U.S. Department
of Transportation
Federal Highway Administration

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

June 13, 2005

In Reply Refer To: HSA-10/B-137

Mr. Bill Neusch, President
Gibraltar
320 Southland Road
Burnet, Texas 78611

Dear Mr. Neusch:

In your May 30 letter to Mr. Richard Powers of my staff, you requested the Federal Highway Administration (FHWA) acceptance of a high-tension, 3-strand cable barrier system. Copies of a May 26 report prepared by Karco Engineering and entitled "Crash Test Report for Gibraltar Tested to National Cooperative Highway Research Program (NCHRP) Report 350 Recommendations for test level 3-10 and 3-11 Cable Barrier System" and digital videos of the two tests were also submitted.

Your cable barrier system consists of three ¾-inch 3 X 7 prestretched, post-tensioned galvanized steel cables supported by steel C-posts 3.25 x 2.5 x 0.15-inches thick and 4-ft long, set in HSS 4 x 3 x 3/16 sockets. These sockets were 15-inches deep and placed in reinforced concrete footings 42-inches deep and 12-inches in diameter. Post spacing was 15 feet on centers. The posts were installed on alternate sides of the 3 cables that are held in place by a 7/16-inch diameter x 24-inch long galvanized steel hairpin and lock plate, with which the bottom, middle, and top cable heights are set and held in place at above-ground heights of 20 inches, 25 inches and 30 inches, respectively. These details for the line posts are shown in Enclosure 1. This enclosure also includes drawings of the terminal you developed for use with the Gibraltar Cable Barrier, which will be addressed in a separate acceptance letter in the immediate future. The barrier test installation was 200 feet long and each cable was tensioned to 4800 lbs. prior to the tests.

The NCHRP Report 350 tests 3-10 and 3-11 were both successfully conducted and the summary results of each are shown in Enclosure 2. Dynamic deflection was reported to be 8.5 feet. Based on the test results, the Gibraltar Cable Barrier may be considered an NCHRP Report 350 traffic barrier at test level 3 as a median barrier when the posts are set an alternate sides of the cables or as a roadside barrier when the cables are all on the traffic side of the C-posts.

You also asked about the acceptability of an alternative post embedment detail and the effect additional tension in the cables might have on the dynamic deflection of your barrier. Regarding post embedment details, a 30-inch deep reinforced concrete footing can be used when a mowing strip is used under the barrier. While longer posts embedded directly into the ground would almost certainly work, other factors such as post type and spacing, the use of soil plates, soil conditions, the distance between adjacent terminals or anchors, and the method used to connect the cables to the posts will affect the deflection distance and there is currently no way to predict that deflection with any degree of confidence. Similarly, increasing the cable tension will intuitively decrease deflection, but any such decrease cannot be readily quantified as it, too, is dependent on the factors listed above. To determine the design deflections for alternative post designs or post spacing, testing would need to be done. Design deflections for longitudinal barriers are only a reasonable approximation of what may be seen in the field. Because they are the observed results of a single test, actual deflections for any specific barrier can be much more or much less, depending on the size, speed, and impact angle of the vehicle that strikes it. In locations where deflection is a critical design element, a rigid concrete barrier would be a more logical choice than a flexible or semi-flexible barrier type.

Please note the following standard provisions that apply to the FHWA letters of acceptance:

- Our acceptance is limited to the crashworthiness characteristics of the tested device and does not cover its structural features, durability, or maintenance characteristics.
- Any design or material changes that may adversely affect the crashworthiness of the barrier will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the barrier being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that they will meet the crashworthiness requirements of the FHWA and the NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number B-137 shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The Gibraltar Cable Barrier includes patented components and is considered proprietary. When proprietary devices are *specified by a highway agency* for use on Federal-aid projects, except exempt, non-NHS projects, they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that

no equally suitable alternative exists or; (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411.

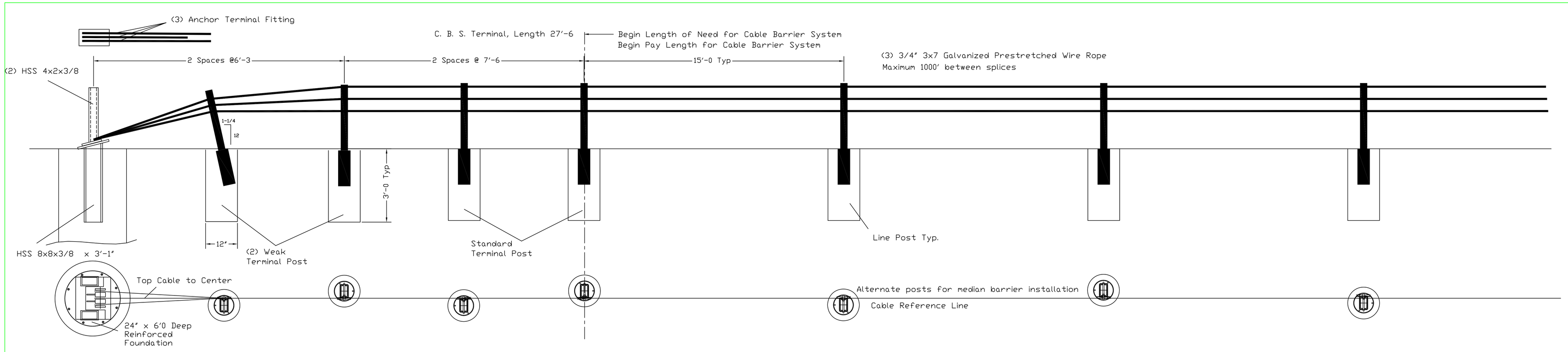
Sincerely yours,

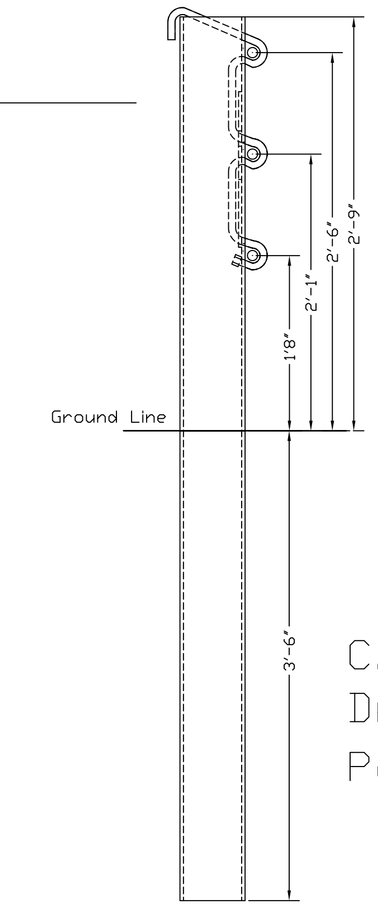
/original signed by/

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

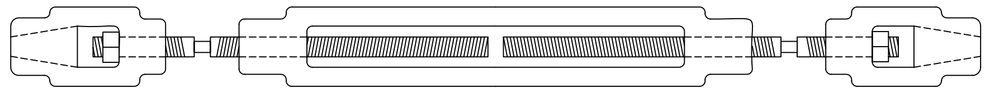
2 Enclosures

FHWA:HSA-10:DPowers:tb:x61320:6/13/05
File: h://directory folder/dpowers/B137(GibraltarWR)
cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10;
D.Powers, HSA-10)

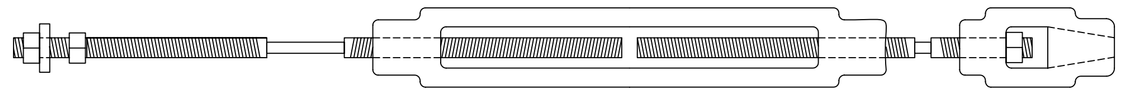




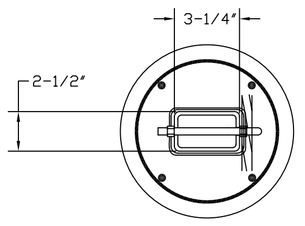
C. B. S.
Driven
Post

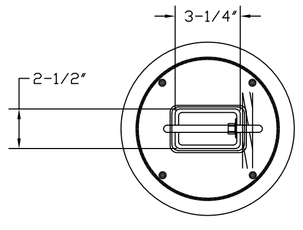


3/4" x 24" T/B Cable Splice Fitting

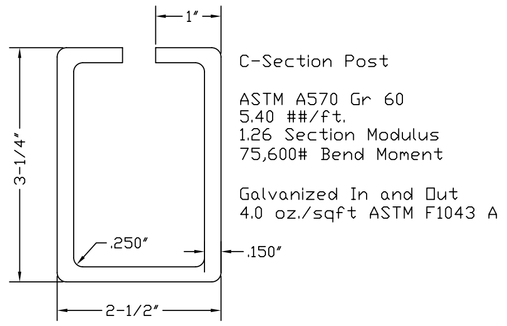


3/4" x 30" Anchor Terminal Fitting





7/16 Round
x 24" long
Hairpin,
Galvanized

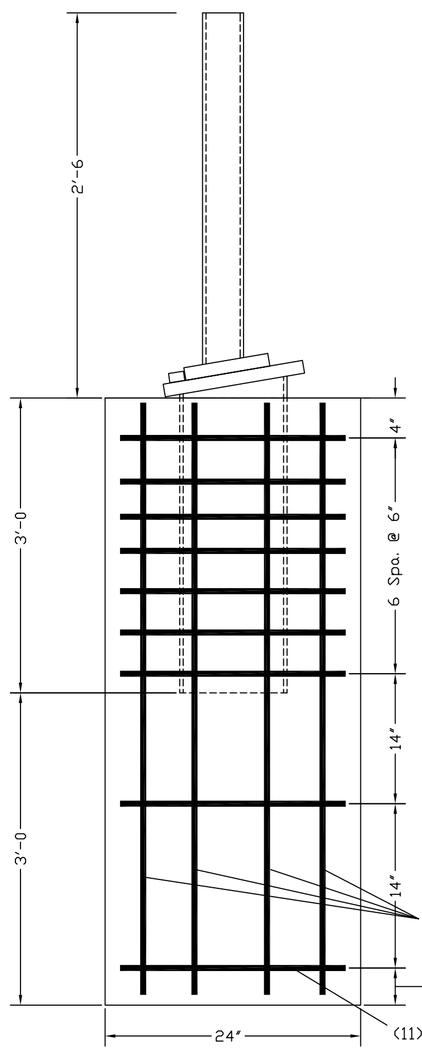


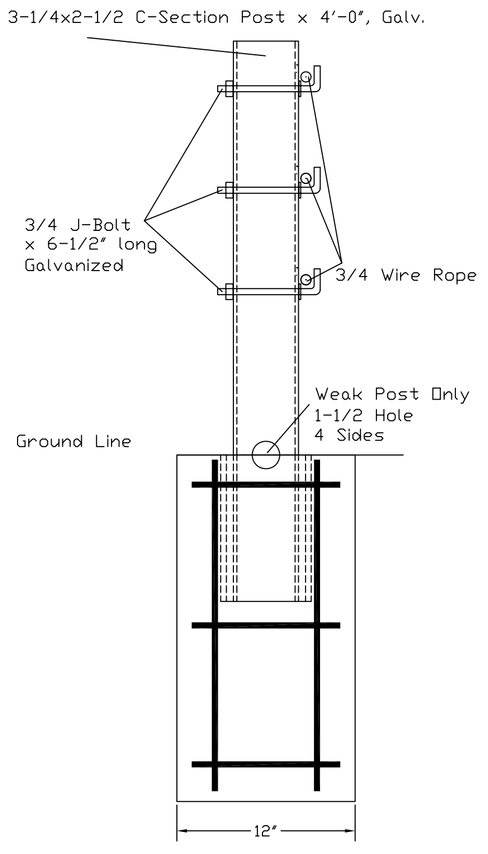
C-Section Post

ASTM A570 Gr 60
5.40 ##/ft.
1.26 Section Modulus
75,600# Bend Moment

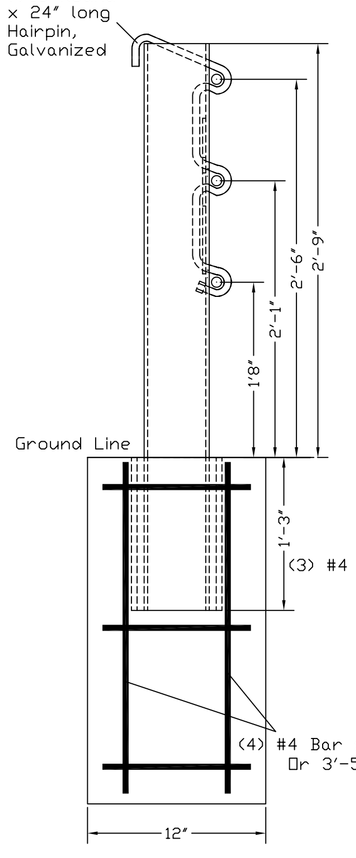
Galvanized In and Out
4.0 oz./sqft ASTM F1043 A

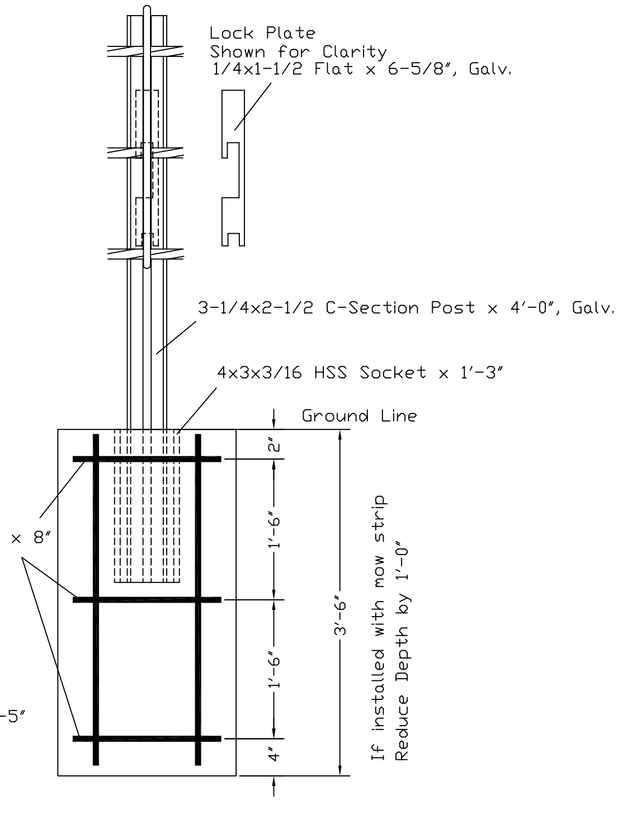
Cable Release
Anchor Post





Terminal Post





Line Post

GENERAL NOTES

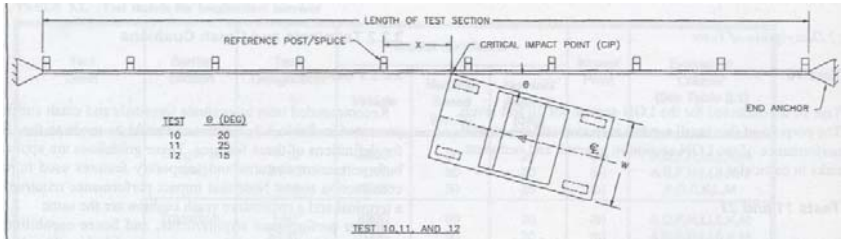
1. For additional information contact Gibraltar at 1-800-495-8957.
2. All concrete shall be Class C. All posts shall be socketed design unless otherwise specified.
3. The Cable Barrier System is designed for bi-directional traffic flow. If installed for traffic in one direction install cables on traffic side of posts.
4. The Cable Barrier System shall be installed on median shoulders or on depressed medians with slopes of 6:1 or flatter without obstructions, depressions, etc. that may influence trajectory of an errant vehicle.
5. See the Texas MUTCD for proper delineation.

Cable	Tension
-10F	9122
0	8688
10	8274
20	7954
30	7419
40	7001
50	6586
60	6151
70	5728
80	5303
90	4878
100	4455
110	4030

Date 6/10/05			Gibraltar 320 Southland Road Burnet, Texas 78611
Drawn by DM			
Issued For Construction			Cable Barrier System
Approver	Date		1 May 2005

DATA SHEET NO. 3

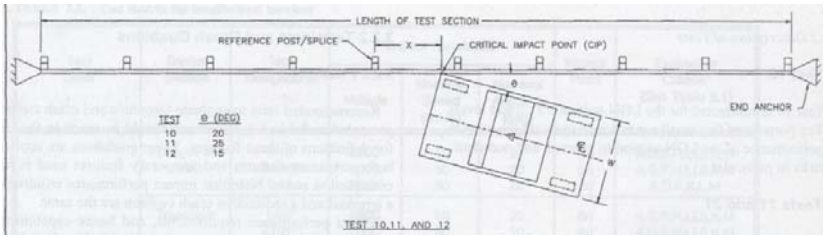
SUMMARY OF RESULTS FOR TEST NO. 3-10



GENERAL INFORMATION		OCCUPANT RISK VALUES	
TEST AGENCY	KARCO ENGINEERING	IMPACT VELOCITY (m/sec)	
TEST NO.	3-10	X-DIRECTION	2.4
DATE	05/26/05	Y-DIRECTION	3.7
TEST ARTICLE		THIV (optional)	N/A
TYPE	LONGITUDINAL FENCE BARRIER UNIT	RIDEDOWN ACCELERATION (g's)	
INSTALLATION LENGTH (m)	N/A	X-DIRECTION	-6.2
SIZE AND/OR DIMENSION OF KEY ELEMENTS	200 ft LON	Y-DIRECTION	-7.1
SOIL TYPE AND CONDITION	CONCRETE	PHD (optional)	N/A
TEST VEHICLE	820C	ASI (optional)	0.66
TYPE	PRODUCTION	TEST ARTICLE DEFLECTIONS (m)	N/A
DESIGNATION	3-10	DYNAMIC	762 mm(2.5 ft)
MODEL	CHEVROLET METRO 2-DOOR	PERMANENT	N/A
MASS (CURB)	807 Kg (1780 lbs)	VEHICLE DAMAGE	
MASS (TEST INERTIAL)	827 Kg (1823 lbs)	EXTERIOR	
DUMMY(s) MASS	75 kg (165 lbs.)	VDS	1FR1
GROSS STATIC WEIGHT	895 Kg (1974 lbs)	CDC	01RDEN2
IMPACT CONDITIONS		INTERIOR	
SPEED (km/h)	100.2 (62.9 mph)	OCDI	FS0000000
ANGLE (Deg.)	20		
IMPACT SEVERITY (kJ)	41.3	POST IMPACT VEHICULAR BEHAVIOR	
EXIT CONDITIONS		MAXIMUM ROLL ANGLE (Deg.)	-32.7
SPEED (km/h)	79 (49.2 mph)	MAXIMUM PITCH ANGLE (Deg.)	-31.5
ANGLE (Deg.)	0	MAXIMUM YAW ANGLE (Deg.)	-18.4

DATA SHEET NO. 3

SUMMARY OF RESULTS FOR TEST NO. 3-11



GENERAL INFORMATION		OCCUPANT RISK VALUES	
TEST AGENCY	KARCO ENGINEERING	IMPACT VELOCITY (m/sec)	
TEST NO.	3-11	X-DIRECTION	3.6
DATE	5/26/05	Y-DIRECTION	3.3
TEST ARTICLE		THIV (optional)	N/A
TYPE	LONGITUDINAL FENCE BARRIER UNIT	RIDEDOWN ACCELERATION (g's)	
INSTALLATION LENGTH (m)	N/A	X-DIRECTION	3.7
SIZE AND/OR DIMENSION OF KEY ELEMENTS		Y-DIRECTION	2.9
SOIL TYPE AND CONDITION	CONCRETE	PHD (optional)	N/A
TEST VEHICLE	2000P	ASI (optional)	0.33
TYPE	PRODUCTION	TEST ARTICLE DEFLECTIONS (m)	N/A
DESIGNATION	3-11	DYNAMIC	2.62 m (8.6 ft)
MODEL	GMC SIERRA 2-DOOR TRUCK	PERMANENT	N/A
MASS (CURB)	2244 Kg (4948 lbs)	VEHICLE DAMAGE	
MASS (TEST INERTIAL)	2065 Kg (4552 lbs)	EXTERIOR	
DUMMY(s) MASS	N/A	VDS	1FR1
GROSS STATIC WEIGHT	2065 Kg (4552 lbs)	CDC	01RDEN2
IMPACT CONDITIONS		INTERIOR	
SPEED (km/h)	102.4 km/h (63.7 mph)	OCDI	FS0000000
ANGLE (Deg.)	25		
IMPACT SEVERITY (kJ)	149.2	POST IMPACT VEHICULAR BEHAVIOR	
EXIT CONDITIONS		MAXIMUM ROLL ANGLE (Deg.)	-35.5
SPEED (km/h)	48 (29.8 mph)	MAXIMUM PITCH ANGLE (Deg.)	-62.2
ANGLE (Deg.)	N/A	MAXIMUM YAW ANGLE (Deg.)	-4.5