



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

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

January 19, 1995

Refer to: HNG-14

Ronald K. Faller, P.E.
Research Associate Engineer
University of Nebraska-Lincoln
1901 'Y' Street, Building C
P.O. Box 880601
Lincoln, Nebraska 68588-0601

Dear Mr. Faller:

Members of my staff have reviewed the information submitted with your December 15, 1994, letter to Mr. William A. Weseman. You requested the Federal Highway Administration to accept five bridge railing systems for use on timber-decked bridges based on the results of full-scale crash testing.

Three of these railings were tested to performance level 1 (PL-1), as defined by the American Association of State Highway and Transportation Officials' (AASHTO) 1989 "Guide Specifications for Bridge Railings." These were: (a) A Glulam Timber Rail with a Curb (curb system); (b) A Glulam Timber Rail with no Curb (shoe box system); and (c) A Steel Rail System. The fourth railing, designated TBC-8000, was tested to AASHTO performance level 2 (PL-2), and consisted of a three-beam rail element supported by stiffened steel posts with spacer blocks. The final railing, a glulam timber rail design with a curb (GC-8000), was tested to the National Cooperative Highway Research Program (NCHRP) Report 350 test level 4 (TL-4). The post spacing for all five designs is 1905-mm (6-feet 3 inches).

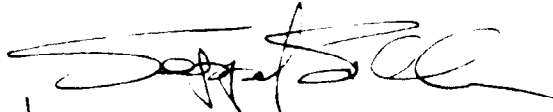
In our review, we noted that not all recommended tests were run on each design. The researchers stated that the appropriate tests had been run on similar designs and did not need to be repeated. We concur with these determinations. The tests that were run on each design are summarized on Enclosure A, and a sketch of the design details for the tested railings are shown on Enclosure B.

Included with your original submission were draft test reports on two transition designs, one of which was tested at 15 degrees and one at 25 degrees with 2000 kg passenger cars at 100 k/hr. These tests were identified as the NCHRP Report 230 multiple service levels 1 and 2 (MSL 1 and MSL 2), respectively. We will withhold comments on these designs until the final reports are completed, detailed final drawings are provided, and the bridge railings for which these transitions were designed and tested are identified.

To summarize, we conclude that the five bridge rails substantially meet the performance levels or test levels indicated above and may be used on Federal-aid highway projects when requested by a State agency. However, we noted that the drawings submitted with your request were in draft form and that some of the washer sizes were not identified. As soon as possible please send us copies of the final drawings.

Please call Mr. Richard Powers of my staff if you have any questions.

Sincerely yours,



ja Jerry L. Poston, Chief
Federal-Aid and Design Division

2 Enclosures

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Geometric and Roadside Design Acceptance Letter B-29

PERFORMANCE LEVEL 1 (PL-1) DESIGNSGlulam "Curb System"

Test Number	C-1
Vehicle Mass (kg)	2452
Impact Speed (km/h)	71.0
Impact Angle (degrees)	23.4
Occupant Impact Velocity (m/s)	
Longitudinal/Lateral	3.26/4.45
Ridedown Acceleration (g's)	
Longitudinal/Lateral	2.3/9.6

Glulam "Shoebox System"

Test Number	FSSB-1	FSSB-2
Vehicle Mass (kg)	2452	839
Impact Speed (km/h)	72.4	80.7
Impact Angle (degrees)	21.8	21.5
Occupant Impact Velocity (m/s)		
Longitudinal/Lateral	3.42/51.9	4.54/6.50
Ridedown Acceleration (g's)		
Longitudinal/Lateral	2.0/2.5	1.1/65

Glulam "Steel System"

Test Number	FSSR-1
Vehicle Mass (kg)	2542
Impact Speed (km/h)	71.2
Impact Angle (degrees)	19.1
Occupant Impact Velocity (m/s)	
Longitudinal/Lateral	4.09/5.98

Ridedown Acceleration (g's)

Longitudinal/Lateral -2.7/11.4

PERFORMANCE LEVEL ² (PL-~~4~~²) DESIGN

Thrie-beam with Channel Bridge Railing (TBC-8000)

Test Number	FSTC-1
Vehicle Mass (kg)	8,165
Impact Speed (km/h)	76.3
Impact Angle (degrees)	16.1
Occupant Impact Velocity (m/s)	
Longitudinal/Lateral	3.3/4.8
Ridedown Acceleration (g's)	
Longitudinal/Lateral	1.8/6.1

NCHRP REPORT 350 TEST LEVEL 4 (TL-4) DESIGN

Glulam Timber with Curb Bridge Railing (GC-8000)

Test Number	FSCR-1	FSCR-4
Vehicle Mass (kg)	8165	2087
Impact Speed (km/h)	82.4	98.0
Impact Angle (degrees)	16.8	24.9
Occupant Impact Velocity (m/s)		
Longitudinal/Lateral	2.7/2.1	8.2/7.4
Ridedown Acceleration (g's)		
Longitudinal/Lateral	1.0/1.8	10/12.5

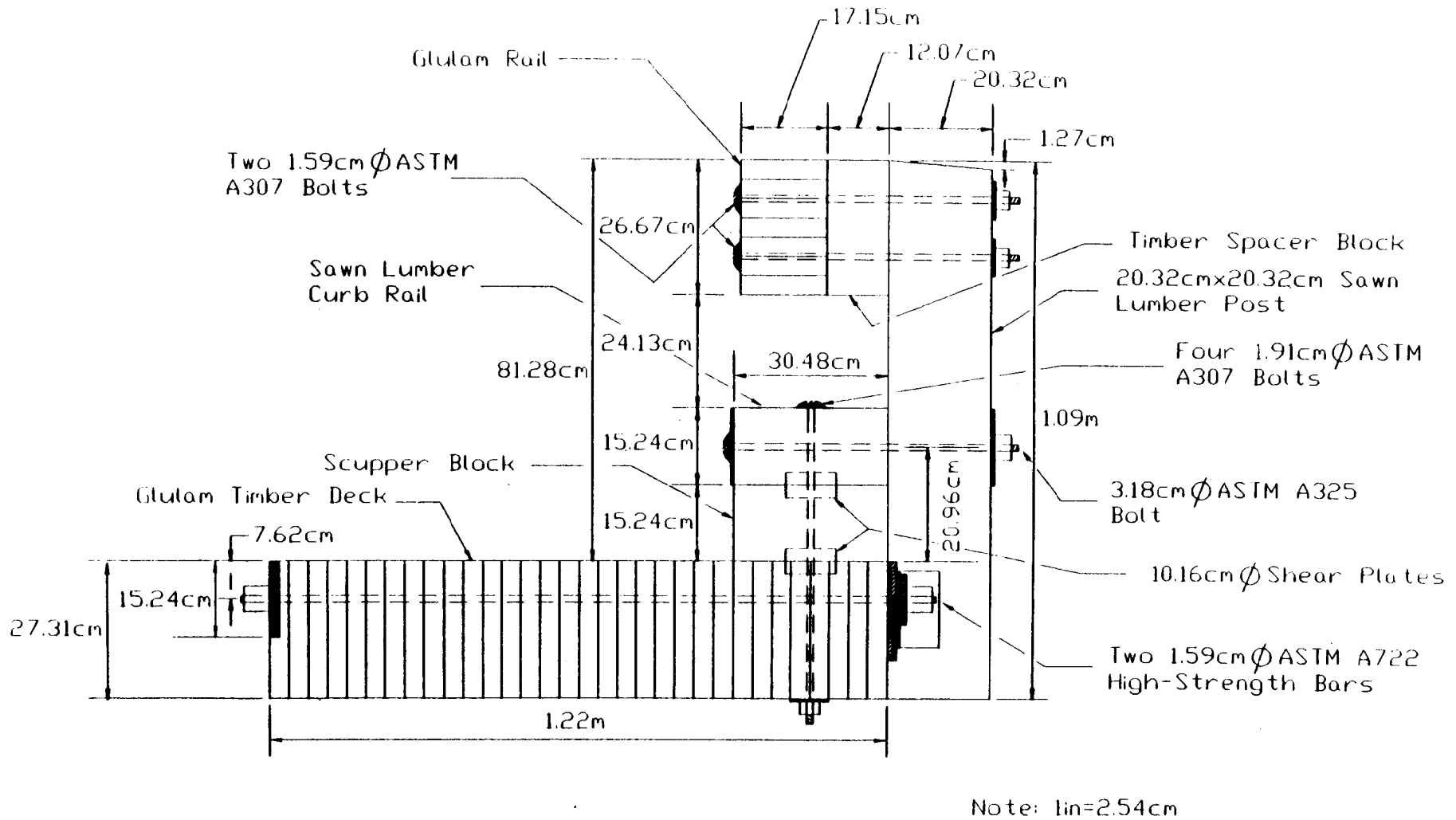
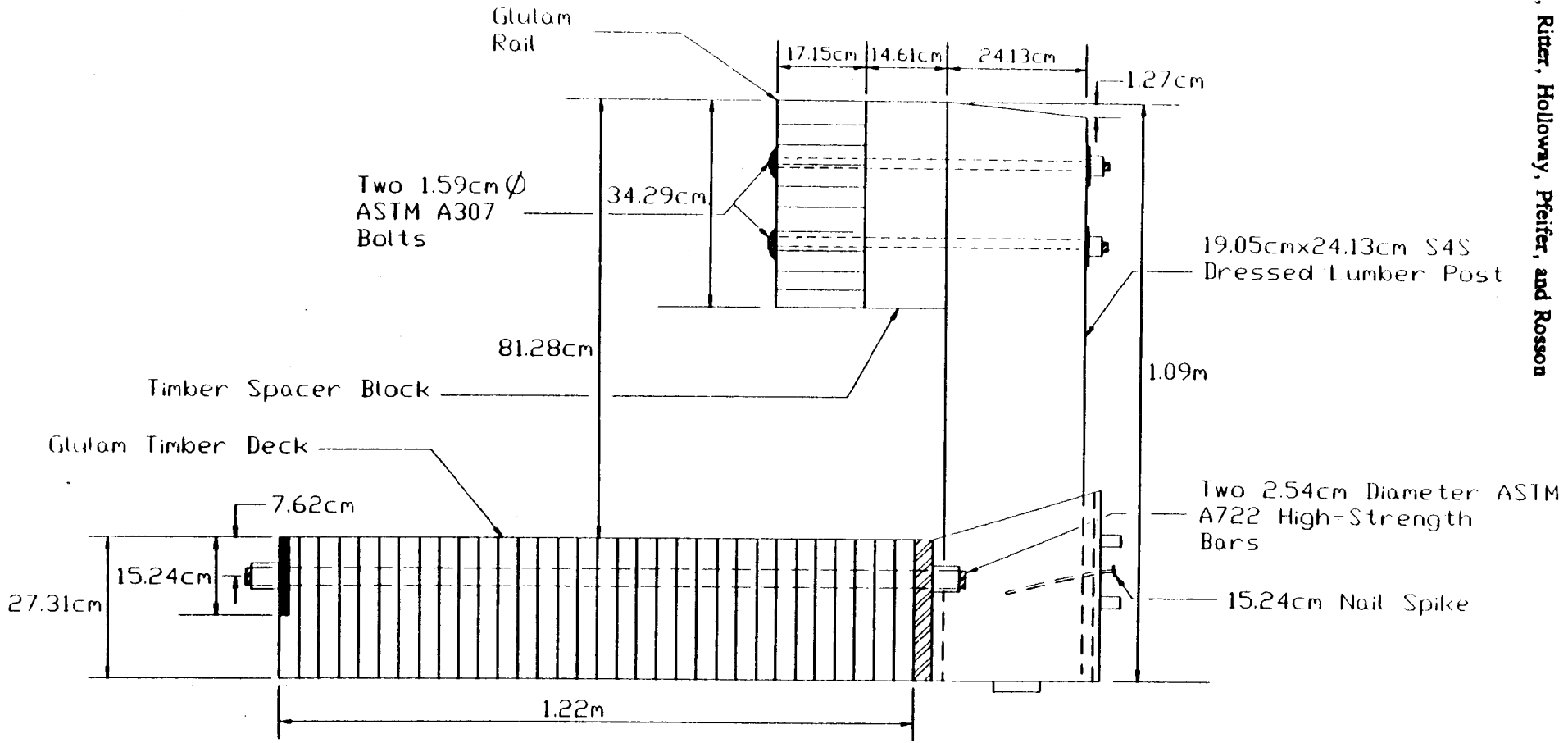


Figure 1. Longitudinal Glulam and Sawn Lumber Curb Bridge Railing or "Curb System"



Note: 1in.=2.54cm

Figure 2. Single Longitudinal Glulam Bridge Railing or "Shoe Box System"

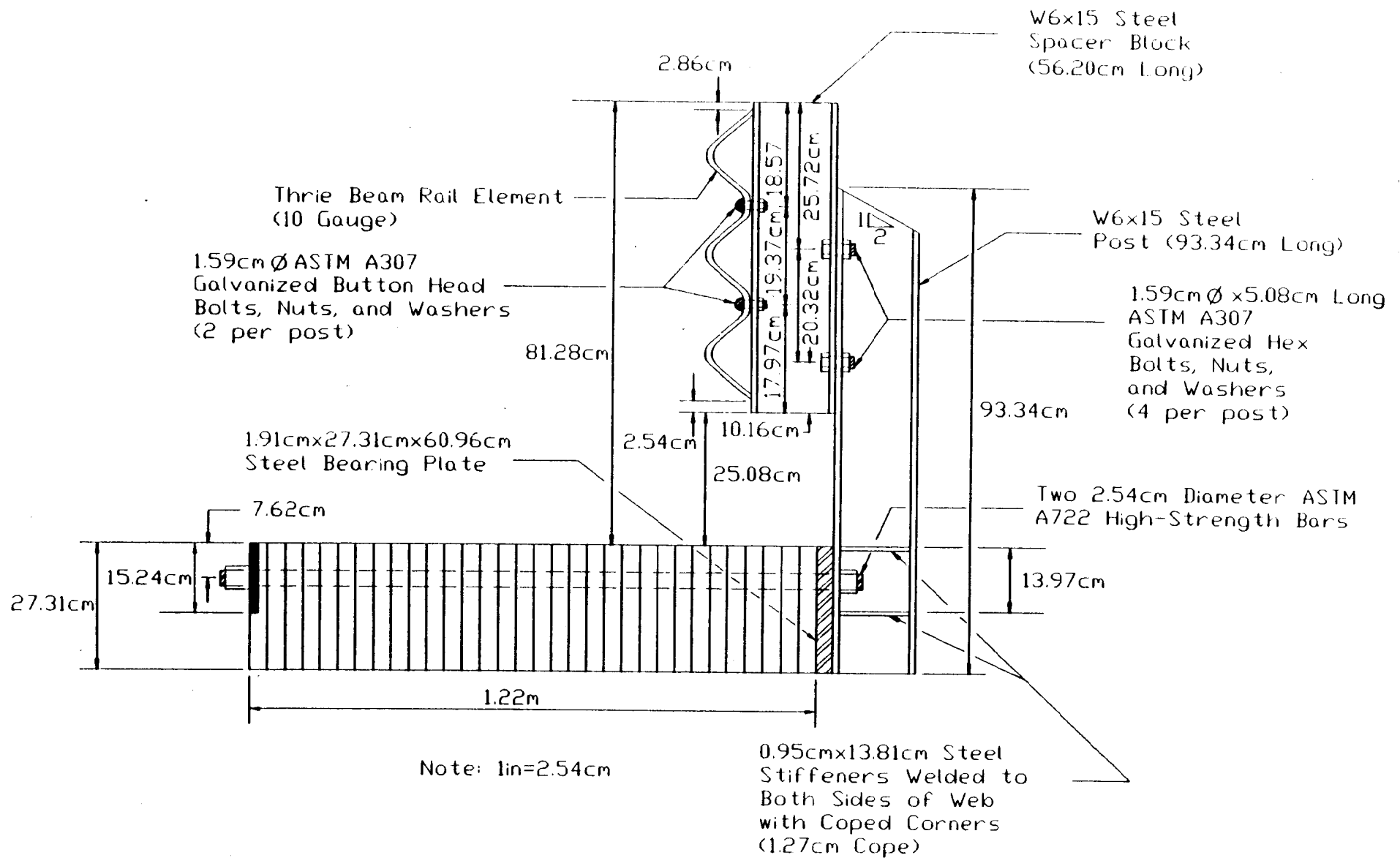
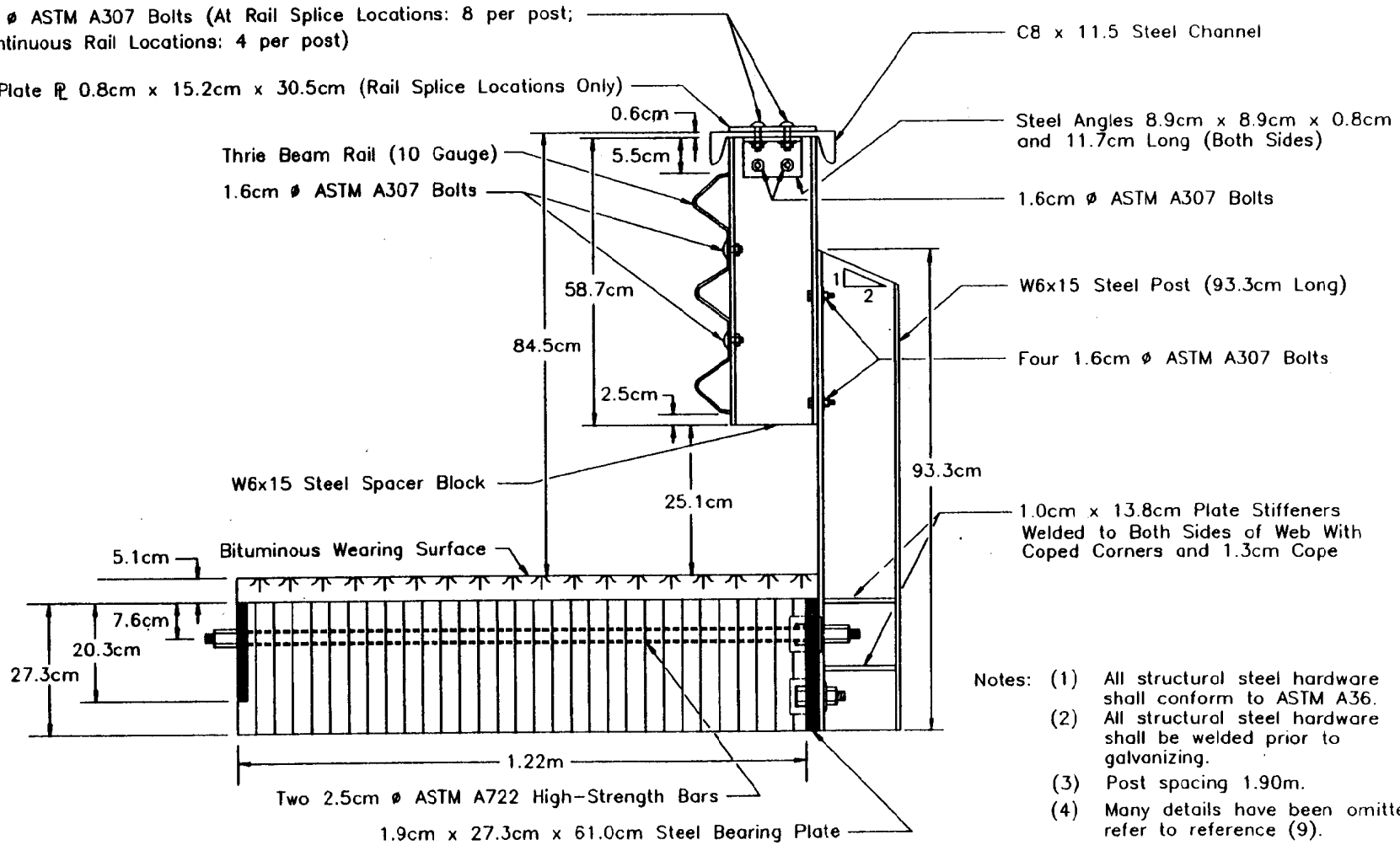


Figure 3. Single Steel Thrie Beam Bridge Railing or "Steel System"

1.6cm \varnothing ASTM A307 Bolts (At Rail Splice Locations: 8 per post;
At Continuous Rail Locations: 4 per post)

Steel Plate \mathbb{R} 0.8cm x 15.2cm x 30.5cm (Rail Splice Locations Only)



- Notes: (1) All structural steel hardware shall conform to ASTM A36.
(2) All structural steel hardware shall be welded prior to galvanizing.
(3) Post spacing 1.90m.
(4) Many details have been omitted, refer to reference (9).

Figure 1. Thrie-beam with channel bridge railing (TBC-8000).

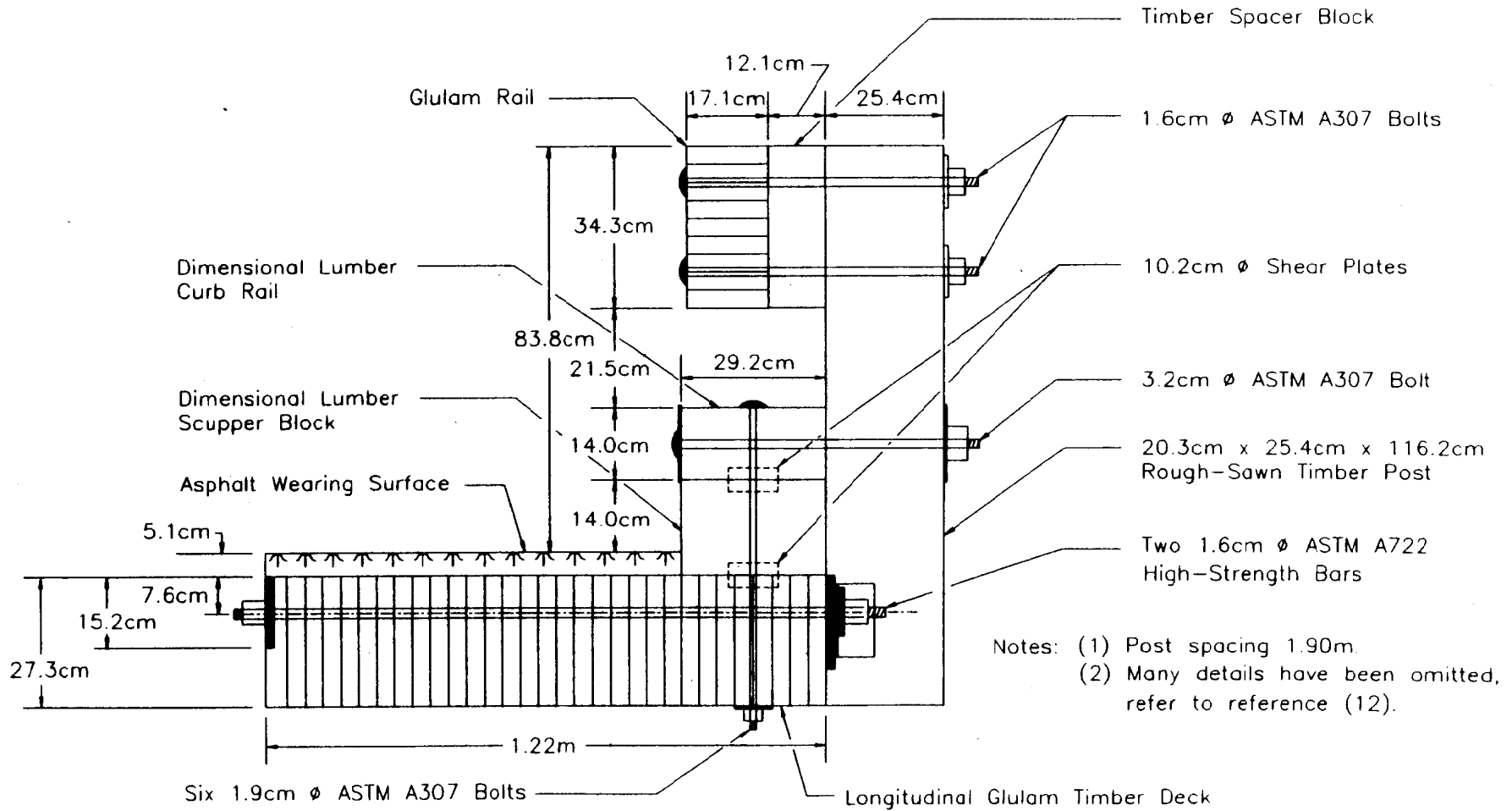


Figure 4. Glulam timber with curb bridge railing (GC-8000).