



U.S. Department
of Transportation

**Federal Highway
Administration**

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

JUL 17 2000

Refer to: HSA-B70

Milford L. Miller, P.E./L.S.
Standard Drawing Engineer
State of Idaho Transportation Department
P.O. Box 7129
Boise, Idaho 83707-1 129

Dear Mr. Miller:

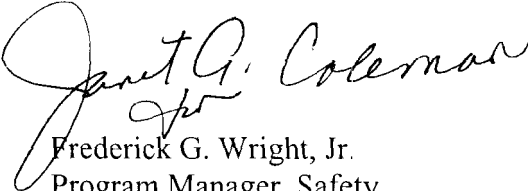
In your June 20 letter you requested formal Federal Highway Administration acceptance of the Idaho Transportation Department's 6095-mm (20-foot) long precast concrete barrier for use on the National Highway System (NHS) as a test level 3 (TL-3) barrier. To support your request, you also sent a copy of an April 2000 test report prepared by E-TECH Testing Services, Inc., in Rockland, California, entitled "NCHRP Report 350 Crash Test Results for the Idaho 6095-mm Concrete Barrier" and a video tape of the two tests that were conducted.

The barrier you tested was a standard New Jersey profile concrete barrier 810-mm (32-inches) tall and 6.095-m (20-feet) long. The base width was 610-mm (24 inches) and the top width was 150-mm (6 inches). Each segment weighed approximately 3630 kg (8000 pounds). Adjacent segments were connected using 3 1.8-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. Two different connection designs were tested. The first consisted of galvanized 32-mm (1.25-inch) diameter by 638-mm (25-inch) long A307 hex bolts secured by 32-mm (1.25-inch) A536 heavy hex nuts. Two F844 Wide Type A washers were used, one under the bolt head and one above the nut. Enclosure 1 is a schematic drawing of this connection detail. The connection in the second test was a 32-mm (1.25-inch) diameter A36 steel pin that was 660-mm (26-inches) long. No locking nut or other pin retention device was used in this design. The steel loops were identical in both tests.

Staff members have reviewed the results of the two tests you conducted and concur with your assessment that appropriate NCHRP Report 350 evaluation criteria were met. They also agree that it is not necessary to test the 860-kg car since the barrier is identical to California's K-Rail which was successfully tested with the small car. The summary results of each test are shown in Enclosure 2. Maximum permanent deflection was 1.0 m with the bolted connection and 1.1 m with the pinned connection. The test installation was 73.2 m long and

the pickup truck impacted 1.2 m from the mid-point in both tests. Impacts nearer the ends of an installation would be expected to increase the deflection distance under similar impact conditions. Based on these test results, the Idaho Concrete Barrier, with either the bolted pin connection or the drop-pin connection, may be considered acceptable for use as an NCHRP Report 350 TL-3 barrier on the NHS when such use is requested by a State transportation agency. I understand that this design remains nonproprietary and that anyone wanting to obtain detailed specifications and plan sheets for this barrier (can request them by calling you directly at (208) 334-8475.

Sincerely yours,



Frederick G. Wright, Jr.
Program Manager, Safety

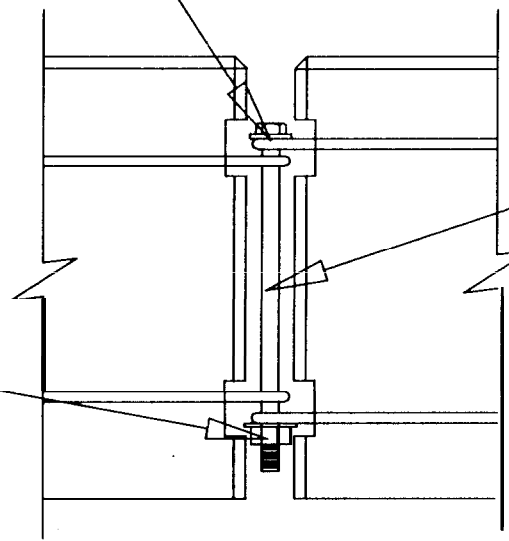
2 Enclosures



32 mm F844 Type A Wide Plain Flatwasher (Typ 2 plcs)

32 mm dia. x 638 mm long A307 Grade A Hex Bolt w/76 mm long machined threads at 2.8 threads per centimeter

32 mm A563 Grade A Heavy Hex Nut



Note: All fasteners galvanized per A153 Class C. Drawing not to scale.

BOLTED CONNECTION

Illustration D-2 Bolted Connection and Material Certifications (1 of 2)



t = 0.000 set

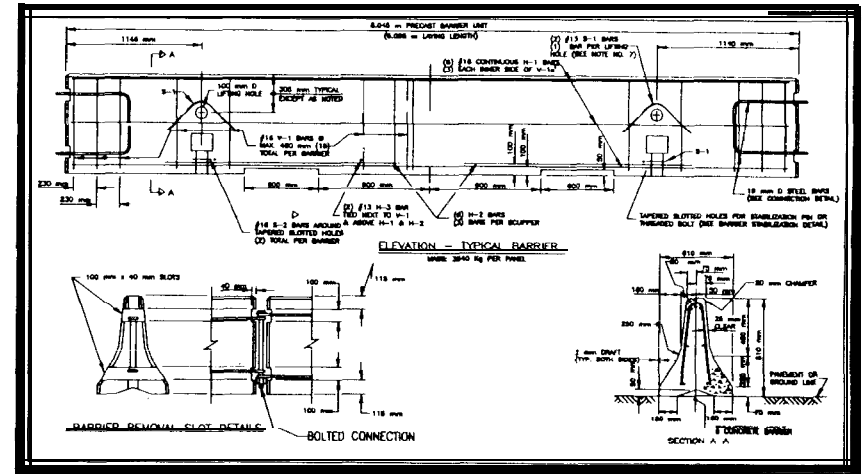
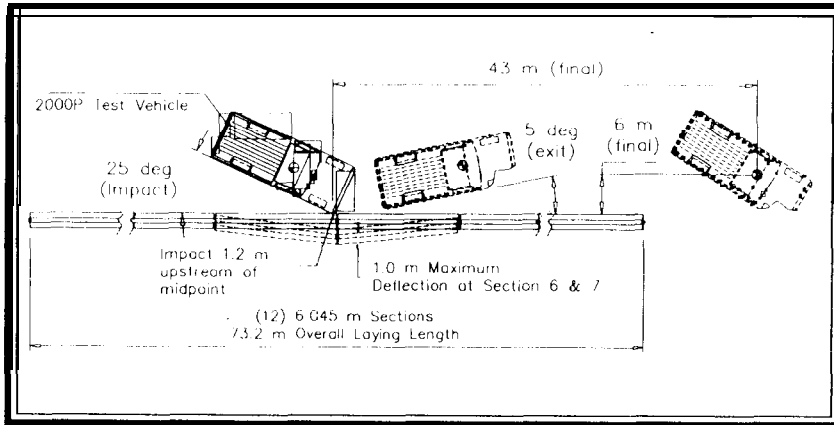
t = 0.150 sec

t = 0.300 sec

t = 0.450 set

t = 0.600 SW

t = final



E-TECH Testing Services, Inc.

General Information

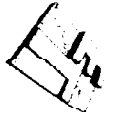
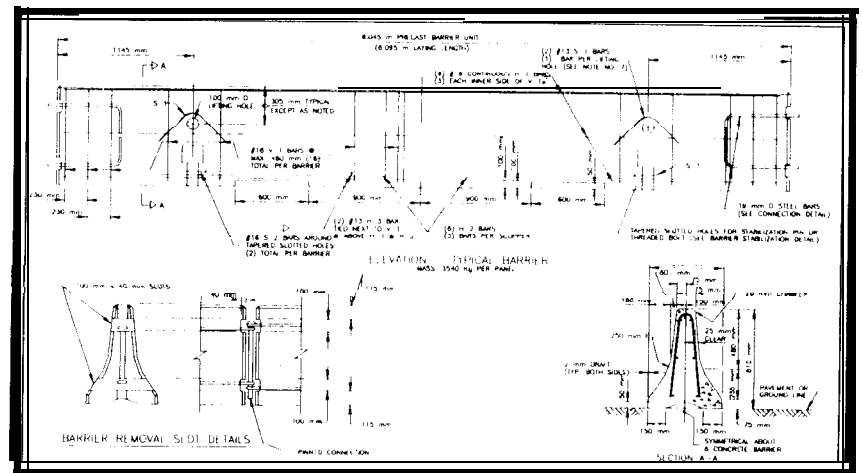
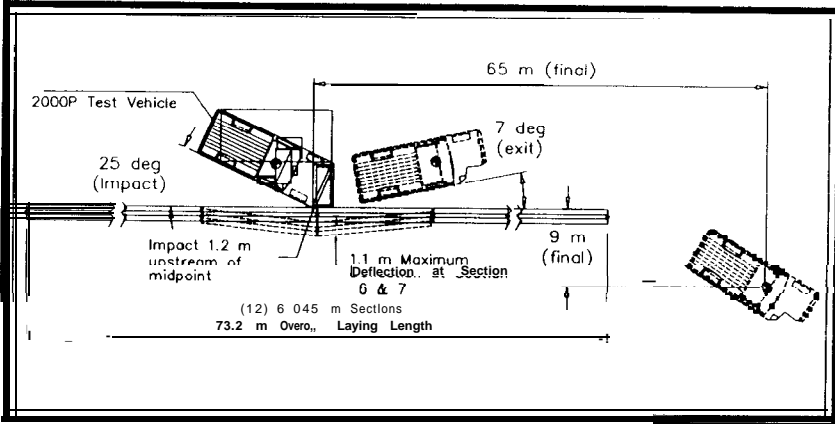
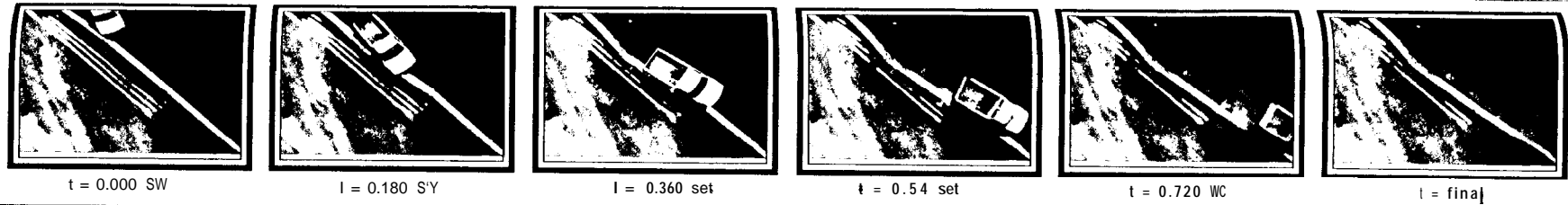
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|-------------------------------------|----------------------------------|
| Test Agency | E-TECH Testing Services, Inc. |
| Test Designation | NCHRP 350 Test 3-1.1 |
| Test No. | 13-4300-001 |
| Date | 3/16/00 |
| Test Article | |
| Type | Idaho Transportation Department |
| ..... | 6095 mm Concrete Barrier |
| Installation Length, (m) | 73.2 (overall installation) |
| Material and key elements | 6095 mm long NJ Shaped |
| ..... | Concrete Barrier section with |
| ..... | 32 mm dia. bolted connection and |
| ..... | 19 mm dia. solid steel loops |
| Foundation Type and Condition | Aged chip-sealed asphalt |
| Test Vehicle | |
| Type | Production Model |
| Designation | 2000P |
| Model | 1993 Chevrolet C2500 |
| ..... | 314 Ton Pickup |
| Mass (kg) | |
| Curb | 1859 |
| Test inertial | 1975 |
| Dummy | N/A |
| Gross Static | 1975 |
| Impact Conditions | |
| Speed (km/h) | 101.1 |
| Angle (deg) | 25 |
| Impact Severity (kJ) | 138.9 |

| | |
|---|-----------|
| Exit conditions | |
| Speed (km/h) | 76 |
| Angle (deg) | 5 |
| Occupant Risk Values | |
| Impact Velocity (m/s) | |
| x-direction | 5.2 |
| y-direction | -5.9 |
| ridedown Acceleration (g's) | |
| x-direction | -11.7 |
| y-direction | -10.1 |
| European Committee for Normalization (CEN) Values | |
| THIV (m/s) | 7.9 |
| PIID (g's) | 13.8 |
| ASI | 1.2 |
| Test Article Deflections (m) | |
| Dynamic | 1.0 |
| Permanent | 1.0 |
| Vehicle Damage | |
| Exterior | |
| VDS | RFQ-5 |
| CDC | O1RFEW3 |
| Interior | |
| OCDI | RF0001000 |
| Post-Impact Vehicular Behavior (deg - rate gyro) | |
| Maximum Roll Angle | -52.7 |
| Maximum Pitch Angle | 16.4 |
| Maximum Yaw Angle | -69.5 |

Figure 1. Summary of Results - Idaho 6095 mm Concrete Barrier Test 13-4300-001

Idaho Concrete Barrier Crash Test Results - 9 of 44

ENCLOSURE 2 (1 OF 2)



E-TECH Testing Services, Inc.

General Information

| | |
|-------------------------------------|----------------------------------|
| Test Agency | E-TECH Testing Services, Inc. |
| Test Designation | NCHRP 350 Test 3-11 |
| Test No. | 13-4300-002 |
| Date | 4/11/00 |
| Test Article | |
| Type | Idaho Transportation Department |
| ..... | 6095 mm Concrete Barrier |
| Installation Length, (m) | 73.2 (overall installation) |
| Material and key elements | 6095 mm long NJ Shaped |
| ..... | Concrete Barrier section with |
| ..... | 32 mm dia. pinned connection and |
| ..... | 19 mm dia. solid steel loops |
| Foundation Type and Condition | Aged chip-sealed asphalt |
| Test Vehicle | |
| Type | Production Model |
| Designation | 20001* |
| Model | 1995 Chevrolet C2500 |
| ..... | 314 Ton Pickup |
| Mass (kg) | |
| Curb | 1972 |
| Test inertial | 1994 |
| Dummy | N/A |
| Gross Static | 1994 |
| Impact Conditions | |
| Speed (km/h) | 99.0 |
| Angle (deg) | 25 |
| Impact Severity (kJ) | 134.6 |

| | |
|--|-----------|
| Exit conditions | |
| Speed (km/h) | 72 |
| Angle (deg) | 7 |
| Occupant Risk Values | |
| Impact Velocity (m/s) | |
| x-direction | 4.9 |
| y-direction | -5.8 |
| z-direction | 1.6 |
| x-direction | -4.0 |
| y-direction | -8.8 |
| European Committee for Normalization (CEN) Values | |
| THIV (m/s) | 7.8 |
| PIID (g's) | x.9 |
| AS1 | 1.2 |
| Test Article Deflections (m) | |
| Dynamic | 1.1 |
| Permanent | 1.1 |
| Vehicle Damage | |
| Exterior | |
| VDS | RI'Q-5 |
| CDC | 01 RIWW3 |
| Interior | |
| <WJ1 | AS0000000 |
| Post-Impact Vehicular Behavior (deg - rate gyro) | |
| Maximum Roll Angle | 23.3 |
| Maximum Pitch Angle | 2x.3 |
| Maximum Yaw Angle | 135.x |

Figure 6. Summary of Results - Idaho 6095 mm Concrete Barrier Test 13-4300-002