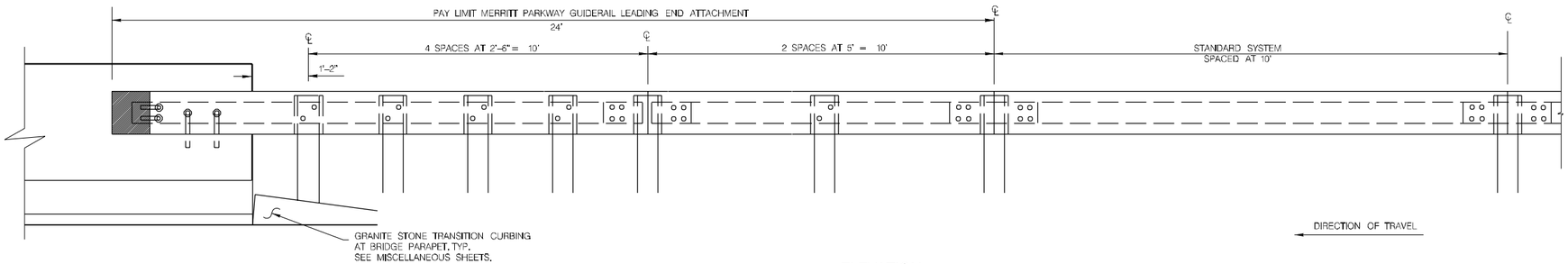
TOWN:
PROJECT NO.:
DRAWING NO.:
SHEET NO.:

DRAWING TITLE:
MISCELLANEOUS CONNECTICUT DETAIL
MERRITT PARKWAY GUIDERAIL
STANDARD DETAILS

NOTES:
1. THIS DRAWING SHOWS LEADING END ATTACHMENT TO PROPOSED PARAPETS.
AT EXISTING PARAPETS ATTACH GUIDERAIL USING D.O.T. APPROVED CHEMICAL ANCHORS.



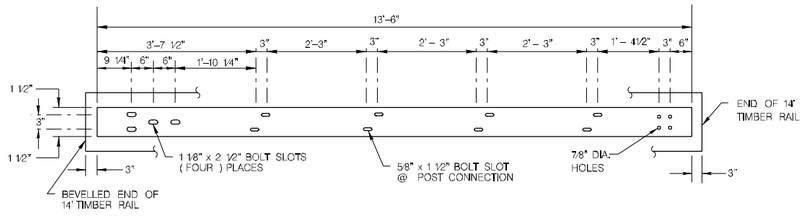
PLAN



ELEVATION

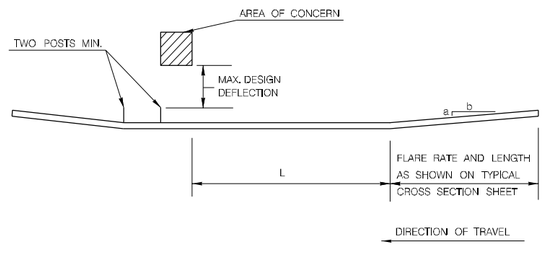
ATTACHMENT AT LEADING END

(JERSEY SHAPE BARRIER SHOWN)



REAR VIEW

STEEL TRANSITION RAIL 6" x 3/8" x 13'–6" FOR LEADING END ATTACHMENT



PLAN

Maximum Design Deflection (ft)	Area Of Concern Plus 2 Posts (see sketch)	SYSTEM 3	SYSTEM 2	Standard System	L
		W6x15 Posts Spaced at 2'– 6"	W6x15 Posts Spaced at 5'	W6x15 Posts Spaced at 10'	Min. Length Needed
1'	System 3	10'	10'	50'	70'
2' – 6"	System 2	–	10'	60'	70'
4'	Standard System	–	–	70'	70'

APPROACH TO FIXED OBJECTS SYSTEM 2 AND 3

REVISED: 040505

REV.	DATE	DESCRIPTION	SHEET. NO
		REVISIONS	

NOT TO SCALE

DESIGNER:
DRAFTER:
CHECKED BY:
DATE CHECKED:

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION

ENGINEER: OFFICE OF ENGINEERING
APPROVED BY: DATE:

OFFICE OF ENGINEERING

PROJECT TITLE:
PLOTTED

TOWN:

DRAWING TITLE:
MISCELLANEOUS CONNECTICUT DETAIL
MERRITT PARKWAY GUIDERAIL LEADING END ATTACHMENT AND SYSTEMS 2 & 3

PROJECT NO.:
DRAWING NO.:
SHEET NO.:

CONNECTICUT DEPARTMENT OF TRANSPORTATION
Division of Research
August 1996

Merritt Parkway Guiderail (MPG)
NCHRP Report 350, Test Level 3 Crash Tests

Summary of Results

NCHRP Report 350 Test Designation	**3-11** No Curb	**3-10** No Curb	**3-11** With Curb	**3-21** Transition
Vehicle Mass (kg)	2000	896	2000	2000
Impact Velocity (km/h)	100.02	99.29	99.33	101.96
Impact Angle (degrees)	25.20	20.30	25.24	26.38
Impact Location	0 mm upstream from a post.	1800 mm upstream from a post.	0 mm upstream from a post.	1880 mm from end of rigid barrier.
Lateral Dynamic Deflection (mm)	1150	750	1020	150
Occupant Impact Velocity (m/s)				
Longitudinal (max. allowable=12)	8.09	5.99	6.96	9.22
Lateral (max. allowable=12)	4.25	5.27	4.78	7.91
Occupant Ridedown Acceleration (peak 10 ms avg g's)				
Longitudinal (max. allowable=20)	-9.58	-4.27	-10.12	-8.15
Lateral (max. allowable=20)	-10.13	8.23	-10.16	-10.38
Exit Angle (degrees)	0.50	8.80	12.53	9.20
Exit Velocity (km/h)	40.90	76.20	59.37	56.93
Assessment	Passed all requirements	Passed all requirements	Passed all requirements	Passed all requirements