U.S. Department
of Transportation
Federal Highway
Administration

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

December 6, 2000

Refer to: HSA-1\HSA-B77

Bradley J. Smith, P.E.
Manager of State Design
Connecticut Department of Transportation
2800 Berlin Turnpike
P.O. Box 317546
Newington, CT 06131-7546

Dear Mr. Smith:

The guardrail-to-bridge parapet transition design developed by your Department was tested as part of an FHWA pooled-fund study to verify the performance of selected roadside hardware items under NCHRP Report 350 evaluation guidelines. In your July 25 letter, you requested formal acceptance of the Connecticut transition design based on its successful performance in a test conducted by the Texas Transportation Institute (TTI). To support this request, you also sent copies of TTI's April 2000 report entitled "NCHRP Report 350 Test 3-21 of the Connecticut Transition" and the crash test video tape.

As shown in greater detail in Enclosure 1, the Connecticut transition consists of 3810 mm of nested 12-gauge W-beam blocked out from a New Jersey concrete parapet with a 150-mm diameter spacer tube. An additional single 3810-mm W-beam section is bolted to the concrete downstream from the spacer using a standard terminal connector. This design also incorporates a C150 x 12 steel channel and bent plate rubrail and a 100-mm high asphalt curb. The post closest to the parapet (Post 1) is centered 300 mm from the concrete. The next four posts are on 476.5 mm centers, followed by four posts on 952.5 mm centers. The two posts nearest the bridge end are both W200 x 19 x 2290-mm long. All other posts are standard W150 x 13 x 1830-mm long standard line posts. The heavily-reinforced parapet had a 580-mm wide footing that extended 1895 mm below grade. I understand that anyone wanting detailed information on this design may call Ms. Monique Burns, Standards Engineer, at (860) 594-3292 or contact her via e-mail at Monique.Burns@po.state.ct.us.

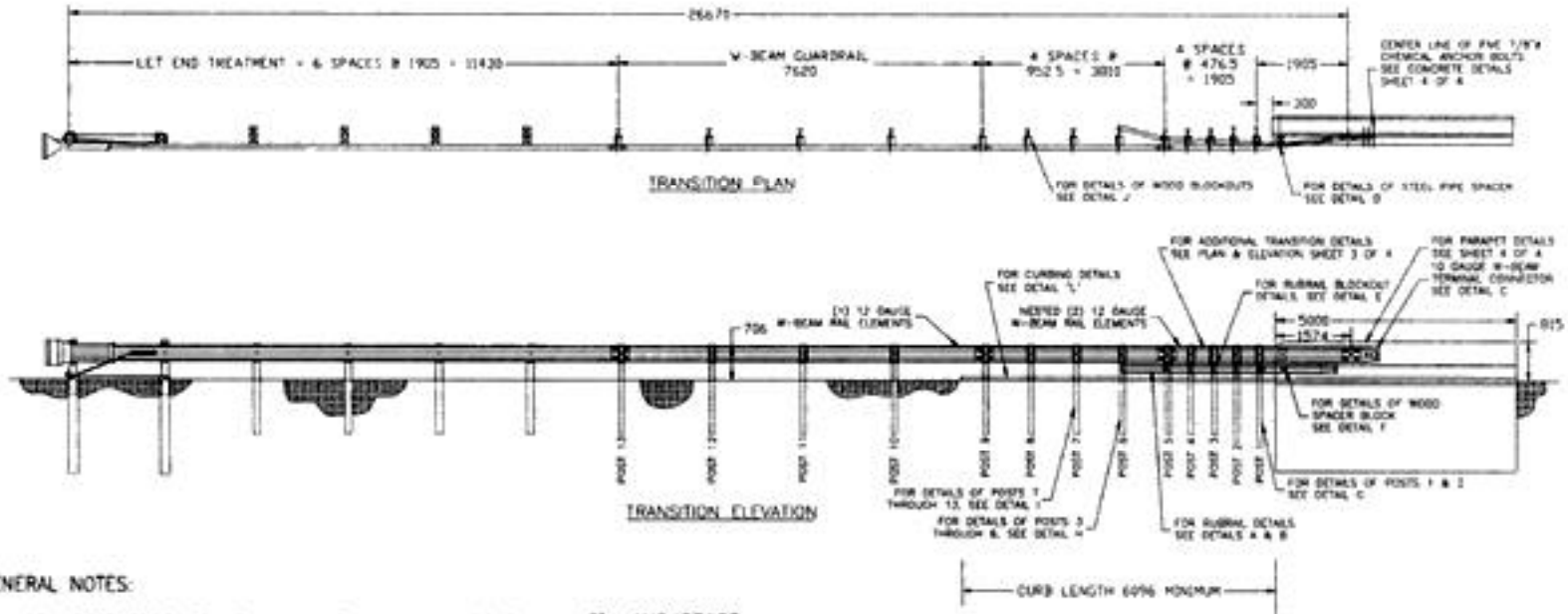
Test 3-21 was successfully conducted as reported by TTI. The summary results of that test are shown in Enclosure 2. Based on these test results, I agree that the Connecticut transition design meets the appropriate evaluation criteria for an NCHRP Report 350 test level 3 (TL-3) transition

and may be used on the National Highway System to connect W-beam approach rail directly to an adequately anchored New Jersey shaped concrete parapet. With minor modifications to the rubrail connection, this design can also be used with an F-shape parapet.

Sincerely yours,

Frederick G. Wright, Jr.
Program Manager, Safety

2 Enclosures



GENERAL NOTES:

1) CONCRETE STRENGTH SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH (f'_c) OF 27.6 MPA (4000 PSI)

2) REINFORCING STEEL SHALL HAVE A YIELD STRENGTH OF 420 MPA (60 KSI) AND SHALL BE BARE STEEL (NOT EPOXY COATED)

3) POSTS 1 THROUGH 5 REQUIRE AN ADDITIONAL HOLE TO ATTACH LOWER BLOCKS AND/OR RUBRAIL

4) RUBRAIL BLOCKS LOCATED ON POSTS 1 THROUGH 4 ARE OFFSET DRILLED AND SECURED WITH 16mm BUTTONHEAD BOLTS (SEE CHART FOR BOLT LENGTHS). SECURE BLOCKS ONLY TO POSTS 2 & 4. SECURE RUBRAIL & BLOCKS TO POSTS 1 & 3. RUBRAIL IS SECURED TO POST 5 WITH A 16mm X 114mm BUTTONHEAD BOLT. RUBRAIL IS FLARED TO BACK OF POST 6 AND NOT SECURED.

5) SHOP FABRICATE THE C150X12 RUBRAIL END TO BE CONSISTENT WITH THE SLOPE OF THE JERSEY SHAPE OR F-SHAPE AND ATTACH FLUSH WITH THE SLOPED TOE OF THE PARAPET OR BARRIER.

6) ANCHORAGE:
   A) AT EXISTING PARAPETS OR BARRIERS RUBRAIL SHALL BE ANCHORED USING THREE 16mm X 150mm CHEMICALLY ANCHORED BOLTS WITH WASHERS. MAXIMUM PROJECTION FOR BOLTS SHALL BE 25mm.
   B) AT EXISTING PARAPETS OR BARRIERS, THE W-BEAM TERMINAL CONNECTOR SHALL BE ANCHORED USING FIVE 22mm X 300mm CHEMICALLY ANCHORED BOLTS WITH WASHERS. MAXIMUM PROJECTION FOR BOLTS SHALL BE 25mm. THE W-BEAM TERMINAL CONNECTOR SHALL BE INSTALLED BEHIND THE NESTED W-BEAM ELEMENTS.
   C) AT NEW PARAPETS OR BARRIERS, THE W-BEAM TERMINAL CONNECTOR AND RUBRAIL SHALL BE ANCHORED AS DETAILED ON THE STRUCTURE PLANS.

7) FOR NEW CONSTRUCTION WHERE CURBING IS NEEDED, USE EITHER 100mm BITUMINOUS CONCRETE PARK CURBING IF EXISTING CURBING IS GRANITE STONE TRANSITION CURBING, RESET IT TO A 100mm REVEAL. THE PREFERRED CURBING FOR HIGH SPEED ROADWAYS (>=80km/h) IS 100mm, HOWEVER, ON LOW SPEED ROADWAYS (<80km/h), A 150 mm CURBING MAY BE USED.

8) ALL STRUCTURAL STEEL SHALL MEET THE REQUIREMENTS OF AASHTO M 270M MATERIAL, GRADE 250 (A36).

Figure 1. Details of the Connecticut transition.

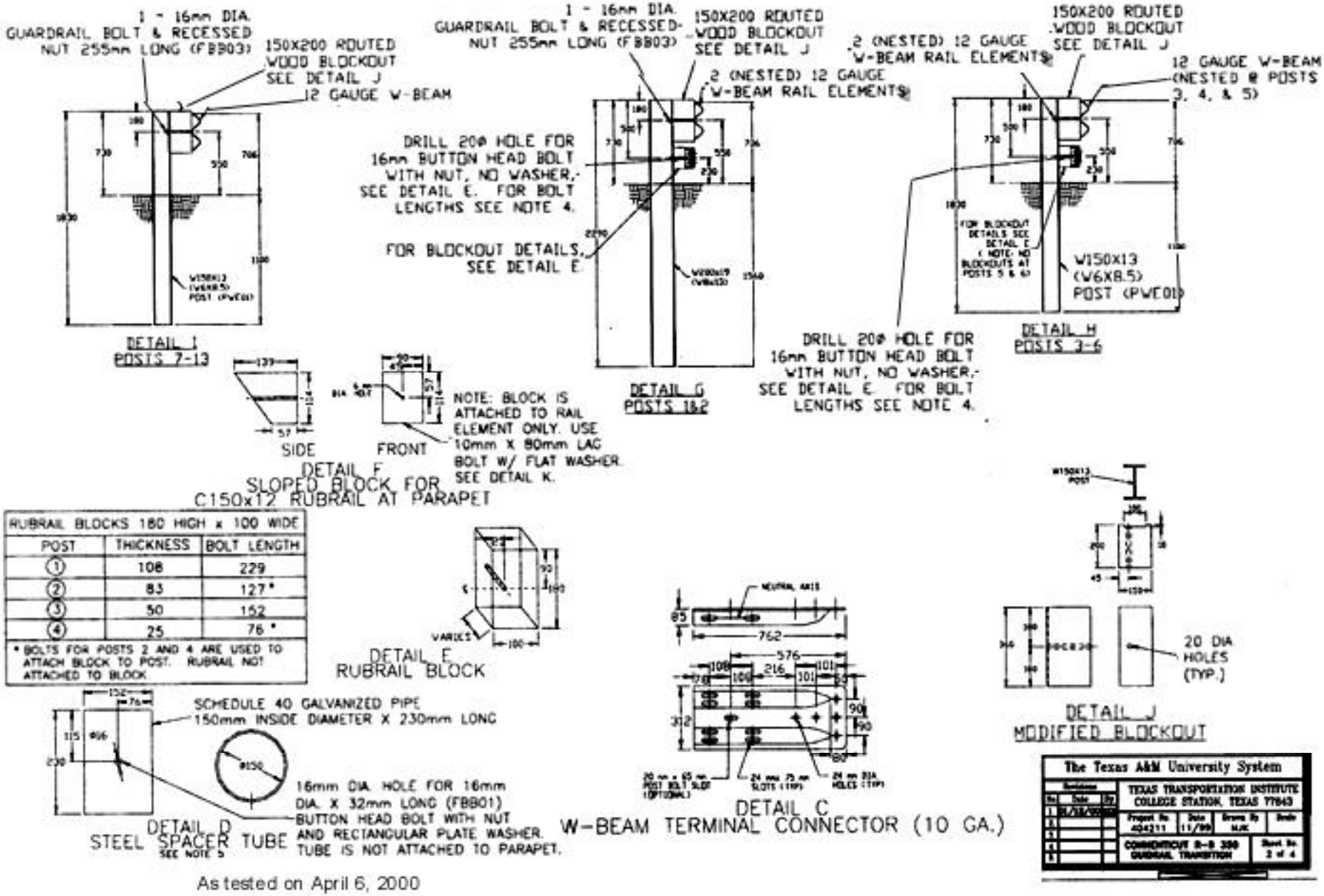


Figure 1. Details of the Connecticut transition (continued).

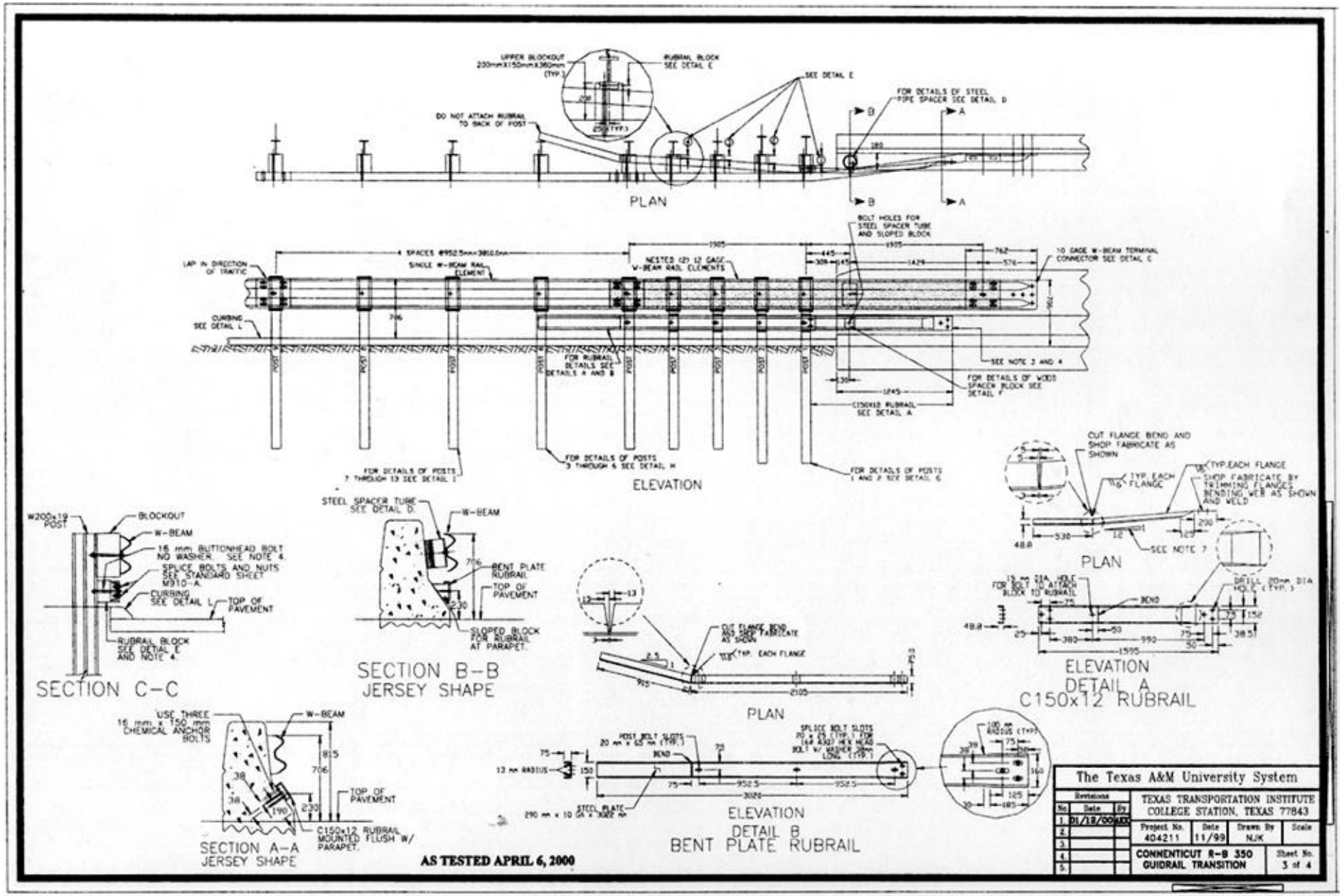


Figure 1. Details of the Connecticut transition (continued).

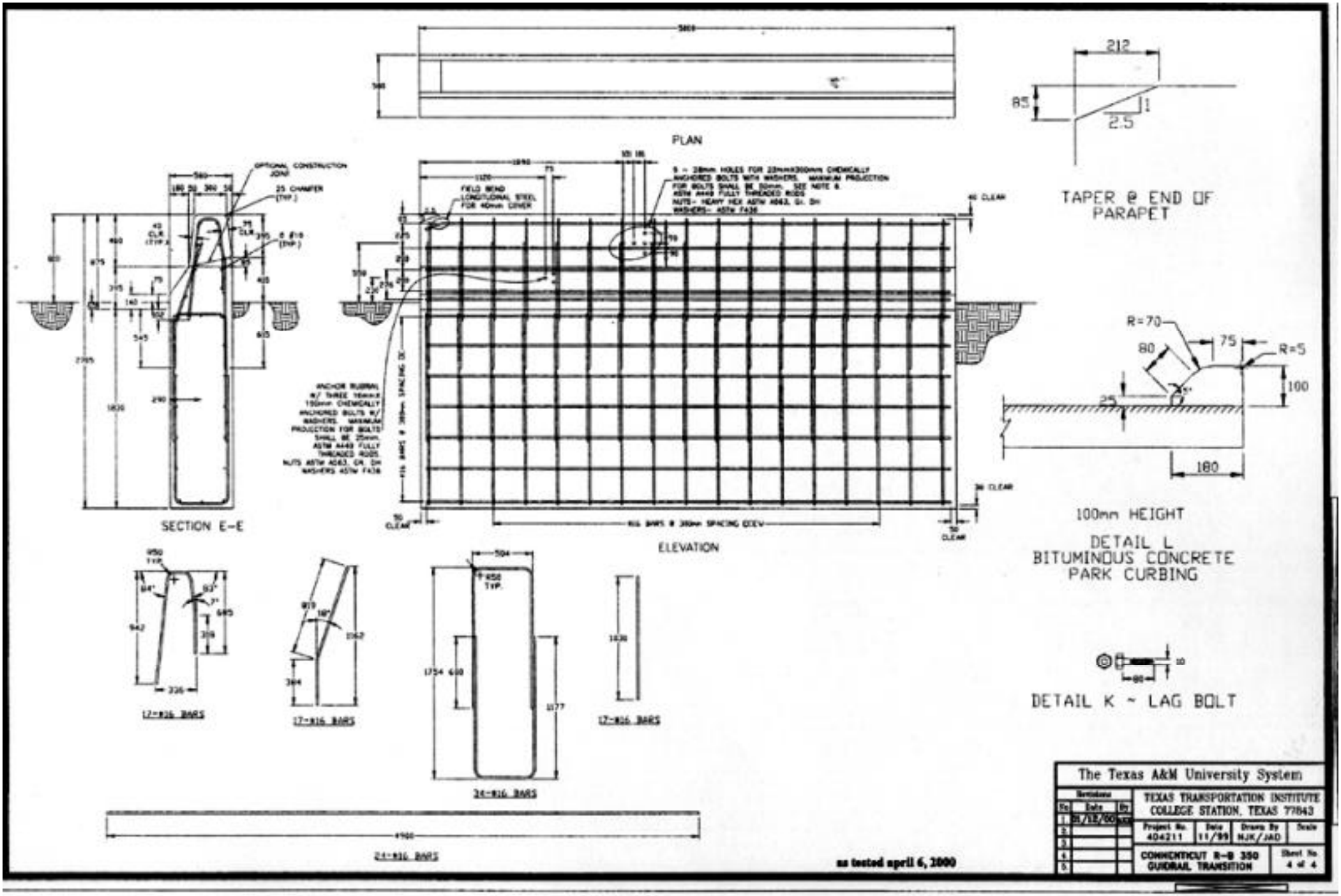
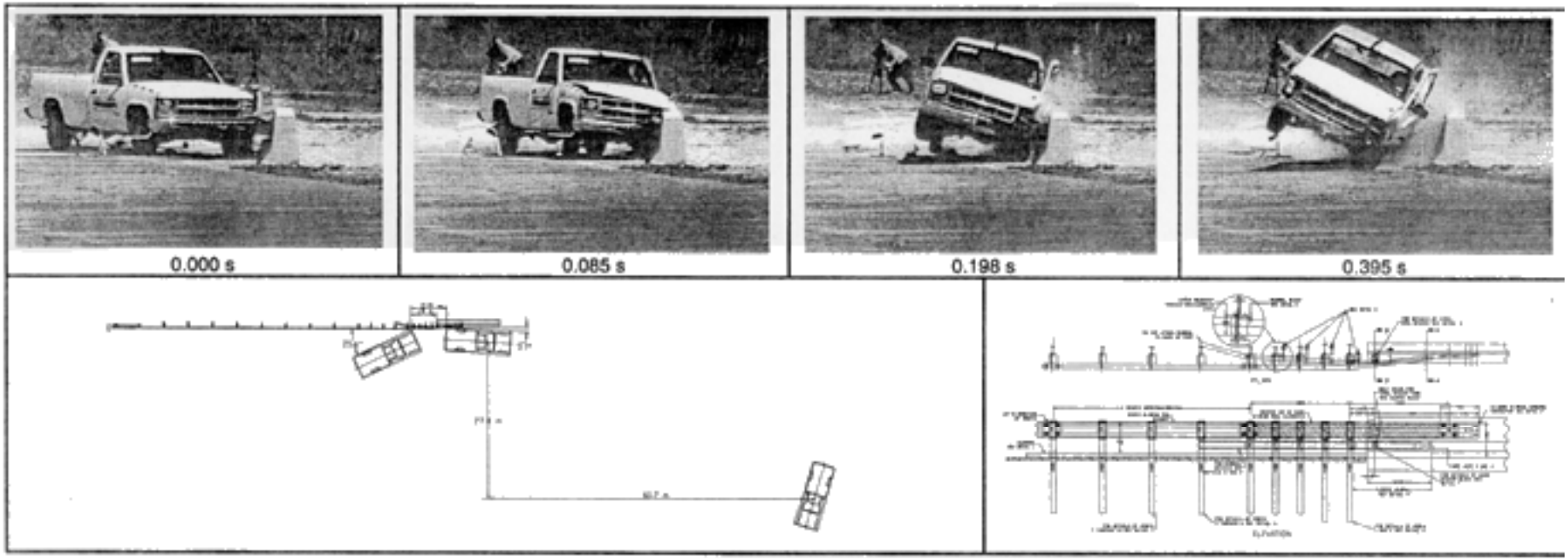


Figure 1. Details of the Connecticut transition (continued).



General Information
- Test Agency ..... Texas Transportation Institute
- Test No. 404211-9
- Date 04/06/00

Test Article
- Type ..... Transition
- Name ..... Connecticut Transition
- Installation Length (m) 26.7
- Material or Key Elements ... W-beam Rail with Rubrail Attached to Connecticut Jersey Shape Parapet

Soil Type and Condition .... Standard Soil, Dry

Test Vehicle
- Type ..... Production
- Designation 2000P
- Model ..... 1995 Chevrolet 2500 Pickup Truck
- Mass (kg)
  - Curb 1940
  - Test Inertial 2000
  - Dummy 75
  - Gross Static 2075

Impact Conditions
- Speed (km/h) 100.8
- Angle (deg) 25.6

Exit Conditions
- Speed (km/h) 77.0
- Angle (deg) 3.7

Occupant Risk Values
- Impact Velocity (m/s)
  - x-direction 4.9
  - y-direction 7.0
- THIV (km/h) 31.0
- Ridedown Accelerations (g's)
  - x-direction ..... -11.4
  - y-direction 17.2
- PHD (g's) 18.6
- ASI 1.68
- Max. 0.050-s Average (g's)
  - x-direction ..... -10.1
  - y-direction 12.6
  - z-direction ..... -7.0

Test Article Deflections (m)
- Dynamic 0.077
- Permanent 0.068

Vehicle Damage
- Exterior
  - VDS 11LFQ4
  - CDC ..... 11FLEK3 & 11LDEW3
- Maximum Exterior
  - Vehicle Crush (mm) 430
- Interior
  - OCDI LF0212100
- Max. Occ. Compart. Deformation (mm) 130

Post-Impact Behavior (during 1.0 s after impact)
- Max. Yaw Angle (deg) 35
- Max. Pitch Angle (deg) ..... -7
- Max. Roll Angle (deg) ..... -28

Figure 10. Summary of Results for test 404211-9, *NCHRP Report 350* test 3-21.