



U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

1957

DOT HS 808 044

July 1993

Final Report

Reducing Heavy Truck Aggressiveness
Moving Heavy Truck into a 1993 Honda
Civic 3-Door Hatchback at 80.3 KPH

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1. Report No. DOT HS 808 044	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle REDUCING HEAVY TRUCK AGGRESSIVENESS MOVING HEAVY TRUCK INTO A 1993 HONDA CIVIC 3-DOOR HATCHBACK AT 80.3 KPH		5. Report Date JULY 1993	
		6. Performing Organization Code	
7. Author(s) S. A. Johnston, Project Engineer, TRC		8. Performing Organization Report No. 930621	
9. Performing Organization Name and Address National Highway Traffic Safety Admin. Vehicle Research and Test Center P. O. BOX 37 East Liberty, OH 43319		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. DTNH22-88-C-07292	
12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh St., S.W. Washington, DC 20590		13. Type of Report and Period Covered FINAL REPORT JUNE - JULY 1993	
		14. Sponsoring agency Code DOT/NHTSA/VRTC	
15. Supplemental Notes			
16. Abstract This test report documents a crash test that was conducted for research and development in support of reducing heavy truck aggressiveness. This test was conducted with a 1993 Honda Civic 3-door hatchback, VIN 2HGEH2356PH530319, at Transportation Research Center Inc. on June 21, 1993. The test vehicle was impacted on the left front of the vehicle by the heavy truck. The struck vehicle contained ten (10) accelerometers and one (1) instrumented Hybrid III driver dummy.			
17. Key Words Heavy Truck Aggressiveness Occupant Response		18. Distribution Statement Available from: Document is available to the public from the National Technical Information Service, Springfield, VA 22161	
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 128	22. Price

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
m ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
ts	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³

TEMPERATURE (exact)

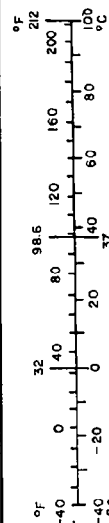
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
----	------------------------	----------------------------	---------------------	----

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³

TEMPERATURE (exact)

°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F
----	---------------------	-------------------	------------------------	----



*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10-286.

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SECTION 1.0

PURPOSE AND TEST SUMMARY

This test was conducted as research in support of reducing heavy truck aggressiveness. This test was conducted on June 21, 1993.

The stationary vehicle, a 1993 Honda Civic 3-door hatchback, was equipped with a 1.5-liter, 4-cylinder, transverse gasoline engine and a 5-speed manual transmission. The test weight of the vehicle was 1122 kg. The vehicle was instrumented with eight (8) longitudinal axis accelerometers, one (1) lateral axis accelerometer, one (1) vertical axis accelerometer and two (2) seat belt force load cells. One (1) Part 572E dummy was seated in the left front outboard seating position according to the dummy placement procedure specified in Appendix B and Optional Appendix C of Laboratory Procedure TP-208-08. The dummy was instrumented in the head, chest, and pelvis with longitudinal, lateral, and vertical accelerometers. The dummy was also instrumented with a 6-axis neck load cell, two (2) femur load cells, and a chest deflection potentiometer.

The stationary vehicle was impacted in the left front at 340 degrees by a moving heavy truck at 80.3 kph. The intended impact engagement was the left front of the car with the right front of the truck.

The moving heavy truck's test weight was 11,353 kg. The truck was equipped with a lowered flat bumper of 60 psi energy absorbing honeycomb. The truck was instrumented with two (2) longitudinal and lateral axis accelerometers and one (1) vertical axis accelerometer.

The dummy's head injury criterion, HIC, was 1542. The dummy's chest deceleration with 3 milliseconds minimum duration was 60.8 g. The dummy's maximum left femur force was 4614 N. The dummy's maximum right femur force was 6866 N.

The vehicle, dummy, and heavy truck data were multiplexed and recorded on a 14-channel analog tape deck. The analog data was digitally sampled at 8000 samples per second. The data was digitally filtered as per SAE J211 OCT88.

The test was filmed by one (1) real-time panning motion picture camera and five (5) high-speed motion picture cameras operating at approximately 500 frames per second.

Section 2.0 contains the vehicle, dummy, truck, and test data. Appendix A contains the pre- and post-test still photographs. Appendix B contains the final test data plots. Appendix C contains miscellaneous test information.

SECTION 2.0

VEHICLE, DUMMY, TRUCK AND TEST DATA

DATA ACQUISITION EXPLANATIONS

The driver neck X-axis shear force, NEKXF1, recorded anomalous spikes at 94 and 258 milliseconds. The driver neck resultant force, NEKRF1, calculation was affected by this anomaly.

TABLE 1 CRASH TEST SUMMARY

TEST TYPE: Heavy Truck into Stationary Vehicle

TEST DATE: 06/21/93 TEST TIME: 1416 AMBIENT TEMP. (°C): 22

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1993/Honda/Civic/3-door hatchback

VEHICLE TEST WEIGHT (KG): 1122

IMPACT ANGLE (DEG)*: 340

IMPACT VELOCITY (KPH)**: PRIMARY = 80.3 SECONDARY = 80.3

MAXIMUM STATIC CRUSH (MM): 551

DUMMY: Driver #048

TYPE: Part 572E

LOCATION: Left front

RESTRAINT: 3-point unbelt
and airbag

NUMBER OF DATA CHANNELS: 35

NUMBER OF CAMERAS: HIGH-SPEED 5 REAL-TIME 1

*With respect to tow track centerline.

**Speed trap measurement ($\pm$.08 kph accuracy)

TABLE 2 TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Honda of Canada, Mfg.

MAKE/MODEL: Honda/Civic

VIN: 2HGEH2356PH530319

BODY STYLE: 3-door hatchback

MODEL YEAR: 1993

COLOR: Red

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 1.5 liters

TRANSMISSION DATA: 5 SPEED, X MANUAL, AUTOMATIC, X FWD, RWD, 4WD

DATE VEHICLE RECEIVED: NA

ODOMETER READING: 102

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	Yes
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

CERTIFICATION DATA FROM VEHICLE'S LABEL:

VEHICLE MANUFACTURED BY: Honda of Canada, Mfg.

DATE OF MANUFACTURE: 04/93

VIN: 2HGEH2356PH530319

GVWR: 3055 LBS

GAWR: FRONT: 1610 LBS., REAR: 1500 LBS.

TABLE 2 TEST VEHICLE INFORMATION CONT'D.

TIRES ON VEHICLE (MFR., LINE, SIZE): Goodyear, Invicta GL, P165/70R13

TIRE PRESSURE WITH MAXIMUM CAPACITY VEHICLE LOAD: FRONT: 44 PSI
REAR: 44 PSI

SPARE TIRE (MFR., SIZE): Space saver, T105/80D14

TYPE OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manually adjustable

MAXIMUM WIDTH: 1690 MILLIMETERS

WHEELBASE: 2570 MILLIMETERS

LOCATION OF LABEL STATING TIRE & CAPACITY DATA:

The label was located in the glove box.

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: P165/70R13 78S

RECOMMENDED COLD TIRE PRESSURE: FRONT: 35 PSI; REAR: 32 PSI

DESIGNATED SEATING CAPACITY: 2 FRONT 3 REAR 5 TOTAL

VEHICLE CAPACITY WEIGHT: 850 LBS.

TEST VEHICLE ATTITUDE (ALL MEASUREMENTS ARE IN MILLIMETERS):

DELIVERED ATTITUDE: LF 657; RF 657; LR 660; RR 660

PRE-TEST ATTITUDE: LF 639; RF 642; LR 616; RR 616

POST-TEST ATTITUDE: LF 592; RF 635; LR NA; RR 635

TABLE 2 TEST VEHICLE INFORMATION CONT'D.

WEIGHT OF TEST VEHICLE AS RECEIVED (WITH MAXIMUM FLUIDS):

RIGHT FRONT	288 KG	RIGHT REAR	164 KG
LEFT FRONT	291 KG	LEFT REAR	169 KG
TOTAL FRONT WEIGHT	579 KG	(63.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	333 KG	(36.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	912 KG		
TARGET TEST WEIGHT	1122 KG ¹		

WEIGHT OF TEST VEHICLE:

RIGHT FRONT	319 KG	RIGHT REAR	234 KG
LEFT FRONT	314 KG	LEFT REAR	255 KG
TOTAL FRONT WEIGHT	633 KG	(56.4% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	489 KG	(43.6% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	1122 KG		

WEIGHT OF BALLAST SECURED IN VEHICLE CARGO AREA: None

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: None

CG = 1120 MILLIMETERS REARWARD OF FRONT WHEEL CENTERLINE

¹The target test weight was established during Test 920825.

TABLE 3 TRUCK INFORMATION

WEIGHT DISTRIBUTION

FRONT: 3742 KG

REAR: 7611 KG

AXLE SPACING

FRONT: 3835 MM

REAR: 1308 MM

DISTANCE OF C.G. BEHIND FRONT AXLE: 3009 MM

BUMPER DESCRIPTION: Lowered flat bumper of 60 psi energy absorbing honeycomb.

TRUCK DAMAGE: The 60 psi honeycomb bumper face became detached from the truck during the crash test.

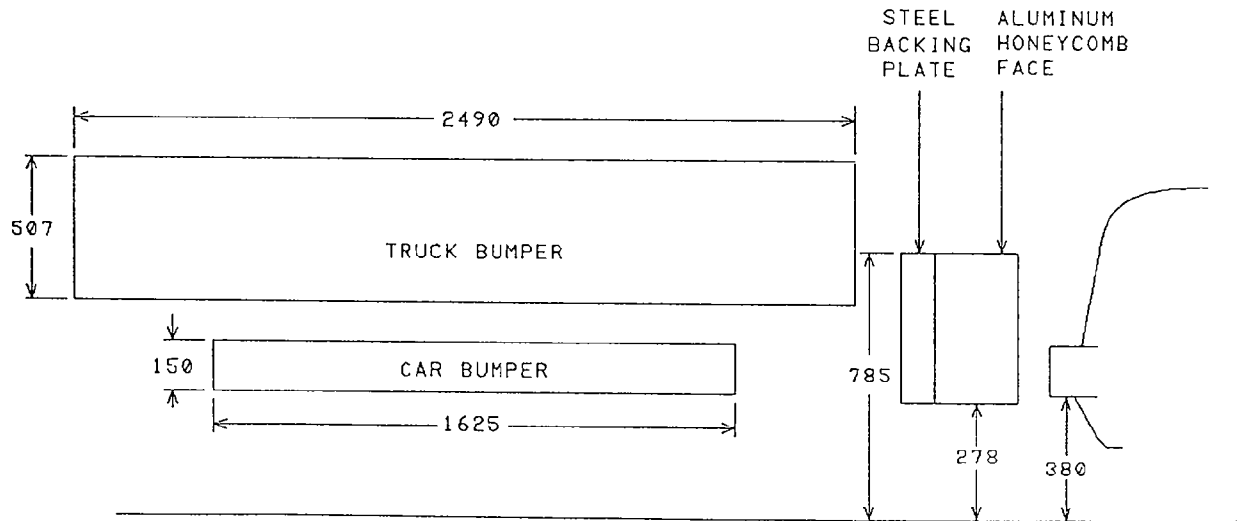


TABLE 4 POST-IMPACT DATA

TEST NUMBER: 930621

TEST DATE: 06/21/93

TEST TIME: 1416

TEST TYPE: Heavy Truck into Stationary Vehicle

IMPACT ANGLE: 340

AMBIENT TEMPERATURE AT IMPACT AREA: 22° C

TEMPERATURE IN OCCUPANT COMPARTMENT: 22° C

IMPACT VELOCITY: PRIMARY = 80.3 KPH
SECONDARY = 80.3 KPH

(SPECIFIED RANGE = 79.7 TO 81.3 KPH)

DISTANCE FROM VEHICLE TO BARRIER: ENTERING VELOCITY TRAP = 381 MM

EXITING VELOCITY TRAP = 51 MM

TEST VEHICLE STATIC CRUSH (ALL MEASUREMENTS ARE IN MILLIMETERS):

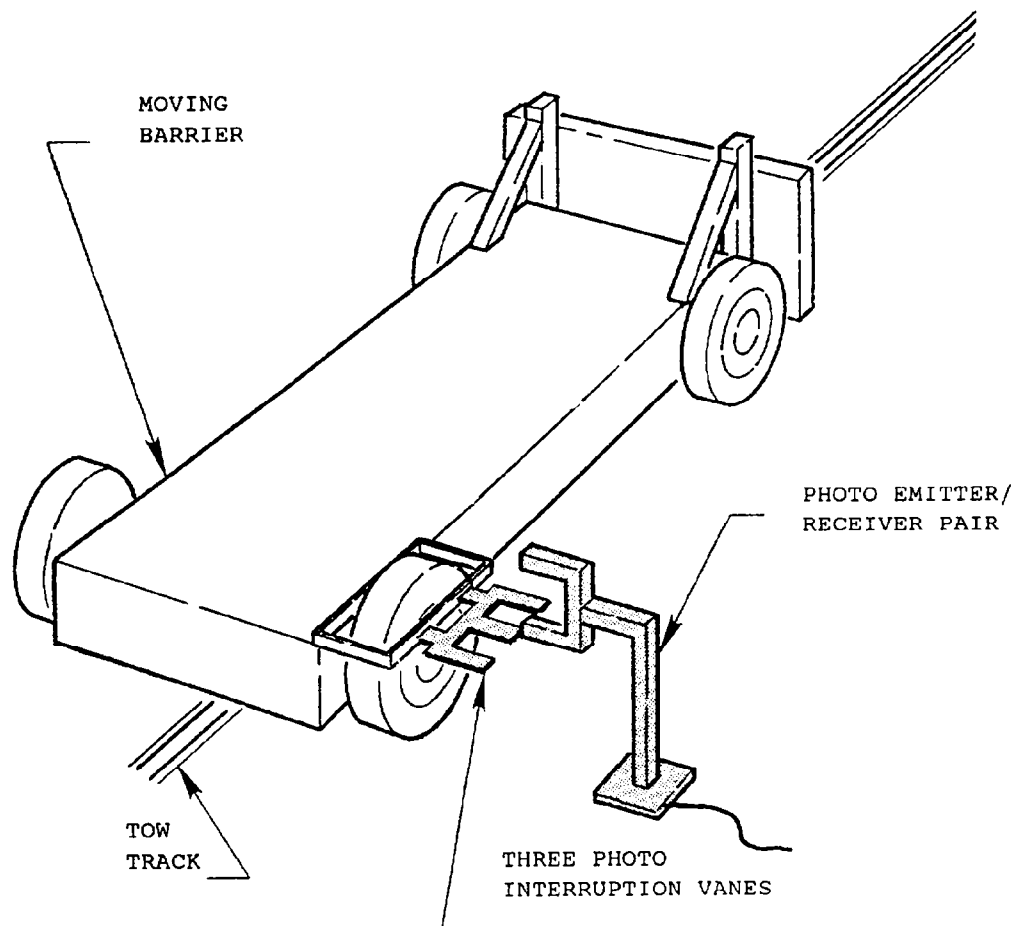
OVERALL LENGTH OF TEST VEHICLE: PRE-TEST: L 3910; C 4070; R 3910

POST-TEST: L 3535; C 3519; R 3637

TOTAL CRUSH: L 375; C 551; R 273

AVERAGE CRUSH: 400

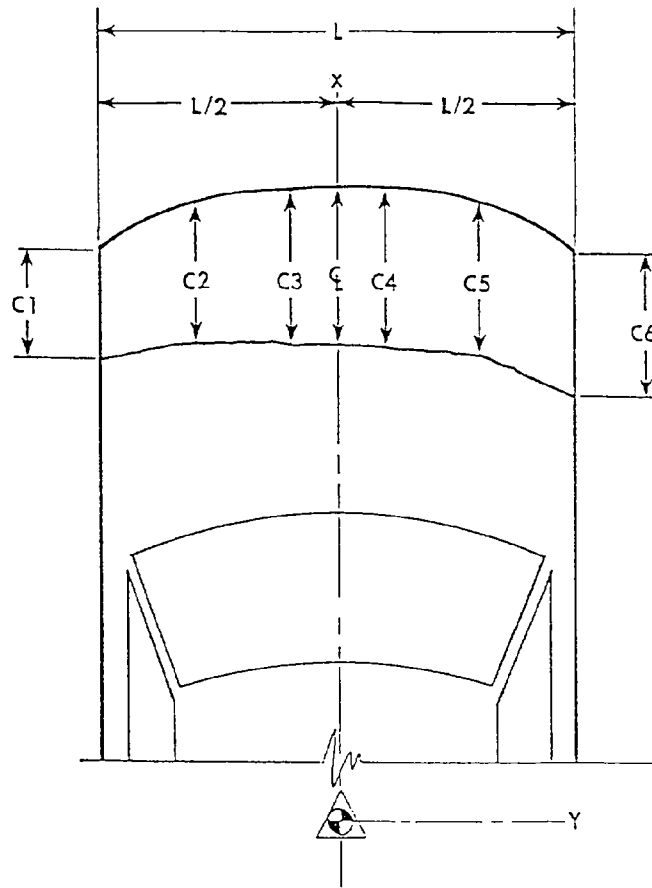
FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane clears emitter/receiver 51 millimeters before impact.

The vanes have 305-millimeter spacing.

FIGURE 2 VEHICLE CRUSH



NOTES: L is pre-test length of contact surface.
 $C1$ through $C6$ are spaced equally apart.
 CL is vehicle centerline.
 All measurements are in millimeters.

Vehicle Honda Civic

PRE-TEST		POST-TEST		CRUSH	
L	<u>1422</u>				
C1	<u>3910</u>	C1	<u>3535</u>	C1	<u>375</u>
C2	<u>4023</u>	C2	<u>3599</u>	C2	<u>424</u>
C3	<u>4068</u>	C3	<u>3533</u>	C3	<u>535</u>
C4	<u>4071</u>	C4	<u>3545</u>	C4	<u>526</u>
C5	<u>4032</u>	C5	<u>3604</u>	C5	<u>428</u>
C6	<u>3910</u>	C6	<u>3637</u>	C6	<u>273</u>
CL	<u>4070</u>	CL	<u>3519</u>	CL	<u>551</u>

FIGURE 3 PRE-TEST AND POST-TEST MEASUREMENT POINTS

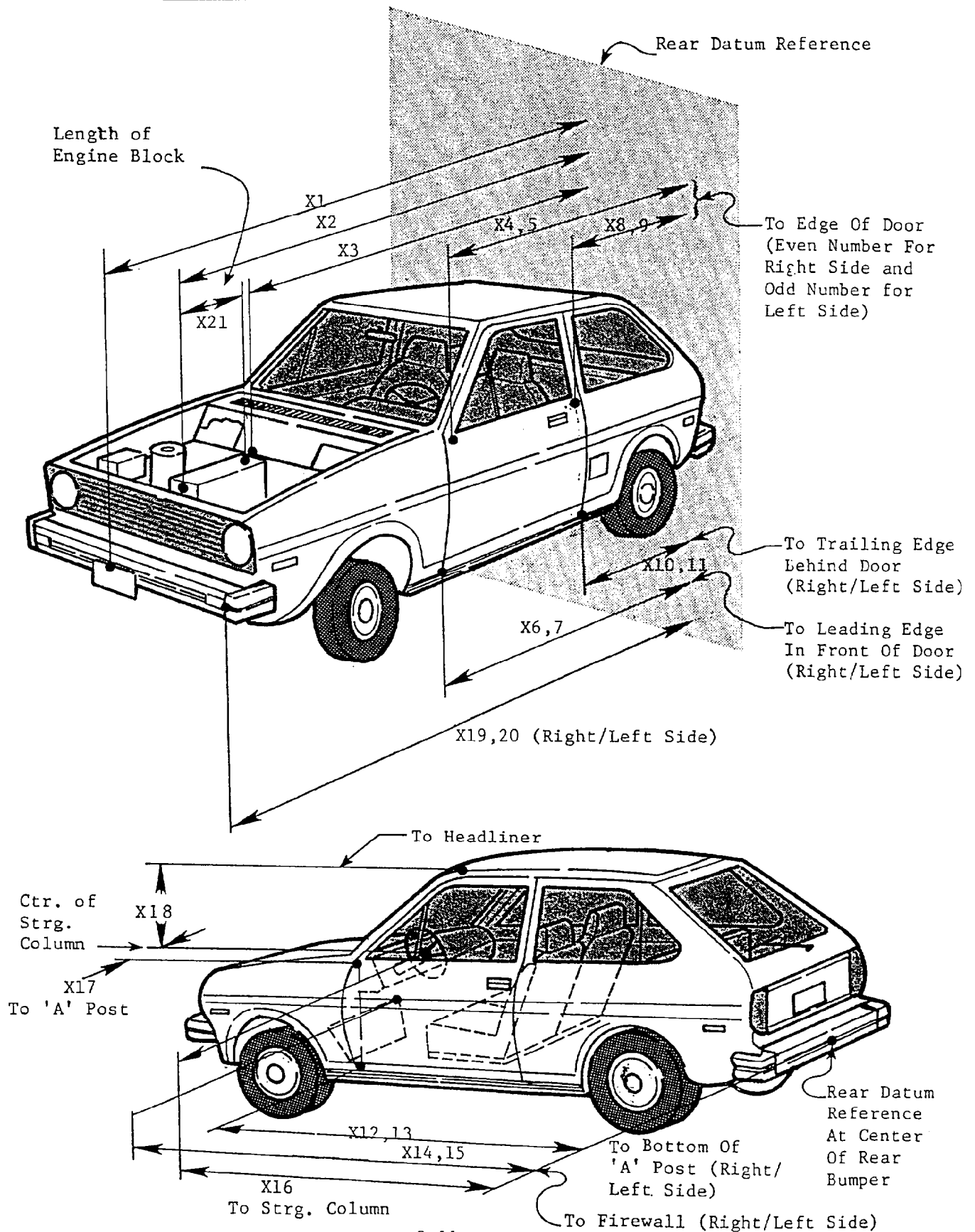
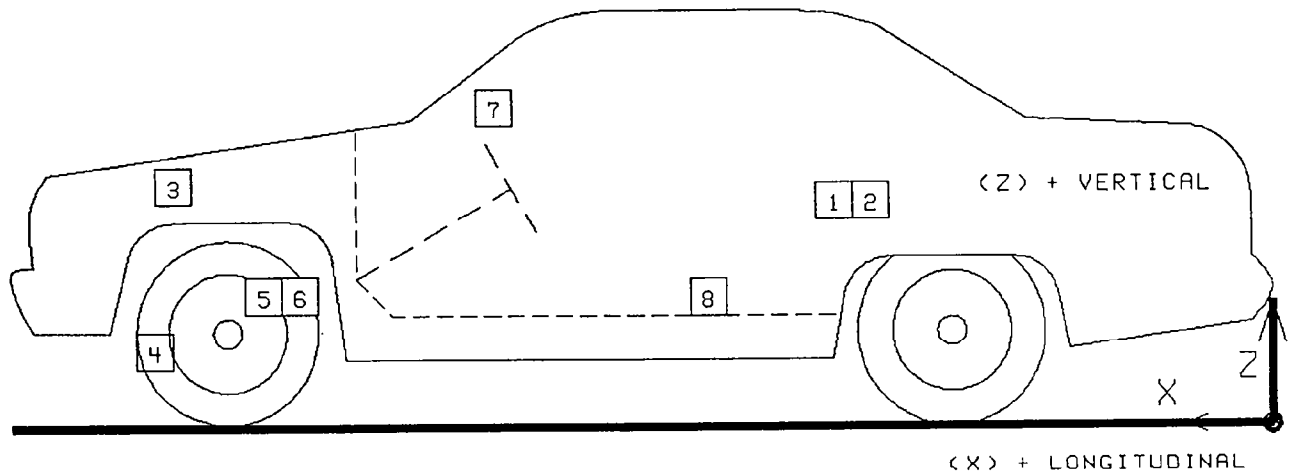


TABLE 5 IMPACTED VEHICLE MEASUREMENTS

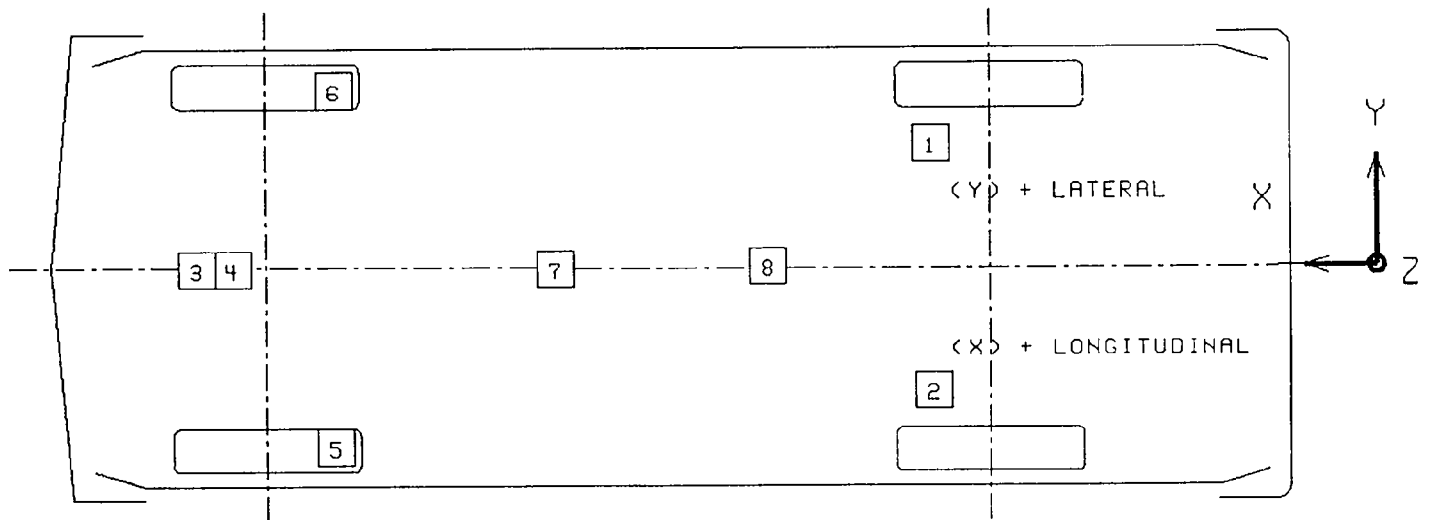
VEHICLE MAKE/MODEL: <u>Honda/Civic</u>		TEST NUMBER: <u>930621</u>			
NO.	TYPE OF MEASUREMENT	PRE-TEST	POST-TEST	DIFF.	
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	4070	3519	551	
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	3585	3341	244	
X3	REAR SURFACE OF VEHICLE TO FIREWALL	3048	2874	174	
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	2732	2724	8	
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	2735	2616	119	
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	2740	2723	17	
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	2739	2642	97	
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	1473	1480	-7	
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	1475	1464	11	
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	1534	1513	21	
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	1532	1492	40	
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	2727	2752	-25	
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	2731	2541	190	
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	2940	2859	81	
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	2969	2791	178	
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	2282	2135	147	
X17	CENTER OF STEERING COLUMN TO "A" POST	290	295	-5	
X18	CENTER OF STEERING COLUMN TO HEADLINER	450	595	-145	
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	3910	3637	273	
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	3910	3535	375	
X21	LENGTH OF ENGINE BLOCK	410	410	0	

All distance measurements are in millimeters.

FIGURE 4 VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 6

STRUCK VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 930621

No. LOCATION	X*	Y*	Z*	POSITIVE		NEGATIVE	
				DIRECTION		DIRECTION	
				MAX G	MSEC	MAX G	MSEC
1 LEFT REAR SEAT CROSSMEMBER LONGITUDINAL	1410	375	391				
				1.3	303.0	31.5	35.1
2 RIGHT REAR SEAT CROSSMEMBER LONGITUDINAL	1410	-380	405				
				2.9	127.9	38.6	75.3
3 ENGINE TOP LONGITUDINAL	3500	32	760				
				15.3	35.0	100.1	23.5
4 ENGINE BOTTOM LONGITUDINAL	3424	214	182				
				4.5	81.5	74.9	23.8
5 RIGHT BRAKE CALIPER LONGITUDINAL	3334	-655	260				
				30.7	57.1	94.5	45.1
6 LEFT BRAKE CALIPER LONGITUDINAL	3333	655	263				
				35.1	34.5	107.8	21.9

TABLE 6

STRUCK VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY CONTINUED

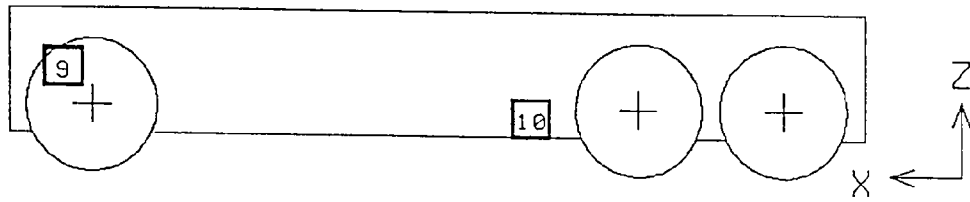
TEST NUMBER 930621

No. LOCATION	X*	Y*	Z*	POSITIVE		NEGATIVE	
				DIRECTION		DIRECTION	
				MAX G MSEC		MAX G MSEC	
7 INSTRUMENT PANEL CENTER	2636	0	915				
LONGITUDINAL				26.5	78.9	82.4	54.5
8 CENTER OF GRAVITY	2157	0	333				
LONGITUDINAL				1.8	147.6	43.7	42.3
LATERAL				3.2	7.9	24.1	67.5
VERTICAL				23.0	50.0	23.1	37.4
RESULTANT				43.9	42.3		

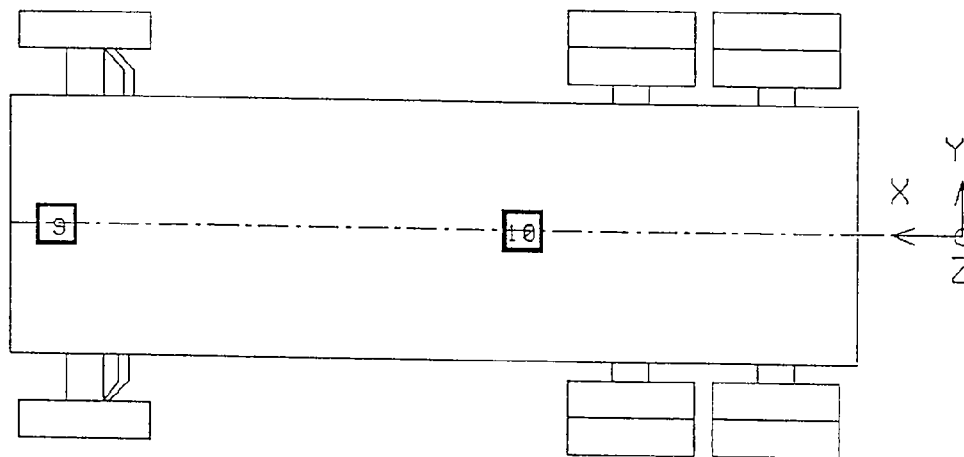
* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN MILLIMETERS.

REFERENCE: X: + FORWARD FROM REAR BUMPER
 Y: + LEFTWARD FROM VEHICLE CENTERLINE
 Z: + UPWARD FROM GROUND LEVEL

FIGURE 5 TRUCK ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 7

HEAVY TRUCK ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 930621

No. LOCATION	X*	Y*	Z*	POSITIVE		NEGATIVE	
				DIRECTION	MAX G MSEC	DIRECTION	MAX G MSEC
9 FRONT FRAME	6160	0	658				
CROSSMEMBER							
LONGITUDINAL				3.9	16.5	7.9	22.5
LATERAL				7.3	63.0	9.7	73.1
VERTICAL				5.3	85.5	6.9	58.3
RESULTANT				10.2	73.3		
10 CENTER OF GRAVITY	2527	0	1050				
LONGITUDINAL				0.9	31.1	6.6	25.4
LATERAL				1.7	44.3	1.7	73.0

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN MILLIMETERS.

REFERENCE: X: + FORWARD FROM TRAILING EDGE OF TRUCK
Y: + LEFT FROM TRUCK CENTERLINE
Z: + UP FROM GROUND LEVEL

TABLE 8

DUMMY DATA SUMMARY

TEST NUMBER 930621

DRIVER DUMMY

SN: 048

POSITIVE DIRECTION MAX	NEGATIVE DIRECTION MAX	MSEC
------------------------------	------------------------------	------

HEAD ACCELERATION (g)			
LONGITUDINAL	65.7	127.1	94.5 66.8
LATERAL	10.8	64.4	22.8 121.0
VERTICAL	6.6	304.3	38.0 56.3
RESULTANT	96.0	66.8	
HIC	1542 FROM 55.8 TO 84.9		
NECK FORCE (N)			
LONGITUDINAL ¹	---	---	---
LATERAL	478.4	106.0	158.6 184.0
VERTICAL	3337.7	70.0	179.2 28.3
RESULTANT ¹	---	---	
NECK MOMENT (N-M)			
ABOUT X	16.4	84.8	38.6 119.3
ABOUT Y	23.0	112.6	57.8 57.4
ABOUT Z	10.0	245.5	17.6 161.8
RESULTANT	57.9	57.4	
CHEST ACCELERATION (g)			
LONGITUDINAL	13.5	106.0	62.3 69.5
LATERAL	4.2	46.3	31.0 98.3
VERTICAL	13.5	106.4	12.4 52.0
RESULTANT	63.3	69.5	
3 MSEC	60.8		

TABLE 8

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 930621

DRIVER DUMMY

SN: 048

POSITIVE	NEGATIVE
DIRECTION	DIRECTION
MAX	MAX
MSEC	MSEC

CHEST DEFLECTION (mm)					
LONGITUDINAL	0.3	27.8	49.5	70.8	
PELVIS ACCELERATION (g)					
LONGITUDINAL	12.1	112.4	51.6	48.1	
LATERAL	12.7	45.5	28.2	71.6	
VERTICAL	22.9	68.9	10.3	242.9	
RESULTANT	52.9	64.0			
FEMUR LOAD (N)					
LEFT	1617.9	47.1	4613.8	38.8	
RIGHT	1580.5	82.5	6866.3	47.8	
POSITIVE DIRECTION					NEGATIVE DIRECTION
LONGITUDINAL: FORWARD					LONGITUDINAL: REARWARD
LATERAL: LEFTWARD					LATERAL: RIGHTWARD
VERTICAL: UPWARD					VERTICAL: DOWNWARD
FORCE: TENSION					FORCE: COMPRESSION

1 See DATA ACQUISITION EXPLANATIONS

TABLE 9 POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #048	PASSENGER # NA
HEAD	<u>Airbag</u>	<u></u>
CHEST	<u>Airbag</u>	<u></u>
ABDOMEN	<u>Airbag</u>	<u></u>
LEFT KNEE	<u>Instrument panel</u>	<u></u>
RIGHT KNEE	<u>Instrument panel</u>	<u></u>

DOOR OPENING:

	LEFT	RIGHT
FRONT	<u>Tools required</u>	<u>Opened easily</u>
REAR	<u>NA</u>	<u>NA</u>

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	<u>None</u>	<u>None</u>
REAR	<u>NA</u>	<u>NA</u>

GLAZING DAMAGE:

The entire windshield, driver's side door glass, and
driver's side rear window broke out during the crash
test.

OTHER NOTABLE IMPACT EFFECTS:

None

DUMMY KINEMATIC SUMMARY

The dummy translated forward at impact. The airbag inflated and reacted against the dummy's head and upper torso. The dummy's hands and knees impacted the instrument panel. The dummy's head and upper torso translated to the left. The dummy's left hand and the back of the dummy's head impacted the inner panel of the driver's door. The dummy came to rest against the driver's side door.

FIGURE 6 DUMMY AND SEAT POSITIONING DATA

PRE-IMPACT DATA:

MAKE/MODEL/BODY STYLE: Honda/Civic/3-door hatchback
 MODEL YEAR: 1993 COLOR: Red

DATA FROM CERTIFICATION LABEL:

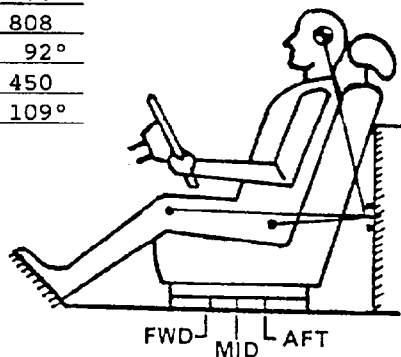
VEHICLE MANUFACTURER: Honda of Canada, Mfg.
 DATE OF MANUFACTURE: 04/93 VIN: 2HGEH2356PH530319
 GVWR: 3055 LBS.; GAWR: FRONT = 1610 LBS.; REAR = 1500 LBS.

POST-IMPACT DATA:

DATE OF TEST: 06/21/93 TIME: 1416 TEMPERATURE: 22° C
 IMPACT VELOCITY: PRIMARY = 80.3 MPH SECONDARY = 80.3 MPH
 REQUIRED IMPACT VELOCITY RANGE: 79.7 TO 81.3 MPH
 SEAT TYPE: Bucket ADJUSTER TYPE: Manual
 FRONT SEAT BACK TYPE: Manually-adjustable
 TECHNICIANS: R. Benavides, R. Branham, K. Watkins

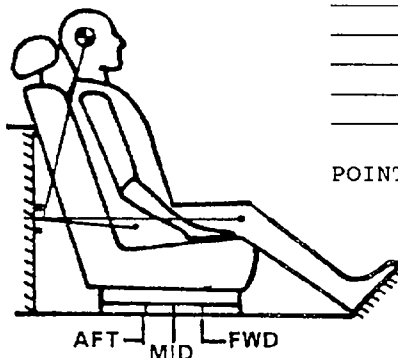
DRIVER DUMMY # 048 TYPE: IIII

HEAD 560
 TARGET 30°
 KNEE 808
 JOINT 92°
 APPROX- 450
 IMATE 109°
 "H"
 POINT

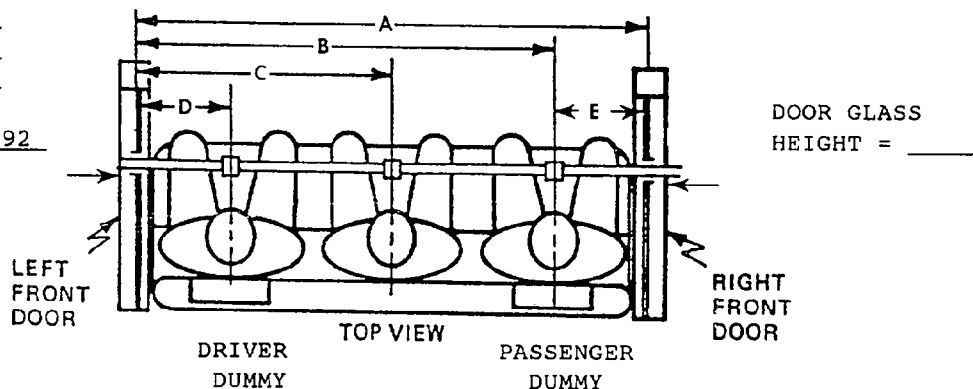


PASSENGER DUMMY # NA TYPE: _____

HEAD _____
 TARGET _____
 KNEE _____
 JOINT _____
 APPROX- _____
 IMATE _____
 "H"
 POINT



A = 1365
 B = NA
 C = NA
 D = 356
 E = NA
 DOOR GLASS
 HEIGHT = 192



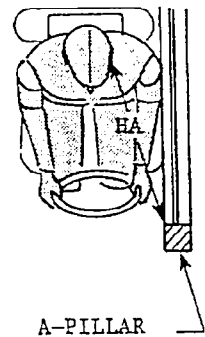
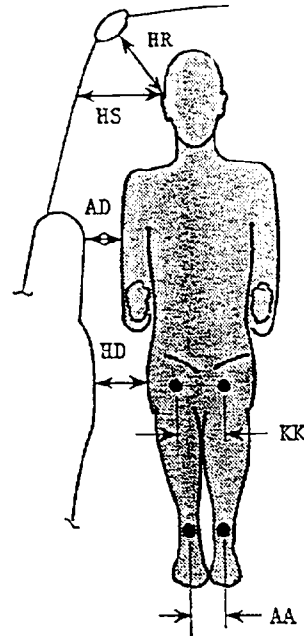
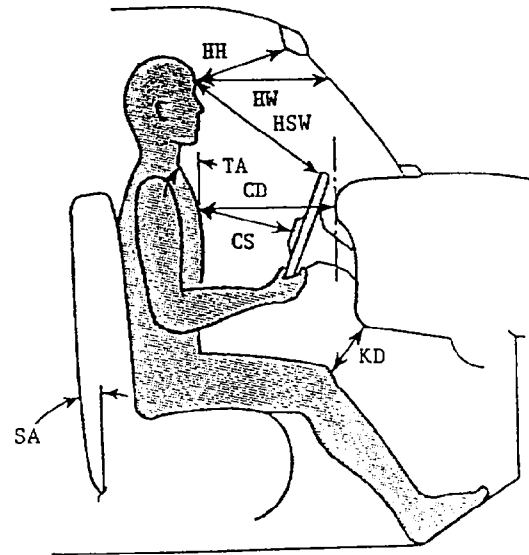
ALL ANGLES ARE RELATIVE TO VERTICAL PLANE THROUGH DOOR STRIKER.
 ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.

FIGURE 7 DUMMY IN VEHICLE POSITIONING DATA

	DRIVER 048	PASSENGER NA
HH	290	
HW	544	
CD	537	
CS	281	
KDL	94	
KDR	97	
TA	18°	
SA	23°	
HSW	430	

	DRIVER 048	PASSENGER NA
HR	161	
HS	282	
AD	106	
HD	150	
KK	210	
AA	250	
HA	477	

KNEE OUTER CLEVIS TO
OUTER CLEVIS SPACING:
DRIVER = 280
PELVIS ANGLE:
DRIVER = 23°

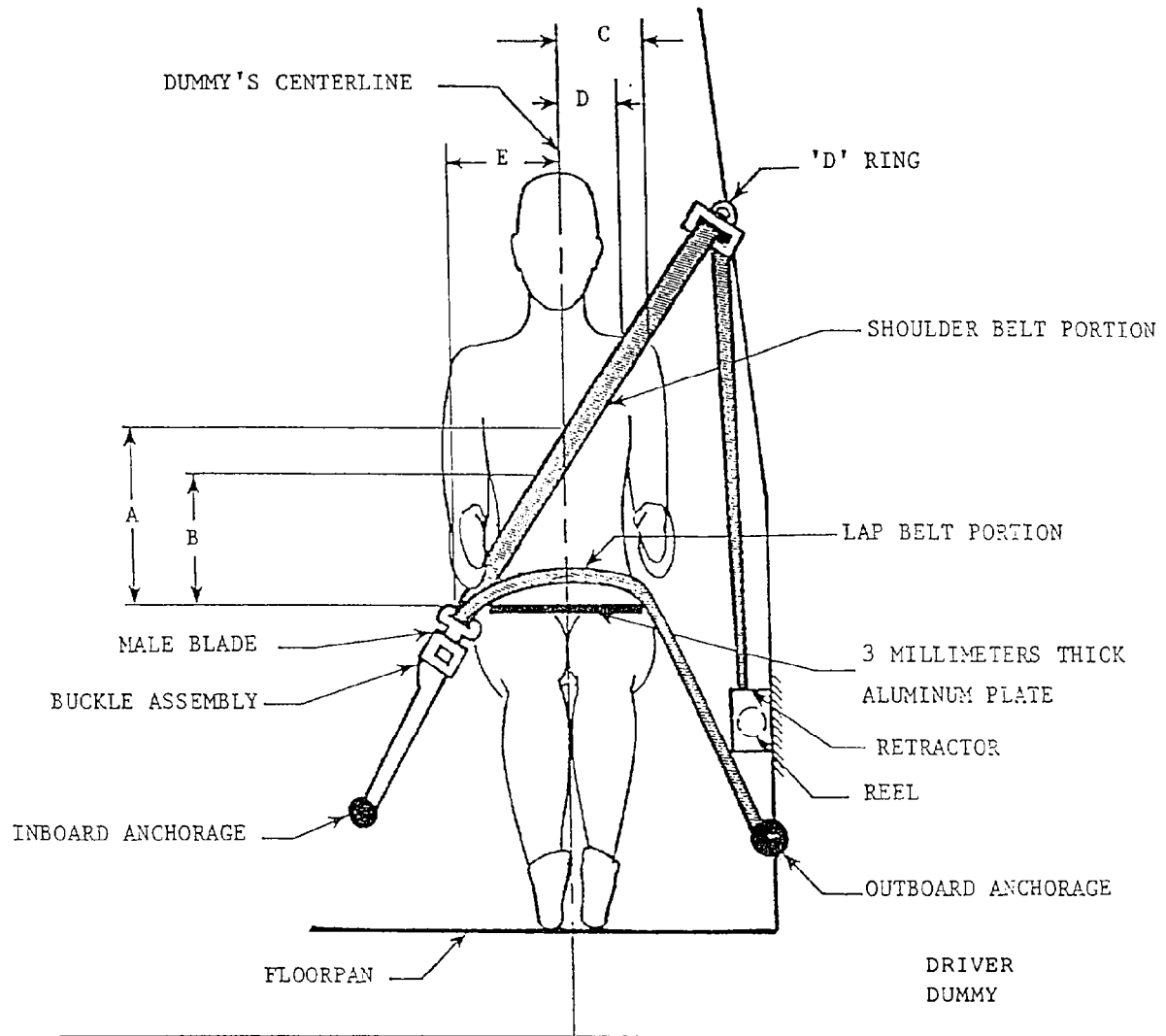


HH = HEAD TO WINDSHIELD HEADER
HW = HEAD TO WINDSHIELD
CD = CHEST TO DASH
CS = CHEST TO STEERING WHEEL
KD = KNEE TO DASH
TA = TORSO ANGLE
SA = SEAT BACK ANGLE
HSW = HEAD TO STEERING WHEEL

HR = HEAD C.G. TARGET TO SIDE ROOF HEADER
HS = HEAD C.G. TARGET TO SIDE WINDOW
AD = ARM TO DOOR
HD = HIP TO DOOR
KK = KNEE TO KNEE
AA = ANKLE TO ANKLE
HA = HEAD C.G. TARGET TO A-PILLAR

TORSO AND SEAT BACK ANGLES ARE RELATIVE TO VERTICAL.
ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.

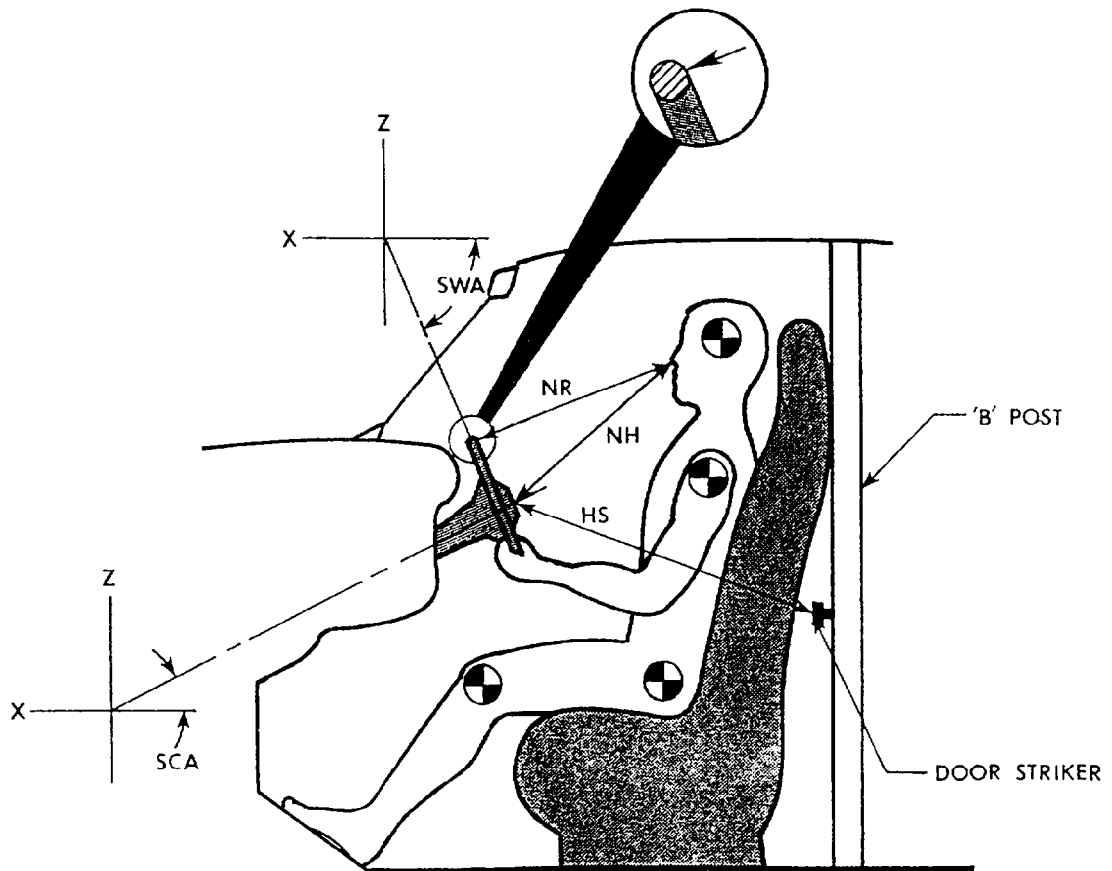
FIGURE 8 SEAT BELT POSITIONING DATA



A - TOP SURFACE OF ALUMINUM PLATE TO BELT UPPER EDGE	344
B - TOP SURFACE OF ALUMINUM PLATE TO BELT LOWER EDGE	265
C - DUMMY CENTERLINE TO OUTER EDGE OF BELT AT CHEST FLESH TOP	85
D - DUMMY CENTERLINE TO INNER EDGE OF BELT AT CHEST FLESH TOP	21
E - DUMMY CENTERLINE TO INTERSECTION OF UPPER TORSO BELT AND LAP BELT	295

ALL MEASUREMENTS ARE IN MILLIMETERS.

FIGURE 9 DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSEMBLY DATA



POSITION OF STEERING COLUMN TILTING AND TELESCOPING ADJUSTMENTS, IF ANY:
There were no steering column adjustments.

MEASUREMENTS

NR	- DISTANCE FROM TIP OF DUMMY'S NOSE TO TOP REAR SURFACE OF STEERING WHEEL RIM.	400
NH	- DISTANCE FROM TIP OF DUMMY'S NOSE TO CENTER OF STEERING COLUMN HUB.	392
HS	- DISTANCE FROM CENTER OF STEERING COLUMN HUB TO THE FORWARD SURFACE OF THE DOOR LOCK STRIKER PIN.	720
SCA	- ANGLE OF STEERING COLUMN RELATIVE TO THE HORIZONTAL X AXIS	22°
SWA	- ANGLE OF STEERING WHEEL RELATIVE TO THE HORIZONTAL X AXIS	68°

ALL DISTANCE MEASUREMENTS ARE IN MILLIMETERS.

FIGURE 10 CAMERA POSITIONS

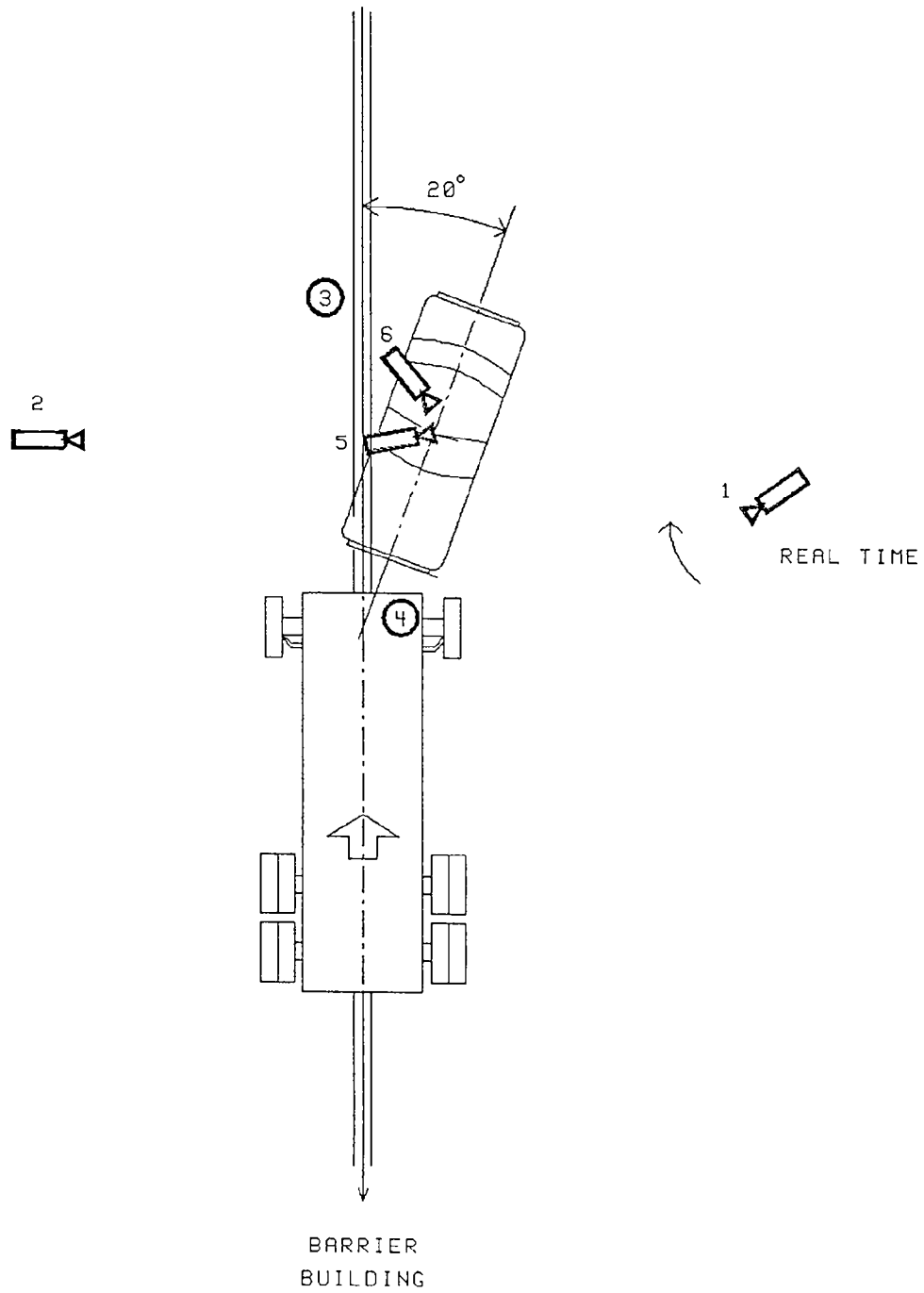


TABLE 10 MOTION PICTURE CAMERA INFORMATION

CAMERA NUMBER	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right panning	Bolex	18	24	Real-time documentation
2	Left wide	Photosonic	13	998	Vehicle dynamics
3	Overhead wide	Photosonic	8.5	990	Vehicle dynamics
4	Onboard truck	Photosonic	8	1000	Dummy kinematics
5	Onboard car-front	Photosonic	8	998	Dummy kinematics
6	Onboard car-rear	Photosonic	8	1005	Dummy kinematics

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST VEHICLE FRONT VIEW



Figure A-2. POST-TEST VEHICLE FRONT VIEW



Figure A-3. PRE-TEST VEHICLE LEFT SIDE VIEW



Figure A-4. POST-TEST VEHICLE LEFT SIDE VIEW



Figure A-5. PRE-TEST VEHICLE REAR VIEW



Figure A-6. POST-TEST VEHICLE REAR VIEW



Figure A-7. PRE-TEST VEHICLE RIGHT SIDE VIEW



Figure A-8. POST-TEST VEHICLE RIGHT SIDE VIEW



Figure A-9. PRE-TEST BUMPER ENGAGEMENT VIEW

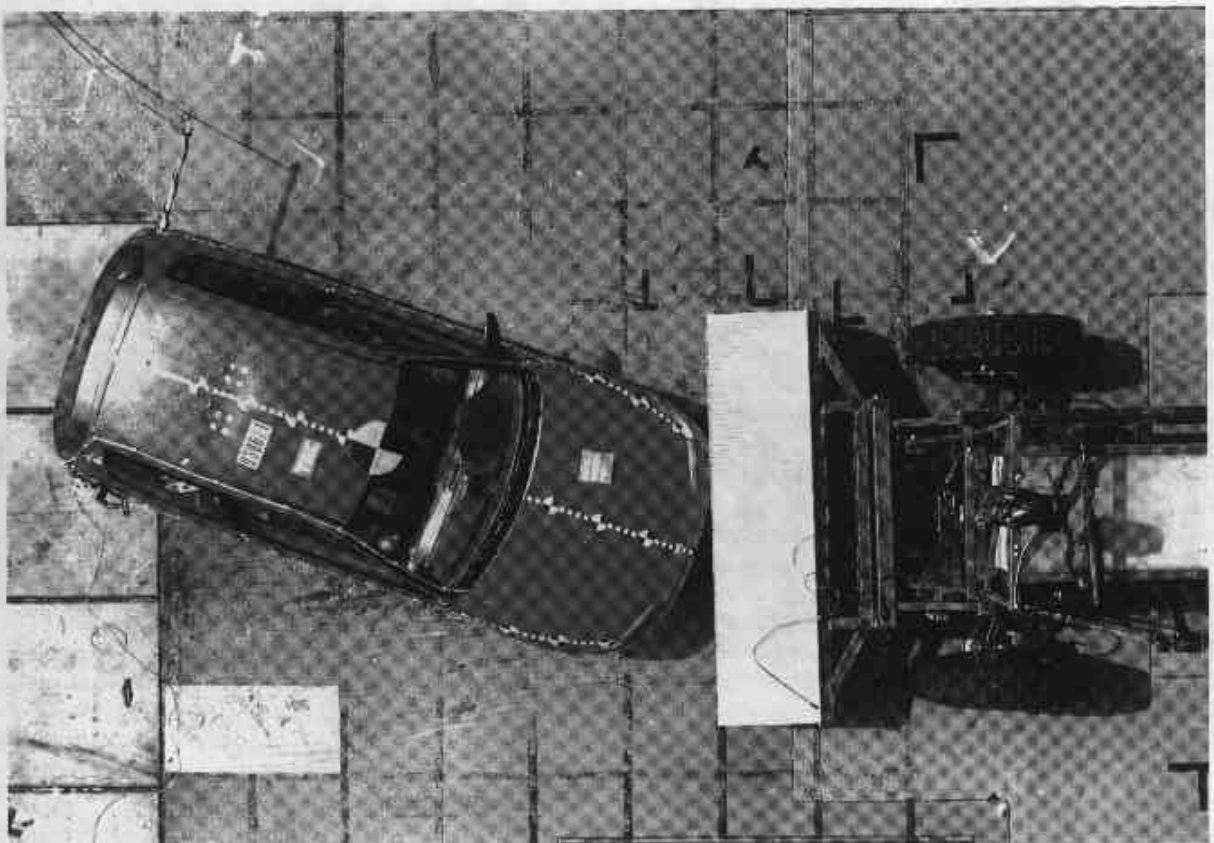


Figure A-10. PRE-TEST OVERHEAD - VIEW 1

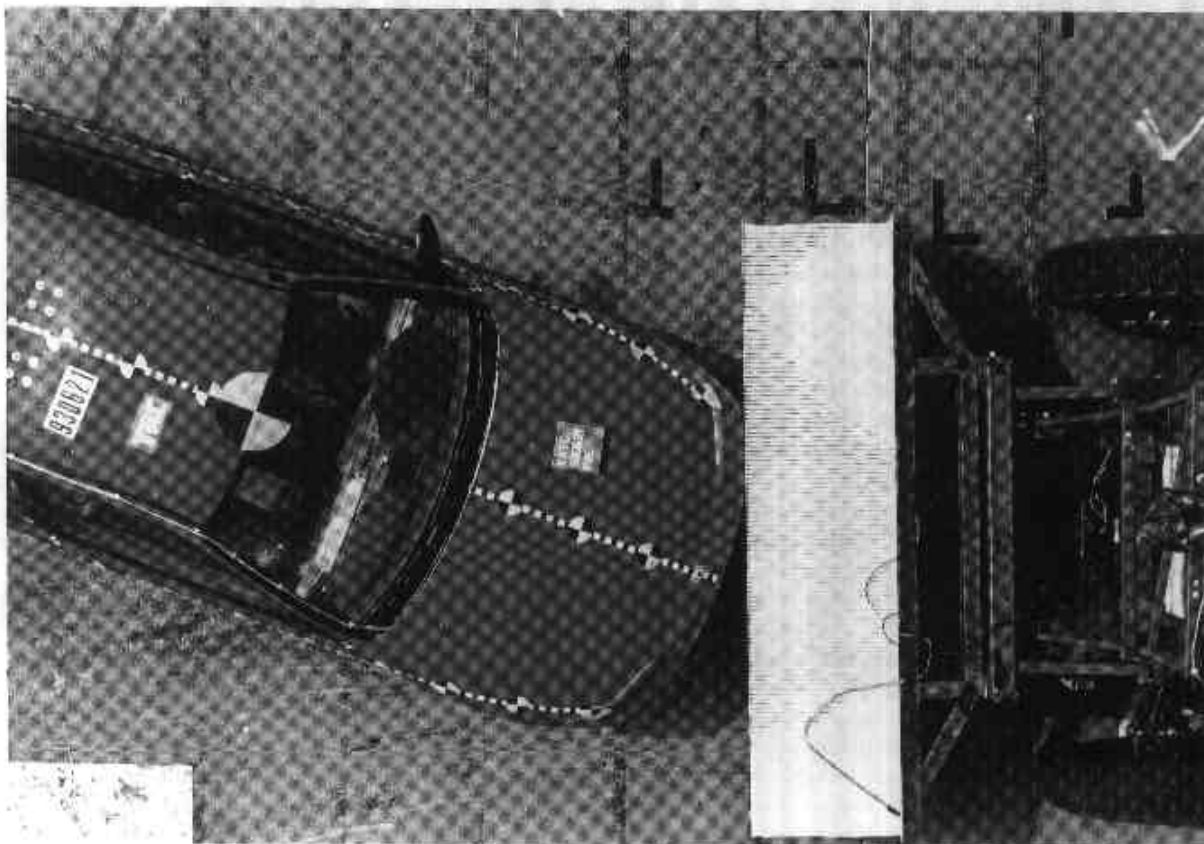


Figure A-11. PRE-TEST OVERHEAD - VIEW 2

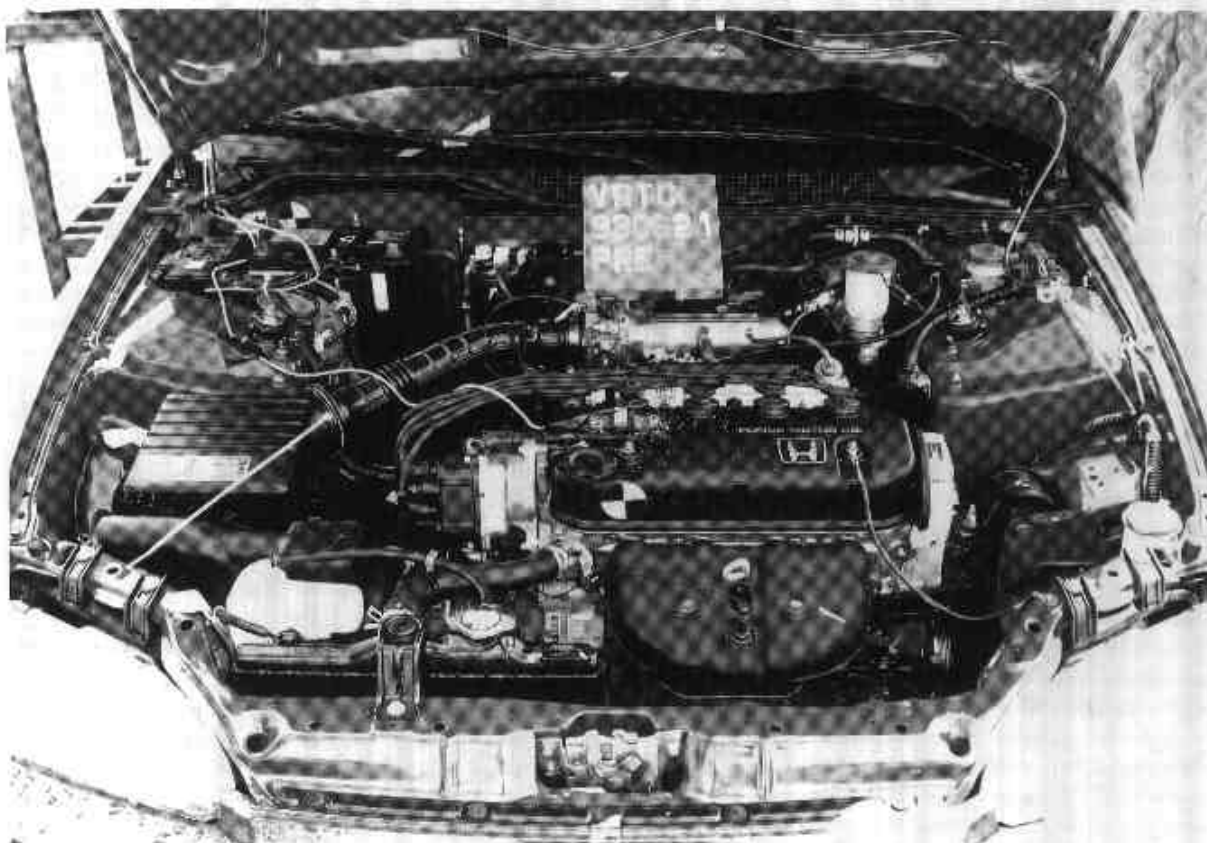


Figure A-12. PRE-TEST VEHICLE ENGINE COMPARTMENT VIEW



Figure A-13. PRE-TEST VEHICLE WINDSHIELD VIEW



Figure A-14. POST-TEST VEHICLE WINDSHIELD VIEW

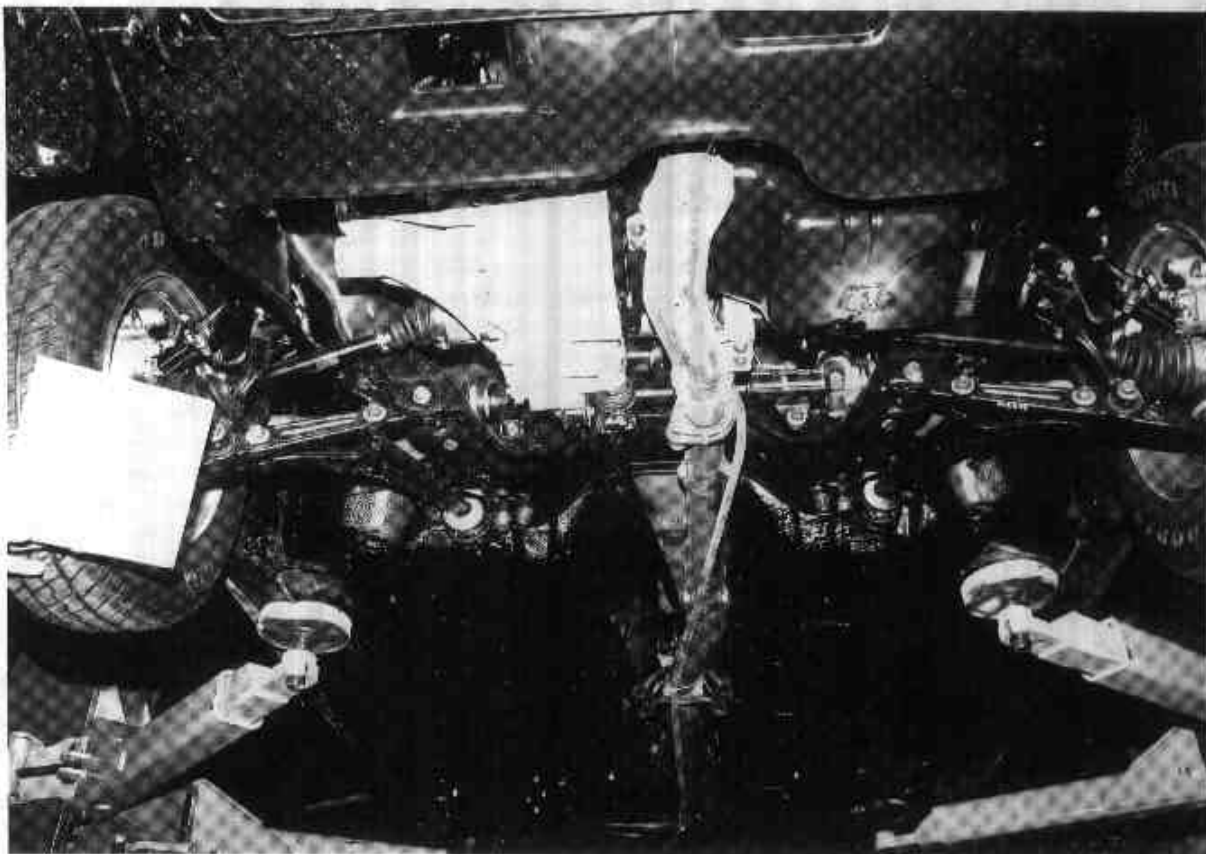


Figure A-15. PRE-TEST VEHICLE FRONT UNDERBODY

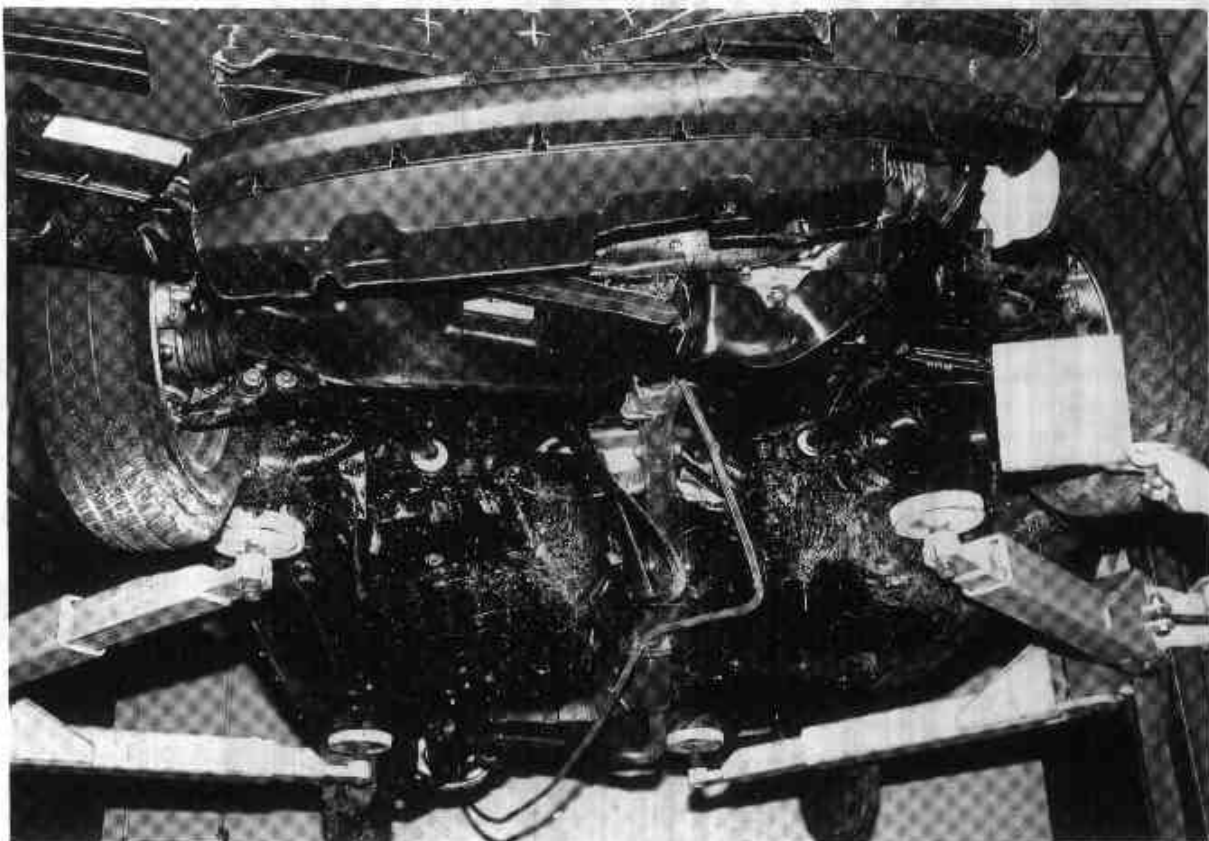


Figure A-16. POST-TEST VEHICLE FRONT UNDERBODY

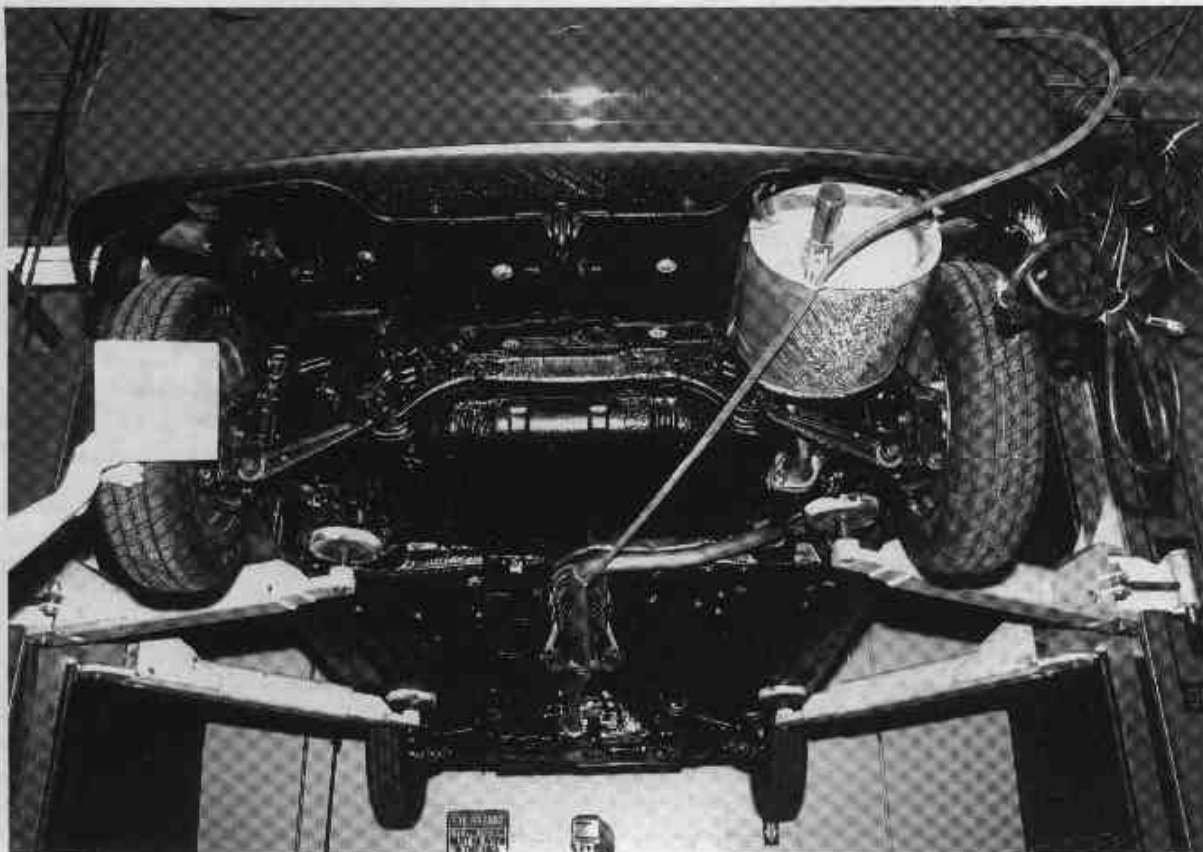


Figure A-17. PRE-TEST VEHICLE REAR UNDERBODY

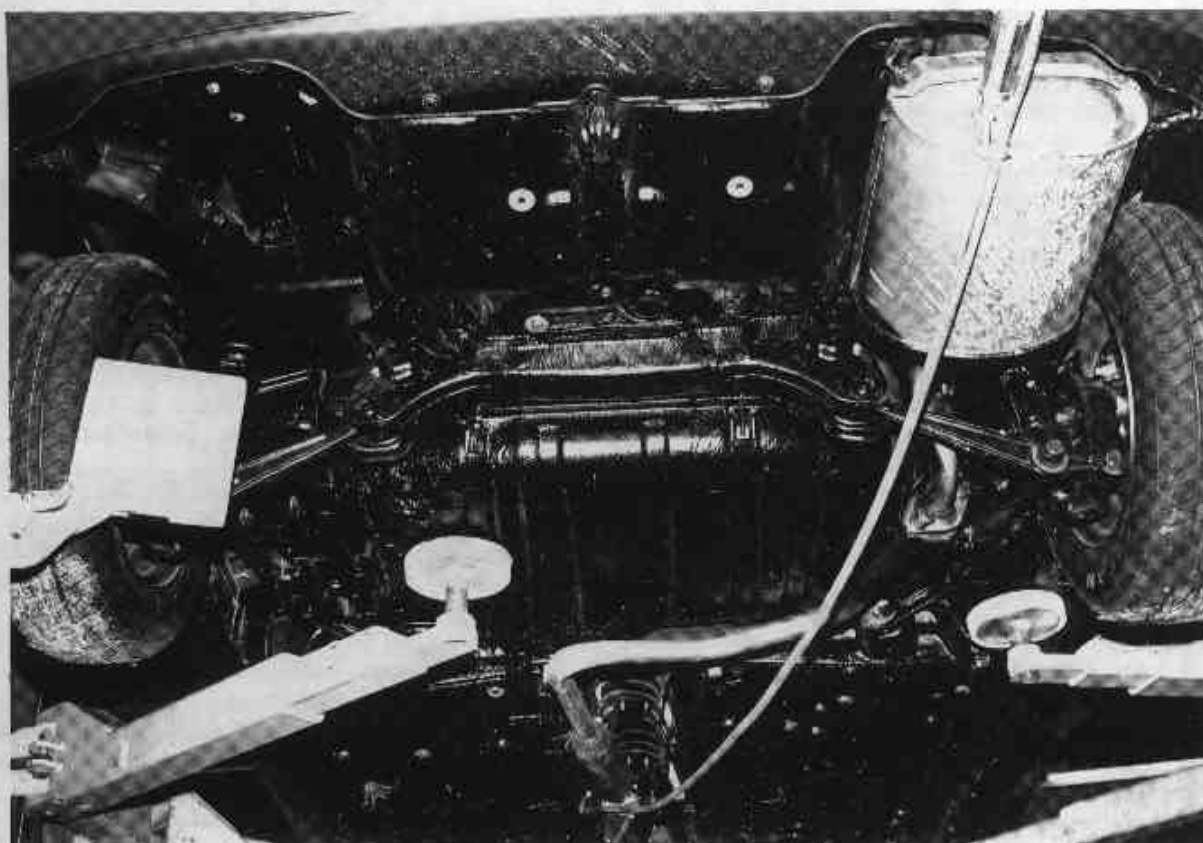


Figure A-18. POST-TEST VEHICLE REAR UNDERBODY

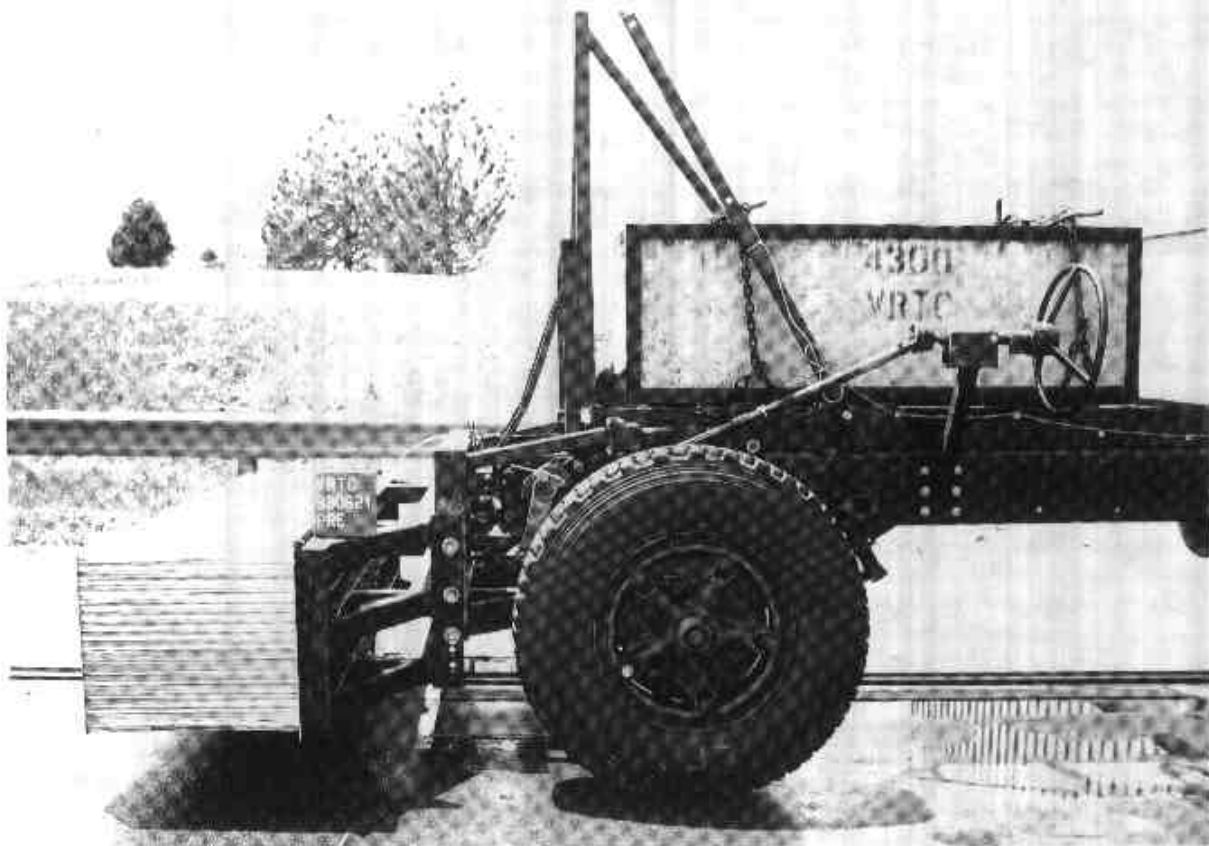


Figure A-19. PRE-TEST TRUCK LEFT SIDE VIEW

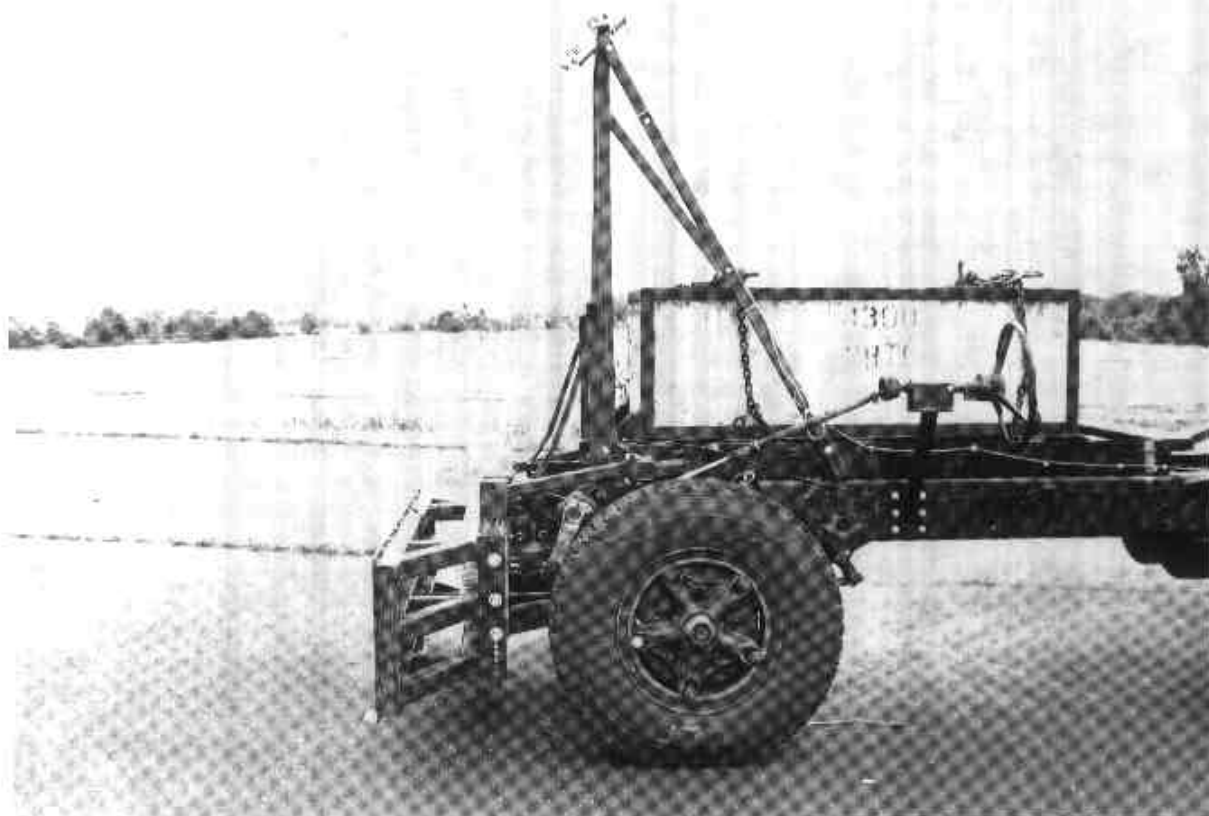


Figure A-20. POST-TEST TRUCK LEFT SIDE VIEW

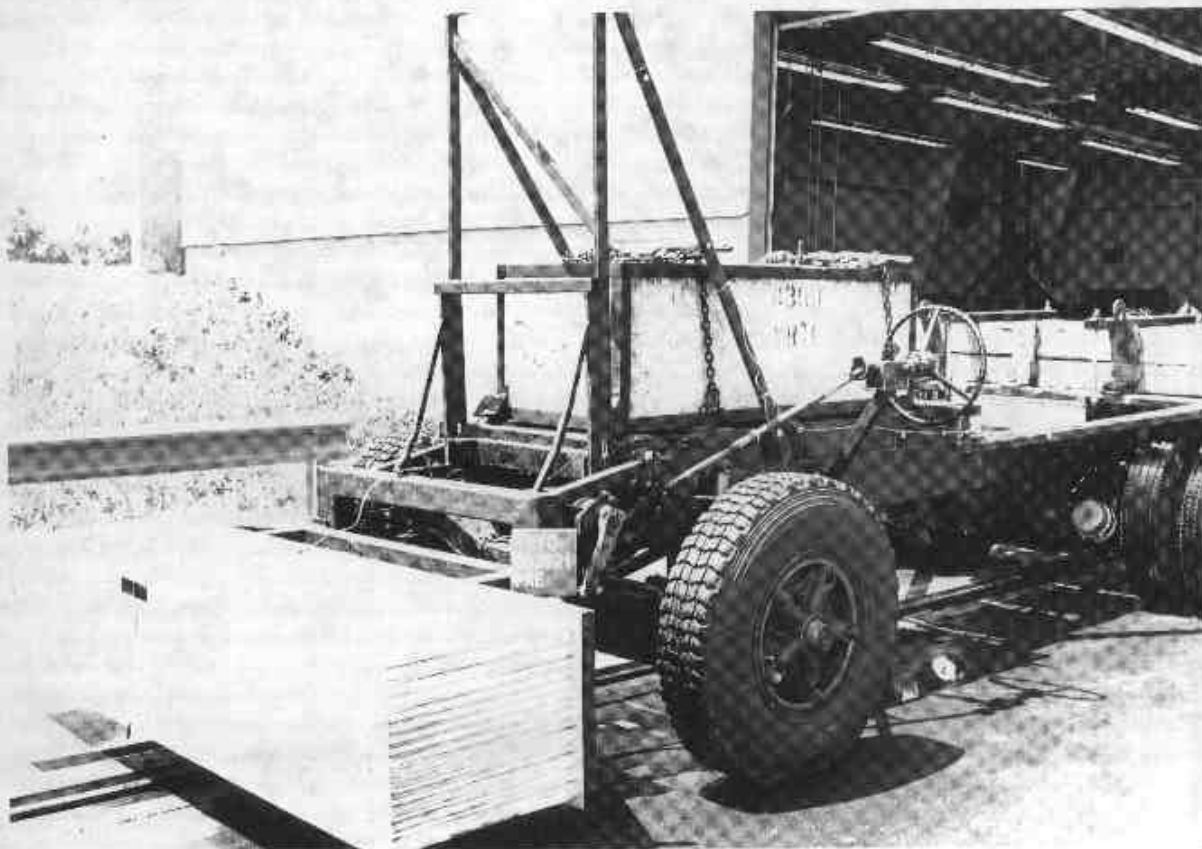


Figure A-21. PRE-TEST TRUCK LEFT FRONT VIEW



Figure A-22. POST-TEST TRUCK LEFT FRONT VIEW

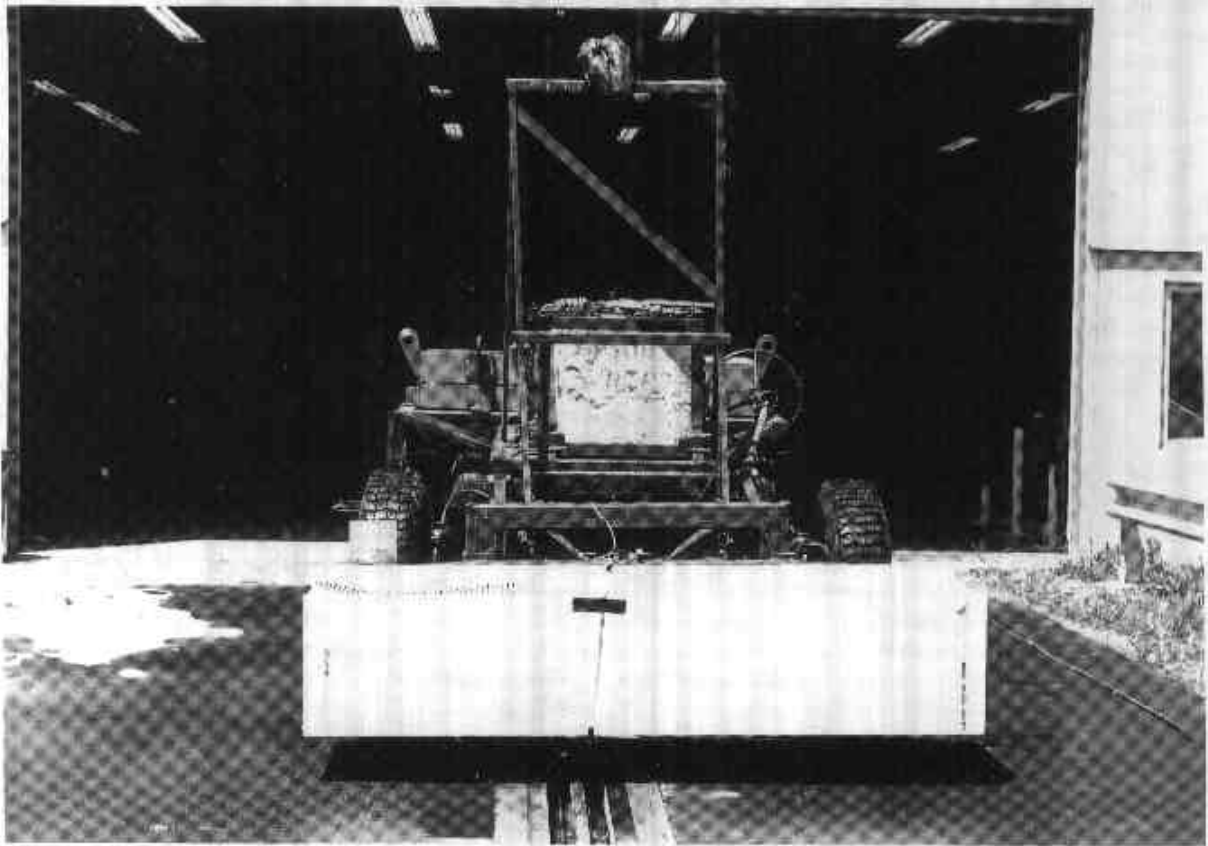


Figure A-23. PRE-TEST TRUCK FRONT VIEW

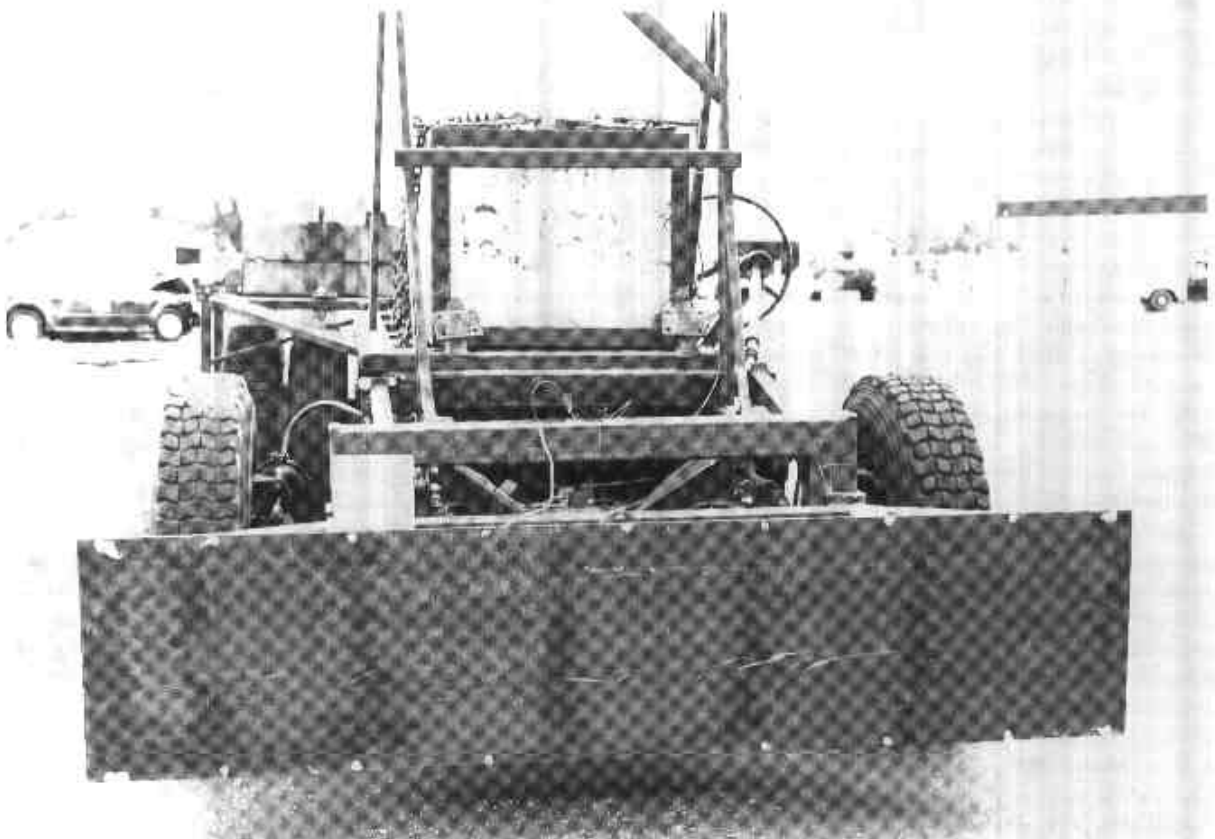


Figure A-24. POST-TEST TRUCK FRONT VIEW

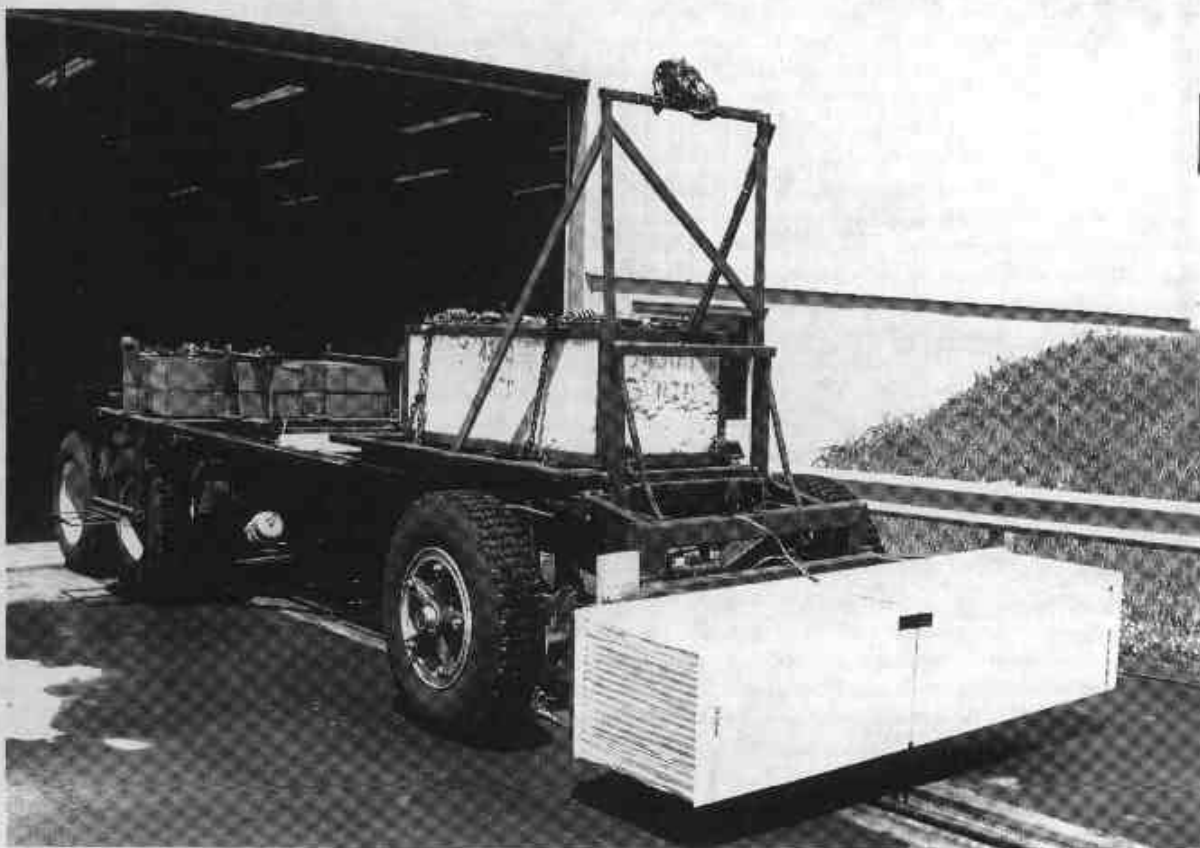


Figure A-25. PRE-TEST TRUCK RIGHT FRONT VIEW

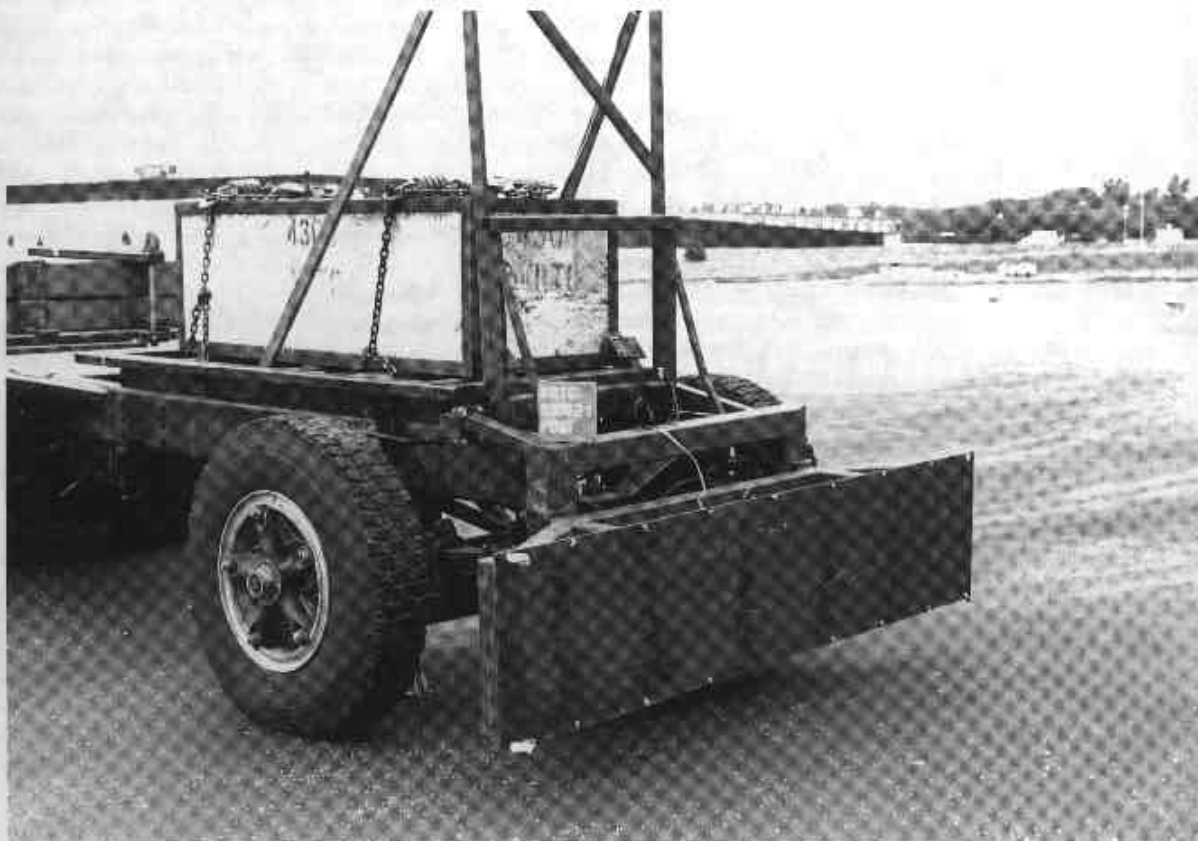


Figure A-26. POST-TEST TRUCK RIGHT FRONT VIEW

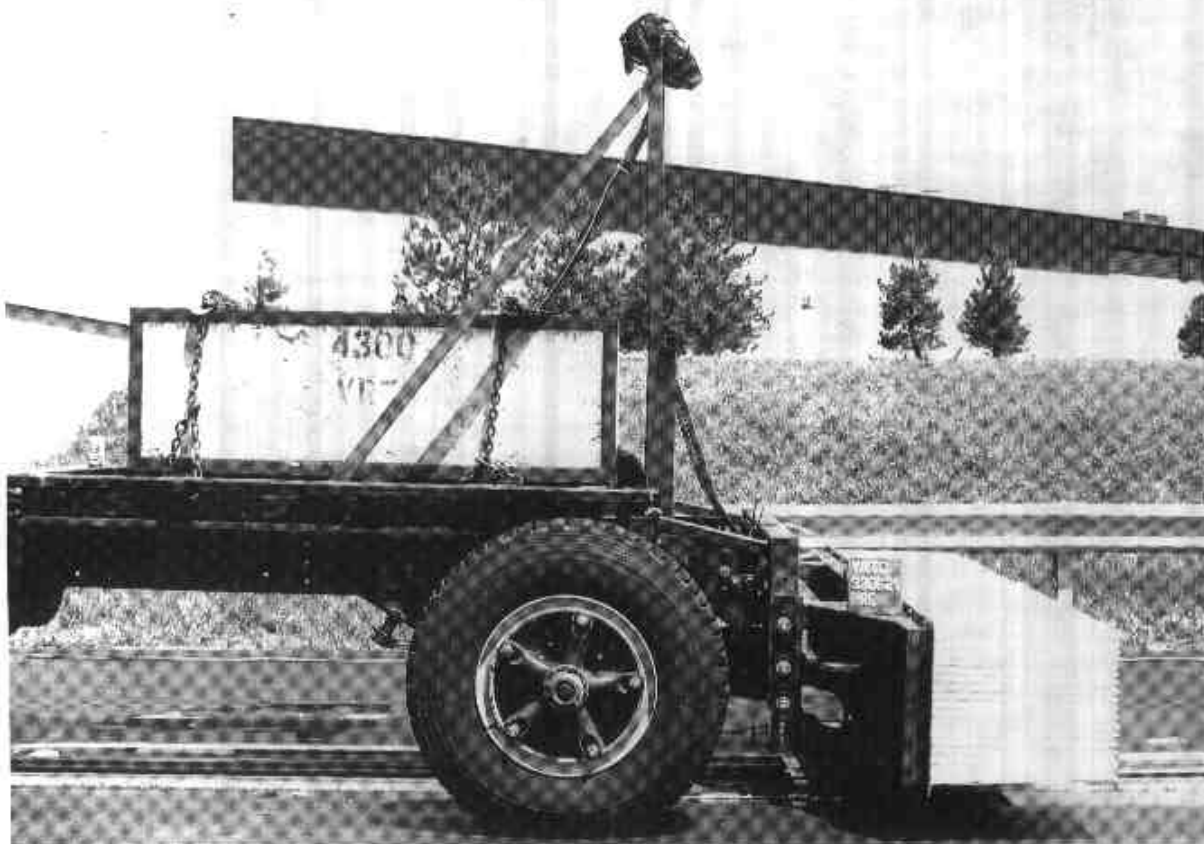


Figure A-27. PRE-TEST TRUCK RIGHT SIDE VIEW



Figure A-28. POST-TEST TRUCK RIGHT SIDE VIEW



Figure A-29. PRE-TEST DUMMY VIEW



Figure A-30. POST-TEST DUMMY VIEW

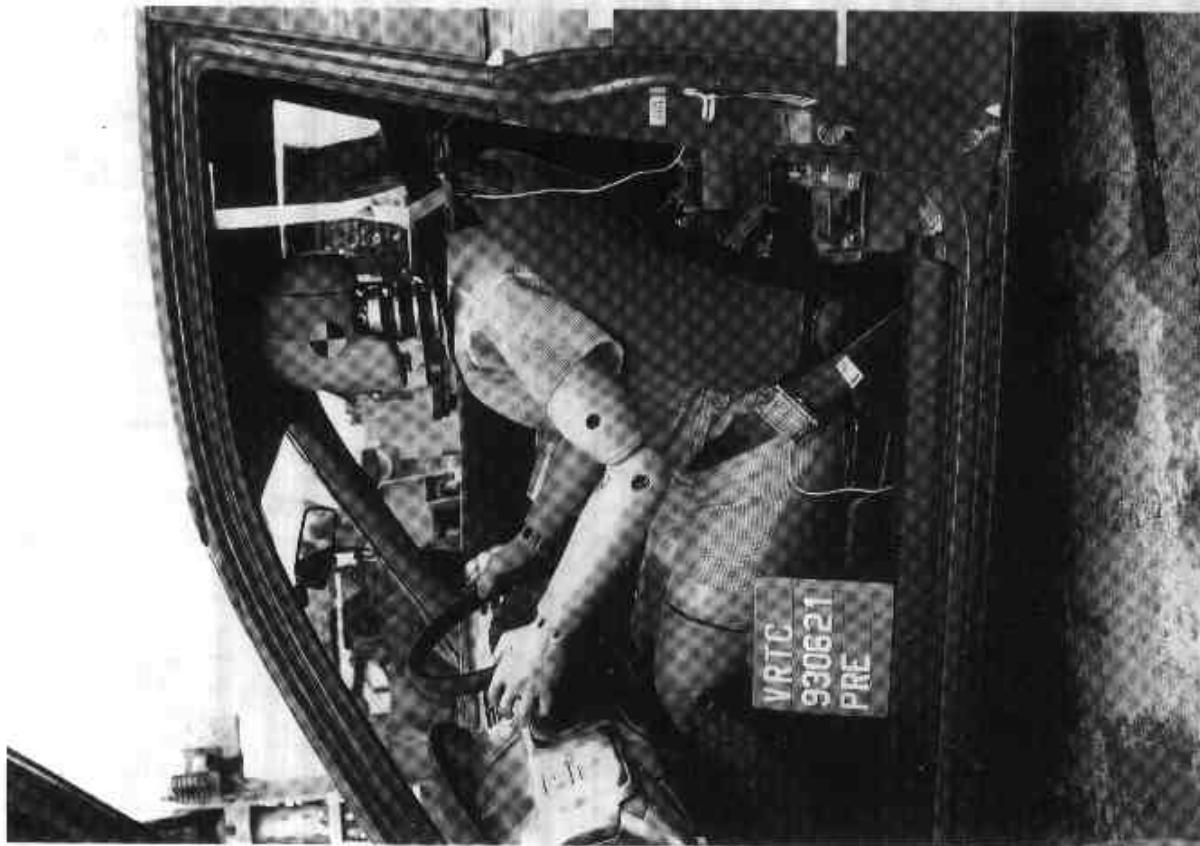


Figure A-31. PRE-TEST VEHICLE INTERIOR AND DUMMY - VIEW 1



Figure A-32. PRE-TEST VEHICLE INTERIOR AND DUMMY - VIEW 2

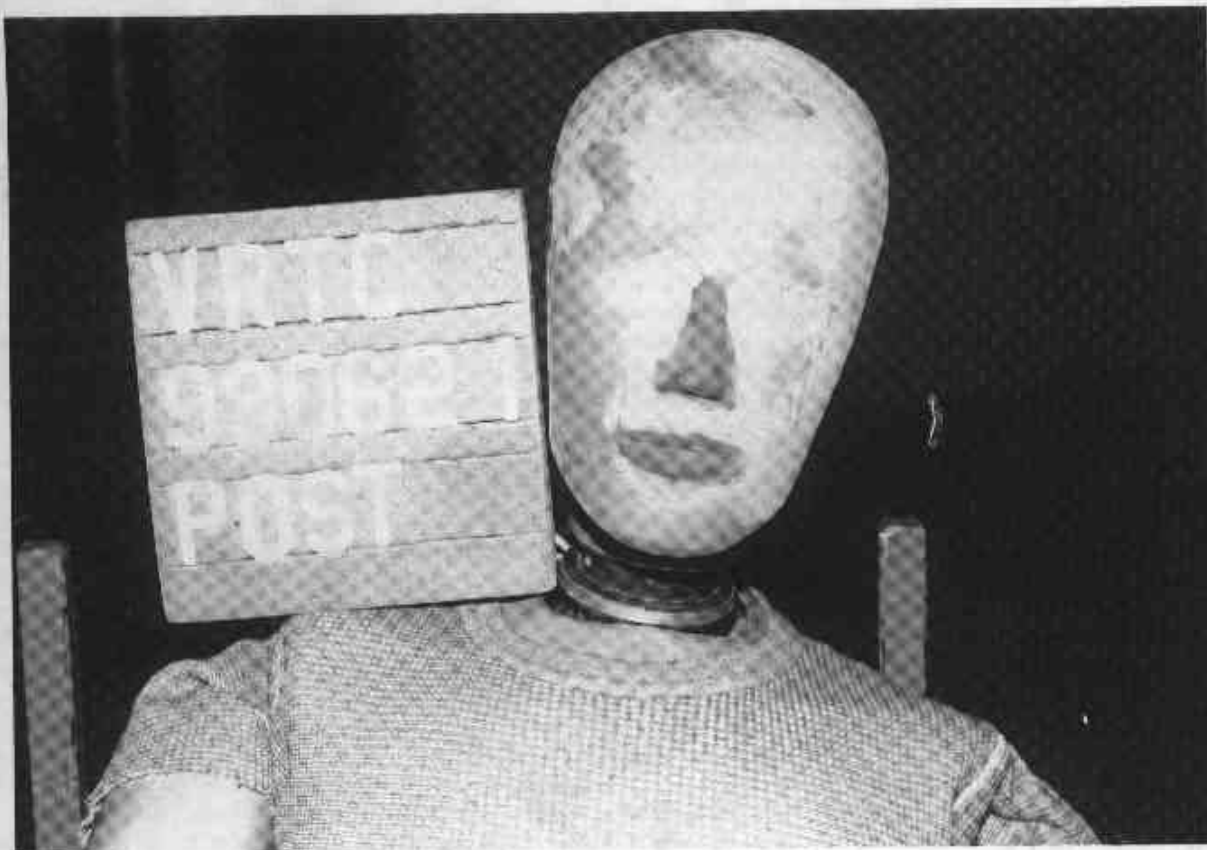


Figure A-33. POST-TEST DUMMY HEAD CONTACT - VIEW 1

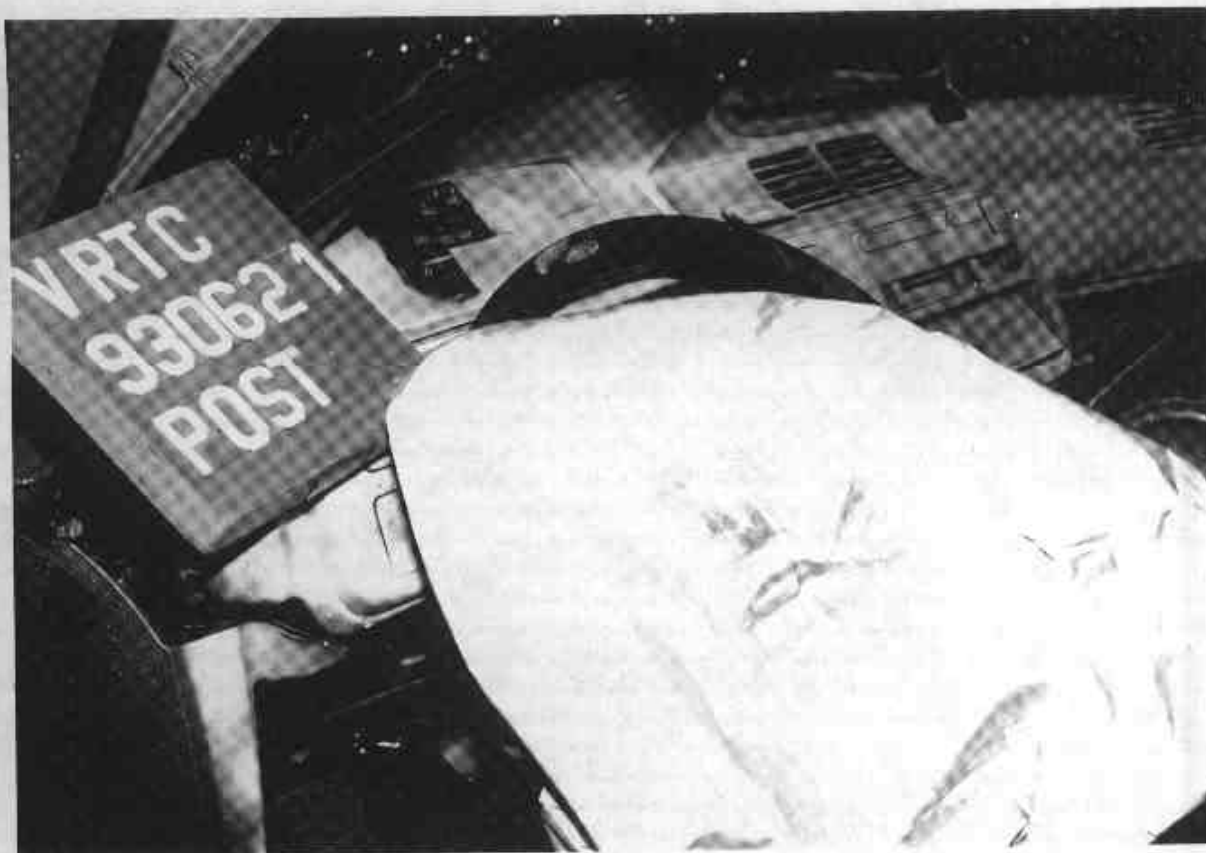


Figure A-34. POST-TEST DUMMY HEAD CONTACT - VIEW 2

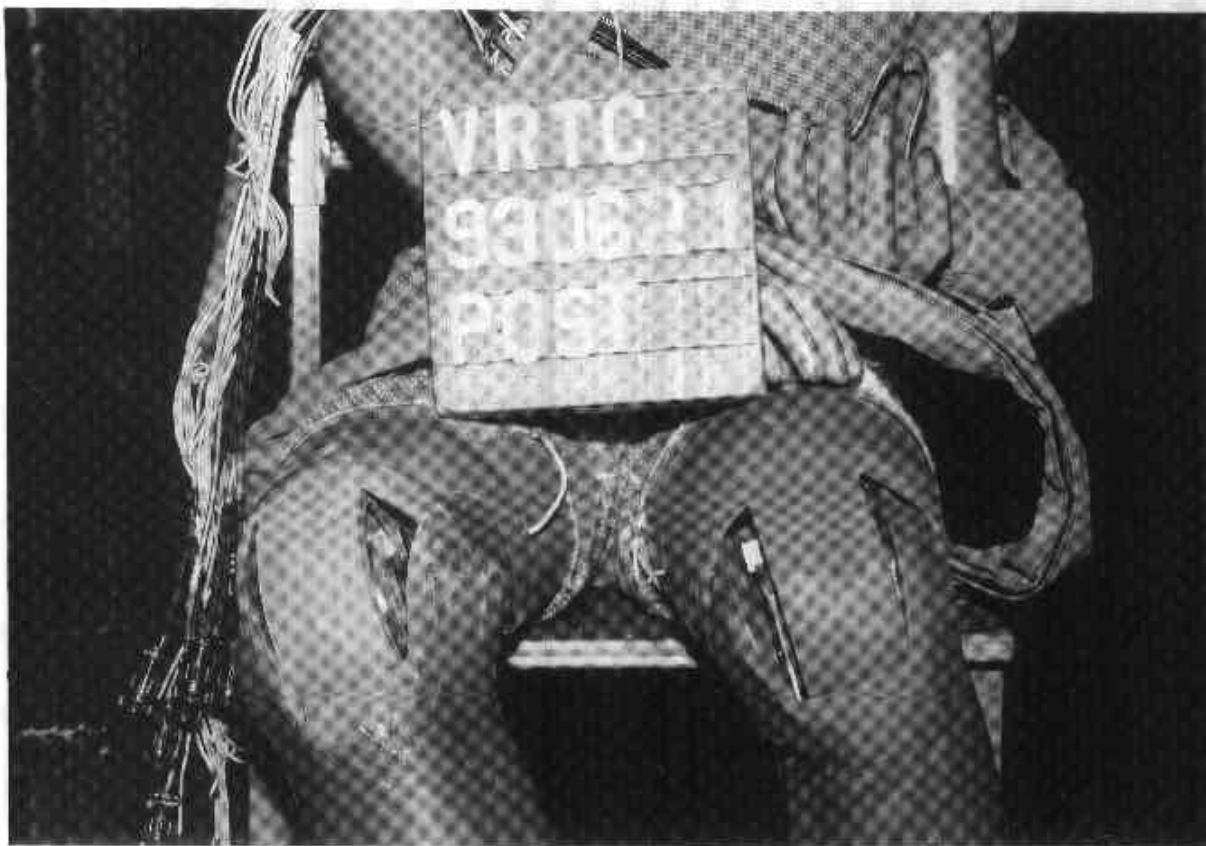


Figure A-35. POST-TEST DUMMY KNEE CONTACT VIEW

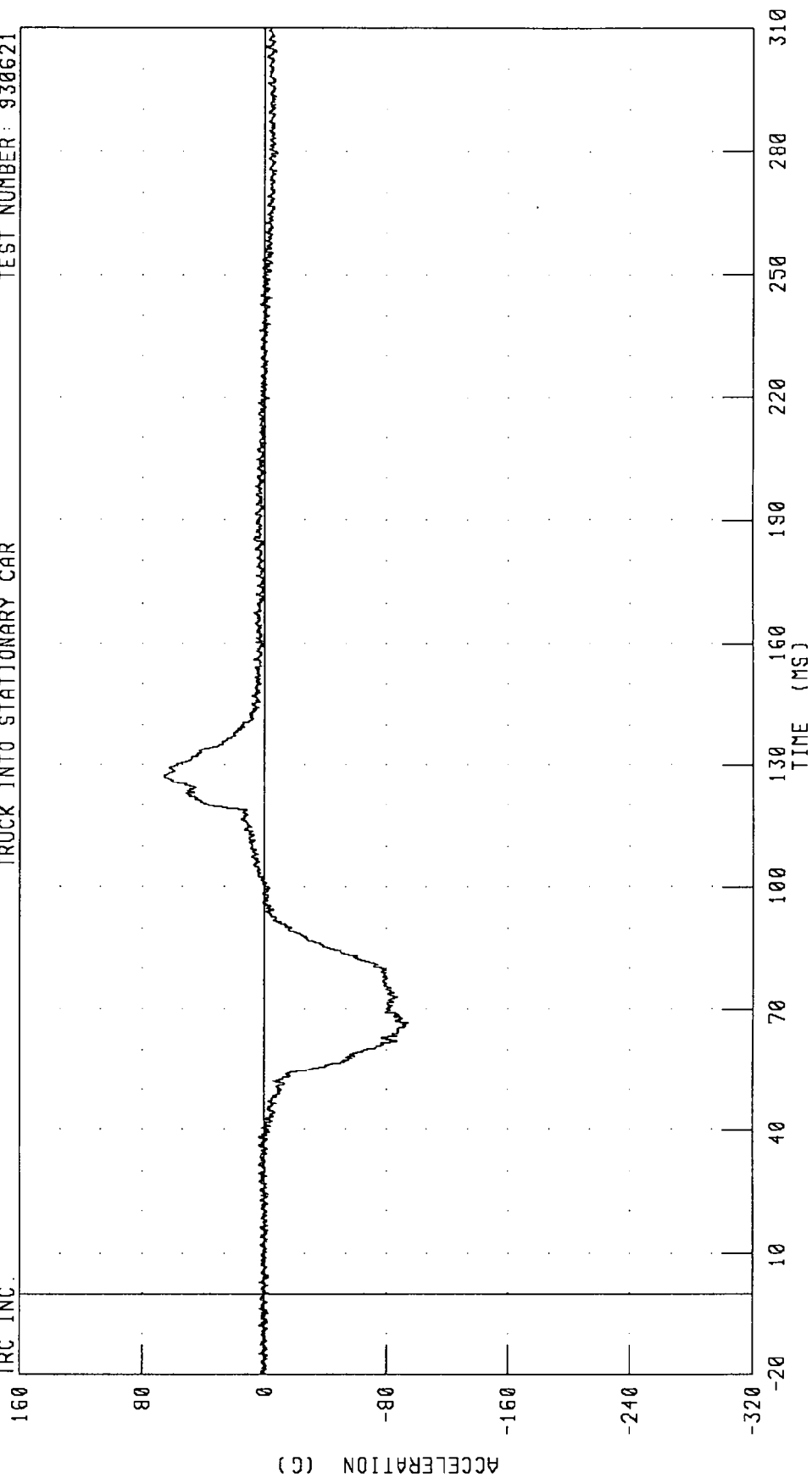
APPENDIX B

DATA PLOTS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER HEAD X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



CHANNEL: HEDXG1 FILTER: CH. CLASS 1000

PEAK DATA: 65.74 G @ 127.13 MS, -94.46 G @ 66.75 MS

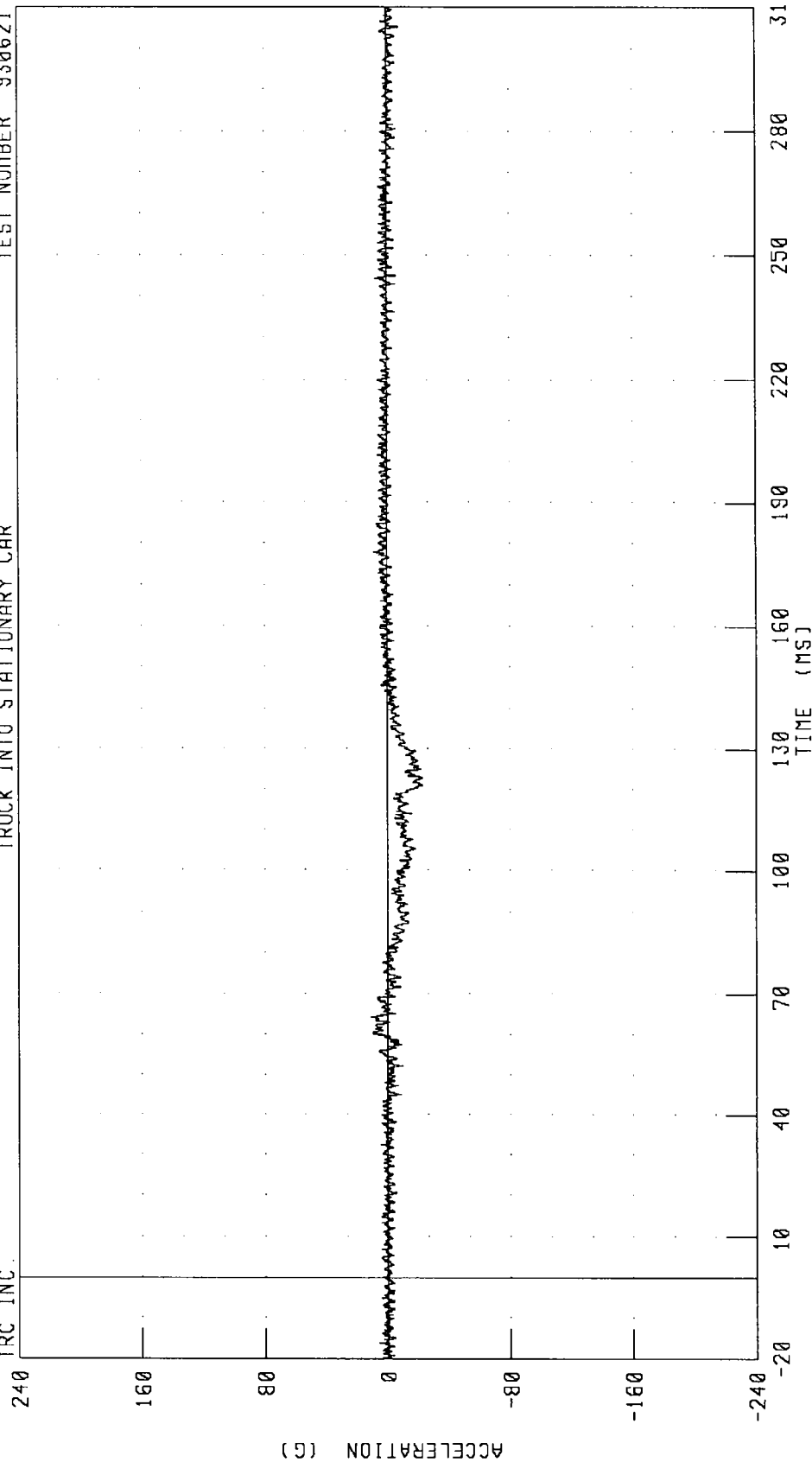
REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16

DRIVER HEAD Y-AXIS ACCELERATION

TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.

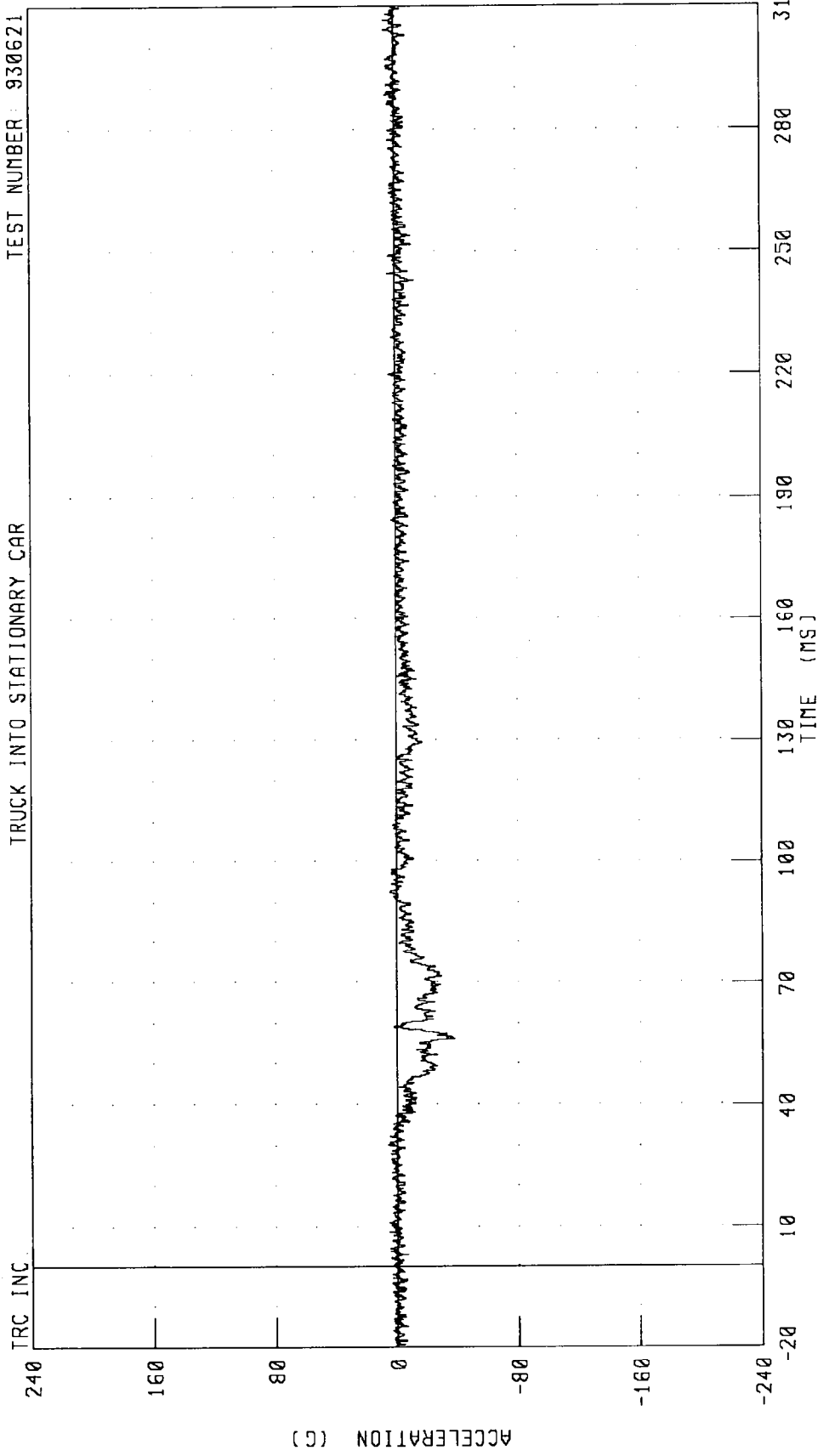


CHANNEL: HEDYG1 FILTER: CH. CLASS 1000

PEAK DATA: 10.78 G @ 64.38 MS; -22.78 G @ 121.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER HEAD Z-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



CHANNEL: HEDZG1 FILTER: CH. CLASS 1000

PEAK DATA: 6.63 G @ 304.25 MS, -37.96 G @ 56.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER HEAD RESULTANT ACCELERATION

TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC

320

240

160

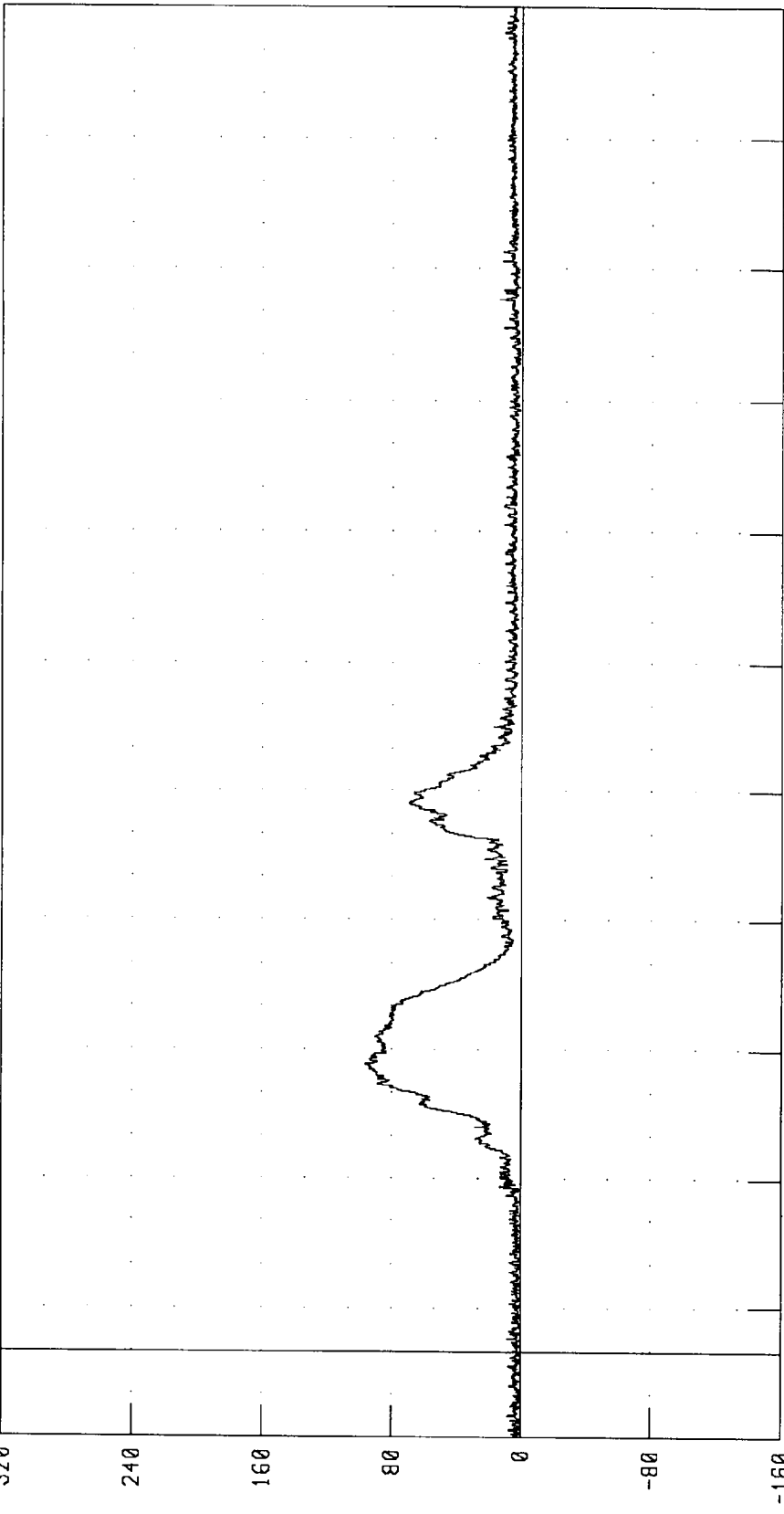
80

0

-80

-160

ACCELERATION (G)



TIME (MS)

310

280

250

220

190

160

130

100

70

40

10

-20

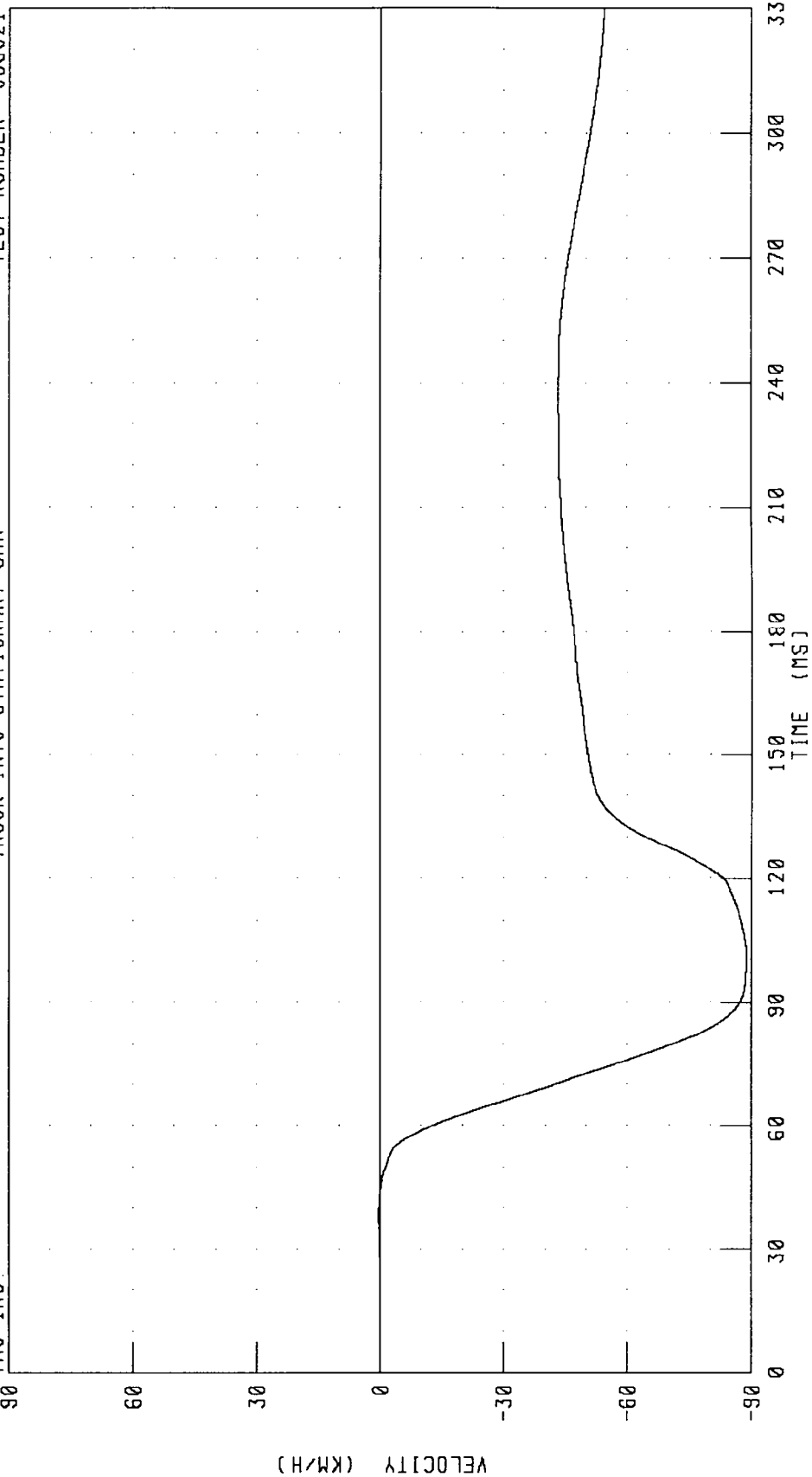
CHANNEL: HEDRG1 FILTER: CH. CLASS 1000

PEAK DATA: 96.02 G @ 66.75 MS; 0.31 G @ -0.88 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER HEAD X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



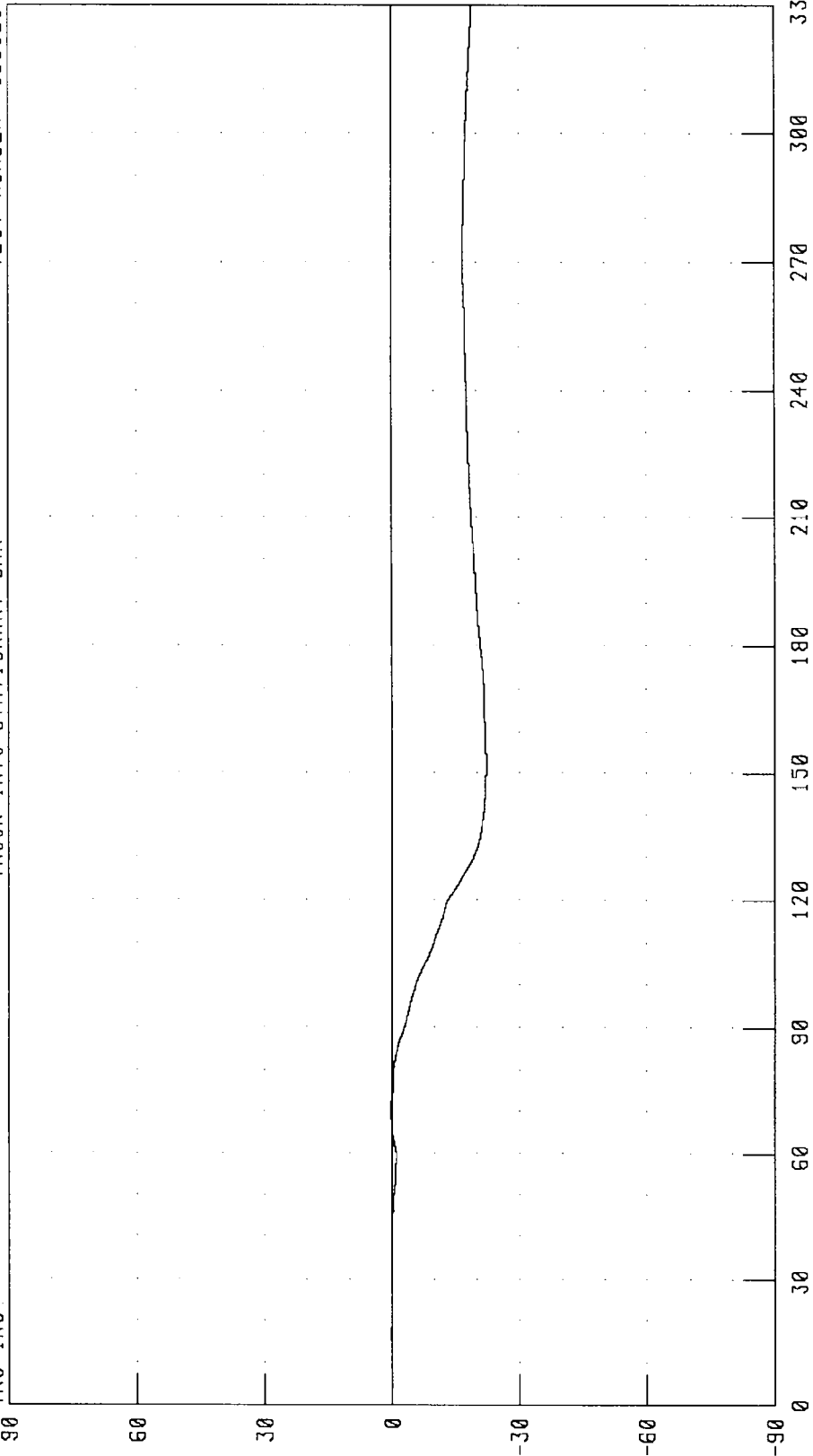
CHANNEL: HEDXV1 FILTER: CH. CLASS 180

PEAK DATA: 0.43 KM/H @ 38.88 MS, -88.69 KM/H @ 101.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER HEAD Y-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



CHANNEL: HEDYV1 FILTER: CH. CLASS 180
PEAK DATA: 0.29 KM/H @ 69.88 MS; -22.28 KM/H @ 152.13 MS

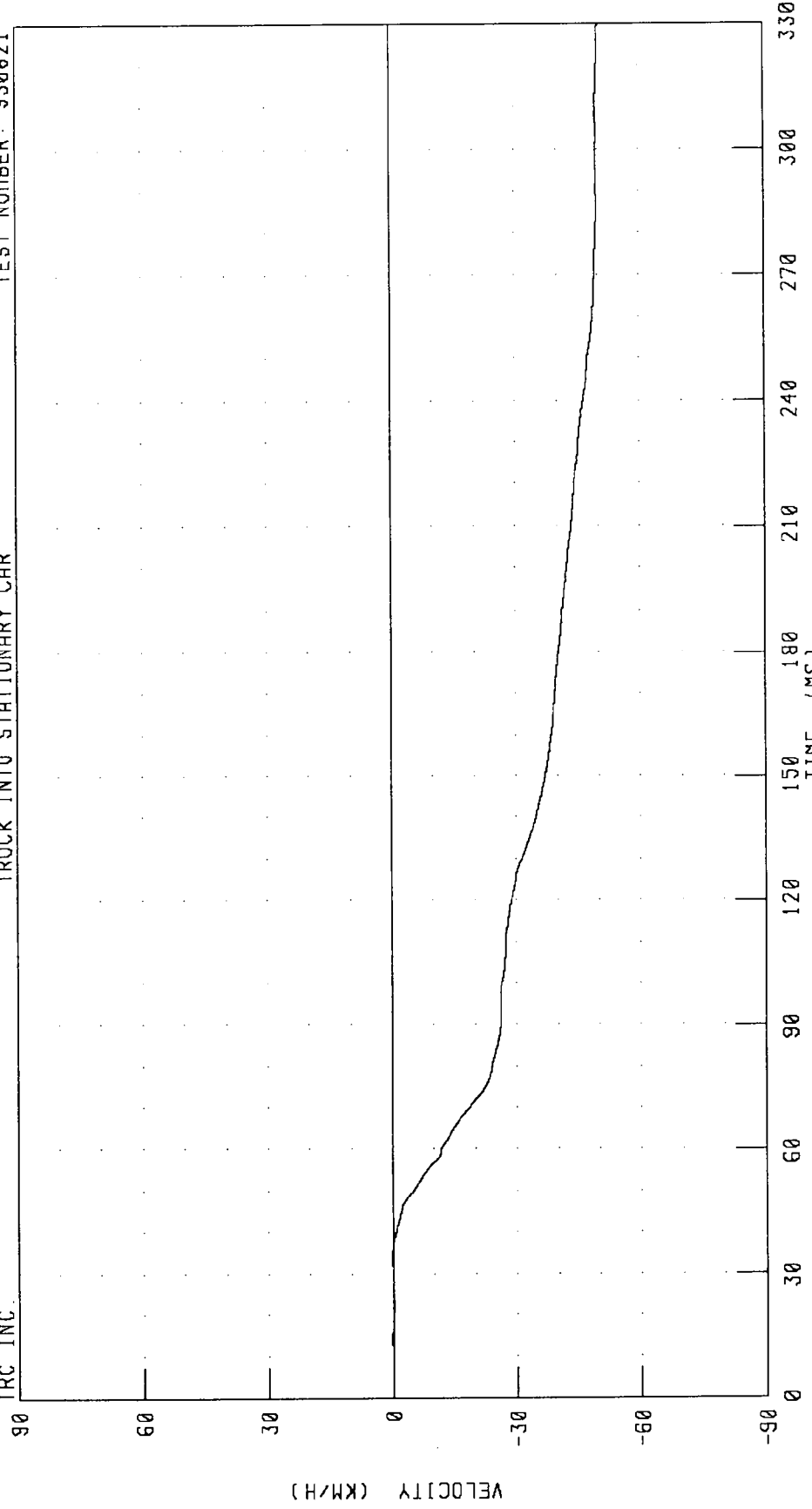
REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16

DRIVER HEAD Z-AXIS VELOCITY

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

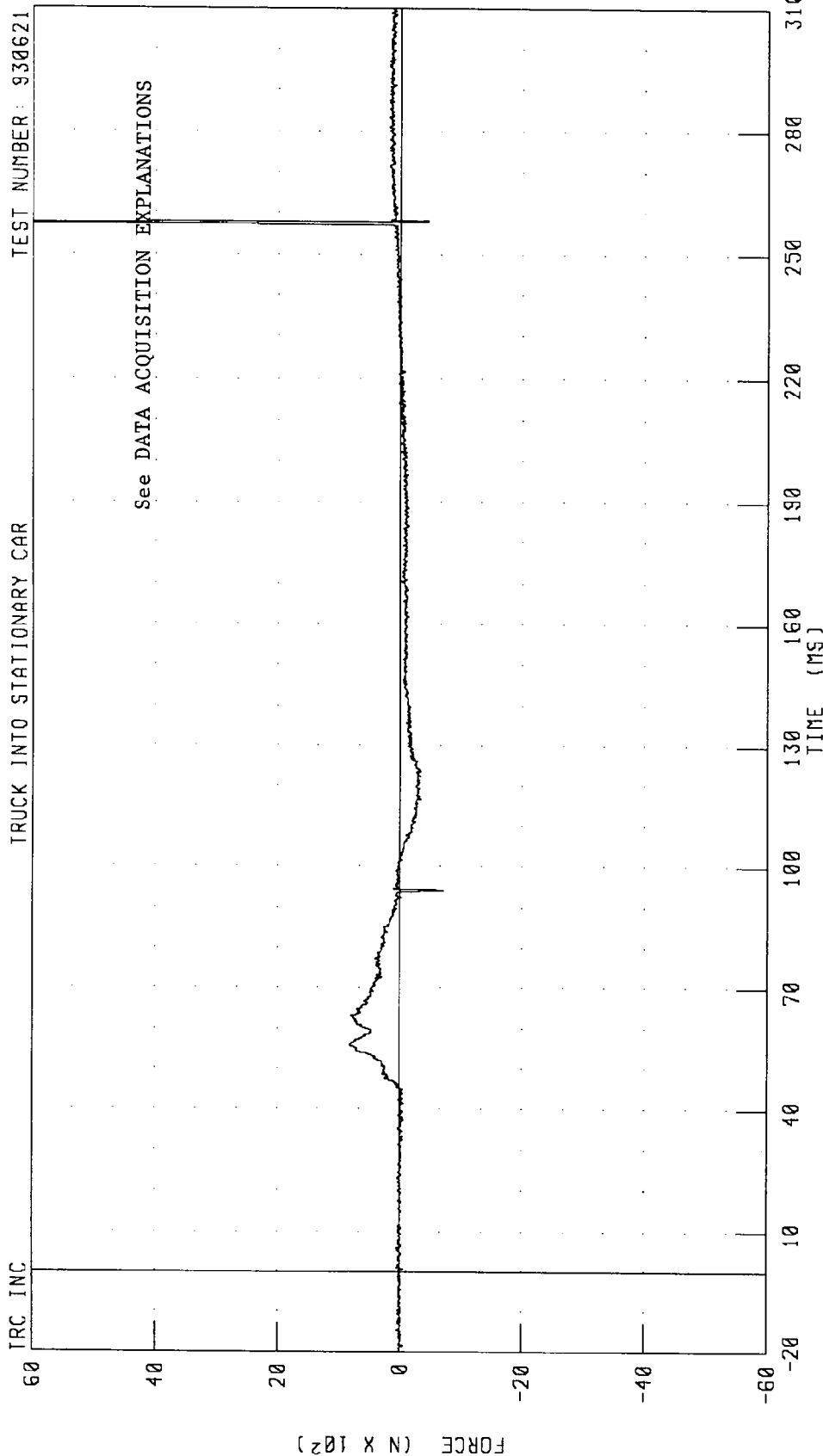
TRC INC.



CHANNEL: HEDZV1 FILTER: CH CLASS 180 PEAK DATA: 0.19 KM/H @ 33.25 MS; -50.18 KM/H @ 330.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK X-AXIS SHEAR FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



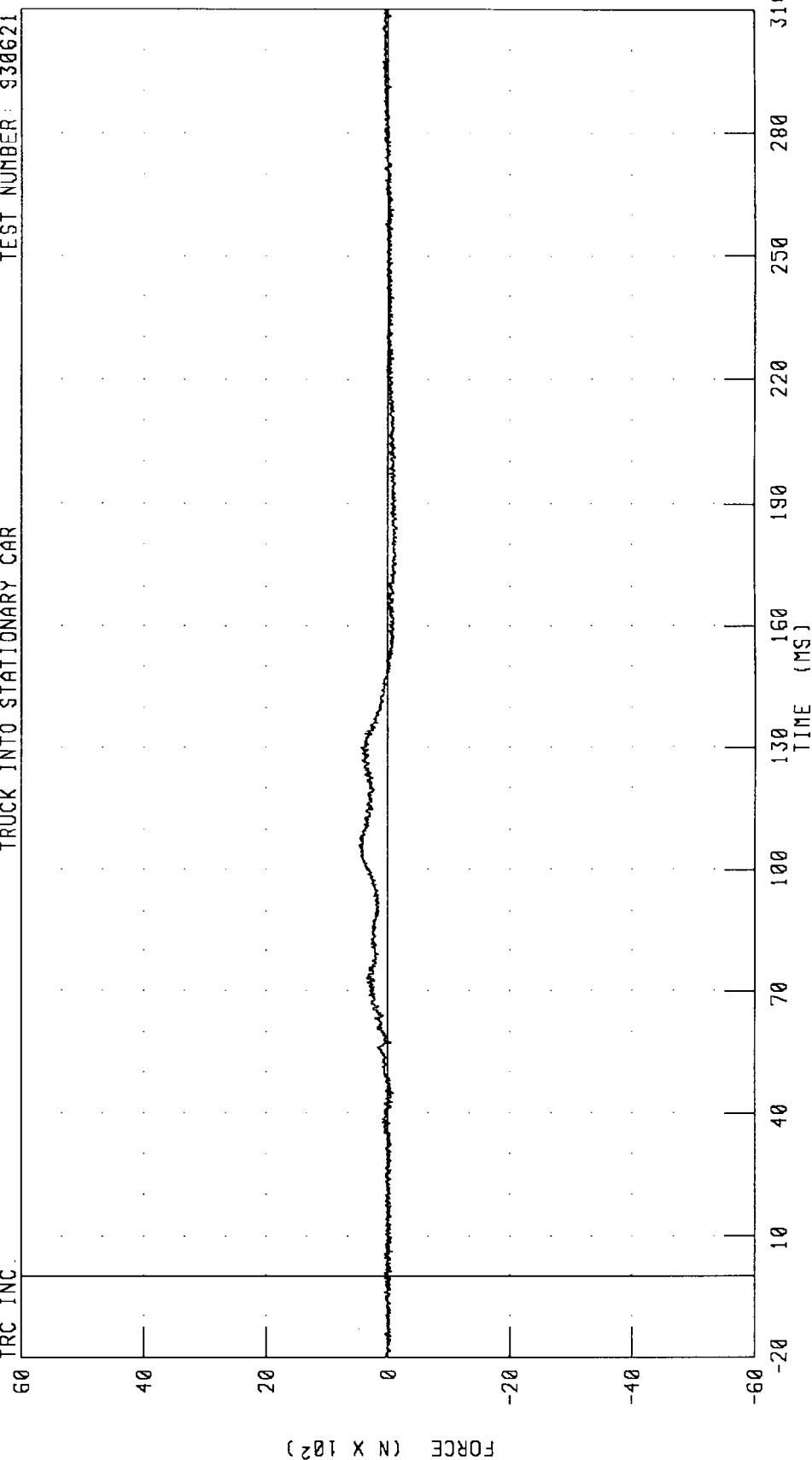
CHANNEL: NEKXF1 FILTER: CH. CLASS 1000

PEAK DATA: 6582.15 N @ 257.63 MS; -710.03 N @ 94.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK Y-AXIS SHEAR FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



CHANNEL: NEKYF1 FILTER: CH. CLASS 1000

PEAK DATA: 478 40 N @ 106.00 MS, -158.64 N @ 184 00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK Z-AXIS AXIAL FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC

100

80

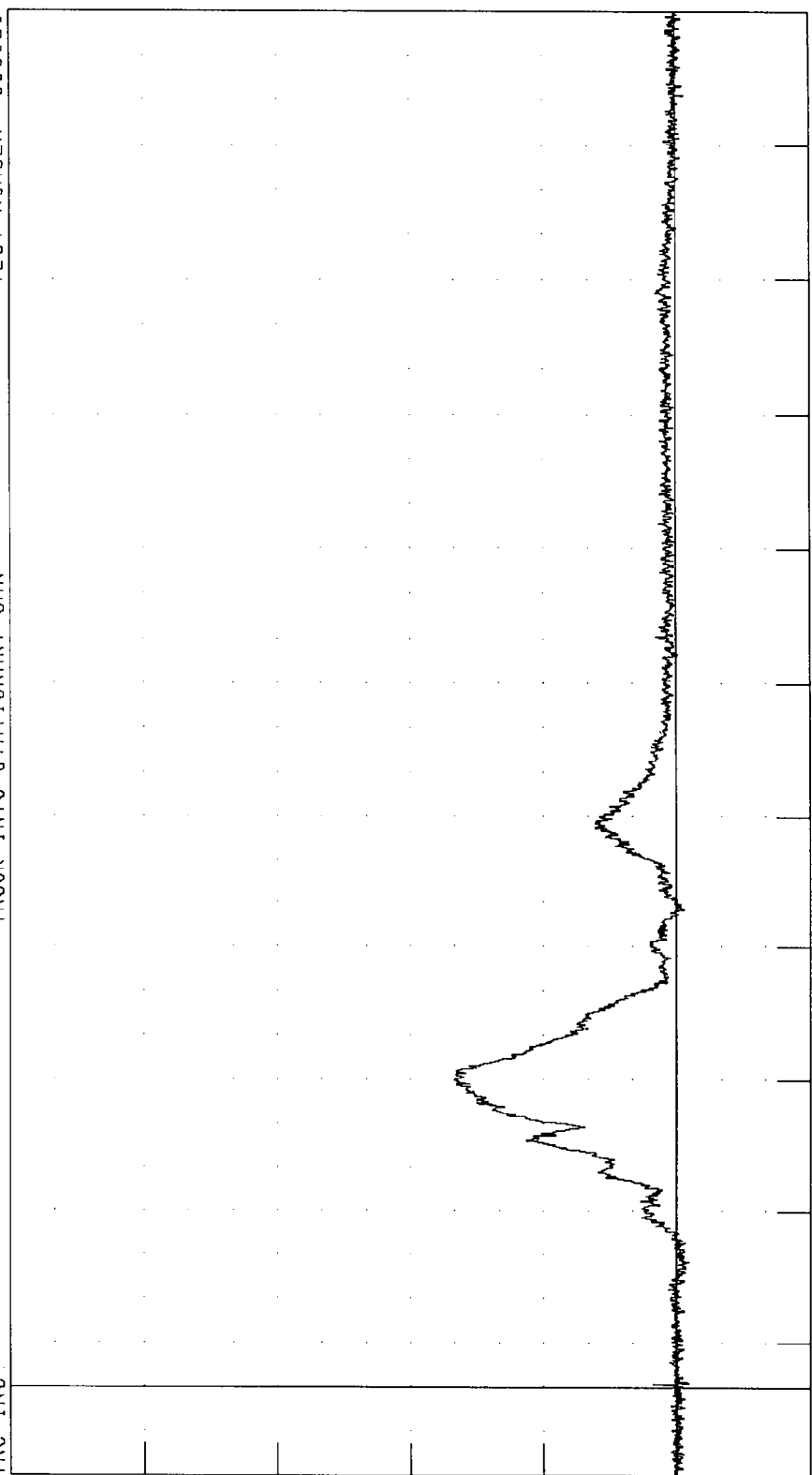
60

40

20

-20

FORCE (N X 10²)



TIME (MS)

310

280

250

220

190

160

130

100

70

40

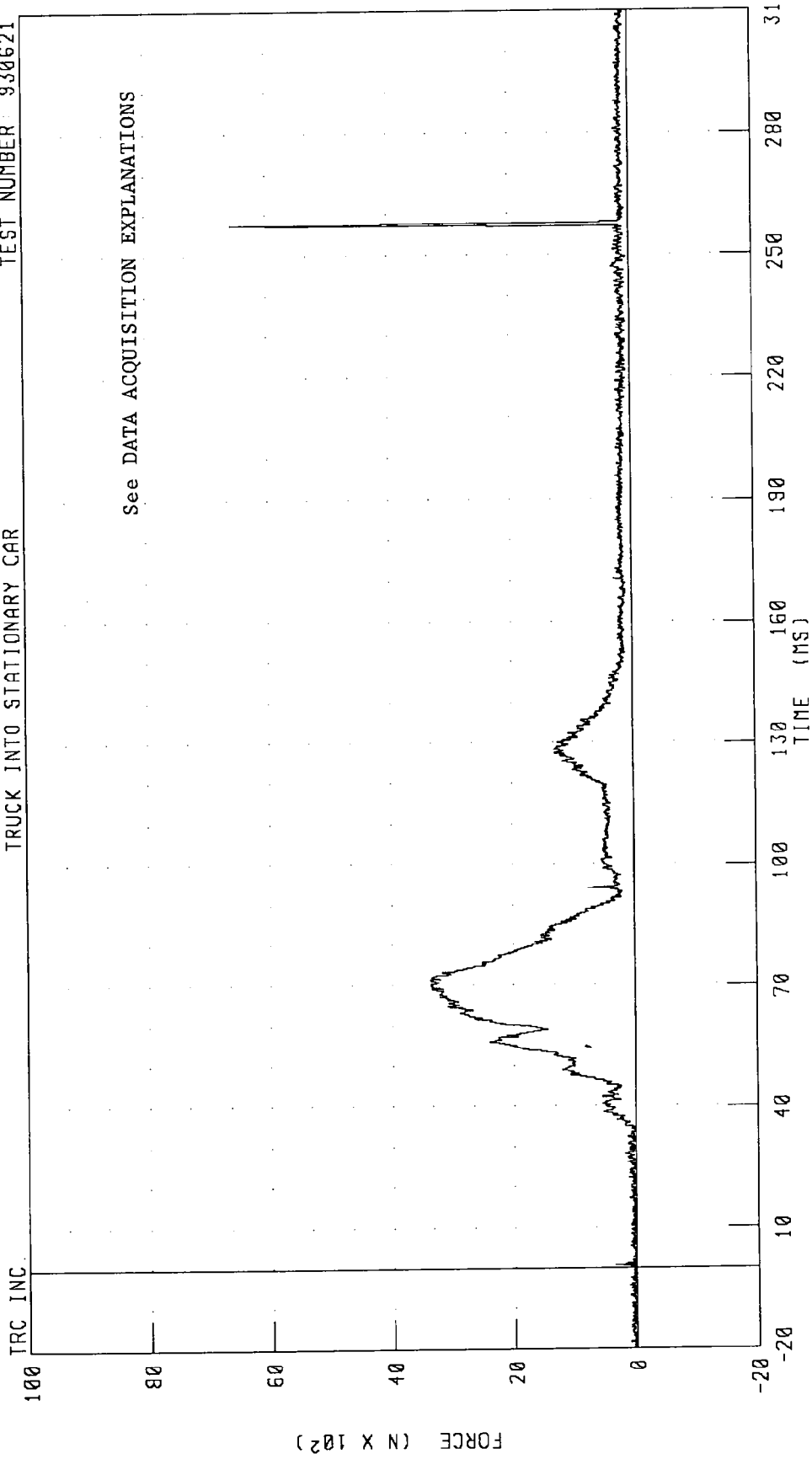
10

CHANNEL: NEKZF1 FILTER: CH. CLASS 1000

PEAK DATA: 3337.75 N @ 70.00 MS, -179.23 N @ 28.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
 DRIVER NECK RESULTANT FORCE
 TRUCK INTO STATIONARY CAR

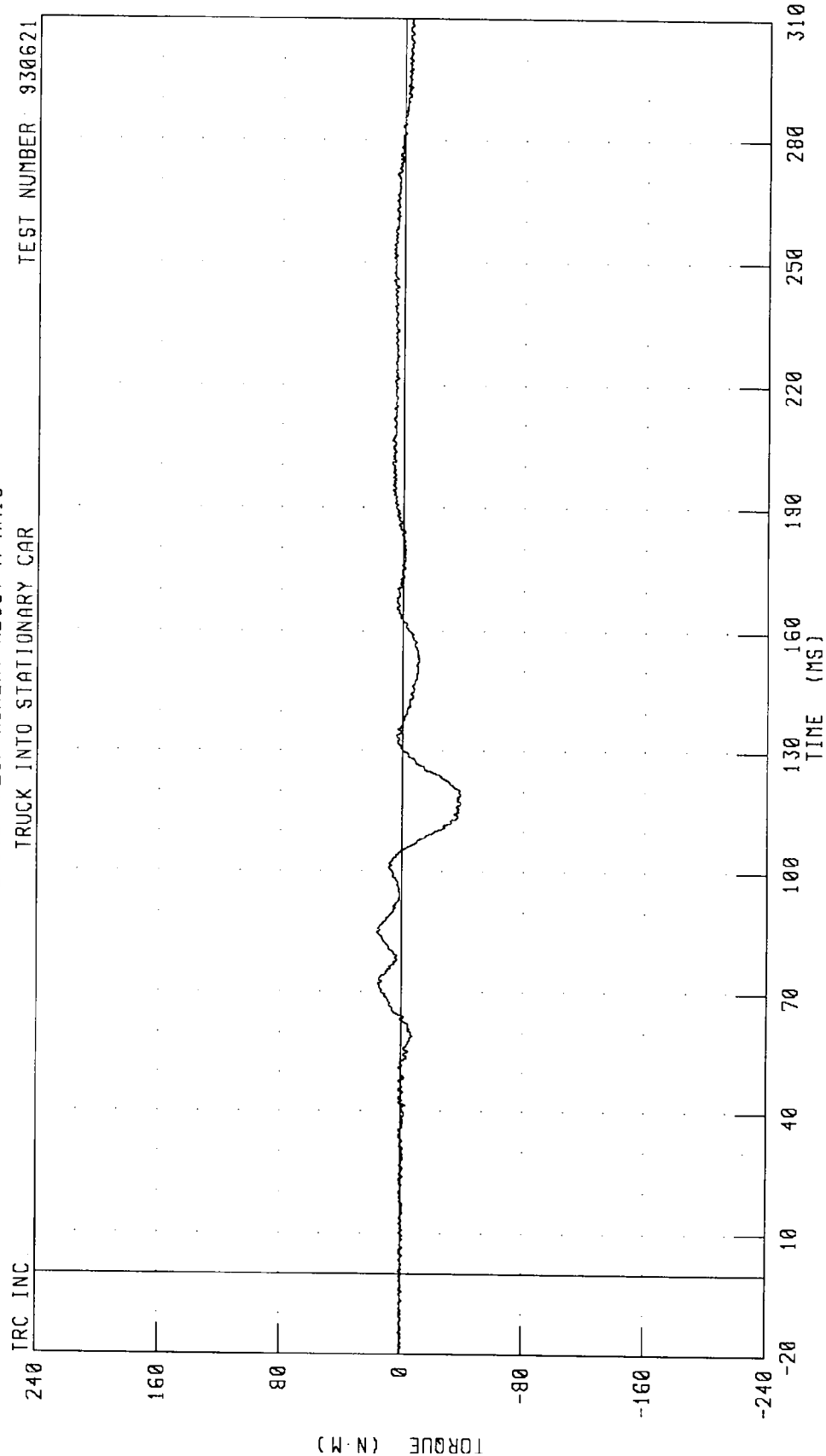
TEST NUMBER: 930621



CHANNEL: NEKRF1 FILTER: CH. CLASS 1000 PEAK DATA: 6583.77 N @ 257.63 MS; 5.50 N @ 12.38 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK MOMENT ABOUT X AXIS
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

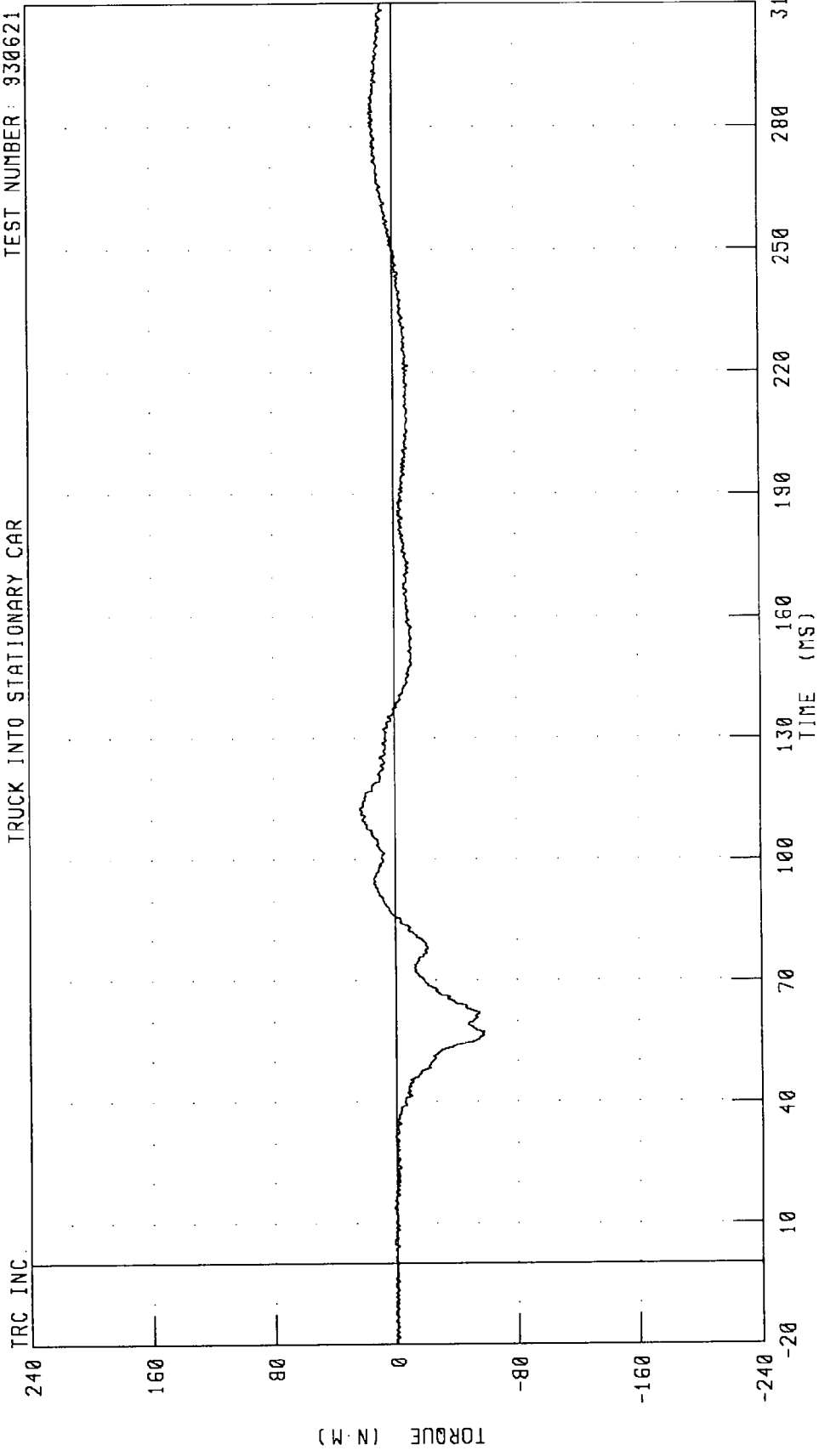


CHANNEL: NEKXM1 FILTER: CH. CLASS 600

PEAK DATA: 16 41 N·M @ 84.75 MS, -38.64 N·M @ 119.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK MOMENT ABOUT Y AXIS
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

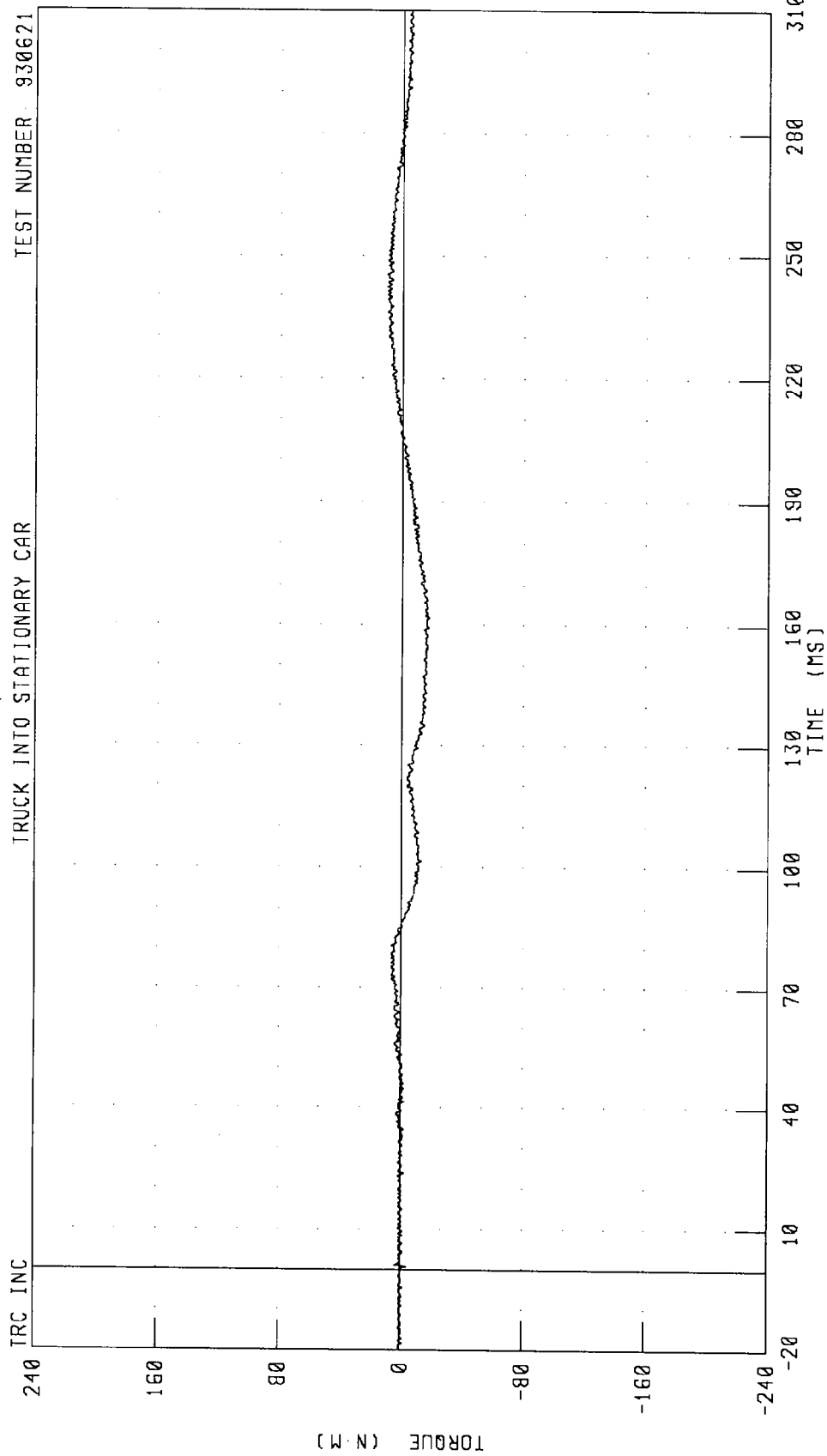


CHANNEL: NEKYM1 FILTER: CH. CLASS 600

PEAK DATA: 22.97 N M @ 112.63 MS, -57.76 N M @ 57.38 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK MOMENT ABOUT Z AXIS
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

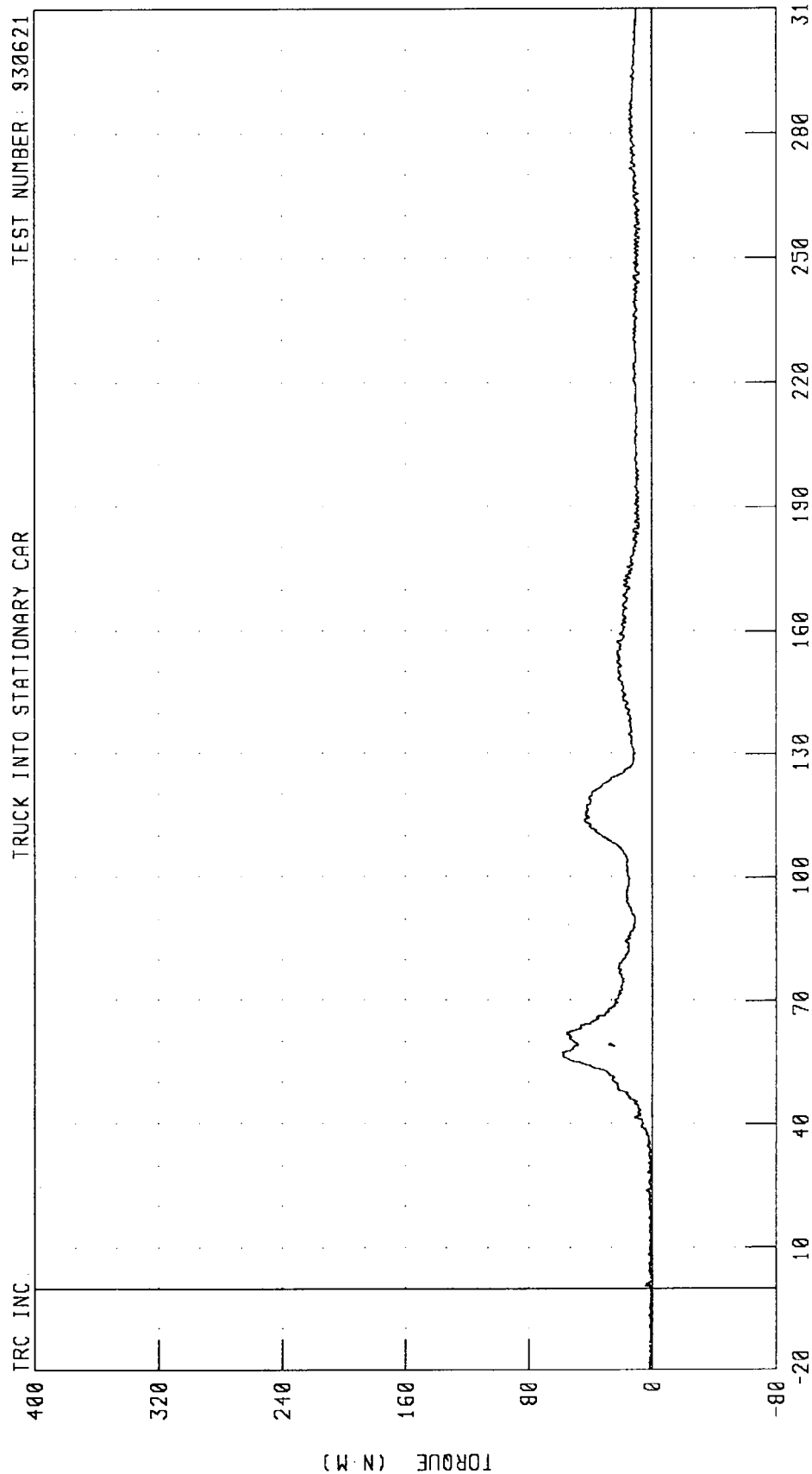


CHANNEL: NEKZM1 FILTER: CH. CLASS 600

PEAK DATA: 9.96 N·M @ 245.50 MS; -17.59 N·M @ 161.75 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER NECK MOMENT RESULTANT
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



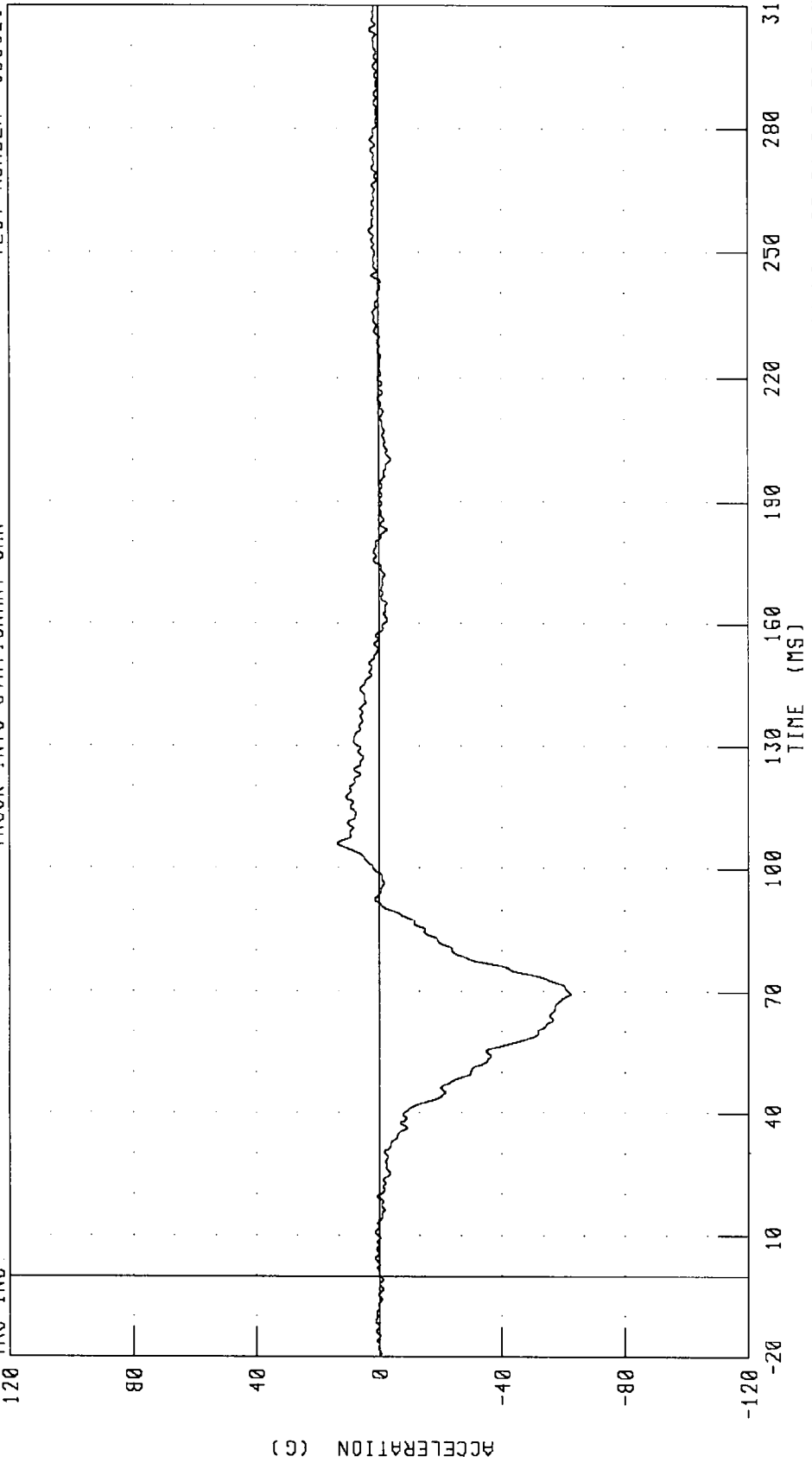
CHANNEL: NEKRM1 FILTER: CH. CLASS 600

PEAK DATA: 57.95 N M @ 57.38 MS; 0.10 N M @ -16.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.



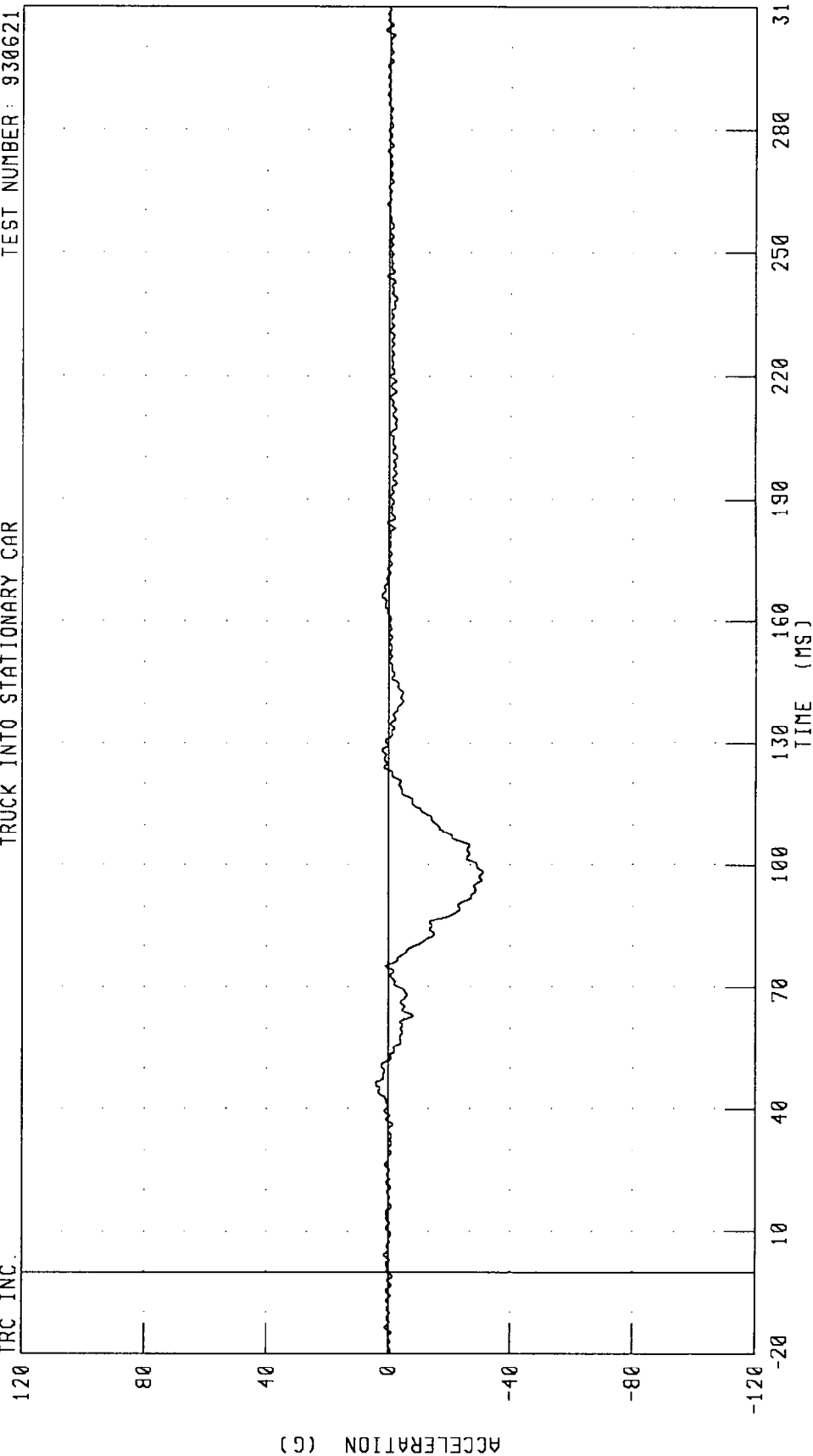
PEAK DATA: 13.45 G @ 106.00 MS, -62.34 G @ 69.50 MS

CHANNEL: CSTXG1 FILTER: CH. CLASS 180

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST Y-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



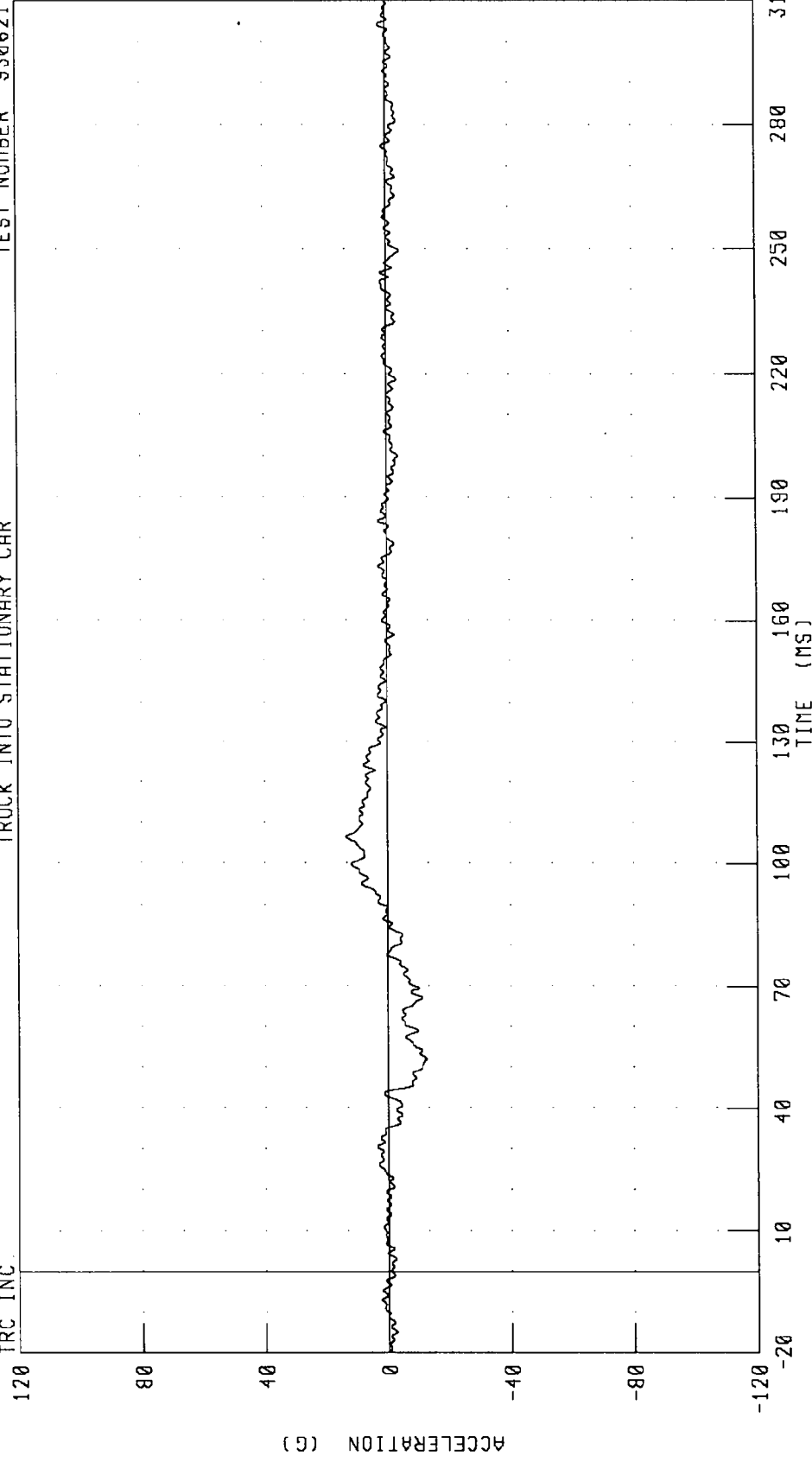
CHANNEL: CSTYG1 FILTER: CH. CLASS 180

PEAK DATA: 4.24 G @ 46.25 MS; -31.00 G @ 98.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST Z-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



CHANNEL: CSTZG1 FILTER: CH. CLASS 180

PEAK DATA: 13.47 G @ 106.38 MS; -12.43 G @ 52.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST RESULTANT ACCELERATION

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

120

80

40

0

-40

-80

-120

ACCELERATION (G)

10

40

70

100

130

160

190

220

250

280

310

TIME (MS)

PEAK DATA: 63.31 G @ 69.50 MS; 0.15 G @ -20.00 MS

CHANNEL: CSTRG1 FILTER: CH. CLASS 180

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

90

60

30

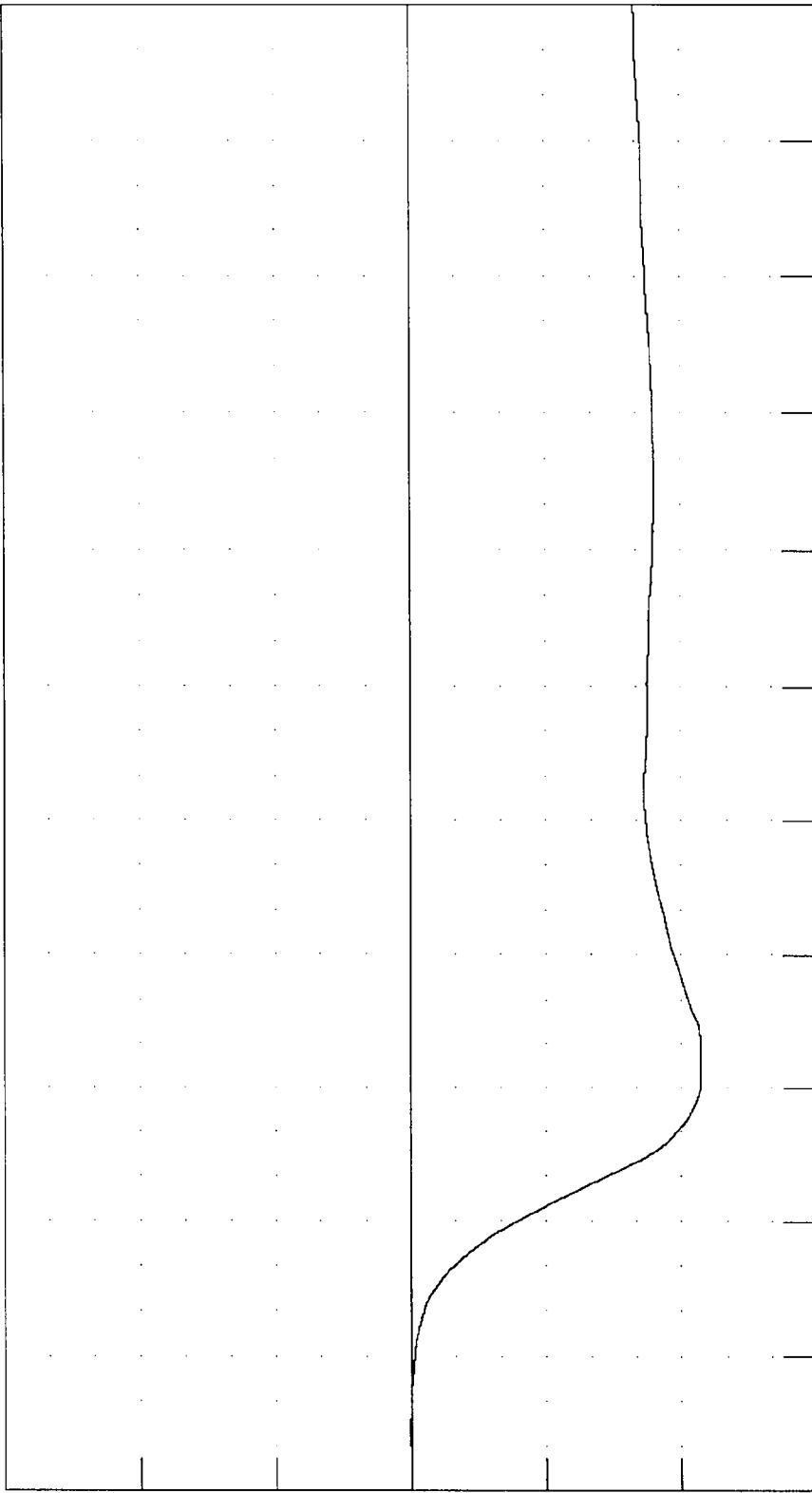
0

-30

-60

-90

VELOCITY (KM/H)



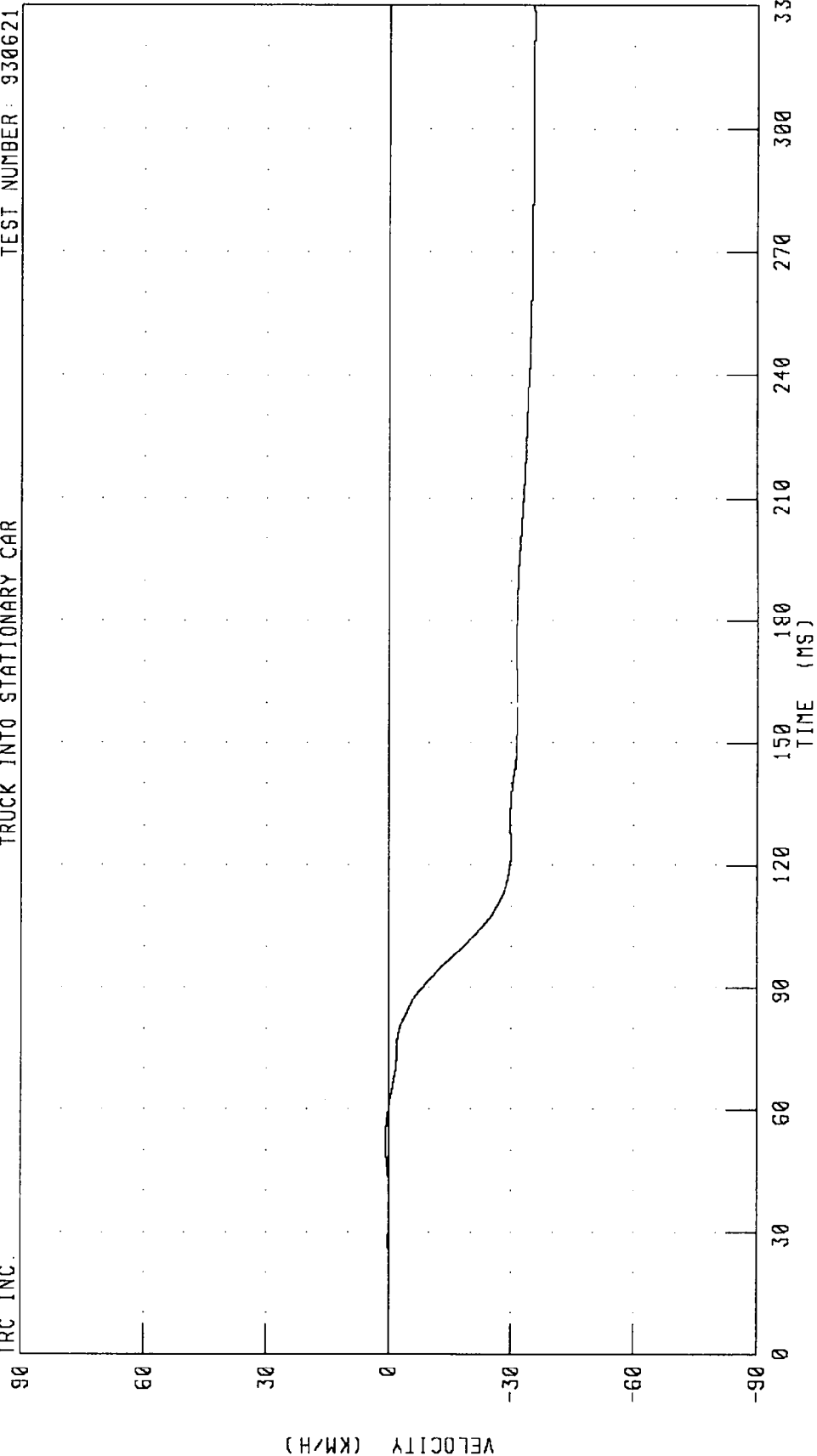
PEAK DATA: 0.23 KM/H @ 13.50 MS, -64.35 KM/H @ 98.88 MS

CHANNEL: CSTXV1 FILTER: CH. CLASS 180

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST Y-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



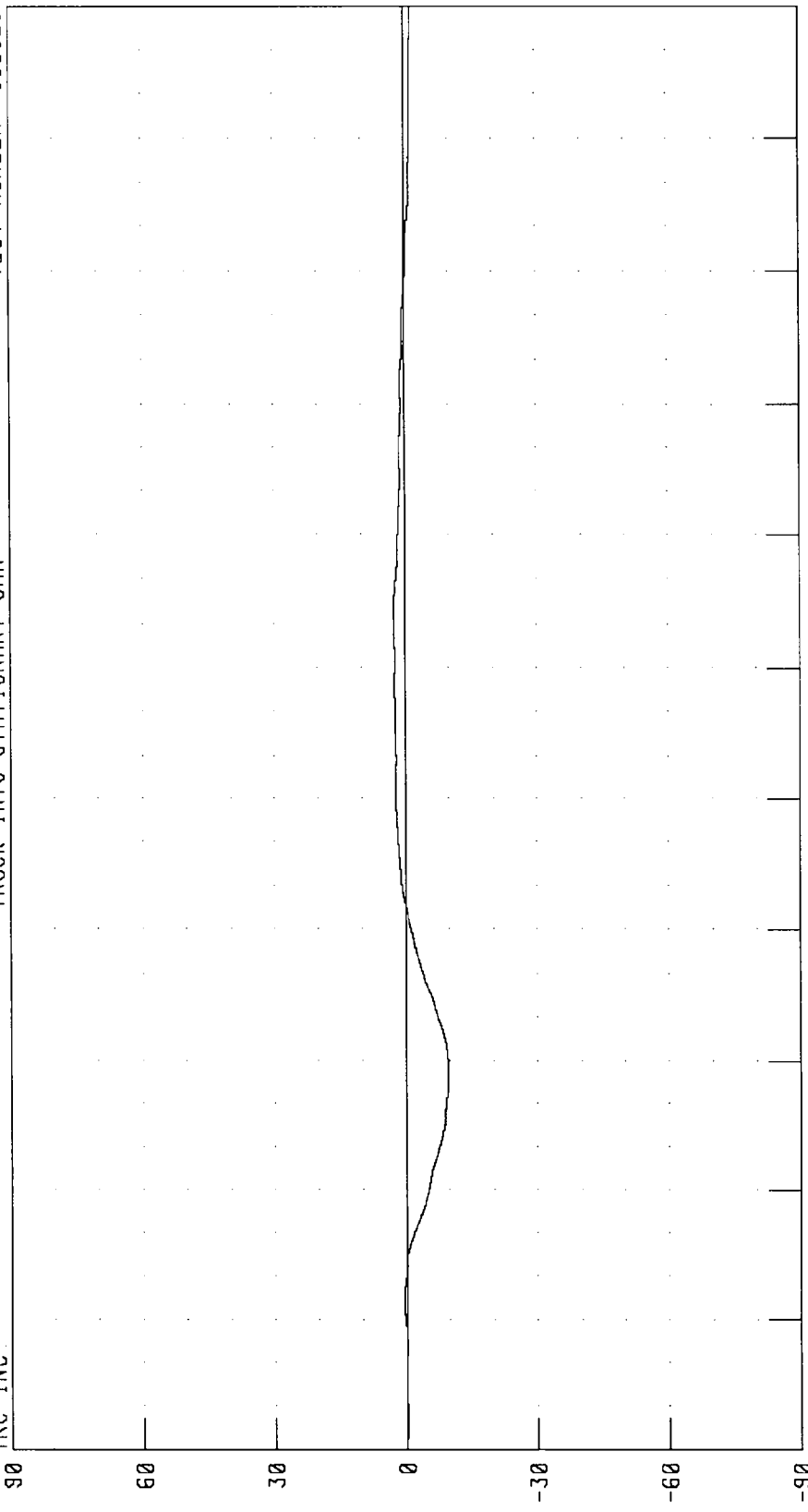
CHANNEL: CSTYV1 FILTER: CH. CLASS 180

PEAK DATA: 0.84 KM/H @ 51.88 MS, -35.48 KM/H @ 325.38 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST Z-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

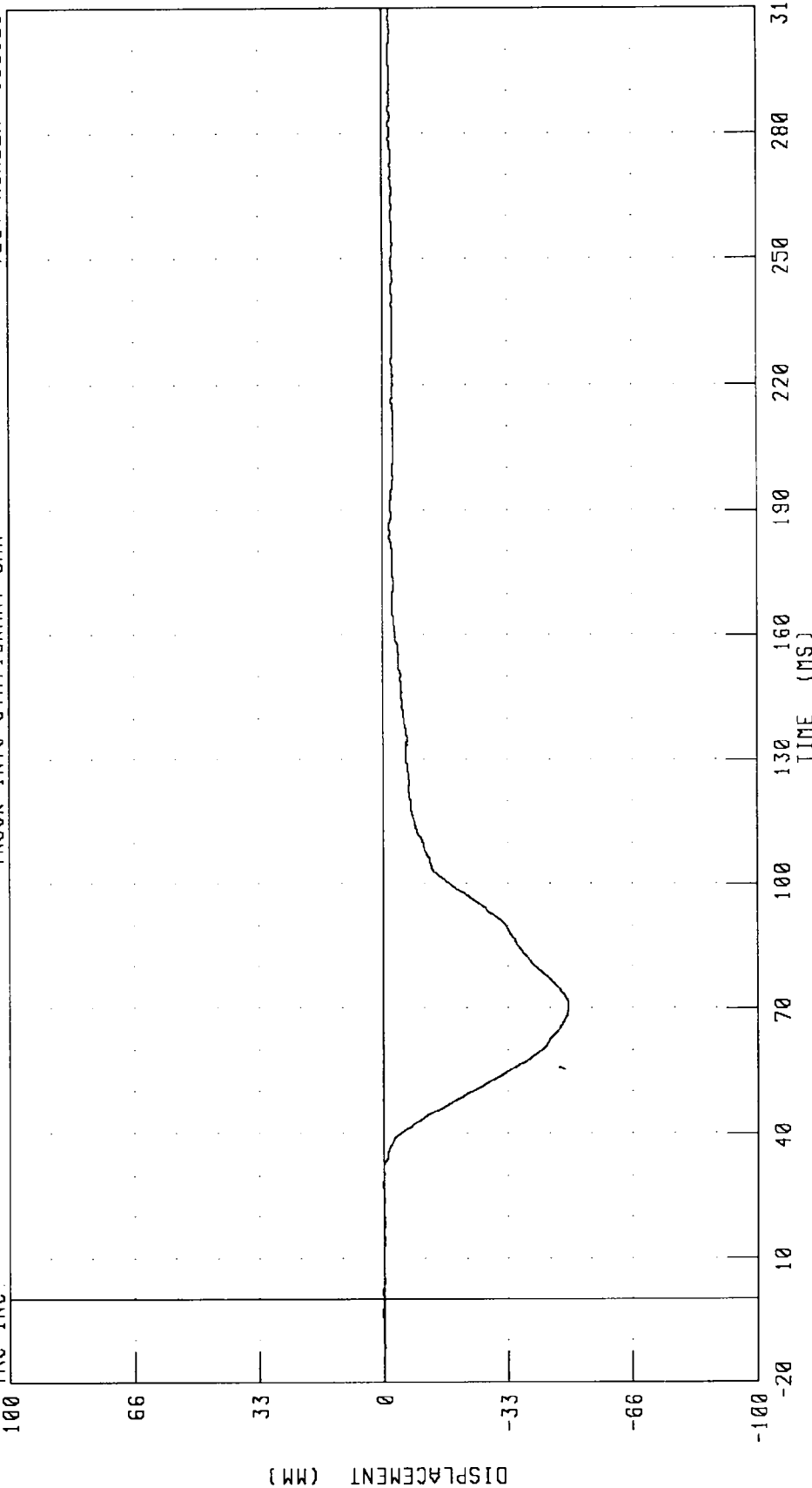


CHANNEL: CSTZV1 FILTER: CH. CLASS 180
PEAK DATA: 2.63 KM/H @ 191.25 MS; -9.65 KM/H @ 85.75 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER CHEST DEFLECTION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



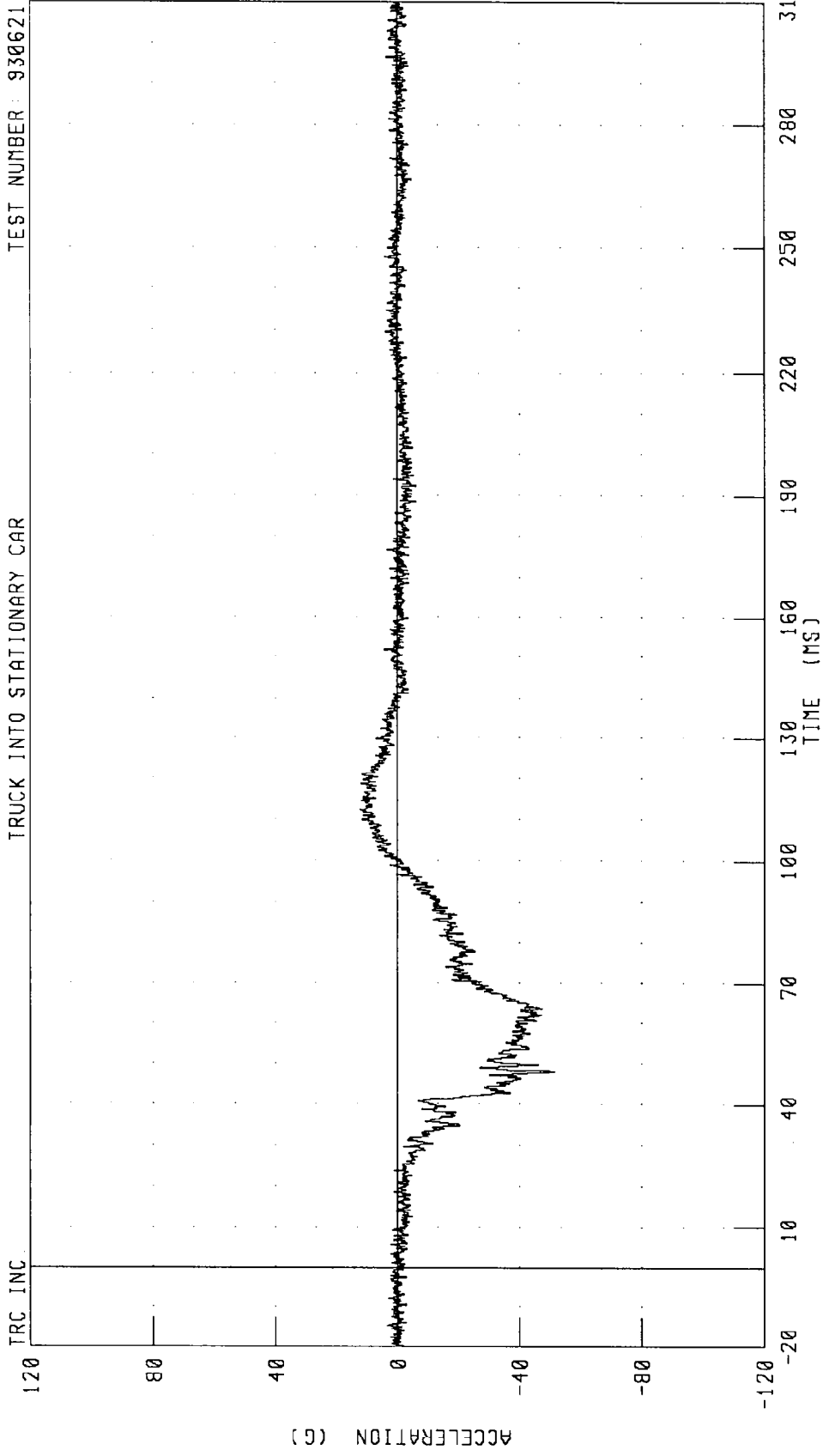
PEAK DATA: 0.28 MM @ -3.25 MS, -49.50 MM @ 70.75 MS

CHANNEL: CSTXD1 FILTER: CH. CLASS 180

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER PELVIS X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

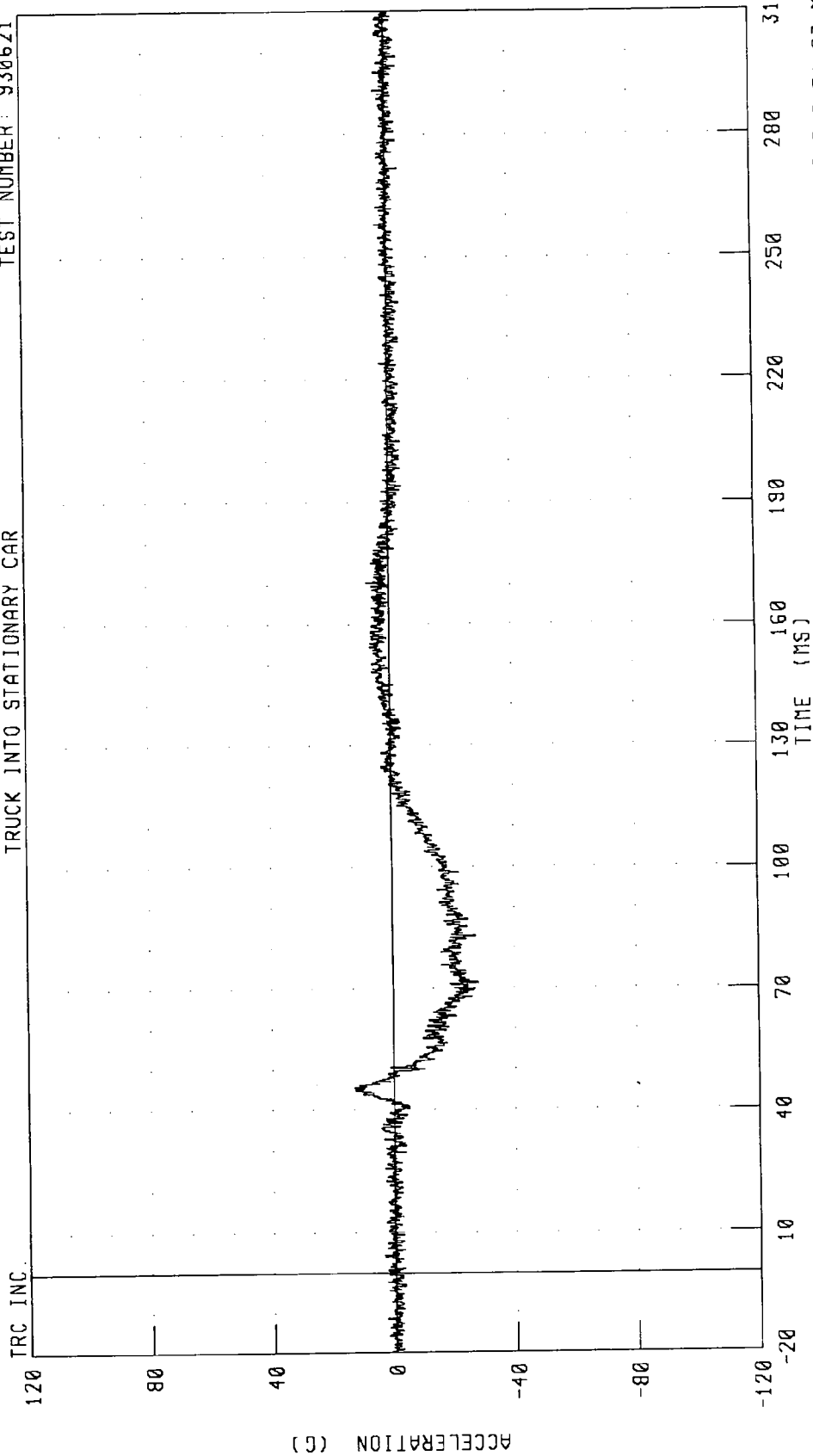


CHANNEL: PEVXG1 FILTER: CH. CLASS 1000

PEAK DATA: 12.09 G @ 112.38 MS; -51.58 G @ 48.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER PELVIS Y-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



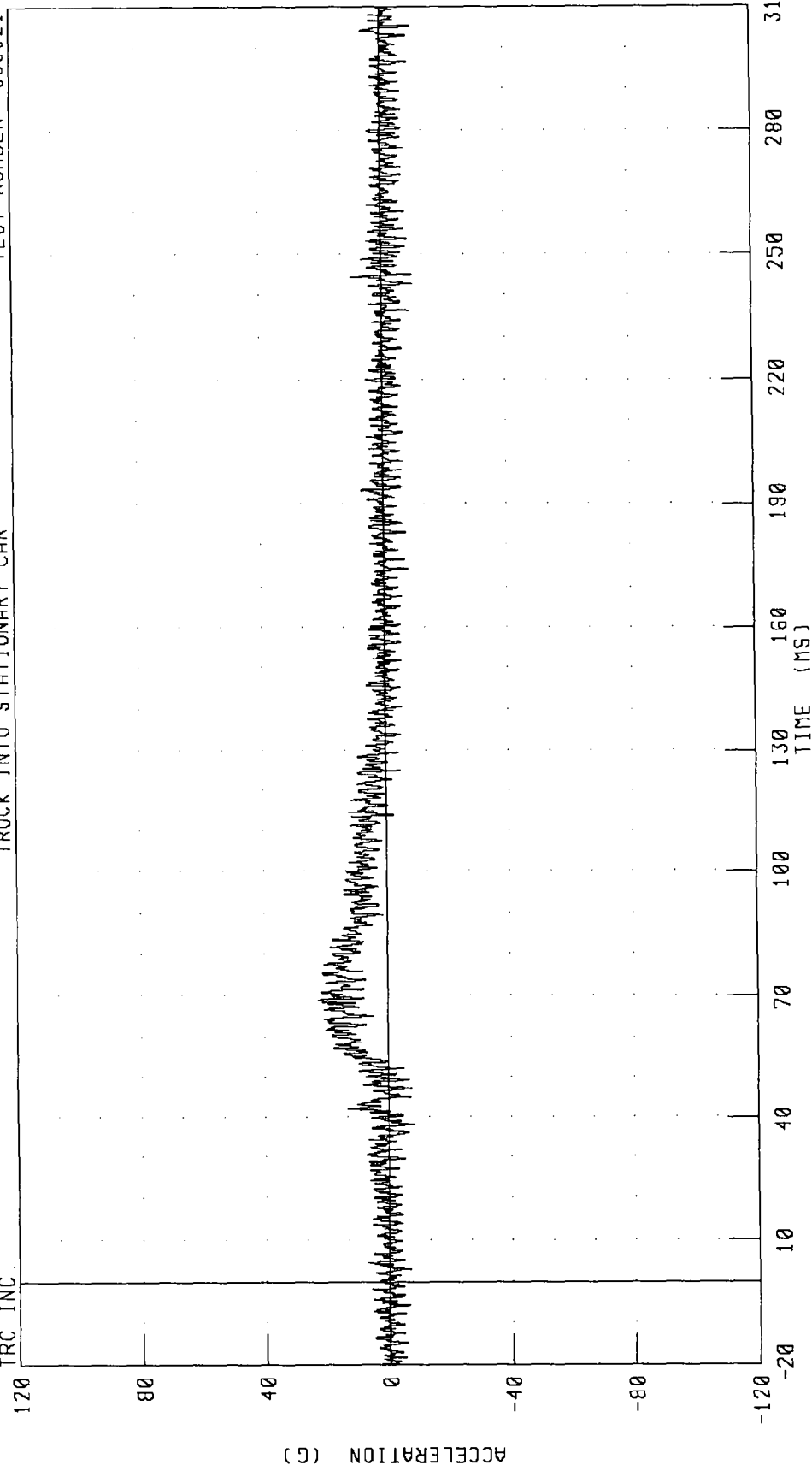
PEAK DATA: 12 73 G @ 45.50 MS; -28 18 G @ 71.63 MS

CHANNEL: PEVYG1 FILTER: CH. CLASS 1000

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
 DRIVER PELVIS Z-AXIS ACCELERATION
 TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC

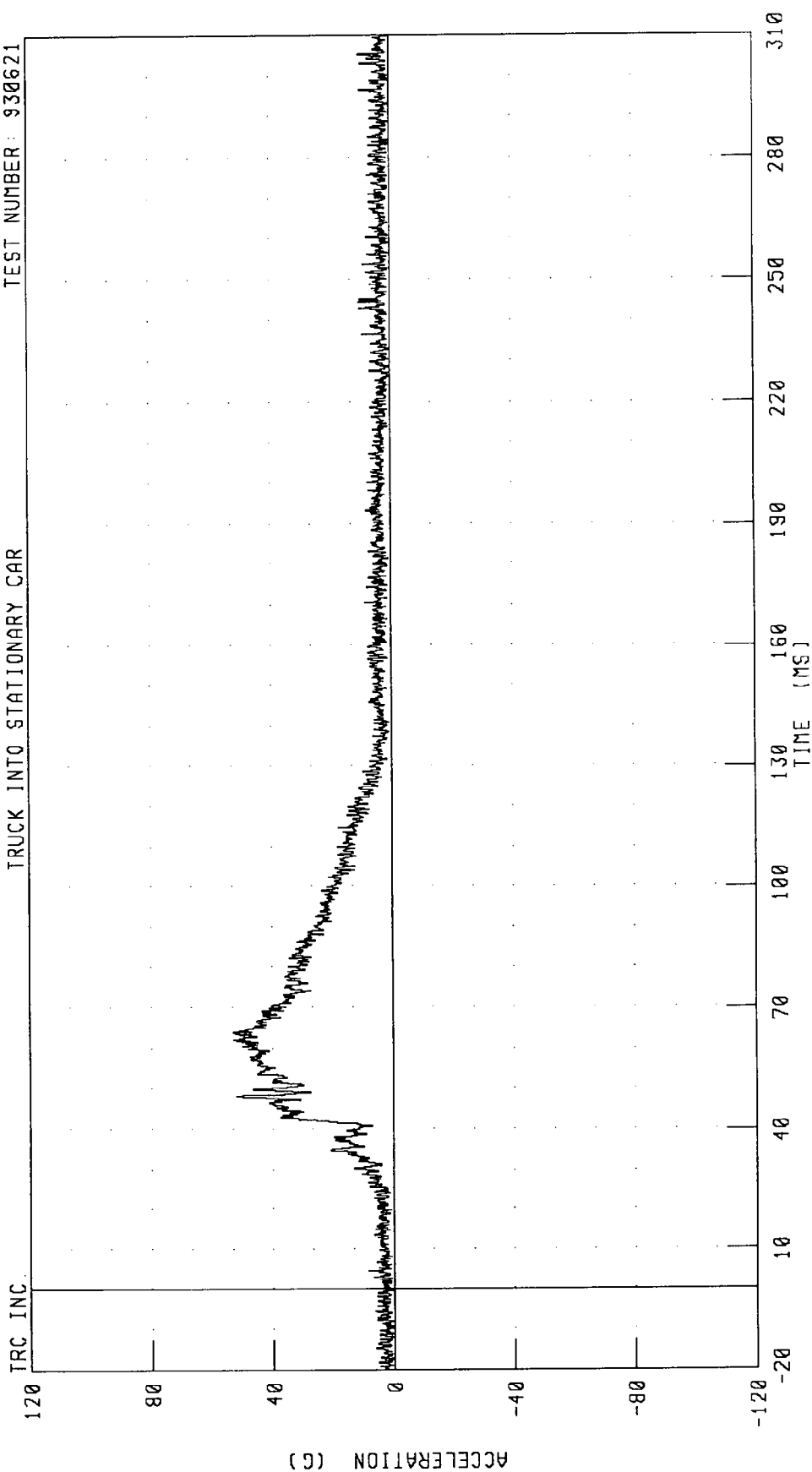


PEAK DATA: 22.89 G @ 68.88 MS, -10.27 G @ 242.88 MS

CHANNEL: PEVZG1 FILTER: CH. CLASS 1000

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER PELVIS RESULTANT ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



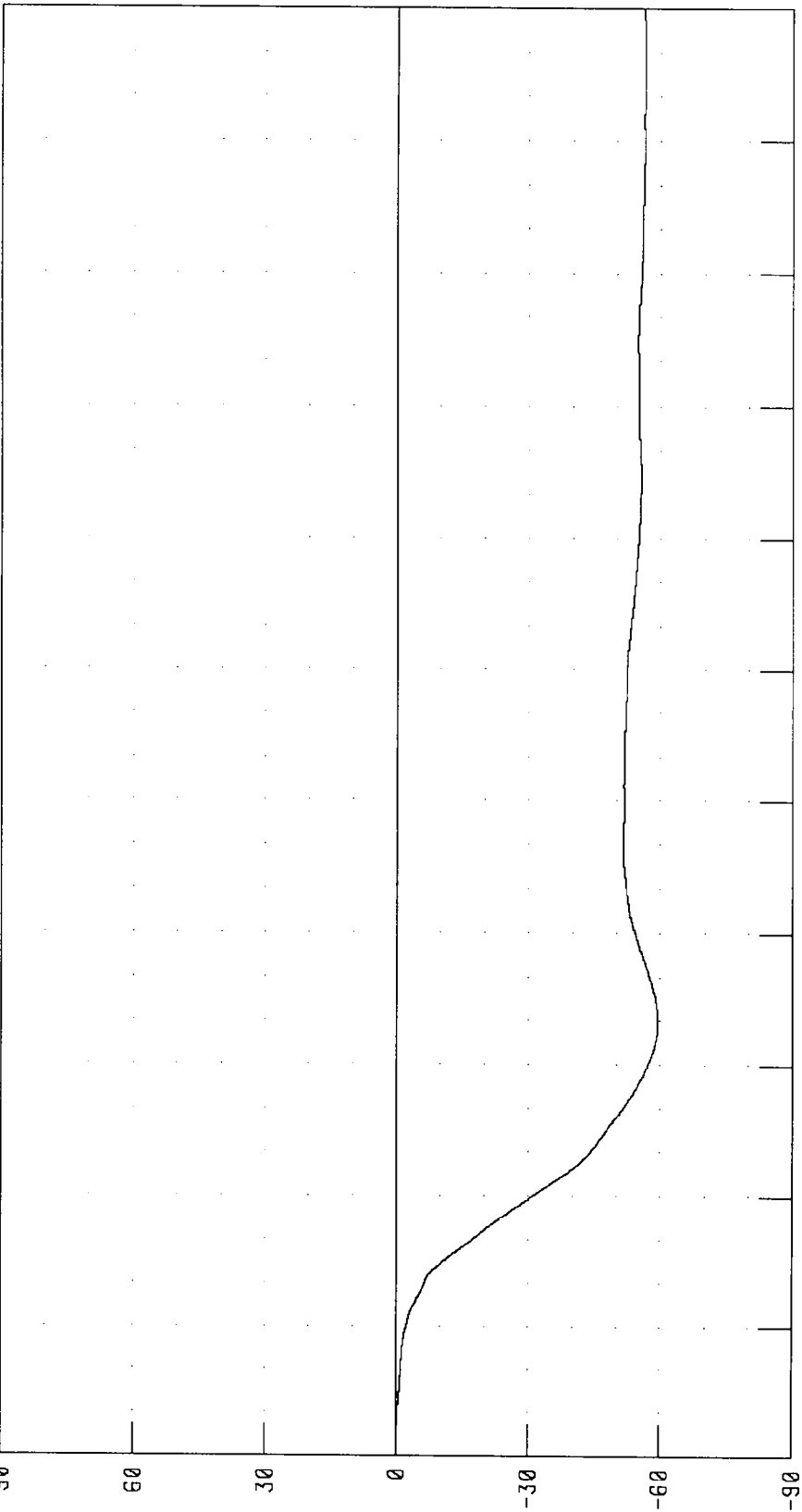
CHANNEL: PEVRG1 FILTER: CH. CLASS 1000

PEAK DATA: 52.93 G @ 64.00 MS; 0.17 G @ -17.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER PELVIS X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.



CHANNEL: PEVXV1 FILTER: CH. CLASS 180
PEAK DATA: 0.00 KM/H @ 0.00 MS; -59.48 KM/H @ 180.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER PELVIS Y-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.



TIME (MS)

PEAK DATA: 1.42 KM/H @ 48.63 MS, -37.27 KM/H @ 123.88 MS

CHANNEL: PEVYV1 FILTER: CH. CLASS 180

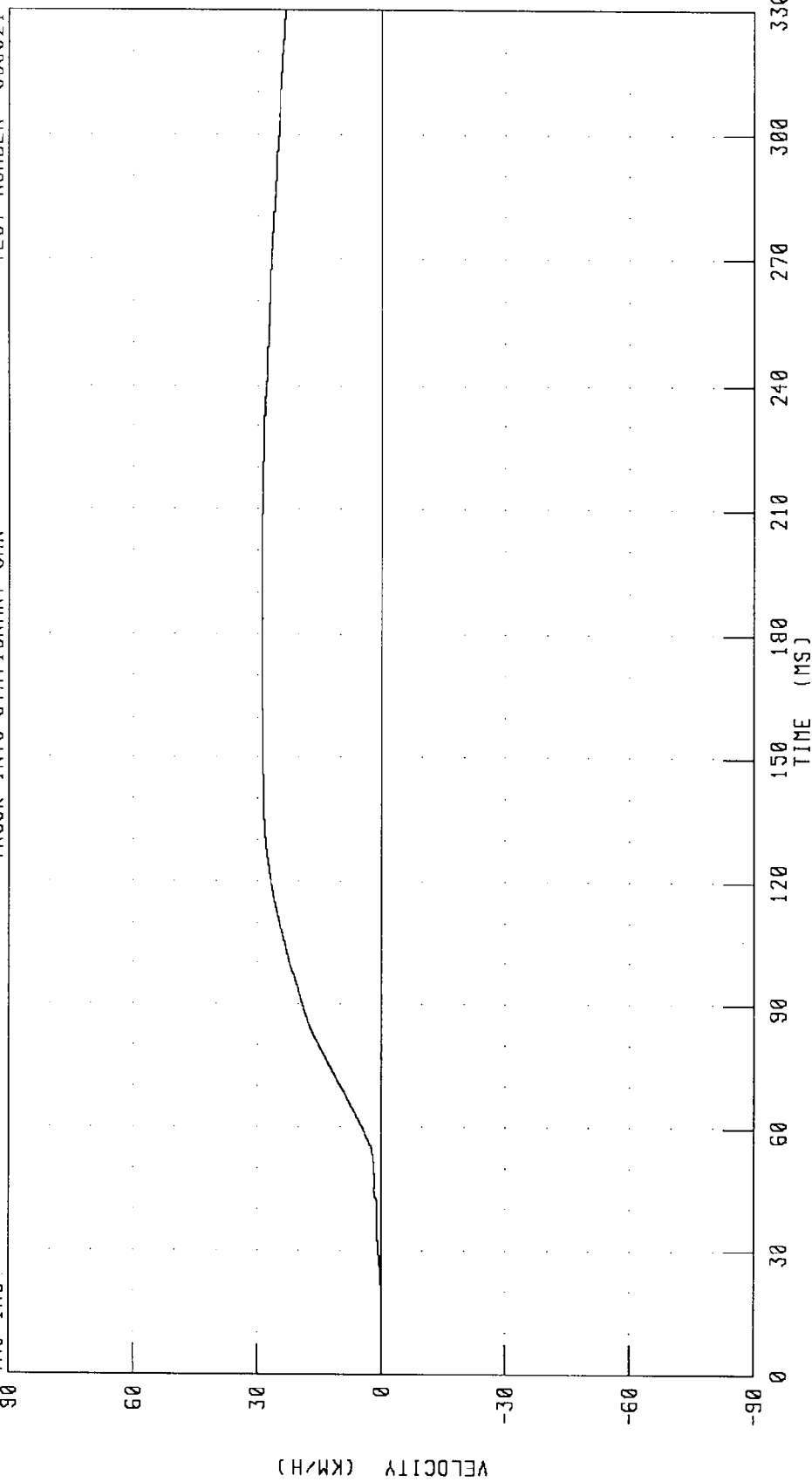
REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16

DRIVER PELVIS Z-AXIS VELOCITY

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

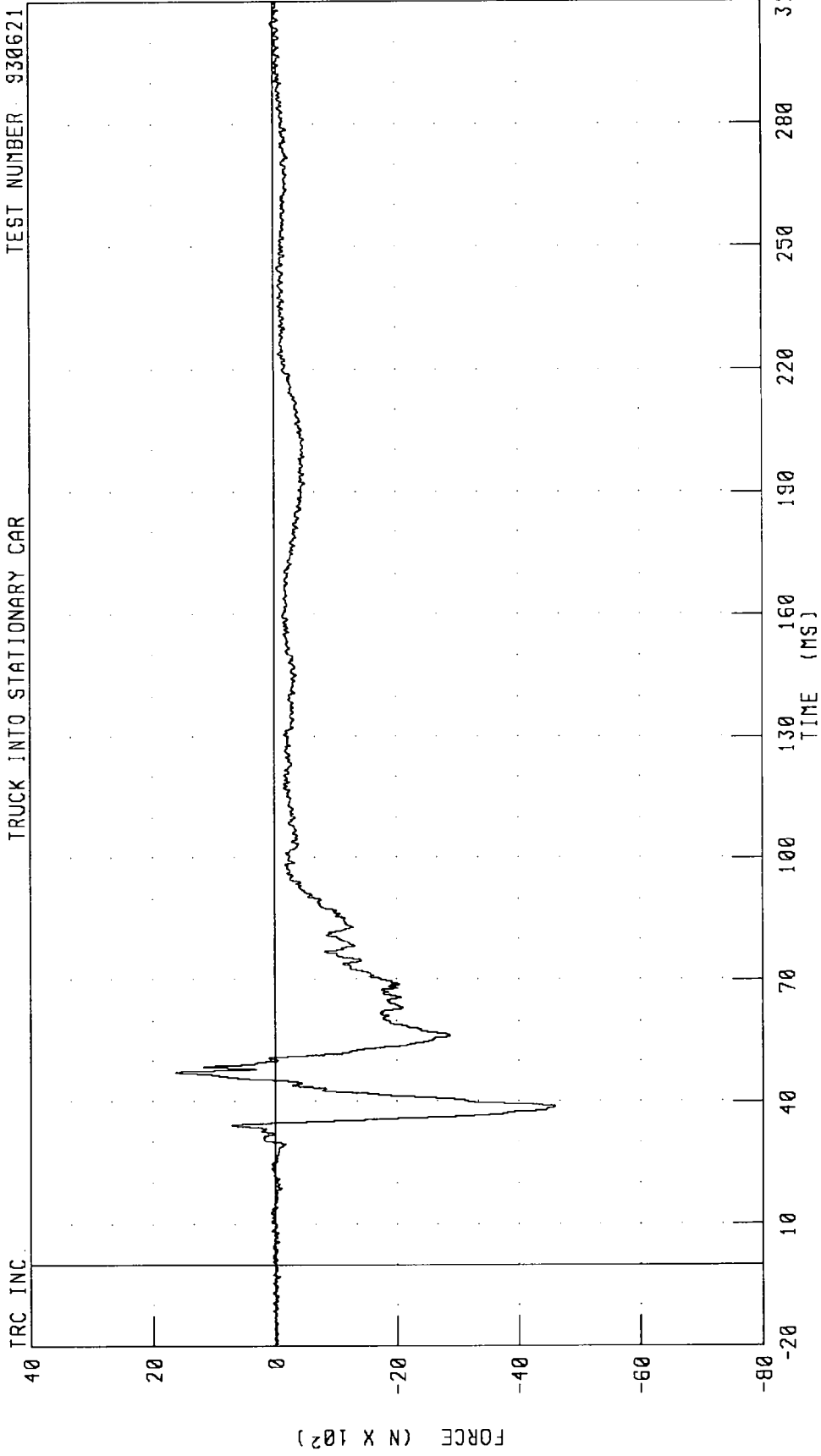


CHANNEL: PEVZV1 FILTER: CH. CLASS 180

PEAK DATA: 29.05 KM/H @ 195.63 MS, -0.04 KM/H @ 3.50 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER LEFT FEMUR FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



CHANNEL: LFMF1 FILTER: CH. CLASS 600 PEAK DATA: 1617.89 N @ 47.13 MS, -4613.75 N @ 38.75 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER RIGHT FEMUR FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC

40

20

FORCE (N X 10²)

-20

-40

-60

-80

TIME (MS)

130

100

70

40

10

-20

-40

-60

-80

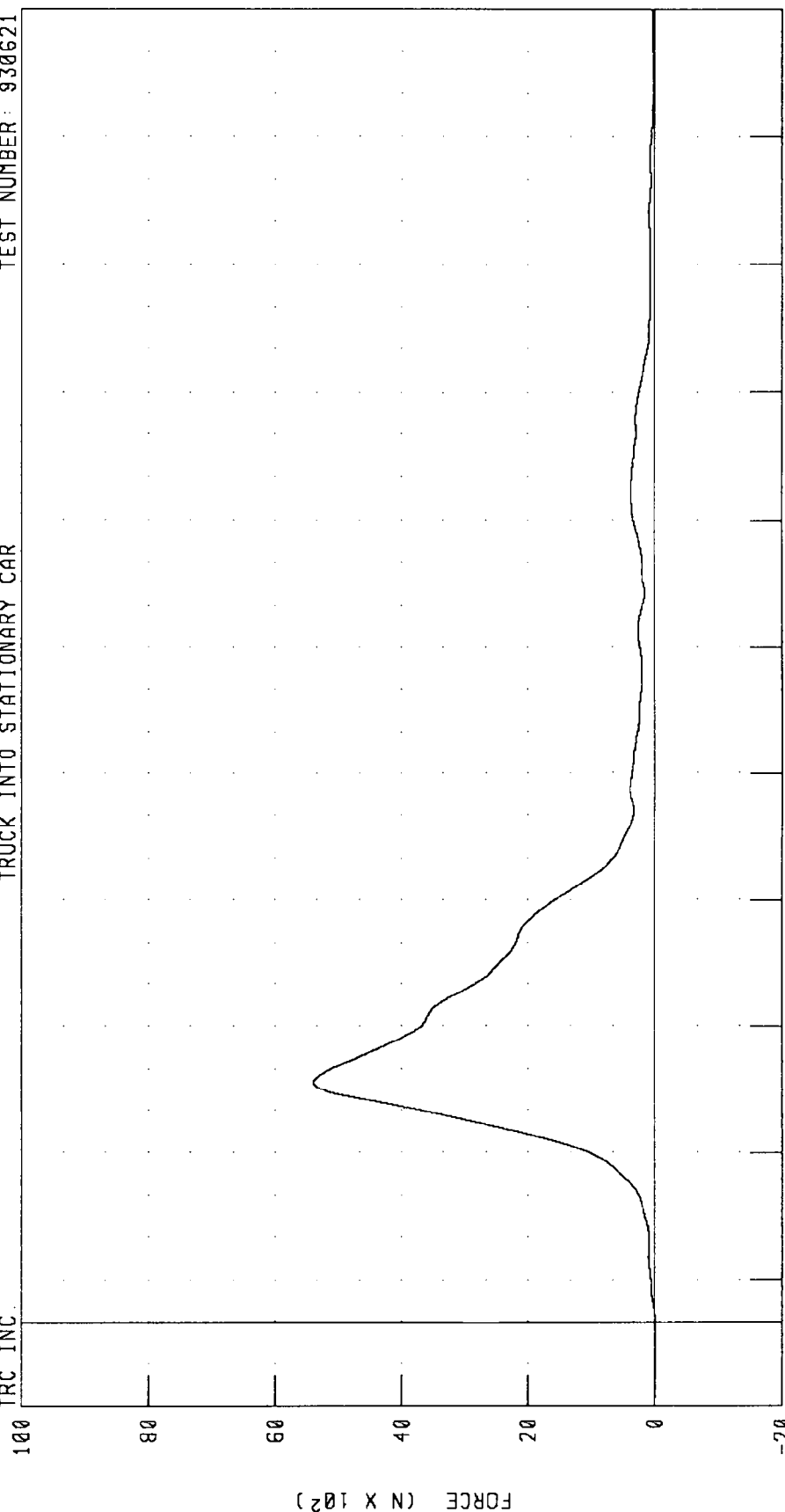
CHANNEL: RFMF1 FILTER: CH. CLASS 600

PEAK DATA: 1580.49 N @ 82.50 MS, -6866.30 N @ 47.75 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER LAP BELT OUTBOARD FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

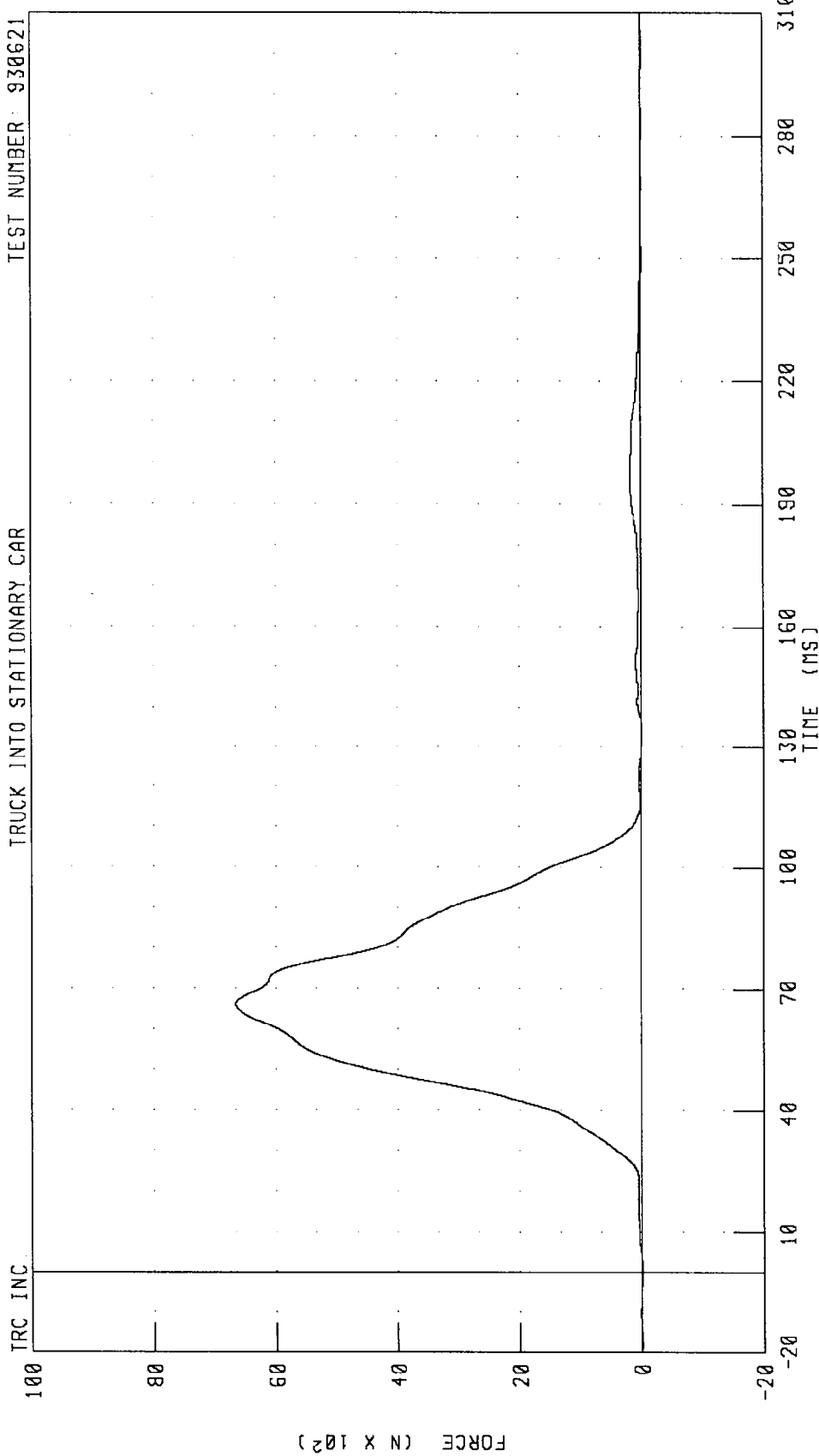


CHANNEL: LBOFI FILTER: CH. CLASS 60

PEAK DATA: 5388.01 N @ 56.75 MS, -12.74 N @ -1.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
DRIVER SHOULDER BELT FORCE
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



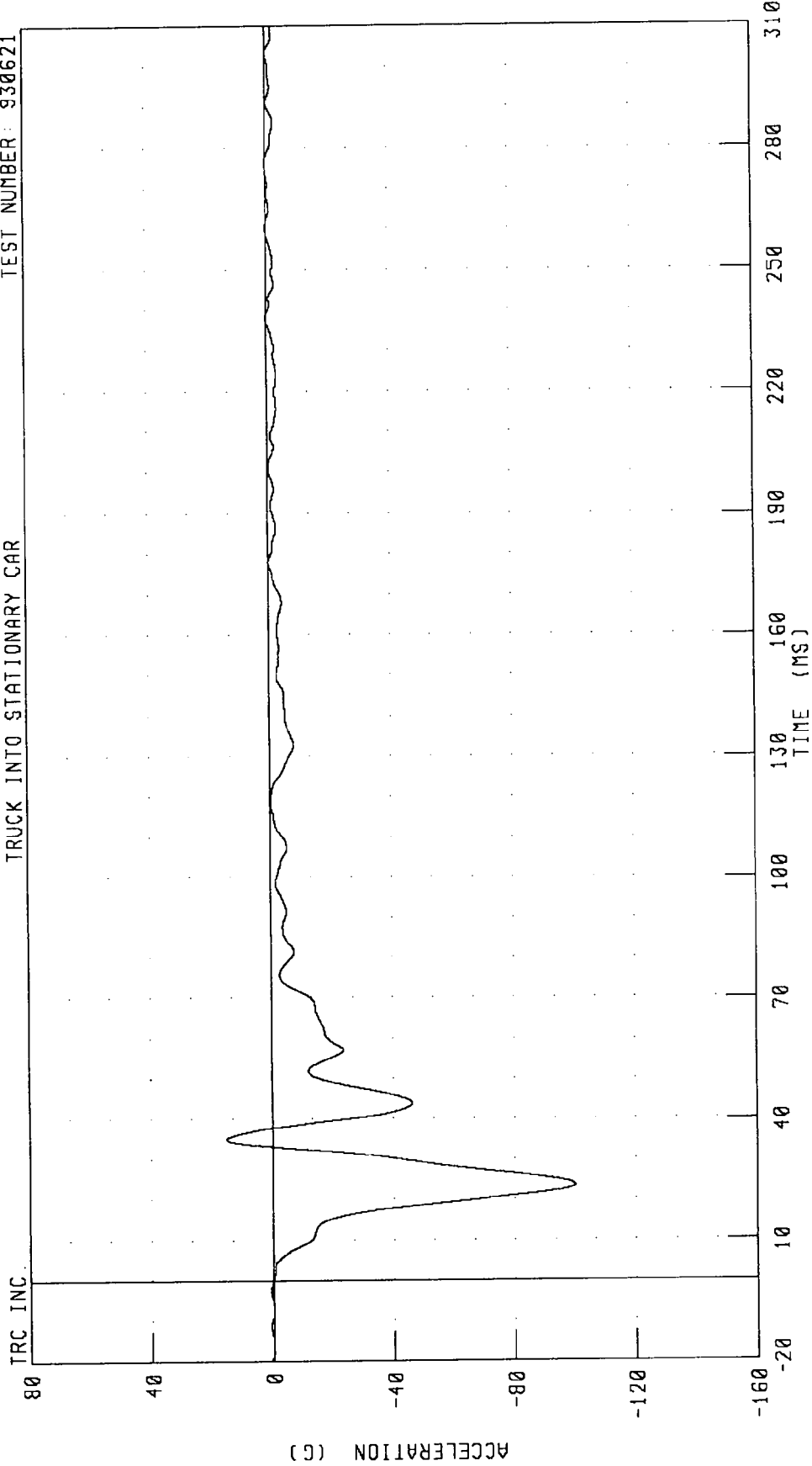
PEAK DATA: 6657.55 N @ 66.25 MS; -16.99 N @ 249.63 MS

CHANNEL: SHBF1 FILTER: CH. CLASS 60

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
ENGINE TOP X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



PEAK DATA: 15 27 G @ 35.00 MS, -100.10 G @ 23.50 MS

CHANNEL: ENGCG1 FILTER: CH. CLASS 60

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
ENGINE TOP X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.

90

60

30

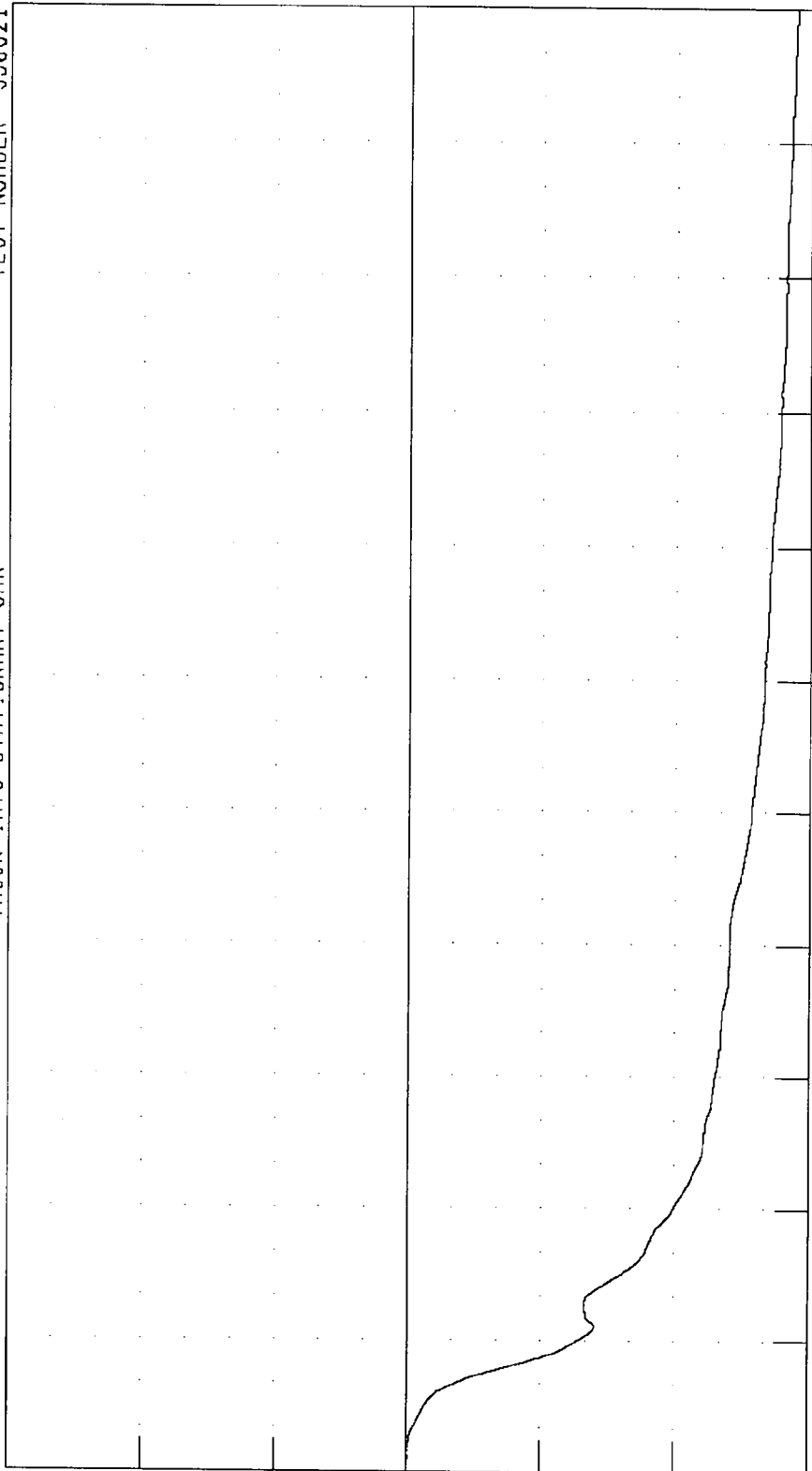
0

-30

-60

-90

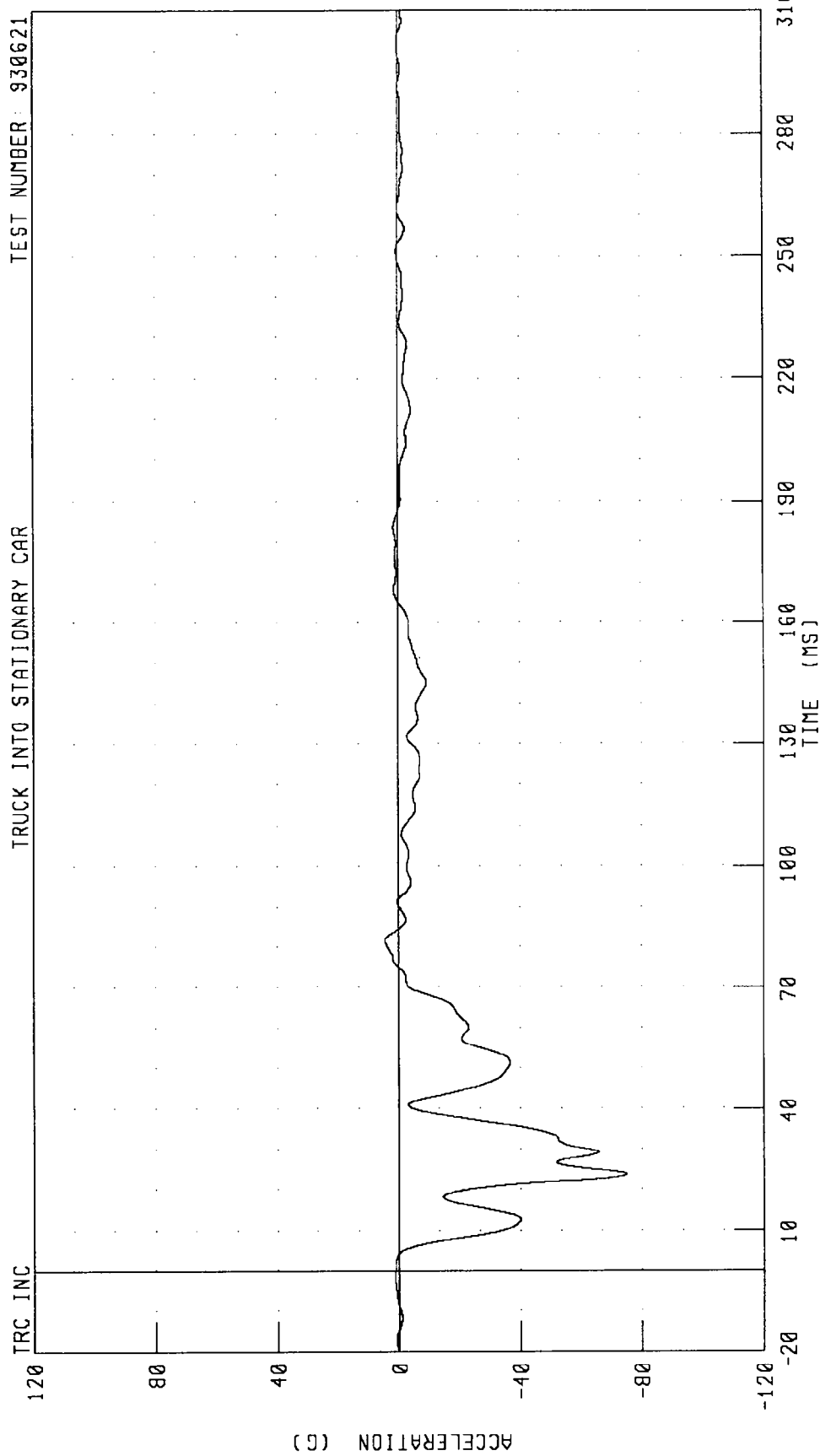
VELOCITY (KM/H)



CHANNEL: ENG5V1 FILTER: CH. CLASS 180
PEAK DATA: 0.00 KM/H @ 0.00 MS; -86.71 KM/H @ 330.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
ENGINE BOTTOM X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

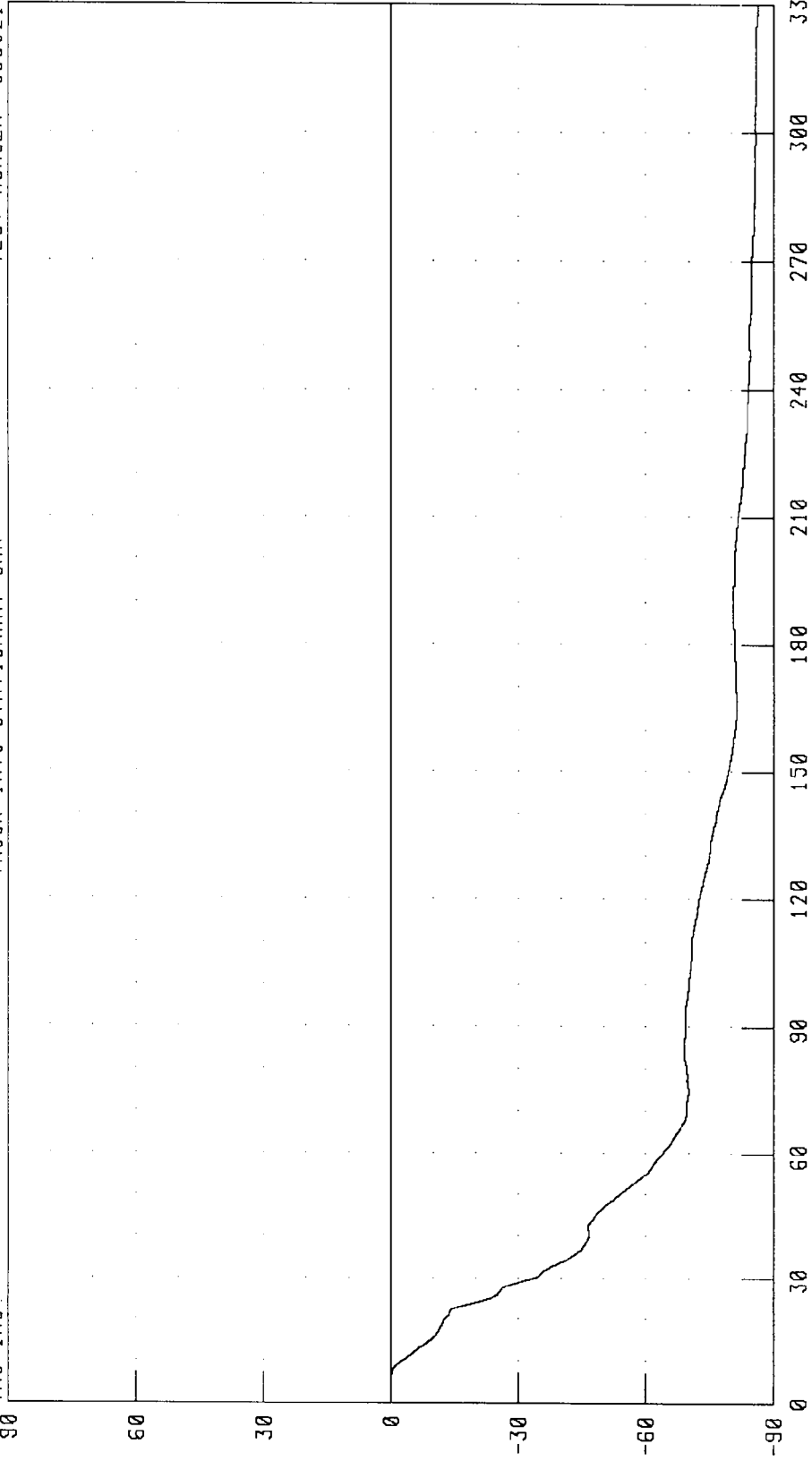


CHANNEL: ENGCG2 FILTER: CH CLASS 60 PEAK DATA: 4.50 G @ 81.50 MS; -74.93 G @ 23.75 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
ENGINE BOTTOM X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC



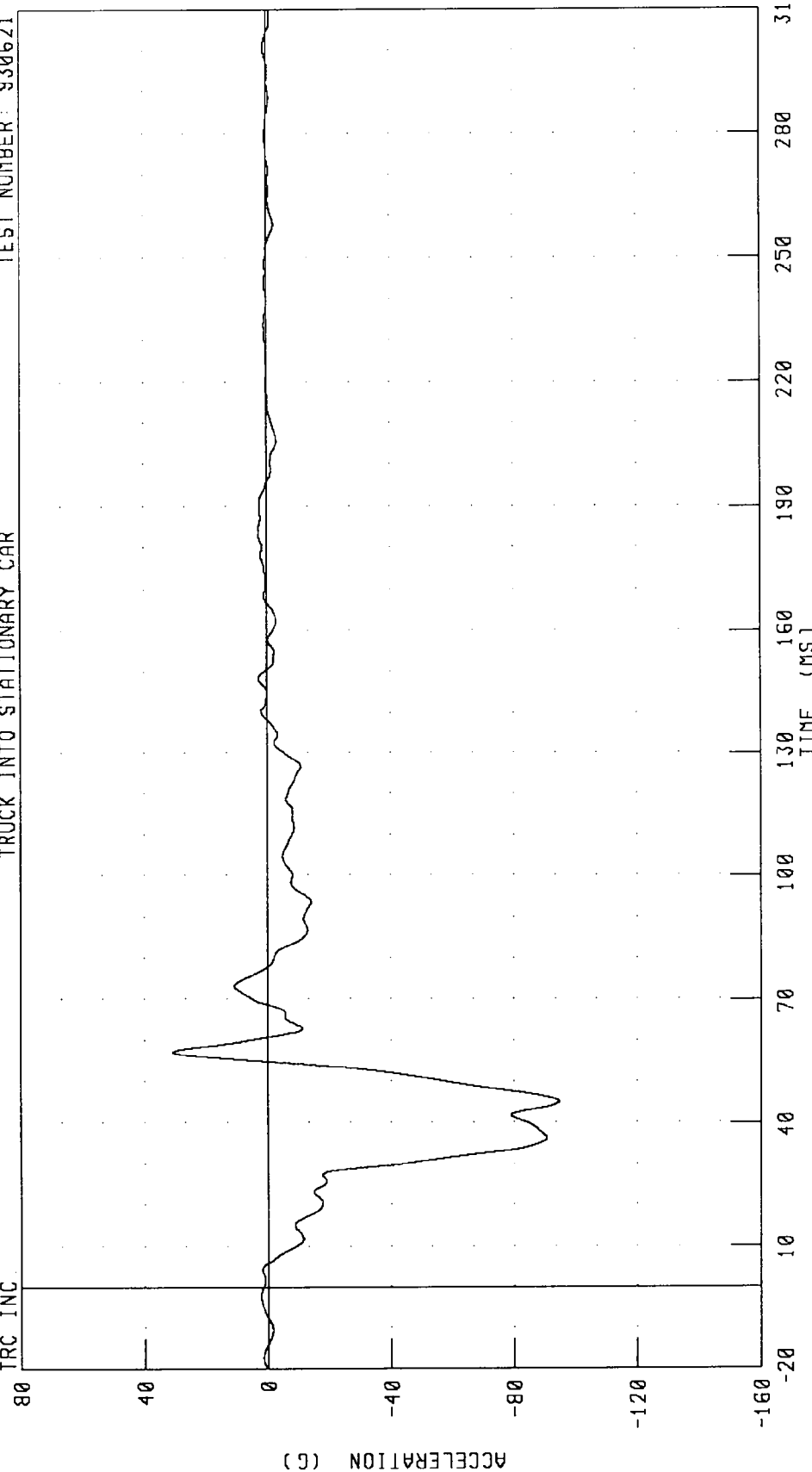
CHANNEL: ENGXY2 FILTER: CH. CLASS 180

PEAK DATA: 0.05 KM/H @ 3.38 MS; -86.41 KM/H @ 330.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
RIGHT BRAKE CALIPER X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC

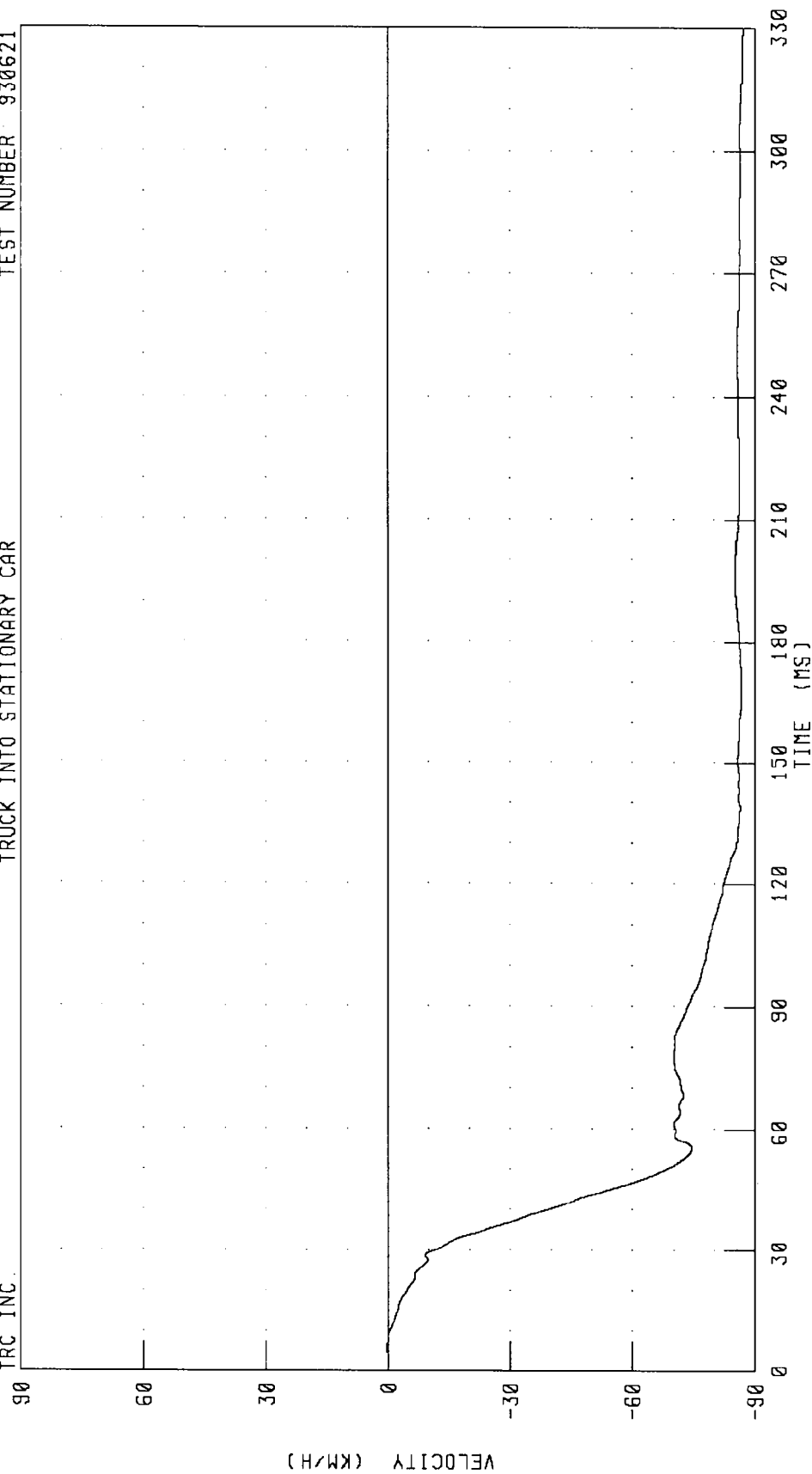


CHANNEL: BCRXG1 FILTER: CH. CLASS 60

PEAK DATA: 30.66 G @ 57.13 MS; -94.53 G @ 45.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
RIGHT BRAKE CALIPER X-AXIS VELOCITY

TRC INC. TRUCK INTO STATIONARY CAR TEST NUMBER 930621



CHANNEL: BCRXY1 FILTER: CH. CLASS 180 PEAK DATA: 0.32 KM/H @ 5.63 MS, -86.99 KM/H @ 330.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
LEFT BRAKE CALIPER X-AXIS ACCELERATION

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

60

30

0

-30

-60

-90

-120

ACCELERATION (G)

TIME (MS)

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310

CHANNEL: BCLXG1 FILTER: CH. CLASS 60

PEAK DATA: 35.13 G @ 34.50 MS, -107.80 G @ 21.88 MS

TRC INC.

60

30

0

-30

-60

-90

-120

ACCELERATION (G)

TIME (MS)

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310

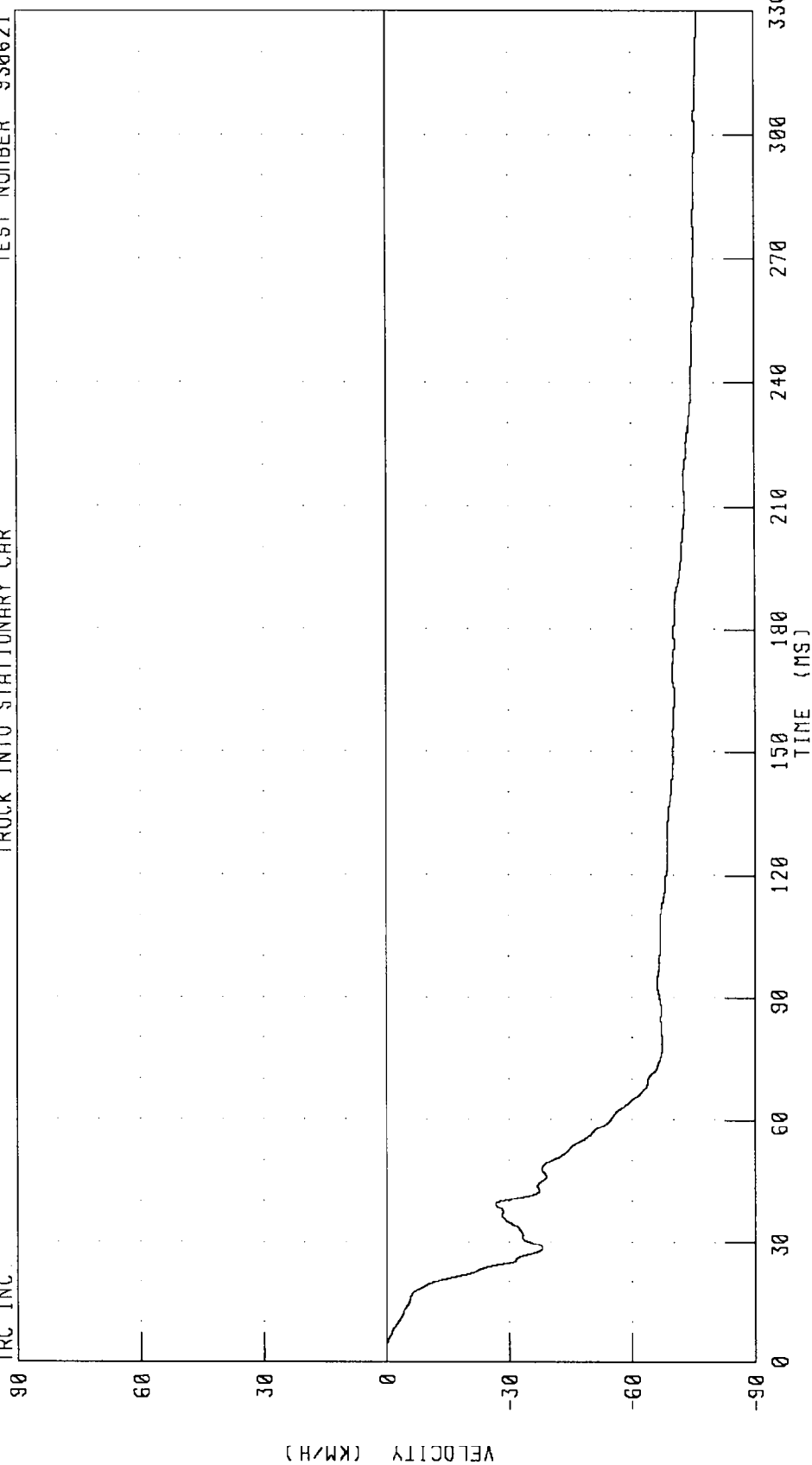
CHANNEL: BCLXG1 FILTER: CH. CLASS 60

PEAK DATA: 35.13 G @ 34.50 MS, -107.80 G @ 21.88 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
LEFT BRAKE CALIPER X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC

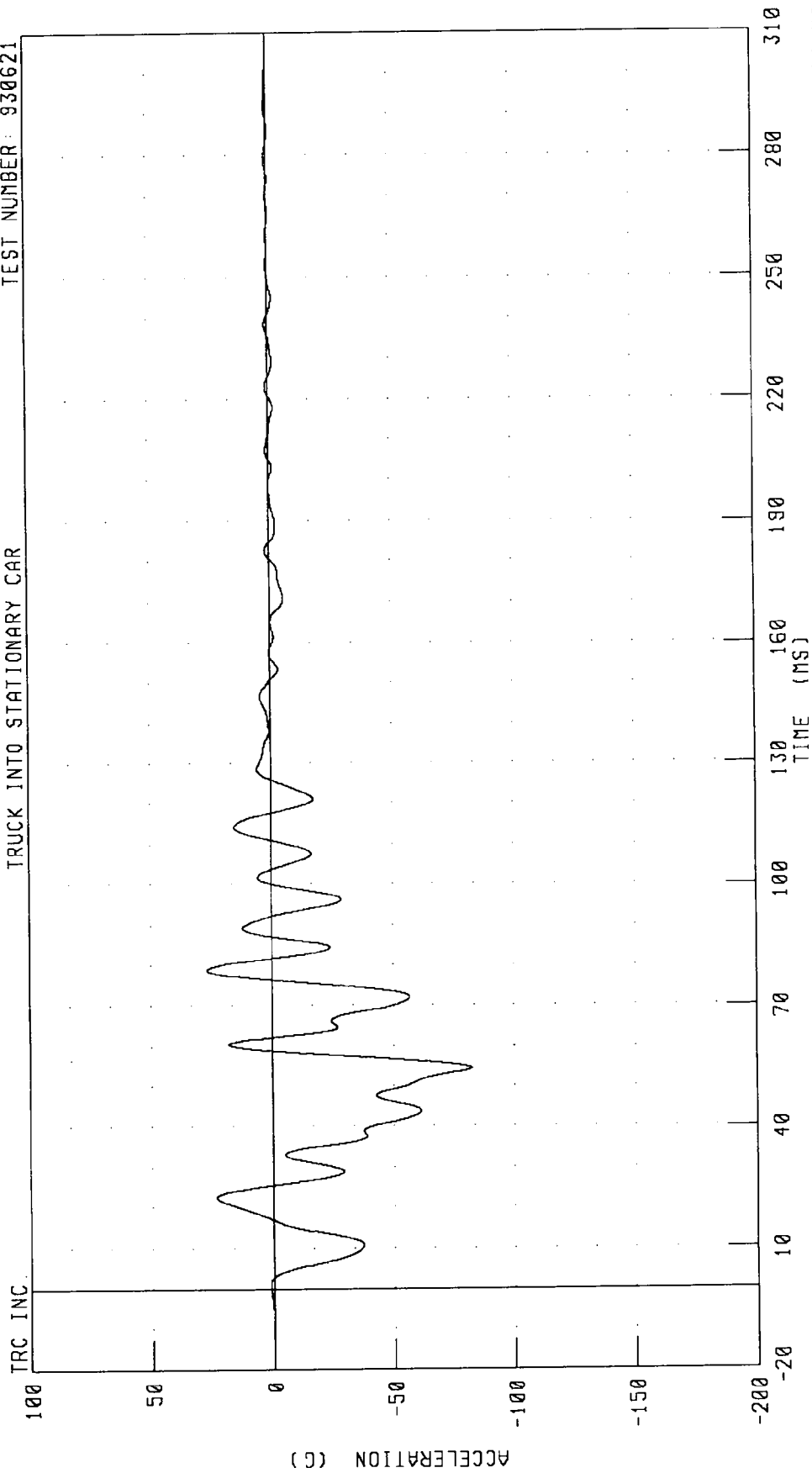


PEAK DATA: 0.11 KM/H @ 3.13 MS; -75.98 KM/H @ 330.00 MS

CHANNEL: BCLXV1 FILTER: CH. CLASS 180

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
INSTRUMENT PANEL CENTER X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

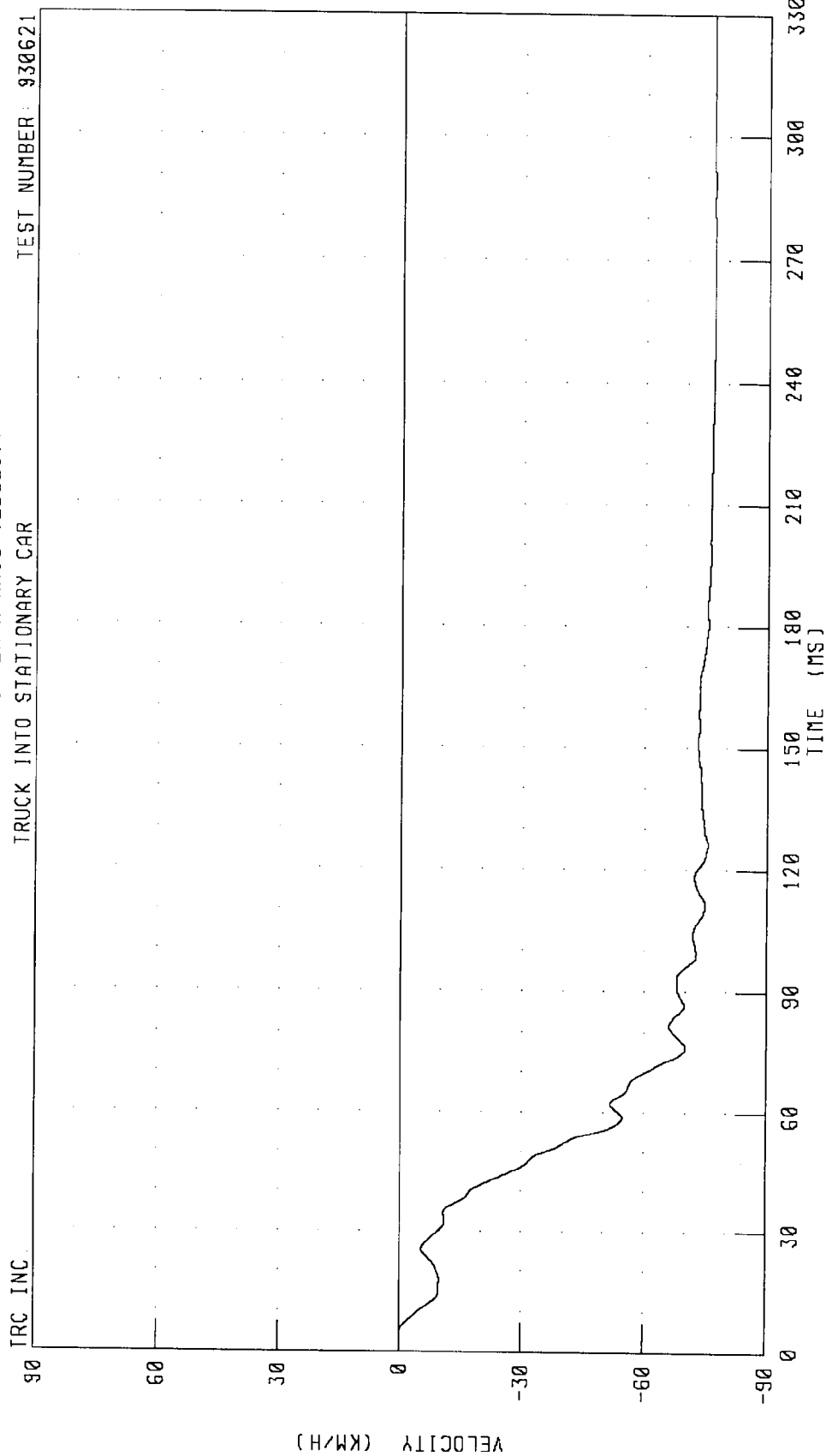


PEAK DATA: 26.53 G @ 78.88 MS, -82.36 G @ 54.50 MS

CHANNEL: DPCXG1 FILTER: CH. CLASS 60

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
INSTRUMENT PANEL CENTER X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

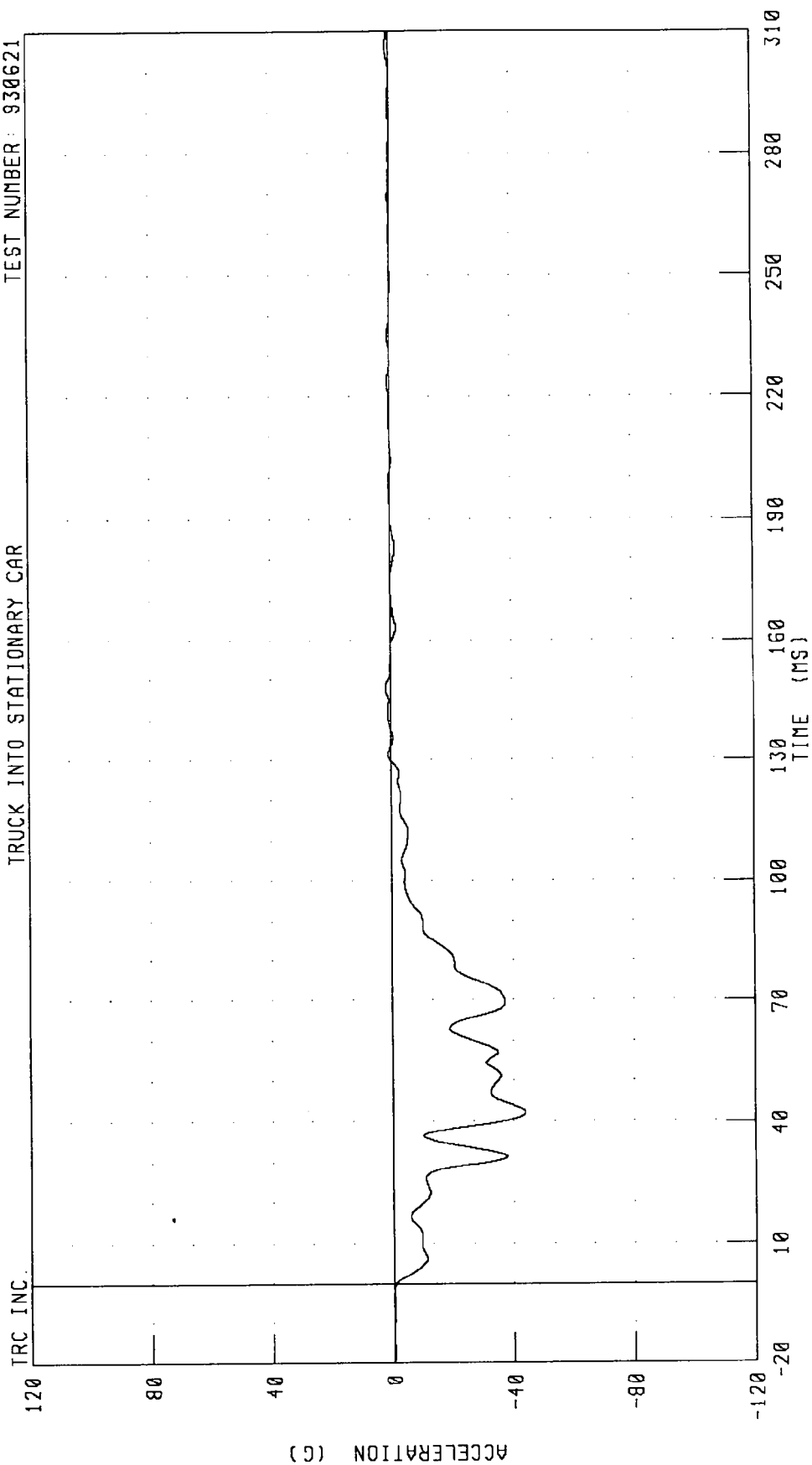


CHANNEL: DPCXY1 FILTER: CH. CLASS 180

PEAK DATA: 0.04 KM/H @ 3.88 MS; -76.68 KM/H @ 276.50 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



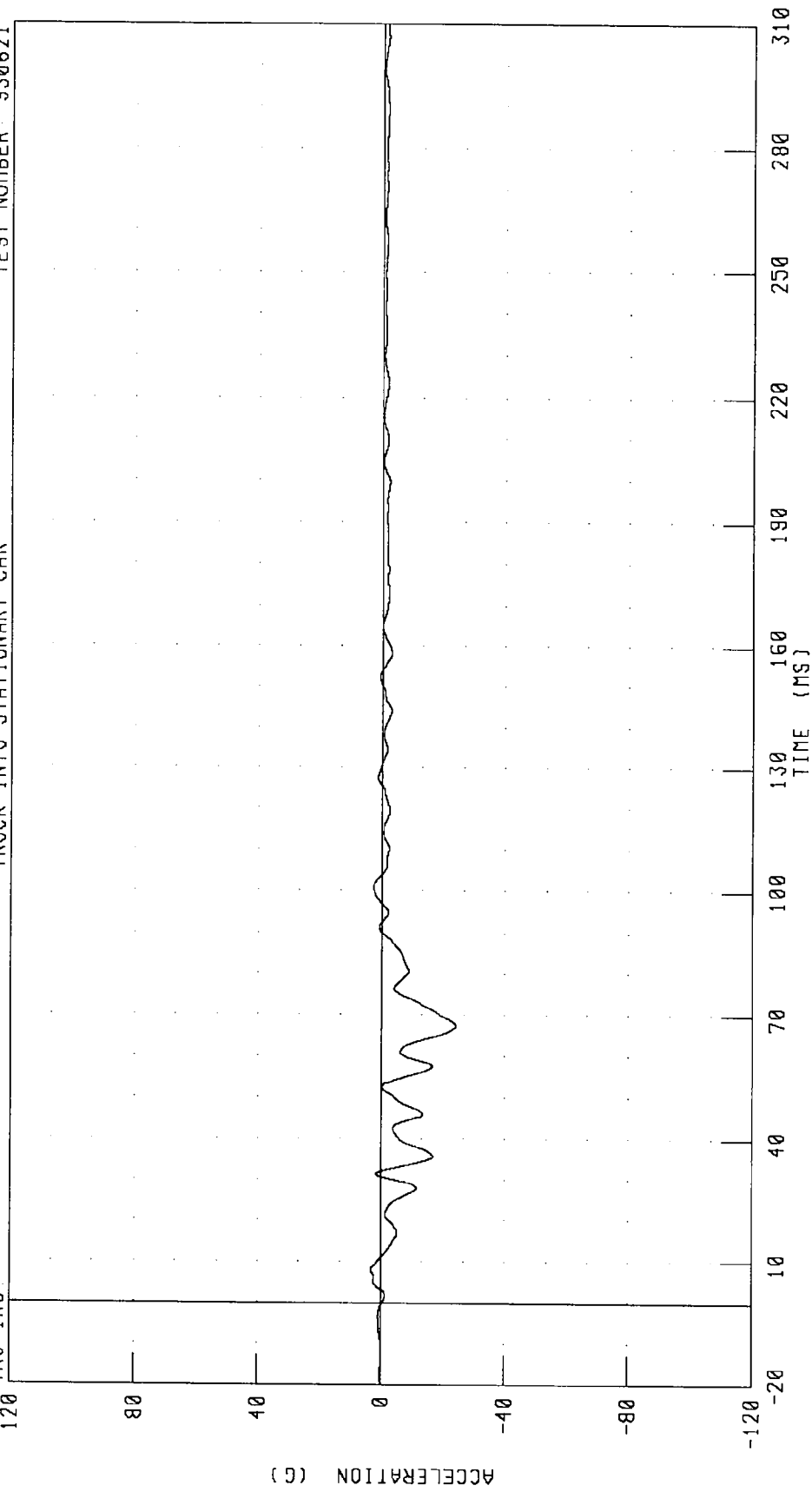
CHANNEL: VCGXG1 FILTER: CH. CLASS 60 PEAK DATA: 1.77 G @ 147.63 MS, -43.73 G @ 42.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY Y-AXIS ACCELERATION

TEST NUMBER: 930621

TRUCK INTO STATIONARY CAR

TRC INC.

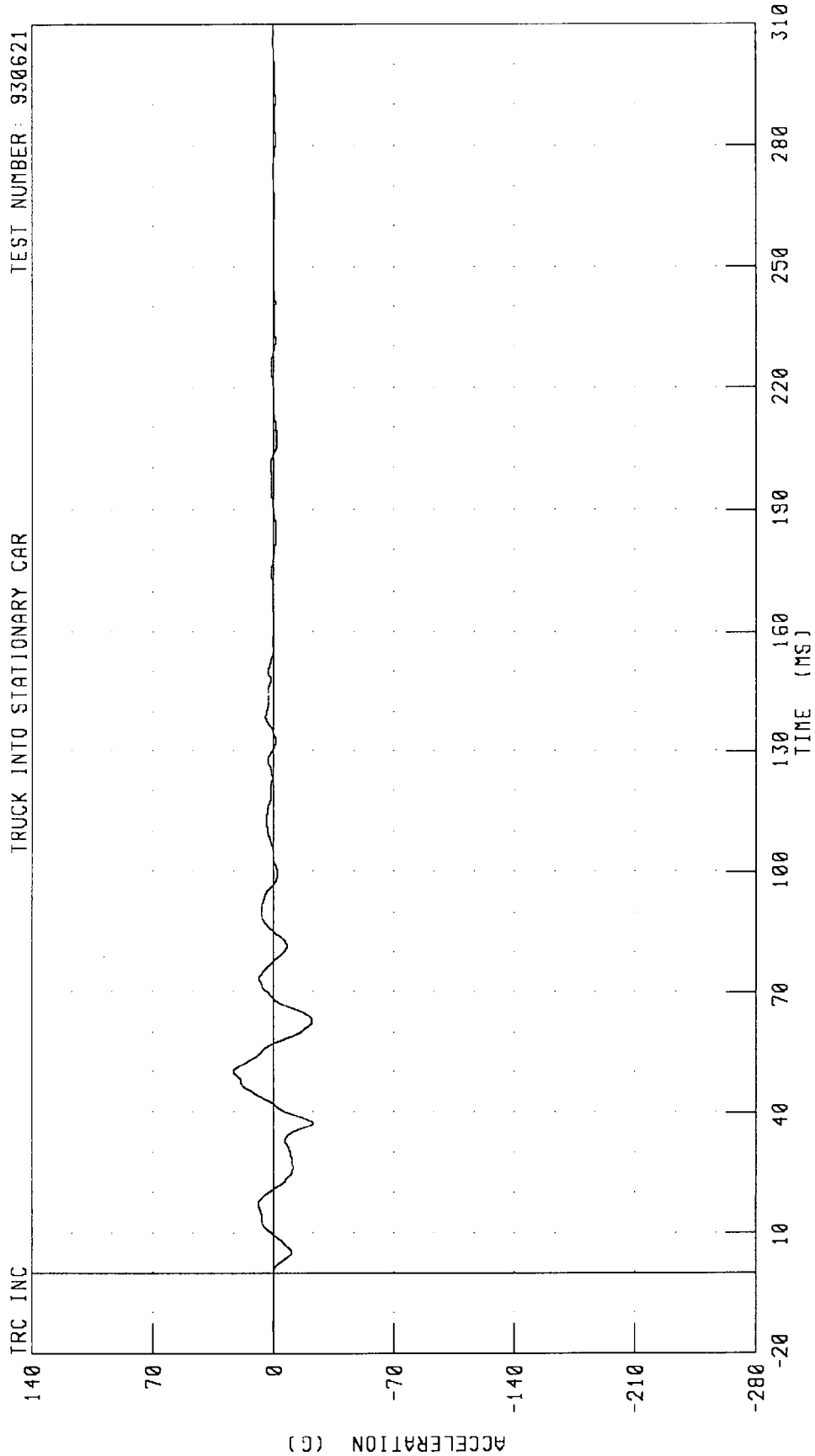


CHANNEL: VCGYG1 FILTER: CH. CLASS 60

PEAK DATA: 3.22 G @ 7.88 MS; -24.14 G @ 67.50 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY Z-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



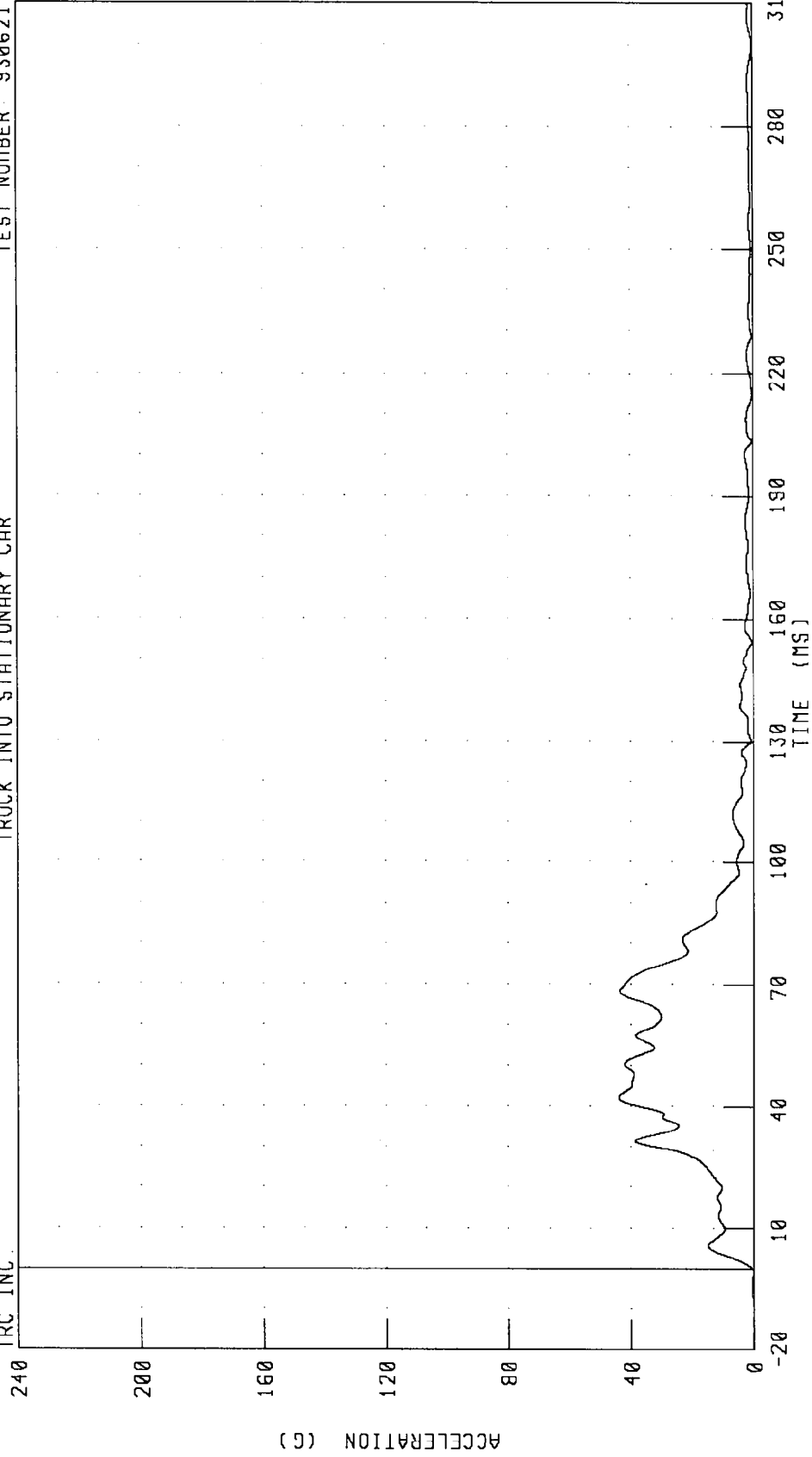
CHANNEL: VCGZG1 FILTER: CH. CLASS 60 PEAK DATA: 22.96 G @ 50.00 MS, -23.14 G @ 37.38 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY RESULTANT ACCELERATION

TEST NUMBER: 930621

TRUCK INTO STATIONARY CAR

TRC INC.



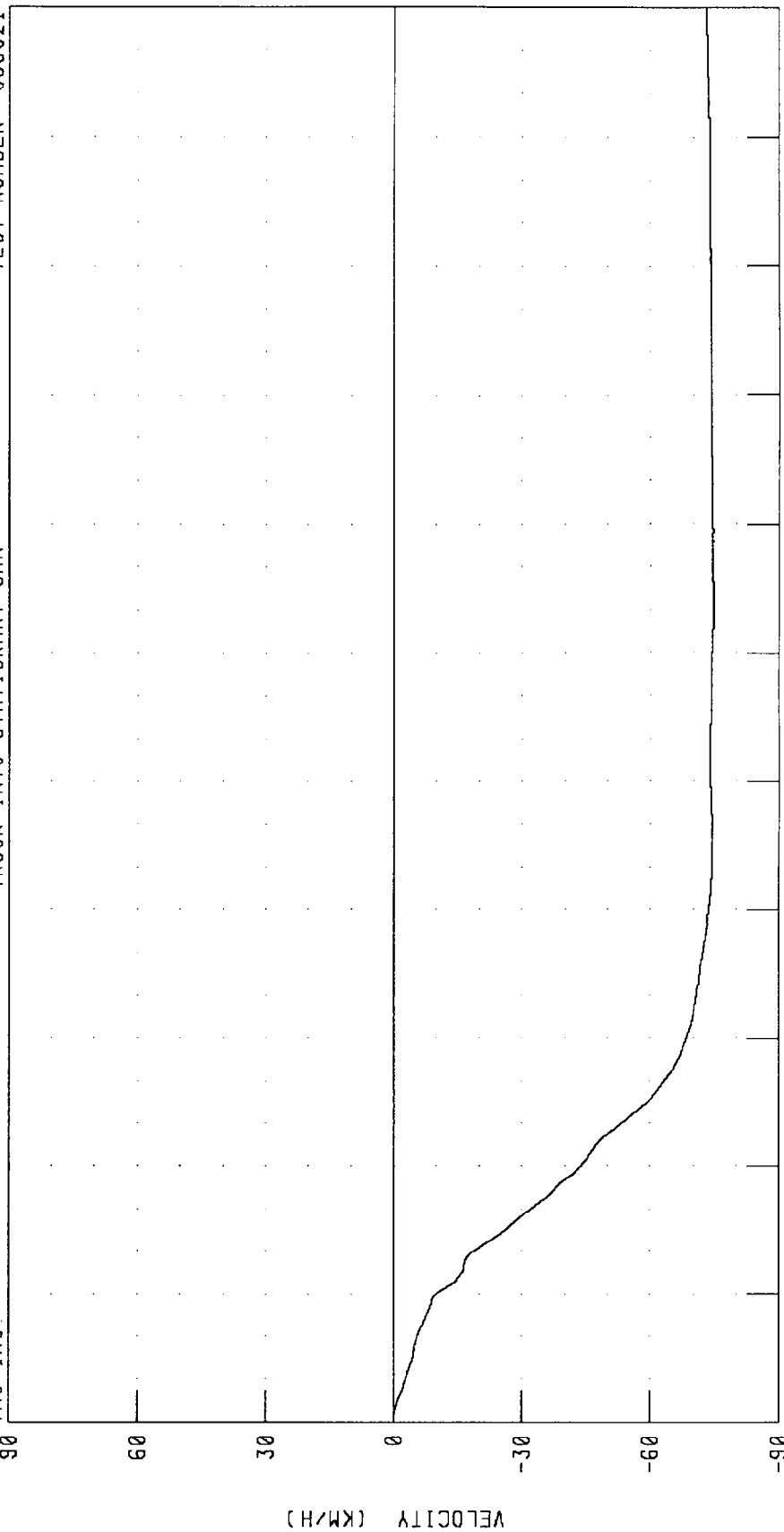
PEAK DATA: 43.90 G @ 42.25 MS; 0.10 G @ -20.00 MS

CHANNEL: VCGRG1 FILTER: CH. CLASS 60

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

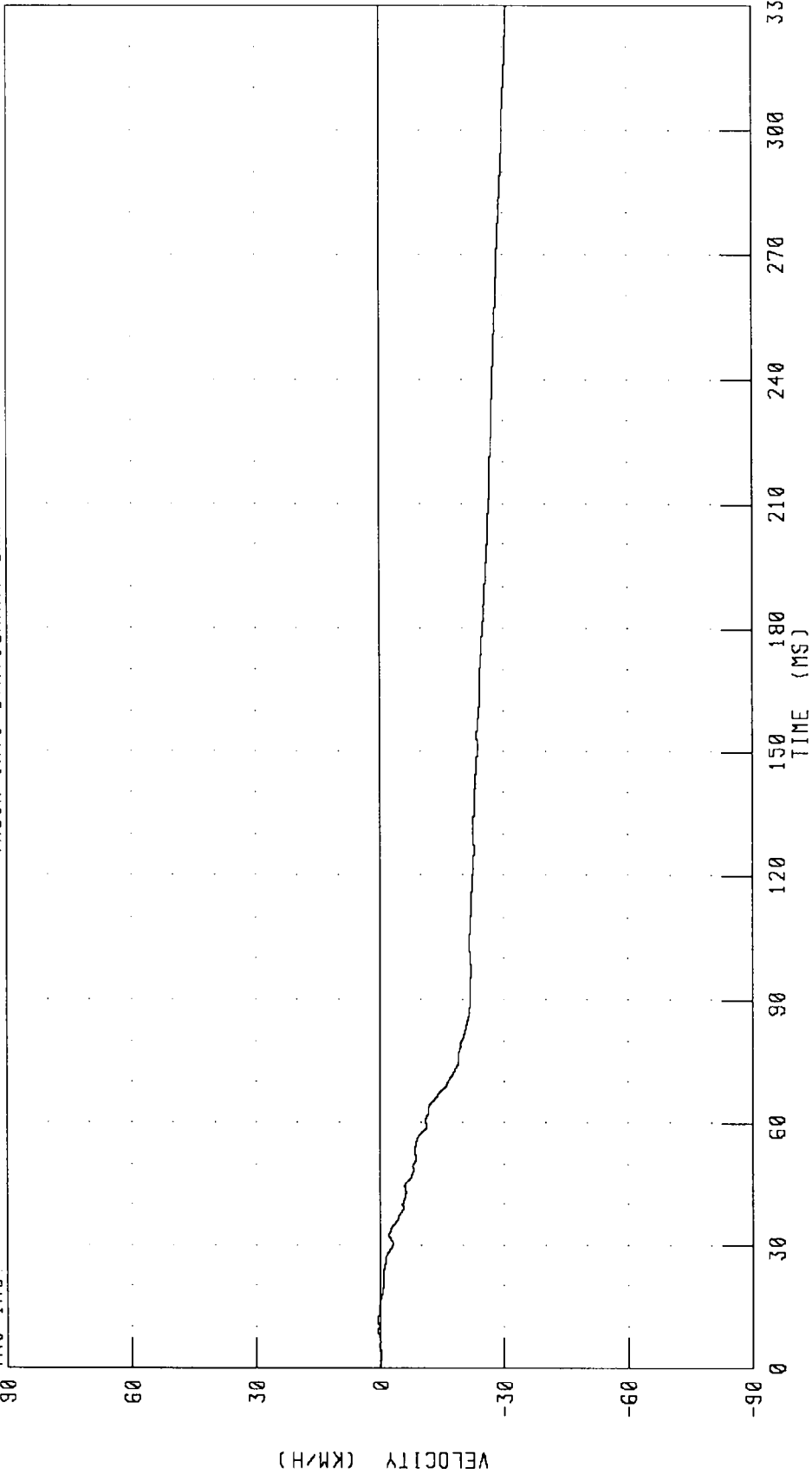


CHANNEL: VCGXV1 FILTER: CH. CLASS 180
PEAK DATA: 0.02 KM/H @ 1.00 MS; -74.59 KM/H @ 189.88 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY Y-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



CHANNEL: VCGYV1 FILTER: CH. CLASS 180

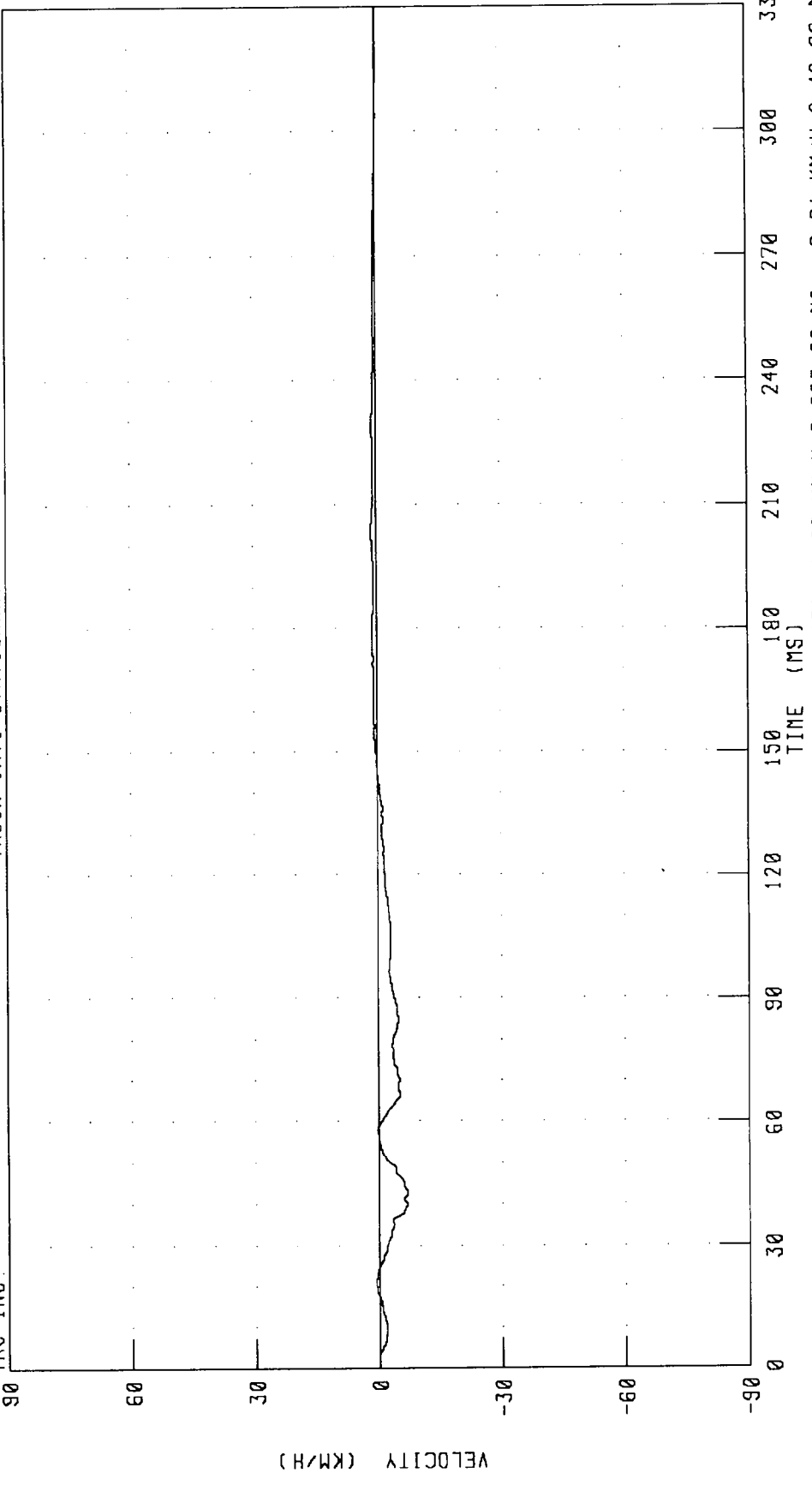
PEAK DATA: 0.47 KM/H @ 8.88 MS; -30.86 KM/H @ 330.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
CAR CENTER OF GRAVITY Z-AXIS VELOCITY

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



CHANNEL: VCGZV1 FILTER: CH. CLASS 180

PEAK DATA: 1.26 KM/H @ 203.00 MS, -6.91 KM/H @ 42.88 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
LEFT REAR SEAT X-AXIS ACCELERATION

TEST NUMBER 930621

TRUCK INTO STATIONARY CAR

TRC INC

60

40

20

0

-20

-40

-60

ACCELERATION (G)

TIME (MS)

100

70

40

10

-20

-40

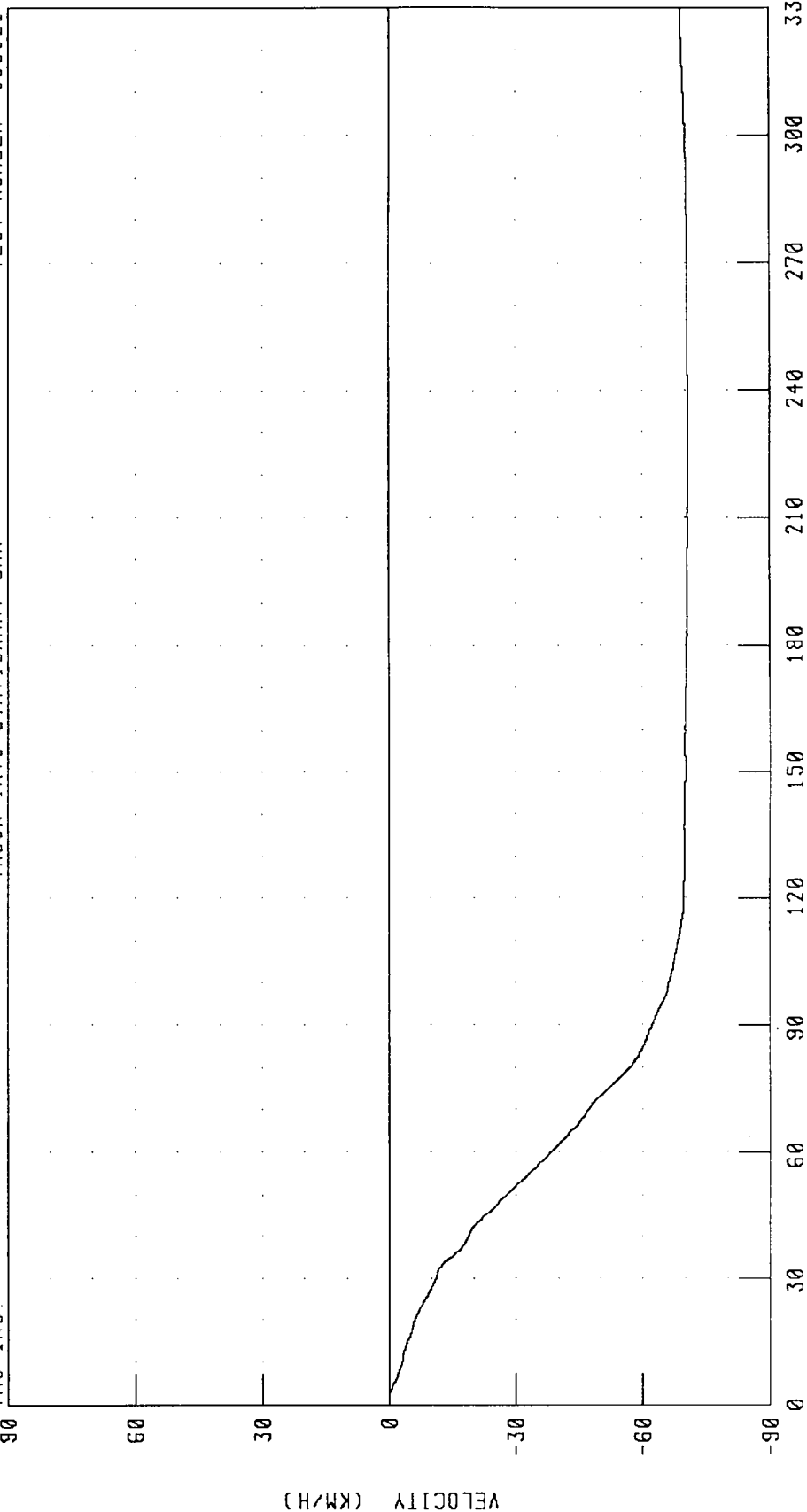
-60

CHANNEL: TLRXG1 FILTER: CH. CLASS 60 PEAK DATA: 1.29 G @ 303.00 MS; -31.48 G @ 35.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
LEFT REAR SEAT X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



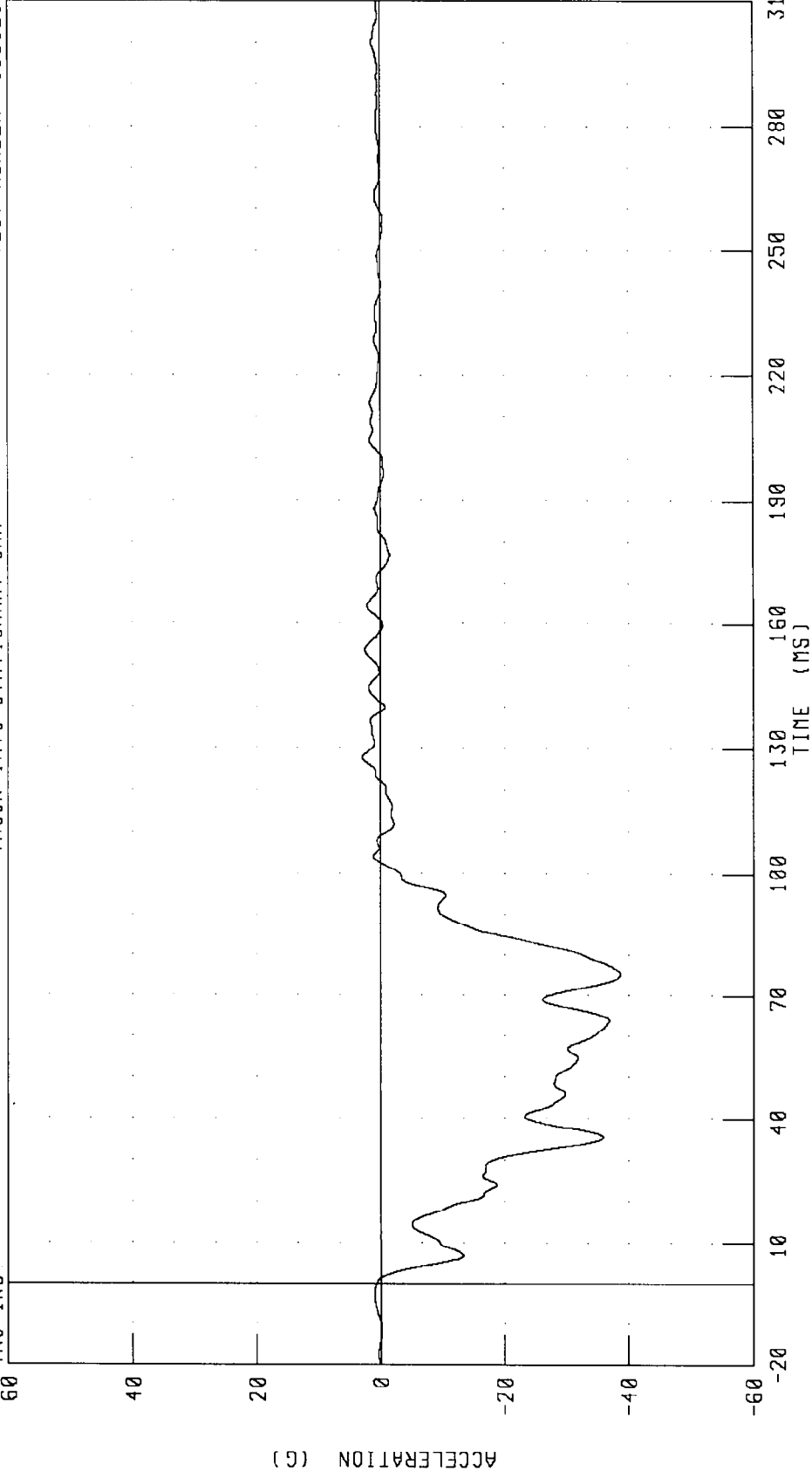
CHANNEL: TLRXV1 FILTER: CH. CLASS 180

PEAK DATA: 0.03 KM/H @ 1.75 MS, -70.94 KM/H @ 229.50 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
RIGHT REAR SEAT X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC



CHANNEL: TRRXG1 FILTER: CH. CLASS 60

PEAK DATA: 2.89 G @ 127.88 MS, -38.65 G @ 75.25 MS

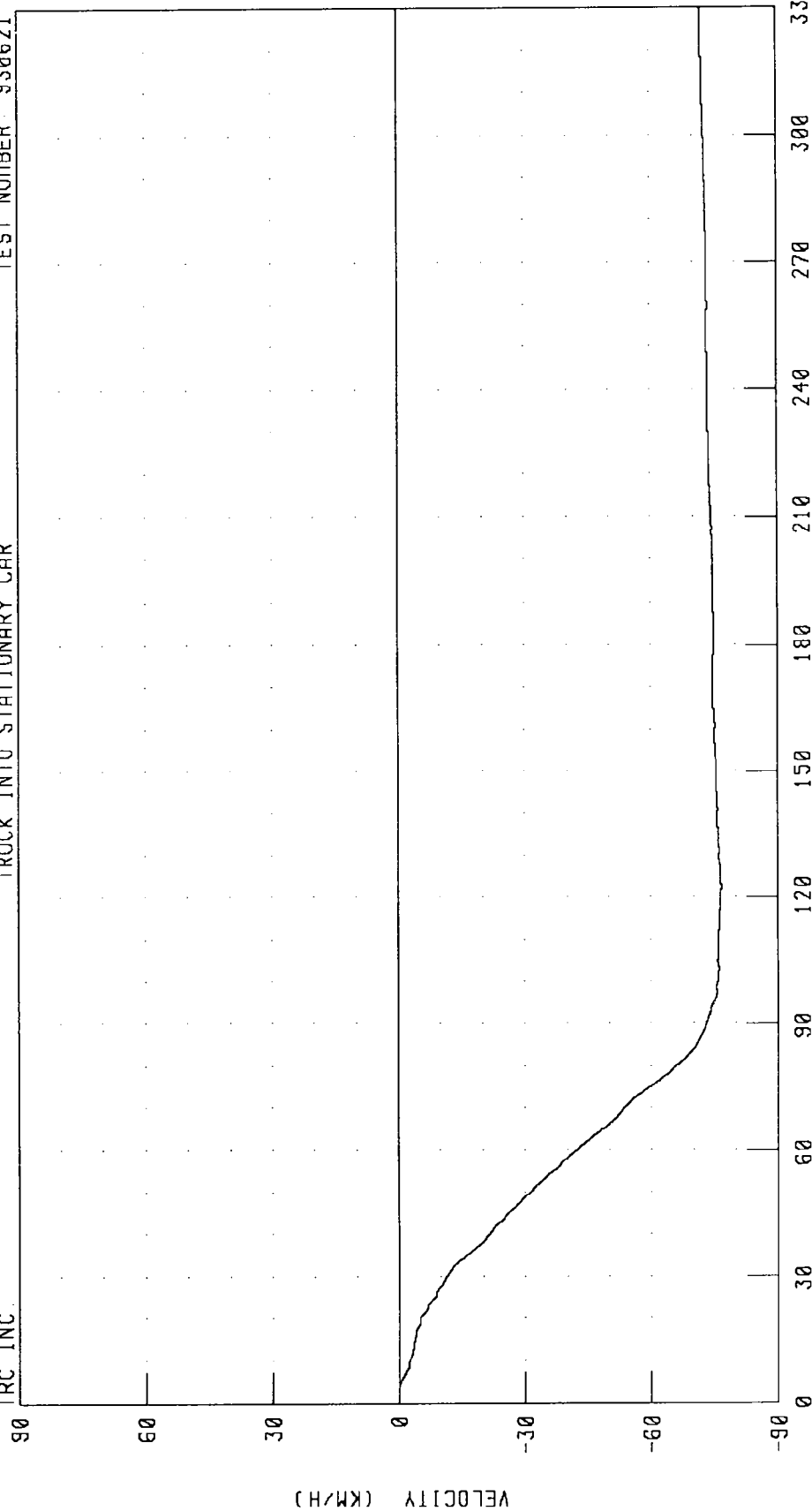
REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16

RIGHT REAR SEAT X-AXIS VELOCITY

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



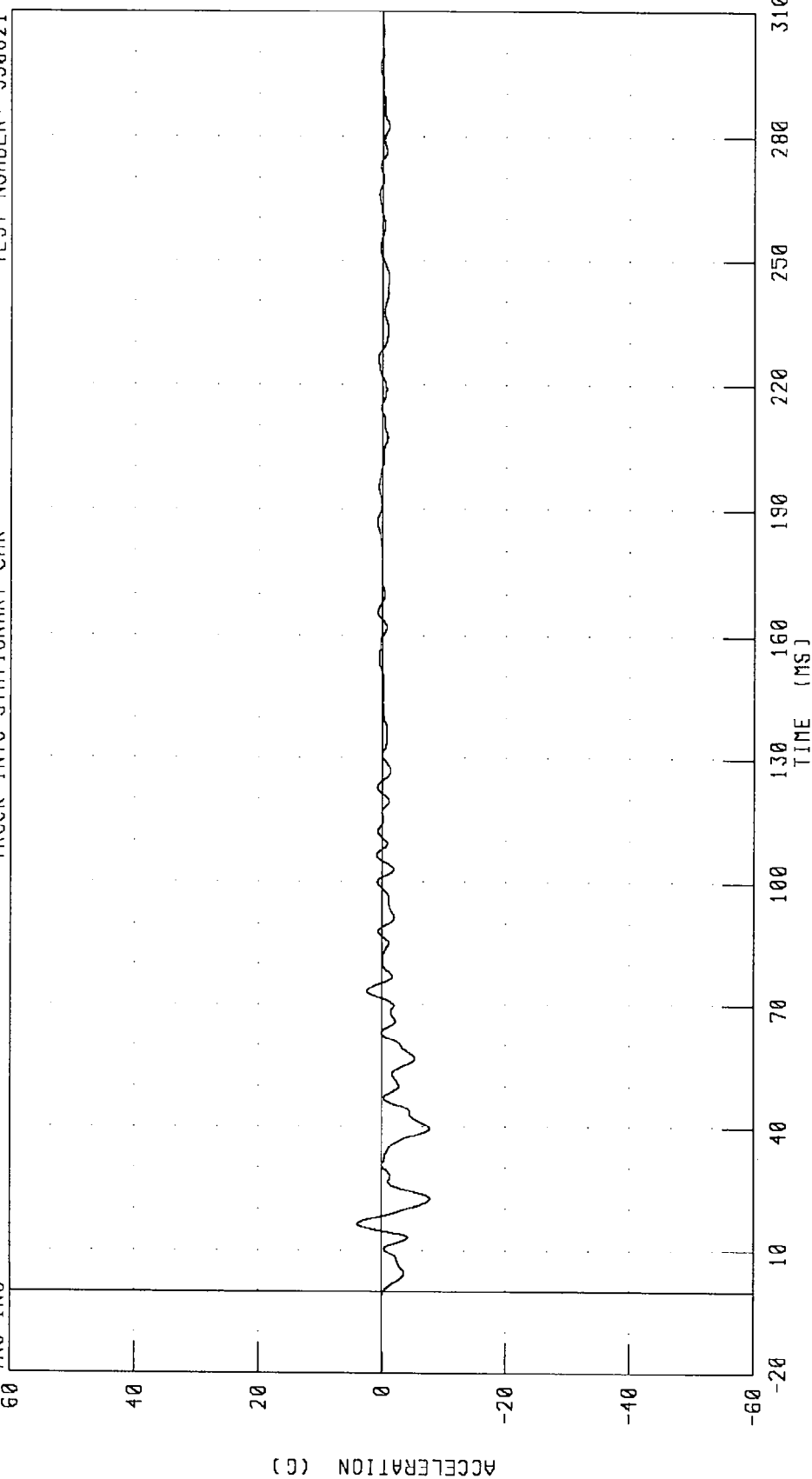
CHANNEL: TRRXV1 FILTER: CH. CLASS 180

PEAK DATA: 0.00 KM/H @ 1.00 MS; -76.60 KM/H @ 122.38 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC



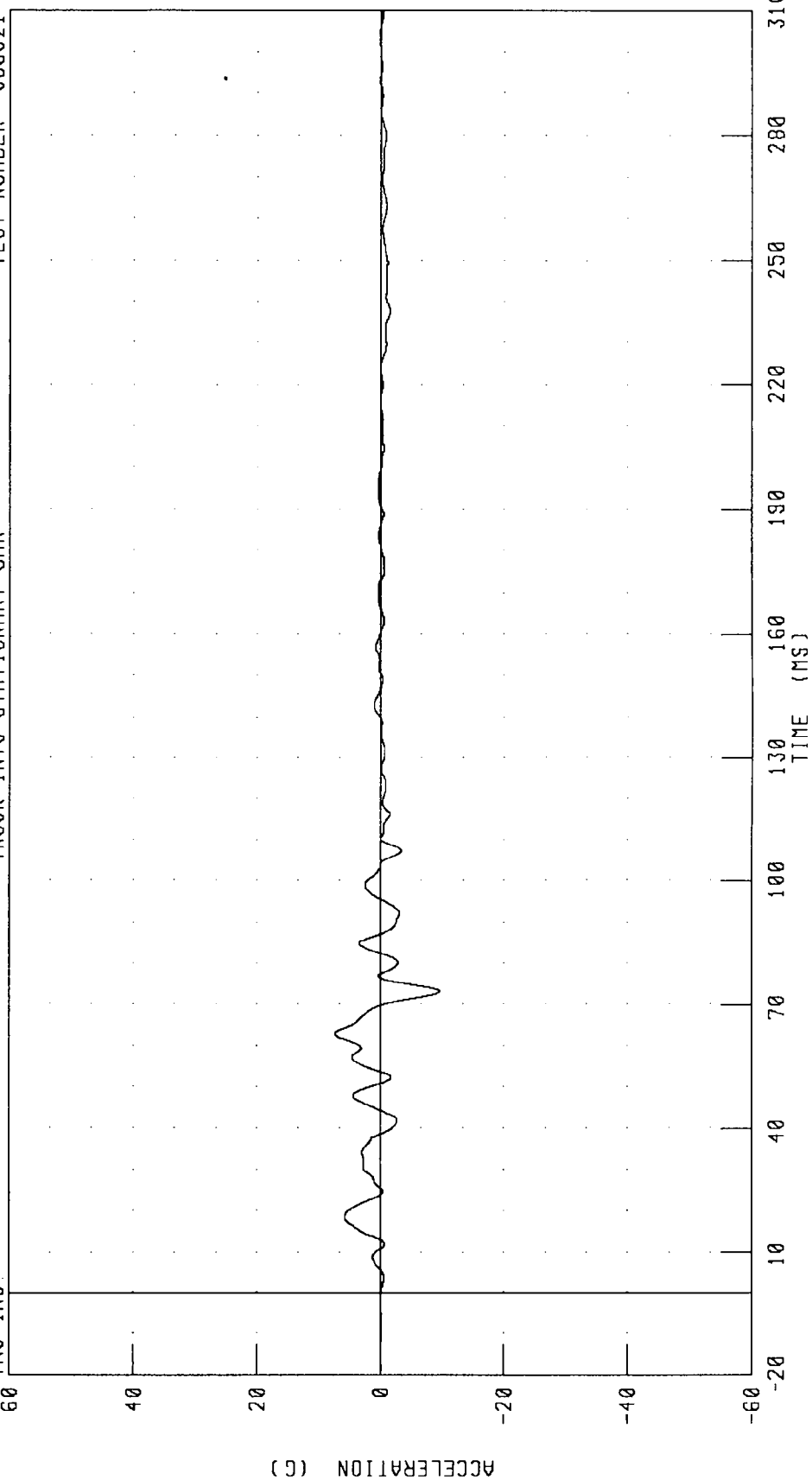
CHANNEL: FFCXGA FILTER: CH. CLASS 60

PEAK DATA: 3.89 G @ 16.50 MS, -7.87 G @ 22.50 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER Y-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.



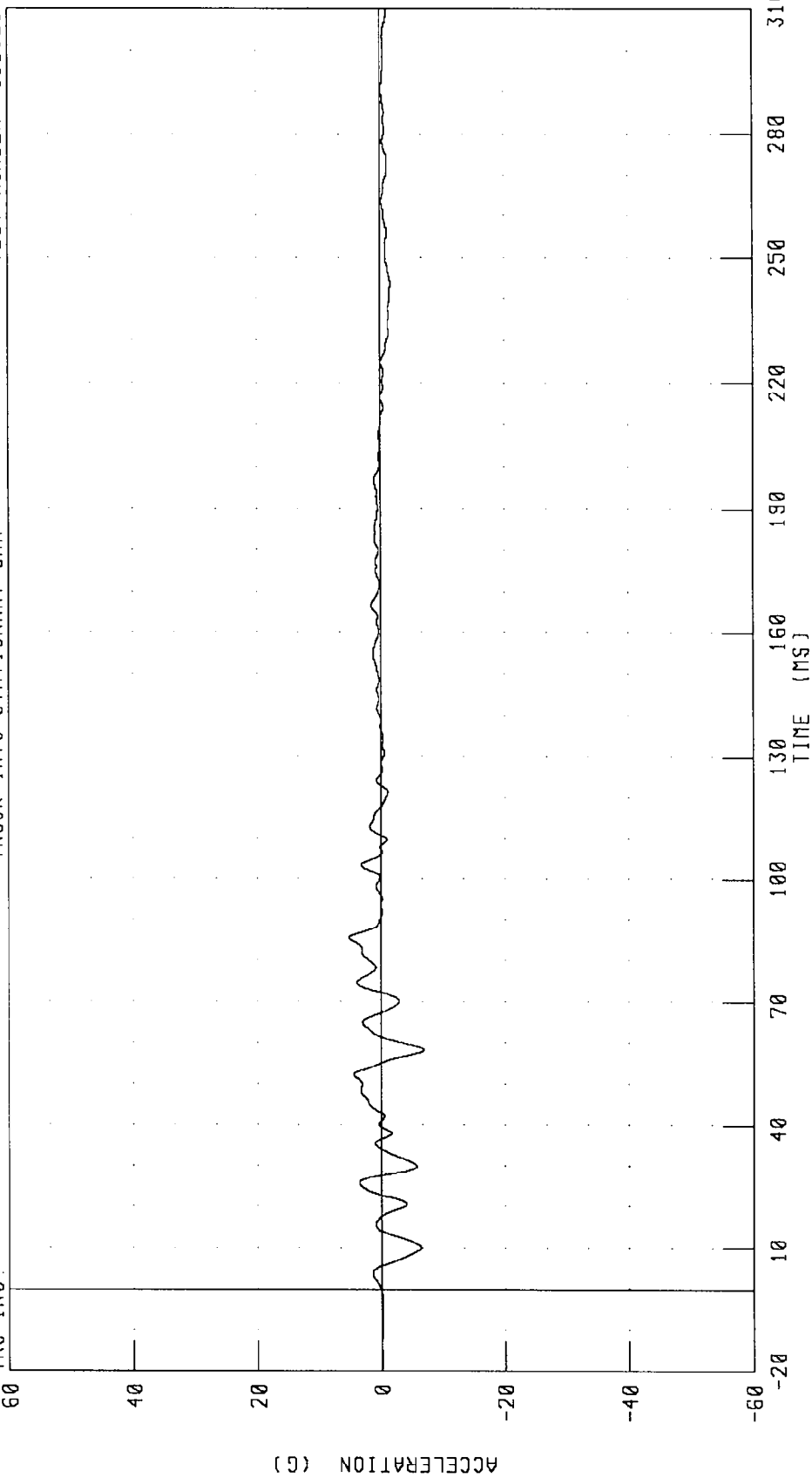
CHANNEL: FFCYGA FILTER: CH. CLASS 60

PEAK DATA: 7.32 G @ 63.00 MS, -9.70 G @ 73.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER Z-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.

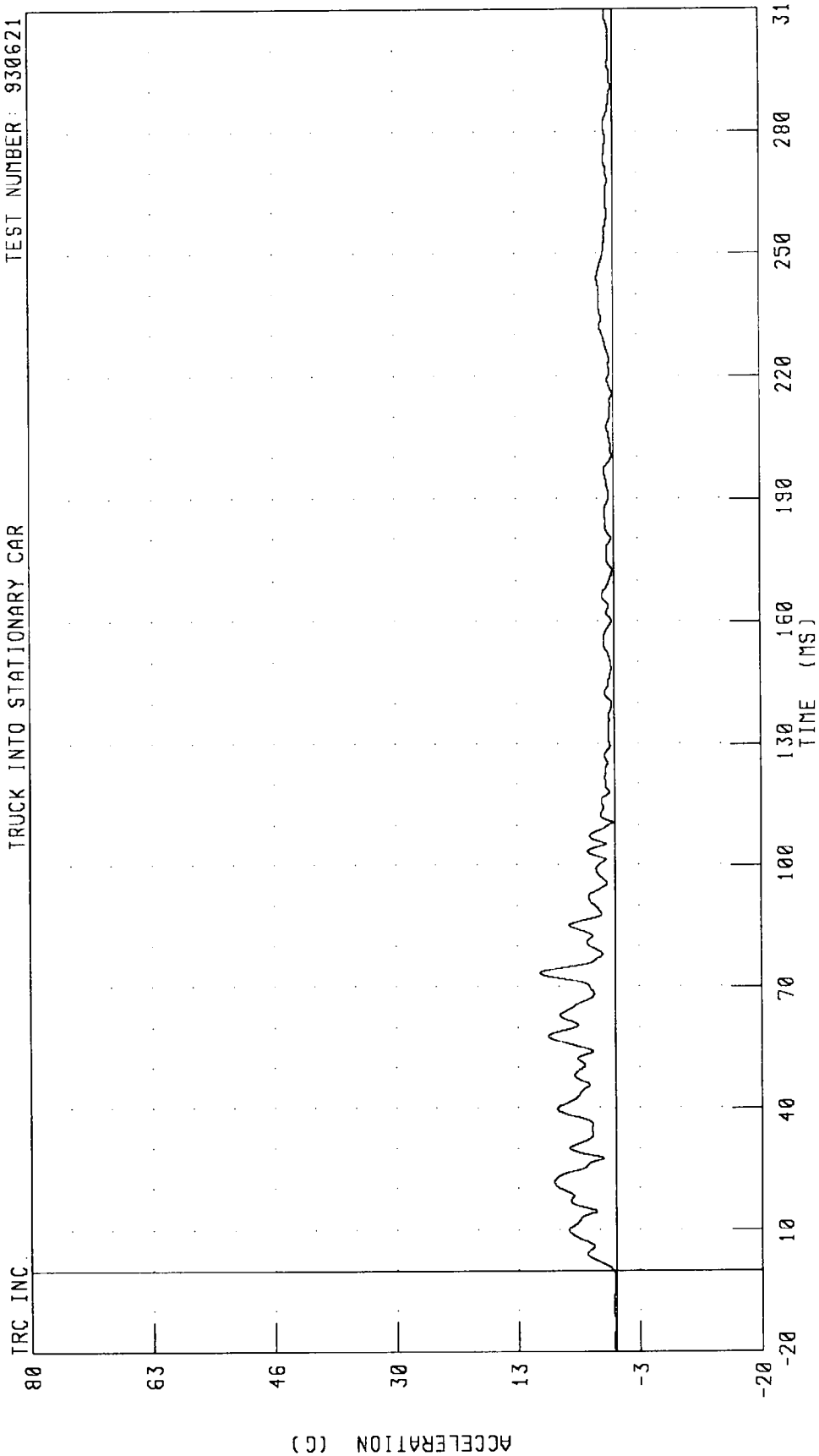


CHANNEL: FFCZGA FILTER: CH. CLASS 60

PEAK DATA: 5.25 G @ 85.50 MS; -6.90 G @ 58.25 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER RESULTANT ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

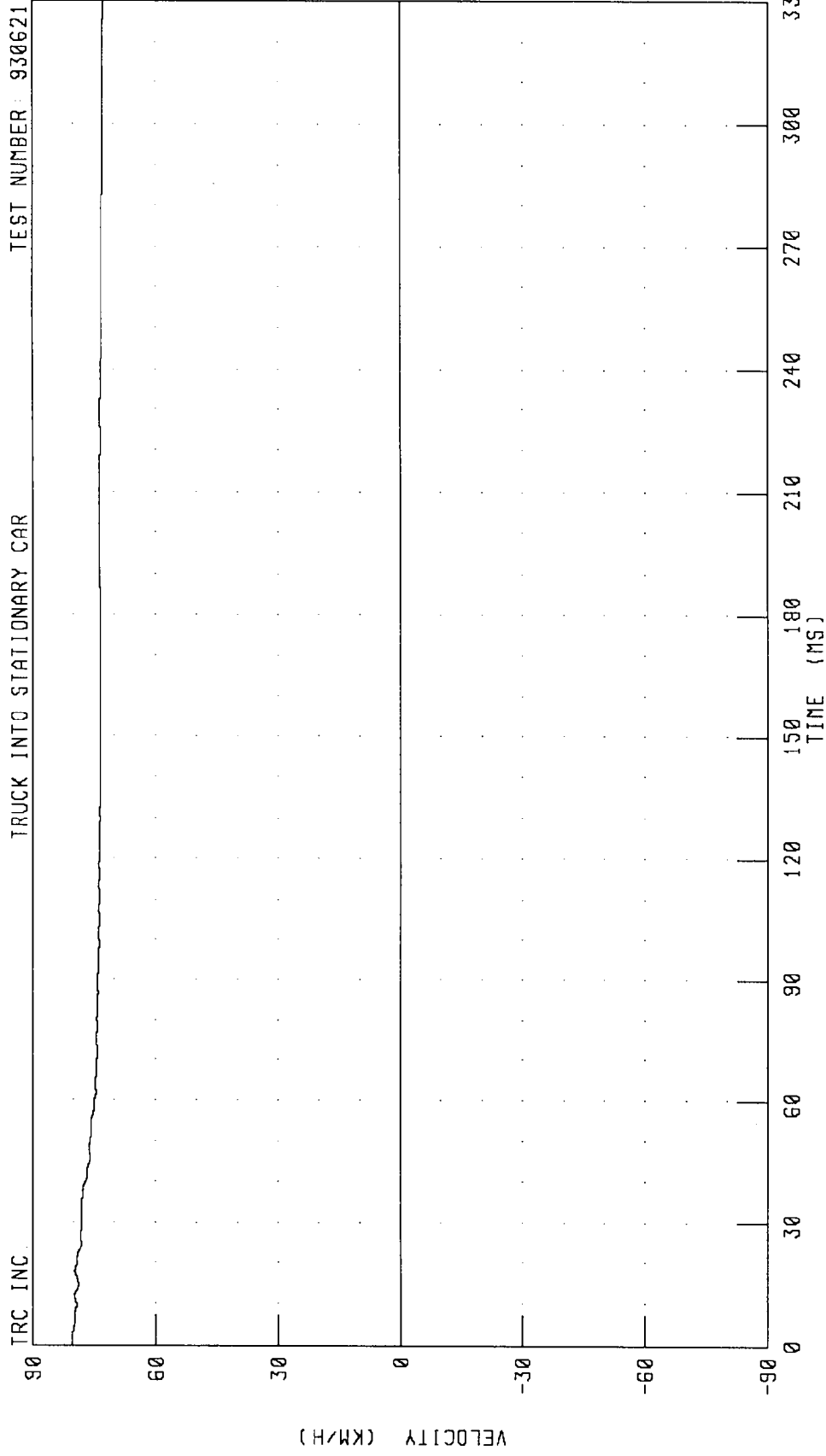


CHANNEL: FFCRGA FILTER: CH. CLASS 60

PEAK DATA: 10.25 G @ 73.25 MS, 0.04 G @ -13.50 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER X-AXIS VELOCITY
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



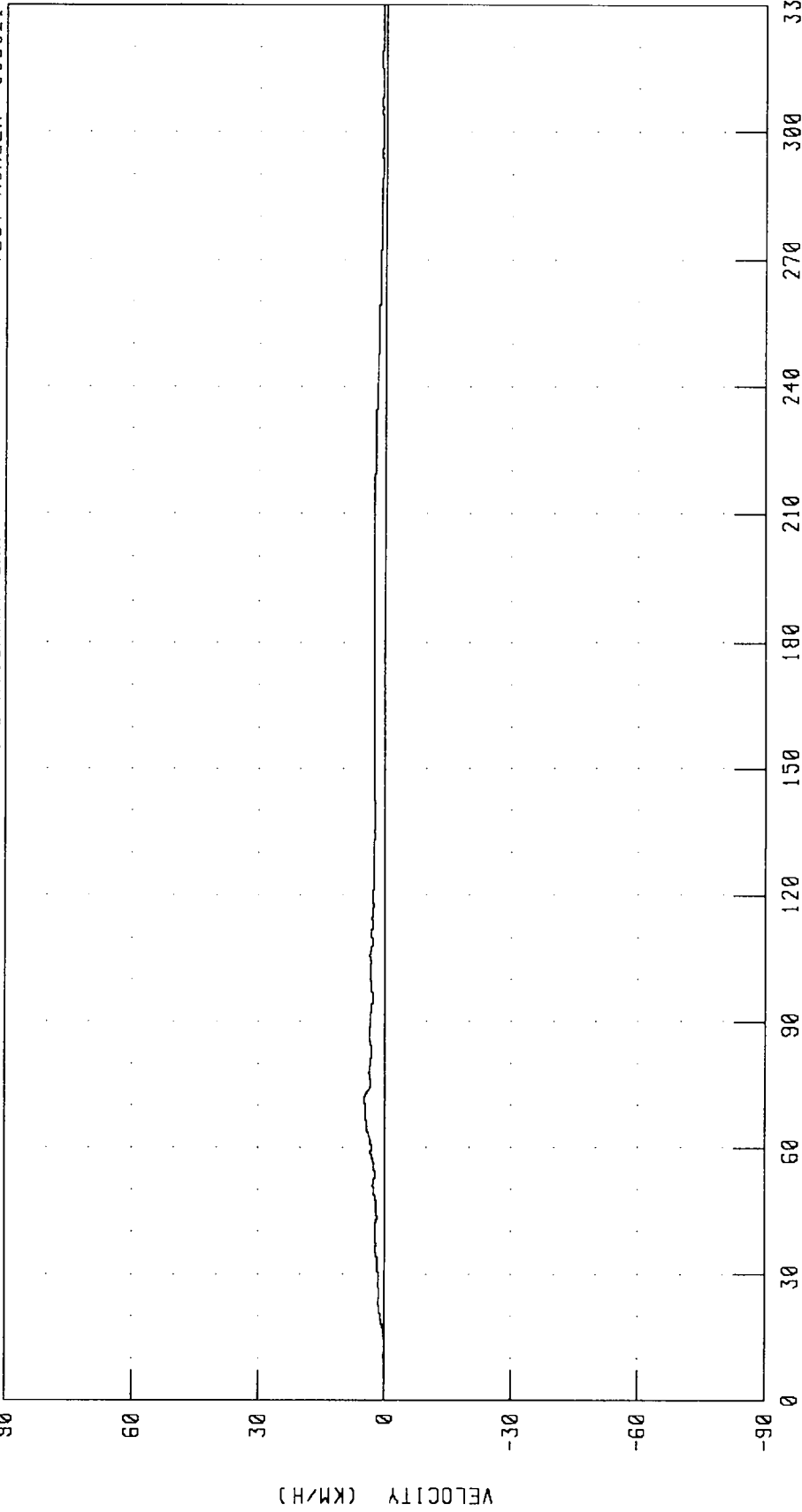
CHANNEL: FFCXVA FILTER: CH. CLASS 180 PEAK DATA: 80.31 KM/H @ 1.25 MS; 72.76 KM/H @ 326.63 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER Y-AXIS VELOCITY

TEST NUMBER: 930621

TRUCK INTO STATIONARY CAR

TRC INC.



CHANNEL: FFCYVA FILTER: CH. CLASS 180

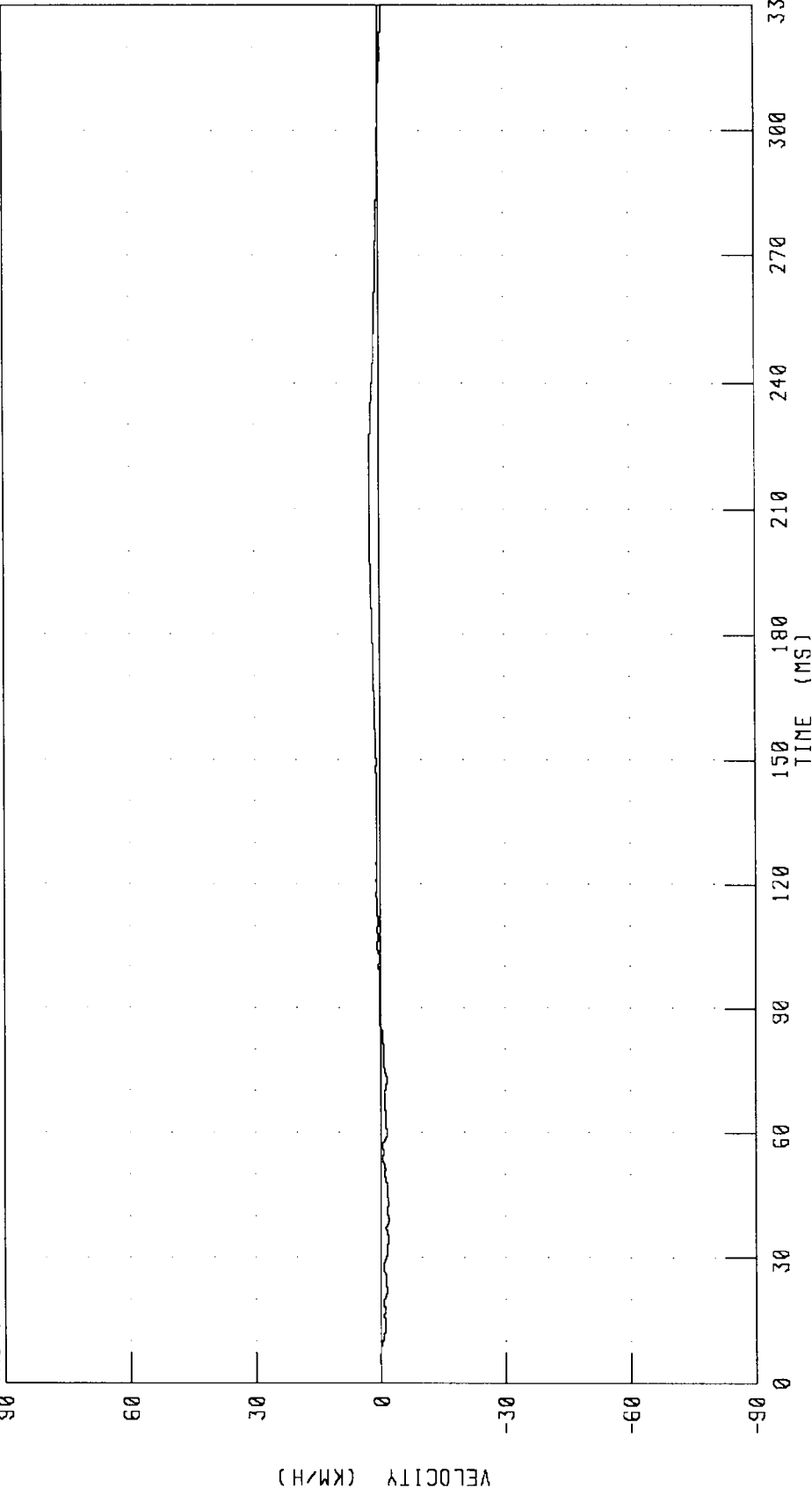
PEAK DATA: 4.80 KM/H @ 71.38 MS, -0.09 KM/H @ 6.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK FRONT FRAME CROSSMEMBER Z-AXIS VELOCITY

TEST NUMBER: 930621

TRUCK INTO STATIONARY CAR

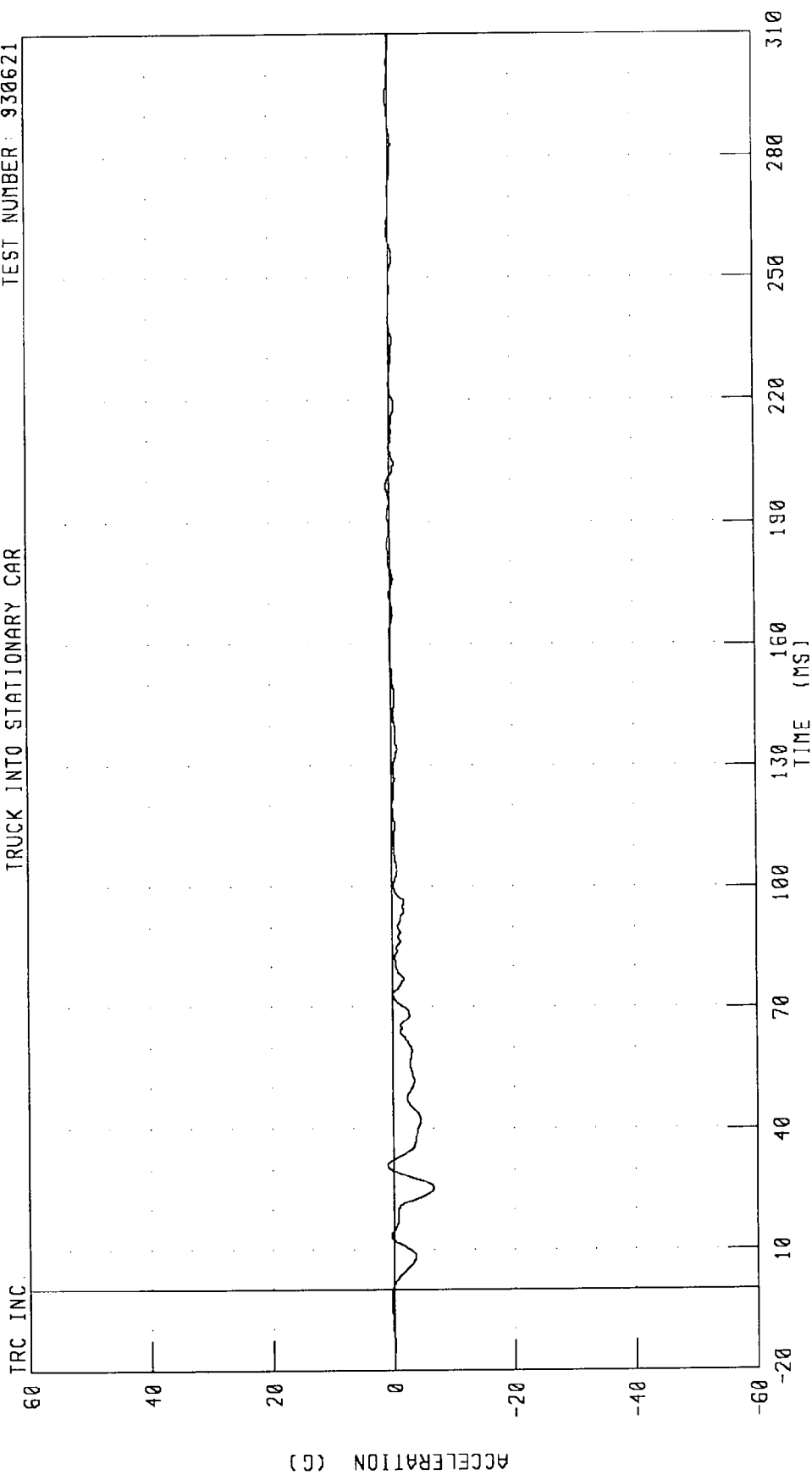
TRC INC



CHANNEL: FFCZVA FILTER: CH. CLASS 180 PEAK DATA: 2.40 KM/H @ 212.88 MS, -1.92 KM/H @ 39.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK CENTER OF GRAVITY X-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621



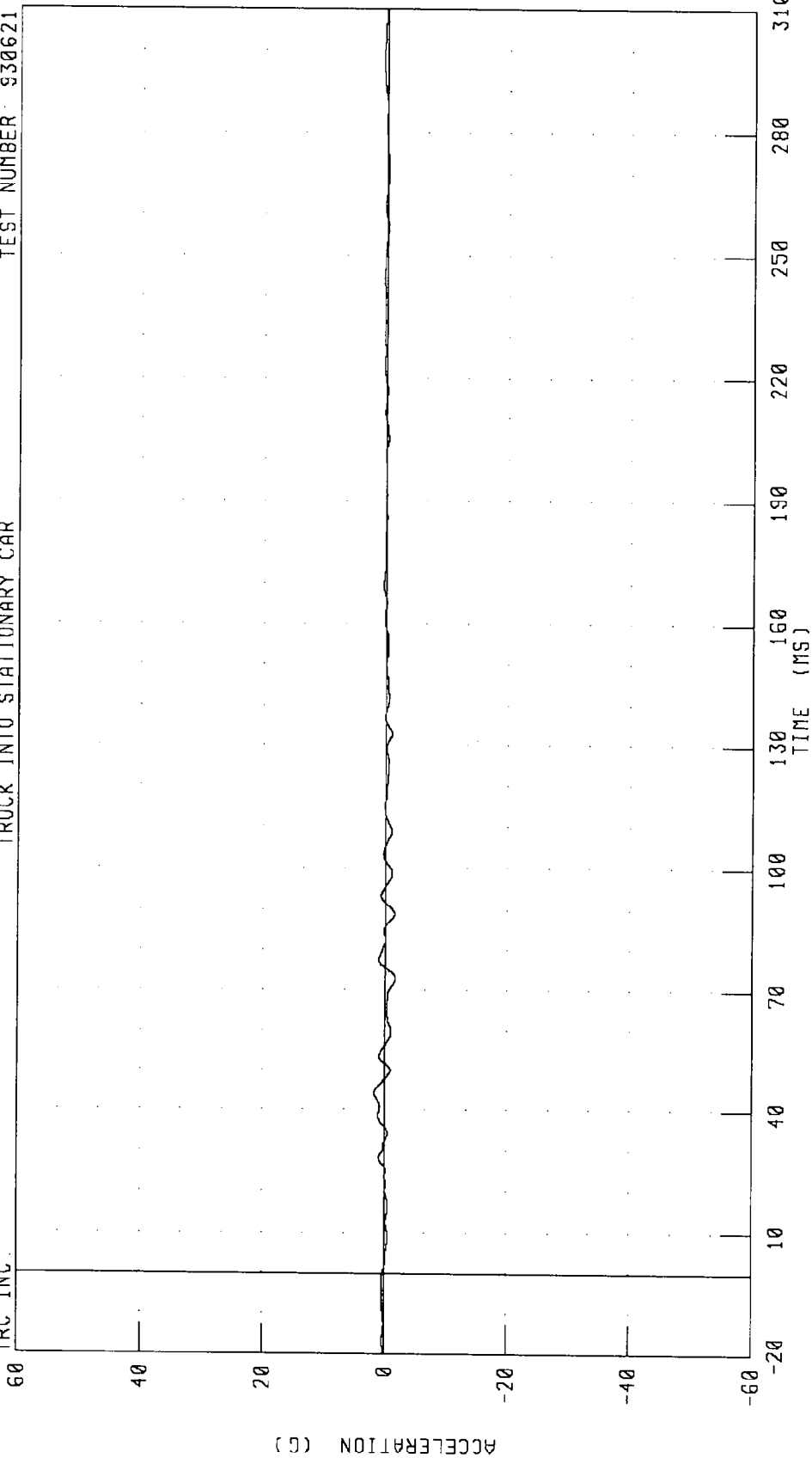
CHANNEL: VCGXGA FILTER: CH. CLASS 60

PEAK DATA: 0.86 G @ 31.13 MS; -6.62 G @ 25.38 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK CENTER OF GRAVITY Y-AXIS ACCELERATION
TRUCK INTO STATIONARY CAR

TEST NUMBER 930621

TRC INC.



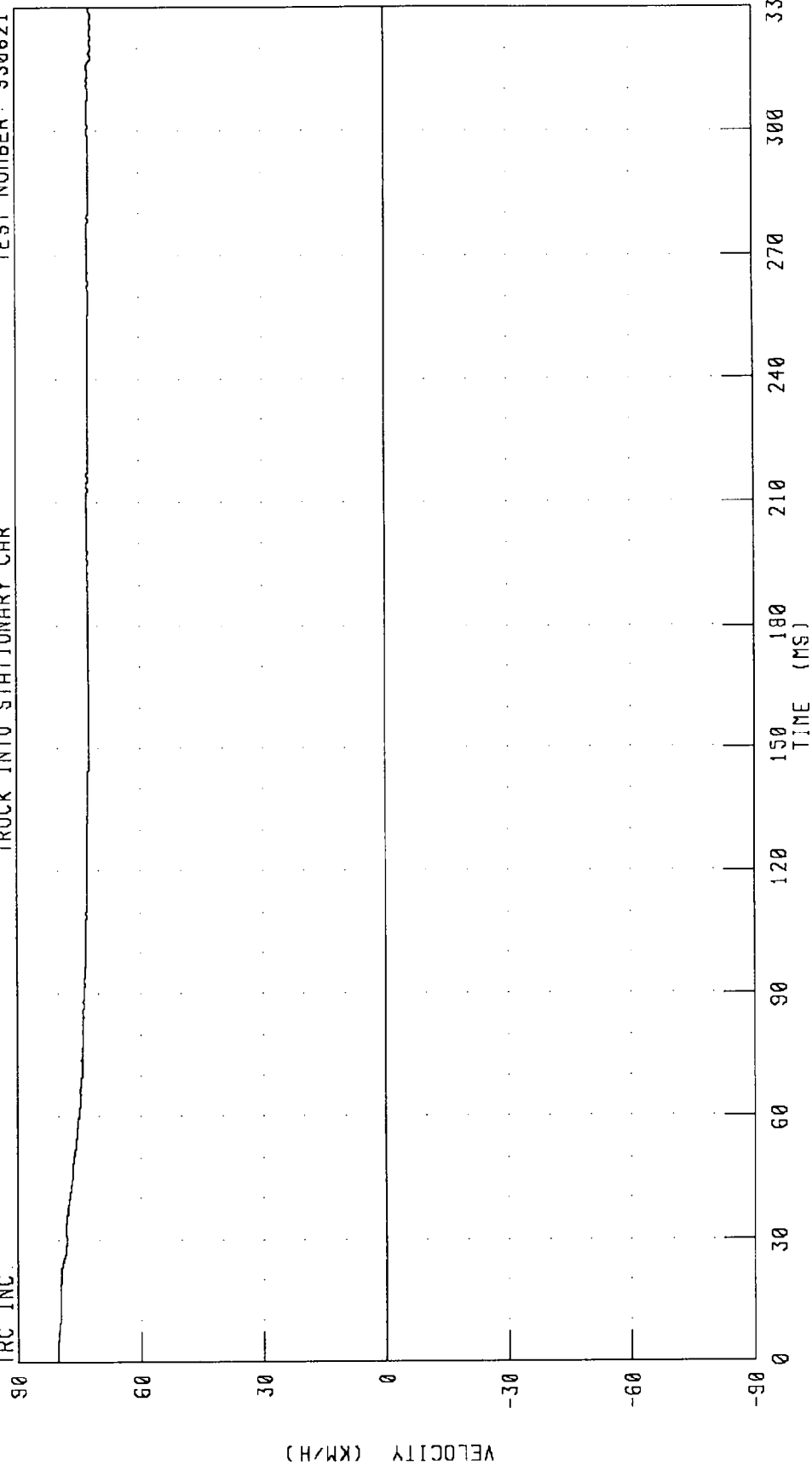
CHANNEL: VCGYGA FILTER: CH. CLASS 60

PEAK DATA: 1.71 G @ 44.25 MS; -1.71 G @ 73.00 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK CENTER OF GRAVITY X-AXIS VELOCITY

TRC INC. TEST NUMBER: 930621

TRUCK INTO STATIONARY CAR



CHANNEL: VCGXVA FILTER: CH. CLASS 180

PEAK DATA: 80 30 KM/H @ 0.00 MS; 71.31 KM/H @ 320.13 MS

REDUCING HEAVY TRUCK AGGRESSIVENESS - TEST 16
TRUCK CENTER OF GRAVITY Y-AXIS VELOCITY

TRUCK INTO STATIONARY CAR

TEST NUMBER: 930621

TRC INC.

90

60

30

0

-30

-60

-90

VELOCITY (KM/H)

30

60

90

120

150

180

210

240

270

300

330

TIME (MS)

CHANNEL: VCCYVA FILTER: CH. CLASS 180

PEAK DATA: 0.25 KM/H @ 48.75 MS; -1.02 KM/H @ 158.50 MS

APPENDIX C

MISCELLANEOUS TEST INFORMATION

DUMMY INSTRUMENTATION PLACEMENT

DUMMY MFR. & S/N: HUMANOID/048

SEATING POSITION: DRIVER

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
HEAD ACCELERATION	X	ENDEVCO	7264	EH78J	REAR
HEAD ACCELERATION	Y	ENDEVCO	7264	DH37J	LEFT
HEAD ACCELERATION	Z	ENDEVCO	7264	DD17J	UP
NECK FORCE	X	DENTON	1716	0106	*
NECK FORCE	Y	DENTON	1716	0106	*
NECK FORCE	Z	DENTON	1716	0106	*
NECK MOMENT	X	DENTON	1716	0106	*
NECK MOMENT	Y	DENTON	1716	0106	*
NECK MOMENT	Z	DENTON	1716	0106	*
CHEST ACCELERATION	X	ENDEVCO	7264	EH92J	FRONT
CHEST ACCELERATION	Y	ENDEVCO	7264	CC24H	LEFT
CHEST ACCELERATION	Z	ENDEVCO	7264	FG28J	UP
CHEST DEFLECTION	X	VERNITECH	81422A	9041	OUTWARD
PELVIS ACCELERATION	X	ENDEVCO	7264	BC75J	REAR
PELVIS ACCELERATION	Y	ENDEVCO	7264	FC43J	LEFT
PELVIS ACCELERATION	Z	ENDEVCO	7264	AP87	UP
LEFT FEMUR FORCE		GSE	2435	726	TENSION
RIGHT FEMUR FORCE		GSE	2430	756	TENSION

*See SIGN CONVENTION sheet for positive sensing orientation of neck load channels.

VEHICLE INSTRUMENTATION INFORMATION

TEST NO. 930621

NO.	LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
1	LEFT REAR SEAT					
	CROSSMEMBER LONGITUDINAL	X	ENDEVCO	2264	AG24	REAR
2	RIGHT REAR SEAT					
	CROSSMEMBER LONGITUDINAL	X	ENDEVCO	2264	AY66	REAR
3	ENGINE TOP LONGITUDINAL	X	ENDEVCO	2264	AK21	REAR
4	ENGINE BOTTOM LONGITUDINAL	X	ENDEVCO	2264	AZ67	REAR
5	RIGHT BRAKE CALIPER					
	LONGITUDINAL	X	ENDEVCO	2264	AT38	REAR
6	LEFT BRAKE CALIPER					
	LONGITUDINAL	X	ENDEVCO	2264	BA68	REAR
7	INSTRUMENT PANEL CENTER					
	LONGITUDINAL	X	ENDEVCO	2264	AV09	REAR
	LAP BELT OUTBOARD FORCE		LEBOW	3419	590	TENSION
	SHOULDER BELT OUTBOARD FORCE		LEBOW	3419	613	TENSION
8	VEHICLE CENTER OF GRAVITY					
	LONGITUDINAL	X	ENDEVCO	2264	AR38	FRONT
	LATERAL	Y	ENDEVCO	2264	BA46H	RIGHT
	VERTICAL	Z	ENDEVCO	2264	AR49	UP

HEAVY TRUCK ACCELEROMETER INFORMATION

TEST NO. 930621

NO.	LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
9	FRONT FRAME CROSSMEMBER	X	ENDEVCO	7264	CJ72H	FRONT
		Y	ENDEVCO	7264	CK56H	LEFT
		Z	ENDEVCO	7264	CH81H	UP
10	TRUCK CENTER OF GRAVITY	X	ENDEVCO	7264	CJ72H	REAR
		Y	ENDEVCO	7264	CL83H	RIGHT

SIGN CONVENTION
NHTSA DATA TAPE REFERENCE GUIDE

ACCELEROMETERS:

+X: FORWARD
+Y: LEFTWARD
+Z: UPWARD

POTENTIOMETERS:

+CHEST LONGITUDINAL DEFLECTION: OUTWARD
+CHEST LATERAL DEFLECTION: LEFTWARD
+SEAT BELT DISPLACEMENT: OUTWARD
+SEAT BELT EXTENSION: ELONGATION
+KNEE SLIDER DISPLACEMENT: DISTANCE BETWEEN FEMUR
AND TIBIA INCREASED
(IN RELATION TO A
SEATED DUMMY)

LOAD CELLS:

+FEMUR FORCE: TENSION
+SEAT BELT FORCE: TENSION
+BARRIER FORCE: TENSION

NECK LOAD CELLS:

+X FORCE: HEAD PUSHED FORWARD
+Y FORCE: HEAD PUSHED LEFTWARD
+Z FORCE: HEAD PULLED UPWARD (TENSION ON NECK)
+X MOMENT: RIGHT EAR ROTATING TOWARD RIGHT SHOULDER
+Y MOMENT: CHIN ROTATING TOWARD CHEST
+Z MOMENT: CHIN ROTATING TOWARD LEFT SHOULDER

TIBIA LOAD CELLS:

+X FORCE: TENSION
+Y FORCE: TENSION
+Z FORCE: TENSION
+X MOMENT: BOTTOM OF TIBIA MOVING LEFTWARD
+Y MOMENT: BOTTOM OF TIBIA MOVING REARWARD