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16. Abstract

The purpose of this project has been to improve and document the methodology for investigating real-world accidents using computerized vehicle crash and occupant motion simulation models with the objectives of:

- improvement of the quality of biomechanics injury data derived from accident investigation
- improvement of definition of scenarios for staged laboratory collision tests (direction, velocity, and location of the interaction between the occupant and the vehicle).

This report covers the second phase (1983-1985) of a project originally initiated in 1981. Part 2 of the report describes the background of the project and the methods used in developing analytical reconstructions. Part 3 summarizes the preliminary accident investigations which were used in selecting the four second phase cases. Part 4 details the two- and three-dimensional reconstructions which were accomplished. It also contains a biomechanical review of the reconstructions. Part 5 reviews the work conducted during the project and presents guidelines for the application of the biomechanical accident investigation methodology using occupant motion simulation software.

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Biomechanical Accident Investigation Methodology: Second Phase Case Reports and Guidelines for Application

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1.0 INTRODUCTION

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2.0 BACKGROUND AND METHODS

For nearly 20 years, the MVMA has supported field accident investigations at UMTRI under the direction of Dr. D. F. Huelke. That investigation program, having the potential to incorporate biomechanically specialized additions to its ongoing program, provided a trained team for the additional accident investigations.

In Europe this type of detailed investigation has been supplemented by actual crash tests with anthropomorphic test devices and cadavers to obtain biomechanical data. This type of approach is relatively costly and only a limited number of tests have been performed. In addition, NHTSA has staged a number of experimental reconstructions using anthropomorphic test devices. The current project substituted computer simulations for both the vehicle crash and the occupant motion phases of the study. This approach was designed to be:

- more flexible in dealing with the variables associated with the cases,
- less costly, and
- ultimately of much greater general utility in advancing knowledge of injury causation, tolerance and protection of occupants in crashes.

2.1 First Phase Project

During the first phase, the goal of the project was to combine state-of-the-art detailed accident investigation methods, computerized vehicle crash and occupant motion modeling, and biomechanical analysis of human injury into a method for obtaining enhanced biomechanical data from vehicle crashes (1,2)[1] The findings of the investigations, in the form of probable occupant contact velocities, impact forces and occupant impact responses, were compared with existing biomechanical knowledge for the purpose of demonstrating the utility of the methods.

Protocols for the computer simulation procedures and specialized investigations were developed prior to initiation of the active accident investigation.

The following criteria were the primary factors in choosing an

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[1]Numbers in parenthesis refer to the references listed in Section 6.

accident for an in-depth investigation:

1. Occupant injuries of particular biomechanical significance;
2. Type or direction of impact (limited to direct front or side impacts);
3. Reconstructibility of the crash in terms of vehicle factors and kinematics;
4. Comparability to accidents representative of national accident statistics.

The focus of the project was to understand, as well as possible, the injuries sustained by the occupant, the sources of the injury and the occupant kinematics that were responsible for the injury-producing contact. Since occupant injuries were the primary concern, initial identification of a prospective case was through notification that specific types of injuries had been sustained by a person who was an occupant in a crashed motor vehicle. Following this notification, the vehicle and the accident site were investigated in a preliminary manner. Based on the medical factors, vehicle factors and accident site factors, a review of the case was made by the principal investigators. If the predetermined criteria of injury type, source of injury, crash type and probability of accurate reconstruction were met, then the investigation proceeded.

The basic field investigation was carried out by the Huelke team. Dr. John Melvin indirectly assisted in the investigation from the standpoint of injury sources, contact points, injury mechanisms and other biomechanical factors. Dr. Robbins was directly involved in assessing the reconstructibility of the occupant kinematics, including occupant anthropometry and pre-crash geometry.

Following the gathering of the accident data, work commenced on reconstructing the vehicle crash factors using the CRASH II computer model. When suitable simulation of the vehicle crash was obtained, the resulting dynamic data were available as input for two- and three-dimensional dynamic occupant motion computer simulation models such as those used in other MVMA-sponsored studies at HSRI. The MVMA-2D occupant motion simulation (3) was used in this preliminary study. The computerized reconstruction of the occupant kinematics and contact points were compared with the case data and judgements made as to the realism of the simulation.

The several conclusions reached during the first phase covered items including:

- Necessity for detail on vehicle trajectory in order to estimate the vehicle deceleration.
- Desirability for improved force-deflection data describing both the vehicle and the occupant.
- The desirability of an interview with the injured vehicle occupant in order to obtain details of the accident, his or her physical size, and estimated driving posture using photographs taken in a vehicle essentially the same as the one involved in the crash.
- Need for a data bank on human anthropometry including human dimensions, mass distribution, inertial properties, joint locations, joint mobility, and joint strength (Note: many of the quantities, particularly with respect to joint resistance to torque, were obtained from anthropomorphic test devices).
- The analytical methodology appears to be viable as forces predicted in the simulations could be used to estimate injury levels which were consistent with those observed independently under similar loadings to cadaver subjects.

2.2 Second Phase Project

The activities in the second phase included a broadening of the investigation and analysis activities. This included selection of cases necessitating three-dimensional simulation of occupant motions. In addition, the activities included analysis of the results of both phases of the project and preparation of guidelines for future users of these techniques.

3.0 SUMMARY OF SECOND PHASE PRELIMINARY CASE INVESTIGATIONS

Seven crashes were identified as being of possible interest after the initial screening of crash investigation information during the period of early 1983 through mid-1984. During the initial screening, approximately twenty cases were rejected for reasons such as:

- rollover component to motion
- impact of subject vehicle with more than one other vehicle
- vehicle removed from site so that final resting position could not be determined
- vehicle not available for study by investigation team
- too low severity

The remaining cases are described as follows.

Case 2-1.

The driver of a 1969 Dodge Dart 4 door sedan fell asleep while travelling down a major city thoroughfare. The car drifted to the right, into a driveway of a gas station, and struck an 8 inch diameter steel pole just past the driveway. The driver, a 21 year old female, suffered a fractured right femur, facial and right knee lacerations and a fractured right third metacarpal bone. Close examination of the vehicle revealed significant deterioration of the vehicle structures due to rust. From the standpoint of finding a similar deteriorated car, it was concluded that the case would not be appropriate for restaging.

Case 2-2.

The driver of a 1973 Oldsmobile Cutlass was backing up in the left hand lane of a freeway to reach a median turn-around when it was struck by a 1980 Plymouth Horizon TC-3. The driver of the TC-3 is the subject of interest. This 22 year old male received various surface abrasions and abdominal injuries consisting of a lacerated liver and spleen. He also sustained a closed head injury. This severe frontal/oblique crash provided good information using the case selection criteria listed in Section 2.1. It was selected for detailed investigation and analysis as part of the program.

Case 2-3.

The driver of a 1977 Sunbird pulled out onto a two-lane road from a driveway and was struck in the left side by a 1980 Monza. The driver of the Sunbird was a 31 year old female who sustained a broken nose and numerous bruises, abrasions and lacerations. This nearside lateral impact was initially selected for investigation and analysis as part of the program even though the roadway markings and initial accident reports made documentation of vehicle motions and final resting positions difficult. In addition, it was not possible (after three months of trying Detroit area dealerships and newspaper For Sale columns in the Detroit area) to find a similar vehicle for use in a subject interview. Therefore, the case was dropped. For a three-dimensional side impact reconstruction, the Case 14 from the first phase was substituted.

Case 2-4.

A 1981 Volkswagen Rabbit was proceeding normally on a two-lane road near Ann Arbor when a second vehicle crossed the center lane and struck it head on. The five young occupants all received moderate injuries in the accident. Passive restraints were in use by the front occupants. Two of the three rear seat occupants were wearing active lap belts. The rear seat occupants did interact with the front seat backs and may have influenced the dynamics of the front seat occupants. Although the accident was nearly a direct frontal collision, this case was rejected because of the uncertainty of the interactions between occupants.

Case 2-5.

A 1983 Ford Escort attempted to make a left turn in front of a 1977 Chevrolet Vega. A 45° oblique impact occurred in the region of the passenger door. The Escort was pushed against a third vehicle before it came to rest. Velocities, damage, and injuries were all well documented. It appears that the primary source of interactions was between the driver and the side structure during the initial impact. However, the case was rejected due to the subsequent impact and damage. Experimental reconstruction of this crash would also be difficult if not impossible because of the third vehicle.

Case 2-6.

A 1982 Mercury Lynx was proceeding on a two-lane rural road in snow conditions. Another vehicle lost control and the Lynx impacted it in an almost square frontal manner. The Lynx received extensive frontal exterior damage with a maximum crush of 37 cm. The two female occupants were wearing three-point belt restraint systems. On seeing the impending crash the driver put her right hand on the floor-mount shift lever and was attempting to down-shift at the time of the crash. The right front passenger had just entered the car moments before the crash and had buckled the belt, but had not properly adjusted and tightened it. When she saw that the crash was imminent she slid down in the seat. The detailed investigation was very complete, including evidence of the amount of slack indicated by markings on the belts where they passed through the rings during the high loading. This case was selected for reconstruction of both occupants due to the classic crash configuration, two occupants who are very similar in size and age, and difference in use of the belt system.

Case 2-7.

The driver of a 1982 Pontiac J2000 was killed in a very symmetric impact of a large oak tree (1 meter diameter) estimated at 72 km/hr. There was thoracic involvement with the column and façial involvement with the padded eyebrow above the instrument panel to the right of the steering wheel. Both knees broke through the lower panel on each side of the steering column. The case is reasonably well documented, especially with respect to the vehicle, and could be the subject of simulation. However, it has been held in reserve for possible future use even though a subject interview is not possible.

4.0 THE RECONSTRUCTIONS

The following four sub-sections describe the reconstruction of occupant kinematics for the accident cases which were selected. In each case information is presented in the following order:

- Accident description including vehicle damage and injuries
- Geometric definition of the subject in the vehicle
- Occupant kinematics during the crash sequence
- Occupant dynamics including forces of interaction between the occupant and the vehicle and accelerations of the head, chest, and pelvis.

4.1 Case 2-6. 1982 Mercury Lynx (Frontal Impact. 32 kph. Driver.)

In this case a 1982 Mercury Lynx driven by a 38-year-old female driver was proceeding on a snow-covered two-lane rural road. A second vehicle, while rounding a slight curve went out of control. It began to yaw to the left as it crossed the centerline where it was struck in the right rear quarter panel by the case vehicle which was unable to stop in time. Figure 1 is a schematic of the accident scene showing the impact as well as the well-defined resting points of the vehicles. Figure 2 shows the damage to the front end of the Lynx.

The female driver was wearing a three-point belt restraint system. On seeing the impending crash she put her hand on the floor-mounted shift lever and was attempting to downshift at the time of the crash. Upon impact she continued forward against the restraint system. Her knees contacted the lower panel symmetrically on either side of the steering column and her right hand struck the center of the mid panel and heater controls. Following the impact she rebounded back into the seat where she contacted the head restraint with her posterior head and neck.

Damage to the interior was moderate. There was no apparent driver contact with or damage to the steering wheel, no compression of the energy absorbing device, no separation of the shear capsules, and no apparent movement of the steering column. Driver contact deformed the lower panel to the left of the steering column, scuffed the lower panel to the right of the column, and smashed the heater controls in the center of the mid panel.

The driver sustained a variety of injuries which are illustrated in Figure 3. These include well-defined contusions and abrasions caused by interaction with the well-positioned belt, abrasions and lacerations of the knees, a neck strain and contusions to the back of the head and neck, as well as injuries to the right hand.

Use of the CRASH II program yielded a velocity change of 32 kph along the axis of the Lynx. This was represented for the purpose of simulation as an deceleration in the form of a trapezoid with a total duration of 80 milliseconds and rise and decay times of 5 milliseconds. The magnitude of the deceleration was 12.07 G's.

Because of the symmetry of the crash event, the MVMA-2D occupant motion simulation was selected. The first step was to develop an estimate of vehicle geometry and location of the occupant within the vehicle. The key information was obtained from vehicle drawings and an interview with the driver. During the interview simple anthropometric measurements were made documenting her size as:

- 163.3 cm (64.3 in) status
- 55.5 kgf (122 lb) weight
- 86.1 cm (33.9 in) seated height
- 56.8 cm (22.4 in) knee to buttock length

To develop the estimate of the posture of the occupant in the vehicle, photographs were taken showing her estimated posture while driving and attempting to down shift (Figure 4). A schematic of the vehicle interior cross-section was then made for a plane through the centerline of the occupant using vehicle scale drawings. The photograph of the occupant was then projected onto the schematic taking account, insofar as possible, of distortions based on camera placement. An outline of the occupant was then sketched onto the schematic.

The next step was to develop a linkage, mass properties, and the external geometry for the seated driver. The linkage was developed from data developed by Robbins et al (4,5) in a recent study of the seated posture of vehicle occupants sponsored by NHTSA. The data used were link lengths, segment masses, and joint locations scaled to the overall size parameters of the driver. The external geometry, modeled as a collection of ellipses, is based on the photograph with ellipses located where contacts were known or anticipated to occur during the dynamic phase of the simulation. Figure 5 shows a schematic of the resulting occupant and vehicle. Particular items to be noted are the location of the hand with respect to the shifter and the orientation of the pelvis with respect to the belts.

Because of the lack of force-deflection data for the vehicles studied and the exploratory nature of the project, engineering estimates based on available data were used for these quantities. The complete data set used in the simulation is included in Appendix A along with those of the other reconstructions.

Figures 6 and 7 show schematics of occupant position during the simulation at times of 70 and 110 ms. At 70 ms the occupant has moved forward into the belt restraint system, contacted the shifter and radio region with the right hand, and impacted the lower instrument panel with the knees and shins. It should be noted that the line of action of the lap belt is appropriate for restraint of the lower torso region at the pelvis. At no point in the simulation did submarining appear imminent. At 110 ms the occupant has rebounded with some energy into the seat back completing the simulation.

Figures 8-15 show some of the dynamic output results produced by the simulation. Figures 8 and 9 shown the interaction of the hand first with the shifter and then with a contact surface in the location of the radio. The predicted forces are unlikely to be accurate due to the lack of force-deformation information for an interaction of this type. In Figures 10 and 11, the interaction of the knee/shin region with the lower instrument panel is shown. The knee interacts first, looses contact, and then interacts again along with the shin. The loss of contact after the initial loading can probably be attributed to a small reduction in deformation coupled with a high rate of energy absorption attributed to the panel force-deflection curve. Accurate experimental data defining the properties of the panel would be required to explore this question in more detail. Figure 12 shows the belt loads. Their magnitude is substantial but well-distributed geometrically on the body. Figures 13 and 14 show the interactions of the head and the chest with the seatback on rebound. The force begins to build in the chest followed by an abrupt high level force to the head. The cause does not appear to be a bottoming out of the neck joints at stops so probably is due to the constitution of the force-deformation relation for the interaction. However, the timing is consistent with the pattern of injury. The resultant accelerations of head, chest, and pelvis are shown in Figure 15. With the exception of the head loadings associated with the rebound into the seatback, the values are quite reasonable.

A biomechanical review of these results yields a classic case of the effectiveness of properly worn seat belts. The primary crash force was absorbed by the belts and yielded contusions to the regions underneath the belt (left clavicle, surface of chest between breasts, the lower ribs, and the region across the iliac crests and lower abdomen). These loadings (4800N (1078 lb)), although substantial, were within known tolerance estimates based on the work of Kroell et al (6) and used by Robbins et al (2) in the previous study. On one hand this supports the work of Kroell in that injuries were not observed. On the other it provides a data point estimate for human tolerance derived from real crash conditions.

Recent geometric data of Robbins et al (4), derived in a study of the seated posture of vehicle occupants, can also be used to evaluate the biomechanics of this case. That study estimated the location of skeletal landmarks such as the iliac crests and defined the joints and bony linkage of the body in the vehicle seated posture. It was thus possible to estimate the rotation of the pelvic bone within the body during the crash event. The pelvic bone was superimposed on the computer-generated body linkage (See Figures 5-7). At different times during the event, the relationship between the line of a lap belt and the angular orientation of the pelvis can be observed. In this case (simulation and actual crash) the belt appeared to provide a force vector consistent with excellent restraint.

The knee loadings (1100N (250 lb)) were quite low reflecting the restraint effect of the lap belt and the low level of the injuries (lacerations). It was not possible to relate the neck injury to a specific event in the crash due to the lack of a well-defined contact location on the seatback during rebound. Likewise, it was not possible to correlate the lacerative injuries to the hand with a known data base other than to make the observation that the forces would be substantial.

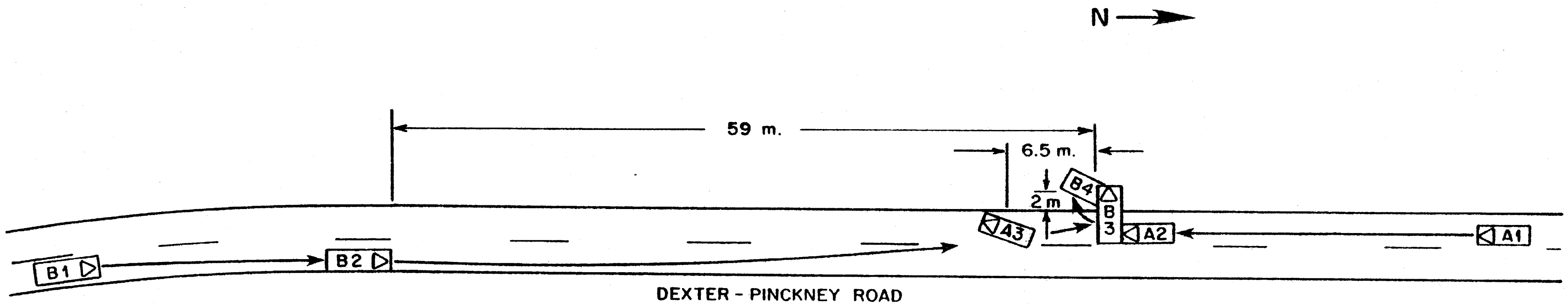


Figure 1. Schematic of Accident Scene (Case No. 2-6).

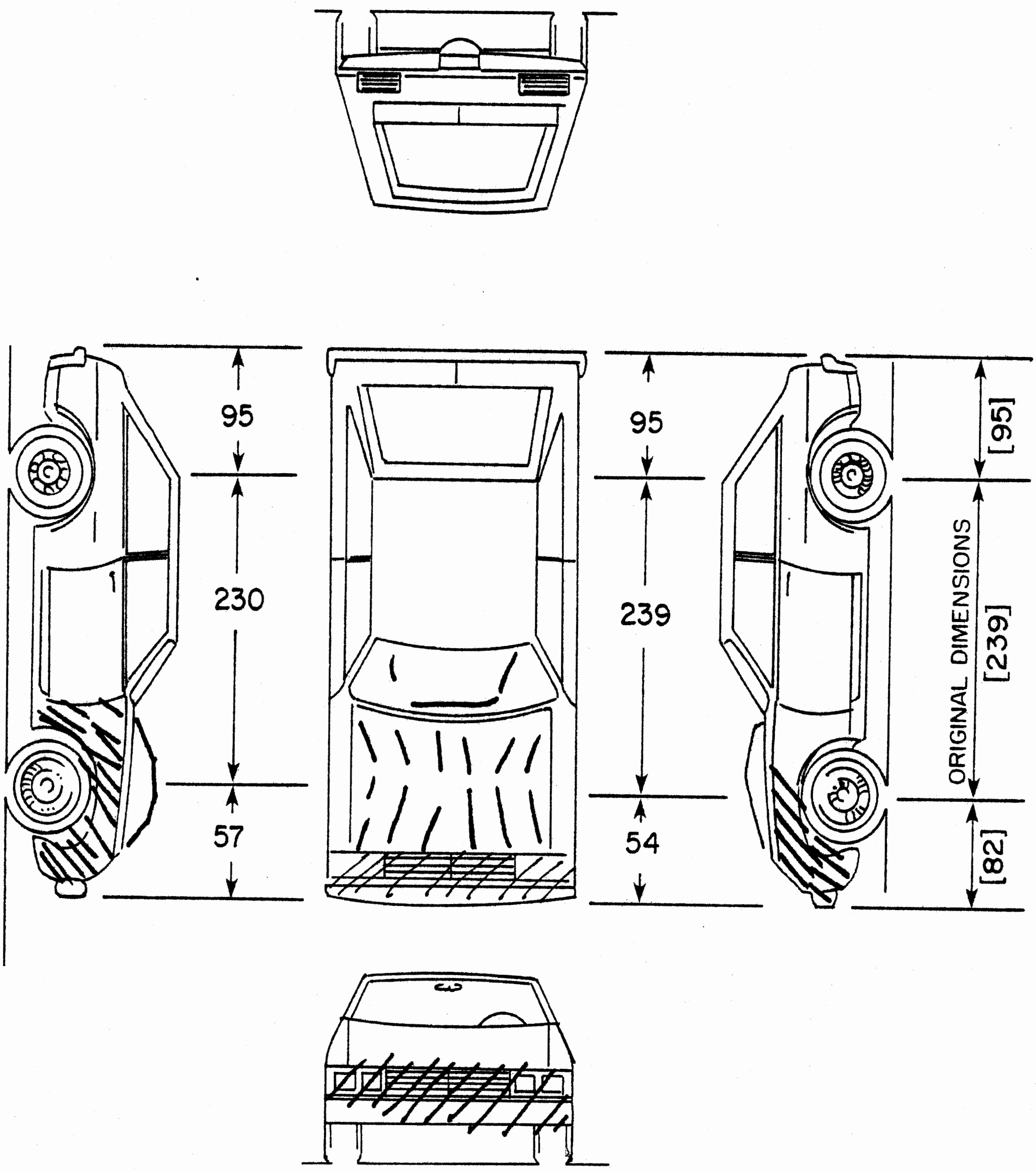
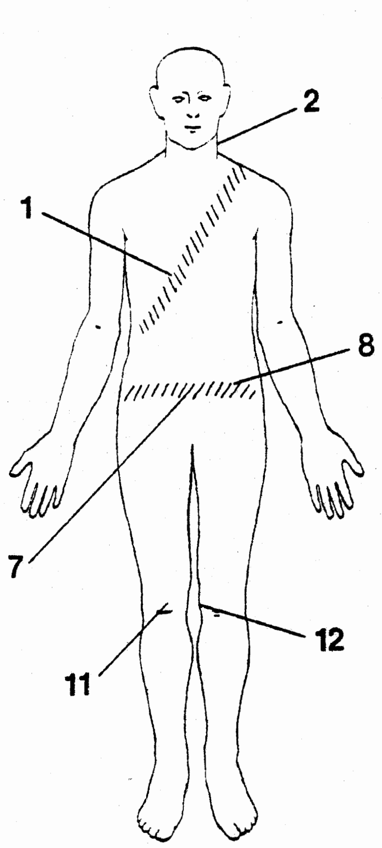
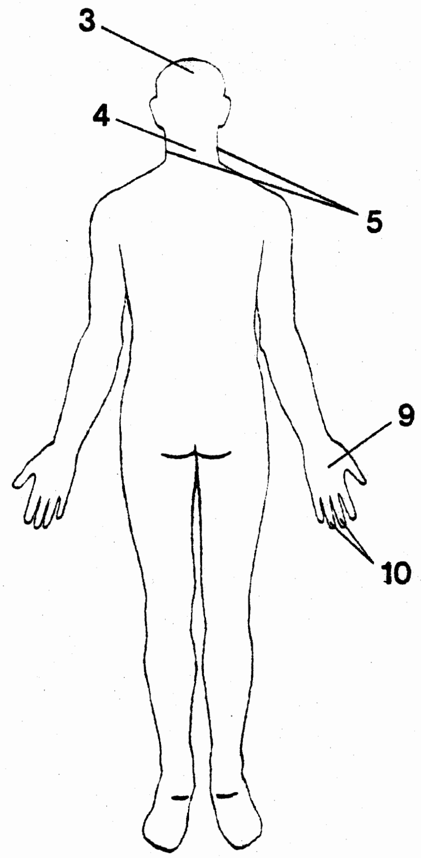
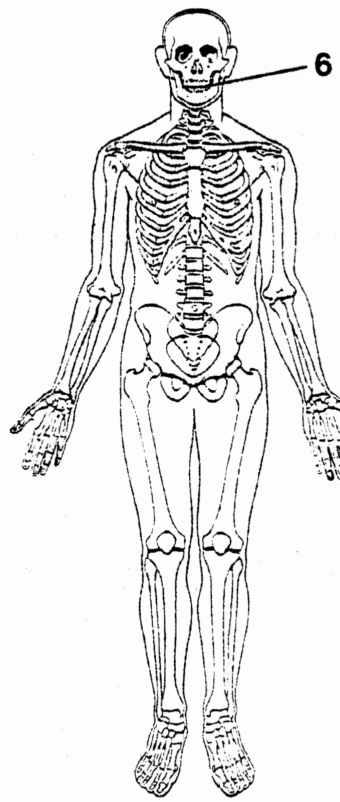


Figure 2. Vehicle Damage (Case No. 2-6).







1. Extensive Contusion: Left Clavicle; Above Left Breast; Lower Sternum; Below Right Breast; Lower Right Ribs (1)
2. Three Linear Abrasions Lateral Left Neck (1)
3. Contusion Posterior Head (1)
4. Contusion Posterior Neck (1)
5. Bilateral Neck Strain (1)
6. Left Lower Lateral Incisor Chipped (1)
7. Contusion Across Abdomen (1)
8. Abrasion Left Iliac Crest (1)
9. Avulsions Dorsum Right Hand (1)
10. Contusions 2nd and 3rd Right Fingers (1)
11. 2 cm Laceration and Abrasion Right Knee (1)
12. Abrasion and Laceration Medial Left Knee (1)

Figure 3. Injuries to the Driver (Case No. 2-6).

Figure 4. Driver in Case 2-6 shown seated in similar vehicle.

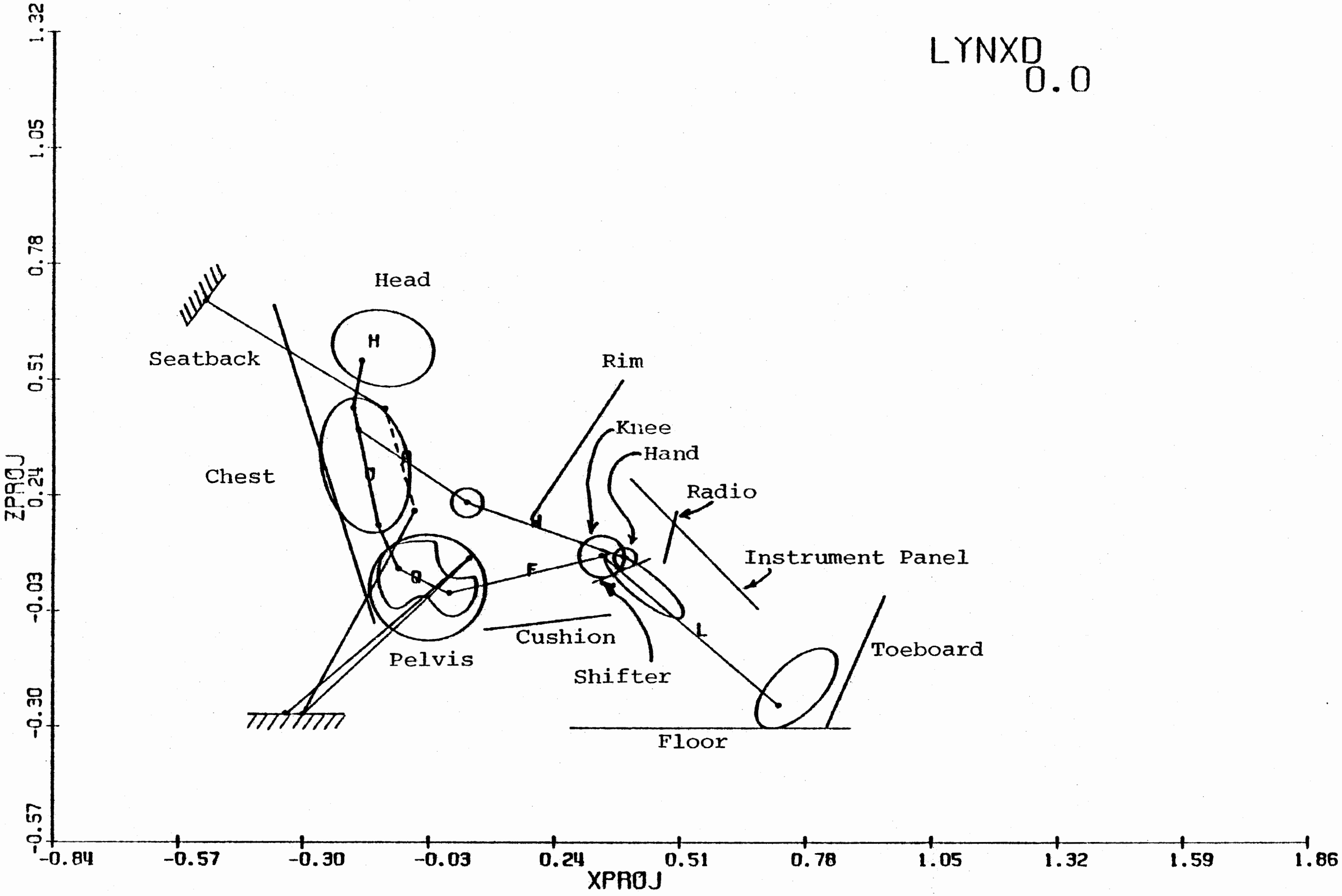


Figure 5. Schematic of driver in simulated vehicle (Case No. 2-6).

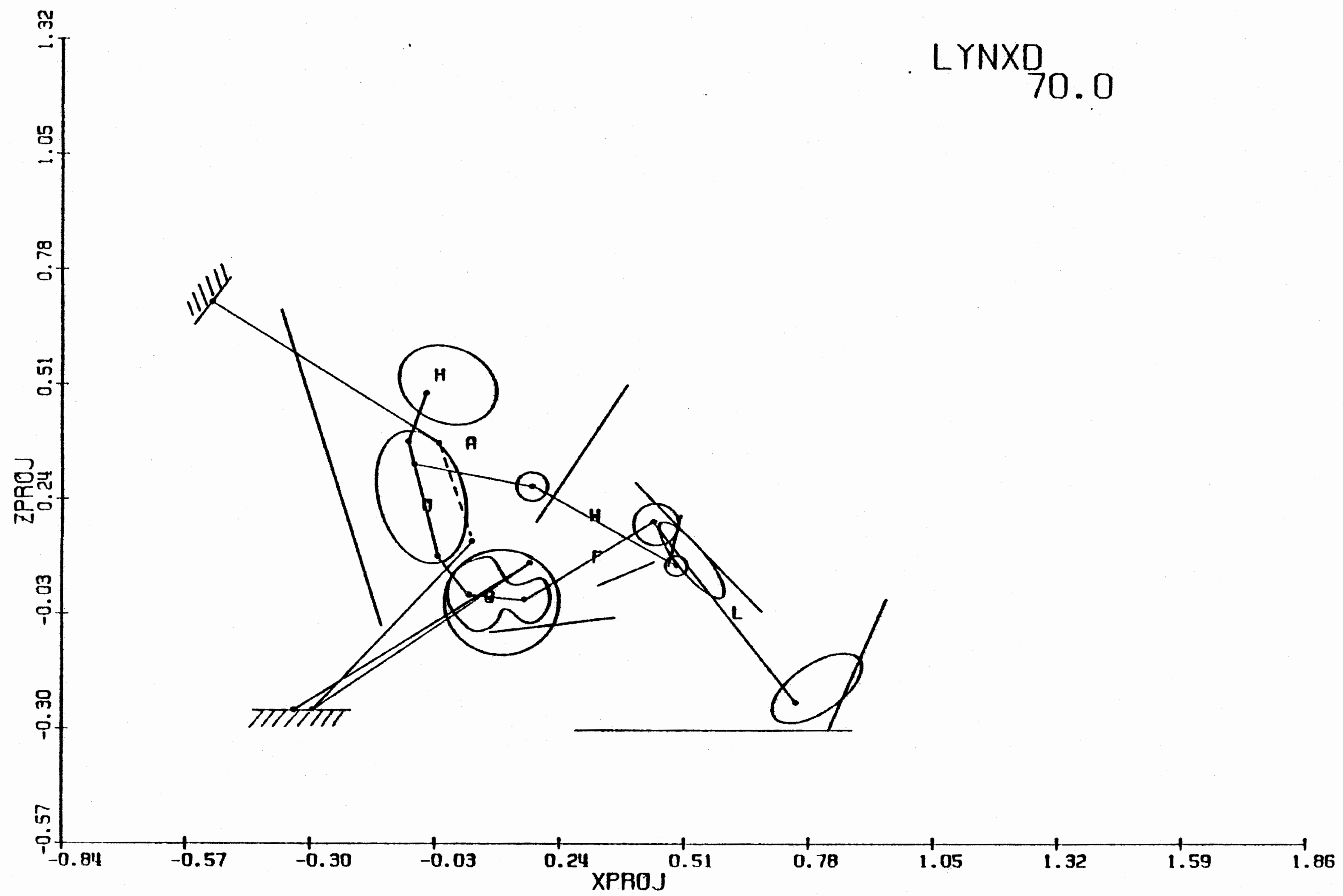


Figure 6. Driver Position. 70 ms. (Case No. 2-6).

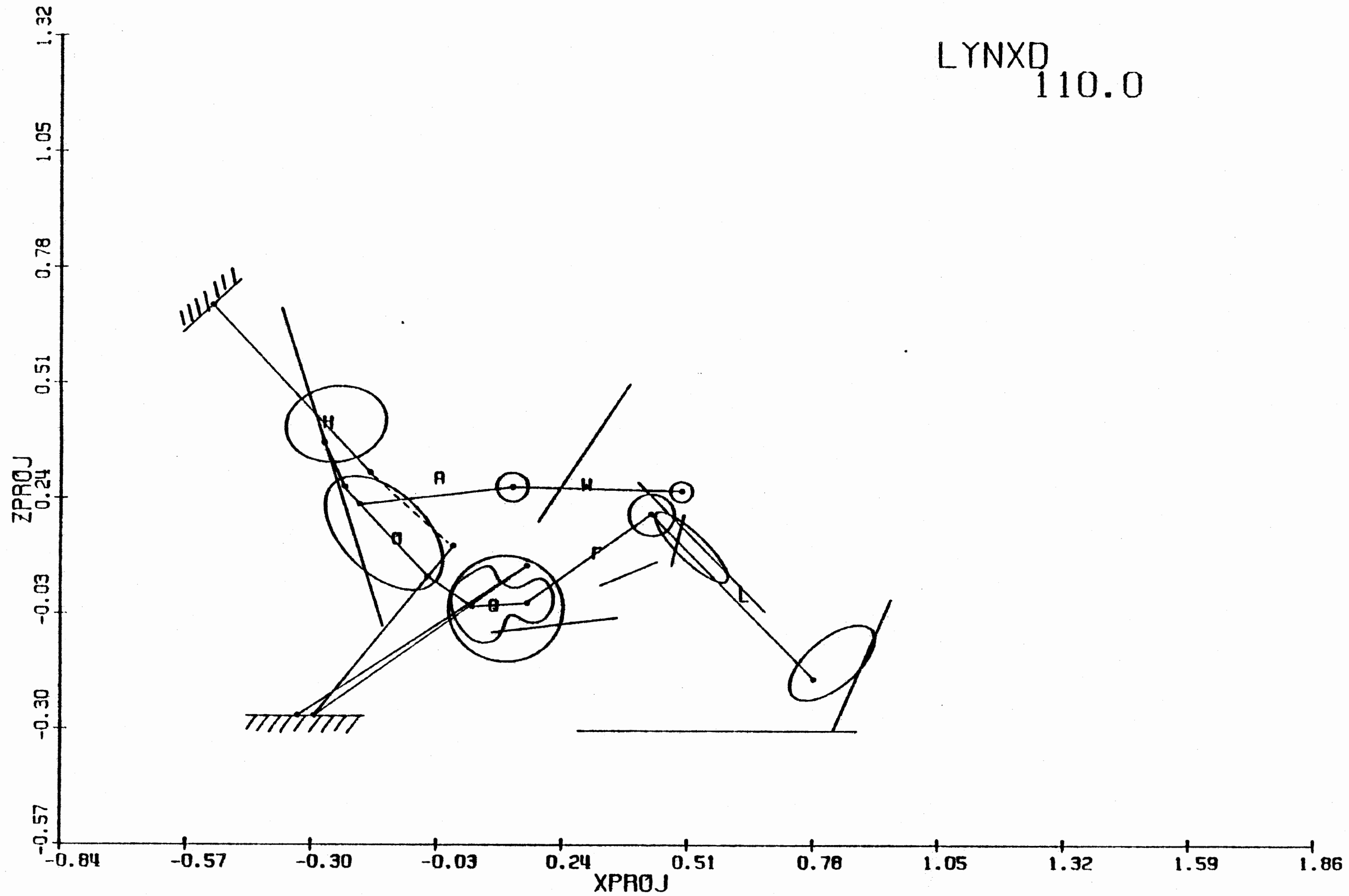


Figure 7. Driver Position. 110 ms. (Case No. 2-6).

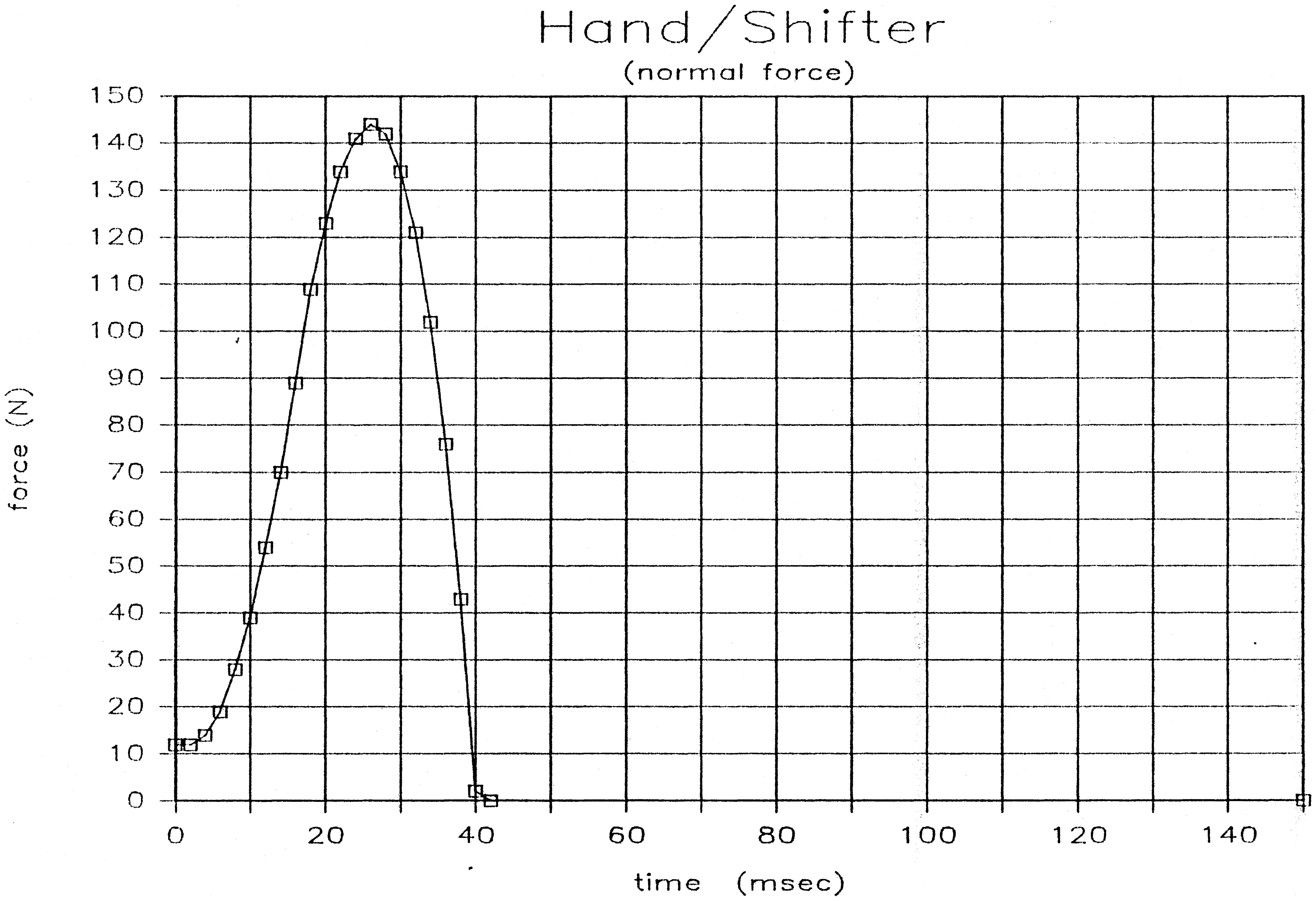


Figure 8. Force on Hand Due to Interaction with Shifter. (Case No. 2-6 Driver).

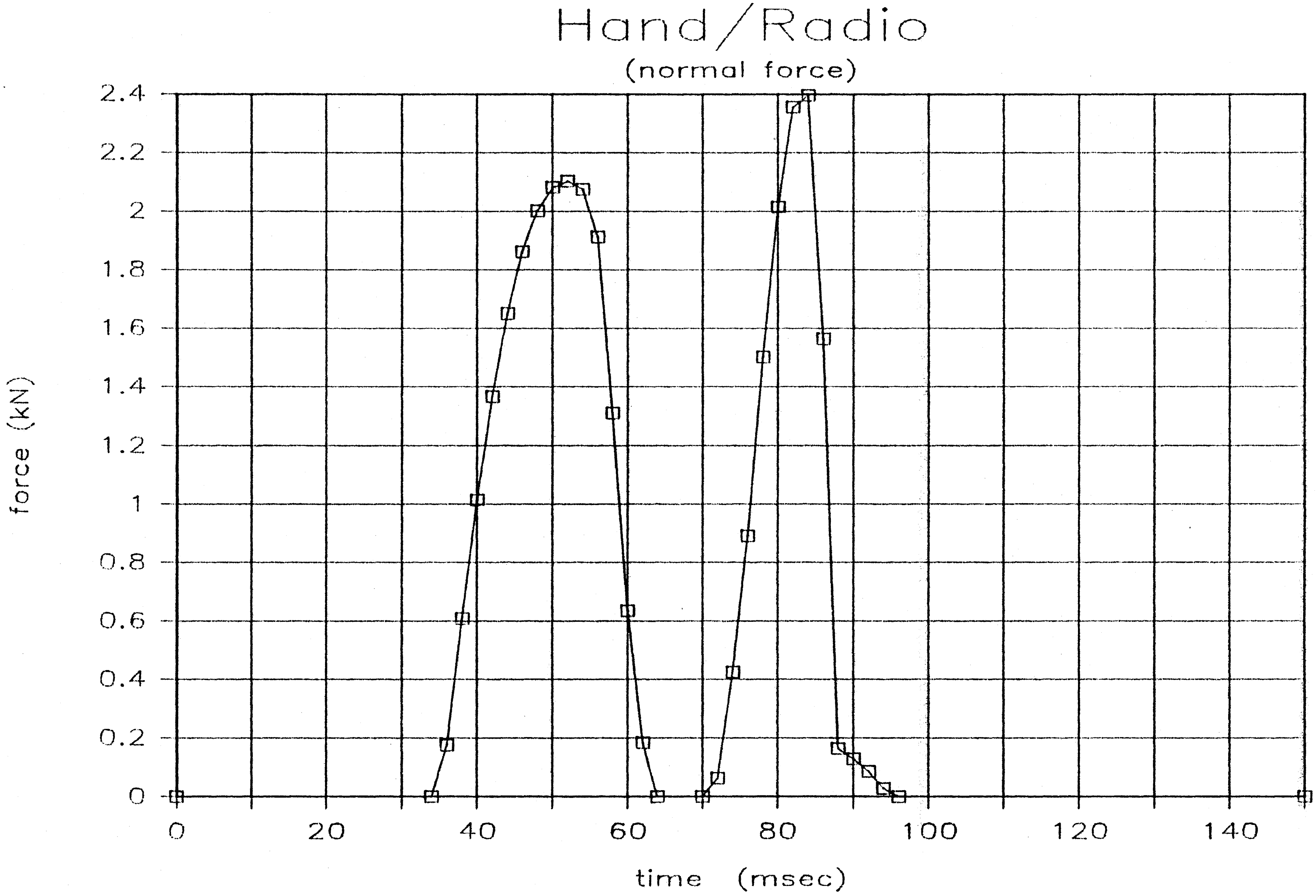


Figure 9. Force on Hand Due to Interaction with Radio. (Case No. 2-6 Driver).

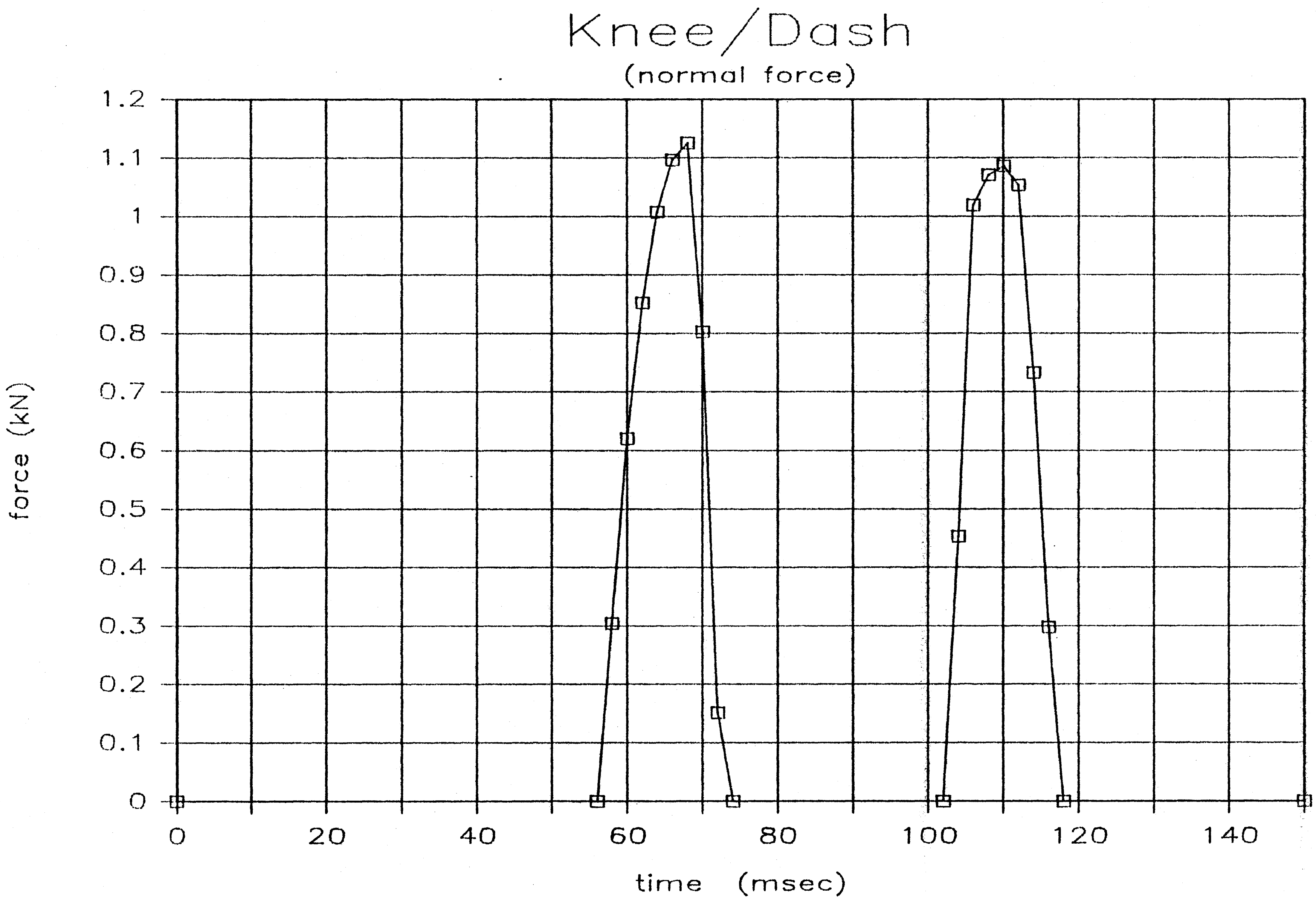


Figure 10. Force on Knee Due to Interaction with Lower Instrument Panel. (Case No. 2-6 Driver).

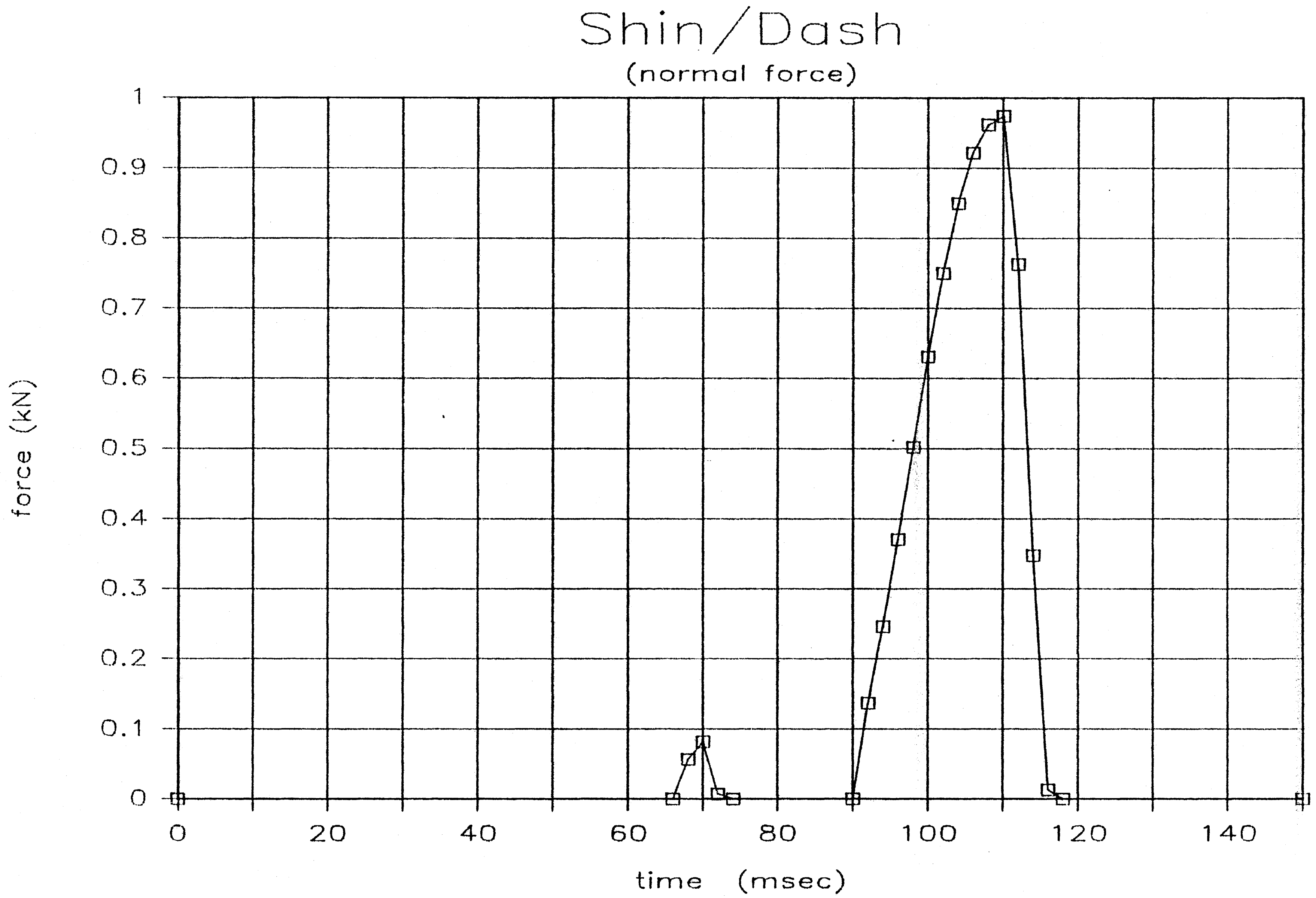


Figure 11. Force on Shin Due to Interaction with Lower Instrument Panel. (Case No. 2-6 Driver).

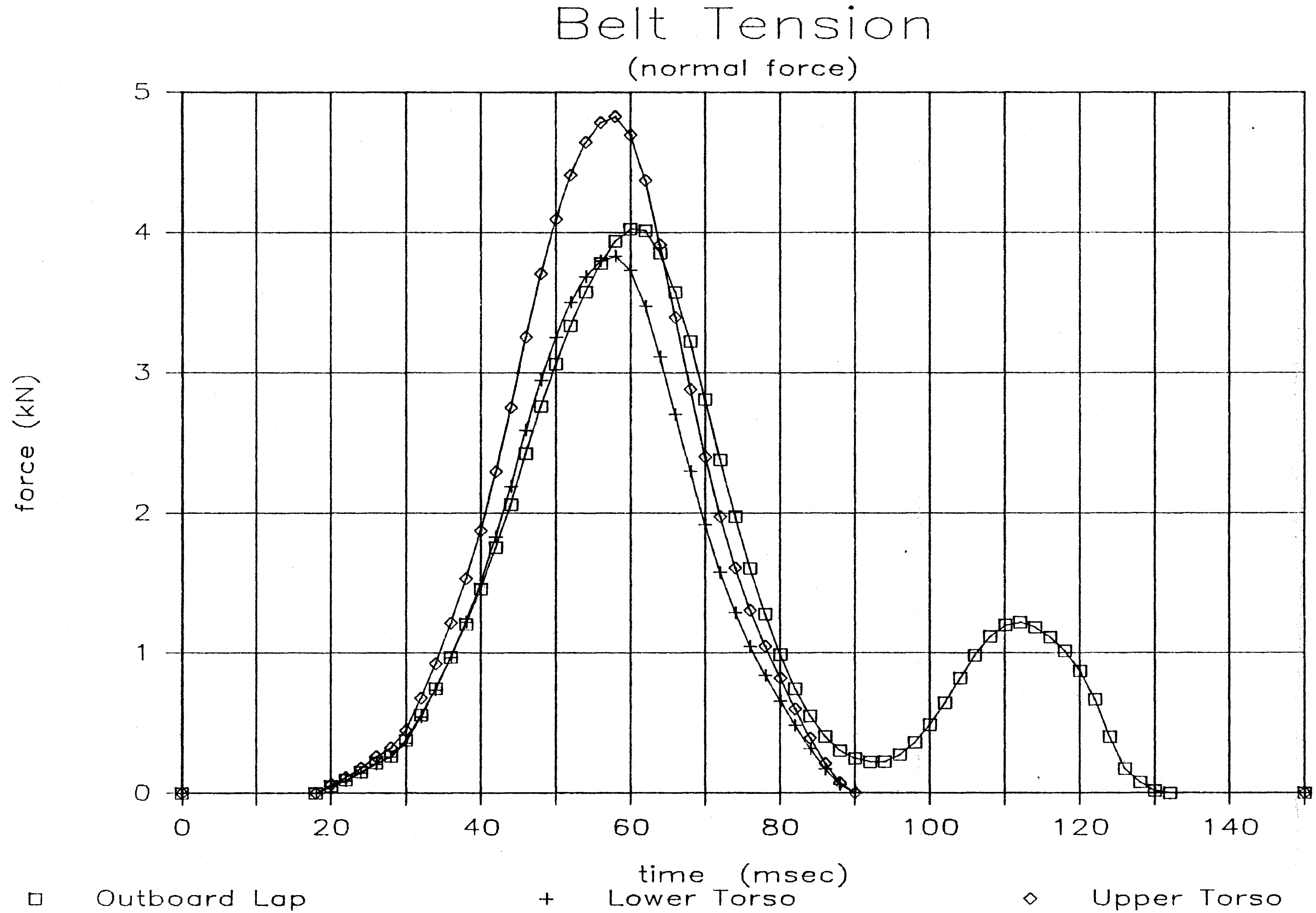


Figure 12. Belt Forces vs. Time. (Case No. 2-6 Driver).

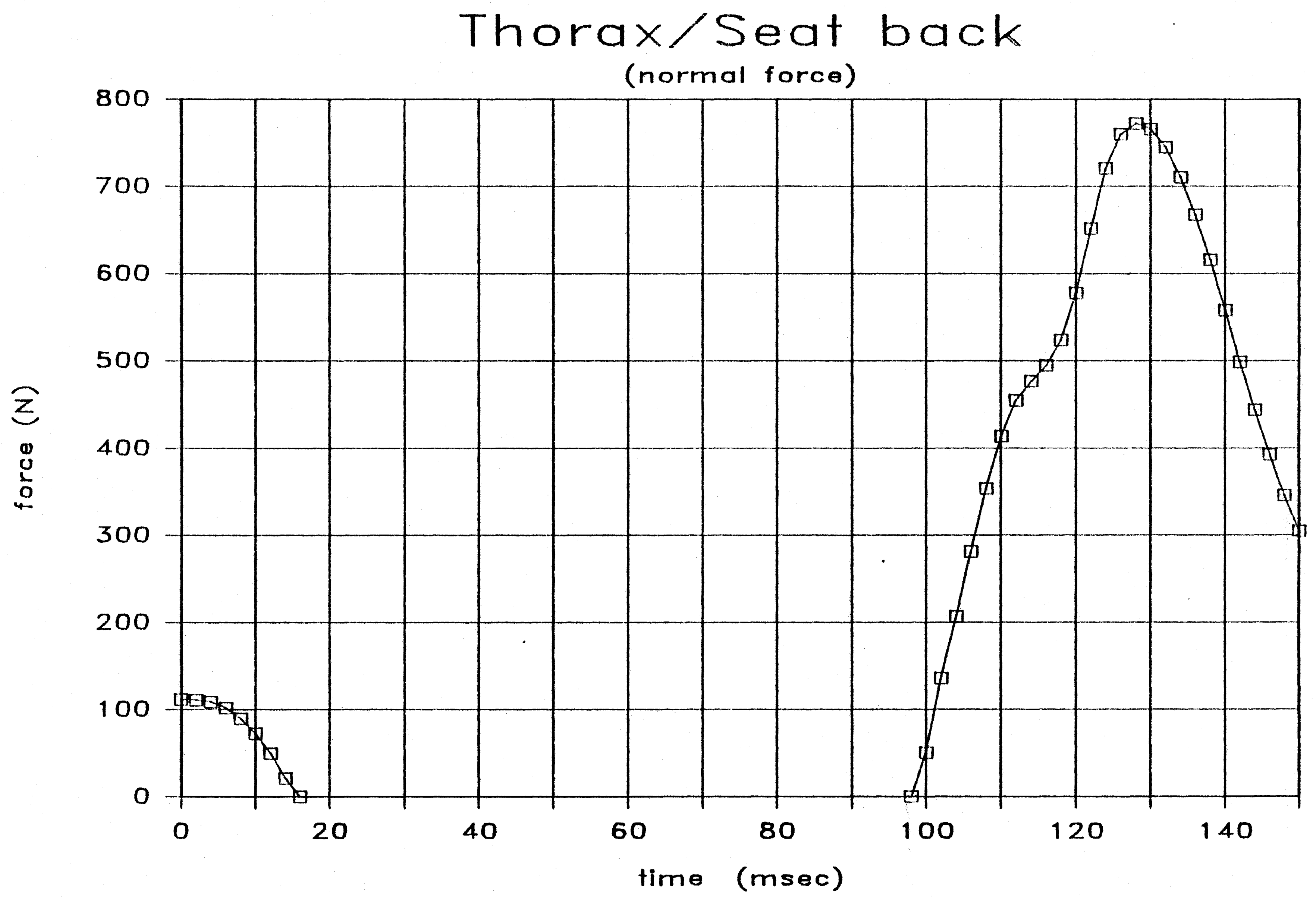


Figure 13. Force on Chest from Seatback during Rebound. (Case No. 2-6 Driver).

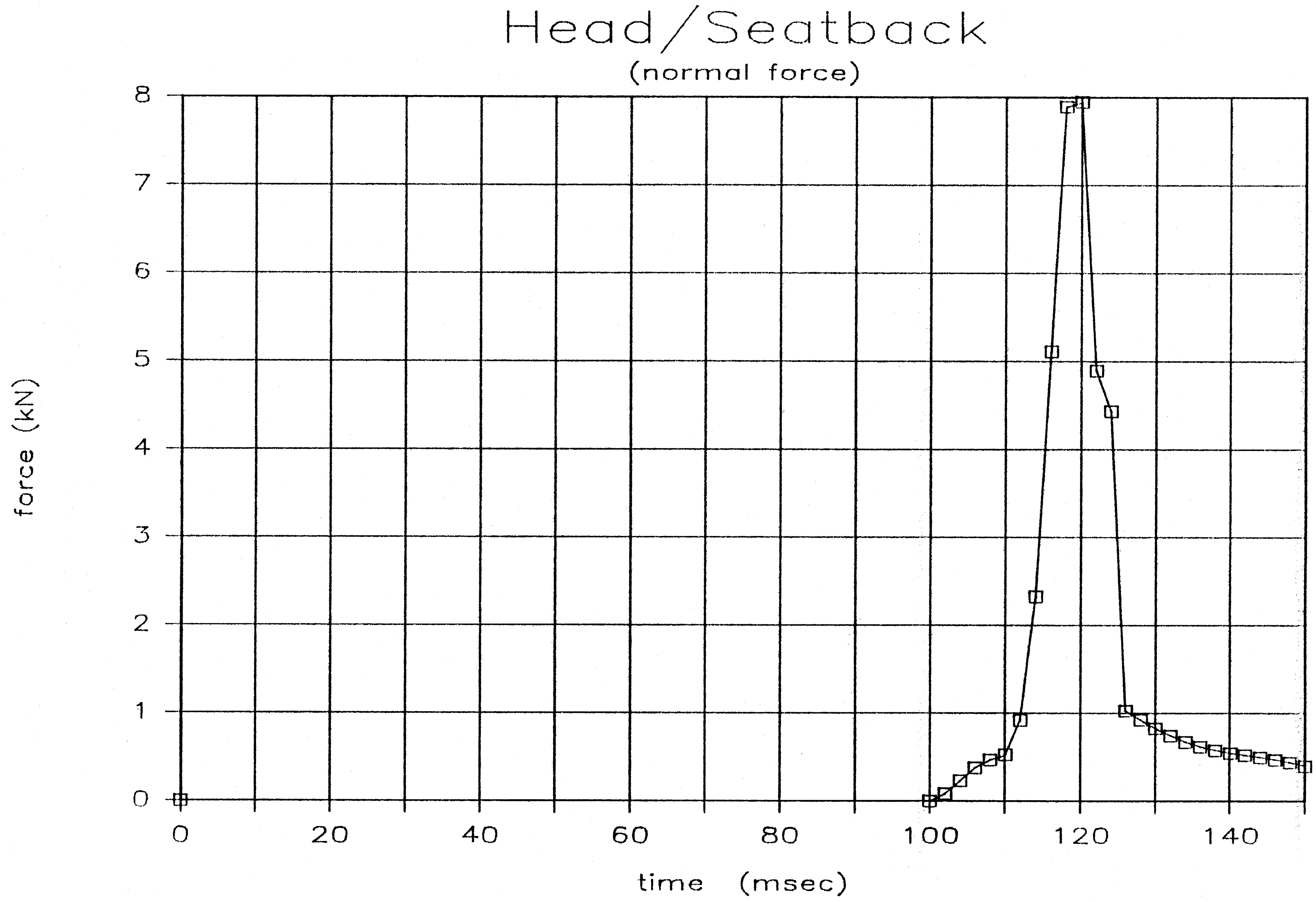


Figure 14. Force on Head from Seatback during Rebound. (Case No. 2-6 Driver).

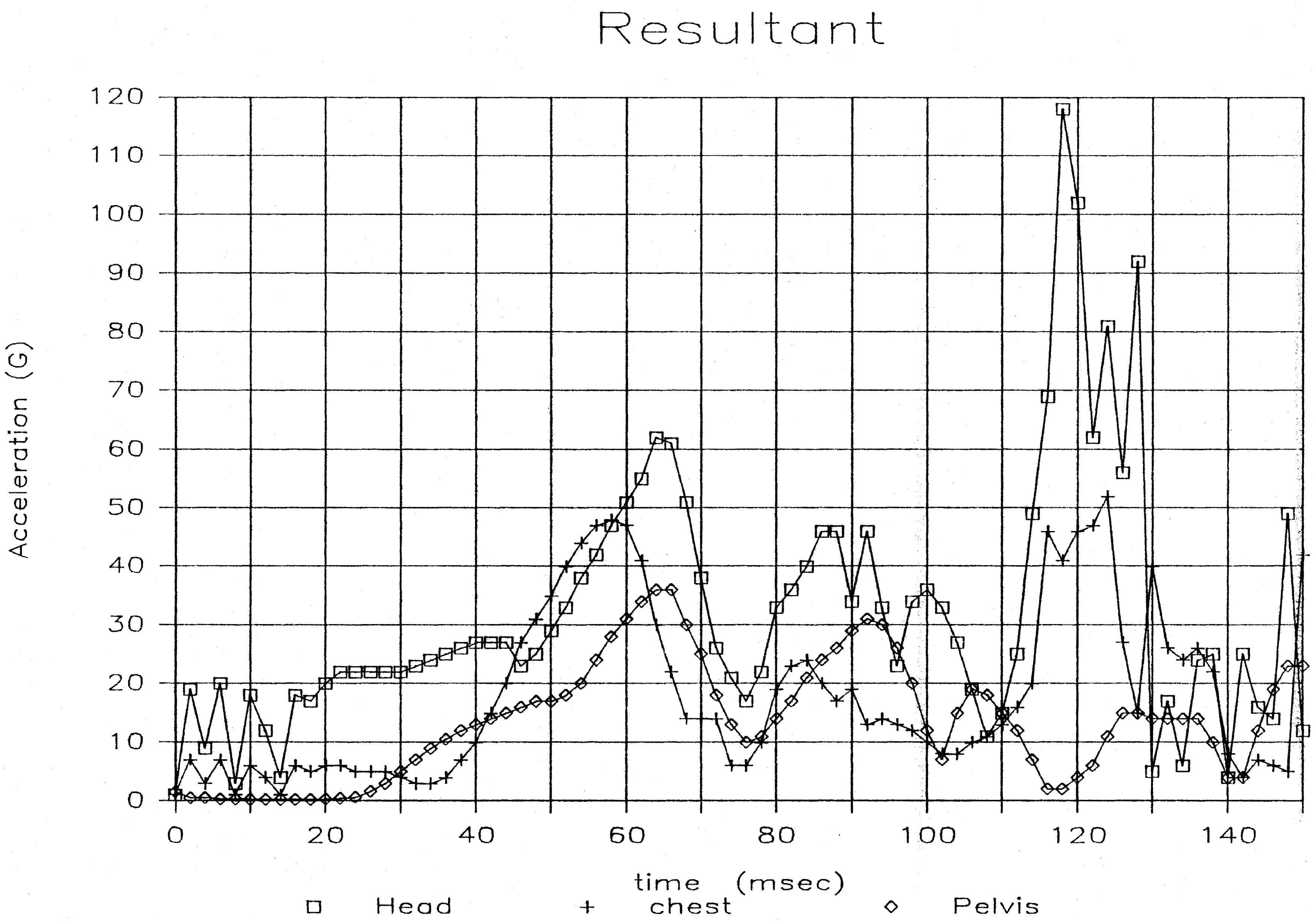


Figure 15. Head, Chest, and Pelvis Resultant Accelerations. (Case No. 2-6 Driver).

4.2 Case 2-6. 1982 Mercury Lynx (Frontal Impact. 32 kph. Passenger.)

This case involves the right front passenger of the same vehicle described in Section 4.1. The 44-year old passenger was wearing a heavy down-filled winter coat. She had just gotten into the car shortly before the crash and had buckled the seat belt, but had not properly adjusted it and tightened it up. When she saw that the crash was imminent she slid down (submarining fashion) in the seat so that the lap belt rode up on her heavy coat to her lower rib margin. Upon impact she continued forward against the restraints. She sustained a variety of injuries which are illustrated in Figure 16.

The radio mounted in the center of the lower panel was forced upward and may have been contacted by the passenger. The glove box area was damaged by the heater ducts, which were damaged by the deformation of the fire wall. In addition, it is likely, but not conclusively evident from damage marks, that the passenger contacted this region with her knees and shins. Loading of the restraint system during impact damaged the plastic trim on both the left and right B-pillars. An examination of the seat belt was concentrated on markings at the D-ring and on the ring on the B-pillar where the shoulder belt is routed to the floor. It was concluded that approximately 20 cm (7.9 in) of slack was present in the lap belt section while 10 cm (3.9 in) was in the torso section. There was no evidence that material transferred from the lap to the shoulder section during the peak loading on the basis of a sharp crease mark at the location where the belt passed through the buckle. However, it is certainly possible that some material may have been transferred before the loading pattern became well-established.

As in the case involving the driver of the vehicle (Section 4.1), the MVMA-2D occupant motion was selected for use in the reconstruction because of the symmetry of the crash event. Also, the same techniques were used in defining vehicle geometry and the crash deceleration pulse.

The interview with the subject yielded the following anthropometric information:

- 160.4 cm (63.1 in) stature
- 58.2 kgf (128 lb) weight
- 86.4 cm (34.0 in) seated height

- 53.8 cm (21.2 in) knee to buttock length

Both the driver and passenger participated in the interview. Both had vivid recollections of the time period leading up to the crash event.

In the case of the passenger, she indicated that she slid down in the seat and attempted to grab the lower edges of the seat. The photograph of this posture is included as Figure 17. A schematic of the vehicle interior cross-section was then made for a plane through the centerline of the occupant using vehicle scale drawings as well as some measurements taken directly from the vehicle due to the unusual occupant posture. The photographic slide of the occupant was then projected onto the schematic taking account, as before, of distortions based on camera placement. An outline of the occupant was then sketched onto the schematic. The occupant linkage, mass properties, and collection of contact ellipses were developed using the same procedure described in Section 4.1. Figure 18 is the resulting schematic of the occupant positioned in the vehicle. As in previous cases, engineering estimates and available data were used for the description of the deformability of vehicle interior components. A complete data set used in the simulation is included in Appendix A.

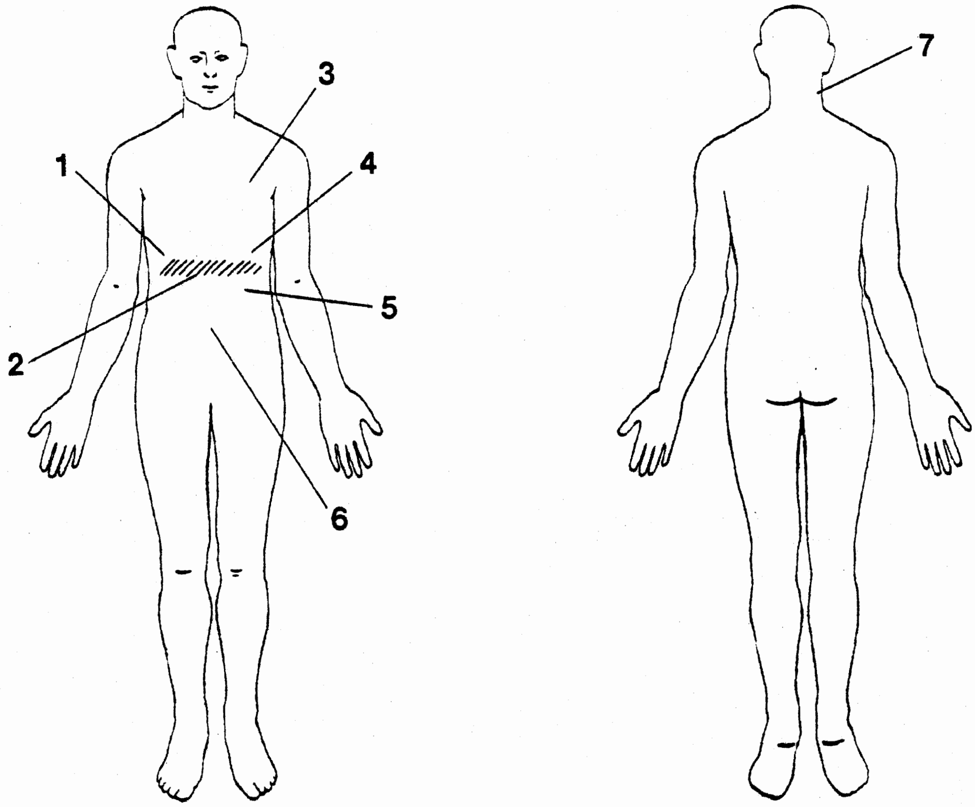
Figures 18 through 20 are schematics of occupant position at three points during the simulation. Figure 18 shows the initial position. The orientation of the pelvis has been superimposed on this drawing. It should be noted that the line of action of the belt system does not pass through the pelvis even at the beginning. Figure 19 shows the predicted position of the occupant at a time of 80 milliseconds into the crash event. This time corresponds to the most forward motions and the peak loadings of the occupant. The line of action of the belt is in the upper abdomen rather than across the pelvis. Figure 20 illustrates the position of the occupant upon rebound at 150 ms.

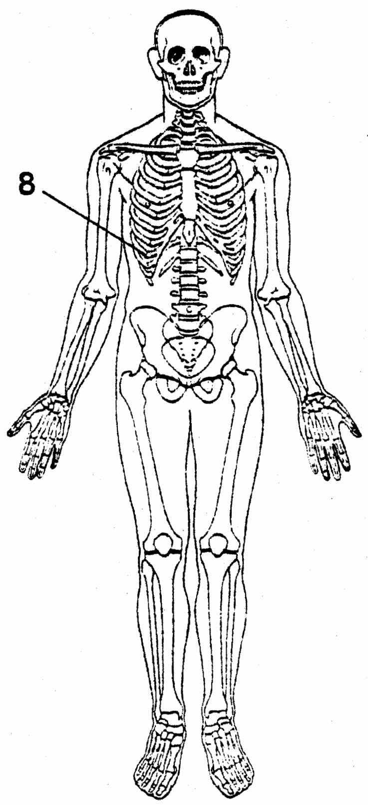
Figures 21 through 24 show some of the dynamic output results produced by the simulation. Figures 21 and 22 indicate substantial forces applied to the knee and lower leg (Peak of about 2325N (522 lb) per leg). As discussed previously, these are sub-injury loadings. Figure 23 shows the loadings predicted for the belts. The shoulder belts were loaded to less than 4000N (900 lb) while the lap belts each produced 2700N (607 lb). The resultant G-levels experienced by the head, chest, and pelvis appear to be substantial but potentially non-injurious.

A biomechanical review of this case can be made from two points of view:

- the first based on the loadings to the body
- the second based on the geometric relationship of the body to the load-producing environment

From the first point of view, it was predicted that the subject was exposed to loadings which probably should not correlate with serious injury. From the second point of view, a review of the geometry of the seating posture, including the placement of the belts, indicates that the belts will apply forces to the wrong parts of the body - the soft abdomen rather than the pelvis which has load-carrying capability. The use of graphics obtained as output from the simulation clearly illustrates the value of the geometrical aspects to the biomechanical reconstruction.





1. Large Fracture Right Lobe Liver (5)
2. Contusion Across Lower Rib Cage and Upper Abdomen (1)
3. Contusion Above Left Breast (1)
4. Left Adrenal Hematoma (2)
5. Large Fracture Spleen (4)
6. 2 cm Laceration Duodenum Bulb (4)
7. Contusion Base Right Neck and Shoulder (1)
8. Fracture 8th Right Rib (1)

Figure 16. Injuries to the Passenger. (Case No. 2-6).

Figure 17. Passenger in Case 2-6 Shown Seated in Similar Vehicle.

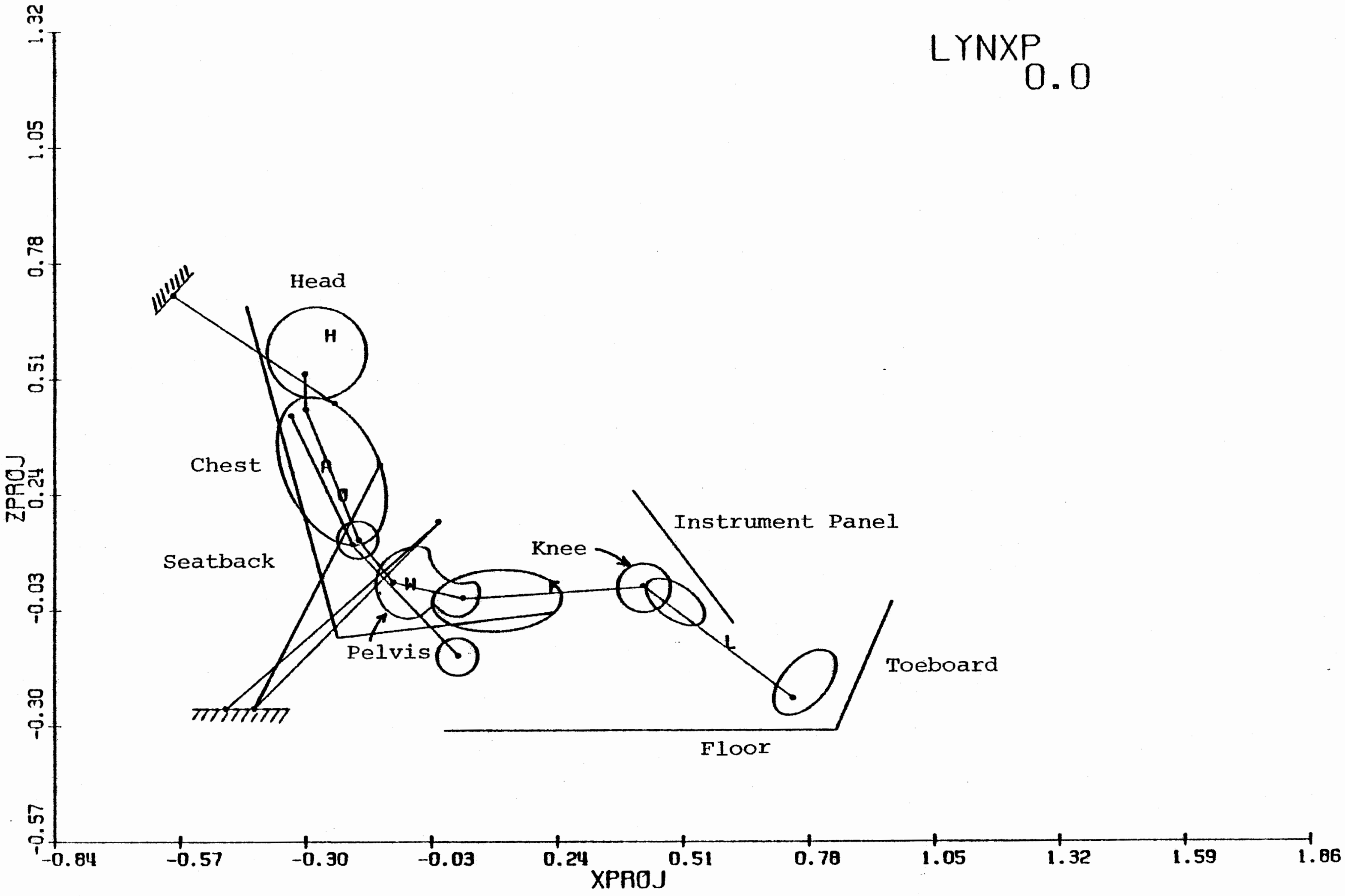


Figure 18. Schematic of Passenger in Simulated Vehicle. (Case No. 2-6).

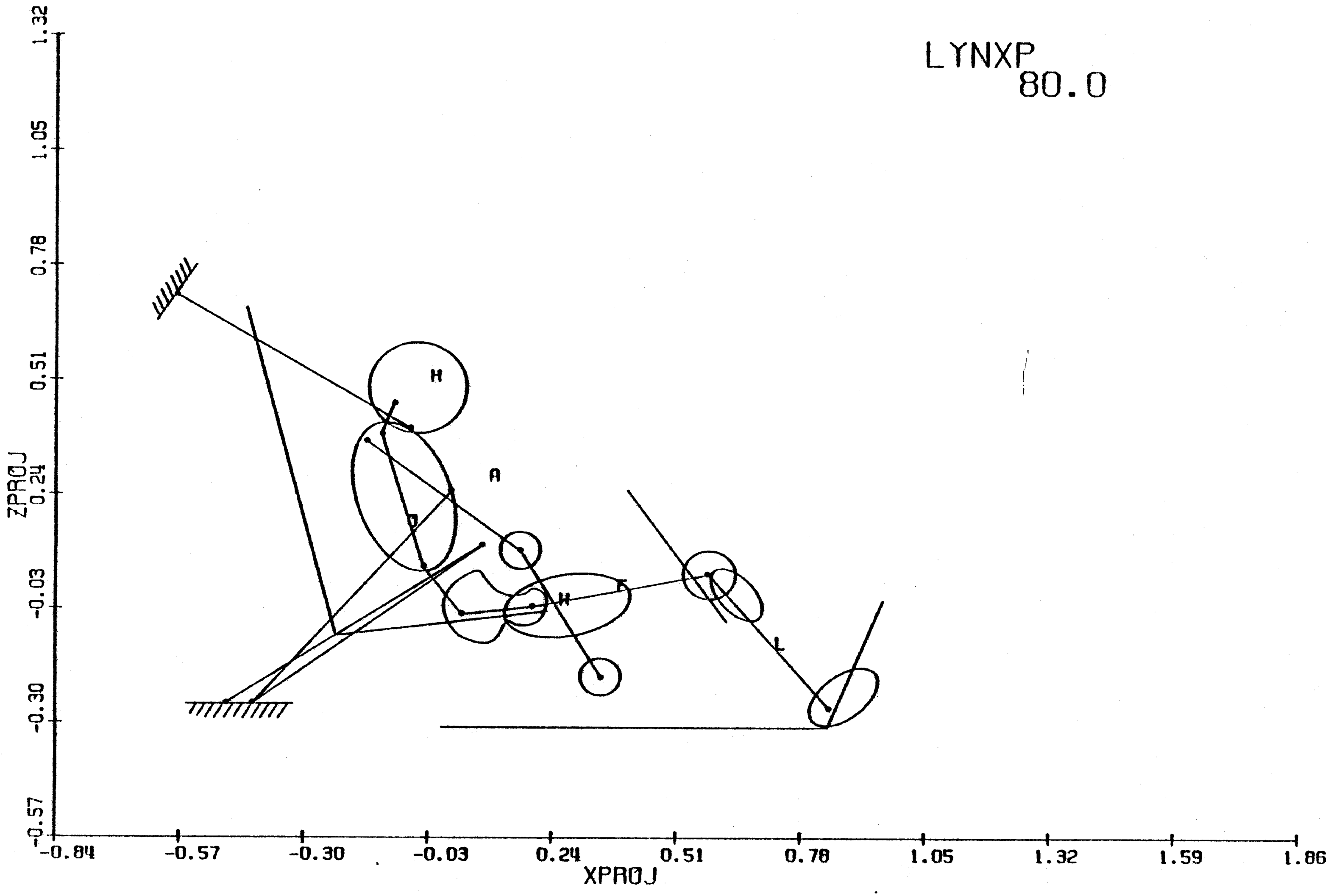


Figure 19. Passenger Position. 80 ms. (Case No. 2-6).

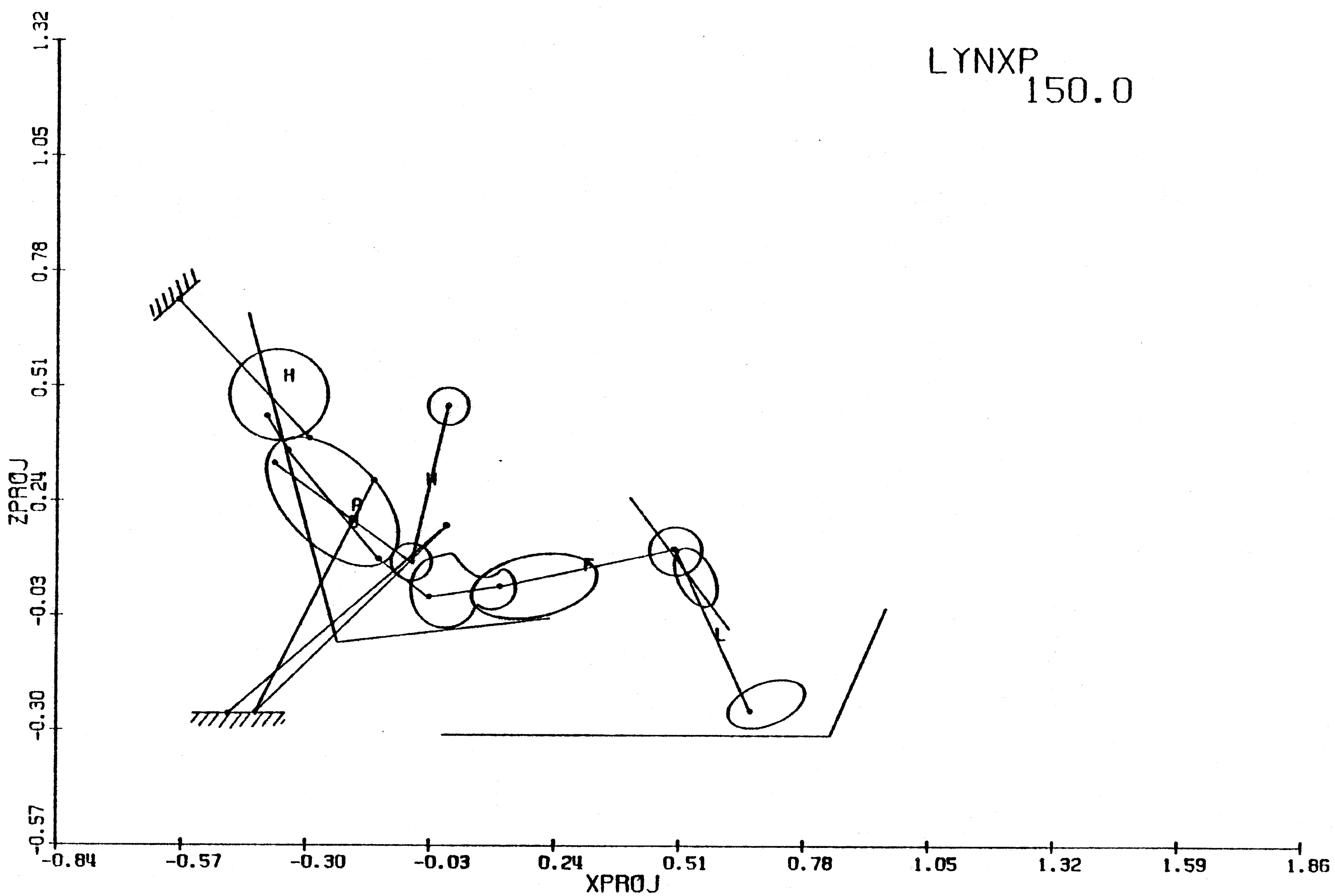


Figure 20. Passenger Position. 150 ms. (Case No. 2-6).

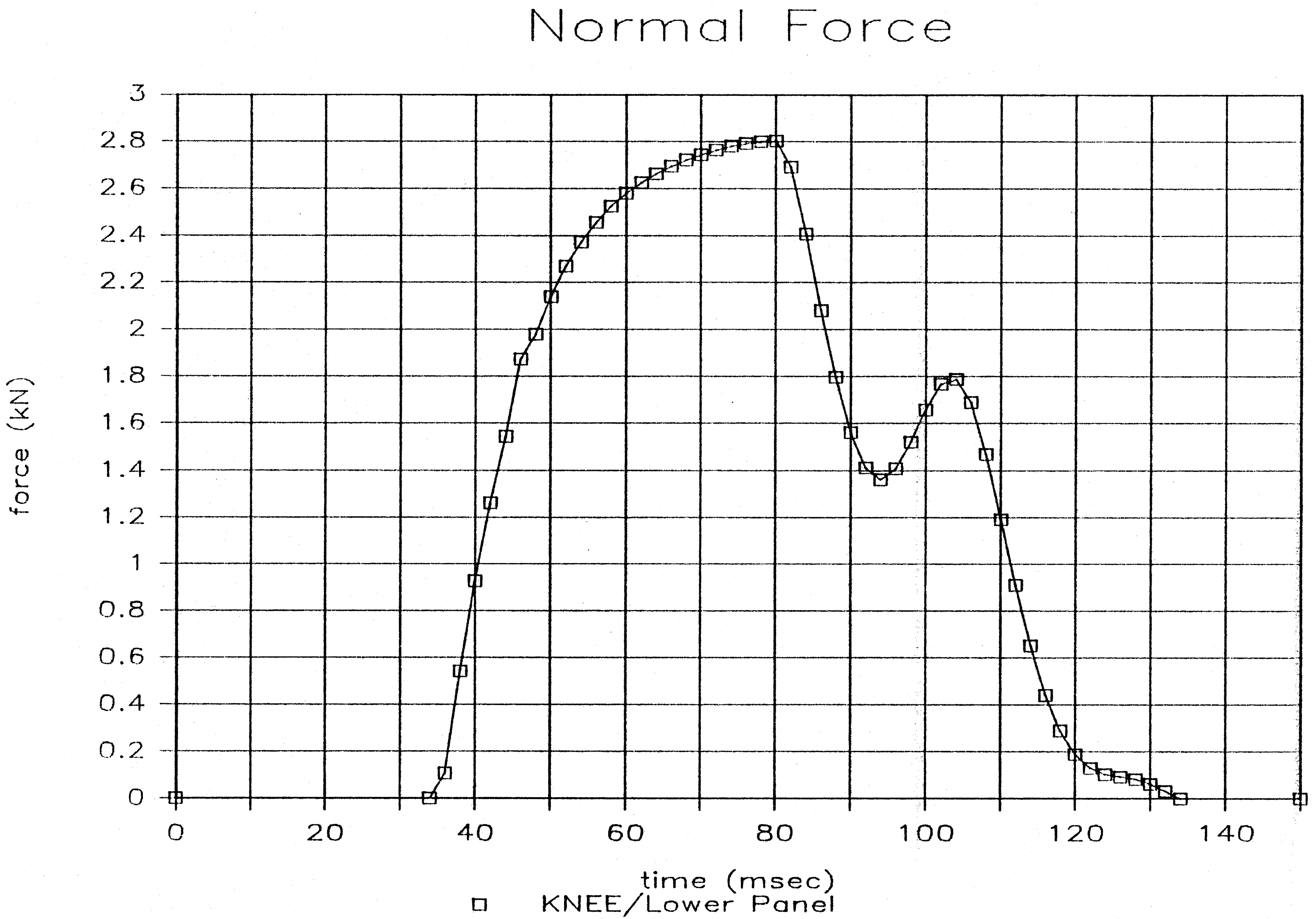


Figure 21. Force on Knees Due to Interaction with Lower Instrument Panel. (Case No. 2-6 Passenger).

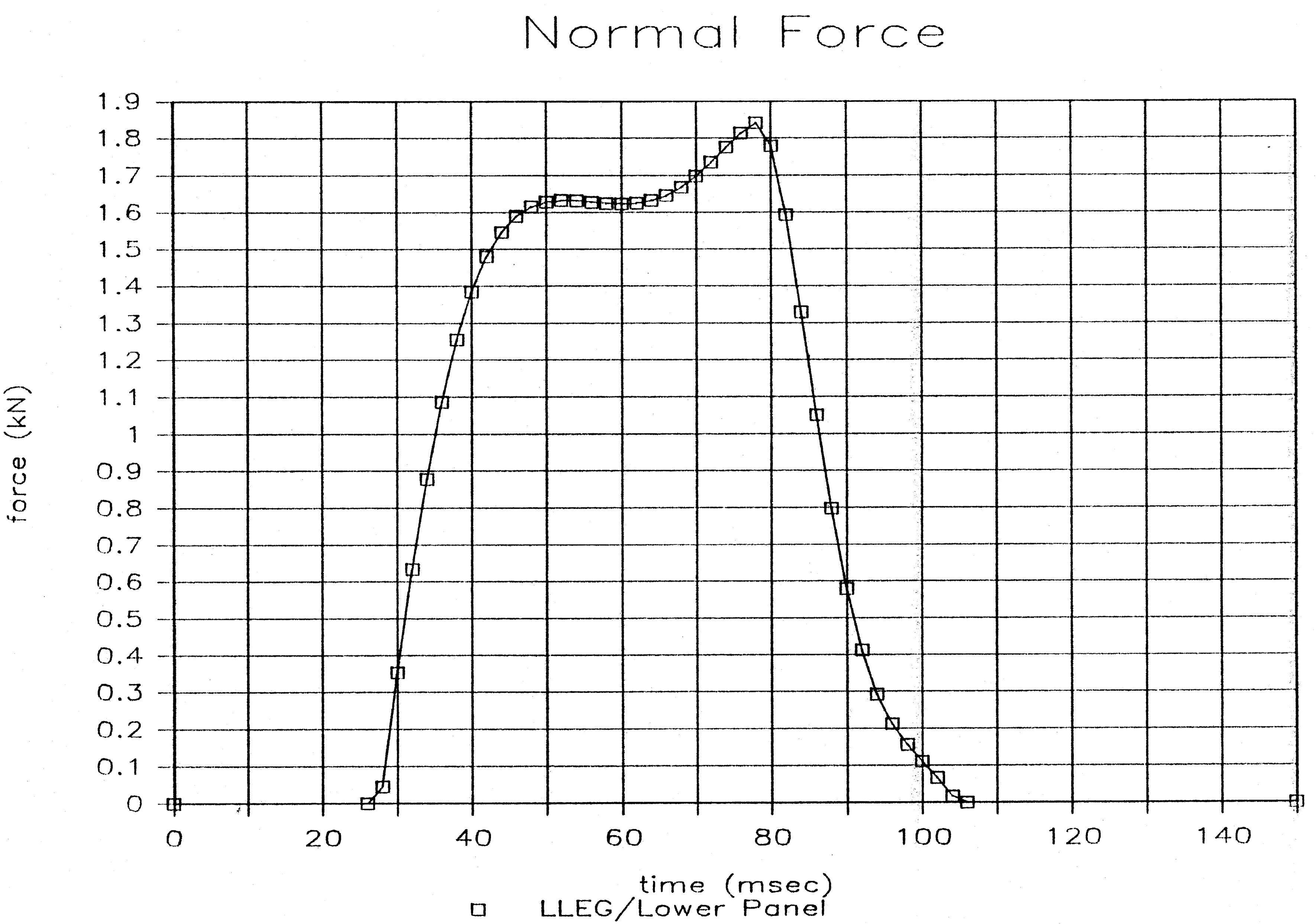


Figure 22. Force on Lower Leg (Shins) Due to Interaction with Lower Instrument Panel. (Case No. 2-6 Passenger).

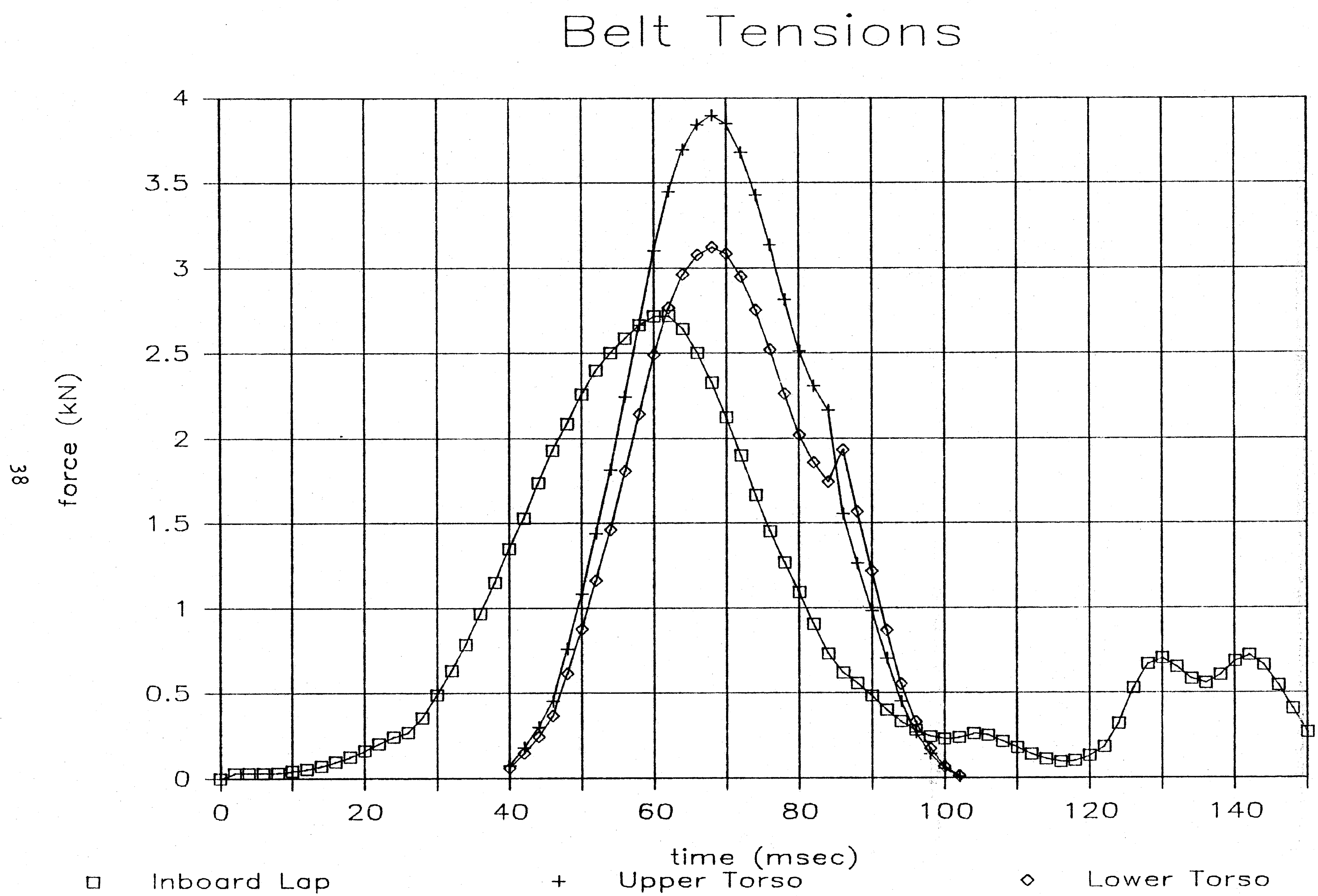


Figure 23. Belt Forces vs. Time. (Case No. 2-6 Passenger).

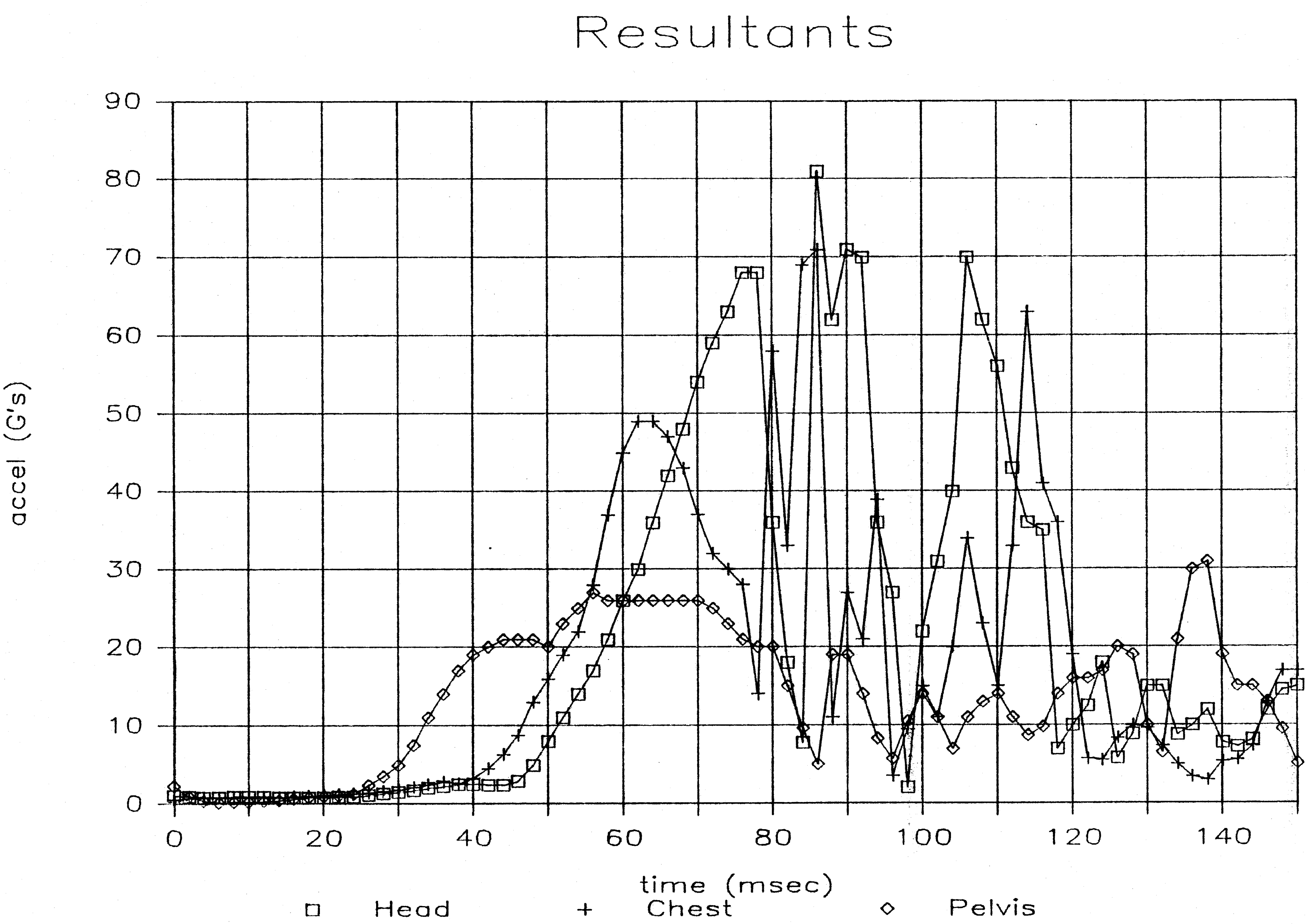


Figure 24. Head, Chest, and Pelvis Resultant Accelerations. (Case No. 2-6 Passenger).

4.3 Case 2-2. 1980 Plymouth Horizon TC-3 (Front oblique impact. 64 kph. Driver).

In this case a 1980 Plymouth Horizon TC-3 was northbound at an unknown speed in the left lane of US-23, a 4-lane divided concrete expressway north of Ann Arbor. Another vehicle had also been northbound in the left lane, but the driver, who was lost had stopped the car and was driving it in reverse at an unknown speed so that he could cross the emergency median crossover to the southbound lanes. The driver of the case vehicle (Plymouth) did not recognize that the other vehicle was backing up and the front of the case vehicle struck the rear of the other vehicle. Following the impact both vehicles apparently rotated counterclockwise. The case vehicle meanwhile went to the right and came to rest about 3 meters east of the pavement and about 15 meters north of the impact point headed southwesterly. Figure 25 is a schematic of the accident scene showing the slightly oblique impact as well as the well-defined resting points of the vehicles. Figure 26 shows the damage to the Horizon.

The driver did not remember whether or not he was wearing the restraint system; however, the seat belt was in an extended condition and may have been worn. On impact the driver flexed over the intruding steering wheel and struck his forehead on the upper left A-pillar. He also struck his face on the steering wheel and, in addition, contacted it with his upper right chest area and abdomen. In addition, he contacted the interior of the left door with his left side, left forearm and elbow. His left knee contacted the left end of the lower panel and the headlight switch knob, while his right knee contacted the lower panel and underside of the steering column.

There was extensive damage to the driver's area. The left A-pillar and left roof side rail were deformed and the upper left A-pillar and contiguous windshield area were contacted by the driver. Forward movement of the steering wheel damaged the upper left corner of the instrument eyebrow. Driver contact slightly deformed the steering wheel rim and spokes and dislodged the horn button. This contact also tilted the deep dish steering wheel upward and forward, but the deep dish dimension appeared to be essentially unchanged. Due to frontal impact the steering column appeared to be rotated upward and to the left. As indicated earlier the left A-pillar, instrument panel and steering assembly intruded unknown amounts to the rear. Displacement of the lower left A-pillar deformed the left door, which had been contacted by the driver. The driver's left knee damaged the left end of the lower panel and bent the headlight switch knob upward. Meanwhile, his right knee contacted the underside of the steering column and broke the lower panel. The damaged left end of the instrument panel pulled away from the A-pillar and the floorpan intruded rearward. There was no visible damage to the remainder of the instrument panel and glove box areas. In the left rear the side interior and B-pillar were deformed.

The driver sustained a variety of injuries which are illustrated in Figure 27. These include head and left shoulder and arm injuries probably due to the observed interactions with the door/A-pillar region. The knee abrasions can be associated with the lower panel and steering column contacts. The spleen, liver, and stomach injuries are likely due to an interaction with the steering wheel rim and column.

Use of the CRASH II program yielded a velocity change of 63 kph (39.1 mph) along the front-to-rear axis of the Horizon. Due to the somewhat oblique impact, a side component of 11 kph (6.8 mph) was also computed. The resultant linear velocity change was thus 64 kph (39.8 mph) at an angle of 10 degrees counterclockwise from the vehicle axis.

Because of the asymmetry of the crash it was decided to use the CAL-3D CVS software (Version 20) package (7). Due to the lack of well-defined procedures for estimating the occupant compartment rotation during the time period of an oblique contact between two vehicles, and making the assumption that much of the energy of the crash is transmitted in the vector direction of the velocity change, the deceleration vector was chosen to yield a velocity change of 64 kph (38.8 mph) with a direction of 10 degrees off-axis. The deceleration pulse which was used is scaled up in magnitude from a 56 kph (35 mph) barrier crash test result for a small car as an approximation.

Because of the complex three-dimensional interaction between the occupant and the vehicle, it was decided that direct measurements taken from a similar vehicle would provide sufficient data necessary for the simulation of the vehicle interior geometry. A more accurate procedure (also requiring some measurements in three dimensions of the location of occupant contact points on vehicle components) would involve the identification of appropriate vehicle drawings, and the derivation of geometric data therefrom. This process (which was tedious even in the more simple symmetric cases in the first phase project) was believed to be beyond the scope of the second phase project because of the addition of complex side door and A-pillar components and other three-dimensional aspects.

Key aspects of the data were obtained during an interview with the occupant. Simple anthropometric measurements were taken documenting his size as:

- 177.8 cm (70 in.) stature
- 66.4 kg (146 lb) weight. (Note: The subject indicated that his weight was between 155-160 lb at the time of the crash, so a value of 71.4 kgf (157 lb) was selected for the simulation.
- 91.4 cm (36 in.) seated height
- 57.2 cm (22.5 in.) knee to buttock length

To develop an estimate of the posture of the occupant in the vehicle, photographs were taken showing his estimated position while driving (Figure 28). A schematic of the vehicle interior (in three dimensions) was then made using the various measurements taken on the vehicle. The photographic slide of the occupant was then projected onto a lateral view of the vehicle interior taking account, insofar as possible, of distortions based on camera placement. An outline of the occupant was then sketched onto the schematic.

The next step was to develop a linkage, mass properties, and the external geometry for the seated driver. A three dimensional linkage was prepared from data developed by Robbins et al (4,5) and refined for use as CAL-3D data sets in more recent work for NHTSA (8). The linkage consists of the following masses:

- head (connected to neck)
- neck (connected to upper spine)
- upper spine (T1T4) (connected to middle spine)
- middle spine (T5T8) (connected to lower spine)
- lower spine (T9T12) (connected to lumbar spine)
- lumbar spine (L1L5) (connected to pelvis)

- pelvis (connected to left and right upper upper legs)
- upper legs (connected to left and right lower legs)
- lower legs (connected to left and right feet)
- thorax (connected to the upper and middle spines)
- shoulders (connected to the middle spine mass at the location of the sternoclavicular joints)
- upper arms (connected to the shoulders)
- lower arms/hands (connected to the upper arms)

The thorax is pinned to the upper spine mass at a point corresponding to the joint between the upper and middle spine segments. This pin joint is based on the observation in cadaver tests (belts and flat impactors) that little deformation is observed at the top of the chest (first two ribs) and much more is observed at the bottom. The lower portion of the thorax mass resists chest compression by means of a contact surface attached to the lower spine segment. This contact interaction can thus utilize force-deflection data for belt, column or other interactions. Motion by the thorax segment toward the front of the body is restrained by a spring/damper element.

The external geometry was modeled as a collection of ellipsoids based on the photograph taken of the occupant and on the expected interactions with the vehicle interior. Figures 29, 30, and 31 show side, front, and top views of the occupant seated in the vehicle at the beginning of the simulation. The various contact surfaces are labeled. It should be noted that ellipsoids are placed only where contacts are expected. As a result, it appears that the lower portion of the back and the lower shins are missing when in actual fact the linkage is indeed present. This illustrates the problems in modeling three-dimensional objects using wire frame algorithms without hidden line removal. The program called VIEW, not available with the original releases of CAL-3D Version 20, and not yet completely installed at UMTRI, alleviates this problem to some extent, but is extremely expensive to operate. The most recent documentation on this program, which still is undergoing some development and correction, has been prepared by Leetch et al (9).

Because of the lack of force-deflection data for the vehicles studied and the exploratory nature of the project, engineering estimates based on available data were used for these quantities. The complete data set used in the simulation is included in Appendix A along with those of the other reconstructions. The baseline data set for this case is supplemented by a second data set which adds belt restraints. This is based on the observation made by the accident investigator and confirmed by the occupant that belts could have been in use.

Figures 32-34 show side, front, and top views of the driver position at 60 ms into the crash event. No belts are used in this simulation. From the front view (Figure 33) it can be seen that the driver has already move considerably off center and toward the door. From the front as well as the top views (Figures 33-34), the right upper leg is nearly in contact with the right side of the shroud underneath the steering column. As would be expected the left leg has moved away from the column toward the door. The interaction of the lower legs with the lower instrument panel is clearly shown in the side view (Figure 32) while the interaction of the right upper arm with the plane of the steering column is shown in the top view (Figure 33).

Figure 34 is a front view of the driver position at 80 ms. It illustrates the initial contact between the left driver window region and his left shoulder. Figures 36 and 37, at 90 ms, show side as well as front views. The side view (Figure 36) illustrates the initial contacts of the head with the A-pillar and windshield as well as the contacts of the upper torso with the thorax and right shoulder region. A variety of initial contacts are illustrated by the front view including:

- head vs. windshield and A-pillar
- thorax and right shoulder vs. steering column
- left shoulder, arm, and leg vs. driver door

These illustrations show the driver beginning to rotate around the column toward the A-pillar region.

Figures 38-40 illustrate the driver position at the end of the simulation (150 ms). The rotation around the column and some rebound are most clearly shown in the top view (Figure 40).

Figure 41-55 show some of the dynamic output results produced by the simulation. The vehicle deceleration used to drive the dynamics is illustrated in Figure 41 along with the velocity and position. Curves for both belted and unbelted cases are included in the following output data plots. The interaction of the right upper leg with the shroud underneath the column is present for both cases as shown in Figure 42. Little difference between the two cases is shown for interactions of the feet with the toepan (Figure 43). The lack of a belt system shows up in the interaction of the right and left upper and lower legs (RULG, LULG, RLLG, LLLG) with the respective lower instrument panels (Figures 44 and 45). The curves labeled TC3 for the unbelted driver show significantly higher loads than do those labeled TC3B for the belted driver. Contacts of the left upper leg (LULG), left upper arm (LUA), and left shoulder with the driver side door and window are given in Figures 46-48. It should be noted that the belted driver does not interact with those structures. Figure 49 deals mostly with the right side of the body as it includes the major interaction of the thorax with the side of the steering column as well as various interactions with the right shoulder and arm. Only the arm of the belted driver interacts with the column lending some credibility to the presumption that he was in actual fact not using the belt system. Interactions of the head with the windshield and A-pillar are shown in Figures 50 and 51 while belt loadings (in the case where belt usage is presumed) re given in Figure 52.

Figures 53 through 56 present chest, head, and pelvis acceleration output data. Figure 53 shows curves for the unbelted driver for the front of the thorax (THOR) and the spine in the region of T9-T12. The loads are somewhat higher and occur earlier in the event for the front of the thorax. The high G-loads (the signal is not filtered) may reflect the fact that steering column collapse data not including wheel rim deformation was used for the thorax/column interaction. Figure 54 shows G-levels for the driver chest in the case where belt use is assumed. The G-loads are substantial but lower without the sudden column interaction. In Figure 55 the interaction of the head with the header and windshield is reflected in the spike in the acceleration curve at 82 ms for the case of the unbelted driver. Pelvic accelerations are similar for the belted and unbelted cases are illustrated in Figure 56.

The injuries sustained by the driver are consistent with:

- the observations of contact spots in the vehicle due to driver contact made by the accident investigation team
- the motions, forces, and accelerations predicted by the analytical reconstruction
- the presumption that the driver was unbelted

Although it was impossible to correlate chest G-loadings with injury, the geometric observations of the subject pivoting around the steering column and into the A-pillar region do correlate with the presence of loadings to the upper region of the abdomen where severe injuries occurred. Also, the closed head injury (considerable memory loss two months after the accident) are consistent with the high head accelerations which were predicted.

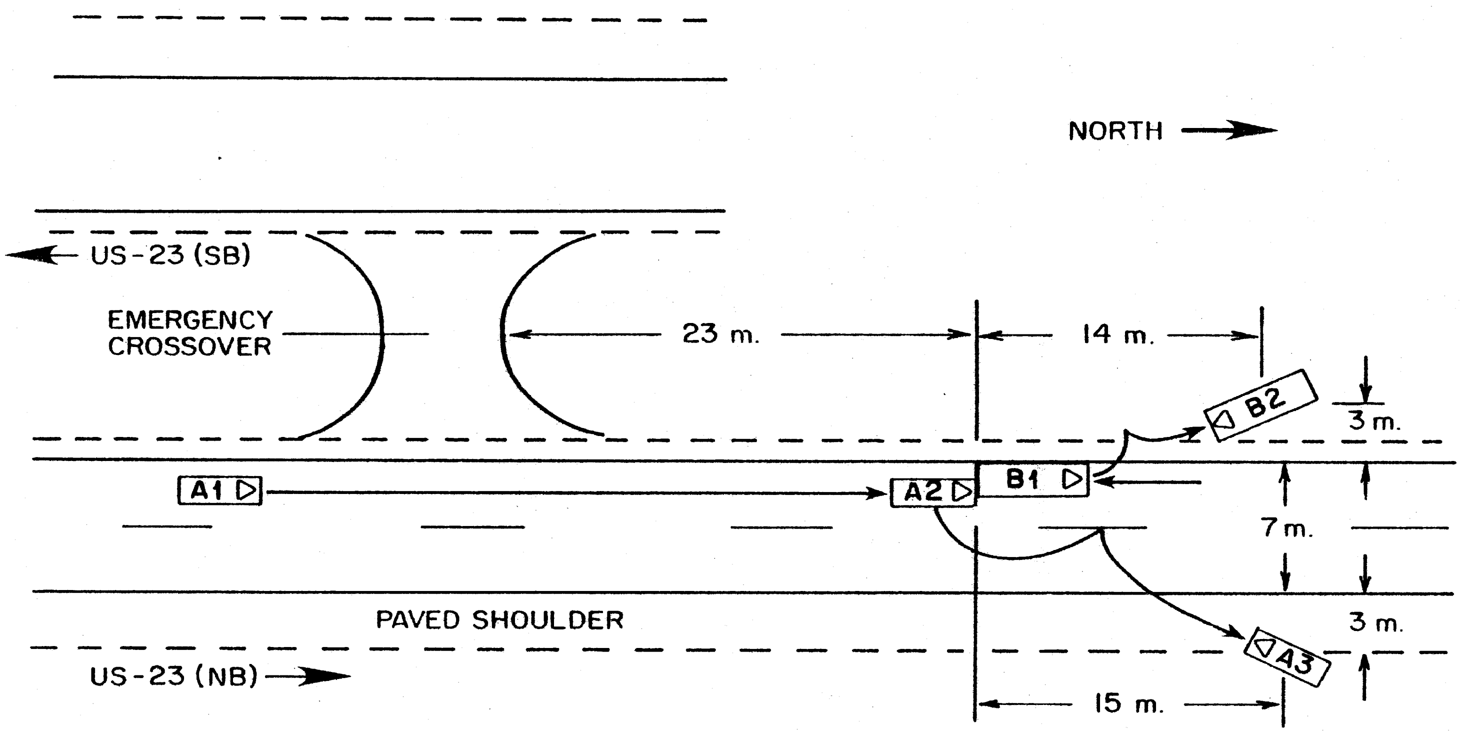


Figure 25. Schematic of Accident Scene. (Case No. 2-2).

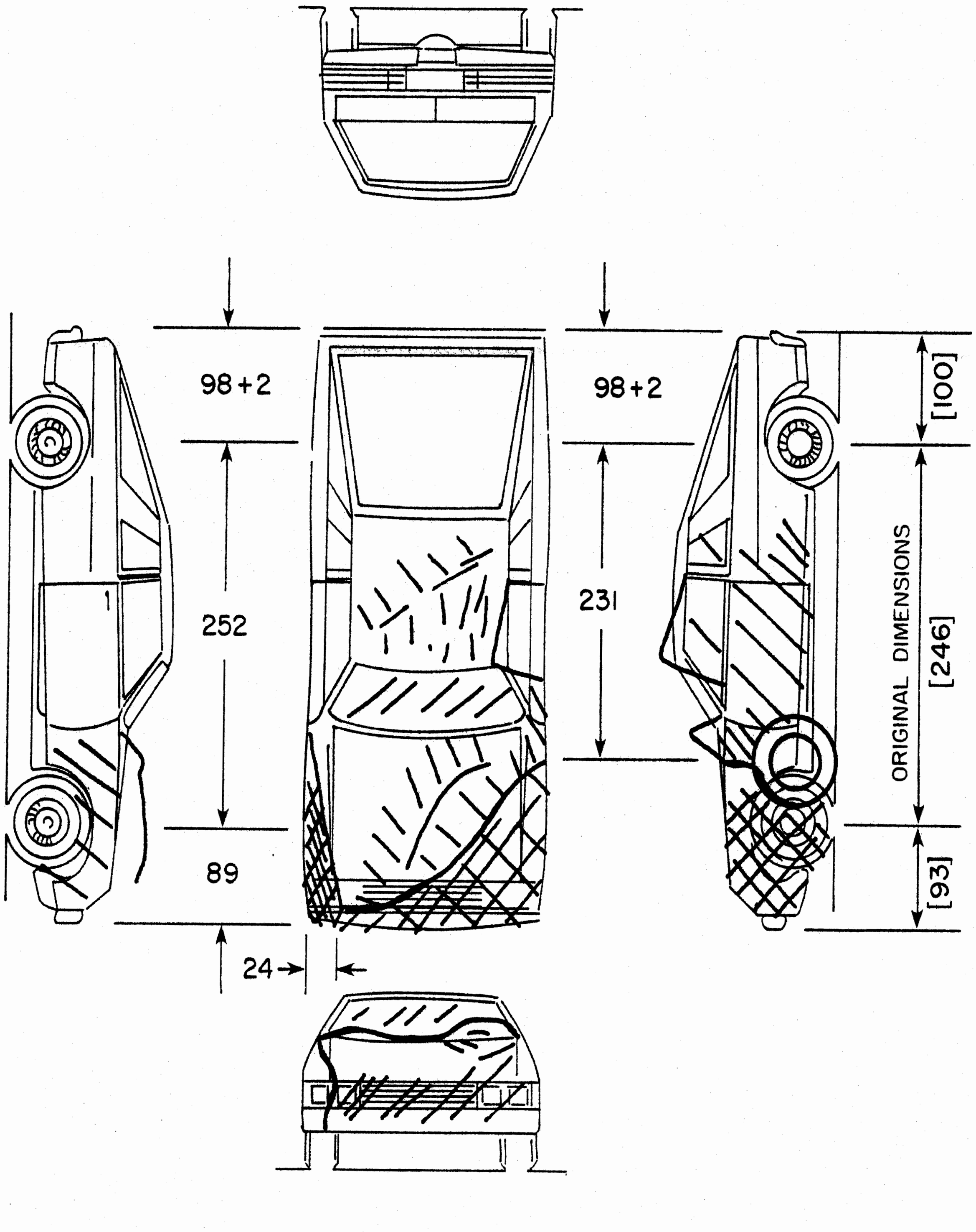
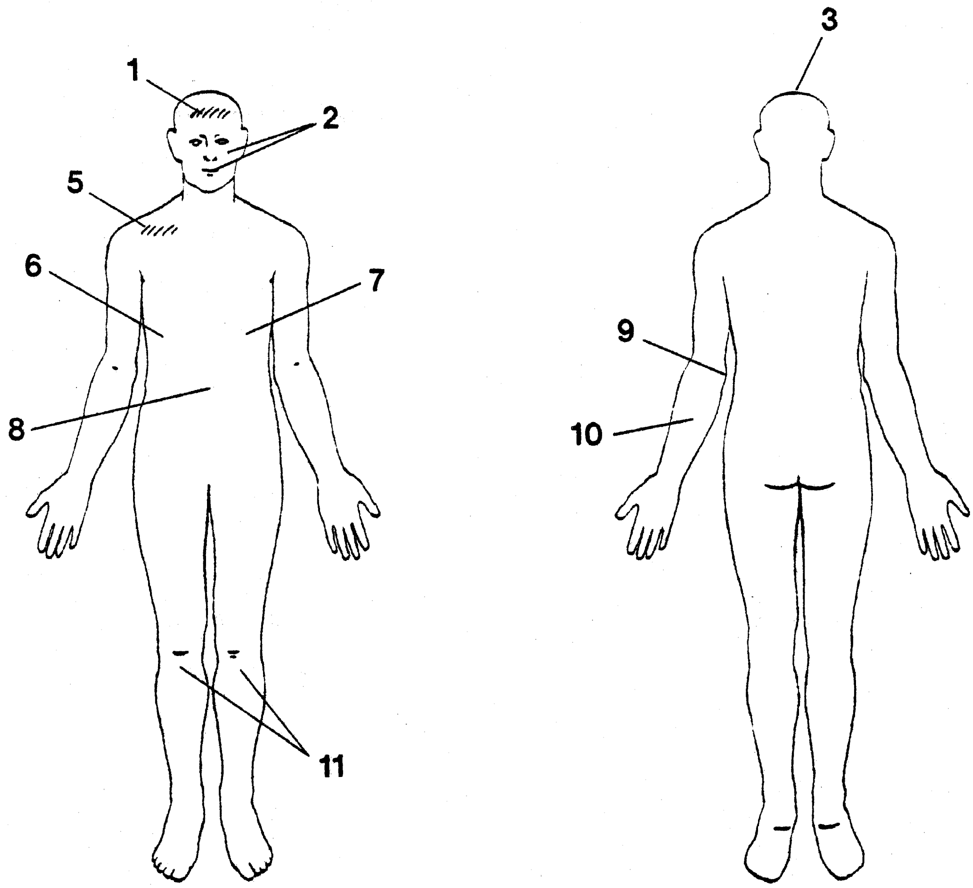
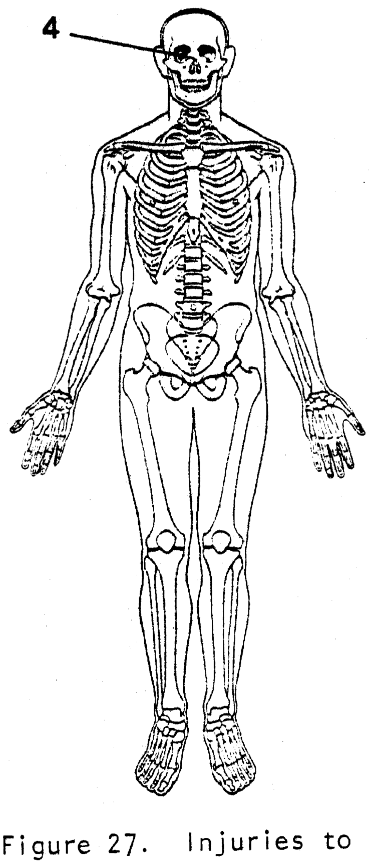


Figure 26. Vehicle Damage. (Case No. 2-2).





1. Abrasions Forehead at Hairline (1)
2. Superficial Abrasions and Lacerations Left Cheek and Lips (1)
3. Closed Head Injury (5)
4. Fracture Nose (1)
5. Abrasions Below Right Clavicle (1)
6. Superficial Laceration Liver (4)
7. Laceration Spleen (4)
8. Contusion Stomach (2)
9. 1.5 cm Laceration Medial Posterior Left Elbow (1)
10. Superficial Lacerations and Abrasions Dorsal Left Forearm (1)
11. Abrasions Below Both Knees (1)

Figure 27. Injuries to the Driver. (Case No. 2-2).

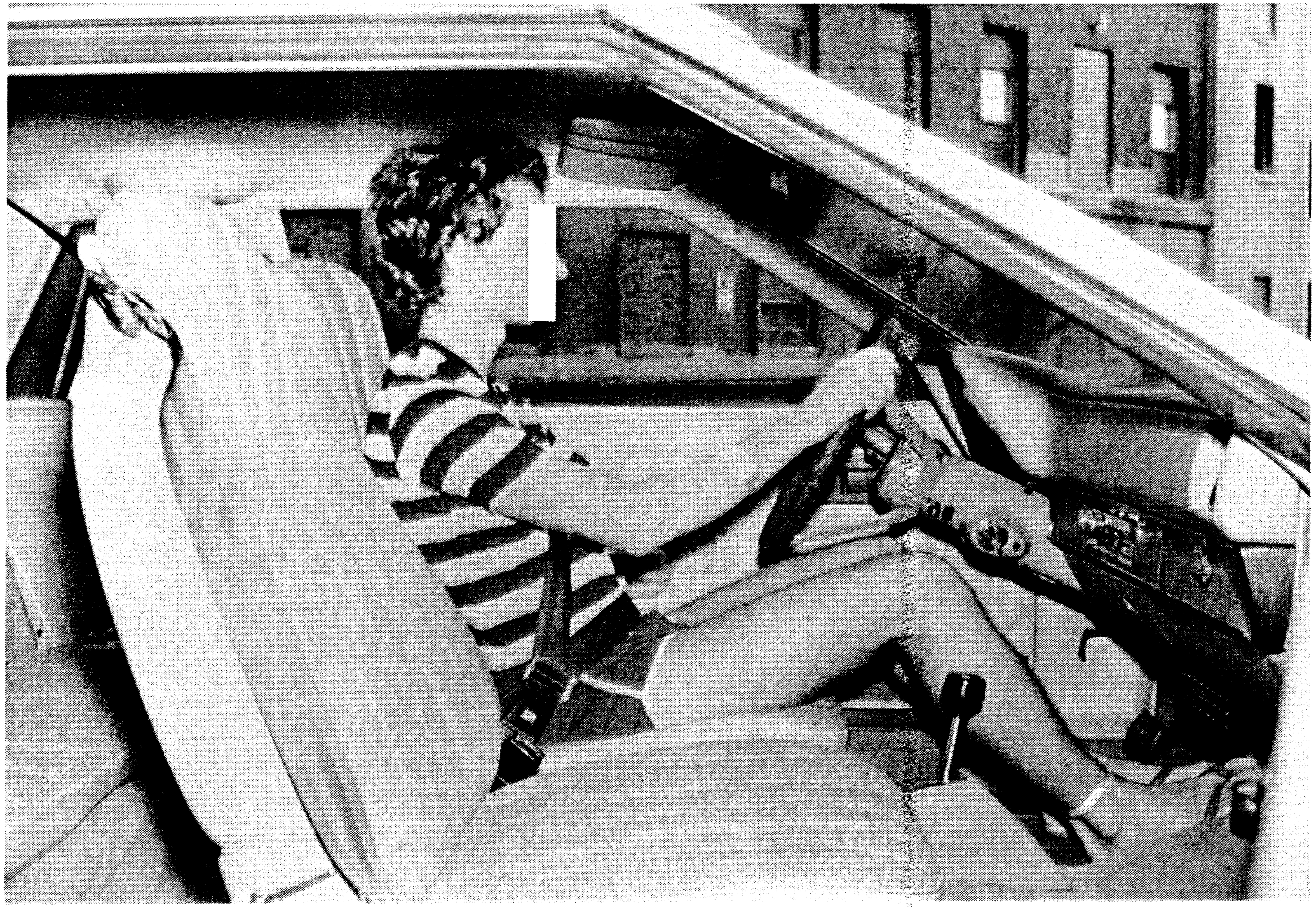


Figure 28. Driver in Case 2-2 Shown Seated in a Similar Vehicle.

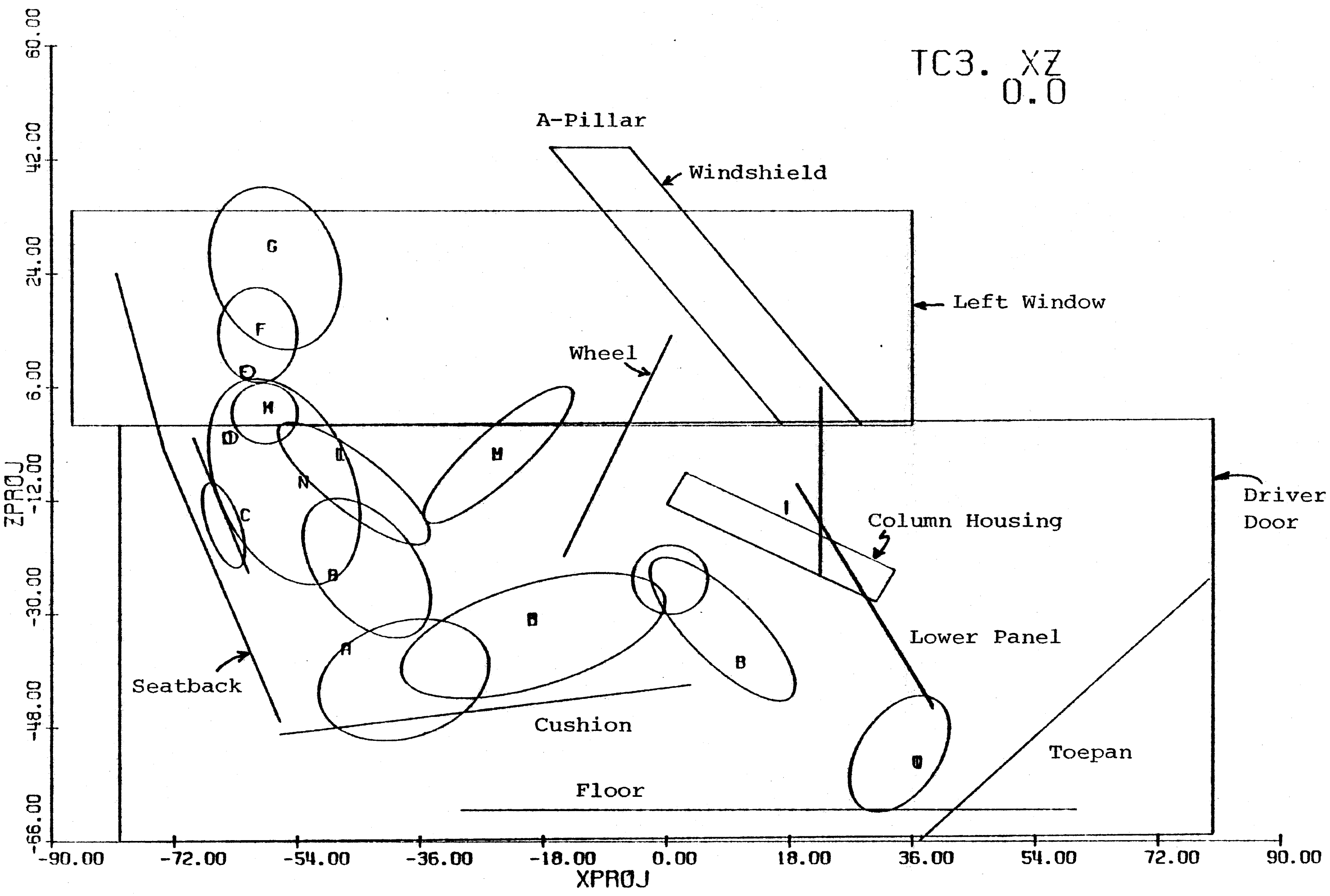


Figure 29. Side View Schematic of Driver in Simulated Vehicle. (Case 2-2).

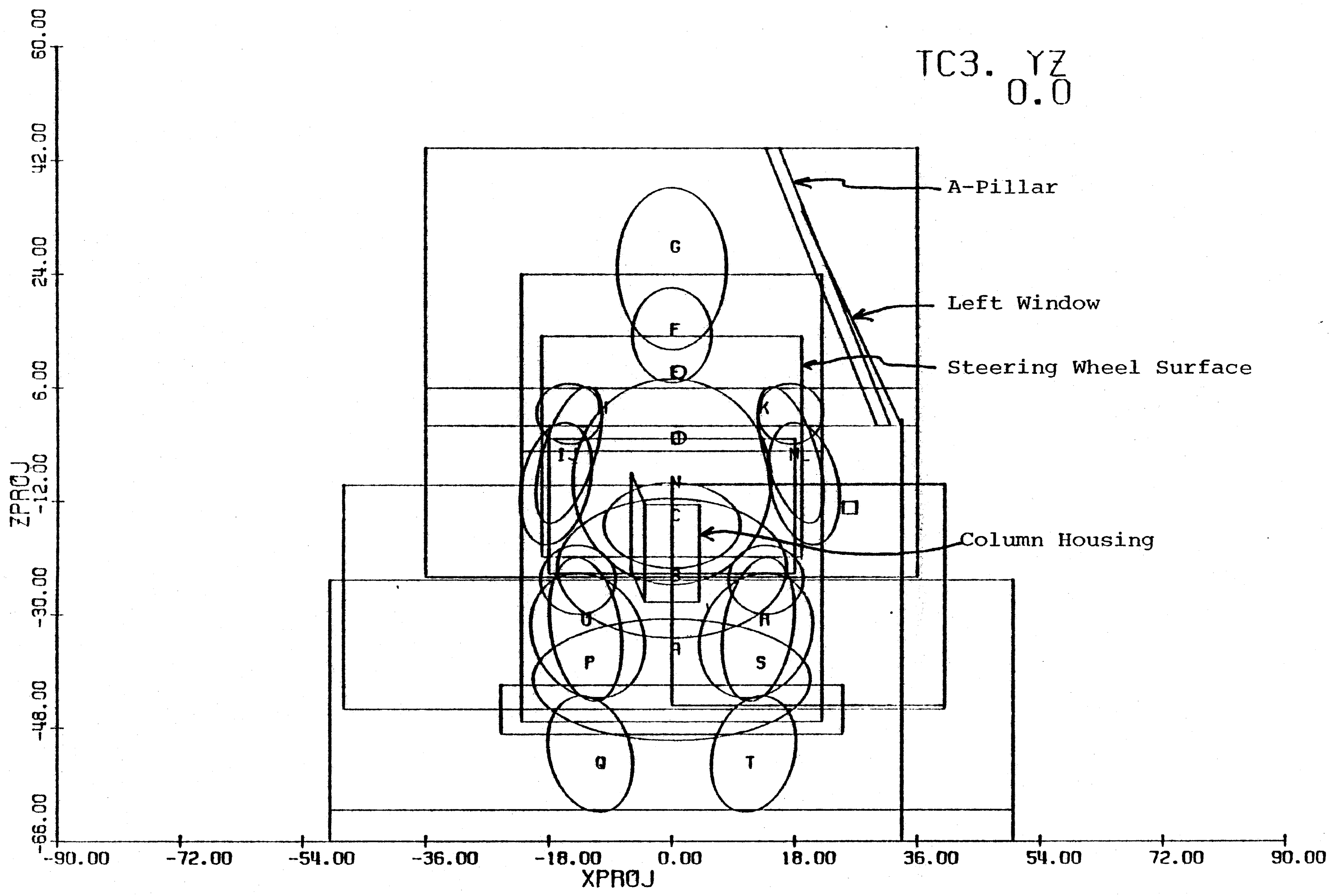


Figure 30. Front View Schematic of Driver in Simulated Vehicle. (Case No. 2-2).

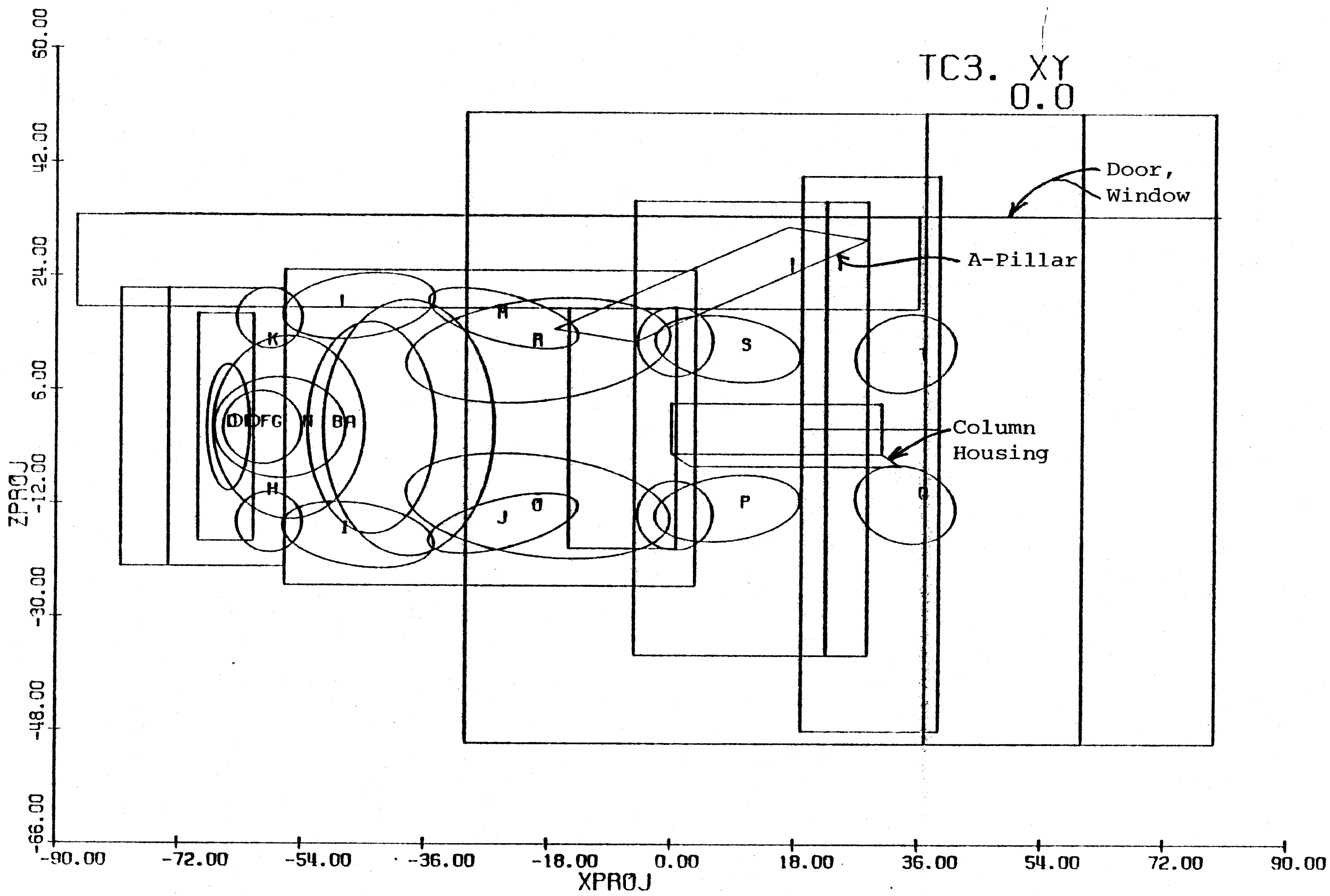


Figure 31. Top View Schematic of Driver in Simulated Vehicle. (Case No. 2-2).

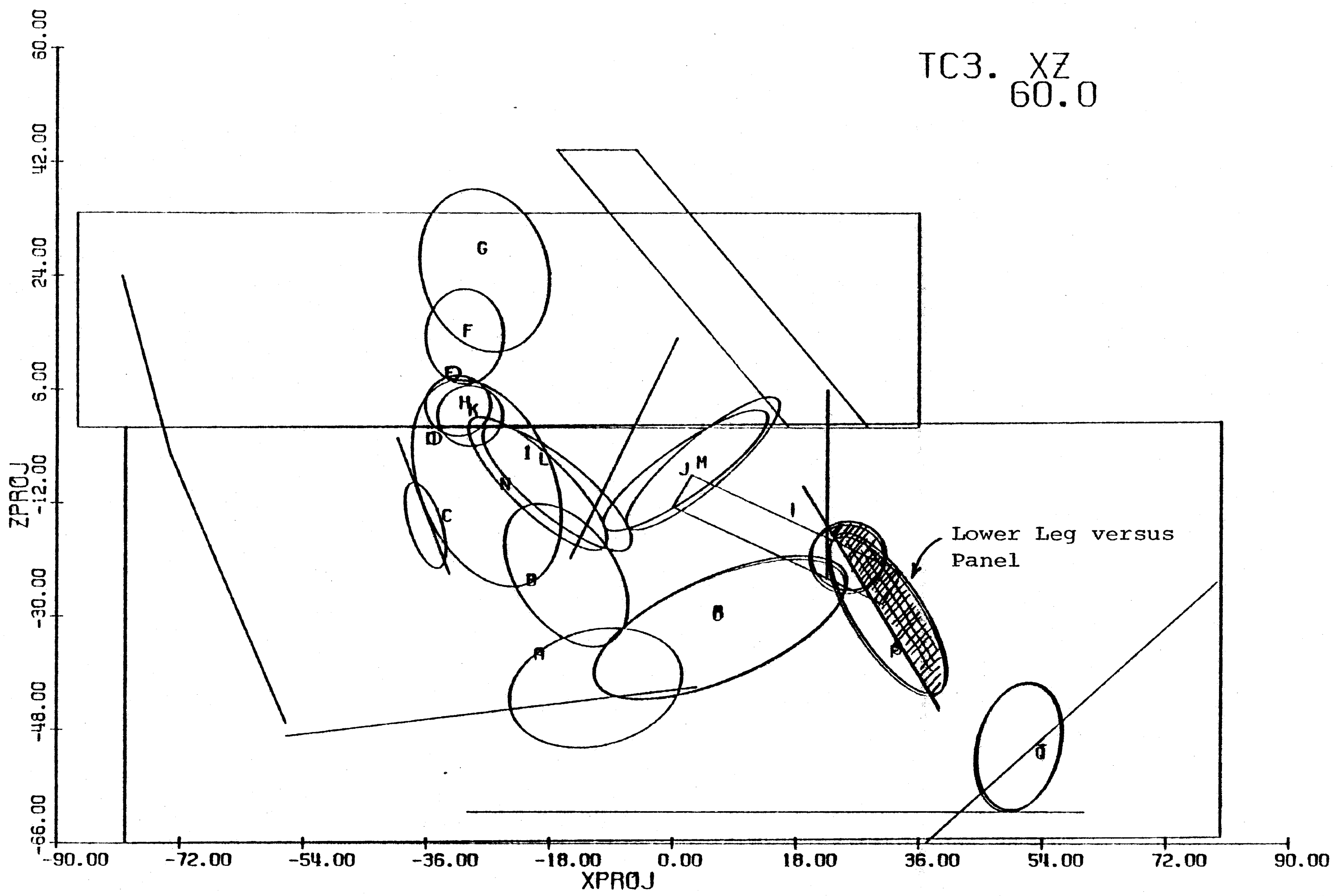


Figure 32. Side View of Driver Position. 60 ms. (Case No. 2-2).

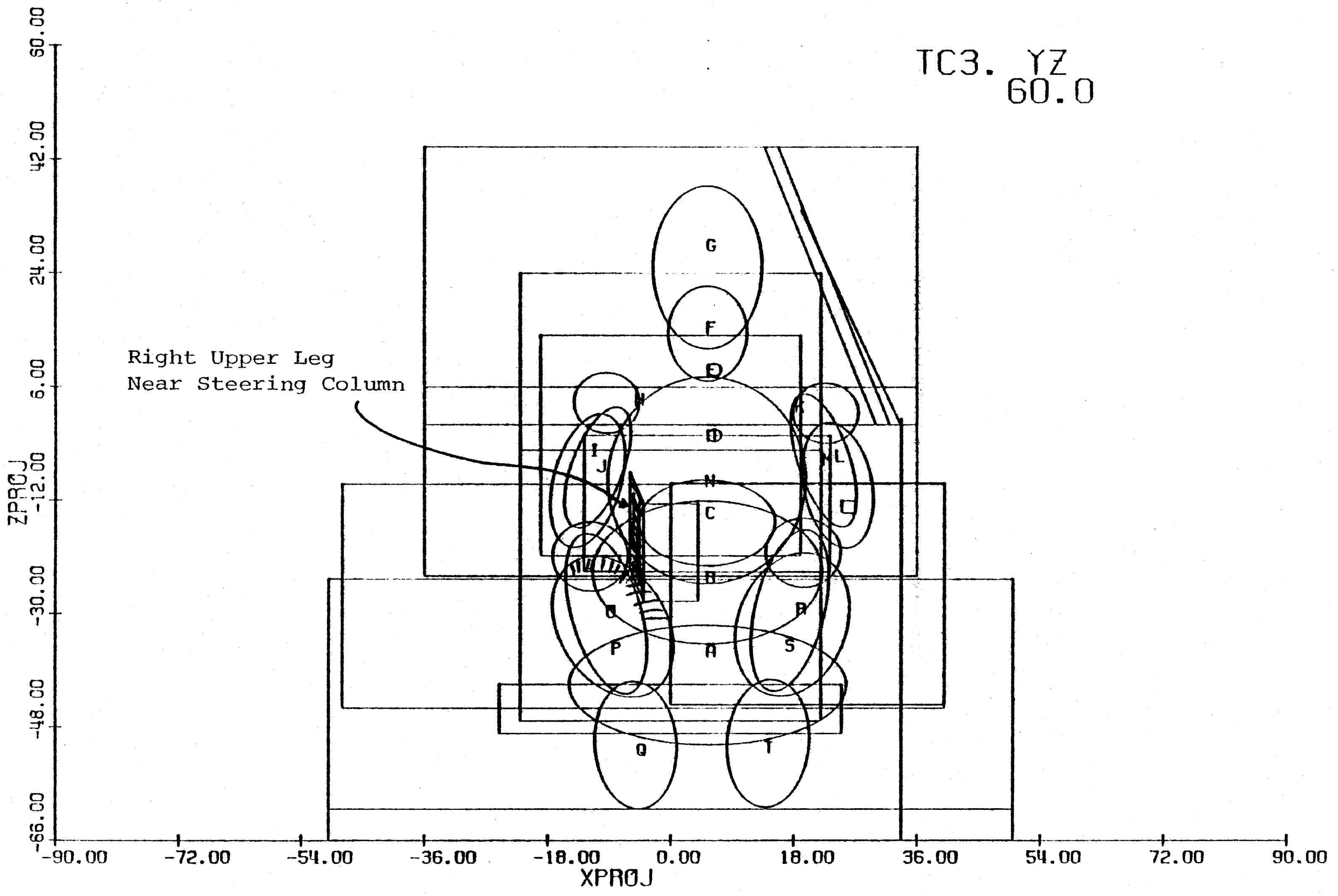


Figure 33. Front View of Driver Position. 60 ms. (Case No. 2-2).

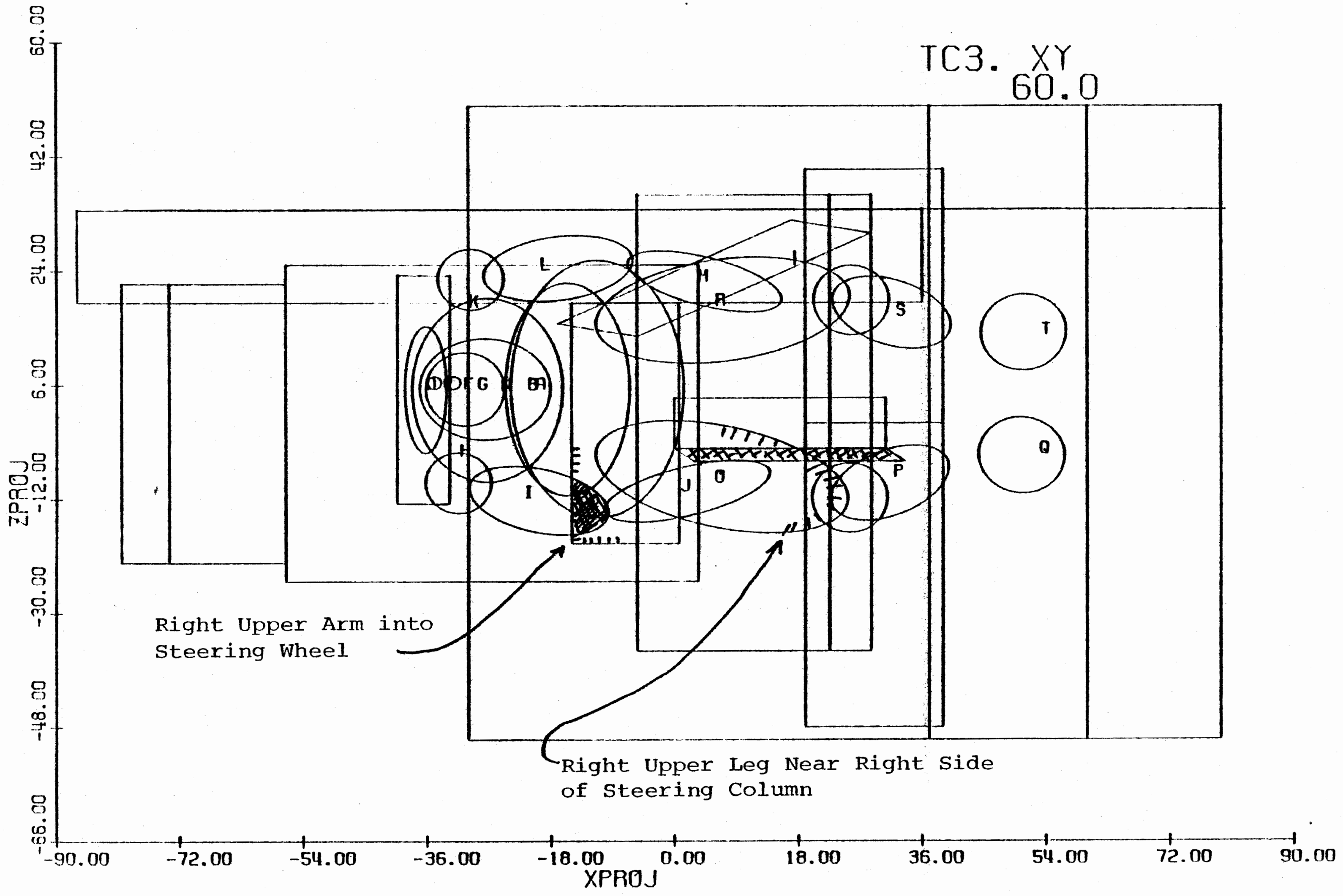


Figure 34. Top View of Driver Position. 60 ms. (Case No. 2-2).

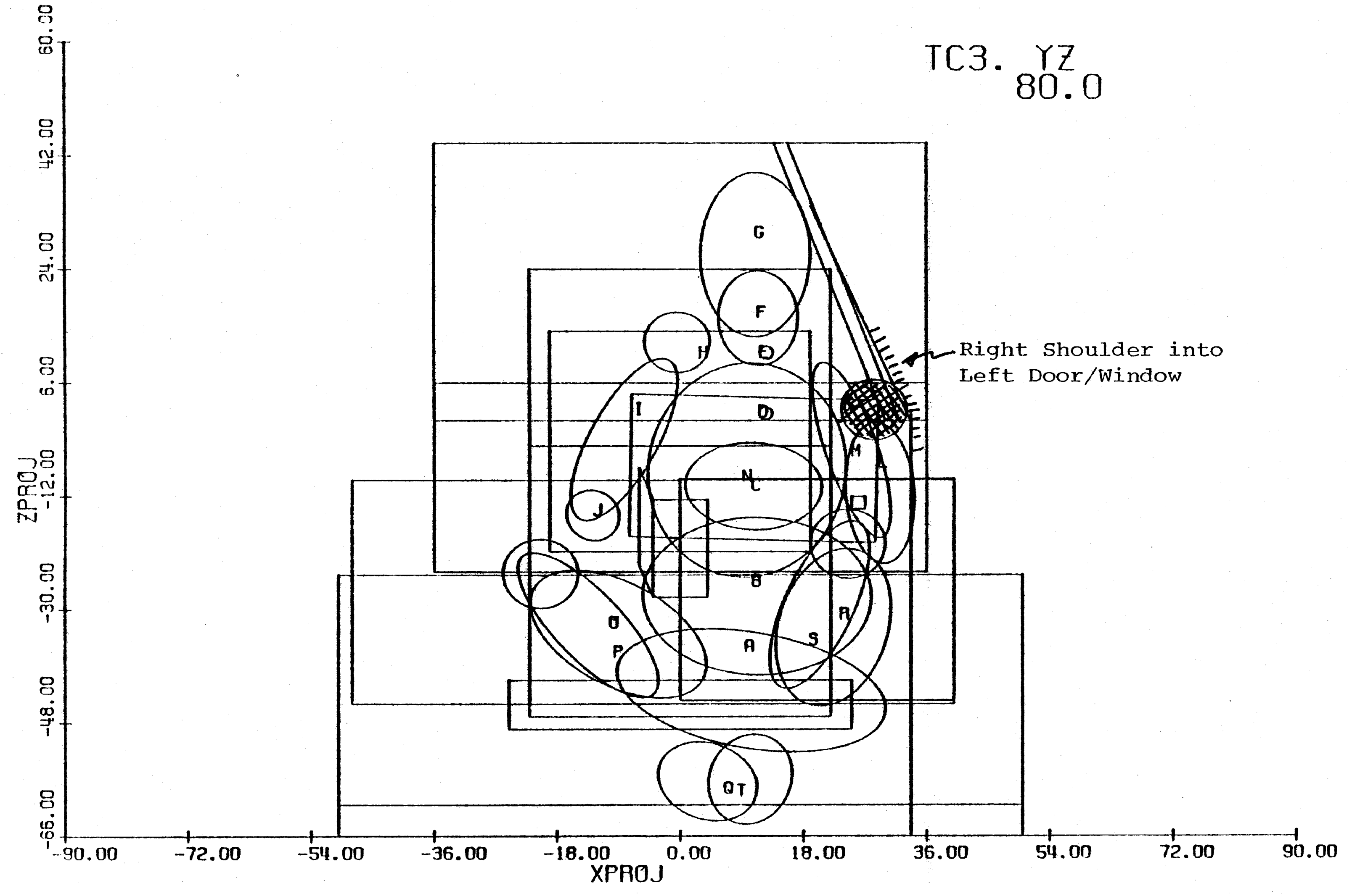


Figure 35. Front View of Driver Position. 80 ms. (Case No. 2-2).

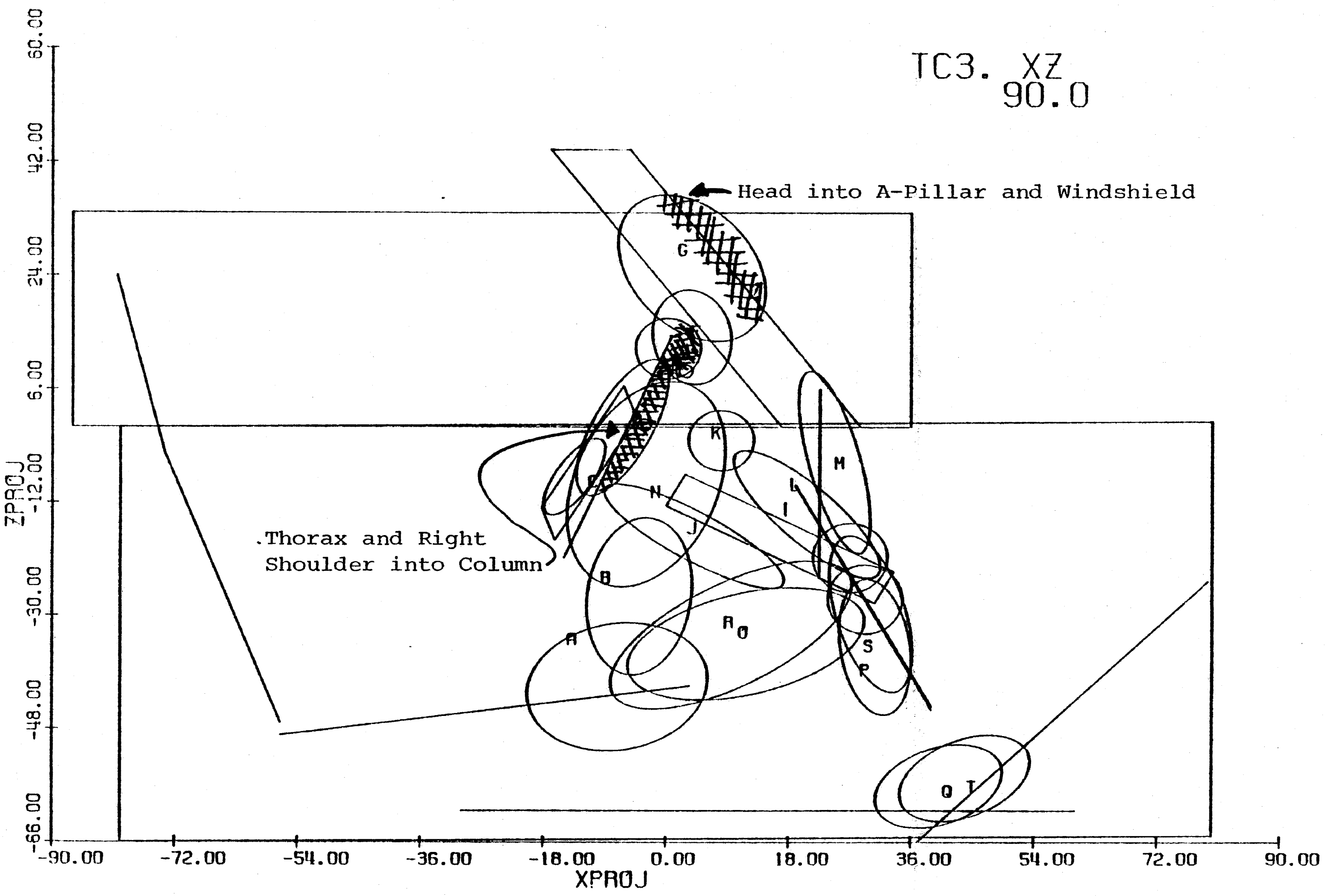


Figure 36. Side View of Driver Position. 90 ms. (Case No. 2-2).

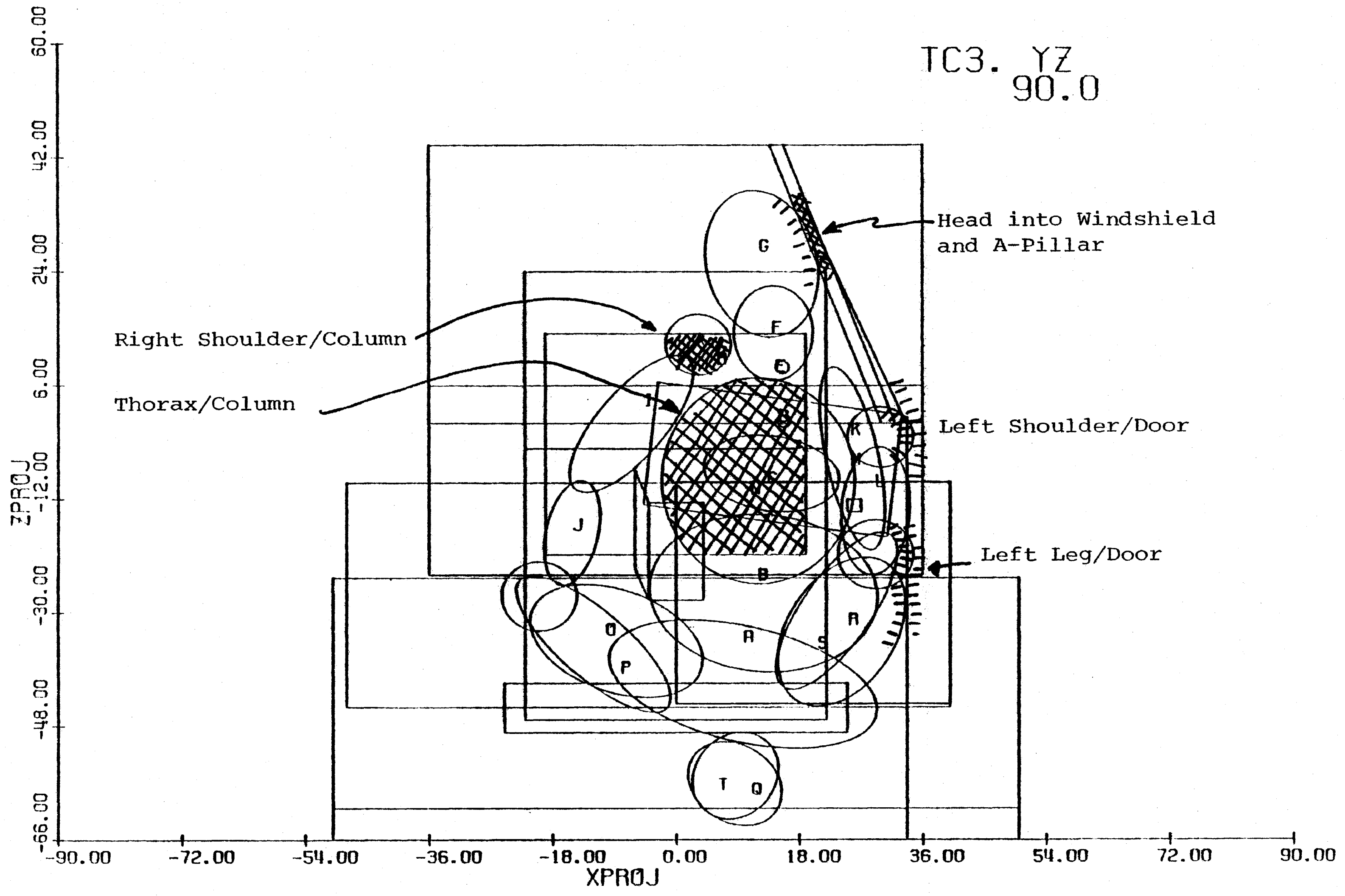


Figure 37. Front View of Driver Position. 90 ms. (Case No. 2-2).

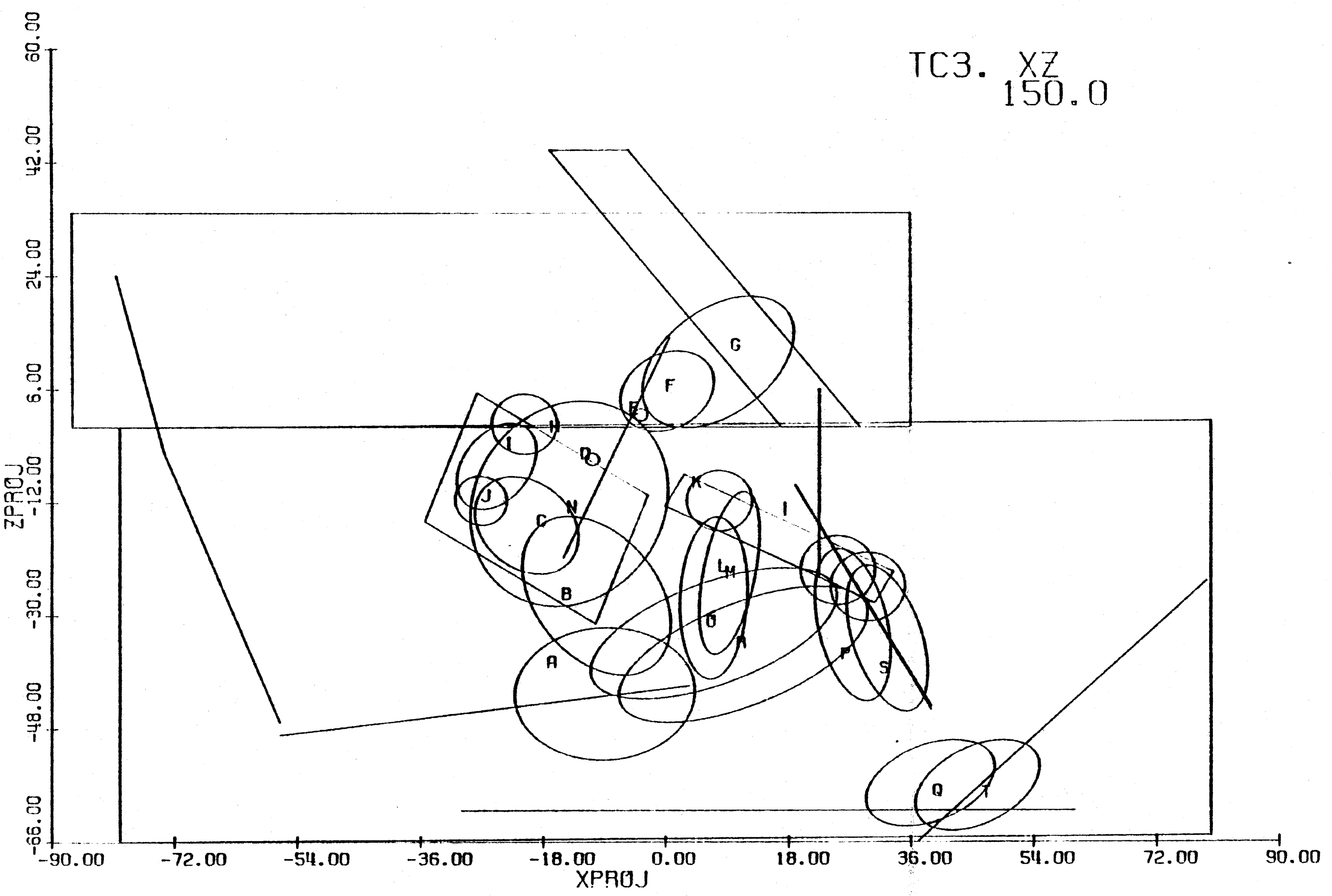


Figure 38. Side View of Driver Position. 150 ms. (Case No. 2-2).

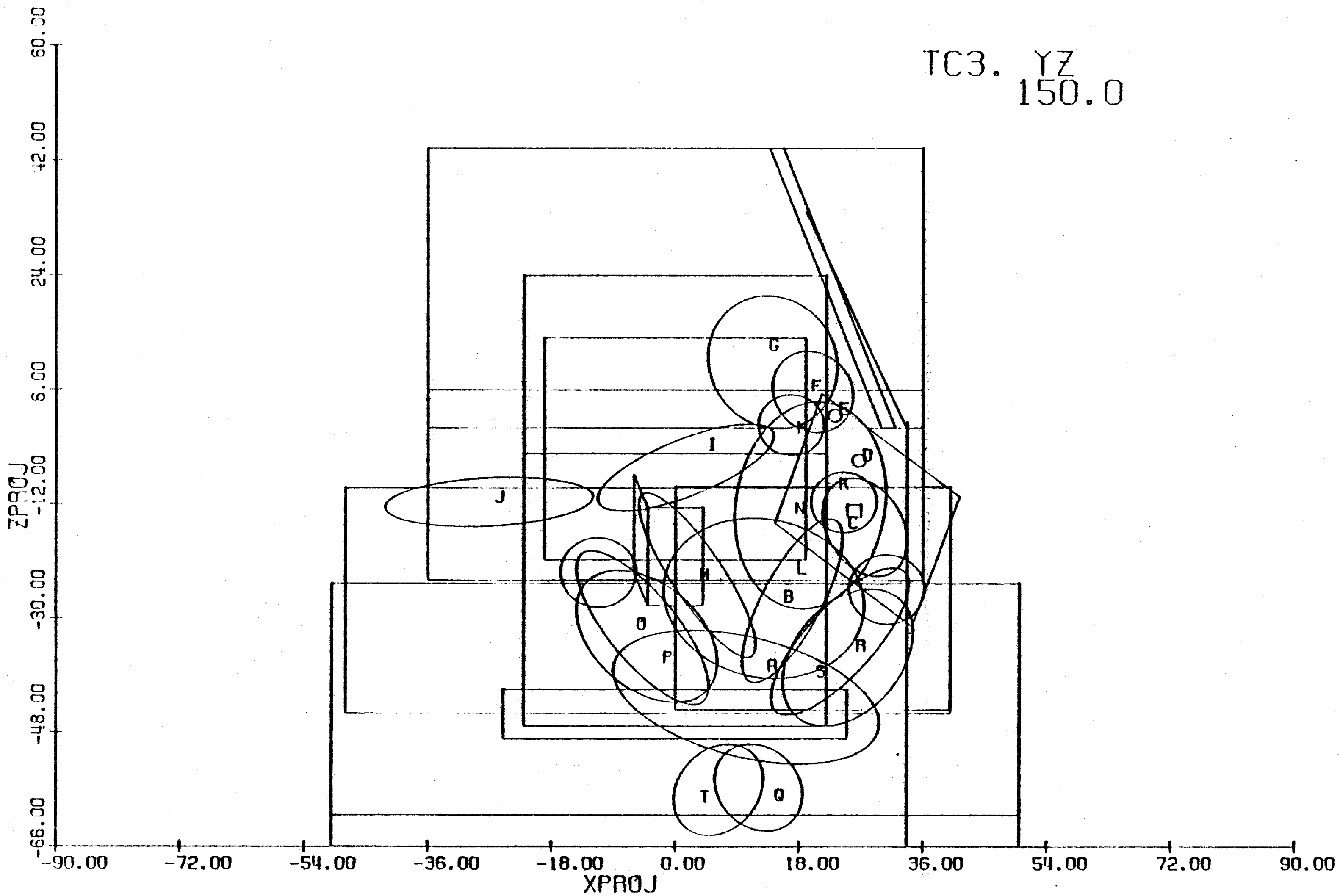


Figure 39. Front View of Driver Position. 150 ms. (Case No. 2-2).

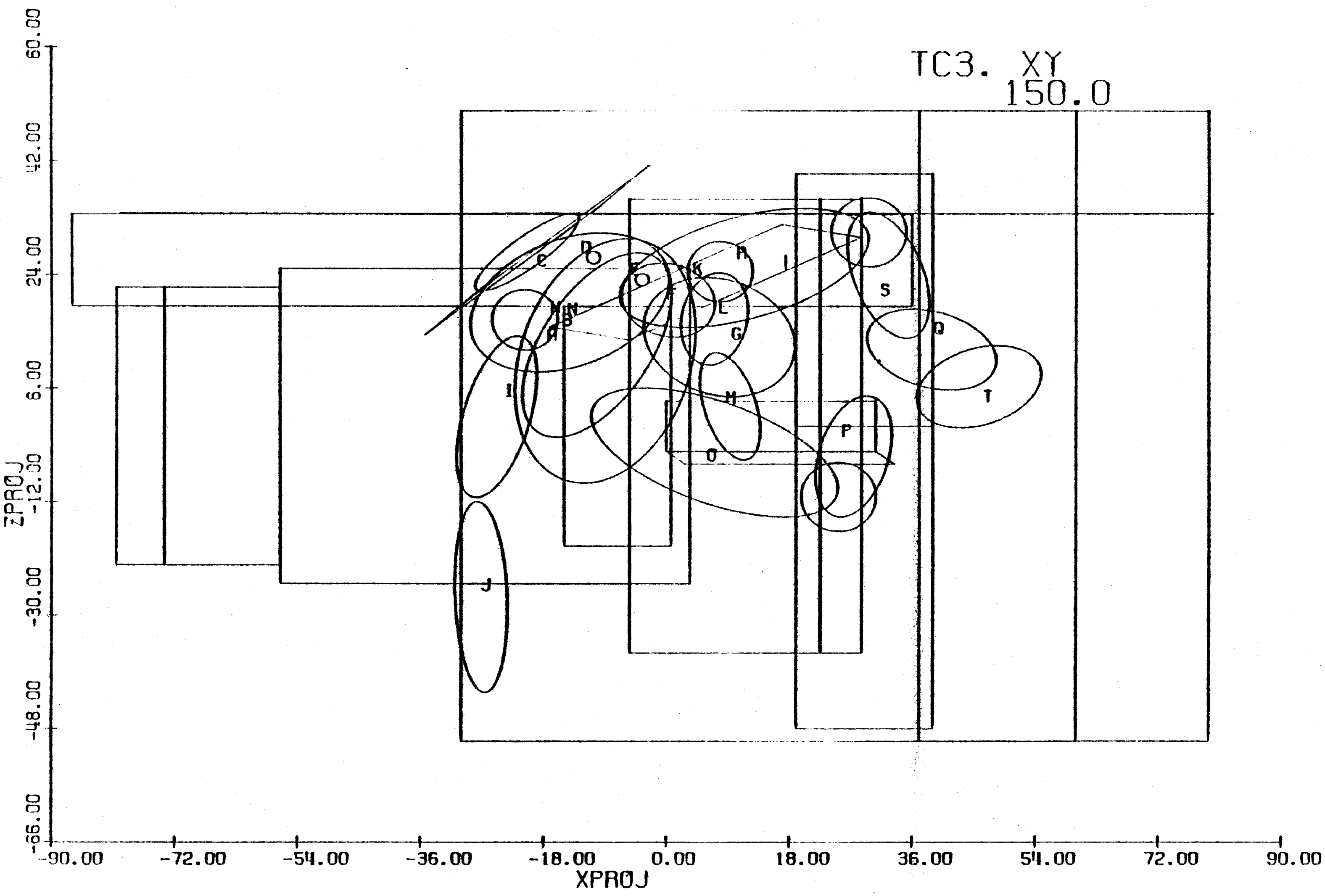


Figure 40. Top View of Driver Position. 150 ms. (Case No. 2-2).

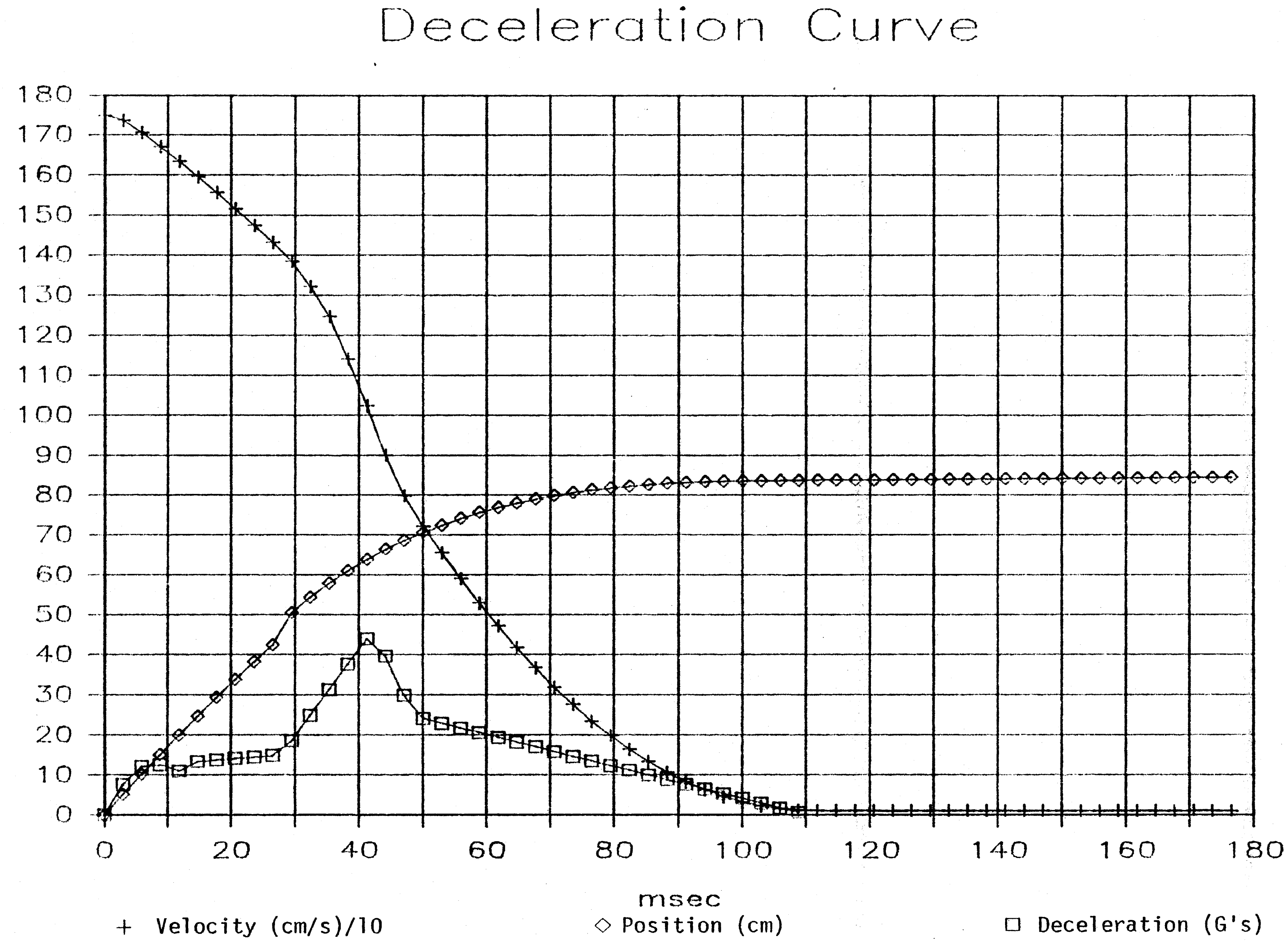


Figure 41. Vehicle Deceleration, Velocity, and Position. (Case No. 2-2).

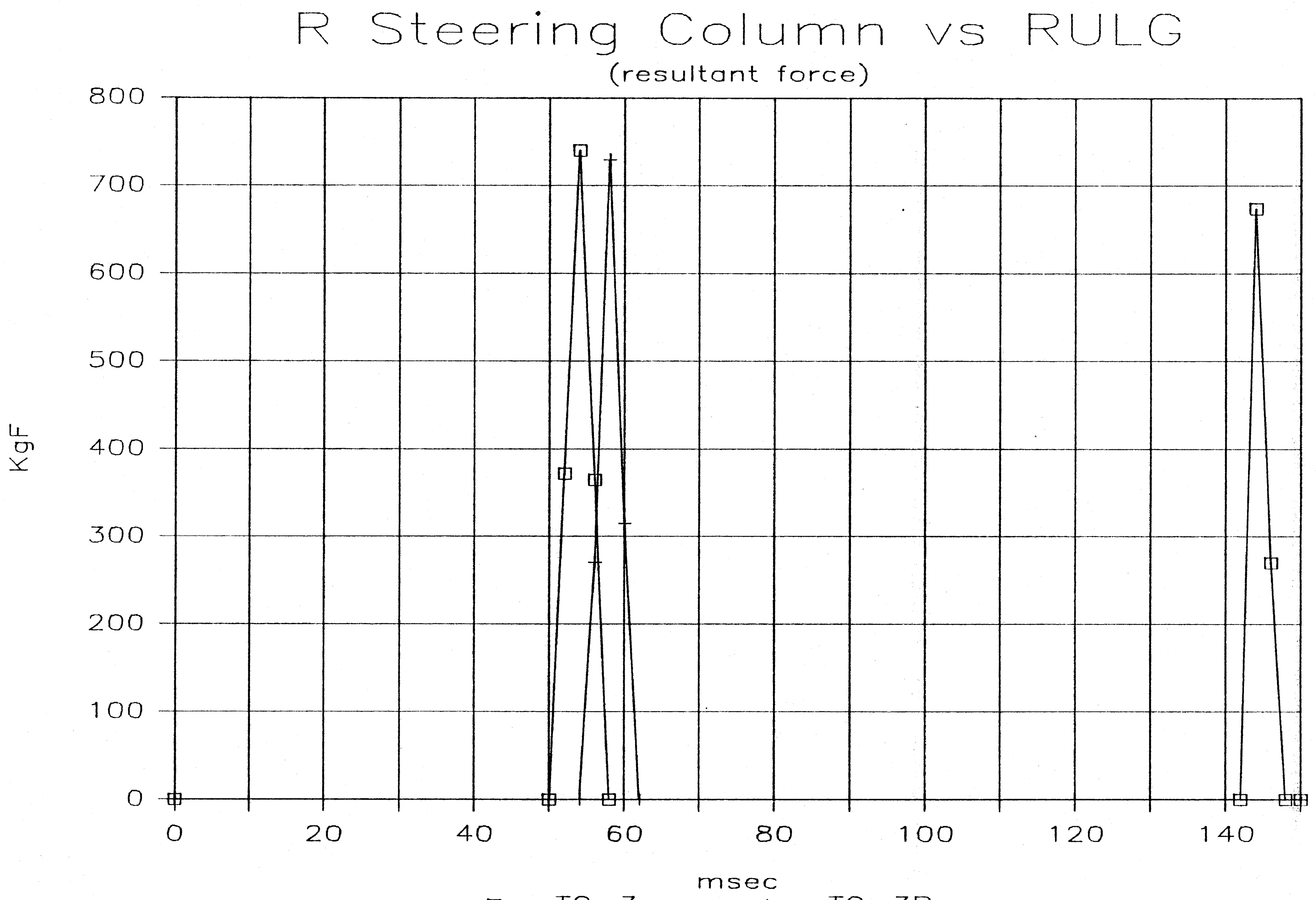


Figure 42. Interaction of Right Side of Steering Column with Right Upper Leg. (Case No. 2-2).

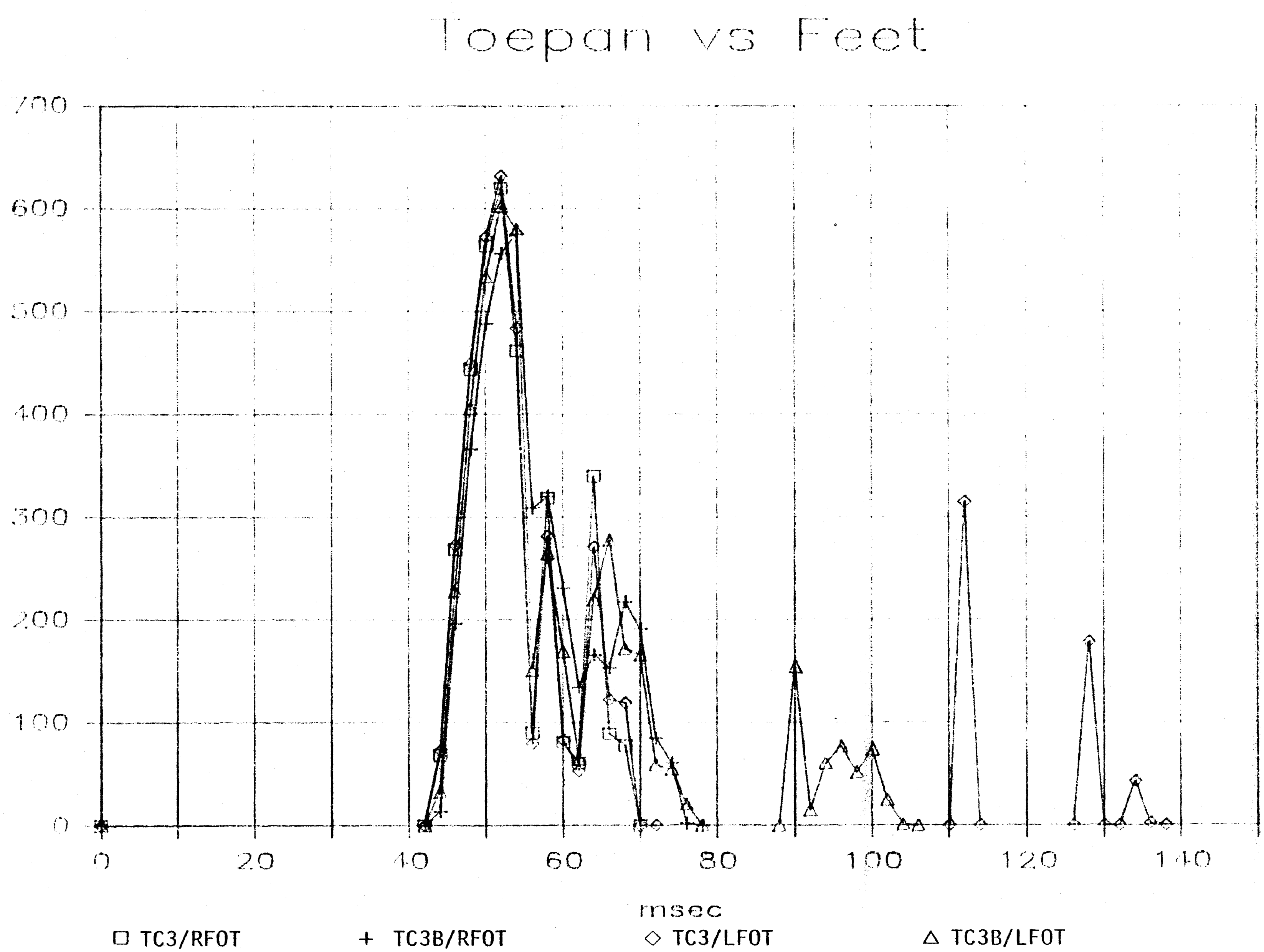


Figure 43. Interaction with Toepan with Feet. (Case No. 2-2).

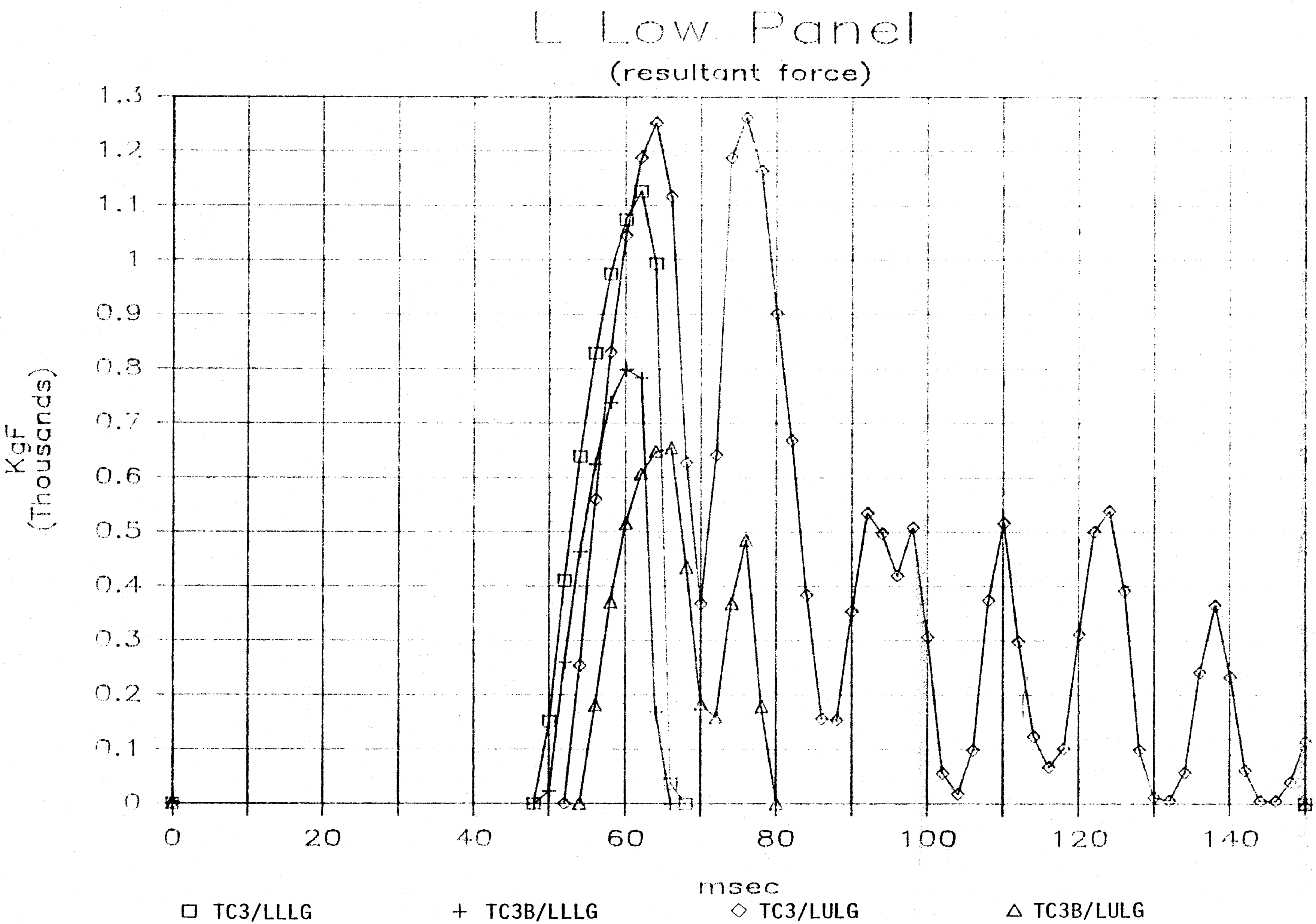


Figure 44. Interaction of Left Leg with Left Lower Instrument Panel. (Case No. 2-2).

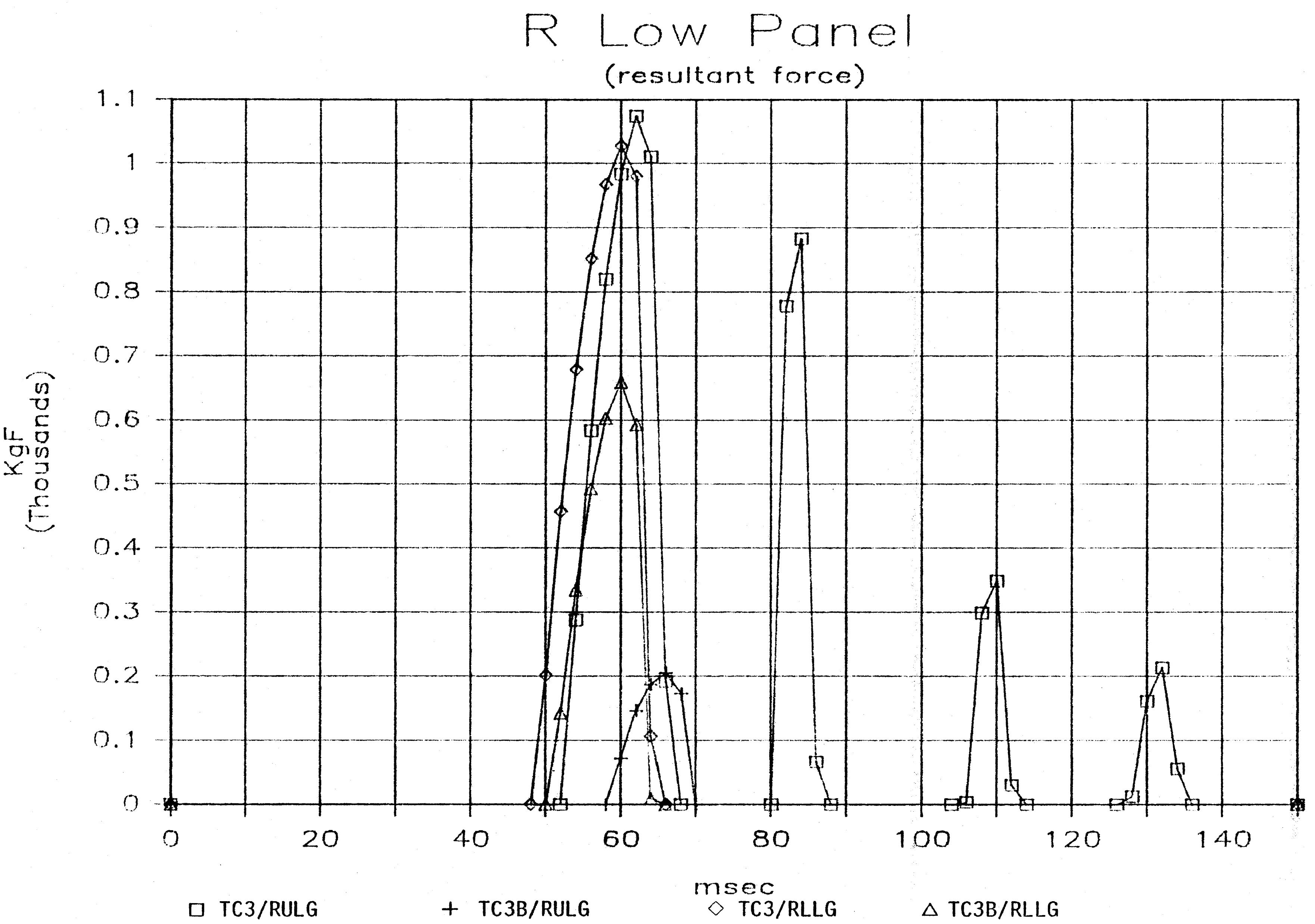


Figure 45. Interaction of Right Leg with Right Lower Instrument Panel. (Case No. 2-2).

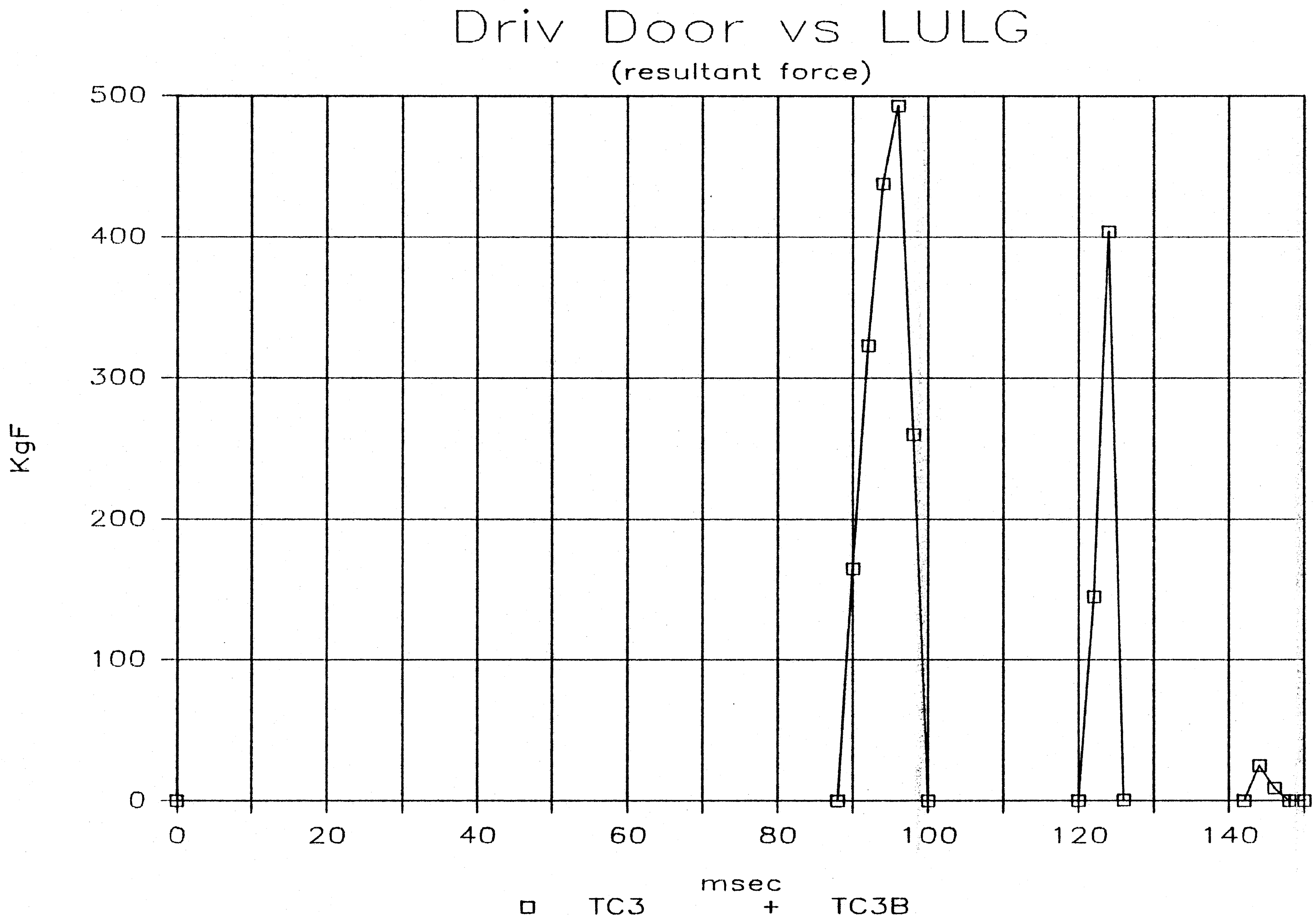


Figure 46. Interaction of Left Upper Leg with the Driver Door. (Case No. 2-2).

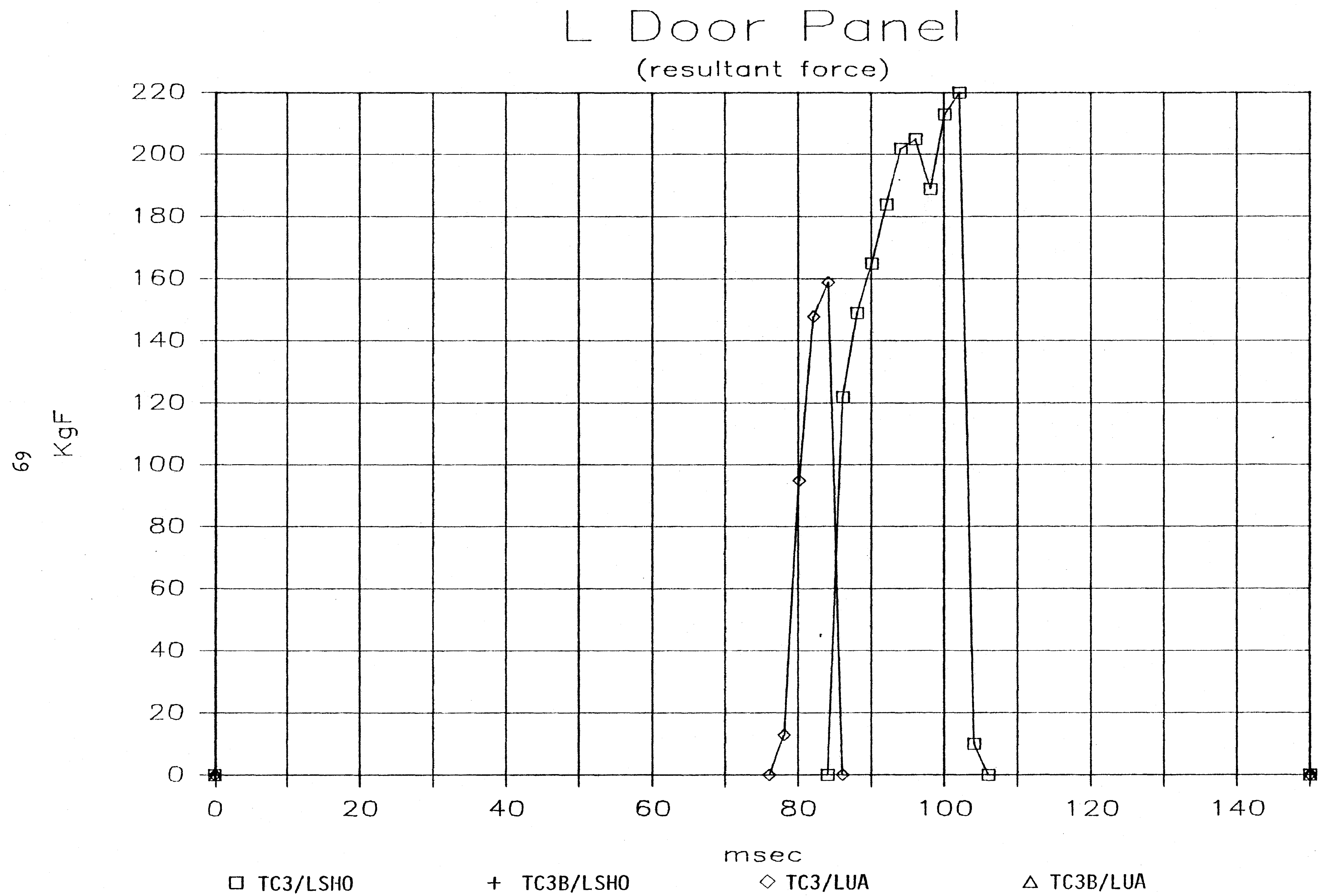


Figure 47. Interaction of Left Door Panel with the Left Upper Arm and Shoulder. (Case No. 2-2).

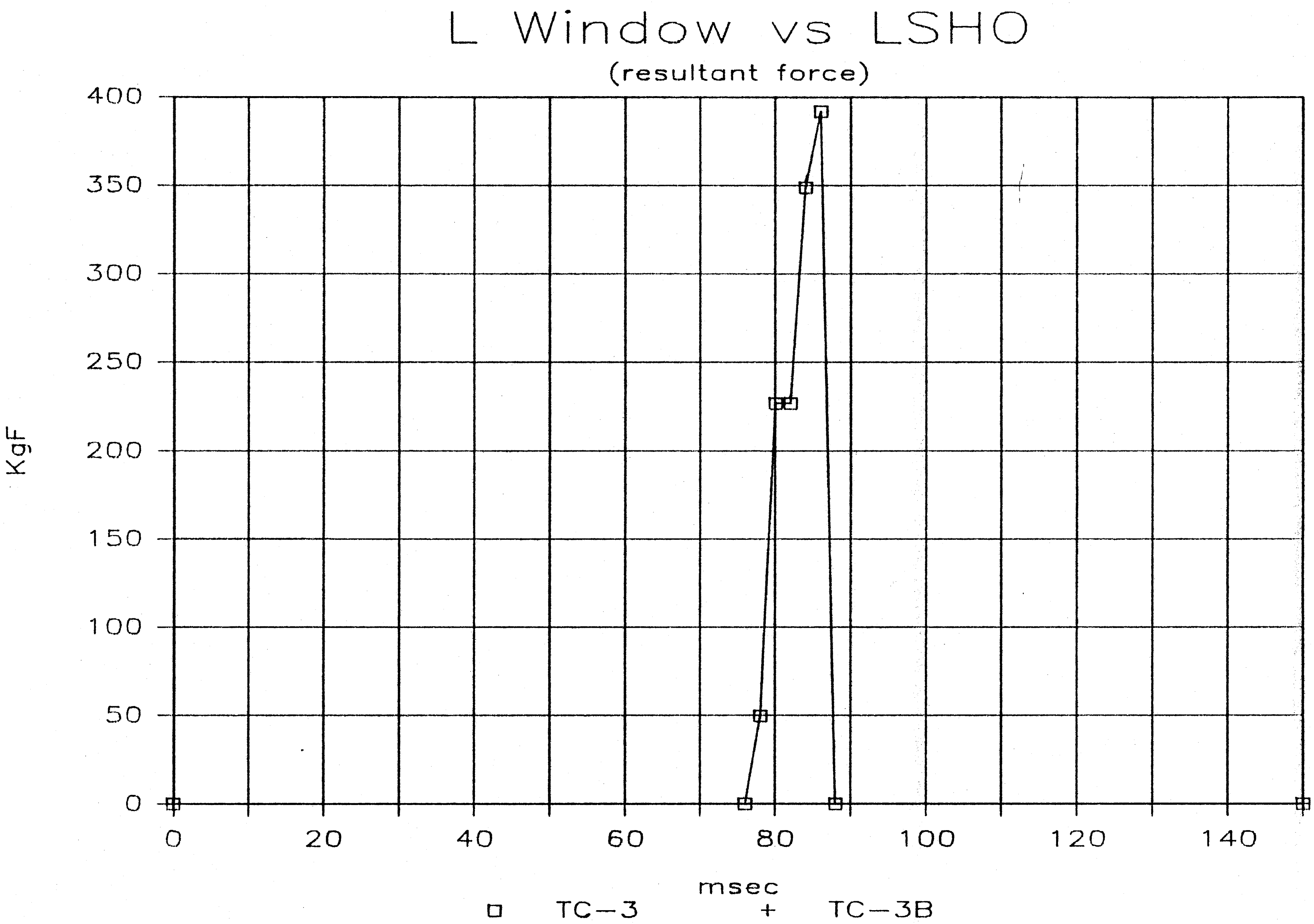


Figure 48. Interaction of the Left Shoulder with the Left Driver Window. (Case No. 2-2).

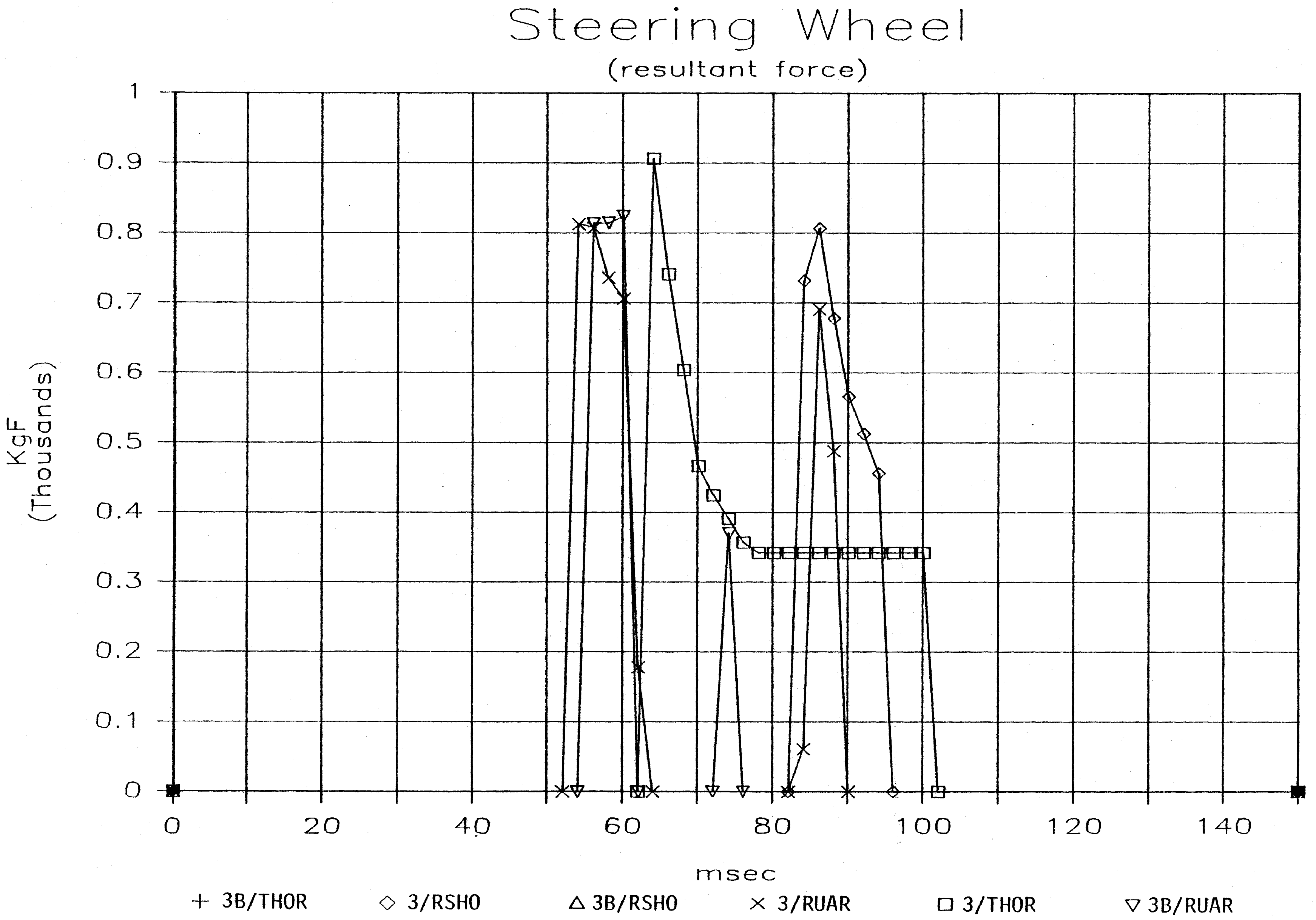


Figure 49. Interaction of Arms, Thorax, and Shoulders with Steering Column. (Case No. 2-2).

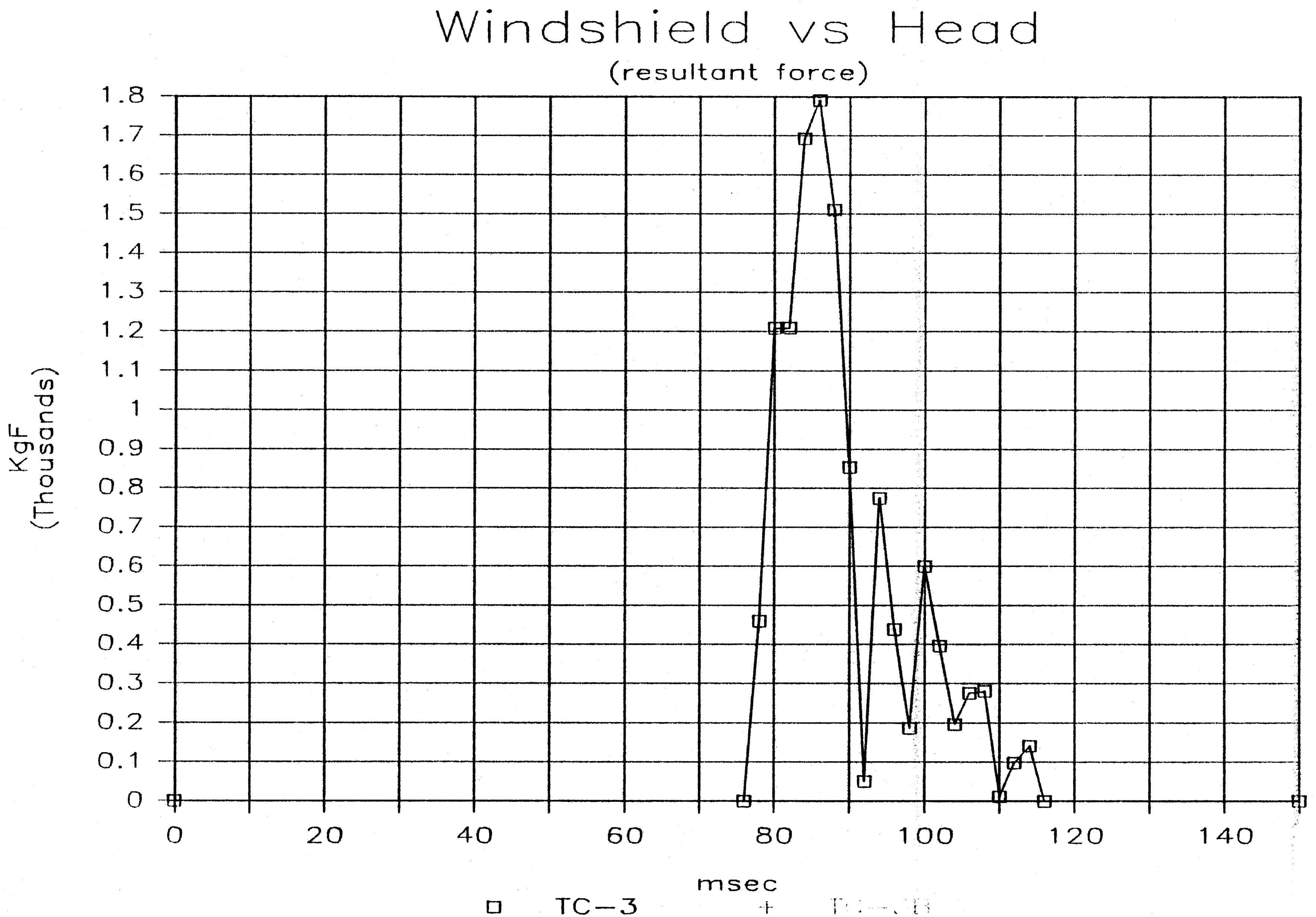


Figure 50. Interaction of the Head with the Windshield. (Case No. 2-2).

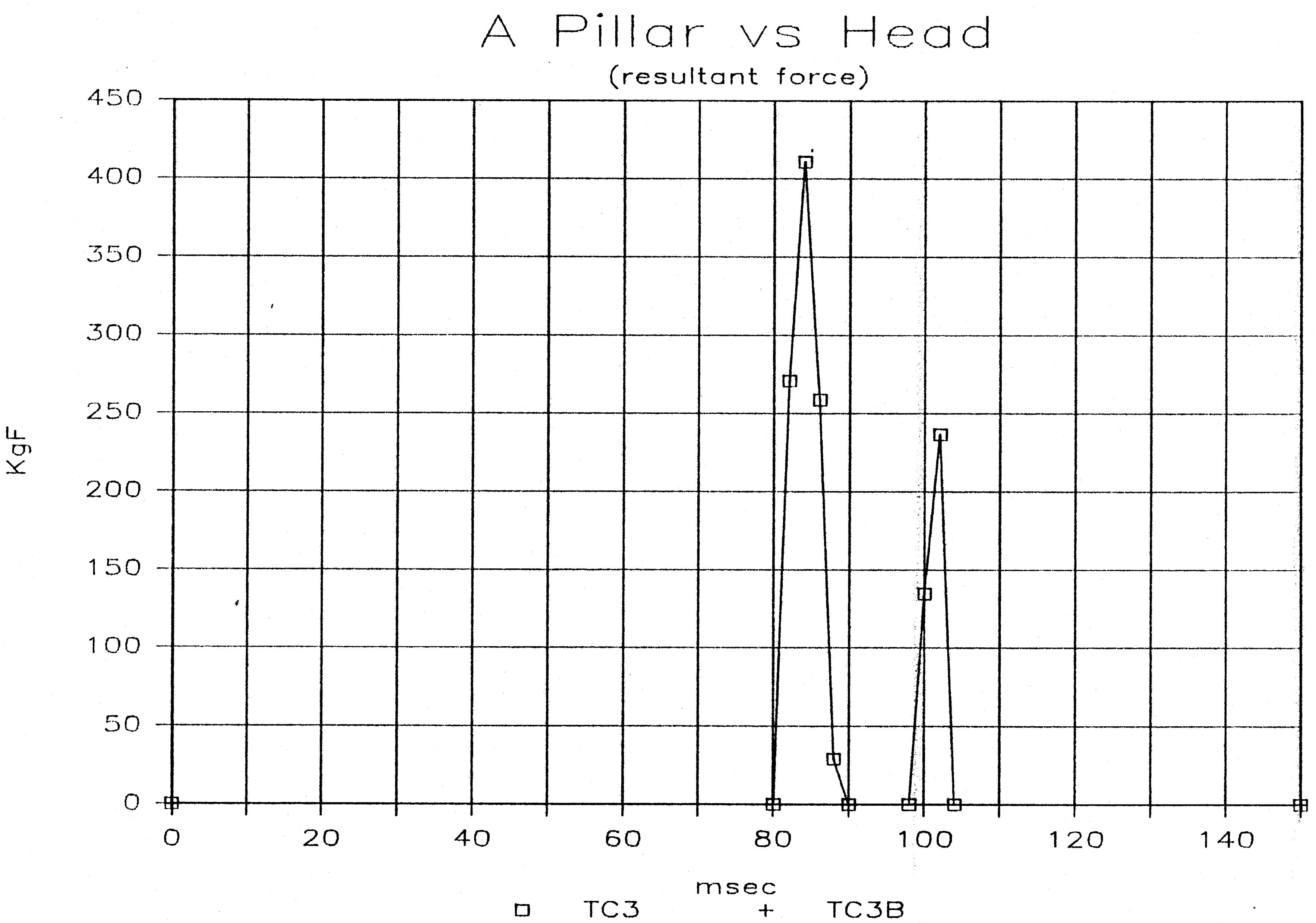


Figure 51. Interaction of the Head with the A-Pillar. (Case No. 2-2).

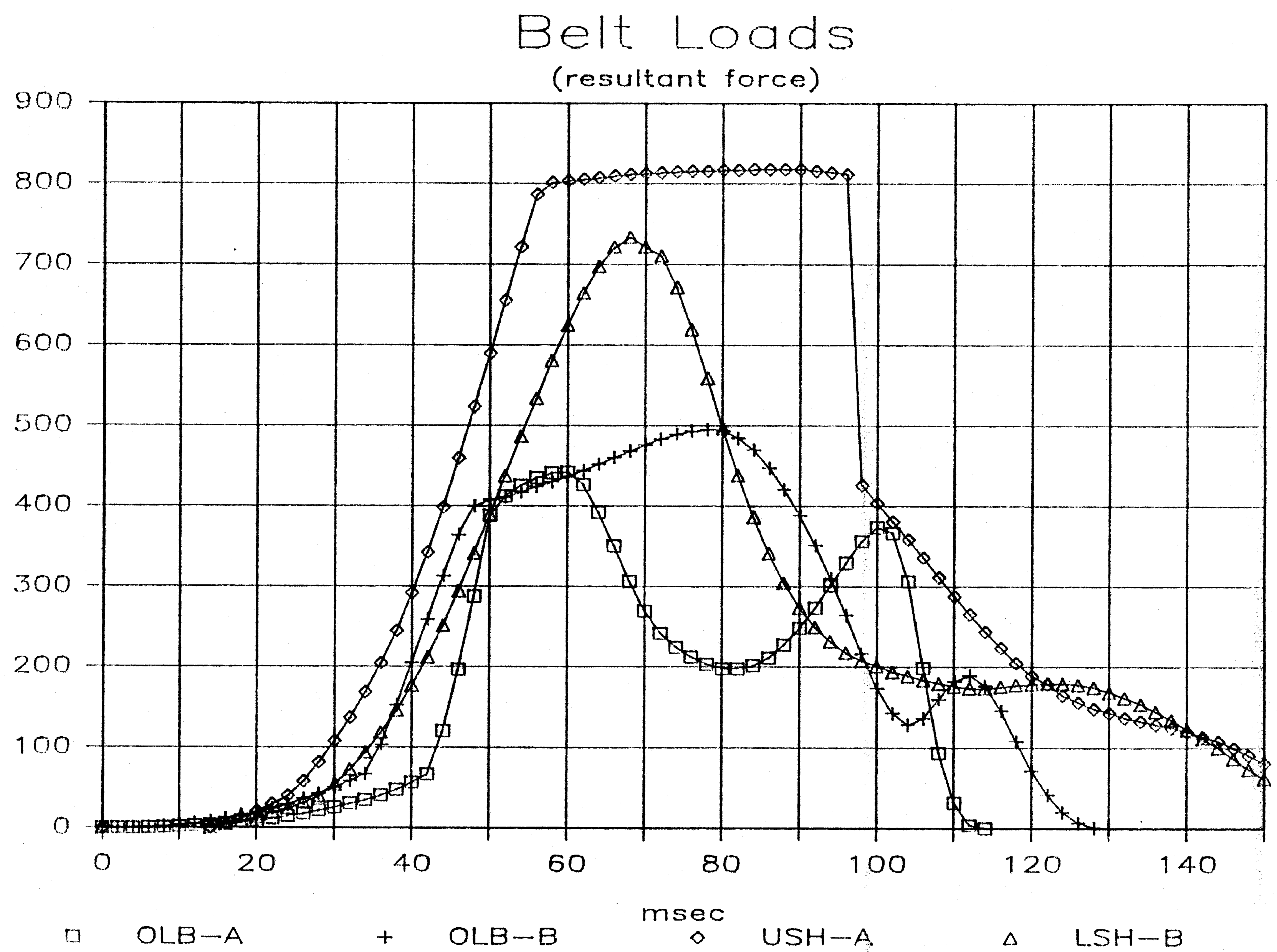


Figure 52. Belt Loads. (Case No. 2-2).

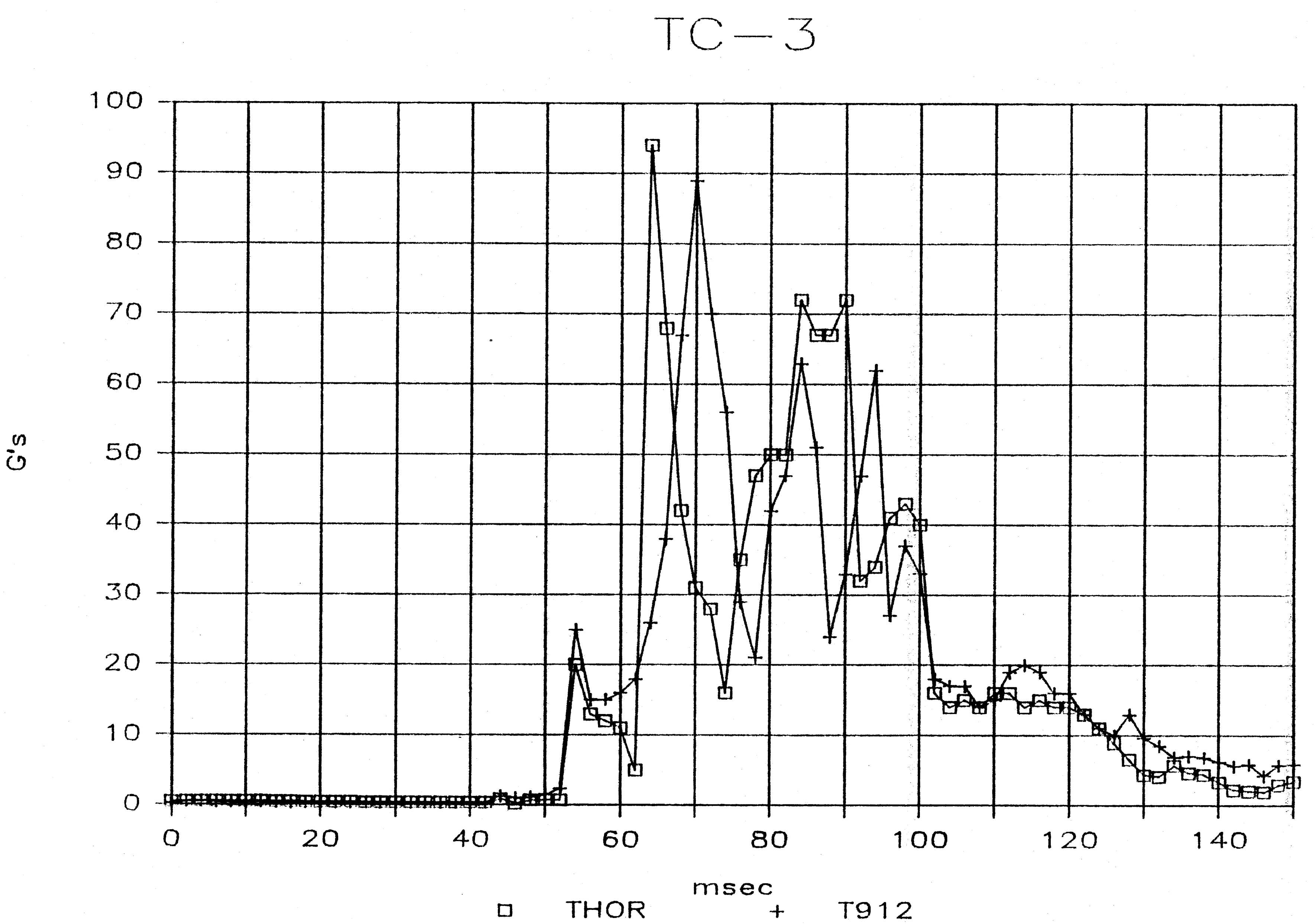


Figure 53. Thoracic Resultant Acceleration. (Case No. 2-2). (Unbelted).

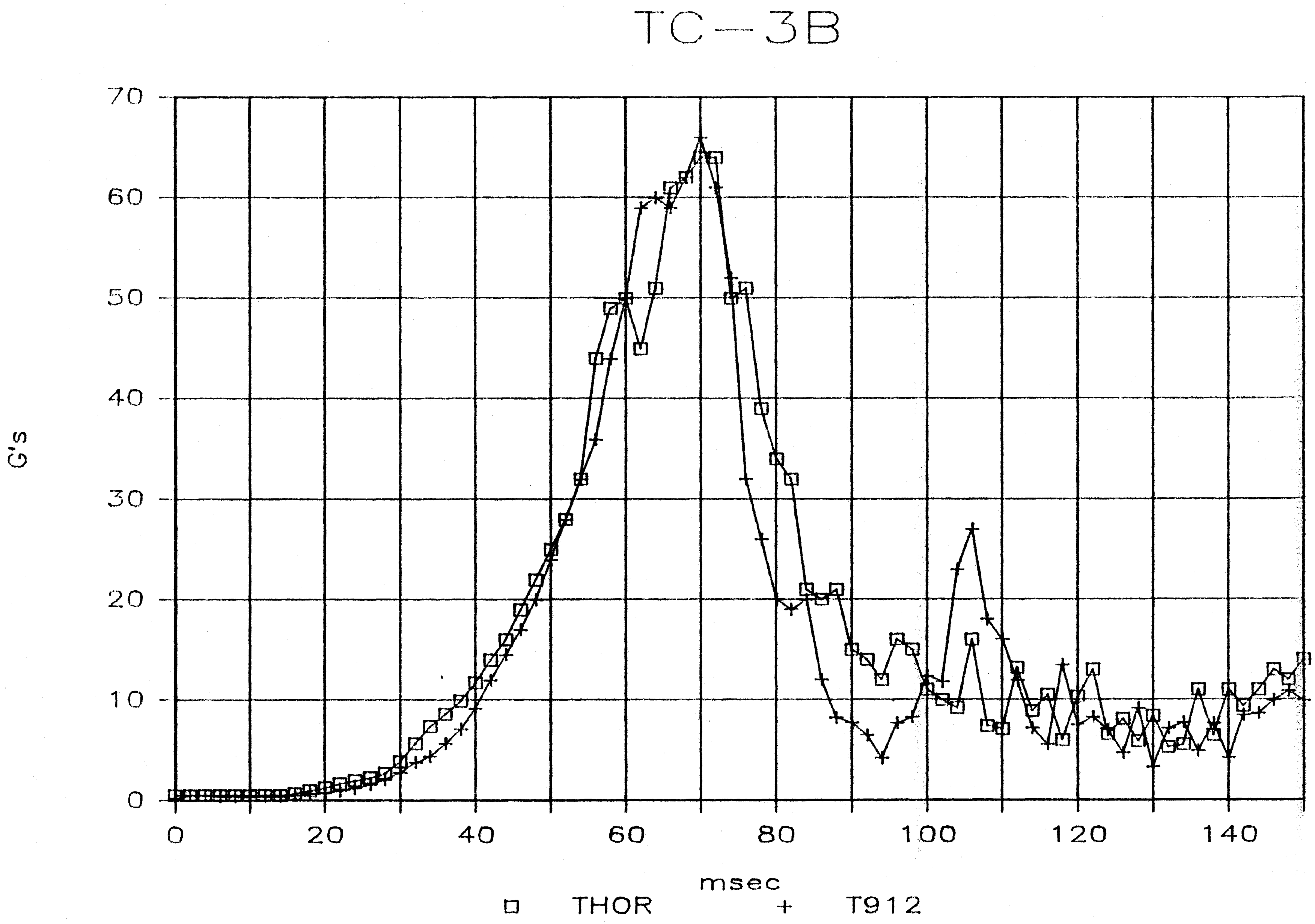


Figure 54. Thoracic Resultant Acceleration. (Case No. 2-2). (Belted).

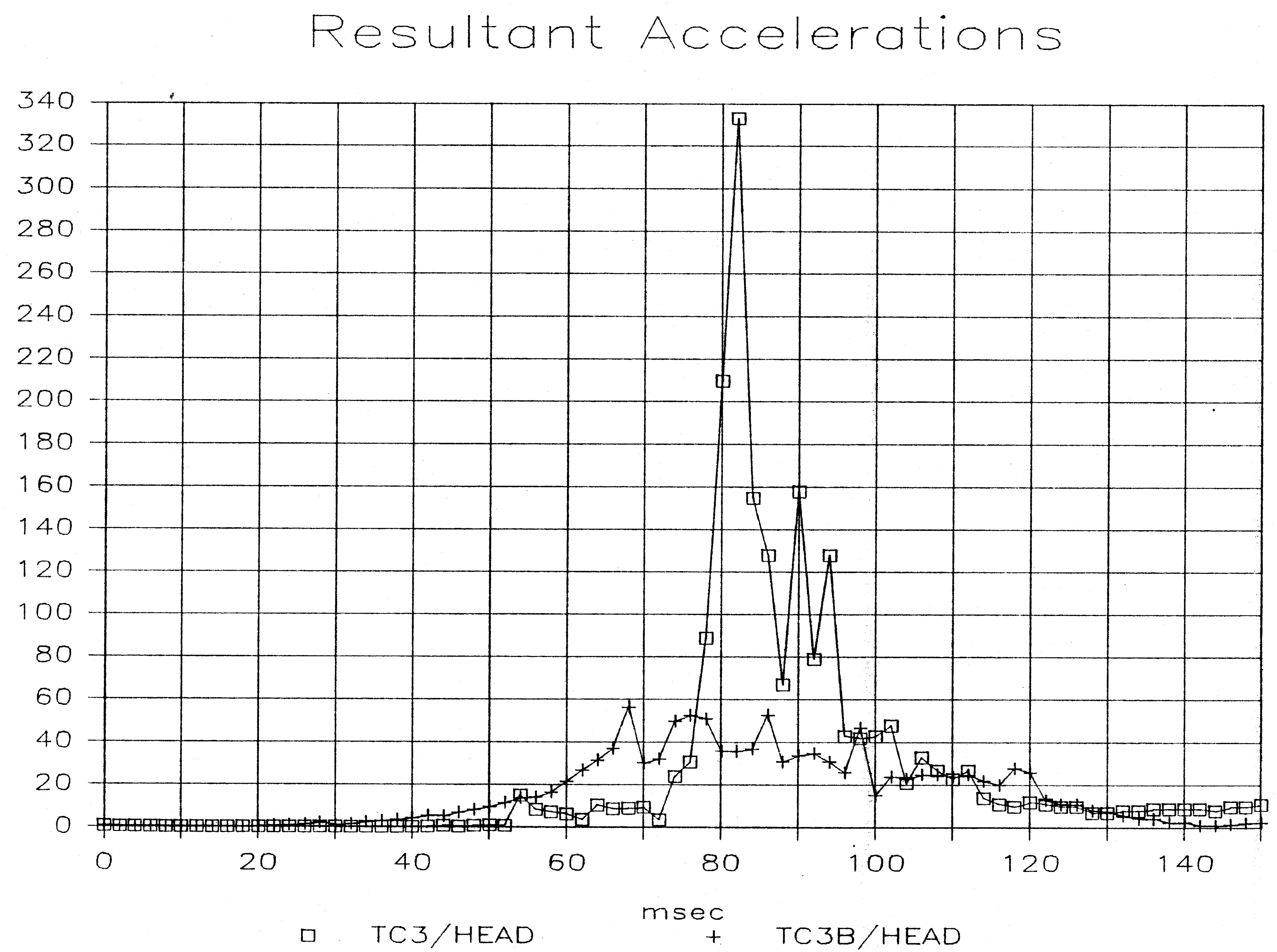


Figure 55. Head Resultant Acceleration. (Case No. 2-2).

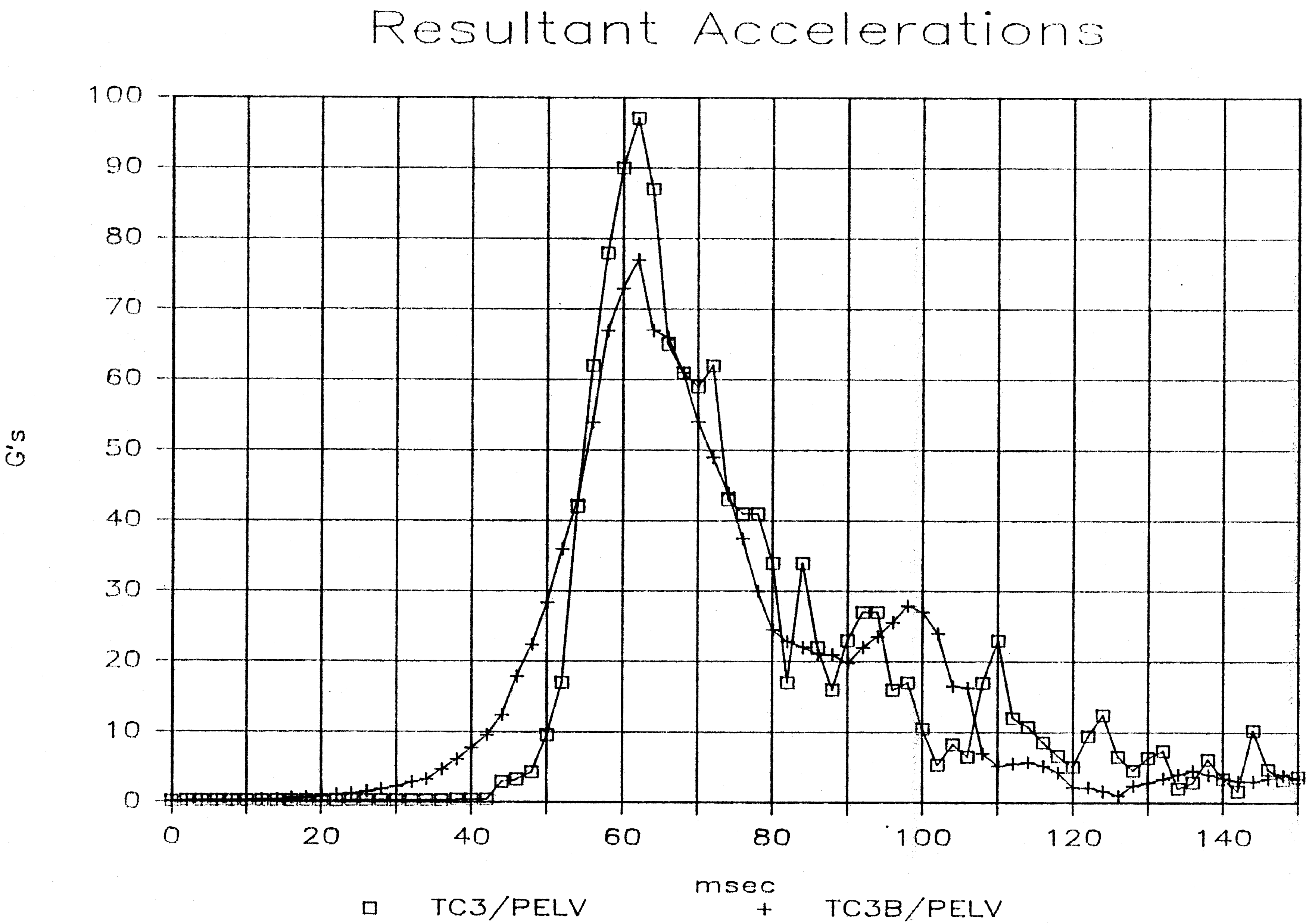


Figure 56. Pelvic Resultant Acceleration. (Case No. 2-2).

4.4 Case 14. 1980 Chevrolet Chevette (Lateral Impact. 56 kph. Driver).

As a substitute for the side impact Case 2-3 and as an additional three dimensional case, Case 14 used during the first phase project was re-analyzed using the CAL-3D code.

In this case a 1980 Chevrolet Chevette was struck in the side by a C/20 Chevy Van. Intrusion was extensive on the passenger's side. The female driver of the Chevette was wearing a lap-shoulder belt and sustained minimal injuries. A schematic of the accident scene is shown in Figure 57. Damage to the Chevette is shown in Figure 58. Although there was a spin by the subject vehicle, it appeared that the primary force vector was lateral as judged by the exterior damage. The accident occurred on snow-covered and slippery surfaces.

The lone female driver was wearing the 3-point restraint system. Upon impact she flexed to the right contacting the front right door and floor-mounted shift lever.

Damage was extensive to the right side of the passenger compartment. The floor-mounted T-bar shift lever was bent to the right by the driver causing its plastic housing to crack. Deformation of the right upper A-pillar crazed the right half of the windshield, deformed the header, bowed the right sunvisor and deformed the roof in the front right corner. The front right door intruded about 41 cm (16.14 in) damaging its latch housing and the front right seat cushion and seat adjuster. Its window sill was also contacted by the driver. The right B-pillar intruded about 46 cm (18.11 in) damaging the front right seat back and causing it to bend to the left behind the driver's seat back. Intrusion of the right roof side rail deformed the roof.

The driver sustained only minimal injuries as illustrated in Figure 59. These were apparently due to contacts with the right door, T-bar shift lever, and seat belt buckle.

Use of the CRASH II program yielded a lateral velocity change of 56.2 kph (35 mph). This was represented as an acceleration in the form of a trapezoid with a total duration of 60 milliseconds and rise and decay times of 5 milliseconds. This was based on an estimate of the amount of time for the impacting vehicle to cause the intrusion and transfer its motion.

Procedures similar to those used in Case 2-2 were used to develop both the occupant linkage and vehicle data. The vehicle deceleration pulse is given in Figure 60 as well as its velocity and lateral position. In order to represent the door intrusion, a free segment (named SIDE) was introduced into the data set. This segment intruded during the time at which deceleration was applied to the primary vehicle. This motion, specified using the spline fit option, is shown in Figure 61 along with the vehicle motion. It should be noted that the intrusion was complete by 60 ms. Thereafter, the vehicles are seen to move together.

Figures 62-64 show the initial occupant geometry superimposed on the vehicle. It was found necessary to flesh out the lower spine contact ellipsoid to allow for seatback interactions. The addition of a lower seatback element was also found helpful to provide a more realistic contour of the back/seat interface in reacting to the forces due to the belt system which tended to pull the occupant toward the seat back during rotation to the side.

Figures 65-72 show various views of occupant motions at different times during the crash sequence. Figure 65, at 30 ms illustrates the first interaction with the transmission housing by the occupant (right foot). Also the indication of side door intrusion should be noted on this figure. Figures 66 and 67 are front and side views of the occupant at 40 ms. At this point in the crash sequence the pelvis has begun to interact with the housing and the right upper leg has contacted the shifter. Intrusion has also progressed further inward. By 60 ms (Figure 68), the pelvis has interacted somewhat with the housing releasing the seat cushion force. At the same time the upper portions of the body are beginning to rotate down and toward the side of the vehicle as the result of the restraint action of the belt on the pelvis. By 60 ms the right arm has begun to contact the side door and intrusion is complete (Figure 69). Figure 70 illustrates a problem (a solvable and non-fatal one) with this simulation. It should be noted that the feet are shown behind the lower instrument panel. It should also be noted that there are no contact ellipsoids attached to the lower portion of the shins to counter this motion through an interaction with the lower panel. By 70 milliseconds (Figure 71) the arm, shoulder, and head are contacting the window, door, and sill. This is the maximum excursion of the body before rebound is initiated. At the end of the simulation (150 ms) the belts have pulled the lower torso back toward the initial seated position and the upper torso and head down toward the seat (Figure 72).

Figures 73-82 present the predicted dynamic results. A variety of interactions with the housing are presented in Figure 73 while the shifter interaction with the right upper leg is shown in Figure 74. The reduction to zero of the belt forces and seat cushion/pelvis interaction between 40 and 50 ms correspond to the increasing interaction of the pelvis with the housing (Figures 75 and 76). Figure 77 shows the major interaction of the pelvis and lower spine with the seatback as the belt loadings cause the torso to rotate back toward the seat during maximum loading. Figures 78 and 79 show the sequence of loadings on the head, and shoulders by the side window and door structures. These forces, exceeding 2000 kgf (4400 lb) appear to be too large and reflect on the force-deformation data used to model both the human body and the vehicle structures. Figures 80-82 present the acceleration traces for the thorax, head, and pelvis. The high thorax loadings near the end of the simulation appear to be related to the rebound back toward the seat. The head loadings correlate well in the time sequence with side window and door intrusions. The high pelvic accelerations, particularly near the beginning of the event, correlate well with the initial interactions with the transmission housing. It should also be noted that the high loadings which are observed could be the result of the selection of the vehicle deceleration based on a simple application of the CRASH II program without an attempt to take into account any mitigating effect rotation might have on the linear accelerations.

As was the case with the MVMA-2D simulation, the predicted forces were higher than would ordinarily be expected with the injuries which were observed. The kinematics were similar in the two cases with the belts allowing somewhat less excursion in the two-dimensional case. The simulation of the interaction with the housing was easier in the case of the MVMA-2D code due to the superior modeling of interactions of edges of contact surface with contact ellipses. The belt simulation used in the CAL-3D was better for this problem in that, in a sense, it did wrap around the lap of the occupant.

Some of the conclusions which may be drawn from this particular simulation are:

- The addition of vehicle rotation to the deceleration could have a major effect on the occupant motions and should be attempted in further studies of this nature. The software for accomplishing full six-degree-of-freedom vehicle motions is now reasonably functional after a number of years of development.
- The performance of the belt system for both the MVMA-2D and CAL-3D codes was not too good. Neither system allowed material to slip across the lower torso of the occupant. Also, it was not possible to generate reasonable lines of force action for the lap belt sections of the MVMA-2D belt system.
- The simulations were both successful in producing reasonable side excursions of the body yielding an appropriate geometric interaction with the side door structures.

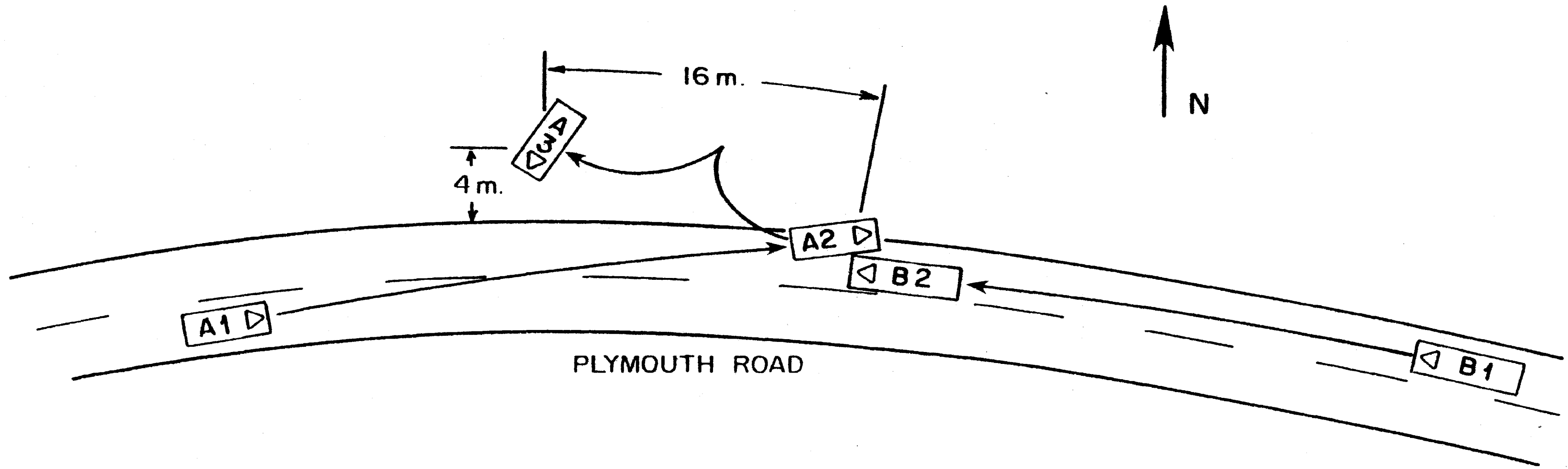


Figure 57. Schematic of Accident Scene. (Case No. 14).

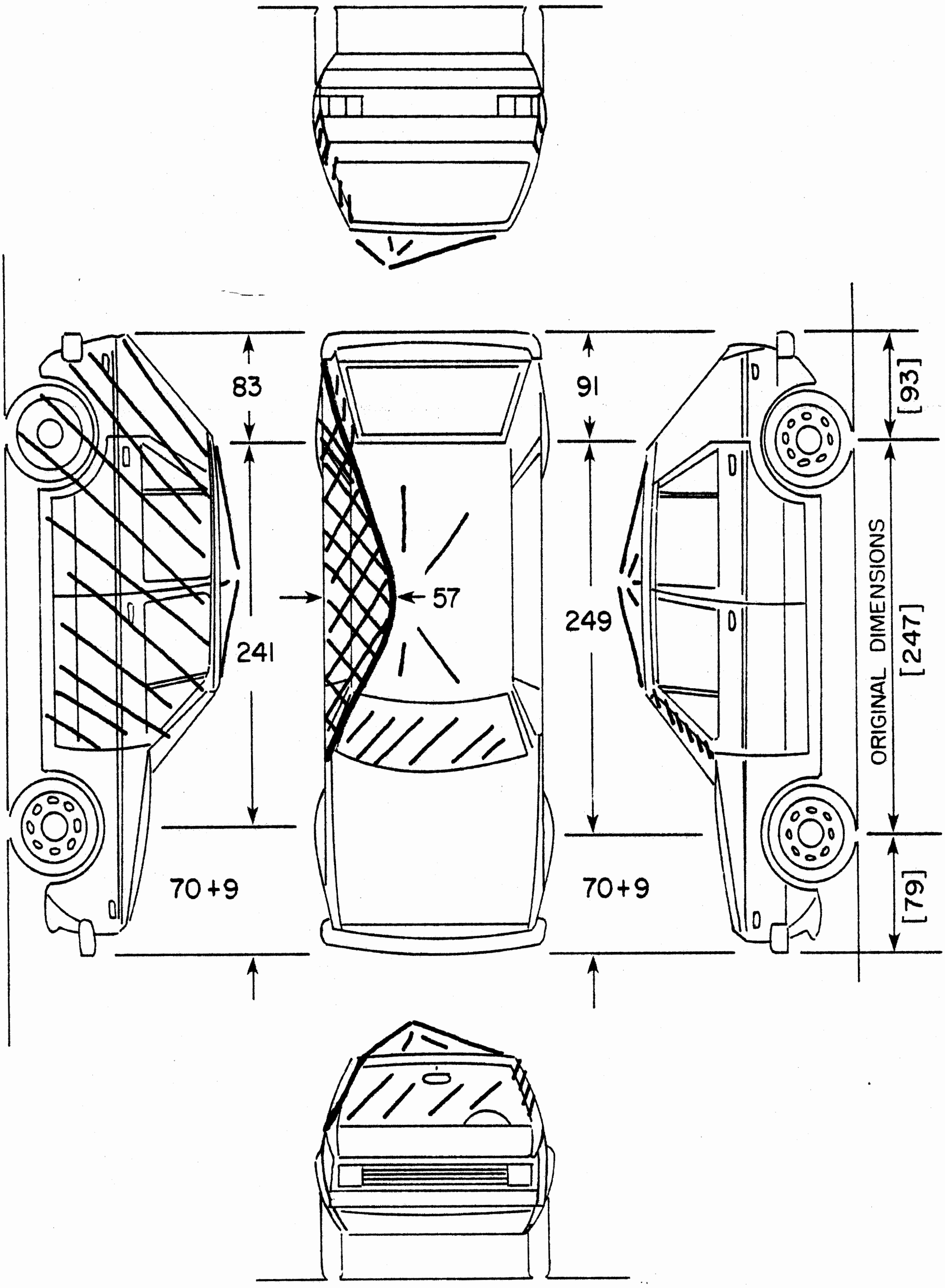
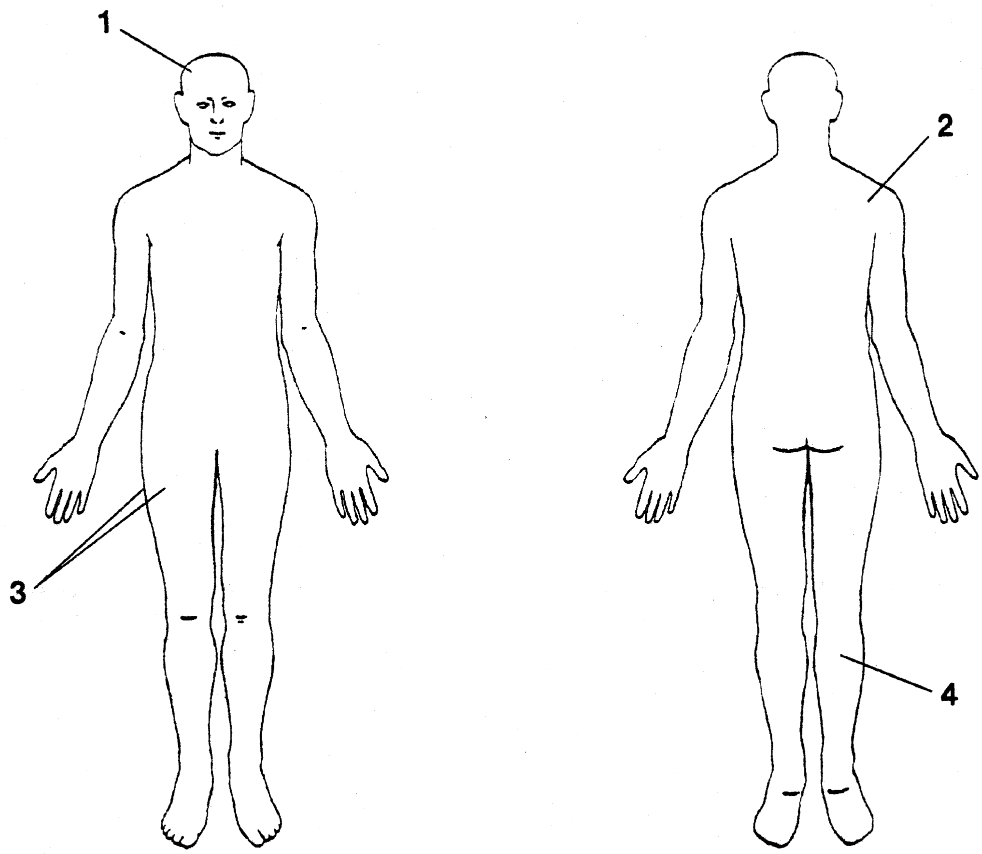


Figure 58. Vehicle Damage. (Case No. 14).



1. Laceration Right Frontal
   Scalp (1)
2. Laceration Posterior Right
   Shoulder (1)
3. Contusion Right Proximal
   Anterior and Medial Thigh (1)
4. Contusion Right Calf (1)

Figure 59. Injuries to Driver. (Case No. 14).

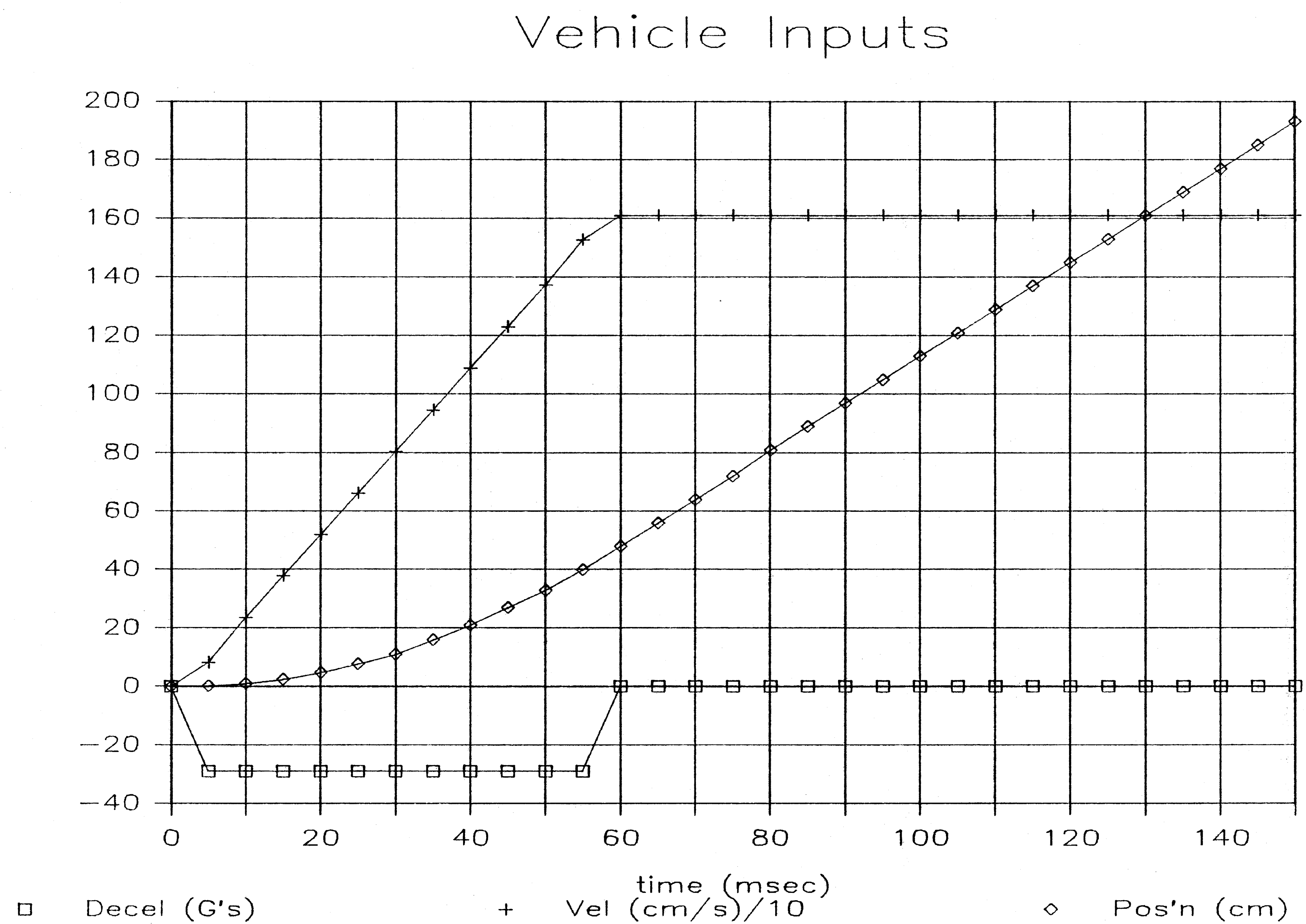


Figure 60. Primary Vehicle Deceleration, Velocity, and Position. (Case No. 14).

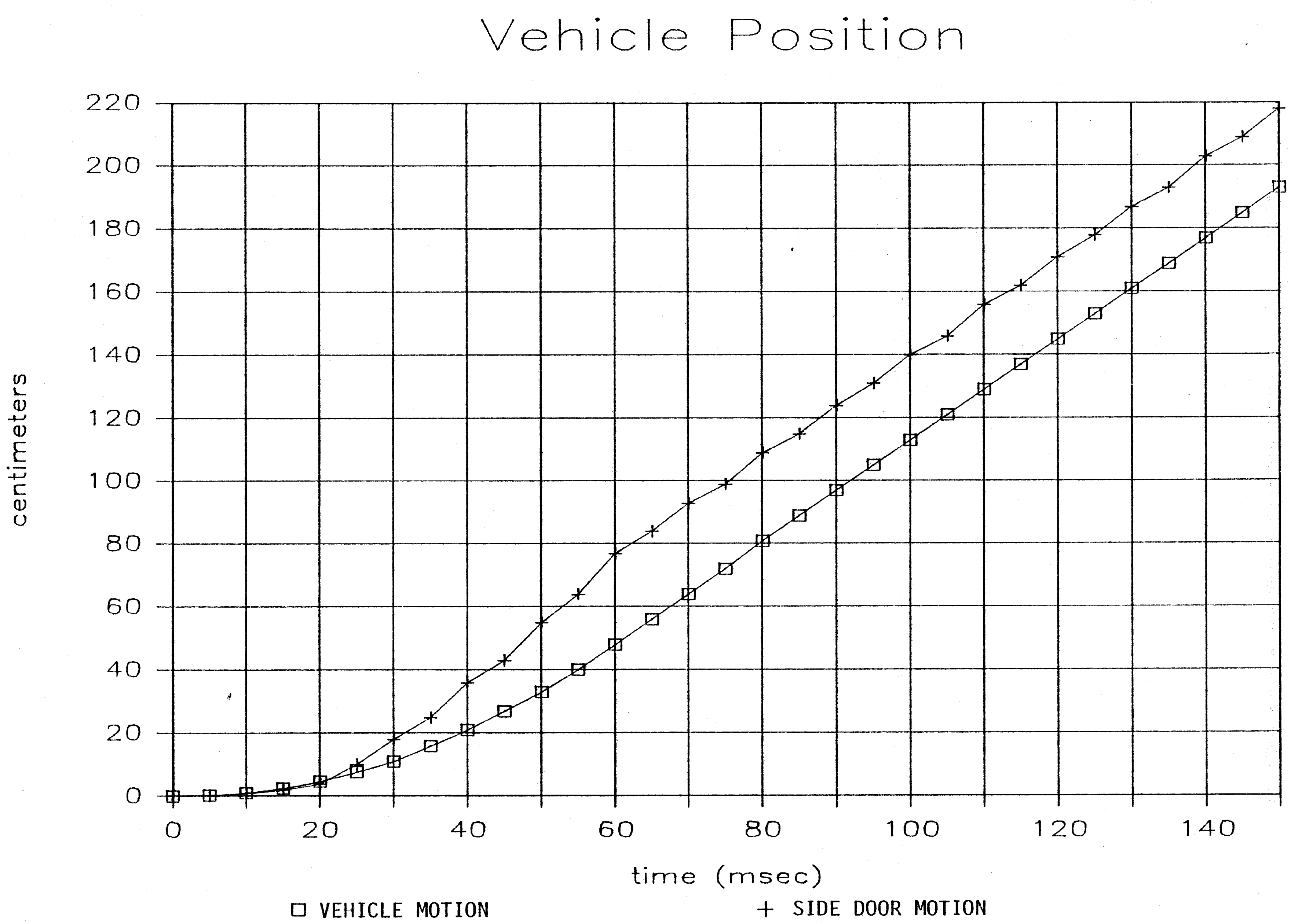


Figure 61. Motion of the Intruding Door. (Case No. 14).

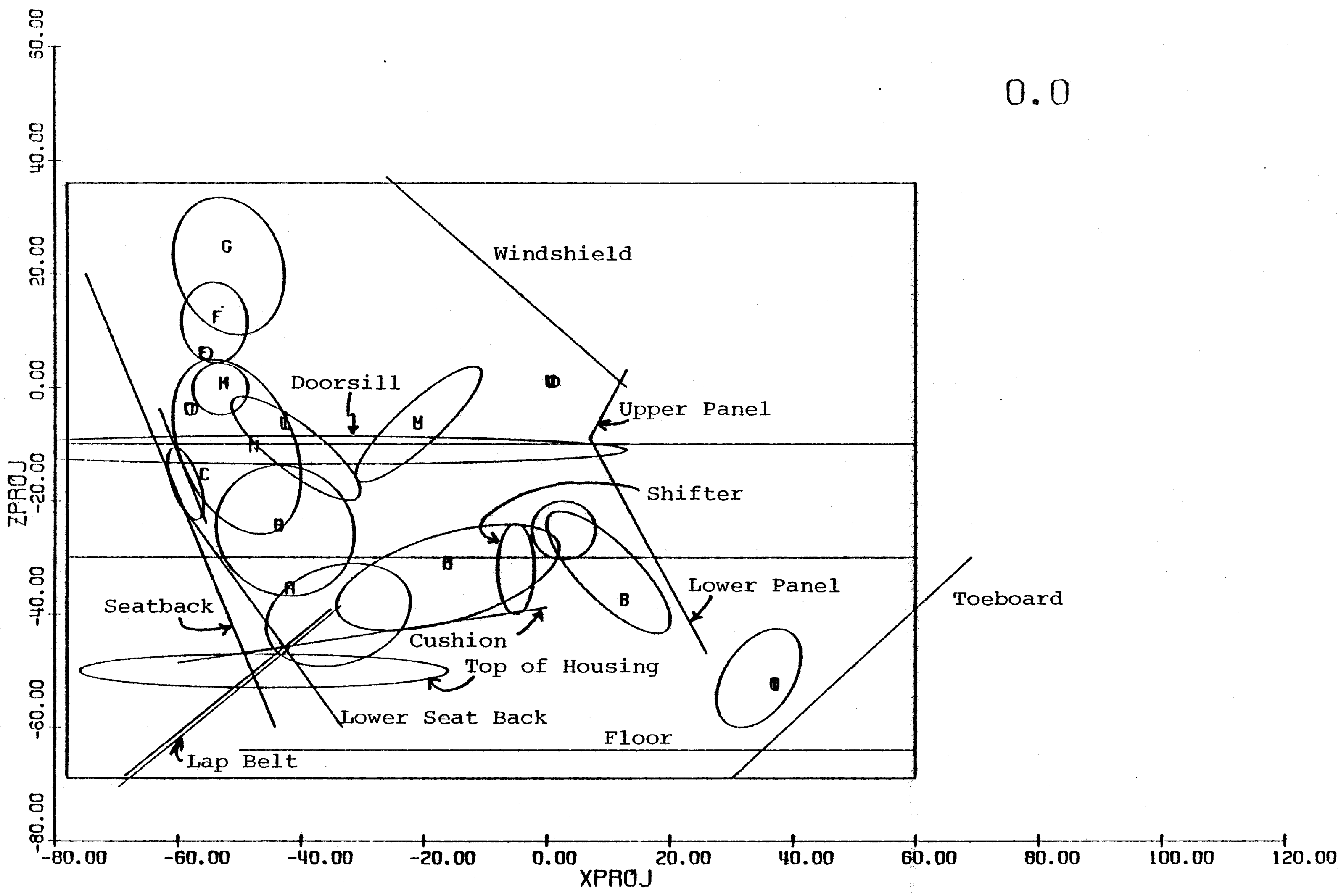


Figure 62. Side View of Driver Position. 0 ms. (Case No. 14).

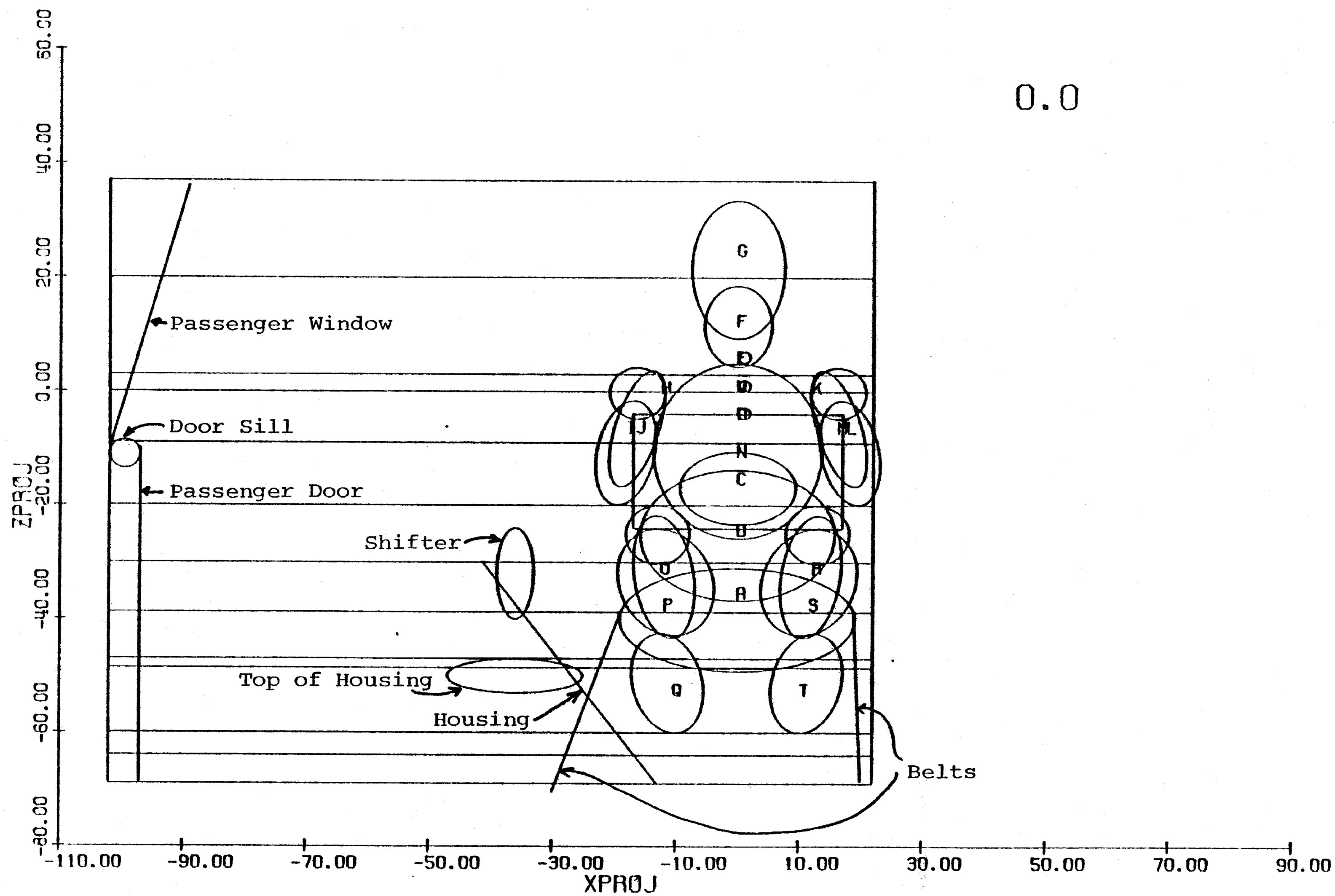


Figure 63. Front View of Driver Position. 0 ms. (Case No. 14).

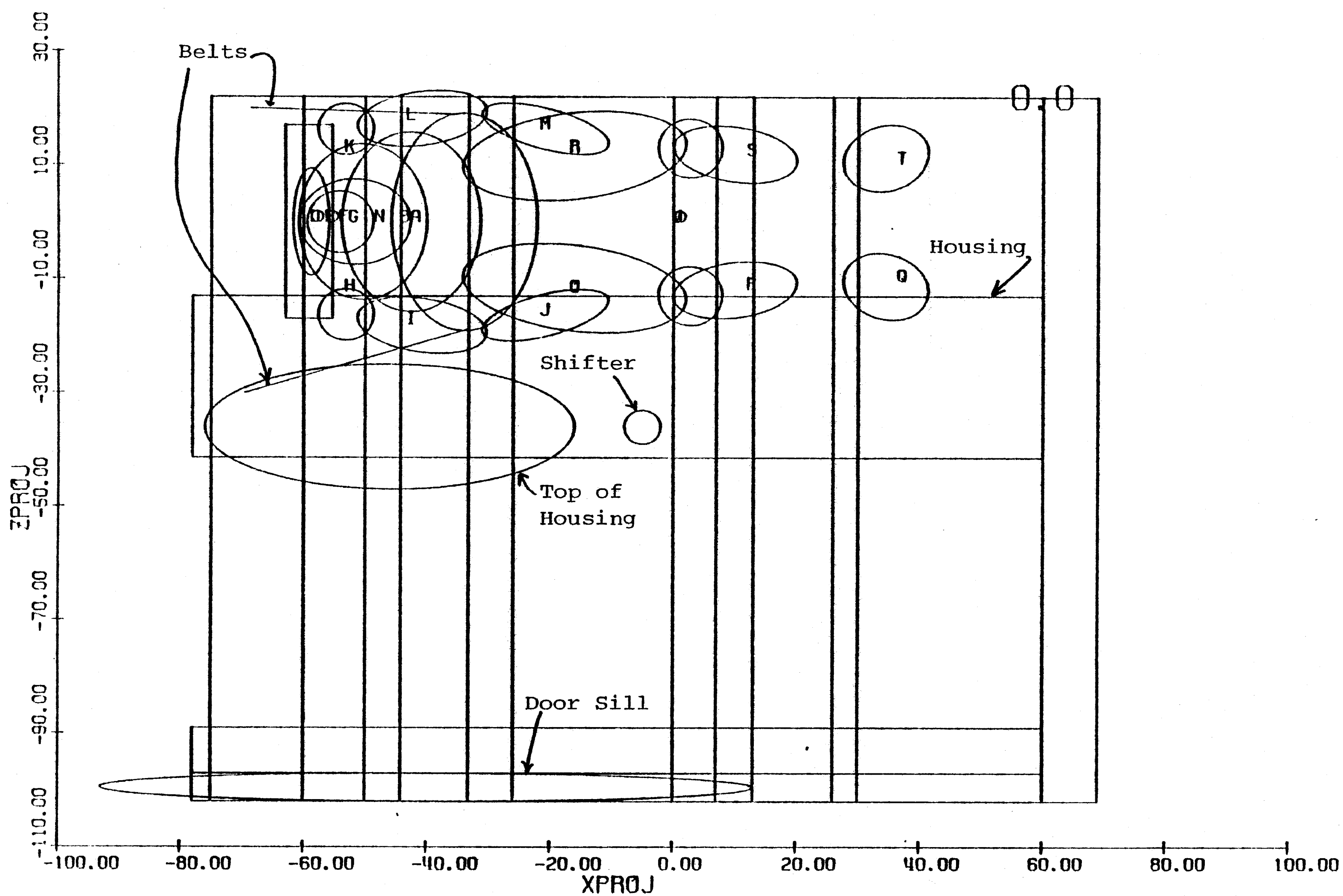


Figure 64. Top View of Driver Position. 0 ms. (Case No. 14).

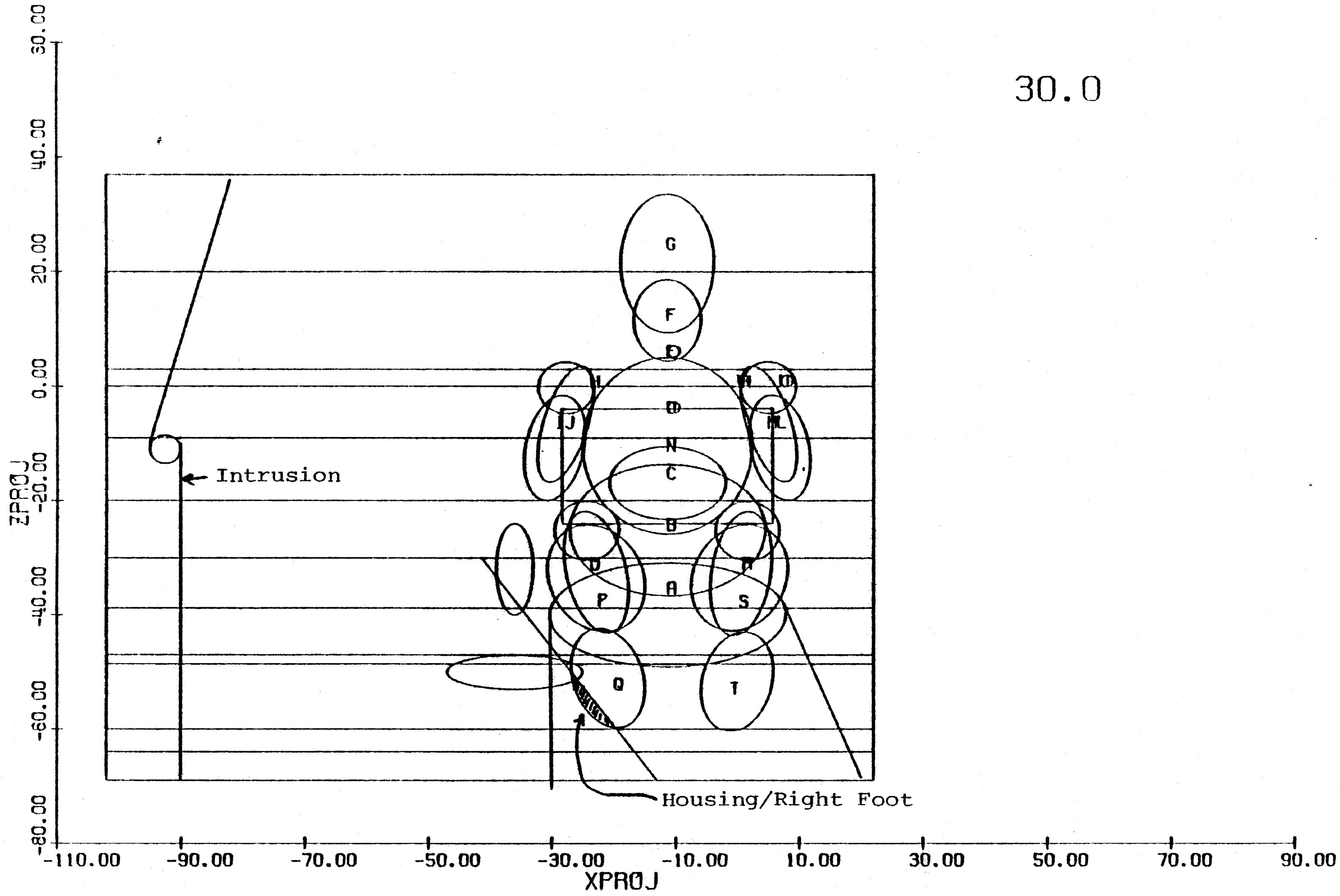


Figure 65. Front View of Driver Position. 30 ms. (Case No. 14).

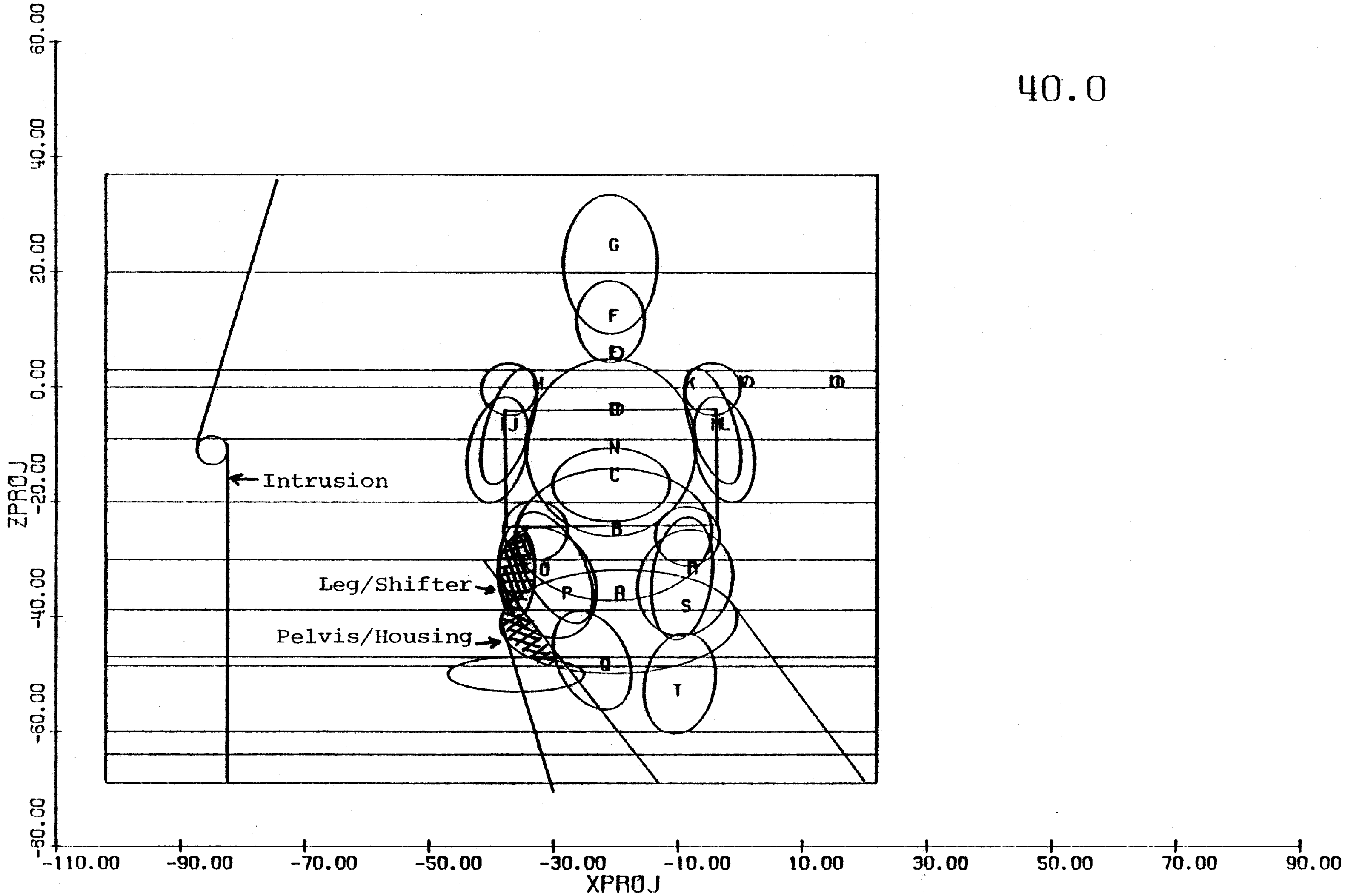


Figure 66. Front View of Driver Position. 40 ms. (Case No. 14).

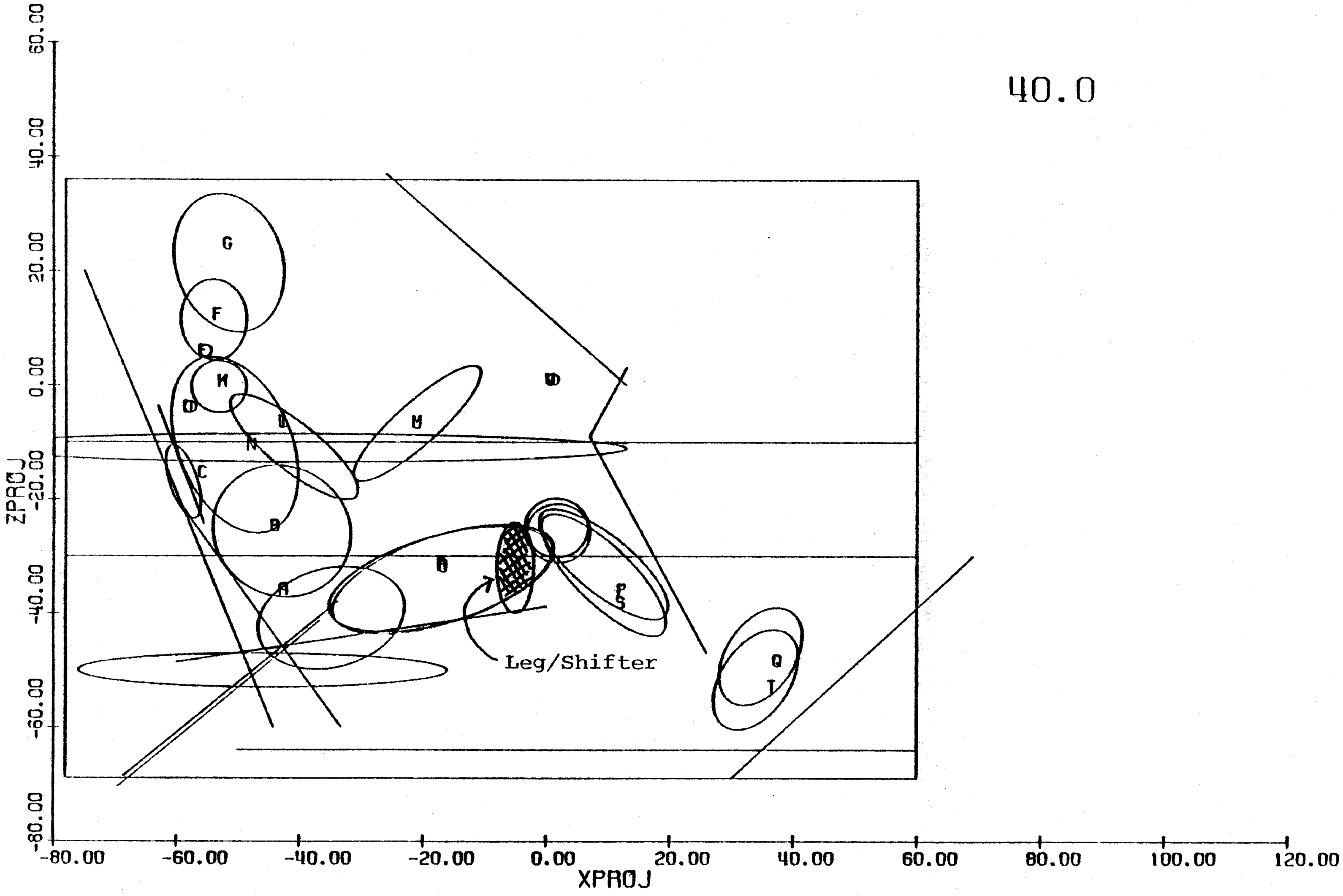


Figure 67. Side View of Driver Position. 40 ms. (Case No. 14).

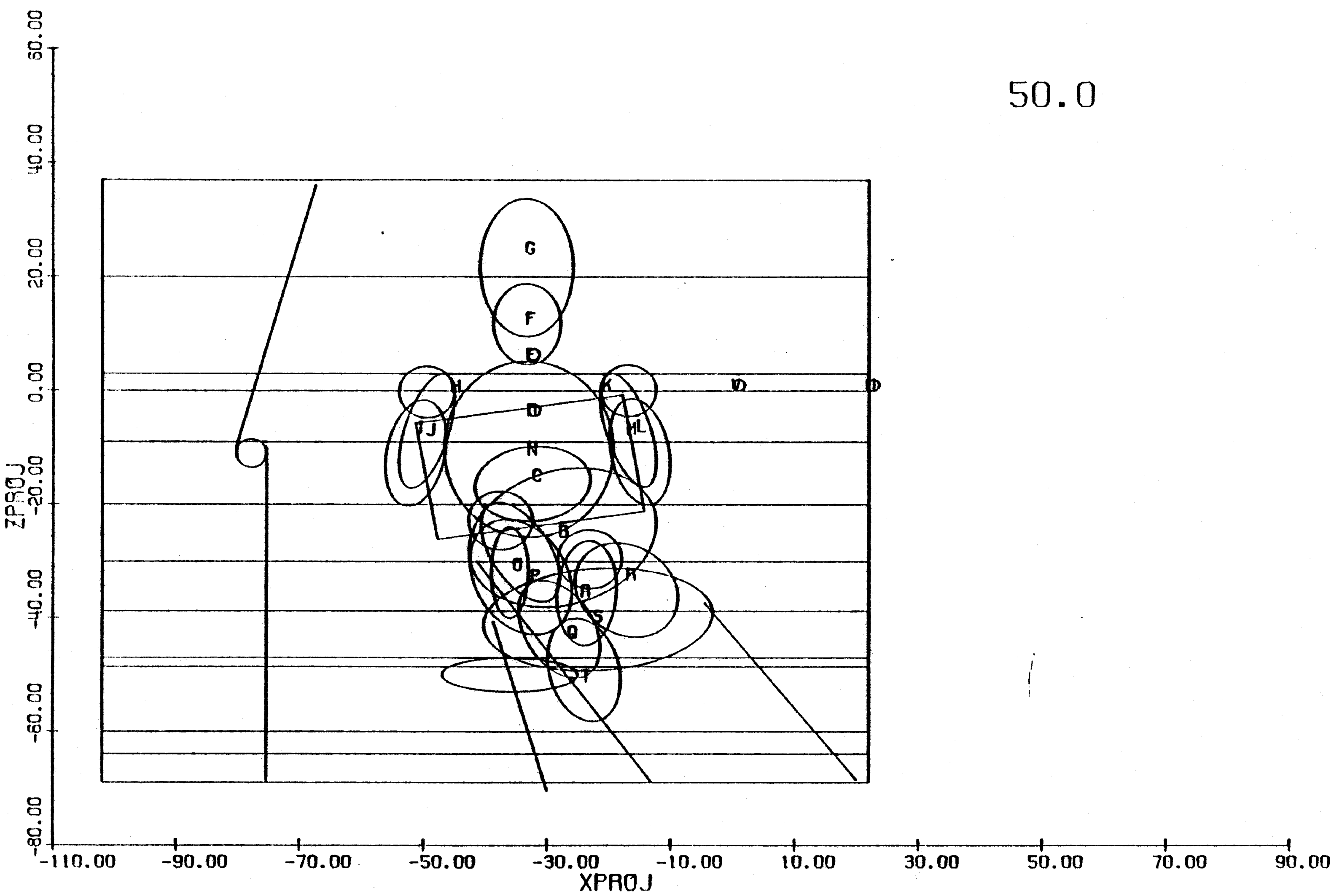


Figure 68. Front View of Driver Position. 50 ms. (Case No. 14).

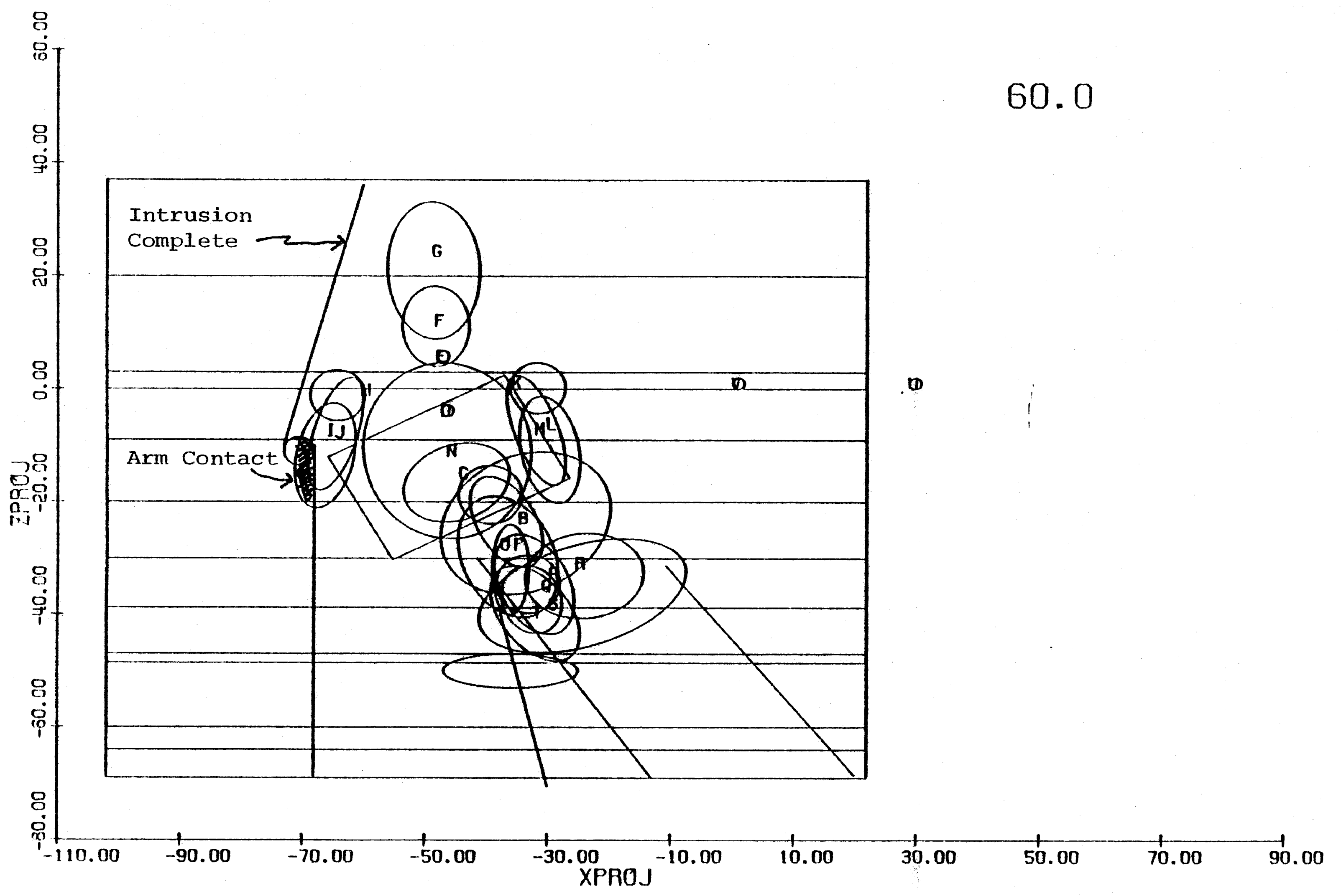


Figure 69. Front View of Driver Position. 60 ms. (Case No. 14).

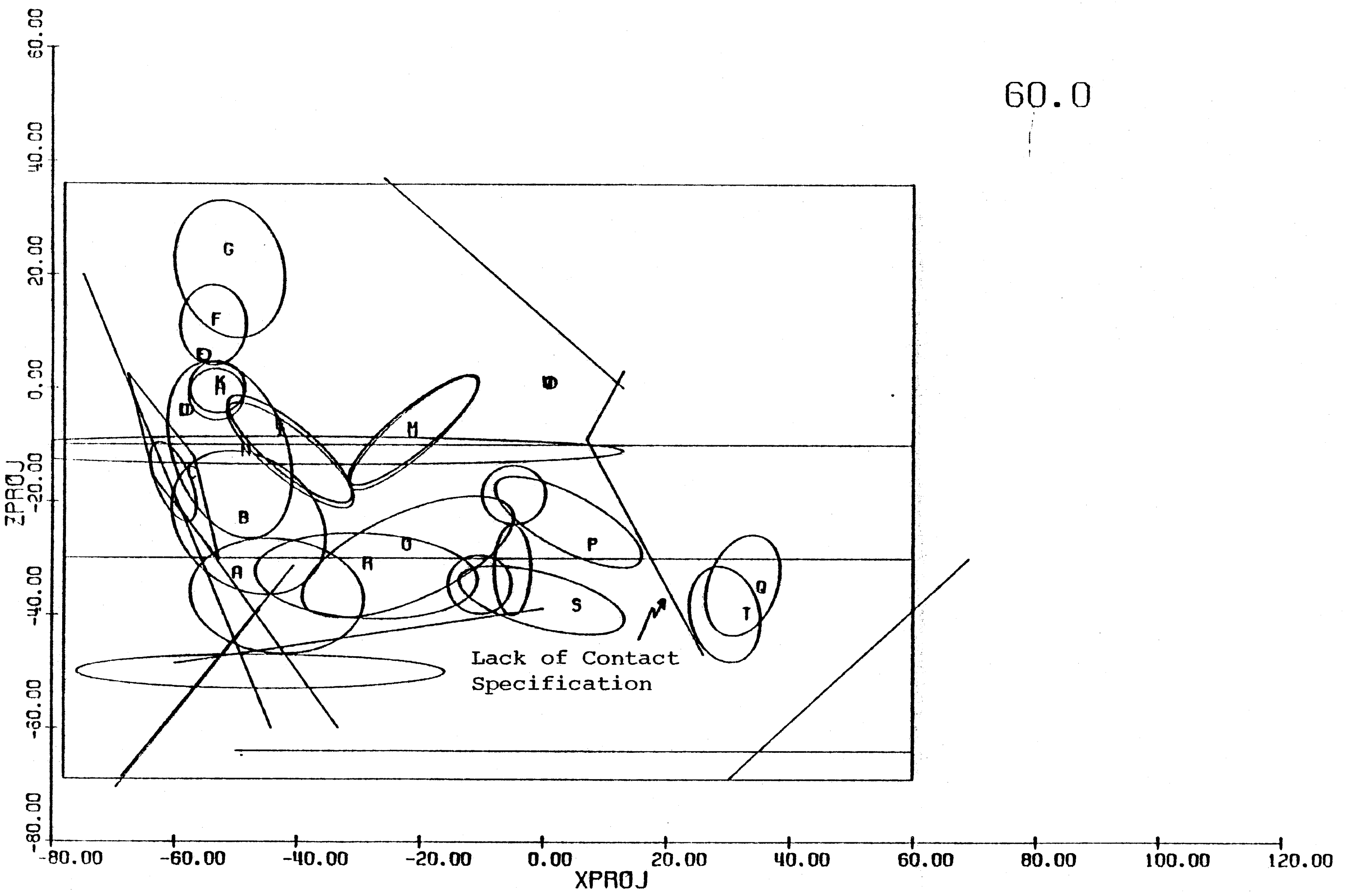


Figure 70. Side View of Driver Position. 60 ms. (Case No. 14).

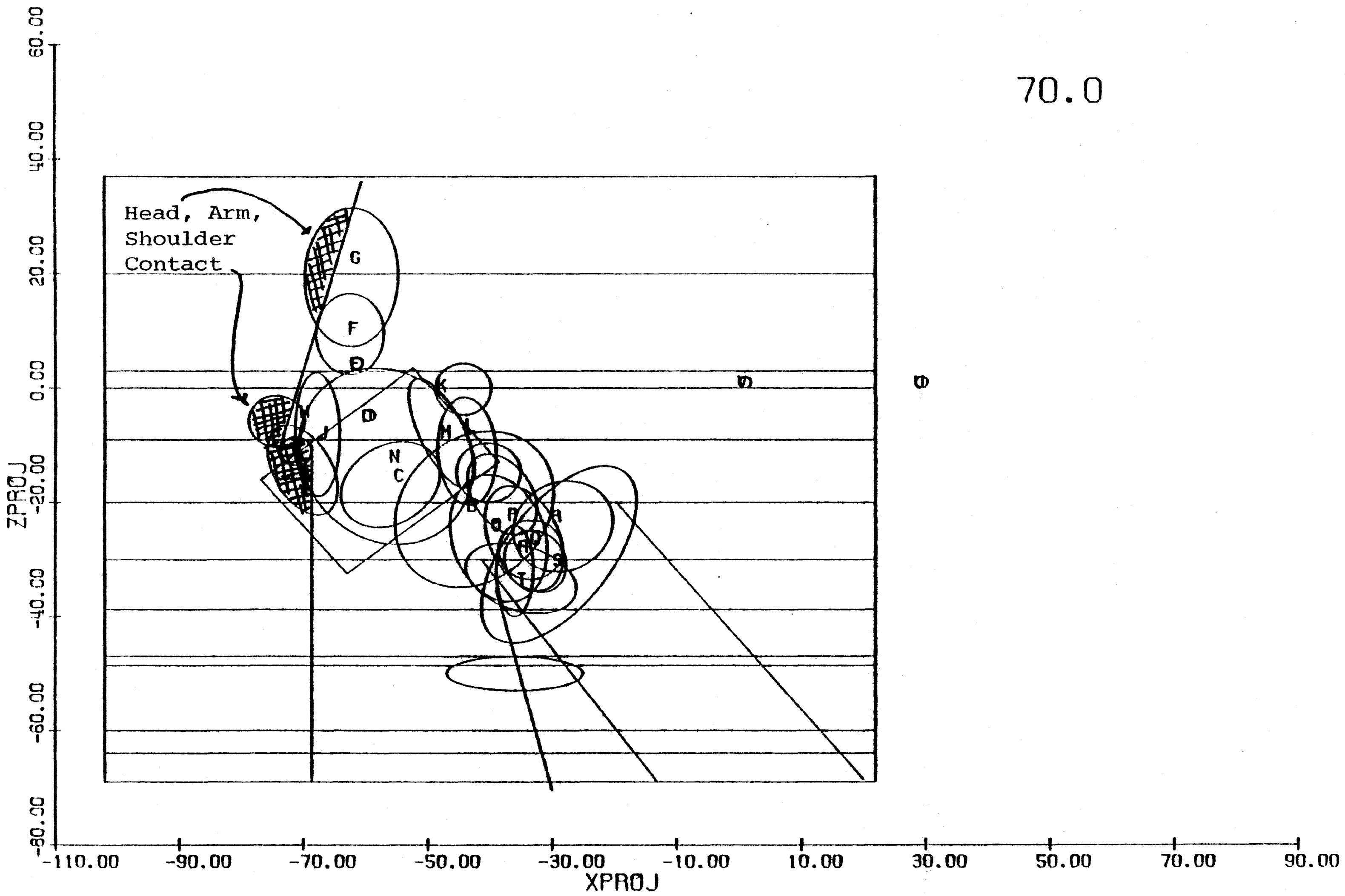


Figure 71. Front View of Driver Position. 70 ms. (Case No. 14).

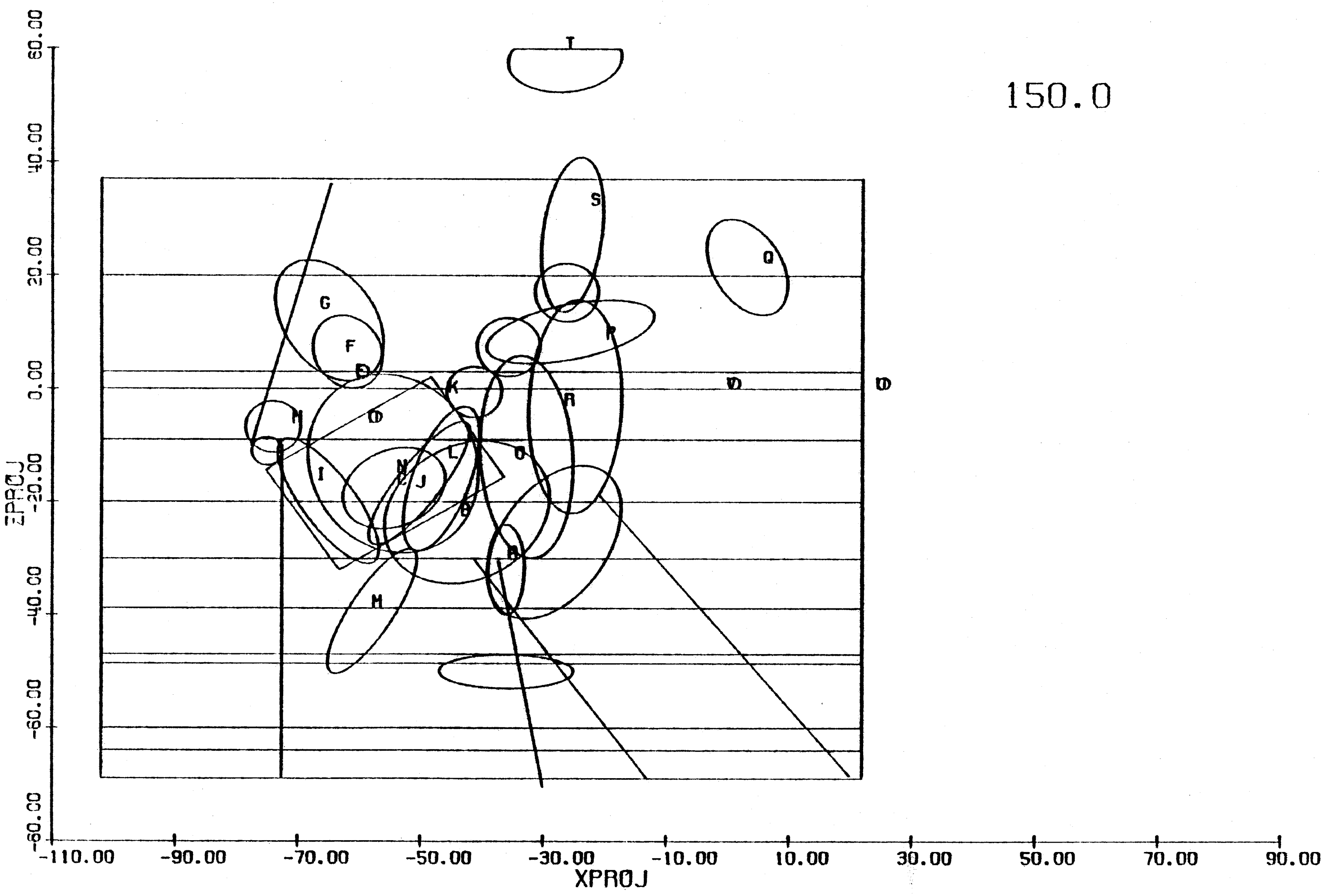


Figure 72. Front View of Driver Position. 150 ms. (Case No. 14).

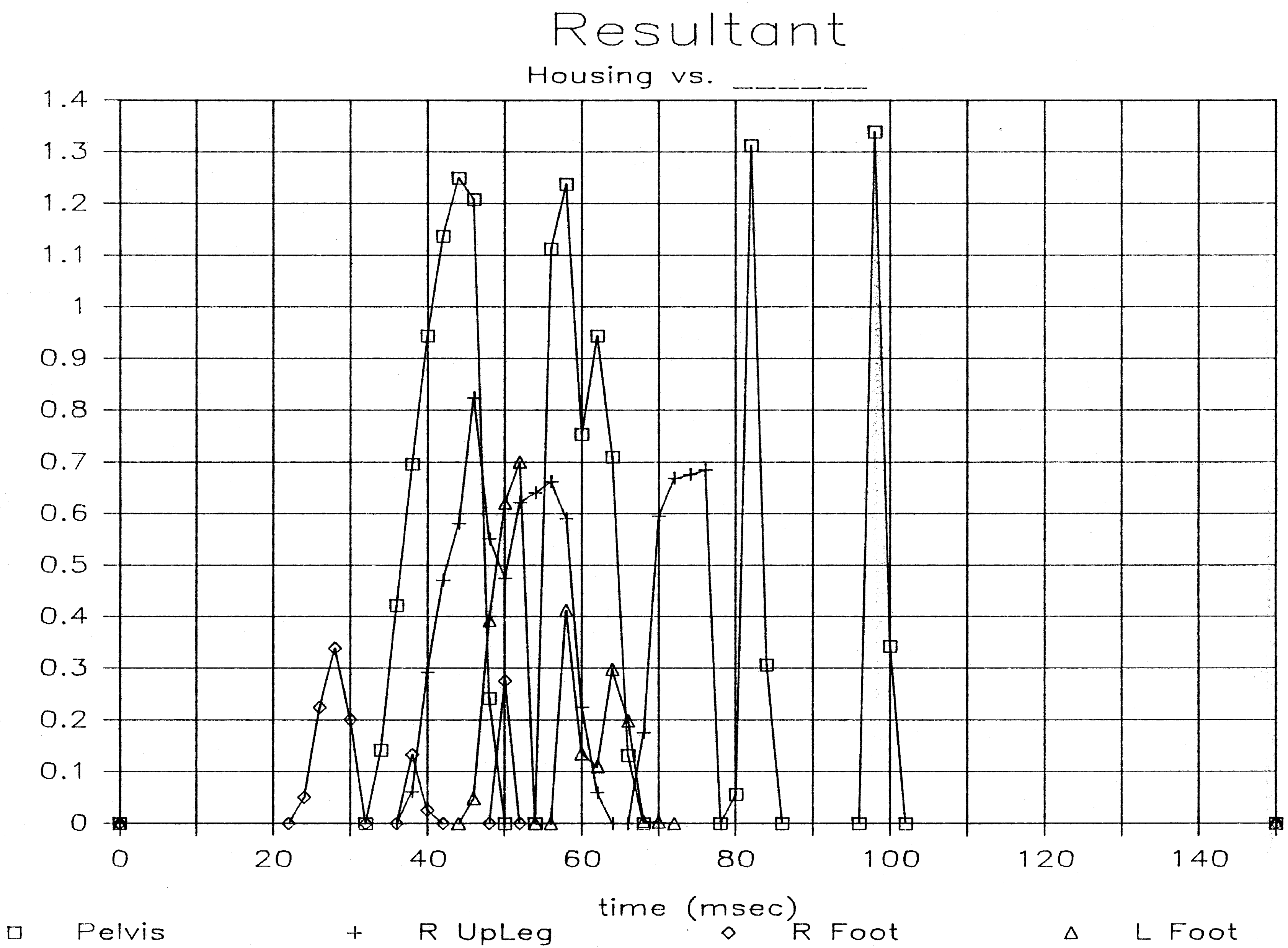


Figure 73. Interaction of Various Body Segments with Transmission Housing. (Case No. 14).

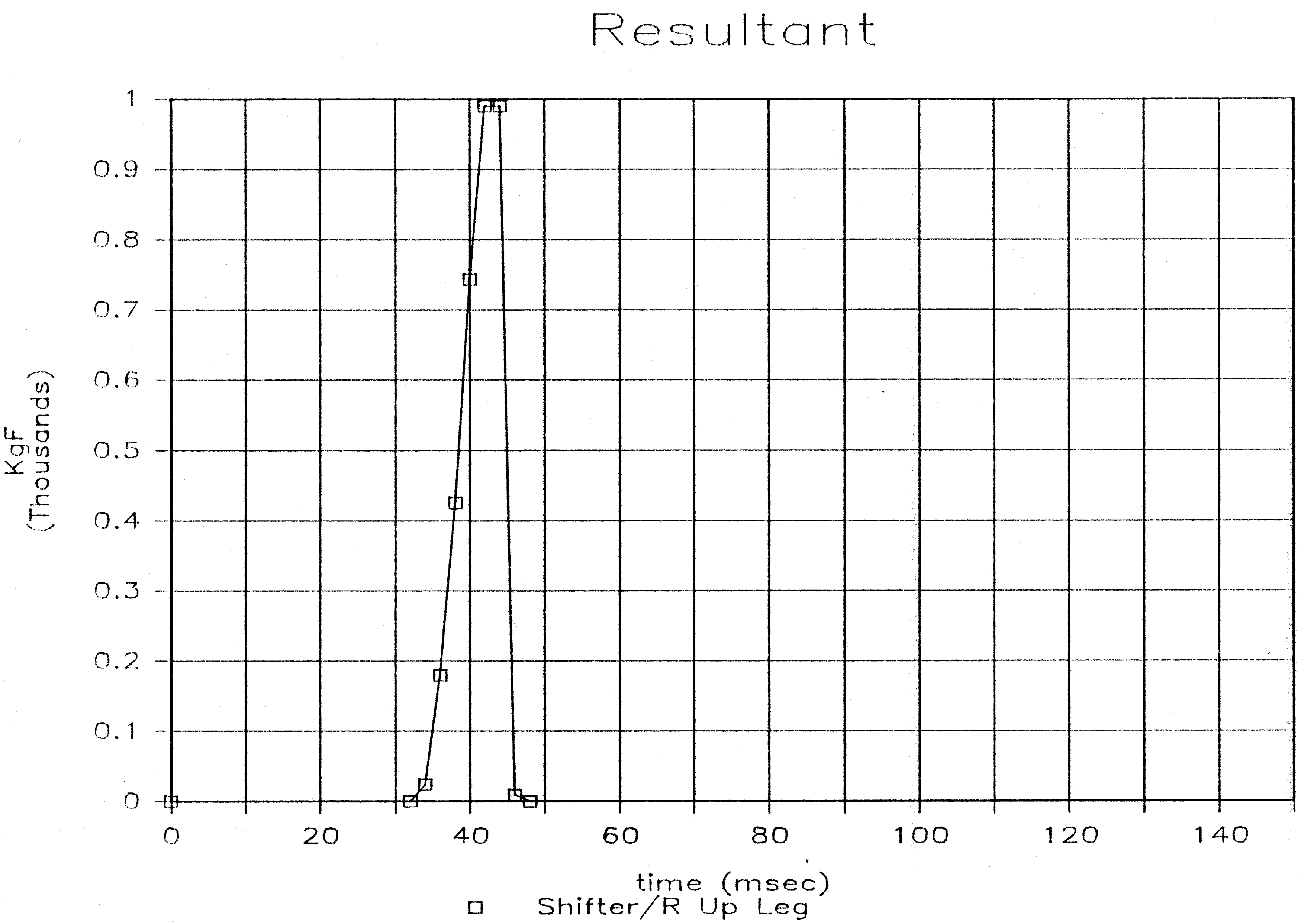


Figure 74. Interaction of Right Upper Leg with Shift Lever. (Case No. 14).

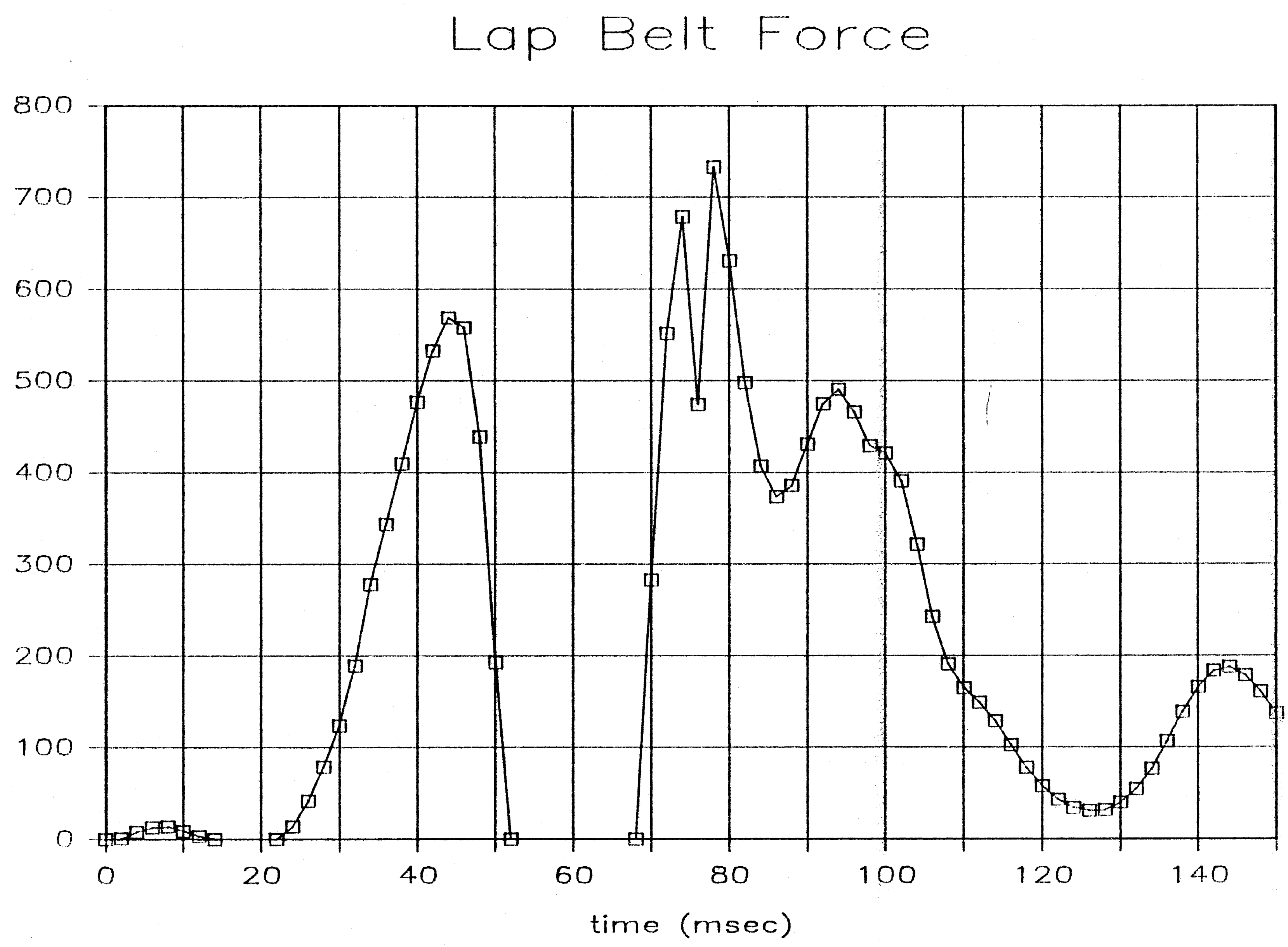


Figure 75. Lap Belt Forces. (Case No. 14).

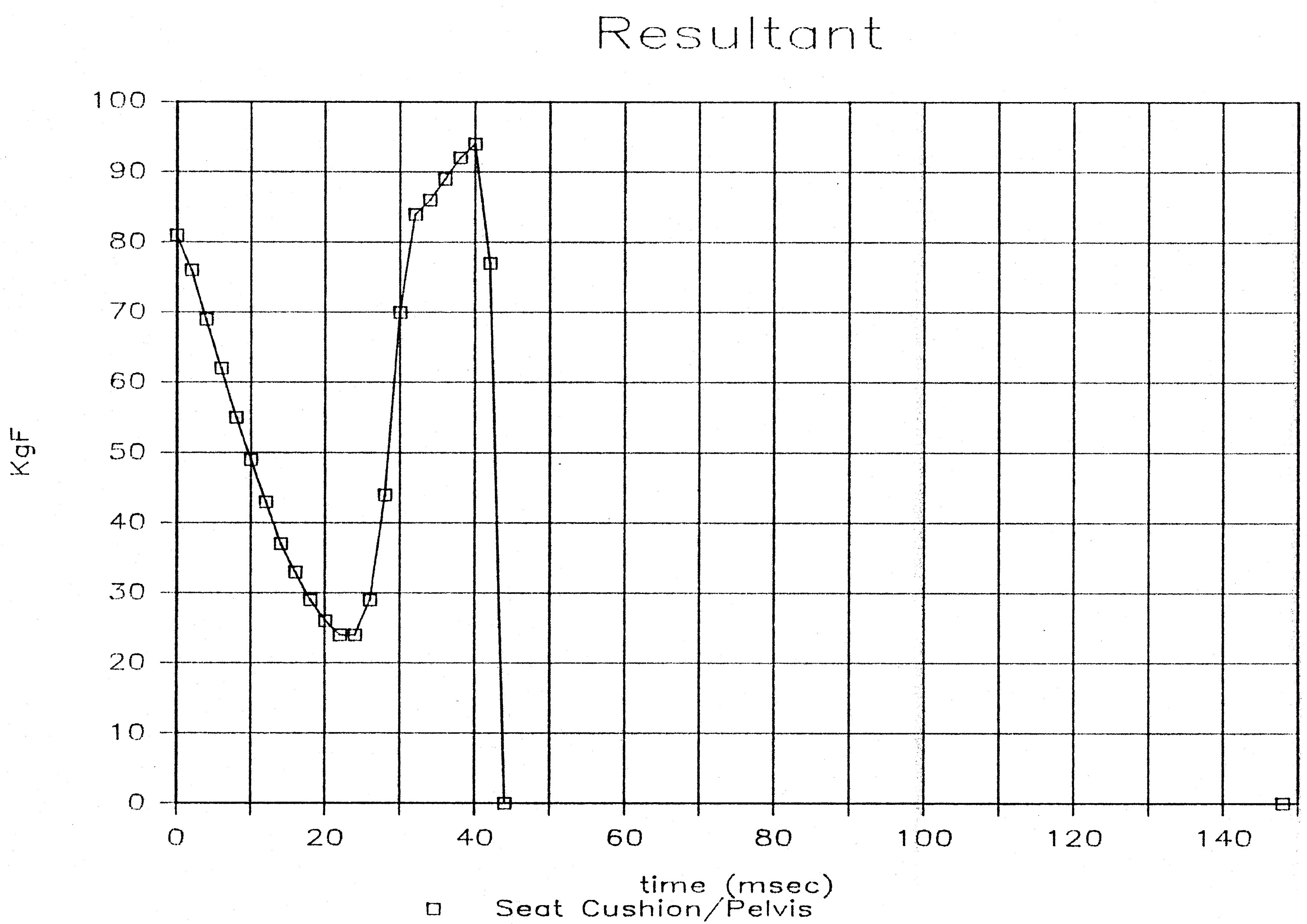


Figure 76. Interaction of Pelvic Region with Seat Cushion. (Case No. 14).

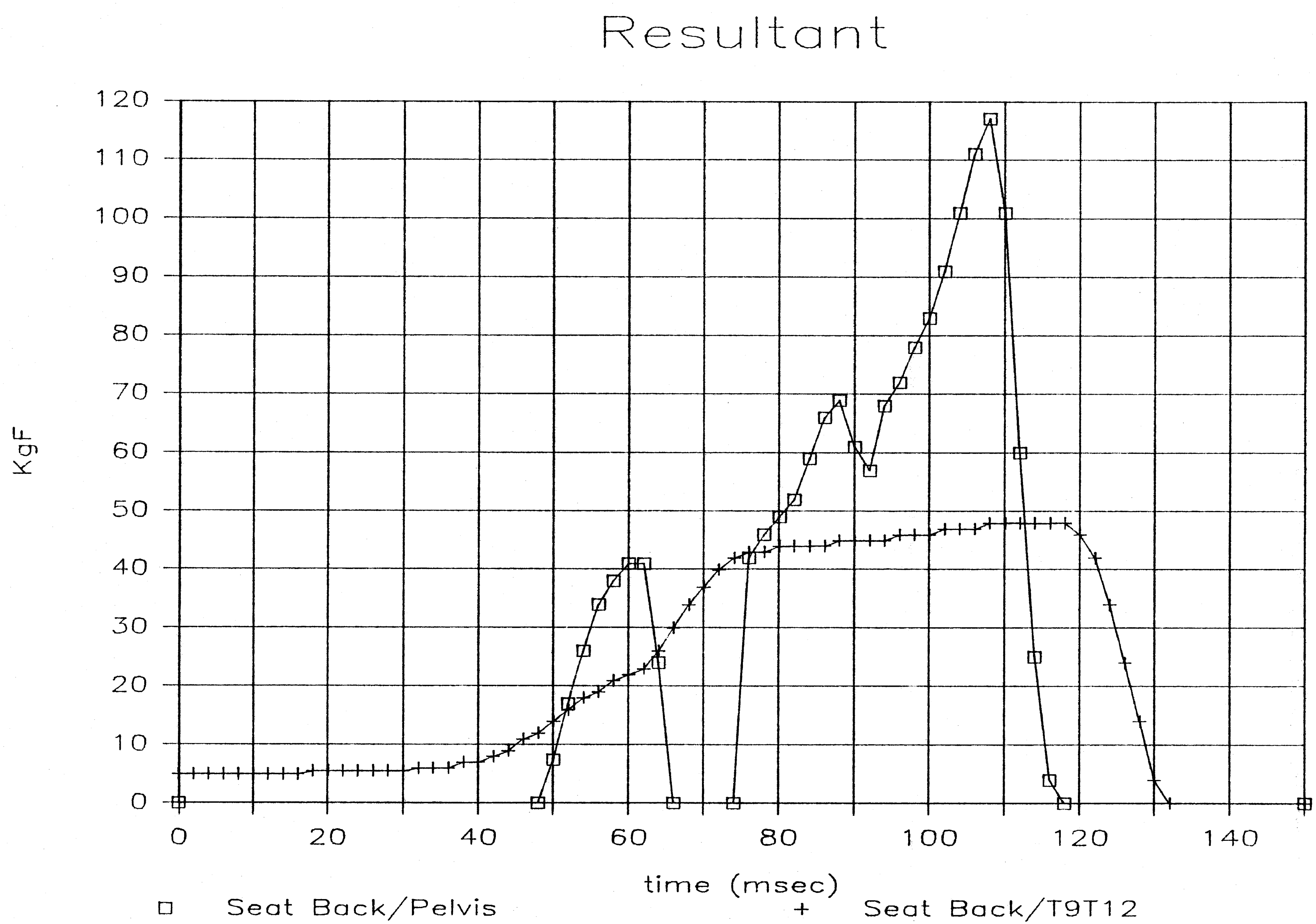


Figure 77. Interaction of Pelvis and Back (T9T12) with Seatback. (Case No. 14).

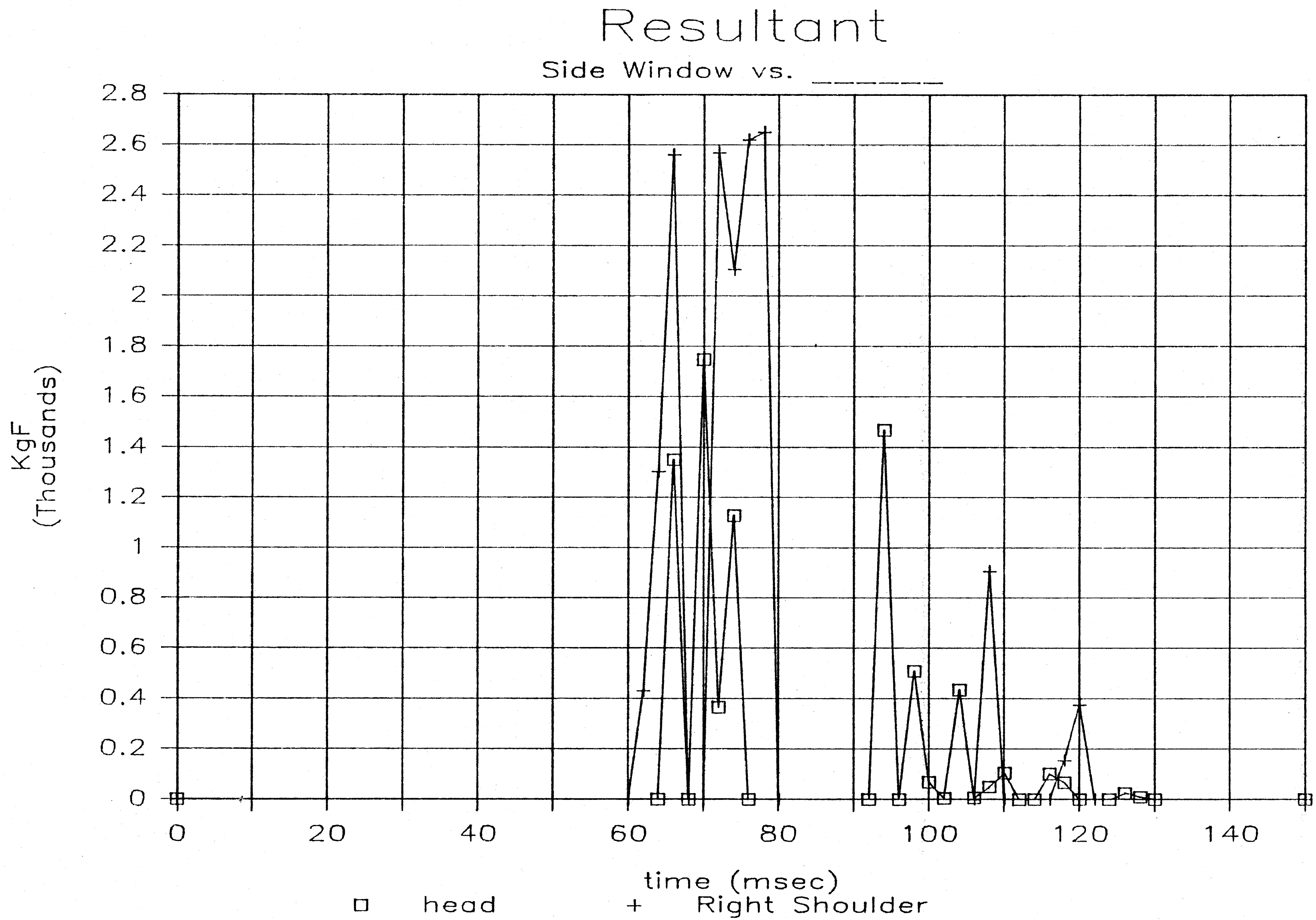


Figure 78. Interaction of Head and Right Shoulder with Side Door Window. (Case No. 14).

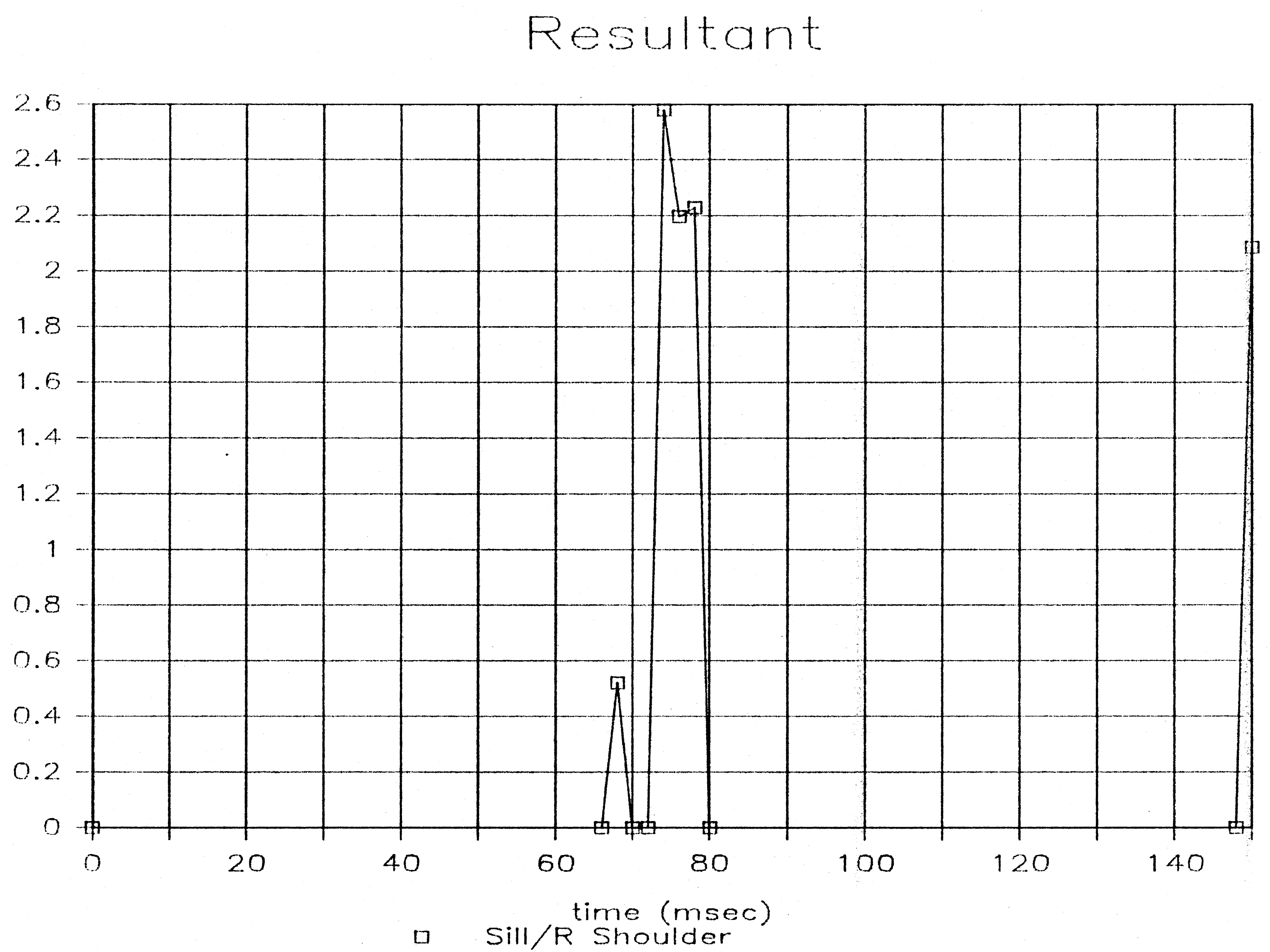


Figure 79. Interaction of Right Shoulder with Door Sill. (Case No. 14).

Deceleration

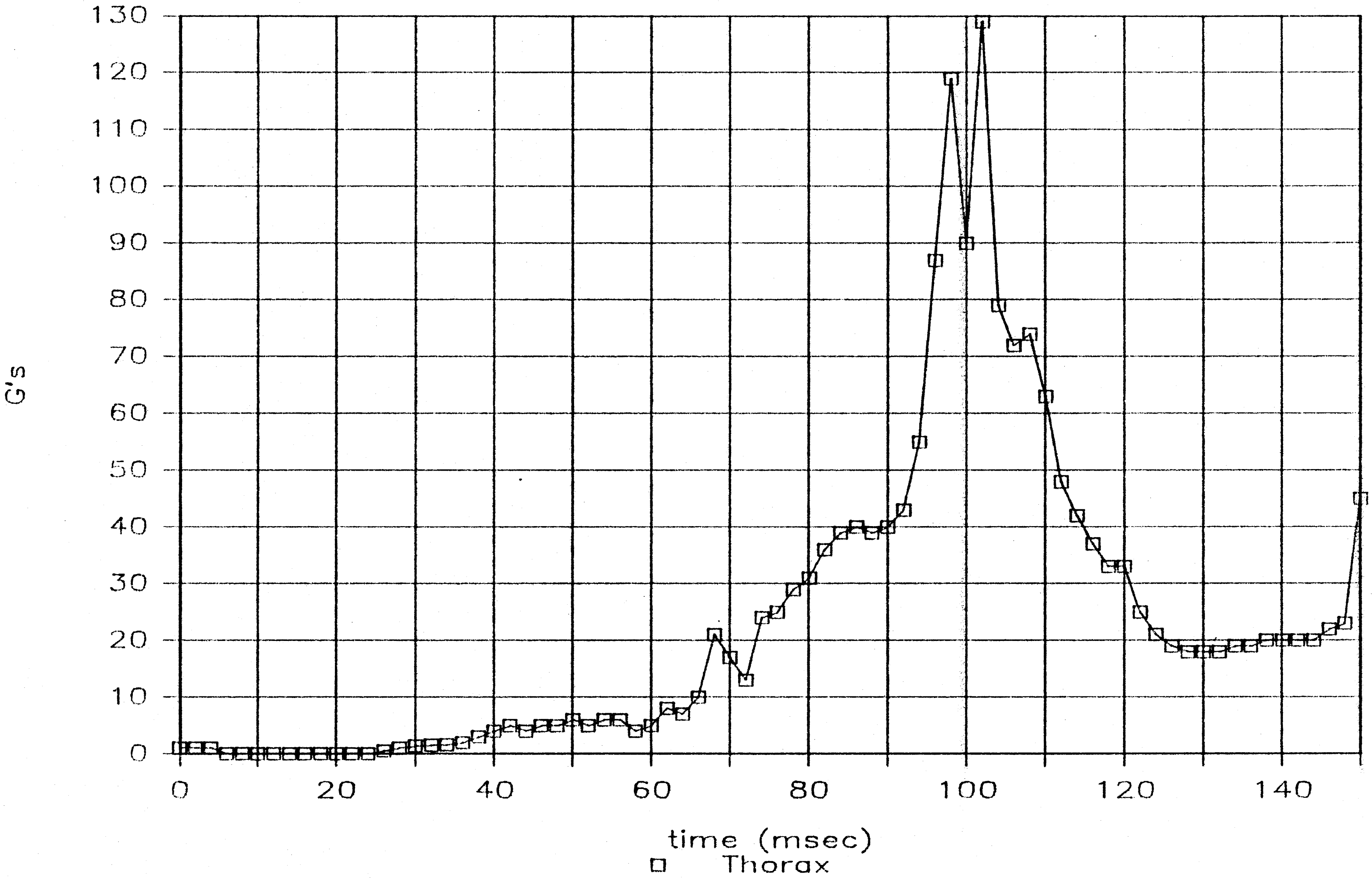


Figure 80. Thorax Resultant Acceleration. (Case No. 14).

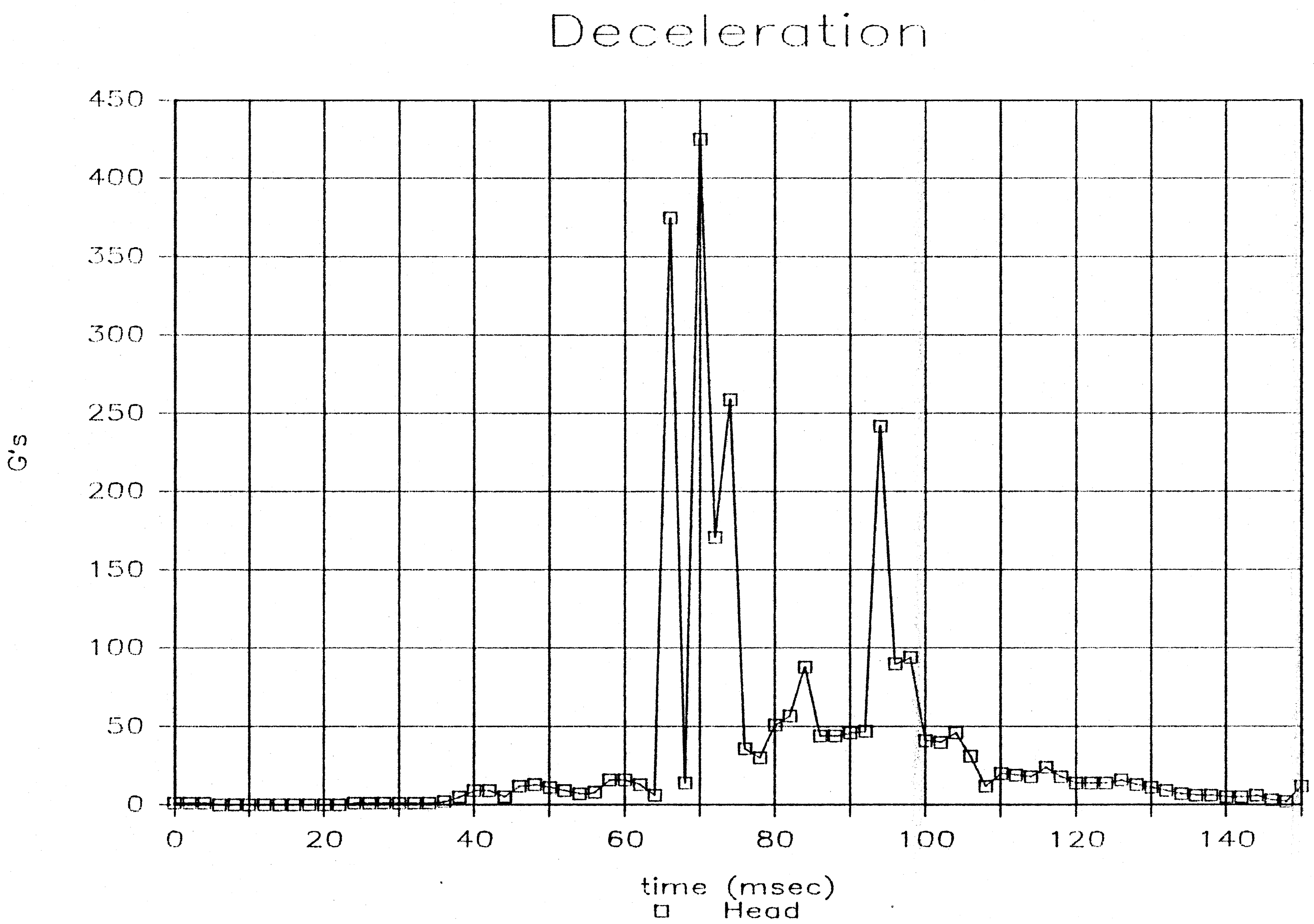


Figure 81. Head Resultant Acceleration. (Case No. 14).

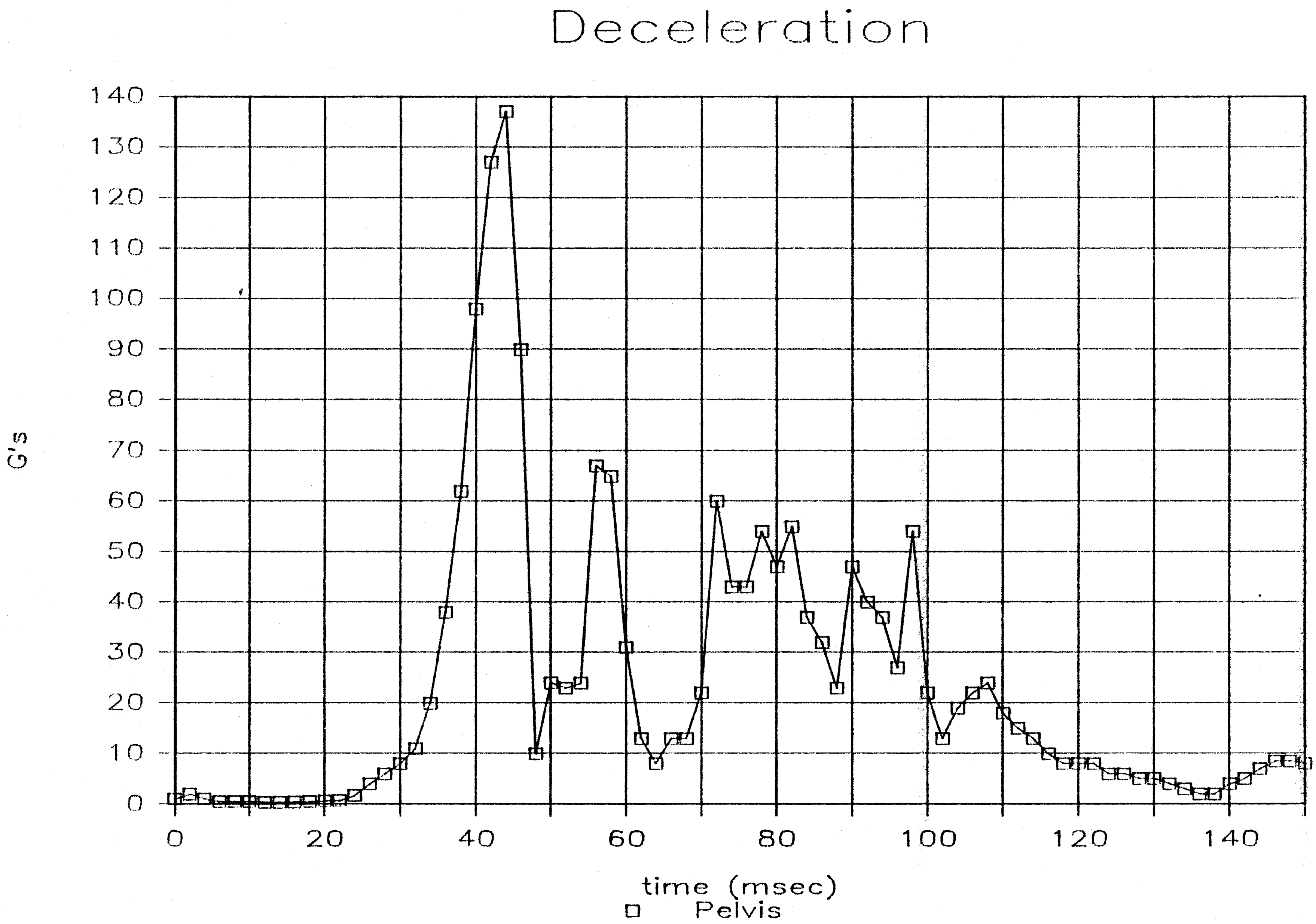


Figure 82. Pelvis Resultant Acceleration. (Case No. 14).

5.0 GUIDELINES FOR THE USE AND FURTHER DEVELOPMENT OF BIOMECHANICAL ACCIDENT INVESTIGATION METHODOLOGY USING OCCUPANT MOTION SIMULATION SOFTWARE

The first five sections of Part 5 cover the five aspects of the methodology:

1. Accident Investigation Process.
2. Vehicle Data Required for the Simulation Process.
3. Occupant Data Required for the Simulation Process.
4. The Simulation.
5. Analysis of Results.

The two final sections summarize conclusions and recommendations as well as future directions.

5.1 The Accident Investigation Process

The accident investigation process can be thoroughly documented by use of the UMIVOR (University of Michigan In-Depth Vehicle Occupant Report form) (10). When filled out completely, this form by itself is a great aid in determining whether a case can be reconstructed using the available analytical tools. The information which is normally contained on this form is supplemented considerably by visits to the accident scene and to the crashed vehicle by the complete medical, engineering, and biomechanics team.

A visit to the scene documents, insofar as is possible, information such as:

- the location of vehicle contact
- an estimation of the geometric distance covered while the vehicles were in contact
- the final vehicle resting points
- pavement markings

This information is all necessary in determining the path of the vehicles before, during, and after the collision event.

The visit to the vehicle provides the damage information required for input to programs such as CRASH II which is used to predict the change in linear velocity of the vehicle. This, when combined with path information and the estimate of the geometric extent of contact, allows computation of an estimated linear acceleration vector coupled with an estimate of the time scaling of vehicle interior component intrusion.

Without crash test data, this process is limited at best. The assumption has been made that the velocity change starts at the point of initial contact and continues until the deformation is complete or until the vehicles are estimated to separate, if that is possible from the ground markings. Using the predicted velocity change and the assumption of a trapezoidal form (with 5 ms rise and decay times) for the deceleration curve, it is possible to estimate the time duration and magnitude of the pulse based on an estimate of either time duration or distance traversed while energy was transferred from one vehicle to the other. The latter being more difficult to assess than the former, most simulations have been based on a estimated pulse length of 80 ms. The refinement of this important procedure is believed to be one of the most important subject areas for future work.

The visit to the vehicle by the biomechanics and engineering team also provided a variety of viewpoints and information about the occupant/interior interactions. This includes:

- marking locations of occupant/interior contacts
- photographs of contacts
- measurement of location of contact relative to identifiable vehicle landmarks
- if possible, measurement or estimate of depth of penetration of interactions
- measurement of marks and deformations of belt system hardware for estimation of belt geometry when load is applied
- measurement of intrusion

5.2 Vehicle Data Required for the Simulation Process

The two types of data required for a description of the vehicle interior are geometric and structural. The most well-defined source of vehicle initial geometry is the engineering drawing. However, the identification of those drawings which are required for defining vehicle shape at all locations where occupant/vehicle interactions may occur, involves many vehicle systems (seat, instrument group, steering assembly, body, doors, windows, etc. - all in three dimensions). This requires considerable interaction with drawing archivists which, potentially, could require more time than is available.

An acceptable subset of drawings would include the seating package and steering assembly. Additional details of the interior geometry can be obtained within 1 cm (1/2 in) by direct measurement from landmarks which are present both in a vehicle identical to the one in the accident and in the drawings.

A more difficult aspect of the preparation of vehicle data for simulation is the assembly of force-deformation information from the various occupant/vehicle interactions which were observed to occur. Fortunately, a small body of data does exist for interactions of the occupant with belts and other safety systems such as the EA column and knee restraints. However, the buttock/seat interaction is not well-documented. Also, virtually no data exists for the structural properties of components which are often contacted in practice (headers, glass, A- and B-pillars, door frames, structural supports for safety systems, pedals, controls, etc.). Further, for three-dimensional interactions (oblique or off-center interactions with columns, etc.), the properties of structural components may well be different than when measurements are taken in the standardized test environment.

The factor which makes it possible to accommodate these problems is the ease of rerunning simulations with new or modified parameters. If a predicted interaction is clearly incorrect as the result of data which has a high potential for inaccuracy, then new predictions can be made with data selected from the reasonable possibilities.

5.3 Occupant Data Required for the Simulation Process

Data required for simulation of the occupant include the physical and geometric quantities necessary to represent him as an engineering system. The sources for these data are the interview and measurement session supplemented by biomechanics and anthropometry data bases.

All persons who were contacted were willing to participate in an interview which included:

- anthropometric measurements (height, weight, sitting height, knee to buttock length)
- discussion of the crash for any details that might aid in reconstruction, particularly with respect to clothing worn and driving posture
- photographs of the person sitting in a vehicle identical, insofar as possible, to the one involved in the accident

The anthropometric measurements were needed to estimate the mass and inertial physical properties of the occupant while the photographs were required to determine a plausible initial geometry of the occupant in the vehicle at the time of the accident.

The data base of human physical properties is largely based on the work of Robbins et al (4,5,8) in recent work for NHTSA. The purpose of that work was to define the seated posture of people in cars and to develop specifications for a new generation of anthropomorphic test devices. Masses, inertial properties, posture, the bony linkage, shape of the seated body, location of the skeleton within the body, joint locations, and other properties are available for small female, mid-size male, and large male sizes. Interpolations of these data have been used in the reconstructions and are recommended for use in future work.

5.4 The Simulation

The two public computer codes which have detail sufficient for the reconstructions which have been attempted are the CAL-3D and MVMA-2D software packages (7,3). Both of these codes allow the intrusion of vehicle components due to crash deformation. The process is easier with the MVMA-2D code, largely to the data structure. The CAL-3D code has the obvious advantage of its three-dimensionality but is far more difficult to use. It also allows for predictive dynamic motion of vehicle elements. Both codes require experienced personnel for their application.

To set up a data set for simulation, the four major groupings of data which are required are:

- vehicle deceleration
- vehicle geometric and structural properties
- occupant physical description
- initial posture of the occupant in the vehicle

The first three items have been discussed in Section 5.1-5.3. The fourth combines the vehicle occupant geometry with the capabilities of the computer code. To accomplish this a linkage representation of the occupant is superimposed upon a schematic of the vehicle geometry. The location of the occupant linkage within the vehicle is determined through the use of the photograph taken of the seated occupant during the interview described in Section 5.3. The process is illustrated in detail by Robbins et al (1) in the first phase report and in a subsequent publication (2). It is also discussed for each case study included in the current report.

5.5 Analysis of Results

The results from the simulation include graphic displays of occupant position as well as plots of dynamic quantities such as interaction forces, acceleration, and many other quantities describing the dynamics of the event. Three questions should be asked about the predictions:

1. Does the occupant make contact at the vehicle interior locations observed during the accident investigation?
2. Are the injuries observed in the accident investigation consistent with the loadings applied to the body and the directions of these loads?
3. Are the magnitudes of the loadings consistent with current biomechanical knowledge?

If the answers to any of these questions are negative, several steps should be taken. The first is to identify input data parameters which are most likely to be suspect. The most typical (and relatively easy to correct) problems are poor choices of contact surface and ellipsoid geometry. An example of this was intentionally included in Section 4.4 as an illustration (lower legs and feet versus lower instrument panel). After identifying suspect parameters, a reasonable engineering estimate should be made for the range that they can take. Following this, the simulation can be rerun with new parameters and reanalyzed.

If, following the above process, the results still are not reasonable, the potential of the code to model the physical problem should be evaluated. In many cases, a new linkage describing the desired details of the occupant, or a different physical representation of the vehicle can be generated which solves the problem.

If the procedure still fails, then the biomechanics of injury data base should be reviewed. The primary question which should be raised is whether the predicted direction, velocity, and magnitude of the applied load are the same as those used in the testing program generating the biomechanics data. If differences cannot be reconciled, the reconstruction process and results should be documented, and the process terminated.

5.6 Summary of Recommendations and Conclusions

1. A primary goal of this project was to combine state-of-the-art detailed accident investigation procedures, computerized vehicle crash and occupant motion modeling, and biomechanical analysis of human injury causation into a method for obtaining enhanced biomechanical data from vehicle crashes. This method involved organization of a multi-disciplinary team which investigated and analytically reconstructed four accident cases. The reconstructions, using largely preliminary data, were evaluated and the dynamic loadings predicted for application to the vehicle occupant yielded injury results which were generally within accepted ranges of known tolerance data.

2. Vehicle trajectories and resting positions after the accident must be documented completely, insofar as is possible, to allow a reasonable prediction of velocity change during impact, and hence, to allow a reasonable approximation for vehicle acceleration or position to be made as a function of time. Use of CRASH and SMAC programs are not reliable if this information is not available. For three-dimensional simulation, additional techniques must be developed to obtain reasonable estimates of vehicle rotations as a function of time. Because of the crude techniques which have been used to establish deceleration pulses (Section 5.1), refinement of the procedures which are available and used in this project (CRASH , etc.) are believed to be one of the most important areas for future work.

3. Improved force - deformation data for both vehicle components and the occupant would improve predictions of force and acceleration magnitudes, energy absorbed by segments of the human body, and as a result, the rebound.

4. The use of the interview of the injured vehicle occupant was very informative with respect to:

- details of the accident
- his or her physical size
- additional medical details of the injuries
- estimated driving posture in a vehicle essentially the same as

the one involved in the crash

The subjects were very interested in the project and much more cooperative and useful than was originally estimated.

5. A data bank on human anthropometry should be established for use in studies such as this based on human dimensions, mass distribution, inertial properties, joint locations, joint mobility, and joint strength. Fortunately, during the course of the project, data on the seated posture of the vehicle occupants became available (4,5,8) which aided greatly in constructing the occupant linkage. In addition, these data also aided in the evaluation of geometric factors of load application such as the line of force of belts in relation to the pelvis. However, a considerable body of the data available to the project for occupant description was based on definitions and measurements made on anthropomorphic test devices. These data are particularly suspect for neck, shoulder, and spine mobility, flexibility, and elongation.

6. Improved graphic output displays, particularly for the three-dimensional simulation, would aid in the evaluation of results. In addition, the development and public release of an interactive, graphics-based preprocessor for the MVMA-2D and CAL-3D software package would aid considerably in reducing the time required to establish realistic initial conditions for simulations.

7. The analytical methodology provides a technique for adjusting parameters as new data become available. For example, these parameters, all required in the analytical reconstruction, could represent quantities relating to the vehicle dimensions, the accident definition, vehicle damage definitions, occupant anthropometry, and physical properties (strength, force-deformation) of the occupant or vehicle. In other words, a reconstruction is not lost after the first attempt. It can be improved upon either by the original team or, later, by others with more complete data.

5.7 Future Directions

A variety of activities can be proposed to use and improve the methodology which has been developed. In order to prove the accuracy of the methodology, two types of projects could be conducted. One of these would be to provide two independent analysis groups with the same data base and then have them proceed to predict kinematic and dynamic results. This would be difficult as the biomechanics and accident investigation teams would have to interact with both teams independently. Alternatively, two complete teams could investigate the accident. This is also difficult because of the diverse locations of qualified teams and the short investigation time available during the period immediately following the accident.

A second type of project would be to have simulation teams (multiple full-scale test and analysis teams) reconstruct the same event and compare techniques and results. The accident investigation team could supply identical results to all participants. This is similar to the recent and related project conducted by Volvo with respect to the vehicle aspects of the reconstruction and crash velocity estimates.

To improve the methodology, two specific recommendations can be made based on comments 2 and 6 contained in Section 5.6. These deal with the development of improved procedures for estimating vehicle deceleration during an accident and with the development of improved graphics software to supplement the two occupant motion simulation codes which have been used.

Finally, three additional activities are proposed for continuing and future use of the methodology:

1. Continuation of work with the objective of studying specific performance aspects of seat belts and energy absorbing steering columns.

2. Continuation of work to identify the interaction sequence of the occupant/vehicle combination with respect to direction and velocity of impact in order to provide input to component testing programs.

3. Continuation of work in order to integrate predicted impact injury data gained from crash reconstructions with the traditional data

base gained from surrogate (cadaver) testing.

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APPENDIX. COMPENDIUM OF DATA SETS

A. Case 2-6. Mercury Lynx Driver. (LYNXD)
B. Case 2-6. Mercury Lynx Passenger. (LYNXP)
C. Case 2-2. Plymouth TC3 Driver. (TC3)
D. Case 2-2. Plymouth TC3 Driver. Belted. (TC3B)
E. Case 14. Chevrolet Chevette Driver. (CHEV)

```
1      1982 MERCURY LYNX 2-PASSENGER FRONTAL IMPACT                                    100
2      0.      -10.    9.80665 0.      0.      150.     .5       2.      10.          101
3          3.      0.      0.      0.      0.      0.     .254 .000001      5.        102
4      HEAD            STEERWHL                                                        106
5      HAND            RADIO                                                           106
6      HAND            SHIFTER                                                         106
7      KNEE            DASH                                                            106
8      SHIN            DASH                                                            106
9      FOOT            FLOOR                                                           106
10     FOOT            FOOTCONT                                                        106
12     PELVIS          SEATCUSHION                                                     106
13     PELVIS          SEATBACK                                                        106
14     THORAX          SEATBACK                                                        106
15     HEAD            SEATBACK                                                        106
16         0.      1.      1.      0.      0.      0.      0.      0.      1.          107
17         0.      0.      0.      0.      0.      0.      0.      0.      1.          108
18         1.      1.      0.      0.      0.      0.      0.      0.      0.          109
19         0.      0.      0.      0.      0.      1.      1.      1.      1.          110
20         0.      1.      1.      0.      0.      0.      0.      0.      0.          111
21       DRIVER                                                                        200
22         1.    27.9    14.3     9.5    35.7            28.2     14.     5.3          201
23        5.7    17.7     6.5     2.3    19.3    27.5    11.9    15.5     0.5          202
24      3.339  17.662  1.7098  8.2517 12.4549  6.6048  2.5578  2.9236  0.6976          203
25    .013931 .202632.0067004 .059256 .1657    .066443 .015409 .038891                 204
26     20.     56.5    0.      0.      40.     100.            -45.    .5              205
27     20.     56.5    0.      0.      40.     100.            -45.    .5              206
28     56.5    56.5    0.      0.      40.     100.    -5.     -25.    .5              207
29     56.5    56.5    0.      0.      40.     100.    -23.    -53.    .5              208
30     56.5    56.5    0.      0.      40.     100.    13.5    -135.   .5              209
31     0.      82.5    0.      0.      40.     100.    103.4   0.      .75             210
32     56.5    56.5    0.      0.      40.     100.    41.     -180.   .5              211
33         0.0   250.0     0.0     0.0    40.0   100.0     0.0  -142.0     0.75        212
34       980.9     0.0     0.0                                                         213
35         0.    980.9     0.0                             8.5              0.5        214
35.5   56.5    56.5    0.      0.      40.     100.    45.             .5              215
35.7   56.5    56.5    0.      0.      40.     100.    45.             .5              216
36     -2.6    -21.9   -14.3   -37.9   -42.3   56.2    -45.    -12.5                   217
37                                                                                     218
38     HEAD                                    1.      1.                              219
39     THORAX                                  2.      1.                              219
40     PELVIS                                  4.      1.                              219
41     KNEE                                    5.      1.                              219
42     SHIN                                    6.      1.                              219
43     FOOT                                    6.      1.                              219
44     ELBOW                                   7.      1.                              219
45     HAND                                    8.      3.                              219
46     HEAD                    -.3     -2.7    8.8     11.0                            220
47     THORAX                  -3.3    -.3     15.9    9.3                             220
48     PELVIS                  3.4     -.5     12.4    12.4                            220
49     KNEE                    16.2    -.3     4.9     4.9                             220
50     SHIN                    -16.5   -.9     11.0    3.1                             220
51     FOOT                    24.0    -4.5    5.5     11.5                            220
52     ELBOW                   16.6    -.1     3.4     3.4                             220
53     HAND                    21.2    -.8     2.4     2.4                             220
54       980.9     0.0     0.0                                                         242
55     DRIVER ORIENTATION                                                              300
56       76.0    100.5   114.8   152.7    15.0   -41.2   -34.5   -22.0    78.6         301
57                                                                                     302
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 58     -16.3    0.0   -27.7    0.0    8.5     0.0                                303
 59       3.1    0.0     5.3    0.0                                               304
 60  LYNX INTERIOR PANEL                                                          400
 61  SEATBACK        MATSEATBACK        0.      1.      1.      1.                401
 62  SEATCUSHION     MATCUSHION         0.      1.      1.      1.                401
 63  SHIFTER         MATSHIFTER         0.      1.      1.      1.                401
 64  RADIO           MATRADIO           0.      1.      1.      1.                401
 65  DASH            MATDASH            0.      1.      1.      1.                401
 66  STEERWHL        MATSTEERWHL        0.      1.      1.      1.                401
 67  FLOOR           MATFLOOR           0.      1.      1.      1.                401
 68  FOOTCONT        MATFOOTCONT        0.      1.      1.      1.                401
 69  SEATBACK                1.     2.  1.      0.      0.                        402
 70  SEATCUSHION             2.     3.  1.      0.      0.                        402
 71  SHIFTER                 1.     4.  1.      0.      0.                        402
 72  RADIO                   1.     3.  1.      0.      0.                        402
 73  DASH                    1.     2.  1.      0.      0.                        402
 74  STEERWHL                1.     5.  1.      0.      0.                        402
 75  FLOOR                   1.     4.  1.      0.      0.                        402
 76  FOOTCONT                1.     4.  1.      0.      0.                        402
 77  MATSEATBACK             0.     0.  0.  2540.0  5080.        0.        0.     403
 78  MATCUSHION              0.     0.  0.  2540.0  5080.        0.        0.     403
 79  MATSHIFTER              0.     0.  0.  2540.0  5080.        0.        0.     403
 80  MATRADIO                0.     0.  0.  2540.0  5080.        0.        0.     403
 81  MATDASH                 0.     0.  0.  2540.0  5080.        0.        0.     403
 82  MATSTEERWHL             0.     0.  0.  2540.0  5080.        0.        0.     403
 83  MATFLOOR                0.     0.  0.  2540.0  5080.  10675.7  14010.1      403
 84  MATFOOTCONT             0.     0.  0.  2540.0  5080.        0.        0.     403
 85  MATSEATBACK          8.90     0.  0.      0.STSEAT   INSPIKE GRSEAT          404
 86  MATCUSHION           8.90     0.  0.      0.STCUSH   INSPIKE GRCUSH          404
 87  MATSHIFTER           8.90     0.  0.      0.STSHIFT  INSPIKE GRSHIFT         404
 88  MATRADIO             8.90     0.  0.      0.STRADIO  INSPIKE GRRADIO         404
 89  MATDASH              8.90     0.  0.      0.STDASH   INSPIKE GRDASH          404
 90  MATSTEERWHL          8.90     0.  0.      0.STSTEER  INSPIKE GRSTEER         404
 91  MATFLOOR             8.90     0.  0.      0.STFLOOR  INSPIKE GRFLOOR         404
 92  MATFOOTCONT          8.90     0.  0.      0.STFOOT   INSPIKE GRFOOTC         404
 93  GRSEAT        -1.      .1                                                    405
 94  GRSEAT        -1.     .85                                                    406
 95  GRCUSH        -1.      .1                                                    405
 96  GRCUSH        -1.     .85                                                    406
 97  GRSHIFT       -1.      .1                                                    405
 98  GRSHIFT       -1.     .85                                                    406
 99  GRRADIO       -1.      .8                                                    405
100  GRRADIO       -1.     .08                                                    406
101  GRDASH        -1.      .8                                                    405
102  GRDASH        -1.     .08                                                    406
103  GRSTEER       -1.     .95                                                    405
104  GRSTEER       -1.     .05                                                    406
105  GRFLOOR       -1.      .2                                                    405
106  GRFLOOR       -1.      .2                                                    406
107  GRFOOTC       -1.      .2                                                    405
108  GRFOOTC       -1.      .3                                                    406
109  STSEAT        -1.  136.60  -45.09   18.29   -3.14     .180                   407
110  STCUSH        -1.  257.44   25.93  -20.21    2.37                            407
111  STDASH        -1.  772.74  -75.60    2.55   .0182                            407
112  STFLOOR       -1. 1401.04                                                    407
113  STSTEER        0.      0.                                                    407
114  STSTEER      .254   6948.                                                    407
115  STSTEER     1.245   8340.                                                    407
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STSTEER    1.295  11121.                                                              407
STSTEER    1.905   8340.                                                              407
STSTEER     3.81   6948.                                                              407
STSTEER     6.10   4448.                                                              407
STSTEER     9.91   3336.                                                              407
STSTEER    20.32   3336.                                                              407
STSTEER     25.4  44482.                                                              407
STFOOT       -1. 1401.04                                                              407
STSHIFT      -1.  175.13                                                              407
STRADIO      -1.  772.74  -75.60     2.55   .0182                                     407
INSPIKE      -1.      O.                                                              408
SEATBACK        SEATBACK             50.8     .25       1.       1.                   409
CUSHIONFRONT    SEATCUSHION          50.8     .25       1.       1.                   409
CUSHIONBACK     SEATCUSHION          50.8     .25       1.       2.                   409
SHIFTER         SHIFTER              5.08     .25       1.       1.                   409
RADIO           RADIO                10.2     .25       1.       1.                   409
DASH            DASH                 10.2     .25       1.       1.                   409
STEERWHL        STEERWHL             5.08     .25       1.       1.                   409
FLOOR           FLOOR                50.8     .25       1.       1.                   409
FOOTCONT        FOOTCONT             50.8     .25       1.       1.                   409
SEATBACK                1.                                                            410
CUSHIONFRONT            1.                                                            410
CUSHIONBACK             1.                                                            410
SHIFTER                 1.                                                            410
RADIO                   1.                                                            410
DASH                    1.                                                            410
STEERWHL                1.                                                            410
FLOOR                   1.                                                            410
FOOTCONT                1.                                                            410
SEATBACK               -1.   -36.3    -68.5    -14.5      5.8                         411
CUSHIONFRONT           -1.     9.1      7.3     36.0      3.8                         411
CUSHIONBACK            -1.   -12.6      8.1      9.1      7.3                         411
SHIFTER                -1.    32.3     -3.7     44.6     -9.3                         411
RADIO                  -1.    47.7     -8.3     50.4    -20.3                         411
DASH                   -1.    40.4    -28.0     67.9      2.4                         411
STEERWHL               -1.    19.0    -18.6     38.7    -50.9                         411
FLOOR                  -1.    27.6     30.3     87.6     30.3                         411
FOOTCONT               -1.    82.5     30.3     95.0      -.5                         411
DRIVER RESTRAINT CONFIG                                                               500
32 KPH FRONTAL CRASH                                                                  600
     0.0    8.88     0.0     0.0      0.0      0.0       0.       0.       0.         601
      5.      1.      O.                                                              602
      O.      O.      5.  -12.07      75.   -12.07      80.       0.
    200.      O.
ADVANCED BELT SYSTEM                                                                  700
BELTMAT                 O.      O.       O.     100.     101.       O.      0.1       704
BELTMAT                10.      O.       O.       O.STBELT   INBELT   GRBELT          705
GRBELT       -1.       .50                                                            706
GRBELT       -1.       .50                                                            707
STBELT        O.        O.                                                            708
STBELT     .0012       32.                                                            708
STBELT     .0067       82.                                                            708
STBELT     .0132      157.                                                            708
STBELT     .0198      239.                                                            708
STBELT     .0264      283.                                                            708
STBELT     .0331      475.                                                            708
STBELT     .0430      762.                                                            708
STBELT     .0532     1115.                                                            708
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  174     STBELT      .0637   1527.                                                               708
  175     STBELT      .0744   2077.                                                               708
  176     STBELT      .0856   2819.                                                               708
  177     STBELT      .1004   3787.                                                               708
  178     STBELT      .1153   4855.                                                               708
  179     STBELT      .1304   5726.                                                               708
  180     STBELT      .1457   6316.                                                               708
  181     STBELT      .1610   6711.                                                               708
  182     STBELT      .1758   7226.                                                               708
  183     STBELT      .1909   8095.                                                               708
  184     STBELT      .2060   8854.                                                               708
  185     STBELT      .2213   9420.                                                               708
  186     STBELT      .2349   9834.                                                               708
  187     STBELT      .2451  10069.                                                               708
  188     STBELT      .2554  10118.                                                               708
  189     STBELT      .2657   9961.                                                               708
  190     STBELT      .2760   9705.                                                               708
  191     STBELT      .2816   9366.                                                               708
  192     STBELT      .2819   8925.                                                               708
  193     STBELT      .2823   8457.                                                               708
  194     STBELT      .2826   7983.                                                               708
  195     STBELT      .2830   7532.                                                               708
  196     INBELT        -1.      0.                                                               709
  197          1.2      6.0   -51.4   -66.5      1.BELTMAT                                        710
  198          1.       9.5   -29.8    26.5      1.BELTMAT                                        711
  199          8.5     11.3   -29.8    26.5      1.BELTMAT                                        712
  200          8.5     11.3   -32.6    26.5      1.BELTMAT                                        713
  202           1.       1.      3.    21.6    21.6       1.       1.                             717
  203          -1.      20.   88.96                                                               718
  204         .150       .3     0.0      1.                                                       719
  205           3.       3.      0.      3.      1.       1.                                      720
  206     11.      10.      22.     23.5                                                          725
  208                                                                                             800
  209                                                                                            1000
 1501     16.      O.       O.       O.       O.       O.       1.       O.       O.             1501
 1600                                                                                            1600
 2000                                                                                            2000
 2001      0 1 1 0 0 1 1 0
 2002     O.        .15      .01
 2002.1   O.       O.       O.
 2003     1.       O.       O.
 2004     O.       1.       O.
 2005     O.       O.       -1.
 2005.1   1.       O.       O.
 2005.2   O.       1.       O.
 2005.3   O.       O.       1.
 2006     .5       .5       11.      8.5
 2007     .5       .5       10.      7.
 2008     -.8384   -.57     2.6166   1.83162 .005
 2009     LYNXD
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1982 MERCURY LYNX 2-PASSENGER FRONTAL IMPACT                                            100
O.      -10.     9.80665 O.      O.       150.     .5       2.       10.                101
       3.       O.       O.                                                             102
HEAD             SEATBACK                                                               106
THORAX           SEATBACK                                                               106
PELVIS           CUSHION                                                                106
FEET             FLOOR                                                                  106
KNEES            LOWPANEL                                                               106
LLEGS            LOWPANEL                                                               106
       O.       1.       1.       O.       O.       O.       O.       O.       1.       107
       O.       O.       O.       O.       O.       O.       O.       O.       1.       108
       1.       1.       O.       O.       O.       O.       O.       O.       O.       109
       O.       O.       O.       O.       O.       1.       1.       1.       1.       110
       O.       1.       1.       O.       O.       O.       O.       O.       O.       111
PASSENGER                                                                               200
     3.0     31.3     16.0      9.8     42.0      0.0     30.0      19.      6.2       201
     6.6     21.0     10.5      3.3     22.0     22.8     13.6     16.6      0.5       202
   3.1381 18.0252  1.7939  8.6579 13.0681    6.93  2.6837  3.0675  0.7320             203
.0141    .2051    .00678   .06      .1657    .0673    .0156    .0394                    204
20.      56.5     O.       O.       40.      100.              -45.     .5            205
20.      56.5     O.       O.       40.      100.              -45.     .5            206
56.5     56.5     O.       O.       40.      100.     -5.      -25.     .5            207
56.5     56.5     O.       O.       40.      100.     -23.     -53.     .5            208
56.5     56.5     O.       O.       40.      100.     13.5     -135.    .5            209
O.       82.5     O.       O.       40.      100.     144.     O.       .75           210
56.5     56.5     O.       O.       40.      100.     41.      -180.    .5            211
O.       250.     O.       O.       40.      100.     O.       -142.    .75           212
   980.9      0.0      0.0                                                              213
   980.9      0.0      0.0                                                              242
   O.         980.9    0.0                                  10.               0.5       214
56.5     56.5     O.       O.       40.      100.     45.               .5            215
56.5     56.5     O.       O.       40.      100.     45.               .5            216
-23.     -22.     -16.     -47.     -8.5     41.5     -8.5     -5.5                     217
                                                                                        218
HEAD                                         1.       1.                                219
THORAX                                       2.       1.                                219
PELVIS                                       5.       1.                                219
KNEES                                        5.       1.                                219
LLEGS                                        6.       1.                                219
FEET                                         6.       1.                                219
ELBOWS                                       7.       1.                                219
HANDS                                        8.       1.                                219
HEAD                      3.3      1.0      10.7     10.7                               220
THORAX                   -7.0     -1.2      18.2     10.3                               220
PELVIS                  -11.6      1.0      13.9      7.25                              220
KNEES                    20.1      0.0       5.7      5.7                               220
LLEGS                   -15.4     -1.6       7.4      3.9                               220
FEET                     18.1     -3.8       4.9      8.9                               220
ELBOWS                   17.5      1.6       4.4      4.4                               220
HANDS                    19.0      0.5       4.4      4.4                               220
      67.     112.     128.     175.      3.5      -38.     -59.5    -54.      90.      301
   -22.7       O.     -22.7      O.      12.8       O.                                  303
    -2.0       O.       8.9      O.                                                     304
VEHICLE  INTERIOR                                                                       400
FLOOR            MATFL                       O.       1.       1.       1.              401
CUSHION          MATCH                       O.       1.       1.       1.              401
SEATBACK         MATSB                       O.       1.       1.       1.              401
LOWPANEL         MATLP              O.       1.       1.       1.                       401
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  57    FLOOR                  2.      4.      1.      0.      0.                  402
  58    CUSHION                1.      3.      1.      0.      0.                  402
  59    SEATBACK               1.      2.      1.      0.      0.                  402
  59.1  LOWPANEL         1.      1.      1.      0.      0.                        402
  60    MATFL                  0.      0.      0.   1000.   2000.   2400.   8000.  403
  61    MATCH                  0.      0.      0.   1000.   2000.      0.      0.  403
  62    MATSB                  0.      0.      0.   1000.   2000.      0.      0.  403
  62.1  MATLP            0.      0.      0.      2540.   5080.   0.      0.        403
  63    MATFL                  2.      0.      0.      0.FLSTAT  INERZ   FLGR      404
  64    MATCH                  2.      0.      0.      0.CHSTAT  INERZ   CHGR      404
  65    MATSB                  2.      0.      0.      0.SBSTAT  INERZ   SBGR      404
  65.1  MATLP            8.9     0.      0.      0.      STDASH  INERZ   GRDASH    404
  66    FLGR          -1.      .2                                                  405
  67    FLGR          -1.      .2                                                  406
  68    CHGR          -1.      .1                                                  405
  69    CHGR          -1.     .85                                                  406
  70    SBGR          -1.      .1                                                  405
  71    SBGR          -1.     .85                                                  406
  71.1  GRDASH  -1.      .8                                                        405
  71.2  GRDASH  -1.      .08                                                       406
  72    FLSTAT        -1.    800.                                                  407
  73    CHSTAT        -1.    147.    37.6  -74.48   22.16                          407
  74    SBSTAT        -1.     78.   -67.4   -29.4    4.28                          407
  74.1  STDASH  -1.      772.74  -75.6   2.55    .0182                             407
  75    INERZ         -1.      0.                                                  408
  76    FLOOR            FLOOR           20.     .25     1.      1.                409
  77    TOEPAN           FLOOR           20.     .25     1.      2.                409
  78    CUSHION          CUSHION         20.     .25     1.      1.                409
  79    SEATBACK         SEATBACK        20.     .25     1.      1.                409
  79.1  LOWPANEL         LOWPANEL        20.     .25     1.      1.                409
  80    FLOOR                  1.                                                  410
  81    TOEPAN                 1.                                                  410
  82    CUSHION                1.                                                  410
  83    SEATBACK               1.                                                  410
  83.1  LOWPANEL         1.                                                        410
  84    FLOOR            -1.     0.      31.     84.     31.                       411
  85    TOEPAN           -1.     84.     31.     96.     1.                        411
  86    CUSHION          -1.     -23.    9.3     23.     3.5                       411
  87    SEATBACK         -1.     -23.    9.3     -42.5   -68.                      411
  87.1  LOWPANEL         -1.     62.     6.      40.5    -25.                      411
  88    32 KPH FRONTAL CRASH                                                       600
  89        0.0    8.88    0.0     0.0     0.0     0.0      0.      0.      0.     601
  90         5.     1.     0.                                                      602
  91         0.     0.     5.  -12.07     75.  -12.07     80.      0.
  92       200.     0.
  93    ADVANCED BELT SYSTEM                                                       700
  95    BLTMAT                 0.      0.      0.    100.    101.      0.     0.1  704
  96    BLTMAT                10.      0.      0.      0.BLTST   BLTIN   BLTGR     705
  97    BLTGR         -1.     .50                                                  706
  98    BLTGR         -1.     .50                                                  707
  99    BLTST      .0012      32.                                                  708
 100    BLTST      .0067      82.                                                  708
 101    BLTST      .0132     157.                                                  708
 102    BLTST      .0198     239.                                                  708
 103    BLTST      .0264     283.                                                  708
 104    BLTST      .0331     475.                                                  708
 105    BLTST      .0430     762.                                                  708
 106    BLTST      .0532    1115.                                                  708
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  107     BLTST       .0637   1527.                                                         708
  108     BLTST       .0744   2077.                                                         708
  109     BLTST       .0856   2819.                                                         708
  110     BLTST       .1004   3787.                                                         708
  111     BLTST       .1153   4855.                                                         708
  112     BLTST       .1304   5726.                                                         708
  113     BLTST       .1457   6316.                                                         708
  114     BLTST       .1610   6711.                                                         708
  115     BLTST       .1758   7226.                                                         708
  116     BLTST       .1909   8095.                                                         708
  117     BLTST       .2060   8854.                                                         708
  118     BLTST       .2213   9420.                                                         708
  119     BLTST       .2349   9834.                                                         708
  120     BLTST       .2451  10069.                                                         708
  121     BLTST       .2554  10118.                                                         708
  122     BLTST       .2657   9961.                                                         708
  123     BLTST       .2760   9705.                                                         708
  124     BLTST       .2816   9366.                                                         708
  125     BLTST       .2819   8925.                                                         708
  126     BLTST       .2823   8457.                                                         708
  127     BLTST       .2826   7983.                                                         708
  128     BLTST       .2830   7532.                                                         708
  129     BLTIN         -1.       O.                                                        709
  130     -2.     5.5     -55.    -65.8   5.      BLTMAT                                    710
  131     31.     9.5     -36.    27.     5.      BLTMAT                                    711
  132     6.5     17.8    -36.    27.     10.     BLTMAT                                    712
  133     6.5     17.8    -33.    27.     10.     BLTMAT                                    713
  135          1.      1.      2.     21.6    21.6      1.      1.                          717
  136     -1.     20.     20.                                                               718
  137        .150     .3     O.O      1.                                                    719
  138          3.      3.      O.      3.       1.      1.                                  720
  139        11.0    10.0    22.0    23.5                                                   725
  141                                                                                      1000
 1501     16.     O.      O.      O.      O.      O.      1.      O.      O.               1501
 1600
 2001      O 1 1 O O 1 1 O
 2002     O.      .15     .01
 2002.1   O.      O.      O.
 2003     1.      O.      O.
 2004     O.      1.      O.
 2005     O.      O.      -1.
 2005.1   1.      O.      O.
 2005.2   O.      1.      O.
 2005.3   O.      O.      1.
 2006     .5      .5      11.     8.5
 2007     .5      .5      10.     7.
 2008     -.8384  -.57    2.6166  1.83162 .005
 2009     LYNXP
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JULY 1984                                                                                A.1.A
SEVENTY NINE PLYMOTH TC3 OBLIQUE IMPACT                                                  A.1.B
                                                                                         A.1.C
  CM KGF SEC          0.0          0.0      -980.665                                    A.3
   6 150.001    .0005    .001    .0005                                                   A4
 0 010 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0                          A5
    20     19             NEW DUMMY                                                      B.1
PELV A11.4141.0157.942381.1847  1.0   1.0   1.0   1.0   1.0   1.0   0   1 B.2.A
L1L5 B2.365 .16761.10656.25484  1.0   1.0   1.0   1.0   1.0   1.0   0   2 B.2.A
T912 C4.753 .91358.64452.60318  1.0   1.0   1.0   1.0   1.0   1.0   0   3 B.2.A
T5T8 D4.753 .91358.64452.60318  1.0   1.0   1.0   1.0   1.0   1.0   0   4 B.2.A
T1T4 E1.078 .45664.32226.30159  1.0   1.0   1.0   1.0   1.0   1.0   0   5 B.2.A
NECK FO.965 .01480.01846.02291  1.0   1.0   1.0   1.0   1.0   1.0   0   6 B.2.A
HEAD G4.137 .20027.22155.14455  1.0   1.0   1.0   1.0   1.0   1.0   0   7 B.2.A
RSHO H2.376 .45664.32226.30159  1.0   1.0   1.0   1.0   1.0   1.0   0   8 B.2.A
RUAR I1.769 .11247.12253.02312  1.0   1.0   1.0   1.0   1.0   1.0   0   9 B.2.A
RLAR J2.022 .31077.30925.02015  1.0   1.0   1.0   1.0   1.0   1.0   0  10 B.2.A
LSHO K2.376 .45664.32226.30159  1.0   1.0   1.0   1.0   1.0   1.0   0  11 B.2.A
LUAR L1.769 .11247.12253.02312  1.0   1.0   1.0   1.0   1.0   1.0   0  12 B.2.A
LLAR M2.022 .31077.30925.02015  1.0   1.0   1.0   1.0   1.0   1.0   0  13 B.2.A
THOR N7.129 1.3699.96678.90477  1.0   1.0   1.0   1.0   1.0   1.0   0  14 B.2.A
RULG O8.614 1.23091.3015.36712  1.0   1.0   1.0   1.0   1.0   1.0   0  15 B.2.A
RLLG P3.587 .52040.52834.06069  1.0   1.0   1.0   1.0   1.0   1.0   0  16 B.2.A
RFOT QO.981 .00873.04297.04413  1.0   1.0   1.0   1.0   1.0   1.0   0  17 B.2.A
LULG R8.614 1.23091.3015.36712  1.0   1.0   1.0   1.0   1.0   1.0   0  18 B.2.A
LLLG S3.587 .52040.52834.06069  1.0   1.0   1.0   1.0   1.0   1.0   0  19 B.2.A
LFOT TO.981 .00873.04297.04413  1.0   1.0   1.0   1.0   1.0   1.0   0  20 B.2.A
W     1    1  -2   1.2   0.0   2.4  -4.1   0.0  -8.5                 1 B.3.A
                   0.0 26.12   0.0   0.0 -6.83   0.0             3 2 1 3 2 1
S1    2    2  -2  -5.5   0.0   7.1  4.58   0.0 -5.95                 2 B.3.A
                   0.0  10.8   0.0   0.0 -17.3   0.0             3 2 1 3 2 1        2 B.3.B
S2    3    3  -2   .36   0.0  6.26  3.05   0.0 -5.88                 3 B.3.A
                   0.0  -3.4   0.0   0.0  -3.4   0.0             3 2 1 3 2 1        3 B.3.B
S3    4    4  -2  2.52   0.0  5.11   0.0   0.0 -5.34                 4 B.3.A
                   0.0 20.56   0.0   0.0 20.56   0.0             3 2 1 3 2 1        4 B.3.B
S4    5    5  -2  2.67   0.0  2.21   1.8   0.0  -4.2               . 5 B.3.A
                  00.0  1.45   0.0   0.0-22.14   0.0             3 2 1 3 2 1        5 B.3.B
HN    6    6  -2  -2.7   0.0   6.8  -2.1   0.0  -5.7                 6 B.3.A
                   0.0 -4.36   0.0   0.0 20.15   0.0             3 2 1 3 2 1        6 B.3.B
RSC   7    4  -2  10.1  -2.0   8.8   4.1   8.7   4.0                 7 B.3.A
                   0.0 -90.0 -76.0   0.0 -90.0 -76.0             3 2 1 3 2 1        7 B.3.B
RGH   8    8  -2   0.0  -4.3   0.0  -.45   0.3  13.0                 8 B.3.A
               52.9  27.55 121.4 77.43 38.03 184.47              3 2 1 3 2 1B3A2
RE    9    9  -1-2.2  .9    -16.5 -.48  -.19  16.76                B3A1
               173.52 67.61178.  206.3 -16.02181.24              3 2 1 3 2 1        9 B.3.B
LSC   !    4  -2  10.1   4.3   8.8   4.1  -8.7   4.0                10 B.3.A
                   0.0 -90.0  76.0   0.0 -90.0  76.0             3 2 1 3 2 1       10 B.3.B
LGH   "   11  -2   0.0   4.3   0.0  -.45  -0.3  13.0                11 B.3.A
               127.1 -27.55121.4 102.57-38.03184.47              3 2 1 3 2 1B3A2
LE    #   12  -1 -2.2   -0.9 -16.5  -.48   .19 16.76                12 B.3.A
               186.47 67.61 182.0 153.7-16.02178.76              3 2 1 3 2 1       12 B.3.B
T     $    4   1 2.6     0.0  5.2   -8.5   0.0  12.2                13 B.3.A
                   0.0   0.0   0.0   0.0   0.0   0.0             3 2 1 3 2 1       13 B.3.B
RHP   %    1  -2  2.08  -8.2 -7.27   0.7   5.7  20.7                14 B.3.A
               174.6749.069166.59182.65.85947172.67              3 2 1 3 2 1       14 B.3.B
RKN   &   15  -1  -0.6  -1.5 -21.8   2.3   0.9  17.0                15 B.3.A
               147.61-70.63210.49191.89 5.838178.17              3 2 1 3 2 1       15 B.3.B
RAKL  (   16  -2  1.19   2.0 -24.4 -4.71  1.46  6.42                16 B.3.A
```

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                      141.39 87.62134.03192.16 71.42197.25              3 2 1 3 2 1          16 B.3.B
LHP  )   1  -2  2.08    8.2 -7.27   0.7  -5.7  20.7                        17 B.3.A
                      185.3349.069193.41177.33-.8594187.33              3 2 1 3 2 1          17 B.3.B
LKN  *  18  -1  -0.6    1.5 -21.8   2.3  -0.9  17.0                        18 B.3.A
                       32.39 70.63210.49-11.89 5.838178.17              3 2 1 3 2 1          18 B.3.B
LAKL =  19  -2  1.19   -2.0 -24.4 -4.71 -1.46  6.42                        19 B.3.A
                       38.61-87.62134.03-12.16-71.42197.25              3 2 1 3 2 1          19 B.3.B
 65.6   56.5   0.0   0.5  15.0        56.5  56.5   0.0   0.5  10.0          1 B.4.A
 144.3  56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0          2 B.4.A
 144.3  56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0          3 B.4.A
 144.3  56.5   0.0   0.5  10.0       56.5   56.5   0.0   0.5  10.0          4 B.4.A
 16.3   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0          5 B.4.A
 25.5   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0          6 B.4.A
 25.    56.5   0.0   0.5  22.0        56.5  56.5   0.0   0.5  22.0          7 B.4.A
 25.    56.5   0.0   0.5  55.0        56.5  56.5   0.0   0.5  55.0          8 B.4.A
   0.0 250.0   0.0  0.75  71.0         0.0   0.0   0.0   0.0   0.0          9 B.4.A
 25.    56.5   0.0   0.5  22.0        56.5  56.5   0.0   0.5  22.0         10 B.4.A
 25.    56.5   0.0   0.5  55.0        56.5  56.5   0.0   0.5  55.0         11 B.4.A
   0.0 250.0   0.0  0.75  71.0         0.0   0.0   0.0   0.0   0.0         12 B.4.A
   0.0   0.0   0.0   0.0   0.0         0.0   0.0   0.0   0.0   0.0         13 B.4.A
  56.5  56.5   0.0   0.5  40.0        56.5  56.5   0.0   0.5  40.0         14 B.4.A
   0.0  82.5   0.0  0.75  72.0         0.0   0.0   0.0   0.0   0.0         15 B.4.A
  56.5  56.5   0.0   0.5  30.0        56.5  56.5   0.0   0.5  40.0         16 B.4.A
  56.5  56.5   0.0  0.75  40.0        56.5  56.5   0.0   0.5  40.0         17 B.4.A
   0.0  82.5   0.0  0.75  72.0         0.0   0.0   0.0   0.0   0.0         18 B.4.A
  56.5  56.5   0.0  0.75  30.0        56.5  56.5   0.0   0.5  40.0         19 B.4.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                1 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                2 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                3 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                4 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                5 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                6 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                7 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                8 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0                9 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               10 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               11 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               12 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               13 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               14 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               15 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               16 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               17 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               18 B.5.A
   0.0 300.0 100.0 300.0   0.0                     0.0   0.0               19 B.5.A
                                    00.1 00.10 00.10 00.01 00.01 00.01    B.6
                                    00.1 00.10 00.1
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.10 00.10
                                    00.1 00.1  00.1
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Listing of TC3 at 15:42:20 on AUG 30, 1985 for CCId=SUSP

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117                                                    00.1 00.1  00.1
118                                                    00.1 00.1  00.1
119                                                    00.1 00.1  00.1
120                                                    00.1 00.1  00.1
121                                                    00.1 00.1  00.1
122                                                    00.1 00.1  00.1
123                                                    00.1 00.1  00.1                                        C.1
124   SEVENTY NINE PLYMOUTH TC3                                                                               C.2.A
125    10.06   0.0        1749.1      0.     0.0    0.0    0.0      60    0.0.00294
126      0.0  7.64 12.25 12.65 13.04 13.43 13.83 14.22 14.61 15.00 18.63 25.00
127    31.38 37.76 44.14 39.72 29.92 24.12 22.95 21.78 20.60 19.42 18.24 17.06
128    15.89 14.71 13.53 12.35 11.18 10.00  8.82  7.64  6.47  5.29  4.11  2.93                                C3A
129   1.76   .6     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.                         C3A
130   0.     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.     0.                          D.1
133       18      0     0     20           1                        0      0      0                         1 D.2.A
134        1     STEERWHL                                                                                   D.2.C
135                .7          19.0         14.2                                                            D.2.B
136             -15.0          19.0        -20.8                                                            D.2.D
137                .7         -19.0         14.2                                                          2 D.2.A
138        2     APILLAR                                                                                    D.2.B
139              17.0          32.0          0.0                                                            D.2.C
140              28.6          30.0          0.0                                                            D.2.D
141             -17.0          15.7         44.0                                                          3 D.2.A
142        3     LDOORPANEL                                                                                 D.2.C
143              80.           33.7          1.0                                                            D.2.D
144             -80.0          33.7          0.0                                                            D.2.B
145              80.0          33.7        -65.0                                                          4 D.2.A
146        4     DRIVDOOR                                                                                   D.2.C
147              80.           33.7          1.0                                                            D.2.D
148             -80.0          33.7          0.0                                                            D.2.B
149              80.0          33.7        -65.0                                                          5 D.2.A
150        5     FLOOR                                                                                      D.2.B
151              60.0          50.0        -61.0                                                            D.2.C
152             -30.0          50.0        -61.0
153              60.0         -50.0        -61.0                                                          5 D.2.A
154        6     LLOWPANEL
155    39.          0.                -44.4
156    19.          0.                -9.2
157    39.          40.               -44.4                                                               6 D.2.A
158        7     LIGHTKNOB                                                                                  D.2.C
159              17.5          25.0        -14.0                                                            D.2.B
160              17.5          25.0        -12.0                                                            D.2.D
161              17.5          27.0        -14.0                                                          7 D.2.A
162        8     RLOWPANEL
163    19.          40.               -9.4
164    39.          40.               -45.
165    19.         -48.               -9.4                                                                9 D.2.A
166        9     UNDERSTCOLUMN                                                                              D.2.B
167               0.0          -4.0        -12.5                                                            D.2.D
168               0.0           4.0        -12.5                                                            D.2.C
169              30.7          -4.0        -28.0                                                         10 D.2.A
170       10     RIGHTSTCOLUMN                                                                              D.2.B
171               0.0          -4.0        -12.5                                                            D.2.D
172              30.7          -4.0        -28.0                                                            D.2.C
173               2.8          -6.0         -7.5                                                         11 D.2.A
174       11     CUSHION
175    3.5          25.               -41.17                                                                D.2.D
176             -56.5          25.0        -49.0
```

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3.5         -25.         -41.17
  12     LOWSEATBACK                                                                12 D.2.B
       -56.5       22.0        -47.0                                                     D.2.B
       -73.5       22.0         -4.0                                                     D.2.D
       -56.5      -22.0        -47.0                                                     D.2.C
  13     UPPSEATBACK                                                                13 D.2.A
       -73.5      -22.0         -4.0                                                     D.2.C
       -73.5       22.0         -4.0                                                     D.2.B
       -80.5      -22.0         24.0                                                     D.2.D
  14     LWINDOW                                                                    14 D.2.A
        36.0       33.6          0.0                                                     D.2.B
        36.0       19.0         34.0                                                     D.2.C
       -87.0       33.6          0.0                                                     D.2.D
  15     MIDDASH                                                                    15 D.2.A
22.5        -36.       -24.                                                            D2
22.6        -36.        6.                                                             D2
22.5         36.       -24.                                                            D2
  16     BACKBONE                                                                   16 D.2.A
        -7.1       -18.         13.0                                                          D.2.B
         1.0       -18.         -8.4                                                            D.2.C
        -7.1        18.         13.0
  17     TOEPAN
        37.0       50.0        -71.0
        37.0      -50.0        -71.0
        79.4       50.0        -24.5
  18     WINDSHIELD                                                                    D2
28.6         36.         O.                                                            D2
28.6        -36.         O.                                                            D2
-5.4         36.         44.                                                           D2
      1  12.9  20.3   9.1  .846   0.0 -9.81   0.0  40.3    0.0                       1 D.5.A
      2   7.4  16.8  12.5   5.8   0.0 -0.76   0.0  -6.8    0.0                       2 D.5.A
      3   2.4   10. 7.073 -2.67   0.0 -0.76   0.0-17.3     0.0                       3 D.5.A
      6 5.725   5.8 7.529   0.0   0.0   0.0   0.0-22.22    0.0                       6 D.5.A
      7 9.294   8.013.059 0.764   0.0-2.648   0.0-10.86    0.0                       7 D.5.A
      8   4.8   4.8   4.8    O.  -4.3      0.110.97 19.29237.13                      8 D.5.A
      9  14.2   4.3   5.0 -1.32  0.63   -4.2162.4786.96891.585                       9 D.5.A
     10  15.2   3.8   3.8  0.11 -0.21   -1.0-56.46   90.0 14.78                     10 D.5.A
     11   4.8   4.8   4.8    O.  4.3       O. 69.02-19.93237.13                     11 D.5.A
     12  14.2   4.3   5.0 -1.32 -0.63   -4.2197.5186.92591.612                      12 D.5.A
     13  15.2   3.8   3.8  0.11  0.21   -1.056.458   90.014.783                     13 D.5.A
     14  9.89  14.5 17.07-2.235   0.0      1.   0.0 -20.8    0.0                    14 D.5.A
     15  20.3   8.0   8.0 -1.82  0.56   0.01260.35 80.36163.89                      15 D.5.A
     16  14.8   5.1   5.1  2.38  1.27   5.99135.11 87.86   23.1                     16 D.5.A
     17  10.3   6.0   6.0  1.06 -0.45   3.06   0.0   0.0    0.0                     17 D.5.A
     18  20.3   8.0   8.0 -1.82 -0.56   0.01 99.65 80.36  16.11                     18 D.5.A
     19  14.8   5.1   5.1  2.38 -1.27   5.99224.89 87.86  156.9                     19 D.5.A
     20  10.3   6.0   6.0  1.06  0.45   3.06   0.0   0.0    0.0                     20 D.5.A
     22   5.5   5.5   5.5 -0.58 -1.51-21.79-32.39 70.65 149.5                       22 D.5.A
     235.5   5.5   5.5   -.58  1.51  -21.7932.39 70.65 30.5                         23
                                                                                       D.7
                                                                                       D.7
   3 140.    O.    O.    3.5   O.    -1.1   13.   -500. O.    O.     O.          D8
   1     DASHSTAT                                                                  1 E.1
O             1000000.    O                                                        1 E.2
              57.54       2.78         .77                                        E3
   2     CUSHIONSTAT                                                               2 E.1
O             1000000.    O                                                        2 E.2
              26.25126    2.643656     -2.0616064  0.241544                        2 E.3
```

```
 231         3   SEATBACKSTAT                                                             3 E.1
 232     0           1000000.     0                                                       3 E.2
 233                 13.92924    -4.598274   1.865632    -0.32046    0.0183629            3 E.3
 234         4   FLOORSTAT                                                                4 E.1
 235     0           -10.         0                                                       4 E.2
 235.1         3                                                                           E4
 236     O.          O.           2.          50.         10.         1500.                E4
 237         5   WINDSHSTAT                                                               5 E.1
 238     0           1000000.     0                                                       5 E.2
 239                 357.16                                                               5 E.3
 240         6   HEADERSTAT                                                               6 E.1
 241     0           1000000.     0                                                       6 E.2
 242                 714.32                                                               6 E.3
 243         7   BOLDSTERDSTAT                                                            7 E.1
 244     0           -2449.399    0                                                       7 E.2
 245           3                                                                          7 E.4.A
 246     O.          O.           9.          1600.       10.         3000.
 247         8   STRWHLSTAT                                                               8 E.1
 248     0           -4535.924                                                            8 E.2
 249          10                                                                          8 E.4.A
 250     0.0         0.0          0.254       708.511     1.245       850.486             8 E.4.B
 251     1.295       1133.981     1.905       850.486     3.81        708.511             8 E.4.C
 252     6.096       453.592      9.906       340.194     20.32       340.194             8 E.4.D
 253     25.4        4535.924                                                             8 E.4.E
 254         9   ROOFSTAT                                                                 9 E.1
 255     0           -5896.70                                                             9 E.2
 256           3                                                                          9 E.4.A
 257     0.0         0.0          5.08        907.185     7.62        5896.701            9 E.4.B
 258        10   FRIC=0.1                                                                   E.1
 259     O.          O.           0.1                                                       E.2
 260        11   G=O. TO 0.95                                                               E.1
 261     O.          -1000.       O.                                                        E.2
 262           4                                                                            E.4.A
 263     O.          O.           0.5         O.          0.6         0.95                  E.4.B
 264     1000.       0.95                                                                   E.4.B
 265        12   R=1. TO 0.05                                                               E.1
 266     O.          -1000.       O.                                                        E.2
 267           4                                                                            E.4.A
 268     O.          1.           0.5         1.          0.6         0.05                  E.4.B
 269     1000.       0.05                                                                   E.4.B
 270        13   THORAXSTAT                                                                 E.1
 271     O.          -110.2       O.                                                        E.2
 272           4                                                                            E.4.A
 273     O.          O.           1.06        455.        10.2        455.                  E.4.B
 274     110.2       43355.                                                                 E.4.B
 274.1      14   NUTOEPANSTAT
 274.2   O.          -12.
 274.3         3
 274.4   O.          O.           7.          1143.       12.         4000.
 274.5      15   FRIC=1.                                                                   E1
 274.6   O.          O.           1.                                                       E2
 275       999   ENDFUCTINPUT                                                            10 E.1
 276         3   2   5   5   2   2   1   2   1   3   3   1   2   3   5   1   2   2          F.1
 277         1  21   8   8   8   0  12  11  10                                            1 F.1.A
 278         1  21   9   9   8   0  12  11  10                                            1 F.1.B
 281         1  21  14  14   8   0  12  11  10                                            1 F.1.E
 282         2  21   6   6   6   0  12  11  10                                            2 F.1.A
 283         2  21   7   7   6   0  12  11  10                                            2 F.1.B
```

284	3	21	1	1	9	0	12	11	10				3	F.1.A
285	3	21	2	2	9	0	12	11	10				3	F.1.B
286	3	21	3	3	9	0	12	11	10				3	F.1.C
287	3	21	11	11	9	0	12	11	10				3	F.1.D
288	3	21	12	12	9	0	12	11	10				3	F.1.E
289	4	21	13	13	9	0	12	11	10				4	F.1.A
290	4	21	14	14	9	0	12	11	10				4	F.1.B
290.1	4	21	17	17	9	0	12	11	10					
290.2	4	21	18	23	9	0	12	11	10					
290.3	4	21	20	20	9	0	12	11	10					
291	5	21	17	17	4	0	12	11	10				5	F.1.A
292	5	21	20	20	4	0	12	11	10				5	F.1.B
293	6	21	18	23	7	0	12	11	10				6	F.1.A
294	6	21	19	19	7	0	12	11	10				6	F.1.B
295	7	21	13	13	6	0	12	11	10				7	F.1.A
296	8	21	15	22	7	0	12	11	10				8	F.1.A
297	8	21	16	16	7	0	12	11	10				8	F.1.B
298	9	21	15	15	6	0	12	11	10				9	F.1.A
299	10	21	10	10	8	0	12	11	10				10	F.1.A
300	10	21	15	22	8	0	12	11	10				10	F.1.B
301	10	21	16	16	8	0	12	11	10				10	F.1.C
302	11	21	1	1	2	0	12	11	10				11	F.1.A
303	11	21	15	15	2	0	12	11	10				11	F.1.B
304	11	21	18	18	2	0	12	11	10				11	F.1.C
305	12	21	3	3	3	0	12	11	10				12	F.1.A
306	13	21	6	6	3	0	12	11	10				13	F.1.A
307	13	21	7	7	3	0	12	11	10				13	F.1.B
308	14	21	6	6	5	0	12	11	10				14	F.1.A
309	14	21	7	7	5	0	12	11	10				14	F.1.B
310	14	21	11	11	5	0	12	11	10				14	F.1.C
311	15	21	8	8	1	0	12	11	10					F1
312	15	21	10	10	1	0	12	11	10					F1
312.1	15	21	11	11	1	0	12	11	10					F1
312.2	15	21	13	13	1	0	12	11	10					F1
312.3	15	21	14	14	1	0	12	11	10					F1
313	16	3	14	14	13	0	12	11	10				16	F.1.A
314	17	21	17	17	14	0	12	11	10					
315	17	21	20	20	14	0	12	11	10					
315.1	18	21	6	6	5	0	12	11	10					F1
315.2	18	21	7	7	5	0	12	11	10					F1
316														F.3.A
317														F.3.B
318														F.4.A
319														F.4.B
320		0.0		0.0			0.0							G.1.A
321		-47.4		0.0			-36.3						1	G.2.A
322		0.0		-61.045			0.0						1	G.3.A
323		0.0		-28.099			0.0						2	G.3.A
324		0.0		0.0			0.0						3	G.3.A
325		0.0		0.0			0.0						4	G.3.A
326		0.0		0.0			0.0						5	G.3.A
327		0.0		20.793			0.0						6	G.3.A
328		0.0		-3.859			0.0						7	G.3.A
329		0.0		0.0			0.0						8	G.3.A
330		23.910		-48.245			-25.489			3	2	1	9	G.3.A
331		207.302		-45.890			171.889			3	2	1	10	G.3.A
332		0.0		0.0			0.0			3	2	1	11	G.3.A
333		-23.910		-48.245			25.489			3	2	1	12	G.3.A

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 334        152.698    -45.890   188.111                                  3   2   1   13 G.3.A
 335          0.0        0.0       0.0                                    3   2   1   14 G.3.A
 336        196.876    -68.125   166.277                                  3   2   1   15 G.3.A
 337        -28.900    -37.734    23.094                                  3   2   1   16 G.3.A
 338        -21.762    -57.352    25.473                                  3   2   1   17 G.3.A
 339        163.124    -68.125   193.723                                  3   2   1   18 G.3.A
 340         28.900    -37.734   -23.094                                  3   2   1   19 G.3.A
 341         21.762    -57.352   -25.473                                  3   2   1   20 G.3.A
1001     O.       150.    2.          0                                               HO1
1002        1   2   3   4   5   6   7   8   9  12                                     HO2
1003                                                                                  HO3
1004       20   O  10.          O.          O.                                        H1
1005            O  20.          O.          O.                                        H1
1006            O  30.          O.          O.                                        H1
1007            O  40.          O.          O.                                        H1
1008            O  50.          O.          O.                                        H1
1009            O  60.          O.          O.                                        H1
1010            O  70.          O.          O.                                        H1
1011            O  80.          O.          O.                                        H1
1012            O  90.          O.          O.                                        H1
1013            O 100.          O.          O.                                        H1
1014            O 110.          O.          O.                                        H1
1015            O 120.          O.          O.                                        H1
1016            O 130.          O.          O.                                        H1
1017            O 140.          O.          O.                                        H1
1018            O 150.          O.          O.                                        H1
1019            O 160.          O.          O.                                        H1
1020            O 170.          O.          O.                                        H1
1021            O 180.          O.          O.                                        H1
1022            O 190.          O.          O.                                        H1
1023            O 200.          O.          O.                                        H1
1024       20   O  10.          O.          O.                                        H2
1025            O  20.          O.          O.                                        H2
1026            O  30.          O.          O.                                        H2
1027            O  40.          O.          O.                                        H2
1028            O  50.          O.          O.                                        H2
1029            O  60.          O.          O.                                        H2
1030            O  70.          O.          O.                                        H2
1031            O  80.          O.          O.                                        H2
1032            O  90.          O.          O.                                        H2
1033            O 100.          O.          O.                                        H2
1034            O 110.          O.          O.                                        H2
1035            O 120.          O.          O.                                        H2
1036            O 130.          O.          O.                                        H2
1037            O 140.          O.          O.                                        H2
1038            O 150.          O.          O.                                        H2
1039            O 160.          O.          O.                                        H2
1040            O 170.          O.          O.                                        H2
1041            O 180.          O.          O.                                        H2
1042            O 190.          O.          O.                                        H2
1043            O 200.          O.          O.                                        H2
1044       20   O  10.          O.          O.                                        H3
1045            O  20.          O.          O.                                        H3
1046            O  30.          O.          O.                                        H3
1047            O  40.          O.          O.                                        H3
1048            O  50.          O.          O.                                        H3
1049            O  60.          O.          O.                                        H3
1050            O  70.          O.          O.                                        H3
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1051              0  80.       0.         0.                                        H3
1052              0  90.       0.         0.                                        H3
1053              0 100.       0.         0.                                        H3
1054              0 110.       0.         0.                                        H3
1055              0 120.       0.         0.                                        H3
1056              0 130.       0.         0.                                        H3
1057              0 140.       0.         0.                                        H3
1058              0 150.       0.         0.                                        H3
1059              0 160.       0.         0.                                        H3
1060              0 170.       0.         0.                                        H3
1061              0 180.       0.         0.                                        H3
1062              0 190.       0.         0.                                        H3
1063              0 200.       0.         0.                                        H3
1064         20     1    2    3    4    5    6    7    8    9    10               11H4
1065               12   13   14   15   16   17   18   19   20                       H4
1066         20     1    2    3    4    5    6    7    8    9    10               11H5
1067               12   13   14   15   16   17   18   19   20                       H5
1068         20     1    2    3    4    5    6    7    8    9    10               11H6
1069               12   13   14   15   16   17   18   19   20                       H6
1070         18     1    2    3    4    5    6    7    8    9    10               11H7
1071               12   14   15   16   17   18   19                                 H7
1072        7   4                                                                   H8
2001      0 1 1 1 0 3 1 0
2002      0.      .150    .010
2003      0.      0.      0.
2004      1.      0.      0.
2005      0.      1.      0.
2006      0.      0.      1.
2007      1.      0.      0.
2008      0.      1.      0.
2009      0.      0.      1.
2010      .5      .5      11.     8.5
2011      .5      .5      10.     7.
2012      -90.    -66.    180.    126.    1.
2013      TC3. XZ
2014      0.      1.      0.
2015      1.      0.      0.
2016      0.      0.      1.
2017      .5      9.      11.     8.5
2018      .5      .5      10.     7.
2019      -90.    -66.    180.    126.    1.
2020      TC3. YZ
2021      1.      0.      0.
2022      0.      0.      1.
2023      0.      1.      0.
2024      .5      17.5    11.     8.5
2025      .5      .5      10.     7.
2026      -90.    -66.    180.    126.    1.
2027      TC3. XY
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JULY 1984                                                                              A.1.A
SEVENTY NINE PLYMOTH TC3 OBLIQUE IMPACT                                                A.1.B
                                                                                       A.1.C
  CM KGF SEC           0.0          0.0    -980.665                                    A.3
   6 150.001    .0005    .001     .0005                                                A4
 0 010 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0                       A5
    20     19           NEW DUMMY                                                      B.1
PELV A11.4141.0157.942381.1847   1.0    1.0    1.0    1.0    1.0    1.0    0    1 B.2.A
L1L5 B2.365 .16761.10656.25484   1.0    1.0    1.0    1.0    1.0    1.0    0    2 B.2.A
T912 C4.753 .91358.64452.60318   1.0    1.0    1.0    1.0    1.0    1.0    0    3 B.2.A
T5T8 D4.753 .91358.64452.60318   1.0    1.0    1.0    1.0    1.0    1.0    0    4 B.2.A
T1T4 E1.078 .45664.32226.30159   1.0    1.0    1.0    1.0    1.0    1.0    0    5 B.2.A
NECK FO.965 .01480.01846.02291   1.0    1.0    1.0    1.0    1.0    1.0    0    6 B.2.A
HEAD G4.137 .20027.22155.14455   1.0    1.0    1.0    1.0    1.0    1.0    0    7 B.2.A
RSHO H2.376 .45664.32226.30159   1.0    1.0    1.0    1.0    1.0    1.0    0    8 B.2.A
RUAR I1.769 .11247.12253.02312   1.0    1.0    1.0    1.0    1.0    1.0    0    9 B.2.A
RLAR J2.022 .31077.30925.02015   1.0    1.0    1.0    1.0    1.0    1.0    0   10 B.2.A
LSHO K2.376 .45664.32226.30159   1.0    1.0    1.0    1.0    1.0    1.0    0   11 B.2.A
LUAR L1.769 .11247.12253.02312   1.0    1.0    1.0    1.0    1.0    1.0    0   12 B.2.A
LLAR M2.022 .31077.30925.02015   1.0    1.0    1.0    1.0    1.0    1.0    0   13 B.2.A
THOR N7.129 1.3699.96678.90477   1.0    1.0    1.0    1.0    1.0    1.0    0   14 B.2.A
RULG O8.614 1.23091.3015.36712   1.0    1.0    1.0    1.0    1.0    1.0    0   15 B.2.A
RLLG P3.587 .52040.52834.06069   1.0    1.0    1.0    1.0    1.0    1.0    0   16 B.2.A
RFOT QO.981 .00873.04297.04413   1.0    1.0    1.0    1.0    1.0    1.0    0   17 B.2.A
LULG R8.614 1.23091.3015.36712   1.0    1.0    1.0    1.0    1.0    1.0    0   18 B.2.A
LLLG S3.587 .52040.52834.06069   1.0    1.0    1.0    1.0    1.0    1.0    0   19 B.2.A
LFOT TO.981 .00873.04297.04413   1.0    1.0    1.0    1.0    1.0    1.0    0   20 B.2.A
W     1   1  -2   1.2   0.0   2.4  -4.1   0.0  -8.5                              1 B.3.A
                  0.0 26.12   0.0   0.0 -6.83   0.0                        3 2 1 3 2 1
S1    2   2  -2  -5.5   0.0   7.1  4.58   0.0 -5.95                              2 B.3.A
                  0.0  10.8   0.0   0.0 -17.3   0.0                        3 2 1 3 2 1          2 B.3.B
S2    3   3  -2   .36   0.0  6.26  3.05   0.0 -5.88                              3 B.3.A
                  0.0  -3.4   0.0   0.0  -3.4   0.0                        3 2 1 3 2 1          3 B.3.B
S3    4   4  -2  2.52   0.0  5.11   0.0   0.0 -5.34                              4 B.3.A
                  0.0 20.56   0.0   0.0 20.56   0.0                        3 2 1 3 2 1          4 B.3.B
S4    5   5  -2  2.67   0.0  2.21   1.8   0.0  -4.2                              5 B.3.A
                 00.0  1.45   0.0   0.0-22.14   0.0                        3 2 1 3 2 1          5 B.3.B
HN    6   6  -2  -2.7   0.0   6.8  -2.1   0.0  -5.7                              6 B.3.A
                  0.0 -4.36   0.0   0.0 20.15   0.0                        3 2 1 3 2 1          6 B.3.B
RSC   7   4  -2  10.1  -2.0   8.8   4.1   8.7   4.0                              7 B.3.A
                  0.0 -90.0 -76.0   0.0 -90.0 -76.0                        3 2 1 3 2 1          7 B.3.B
RGH   8   8  -2   0.0  -4.3   0.0  -.45   0.3  13.0                              8 B.3.A
               52.9  27.55 121.4 77.43 38.03 184.47                        3 2 1 3 2 1B3A2
RE    9   9  -1-2.2  .9    -16.5 -.48  -.19  16.76                            B3A1
               173.52 67.61178.  206.3 -16.02181.24                        3 2 1 3 2 1          9 B.3.B
LSC   !   4  -2  10.1   4.3   8.8   4.1  -8.7   4.0                             10 B.3.A
                  0.0 -90.0  76.0   0.0 -90.0  76.0                        3 2 1 3 2 1         10 B.3.B
LGH   "  11  -2   0.0   4.3   0.0  -.45  -0.3  13.0                             11 B.3.A
               127.1 -27.55121.4 102.57-38.03184.47                        3 2 1 3 2 1B3A2
LE    #  12  -1 -2.2   -0.9 -16.5  -.48   .19 16.76                             12 B.3.A
               186.47 67.61 182.0 153.7-16.02178.76                        3 2 1 3 2 1         12 B.3.B
T     $   4   1 2.6     0.0  5.2   -8.5   0.0  12.2                             13 B.3.A
                  0.0   0.0   0.0   0.0   0.0   0.0                        3 2 1 3 2 1         13 B.3.B
RHP   %   1  -2  2.08  -8.2 -7.27   0.7   5.7  20.7                             14 B.3.A
               174.6749.069166.59182.65.85947172.67                        3 2 1 3 2 1         14 B.3.B
RKN   &  15  -1  -0.6  -1.5 -21.8   2.3   0.9  17.0                             15 B.3.A
               147.61-70.63210.49191.89 5.838178.17                        3 2 1 3 2 1         15 B.3.B
RAKL  (  16  -2  1.19   2.0 -24.4 -4.71  1.46  6.42                             16 B.3.A
```

```
                      141.39 87.62134.03192.16 71.42197.25                  3 2 1 3 2 1          16 B.3.B
  LHP  )    1  -2  2.08    8.2 -7.27   0.7  -5.7  20.7                               17 B.3.A
                      185.3349.069193.41177.33-.8594187.33                  3 2 1 3 2 1          17 B.3.B
  LKN  *   18  -1  -0.6    1.5 -21.8   2.3  -0.9  17.0                               18 B.3.A
                       32.39 70.63210.49-11.89 5.838178.17                  3 2 1 3 2 1          18 B.3.B
  LAKL =   19  -2  1.19   -2.0 -24.4 -4.71 -1.46  6.42                               19 B.3.A
                       38.61-87.62134.03-12.16-71.42197.25                  3 2 1 3 2 1          19 B.3.B
   65.6   56.5   0.0   0.5  15.0        56.5  56.5   0.0   0.5  10.0         1 B.4.A
   144.3  56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0         2 B.4.A
   144.3  56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0         3 B.4.A
   144.3  56.5   0.0   0.5  10.0       56.5   56.5   0.0   0.5  10.0         4 B.4.A
   16.3   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0         5 B.4.A
   25.5   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0         6 B.4.A
   25.    56.5   0.0   0.5  22.0        56.5  56.5   0.0   0.5  22.0         7 B.4.A
   25.    56.5   0.0   0.5  55.0        56.5  56.5   0.0   0.5  55.0         8 B.4.A
     0.0 250.0   0.0  0.75  71.0         0.0   0.0   0.0   0.0   0.0         9 B.4.A
   25.    56.5   0.0   0.5  22.0        56.5  56.5   0.0   0.5  22.0        10 B.4.A
   25.    56.5   0.0   0.5  55.0        56.5  56.5   0.0   0.5  55.0        11 B.4.A
     0.0 250.0   0.0  0.75  71.0         0.0   0.0   0.0   0.0   0.0        12 B.4.A
     0.0   0.0   0.0   0.0   0.0         0.0   0.0   0.0   0.0   0.0        13 B.4.A
    56.5  56.5   0.0   0.5  40.0        56.5  56.5   0.0   0.5  40.0        14 B.4.A
     0.0  82.5   0.0  0.75  72.0         0.0   0.0   0.0   0.0   0.0        15 B.4.A
    56.5  56.5   0.0   0.5  30.0        56.5  56.5   0.0   0.5  40.0        16 B.4.A
    56.5  56.5   0.0  0.75  40.0        56.5  56.5   0.0   0.5  40.0        17 B.4.A
     0.0  82.5   0.0  0.75  72.0         0.0   0.0   0.0   0.0   0.0        18 B.4.A
    56.5  56.5   0.0  0.75  30.0        56.5  56.5   0.0   0.5  40.0        19 B.4.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               1 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               2 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               3 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               4 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               5 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               6 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               7 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               8 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0               9 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              10 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              11 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              12 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              13 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              14 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              15 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              16 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              17 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              18 B.5.A
     0.0 300.0 100.0 300.0   0.0                     0.0   0.0              19 B.5.A
                                        00.1 00.10 00.10 00.01 00.01 00.01     B.6
                                        00.1 00.10 00.1
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.10 00.10
                                        00.1 00.1  00.1
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117                                                 00.1 00.1  00.1
118                                                 00.1 00.1  00.1
119                                                 00.1 00.1  00.1
120                                                 00.1 00.1  00.1
121                                                 00.1 00.1  00.1
122                                                 00.1 00.1  00.1
123                                                 00.1 00.1  00.1
124     SEVENTY NINE PLYMOUTH TC3                                                        C.1
125      10.06   0.0     1749.1    0.    0.0   0.0   0.0    60   0.0.00294             C.2.A
126        0.0  7.64 12.25 12.65 13.04 13.43 13.83 14.22 14.61 15.00 18.63 25.00
127      31.38 37.76 44.14 39.72 29.92 24.12 22.95 21.78 20.60 19.42 18.24 17.06
128      15.89 14.71 13.53 12.35 11.18 10.00  8.82  7.64  6.47  5.29  4.11  2.93
129     1.76  .6    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.          C3A
130     0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.         C3A
133        18    2     0     20          1           0     0     0                     D.1
134       1     STEERWHL                                                             1 D.2.A
135               .7          19.0         14.2                                        D.2.C
136            -15.0          19.0        -20.8                                        D.2.B
137               .7         -19.0         14.2                                        D.2.D
138       2     APILLAR                                                              2 D.2.A
139             17.0          32.0          0.0                                        D.2.B
140             28.6          30.0          0.0                                        D.2.C
141            -17.0          15.7         44.0                                        D.2.D
142       3     LDOORPANEL                                                           3 D.2.A
143             80.           33.7          1.0                                        D.2.C
144            -80.0          33.7          0.0                                        D.2.D
145             80.0          33.7        -65.0                                        D.2.B
146       4     DRIVDOOR                                                             4 D.2.A
147             80.           33.7          1.0                                        D.2.C
148            -80.0          33.7          0.0                                        D.2.D
149             80.0          33.7        -65.0                                        D.2.B
150       5     FLOOR                                                                5 D.2.A
151             60.0          50.0        -61.0                                        D.2.B
152            -30.0          50.0        -61.0                                        D.2.C
153             60.0         -50.0        -61.0
154       6     LLOWPANEL                                                            5 D.2.A
155     39.           0.           -44.4
156     19.           0.            -9.2
157     39.           40.          -44.4
158       7     LIGHTKNOB                                                            6 D.2.A
159             17.5          25.0        -14.0                                        D.2.C
160             17.5          25.0        -12.0                                        D.2.B
161             17.5          27.0        -14.0                                        D.2.D
162       8     RLOWPANEL                                                            7 D.2.A
163     19.           40.           -9.4
164     39.           40.          -45.
165     19.          -48.           -9.4
166       9     UNDERSTCOLUMN                                                        9 D.2.A
167              0.0          -4.0        -12.5                                        D.2.B
168              0.0           4.0        -12.5                                        D.2.D
169             30.7          -4.0        -28.0                                        D.2.C
170      10     RIGHTSTCOLUMN                                                       10 D.2.A
171             0.0          -4.0        -12.5                                         D.2.B
172            30.7          -4.0        -28.0                                         D.2.D
173             2.8          -6.0         -7.5                                         D.2.C
174      11     CUSHION                                                             11 D.2.A
175     3.5           25.          -41.17
176            -56.5          25.0        -49.0                                        D.2.D
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177      3.5          -25.         -41.17
178       12     LOWSEATBACK                                                      12 D.2.B
179             -56.5       22.0         -47.0                                        D.2.B
180             -73.5       22.0          -4.0                                        D.2.D
181             -56.5      -22.0         -47.0                                        D.2.C
182       13     UPPSEATBACK                                                      13 D.2.A
183             -73.5      -22.0          -4.0                                        D.2.C
184             -73.5       22.0          -4.0                                        D.2.B
185             -80.5      -22.0          24.0                                        D.2.D
186       14     LWINDOW                                                          14 D.2.A
187              36.0       33.6           0.0                                        D.2.B
188              36.0       19.0          34.0                                        D.2.C
189             -87.0       33.6           0.0                                        D.2.D
190       15     MIDDASH                                                          15 D.2.A
191      22.5         -36.         -24.                                             D2
192      22.6         -36.          6.                                              D2
193      22.5          36.         -24.                                             D2
194       16     BACKBONE                                                         16 D.2.A
195              -7.1      -18.           13.0                                                  D.2.B
196               1.0      -18.           -8.4                                                     D.2.C
197              -7.1       18.           13.0
198       17     TOEPAN
199              37.0       50.0         -71.0
200              37.0      -50.0         -71.0
201              79.4       50.0         -24.5
201.1     18     WINDSHIELD                                                         D2
201.2    28.6          36.          0.                                              D2
201.3    28.6         -36.          0.                                              D2
201.4    -5.4          36.          44.                                             D2
201.5    LAP BELT                                                                 D3
201.51   -62.          26.5        -54.          -63.         -23.5       -56.      D3
201.52   1.15          0.          .84                        .01                   D3
201.53   SHOULDER BELT                                                            D3
201.54   -95.5         15.          37.          -63.         -23.5       -56.      D3
201.55   9.31          0.           3.5                        1.                   D3
202            1  12.9  20.3   9.1  .846   0.0 -9.81   0.0  40.3   0.0            1 D.5.A
203            2   7.4  16.8  12.5   5.8   0.0 -0.76   0.0  -6.8   0.0            2 D.5.A
204            3   2.4   10. 7.073 -2.67   0.0 -0.76   0.0-17.3    0.0            3 D.5.A
205            6 5.725   5.8 7.529   0.0   0.0   0.0   0.0-22.22   0.0            6 D.5.A
206            7 9.294   8.013.059 0.764   0.0-2.648   0.0-10.86   0.0            7 D.5.A
207            8   4.8   4.8   4.8    0.  -4.3      0.110.97 19.29237.13          8 D.5.A
208            9  14.2   4.3   5.0 -1.32  0.63   -4.2162.4786.96891.585           9 D.5.A
209           10  15.2   3.8   3.8  0.11 -0.21   -1.0-56.46  90.0 14.78          10 D.5.A
210           11   4.8   4.8   4.8    0. 4.3      0. 69.02-19.93237.13          11 D.5.A
211           12  14.2   4.3   5.0 -1.32 -0.63   -4.2197.5186.92591.612          12 D.5.A
212           13  15.2   3.8   3.8  0.11  0.21   -1.056.458  90.014.783          13 D.5.A
213           14  9.89  14.5 17.07-2.235   0.0    1.   0.0 -20.8   0.0          14 D.5.A
214           15  20.3   8.0   8.0 -1.82  0.56   0.01260.35 80.36163.89          15 D.5.A
215           16  14.8   5.1   5.1  2.38  1.27   5.99135.11 87.86  23.1          16 D.5.A
216           17  10.3   6.0   6.0  1.06 -0.45   3.06   0.0   0.0   0.0          17 D.5.A
217           18  20.3   8.0   8.0 -1.82 -0.56   0.01 99.65 80.36 16.11          18 D.5.A
218           19  14.8   5.1   5.1  2.38 -1.27   5.99224.89 87.86 156.9          19 D.5.A
219           20  10.3   6.0   6.0  1.06  0.45   3.06   0.0   0.0   0.0          20 D.5.A
220           22   5.5   5.5   5.5 -0.58 -1.51-21.79-32.39 70.65 149.5          22 D.5.A
221           235.5   5.5   5.5   -.58  1.51  -21.7932.39 70.65 30.5            23
222                                                                                 D.7
223                                                                                 D.7
224         3 140.    0.    0.    3.5   0.    -1.1  13.   -500. 0.    0.    0.    D8
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225		1	DASHSTAT					1 E.1
226	O		1000000.	O				1 E.2
227			57.54	2.78	.77			E3
228		2	CUSHIONSTAT					2 E.1
229	O		1000000.	O				2 E.2
230			26.25126	2.643656	-2.0616064	0.241544		2 E.3
231		3	SEATBACKSTAT					3 E.1
232	O		1000000.	O				3 E.2
233			13.92924	-4.598274	1.865632	-0.32046	0.0183629	3 E.3
234		4	FLOORSTAT					4 E.1
235	O		-10.	O				4 E.2
235.1		3						E4
236	O.		O.	2.	50.	10.	1500.	E4
237		5	WINDSHSTAT					5 E.1
238	O		1000000.	O				5 E.2
239			357.16					5 E.3
240		6	HEADERSTAT					6 E.1
241	O		1000000.	O				6 E.2
242			714.32					6 E.3
243		7	BOLDSTERDSTAT					7 E.1
244	O		-2449.399	O				7 E.2
245		3						7 E.4.A
246	O.		O.	9.	1600.	10.	3000.	
247		8	STRWHLSTAT					8 E.1
248	O		-4535.924					8 E.2
249		10						8 E.4.A
250	O.O		O.O	O.254	708.511	1.245	850.486	8 E.4.B
251	1.295		1133.981	1.905	850.486	3.81	708.511	8 E.4.C
252	6.096		453.592	9.906	340.194	20.32	340.194	8 E.4.D
253	25.4		4535.924					8 E.4.E
254		9	ROOFSTAT					9 E.1
255	O		-5896.70					9 E.2
256		3						9 E.4.A
257	O.O		O.O	5.08	907.185	7.62	5896.701	9 E.4.B
258		10	FRIC=O.1					E.1
259	O.		O.	O.1				E.2
260		11	G=O. TO O.95					E.1
261	O.		-1000.	O.				E.2
262		4						E.4.A
263	O.		O.	O.5	O.	O.6	O.95	E.4.B
264	1000.		O.95					E.4.B
265		12	R=1. TO O.05					E.1
266	O.		-1000.	O.				E.2
267		4						E.4.A
268	O.		1.	O.5	1.	O.6	O.05	E.4.B
269	1000.		O.05					E.4.B
270		13	THORAXSTAT					E.1
271	O.		-110.2	O.				E.2
272		4						E.4.A
273	O.		O.	1.06	455.	10.2	455.	E.4.B
274	110.2		43355.					E.4.B
274.1		14	NUTOEPANSTAT					
274.2	O.		-12.					
274.3		3						
274.4	O.		O.	7.	1143.	12.	4000.	
274.5		15	FRIC=1.					E1
274.6	O.		O.	1.				E2
274.71		16	LAP BELT FDF					E1

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274.72  O.          -1.5                                                              E2
274.73       5                                                                        E4
274.74  O.           O.          .125        70.          .254        400.            E4
274.75  1.25         800.        1.5         800.                                     E4
274.76    17     SHOULDER BELT FDF                                                    E1
274.77  O.          -1.25                                                             E2
274.78       5                                                                        E4
274.79  O.           O.          .0254       44.          .25         800.            E4
274.8   .95          900.        1.25        900.                                     E4
274.81    18     BELT R                                                               E1
274.82  O.           O.          .75                                                  E2
274.83    19     BELT G                                                               E1
274.84  O.           O.          .15                                                  E2
274.85    20     BELT CF                                                              E1
274.86                           1.                                                   E2
275       999    ENDFUCTINPUT                                                         10 E.1
276         3   2   5   5   2   2   1   2   1   3   3   1   2   3   5   1   2   2        F.1
277         1  21   8   8   8   O  12  11  10                                          1 F.1.A
278         1  21   9   9   8   O  12  11  10                                          1 F.1.B
281         1  21  14  14   8   O  12  11  10                                          1 F.1.E
282         2  21   6   6   6   O  12  11  10                                          2 F.1.A
283         2  21   7   7   6   O  12  11  10                                          2 F.1.B
284         3  21   1   1   9   O  12  11  10                                          3 F.1.A
285         3  21   2   2   9   O  12  11  10                                          3 F.1.B
286         3  21   3   3   9   O  12  11  10                                          3 F.1.C
287         3  21  11  11   9   O  12  11  10                                          3 F.1.D
288         3  21  12  12   9   O  12  11  10                                          3 F.1.E
289         4  21  13  13   9   O  12  11  10                                          4 F.1.A
290         4  21  14  14   9   O  12  11  10                                          4 F.1.B
290.1       4  21  17  17   9   O  12  11  10
290.2       4  21  18  23   9   O  12  11  10
290.3       4  21  20  20   9   O  12  11  10
291         5  21  17  17   4   O  12  11  10                                          5 F.1.A
292         5  21  20  20   4   O  12  11  10                                          5 F.1.B
293         6  21  18  23   7   O  12  11  10                                          6 F.1.A
294         6  21  19  19   7   O  12  11  10                                          6 F.1.B
295         7  21  13  13   6   O  12  11  10                                          7 F.1.A
296         8  21  15  22   7   O  12  11  10                                          8 F.1.A
297         8  21  16  16   7   O  12  11  10                                          8 F.1.B
298         9  21  15  15   6   O  12  11  10                                          9 F.1.A
299        10  21  10  10   8   O  12  11  10                                         10 F.1.A
300        10  21  15  22   8   O  12  11  10                                         10 F.1.B
301        10  21  16  16   8   O  12  11  10                                         10 F.1.C
302        11  21   1   1   2   O  12  11  10                                         11 F.1.A
303        11  21  15  15   2   O  12  11  10                                         11 F.1.B
304        11  21  18  18   2   O  12  11  10                                         11 F.1.C
305        12  21   3   3   3   O  12  11  10                                         12 F.1.A
306        13  21   6   6   3   O  12  11  10                                         13 F.1.A
307        13  21   7   7   3   O  12  11  10                                         13 F.1.B
308        14  21   6   6   5   O  12  11  10                                         14 F.1.A
309        14  21   7   7   5   O  12  11  10                                         14 F.1.B
310        14  21  11  11   5   O  12  11  10                                         14 F.1.C
311        15  21   8   8   1   O  12  11  10                                            F1
312        15  21  10  10   1   O  12  11  10                                            F1
312.1      15  21  11  11   1   O  12  11  10                                            F1
312.2      15  21  13  13   1   O  12  11  10                                            F1
312.3      15  21  14  14   1   O  12  11  10                                            F1
313        16   3  14  14  13   O  12  11  10                                         16 F.1.A
```

```
 314       17  21  17  17  14   0  12  11  10
 315       17  21  20  20  14   0  12  11  10                                   F1
 315.1     18  21   6   6   5   0  12  11  10                                   F1
 315.2     18  21   7   7   5   0  12  11  10
 315.3      1   1                                                            F2
 315.4      1  21   1   1  16   0  18  19  20                                F2
 315.5      2  21  14  14  17   0  18  19  20                                F2
 316                                                                            F.3.A
 317                                                                            F.3.B
 318                                                                            F.4.A
 319                                                                            F.4.B
 320             0.0         0.0         0.0                                    G.1.A
 321           -47.4         0.0       -36.3                                  1 G.2.A
 322             0.0     -61.045         0.0                                  1 G.3.A
 323             0.0     -28.099         0.0                                  2 G.3.A
 324             0.0         0.0         0.0                                  3 G.3.A
 325             0.0         0.0         0.0                                  4 G.3.A
 326             0.0         0.0         0.0                                  5 G.3.A
 327             0.0      20.793         0.0                                  6 G.3.A
 328             0.0      -3.859         0.0                                  7 G.3.A
 329             0.0         0.0         0.0                                  8 G.3.A
 330          23.910     -48.245     -25.489                    3   2   1     9 G.3.A
 331         207.302     -45.890     171.889                    3   2   1    10 G.3.A
 332             0.0         0.0         0.0                    3   2   1    11 G.3.A
 333         -23.910     -48.245      25.489                    3   2   1    12 G.3.A
 334         152.698     -45.890     188.111                    3   2   1    13 G.3.A
 335             0.0         0.0         0.0                    3   2   1    14 G.3.A
 336         196.876     -68.125     166.277                    3   2   1    15 G.3.A
 337         -28.900     -37.734      23.094                    3   2   1    16 G.3.A
 338         -21.762     -57.352      25.473                    3   2   1    17 G.3.A
 339         163.124     -68.125     193.723                    3   2   1    18 G.3.A
 340          28.900     -37.734     -23.094                    3   2   1    19 G.3.A
 341          21.762     -57.352     -25.473                    3   2   1    20 G.3.A
1001     0.        150.      2.          0                                   HO1
1002        1   2   3   4   5   6   7   8   9  10  12                        HO2
1003                                                                         HO3
1004       20   0  10.          0.         0.                                H1
1005            0  20.          0.         0.                                H1
1006            0  30.          0.         0.                                H1
1007            0  40.          0.         0.                                H1
1008            0  50.          0.         0.                                H1
1009            0  60.          0.         0.                                H1
1010            0  70.          0.         0.                                H1
1011            0  80.          0.         0.                                H1
1012            0  90.          0.         0.                                H1
1013            0 100.          0.         0.                                H1
1014            0 110.          0.         0.                                H1
1015            0 120.          0.         0.                                H1
1016            0 130.          0.         0.                                H1
1017            0 140.          0.         0.                                H1
1018            0 150.          0.         0.                                H1
1019            0 160.          0.         0.                                H1
1020            0 170.          0.         0.                                H1
1021            0 180.          0.         0.                                H1
1022            0 190.          0.         0.                                H1
1023            0 200.          0.         0.                                H1
1024       20   0  10.          0.         0.                                H2
1025            0  20.          0.         0.                                H2
```

```
1026           0  30.      0.      0.                                  H2
1027           0  40.      0.      0.                                  H2
1028           0  50.      0.      0.                                  H2
1029           0  60.      0.      0.                                  H2
1030           0  70.      0.      0.                                  H2
1031           0  80.      0.      0.                                  H2
1032           0  90.      0.      0.                                  H2
1033           0 100.      0.      0.                                  H2
1034           0 110.      0.      0.                                  H2
1035           0 120.      0.      0.                                  H2
1036           0 130.      0.      0.                                  H2
1037           0 140.      0.      0.                                  H2
1038           0 150.      0.      0.                                  H2
1039           0 160.      0.      0.                                  H2
1040           0 170.      0.      0.                                  H2
1041           0 180.      0.      0.                                  H2
1042           0 190.      0.      0.                                  H2
1043           0 200.      0.      0.                                  H2
1044        20 0  10.      0.      0.                                  H3
1045           0  20.      0.      0.                                  H3
1046           0  30.      0.      0.                                  H3
1047           0  40.      0.      0.                                  H3
1048           0  50.      0.      0.                                  H3
1049           0  60.      0.      0.                                  H3
1050           0  70.      0.      0.                                  H3
1051           0  80.      0.      0.                                  H3
1052           0  90.      0.      0.                                  H3
1053           0 100.      0.      0.                                  H3
1054           0 110.      0.      0.                                  H3
1055           0 120.      0.      0.                                  H3
1056           0 130.      0.      0.                                  H3
1057           0 140.      0.      0.                                  H3
1058           0 150.      0.      0.                                  H3
1059           0 160.      0.      0.                                  H3
1060           0 170.      0.      0.                                  H3
1061           0 180.      0.      0.                                  H3
1062           0 190.      0.      0.                                  H3
1063           0 200.      0.      0.                                  H3
1064        20     1    2    3    4    5    6    7    8    9   10    11H4
1065              12   13   14   15   16   17   18   19   20           H4
1066        20     1    2    3    4    5    6    7    8    9   10    11H5
1067              12   13   14   15   16   17   18   19   20           H5
1068        20     1    2    3    4    5    6    7    8    9   10    11H6
1069              12   13   14   15   16   17   18   19   20           H6
1070        18     1    2    3    4    5    6    7    8    9   10    11H7
1071              12   14   15   16   17   18   19                     H7
1072       7   4                                                      H8
2001     0 1 1 1 0 3 1 0
2002     0.      .150     .010
2003     0.      0.       0.
2004     1.      0.       0.
2005     0.      1.       0.
2006     0.      0.       1.
2007     1.      0.       0.
2008     0.      1.       0.
2009     0.      0.       1.
2010     .5      .5       11.      8.5
2011     .5      .5       10.      7.
```

2012	-90.	-66.	180.	126.	1.
2013	TC3. XZ				
2014	0.	1.	0.		
2015	1.	0.	0.		
2016	0.	0.	1.		
2017	.5	9.	11.	8.5	
2018	.5	.5	10.	7.	
2019	-90.	-66.	180.	126.	1.
2020	TC3. YZ				
2021	1.	0.	0.		
2022	0.	0.	1.		
2023	0.	1.	0.		
2024	.5	17.5	11.	8.5	
2025	.5	.5	10.	7.	
2026	-90.	-66.	180.	126.	1.
2027	TC3. XY				

```
JULY 1984                                                                                      A.1.A
1980 CHEVETTE SIDE IMPACT                                                                   A1B
                                                                                               A.1.C
  CM KGF SEC           0.0          0.0     -980.665                                           A.3
   6 375.0004   .0001    .0004    .0001                                                        A4
 0 010 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0                                A5
     22    21         56.8KG, 167.6CM FEM.                                                  B1
PELV A9.131 .7618 .7068 .8885 1.     1.     1.     1.     1.     1.          O  B2
L1L5 B1.892 .1257 .07992.1911 1.     1.     1.     1.     1.     1.          O  B2
T912 C3.802 .6852 .4834 .4524     1.0    1.0    1.0    1.0    1.0    1.0    O    3 B.2.A
T5T8 D3.802 .6852 .4834 .4524     1.0    1.0    1.0    1.0    1.0    1.0    O    4 B.2.A
T1T4 E.8624 .3425 .2417 .2262     1.0    1.0    1.0    1.0    1.0    1.0    O    5 B.2.A
NECK F.772  .0111 .01385.01718    1.0    1.0    1.0    1.0    1.0    1.0    O    6 B.2.A
HEAD G3.310 .1502 .1662 .1084     1.0    1.0    1.0    1.0    1.0    1.0    O    7 B.2.A
RSHO H1.901 .3425 .2417 .2262     1.0    1.0    1.0    1.0    1.0    1.0    O    8 B.2.A
RUAR I1.415 .08435.09190.01734    1.0    1.0    1.0    1.0    1.0    1.0    O    9 B.2.A
RLAR J1.618 .2331 .2319 .01511    1.0    1.0    1.0    1.0    1.0    1.0    O   10 B.2.A
LSHO K1.901 .3425 .2417 .2262     1.0    1.0    1.0    1.0    1.0    1.0    O   11 B.2.A
LUAR L1.415 .08435.09190.01734    1.0    1.0    1.0    1.0    1.0    1.0    O   12 B.2.A
LLAR M1.618 .2331 .2319 .01511    1.0    1.0    1.0    1.0    1.0    1.0    O   13 B.2.A
THOR N5.703 1.0274.7251 .6786     1.0    1.0    1.0    1.0    1.0    1.0    O   14 B.2.A
RULG O6.891 .9232 .9761 .2753     1.0    1.0    1.0    1.0    1.0    1.0    O   15 B.2.A
RLLG P2.870 .3903 .3963 .04552    1.0    1.0    1.0    1.0    1.0    1.0    O   16 B.2.A
RFOT Q.7848 .00655.03223.03310    1.0    1.0    1.0    1.0    1.0    1.0    O   17 B.2.A
LULG R6.891 .9232 .9761 .2753     1.0    1.0    1.0    1.0    1.0    1.0    O   18 B.2.A
LLLG S2.870 .3903 .3963 .04552    1.0    1.0    1.0    1.0    1.0    1.0    O   19 B.2.A
LFOT T.7848 .00655.03223.03310    1.0    1.0    1.0    1.0    1.0    1.0    O   20 B.2.A
SIDE U1.    .3    .3    .3    1.     1.     1.     1.     1.     1.          O     21B2A
VEHI V1.    .3    .3    .3    1.     1.     1.     1.     1.     1.          O     22B2A
W     1   1  -21.16  O.     2.26  -3.87 O.     -8.02                                1 B.3.A
                 0.0 26.12   0.0   0.0 -6.83   0.0                        3 2 1 3 2 1
S1    2   2  -2-5.19 O.     6.7    4.32  O.     -5.61                               2 B.3.A
                 0.0  10.8   0.0   0.0 -17.3   0.0                        3 2 1 3 2 1           2 B.3.B
S2    3   3  -2.34   O.     5.9    2.88  O.     -5.54                               3 B.3.A
                 0.0  -3.4   0.0   0.0  -3.4   0.0                        3 2 1 3 2 1           3 B.3.B
S3    4   4  -22.38  O.     4.82  O.     O.     -5.04                               4 B.3.A
                 0.0 20.56   0.0   0.0 20.56   0.0                        3 2 1 3 2 1           4 B.3.B
S4    5   5  -22.52  O.     2.08  1.7    O.     -3.96                               5 B.3.A
                00.0  1.45   0.0   0.0-22.14   0.0                        3 2 1 3 2 1           5 B.3.B
HN    6   6  -2-2.55 O.     6.41  -1.98 O.      -5.38                               6 B.3.A
                 0.0 -4.36   0,0   0.0 20.15   0.0                        3 2 1 3 2 1           6 B.3.B
RSC   7   4  -29.52  -4.05 8.3    3.87  8.2    3.77                                 7 B.3.A
                 0.0 -90.0 -76.0   0.0 -90.0 -76.0                        3 2 1 3 2 1           7 B.3.B
RGH   8   8  -20.    -4.05 O.     -.42  .28    12.26                                8 B.3.A
              52.9  27.55 121.4 77.43 38.03 184.47                        3 2 1 3 2 1B3A2
RE    9   9  -1-2.07 .85    -15.6 -.45  -.18   15.8                            B3A1
              173.52 67.61178.  206.3 -16.02181.24                        3 2 1 3 2 1           9 B.3.B
LSC   !   4  -29.52  4.05   8.3    3.87  -8.2  3.77                               10 B.3.A
                 0.0 -90.0  76.0   0.0 -90.0  76.0                        3 2 1 3 2 1          10 B.3.B
LGH   "  11  -20.    4.05   O.     -.42  -.28  12.26                              11 B.3.A
              127.1 -27.55121.4 102.57-38.03184.47                        3 2 1 3 2 1B3A2
LE    #  12  -1-2.07 -.85   -15.6 -.45   .18   15.8                               12 B.3.A
              186.47 67.61 182.0 153.7-16.02178.76                        3 2 1 3 2 1          12 B.3.B
T     $   4   12.45  O.     4.9   -8.02 O.     11.5                               13 B.3.A
                 0.0   0.0   0.0   0.0   0.0   0.0                        3 2 1 3 2 1          13 B.3.B
RHP   %   1  -21.96  -7.73 -6.86 .66    5.38  19.52                               14 B.3.A
              174.6749.069166.59182.65.85947172.67                        3 2 1 3 2 1          14 B.3.B
RKN   &  15  -1-.57  -1.41 -20.562.17   .85    16.03                              15 B.3.A
```

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57                    147.61-70.63210.49191.89 5.838178.17                3 2 1 3 2 1          15 B.3.B
58     RAKL (   16  -21.12  1.89  -23.01-4.44 1.38  6.05                    16 B.3.A
59                    141.39 87.62134.03192.16 71.42197.25                3 2 1 3 2 1          16 B.3.B
60     LHP  )    1  -21.96  7.73  -6.86 .66    -5.38 19.52                  17 B.3.A
61                    185.3349.069193.41177.33-.8594187.33                3 2 1 3 2 1          17 B.3.B
62     LKN  *   18  -1-.57  1.41  -20.562.17  -.85  16.03                   18 B.3.A
63                     32.39 70.63210.49-11.89 5.838178.17                3 2 1 3 2 1          18 B.3.B
64     LAKL =   19  -21.12  -1.89 -23.01-4.44 -1.38 6.05                    19 B.3.A
65                     38.61-87.62134.03-12.16-71.42197.25                3 2 1 3 2 1          19 B.3.B
65.1                                                                              B3
65.2                                                                              B3
65.6                                                                              B3
65.7                                                                              B3
66      65.6   56.5   0.0   0.5  15.0        56.5  56.5   0.0   0.5  10.0     1 B.4.A
67     144.3   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0     2 B.4.A
68     144.3   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0     3 B.4.A
69     144.3   56.5   0.0   0.5  10.0      56.5    56.5   0.0   0.5  10.0     4 B.4.A
70      16.3   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0     5 B.4.A
71      25.5   56.5   0.0   0.5  10.0        56.5  56.5   0.0   0.5  10.0     6 B.4.A
72      25.    56.5   0.0   0.5  22.0        56.5  56.5   0.0   0.5  22.0     7 B.4.A
73      25.    56.5   0.0   0.5  55.0        56.5  56.5   0.0   0.5  55.0     8 B.4.A
74        0.0 250.0   0.0  0.75  71.0         0.0   0.0   0.0   0.0   0.0     9 B.4.A
75      25.    56.5   0.0   0.5  22.0        56.5  56.5   0.0   0.5  22.0    10 B.4.A
76      25.    56.5   0.0   0.5  55.0        56.5  56.5   0.0   0.5  55.0    11 B.4.A
77        0.0 250.0   0.0  0.75  71.0         0.0   0.0   0.0   0.0   0.0    12 B.4.A
78        0.0   0.0   0.0   0.0   0.0         0.0   0.0   0.0   0.0   0.0    13 B.4.A
79       56.5  56.5   0.0   0.5  40.0        56.5  56.5   0.0   0.5  40.0    14 B.4.A
80        0.0  82.5   0.0  0.75  72.0         0.0   0.0   0.0   0.0   0.0    15 B.4.A
81       56.5  56.5   0.0   0.5  30.0        56.5  56.5   0.0   0.5  40.0    16 B.4.A
82       56.5  56.5   0.0  0.75  40.0        56.5  56.5   0.0   0.5  40.0    17 B.4.A
83        0.0  82.5   0.0  0.75  72.0         0.0   0.0   0.0   0.0   0.0    18 B.4.A
84       56.5  56.5   0.0  0.75  30.0        56.5  56.5   0.0   0.5  40.0    19 B.4.A
84.5                                                                          B4
84.6                                                                          B4
85        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           1 B.5.A
86        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           2 B.5.A
87        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           3 B.5.A
88        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           4 B.5.A
89        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           5 B.5.A
90        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           6 B.5.A
91        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           7 B.5.A
92        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           8 B.5.A
93        0.0 300.0 100.0 300.0   0.0                     0.0   0.0           9 B.5.A
94        0.0 300.0 100.0 300.0   0.0                     0.0   0.0          10 B.5.A
95        0.0 300.0 100.0 300.0   0.0                     0.0   0.0          11 B.5.A
96        0.0 300.0 100.0 300.0   0.0                     0.0   0.0          12 B.5.A
97        0.0 300.0 100.0 300.0   0.0                     0.0   0.0          13 B.5.A
98        0.0 300.0 100.0 300.0   0.0                     0.0   0.0          14 B.5.A
99        0.0 300.0 100.0 300.0   0.0                     0.0   0.0          15 B.5.A
100       0.0 300.0 100.0 300.0   0.0                     0.0   0.0          16 B.5.A
101       0.0 300.0 100.0 300.0   0.0                     0.0   0.0          17 B.5.A
102       0.0 300.0 100.0 300.0   0.0                     0.0   0.0          18 B.5.A
103       0.0 300.0 100.0 300.0   0.0                     0.0   0.0          19 B.5.A
103.5                                                                         B5
103.7                                                                         B5
104                                         00.1 00.10 00.10 00.01 00.01 00.01    B.6
105                                         00.1 00.10 00.1
106                                         00.1 00.10 00.10
```

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107                                                  00.1 00.10 00.10
108                                                  00.1 00.10 00.10
109                                                  00.1 00.10 00.10
110                                                  00.1 00.10 00.10
111                                                  00.1 00.10 00.10
112                                                  00.1 00.10 00.10
113                                                  00.1 00.10 00.10
114                                                  00.1 00.10 00.10
115                                                  00.1 00.10 00.10
116                                                  00.1 00.1  00.1
117                                                  00.1 00.1  00.1
118                                                  00.1 00.1  00.1
119                                                  00.1 00.1  00.1
120                                                  00.1 00.1  00.1
121                                                  00.1 00.1  00.1
122                                                  00.1 00.1  00.1
123                                                  00.1 00.1  00.1
123.5                                               .1    .1    .1    .01   .01   .01     B6
123.7                                               .1    .1    .1    .01   .01   .01           B6
200      1980 CHEVETTE SIDE DOOR INTRUSION                                                C1
200.5    -90.  O.    O.    1564.10.   O.     O.    O.       -770.    .002      21   C2A
201            1     3     77                       O.       O.       O.             C2B
202      O.         O.         O.         O.         O.       O.       O.             C5A
203      .002       O.         .008       O.         O.       O.       O.             C5A
204      .004       O.         .06        O.         O.       O.       O.             C5A
205      .006       O.         .204       O.         O.       O.       O.             C5A
206      .008       O.         .46        O.         O.       O.       O.             C5A
207      .01        O.         .83        O.         O.       O.       O.             C5A
208      .012       O.         1.31       O.         O.       O.       O.             C5A
209      .014       O.         1.91       O.         O.       O.       O.             C5A
210      .016       O.         2.62       O.         O.       O.       O.             C5A
211      .018       O.         3.45       O.         O.       O.       O.             C5A
212      .02        O.         4.38       O.         O.       O.       O.             C5A
213      .022       O.         6.07       O.         O.       O.       O.             C5A
214      .024       O.         9.65       O.         O.       O.       O.             C5A
215      .026       O.         12.46      O.         O.       O.       O.             C5A
216      .028       O.         15.38      O.         O.       O.       O.        C5A
217      .03        O.         18.41      O.         O.       O.       O.             C5A
218      .032       O.         21.55      O.         O.       O.       O.             C5A
219      .034       O.         24.82      O.         O.       O.       O.             C5A
220      .036       O.         28.19      O.         O.       O.       O.             C5A
221      .038       O.         31.68      O.         O.       O.       O.              C5A
222      .04        O.         35.56      O.         O.       O.       O.              C5A
223      .042       O.         39.        O.         O.       O.       O.             C5A
224      .044       O.         42.82      O.         O.       O.       O.             C5A
225      .046       O.         46.77      O.         O.       O.       O.             C5A
226      .048       O.         50.82      O.         O.       O.       O.             C5A
227      .05        O.         54.99      O.         O.       O.       O.             C5A
228      .052       O.         59.27      O.         O.       O.       O.             C5A
229      .054       O.         63.67      O.         O.       O.       O.             C5A
230      .056       O.         68.18      O.         O.       O.       O.             C5A
231      .058       O.         72.79      O.         O.       O.       O.             C5A
232      .06        O.         77.42      O.         O.       O.       O.             C5A
233      .062       O.         80.55      O.         O.       O.       O.             C5A
234      .064       O.         83.68      O.         O.       O.       O.             C5A
235      .066       O.         88.81      O.         O.       O.       O.             C5A
236      .068       O.         89.94      O.         O.       O.       O.             C5A
237      .07        O.         93.06      O.         O.       O.       O.             C5A
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238     .072    0.      96.19   0.      0.      0.      0.            C5A
239     .074    0.      99.32   0.      0.      0.      0.            C5A
240     .076    0.      102.45  0.      0.      0.      0.            C5A
241     .078    0.      105.58  0.      0.      0.      0.            C5A
242     .08     0.      108.71  0.      0.      0.      0.            C5A
243     .082    0.      111.83  0.      0.      0.      0.            C5A
244     .084    0.      114.96  0.      0.      0.      0.            C5A
245     .086    0.      118.09  0.      0.      0.      0.            C5A
246     .088    0.      121.22  0.      0.      0.      0.            C5A
247     .09     0.      124.35  0.      0.      0.      0.            C5A
248     .092    0.      127.48  0.      0.      0.      0.            C5A
249     .094    0.      130.6   0.      0.      0.      0.            C5A
250     .096    0.      133.73  0.      0.      0.      0.            C5A
251     .098    0.      136.86  0.      0.      0.      0.            C5A
252     .1      0.      139.99  0.      0.      0.      0.            C5A
253     .102    0.      143.12  0.      0.      0.      0.            C5A
254     .104    0.      146.25  0.      0.      0.      0.            C5A
255     .106    0.      149.37  0.      0.      0.      0.            C5A
256     .108    0.      152.5   0.      0.      0.      0.            C5A
257     .11     0.      155.63  0.      0.      0.      0.            C5A
258     .112    0.      158.76  0.      0.      0.      0.            C5A
259     .114    0.      161.89  0.      0.      0.      0.            C5A
260     .116    0.      165.02  0.      0.      0.      0.            C5A
261     .118    0.      168.14  0.      0.      0.      0.            C5A
262     .12     0.      171.27  0.      0.      0.      0.            C5A
263     .122    0.      174.4   0.      0.      0.      0.            C5A
264     .124    0.      177.53  0.      0.      0.      0.            C5A
265     .126    0.      180.66  0.      0.      0.      0.            C5A
266     .128    0.      183.79  0.      0.      0.      0.            C5A
267     .13     0.      186.91  0.      0.      0.      0.            C5A
268     .132    0.      190.04  0.      0.      0.      0.            C5A
269     .134    0.      193.17  0.      0.      0.      0.            C5A
270     .136    0.      196.3   0.      0.      0.      0.            C5A
271     .138    0.      199.43  0.      0.      0.      0.            C5A
272     .14     0.      202.55  0.      0.      0.      0.            C5A
273     .142    0.      205.68  0.      0.      0.      0.            C5A
274     .144    0.      208.81  0.      0.      0.      0.            C5A
275     .146    0.      211.94  0.      0.      0.      0.            C5A
276     .148    0.      215.07  0.      0.      0.      0.            C5A
277     .15     0.      218.2   0.      0.      0.      0.            C5A
278     .152    0.      221.33  0.      0.      0.      0.            C5A
278.5   1980 CHEVETTE DECELERATION                                    C1
279      90.   0.    0.    0.    0.    0.    0.    0.       310.   .005    22  C2A
280     0.   -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.
281     0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
282     0.    0.    0.    0.    0.    0.    0.
283     NULL VEHICLE                                                          C1
284      90.   0.    0.    0.    0.    0.    0.    0.       310.   .005     0  C2A
285     0.   -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.  -29.
286     0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.    0.
287     0.    0.    0.    0.    0.    0.    0.
300        12     1     0    23     0     1     0     0     0     0        D1
301        1     SEAT CUSHION                                             D2A
302     -60.          22.         -48.6                                   D2B
303     -60.         -102.        -48.6                                   D2B
304     0.            22.         -38.8                                   D2B
305        2     SEAT BACK                                                D2A
306     -44.2         22.         -60.                                    D2B
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307   -75.        22.        20.                                                    D2B
308   -44.2        -102.     -60.                                                   D2B
309      3     FLOOR                                                                D2A
310   -50.        22.        -64.                                                   D2B
311   -50.         -102.     -64.                                                   D2B
312   60.         22.        -64.                                                   D2B
313      4     TOEBOARD                                                             D2A
314   30.         22.        -69.                                                   D2B
315   30.          -102.     -69.                                                   D2B
316   69.         22.        -30.                                                   D2B
317      5     LOWER PANEL                                                          D2A
318   26.         22.        -47.                                                   D2B
319   26.          -102.     -47.                                                   D2B
320   7.          22.        -9.                                                    D2B
321      6     UPPER PANEL                                                          D2A
322   7.          22.        -9.                                                    D2B
323   7.           -102.     -9.                                                    D2B
324   13.         22.        3.                                                     D2B
325      7     WINDSHIELD                                                           D2A
326   13.         22.        0.                                                     D2B
327   13.          -102.     0.                                                     D2B
328   -26.        22.        37.                                                    D2B
329      8     HOUSING                                                              D2A
330   60.          -13.      -69.                                                   D2B
331   -78.         -13.      -69.                                                   D2B
332   60.          -41.4     -30.                                                   D2B
333      9     SIDE WINDOW                                                          D2A
334   60.          -102.     -10.                                                   D2B
335   -78.         -102.     -10.                                                   D2B
336   60.          -89.      36.                                                    D2B
337     10     DOOR                                                                 D2A
338   60.          -97.      -69.                                                   D2B
339   -78.         -97.      -69.                                                   D2B
340   60.          -97.      -10.                                                   D2B
341     11     BACKBONE                                                             D2A
342   -6.7         -17.      12.3                                                   D2B
343   .94          -17.      -7.9                                                   D2B
344   -6.7         17.       12.3                                                   D2B
345     12     SB2                                                                  D2A
346   -33.2        -102.     -60.                                                   D2B
347   -33.2        22.       -60.                                                   D2B
348   -60.         -102.     -20.                                                   D2B
400   LAP BELT                                                                      D3
401   -68.5        20.       -68.5       -69.5       -30.          -70.5            D3
402   1.08         0.        .79                     .01                            D3
450        112.2  19.1  8.58  .798  0.     -9.25    0.0  40.3   0.0              1 D.5.A
451       210.98  15.8  11.8  1.47  0.     -.717    0.0  -6.8   0.0              2 D.5.A
452        32.26  9.43  6.67  -2.52 0.     -.717    0.0-17.3    0.0              3 D.5.A
453        65.40  5.47  7.10  0.    0.     0.       0.0-22.22   0.0              6 D.5.A
454        78.76  7.54  12.3  .720  0.     -2.50    0.0-10.86   0.0              7 D.5.A
455        84.53  4.53  4.53  0.    -4.05  0.     110.97 19.29237.13             8 D.5.A
456        913.4  4.05  4.72  -1.24 .594   -3.96  162.4786.96891.585             9 D.5.A
457       1014.3  3.58  3.58  .104  -.198  -.943  -56.46  90.0 14.78            10 D.5.A
458       114.53  4.53  4.53  0.    4.05   0.      69.02-19.93237.13            11 D.5.A
459       1213.4  4.05  4.72  -1.24 -.594  -3.96  197.5186.92591.612            12 D.5.A
460       1314.3  3.58  3.58  .104  .198   -.943  56.458  90.014.783            13 D.5.A
461       149.33  13.7  16.1  -2.11 0.     .943      0.0 -20.8   0.0            14 D.5.A
462       1519.1  7.54  7.54  -1.72 .528   .0094  260.35 80.36163.89            15 D.5.A
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463        1614.0  4.81  4.81  2.24  1.20  5.65   135.11 87.86  23.1           16 D.5.A
464        179.71  5.66  5.66  1.00  -.424 2.89     0.0   0.0    0.0           17 D.5.A
465        1819.1  7.54  7.54  -1.72 -.528 .0094  99.65 80.36 16.11            18 D.5.A
466        1914.0  4.81  4.81  2.24  -1.20 5.65  224.89 87.86 156.9            19 D.5.A
467        209.71  5.66  5.66  1.00  .424  2.89     0.0   0.0    0.0           20 D.5.A
468        245.19  5.19  5.19  -.547 -1.42 -20.5 -32.39 70.65 149.5            22 D.5.A
469        255.19  5.19  5.19  -.547 1.42  -20.5 32.39 70.65 30.5              23
469.1      2630.   11.   3.    -46.  -36.  -50.  0.    0.    0.                 D5A
469.2      273.    3.    8.    -5.   -36.  -32.  0.    0.    0.                 D5A
469.3      28 53.  2.5   2.5   -40.  -99.5 -11.  0.    0.    0.                 D5A
470                                                                             D.7
471                                                                             D.7
472      3 140.    0.    0.    3.3   0.    -1.04 12.3  -500. 0.    0.    0.    D8
500       1     DASHSTAT                                                       1 E.1
501     0          1000000.    0                                               1 E.2
502                57.54       2.78        .77                                 E3
503       2     CUSHIONSTAT                                                    2 E.1
504     0          1000000.    0                                               2 E.2
505                26.25126    2.643656    -2.0616064  0.241544                2 E.3
506       3     SEATBACKSTAT                                                   3 E.1
507     0          1000000.    0                                               3 E.2
508                13.92924    -4.598274   1.865632    -0.32046    0.0183629   3 E.3
509       4     FLOORSTAT                                                      4 E.1
510     0          -10.        0                                               4 E.2
511        3                                                                    E4
512     0.         0.          2.          50.         10.         1500.        E4
513       5     WINDSHSTAT                                                     5 E.1
514     0          1000000.    0                                               5 E.2
515                357.16                                                      5 E.3
516       6     HEADERSTAT                                                     6 E.1
517     0          1000000.    0                                               6 E.2
518                714.32                                                      6 E.3
519       7     BOLDSTERDSTAT                                                  7 E.1
520     0          -2449.399   0                                               7 E.2
521        3                                                                   7 E.4.A
522     0.         0.          9.          1600.       10.         3000.
523       8     STRWHLSTAT                                                     8 E.1
524     0          -4535.924                                                   8 E.2
525        10                                                                  8 E.4.A
526     0.0        0.0         0.254       708.511     1.245       850.486     8 E.4.B
527     1.295      1133.981    1.905       850.486     3.81        708.511     8 E.4.C
528     6.096      453.592     9.906       340.194     20.32       340.194     8 E.4.D
529     25.4       4535.924                                                    8 E.4.E
530       9     ROOFSTAT                                                       9 E.1
531     0          -5896.70                                                    9 E.2
532        3                                                                   9 E.4.A
533     0.0        0.0         5.08        907.185     7.62        5896.701    9 E.4.B
534      10     FRIC=0.1                                                         E.1
535     0.         0.          0.1                                               E.2
536      11     G=0. TO 0.95                                                     E.1
537     0.         -1000.      0.                                                E.2
538        4                                                                     E.4.A
539     0.         0.          0.5         0.          0.6         0.95          E.4.B
540     1000.      0.95                                                          E.4.B
541      12     R=1. TO 0.05                                                     E.1
542     0.         -1000.      0.                                                E.2
543        4                                                                     E.4.A
544     0.         1.          0.5         1.          0.6         0.05          E.4.B
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545    1000.      0.05                                                        E.4.B
546      13     THORAXSTAT                                                    E.1
547    0.          -110.2      0.                                             E.2
548          4                                                                E.4.A
549    0.         0.          1.06        455.        10.2        455.        E.4.B
550    110.2      43355.                                                      E.4.B
551      14     NUTOEPANSTAT
552    0.          -12.
553          3
554    0.         0.          7.          1143.       12.         4000.
555      15     FRIC=1.                                                      E1
556    0.         0.          1.                                             E2
557      14     NUTOEPANSTAT
558    0.          -12.
559          3
560    0.         0.          7.          1143.       12.         4000.
561      15     FRIC=1.                                                      E1
562    0.         0.          1.                                             E2
563      16     LAP BELT FDF                                                  E1
564    0.          -1.5                                                     E2
565          5                                                              E4
566    0.         0.          .0125       300.        .0254       450.        E4
567    .125       1500.       .15         3000.                               E4
568      17     SHOULDER BELT FDF                                           E1
569    0.          -1.25                                                    E2
570          5                                                              E4
571    0.         0.          .0254       44.         .25         800.      E4
572    .95        900.        1.25        900.                              E4
573      18     BELT R                                                      E1
574    0.         0.          .75                                           E2
575      19     BELT G                                                      E1
576    0.         0.          .15                                           E2
577      20     BELT CF                                                     E1
578                           1.                                            E2
579     999     ENDFUCTINPUT                                                10 E.1
600        3   3   2   2   4   2   1   4   2   5   1   2                      F1A
601        1  22   1   1   2   0  12  11  10                                  F1B
602        1  22   8   8   2   0  12  11  10                                  F1B
603        1  22  14  14   2   0  12  11  10                                  F1B
604        2  22   1   1   3   0  12  11  10                                  F1B
605        2  22   3   3   3   0  12  11  10                                  F1B
605.1      2  22  14  14   3   0  12  11  10                                  F1B
606        3  22  17  17   4   0  12  11  10                                  F1B
607        3  22  20  20   4   0  12  11  10                                  F1B
608        4  22  17  17  14   0  12  11  10                                  F1B
609        4  22  20  20  14   0  12  11  10                                  F1B
610        5  22  16  16   7   0  12  11  10                                  F1B
611        5  22  19  19   7   0  12  11  10                                  F1B
612        5  22  15  24   7   0  12  11  10                                  F1B
613        5  22  18  25   7   0  12  11  10                                  F1B
614        6  22   7   7   1   0  12  11  10                                  F1B
615        6  22  14  14   1   0  12  11  10                                  F1B
616        7  22   7   7   5   0  12  11  10                                  F1B
617        8  22   1   1   7   0  12  11  10                                  F1B
618        8  22  15  15   7   0  12  11  10                                  F1B
618.1      8  22  17  17   7   0  12  11  10                                  F1B
618.2      8  22  20  20   7   0  12  11  10                                  F1B
619        9  21   7   7   5   0  12  11  10                                  F1B
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 620        9  21    8    8    5    0   12   11   10                                              F1B
 621       10  21    7    7    7    0   12   11   10                                              F1B
 622       10  21    8    8    7    0   12   11   10                                              F1B
 622.05    10  21   10   10    7    0   12   11   10                                              F1B
 622.1     10  21   15   15    7    0   12   11   10                                              F1B
 622.2     10  21   17   17    7    0   12   11   10                                              F1B
 623       11   3   14   14   13    0   12   11   10                                              F1B
 623.1     12  22    1    1    2    0   12   11   10                                              F1B
 623.2     12  22    2    2    2    0   12   11   10                                              F1B
 624        1                                                                                     F2A
 625        1  22    1    1   16    0   18   19    0                                              F2B
 626        0   0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0  F3A
 627        0   0    2    5                                                                       F3A
 627.5     21  28    7    7    6    0   12   11   10                                              F3B
 628       21  28    8    8    6    0   12   11   10                                              F3B
 629       22  27   15   15    1    0   12   11   10                                              F3B
 630       22  27   16   16    1    0   12   11   10                                              F3B
 631       22  26    1    1    7    0   12   11   10                                              F3B
 632       22  26    2    2    7    0   12   11   10                                              F3B
 633       22  26   14   14    7    0   12   11   10                                              F3B
 634                                                                                              F4A
 635                                                                                              F4A
 700             0.0         0.0         0.0                                                        G.1.A
 701           -42.4         0.0       -36.3                                                      1 G.2.A
 701.1   0.         0.         0.                                                                 G3A
 701.2   0.         0.         0.                                                                 G3A
 702             0.0     -61.045         0.0                                                      1 G.3.A
 703             0.0     -28.099         0.0                                                      2 G.3.A
 704             0.0         0.0         0.0                                                      3 G.3.A
 705             0.0         0.0         0.0                                                      4 G.3.A
 706             0.0         0.0         0.0                                                      5 G.3.A
 707             0.0      20.793         0.0                                                      6 G.3.A
 708             0.0      -3.859         0.0                                                      7 G.3.A
 709             0.0         0.0         0.0                                                      8 G.3.A
 710          23.910     -48.245     -25.489                                        3   2   1     9 G.3.A
 711         207.302     -45.890     171.889                                        3   2   1    10 G.3.A
 712             0.0         0.0         0.0                                        3   2   1    11 G.3.A
 713         -23.910     -48.245      25.489                                        3   2   1    12 G.3.A
 714         152.698     -45.890     188.111                                        3   2   1    13 G.3.A
 715             0.0         0.0         0.0                                        3   2   1    14 G.3.A
 716         196.876     -68.125     166.277                                        3   2   1    15 G.3.A
 717         -28.900     -37.734      23.094                                        3   2   1    16 G.3.A
 718         -21.762     -57.352      25.473                                        3   2   1    17 G.3.A
 719         163.124     -68.125     193.723                                        3   2   1    18 G.3.A
 720          28.900     -37.734     -23.094                                        3   2   1    19 G.3.A
 721          21.762     -57.352     -25.473                                        3   2   1    20 G.3.A
 722                                                                                              21G3A
 723                                                                                              22G3A
1001     0.        150.    2.        0                                                          HO1
1002        1   2    3    4    5    6    7    8    9   10   12                                   HO2
1003                                                                                            HO3
1004         20   0   10.         0.          0.                                                H1
1005              0   20.         0.          0.                                                H1
1006              0   30.         0.          0.                                                H1
1007              0   40.         0.          0.                                                H1
1008              0   50.         0.          0.                                                H1
1009              0   60.         0.          0.                                                H1
1010              0   70.         0.          0.                                                H1
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1011		O	80.		0.		0.						H1
1012		O	90.		0.		0.						H1
1013		O	100.		0.		0.						H1
1014		O	110.		0.		0.						H1
1015		O	120.		0.		0.						H1
1016		O	130.		0.		0.						H1
1017		O	140.		0.		0.						H1
1018		O	150.		0.		0.						H1
1019		O	160.		0.		0.						H1
1020		O	170.		0.		0.						H1
1021		O	180.		0.		0.						H1
1022		O	190.		0.		0.						H1
1023		O	200.		0.		0.						H1
1024	20	O	10.		0.		0.						H2
1025		O	20.		0.		0.						H2
1026		O	30.		0.		0.						H2
1027		O	40.		0.		0.						H2
1028		O	50.		0.		0.						H2
1029		O	60.		0.		0.						H2
1030		O	70.		0.		0.						H2
1031		O	80.		0.		0.						H2
1032		O	90.		0.		0.						H2
1033		O	100.		0.		0.						H2
1034		O	110.		0.		0.						H2
1035		O	120.		0.		0.						H2
1036		O	130.		0.		0.						H2
1037		O	140.		0.		0.						H2
1038		O	150.		0.		0.						H2
1039		O	160.		0.		0.						H2
1040		O	170.		0.		0.						H2
1041		O	180.		0.		0.						H2
1042		O	190.		0.		0.						H2
1043		O	200.		0.		0.						H2
1044	20	O	10.		0.		0.						H3
1045		O	20.		0.		0.						H3
1046		O	30.		0.		0.						H3
1047		O	40.		0.		0.						H3
1048		O	50.		0.		0.						H3
1049		O	60.		0.		0.						H3
1050		O	70.		0.		0.						H3
1051		O	80.		0.		0.						H3
1052		O	90.		0.		0.						H3
1053		O	100.		0.		0.						H3
1054		O	110.		0.		0.						H3
1055		O	120.		0.		0.						H3
1056		O	130.		0.		0.						H3
1057		O	140.		0.		0.						H3
1058		O	150.		0.		0.						H3
1059		O	160.		0.		0.						H3
1060		O	170.		0.		0.						H3
1061		O	180.		0.		0.						H3
1062		O	190.		0.		0.						H3
1063		O	200.		0.		0.						H3
1064	20		1	2	3	4	5	6	7	8	9	10	11H4
1065			12	13	14	15	16	17	18	19	20		H4
1066	20		1	2	3	4	5	6	7	8	9	10	11H5
1067			12	13	14	15	16	17	18	19	20		H5
1068	20		1	2	3	4	5	6	7	8	9	10	11H6

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1069               12      13      14      15      16      17      18      19      20             H6
1070          18    1       2       3       4       5       6       7       8       9      10  11H7
1071               12      14      15      16      17      18      19                             H7
1072        7    4                                                                                H8
2001      0 1 1 1 0 3 1 0
2002      0.        .150    .010
2003      0.        0.      0.
2004      1.        0.      0.
2005      0.        1.      0.
2006      0.        0.      1.
2007      1.        0.      0.
2008      0.        1.      0.
2009      0.        0.      1.
2010      .5        .5      11.     8.5
2011      .5        .5      10.     7.
2012      -80.      -80.    200.    140.    1.
2013      TC3. XZ
2014      0.         1.     0.
2015      1.        0.      0.
2016      0.        0.      1.
2017      .5        9.      11.     8.5
2018      .5        .5      10.     7.
2019      -110.     - 80.   200.    140.    1.
2020      TC3. YZ
2021      1.        0.      0.
2022      0.        0.      1.
2023      0.         1.     0.
2024      .5        17.5    11.     8.5
2025      .5        .5      10.     7.
2026      -100.     -110.   200.    140.    1.
2027      TC3. XY
```