March 6, 1998

Refer to: HNG-14

Ronald K. Faller, P.E.
Research Associate Engineer
University of Nebraska-Lincoln
W348 Nebraska Hall
P.O. Box 880531
Lincoln, Nebraska 68588-0531

Dear Mr. Faller:

In your February 10 letter addressed to Mr. Gerald Eller, former Director of the Federal Highway Administration's Office of Engineering, you requested the FHWA's formal acceptance of two thrie-beam guardrail-to-bridge rail transition designs. In support of this request, you also sent us video tapes of the tests you conducted, 35-mm photographs, and a draft copy of the test report.

The two designs are similar in that both use a w-beam to thrie-beam transition piece, followed by a nested thrie-beam with a reduced post spacing that is bolted to a modified New Jersey shape concrete parapet. The thrie-beam is kept in a vertical plane at the attachment point by means of a special fabricated steel spacer block. One design uses 1970-mm long W150 x 13.5 steel posts with 102 mm x 178 mm x 4.76-mm thick structural tube blockouts behind the nested thrie-beam; the other uses 2134-mm long timber posts with 150 mm x 200 mm wood blockouts. Both use a 100-mm high triangular curb under the thrie-beam. Design details for the steel and wood post designs are shown in Enclosures 1 and 2 respectively. The spacer block used with both designs is shown in Enclosure 3.

NCHPR Report 350 test 3-21, a 2000-kg pickup truck impacting at an angle of 25 degrees and a speed of 100 km/h, was successfully conducted on the final design of both the steel and wood post systems. You reported that the critical impact point (CIP) was calculated to be 2435 mm upstream from the end of the concrete barrier for both designs. Enclosures 4 and 5 contain summary data of the tests run on the final designs. All of the Report 350 evaluation criteria for test 3-21 were satisfied. We agree with your analysis that test 3-20, an 820-kg car at 20 degrees and 100 km/h, can be waived based on the observed results of the pickup truck tests and the expected interaction of the smaller vehicle with the physical elements of the two transition designs. Therefore, we agree that the two designs shown in Enclosures 1 and 2 meet the appropriate Report 350 evaluation criteria for a guardrail to bridge rail transition at test level 3 (TL-3), and that either one may be used on the National Highway System when such use is proposed by a State transportation agency.

We note that both the steel post and the wood post final designs incorporated modifications resulting from unsuccessful tests on prototype designs that used shorter posts. Thus, it is critical that the accepted designs be installed as tested, with particular emphasis on use of the tested post

lengths and embedment depths and on the use of a well-graded and compacted soil of sufficient width and depth to provide adequate soil backing behind the posts. You have reported separately via Mr. John Rohde's March 5 letter to Mr. Richard Powers of my staff that the select backfill material used in the passing tests conformed to an AASHTO M 147-65 (1990) base course material with Grading B and was mechanically compacted in 150-mm deep lifts. Mr. Rohde also reported that the embankment material should extend flat behind the posts at least 610 mm, at which point a slope no steeper than 1:2 should extend a minimum of 1220 mm further. Under these criteria, post deflections are expected to be equivalent to those of posts tested under level soil conditions.

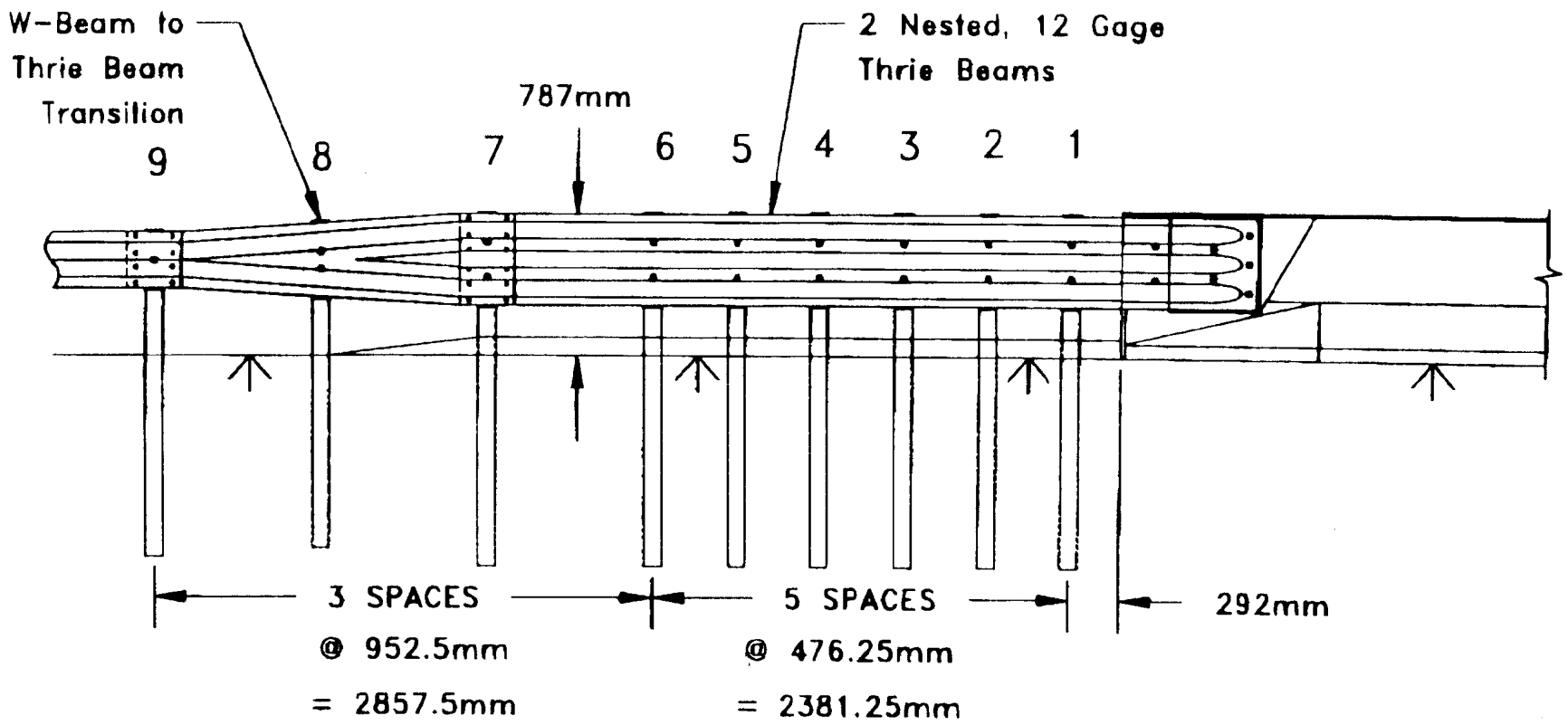
It is our understanding that these designs are non-proprietary and may be used by transportation agencies without reservation. By copy of this letter, we will advise FHWA field offices of the availability of these NCHRP Report 350 TL-3 transition designs.

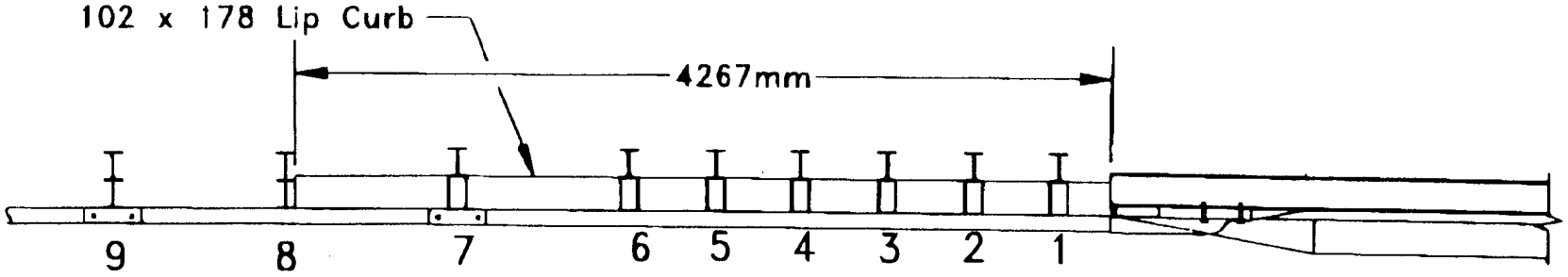
Sincerely yours,

(original signed by Dwight A. Horne)

Dwight A. Horne
Chief, Federal-Aid and Design Division

5 Enclosures
Acceptance Letter B-47



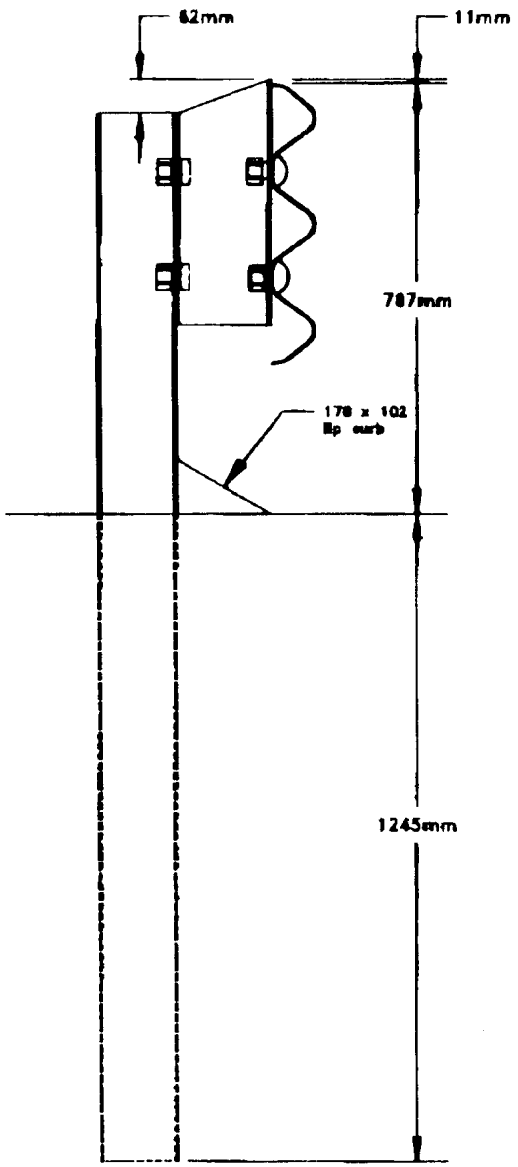


MwRSF University of Nebraska C.E. Department

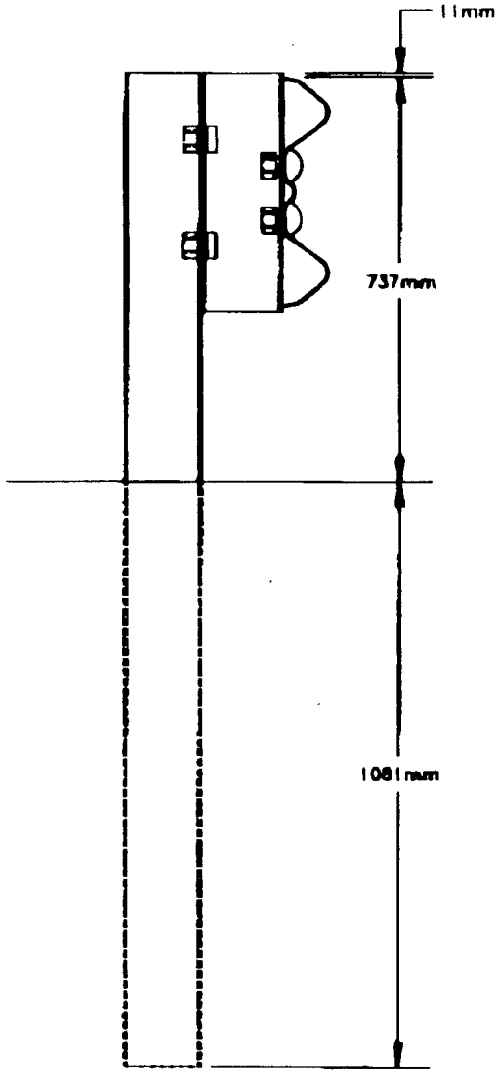
ITRANS

DATE: 5-24-96		
SCALE: none		t2sys\t2s
DR'N: EAK		

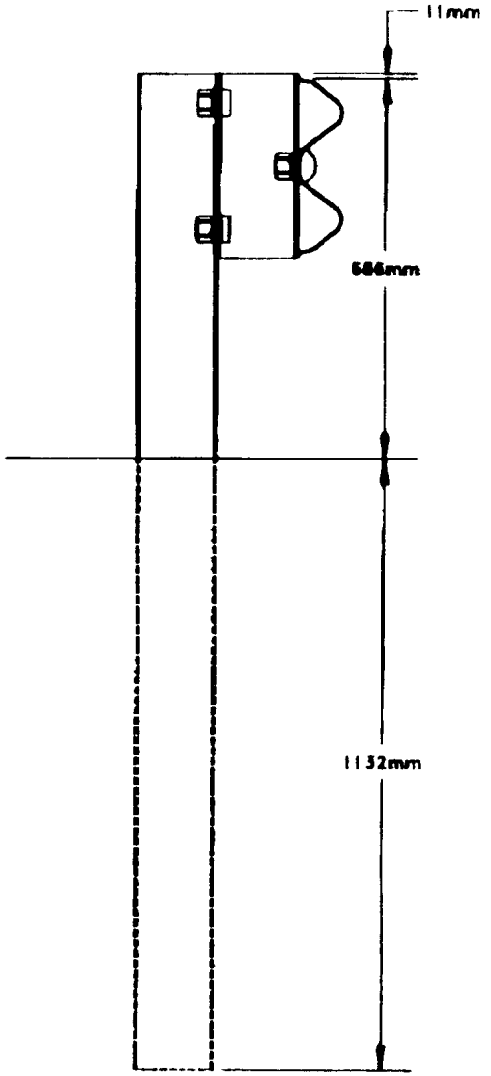
THRIE BEAM POSTS 1-7



W-BEAM TO THRIE BEAM
TRANSITION POST 8



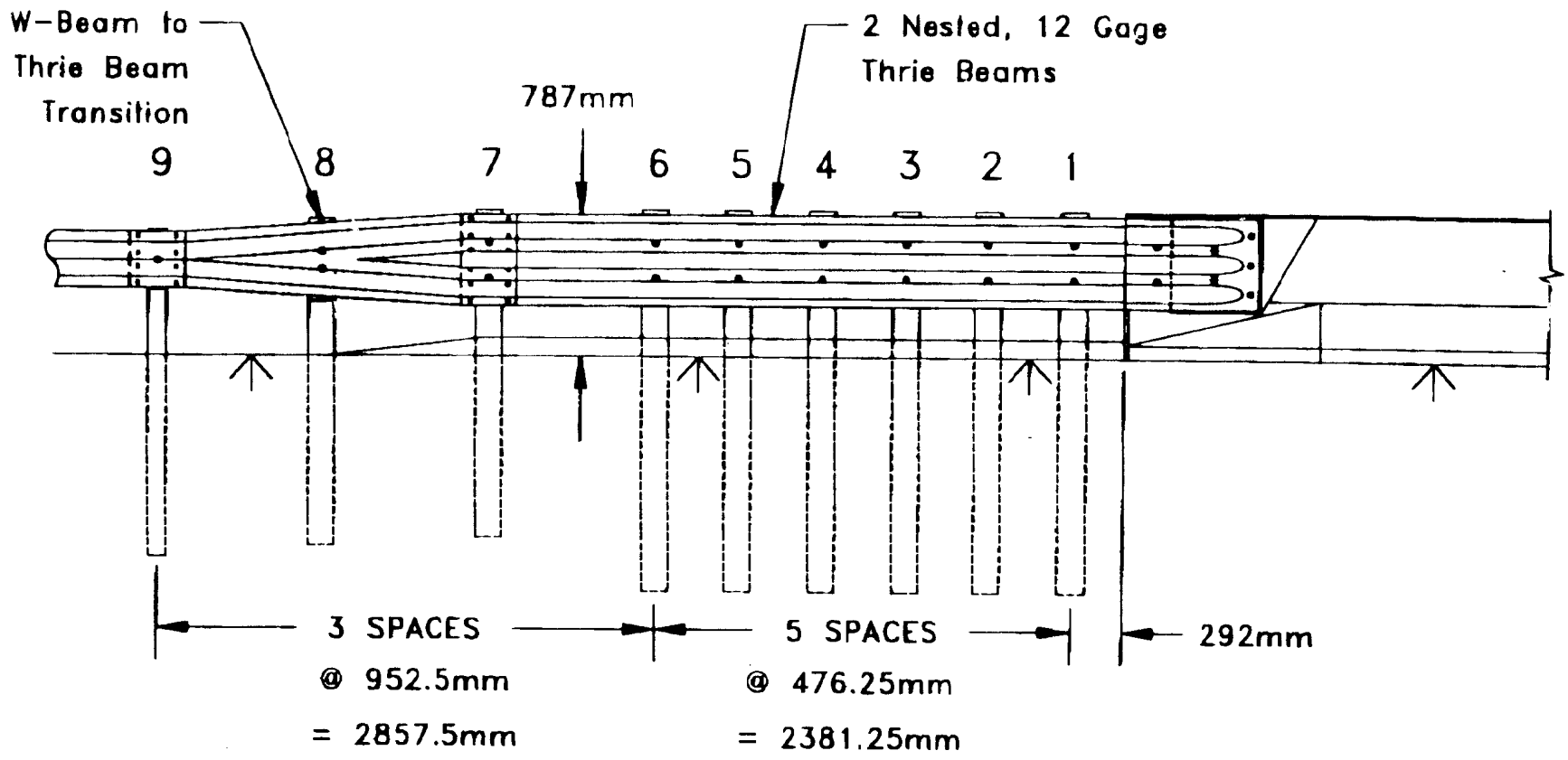
W-BEAM POSTS

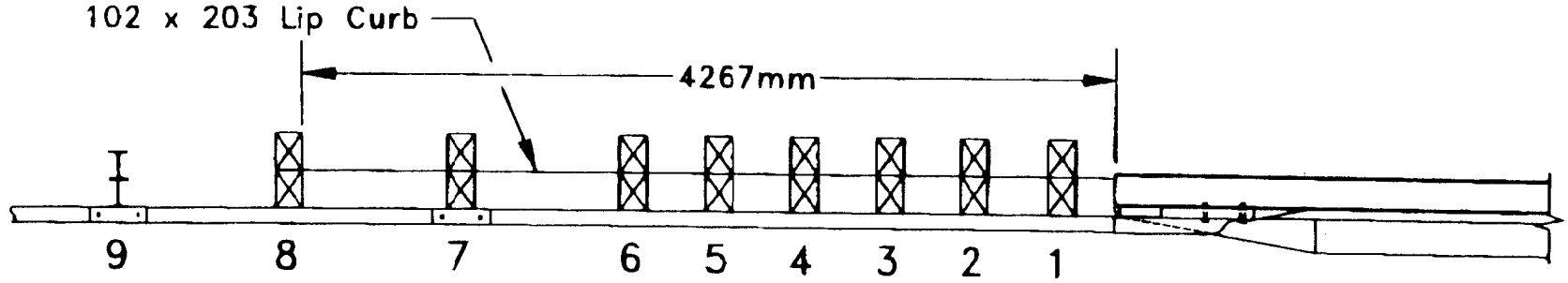


MwRSF University of Nebraska C.E. Department

ITRANS

DATE: 5-22-96		
SCALE: none		123
DRN: EAM		



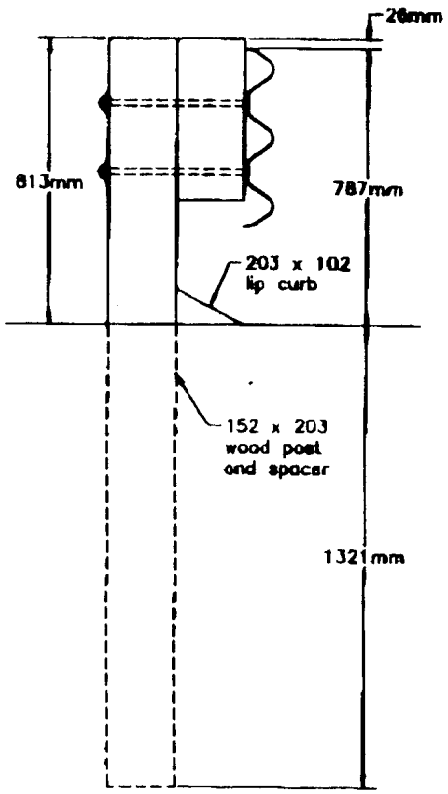


MwRSF University of Nebraska C.E. Department

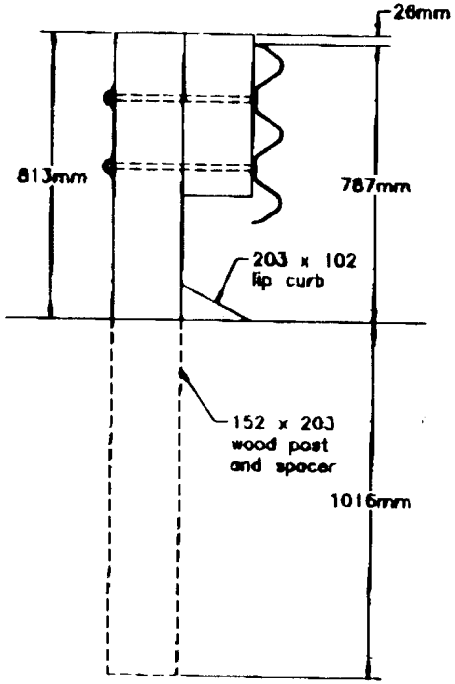
ITRANS

DATE: 5-24-96		
SCALE: none		
DRN: EAK		wayst02

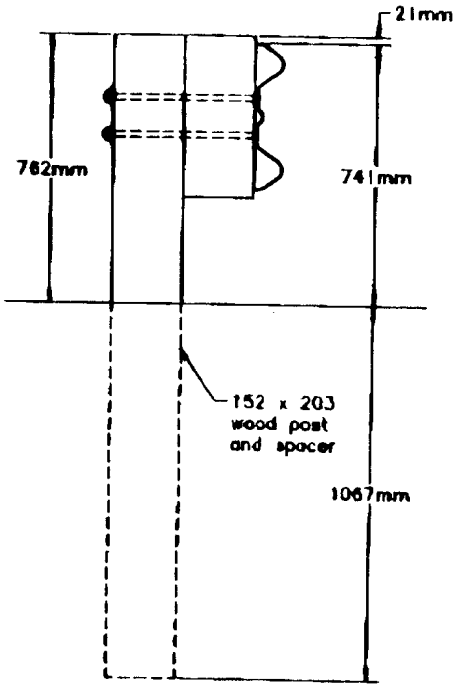
Thrie Beam Posts 1–6



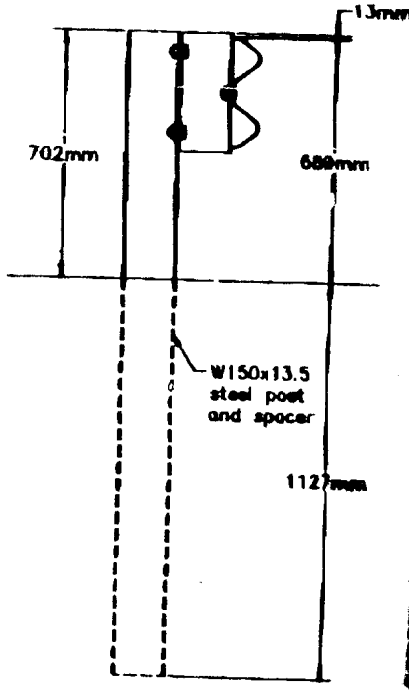
Thrie Beam Post 7



W – Thrie Trans. Post 8



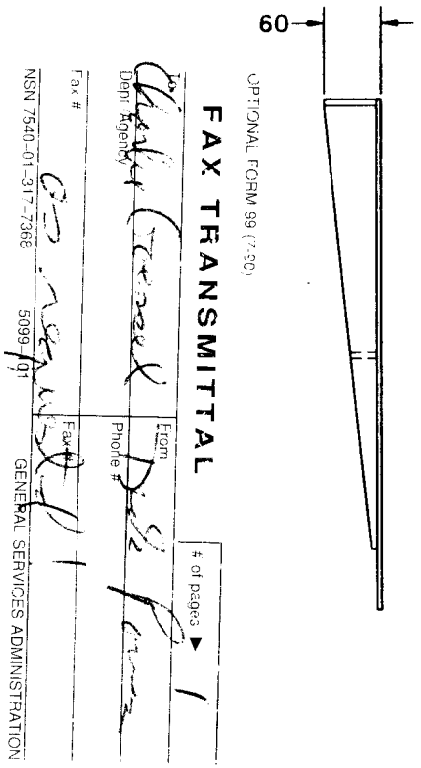
W Beam Posts

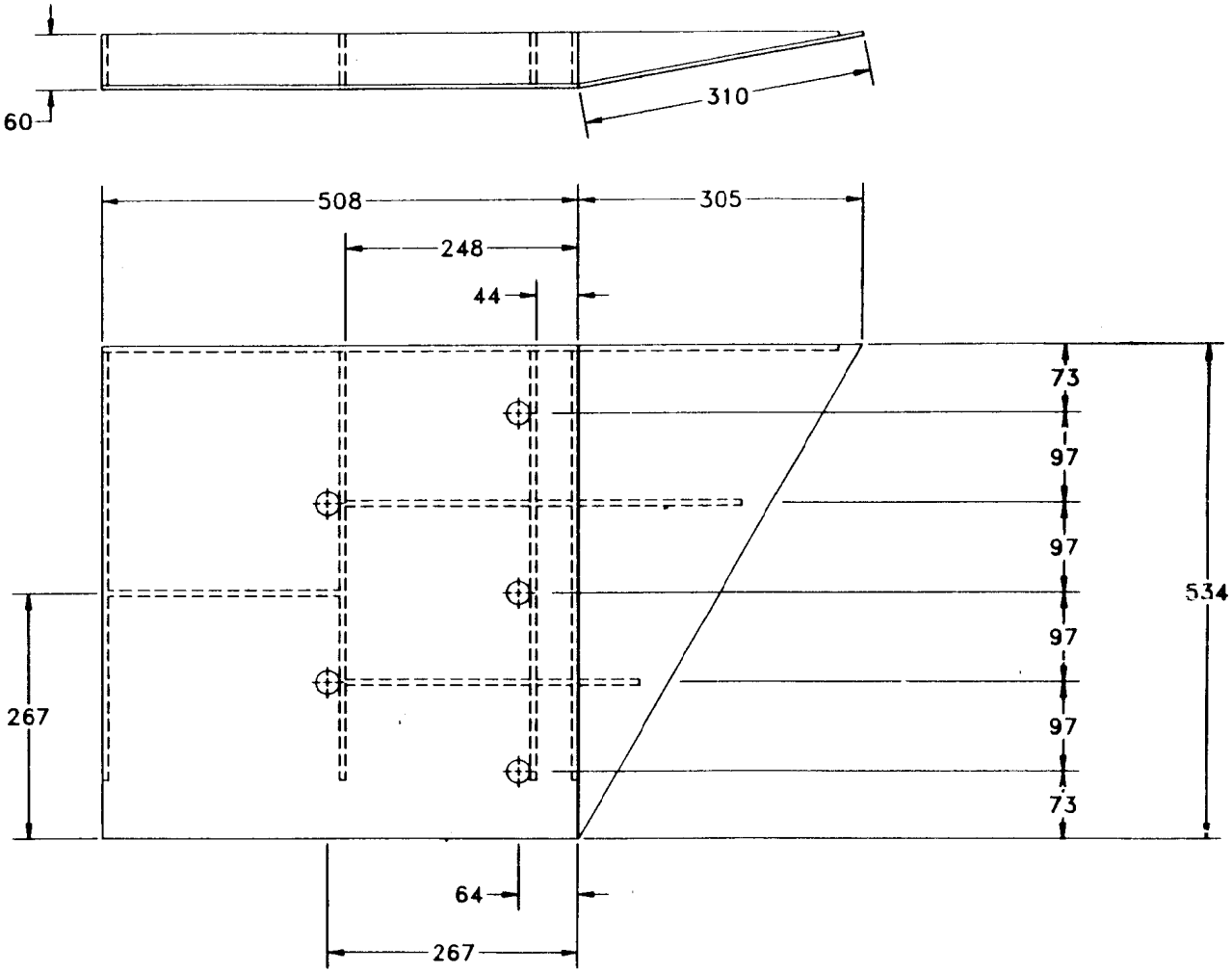


MwRSF University of Nebraska C.E. Department

ITRANS

DATE: 6-12-97		
SCALE: none		w3posts
DRN: EAK		





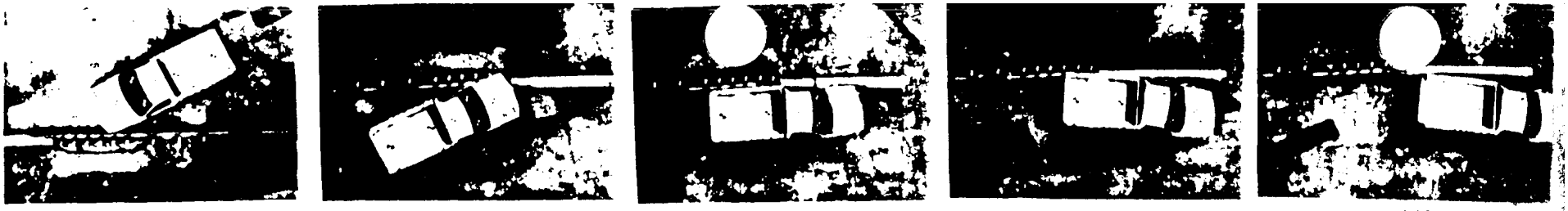
Notes:

1. All steel shall conform to ASTM A36.
2. Flat plate panels are 4.76mm thick.
3. Stiffeners are 6.35mm thick.
4. All hole diameters are 25mm.
5. Weld components with E60 rod.
6. Galvanize or paint.

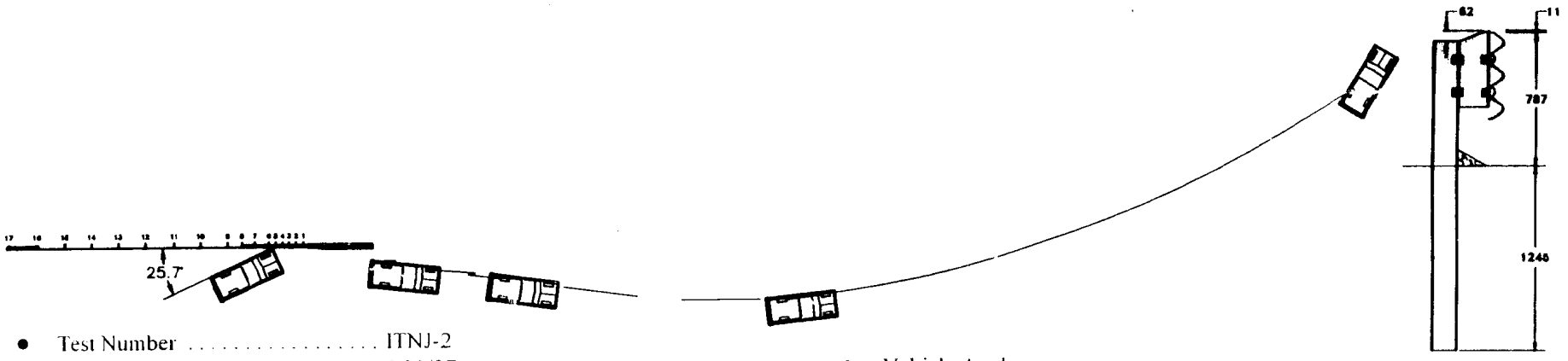
Welding Instructions:

(a) Stiffeners located on the outside edges of the cover plates shall be welded as follows: 4.76mm continuous back weld on external sides and 4.76mm fillet weld by 25mm long spaced at 51mm on internal sides.
(b) Stiffeners located on the inside of the cover plates shall be welded as follows: 4.76mm fillet weld by 25mm long spaced at 51mm.
(c) Retangular and triangular cover plates shall be welded together with a 4.76mm continuous back weld on both sides.

Figure 8. New Jersey Connector Plate, Design No. 1

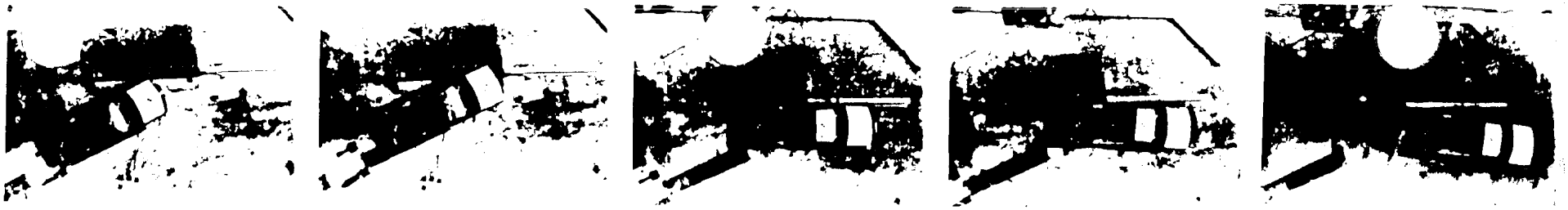


0.000 sec 0.066 sec 0.176 sec 0.235 sec 0.319 sec

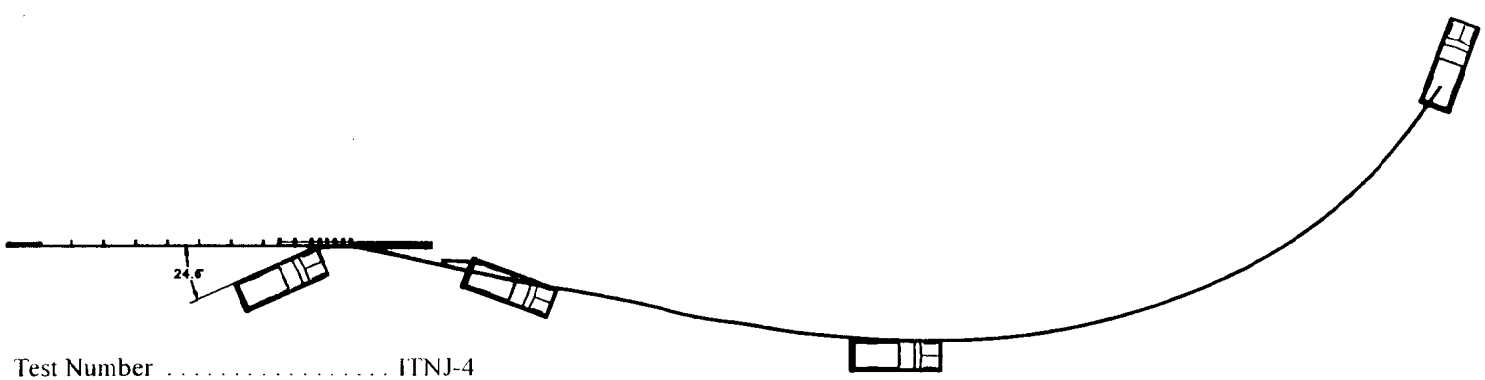


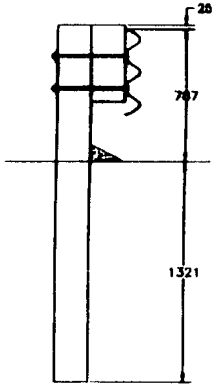
- Test Number ITNJ-2
- Date 5/30/97
- Appurtenance ..... Approach Guardrail Transition to a NJ Safety Shape End Section w/ Curb
- Total Length ..... 25.34 m
- Steel Thrie Beam (Nested)
  - Thickness ..... 2.66 mm
  - Top Mounting Height ..... 787 mm
- Steel Posts
  - Post Nos. 1 - 7 ..... W150x13.5 by 1981-mm long
  - Post Nos. 8 - 15 ..... W150x13.5 by 1829-mm long
- Steel Spacer Blocks
  - Post Nos. 1 - 7 ..... TS 180x100x4.76 by 443-mm long
  - Post No. 8 ..... W150x13.5 by 435-mm long
  - Post Nos. 9 - 15 ..... W150x13.5 by 337-mm long
- Soil Type ..... Grading B - AASHTO M 147-65 (1990)
- Vehicle Model ..... 1991 Chevrolet 2500 2WD
  - Curb ..... 1,722 kg
  - Test Inertial ..... 1,977 kg
  - Gross Static ..... 1,977 kg
- Vehicle Speed
  - Impact ..... 101.6 km/hr
  - Exit ..... 70.8 km/hr
- Vehicle Angle
  - Impact ..... 25.7 deg
  - Exit ..... 6.9 deg
- Vehicle Snagging ..... Minor contact on top of spacer blocks and concrete end section
- Vehicle Pocketing ..... None
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... 11.24/-17.72 < 20 G's
  - Lateral (not required) 18.43
- Occupant Impact Velocity (Normalized)
  - Longitudinal ..... 6.94 < 12 m/s
  - Lateral (not required) 7.07
- Vehicle Damage ..... Moderate
  - TAD[18] 11-LFQ-5
  - SAE[19] 11LDEW3
- Vehicle Stopping Distance ..... 76.8 m downstream 11.2 m behind
- Barrier Damage ..... Moderate
- Maximum Deflections
  - Permanent Set ..... 92 mm
  - Dynamic ..... 133 mm (visible)

Figure 37. Summary of Test Results and Sequential Photographs, Test ITNJ-2 (Design No. 2)



0.000 sec 0.058 sec 0.185 sec 0.223 sec 0.321 sec





- Test Number ITNJ-4
- Date 9/10/97
- Appurtenance ..... Approach Guardrail Transition to a NJ Safety Shape End Section w/ Curb
- Total Length ..... 25.34 m
- Steel Thrie Beam (Nested)
  - Thickness ..... 2.66 mm
  - Top Mounting Height ..... 787 mm
- Wood Posts
  - Post Nos. 1 - 7 ..... 152 mm x 203 mm by 2134-mm long
  - Post Nos. 8 ..... 152 mm x 203 mm by 1829-mm long
- Wood Spacer Blocks
  - Post Nos. 1 - 8 ..... 152 mm x 203 mm by 457-mm long
- Steel Posts
  - Post Nos. 9 - 15 ..... W150x13.5 by 1829-mm long
- Steel Spacer Blocks
  - Post Nos. 9 - 15 ..... W150x13.5 by 337-mm long
- Soil Type ..... Grading B - AASHTO M 147-65 (1990)
- Vehicle Model ..... 1988 Chevrolet 2500 2WD
  - Curb ..... 2,009 kg
  - Test Inertial ..... 1,999 kg
  - Gross Static ..... 1,999 kg
- Vehicle Speed
  - Impact ..... 102.3 km/hr
  - Exit ..... 72.3 km/hr
- Vehicle Angle
  - Impact ..... 24.6 deg
  - Exit ..... 7.2 deg
- Vehicle Snagging ..... Contact on top of spacer blocks and concrete end section
- Vehicle Pocketing ..... None
- Vehicle Stability ..... Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
  - Longitudinal ..... 5.79/-6.05 < 20 G's
  - Lateral (not required) 9.22
- Occupant Impact Velocity (Normalized)
  - Longitudinal ..... 7.74 < 12 m/s
  - Lateral (not required) 6.59
- Vehicle Damage ..... Moderate
  - TAD[18] 11-LFQ-5
  - SAE[19] 11-LDEW3
- Vehicle Stopping Distance ..... 68.4 m downstream 12.9 m behind
- Barrier Damage ..... Moderate
- Maximum Deflections
  - Permanent Set ..... 32 mm
  - Dynamic ..... 99 mm (visible)

Figure 64. Summary of Test Results and Sequential Photographs, Test ITNJ-4 (Design No. 4)