



U.S. Department
of Transportation
**Federal Highway
Administration**

November 22, 1999

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

Refer to: HMHS-B61

Mr. Rich Peter
Chief, Roadside Safety Technology Branch
Division of Materials Engineering and
Testing Services
5900 Folsom Boulevard
Sacramento, California 95819-0128

Dear Mr. Peter:

Your October 14 letter to Mr. Henry Rentz was forwarded to me for a response. In that letter, you requested a formal Federal Highway Administration acceptance of the California precast concrete barrier (K-rail) for use in semi-permanent installations. To support your request, you also sent a copy of your October 1999 report entitled "Compliance Crash Testing of K-rail Used in Semi-Permanent Installations" and a video tape of the two tests you conducted.

The K-rail you tested is a New Jersey profile concrete barrier 810-mm (32-inches) tall with each segment having a nominal length of 6.1-m (20 feet). The base width is 610 mm (24 inches). Each segment weighed approximately 3630 kg (8000 pounds). Adjacent segments were connected using 31.8-mm (1.25-inch) diameter steel pins passed through four loops made from 19-mm (.75-inch) diameter steel bars. Longitudinal reinforcement consisted primarily of six No.16 bars per segment. Additionally, each segment was staked to an AC pavement with four 25-mm (1-inch) diameter by 610-mm (24-inch) long steel stakes driven through holes cast in the lower sloped section of the K-rail near each corner. The head of each stake was driven below the traffic face of the barrier to prevent snagging. Your report recommends a stake length of 1000 mm (39.4 inches) and installation on an AC pad having a minimum thickness of 51 mm (2 inches) and a minimum width of 1200 mm (4 feet). As an alternative to an asphalt pad, you allow the K-rail to be installed on a compacted base material having a minimum thickness of 150 mm (6 inches) and a width of at least 1200 mm (4 feet). We concur with these design recommendations. Enclosure 1 is a schematic drawing of the final design. We assume anyone needing a detailed drawing and material specifications can obtain those directly from your office.

Staff members have reviewed the results of the two tests you conducted on the K-rail and concur with your assessment that appropriate NCHRP Report 350 evaluation criteria were met. The summary results of each test are shown in Enclosure 2. Maximum permanent deflection was only

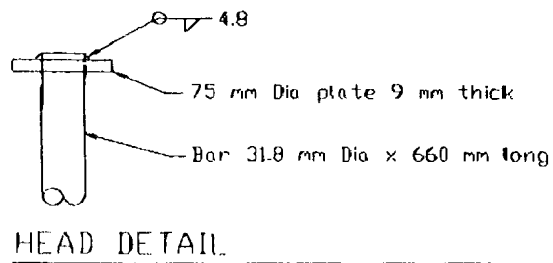
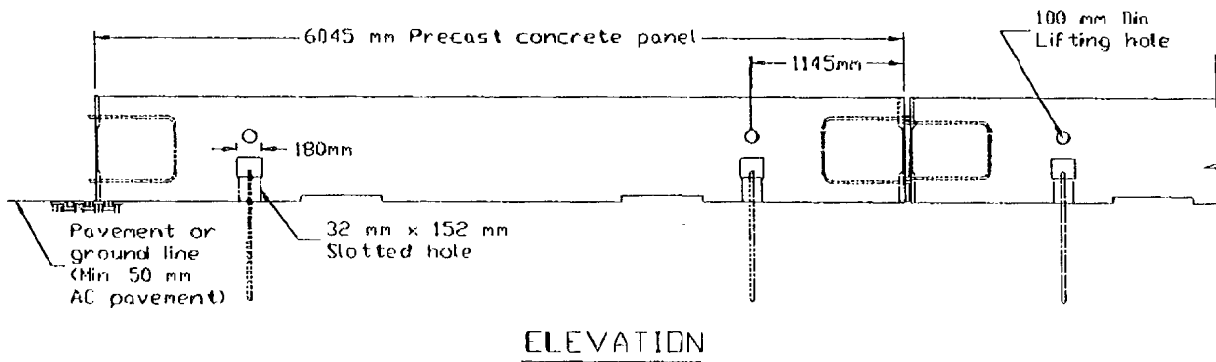
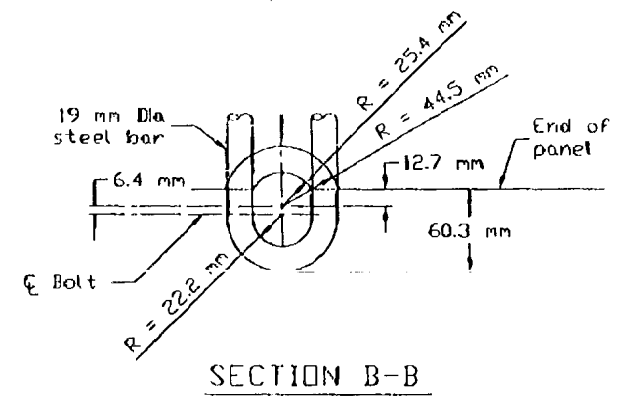
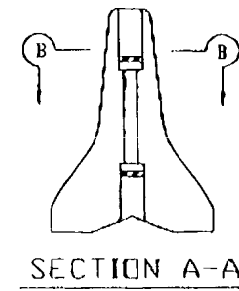
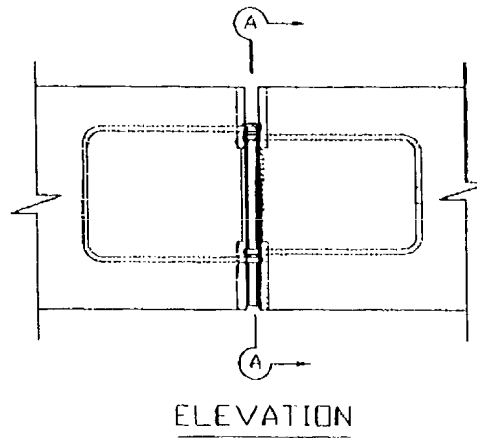
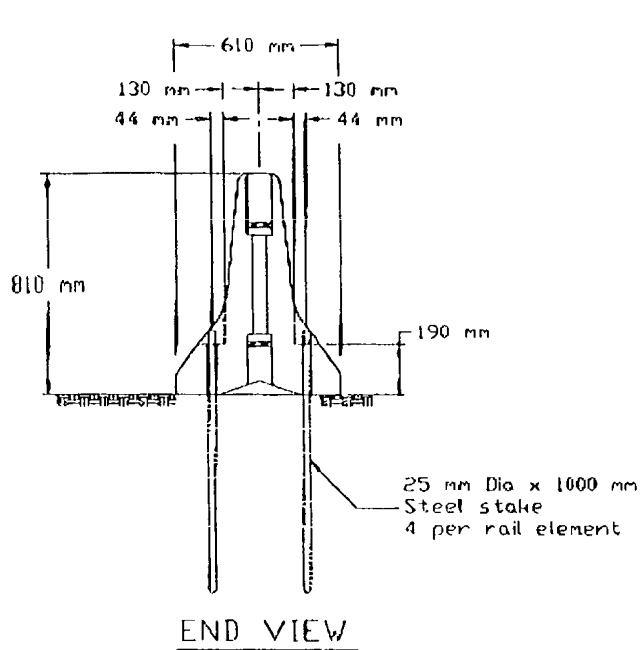
25 mm (1 inch) in test 3-10 with the 820-kg (1800-pound) car impacting at 20 degrees and 100 km/h (62.2 mph), and 70 mm (2.75 inches) in test 3-11 with the 2000-kg (4400-pound) pickup truck at 25 degrees and 100 km/h (62.2 mph). Maximum dynamic deflection at the top of the K-rail in the latter test was reported at 260 mm (approximately 10 inches). Based on these test results, the K-rail, when anchored as tested, may be considered acceptable for use as an NCHRP Report 350 test level 3 (TL-3) barrier and installed on the National Highway System (NHS) when such use is requested by a State transportation agency.

Sincerely yours,



Dwight A. Horne
Director, Office of Highway Safety Infrastructure

2 Enclosures



Enclosure 1

Part ID No.	Quantity	Description			
Unless otherwise specified tolerances are:		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION Roadside Safety Features Technology Branch			
Drawing No: Drawing Number		Semi Permanent Rail (Type K)			
Scale:	File:	Drawn:	Checked:		
None	File.dwg	Mike O'Keefe	John Jewell		
Size:	Sheet	Revision Dates (Use regard Prints Bearing Carter Revision Dates)			
A	1	1			

Test 551 Data Summary Sheet

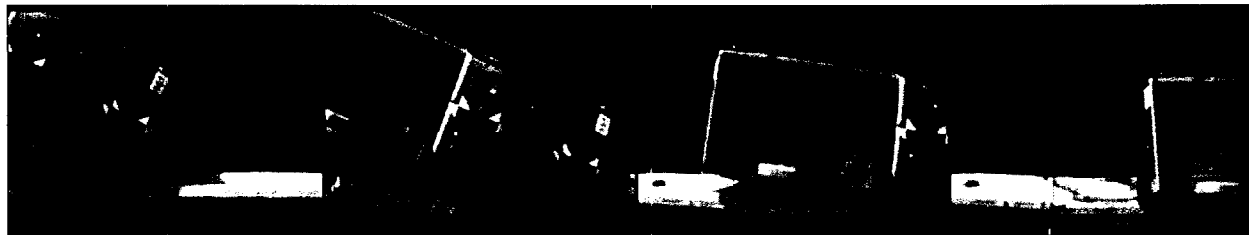


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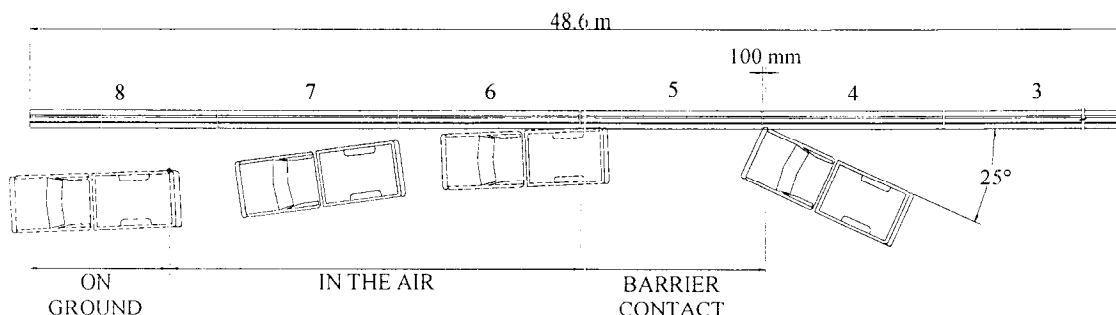


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t = 0.160

t = 0.240



General Information:

Test Agency California DOT
 Test Number 551
 Test Date January 27, 1999

Test Article:

Name Pinned K-rail
 Installation Length 48.77 m
 Description 8 segments of K-rail,
 staked with 24-mm
 stakes & connected with
 31.8-mm pins

Test Vehicle:

Model 1989 Chevy 2500
 Inertial Mass 2016 kg

Impact Conditions:

Velocity 100.6 km/h
 Angle 25°

Exit Conditions:

Velocity 82 km/h
 Angle 6 degrees

Test Dummy:

Type NA
 Weight / Restraint NA
 Position NA

Vehicle Exterior:

VDS⁴ FR-4, RD-4
 CDC⁵ 02RFEW4

Vehicle Interior:

O.C.D.I. RF0000000

Barrier Damage:

Spalling at the pin-and-loop
 connection at point of
 impact, also at some of the
 anchor stakes. Superficial
 scuffing

<i>Occupant Risk Values</i>	<i>Longitudinal</i>	<i>Lateral</i>
Occupant Impact Velocity	5.17 m/s	6.62 m/s
Ridedown Acceleration	-5.48 g	-14.88 g
Max. 50 ms avg. Acceleration	-5.99 g	-11.33 g

Test 552 Data Summary Sheet



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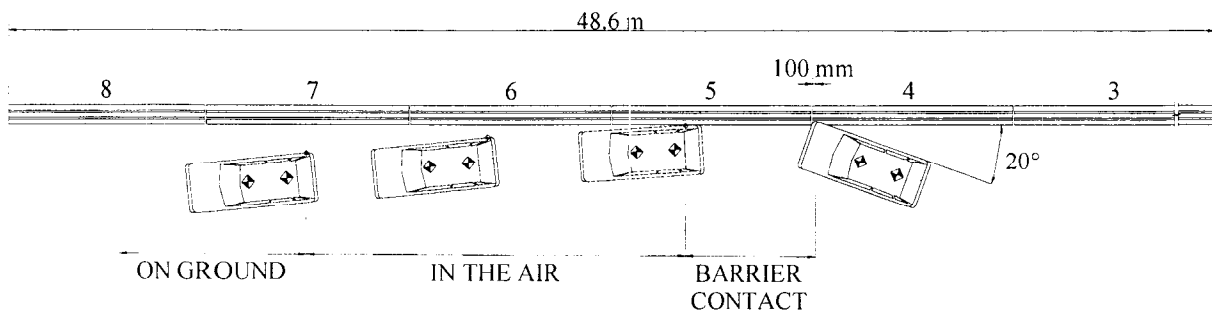


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t = 1.200

t = 1.400



General Information:

Test Agency California DOT
 Test Number 552
 Test Date February 24, 1999

Test Article:

Name Pinned K-rail
 Installation Length 48.77 m
 Description 8 segments of K-rail,
 staked with 24-mm
 stakes & connected with
 31.8-mm pins

Test Vehicle:

Model 1994 Geo Metro
 Inertial Mass 844 kg

Impact Conditions:

Velocity 101.7 km/h
 Angle 20°

Exit Conditions:

Velocity 97 km/h
 Angle 4 degrees

Test Dummy:

Type Hybrid III
 Weight / Restraint 74.8 kg / belted
 Position Front Right

Vehicle Exterior:

VDS⁴ FR-4, RD-4
 CDC⁵ 02RFEW3

Vehicle Interior:

OCDI RF0000000

Barrier Damage: Superficial scuffing.

<i>Occupant Risk Values</i>	<i>Longitudinal</i>	<i>Lateral</i>
Occupant Impact Velocity	3.94 m/s	5.8 m/s
Ridedown Acceleration	-1.13 g	-17.62 g
Max. 50 ms avg. Acceleration	-7.29 g	-11.2 g