

August 20, 2004

Refer to: HSA-10/CC-61C

Dean L. Sicking, PhD., P.E.
Director, Midwest Roadside Safety Facility
W. 328.1 Nebraska Hall
PO Box 880529
Lincoln, NE 68588-0529

Dear Dr. Sicking:

The Federal Highway Administration allowed conditional use of a two-bolt breakaway post with the Sequential Kinking Terminal (SKT) terminal in Ms. Carol Jacoby's October 30, 2002, acceptance letter CC-61A, but requested an additional test before this post was used with the flared FLEAT terminal. Your March 25, 2004, letter transmitted the results of this additional test as well as a copy of the Midwest Roadside Safety Facility's report entitled "Performance Evaluation of the FLEAT-MGS End Terminal – NCHRP Test No. 3-35" and my April 5, 2004 letter accepted the two-bolt post design for use with both the SKT and FLEAT W-beam guardrail terminals.

Your March 25 letter included a second test report, entitled "Performance Evaluation of the FLEAT-MGS End Terminal with Redesigned Breakaway Posts and End Anchorage–NCHRP Test No. 3-35 (FLEAT 7)." You subsequently asked Mr. Richard Powers of my staff to delay formal acceptance of both the redesigned breakaway posts used in this test and the redesigned end anchorage. In early August, by telephone, you requested him to proceed with his review and analysis of the modified post design.

For test FLEAT 7, the original FLEAT was modified to connect to your Midwest Guardrail System (MGS), a strong post W-beam barrier that has been successfully tested to NCHRP Report 350 guidelines, but has not yet been submitted for formal FHWA acceptance. To match the design features of the MGS barrier, the FLEAT posts were increased to an above-ground height (breakaway height) of 33.5 inches to attain a top rail height of 31 inches, posts 3 through 6 were fitted with the 6-in wide by 12-in deep x 14-in long routed wood offset blocks used throughout the MGS barrier, and the lead section of W-beam was a 16.67-ft long section of 12-gauge W-beam with five pairs of slots on the upstream end of the rail. Use of this initial length section of rail resulted in all rail splices falling midway between the support posts throughout the terminal and the barrier proper, a key characteristic of the MGS design. However, for this test the two 9/16-inch diameter splice bolts used to connect the top and bottom sections of the breakaway line posts in the earlier design were replaced with a single 3/4-inch diameter x 8-inch long Grade 5 hex bolt. The holes in the splice plate and top post base flanges were increased

to 7/8-inch diameter to allow insertion of the larger bolt. Enclosures 1 and 2 show the details of the single-bolt design as tested.

Test 3-35 (FLEAT 7) was conducted on a barrier layout with the FLEAT offset 4 feet from the line of the MGS barrier. The 2000P truck was contained and redirected upright. Enclosure 3 is the test summary page from the aforementioned report. Because the single-bolt hinge allows the post to rotate back with virtually no resistance when struck head-on, you did not conduct either of the standard end-on terminal tests. However, the reduced weak-axis strength of the single-bolt post will likely result in greater intrusion into the system for very shallow angle impacts. Proper end-on performance also depends upon the single bolt being placed in the downstream splice plate/top post flange holes. Users and installers of the single-bolt design need to be aware of these considerations.

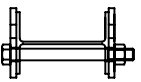
Based on the reported test results, I find the single-bolt breakaway post design to be acceptable for use on the National Highway System with both the SKT and the FLEAT W-beam terminals at test level 3. The field performance of both of these terminals should be monitored to verify acceptable crash performance when connected to a standard W-beam design.

Sincerely yours,

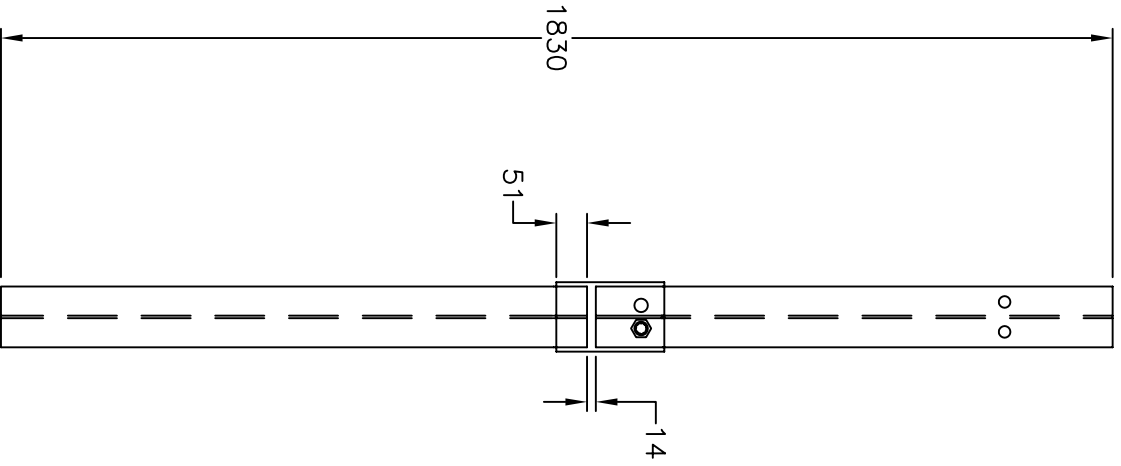
(original signed by Richard D. Powers)

for: John R. Baxter
Director, Safety Design
Office of Safety

3 Enclosures



ITEM	QTY	DESCRIPTION	MATERIAL
a1	1	Post Top #HP6A MGS	W152X13.4
a1	1	Post Bottom #HP6B	W152X13.4
c1	2	Side Plates	10 mm A36
d1	1	Hex Bolt #B580204A	19 x 203 mm Grade 5
f1	2	Hex Nut #N055	16 mm Hex Nut



Road Systems, Inc.

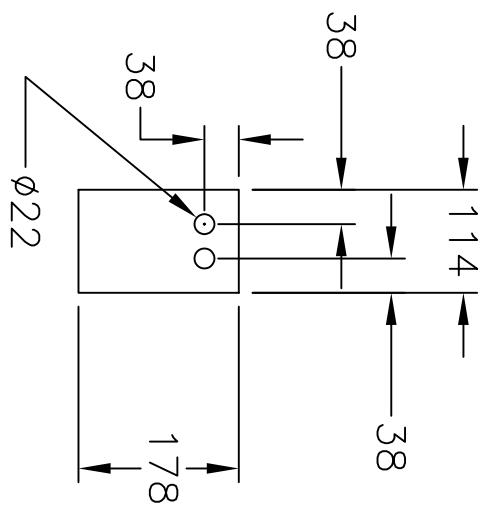
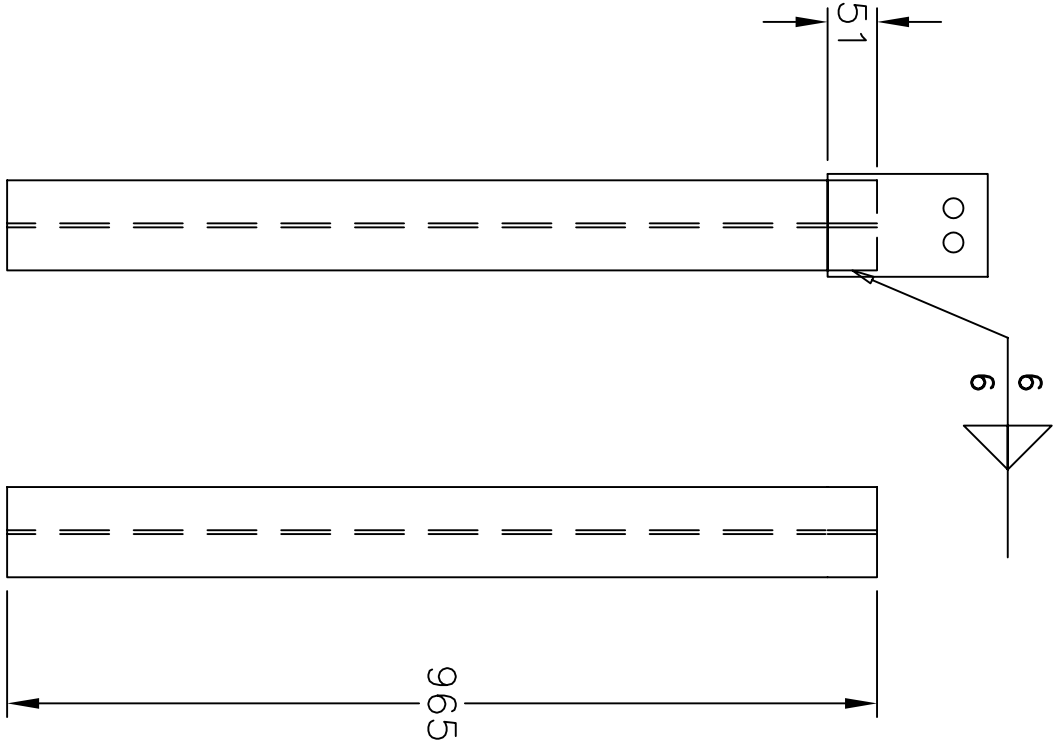
Big Spring, TX
 Phone: 915-263-2435
 or Phone: 330-346-0721

Hinged Breakaway
 Second Post
 Assembly Drawing

Sheet:
101

Drawing Name:	Scale:	By:	Rev:
Hinged Breakaway Second Post Assembly Drawing	NONE	JRR	
Date:			

ITEM	QTY	DESCRIPTION	MATERIAL
b1	1	Bottom Post	W152X13.4
c1	2	Side Plates	10 mm A36



Road Systems, Inc.

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 Phone: 915-263-2435
 or Phone: 330-346-0721

Hinged Breakaway
 Second Post

Post Bottom
 Part #HP6B MGS

Sheet:
101

Drawing Name: Hinged Breakaway Second Post
 Scale: NONE
 By: JRR
 Rev:



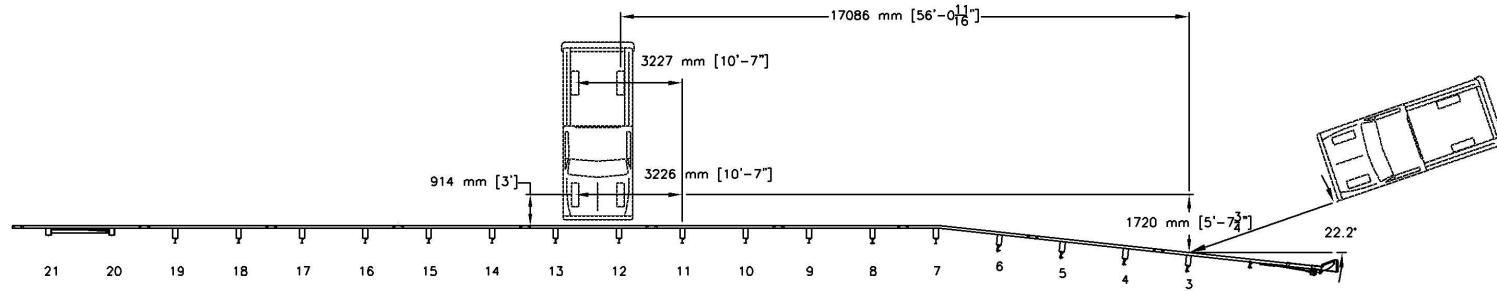
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42

- Test Number FLEAT-7 (3-35)
- Date 10/31/03
- Test Article
 - Type FLEAT-MGS End Terminal
 - Key Elements FLEAT impact head
Hinged, breakaway steel posts
Midwest Guardrail System
 - Orientation Impact at post no. 3
- Soil Type Grading B - AASHTO M 147-65 (1990)
- Vehicle Model 1997 Chevrolet C2500 pickup truck
 - Curb 1,985 kg (4,377 lbs)
 - Test Inertial 2,009 kg (4,429 lbs)
 - Gross Static 2,009 kg (4,429 lbs)
- Vehicle Speed
 - Impact 101.6 km/h
 - Exit 0.0 km/h
- Vehicle Angle
 - Impact (trajectory) 22.2 deg
 - Exit (trajectory) NA
- Vehicle Stability Satisfactory
- Occupant Ridedown Deceleration (10 msec avg.)
 - Longitudinal 7.09 g's < 20 g's
 - Lateral (not required) 5.10 g's
- Occupant Impact Velocity
 - Longitudinal 5.36 m/s < 12 m/s
 - Lateral (not required) 4.13 m/s
- Vehicle Damage Moderate
 - TAD¹² 11-LFQ-3
 - SAE¹³ 11FZEW2
11LFES2
- Vehicle Stopping Distance 17.09 m downstream
1.72 m to the right
- Test Article Damage Moderate
- Maximum Deflection
 - Permanent Set NA
 - Dynamic 1,761 mm
- Working Width 1,803 mm

Figure 24. Summary of Test Results and Sequential Photographs, Test FLEAT-7