August 17, 2001

Mr. Daniel J. MacDonald
Standards Engineer
Oregon Department of Transportation
222 Transportation Building
Salem, Oregon 97310

Refer to: HSA-10/B-86

Dear Mr. MacDonald:

The information on the Oregon precast barrier that you sent with your May 25 letter was forwarded to my staff for review. Although the tested barrier, an 810-mm tall, 3.84-m long F-shape barrier with a pin and loop connection, appeared to meet all evaluation criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350 at test level 3 (TL-3), the test report, prepared by KARKO Engineering Automotive Research Center, did not contain all of the information recommended in Chapter 6 of NCHRP Report 350. The most obvious omission was the lack of a detailed description of the test article, including internal reinforcing and connection details, and there were questions concerning the accuracy of some of the data.

On July 26, you sent Mr. Richard Powers copies of revised reports, both for the original 810-mm barrier (Test Report No. KAR21007-01) and for a subsequent test of a 1065-mm tall precast concrete barrier (Test Report No. KAR21007-02). Descriptions of each of these designs and their crash performance are as follows:

Standard barrier: test installation consisted of 16 precast concrete F-shape segments, each 810-mm high, 3.8-m long, 610-mm wide at the base, and 240-mm wide at the top. The pin and loop connection consisted of two 19-mm A36 steel loops near the top of one segment end, above a single 19-mm steel loop near the bottom on the same end. The corresponding loops on the adjacent barrier segment consisted of a single loop near the top and double loops on the bottom. When placed together, the single loops fit between the double loops, forming two connection points, each consisting of three loops. A 25-mm diameter , 735-mm long ASTM A449 steel pin, with no nut or retention device, was dropped through the loops to complete the connection. This system was impacted near its midpoint with a 2000-kg pickup truck at 100.7 km/h and a 25 degree angle. Occupant impact velocity was reported to be 5.8 m/sec and maximum 10-millisecond ridedown acceleration was 18.2 g's. The maximum roll angle of the vehicle was less than 15 degrees and the barrier dynamic deflection was only 762 mm. This design is shown in Enclosure 1.

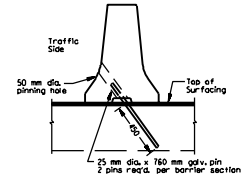
Tall barrier: test installation consisted of 20 precast concrete F-shape segments, each 1065-mm high, 3.02-m long, 660-mm wide at the base, and 230-mm wide at the top. The connection between segments consisted of two sets of two perforated C-shape steel channels with the open sides alternately positioned such that one leg of each channel fits between the legs of the mating channel on the adjacent barrier segment. A 25-mm diameter ASTM A449 end bolt, 760-mm long, was inserted through holes in each C-channel leg and into a nut welded to the bottom of the lower C-channel, effectively forming eight points of connection. This system was impacted near its midpoint with a 2000-kg pickup truck at 102.4 km/h and a 25 degree angle. Occupant impact velocity was reported to be 6.2 m/sec and maximum 10-millisecond ridedown acceleration was 19.4 g's. Maximum vehicle roll was approximately 16 degrees and the barrier dynamic deflection was 813 mm. This design is shown in Enclosure 2.

Based on the reported results of the tests run on these barriers, both the 810-mm tall and the 1065-mm tall designs are considered to meet the evaluation criteria of the National Cooperative Highway Research Program (NCHRP) Report 350 at test level 3 (TL-3) and may be used on the National Highway System when such use is acceptable to the contracting authority. Both barriers exhibited the least amount of deflection and resulted in the most stable, post-impact vehicle trajectories of any free-standing, precast barrier tested to date. I understand that the drawings for these non-proprietary barriers can be obtained by contacting you at (503) 986-3779 or from your web site at ftp://ftp.odot.state.or.us/techserv/roadway/standards **under drawing nos. odot_apwa500.pdf and odot_apwa545.pdf.Sincerely yours,**

(original signed by Frederick G. Wright, Jr.)

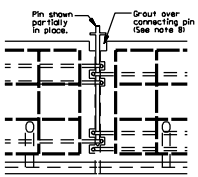
Frederick G. Wright, Jr.
Program Manager, Safety

2 Enclosures



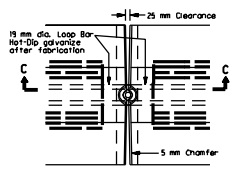
PINNING CONCRETE SHOULDER BARRIER TO ROADWAY

(Use when req'd. by plans or as directed)



SECTION C-C

For details not shown, see End Views A-A and B-B

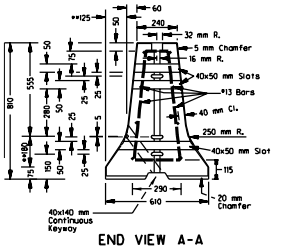


PLAN

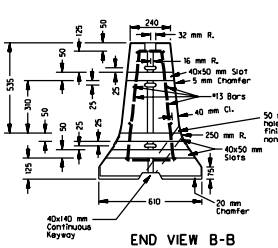
For details not shown, see End Views A-A and B-B

PIN AND LOOP CONNECTION

** Dimensions marked thus are to the intersection point of the barrier slopes. Construct the 250 mm radius to provide a smooth transition between the slopes.



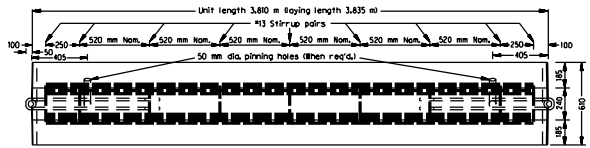
END VIEW A-A



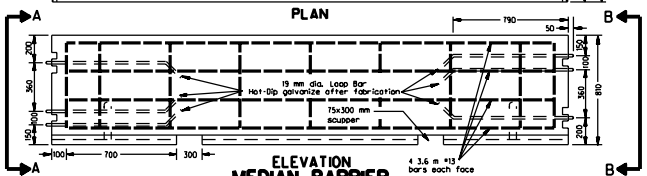
END VIEW B-B

Pin Notes:

1. Washer shall be forged as integral part of pin or shall be welded as shown.
2. Pin shall be galvanized after fabrication.
3. Pins that conform to critical dimensions, pin length & dia., washer dia. & thkn.) are acceptable if an approved top configuration for lifting the pin is provided.
4. Pins shall conform to ASTM A449.

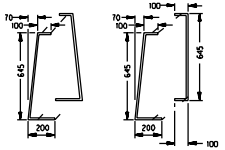


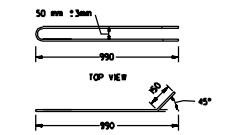
PLAN



ELEVATION

MEDIAN BARRIER



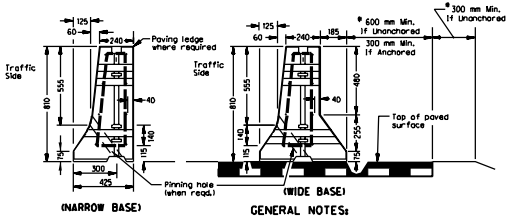


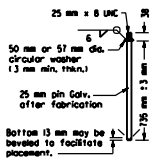
REINFORCEMENT DETAIL

SHOULDER BARRIER

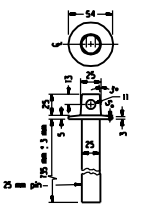
(For assembly details and dimensions, see median barrier at left)

* Barrier used as shoulder barrier and placed in areas where these dimensions cannot be obtained shall be pinned or otherwise anchored





PIN DETAIL



ALTERNATE PIN DETAIL

GENERAL NOTES:

1. All metal reinforcement shall be 50 mm clear of nearest face of concrete unless otherwise shown.
2. Maximum chord length for curves with a 435 m radius or less shall be 3,810 m. Maximum chord length for curves with radii exceeding 435 m shall be 7,620 m.
3. Normal use of precast barrier units is restricted to curvatures with radii greater than 235 m.
4. Narrow base shoulder barrier to be used only at locations with backfill behind barrier as shown on plans.
5. Concrete median barrier is an acceptable alternate to wide base shoulder barrier.
6. Temporary concrete barrier to be precast concrete median barrier with pin and loop assembly.
7. When scuppers are not required, plug them with a minimum 50 mm of grout.
8. Concrete grout for grouting over pins, pinning holes or grouting of scuppers shall be a non-shrinking grout, weak in strength and of thick consistency.
9. Precast barrier used as permanent median barrier in medians less than 2,4 m in width shall be anchored to the roadway. See Std. Drg. No. RD56 for details.

* All dimensions are in mm unless otherwise noted.

NOTE: All material and workmanship shall be in accordance with the current State of Oregon Standard Specifications for Highway Construction.

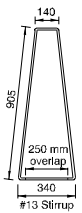
OREGON
DEPARTMENT OF TRANSPORTATION
STANDARD

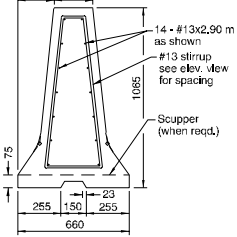
PRECAST CONCRETE BARRIER PIN AND LOOP ASSEMBLY

JANUARY 1996

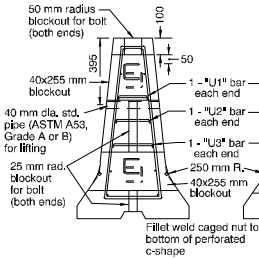
REVISIONS		APPROVED
DATE	DESCRIPTION	
10-99	REVISE DETAIL AND NOTE	STANDARDS ENGINEER
6-00	REVISE DIMENSIONS	
01-01	REVISE DETAILS	DRG. NO. RD500

RD500

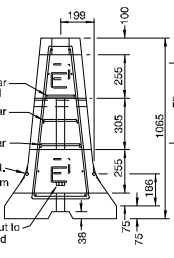




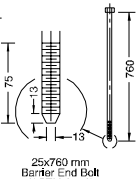
TYPICAL SECTION



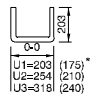
END VIEW A-A



END VIEW B-B



BOLT DETAILS

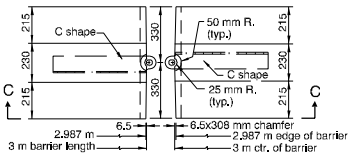


U-BAR DETAIL

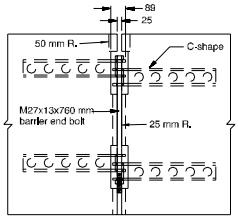
* Vertical back barrier #13 bar

GENERAL NOTES

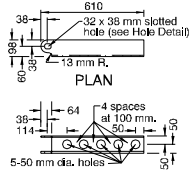
1. All reinforcing steel shall conform to ASTM A706M or AASHTO M31M (ASTM A615M) Grade 420. All bars shall be full length as shown and shall be placed 50 mm clear of the nearest face of concrete unless shown otherwise.
2. All structural steel including fasteners shall be hot-dip galvanized after fabrication.
3. Normal use of precast tall median barrier is restricted to curves with radii greater than 220 m.
4. Chamfer all edges 20 mm (typical).
5. Perforated C-shape shall be placed in location shown to a tolerance of 2 mm.
6. Estimated barrier weight is 2880 kg per 3 m unit length. estimated vertical backed barrier weight is 2340 kg.



PLAN



SECTION C-C

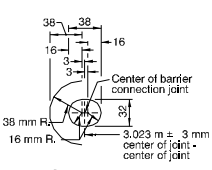


PLAN

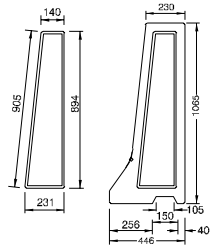
ELEVATION

PERFORATED C-SHAPE

Cut from 7.9 mm thick steel plate or bar (AASHTO M183M, ASTM A36M). Hot dip galvanize after fabrication. (See note 5 for casting instructions).

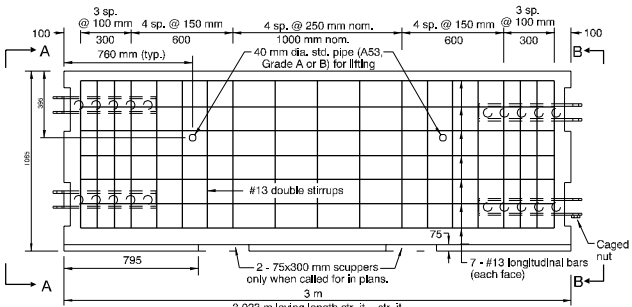


HOLE DETAIL



NARROW BASE BARRIER

Only use against retaining walls or as directed.
(For details not shown see other barrier details on this sheet.)



ELEVATION

- All dimensions are in mm unless otherwise noted.

REGISTERED PROFESSIONAL ENGINEER
14,037
OREGON
JULY 26, 1988
DANIEL J. MACDONALD
EXPIRES 12-31-2002

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications

OREGON STANDARD DRAWINGS

PRECAST TALL (1065 mm) CONCRETE BARRIER

REVISIONS	
DATE	DESCRIPTION

RD545

RD545