



CRASH TEST REPORT FOR

Premier Plastics

TESTED TO NCHRP 350

RECOMMENDATIONS FOR TEST LEVEL 3-71

Work Zone Traffic Control Devices

Prepared for:

**Premier Plastics
8328 River Way
Delta, B.C. V4G1C4**

Test Report No. TR-P23140-01-NC

KARCO Engineering L.L.C.
AUTOMOTIVE RESEARCH CENTER
9270 Holly Road
Adelanto, CA 92301
Tel: (760) 246-1672
Fax: (760) 246-8112

October 17, 2003

TR-P23140-01-NC

SECTION 3

TEST RESULTS AND DATA SHEETS

3.1 TEST NO. 3-71

This one hundred kilometers per hour (100 km/h) frontal impact crash test was conducted using a 1996 Geo Metro to determine if the tested traffic barriers meet the minimum performance standards of the NCHRP 350 recommendations for test level 3 work zone traffic control devices. NCHRP 350 Test 3-71 is intended to evaluate occupant risk, vehicle stability, and test article trajectory with a type 820C vehicle.

The test articles were setup so that the centerline of the vehicle was aligned with the vertical centerline of the barriers, with the first barrier oriented to allow a head-on impact and the second barrier oriented to allow an end-on impact. The test vehicle contained one (1) part 572E 50th percentile adult male anthropomorphic test device (ATD) located in the driver side front seating position. This crash test was documented by two (2) real-time video cameras and three (3) high-speed video cameras, all focused on the barriers at the impact site. Pre- and post-test photographs of the vehicle and barriers can be found in Appendix A. The damage shown in these photographs is due to the the test vehicle striking the test facility's runaway barriers.

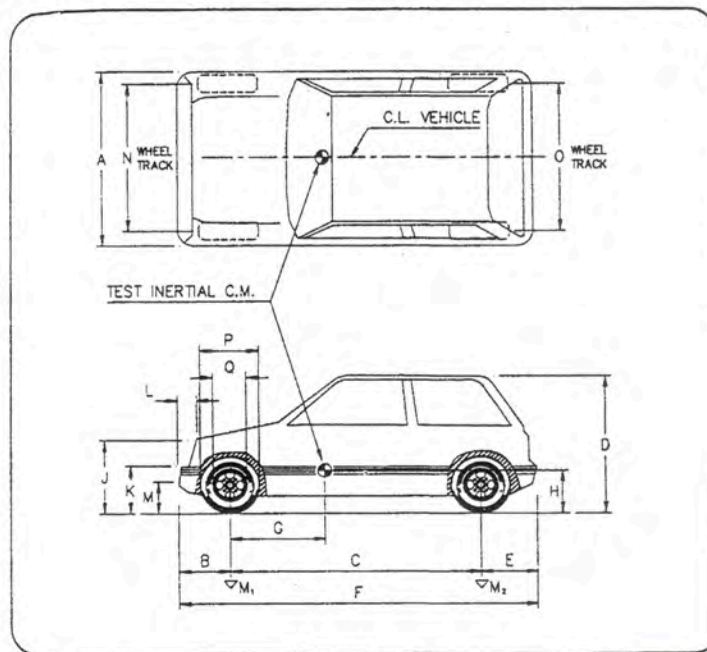
Test 3-71 was conducted on October 17, 2003. The test inertial weight of the vehicle was 790 kg (1742 lb.) and its gross static weight was 875 kg (1928 lb.). The height to the lower edge of the front bumper was 430 mm (16.8 in.) and the upper edge was 520 mm (20.3 in.). Additional dimensions and vehicle information are presented in Data Sheet No. 1.

The test vehicle impacted the first barrier at a velocity of 100.95 km/h (62.70 mph). The vehicle remained in physical contact with the first traffic barrier for at least 490 milliseconds (ms), at which point the barrier and the front of the vehicle exited the last video screen. Impact at the second barrier occurred at approximately 200 ms, and separation of this second barrier from the vehicle/first barrier occurred at 400 ms. When the second barrier exited the video screen at 432 ms, it was separated from the first barrier and car. The vehicle's exit speed was 93.6 km/h (58.16 mph). The vehicle came to rest approximately 9.91 meters (32.5 ft.) to the right of and approximately 98.67 meters (323.5 ft.) forward of the point of impact after hitting the test facility's runaway barriers. This impact caused the damage to the vehicle, and is not related to the primary impact. Both traffic barriers came to rest forward and to the left of the initial impact. A diagram of the impact points and final positions are shown in Figures 1 and 2 (Appendix C). Sequential photographs of the test sequence are shown in Appendix D. The vehicle sustained no significant damage due to the impact from the Premier Plastics barrier. The vehicle sustained no vertical or longitudinal deformation to the roof. There was no deformation or intrusion into the vehicle occupant compartment.

The traffic barriers sustained no penetration with no severe damage for either of the two units. Both modules were displaced by the impact. A summary of the electronic data is presented in Data Sheet No. 2, with data plots presented in Appendix B. In Section 4, Table 3 shows the NCHRP Report 350 evaluation criteria and the assessment of the performance of this installation with respect to those criteria.

DATA SHEET NO. 1
VEHICLE PROPERTIES FOR TEST NO. 3-71

DATE	10/17/03	TEST NO.	1	VIN	2CIMR2262T6775929	
YEAR	1996	MAKE	GEO	MODEL	METRO	
TIRE PRESSURE	32 psi	ODOMETER	1028454	TIRE SIZE	175/70R13	
ENGINE	Transverse	CYLINDERS	3	DISPLACEMENT	1.0 Liter	
TRANSMISSION				MANUAL	5 Speed	
DUMMY TYPE	Hybrid III	MASS	75 kg. (165 lbs)	PLACEMENT	Driver Front	
DESCRIBE ANY DAMAGE TO VEHICLE PRIOR TO TEST:			None			



TEST VEHICLE GEOMETRY mm (in)

A	1420 (55.9)	E	540 (21.3)	J	640 (25.2)	N	1380 (54.3)
B	760 (29.9)	F	3680 (144.9)	K	520 (20.5)	O	1380 (54.3)
C	2380 (93.7)	G	926 (36.5)	L	100 (3.9)	P	560 (22.0)
D	1410 (55.5)	H		M	430 (16.6)	Q	350 (13.8)

MASS kg (lbs)	CURB		TEST INERTIAL		GROSS STATIC		
FRONT AXLE	489 (1078)		484 (1068)		534 (1176)		
REAR AXLE	322 (710)		306 (674)		341 (752)		
TOTAL VEHICLE	811 (1788)		790 (1742)		875 (1928)		
DISTRIBUTION							
LEFT FRONT	276 (608)	RIGHT FRONT	258 (568)	LEFT REAR	183 (402)	RIGHT REAR	159 (350)

SECTION 4

EVALUATION OF TEST RESULTS

4.1 STRUCTURAL ADEQUACY

The factors used to determine structural adequacy was NCHRP 350 Evaluation Criteria:

B. The test article should readily activate in a predictable manner by breaking away, fracturing, or yielding.

4.2 OCCUPANT RISK

The factors used to determine occupant risk were NCHRP 350 Evaluation Criteria:

D. Detached elements should not penetrate the occupant compartment, or present an undue hazard to other traffic, pedestrians, or personnel in a work zone. Deformations of the occupant compartment that could cause serious injuries should not be permitted.

E. Detached elements, fragments or other debris from the test article, or vehicular damage should not block the driver's vision or otherwise cause the driver to lose control of the vehicle.

F. The vehicle should remain upright during and after collision although moderate roll, pitching and yawing are acceptable.

H. Occupant impact velocities should satisfy the following;

Occupant Impact Velocity Limits (m/sec.)		
Component	Preferred	Maximum
Longitudinal	3	5

I. Occupant ridedown accelerations should satisfy the following;

Occupant Ridedown Acceleration Limits (G's)		
Component	Preferred	Maximum
Longitudinal and Lateral	15	20

J. (Optional) Hybrid III dummy. Response should conform to evaluation criteria of Part 571.208, Title 49 Code of Federal Regulation, Chapter V (10-1-88 Edition).

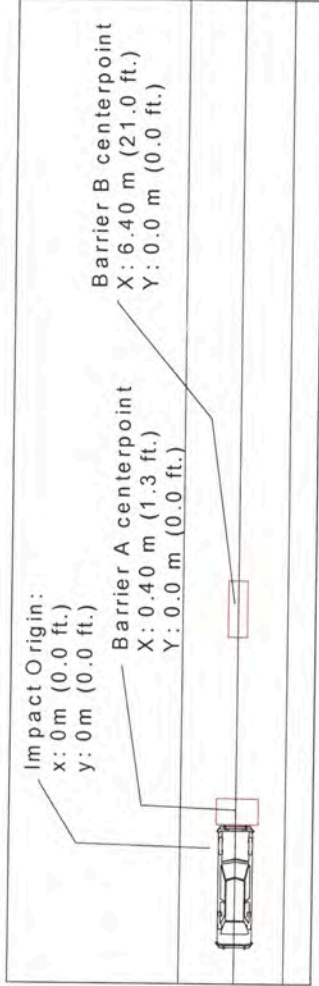
4.3 VEHICLE TRAJECTORY

The factors used to determine occupant risk were NCHRP 350 Evaluation Criteria:

K. After collision it is preferable that the vehicle's trajectory, not intrude into adjacent traffic lanes.

N. Vehicle trajectory behind the test article is acceptable.

DATA SHEET NO. 2
SUMMARY OF RESULTS FOR TEST NO. 3-71



GENERAL INFORMATION		OCCUPANT RISK VALUES	
TEST AGENCY	KARCO ENGINEERING	IMPACT VELOCITY	28.0 m/sec (91.8 ft/sec)
TEST NO.	TR-P23140-01	X-DIRECTION	2.0 m/sec (6.6 ft/sec)
DATE	10/17/03	Y-DIRECTION	0.2 (0.7 ft/sec)
TEST ARTICLE		THIV (optional)	N/A
TYPE	WORK ZONE TRAFFIC BARRIER	RIDEDOWN ACCELERATION (g's)	
INSTALLATION LENGTH	6m (19.7ft) apart (center to center)	X-DIRECTION	0.2
SIZE AND/OR DIMENSION OF KEY ELEMENTS	1.7m x .7m (5.6 ft. x 2.5 ft.)	Y-DIRECTION	-0.3
SOIL TYPE AND CONDITION	PAVEMENT	PHD (optional)	N/A
TEST VEHICLE	820C	ASI (optional)	0.19
TYPE	PRODUCTION	TEST ARTICLE DEFLECTIONS (m)	N/A
DESIGNATION	3-71	DYNAMIC	N/A
MODEL	GEO METRO	PERMANENT	N/A
MASS (CURB)	811 kg (1787 lbs)	VEHICLE DAMAGE	
MASS (TEST INERTIAL)	790 kg (1741 lbs)	EXTERIOR	
DUMMY(S) MASS	75 kg (165 lbs)	VDS	12FD1
GROSS STATIC WEIGHT	875 kg (1929 lbs)	CDC	12FDEW1
IMPACT CONDITIONS		INTERIOR	
SPEED	100.95 km/h (62.7 mph)	OCDI	FS0000000
ANGLE (Deg.)	0		
IMPACT SEVERITY (kJ)	310	POST IMPACT VEHICULAR BEHAVIOR	
EXIT CONDITIONS		MAXIMUM ROLL ANGLE (Deg.)	N/A
SPEED	93.6 km/h (58.2 mph)	MAXIMUM PITCH ANGLE (Deg.)	N/A
ANGLE (Deg.)	0	MAXIMUM YAW ANGLE (Deg.)	N/A

Table 3. Assessment of Compliance with NCHRP Report 350 for Test No. 3-71

EVALUATION CRITERIA	FACTOR	TEST RESULTS	ASSESSMENT
STRUCTURAL ADEQUACY	B	THE TRAFFIC BARRIER PERMITTED THE VEHICLE TO BREAK THROUGH THE DEVICE	PASS
OCCUPANT RISK	D	NO DEFORMATION AND INTRUSION INTO THE OCCUPANT COMPARTMENT OCCURRED	PASS
VEHICLE REMAINS UPRIGHT	F	THE VEHICLE REMAINED UPRIGHT DURING AND AFTER THE IMPACT EVENT	PASS
IMPACT VELOCITY X	H	OCCUPANT IMPACT VELOCITY WELL BELOW PREFERRED LIMIT	PASS
IMPACT VELOCITY Y	H	OCCUPANT IMPACT VELOCITY WELL BELOW PREFERRED LIMIT	PASS
RIDEDOWN ACCELERATION X	I	OCCUPANT RIDEDOWN ACCELERATION WELL BELOW PREFERRED LIMIT	PASS
RIDEDOWN ACCELERATION Y	I	OCCUPANT RIDEDOWN ACCELERATION WELL BELOW PREFERRED LIMIT	PASS
(OPTIONAL) HYBRID III DUMMY RESPONSE	J	TEST NOT PERFORMED	N/A
VEHICLE TRAJECTORY	K	THE VEHICLE TRAJECTORY WAS JUDGED TO BE ACCEPTABLE	PASS
VEHICLE TRAJECTORY	N	THE VEHICLE CONTINUED PAST THE TEST ARTICLE	PASS