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16. Abstract
The purpose of this project has been to expand the Crash Victim Simulation software, originally developed at Calspan Corp. The objectives were to: 1. review the capability of advanced features of the software; 2. improve the contact algorithm in the CVS; 3. develop software for use in correlation and validation studies; and, 4. apply the software to problems in side impact.

This report is organized in three volumes which are supplementary to existing CVS documentation. The first volume describes the analysis of new features (moveable contact surfaces, sharing of deflections between ellipsoids and contact surfaces, and bivariate representation of force-deflection characteristics in deflection as well as deflection rate). This volume is intended for the analyst who wishes to understand the basic assumptions incorporated in this model. Volume II presents an updated User's Manual for the entire CVS model which is expected to serve as sufficient documentation for the ordinary user of the model. Volume III presents information concerning the CVS model as a computer program and is intended for professional programmers who need to study or make changes in the program.

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1.0 INTRODUCTION

1.1 General

The purpose of this project has been to expand the Crash Victim Simulation software, originally developed at Calspan Corp. The objectives were to: 1. review the capability of advanced features of the software; 2. improve the contact algorithm in the CVS; 3. develop software for use in correlation and validation studies; and, 4. apply the software to problems in side impact. This three volume report considers the first two of the objectives.

1.2 Organization of Report

This report is organized in three volumes. The first volume deals with the analysis of the new features and is supplementary to the initial CVS writeups (1) and updates (2). This volume is intended for the analyst who wishes to understand the basic assumptions incorporated in this model. The second volume presents an updated user's manual for the entire CVS model as now constituted and is expected to serve as sufficient documentation for the ordinary user of the model. The third volume presents information concerning the CVS model as a computer program and is intended for professional programmers who need to make changes in the program.

Volume One contains sections dealing with the new ellipsoid-plane contact algorithms, the material properties now available, and shared deflection.

Volume Two contains sections dealing with the updated, machine-produced input writeup, a general description of output options and an example run.

Volume Three contains sections describing the layout of packing tables for variable information, the structure of the program and a detailed layout of possible output from the program.

1.3 Scope of Changes

The HSRI Version of the CALSPAN CVS Model is based on Version 18A of that model augmented by some of the corrections of Version 19 concerning Euler joints. HSRI refined the contact algorithms for ellipsoid-panel interactions. Three important basic problems in the contact algorithms were addressed. The first problem is accurate computation of deflections even for the case of complete penetration of an ellipsoid into a contact surface. The second problem is the computation of contact forces based on mutual deformation of the interacting elements. The third problem is handling of permanent deformation by contact surfaces.

The contact section of the old CVS was largely replaced with an algorithm based on the approach taken in earlier HSRI models (3,4,5) incorporating some of the ideas of British Leyland (6). In our early dealings with the old CVS, we modified the input section to read and check the ID field of the input cards. In addition, we modified the output section to use only one logical device and to print optionally in equal increments of simulated time. These changes were made to partially facilitate the use of the model. A more general specification of vehicle initial conditions and more flexibility in reporting of kinematics were later incorporated for the same reason. In general, we have followed the policy of making changes only where such changes were defendable by their utility to Occupant Side Impact Simulations.

1.4 References

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6. Butterfield, K. R., "The Computation of the Maximum Penetration of an Ellipsoid Through a Panel," Report No. NA2, British Leyland, unpublished, July 1976, 5 pg.

2.0 INPUT TO CVS

This section consists of two subsections. The first subsection contains a general introduction to the HSRI Version of the CALSPAN CVS. The second subsection consists of an updated version of the computer-produced input description produced by CALSPAN.

2.1 General Remarks

While it was not within the scope of our project to completely revise the input section of the program, we did add one important new feature to aid the user in debugging his/her data sets. In the original CVS, ID fields were optional and for the user's information. Card order and completeness was critical to proper functioning the program but the error would turn up as a division by zero or negative square root or some other apparently unrelated error.

We modified the input section so that every card has an identification and that identification is read and checked against the next expected card. The result is that errors in order and completeness are now flagged in an identifiable manner before the simulation is started.

The input is in terms of 80 column cards. The body of the card contains information and consists of card columns one through seventy two. Many different formats are employed in the body of the card depending on the type of information present on that card. These formats are described in detail in the next subsection. Card columns seventy-three through eighty are always used for unique identification of the card. The identification field is read and checked by the program to enforce the data requirements of the model. Data card order is also enforced as described in the next subsection.

2.2 Input Description for CVS

INPUT DESCRIPTION FOR THE CALSPAN 3-D CRASH VICTIM SIMULATION PROGRAM

(HSRI VERSION) 4/10/81

"<>" IS USED TO INDICATE "NOT EQUAL".
"<" IS USED TO INDICATE "LESS THAN".
">" IS USED TO INDICATE "GREATER THAN".
"|" IS USED TO INDICATE "ABSOLUTE VALUE".

OUTPUT OF INPUT TO THE PROGRAM:

CARDS A - DATE AND RUN DESCRIPTION, UNITS OF INPUT AND OUTPUT, CONTROL OF RESTART, INTEGRATOR AND OPTIONAL OUTPUT.

CARDS B - PHYSICAL CHARACTERISTICS OF THE SEGMENTS AND JOINTS.

CARDS C - DESCRIPTION OF THE VEHICLE MOTION.

CARDS D - CONTACT PLANES, BELTS, AIR BAGS, CONTACT ELLIPSOIDS, CONSTRAINTS AND SYMMETRY OPTIONS.

CARDS E - FUNCTIONS DEFINING FORCE-DEFLECTIONS, INERTIAL SPIKE, ENERGY ABSORPTION FACTOR AND FRICTION COEFFICIENTS.

CARDS F - ALLOWED CONTACTS AMONG SEGMENTS, PLANES, BELTS, AIR BAGS AND CONTACT ELLIPSOIDS.

CARDS G - INITIAL ORIENTATIONS AND VELOCITIES OF THE SEGMENTS.

CARDS H - CONTROL OF OUTPUT OF TIME HISTORY OF SELECTED SEGMENT MOTIONS AND JOINT PARAMETERS.

NOTE: THE FORMATS HAVE BEEN CHANGED SO THAT EVERY CARD USES COLUMNS 76-80 FOR CARD TYPE IDENTIFICATION OF FORM "L.N.L" WHERE "L" STANDS FOR ALPHABETIC CHARACTER AND "N" STANDS FOR NUMERIC CHARACTER. IF THE CARD IN QUESTION IS UNIQUE, THE LAST CHARACTER AND DOT MUST BE SPECIFIED AS BLANKS. COLUMNS 73-74 ARE USED FOR ADDITIONAL RIGHT-ADJUSTED IDENTIFICATION FOR UNIQUENESS AS SPECIFIED IN EACH CARD TYPE DESCRIPTION IF MORE THAN ONE CARD OF THAT TYPE MAY BE PRESENT IN THE DATA DECK AND NO OTHER UNIQUE I.D. IS PRESENT ON CARD. THESE I.D. FIELDS ARE CHECKED DURING THE READING OF THE DATA. VIOLATION OF REQUIRED CARD ORDER OR PRESENCE CAUSES TERMINATION OF THE RUN.

A. GENERAL MODEL CONTROL

CARD A.1.A	COL	RESTART CONTROL, RUN DATE, AND TIME-DEPENDENT DEBUG CONTROL
DATE(I),I=1,3	1-12	DATE OF THE RUN (12 CHARACTERS).
IRSIN	13-16	RESTART INPUT UNIT NO. IF BLANK OR ZERO, ALL INPUT TO BE SUPPLIED ON CARDS A.3 TO CARDS H.7. IF NONZERO (SUGGESTED VALUE=4) INPUT WILL BE SUPPLIED FROM A PREVIOUS RESTART TAPE AND CARDS A.1.B,C AND A.2.
IRSOUT	17-20	RESTART OUTPUT UNIT NO. IF NONZERO (SUGGESTED VALUE=3) RECORDS WILL BE WRITTEN ON THIS OUTPUT UNIT FOR FUTURE RESTART RUNS. AN INITIAL RECORD CONTAINING ALL INPUT AND INITIALIZATION DATA WILL BE WRITTEN PLUS A TIME POINT RECORD AT EVERY TIME INTERVAL AS SPECIFIED BY DT ON CARD A.4.
RSTIME	21-28	RESTART TIME (SEC.) REQUIRED IF IRSIN<>0. SHOULD BE NONZERO AND AN INTEGER MULTIPLE OF DT ON CARD A.4. PROGRAM WILL READ RECORDS FROM THE PREVOUS RESTART TAPE UP TO AND INCLUDING THIS TIME, MAKE CHANGES PER CARD A.2 AND CONTINUE OPERATION FROM THERE.
NPRT(I),I=1,11		AN ARRAY OF INDICATORS THAT CONTROL VARIOUS OPTIONAL DIAGNOSTIC OUTPUT FOR THE PROGRAM. A VALUE OF ZERO OR BLANK INDICATES NO OUTPUT FOR THAT PARTICULAR ITEM. IN GENERAL, A VALUE OF 1 MEANS THAT THE OUTPUT WILL BE PRODUCED EVERY TIME A PARTICULAR ROUTINE IS EXECUTED. HOWEVER, FOR ITEMS 1,2,3,5 AND 6, THE VALUE INDICATES THE PRINT FREQUENCY, E.G., A VALUE OF 5 WILL PRODUCE OUTPUT EVERY 5TH EXECUTION OF THE SUBROUTINE.

		NPRT
29-32	1	TAPE 1 OUTPUT
33-36	2	ELTIME OUTPUT
37-40	3	ACCEL OUTPUT
41-44	4	HIC TAPE
45-48	5	Y-Z PRINTER PLOT
49-52	6	X-Z PRINTER PLOT
53-56	7	HA, HB FROM BINPUT
57-60	8	ACCEL FROM DAUX
61-64	9	PACKING DICTIONARY
65-68	10	OUTPUT FROM CMPUTE, DINT
69-72	11	ACCEL FROM EQUILB

CARDS A.1.B-A.1.C	COL	RUN DESCRIPTION
COMENT(I),	1-72	DESCRIPTION OF THE RUN (144
I=1,36	1-72	CHARACTERS ON TWO CARDS).

CARDS A.2 RESTART QUANTITY UPDATE CARDS
(PLACE NUMBERING OF THESE CARDS IN COLUMNS 73-74.)

THESE CARDS REQUIRED ONLY IF IRSIN>0, IN WHICH CASE ALL OTHER INPUT AS SPECIFIED ON CARDS A.3 TO H.7 ARE BYPASSED. TWO SETS OF A.2 (EACH TERMINATED WITH A BLANK CARD) ARE REQUIRED. THE FIRST SET IS PROCESSED AFTER THE INITIAL INPUT RECORD IS READ FROM INPUT UNIT IRSIN AND, IF IRSOUT<>0, BEFORE THE INPUT RECORD IS WRITTEN ON OUTPUT UNIT IRSOUT. THE SECOND SET IS PROCESSED AFTER THE TIME POINT RECORD FOR TIME=RSTIME HAS BEEN READ AND, IF IRSOUT<>0, AFTER THE SAME RECORD IS WRITTEN ON OUTPUT UNIT IRSOUT, BUT BEFORE THE PROGRAM RESUMES OPERATION.

AVAR	1-8	ALPHANUMERIC NAME (LEFT ADJUSTED IN FIELD) OF VARIABLE TO BE REDEFINED FOR RESTART. PROGRAM IS CAPABLE OF CHANGING ANY VARIABLE IN THE LABELED COMMON BLOCKS AS USED AFTER ALL INITIALIZATION HAS BEEN PERFORMED. THE USER SHOULD ASCERTAIN THAT CHANGING THIS VARIABLE IS VALID FOR THE PROGRAM.
INDEX(I), I=1,3	9-12 13-16 17-20	THE ARRAY INDICES, IF ANY, OF THE VARIABLE. MUST AGREE IN NUMBER AND THE VALUES MUST BE LESS THAN OR EQUAL TO THE DIMENSIONS OF THE VARIABLE. BLANK OR ZERO FOR NO DIMENSION.
ITYPE	21-24	SUPPLY 1, 2 OR 3 TO INDICATE THAT THE NEW VALUE IS TO BE REAL (RR), INTEGER (II) OR ALPHANUMERIC (AA). MUST AGREE WITH THE TYPE OF THE VARIABLE WITHIN THE PROGRAM.
RR II AA	25-32 33-40 41-48	NEW VALUE OF THE VARIABLE AVAR TO BE SUPPLIED IN THE APPROPRIATE FIELD DETERMINED BY THE VALUE OF ITYPE.
RROLD IIOLD AAOLD	49-56 57-64 65-72	THE PREVIOUS VALUE OF THE VARIABLE AVAR IN THE APPROPRIATE FIELD ACCORDING TO THE ITYPE VALUE. INTEGER OR ALPHANUMERIC

DATA WILL BE TESTED EXACTLY, REAL DATA TO 5 SIGNIFICANT DIGITS. IF THE CURRENT VALUE IS DIFFERENT, THE PROGRAM WILL TERMINATE WITH AN ERROR MESSAGE. IF ZERO OR BLANK IS SUPPLIED, NO CHECK IS PERFORMED.

THESE A.2 CARDS WILL BE PROCESSED UNTIL A BLANK VALUE FOR AVAR IS ENCOUNTERED. NO FURTHER INPUT IS REQUIRED.

CARD A.3 SPECIFICATION OF INPUT UNITS

UNITL	1-4	UNIT OF LENGTH (4 CHARACTERS).
UNITF	5-8	UNIT OF FORCE (4 CHARACTERS).
UNITT	9-12	UNIT OF TIME (4 CHARACTERS).
CONVL	13-22	UNIT OF LENGTH IN TERMS OF INCHES.
CONVF	23-32	UNIT OF FORCE IN TERMS OF LBS.
CONVT	33-42	UNIT OF TIME IN TERMS OF SECS.

NOTE: UNITL, UNITF AND UNITT SHOULD CORRESPOND TO THE USER'S INPUTS. THROUGHOUT THIS DESCRIPTION, INCHES, POUNDS AND SECONDS (IN,LBS,SEC) ARE USED AS SAMPLE UNITS.

GRAVTY(I),	43-52	THE X, Y AND Z COMPONENTS
I=1,3	53-62	OF GRAVITY (IN PER SEC**2).
	63-72	

CARD A.4 INTEGRATOR CONTROLS

NDINT	1-4	NUMBER OF ITERATIONS FOR FINAL CONVERGENCE TEST OF THE INTEGRATOR SUBROUTINE DINT (MINIMUM VALUE=2, SUGGESTED VALUE=4).
NSTEPS	5-8	NUMBER OF INTEGRATION STEPS (OR OUTPUT TIME POINTS) FOR THE INTEGRATOR ROUTINE. MAY BE ZERO TO OBTAIN INITIAL CONDITIONS.
DT	9-16	MAIN PROGRAM TIME INTERVAL FOR INTEGRATOR ROUTINE OUTPUT (SEC). TOTAL TIME OF RUN WILL BE NSTEPS*DT SECONDS WITH MAIN PROGRAM TAPE 1, PRINTER PLOT AND OPTIONAL OUTPUT PRODUCED EVERY DT SECONDS.
HO	17-24	INITIAL INTEGRATOR STEP SIZE (SEC).
HMAX	25-32	MAXIMUM INTEGRATOR STEP SIZE (SEC). FOR BEST EFFICIENCY DT SHOULD BE AN INTEGRAL MULTIPLE OF HMAX AND HMAX A POWER OF TWO MULTIPLE OF H0. (SUGGESTED VALUE = 0.001 SEC.)
HMIN	33-40	MINIMUM INTEGRATOR STEP SIZE (SEC). IF A FIXED STEP SIZE IS DESIRED, SET HMIN GREATER THAN HMAX, AND STEP SIZE WILL DOUBLE FROM H0 UNTIL HMAX IS ACHIEVED.
KNTLPR	41-44	SWITCH=0 PRINT EVERY INTEGRATION. SWITCH<>0 PRINT IN INCREMENTS OF DT.
MAXLIN	45-48	MAX NUMBER OF TIME POINTS, EFFECTIVE. ONLY NEEDED IF KNTLPR=0.

CARD A.5 MISC. ITERATION CONTROLS

EPSLN	1-12	TOLERANCE FOR ZERO TESTS OF PANEL SYSTEM CORNER POINTS (IN).
EPSLON	13-24	RELATIVE TOLERANCE FOR TEST ON LOSS OF SIGNIFICANCE IN BIVARIATE TABLE INTERPOLATION.
CEPLSN	25-36	FORCE TOLERANCE FOR CONVERGENCE TEST IN SHARED DEFLECTION (LBS).
DELFSP	37-48	RAMP LENGTH FOR FULL USE OF FORCE RATE TERMS (IN).
HARDCF	49-60	LINEAR SPRING COEFFICIENT FOR RIGID-RIGID INTERACTION (LBS/IN).
HARDLM	61-72	MAXIMUM FORCE FOR RIGID-RIGID INTERACTION (LBS).

CARDS A.6.A-A.6.B TIME-DEPENDENT DEBUG CONTROL

CARD A.6.A

TIMHEX(1)	1-8	EFFECTIVE TIME FOR FIRST HEXIDECIMAL CONTROL WORD.
HEX(1)	9-16	SIXTEEN DEBUG SWITCH SETTINGS (TWO BITS EACH) REPRESENTED AS EIGHT DIGIT HEXIDECIMAL WORD.
TIMHEX(2)	17-24	SIMILAR FOR OTHER EFFECTIVE TIMES AND CONTROL WORDS.
HEX(2)	25-32	
TIMHEX(3)	33-40	
HEX(3)	41-48	
TIMHEX(4)	49-56	
HEX(4)	57-64	

CARD A.6.B

INPUT ELEMENTS FIVE THROUGH EIGHT OF THESE TWO ARRAYS WITH THE SAME CARD LAYOUT. THE TABLE PRESENTED BELOW GIVES THE CORRESPONDENCE BETWEEN IBUG INDEX AND THE RESULTING DEBUG PRINTOUT.

IBUG	DEBUG PRODUCED
1	AIR BAG QUANTITIES
2	BELT QUANTITIES
3	LEVEL 1: JOINT POSITIONS LEVEL 2: BODY SEGMENT POSITIONS & VELOCITIES
4	SYSTEM EQUATION MATRIX AND RIGHT HAND SIDE
5	TIME STEP CONVERGENCE QUANTITIES
6	ELLIPSOID-ELLIPSOID PENETRATION QUANTITIES
7	IMPULSE FUNCTION QUANTITIES
8	TORQUE AND JOINT CONSTRAINT QUANTITIES
9	ROLL-SLIDE CONSTRAINT QUANTITIES
10	JOINT QUANTITIES
11	BODY CONTACT QUANTITIES
12	ELLIPSOID-PLANE DEFLECTION QUANTITIES
13	LOAD-DEFLECTION QUANTITIES
14	SHARED DEFLECTION AND TABULAR FITTING QUANTITIES
15	FORCE EVALUATION QUANTITIES
16	LEVEL 1: STORAGE ALLOCATION QUANTITIES LEVEL 3: ABORT AND DUMP

B. PHYSICAL CHARACTERISTICS OF SEGMENTS AND JOINTS

CARD B.1 CRASH VICTIM GENERAL DESCRIPTION

NSEG	1-6	NUMBER OF SEGMENTS (MAXIMUM NSEG+NBAG = 20). NOTE: THE VEHICLE AND GROUND WILL BE ASSIGNED SEGMENT NUMBERS NSEG+1 AND NSEG+NBAG+2.
NJNT	7-12	THE NUMBER OF JOINTS (MAXIMUM=21). NOTE: NORMALLY NJNT = NSEG-1, BUT JOINT NUMBERS NVEH-1 AND NGRND-1 MAY BE USED TO CONNECT THE VEHICLE AND THE GROUND TO A LOWER NUMBERED SEGMENT.
BDYTTL(I), I=1,5	21-40	DESCRIPTION OF THE CRASH VICTIM (20 CHARACTERS).

CARDS B.2 BODY SEGMENT SPECIFICATIONS
(NSEG CARDS, PLACE "I" IN COLS 73-74)

EACH CARD (I) FOR I=1,NSEG WILL CONTAIN INPUT DATA FOR THE ITH SEGMENT. THE SEGMENT IDENTIFYING NUMBERS (I) WILL BE REFERRED TO ON LATER INPUT CARDS.

SEG(I)	1-4	AN ABBREVIATION OF THE NAME OF THE ITH SEGMENT (4 CHARACTERS).
CGS(I)	6	THE PLOT SYMBOL OF THE SEGMENT C.G. (1 CHARACTER).
W(I)	7-18	THE MASS OF THE SEGMENT (LBS*SEC**2/IN).
PHI(J,I), J=1,3	19-30 31-42 43-54	THE PRINCIPAL MOMENTS OF INERTIA OF THE SEGMENTS ABOUT THE X, Y AND Z AXES OF THE SEGMENT (LBS-SEC**2-IN). THERE ARE NO RESTRICTIONS ON THE VALUES OF W(I) OR PHI(J,I), THEY MAY BE NEGATIVE OR ZERO. IF ANY COMPONENT IS ZERO, IT IS ASSUMED THAT THE SYSTEM IS SUITABLY CONSTRAINED SO THAT THE SYSTEM MATRIX IS NONSINGULAR.

CARDS B.3.A-B.3.B JOINT SPECIFICATIONS

(2*NJNT CARDS - 2 CONTIGUOUS CARDS FOR EACH JOINT, PLACE "J" IN COL 73-74) EACH CARD (J) FOR J=1,NJNT WILL CONTAIN INPUT DATA FOR THE JTH JOINT. THE JOINT IDENTIFYING NUMBERS (J) WILL BE REFERRED TO ON LATER INPUT CARDS.

FOLLOWING DATA IS ON FIRST CARD (B.3.A) FOR EACH JOINT.

JOINT(J)	1-4	AN ABBREVIATION OF THE NAME OF THE JTH JOINT (4 CHARACTERS).
JS(J)	6	PLOT SYMBOL OF THE JOINT LOCATION (1 CHARACTER).
JNT(J)	7-10	MAGNITUDE IS NUMBER OF SEGMENT CONNECTED TO SEGMENT J+1 BY JOINT J. IF ZERO, SEGMENT J+1 IS THE REFERENCE SEGMENT OF ANOTHER BODY. IF NEGATIVE, JOINT J IS ASSOCIATED WITH A FLEXIBLE ELEMENT. (IT IS REQUIRED THAT |JNT(J)|<J+1).
IPIN(J)	11-14	0 - JOINT J HAS NO CONSTRAINTS. 1 - JOINT J IS PINNED (HINGE). 2 - JOINT J IS BALL AND SOCKET. 3 - JOINT J IS GLOBALGRAPHIC (BALL AND SOCKET).

JOINT IS INITIALLY UNLOCKED IF IPIN>0 AND LOCKED IF IPIN<0.

4 - JOINT J IS AN EULER JOINT.

AN EULER JOINT MAY USE THE GLOBALGRAPHIC OPTION (SPECIFY IGLOB = 1 ON CARD F.4.A). ITS INITIAL STATE IS SET BY IPIN AS BELOW, WITH PRECESSION ABOUT Z, NUTATION ABOUT RESULTANT X AND SPIN ABOUT RESULTANT Z. IF IPIN<-3, PROGRAM WILL SET IEULER AS BELOW AND THEN RESET IPIN=-4.

IPIN	IEULER	STATE
4	8	FREE
- 4	7	ALL AXES LOCKED
- 5	6	SPIN FREE, OTHERS LOCKED
- 6	5	NUTATION FREE, OTHERS LOCKED
- 7	4	PRECESSION FREE, OTHERS LOCKED
- 8	3	SPIN LOCKED, OTHERS FREE
- 9	2	NUTATION LOCKED, OTHERS FREE
-10	1	PRECESSION LOCKED, OTHERS FREE

SR(I,2*J-1), I=1,3	15-20 21-26 27-32	COORDINATES OF LOCATION OF JOINT J (IN.) IN THE LOCAL REFERENCE SYSTEM OF PROXIMAL SEGMENT JNT(J).
SR(I,2*J), I=1,3	33-38 39-44 45-50	COORDINATES OF LOCATION OF JOINT J (IN.) IN THE LOCAL REFERENCE SYSTEM OF DISTAL SEGMENT J+1.

FOLLOWING DATA IS ON SECOND CARD (B.3.B) FOR EACH JOINT.

YPR1(I,J), I=1,3	15-20 21-26 27-32	THE YAW, PITCH AND ROLL ANGLES (DEGREES) SPECIFYING THE PRINCIPAL AXES OF JOINT J IN THE LOCAL REFERENCE SYSTEM OF PROXIMAL SEGMENT JNT(J). YAW ABOUT Z AXIS, PITCH ABOUT RESULTANT Y AXIS, ROLL ABOUT RESULTANT X AXIS.
YPR2(I,J), I=1,3	33-38 39-44 45-50	THE YAW, PITCH AND ROLL ANGLES (DEGREES) SPECIFYING THE PRINCIPAL AXES OF JOINT J IN THE LOCAL REFERENCE SYSTEM OF DISTAL SEGMENT J+1. THE ANGLE BETWEEN PROXIMAL AND DISTAL JOINT SYSTEM Z AXES DEFINES FLEXURE. FLEXURE FOR A HINGE JOINT IS ABOUT THE Y (PIN) AXIS. THE XY PLANE IS USED FOR GLOBALGRAPHIC JOINTS WITH X AS THE REFERENCE AXIS.
YPR3(I,J), I=1,3	51-56 57-62 63-68	THE CENTER OF SYMMETRY (DEGREES) FOR EULER JOINTS ONLY. SUPPLIED IN THE ORDER PRECESSION, NUTATION AND SPIN WITH RESPECT TO DISTAL LINK JOINT AXES WHEN PROXIMAL AND DISTAL LINK JOINT AXES ARE "IN-LINE". JOINT TORQUES FOR EULER JOINTS ARE A FUNCTION OF THE DEVIATION OF THE EULER ANGLES FROM THESE.

NOTE: PROXIMAL MEANS NEARER TO AND DISTAL MEANS FURTHER FROM THE BODY REFERENCE SEGMENT.

CARDS B.4.A-B.4.B JOINT SPRING CHARACTERISTICS

(NJNT SETS OF CARDS, ONE FOR EACH JOINT J. IF IPIN(J)< 4, EACH SET READS VALUES FOR 3*J-2 AND 3*J-1 ON ONE CARD ONLY (B.4.A). IF |IPIN(J)|=4 , JOINT J IS AN EULER JOINT AND A SECOND CARD (B.4.B) IS NECESSARY TO READ VALUES FOR 3*J. PLACE "J" IN COL 73-74.)

SPRING(I, 3*J-2),I=1,5	1-6 7-12 13-18 19-24 25-36	FLEXURAL SPRING CHARACTERISTICS (BENDING), IF HINGE OR BALL AND SOCKET. IF EULER JOINT, SPRING CHARACTERISTICS ABOUT PRECESSION AXIS. (SEE NOTE BELOW FOR LAYOUT)
SPRING(I, 3*J-1),I=1,5	37-42 43-48 49-54 55-60 61-72	TORSIONAL SPRING CHARACTERISTICS (TWIST), IF BALL AND SOCKET. IF HINGE, OMITTED. IF EULER JOINT, SPRING CHARACTERISTICS ABOUT THE NUTATION AXIS. (SEE NOTE BELOW)
SPRING(I, 3*J),I=1,5	1-6 7-12 13-18 19-24 25-36	SECOND CARD OF EACH SET IS REQUIRED ONLY IF J IS AN EULER JOINT, THE SPRING CHARACTERISTICS ABOUT THE SPIN AXIS. (SEE NOTE BELOW FOR LAYOUT OF FIVE FIELDS)

NOTE: LAYOUT OF JOINT SPRING CHARACTERISTICS

I=1	LINEAR SPRING COEFFICIENT (IN-LBS/DEG).
I=2	QUADRATIC SPRING COEFFICIENT (IN-LBS/DEG**2).
I=3	CUBIC SPRING COEFFICIENT (IN-LBS/DEG**3).
I=4	ENERGY DISSIPATION COEFFICIENT (DIMENSIONLESS). A VALUE OF 1. SPECIFIES NO LOSS A VALUE OF 0. SPECIFIES MAXIMUM LOSS
I=5	JOINT STOP LOCATION (DEG): FOR EULER JOINT, SYMMETRIC ABOUT CENTER OF SYMMETRY AXES WHEN JOINT AXIS SYSTEMS ARE IN-LINE; FOR HINGE OR BALL AND SOCKET, SYMMETRIC ABOUT DISTEL LINK BODY AXES WHEN JOINT AXIS SYSTEMS ARE IN-LINE. FOR A VALUE OF ZERO THE ROUTINE WILL USE ONLY THE LINEAR SPRING COEFFICIENT AND WILL APPLY THE ENERGY DISSIPATION FACTOR.

ANG(I,J), I=1,3	37-42 43-48 49-54	THE INITIAL ROTATION ANGLES IN THE ORDER PRECESSION, NUTATION AND SPIN (DEGREES) FOR AN EULER JOINT. THESE ARE USED AS INITIAL ANGLES FOR THE MEMORY MODE IN SUBROUTINE EULRAD AND NEED NOT BE EXACT. THE VALUES ARE ABSOLUTE, NOT RELATIVE TO THE CENTER OF SYMMETRY.

CARDS B.5.A-B.5.C JOINT VISCOUS CHARACTERISTICS
(NJNT SETS, ONE FOR EACH JOINT J. IF |IPIN(J)|<4, VALUES FOR 3*J-2 ARE ON ONE CARD ONLY (B.5.A). IF |IPIN(J)|=4, J IS AN EULER JOINT AND VALUES FOR 3*J-1 ARE REQUIRED ON A SECOND (B.5.B) AND FOR 3*J ON A THIRD (B.5.C) CARD OF EACH SET. PLACE "J" IN COLS 73-74.)

VISC(I,3*J-2), I=1,7	THE VISCOUS CHARACTERISTICS (FLEXURAL AND TORSIONAL), IF HINGE OR BALL AND SOCKET. IF EULER JOINT, THE VISCOUS CHARACTERISTICS ABOUT THE PRECESSION AXIS. (SEE NOTE BELOW FOR FIELD LAYOUT)
VISC(I,3*J-1), I=1,7	THE SECOND CARD OF EACH SET IS REQUIRED ONLY IF J IS AN EULER JOINT AND CONTAINS THE VISCOUS CHARACTERISTICS ABOUT THE NUTATION AXIS. (SEE NOTE BELOW FOR LAYOUT)
VISC(I,3*J), I=1,7	THE THIRD CARD OF EACH SET IS REQUIRED ONLY IF J IS AN EULER JOINT AND CONTAINS THE VISCOUS CHARACTERISTICS ABOUT THE SPIN AXIS. (SEE NOTE BELOW FOR LAYOUT)

NOTE: LAYOUT OF JOINT VISCOUS CHARACTERISTICS CARDS

I=1	1-6	VISCOUS COEFFICIENT (IN-LB-SEC/DEG).
I=2	7-12	COULOMB FRICTION COEFFICIENT (IN-LB).
I=3	13-18	RELATIVE ANGULAR VELOCITY OF JOINT AT WHICH FULL COULOMB FRICTION IS APPLIED (DEG/SEC). MUST BE GREATER THAN 0.
I=4	19-24	T1: THE MAXIMUM TORQUE (IN-LBS) ALLOWED FOR A LOCKED JOINT (OR EULER AXIS). IF EXCEEDED, THE JOINT WILL UNLOCK. IF T1=0, THE TEST WILL NOT BE PERFORMED. NOTE: IF JOINT J IS LOCKED, IF T1=0, AND IF SUBROUTINE EQUILB IS CALLED, THEN VISC(4,3*J-2) WILL BE SET BY SUBROUTINE EQUILB. (SEE DESCRIPTION UNDER CARDS G.6)

I=5	25-30	T2: THE MINIMUM TORQUE (IN-LBS) ALLOWED FOR JOINT J TO REMAIN UNLOCKED. IF T2=0, THE TEST WILL NOT BE PERFORMED.
I=6	49-54	T3: THE MINIMUM ANGULAR VELOCITY (RAD/SEC) NECESSARY FOR JOINT J TO REMAIN UNLOCKED. IF T3=0, THE TEST WILL NOT BE PERFORMED.
I=7	55-60	E=(1+U)/2 WHERE U IS THE CLASSICAL COEFFICIENT OF RESTITUTION TO BE USED FOR THE IMPULSE OPTION IF THE JOINT HITS THE JOINT STOP (0<E<1 OR -1<U<+1). A VALUE OF E=0 MEANS THAT THE IMPULSE OPTION WILL NOT BE EXERCISED FOR THIS JOINT.

CARD B.6 SEGMENT CONVERGENCE TEST PARAMETERS
(NSEG CARDS, PLACE "I" IN COLS 73-74.)

SGTEST(1,1,I)	1-6	MAGNITUDE TEST FOR THE ANGULAR VELOCITY OF SEGMENT NO. I (RAD/SEC).
SGTEST(2,1,I)	7-12	ABSOLUTE ERROR TEST FOR ANGULAR VELOCITY OF SEGMENT NO.I (RAD/SEC).
SGTEST(3,1,I)	13-18	RELATIVE ERROR TEST FOR THE ANGULAR VELOCITY OF SEGMENT NO. I (DIMENSIONLESS).
SGTEST(1,2,I)	19-24	SAME AS ABOVE, BUT FOR THE LINEAR
SGTEST(2,2,I)	25-30	VELOCITY OF SEGMENT NO. I
SGTEST(3,2,I)	31-36	(IN/SEC).
SGTEST(1,3,I)	37-42	SAME AS ABOVE, BUT FOR THE ANGULAR
SGTEST(2,3,I)	43-48	ACCELERATION OF SEGMENT NO. I
SGTEST(3,3,I)	49-54	(RAD/SEC**2).
SGTEST(1,4,I)	55-60	SAME AS ABOVE BUT FOR THE LINEAR
SGTEST(2,4,I)	61-66	ACCELERATION OF SEGMENT NO. I
SGTEST(3,4,I)	67-72	(IN/SEC**2).

NOTE: THESE CONVERGENCE TESTS ARE PERFORMED IN SUBROUTINE DINT ON THE RESULTANT OF THE DERIVATIVE VECTORS. THE LINEAR VELOCITIES AND ACCELERATIONS ARE COMPUTED ONLY FOR REFERENCE SEGMENTS (I.E. SEGMENT NO. 1 AND THOSE SEGMENTS I WHERE JNT(I-1)=0), THEREFORE ANY TEST NUMBERS SUPPLIED FOR LINEAR VELOCITIES AND ACCELERATIONS OF OTHER SEGMENTS WILL BE IGNORED. THE TESTS FOR CONVERGENCE ARE PERFORMED IN THE FOLLWING ORDER:

1) IF THE MAGNITUDE TEST IS ZERO, NO TESTING IS DONE FOR THAT VARIABLE.

2) IF THE MAGNITUDE OF THE RESULTANT VECTOR IS LESS THAN THE MAGNITUDE TEST, THE ROUTINE HAS PASSED THE CONVERGENCE TEST FOR THAT VARIABLE.

3) IF THE ABSOLUTE ERROR TEST IS GREATER THAN ZERO, AND THE MAGNITUDE OF THE ABSOLUTE ERROR (DIFFERENCE BETWEEN THE PREDICTED AND COMPUTED VECTOR) IS LESS THAN THE ABSOLUTE ERROR TEST, THE ROUTINE HAS PASSED THE CONVERGENCE TEST FOR THAT VARIABLE.

4) IF THE RELATIVE ERROR OF THE MAGITUDE OF THE ABSOLUTE ERROR COMPARED TO THE MAGNITUDE OF THE COMPUTED VECTOR IS GREATER THAN THE RELATIVE ERROR TEST, THE CONVERGENCE TEST HAS FAILED.

IF ANY JNT(J)<0, CARDS B.7 ARE REQUIRED. EACH FLEXIBLE ELEMENT AS DEFINED ON CARDS B.3 CONTAINS AT LEAST THREE CONNECTED SEGMENTS CONSISTING OF A REFERENCE SEGMENT, ONE OR MORE INTERIOR SEGMENTS AND A TERMINATING SEGMENT. EACH JOINT IN THE ELEMENT SHOULD HAVE A NEGATIVE VALUE FOR JNT, AND THE NUMBER OF INTERIOR SEGMENTS WILL BE ONE LESS THAN THE NUMBER OF NEGATIVE VALUES OF JNT FOR EACH ELEMENT. NFLX IS THE TOTAL NUMBER OF INTERIOR SEGMENTS OF ALL FLEXIBLE ELEMENTS AND HAS A MAXIMUM OF 17.

CARD B.7.A INTERIOR SEGMENT SPECIFICATION

NFX	1-4	THE NUMBER OF INTERIOR SEGMENTS FOR WHICH HF ARRAYS ARE TO BE SUPPLIED.
KNT(K),K=1,NFX	5-8 9-12 ETC. 69-72	THE INTERIOR SEGMENT IDENTIFICATION NUMBERS IN THE ORDER OF THE HF ARRAYS TO BE SUPPLIED. IF THE VALUES OF NFX AND KNT ARE NOT CONSISTENT WITH THE NEGATIVE VALUES OF JNT ON CARDS B.3, THE PROGRAM WILL TERMINATE WITH AN APPROPRIATE ERROR MESSAGE.

CARDS B.7.B-B.7.E INTERIOR SEGMENT ORIENTATION
(4*NFX CARDS, 4 CARDS FOR EACH SEGMENT B.7.B TO B.7.E CORRESPONDING TO I=1 TO 4 RESPECTIVELY AS THEY ARE DEFINED IN THE KNT VECTOR. PLACE "K" IN COLS 73-74.)

(HF(I,J,K), J=1,12),I=1,4	1-6 7-12 13-18 ETC. 67-72	THE COEFFICIENTS OF THE QUADRATIC FORM FUNCTION USED TO DEFINE THE ORIENTATION OF INTERIOR SEGMENT KNT(K) WITH RESPECT TO REFERENCE SEGMENT OF THE ELEMENT.

NOTE:
FORM THE COLUMN VECTOR V WITH FOUR COMPONTENTS Y,P,R AND 1, WHERE Y,P,R ARE THE YAW, PITCH AND ROLL OF THE TERMINATING SEGMENT RELATIVE TO THE REFERENCE SEGMENT. LET H BE A SYMMETRIC 4X4 MATRIX SUCH THAT F(V)=1/2 V.HV REPRESENTS A QUADRATIC SCALAR FUNCTION OF THE VARIABLES Y, P AND R IN RADIANS. THUS

YAW OF SEGMENT KNT(K)=1/2 V.HF(I,J,K)V
PITCH OF SEGMENT KNT(K)=1/2 V.HF(I,J+4,K)V
ROLL OF SEGMENT KNT(K)=1/2 V.HF(I,J+8,K)V (I,J=1,4)

C. VEHICLE DECELERATION SPECIFICATIONS

CARD C.1		VEHICLE DECELERATION DESCRIPTION	
VPSTTL(I), I=1,18	1-72	DESCRIPTION OF THE CRASH VEHICLE DECELERATION (72 CHARACTERS).	
CARD C.2		VEHICLE DECELERATION TYPE CONTROLS	
ANGLE(I), I=1,3	1-6 7-12 13-18	FOR HALF SINE-WAVE DECELERATION (NBTAB=0) OR FOR UNIDIRECTIONAL DECELERATION TABULAR INPUT (NATAB>0), ANGLE(1) AND ANGLE(2) REPRESENT THE AZIMUTH AND ELEVATION (OBLIQUE ANGLES) OF THE DIRECTION OF THE DECELERATION IMPULSE (DEG). ANGLE(3) IS NOT USED AND THE INITIAL YAW, PITCH AND ROLL OF THE VEHICLE ARE ASSUMED TO BE ZERO. FOR THE OMNIDIRECTIONAL TABULAR INPUT (NATAB<0), THEY REPRESENT THE INITIAL YAW, PITCH AND ROLL OF THE VEHICLE (DEG).	
XIPS	19-24	THE INITIAL X-DIRECTION VELOCITY OF THE CRASH VEHICLE (IN/SEC). A NEGATIVE VALUE MAY BE SUPPLIED FOR NATAB=0 TO INDICATE THAT THE VEHICLE WILL ACCELERATE FROM A VELOCITY OF ZERO TO |XIPS|. FOR NATAB>0 AND NATAB=0, XIPS IS INERTIAL. FOR NATAB<0, XIPS IS IN THE REFERENCE SYSTEM DEFINED BY THE VALUE OF NATAB.	
YIPS OR VTIME	25-30	FOR NATAB=0, THE TIME DURATION OF THE DECELERATION IMPULSE (SEC). A VALUE OF ZERO IS NOT PERMITTED. FOR NATAB<0, THE INITIAL Y-DIRECTION VELOCITY OF THE CRASH VEHICLE (IN/SEC) IN THE REFERENCE SYSTEM DEFINED BY THE VALUE OF NATAB. NOT USED FOR NATAB>0.	
ZIPS	31-36	FOR NATAB<0, THE INITIAL Z-	

		DIRECTION VELOCITY OF THE CRASH VEHICLE (IN/SEC) IN THE REFERENCE SYSTEM DEFINED BY THE VALUE OF NATAB. NOT USED FOR NATAB>0 OR NATAB=0.
X0(I),I=1,3	37-42 43-48 49-54	THE INITIAL X, Y AND Z COORDINATES OF THE VEHICLE REFERENCE ORIGIN IN INERTIAL REFERENCE (IN).
NATAB	55-60	INTEGER NUMBER OF TIME POINTS FOR WHICH VEHICLE DECELERATION DATA IS TO BE SUPPLIED. THE ALGEBRAIC SIGN OF NATAB DETERMINES THE TYPE OF VEHICLE MOTION AS FOLLOWS: IF NATAB=0, THE DIRECTION IMPULSE IS AN ANALYTICAL HALF-SINE WAVE FUNCTION THAT DECELERATES THE VEHICLE FROM AN INITIAL SPEED OF VMPH TO ZERO IN VTIME SECONDS. IF NATAB>0, THE VEHICLE MOTION IS UNIDIRECTIONAL AND ONLY THE RESULTANT LINEAR DECELERATION IS INPUTTED IN TABULAR FORM ON CARDS C.3. (NATAB SHOULD BE ODD AND MAXIMUM VALUE IS 99.) IF NATAB<0, THE VEHICLE MOTION IS FULL THREE DIMENSIONAL AND SIX DEGREES OF FREEDOM IN ACCELERATION ARE INPUTTED IN TABULAR FORM ON CARDS C.4. (MAXIMUM NUMBER OF TABLE POINTS IS 100.) IF THE ABSOLUTE VALUE OF NATAB IS BETWEEN 1 AND 100, THEN THE INITIAL VELOCITIES XIPS, YIPS AND ZIPS ARE PARALLEL TO THE INERTIAL AXES. IF IT IS BETWEEN 101 AND 200, THEN THEY ARE PARALLEL TO THE VEHICLE AXES.
AT0	61-66	THE BEGINNING TIME POINT FOR THE DECELERATION TABLE INPUT (SEC).
ADT	67-72	FIXED TIME INTERVAL FOR THE DECELERATION TABLE INPUT (SEC).

CARDS C.3 UNIDIRECTIONAL DECELERATION VALUES
THESE CARDS ARE REQUIRED ONLY IF NATAB>0

ATAB(1,I), I=1,NATAB	1-6 7-12 13-18 19-24 25-30 31-36 37-42 43-48 49-54 55-60 61-66 67-72	THE NATAB VALUES OF DECELERATION (G'S) FOR THE CRASH VEHICLE FOR FIXED TIME INTERVALS: T(I)=AT0+(I-1)*ADT FOR I=1,NATAB. INPUT 12 NUMBERS PER CARD, USE AS MANY CARDS AS NECESSARY. SINCE A SIMPSON'S INTEGRATION IS USED TO COMPUTE VELOCITY AND POSITION, THE VALUE OF NATAB SHOULD BE ODD AND THE LAST VALUE IN THE TABLE SHOULD BE ZERO, HOWEVER, THE PROGRAM WILL EXTEND THE TABLE IF NECESSARY TO FULFILL THESE REQUIREMENTS. PLACE "I" FOR FIRST VALUE OF CARD IN COLS 73-74. ONLY THE LAST CARD MAY HAVE LESS THAN 12 VALUES.

CARDS C.4 OMNIDIRECTIONAL DECELERATION VALUES
MATAB CARDS ARE REQUIRED ONLY IF NATAB<0 (MATAB=-NATAB OR -NATAB-100). EACH CARD (I) WILL CONTAIN THE LINEAR AND ANGULAR ACCELERATIONS FOR TIME T(I)=AT0+(I-1)*ADT FOR I=1,MATAB. PLACE "I" IN COLS. 73-74.

ATAB(J,I), J=1,3	11-20 21-30 31-40	THE VALUES OF THE X, Y AND Z COMPONENTS OF LINEAR DECELERATION (G'S) FOR TIME POINT T(I).
ATAB(J,I), J=4,6	41-50 51-60 61-70	THE VALUES OF THE COMPONENTS OF ANGULAR ACCELERATION (DEG/SEC**) FOR TIME POINT T(I).

D. CONTACT SPECIFICATIONS

CARD D.1 CONTACT CONTROLS

NPL	1-6	NUMBER OF CONTACT PLANAR PANELS USED.
NBLT	7-12	NUMBER OF BELTS USED TO RESTRAIN THE CRASH VICTIM (8 MAXIMUM).
NBAG	13-18	NUMBER OF AIRBAGS USED TO RESTRAIN THE CRASH VICTIM (MAX=5, MAX NSEG+NBAG=20).
NELP	19-24	NUMBER OF CONTACT ELLIPSOIDS USED.
NQ	25-30	THE NUMBER OF CONSTRAINTS TO BE SUPPLIED ON CARDS D.6. EACH CONSTRAINT OF TYPE 5 WILL BE CONSIDERED AS TWO CONSTRAINTS REQUIRING TWO SETS OF CARDS. THE FINAL MAXIMUM ON NQ IS 12.
NSD	31-36	THE NUMBER OF SPRING DAMPERS TO BE SUPPLIED ON CARDS D.8 (20 MAXIMUM)
NUMATL	37-42	NUMBER OF MATERIALS SPECIFIED FOR ELLIPSOIDS AND CONTACT PANELS.
NUTANG	43-48	NUMBER OF TANGENTIAL FORCES SPECIFIED FOR CONTACTS.
TPC	49-54	FRACTION OF MOVING CONTACT STEP FOR RAMPING VELOCITY.
TMX	55-60	MAXIMUM RAMP DURATION (SEC).
NUMGR	61-66	NUMBER OF G-R TABLES SPECIFIED FOR MATERIALS.

IF NPL<>0, NPL SETS OF D.2 ARE REQUIRED.

CARD D.2.A CONTACT PLANE CONTROLS

J	1-4	THE NUMBER IDENTIFYING THE PLANE.
NUMTIM	5-8	NUMBER OF TIME POINTS SPECIFIED FOR PANEL. MUST BE POSITIVE.
NMATRL	9-12	NUMBER OF MATERIAL SPECIFICATION, ZERO IF RIGID.
LEDGSW	13-16	EDGE SCALING SWITCH: 0 IS NORMAL SCALING, 1 IS NO OFF SIDE SCALING, 2 IS NO DEPTH SCALING AND 3 IS NO SCALING AT ALL.
NINTRL	17-20	SYSTEM IN WHICH POSITIONS ARE SPECIFIED: 0=INERTIAL, OTHERWISE SEGMENT NO. (NSEG+1 FOR VEHICLE).
ISOLAT	21-24	0=ISOLATED, 1=FACE OF SOLID.
PLTTL(I,J), I=1,4	25-40	A 16 CHARACTER TITLE OF THE JTH PANEL.

NUMTIM SETS OF D.2.B-D.2.D ARE REQUIRED IMMEDIATELY FOLLOWING THE CORRESPONDING D.2.A CARD. EACH SET MUST BE EITHER ONE POINT OR MORE IN ASCENDING ORDER OF TIME WHICH SPANS SIMULATION DURATION. PLACE THE ALPHABETIC CHARACTER CORRESPONDING TO "J" IN COL. 73. PLACE "N" IN COL. 74, WHERE N IS THE INDEX OF THE TIME POINT; IE N=1 TO NUMTIM.

CARDS D.2.B-D.2.D PLANAR PANEL CORNER POSITIONS

CARD D.2.B

TIMEFF	1-12	SIMULATED TIME EFFECTIVE (SEC)
P1(I),I=1,3	13-24 25-36 37-48	THE X, Y AND Z COORDINATES OF POINT P1 IN SYSTEM SPECIFIED ON D.2.A (IN).

CARD D.2.C

P2(I),I=1,3	13-24 25-36 37-48	THE X, Y AND Z COORDINATES OF POINT P2 IN SYSTEM SPECIFIED ON D.2.A (IN).

CARD D.2.D

P3(I),I=1,3	13-24 25-36 37-48	THE X, Y AND Z COORDINATES OF POINT P3 IN SYSTEM SPECIFIED ON D.2.A (IN).

WHERE P1, P2 AND P3 ARE THREE OF THE CORNERS OF A PARALLELOGRAM SUCH THAT THE EDGE LINE P1P2 DEFINES THE X-AXIS IN THE PLANE SYSTEM. CORNER POINT P3 IS THEN CHOSEN TO DEFINE THE PLANE SUCH THAT THE RESULTANT Z-AXIS (THE NORMAL TO THE PLANE IN A RIGHT-HAND SYSTEM) POINTS TOWARD THE OUTSIDE. THE Y-AXIS IN THE PLANE MUST BE LESS THAN 90 DEGREES FROM LINE P1P3.

```
          /P3
         /
        /
       /
 P1   /_______Y-AXIS
     |
     |
     |
     |
     P2
     |
     X-AXIS
```

WHERE Z-AXIS IS
UP OUT OF PAPER
TOWARD OUTSIDE.

IF NBLT<>0, NBLT SETS OF D.3 ARE REQUIRED. PLACE "J" IN COLS 73-74.

CARD D.3.A BELT DESCRIPTION

BLTTTL(I,J), I=1,5	1-20	A 20 CHARACTER DESCRIPTION OF THE JTH BELT.

CARD D.3.B BELT ANCHOR POSITION

BELT(I,J), I=1,3	1-12 13-24 25-36	X, Y AND Z COORDINATES, IN VEHICLE (OR SEGMENT TO WHICH BELT IS ANCHORED) REFERENCE, OF ANCHOR POINT A FOR THE JTH BELT (IN).
BELT(I,J), I=4,6	37-48 49-60 61-72	X, Y AND Z COORDINATES, IN VEHICLE (OR SEGMENT TO WHICH BELT IS ANCHORED) REFERENCE, OF ANCHOR POINT B FOR THE JTH BELT (IN).

NOTE: THE PROGRAM MUST PASS A PLANE THROUGH THE THREE POINTS, ANCHOR POINT A, ANCHOR POINT B AND A FIXED POINT ON THE CONTACTED BODY SEGMENT. IF ANCHOR POINTS A AND B COINCIDE, THEY MUST BE SEPARATED SLIGHTLY FOR INPUT SUCH THAT THE DESIRED BELT PLANE WILL BE DEFINED.

CARD D.3.C BELT CONTACT POINT POSITION

BELT(I,J), I=7,9	1-12 13-24 25-36	X, Y AND Z COORDINATES, IN LOCAL BODY SEGMENT REFERENCE (BUT WITH RESPECT TO ELLIPSOID CENTER, NOT C.G.), OF THE FIXED CONTACT POINT ON THE BODY SEGMENT FOR THE JTH BELT (IN).
BELT(10,J)	37-48	CURRENTLY NOT USED BY THE PROGRAM.
BELT(11,J)	49-60	BELT SLACK (IN). THE SLACK, WHEN ADDED TO THE INITIAL GEOMETRIC LENGTH, RESULTS IN THE INITIAL BELT LENGTH (MAY BE INPUTTED AS A NEGATIVE NUMBER AND THE PROGRAM WILL COMPUTE THE SLACK).

IF NBAG<>0, NBAG SETS OF D.4 ARE REQUIRED BY SUBROUTINE AIRBAG1. PLACE "J" IN COLS 73-74.

CARD D.4.A AIR BAG DESCRIPTION

BAGTTL(I,J), I=I,5	1-20	A 20 CHARACTER DESCRIPTION OF THE JTH AIR BAG
NPANEL(J)	21-24	NUMBER OF VEHICLE CONTACT PANELS THAT ARE ALLOWED TO INTERACT WITH THE JTH AIR BAG (MAXIMUM=4).

CARD D.4.B AIR BAG SIZE AND POSITION

AB(I,J), I=1,3	1-12 13-24 25-36	THE X, Y AND Z SEMIAXES OF THE JTH AIR BAG WHEN FULLY INFLATED AND UNDEFORMED (IN).
BFA(I,J), I=1,3	37-48 49-60 61-72	THE X, Y AND Z COORDINATES OF THE CENTER OF THE AIR BAG CONTACT ELLIPSOID WITH RESPECT TO THE AIR BAG CENTER OF GRAVITY (IN).

CARD D.4.C AIR BAG ORIENTATION

YB PB RB	1-12 13-24 25-36	THE INITIAL ORIENTATION (YAW, PITCH AND ROLL) OF THE JTH AIR BAG IN THE VEHICLE REFERENCE (DEG).
ZDEP(I,J), I=1,3	37-48 49-60 61-72	THE X, Y AND Z COORDINATES OF THE DEPLOYMENT POINT OF THE JTH AIR BAG IN THE LOCAL REFERENCE OF THE 1ST PANEL ON CARD D.4.G (IN).

CARD D.4.D		AIR BAG PHYSICAL PROPERTIES NUMBER ONE
W(NVEH+J)	1-12	MASS OF AIR BAG MEMBRANE AND CONTENTS (LBS-SEC-SEC/IN).
CYTD(J)	13-24	GAS SUPPLY ACTUATOR FIRING TIME RELATIVE TO THE START OF VEHICLE DECELERATION (SEC).
CYPA(J)	25-36	ATMOSPHERIC PRESSURE (PSIA).
CYSP(J)	37-48	INITIAL GAS SUPPLY PRESSURE (PSIG).
CYT0(J)	49-60	INITIAL GAS SUPPLY TEMPERATURE (DEG R).
CYV0(J)	61-72	GAS SUPPLY RESERVOIR VOLUME (IN**3).

CARD D.4.E		AIR BAG PHYSICAL PROPERTIES NUMBER TWO
CYCD(J)	1-12	SONIC THROAT DISCHARGE COEFFICIENT (DIMENSIONLESS).
CYK(J)	13-24	RATIO OF SPECIFIC HEATS OF SUPPLY GAS (DIMENSIONLESS).
CYR(J)	25-36	SPECIFIC GAS CONSTANT (IN/DEG R).
CYAT(J)	37-48	SONIC THROAT AREA (IN**2).
CYPV(J)	49-60	VENT PRESSURE OF THE EXHAUST ORIFICE (PSIG).
CYCD0(J)	61-72	EXHAUST ORIFICE DISCHARGE COEFFICIENT (DIMENSIONLESS).

CARD D.4.F		AIR BAG PHYSICAL PROPERTIES NUMBER THREE
CYA0(J)	1-12	EXHAUST ORIFICE AREA (IN**2).
SPRK(J)	13-24	SPRING CONSTANT OF A LINEAR SPRING USED TO SIMULATE ATTACHMENT OF THE BAG AT THE DEPLOYMENT POINT IN THE VEHICLE (LB/IN).
VSCS(J)	25-36	COEFFICIENT OF SLIDING FRICTION OF THE AIR BAG (DIMENSIONLESS)
CK(J)	37-48	PARAMETER USED TO STABILIZE AIR BAG NUMERICAL INTEGRATION (1/SEC). SUGGESTED VALUE = 250.
CMASS(J)	49-60	MULTIPLIER TO INCREASE OR DECREASE THE MASS OF THE AIR BAG TO ARTIFICIALLY DAMPEN THE INTEGRATED AIR BAG MOTION.
CONVD	61-72	TEMPERATURE UNITS IN TERMS OF DEGREES RANKINE. (J=1 ONLY)

NPANEL(J) SETS OF THE FOLLOWING TWO CARDS ARE REQUIRED TO DEFINE THE ELLIPSOIDS USED TO APPROXIMATE THE CONTACT PANELS FOR THE JTH AIR BAG. THE FIRST PANEL IS THE REACTION PANEL. PLACE AIR BAG "J" IN COL. 73 AND PANEL "K" IN COL. 74.

CARD D.4.G AIR BAG PANEL SIZE AND RELATIVE LOCATION

B(I,K,J), I=1,3	1-12 13-24 25-36	X, Y AND Z SEMIAXES FOR THE KTH PANEL FOR THE JTH AIR BAG (IN).
BFB(I,K,J), I=1,3	37-48 49-60 61-72	THE LOCATION OF THE CENTER OF THE PANEL ELLIPSOID WITH RESPECT TO ITS CENTER OF GRAVITY (IN).

CARD D.4.H AIR BAG PANEL ORIENTATION

ZR(I,K,J), I=1,3	1-12 13-24 25-36	X, Y AND Z COORDINATES IN VEHICLE REFERENCE OF THE CENTER OF GRAVITY OF THE KTH PANEL OF THE JTH AIR BAG (IN).
YP PP RP	37-48 49-60 61-72	ANGULAR ORIENTATION, YAW, PITCH AND ROLL (DEG) OF THE KTH PANEL WITH RESPECT TO THE VEHICLE.

IF NELP<>0, NELP D.5 CARDS ARE REQUIRED.

NOTE: NELP IS THE NUMBER OF CONTACT ELLIPSOIDS. THESE DATA CARDS MUST BE IN ASCENDING ORDER ON NELSEG.

CARD D.5		BODY SEGMENT ELLIPSOID SPECIFICATIONS
M	1-3	CONTACT ELLIPSOID NUMBER.
NELSEG	4-6	NUMBER OF BODY SEGMENT TO WHICH THIS ELLIPSOID IS ATTACHED (MAY ALSO BE NSEG+1 FOR VEHICLE OR NSEG+NBAG+2 FOR GROUND).
NMATRL	7-9	IDENTIFICATION NUMBER OF MATERIAL SPECIFICATION, ZERO IF RIGID.
ELPTTL(I,M), I=1,4	10-25	A 16 CHARACTER TITLE OF THE MTH ELLIPSOID.
P1(I),I=1,3	26-30 31-35 36-40	THE X, Y AND Z SEMIAXES OF THE CONTACT ELLIPSOID (IN).
P2(I),I=1,3	41-45 46-50 51-55	THE X, Y AND Z COORDINATES OF THE ELLIPSOID OFFSET FROM THE SEGMENT CENTER OF GRAVITY (IN).
P3(I),I=1,3	56-60 61-65 66-70	THE YAW, PITCH AND ROLL (DEGREES) OF THE CONTACT ELLIPSOID FROM THE PRINCIPAL AXIS OF THE SEGMENT.

IF NQ<>0, NQ D.6 CARDS ARE REQUIRED. PLACE "J" IN COLS. 73-74.

CARDS D.6.A-D.6.B

KQTYPE(J)	1-6	TYPE NO. OF THE JTH CONSTRAINT

1: POINT SPECIFIED BY RK1 ON SEGMENT KQ1 WILL BE CONSTRAINED TO BE THE SAME AS THE POINT SPECIFIED BY RK2 ON SEGMENT KQ2.

2: POINT SPECIFIED BY RK1 ON SEGMENT KQ1 WILL BE CONSTRAINED TO REMAIN AT AN EQUAL DISTANCE (D>0) FROM THE POINT SPECIFIED BY RK2 ON SEGMENT KQ2.

5: TENSION ELEMENT CONSTRAINT CONNECTING POINT RK1 ON SEGMENT KQ1 TO POINT RK2 ON SEGMENT KQ2 (REQUIRES TWO CARDS WITH KQTYPE, KQ1 AND KQ2 THE SAME ON BOTH).

KQ1(J)	7-12	SEGMENT IDENTIFICATION NUMBER OF THE 1ST SPECIFIED POINT.
KQ2(J)	13-18	SEGMENT IDENTIFICATION NUMBER OF THE 2ND SPECIFIED POINT.
RK1(I,J), I=1,3	19-24 25-30 31-36	COORDINATES OF SPECIFIED POINT ON SEGMENT KQ1 (IN). IF KQTYPE=5, THE SECOND CARD (D.6.B) WILL CONTAIN THE EFFECTIVE MASSES MA, MB AND MAB (LB.SEC**2/IN) INSTEAD OF RK1.
RK2(I,J), I=1,3	37-42 43-48 49-54	COORDINATES OF SPECIFIED POINT ON THE SECOND SEGMENT KQ2 (IN). IF KQTYPE=5, THE SECOND CARD WILL CONTAIN THE SPRING CONSTANT K (LB/IN), THE VISCOUS DAMPING CONSTANT D (LB SEC/IN) AND THE REFERENCE LENGTH L (IN) IN PLACE OF RK2. NOTE: IF KQTYPE=1 AND KQ2 IS THE NUMBER FOR THE VEHICLE, THEN SUBROUTINE EQUILB WILL MODIFY THESE VALUES OF RK2 SUCH THAT THEY WILL BE EQUIVALENT TO RK1 IN INERTIAL REFERENCE FOR TIME ZERO. (SEE DESCRIPTION UNDER CARDS G.6.)

CARD D.7 IS ALWAYS REQUIRED. SUPPLY BLANK CARD FOR NORMAL 3D MOTION.

CARD D.7		RUN SYMMETRY OPTION SPECIFICATION
NSYM(J), J=1,NSEG	1-4 5-8 ETC.	CONTROLS SYMMETRY OPTION OF BODY SEGMENTS AS FOLLOWS :
NSYM(J)=0 :		NORMAL THREE DIMENSIONAL MOTION FOR BODY SEGMENT J.
NSYM(J)=J :		MOTION OF BODY SEGMENT J WILL BE RESTRICTED TO THE X-Y PLANE WITH NO LATERAL MOTION, HENCE IT WILL BE TWO DIMENSIONAL.
NSYM(J)=K :		BODY SEGMENTS J AND K ARE TO REMAIN SYMMETRIC WITH NO LATERAL MOTION. THE MOTION OF EACH WILL BE REPLACED WITH THEIR AVERAGE AND RESTRICTED TO THE LOCAL X-Y PLANE. NSYM(K) MUST EQUAL J.
NSYM(J)=-K:		BODY SEGMENTS J AND K ARE TO REMAIN MIRROR SYMMETRICAL WITH RESPECT TO THE X-Z PLANE. EQUAL BUT OPPOSITE LATERAL MOTION IS PERMITTED. NSYM(K) MUST EQUAL -J.

NOTE: IN THE ABOVE SYMMETRY OPTIONS, THE USER MUST TAKE EXTREME CARE THAT ALL INPUT WILL ALLOW THE SYMMETRY TO EXIST.

IF NSD<>0, NSD D.8 CARDS ARE REQUIRED.

CARDS D.8 · SPRING DAMPER SPECIFICATIONS

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   MSDM(J)          1-3   SEGMENT IDENTIFICATION NUMBERS
   MSDN(J)          4-6   (M AND N) TO WHICH THE JTH SPRING
                          DAMPER IS ATTACHED.

   APSDM(I,J),      7-12  COORDINATES OF ATTACHMENT POINTS
   I=1,3            13-18 IN LOCAL SEGMENT REFERENCE ON
                    19-24 SEGMENTS M AND N FOR THE JTH
   APSDN(I,J),      25-30 SPRING DAMPER (IN).
   I=1,3            31-36
                    37-42

   ASD(I,J),I=1,5         COEFFICIENTS OF QUADRATIC
I=1:DO  (IN)        43-48 FUNCTIONS TO COMPUTE THE SPRING
I=2:A1  (LB/IN)     47-54 FORCE (FS) AND THE VISCOUS FORCE
I=3:A2  (LB/IN**2)  55-60 (FD) FOR THE JTH SPRING DAMPER
I=4:B1  (LB SEC/IN) 61-66 USING THE RELATIONSHIPS:
I=5:B2  (LB SEC**2  67-72 FS=(D-D0)*(|A1| + A2*|D0-D|)
            /IN**2)       FD=DV*(B1 + B2*|DV|)
                          WHERE D AND DV ARE THE DISTANCE
                          AND ITS TIME DERIVATIVE BETWEEN
                          THE POINTS APSDM AND APSDN. IF
                          A1<0. AND (D-D0)<0., PROGRAM WILL
                          SET FS=0., I.E. THIS WILL ACT AS A
                          TENSION ELEMENT.
```

IF NUMATL<>0, NUMATL D.9.A CARDS ARE REQUIRED.

CARD D.9.A NORMAL FORCE MATERIAL SPECIFICATION

NMATRL	1-4	IDENTIFICATION NUMBER OF MATERIAL SPECIFICATION.
MATNAM	5-20	16 CHARACTER MATERIAL NAME.
MSTW	21-24	LOADING CURVE SWITCH: POLYNOMIAL INDEX IF NEGATIVE, BIVARIATE TABLE INDEX IF POSITIVE. ZERO MEANS ZERO PROPERTIES.
NGRTAB	25-28	NUMBER OF G-R TABLE. ZERO MEANS USE DEFAULT VALUES OF G=0 AND R=1. IF NGRTAB=-1, LOADING CURVE MSTW WILL BE USED FOR UNLOADING ALSO.
IFRIK	29-32	FRICTION CLASS. ZERO MEANS NO FRICTION.
DC	33-40	DEFLECTION AT YIELD POINT, WHERE PLASTIC BEHAVIOR BEGINS, IF POSITIVE. IF NEGATIVE, ALTERNATIVE RELOADING WILL BE USED. IF ZERO, BEHAVIOR WILL BE ELASTIC.
DE	41-48	DEFLECTION AT WHICH BREAKDOWN BEGINS. ZERO MEANS NO BREAKDOWN.
DF	49-56	DEFLECTION AT WHICH BREAKDOWN IS COMPLETED. DF MUST BE GREATER THAN DE.
FSAT	57-64	SATURATION FORCE. ZERO MEANS NOT OPERATIONAL.
DM	65-72	SLOPE FOR UNLOADING FROM SATURATION, IF POSITIVE. IF NEGATIVE, ABSOLUTE VALUE OF DM WILL BE USED FOR G INSTEAD.

IF NUTANG<>0, NUTANG D.9.B CARDS ARE REQUIRED.

CARD D.9.B TANGENTIAL FORCE SPECIFICATION

IFRIKA	1-5	FRICTION CLASS ONE.
IFRIKB	6-10	FRICTION CLASS TWO.
FMU0	11-18	ZEROTH ORDER FRICTION COEFFICIENT.
FMU1	19-26	FIRST ORDER FRICTION COEFFICIENT.
FMU2	27-34	SECOND ORDER FRICTION COEFFICIENT.
A1	35-42	FIRST ORDER SNAP BACK COEFFICIENT.
A2	43-50	SECOND ORDER SNAP BACK COEFFICIENT
FTMAX	51-58	MAXIMUM TANGENTIAL FORCE.
TVON	59-66	VELOCITY MAGNITUDE FOR FULL USE OF FRICTION TERMS.

NOTE: TANGENTIAL FORCE IS COMPUTED BY THIS EQUATION:

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FT=MIN(MIN(DELBARDOT/TVON,1.)(FMU0+FMU1*DEL+FMU2*DEL**2)*FN
  +(A1*DELBAR+A2*DELBAR**2),FTMAX)
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E. SPECIFICATION OF MATERIAL PROPERTY FUNCTIONS

THESE FUNCTIONS ARE REFERRED TO BY NUMBER IN THE NF ARRAYS REQUIRED ON CARDS F.2.B AND F.4.B. THEY ARE USED TO DEFINE THE FORCE DEFLECTION, INERTIAL SPIKE, R (ENERGY ABSORPTION) FACTOR, G (DEFLECTION) FACTOR AND FRICTION COEFFICENT FUNCTIONS.

EACH FUNCTION MAY BE SUBDIVIDED, IF DESIRED, INTO TWO SEPARATE PARTS, F1 AND F2 , WHERE

F1(D) IS DEFINED FOR 0 .LE. DO .LE. D .LE. |D1|

F2(D) IS DEFINED FOR |D1| .LE. D .LE. |D2|.

IN ADDITION, EACH PART OF EACH FUNCTION MAY BE DEFINED IN EITHER OF THREE FUNCTIONAL FORMS: CONSTANT VALUE, TABULAR DATA OR A FIFTH DEGREE POLYNOMIAL. THE EXISTENCE AND FORM OF EACH FUNCTION PART IS INDICATED BY THE SUPPLIED VALUES OF D0, D1, D2 AS FOLLOWS:

F1	F2	D0	D1	D2
CONSTANT	-	0	0	F1 = D2
TABULAR	-	D0 .GE. 0	D1 .LT. 0	0
POLYNOMIAL	-	D0 .GE. 0	D1 .GT. 0	0
TABULAR	POLYNOMIAL	D0 .GE. 0	D1 .LT. 0	D2 .GT. 0
POLYNOMIAL	TABULAR	D0 .GE. 0	D1 .GT. 0	D2 .LT. 0
POLYNOMIAL	POLYNOMIAL	D0 .GE. 0	D1 .GT. 0	D2 .GT. 0

THE CONSTANT FORM IS APPLICABLE ONLY TO F1 BECAUSE THE ROUTINES ASSUME
IF D .GT. |D2| THEN F(D) = F(|D2|) FOR D2 .NE. 0 OR
IF D .GT. |D1| THEN F(D) = F(|D1|) FOR D2 = 0.
THE CASE OF BOTH F1 AND F2 BEING TABULAR IS UNNECESSARY. A MAXIMUM OF 50 FUNCTIONS MAY BE SUPPLIED TO THE PROGRAM. EACH FUNCTION WILL REQUIRE THE FOLLOWING INPUT.

CARD E.1		FUNCTION IDENIFICATION
I	1-4	THE FUNCTION IDENTIFYING NUMBER. THESE NUMBERS NEED NOT BE SUPPLIED IN NUMERIC ORDER. IF THE SAME NUMBER IS USED MORE THAN ONCE, A WARNING WILL BE PRINTED AND THE LAST ONE SUPPLIED WILL BE USED. THE END OF THE FUNCTION INPUT IS INDICATED BY SUPPLYING A SINGLE CARD WITH I>50.
KTITLE(I), I=1,5	9-28	A 20 CHARACTER ALPHANUMERIC TITLE DESCRIBING THE FUNCTION.

CARD E.2 FUNCTION CONTROLS
(PLACE FUNCTION I.D. IN COLS. 73-74.)

D0	1-12	THE LOWER ABSCISSA VALUE OF THE FIRST PART OF THE FUNCTION, F1. D0 MUST BE NON-NEGATIVE (UNITS ARE IN. OR RAD. EXCEPT FOR THE BELT STRESS-STRAIN FUNCTIONS WHERE THEY ARE IN/IN).
D1	13-24	THE MAGNITUDE OF D1 IS THE UPPER ABSCISSA VALUE OF F1 AND THE LOWER ABSCISSA VALUE OF F2, IF ANY. D1<0 INDICATES F1 IS TABULAR, D1>0 INDICATES F1 IS A POLYNOMIAL, AND D1=0 INDICATES F1=D2, A CONSTANT.
D2	25-36	IF D1=0, D2 IS THE CONSTANT VALUE OF F1. OTHERWISE, THE MAGNITUDE OF D2 IS THE UPPER ABSCISSA VALUE OF F2. IF D2=0, F2 IS NOT DEFINED; IF D2 IS NEGATIVE, F2 IS TABULAR; IF D2 IS POSITIVE, F2 IS A POLYNOMIAL.
D3	37-48	IF THE FUNCTION IS TO BE USED FOR AN INERTIAL SPIKE, D3 REPRESENTS THE ABSCISSA VALUE FOR WHICH THE INERTIAL SPIKE IS TO BE IGNORED IF UNLOADING OCCURS AFTER DEFLECTION EXCEEDS D3. IF THE FUNCTION IS TO BE USED FOR A COEFFICIENT OF FRICTION, D3=(1+U)/2 WHERE U IS THE COEFFICIENT OF RESTITUTION FOR THE IMPULSE OPTION (-1<U<+1 OR 0<D3<1). A VALUE OF D3=0 MEANS THAT THE IMPULSE OPTION WILL NOT BE USED FOR THOSE CONTACTS USING THIS FUNCTION. WHEN THE GLOBALGRAPHIC OPTION IS USED, A FRICTION FUNCTION IS DEFINED AND THE VALUE OF D3 IS USED TO SPECIFY THE IMPULSE. (SEE CARD B.5.)
D4	49-60	IF USED AS THE FRICTION FUNCTION FOR A ROLL-SLIDE CONSTRAINT, D4 IS THE COEFFICIENT OF STATIC FRICTION FOR THE ROLL CONSTRAINT.

THE DEFINITIONS OF F1 AND F2, IF THEY EXIST, ARE NOW SUPPLIED ON CARD E.3 FOR THE FIFTH DEGREE POLYNOMIAL DEFINITION OR ON CARDS E.4 FOR THE TABULAR DEFINITION.

CARD E.3 POLYNOMIAL FUNCTION SPECIFICATION (PLACE FUNCTION I.D. IN COLS. 73-74.)

A0	1-12	COEFFICIENTS OF FIFTH-DEGREE
A1	13-24	POLYNOMIAL:
A2	25-36	F=A0 + A1*X + A2*X**2
A3	37-48	+ A3*X**3 + A4*X**4 + A5*X**5
A4	49-60	(UNITS ARE DEPENDENT ON USE OF
A5	61-72	FUNCTION.)

CARD E.4.A TABULAR FUNCTION CONTROL

NPI	1-6	THE NUMBER OF DATA POINTS TO BE SUPPLIED TO IDENTIFY THE FUNCTION IF IT IS DEFINED IN TABULAR FORM.

CARDS E.4.B TABULAR FUNCTION SPECIFICATION (PLACE FUNCTION I.D. IN COLS. 73-74. ONLY THE LAST CARD MAY HAVE LESS THAN THREE POINTS.)

(X(I),Y(I),	1-12	THE ABSCISSA AND ORDINATE VALUES
I=1,NPI)	13-24	OF THE DATA POINTS USED TO DEFINE
	25-36	FORM OF THE FUNCTION. SUPPLY
	37-48	THREE POINTS PER CARD. USE AS
	49-60	MANY CARDS AS REQUIRED. (UNITS ARE
	61-72	DEPENDENT ON USE OF FUNCTION.)

ONE SET OF E.5.A-E.5.C CARDS REQUIRED FOR EVERY BIVARIATE POLYNOMIAL USED IN D.9.A CARDS. LAST SET MUST BE FOLLOWED BY A BLANK CARD. MUST BE IN ORDER OF ASCENDING NPOLY.

CARD E.5.A-E.5.C BIVARIATE POLYNOMIAL SPECIFICATION

NPOLY	1-3	NUMBER OF POLYNOMIAL SPECIFICATION
COEFM(I,J), I=1,9	5-67	COEFFICIENTS OF TERMS OF FORM: AKL*DEL**K*DELDOT**L

CARD	I=	1	2	3	4	5	6	7	8	9
	COL.	5-11	12-18	19-25	26-32	33-39	40-46	47-53	54-60	61-67
	J									
E.5.A	1	A10	A20	A30	A40	A50	A60	A11	A21	A31
E.5.B	2	A41	A51	A12	A22	A32	A42	A13	A23	A33
E.5.C	3	A14	A24	A15	A01	A02	A03	A04	A05	A06

ONE E.5.D CARD REQUIRED FOR EVERY TABLE POINT FOR EVERY TABLE USED IN D.9.A CARDS. ALL POINTS FOR EACH TABLE MUST BE CONTIGUOUS. TABLE SPECIFICATIONS MUST BE IN ORDER OF ASCENDING NTABL. LAST TABLE MUST BE FOLLOWED BY A BLANK CARD. THE LAST THREE QUANTITIES NECESSARY FOR FIRST POINT OF EACH TABLE ONLY. NOTE THAT EACH BIVARIATE TABLE MUST HAVE A MINIMUM OF FOUR DISTINCT POINTS, WHILE EACH UNIVARIATE TABLE MUST HAVE A MINIMUM OF TWO DISTINCT POINTS.

CARD E.5.D TABLE SPECIFICATION

NTABL	1-3	NUMBER OF TABLE.
BIVTAB(I,J), I=1,3	5-14 15-24 25-34	DEFLECTION, DEFLECTION RATE AND FORCE POINT FOR TABLE OF RANDOMLY SCATTERED POINTS. IF TABLE CONSISTS OF POINTS ON A LATTICE (REGULAR OR IRREGULAR SPACING), DEFLECTION SHOULD BE SET NEGATIVE HERE AND THE RATE AND FORCE ENTRIES WILL BE IGNORED.
XLATIC (NBIVX)	35-44	DEFLECTION INCREMENT FOR BOX, IF RANDOM TABLE. IF LATTICE, CONTAINS NUMBER OF DEFLECTION POINT VALUES TO BE ENTERED ON E.5.E CARDS. IF TABLE FORCE VALUES ARE NOT DEPENDENT ON DEFLECTION, THIS ENTRY MUST BE SET TO ZERO.
YLATIC (NBIVY)	45-54	DEFLECTION RATE INCREMENT FOR BOX, IF RANDOM TABLE. IF LATTICE, CONTAINS NUMBER OF DEFLECTION RATE POINT VALUES TO BE ENTERED ON E.5.F CARDS. IF TABLE FORCE VALUES ARE NOT DEPENDENT ON DEFLECTION RATE, THIS ENTRY MUST BE SET TO ZERO.
INMETA	55-56	0 FOR LINEAR INTERPOLATION, 1 FOR LOG-LINEAR INTERPOLATION. (MINIMUM FORCE OFFSET TO 1.)

ONE E.5.E CARD IS REQUIRED FOR EVERY LATTICE TABLE, FOLLOWING ITS E.5.D CARD, UNLESS NBIVX=0, IN WHICH CASE THE E.5.E CARD IS OMITTED. (PLACE NTABL IN COLS. 73-74. IF NBIVX>9, CONTINUE ON ANOTHER E.5.E CARD.)

CARD E.5.E   LATTICE HORIZONTAL GRID VALUES

XLAT(K), K=1,NBIVX	1-8 ETC.	DEFLECTION POINT VALUES, IN ASCENDING ORDER.

NBIVY SETS OF E.5.F CARDS ARE REQUIRED FOLLOWING E.5.E CARD. IF NBIVY=0, ONE SET IS STILL NEEDED. (I=1,NBIVY. PLACE NTABL IN COLS. 73-74.)

CARD E.5.F   LATTICE VERTICAL GRID AND FORCE VALUES

I	1-8	DEFLECTION RATE POINT INDEX. (WITH DECIMAL POINT)
YLAT(I)	9-16	DEFLECTION RATE POINT VALUE. (MUST BE IN ASCENDING ORDER ALSO.) IF NBIVY=0, THIS ENTRY WILL BE IGNORED.
FLAT(K,I), K=1,NBIVX	17-24 25-32 ETC.	FORCE VALUES FOR THIS DEFLECTION RATE VALUE AT THE DEFLECTION VALUES GIVEN ON CARD(S) E.5.E. IF NBIVX>7, THESE FORCE VALUES CONTINUE ON THE NEXT CARD BEGINNING IN THE FIRST FIELD.

IF NUMGR=0, NO E.6 CARDS SHOULD BE USED.

ONE E.6 CARD REQUIRED FOR EVERY TABLE POINT FOR EVERY G-R TABLE USED IN D.9.A CARDS. ALL POINTS FOR EACH TABLE MUST BE CONTIGUOUS. TABLE SPECIFICATIONS MUST BE IN ORDER OF ASCENDING NTABL. LAST TABLE MUST BE FOLLOWED BY A BLANK CARD. IT IS THE RESPONSIBILITY OF THE USER TO SEE THAT THE G AND R RATIO VALUES ARE COMPATIBLE.

CARD E.6	G-R TABLE SPECIFICATION	
NTABL	1-3	NUMBER OF G-R TABLE.
GRTAB(I,J),	5-14	DEFLECTION VALUE.
I=1,3	15-24	G RATIO VALUE.
	25-34	R RATIO VALUE.

NOTE: IF R IS NEGATIVE, THE VALUE OF G WILL BE USED AS AN UNLOADING SLOPE INSTEAD. IF R IS ZERO, THE VALUE OF G WILL BE USED FOR LINEAR UNLOADING BASED ON THE G RATIO.

F. ALLOWED CONTACT SPECIFICATIONS

IF NELP<>0, NELP SETS OF F.1.A-F.1.B ARE REQUIRED.

CARD F.1.A — ALLOWED ELLIPSOID-PLANE LINE AND ELLIPSOID-ELLIPSOID CONTACT CONTROLS

MNELPC	1-4	FOR ELLIPSOID MNELPC = 1 TO NELP,
MNELEL	5-8	MNELEL IS THE SUM OF THE NUMBER OF PLANES FOR WHICH SEGMENT-PLANE CONTACT IS ALLOWED AND THE NUMBER OF ELLIPSOIDS FOR WHICH SEGMENT-SEGMENT CONTACT IS ALLOWED FROM CARD D.1. THE VALUE OF MNELEL MUST BE ZERO OR POSITIVE.

MNELEL F.1.B CARDS ARE REQUIRED FOLLOWING F.1.A CARD.

CARD F.1.B — PLANES AND ELLIPSOIDS ALLOWED CONTACTS

NJ	1-4	NUMBER OF ELLIPSOID FOR WHICH CONTACTS ARE BEING SPECIFIED. NJ MUST EQUAL MNELPC ABOVE. THERE MUST BE MNELEL CARDS WITH THIS SAME NJ. IF MNELEL=0, NO CARD WITH NJ=MNELPC SHOULD BE PRESENT. IF NJ<0, ELLIPSOID |NEP| IS INSIDE ELLIPSOID |NJ|.
NEP	5-8	THE PLANE NUMBER OR ELLIPSOID NUMBER FOR WHICH CONTACT IS ALLOWED. IF POSITIVE, INTERPRETED AS PLANE; IF NEGATIVE, INTERPRETED AS ELLIPSOID. ALLOWED ELLIPSOID-ELLIPSOID CONTACTS MUST BE SPECIFIED SO THAT |NEP|>NJ.

IF NBLT<>0, F.2 IS REQUIRED.

CARD F.2.A		ALLOWED BELT-BODY SEGMENT CONTACT CONTROLS
MNBLT(J), J=1,NBLT	1-4 5-8 9-12 ETC. 29-32	FOR BELT J, THE NUMBER OF SEGMENTS FOR WHICH SEGMENT-BELT INTERACTION IS ALLOWED. NBLT IS THE NUMBER OF BELTS FROM CARD D.1. EACH MNBLT MAY HAVE A VALUE OF 0 OR 1 ONLY.

FOR EACH BELT J, MNBLT(J) CARDS OF THE FOLLOWING MUST BE SUPPLIED.

CARDS F.2.B		ALLOWED BELT-BODY SEGMENT CONTACT SPECIFICATION
NJ	1-4	THE BELT NUMBER TO BE CONTACTED, MUST CORRESPOND TO J ABOVE. THERE MUST BE MNBLT(J) CARDS WITH THE SAME NJ. IF MNBLT(J)=0, NO CARD WITH NJ=J SHOULD BE PRESENT.
NS(1)	5-8	THE SEGMENT NUMBER TO WHICH BELT NJ IS ATTACHED. IF VEHICLE, SUPPLY NSEG+1, IF GROUND, SUPPLY NSEG+NBAG+2.
NS(2)	9-12	THE SEGMENT NUMBER (DETERMINED BY THE CARD NUMBER I UNDER CARD B.2.A) FOR WHICH INTERACTION WITH THE NJTH BELT IS ALLOWED.
NS(3)	13-16	THE NUMBER OF THE CONTACT ELLIPSOID ASSOCIATED WITH THE SEGMENT NS(2).
NF(1)	17-20	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE FORCE-DEFLECTION FUNCTION FOR THIS CONTACT. THE ABSCISSA FOR THIS FUNCTION SHOULD BE STRAIN (IN/IN).
NF(2)	21-24	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE INERTIAL SPIKE FUNCTION FOR THIS CONTACT. IF NF(2)=0, NO INERTIAL SPIKE EXISTS.

NF(3)	25-28	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE R (ENERGY-ABSORPTION) FACTOR FUNCTION. IF NF(3)=0, A DEFAULT VALUE OF R=1 IS ASSUMED.
NF(4)	29-32	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE G (DEFLECTION) FACTOR FUNCTION. IF NF(4)=0, A DEFAULT VALUE OF G=0 IS ASSUMED.
NF(5)	33-36	IF NON-ZERO, FULL BELT FRICTION IS ASSUMED, I.E., FORCES ARE COMPUTED FOR EACH HALF OF THE BELT SEPARATELY. IF ZERO, ZERO BELT FRICTION IS ASSUMED, I.E.,BELT TENSION IS THE SAME AT BOTH BELT ANCHOR POINTS.

IF NJNT>0, F.4.A IS REQUIRED. SUPPLY IGLOB=1 FOR GLOBALGRAPHIC OPTION, OTHERWISE SUPPLY 0 OR BLANK

CARD F.4.A GLOBALGRAPHIC JOINT CONTROLS

(18 VALUES ON FIRST CARD. IF NJNT>18, USE TWO CARDS. PLACE "J" FOR FIRST VALUE ON CARD IN COLS. 73-74.)

IGLOB(J), J=1,NJNT	1-4 5-8 ETC. 69-72	FOR EACH JOINT J, SUPPLY 1 FOR IGLOB(J) IF IPIN(J) IS +3 OR -3 ON CARDS B.3.A-B.3.B, OTHERWISE SUPPLY ZERO OR BLANK. ONE CARD F.4.B MUST BE SUPPLIED BELOW FOR EACH J FOR WHICH IGLOB(J)=1.

CARDS F.4.B GLOBALGRAPHIC JOINT SPECIFICATION

NJ	1-4	THE IDENTIFICATION NUMBER FOR A GLOBALGRAPHIC JOINT, MUST CORRESPOND TO J ABOVE AND CARDS MUST BE SUPPLIED IN ASCENDING ORDER ON NJ.
NS(I),I=1,3	5-16	CURRENTLY NOT USED BY PROGRAM.

NF(1)	17-20	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE TORQUE-DEFLECTION FOR THIS GLOBALGRAPHIC JOINT. THE ORDINATE FOR THIS FUNCTION SHOULD BE TORQUE (IN-LB) AND THE ABSCISSA IS THE ANGULAR DEFLECTION (RADIANS) INTO THE STOP.
NF(2)	21-24	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE HERRON FORMULAS FOR T (JOINT STOP ANGLE IN RADIANS) AND ITS DERIVATIVE TP WITH RESPECT TO PHI BOTH AS FUNCTIONS OF PHI (THE JOINT ANGLE FROM THE REFERENCE AXIS IN RADIANS). NORMALLY THEY WILL BE COMPUTED BY T = P1 + SP*P2 TP = P1' + CP*P2 + SP*P2' WHERE P1,P2, ARE THE 5TH DEGREE POLYNOMIAL EVALUATIONS OF COS(PHI) USING THE TWO POLYNOMIALS F1 AND F2 OBTAINED BY SETTING BOTH D1,D2>0 ON CARD E.2; P1',P2' ARE THEIR DERIVATIVES WITH RESPECT TO PHI; AND CP,SP ARE COS(PHI) AND SIN(PHI). IF D1,D2 ARE NOT BOTH POSITIVE, T AND TP WILL BE EVALUATED AS FUNCTIONS OF PHI IN RADIANS (0<PHI<2*PI) AS SPECIFIED ON CARDS E.1-E.4 FOR FUNCTION NF(2).
NF(3)	25-28	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE R (ENERGY-ABSORPTION) FACTOR FUNCTION. IF NF(3)=0, A DEFAULT VALUE OF R=1 IS ASSUMED.
NF(4)	29-32	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE G (DEFLECTION) FACTOR FUNCTION. IF NF(4)=0, A DEFAULT VALUE OF G=0 IS ASSUMED.
NF(5)	33-36	THE FUNCTION NUMBER FROM CARD E.1 TO DEFINE THE FRICTION COEFFICIENT FUNCTION.

IF NBAG<>0, NBAG CARDS OF THE FOLLOWING MUST BE SUPPLIED. SINCE THE AIR BAG ROUTINES DO NOT USE THE FORCE-DEFLECTION FUNCTIONS, THIS INPUT HAS DIFFERENT FORMATS THAN THE ABOVE ALLOWED CONTACTS.

CARDS F.5.A AIR BAG ALLOWABLE CONTACT SPECIFICATIONS

K	1-4	THE AIR BAG NUMBER CORRESPONDING TO INDEX J UNDER CARDS D.4 ABOVE. K MUST BE IN NUMERIC ORDER K=1 TO NBAG, WHERE NBAG IS THE NUMBER OF AIR BAGS DEFINED ON CARD D.1.
NK	5-8	THE NUMBER OF SEGMENTS ALLOWED TO CONTACT THE KTH AIR BAG. THE MAXIMUM VALUE IS 10. IF NK=0, THE REMAINDER OF THE CARD IS BLANK.
MBAG(2,I,K), MBAG(3,I,K), I=1,NK	9-10 11-12 ETC. 47-48	THE SEGMENT NUMBERS (DETERMINED BY THE CARD I OF B.2 CARDS) EACH FOLLOWED BY THE NUMBER OF THE ASSOCIATED CONTACT ELLIPSOID FOR WHICH CONTACT FORCES WITH THE KTH AIR BAG WILL BY COMPUTED. UP TO 10 SETS OF SEGMENT AND ELLIPSOID SPECIFICATIONS.

G. INITIAL CONDITIONS

CARD G.1 PLOT AND INITIAL CONDITION CONTROLS.

ZPLT(I),I=1,3	1-10 11-20 21-30	THE X, Y AND Z PLOT COORDINATES OF THE ORIGIN OF THE VEHICLE REFERENCE SYSTEM. 0 < X < 61 0 < Y < 61 0 < Z < 121
I1	31-34	A VALUE OF 15 IS REQUIRED FOR AUTOMATIC EQUILIBRIUM COMPUTATION AND PROCESSING OF CARDS G.4, G.5 AND G.6
J1,I2,J2	35-38 39-42 43-46	NOT USED BY CURRENT PROGRAM.
I3	47-50	IF ZERO, SEGMENT AND ANGULAR VELOCITIES ARE NOT SUPPLIED ON THE FOLLOWING CARDS BUT ARE SET EQUAL TO THE INITIAL VEHICLE VELOCITY. IF I3<>0, SEGLV AND WMGDEG MUST BE SUPPLIED.

ONE G.2 CARD MUST BE SUPPLIED FOR EACH REFERENCE SEGMENT (I.E., SEGMENT NO. 1 AND EACH SEGMENT J+1 FOR WHICH JNT(J)=0 ON CARD B-3) IN ASCENDING SEGMENT NUMBER SEQUENCE. PLACE "J" IN COLS. 73-74.

CARDS G.2 POSITIONS AND VELOCITIES OF BODY SEGMENTS

SEGLP(I,J), I=1,3	1-10 11-20 21-30	THE INITIAL X, Y AND Z COORDINATES OF THE JTH REFERENCE SEGMENT CENTER OF GRAVITY IN INERTIAL REFERENCE (IN).
SEGLV(I,J), I=1,3	31-40 41-50 51-60	THE INITIAL X, Y AND Z COMPONENTS OF VELOCITY OF THE JTH REFERENCE SEGMENT IN INERTIAL REFERENCE (IN/SEC). THESE FIELDS MAY BE LEFT BLANK IF I3=0 ON CARD G.1 IN WHICH CASE THE INITIAL VELOCITY OF THE VEHICLE WILL BE USED.

CARDS G.3 BODY SEGMENT ORIENTATION AND ANGULAR VELOCITIES (NSEG CARDS, PLACE "J" IN COLS. 73-74.)

YPR(I,J), I=1,3	1-10 11-20 21-30	THE INITIAL YAW, PITCH AND ROLL ANGLES OF THE JTH BODY SEGMENT (DEGREES).

NOTE: FOR THE PURPOSE OF DEFINING INITIAL BODY SEGMENT ORIENTATION ONLY, ROTATIONS MUST BE TAKEN IN THE ORDER ROLL-PITCH-YAW. (I.E., ROLL ABOUT X, PITCH ABOUT RESULTING Y, THEN YAW ABOUT FINAL Z.)

WMGDEG(I,J), I=1,3	31-40 41-50 51-60	THE INITIAL COMPONENTS OF ANGULAR VELOCITY ABOUT THE LOCAL X, Y AND Z AXES OF THE JTH BODY SEGMENT (DEG/SEC). IF I3=0 ON CARD G.1, DO NOT ENTER VALUES FOR WMGDEG.

CARDS G.4, G.5 AND G.6 ARE REQUIRED IF I1=15 ON CARD G.1

CARD G.4 EQUILIBRIUM CONTROLS

NVAR	1-4	NO. OF INDEPENDENT VARIABLES SUPPLIED ON CARDS G.2 AND G.3 THAT ARE TO BE ADJUSTED SUCH THAT CONTACT NORMAL FORCES ARE EQUAL TO EITHER GX SUPPLIED ON CARDS G.5 OR CONSTRAINT NORMAL FORCES CONTROLLED BY CARDS G.6 (MAX=10)
NCON	5-8	NO. OF CONSTRAINTS TO BE IMPOSED TO COMPUTE THOSE CONSTRAINT FORCES WHICH WILL BE SATISFIED BY INITIAL CONTACT FORCES. IF ZERO, THE SUPPLIED VALUES OF GX WILL BE USED. (MAX=5)

CARDS G.5 VARIABLES TO BE ADJUSTED FOR EQUILIBIUM (NVAR CARDS, PLACE "J" IN COLS. 73-74)

NTV(J)	1-4	INDICATES TYPE OF JTH INDEPENDENT VARIABLE; 1 MEANS SEGLP FROM CARDS G.2.; 2 MEANS YPR FROM CARDS G.3.
NI1(J)	5-8	A VALUE OF 1, 2 OR 3 TO INDICATE THE X, Y OR Z COORDINATE OF SEGLP IF NTV(J)=1, OR YAW, PITCH OR ROLL OF YPR IF NTV(J)=2.
NSG(J)	9-12	THE SEGMENT NUMBER (AS SPECIFIED BY INDEX I OF CARDS B.2) FOR THE JTH INDEPENDENT VARIABLE
GX(J)	13-20	THE MAGNITUDE OF THE CONTACT NORMAL FORCE FROM THE JTH INDEPENDENT VARIABLE (LBS.). IF THIS CONTACT IS TO BE CONTROLLED BY A CONSTRAINT OF CARDS G.6 (I.E., J=INDGX(I)), THE SUPPLIED VALUE OF GX WILL BE THE INITIAL VALUE FOR THE ITERATION OF THE CONTACT FORCE TO EQUAL THE CONSTRAINT FORCE; OTHERWISE, THE JTH INDEPENDENT VARIABLE WILL BE ADJUSTED SUCH THAT THE CONTACT NORMAL FORCE WILL BE EQUAL TO GX.

XDEV(J)	21-28	THE MAXIMUM ALLOWABLE DEVIATION FROM THE INITIAL POSITIONS SPECIFIED ON CARDS G.2 AND G.3 DURING THE ITERATION OF THE JTH INDEPENDENT VARIABLE FOR THE CONTACT NORMAL FORCE TO EQUAL GX. IF EXCEEDED, THE PROGRAM WILL TERMINATE WITH AN ERROR MESSAGE. IF XDEV=0, THE TESTS WILL NOT BE PERFORMED.
JPL(J)	29-32	THE PLANE NUMBER CORRESPONDING TO NJ ON F.1.B CARDS FOR THE CONTACT WHOSE NORMAL FORM IS TO BE CONTROLLED BY THE JTH VARIABLE.
JSG(J)	33-36	THE SEGMENT IDENTIFICATION NUMBER (AS SPECIFIED BY INDEX I OF CARDS B.2) INVOLVED IN THE CONTACT WITH PLANE NO. JPL(J). NOTE: A CONTACT FOR THIS PLANE AND SEGMENT MUST HAVE BEEN SET UP ON F.1.B CARDS.
NAV(J)	37-40	NO. OF VARIABLES ASSOCIATED WITH THE JTH INDEPENDENT VARIABLE. (MAX=5, MAY BE ZERO)
KSG(I,J), I=1,NAV	41-44 45-48 49-52 53-56 57-60	THE SEGMENT NUMBERS (DEFINITION SAME AS FOR NSG(J)) FOR THE NAV(J) VARIABLES ASSOCIATED WITH THE JTH INDEPENDENT VARIABLE. ANY CHANGE MADE TO THE JTH INDEPENDENT VARIABLE TO ACHIEVE INITIAL EQUILIBRIUM WILL ALSO BE MADE TO THE CORRESPONDING VARIABLES FOR THESE SEGMENTS SUCH THAT THE INITIAL RELATIVE ORIENTATION WILL BE MAINTAINED AS SPECIFIED ON CARDS G.2 AND G.3.

CARDS G.6 EQUILBRIUM CONSTRAINTS
(NCON CARDS, PLACE "I" IN COLS. 73-74)

IPL(I) ISG(I)	1-4 5-8	THE PLANE AND SEGMENT NUMBERS (DEFINITION SAME AS FOR JPL(J) AND JSG(J) ABOVE) FOR THE ITH CONSTRAINT TO BE IMPOSED FOR INITIAL EQUILIBRIUM DURING THE CONTACT NORMAL FORCE TO CONSTRAINT NORMAL FORCE ITERATION.
LTYPE(I)	9-12	INDICATES THE TYPE OF THE ITH CONSTRAINT: 3=ROLL, 4=SLIDE.
INDGX(I)	13-16	THE INDEX J (FROM 1 TO NVAR) FROM CARD G.5 FOR WHOSE CONTACT NORMAL FORCE WILL BE ITERATED TO BE EQUAL TO THE ITH CONSTRAINT NORMAL FORCE. MAY BE ZERO, BUT IF INDGX(I)=J, THEN IPL(I) AND ISG(I) MUST BE EQUAL TO JPL(J) AND JSG(J)

NOTE: THE EQUILIBRIUM ALGORITHM WILL ADJUST THE INITIAL POSITION PARAMETERS SUPPLIED ON CARDS G.2 AND G.3. IF THE CONSTRAINTS TEMPORARILY IMPOSED BY CARDS G.6 PROPERLY CONSTRAIN ALL OF THE SEGMENTS, ZERO ACCELERATIONS WILL BE OBTAINED WHILE THE CONSTRAINTS ARE ON. THE ITERATION WILL PRODUCE NORMAL AND TANGENTIAL CONTACT FORCES THAT WILL RESULT IN SMALL (<0.02 G) INITIAL LINEAR ACCELERATIONS FOR ALL OF THE BODY SEGMENTS. FOR THE SEATED STANDARD FIFTEEN SEGMENT OCCUPANT, THIS CAN BE ACHIEVED AS FOLLOWS:

A. LOCK JOINT P,W,NP,HP,RA AND LA BY SETTING IPIN=-2 ON CARDS B.3 IF THE MAXIMUM TORQUE FOR A LOCKED JOINT (T1 FOR VISC(4,3*J-2) ON CARDS B. IS ZERO, THEN T1 WILL BE SET FOR THESE LOCKED JOINTS TO 1.5 TIMES THE MAGNITUDE OF THE JOINT TORQUE FINALLY PRODUCED AT TIME ZERO.

B. CONSTRAIN THE ARMS BY EITHER SETTING UP FIXED POINT CONSTRAINTS (TYPE=1 FOR THE RLA AND LLA WITH THE VEHICLE ON CARDS D.6), OR LOCK THE JOINTS RS, LS AND LE AS IN STEP A ABOVE. IF THE CONSTRAINTS ARE IMPOSED ON CARDS D.6 THE POINT ON THE VEHICLE (RK2 ON CARDS D.6) FOR ANY TYPE 1 CONSTRAINT INVOLVING THE VEHICLE WILL BE ADJUSTED SO THAT IT WILL COINCIDE WITH THE SPECIFIED POINT ON THE BODY SEGMENT (RK1 ON CARDS D.6) AS ADJUSTMENTS ARE MADE TO THE INITIAL POSITION PARAMETERS.

C. SET UP ALLOWED CONTACTS AND ASSOCIATED FORCE DEFLECTION FUNCTIONS ON CARDS F.1 FOR THE SEAT CUSHION PLANE WITH THE LT, RUL AND LUL SEGMENTS, THE SEAT BACK PLANE WITH THE LT, CT AND UT SEGMENTS, AND THE FLOORBOARD PLANE WITH THE RF AND LF SEGMENTS.

D. SET UP INITIAL POSITION PARAMETERS ON CARDS G.2 AND G.3 THAT ARE JUST "SHORT OF" OR CLOSE TO THE FINAL PENETRATION DISTANCES FOR THE SEGMENTS WITH THE CONTACT PLANES.

E. SET NVAR = 5 AND NCON = 4 ON CARD G.4

F. SUPPLY THE FOLLING INPUT PARAMETERS ON CARDS G.5:

J	NTV	NI1	NSG	GX	XDEV	JPL	JSG	NAV	KSG
1	1	3	(LT)	90.0	1.0	(SEAT CUSHION)	(LT)	0	
2	1	1	(LT)	5.0	1.0	(SEAT BACK)	(LT)	0	
3	2	2	(UT)	10.0	5.0	(SEAT BACK)	(UT)	4	(LT),(CT), (N),(H)
4	2	2	(RUL)	25.0	10.0	(SEAT CUSHION)	(RUL)	1	(LUL)
5	2	2	(RLL)	10.0	10.0	(FLOORBOARD)	(RF)	1	(LLL)

() INDICATES THAT IDENTIFICATION NUMBER SHOULD BE USED

G. SUPPLY THE FOLLOWING INPUT PARAMETERS ON CARDS G.6:

I	IPL	ISG	LTYPE	INDGX
1	(SEAT CUSHION)	(LT)	3	1
2	(SEAT BACK)	(UT)	4	3
3	(FLOORBOARD)	(RF)	3	5
4	(FLOORBOARD)	(LF)	3	0

USING THE ABOVE INPUT PARAMETERS, THE X AND Z COORDINATES OF THE LT, THE PITCH ANGLES (MAINTAINING THE INITIAL RELATIVE ORIENTATION) OF THE UT, LT, CT, N AND H SEGMENTS, THE RUL AND LUL SEGMENTS, AND THE RLL AND LLL SEGMENTS, AND THE INITIAL NORMAL CONTACT FORCE (GX) OF THE SEAT CUSHION WITH THE LT, THE SEAT BACK WITH THE UT AND THE FLOORBOARD WITH THE RF WILL BE ADJUSTED. IT IS BELIEVED THAT THE RESULTING INITIAL POSITION IS UNIQUE AND IS A FUNCTION OF THE VALUES OF THE CONTACT NORMAL FORCES (GX) SUPPLIED FOR THE SEAT BACK WITH THE LT AND THE SEAT CUSHION WITH THE RUL CONTACTS.

H. CONTROL OF OUTPUT OF SELECTED SEGMENT LINEAR AND ANGULAR ACCELERATIONS, VELOCITIES AND DISPLACEMENTS, AND JOINT PARAMETERS.

H.1 (K=1) SEGMENT LINEAR ACCELERATIONS IN LOCAL REFERENCE

CARD H.1.A LINEAR ACCELERATION CONTROLS

NSG(K)	1-6	THE NUMBER OF SELECTED POINTS ON THE VARIOUS BODY SEGMENTS FOR WHICH TIME HISTORIES ARE DESIRED. THE MAXIMUM VALUE FOR NSG(K) IS 20.
MSG(1,K)	7-12	THE SEGMENT NUMBER OF THE FIRST POINT AS DETERMINED BY THE INDEX I ON CARDS B.2. THE VEHICLE MAY BE SPECIFIED BY NSEG+1, OR THE JTH AIRBAG BY NSEG+1+J. IF NEGATIVE, OUTPUT WILL BE IN INERTIAL REFERENCE.
XSG(I,1,K), I=1,3	13-24 25-36 37-48	THE X, Y AND Z COORDINATES IN SEGMENT REFERENCE OF THE FIRST POINT (INCHES).

CARDS H.1.B REPORT POINTS ON SEGMENT
(NSG(K)-1 CARDS, PLACE "J" IN COLS 73-74.)

MSG(J,K)	1-12	SAME AS ABOVE BUT FOR THE JTH POINT.
XSG(I,J,K), I=1,3	13-24 25-36 37-48	SAME AS ABOVE BUT FOR THE JTH POINT.

H.2 (K=2) SEGMENT LINEAR VELOCITIES IN VEHICLE REFERENCE

CARDS H.2.A, H.2.B DESCRIPTION SAME AS FOR H.1.

H.3 (K=3) SEGMENT LINEAR DISPLACEMENTS IN VEHICLE REFERENCE

CARDS H.3.A, H.3.B DESCRIPTION SAME AS FOR H.1.

H.4 (K=4) SEGMENT ANGULAR ACCELERATIONS IN LOCAL REFERENCE

CARD H.4.A, H.4.B SEGMENTS FOR WHICH ANGULAR ACCELERATIONS TO BE OUTPUTED

NSG(K)	1-6	THE NUMBER OF SELECTED SEGMENTS FOR WHICH TIME HISTORIES ARE DESIRED (MAXIMUM = 20).
MSG(J,K), J=1,KSG WHERE KSG=NSG(K)	7-12 13-18 19-24 ETC. 67-72	THE SEGMENT NUMBERS AS DETERMINED BY INDEX I ON CARDS B.2. THE VEHICLE MAY BE SPECIFIED BY NSEG+1, OR THE JTH AIR BAG BY NSEG+1+J. IF NSG(K)>11, USE THE SECOND CARD (H.4.B), LEAVING THE FIRST FIELD OF 6 COLUMNS BLANK.

H.5 (K=5) SEGMENT ANGULAR VELOCITIES IN VEHICLE REFERENCE

CARD H.5.A, H.5.B DESCRIPTION SAME AS FOR H.4.

H.6 (K=6) SEGMENT ANGULAR DISPLACEMENTS IN VEHICLE REFERENCE

CARD H.6.A, H.6.B DESCRIPTION SAME AS FOR H.4

H.7 (K=7) JOINT PARAMETERS

CARD H.7.A, H.7.B JOINTS FOR WHICH OUTPUT DESIRED

NSG(K)	1-6	THE NUMBER OF SELECTED JOINTS FOR WHICH TIME HISTORIES ARE DESIRED. INSERT BLANK CARD IF NONE ARE DESIRED (NJNT MAXIMUM).
MSG(J,K), J=1,KSG WHERE KSG=NSG(K)	7-12 13-18 19-24 ETC. 67-72	THE JOINT NUMBERS AS DETERMINED BY INDEX J ON CARDS B.3. IF NSG(K)>11, USE THE SECOND CARD (H.7.B), LEAVING THE FIRST FIELD OF 6 COLUMNS BLANK.

3.0 OUTPUT FROM CVS (GENERAL DESCRIPTION)

Output produced by the model has been classified into four types. The four succeeding subsections discuss each of the four types in turn.

3.1 Normal Output

This type of output lists time histories of particular categories of quantities with headings. Eight such categories exist for the CVS model. These are summarized in Table 1.

Table 1 Normal Output Categories

Category Number	Description
1	Segment Linear Accelerations
2	Segment Linear Velocities
3	Segment Linear Displacements
4	Segment Angular Accelerations
5	Segment Angular Velocities
6	Segment Angular Displacements
7	Joint Parameters
8	Contact Output

The first seven categories are controlled by the H cards of the input deck. Category eight is printed automatically for any interaction which produces force.

The first three categories allow the user to specify the points for which corresponding kinematics are to be printed and whether each point is to be printed in local or inertial coordinates. The second three categories allow the user to specify which segments are to be printed as well as whether local or inertial coordinates are desired. The seventh category allows specification of which joints are to be printed.

3.2 Supplementary Normal Output

This type of output is printed with headings but is under switch control and comes out all quantities for each time in sequence. This type of output together with the final type (binary files of information written for post-processors) are controlled by means of the NPRT array which is inputted by the A.1.A card. Table 2 lists the general categories of such output controlled by each element of the NPRT array.

Table 2 NPRT Output Categories

NPRT	Output Categories	Description
1	Tape 1 Output	Input to graphic postprocessor
2	Eltime Output	Printout of elapsed execution times
3	Accel Output	Accelerations at print times
4	HIC Tape	Input to HIC postprocessor data
5	Y-Z Printer Plot	Y-Z printer plot depicting simulated situation
6	X-Z Printer Plot	X-Z printer plot depicting simulated situation
7	HA, HB from Binput	Printout of joint arrays
8	Accel from DAUX	Accelerations at each time step
9	Packing Dictionary	Summary of packing parameters
10	Output from CMPUTE, DINT	Printout of time step control
11	Accel from EQUILB	Accelerations during equilibrium iteration

3.3 Auxiliary (Debugging) Output

This type of output is much like that covered in the last subsection except that it is keyed to block numbers for identification and has few if any headings. These printouts cover details of the run which no ordinary user would desire and is so copious that its use must be controlled within certain time spans during the run rather than over the whole run. Such output is controlled by sixteen two bit (four level) switches which are inputted at a maximum of eight different times during the run packed together as an eight hexidecimal digit number by means of cards A.6.A and A.6.B. Table 3 lists the sixteen debugging printout categories.

Table 3 Debugging Printout Categories

Category	Debugging Information Printed
1	Air bag quantities
2	Belt quantities
3	Level 1: Joint positions Level 2: Body segment positions and velocities
4	System equation matrix and right hand side
5	Time step convergence quantities
6	Ellipsoid-Ellipsoid penetration quantities
7	Impulse function quantities
8	Torque and joint constraint quantities
9	Roll-slide constraint quantities
10	Joint quantities
11	Body contact quantities
12	Ellipsoid-plane deflection quantities
13	Load-deflection quantities
14	Shared deflection and tabular fitting quantities
15	Force evaluation quantities
16	Level 1: Storage allocation quantities Level 2: Abort and dump

A detailed list of individual blocks is presented in Volume 3. Level zero is always off.

3.4 Output for Postprocessors

This output is not in the form of printing but binary information written to external files intended to serve as input for various postprocessors. This optional output is controlled by the NPRT array described in Table 2 of Section 3.2. Detailed formats for these output files are presented in Volume 3. The program also has a restart capability which is controlled by cards A.1.A and A.2. In this case, the program itself serves as its own postprocessor to continue a run with possible minor changes.

4.0 EXAMPLE RUN

The following three subsections present an example data deck and the resulting run. The first subsection explains the physical problem which is being simulated. The second subsection presents the input deck. The last subsection presents parts of the resulting output.

4.1 Run Description

The situation is the collision between two vehicles with gross modeling of the occupant within one of them. Five segments are used with one ellipsoid attached to each together with three contact panels attached to two of the segments. Figure 1 illustrates the layout. The figure shows the segment number and segment name of two or three letters hyphenated below the

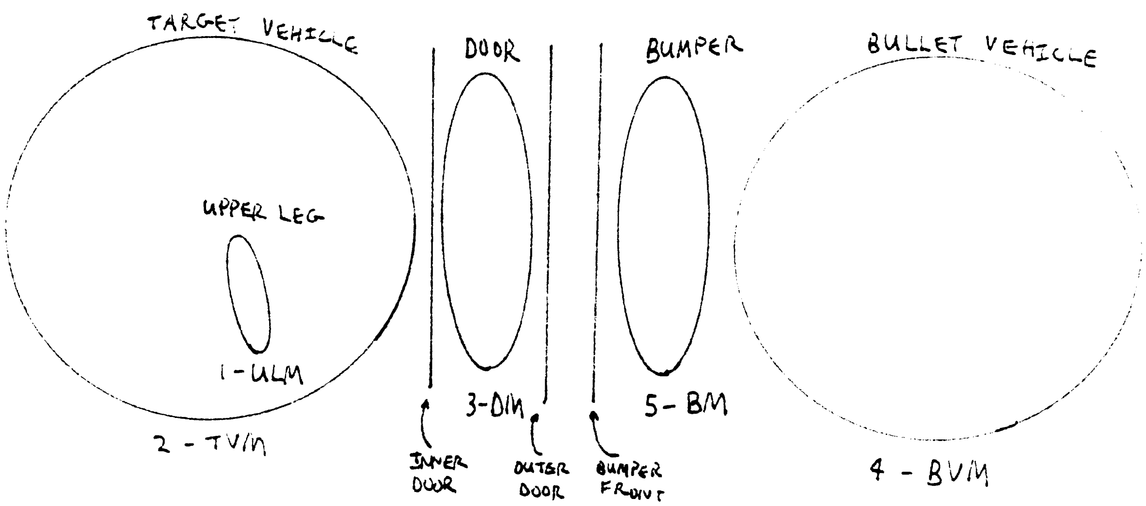

Figure 1. Two Vehicle Collision

ellipsoid. The ellipsoid name (which is sixteen characters including blanks) is shown above the ellipsoid in each case. The three vertical lines represent the contact panels with their names specified below.

Five contact interactions are allowed: three of the ellipsoid-panel type: Upper Leg - Inner Door, Bumper - Outer Door, and Bullet Vehicle - Outer Door and two of the ellipsoid-ellipsoid type: Target Vehicle - Door and Bullet - Bumper. The purpose of this configuration is to simplify contact interactions between the occupant and two vehicles.

4.2 Input Data Deck with Comments

The input data deck contains the formal description of the situation described above. In the data deck presented in Table 4 below, the B-cards list and specify the five segments; ULM, TVM, DM, BVM and BM. The D.2 - cards describe the three contact panels: INNER DOOR, OUTER DOOR, and

BUMPER FRONT. The D.5 - cards describe the five ellipsoids: BUMPER, DOOR, TARGET VEHICLE, UPPER LEG, and BULLET VEHICLE. The D.9.A - cards specify three materials. Outer Door and Bumper Front have properties of material 1 (MAT1), the two vehicles have properties of MAT2, and Upper Leg has properties of MAT3. The Bumper, Door, and Inner Door are considered rigid. The F.1 - Cards list the allowable interactions which were listed in the previous subsection. The G - cards state initial conditions, that the target vehicle is sitting still while the bullet vehicle is coming from the side at 300 in/sec. The H - cards list the desired normal output: linear acceleration, velocity, and displacement of center of gravity of each of the five segments.

```
$SIG SMWB T=3M P=800 C=0 PRIO=D 'J.M.BECKER'
BATCH,DEFERRED,UNIV
**LAST SIGNON WAS: 12:06:22    THU JUN 26/80
 USER "SMWB" SIGNED ON AT  00:01:44 ON FRI JUN 27/80
$GET OLDBAS
READY.
   $.00,    $.03T
$LIST OLDBAS
      9 JUNE 80       0   0         1   0   0   0   0   0   0   0   1   0   0    A.1.A
      SIDE IMPACT -- TWO CAR -- OCCUPANT                                         A.1.B
      BASE NO. 1                                                                 A.1.C
        IN. LB.SEC.        1.        1.        1.        0.        0.        0.  A.3
          4   40    .001    .001    .005    .0005    1                           A.4
      .01               .001       1.            .1          2000.       5000.   A.5
      0.        00000000 .011   FFFFFFFE .015   0000000F                         A.6.A
                                                                                 A.6.B
              5     4          ONE MASS SPHERE                                   B.1
        ULM 00.1294       0.8         0.8         0.8                          1 B.2
        TVM T10.8696      6000.       25000.      25000.                       2 B.2
         DM D0.5176       1000.       200.        1000.                        3 B.2
        BVM V9.9638       6000.       25000.      25000.                       4 B.2
         BM B0.3882       700.        200.        700.                         5 B.2
                 0                                                             1 B.3.A
                                                                               1 B.3.B
                 0                                                             2 B.3.A
                                                                               2 B.3.B
                 0                                                             3 B.3.A
                                                                               3 B.3.B
                 0   .                                                         4 B.3.A
                                                                               4 B.3.B
                                                                               1 B.4.A
                                                                               2 B.4.A
                                                                               3 B.4.A
                                                                               4 B.4.A
                                                                               1 B.5.A
                                                                               2 B.5.A
                                                                               3 B.5.A
                                                                               4 B.5.A
                                                                  0.1          1 B.6
                                                                  0.1          2 B.6
                                                                  0.1          3 B.6
                                                                  0.1          4 B.6
                                                                  0.1          5 B.6
      NONE                                                                       C.1
      0.    0.    0.    0.    0.2  0.    0.    0.    0.          00.    0.0      C.2
            3     0     0     5    0     0     3     00.1   .0001      0         D.1
          1   1   0   3   3   OINNER DOOR                                        D.2.A
      0.          -20.        2.          20.                               A1 D.2.B
                  20.         2.          20.                               A1 D.2.C
                  -20.        2.          -20.                              A1 D.2.D
          2   1   1   3   3   OOUTER DOOR                                        D.2.A
      0.          20.         -2.         20.                               B1 D.2.B
                  -20.        -2.         20.                               B1 D.2.C
                  20.         -2.         -20.                              B1 D.2.D
          3   1   1   3   5   OBUMPER FRONT                                      D.2.A
      0.          -20.        3.          20.                               C1 D.2.B
                  20.         3.          20.                               C1 D.2.C
                  -20.        3.          -20.                              C1 D.2.D
          1   5   OBUMPER          10.   2.99 10.  0.   0.   0.   0.   0.   0.   D.5
          2   3   ODOOR            10.   1.99 10.  0.   0.   0.   0.   0.   0.   D.5
```

Table 4 Example Input Data (1 of 2)

```
 53    3  2  2TARGET VEHICLE  30.   30.   30.  0.    0.    0.    0.    0.    0.        D.5
 54    4  1  3UPPER LEG        8.    8.    8.  0.    0.    0.    0.    0.    0.        D.5
 55    5  4  2BULLET VEHICLE  34.   34.   34.  0.    0.    0.    0.    0.    0.        D.5
 56                                                                                    D.7
 57     1 MAT1               -1   -1    0      10.     20.   21.   5000.    5000.      D.9.A
 58     2 MAT2               -2   -1    0      10.     20.   21.   10000.   10000.     D.9.A
 59     3 MAT3               -3   -1    0      10.     20.   21.   5000.    2000.      D.9.A
 60    51                                                                              E.1
 61    1 5000.                                                                         E.5.A
 62    1                                                                               E.5.B
 63    1                                                                               E.5.C
 64    2 10000.                                                                        E.5.A
 65    2                                                                               E.5.B
 66    2                                                                               E.5.C
 67    3 2000.                                                                         E.5.A
 68    3                                                                               E.5.B
 69    3                                                                               E.5.C
 70                                                                                    E.5.A
 71                                                                                    E.5.D
 72     1   2                                                                          F.1.A
 73     1   2                                                                          F.1.B
 74     1  -5                                                                          F.1.B
 75     2   2                                                                          F.1.A
 76     2   3                                                                          F.1.B
 77     2  -3                                                                          F.1.B
 78     3   0                                                                          F.1.A
 79     4   1                                                                          F.1.A
 80     4   1                                                                          F.1.B
 81     5   0                                                                          F.1.A
 82                                                                                    F.4.A
 83   30.        30.       60.        0            1                                   G.1
 84   0.         16.       0.       0.       0.       0.                             1 G.2
 85   0.         34.       0.       0.       0.       0.                             2 G.2
 86   0.         2.        0.       0.       0.       0.                             3 G.2
 87   0.         -40.      0.       0.       300.     0.                             4 G.2
 88   0.         -3.       0.       0.       300.     0.                             5 G.2
 89   0.         0.        0.       0.       0.       0.                             1 G.3
 90   0.         0.        0.       0.       0.       0.                             2 G.3
 91   0.         0.        0.       0.       0.       0.                             3 G.3
 92   0.         0.        0.       0.       0.       0.                             4 G.3
 93   0.         0.        0.       0.       0.       0.                             5 G.3
 94         5    -1          0.         0.         0.                                  H.1.A
 95              -2          0.         0.         0.                                2 H.1.B
 96              -3          0.         0.         0.                                3 H.1.B
 97              -4          0.         0.         0.                                4 H.1.B
 98              -5          0.         0.         0.                                5 H.1.B
 99         5    -1          0.         0.         0.                                  H.2.A
100              -2          0.         0.         0.                                2 H.2.B
101              -3          0.         0.         0.                                3 H.2.B
102              -4          0.         0.         0.                                4 H.2.B
103              -5          0.         0.         0.                                5 H.2.B
104         5    -1          0.         0.         0.                                  H.3.A
105              -2          0.         0.         0.                                2 H.3.B
106              -3          0.         0.         0.                                3 H.3.B
107              -4          0.         0.         0.                                4 H.3.B
108              -5          0.         0.         0.                                5 H.3.B
109         0                                                                          H.4.A
110         0                                                                          H.5.A
111         0                                                                          H.6.A
112         0                                                                          H.7.A
```

Table 4 Example Input Data (2 of 2)

4.3 Program Output with Comments

The first output from the program is a summary with captions of the input deck produced as the deck is read. If there are any error flags, generally only a portion of this output will occur up to the flag at which time the program will terminate. Table 5 presents this summary for the example run.

CALSPAN 3-D CRASH VICTIM SIMULATION PROGRAM

9 JUNE 80 JUN 27, 1980 IRSIN= 0 IRSOUT= 0 RSTIME = 0.0 CARDS A
NPRT ARRAY 1 0 0 0 0 0 0 0 1 0 0

SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1

UNITL = IN. UNITF = LB. UNITT = SEC. 0.1000000000E+01 0.1000000000E+01 0.1000000000E+01
GRAVITY VECTOR = (0.0 , 0.0 , 0.0)

NDINT = 4 NSTEPS = 40 DT =0.001000 HO =0.001000 HMAX =0.005000 HMIN =0.000500
KNTLPR= 1 MAXLIN= 501
EPSILONS 0.100000000000E-01 0.100000000000E-02 0.100000000000E+01 0.100000000000E+00 0.200000000000E+04 0.500000000000E+04

CRASH VICTIM ONE MASS SPHERE 5 SEGMENTS 4 JOINTS CARDS B.2

SEGMENT			MASS	SEGMENT MOMENT OF INERTIA (LB.-SEC.**2- IN.)		
I	SYM	PLOT	(LB.-SEC.**2/ IN.)	X	Y	Z
1	ULM	O	0.129	0.80000	0.80000	0.80000
2	TVM	T	10.870	6000.00000	25000.00000	25000.00000
3	DM	D	0.518	1000.00000	200.00000	1000.00000
4	BVM	V	9.964	6000.00000	25000.00000	25000.00000
5	BM	B	0.388	700.00000	200.00000	700.00000

CARDS B.3

JOINT					LOCATION(IN.) - SEG(JNT)			LOCATION(IN.) - SEG(J+1)			PRIN. AXIS(DEG) - SEG(JNT)			PRIN. AXIS(DEG) - SEG(J+1)		
J	SYM	PLOT	JNT	PIN	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL	YAW	PITCH	ROLL
1			0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2			0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3			0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4			0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5 Example Output of Input (1 of 7)

CARDS B.4

JOINT TORQUE CHARACTERISTICS

JOINT	FLEXURAL SPRING CHARACTERISTICS: SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)	TORSIONAL SPRING CHARACTERISTICS: SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CARDS B.5

JOINT VISCOUS CHARACTERISTICS AND LOCK-UNLOCK CONDITIONS

JOINT	VISCOUS COEFFICIENT (IN. LB.SEC./DEG)	COULOMB FRICTION COEF. (IN. LB.)	FULL FRICTION ANGULAR VELOCITY (DEG/SEC.)	MAX TORQUE FOR A LOCKED JOINT (IN. LB.)	MIN TORQUE FOR UNLOCKED JOINT (IN. LB.)	MIN. ANG. VELOCITY FOR UNLOCKED JOINT (RAD/SEC.)	IMPULSE RESTITUTION COEFFICIENT
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CARDS B.6

SEGMENT INTEGRATION CONVERGENCE TEST INPUT

SEGMENT NO.	SYM	ANGULAR VELOCITIES (RAD/SEC.) MAG. TEST	ABS. ERROR	REL. ERROR	LINEAR VELOCITIES (IN./SEC.) MAG. TEST	ABS. ERROR	REL. ERROR	ANGULAR ACCELERATIONS (RAD/SEC.**2) MAG. TEST	ABS. ERROR	REL. ERROR	LINEAR ACCELERATIONS (IN./SEC.**2) MAG. TEST	ABS. ERROR	REL. ERROR
1	ULM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.0
2	TVM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.0
3	DM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.0
4	BVM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.0
5	BM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.10	0.0

Table 5 Example Output of Input (2 of 7)

VEHICLE DECELERATION INPUTS

CARDS C

NONE

YAW	PITCH	ROLL	XIPS	(YIPS)	VTIME	ZIPS	XO(X)	XO(Y)	XO(Z)	NATAB	ATO	ADT
0.0	0.0	0.0	0.0		0.200	0.0	0.0	0.0	0.0	0	0.0	0.0

```
PASSENGER COMPARTMENT DISPLACEMENT HISTORY
ANALYTICAL HALF-SINE WAVE DECELERATION
VO=   0.0    IN./SEC., OBLIQUE ANGLES =    0.0    0.0    0.0  DEGREES, TIME DURATION =  0.200 SEC.
```

Table 5 Example Output of Input (3 of 7)

PLANE INPUTS

CARDS D.2

PLANE NO. 1, NUMTIM= 1, NMATRL= 0, LEDGSW= 3, NINTRL= 3, ISOLAT= 0, WITH NAME OF INNER DOOR

TIMEFF	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
0.0	-20.0000	2.0000	20.0000	20.0000	2.0000	20.0000	-20.0000	2.0000	-20.0000

PLANE NO. 2, NUMTIM= 1, NMATRL= 1, LEDGSW= 3, NINTRL= 3, ISOLAT= 0, WITH NAME OF OUTER DOOR

TIMEFF	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
0.0	20.0000	-2.0000	20.0000	-20.0000	-2.0000	20.0000	20.0000	-2.0000	-20.0000

PLANE NO. 3, NUMTIM= 1, NMATRL= 1, LEDGSW= 3, NINTRL= 5, ISOLAT= 0, WITH NAME OF BUMPER FRONT

TIMEFF	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3
0.0	-20.0000	3.0000	20.0000	20.0000	3.0000	20.0000	-20.0000	3.0000	-20.0000

ADDITIONAL ELLIPSOID INPUT

CARDS D.5

NO.				SEMIAXES (IN.) X	Y	Z	OFFSET (IN.) X	Y	Z	ROTATION (DEG) YAW	PITCH	ROLL
1	5	0	BUMPER	10.000	2.990	10.000	0.0	0.0	0.0	0.0	0.0	0.0
2	3	0	DOOR	10.000	1.990	10.000	0.0	0.0	0.0	0.0	0.0	0.0
3	2	2	TARGET VEHICLE	30.000	30.000	30.000	0.0	0.0	0.0	0.0	0.0	0.0
4	1	3	UPPER LEG	8.000	8.000	8.000	0.0	0.0	0.0	0.0	0.0	0.0
5	4	2	BULLET VEHICLE	34.000	34.000	34.000	0.0	0.0	0.0	0.0	0.0	0.0

BODY SEGMENT SYMMETRY INPUT

CARD D.7

SEG NO.	1	2	3	4	5
NSYM(J)	0	0	0	0	0

MATERIAL NORMAL FORCE SPECIFICATION

CARD D.9.A

NMATRL	NAME	MSTW	NGRTAB	IFRIK	DC	DE	DF	FSAT	DM
1	MAT1	-1	-1	0	0.1000000E+02	0.2000000E+02	0.2100000E+02	0.5000000E+04	0.5000000E+04
2	MAT2	-2	-1	0	0.1000000E+02	0.2000000E+02	0.2100000E+02	0.1000000E+05	0.1000000E+05
3	MAT3	-3	-1	0	0.1000000E+02	0.2000000E+02	0.2100000E+02	0.5000000E+04	0.2000000E+04

BIVARIANT POLYNOMIAL SPECIFICATIONS

CARDS E.5.A-E.5.C

NPOLY	COEFFICIENTS					
1	0.50000000E+04	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0

Table 5 Example Output of Input (4 of 7)

	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0			
2	0.10000000E+05	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0			
3	0.20000000E+04	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0			

Table 5 Example Output of Input (5 of 7)

ALLOWED CONTACTS AND ASSOCIATED FUNCTIONS

```
 ELLIPSOID  CONTACTS          PANEL        OR        ELLIPSOID
INDEX  NAME               INDEX  NAME               INDEX  NAME

  1 BUMPER                  2 OUTER DOCR
  1 BUMPER                                            5 BULLET VEHICLE
  2 DOOR                    3 BUMPER FRONT
  2 DOOR                                              3 TARGET VEHICLE
  4 UPPER LEG               1 INNER DOCR
```

Table 5 Example Output of Input (6 of 7)

SUBROUTINE INITAL INPUT — CARD G.1

ZPLT(X)	ZPLT(Y)	ZPLT(Z)	I1	J1	I2	J2	I3
30.00	30.00	60.00	0	0	0	0	1

INITIAL POSITIONS (INERTIAL REFERENCE) — CARDS G.2

SEGMENT		LINEAR POSITION (IN.)			LINEAR VELOCITY (IN./SEC.)		
NO.	SEG	X	Y	Z	X	Y	Z
1	ULM	0.0	16.00000	0.0	0.0	0.0	0.0
2	TVM	0.0	34.00000	0.0	0.0	0.0	0.0
3	DM	0.0	2.00000	0.0	0.0	0.0	0.0
4	BVM	0.0	-40.00000	0.0	0.0	300.00000	0.0
5	BM	0.0	-3.00000	0.0	0.0	300.00000	0.0

INITIAL ANGULAR ROTATION AND VELOCITY — CARDS G.3

SEGMENT		ANGULAR ROTATION (DEG)			ANGULAR VELOCITY (DEG/SEC.)		
NO.	SEG	YAW	PITCH	ROLL	X	Y	Z
1	ULM	0.0	0.0	0.0	0.0	0.0	0.0
2	TVM	0.0	0.0	0.0	0.0	0.0	0.0
3	DM	0.0	0.0	0.0	0.0	0.0	0.0
4	BVM	0.0	0.0	0.0	0.0	0.0	0.0
5	BM	0.0	0.0	0.0	0.0	0.0	0.0

Table 5 Example Output of Input (7 of 7)

After the output of input comes the supplementary and auxiliary output which the user has requested. The very first is a summary of the input with references to the packed tables set up to hold contact interaction information. This information is useful in understanding the debugging output. Table 6 presents the packing dictionary and a few sample pages of debugging output from a run which specified that all debugging be printed starting 11.1 milliseconds of simulated time. Reference to the appropriate sections of Volume 3 is necessary to read this information with understanding. While each group is identified uniquely, the captions are generally not self-explanatory. Included also is some of the formatted supplementary normal output in its place within the time sequence.

PACKING DICTIONARY

A. BODY

SEG. NO.	ELL. NO.	CONTROL B.I.	NAME	REAL B.I.	MATERIAL B.I.	B MATRIX B.I.	SEGMENT CONTROL B.I.	NUMBER OF ALLOWED CONTACTS PANEL	NUMBER OF ALLOWED CONTACTS ELLIPSOID	B.I. OF ALLOWED CONTACT LISTS: PANEL	B.I. OF ALLOWED CONTACT LISTS: ELLIPSOID	EXTERNAL ELLIPSOID NO.
1	1	98	UPPER LEG	88	156	0	130	1	0	190	0	4
2	1	85	TARGET VEHICLE	69	145	0	128	0	0	0	0	3
3	1	72	DOOR	50	0	0	126	1	1	186	188	2
4	1	111	BULLET VEHICLE	107	145	0	132	0	0	0	0	5
5	1	59	BUMPER	31	0	0	124	1	1	182	184	1

B. PANELS

INDEX	CONTROL B.I.	NAME	REAL B.I.	MATERIAL B.I.	INPUT PLANE NO.	NUMBER OF TIME POINTS	SOLID SWITCH	COORDINATE SYSTEM SWITCH	EDGE SCALING SWITCH	EXTERNAL PANEL NO.
1	17	INNER DOOR	1	0	1	1	0	3	3	1
2	31	OUTER DOOR	11	134	2	1	0	3	3	2
3	45	BUMPER FRONT	21	134	3	1	0	5	3	3

C. MATERIALS

INDEX	CONTROL B.I.	NAME	REAL B.I.	TABLE B.I. (-KPOLY)	FRICTION CLASS	G-R TABLE B.I.	UNLOADING SWITCH	LOADING CURVE TYPE	EXTERNAL MATERIAL NO.
1	134	MAT1	126	-141	0	-1	2	1	1
2	145	MAT2	131	-168	0	-1	2	1	2
3	156	MAT3	136	-195	0	-1	2	1	3

Table 6 Example Auxiliary Printer (1 of 8)

```
U2 ARRAY
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0          0.0          0.0          0.0

V1 ARRAY
   0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
   0.0          0.0          0.0

 LINEAR POSITIONS AND VELOCITIES OF BODY SEGMENTS FROM CHAIN FOR TIME =    0.011500
     0.0         16.00000     0.0          0.0         34.00621     0.0        0.0        2.79237      0.0
     0.0        -36.55897     0.0          0.0         -0.55014     0.0        0.0        0.0          0.0
     0.0          2.47378     0.0          0.0        135.79233     0.0        0.0      296.49097      0.0
     0.0        139.74082     0.0

11-1-1 0.011500    98   17  199    1    3    0    0    0   0.0           0.0
11-2-1    1.00000000   0.0          0.0          0.0          1.00000000   0.0          0.0          0.0          1.00000000
11-2-2  -20.00000000      0.0          20.00000000    0.0          -20.00000000   0.0
          4.79237037   135.79233073    4.79237037  135.79233073     4.79237037  135.79233073
         20.00000000      0.0          20.00000000    0.0          -20.00000000   0.0
11-2-3   40.00000000      0.0          -0.0           1.00000000    0.0           0.0          20.00000000
          0.0             1.00000000   -0.0          -0.0          -0.0          -1.00000000   20.00000000
         40.00000000      0.0          -0.0           0.0           1.00000000    0.0          11.20762963

11-1-1*                                  0    0    0    0   0.0           0.0          -3.20762963

11-1-1 0.011500    72   45  223    3    5    1    0    0  20.00000000  20.00000000
11-2-1    1.00000000   0.0          0.0          0.0          1.00000000   0.0          0.0          0.0          1.00000000
11-2-2  -20.00000000      0.0          20.00000000    0.0          -20.00000000   0.0
          2.44986439   139.74082335    2.44986439  139.74082335     2.44986439  139.74082335
         20.00000000      0.0          20.00000000    0.0          -20.00000000   0.0
11-2-3   40.00000000      0.0          -0.0           1.00000000    0.0           0.0          20.00000000
          0.0             1.00000000   -0.0          -0.0          -0.0          -1.00000000   20.00000000
         40.00000000      0.0          -0.0           0.0           1.00000000    0.0           0.34250598
12-2-1     -0.0           -0.0           -0.0           0.0          20.00000000    0.0           0.0
           -0.0           -0.0           -0.0           0.0           0.34250598    0.0           0.0
           -0.0           -0.0           -0.0          -3.94849262  -20.00000000    0.0           0.0

13-1-1 0.011500    45   72  223    1    1    1.64749402     3.94849262
13-1-2       1.64749402      0.0            3.94849262      0.0          5000.00000000        0.0          0.0
11-1-2    223  1.64749402      3.94849262  0.0          0.0       1.00000000 1.00000000 0.0
               5000.00000000      0.0           0.0          5000.00000000      0.0
11-3-1      0.0            0.0           0.0           0.0           0.0            0.0            0.0          0.0
            0.80237037   135.79233073    1.00000000    3.94849262   -1.99000000  5000.00000000    1.35250598  5000.00000000
            0.0            0.0           0.0           0.0           0.0            0.0            0.0          0.0
11-2-4   20.00000000    0.0           0.0            -0.0          -0.0
         20.00000000   -0.0        5000.00000000     -0.0          -0.0
         -1.64749402   -3.94849262    0.0            -0.0          -0.0

11-1-1*                                  1    1    0    0  20.00000000  20.00000000   1.64749402

11-1-1 0.011500    59   31  247    5    3    1    0    0  20.00000000  20.00000000
11-2-1    1.00000000   0.0          0.0          0.0          1.00000000   0.0          0.0          0.0          1.00000000
11-2-2   20.00000000      0.0         -20.00000000    0.0           20.00000000   0.0
          0.79237037   135.79233073    0.79237037  135.79233073     0.79237037  135.79233073
         20.00000000      0.0          20.00000000    0.0          -20.00000000   0.0
11-2-3   40.00000000      0.0          -0.0          -1.00000000    0.0           0.0          20.00000000
          0.0            -1.00000000   -0.0          -0.0          -0.0          -1.00000000   20.00000000
         40.00000000      0.0          -0.0           0.0          -1.00000000    0.0           1.34250598
```

Table 6 Example Auxiliary Printout (2 of 8)

```
12-2-1      -0.0          -0.0          -0.0          0.0           -20.00000000   0.0          0.0
            -0.0          -0.0          -0.0          0.0            -1.34250598   0.0          0.0
            -0.0          -0.0          -0.0          -3.94849262   -20.00000000   0.0          0.0

13-1-1 0.011500   31   59  247    1    1    1.64749402     3.94849262
13-1-2      1.64749402       0.0              3.94849262       0.0         5000.00000000      0.0          0.0
11-1-2   247  1.64749402     3.94849262  0.0           0.0         1.00000000 1.00000000 0.0
                  5000.00000000      0.0            0.0         5000.00000000      0.0
11-3-1      0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
            2.43986439    139.74082335  -1.00000000   -3.94849262   2.99000000 -5000.00000000  -0.35250598 -5000.00000000
            0.0           0.0           0.0           0.0           0.0           0.0           0.0           0.0
11-2-4   20.00000000    0.0           0.0           -0.0          -0.0
         20.00000000   -0.0        -5000.00000000   -0.0          -0.0
         -1.64749402   -3.94849262    0.0           -0.0          -0.0

11-1-1*                                1    1    0    0  20.00000000  20.00000000   1.64749402

13-1-1 0.011500   72   85  271    2    2     0.77615857   133.31855204
15-2-2            271    1 -168  131       7761.58566954      20000.00000000        7761.58566954
13-1-2      0.0              0.77615857       0.0            133.31855204   7761.58566954   0.0         0.0

13-1-1 0.011500   59  111  295    2    2     0.98116321   156.75015005
15-2-2            295    1 -168  131       9811.63206936      20000.00000000        9811.63206936
13-1-2      0.0              0.98116321       0.0            156.75015005   9811.63206936   0.0         0.0

 VISPR COMPUTATIONS FOR TIME =     0.011500

 DAUX PRINT OF IJK MATRIX

       1  2  3  4  5  6  7  8
 1    -1  0  0  0  0  0  0  0
 2     0 -2  0  0  0  0  0  0
 3     0  0 -3  0  0  0  0  0
 4     0  0  0 -4  0  0  0  0
 5     0  0  0  0  0  0  0  0
 6     0  0  0  0  0  0  0  0
 7     0  0  0  0  0  0  0  0
 8     0  0  0  0  0  0  0  0

 DAUX PRINT OF RHS ARRAY


    1 0.0           0.0           0.0
    2 0.0           0.0           0.0
    3 0.0           0.0           0.0
    4 0.0           0.0           0.0
    5 0.0           0.0           0.0
    6 0.0           0.0           0.0
    7 0.0           0.0           0.0
    8 0.0           0.0           0.0

 DAUX PRINT OF C ARRAY ELEMENTS


    1  1.000000   0.0     0.0     0.0     1.000000   0.0     0.0     0.0     1.000000
    2  1.000000   0.0     0.0     0.0     1.000000   0.0     0.0     0.0     1.000000
    3  1.000000   0.0     0.0     0.0     1.000000   0.0     0.0     0.0     1.000000
    4  1.000000   0.0     0.0     0.0     1.000000   0.0     0.0     0.0     1.000000
```

Table 6 Example Auxiliary Printout (3 of 8)

```
16-2-1
   I  IQ(I)---IQ(I+24)
   1    5    3    0    3  177  130  128  126  132  124   17   31   45  134  145  156    1    0    3    0    1 INNE R DO OR
  26    1    1    1    0    3   11  134    3    0    1 OUTE R DO OR              2    2   11    0    3   21  134    5    0    1 BUMP
  51 ER F RONT           3    3   21    0    3   31    0    5 BUMP ER                730    1    1  182  184    1   50    0    3 DOOR
  76                   614    1    1  186  188    2   69  145    2 TARG ET V EHIC LE    623    0    0    0    0    3   88  156    1
 101 UPPE R LE G              0    1    0  190    0    4  107  145    4 BULL ET V EHIC LE    739    0    0    0    0    5    1   59
 126    1   72    1   85    1   98    1  111  126 -141    0   -1    2    1    1  MAT 1               131 -168    0   -1    2    1
 151    2  MAT 2                 136 -195    0   -1    2    1    3  MAT 3              0    0    0    3    1  195    2    0    3
 176    0  192  169  167  170  168   31  247  111  295   45  223   85  271   17  199    5    3  199  223  247  271  295    1   17
 201   98  222  271  211  217    2    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    1   45   72
 226  320  369  235  241    1    1    0    0    0    1    0    0    0    5    0    0    1    0    0    5    0    0    1   31   59  418
 251  467  259  265    1    2    0    0    0    1    0    0    5    0    0    1    0    0    5    0    0    2   72   85  516  565
 276  283  289    2    0    0    0    0    0    0    0    0    1    0    0    0    0    0    1    0    2   59  111  632  681  307
 301  313    2    1    0    0    0    0    0    0    0    1    0    0    0    0    0    1    0
```

Table 6 Example Auxiliary Printout (4 of 8)

16-2-2

I	RQ(I)---RQ(I+4)				
1	0.0	-0.2000000000000000E+02	0.2000000000000000E+01	0.2000000000000000E+02	0.2000000000000000E+02
6	0.2000000000000000E+01	0.2000000000000000E+02	-0.2000000000000000E+02	0.2000000000000000E+01	-0.2000000000000000E+02
11	0.0	0.2000000000000000E+02	-0.2000000000000000E+01	0.2000000000000000E+02	-0.2000000000000000E+02
16	-0.2000000000000000E+01	0.2000000000000000E+02	0.2000000000000000E+02	-0.2000000000000000E+01	-0.2000000000000000E+02
21	0.0	-0.2000000000000000E+02	0.3000000000000000E+01	0.2000000000000000E+02	0.2000000000000000E+02
26	0.3000000000000000E+01	0.2000000000000000E+02	-0.2000000000000000E+02	0.3000000000000000E+01	-0.2000000000000000E+02
31	0.1000000000000000E+02	0.2990000000000000E+01	0.1000000000000000E+02	0.0	0.0
36	0.0	0.0	0.0	0.0	0.7663333333333333E+01
41	0.1000000000000000E+01	0.0	0.0	0.0	0.1000000000000000E+01
46	0.0	0.0	0.0	0.1000000000000000E+01	0.1000000000000000E+02
51	0.1990000000000000E+01	0.1000000000000000E+02	0.0	0.0	0.0
56	0.0	0.0	0.0	0.7329999999999999E+01	0.1000000000000000E+01
61	0.0	0.0	0.0	0.1000000000000000E+01	0.0
66	0.0	0.0	0.1000000000000000E+01	0.3000000000000000E+02	0.3000000000000000E+02
71	0.3000000000000000E+02	0.0	0.0	0.0	0.0
76	0.0	0.0	0.3000000000000000E+02	0.1000000000000000E+01	0.0
81	0.0	0.0	0.1000000000000000E+01	0.0	0.0
86	0.0	0.1000000000000000E+01	0.8000000000000000E+01	0.8000000000000000E+01	0.8000000000000000E+01
91	0.0	0.0	0.0	0.0	0.0
96	0.0	0.8000000000000000E+01	0.1000000000000000E+01	0.0	0.0
101	0.0	0.1000000000000000E+01	0.0	0.0	0.0
106	0.1000000000000000E+01	0.3400000000000000E+02	0.3400000000000000E+02	0.3400000000000000E+02	0.0
111	0.0	0.0	0.0	0.0	0.0
116	0.3400000000000000E+02	0.1000000000000000E+01	0.0	0.0	0.0
121	0.1000000000000000E+01	0.0	0.0	0.0	0.1000000000000000E+01
126	0.5000000000000000E+04	0.5000000000000000E+04	0.1000000000000000E+02	0.2000000000000000E+02	0.2100000000000000E+02
131	0.1000000000000000E+05	0.1000000000000000E+05	0.1000000000000000E+02	0.2000000000000000E+02	0.2100000000000000E+02
136	0.5000000000000000E+04	0.2000000000000000E+04	0.1000000000000000E+02	0.2000000000000000E+02	0.2100000000000000E+02
141	0.5000000000000000E+04	0.0	0.0	0.0	0.0
146	0.0	0.0	0.0	0.0	0.0
151	0.0	0.0	0.0	0.0	0.0
156	0.0	0.0	0.0	0.0	0.0
161	0.0	0.0	0.0	0.0	0.0
166	0.0	0.0	0.1000000000000000E+05	0.0	0.0
171	0.0	0.0	0.0	0.0	0.0
176	0.0	0.0	0.0	0.0	0.0
181	0.0	0.0	0.0	0.0	0.0
186	0.0	0.0	0.0	0.0	0.0
191	0.0	0.0	0.0	0.0	0.2000000000000000E+04
196	0.0	0.0	0.0	0.0	0.0
201	0.0	0.0	0.0	0.0	0.0
206	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0
221	0.0	0.0	0.0	0.0	0.0
226	0.0	0.0	0.0	0.0	0.0
231	0.0	0.0	0.0	0.0	0.0
236	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0
251	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	0.0	0.0	0.0
266	0.0	0.0	0.0	0.0	0.0
271	0.0	0.0	0.0	0.0	0.0

Table 6 Example Auxiliary Printout (5 of 8)

16-2-2

I	RQ(I)---RQ(I+4)				
276	0.0	0.0	0.0	0.0	0.0
281	0.0	0.0	0.0	0.0	0.0
286	0.0	0.0	0.0	0.0	0.0
291	0.0	0.0	0.0	0.0	0.0
296	0.0	0.0	0.0	0.0	0.0
301	0.0	0.0	0.0	0.0	0.0
306	0.0	0.0	0.0	0.0	0.0
311	0.0	0.0	0.0	0.0	0.0
316	0.0	0.0	0.0	0.0	0.1644788312270717E+01
321	0.0	0.7174680592958868E+01	0.0	0.1644788312270717E+01	0.7174680592958868E+01
326	0.5000000000000000E+04	0.0	0.0	0.0	-0.1990000000000000E+01
331	0.0	0.0	0.1355211687729283E+01	0.0	0.2000000000000000E+02
336	0.2000000000000000E+02	0.0	0.0	0.0	0.0
341	0.0	0.0	0.0	0.0	0.0
346	0.0	0.0	0.2946641988724662E+04	0.0	0.0
351	0.0	0.0	0.0	0.0	0.0
356	0.0	0.0	0.0	0.0	0.0
361	0.0	0.0	0.0	0.0	0.0
366	0.0	0.0	0.0	0.1647494020939428E+01	0.0
371	C.3948492620885450E+01	0.0	0.1647494020939428E+01	0.3948492620885450E+01	0.5000000000000000E+04
376	0.0	0.0	0.0	-0.1990000000000000E+01	0.0
381	0.0	0.1352505979060572E+01	0.0	0.2000000000000000E+02	0.2000000000000000E+02
386	0.0	0.0	0.0	0.0	0.0
391	0.0	0.0	0.0	0.0	0.0
396	0.0	0.2960170532068220E+04	0.0	0.0	0.0
401	0.0	0.0	0.0	0.0	0.0
406	0.0	0.0	0.0	0.0	0.0
411	0.0	0.0	0.0	0.0	0.0
416	0.0	0.0	0.1644788312270717E+01	0.0	0.7174680592958868E+01
421	0.0	0.1644788312270717E+01	0.7174680592958868E+01	0.5000000000000000E+04	0.0
426	0.0	0.0	0.2990000000000000E+01	0.0	0.0
431	-0.3552116877292832E+00	0.0	0.2000000000000000E+02	0.2000000000000000E+02	0.0
436	0.0	0.0	0.0	0.0	0.0
441	0.0	0.0	0.0	0.0	0.0
446	0.2946641988724663E+04	0.0	0.0	0.0	0.0
451	0.0	0.0	0.0	0.0	0.0
456	0.0	0.0	0.0	0.0	0.0
461	0.0	0.0	0.0	0.0	0.0
466	0.0	0.1647494020939428E+01	0.0	0.3948492620885450E+01	0.0
471	0.1647494020939428E+01	0.3948492620885450E+01	0.5000000000000000E+04	0.0	0.0
476	0.0	0.2990000000000000E+01	0.0	0.0	-0.3525059790605716E+00
481	0.0	0.2000000000000000E+02	0.2000000000000000E+02	0.0	0.0
486	0.0	0.0	0.0	0.0	0.0
491	0.0	0.0	0.0	0.0	0.2960170532068221E+04
496	0.0	0.0	0.0	0.0	0.0
501	0.0	0.0	0.0	0.0	0.0
506	0.0	0.0	0.0	0.0	0.0
511	0.0	0.0	0.0	0.0	0.0
516	0.0	0.7100029054401194E+00	0.0	0.1311789230794863E+03	0.7100029054401194E+00
521	0.1311789230794863E+03	0.7100029054401193E+04	0.0	0.0	0.0
526	0.0	0.6633333333333333E-01	0.0	0.0	0.0
531	0.0	0.0	0.0	0.0	0.0
536	0.0	0.0	0.0	0.0	0.0
541	0.0	0.0	0.0	0.0	0.0
546	0.0	0.0	0.0	0.0	0.0

Table 6 Example Auxiliary Printout (6 of 8)

```
16-2-2
  I   RO(I)---RO(I+4)
 551  0.0                      0.0                      0.0                      0.0                      0.0
 556  0.0                      0.0                      0.0                      0.0                      0.0
 561  0.0                      0.0                      0.0                      0.0                      0.0
 566  0.7761585669538978E+00   0.0                      0.1333185520428590E+03   0.7761585669538978E+00   0.1333185520428590E+03
 571  0.7761585669538978E+04   0.0                      0.0                      0.0                      0.0
 576  0.6633333333333333E-01   0.0                      0.0                      0.0                      0.0
 581  0.0                      0.0                      0.0                      0.0                      0.0
 586  0.0                      0.0                      0.0                      0.0                      0.0
 591  0.0                      0.0                      0.0                      0.0                      0.0
 596  0.0                      0.0                      0.0                      0.0                      0.0
 601  0.0                      0.0                      0.0                      0.0                      0.0
 606  0.0                      0.0                      0.0                      0.0                      0.0
 611  0.0                      0.0                      0.0                      0.9999999999999999E-02   0.0
 616  0.0                      0.0                      0.2525188757859650E+00   0.0                      0.0
 621  0.0                      0.9999999999999999E-02   0.1111111111111111E-02   0.0                      0.0
 626  0.0                      0.1111111111111111E-02   0.0                      0.0                      0.0
 631  0.1111111111111111E-02   0.0                      0.9028091827993079E+00   0.0                      0.1564781676937016E+03
 636  0.9028091827993079E+00   0.1564781676937016E+03   0.9028091827993078E+04   0.0                      0.0
 641  0.0                      0.0                      0.8794117647058823E-01   0.0                      0.0
 646  0.0                      0.0                      0.0                      0.0                      0.0
 651  0.0                      0.0                      0.0                      0.0                      0.0
 656  0.0                      0.0                      0.0                      0.0                      0.0
 661  0.0                      0.0                      0.0                      0.0                      0.0
 666  0.0                      0.0                      0.0                      0.0                      0.0
 671  0.0                      0.0                      0.0                      0.0                      0.0
 676  0.0                      0.0                      0.0                      0.0                      0.0
 681  0.0                      0.9811632069364721E+00   0.0                      0.1567501500529156E+03   0.9811632069364721E+00
 686  0.1567501500529156E+03   0.9811632069364720E+04   0.0                      0.0                      0.0
 691  0.0                      0.8794117647058823E-01   0.0                      0.0                      0.0
 696  0.0                      0.0                      0.0                      0.0                      0.0
 701  0.0                      0.0                      0.0                      0.0                      0.0
 706  0.0                      0.0                      0.0                      0.0                      0.0
 711  0.0                      0.0                      0.0                      0.0                      0.0
 716  0.0                      0.0                      0.0                      0.0                      0.0
 721  0.0                      0.0                      0.0                      0.0                      0.0
 726  0.0                      0.0                      0.0                      0.0                      0.9999999999999999E-02
 731  0.0                      0.0                      0.0                      0.1118555720853234E+00   0.0
 736  0.0                      0.0                      0.9999999999999999E-02   0.8650519031141868E-03   0.0
 741  0.0                      0.0                      0.8650519031141868E-03   0.0                      0.0
 746  0.0                      0.8650519031141868E-03

U2 ARRAY
   0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       0.0       0.0       0.0

V1 ARRAY
   0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0

 LINEAR POSITIONS AND VELOCITIES OF BODY SEGMENTS FROM CHAIN FOR TIME =    0.011500
    0.0        16.00000     0.0        0.0        34.00621     0.0        0.0          2.79237    0.0
    0.0       -36.55897     0.0        0.0        -0.55013     0.0        0.0          0.0        0.0
    0.0         2.47378     0.0        0.0       135.79373     0.0        0.0        296.49108    0.0
    0.0       139.73803     0.0

11-1-1 0.011500    98   17  199    1    3    0    0    0   0.0          0.0
11-2-1   1.00000000    0.0        0.0        0.0        1.00000000   0.0        0.0        0.0        1.00000000
11-2-2  -20.00000000    0.0       20.00000000    0.0       -20.00000000    0.0
```

Table 6 Example Auxiliary Printout (7 of 8)

ELAPSED CPU TIME = 8.54 SECONDS

SUB	CALLS	TIME	%
MAIN3D	1	11	1.29
INPUT	1	12	1.41
CHAIN	162	19	2.22
DINT	41	462	54.10
PDAUX	201	20	2.34
DAUX	161	62	7.26
SETUP1	161	8	0.94
CONTCT	161	160	18.74
SEGSEG	322	41	4.80
VISPR	161	6	0.70
EJOINT	161	2	0.23
SETUP2	161	2	0.23
DAUX11	161	5	0.59
DAUX12	161	0	0.0
DAUX22	161	2	0.23
FSMSOL	161	2	0.23
OUTPUT	41	32	3.75
PRIPLT	41	0	0.0
UPDATE	40	0	0.0
DZP	160	8	0.94
TOTAL		854	100.00

Table 6 Example Auxiliary Printout (8 of 8)

As the run progresses, the information needed to print the normal printout is written out in a binary file. When the run is completed, the binary file produced during the run is read back in and the tabular normal output is produced. Table 7 contains the normal output which was requested for this example run.

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

SEGMENT LINEAR ACCELERATIONS (G'S)

TIME (MSEC)	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 1- ULM W.R.T. (INERTL) X	Y	Z	RES	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 2- TVM W.R.T. (INERTL) X	Y	Z	RES	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 3- DM W.R.T. (INERTL) X	Y	Z	RES
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.43	0.0	14.43
2.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.69	0.0	28.69
3.000	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.03	0.0	40.93	0.0	40.93
4.000	0.0	0.0	0.0	0.0	0.0	0.11	0.0	0.11	0.0	47.65	0.0	47.65
5.000	0.0	0.0	0.0	0.0	0.0	0.24	0.0	0.24	0.0	45.09	0.0	45.09
6.000	0.0	0.0	0.0	0.0	0.0	0.40	0.0	0.40	0.0	41.67	0.0	41.67
7.000	0.0	0.0	0.0	0.0	0.0	0.60	0.0	0.60	0.0	37.45	0.0	37.45
8.000	0.0	0.0	0.0	0.0	0.0	0.83	0.0	0.83	0.0	32.51	0.0	32.51
9.000	0.0	0.0	0.0	0.0	0.0	1.10	0.0	1.10	0.0	26.97	0.0	26.97
10.000	0.0	0.0	0.0	0.0	0.0	1.39	0.0	1.39	0.0	20.93	0.0	20.93
11.000	0.0	0.0	0.0	0.0	0.0	1.69	0.0	1.69	0.0	14.51	0.0	14.51
12.000	0.0	0.0	0.0	0.0	0.0	2.01	0.0	2.01	0.0	7.85	0.0	7.85
13.000	0.0	0.0	0.0	0.0	0.0	2.33	0.0	2.33	0.0	1.07	0.0	1.07
14.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
15.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
16.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
17.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
18.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
19.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
20.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
21.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
22.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
23.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
24.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
25.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
26.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
27.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
28.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
29.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
30.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
31.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
32.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
33.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
34.000	0.0	0.0	0.0	0.0	0.0	2.38	0.0	2.38	0.0	0.0	0.0	0.0
35.000	0.0	2.67	0.0	2.67	0.0	2.38	0.0	2.38	0.0	-0.67	0.0	0.67
36.000	0.0	8.20	0.0	8.20	0.0	2.38	0.0	2.38	0.0	-2.05	0.0	2.05
37.000	0.0	13.57	0.0	13.57	0.0	2.38	0.0	2.38	0.0	-3.39	0.0	3.39
38.000	0.0	18.68	0.0	18.68	0.0	2.38	0.0	2.38	0.0	-4.67	0.0	4.67
39.000	0.0	23.43	0.0	23.43	0.0	2.38	0.0	2.38	0.0	-5.86	0.0	5.86
40.000	0.0	27.72	0.0	27.72	0.0	2.38	0.0	2.38	0.0	-6.93	0.0	6.93

Table 7 Example Normal Printout (1 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

SEGMENT LINEAR ACCELERATIONS (G'S)

TIME (MSEC)	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 4- BVM W.R.T. (INERTL) X	Y	Z	RES	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 5- BM W.R.T. (INERTL) X	Y	Z	RES	SEG NO.
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1.000	0.0	0.0	0.0	0.0	0.0	-19.24	0.0	19.24	
2.000	0.0	0.0	0.0	0.0	0.0	-38.25	0.0	38.25	
3.000	0.0	-0.06	0.0	0.06	0.0	-54.03	0.0	54.03	
4.000	0.0	-0.17	0.0	0.17	0.0	-62.27	0.0	62.27	
5.000	0.0	-0.35	0.0	0.35	0.0	-57.77	0.0	57.77	
6.000	0.0	-0.58	0.0	0.58	0.0	-51.80	0.0	51.80	
7.000	0.0	-0.87	0.0	0.87	0.0	-44.51	0.0	44.51	
8.000	0.0	-1.19	0.0	1.19	0.0	-36.09	0.0	36.09	
9.000	0.0	-1.56	0.0	1.56	0.0	-26.78	0.0	26.78	
10.000	0.0	-1.94	0.0	1.94	0.0	-16.83	0.0	16.83	
11.000	0.0	-2.35	0.0	2.35	0.0	-6.48	0.0	6.48	
12.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
13.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
14.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
15.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
16.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
17.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
18.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
19.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
20.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
21.009	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
22.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
23.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
24.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
25.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
26.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
27.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
28.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
29.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
30.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
31.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
32.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
33.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
34.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
35.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
36.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
37.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
38.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
39.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	
40.000	0.0	-2.60	0.0	2.60	0.0	0.0	0.0	0.0	

Table 7 Example Normal Printout (2 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

SEGMENT LINEAR VELOCITIES (IN./SEC.)

TIME	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 1- ULM W.R.T. (INERTL)				POINT (0.0 , 0.0 , 0.0) ON SEG NO. 2- TVM W.R.T. (INERTL)				POINT (0.0 , 0.0 , 0.0) ON SEG NO. 3- DM W.R.T. (INERTL)			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.73	0.0	2.73
2.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.09	0.0	11.09
3.000	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.00	0.0	24.62	0.0	24.62
4.000	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.03	0.0	42.17	0.0	42.17
5.000	0.0	0.0	0.0	0.0	0.0	0.10	0.0	0.10	0.0	60.10	0.0	60.10
6.000	0.0	0.0	0.0	0.0	0.0	0.22	0.0	0.22	0.0	76.87	0.0	76.87
7.000	0.0	0.0	0.0	0.0	0.0	0.41	0.0	0.41	0.0	92.17	0.0	92.17
8.000	0.0	0.0	0.0	0.0	0.0	0.69	0.0	0.69	0.0	105.70	0.0	105.70
9.000	0.0	0.0	0.0	0.0	0.0	1.06	0.0	1.06	0.0	117.20	0.0	117.20
10.000	0.0	0.0	0.0	0.0	0.0	1.54	0.0	1.54	0.0	126.46	0.0	126.46
11.000	0.0	0.0	0.0	0.0	0.0	2.13	0.0	2.13	0.0	133.31	0.0	133.31
12.000	0.0	0.0	0.0	0.0	0.0	2.85	0.0	2.85	0.0	137.63	0.0	137.63
13.000	0.0	0.0	0.0	0.0	0.0	3.68	0.0	3.68	0.0	139.35	0.0	139.35
14.000	0.0	0.0	0.0	0.0	0.0	4.60	0.0	4.60	0.0	139.42	0.0	139.42
15.000	0.0	0.0	0.0	0.0	0.0	5.52	0.0	5.52	0.0	139.42	0.0	139.42
16.000	0.0	0.0	0.0	0.0	0.0	6.44	0.0	6.44	0.0	139.42	0.0	139.42
17.000	0.0	0.0	0.0	0.0	0.0	7.36	0.0	7.36	0.0	139.42	0.0	139.42
18.000	0.0	0.0	0.0	0.0	0.0	8.28	0.0	8.28	0.0	139.42	0.0	139.42
19.000	0.0	0.0	0.0	0.0	0.0	9.20	0.0	9.20	0.0	139.42	0.0	139.42
20.000	0.0	0.0	0.0	0.0	0.0	10.12	0.0	10.12	0.0	139.42	0.0	139.42
21.000	0.0	0.0	0.0	0.0	0.0	11.04	0.0	11.04	0.0	139.42	0.0	139.42
22.000	0.0	0.0	0.0	0.0	0.0	11.96	0.0	11.96	0.0	139.42	0.0	139.42
23.000	0.0	0.0	0.0	0.0	0.0	12.88	0.0	12.88	0.0	139.42	0.0	139.42
24.000	0.0	0.0	0.0	0.0	0.0	13.80	0.0	13.80	0.0	139.42	0.0	139.42
25.000	0.0	0.0	0.0	0.0	0.0	14.72	0.0	14.72	0.0	139.42	0.0	139.42
26.000	0.0	0.0	0.0	0.0	0.0	15.64	0.0	15.64	0.0	139.42	0.0	139.42
27.000	0.0	0.0	0.0	0.0	0.0	16.56	0.0	16.56	0.0	139.42	0.0	139.42
28.000	0.0	0.0	0.0	0.0	0.0	17.48	0.0	17.48	0.0	139.42	0.0	139.42
29.000	0.0	0.0	0.0	0.0	0.0	18.40	0.0	18.40	0.0	139.42	0.0	139.42
30.000	0.0	0.0	0.0	0.0	0.0	19.32	0.0	19.32	0.0	139.42	0.0	139.42
31.000	0.0	0.0	0.0	0.0	0.0	20.24	0.0	20.24	0.0	139.42	0.0	139.42
32.000	0.0	0.0	0.0	0.0	0.0	21.16	0.0	21.16	0.0	139.42	0.0	139.42
33.000	0.0	0.0	0.0	0.0	0.0	22.08	0.0	22.08	0.0	139.42	0.0	139.42
34.000	0.0	0.0	0.0	0.0	0.0	23.00	0.0	23.00	0.0	139.42	0.0	139.42
35.000	0.0	0.17	0.0	0.17	0.0	23.92	0.0	23.92	0.0	139.38	0.0	139.38
36.000	0.0	2.27	0.0	2.27	0.0	24.84	0.0	24.84	0.0	138.86	0.0	138.86
37.000	0.0	6.48	0.0	6.48	0.0	25.76	0.0	25.76	0.0	137.80	0.0	137.80
38.000	0.0	12.72	0.0	12.72	0.0	26.68	0.0	26.68	0.0	136.24	0.0	136.24
39.000	0.0	20.86	0.0	20.86	0.0	27.60	0.0	27.60	0.0	134.21	0.0	134.21
40.000	0.0	30.75	0.0	30.75	0.0	28.52	0.0	28.52	0.0	131.74	0.0	131.74

Table 7 Example Normal Printout (3 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

SEGMENT LINEAR VELOCITIES (IN./SEC.)

TIME (MSEC)	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 4- BVM W.R.T. (INERTL) X	Y	Z	RES	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 5- BM W.R.T. (INERTL) X	Y	Z	RES	SEG NO.
0.0	0.0	300.00	0.0	300.00	0.0	300.00	0.0	300.00	
1.000	0.0	300.00	0.0	300.00	0.0	296.36	0.0	296.36	
2.000	0.0	300.00	0.0	300.00	0.0	285.22	0.0	285.22	
3.000	0.0	299.99	0.0	299.99	0.0	267.29	0.0	267.29	
4.000	0.0	299.95	0.0	299.95	0.0	244.23	0.0	244.23	
5.000	0.0	299.85	0.0	299.85	0.0	221.01	0.0	221.01	
6.000	0.0	299.67	0.0	299.67	0.0	199.81	0.0	199.81	
7.000	0.0	299.39	0.0	299.39	0.0	181.18	0.0	181.18	
8.000	0.0	299.00	0.0	299.00	0.0	165.59	0.0	165.59	
9.000	0.0	298.47	0.0	298.47	0.0	153.43	0.0	153.43	
10.000	0.0	297.79	0.0	297.79	0.0	144.99	0.0	144.99	
11.000	0.0	296.96	0.0	296.96	0.0	140.49	0.0	140.49	
12.000	0.0	295.99	0.0	295.99	0.0	139.74	0.0	139.74	
13.000	0.0	294.99	0.0	294.99	0.0	139.74	0.0	139.74	
14.000	0.0	293.98	0.0	293.98	0.0	139.74	0.0	139.74	
15.000	0.0	292.98	0.0	292.98	0.0	139.74	0.0	139.74	
16.000	0.0	291.97	0.0	291.97	0.0	139.74	0.0	139.74	
17.000	0.0	290.97	0.0	290.97	0.0	139.74	0.0	139.74	
18.000	0.0	289.97	0.0	289.97	0.0	139.74	0.0	139.74	
19.000	0.0	288.96	0.0	288.96	0.0	139.74	0.0	139.74	
20.000	0.0	287.96	0.0	287.96	0.0	139.74	0.0	139.74	
21.000	0.0	286.96	0.0	286.96	0.0	139.74	0.0	139.74	
22.000	0.0	285.95	0.0	285.95	0.0	139.74	0.0	139.74	
23.000	0.0	284.95	0.0	284.95	0.0	139.74	0.0	139.74	
24.000	0.0	283.95	0.0	283.95	0.0	139.74	0.0	139.74	
25.000	0.0	282.94	0.0	282.94	0.0	139.74	0.0	139.74	
26.000	0.0	281.94	0.0	281.94	0.0	139.74	0.0	139.74	
27.000	0.0	280.93	0.0	280.93	0.0	139.74	0.0	139.74	
28.000	0.0	279.93	0.0	279.93	0.0	139.74	0.0	139.74	
29.000	0.0	278.93	0.0	278.93	0.0	139.74	0.0	139.74	
30.000	0.0	277.92	0.0	277.92	0.0	139.74	0.0	139.74	
31.000	0.0	276.92	0.0	276.92	0.0	139.74	0.0	139.74	
32.000	0.0	275.92	0.0	275.92	0.0	139.74	0.0	139.74	
33.000	0.0	274.91	0.0	274.91	0.0	139.74	0.0	139.74	
34.000	0.0	273.91	0.0	273.91	0.0	139.74	0.0	139.74	
35.000	0.0	272.91	0.0	272.91	0.0	139.74	0.0	139.74	
36.000	0.0	271.90	0.0	271.90	0.0	139.74	0.0	139.74	
37.000	0.0	270.90	0.0	270.90	0.0	139.74	0.0	139.74	
38.000	0.0	269.89	0.0	269.89	0.0	139.74	0.0	139.74	
39.000	0.0	268.89	0.0	268.89	0.0	139.74	0.0	139.74	
40.000	0.0	267.89	0.0	267.89	0.0	139.74	0.0	139.74	

Table 7 Example Normal Printout (4 of 11)

DATE: 9 JUNE 80 PAGE: 25.01

RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1

VEHICLE DECELERATION: NONE

CRASH VICTIM: ONE MASS SPHERE

SEGMENT LINEAR DISPLACEMENTS (IN.)

TIME	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 1- ULM W.R.T. (INERTL)				POINT (0.0 , 0.0 , 0.0) ON SEG NO. 2- TVM W.R.T. (INERTL)				POINT (0.0 , 0.0 , 0.0) ON SEG NO. 3- DM W.R.T. (INERTL)			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.0	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.00	0.0	2.00
1.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.00	0.0	2.00
2.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.01	0.0	2.01
3.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.02	0.0	2.02
4.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.06	0.0	2.06
5.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.11	0.0	2.11
6.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.18	0.0	2.18
7.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.26	0.0	2.26
8.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.36	0.0	2.36
9.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.47	0.0	2.47
10.000	0.0	16.00	0.0	16.00	0.0	34.00	0.0	34.00	0.0	2.59	0.0	2.59
11.000	0.0	16.00	0.0	16.00	0.0	34.01	0.0	34.01	0.0	2.73	0.0	2.73
12.000	0.0	16.00	0.0	16.00	0.0	34.01	0.0	34.01	0.0	2.86	0.0	2.86
13.000	0.0	16.00	0.0	16.00	0.0	34.01	0.0	34.01	0.0	3.00	0.0	3.00
14.000	0.0	16.00	0.0	16.00	0.0	34.01	0.0	34.01	0.0	3.14	0.0	3.14
15.000	0.0	16.00	0.0	16.00	0.0	34.02	0.0	34.02	0.0	3.28	0.0	3.28
16.000	0.0	16.00	0.0	16.00	0.0	34.03	0.0	34.03	0.0	3.42	0.0	3.42
17.000	0.0	16.00	0.0	16.00	0.0	34.03	0.0	34.03	0.0	3.56	0.0	3.56
18.000	0.0	16.00	0.0	16.00	0.0	34.04	0.0	34.04	0.0	3.70	0.0	3.70
19.000	0.0	16.00	0.0	16.00	0.0	34.05	0.0	34.05	0.0	3.84	0.0	3.84
20.000	0.0	16.00	0.0	16.00	0.0	34.06	0.0	34.06	0.0	3.98	0.0	3.98
21.000	0.0	16.00	0.0	16.00	0.0	34.07	0.0	34.07	0.0	4.11	0.0	4.11
22.000	0.0	16.00	0.0	16.00	0.0	34.08	0.0	34.08	0.0	4.25	0.0	4.25
23.000	0.0	16.00	0.0	16.00	0.0	34.09	0.0	34.09	0.0	4.39	0.0	4.39
24.000	0.0	16.00	0.0	16.00	0.0	34.11	0.0	34.11	0.0	4.53	0.0	4.53
25.000	0.0	16.00	0.0	16.00	0.0	34.12	0.0	34.12	0.0	4.67	0.0	4.67
26.000	0.0	16.00	0.0	16.00	0.0	34.14	0.0	34.14	0.0	4.81	0.0	4.81
27.000	0.0	16.00	0.0	16.00	0.0	34.15	0.0	34.15	0.0	4.95	0.0	4.95
28.000	0.0	16.00	0.0	16.00	0.0	34.17	0.0	34.17	0.0	5.09	0.0	5.09
29.000	0.0	16.00	0.0	16.00	0.0	34.19	0.0	34.19	0.0	5.23	0.0	5.23
30.000	0.0	16.00	0.0	16.00	0.0	34.21	0.0	34.21	0.0	5.37	0.0	5.37
31.000	0.0	16.00	0.0	16.00	0.0	34.23	0.0	34.23	0.0	5.51	0.0	5.51
32.000	0.0	16.00	0.0	16.00	0.0	34.25	0.0	34.25	0.0	5.65	0.0	5.65
33.000	0.0	16.00	0.0	16.00	0.0	34.27	0.0	34.27	0.0	5.79	0.0	5.79
34.000	0.0	16.00	0.0	16.00	0.0	34.29	0.0	34.29	0.0	5.93	0.0	5.93
35.000	0.0	16.00	0.0	16.00	0.0	34.31	0.0	34.31	0.0	6.07	0.0	6.07
36.000	0.0	16.00	0.0	16.00	0.0	34.34	0.0	34.34	0.0	6.21	0.0	6.21
37.000	0.0	16.01	0.0	16.01	0.0	34.36	0.0	34.36	0.0	6.34	0.0	6.34
38.000	0.0	16.01	0.0	16.01	0.0	34.39	0.0	34.39	0.0	6.48	0.0	6.48
39.000	0.0	16.03	0.0	16.03	0.0	34.42	0.0	34.42	0.0	6.62	0.0	6.62
40.000	0.0	16.06	0.0	16.06	0.0	34.45	0.0	34.45	0.0	6.75	0.0	6.75

Table 7 Example Normal Printout (5 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

SEGMENT LINEAR DISPLACEMENTS (IN.)

TIME (MSEC)	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 4- BVM W.R.T. (INERTL) X	Y	Z	RES	POINT (0.0 , 0.0 , 0.0) ON SEG NO. 5- BM W.R.T. (INERTL) X	Y	Z	RES	SEG NO.
0.0	0.0	-40.00	0.0	40.00	0.0	-3.00	0.0	3.00	
1.000	0.0	-39.70	0.0	39.70	0.0	-2.70	0.0	2.70	
2.000	0.0	-39.40	0.0	39.40	0.0	-2.41	0.0	2.41	
3.000	0.0	-39.10	0.0	39.10	0.0	-2.13	0.0	2.13	
4.000	0.0	-38.80	0.0	38.80	0.0	-1.88	0.0	1.88	
5.000	0.0	-38.50	0.0	38.50	0.0	-1.64	0.0	1.64	
6.000	0.0	-38.20	0.0	38.20	0.0	-1.43	0.0	1.43	
7.000	0.0	-37.90	0.0	37.90	0.0	-1.24	0.0	1.24	
8.000	0.0	-37.60	0.0	37.60	0.0	-1.07	0.0	1.07	
9.000	0.0	-37.30	0.0	37.30	0.0	-0.91	0.0	0.91	
10.000	0.0	-37.00	0.0	37.00	0.0	-0.76	0.0	0.76	
11.000	0.0	-36.71	0.0	36.71	0.0	-0.62	0.0	0.62	
12.000	0.0	-36.41	0.0	36.41	0.0	-0.48	0.0	0.48	
13.000	0.0	-36.12	0.0	36.12	0.0	-0.34	0.0	0.34	
14.000	0.0	-35.82	0.0	35.82	0.0	-0.20	0.0	0.20	
15.000	0.0	-35.53	0.0	35.53	0.0	-0.06	0.0	0.06	
16.000	0.0	-35.23	0.0	35.23	0.0	0.08	0.0	0.08	
17.000	0.0	-34.94	0.0	34.94	0.0	0.22	0.0	0.22	
18.000	0.0	-34.65	0.0	34.65	0.0	0.36	0.0	0.36	
19.000	0.0	-34.36	0.0	34.36	0.0	0.50	0.0	0.50	
20.000	0.0	-34.08	0.0	34.08	0.0	0.64	0.0	0.64	
21.000	0.0	-33.79	0.0	33.79	0.0	0.78	0.0	0.78	
22.000	0.0	-33.50	0.0	33.50	0.0	0.92	0.0	0.92	
23.000	0.0	-33.22	0.0	33.22	0.0	1.06	0.0	1.06	
24.000	0.0	-32.93	0.0	32.93	0.0	1.20	0.0	1.20	
25.000	0.0	-32.65	0.0	32.65	0.0	1.34	0.0	1.34	
26.000	0.0	-32.37	0.0	32.37	0.0	1.48	0.0	1.48	
27.000	0.0	-32.08	0.0	32.08	0.0	1.62	0.0	1.62	
28.000	0.0	-31.80	0.0	31.80	0.0	1.76	0.0	1.76	
29.000	0.0	-31.52	0.0	31.52	0.0	1.90	0.0	1.90	
30.000	0.0	-31.25	0.0	31.25	0.0	2.04	0.0	2.04	
31.000	0.0	-30.97	0.0	30.97	0.0	2.17	0.0	2.17	
32.000	0.0	-30.69	0.0	30.69	0.0	2.31	0.0	2.31	
33.000	0.0	-30.42	0.0	30.42	0.0	2.45	0.0	2.45	
34.000	0.0	-30.14	0.0	30.14	0.0	2.59	0.0	2.59	
35.000	0.0	-29.87	0.0	29.87	0.0	2.73	0.0	2.73	
36.000	0.0	-29.60	0.0	29.60	0.0	2.87	0.0	2.87	
37.000	0.0	-29.32	0.0	29.32	0.0	3.01	0.0	3.01	
38.000	0.0	-29.05	0.0	29.05	0.0	3.15	0.0	3.15	
39.000	0.0	-28.78	0.0	28.78	0.0	3.29	0.0	3.29	
40.000	0.0	-28.52	0.0	28.52	0.0	3.43	0.0	3.43	

Table 7 Example Normal Printout (6 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

CONTACT INTERACTION BETWEEN

ELLIPSOID UPPER LEG MADE OF MAT3
AND
PLANE INNER DOOR ASSUMED TO BE RIGID

TIME (MSEC)	DEFLECTION PLANE (IN.)	DEFLECTION ELLIPSOID (IN.)	DEFL. RATE PLANE (IN./SEC)	DEFL. RATE ELLIPSOID (IN./SEC)	FORCE NORMAL (LB.)	FORCE TANGNTL (LB.)	CONTACT LOCATION (IN.) ULM SYSTEM X	ULM SYSTEM Y	ULM SYSTEM Z	DM SYSTEM X	DM SYSTEM Y	DM SYSTEM Z
0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35.000	0.0	0.07	0.	139.	133.5	0.0	0.0	-7.93	0.0	0.0	2.00	0.0
36.000	0.0	0.20	0.	137.	409.5	0.0	0.0	-7.80	0.0	0.0	2.00	0.0
37.000	0.0	0.34	0.	131.	677.9	0.0	0.0	-7.66	0.0	0.0	2.00	0.0
38.000	0.0	0.47	0.	124.	933.1	0.0	0.0	-7.53	0.0	0.0	2.00	0.0
39.000	0.0	0.59	0.	113.	1170.4	0.0	0.0	-7.41	0.0	0.0	2.00	0.0
40.000	0.0	0.69	0.	101.	1385.1	0.0	0.0	-7.31	0.0	0.0	2.00	0.0

Table 7 Example Normal Printout (7 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

CONTACT INTERACTION BETWEEN

ELLIPSOID DOOR ASSUMED TO BE RIGID
AND
PLANE BUMPER FRONT MADE OF MAT1

TIME (MSEC)	DEFLECTION PLANE (IN.)	DEFLECTION ELLIPSOID (IN.)	DEFL. RATE PLANE (IN./SEC)	DEFL. RATE ELLIPSOID (IN./SEC)	FORCE NORMAL (LB.)	FORCE TANGNTL (LB.)	CONTACT LOCATION (IN.) DM SYSTEM X	DM SYSTEM Y	DM SYSTEM Z	BM SYSTEM X	BM SYSTEM Y	BM SYSTEM Z
0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.29	0.0	294.	0.	1442.1	0.0	0.0	-1.99	0.0	0.0	2.71	0.0
2.000	0.57	0.0	274.	0.	2866.7	0.0	0.0	-1.99	0.0	0.0	2.43	0.0
3.000	0.83	0.0	243.	0.	4163.1	0.0	0.0	-1.99	0.0	0.0	2.17	0.0
4.000	1.06	0.0	202.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.94	0.0
5.000	1.24	0.0	161.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.76	0.0
6.000	1.38	0.0	123.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.62	0.0
7.000	1.48	0.0	89.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.52	0.0
8.000	1.56	0.0	60.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.44	0.0
9.000	1.61	0.0	36.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.39	0.0
10.000	1.63	0.0	19.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.37	0.0
11.000	1.64	0.0	7.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.36	0.0
12.000	1.65	0.0	2.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
13.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
14.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
15.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
16.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
17.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
18.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
19.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
20.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
21.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
22.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
23.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
24.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
25.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
26.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
27.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
28.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.35	0.0
29.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
30.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
31.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
32.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
33.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
34.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
35.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
36.000	1.66	0.0	1.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
37.000	1.66	0.0	2.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
38.000	1.66	0.0	4.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.34	0.0
39.000	1.67	0.0	6.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.33	0.0
40.000	1.67	0.0	8.	0.	5000.0	0.0	0.0	-1.99	0.0	0.0	1.33	0.0

Table 7 Example Normal Printout (8 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

CONTACT INTERACTION BETWEEN

ELLIPSOID BUMPER ASSUMED TO BE RIGID
AND
PLANE OUTER DOOR MADE OF MAT1

TIME	DEFLECTION		DEFL. RATE		FORCE		CONTACT LOCATION (IN.)					
	PLANE	ELLIPSOID	PLANE	ELLIPSOID	NORMAL	TANGNTL	BM SYSTEM			DM SYSTEM		
(MSEC)	(IN.)	(IN.)	(IN./SEC)	(IN./SEC)	(LB.)	(LB.)	X	Y	Z	X	Y	Z
0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.29	0.0	294.	0.	1442.1	0.0	0.0	2.99	0.0	0.0	-1.71	0.0
2.000	0.57	0.0	274.	0.	2866.7	0.0	0.0	2.99	0.0	0.0	-1.43	0.0
3.000	0.83	0.0	243.	0.	4163.1	0.0	0.0	2.99	0.0	0.0	-1.17	0.0
4.000	1.06	0.0	202.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.94	0.0
5.000	1.24	0.0	161.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.76	0.0
6.000	1.38	0.0	123.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.62	0.0
7.000	1.48	0.0	89.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.52	0.0
8.000	1.56	0.0	60.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.44	0.0
9.000	1.61	0.0	36.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.39	0.0
10.000	1.63	0.0	19.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.37	0.0
11.000	1.64	0.0	7.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.36	0.0
12.000	1.65	0.0	2.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
13.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
14.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
15.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
16.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
17.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
18.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
19.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
20.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
21.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
22.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
23.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
24.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
25.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
26.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
27.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
28.000	1.65	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.35	0.0
29.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
30.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
31.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
32.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
33.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
34.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
35.000	1.66	0.0	0.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
36.000	1.66	0.0	1.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
37.000	1.66	0.0	2.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
38.000	1.66	0.0	4.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.34	0.0
39.000	1.67	0.0	6.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.33	0.0
40.000	1.67	0.0	8.	0.	5000.0	0.0	0.0	2.99	0.0	0.0	-0.33	0.0

Table 7 Example Normal Printout (9 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

CONTACT INTERACTION BETWEEN

ELLIPSOID DOOR ASSUMED TO BE RIGID
AND
ELLIPSOID TARGET VEHICLE MADE OF MAT2

TIME (MSEC)	DEFLECTION ELLIPSOID (IN.)	DEFLECTION ELLIPSOID (IN.)	DEFL. RATE ELLIPSOID (IN./SEC)	DEFL. RATE ELLIPSOID (IN./SEC)	FORCE NORMAL (LB.)	FORCE TANGNTL (LB.)	CONTACT LOCATION (IN.) DM SYSTEM X	DM SYSTEM Y	DM SYSTEM Z	TVM SYSTEM X	TVM SYSTEM Y	TVM SYSTEM Z
0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000	0.0	0.01	0.	25.	146.1	0.0	0.0	0.0	0.07	0.0	0.0	0.0
4.000	0.0	0.05	0.	42.	477.7	0.0	0.0	0.0	0.07	0.0	0.0	0.0
5.000	0.0	0.10	0.	60.	989.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
6.000	0.0	0.17	0.	77.	1673.4	0.0	0.0	0.0	0.07	0.0	0.0	0.0
7.000	0.0	0.25	0.	92.	2516.9	0.0	0.0	0.0	0.07	0.0	0.0	0.0
8.000	0.0	0.35	0.	105.	3502.4	0.0	0.0	0.0	0.07	0.0	0.0	0.0
9.000	0.0	0.46	0.	116.	4610.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
10.000	0.0	0.58	0.	125.	5817.4	0.0	0.0	0.0	0.07	0.0	0.0	0.0
11.000	0.0	0.71	0.	131.	7100.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
12.000	0.0	0.84	0.	135.	8432.1	0.0	0.0	0.0	0.07	0.0	0.0	0.0
13.000	0.0	0.98	0.	136.	9786.7	0.0	0.0	0.0	0.07	0.0	0.0	0.0
14.000	0.0	1.11	0.	135.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
15.000	0.0	1.25	0.	134.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
16.000	0.0	1.38	0.	133.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
17.000	0.0	1.51	0.	132.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
18.000	0.0	1.65	0.	131.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
19.000	0.0	1.78	0.	130.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
20.000	0.0	1.91	0.	129.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
21.000	0.0	2.04	0.	128.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
22.000	0.0	2.16	0.	127.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
23.000	0.0	2.29	0.	127.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
24.000	0.0	2.42	0.	126.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
25.000	0.0	2.54	0.	125.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
26.000	0.0	2.67	0.	124.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
27.000	0.0	2.79	0.	123.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
28.000	0.0	2.91	0.	122.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
29.000	0.0	3.03	0.	121.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
30.000	0.0	3.15	0.	120.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
31.000	0.0	3.27	0.	119.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
32.000	0.0	3.39	0.	118.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
33.000	0.0	3.51	0.	117.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
34.000	0.0	3.63	0.	116.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
35.000	0.0	3.74	0.	115.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
36.000	0.0	3.86	0.	114.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
37.000	0.0	3.97	0.	112.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
38.000	0.0	4.08	0.	110.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
39.000	0.0	4.19	0.	107.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0
40.000	0.0	4.29	0.	103.	10000.0	0.0	0.0	0.0	0.07	0.0	0.0	0.0

Table 7 Example Normal Printout (10 of 11)

DATE: 9 JUNE 80
RUN DESCRIPTION: SIDE IMPACT -- TWO CAR -- OCCUPANT
BASE NO. 1
VEHICLE DECELERATION: NONE
CRASH VICTIM: ONE MASS SPHERE

CONTACT INTERACTION BETWEEN

ELLIPSOID BUMPER ASSUMED TO BE RIGID
AND
ELLIPSOID BULLET VEHICLE MADE OF MAT2

TIME (MSEC)	DEFLECTION ELLIPSOID (IN.)	DEFLECTION ELLIPSOID (IN.)	DEFL. RATE ELLIPSOID (IN./SEC)	DEFL. RATE ELLIPSOID (IN./SEC)	FORCE NORMAL (LB.)	FORCE TANGNTL (LB.)	CONTACT LOCATION (IN.) BM SYSTEM X	BM SYSTEM Y	BM SYSTEM Z	BVM SYSTEM X	BVM SYSTEM Y	BVM SYSTEM Z
0.0	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.000	0.0	0.0	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000	0.0	0.02	0.	33.	227.8	0.0	0.0	0.0	0.09	0.0	0.0	0.0
4.000	0.0	0.07	0.	56.	667.3	0.0	0.0	0.0	0.09	0.0	0.0	0.0
5.000	0.0	0.13	0.	79.	1341.3	0.0	0.0	0.0	0.09	0.0	0.0	0.0
6.000	0.0	0.22	0.	100.	2236.8	0.0	0.0	0.0	0.09	0.0	0.0	0.0
7.000	0.0	0.33	0.	118.	3329.5	0.0	0.0	0.0	0.09	0.0	0.0	0.0
8.000	0.0	0.46	0.	133.	4590.4	0.0	0.0	0.0	0.09	0.0	0.0	0.0
9.000	0.0	0.60	0.	145.	5985.8	0.0	0.0	0.0	0.09	0.0	0.0	0.0
10.000	0.0	0.75	0.	153.	7478.3	0.0	0.0	0.0	0.09	0.0	0.0	0.0
11.000	0.0	0.90	0.	156.	9028.1	0.0	0.0	0.0	0.09	0.0	0.0	0.0
12.000	0.0	1.06	0.	156.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
13.000	0.0	1.22	0.	155.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
14.000	0.0	1.37	0.	154.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
15.000	0.0	1.52	0.	153.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
16.000	0.0	1.68	0.	152.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
17.000	0.0	1.83	0.	151.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
18.000	0.0	1.98	0.	150.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
19.000	0.0	2.13	0.	149.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
20.000	0.0	2.28	0.	148.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
21.000	0.0	2.43	0.	147.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
22.000	0.0	2.57	0.	146.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
23.000	0.0	2.72	0.	145.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
24.000	0.0	2.86	0.	144.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
25.000	0.0	3.01	0.	143.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
26.000	0.0	3.15	0.	142.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
27.000	0.0	3.29	0.	141.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
28.000	0.0	3.43	0.	140.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
29.000	0.0	3.57	0.	139.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
30.000	0.0	3.71	0.	138.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
31.000	0.0	3.85	0.	137.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
32.000	0.0	3.98	0.	136.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
33.000	0.0	4.12	0.	135.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
34.000	0.0	4.25	0.	134.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
35.000	0.0	4.39	0.	133.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
36.000	0.0	4.52	0.	132.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
37.000	0.0	4.65	0.	131.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
38.000	0.0	4.78	0.	130.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
39.000	0.0	4.91	0.	129.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0
40.000	0.0	5.04	0.	128.	10000.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0

EXECUTION TERMINATED 00:02:38 T=9.262 RC=0 $6.25
$6.48, $6.57T

Table 7 Example Normal Printout (11 of 11)