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16. Abstract

This document is a User's Manual for the computer-based mathematical simulation program entitled "Truck and Tractor-Trailer Dynamic Response Simulation - T3DRS:V1" developed in 1979 by the Highway Safety Research Institute/University of Michigan. This manual provides an introduction to the simulation program with a description of its external characteristics sufficient for a user to submit a run and interpret the output obtained. A separate Programmer's Manual (FHWA-RD-79-126) describes the internal function of the program in terms of its flow and the various subroutines used.

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The computer simulation program described in this manual is derived from computer-based mathematical models for trucks and tractor-trailers developed since 1971 at the Highway Safety Research Institute, The University of Michigan. The models were developed in conjunction with earlier computer simulation programs originated in the Motor Truck Braking and Handling Research Program sponsored by the Motor Vehicle Manufacturers Association. The opportunity to consolidate the earlier programs into a single program capable of representing vehicles from trucks to triples combinations was provided by the Federal Highway Administration under the project "Simulation of Effects of Increased Truck Size and Weight." Portions of the program revisions were performed by Dr. James Bernard and Mr. Marty Vanderploeg of Michigan State University.

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1.0 GENERAL INFORMATION

1.1 Purpose of the Manual

This document is a User's Manual for the computer-based mathematical simulation program entitled "Truck and Tractor-Trailer Dynamic Response Simulation - T3DRS:V1" developed in 1979 by the Highway Safety Research Institute/University of Michigan. This manual provides an introduction to the simulation program with a description of its external characteristics sufficient for a user to submit a run and interpret the output obtained. A separate Programmers Manual describes the internal function of the program in terms of its flow and the various subroutines used.

1.2 Background

Since 1971, the HSRI has been conducting research under the sponsorship of the Motor Vehicle Manufacturers Association (MVMA) to develop computer-based methods for analyzing and predicting the directional and braking response of commercial motor vehicles. The initial phase of this research dealt with modeling the braking performance of commercial vehicles and was reported in Reference [1]* (Phase I). The second phase extended vehicle modeling to allow for directional response and was reported in Reference [2] (Phase II). The continuation of research into braking performance led to additional refinements in the braking simulation which were reported in Reference [3] (Phase III). In total, this research under the auspices of MVMA led to four separate computer simulation models:

- Straight Truck Braking Model (Phase I & III)
- Tractor-Trailer Braking Model (Phase I & III)
- Straight Truck Directional Response Model (Phase II)
- Tractor-Trailer Directional Response Model (Phase II)

Though all programs evolved from the same approach to vehicle modeling, separate programs were prepared and maintained.

In 1977-78, the Federal Highway Administration (FHWA) contracted with the HSRI to obtain braking and directional response simulations of trucks

*Cited References are listed in Section 6.0 of this Manual.

and tractor-trailers of the form of the Phase I, II, and III models. Requirements to add one or two full trailers (doubles and triples) to the tractor-semitrailer model were cause for reformulating the computer simulation model for the purposes of:

- Consolidating all vehicle combinations into one program
- Improving the input/output format
- Simplifying the model to include only the most relevant aspects as determined from the intervening research

That work led to the new simulation program using the same model. The program, described here, is designated as "The Truck and Tractor-Trailer Dynamic Response Simulation - T3DRS:V1." Any subsequent changes to this program will be designated by a change in Version number.

1.3 Engineering Units

Throughout the T3DRS:V1 program, the English system of units is used. With the exceptions listed below, all input data are given in units of pounds, inches, degrees and seconds. Masses and weights are in units of pounds, with a gravitational constant of 386 in/sec/sec assumed. The units for input data parameters are defined in the input data echo.

Exceptions:

1) Input for the initial velocity is given in units of ft/sec.
2) Input describing trajectory points for the path-follower steering mode are defined in terms of feet lateral versus feet longitudinal.
3) Longitudinal and lateral road slope is defined in percent grade (Rise/Run).
4) Certain tandem-axle parameters are described in units of percent.

Output data units are defined on the printed output pages. In general, the same units are used throughout, although the vehicle position, velocity and acceleration variables use the length dimensional unit of "ft."

1.4 Computer Requirements

The T3DRS:V1 program is written for use on any large-scale computer system, and requires only one input and one output device. The source code is in level-G Fortran IV language, with 600,000 bytes of memory required for loading. Support software must include the IBM Scientific Subroutine Package (HPCG, SMPY, LOC, GMPRD and GMADD).

Copies of the program are available to the public by contacting the Physical Factors Division, Highway Safety Research Institute, The University of Michigan, Huron Parkway and Baxter Road, Ann Arbor, Michigan 48109.

2.0 APPLICATION

2.1 Description of the Program

The T3DRS:V1 program is a time domain mathematical simulation of a truck/tractor, a semitrailer and up to two full trailers. The vehicles are represented by differential equations derived from Newtonian mechanics that are solved for successive time increments by digital integration.

The program is written in a generalized fashion to allow simulation of a large number of vehicle configurations. The first vehicle is the power unit and may be a truck or tractor, both of which may carry payload. As a single unit with no payload, it is equivalent to an empty truck or bobtail tractor. With payload, it is a truck, which, with a semitrailer as well, simulates a car hauler, dromedary tractor, etc. The second unit is always a semitrailer (i.e., current models do not include a truck with full trailer). The third and fourth units are full trailers consisting of semitrailers on either a fixed or converter dolly. Separate payload may be specified for each trailer.

The truck/tractor unit is distinguished by the fact that it can have only a single front axle with single tires, and can be arbitrarily steered. All other axles on the vehicle combination can be represented as single or tandem axles with single or dual wheel sets.

The mathematical model (see Appendix E) incorporates up to 71 degrees of freedom. The number of degrees of freedom are dependent on the vehicle configuration and derive from the following:

- Six degrees of freedom (three translational and three rotational) for the truck/tractor sprung mass
- Three degrees of freedom for the semitrailer (the three other degrees of freedom of the semitrailer are effectively eliminated by dynamic constraints at the hitch)
- Five degrees of freedom for each of the two full trailers allowed.

- Two degrees of freedom (vertical and roll) for each of the 13 axles allowed
- A wheel rotational degree of freedom for each of the 26 wheels allowed

The motion of each of the sprung masses is determined from the summation of forces and moments upon it arising from the tires (acting through the unsprung mass of the axle and suspension), gravity and the hitch point constraints. Small angle assumptions are made in the derivation of the mathematical equations so that the simulation can be validly applied only up to a maneuver limit at which wheel lift-off occurs.

2.2 Uses of the Program

The great versatility of the T3DRS:V1 program in representing commercial vehicle types and components in steering and braking maneuvers gives it great utility. As indicated previously, it can be used to simulate the following vehicle configurations:

Straight truck, empty and loaded

Bobtail tractor

Tractor-semitrailer (3 to 5 axles), empty and loaded

Tractor-semitrailer-full trailer (5 to 9 axles), empty and loaded

Tractor-semitrailer-full trailer-full trailer (7 to 13 axles), empty and loaded

For simulation of braking performance, the program incorporates state-of-the-art representation of truck air brake systems, antilock wheel control systems and tire-road friction models. Typical examples of braking studies for which it can be or has been used are:

1) Stopping distance performance

2) Effects of brake timing

3) Dynamic behavior in braking

4) Comparisons of antilock wheel control logic

5) Influence of tire-road friction coupling

6) Split friction surfaces

7) Brake proportioning

8) Tandem-axle effects on braking limits

For simulation of cornering performance behavior, the program incorporates state-of-the-art representations of truck tire lateral force characteristics (with roll-off effects during combined braking), and vehicle suspension properties of significance to cornering behavior. Typical examples of studies involving cornering are as follows:

1) Understeer/oversteer properties of commercial vehicles

2) Determining cornering limits

3) Assessing tandem-axle effects on cornering

4) Jackknife prediction

5) Effects of suspension properties on cornering and cornering limits

6) Accident simulation

In addition to the above, the program can be operated open-loop (defined steer angle inputs) or closed-loop (defined path input), and on roads of specified grade or cross-slope.

2.3 Operation

Operation of the T3DRS:V1 program is accomplished by submission of the necessary job control instructions followed by a list of input parameters. The specific job control instructions required are dependent on the user's computer system and whether batch or remote job entry is being used. However, the input parameter list is common to all and is described in Section 3.0 of this Manual.

The program commences by reading the input list containing parametric data describing the vehicle configuration, initial conditions, steering and braking inputs, the output desired, and the road conditions. As input data is read, the data is normally "echoed" as the first pages of output. At the completion of the input read process, the program calculates necessary properties of the total vehicle combination and prints a page of output containing a summary of those vehicle properties. The program then "runs," solving the differential equations of motion for the vehicle until the vehicle reaches a full stop, a default stop (such as rollover), or until the designated maximum simulation time is reached. At various points during the run, simulation output is printed, which (at the option of the user) may include time-based values for the vehicle motion variables, tire forces at each axle, braking conditions on each axle, tire cornering conditions, and the suspension motions and forces.

2.4 Validity

The validity of T3DRS:V1, like any computer program, is dependent on the accuracy and execution of program statements, the capabilities of the simulation models, and the quality of the vehicle and maneuver descriptions defined by the input data.

Every effort, of course, is made to ensure that the program statements are correct and result in solution of the problem to a reasonable level of precision. The time steps have been selected so that round-off and truncation errors do not substantially influence the precision of the calculated results. Nevertheless, if programming errors are discovered, the user should contact the Physical Factors Division, Highway Safety Research Institute, The University of Michigan, Ann Arbor, Michigan.

The modeling used in the simulation is effectively state-of-the-art, reflecting the most practical approaches to mathematical representation of commercial vehicles for braking and handling studies. Over the years, modeling has grown more in sophistication than in detail. For example, early models for truck brake systems extending to mechanical details within the individual brakes have proven no more capable of predicting braking performance than the "black box" representation as a pressure-input, torque-output device. Hence, the latter approach is used in T3DRS:V1, with a

substantial saving in the complexity associated with understanding and using the simulation. With nearly every component model used in the simulation, there are instances where more modeling details would be appropriate for the study at hand; yet, provision for every instance would result in a simulation for which the input data requirements would be untenable. To some extent, these needs are provided for in T3DRS:V1 by allowing optional use of lookup tables, in lieu of a single numerical parameter, as means to describe component characteristics in more detail when needed.

Finally, the ultimate determinant of validity is the user-supplied input data and the interpretation applied to the results. Properly used, the program is capable of validly predicting most aspects of braking performance and directional response in maneuvers up to the limits of wheel lift-off. In the special case where a direct comparison between a vehicle and simulation (i.e., validation) is intended, an iterative process is often involved as the first comparisons of simulation and test reveal unexpected differences, which, when examined, are traced to inaccuracies or errors in the experimental measurements or program input. Fortunately, the usefulness of these simulation programs are not dependent on every user going through the same process. In most applications, the user can assume, for example, a given tire characteristic and investigate vehicle performance with that tire, knowing that it is typical, but yet, not precisely equivalent to any specific tire on hand. Much of the utility of computer simulation programs derives not from absolute prediction of a certain vehicle/test maneuver situation (as required for validation), but as a tool for studying generalized performance and sensitivity of performance to the vehicle parameters.

In this general sense, the T3DRS:V1 program can be expected to yield valid measures of the braking and handling performance comparison when specific vehicle parameters are changed. The T3DRS:V1 program has been tested against other simulations, including its predecessors, which in turn have proven capable of reasonably duplicating actual vehicle performance. The user is referred to the following references for examples of the use and validation of those programs:

	References*
Straight Truck Braking	1, 2, 4, 8, 9, 11
Straight Truck Cornering and Braking	2, 10
Straight Truck Cornering	5
Tractor-Trailer Braking	1, 2
Tractor-Trailer Cornering and Braking	2, 10
Tractor-Trailer Cornering	6
Tractor-Trailer-Full Trailer Cornering	7

*Section 6.0

3.0 PROGRAM INPUT

3.1 General

Program operation is effectively accomplished by input of a parametric data list, along with the necessary job control instructions. This section provides a detailed description of the input data required. Appendix C provides a ready reference list of input parameters. Sample input lists covering the various options are provided in the text and in Appendices A and B.

Depending on the vehicle configuration, the input data list will contain the following elements:

- Title Line (up to 80 characters)
- Simulation Operation Parameters
- Truck/Tractor Parameters
- Truck/Tractor Front Suspension and Axle
- Truck/Tractor Front Tires and Wheels
- Truck/Tractor Rear Suspension and Axle
- Truck/Tractor Rear Tires and Wheels
- Truck/Tractor Front and Rear Brake Parameters (Optional - used only when braking is called)
- First Trailer Parameters (Optional)
- First Trailer Rear Suspension and Axles (Optional)
- First Trailer Rear Tires and Wheels (Optional)
- First Trailer Rear Brake Parameters (Optional)
- Second Trailer Parameters (Optional)
- Second Trailer Dolly, Suspension and Axles (Optional)
- Second Trailer Dolly Tires and Wheels (Optional)
- Second Trailer Rear Suspension and Axles (Optional)
- Second Trailer Rear Tires and Wheels (Optional)
- Second Trailer Front and Rear Brake Parameters (Optional)
- Third Trailer Parameters (Optional)
  (Same as Second Trailer)

The input data is identified only by its position in the input list and hence must be ordered exactly to match the vehicles and options used in the simulation. Errors in the input list will result either in a read fault (with possible system interrupt and abort of the program), or in simulation of the wrong conditions. Every effort has been made to define the input sequence and its alteration with various options in this section. Example input lists are shown throughout the Manual for reference by the user in compiling an input data list.

3.1.1 Tandem-Axle Option. To suit the simulation to the great variety of commercial vehicles, either single or tandem axles may be specified for any suspension in the total vehicle configuration, except on the front (steering) axle of the truck/tractor. Details on use of the tandem suspension are provided in Section 3.3.4.

3.1.2 Table Lookup Option. It is often desirable to include nonlinear characteristics of vehicle components (particularly for tires, springs, and brakes) in the model simulated. For such parameters a table lookup option can be used, allowing the parameter to be described by a multiple point approximation over the range of interest rather than assigning to it a single valued linear characteristic. The program thence interprets the dependent variable's value when needed using linear interpolation methods. In the event the program exceeds the range of the table, the dependent variable is limited to the last entry in the table.

The table lookup option may be used with the following input parameters:

- Suspension spring rate
- Tire cornering stiffness
- Tire longitudinal stiffness
- Brake torque

The table lookup option is called by entry of a negative whole number value for the parameter. The negative sign indentifies it as a table lookup and the numerical value identifies that table and distinguishes it from other tables in the input list. The table is then entered in the input list immediately following the calling point. For the two-dimensional tables (spring rates and brakes), the first line entry in the table is an integer

value equal to the number of data sets to follow, each being a separate line entry of independent versus dependent variable values. Tire parameter tables are more complicated and are explained in Section 3.3.3.

The same table can be used at subsequent points in the input list by entry of the negative whole number identifying that table. The table values should not be re-entered at these subsequent calling points.

More detailed instruction for entering lookup tables are provided in Sections 3.3.2, 3.3.3 and 3.3.6.

3.1.3 Side-to-Side Option. In most simulation studies, a vehicle has symmetric properties left and right. Nevertheless, it is occasionally of interest to investigate the influence of side-to-side differences in springs, tires, brakes, etc. While vehicle mass properties are modeled as symmetric about the vehicle centerline, most components that are paired, one to each side of the vehicle, may be assigned different parametric values. Different values side-to-side may be assigned for the following parameters:

- Steer angle inputs
- Suspension spring rate
  - viscous damping
  - coulomb friction
- Tire cornering stiffness
  - longitudinal stiffness
  - camber stiffness
  - aligning moment
  - spring rate
  - loaded radius
  - polar moment of inertia
- Brake time lag
  - rise time
  - torque
  - antilock systems

In normal input of those parameters, one entry causes the program to assign that value to both sides of the vehicle. The side-to-side option is exercised by making a double entry on the line, in which case the first value is assigned to the left side of the vehicle and the second to the right. A zero

value cannot be assigned to the right-hand side with a nonzero left-hand side value due to the way this option operates, but zero values can be effectively obtained by entry of very small nonzero values. The side-to-side option can also be combined with the table lookup option. By entry of two negative values, tables are assigned to both the left and right sides. The tables for the left and right sides are entered in sequence immediately after the calling line. More detailed instruction for side-to-side entry options are provided in Sections 3.2, 3.3.2, 3.3.3, and 3.3.6.

3.2 Simulation Operation Parameters

The first line entry in the input list is always a user-supplied title line consisting of up to 80 alphanumeric characters. Thereafter, the Simulation Operation Parameters are entered and subsequently echoed as the first page of output, as shown in Figure 1.

The first line of the Simulation Operation Parameters is VEHICLE CONFIGURATION defined by the number of trailers, entered in I2 format, which indicates to the program the extent of input to be expected. Zero trailers indicates a single unit straight truck, which is also equivalent to a bobtail tractor. An "01" entry indicates a tractor/semitrailer. An "02" entry indicates a tractor/semitrailer/full trailer (doubles) configuration. An "03" indicates tractor/semitrailer/full trailer/full trailer (triples) configuration, the maximum number of vehicles allowed.

The second line is INITIAL VELOCITY in units of ft/sec (F15.3 format). At the initiation of the simulation run, all vehicles are in a straight-line configuration, moving forward at the indicated velocity.

The next entries define the steering input to the simulation. Either front-axle steering inputs (open-loop) or a path-following (closed-loop) mode are selected by the respective entry of a positive or negative integer value for STEER TABLE (NUMBER OF LINES) (I3 format). The numerical value of the entry specifies the number of lines appearing in the subsequent table. A "000" entry indicates no steering is involved in the maneuver, hence, no table entries are made and the vehicle performs as if the steering wheel were held fixed in the straight-ahead position (i.e., no steering action occurs except as a result of front suspension roll steer). When a nonzero number of lines is given, a table of the prescribed length must follow according to the following instruction.

[SET TRUCK AND TRACTOR-TRAILER DYNAMIC RESPONSE SIMULATION - T3DRS,V1
TRACTOR-TRAILER CHECK RUN COMPARISON, STEP STEER, 66 FT/SEC.

SIMULATION OPERATION PARAMETERS:

VEHICLE CONFIGURATION (NUMBER OF TRAILERS - ENTER 0 FOR A STRAIGHT TRUCK) 1
INITIAL VELOCITY (FT/SEC) 66.00
STEER TABLE (NUMBER OF LINES): POSITIVE -STEER ANGLE TABLE, NEGATIVE - PATH FOLLOWER TABLE 3
TABLE ENTRIES:

TIME (SEC)	LEFT WHEEL (DEG)	RIGHT WHEEL (DEG)
0.0	0.0	0.0
0.10	1.00	1.00
10.00	1.00	1.00

TREADLE PRESSURE TABLE (NUMBER OF LINES) 2
TABLE ENTRIES:

TIME (SEC)	PRESSURE (PSI)
0.0	0.0
1.00	0.0

MAXIMUM SIMULATION TIME (SEC) 10.0
TIME INCREMENT OF OUTPUT (SEC) 0.10

ROAD KEY = 1 : FLAT ROAD.

OUTPUT PAGE OPTION KEYS: 0 DELETES PAGES

SPRUNG MASS POSITION	SPRUNG MASS VELOCITY	SPRUNG MASS ACCELERATION	TIRE FORCES PAGES	BRAKE SUMMARY PAGES	LATERAL PAGES	UNSPRUNG MASS PAGES
0	0	0	0	0	0	0

Figure 1. Example of simulation operation parameters.

Steer Table (positive numerical entry) - Each line is a set of time (sec) versus left-wheel steer angle (deg) and right-wheel steer (deg) in 3F10.3 format as shown in Figure 1. If both wheels are to be steered identically, only the time and left-wheel angles are required; the absence of the right-wheel steer angle entry causes it to be assigned the same value as left-wheel steer angle. Up to 25 lines of table are allowed. Steer angles are obtained from the table at each time increment by linear interpolation. The table should always start off with an entry for zero time to assure definition of steer angles throughout the simulation run and be listed in ascending order with time. If simulation time exceeds the last time entry in the table, the last steer angle values are retained.

Path-Follower Table (negative numerical entry) - Each line is a pair of X (inertial forward) and Y (inertial lateral) path coordinates (in units of ft, 2F10.2 format) defining the desired path to be followed by the vehicle during closed-loop operation as shown in Figure 2. Linear interpolation is used by the program to determine path coordinates between entered points.

Following the last line of the closed-loop path-follower table, two additional parameters are entered which permit the program user to exert influence over the manner in which the closed-loop driver model functions. The first of these parameters, DRIVER TRANSPORT LAG (F10.4 format) generates a transport time lag (sec) within the controller to provide a simple means for representing human operator lag characteristics when desired. Values for this parameter should range between 0.0 and 0.5 (sec). Values larger than about 0.5 sec will generally produce an unrealistic and potentially unstable vehicle/driver system, and are hence not allowed. A zero entry inactivates the transport lag feature.

The remaining closed-loop parameter, END OF PREVIEW INTERVAL, (F10.4 format) indicates the distance ahead in time (sec) that the driver model looks during closed-loop steering operation. Hence, a value of 1.0 sec for this parameter would cause the driver model to look ahead over a 1 sec interval, or an equivalent maximum distance of 88 ft at a forward speed of 60 mph. Larger values for this parameter will produce a less responsive, more heavily damped system behavior during closed-loop operation. Likewise, smaller values will provide more responsive system behavior exhibiting less

SIMULATION OPERATION PARAMETERS:

VEHICLE CONFIGURATION (NUMBER OF TRAILERS - ENTER 0 FOR A STRAIGHT TRUCK) 1
INITIAL VELOCITY (FT/SEC) 66.00
STEER TABLE (NUMBER OF LINES): POSITIVE -STEER ANGLE TABLE, NEGATIVE - PATH FOLLOWER TABLE -14

CLOSED-LOOP PATH FOLLOWING MODE

X-Y PATH COORDINATES :

X (FEET)	Y (FEET)
0.0	0.0
100.00	-10.10
200.00	-41.70
300.00	-100.00
350.00	-143.00
375.00	-169.00
400.00	-200.00
425.00	-237.00
450.00	-282.00
460.00	-304.00
480.00	-360.00
490.00	-400.00
500.00	-500.00
505.00	-900.00

DRIVER TRANSPORT LAG (SEC) : 0.0
END OF PREVIEW INTERVAL (SEC) : 3.00

TREADIE PRESSURE TABLE (NUMBER OF LINES) 2
TABLE ENTRIES:

TIME (SEC)	PRESSURE (PSI)
0.0	0.0
1.00	0.0

MAXIMUM SIMULATION TIME (SEC) 6.00
TIME INCREMENT OF OUTPUT (SEC) 0.05

ROAD KEY = -1 : USER-DEFINED ROAD SURFACE (SUBROUTINE ROAD).

OUTPUT PAGE OPTION KEYS: 0 DELETES PAGES

SPRUNG MASS POSITION	SPRUNG MASS VELOCITY	SPRUNG MASS ACCELERATION	TIRE FORCES PAGES	BRAKE SUMMARY PAGES	LATERAL PAGES	UNSPRUNG MASS PAGES
1	1	1	1	1	1	1

Figure 2. Example of simulation operation parameters with path-follower option.

damping. Recommended values for this parameter are 1.0 to 3.0 sec. A more detailed description of the operation of the path-follower model is provided in Appendix G of this Manual.

Treadle Pressure Table - The next entry following the last steer table parameter is the integer (I2 format) for the TREADLE PRESSURE TABLE (NUMBER OF LINES) which is to follow. The treadle pressure is the line pressure demanded by the driver during braking and controlled by the driver-actuated pedal valve. Each line of the treadle pressure table is entered as a pair of time (sec) versus pressure (psi) numbers (2F10.2 format). The complete table defines the desired treadle pressure time history used by the program during a braking maneuver and may be varied with time to simulate the pressure depletion caused by antilock cycling, or to simulate fade in the brakes due to heating effects. The table should begin at zero time and be listed in ascending order with time. Intermediate points in the treadle pressure table are obtained by linear interpolation. The number of lines in the table must equal the integer number of lines indicated and may not exceed 10. If the treadle pressure table is given zero lines, the program will not execute any braking, and brake parameters (Section 3.3.6) are deleted from the input data list. On the other hand, entry of a table with one or more lines (even if all are zero pressure values) keys the program to look for entry of brake data.

Immediately following are two lines of program instruction. The first is MAXIMUM SIMULATION TIME (sec, F15.3 format) which defines the time duration of the maneuver to be simulated. The program will run for this simulated time period unless the vehicle reaches a stop within the period or a fault (such as vehicle rollover) occurs. To ensure printout of the last time increment desired, it is helpful to specify the MAXIMUM SIMULATION TIME as 0.001 seconds longer than the desired time. Typical simulation times are 4-8 sec. The second line is TIME INCREMENT OF OUTPUT (sec, F15.3 format) which selects the intervals of simulation time at which the instantaneous values of output parameters are printed. Since the normal integration interval is 0.0025 sec, the time increment should be a multiple of this value. Section 4.4 gives some hints on selection of this input parameter.

ROAD KEY - A key for defining one of three road options is the next entry. ROAD KEY is an integer entry and provides the following three road options:

ROAD KEY	> 0	:	Planar road with a fixed down-slope and cross-slope
	= 0	:	Flat horizontal road
	< 0	:	User-defined road surface programmed in SUBROUTINE ROAD

ROAD KEY should be entered in I2 format when the flat road or user-defined road surface options are selected.

When the planar road option (IROAD > 0) is selected, two additional numbers need to be entered on the same line as the ROAD KEY (I2, 2F10.2 format). These two additional entries represent the percentage of down-slope (forward) and cross-slope (lateral, positive slopes down to the right) of the road plane at time zero and fixed with respect to the inertial co-ordinate system. The planar road option is not currently available for down-slopes when simulating vehicle configurations requiring two or more trailers. (Truck and tractor-semitrailer configurations only.) The initial conditions of the truck or tractor-trailer sprung and unsprung masses in pitch and roll are selected by the program under this option as equal to the specified down-slope and cross-slope of the road. A small initial transient will occur at the beginning of the simulation run using this option, since the lateral and fore/aft suspension forces are not initially in equilibrium.

Selection of the third road option, User-Defined Road (IROAD < 0) allows the program user to define an arbitrary road surface (e.g., road roughness, parabolic bowl, cone, etc.) by providing a SUBROUTINE ROAD containing code which defines road elevation as a function of X-Y inertial co-ordinates. Appendix H discusses this option in greater detail and provides an example user-written subroutine and required format.

OUTPUT PAGE OPTION KEYS - The last line entered for simulation operation parameters requires seven integer keys (7I1 format) that specify which output pages will be printed during program execution. Entry of 1 for any key will cause that page to be printed; entry of 0 will cause its deletion during output printing. The seven output page types corresponding in order from left to right in the 7I1 field are:

Truck, Tractor, Trailer Sprung Mass Position
Truck, Tractor, Trailer Sprung Mass Velocity
Truck, Tractor, Trailer Sprung Mass Acceleration

Longitudinal, Lateral, and Vertical Tire Forces
Brake Summary
Lateral Tire Forces and Moments
Unsprung Mass Summary

3.3 Truck/Tractor Description

The first vehicle is the truck or tractor that is modeled as the sprung mass associated with the cab, chassis, body, payload, etc., supported by suspension systems linking it to the unsprung masses of the axles, supported on the ground in turn by the tire/wheel assemblies. Reference [2], Section 2, provides a comprehensive discussion of the type of mathematical formulation used in the simulation model. Parametric data are needed to describe each of the vehicle components. Figure 3 shows the first portion of that input corresponding to input page 2 "echoed" by the program.

3.3.1 Truck/Tractor Parameters. The basic properties of the truck or tractor are described by its sprung mass parameters included in the first group of entries shown in Figure 3. The sprung mass is modeled as a rigid body shown in Figure 4. The characteristic length of the vehicle is its WHEELBASE, defined as the longitudinal distance in inches (F15.3 format) between the geometric center of the front and rear suspensions. For two-axle vehicles, this is the same as the distance between the front and rear axle centerlines, but for three-axle vehicles it is the distance between the front axle and the geometric center of the rear axles.

The rigid-body sprung mass is represented by mass properties concentrated at its center of gravity (c.g.) at the lateral center of the vehicle. Its mass and fore/aft location are determined by the BASE VEHICLE CURB WEIGHT values in pounds for the FRONT and REAR AXLES (the next two line entries, F15.3 format). This approach is used because the curb weight data is more readily available to users than the properties of sprung mass weight and fore/aft position. Internally, the program determines these parameters by calculations that subtract out the unsprung weight of the axles entered later in the input. The base vehicle curb weight is defined as the weight without payload or a trailer. The rear suspension curb weight with tandem axles is the total ground load for both axles.

TRACTOR PARAMETERS

WHEELBASE - DISTANCE FROM FRONT AXLE TO CENTER OF REAR SUSPENSION (IN)	142.00
BASE VEHICLE CURB WEIGHT ON FRONT SUSPENSION (LB)	8900.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	7116.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	39.70
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	18166.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	69555.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	69555.00
PAYLOAD WEIGHT (LB)	40600.00
PAYLOAD DISTANCE AHEAD OF REAR SUSPENSION CENTER (IN)	50.00
PAYLOAD CG HEIGHT (IN. ABOVE GROUND)	64.50
PAYLOAD ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	37500.00
PAYLOAD PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	1727000.00
PAYLOAD YAW MOMENT OF INERTIA (IN-LB-SEC**2)	1727000.00
FIFTH WHEEL LOCATION (IN. AHEAD OF REAR SUSP. CENTER)	0.0
FIFTH WHEEL HEIGHT ABOVE GROUND (IN)	47.50
5TH WHEEL STIFFNESS (IN-LB/DEG)	2500000.00

TRACTOR FRONT SUSPENSION AND AXLE PARAMETERS	LEFT SIDE	RIGHT SIDE
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	1012.50	1012.50
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	15.00	15.00
COULOMB FRICTION (LB/SIDE/AXLE)	500.00	500.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	3719.00	
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	24.55	
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	0.0	
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	4000.00	
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	32.60	
TRACK WIDTH (IN)	80.50	
UNSPRUNG WEIGHT (LB)	1190.00	

TRACTOR FRONT TIRES AND WHEELS	LEFT SIDE	RIGHT SIDE
CORNERING STIFFNESS (LB/DEG/TIRE)	722.50	722.50
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	28000.00	28000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	5700.00	5700.00
TIRE LOADED RADIUS (IN)	20.30	20.30
REAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	103.00	103.00

Figure 3. Example of first page of truck/tractor parameters.

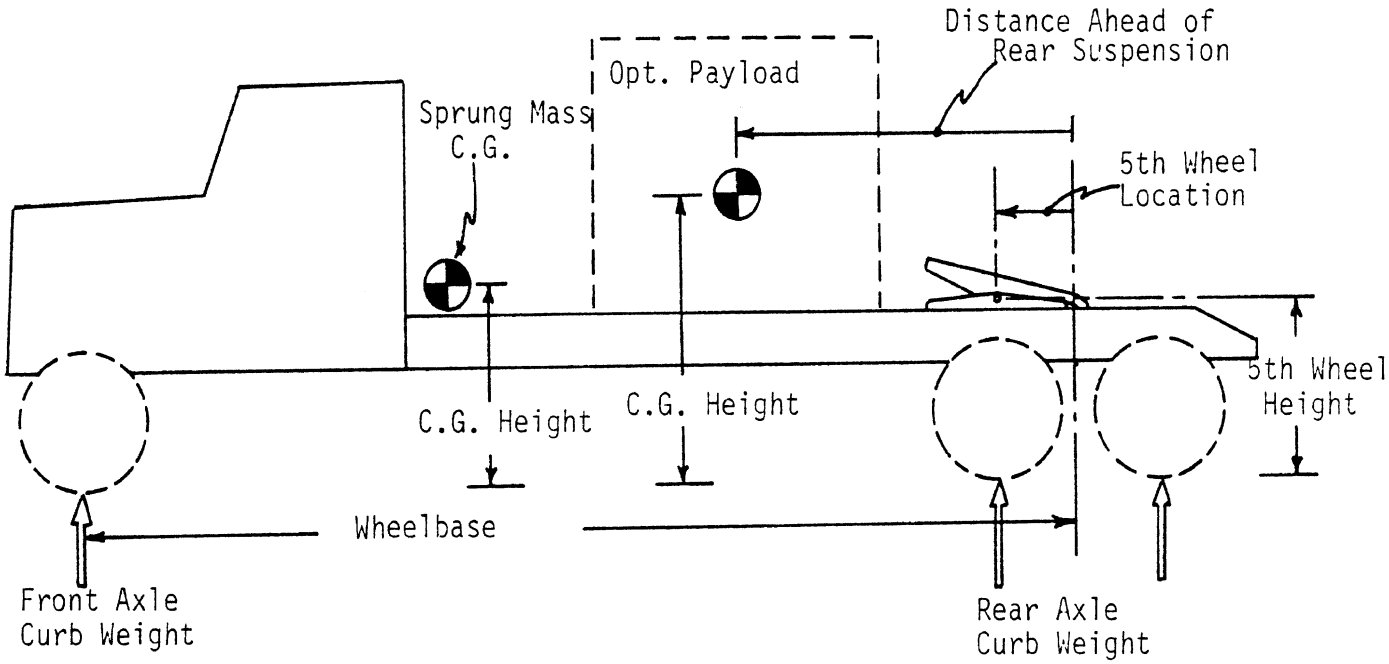


Figure 4. Modeling elements of the truck/tractor sprung mass.

The vertical location of the c.g. is defined by the next entry, SPRUNG MASS CG HEIGHT, which is measured in inches above the ground (F15.3 format). As specified, this is the c.g. of only the sprung mass in the base vehicle configuration corresponding to the curb weight values given above. The height should be given with the vehicle in its fully deflected position as results from loading by a payload or trailer. The sprung mass c.g. height is not readily available to most program users; however, in the absence of such data reasonable estimates can be made. For heavy vehicle cab-chassis configurations, the sprung mass c.g. is usually close to the top of the frame rails (typically 38-40 in above the ground). Such an estimate is reasonable for a tractor or for a truck with a low, light platform bed. However, if the truck includes a substantial body, the c.g. must be measured or estimated from the combined properties of the cab-chassis and vocational body.

The rotational inertia properties of the sprung mass are given by the next three entries for SPRUNG MASS ROLL MOMENT OF INERTIA, PITCH MOMENT OF INERTIA, and YAW MOMENT OF INERTIA. The inertias are given in units of in-lb-sec^2 in F15.3 format. It is normally recommended that these parameters are measured for a vehicle to be simulated, though methods for estimating them have been developed [12]. Appendix F provides a short method for estimating these properties.

As a convenience in using the program to investigate performance of heavy vehicles with variations in payload, the payload parameters are entered separately. The first parameter is PAYLOAD WEIGHT, in lbs (F15.3 format). Thereafter, it is necessary to describe its location by DISTANCE AHEAD OF REAR SUSPENSION CENTER (in, F15.3 format) and CG HEIGHT (inches above the ground in its loaded position, F15.3 format). The payload is always assumed to be located laterally in the center of the vehicle. Likewise, ROLL, PITCH and YAW MOMENTS OF INERTIA are required, in units of in-lb-sec^2 (F15.3 format). If the simulated vehicle is to have no payload, the payload weight is entered as zero, and no entry is required for the subsequent payload parameters. Payload can be specified for both trucks and tractors. If payload is not to be varied, the payload may be lumped in with the vehicle sprung mass properties by entering loaded vehicle axle weights for the BASE VEHICLE CURB WEIGHTS. In that case, the c.g. height and sprung mass moments of inertia must be for the same combination of masses.

Finally, the connection point for a fifth wheel is also located on the sprung mass. If a tractor is being simulated (as indicated by one or more trailers in the VEHICLE CONFIGURATION input), fifth wheel parameters are included at this point in the input list. (The entries are deleted if no trailers are entered.) Three parameters are required: FIFTH WHEEL LOCATION (inches ahead of the rear suspension), HEIGHT ABOVE GROUND (in), and STIFFNESS (in-lb/deg, in the roll direction). All three entries are F15.3 format. The fifth wheel location is arbitrary, typically from 0 to 12 in, and determines the distribution of trailer load on the tractor axles. The height above the ground is the height to the pitch plane hinge point on the fifth wheel for the fully-loaded tractor (typically 45 in). The fifth wheel stiffness parameter is included to allow representation of typical compliances between the payload on the trailer and the frame of the tractor. With a zero entry, the tractor and trailer are completely decoupled in roll. On typical tractor-van trailer combinations, a value of 250,000 in-lb/deg is reasonable. This parameter has significant influence on limit cornering behavior.

The user should be aware that the fifth wheel coupling (as well as pintle hitch couplings, described later) are all represented by spring connections. Thus represented, the equations of motion for different vehicles are coupled by force inputs rather than displacement constraints and may be solved separately and more economically. With the exception of roll stiffness, which may be of interest to some users, all fifth wheel spring rates are selected within the program for optimum operation of the simulation. The resulting rates are high enough to appear effectively rigid.

3.3.2 Truck/Tractor Front Suspension and Axle Parameters. The T3DRS:V1 program models the I-beam type front axle commonly used on medium and heavy trucks. The suspension serves as a compliant link between the sprung and unsprung masses, and is characterized by the forces and moments it produces. All suspensions are modeled in the generalized fashion shown in Figure 5. The parameter entries for the truck or tractor front suspension are shown in Figure 3. The primary compliance of the suspension is in the vertical direction and is defined by SUSPENSION SPRING RATE in lb/in per side of the vehicle. Since these are paired components on an axle, the side-to-side option is available. The rates for the left and right

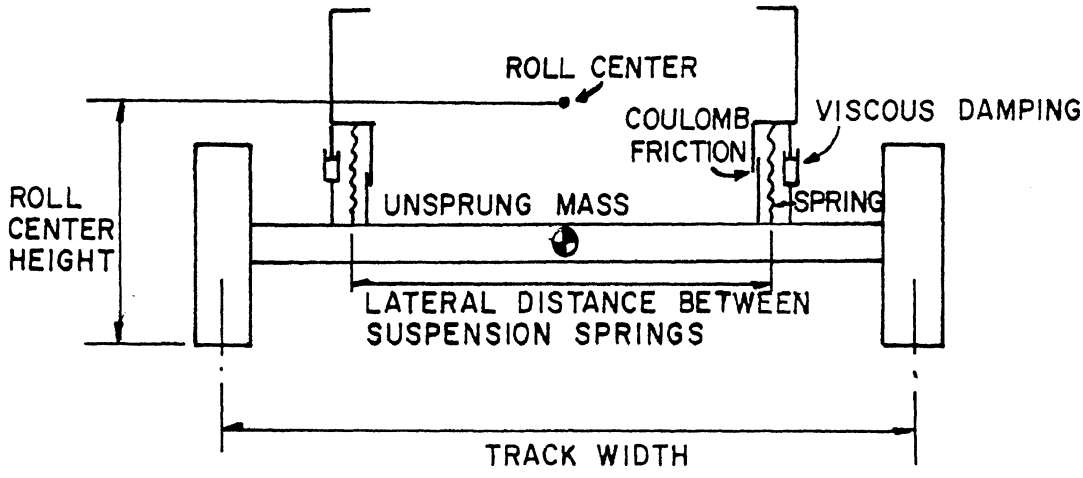


Figure 5. Model of suspension systems.

springs are entered on one line in 2F10.2 format. If left and right are the same, only the first (left) entry needs to be made, and the zero or blank read for the right side causes it to be assigned the same value as for the left. Nonlinear springs can be simulated by defining the force deflection characteristics in a table lookup as follows:

1) Enter a negative whole number for spring rate (the negative sign keys the program for a table lookup, and the numerical value identifies the table).

2) A single (left spring) entry results in use of the table for both left and right springs.

3) Entry of a separate negative number for each spring keys the program to look for two tables.

4) Enter the left spring table immediately in the form as follows:

   Line #1 - Number of lines to follow, maximum of 10 (I2 format)

   Line #2 - Spring force (lb) vs. deflection (in) (2F10.2 format)

   .
   .
   .
   .

   Line #n - Spring force (lb) vs. deflection (in) (2F10.2 format)

5) If a separate right spring table was called for, it is entered next in the same format.

The tables are entered in the positive sense; i.e., positive deflection (spring compression) corresponding to positive force (load) on the axle. The reference point for deflection is arbitrary, since the program simply identifies the initial deflection from the static load, and calculates changes thereafter. It should be noted that even with side-to-side differences in spring characteristics, the program always assumes equal loads on both sides of the axle, adjusting the initial (or static) spring deflection for the fully loaded vehicle to achieve this condition. When using the lookup table, the range of the table should always exceed the expected range of operation of the spring. Typically, it should extend from zero load to

the maximum dynamic load expected. Excursions beyond the range of the table causes it to limit at the last load condition in the table in the direction of the excursion. If tension loads are expected due to the maneuver, the spring force characteristics should be defined in the tension (negative force) range.

The damping characteristics within the suspension are characterized by viscous damping and coulomb friction. SUSPENSION VISCOUS DAMPING is entered in units of lb-sec/in for each side of the suspension (2F10.2 format). The side-to-side option is available. Viscous damping effectively represents the shock absorber damping in the vertical direction, and is applied to motions in both directions. If the shock absorbers to be simulated are at an angle to the vertical, their damping coefficient should be multiplied by the square of the cosine of the angle between the shock absorber centerline and the vertical. Typical front-axle shock absorber damping coefficients should be in the range of 10-20 lb-sec/in.

For heavy vehicles the more common, and sometimes only, damping is coulomb friction derived from interleaf friction of the leaf spring suspensions [18]. COULOMB FRICTION is entered in units of lb/side (2F10.2 format) with the side-to-side option available. The coulomb friction is defined here as one-half the width of the hysteresis loop of the spring force-deflection curve as illustrated in Figure 6. When possible, the coulomb friction magnitude should be selected at the static load condition. In the absence of specific data, the coulomb friction can be estimated at 10% of the static load value. The coulomb friction is neglected during the initial static spring deflection calculations. During the dynamic calculations thereafter, the coulomb friction force is added to or subtracted from the calculated spring force, depending on the direction of relative motion.

The front axle components of the vehicle, including the axle, springs, spindles, hubs, brakes, and wheels, are lumped into one unsprung mass, as shown in Figure 5. The mass has a center of gravity located on the axis of the wheels at the lateral center of the axle. The mass is characterized by a ROLL MOMENT OF INERTIA (units of in-lb-sec^2, F15.3 format), and its UNSPRUNG WEIGHT (in lbs, F15.3 format, last entry in this group). The yaw moment of inertia is assumed equal to the roll moment of inertia, and since

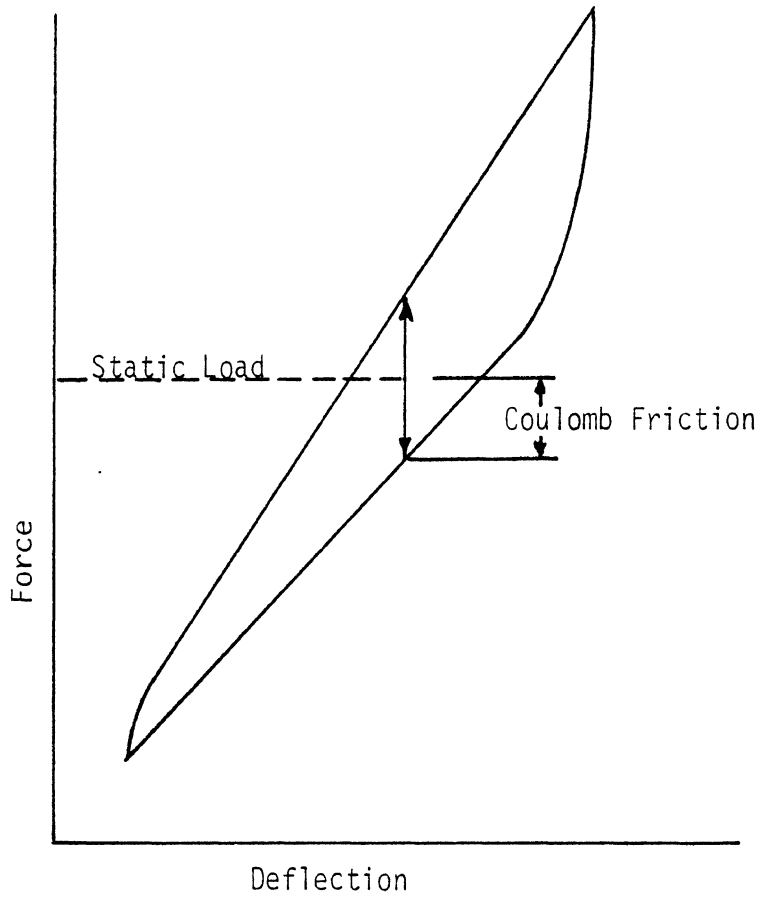


Figure 6. Coulomb friction in a suspension leaf spring assembly.

the axles are constrained to yaw with the sprung mass, the yaw moments of inertia of this and all other axles are added to that of the sprung mass by the program. The pitch moment of inertia for axles is negligible in effect and is not included in the modeling.

While the suspension is primarily a vertical compliance, it also serves to transmit horizontal forces to the sprung mass. The mechanism for transmission of lateral forces through the suspension is important and significant to the overall directional response of the vehicle. When a vehicle is caused to roll on its suspension, it tends to roll about a point designated as the roll center, as shown in Figure 5. Conceptually, the roll center is the point at which lateral forces are transmitted between the sprung and unsprung masses. This parameter is significant to vehicle response because lateral forces present at the roll center cause lateral load transfer on the axle (and hence, tires) and thereby influence the lateral forces developed by the tires. This effect is significant in transient maneuvers due to load transfer effects before the sprung mass has time to roll, and in steady-state maneuvers due to the distribution of roll moment between front and rear axles determined, in part, by the relative height of the front and rear suspension roll centers. The effects of roll center height are included in the modeling and a ROLL CENTER HEIGHT parameter (in. above the ground, F15.3 format) is included in the input list. The suspension and axle system is considered constrained with the sprung mass in the pitch degree of freedom so a similar concept in the pitch plane is not needed to characterize transmission of longitudinal forces and pitch moments.

For various reasons, a suspension system may not always maintain the wheels in alignment with the longitudinal axis of the vehicle throughout all suspension motions. Most suspensions are subject to a small amount of steer effect when the vehicle rolls. Such factors can play an important role in vehicle directional response and overall stability. The input list includes a ROLL STEER COEFFICIENT (in units of degrees steer per degree roll, F15.3 format) to simulate this effect. A positive entry implies an incremental steer to the right when the sprung mass rolls to the right. Hence, a positive front axle roll steer coefficient has an understeer influence.

The vertical force developed within the suspension is the sum of spring deflection, coulomb friction, and viscous damping forces. Roll of the axle relative to the sprung mass produces a roll moment within the suspension due to the lateral spacing between the springs and shock absorbers. The LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (in., F15.3 format) is included as an input parameter, as a basis for calculating the roll moment effect. At times, the suspension may exhibit a roll stiffness in excess of that accountable by the springs and their separation, because of the additional effects of linkages, spring twist, antisway bars, etc. An AUXILIARY ROLL STIFFNESS input parameter (in-lb per deg., F15.3 format) is provided to allow modeling these effects.

The last remaining parameter to be specified for the suspension-axle system is the TRACK WIDTH (in., F15.3 format), defined as the distance between the wheel planes (center of the wheels) of the right and left tires.

3.3.3 Truck/Tractor Front Tires and Wheels. Tire forces within the T3DRS:V1 program are calculated from models that, in effect, determine the forces from the operating conditions. For example, tire vertical load is a result of its instantaneous vertical height (rolling radius) above the road. The cornering and longitudinal force behavior can be represented by either of two models in the simulation:

1) A linear model of cornering and longitudinal stiffness characteristics

2) A nonlinear table lookup model for cornering and longitudinal characteristics with variations due to load and speed conditions.

The first line entry for front tires and wheels, as shown in Figure 3, is the left and right CORNERING STIFFNESS lbs/deg/tire, 2F15.3 format). If the right-side value is left blank or entered as zero, it is assumed equal to the left-side value. The cornering stiffness is the slope of the lateral force versus slip angle behavior of the tire in the vicinity of zero slip angle, as illustrated in Figure 7. It is entered as a positive number and is typically numerically equivalent to approximately 10 percent of the static load (i.e., a tire at 5000 lbs load has a cornering stiffness of approximately 500 lb/deg). Since the stiffness is dependent on the tire load, it should be

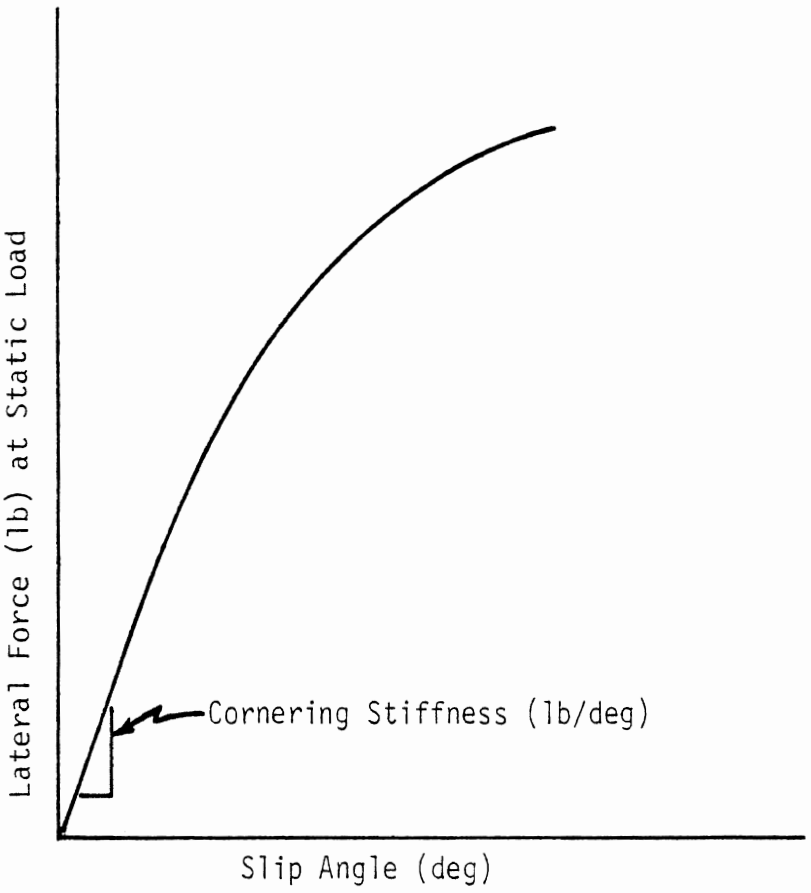


Figure 7. Definition of cornering stiffness parameter.

entered for the condition equivalent to the full static load on that tire in the simulation. Internally, the program continuously adjusts the cornering stiffness in proportion to the changing dynamic load conditions. The linear cornering stiffness model should only be used with moderate cornering maneuvers, where the tire cornering forces generated are less than 50 percent of the vertical load. Beyond this point, the cornering force becomes nonlinear and saturates (no saturation or limit on lateral traction occurs with the linear model). In such cases, the nonlinear table lookup model can be used by entry of a negative whole number to key the model. The numerical value of this entry identifies the table number for the tabular lateral tire force data which is to follow. (The format for the tabular tire data is discussed in the following section, 3.3.3.1.)

The next line entered for front tires and wheels is the left- and right-tire LONGITUDINAL STIFFNESS in lbs/slip (2F15.3 format). The LONGITUDINAL STIFFNESS is equivalent to the initial slope of the brake force versus longitudinal slip curve for a tire, as illustrated in Figure 8, and typically has a numerical value equivalent to about four times the tire static load. The longitudinal stiffness is proportioned inside the program to change with the tire dynamic load. Like the cornering stiffness entry, positive values specify the linear tire model for longitudinal tire force calculations with zero right-side entries, causing the program to assume a right-side value equal to the left. Since it is a linear model, it should only be used with braking maneuvers for which the friction level on each tire is well below the peak (the braking is well below the wheel lockup condition). For high level braking or when antilock braking is used, the tire longitudinal force characteristics are best represented by a table lookup. A negative entry for longitudinal stiffness keys the nonlinear tire force table lookup option. As above, the numerical value of this entry identifies the longitudinal tire force table of data which needs to follow. (Section 3.3.3.1)

Mixtures of linear and nonlinear tire options for longitudinal and lateral tire force representations are permitted for the same tire. Linear and nonlinear mixtures side-to-side are also allowed.

The remaining parameters to be entered for front tires and wheels should be positive or zero. Negative table entry options are not allowed. Two values per line are entered representing left- and right-side values

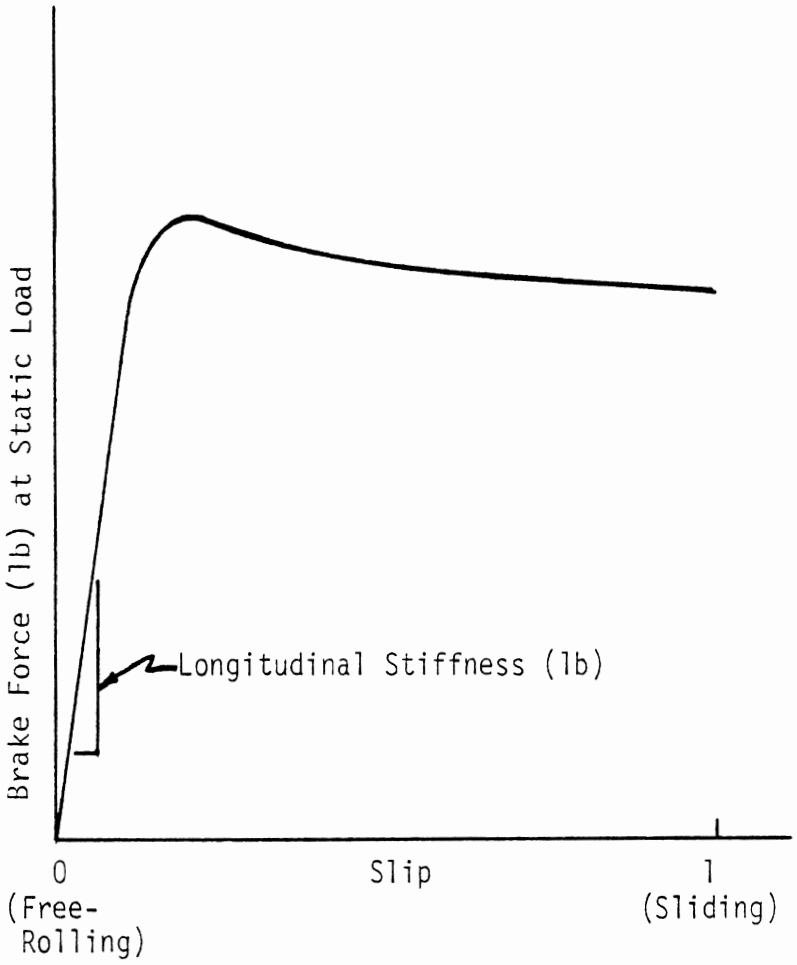


Figure 8. Definition of longitudinal stiffness parameter.

(2F15.3 format). Zero right-side values will equate right with left. The first of these, CAMBER STIFFNESS, defines the lateral force per degree of camber at static load conditions and is entered in lbs/deg. ALIGNING MOMENT at the static load condition is entered next in units of in-lb/deg. TIRE SPRING RATE (lb/in), TIRE LOADED RADIUS (in), and POLAR MOMENT OF INERTIA (in-lb-sec^2) then follow as the last three lines of the tire/wheel parameters. The polar moment of inertia for all rotating wheel components is defined about the spin axis of the wheel. This parameter can be of importance in antilock braking maneuvers.

3.3.3.1 Nonlinear lateral and longitudinal tire table formats. Negative values for CORNERING STIFFNESS or LONGITUDINAL STIFFNESS parameters trigger the nonlinear tire model table lookup option. Tire data conforming to a specific format needs to be entered immediately following each of these negative entries.

Cornering Stiffness (MU-Y) Tables:

Tabular cornering (lateral) force tire data called by a negative CORNERING STIFFNESS value is entered in terms of a normalized lateral traction coefficient, MU-Y, as a function of tire sideslip angle, ALPHA, for at least one, and as many as three, different vertical tire loads and velocities. MU-Y is defined as the nondimensional ratio of tire lateral force to the prevailing vertical load at zero longitudinal slip (free rolling). Two-way linear interpolation is used by the program between entered table points. The format required for entering MU-Y tabular data is as follows (see Appendix A for examples):

(Define number of loads and velocities)	
•Number of vertical loads, NL (3 max.)	(I2 format)
•Vertical load values	(3F10.2 format)
•Number of velocities, NV (3 max.)	(I2 format)
•Velocity values	(3F10.2 format)
(First load/first velocity table)	
•Number of tire sideslip angles, N11, in first ALPHA versus MU-Y table (max. of 10)	(I2 format)
•N11 lines of ALPHA (deg), MU-Y pairs comprising the first table	(2F10.2 format, each line)

(First load/second velocity table)

- Number of tire sideslip angles, N12, in second ALPHA versus MU-Y table (max. of 10) (I2 format)
- N12 lines of ALPHA (deg), MU-Y pairs comprising the second table. (2F10.2 format, each line)

(First load/third velocity table)

- Number of tire sideslip angles, N13, in third ALPHA versus MU-Y table (max. of 10) (I2 format)
- N13 lines of ALPHA (deg), MU-Y pairs comprising the third table. (2F10.2 format)

(Repeat for second load condition)

(Repeat for third load condition)

Note: The total number of ALPHA versus MU-Y tables is equal to the product of NV × NL. Hence, a maximum of nine (9) such tables are permitted (NV = NL = 3) and a minimum of one (1) table (NV = NL = 1) is required.

Immediately following the ALPHA versus MU-Y tables, a "roll-off" tabular function which allows for reduction of the free-rolling tire lateral forces under longitudinal (braking) slip conditions is required. In the event no braking occurs, a simple one-point table may be used. The "roll-off" table is a two-way table of the parameter, ROLLY, as a function of longitudinal slip (SLIP) and sideslip (ALPHA) of the tire. ROLLY is simply a multiplication factor for MU-Y defined at the selected SLIP and ALPHA values in the table and interpolated elsewhere. ROLLY values of 1.0 simply return the free-rolling MU-Y value. Likewise, a ROLLY value of 0.75 would diminish the value of MU-Y by 25 percent at the specified longitudinal/sideslip point in the "roll-off" table.

The following format is used for entering lateral "roll-off" function tabular data:

(Define arguments of the table)

- Number of longitudinal slip (SLIP) points, NS, in the "roll-off" table (10 max.) (I2 format)
- NS lines of longitudinal slip (SLIP) values (F10.2 format, each line)
- Number of sideslip (ALPHA) points, NSS, in the "roll-off" table (10 max.) (I2 format)

NSS lines of sideslip (ALPHA) values (F10.2 format, each line)

NSS × NS matrix of ROLLY values defining the "roll-off" tabular function. NSS lines containing NS ROLLY values/line as shown below. (10F8.2 format)

	$Slip_1$	$Slip_2$	etc.
$Alpha_1$	$ROLLY_{11}$	$ROLLY_{12}$	.....
$Alpha_2$	$ROLLY_{21}$	$ROLLY_{22}$	.....
etc.	.	.	
	.	.	
	.	.	
	.	.	
	.	.	
	.	.	
	.	.	

ROLLY TABLE

Note: The maximum size of the ROLLY table is 10 × 10 (NSS = NS = 10). Minimum size is 1 × 1 (NSS = NS = 1).

Longitudinal Stiffness (MU-X) Tables:

Tabular braking (longitudinal) force tire data is entered in exactly the same format as used for cornering data. This data must follow immediately after the negative LONGITUIDNAL STIFFNESS entry. MU-X, a normalized longitudinal traction coefficient, now replaces MU-Y as the dependent table variable and longitudinal slip, SLIP, replaces ALPHA as the independent table variable. MU-X is defined as the nondimensional ratio of longitudinal tire force to the prevailing vertical load at a zero tire sideslip angle. Like the lateral force table data, up to three vertical loads and speeds may be specified.

A longitudinal "roll-off" function is likewise required in the case of MU-X tabular data. ROLLX, a multiplicative factor analogous to ROLLY for cornering data, is specified in a two-way table of longitudinal slip (SLIP) versus sideslip (ALPHA) identical to that format used for the lateral "roll-off" table.

Sources of lateral and longitudinal tire force data for heavy trucks, that are largely compatible with the T3DRS:V1 program, are contained in References [2, 13, 14, 15, 16, 17].

3.3.4 Truck/Tractor Rear Suspension and Axle Parameters. Medium and heavy trucks all use one or more solid rear axles. Since a large percentage of such vehicles use two (tandem) rear axles, an optional tandem axle is provided in the program models. The rear suspension and axle parameters are the next group of input parameters, as shown in Figure 9. The first parameter is a SUSPENSION KEY (I2 format) for which "00" indicates a single axle is to be used, and "01" indicates a tandem axle set.

3.3.4.1 Single axles. When a single axle has been specified, its characteristics are described by the same set of parameters used to describe the front suspension and axle (see Section 3.3.2 for detailed discussion). Hence, following a "00" suspension key, the following parameters are entered:

- SUSPENSION SPRING RATE (lbs/in/side/axle); 2F10.2 format; table lookup and side-to-side options allowed
- SUSPENSION VISCOUS DAMPING (lbs-sec/in/side); 2F10.2 format; side-to-side option allowed
- COULOMB FRICTION (lbs); 2F10.2 format; side-to-side option allowed
- AXLE ROLL MOMENT OF INERTIA (in-lb-sec^2); F15.3 format
- ROLL CENTER HEIGHT (in above ground); F15.3 format
- ROLL STEER COEFFICIENT (deg steer/deg roll); F15.3 format
- AUXILIARY ROLL STIFFNESS (in-lb/deg); F15.13 format
- LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (in); F15.3 format
- TRACK WIDTH (in); F15.3 format
- UNSPRUNG WEIGHT (lbs); F15.3 format

Because of the dual tires commonly used on rear axles, the TRACK WIDTH must be carefully defined. As used here, track width is the lateral distance between the centers of the dual tires, as shown in Figure 10. The dual tire separation parameter is included in the Tires and Wheels data and defines the wheel locations relative to the track width.

TRACTOR REAR SUSPENSION AND AXLE PARAMETERS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES		1		
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)		50.00		
STATIC (1G) TRANSFER (PERCENT LOAD ON LEAD AXLE)		50.00		
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)		0.0		
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	1500.00	1500.00	1500.00	1500.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	15.00	15.00	15.00	15.00
COULOMB FRICTION (LB/SIDE/AXLE)	250.00	250.00	250.00	250.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4458.00			4458.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	22.00			22.00
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	0.0			0.0
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	0.0			78000.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	35.00			35.00
TRACK WIDTH (IN)	72.00			72.00
UNSPRUNG WEIGHT (LB)	2340.00			2170.00

TRACTOR REAR TIRES - 4 WHEELS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	13.00	13.00	13.00	13.00
CORNERING STIFFNESS (LB/DEG/TIRE)	690.00	690.00	690.00	690.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	28000.00	28000.00	28000.00	28000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	5700.00	5700.00	5700.00	5700.00
TIRE LOADED RADIUS (IN)	20.30	20.30	20.30	20.30
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	115.00	115.00	115.00	115.00

TRACTOR FRONT BRAKES

	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.0200	0.0200
RISE TIME (SEC)	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	100.0000	100.0000

TRACTOR REAR BRAKES

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.0500	0.0500	0.0500	0.0500
RISE TIME (SEC)	0.4000	0.4000	0.4000	0.4000
BRAKE TORQUE (IN-LB/PSI/BRAKE)	200.0000	200.0000	200.0000	200.0000

Figure 9. Example of second page of truck/tractor parameters.

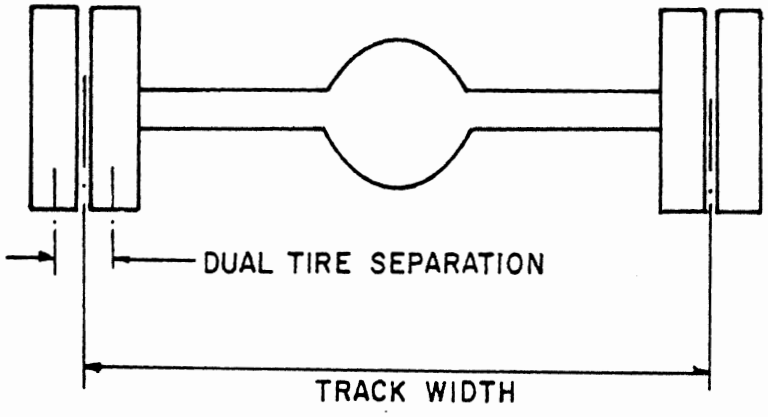


Figure 10. Definition of track width and dual tire separation.

3.3.4.2 Tandem axles option. The tandem axle model has been reformulated for the T3DRS:V1 program. Previously, seven different tandem options have been variously available among the predecessor programs. These included:

1) Walking-beam suspension
2) Basic four-spring suspension
3) Four-spring with spring-type torque rods
4) Four-spring with long load leveler
5) Multiple torque rod four-spring
6) Multiple torque rod four-spring with spring-type lower torque rod
7) Air suspension

Reference [3] provides a detailed discussion of these seven types of tandem suspensions. Each axle/suspension system was defined by a detailed list of geometric parameters that served to establish three basic characteristics:

1) The tandem axle separation
2) The static load distribution among the axles
3) The dynamic load transfer between axles during braking.

That approach to modeling was taken under the philosophy that tandem axle geometric characteristics were more readily available to users than such parameters as dynamic load transfer characteristics. However, the limitations of each geometric formulation has resulted in a proliferation of models, each required to handle particular details associated with the many varieties of tandem systems in use.

In T3DRS:V1, tandem axle systems are modeled as two single axles with the additional specification of the three parameters listed above. Hence, the entry of a tandem-axle system is accomplished by entry of a data list as described below.

The tandem-axle option is indicated by entry of "01" value (I2 format) as the first parameter, SUSPENSION KEY. The next entry is TANDEM AXLE SEPARATION (in. between the centers of the leading and trailing axles, in F15.3 format). Tandem-axle separation is typically 48-52 in. for closely spaced tandem sets. Next is the STATIC LOAD TRANSFER (F15.3 format) which is the percent of the total tandem load carried on the lead axle under static

conditions. On the most common tandem suspensions, this is intended to be 50 percent (50.0 entry), although minor variations may occur due to inaccuracies in the equalizing system or due to differences in the unsprung weights of the axles. The value entered here establishes the final static distribution of the loaded vehicle used in the simulation. Internally, the program works back from the load distribution specified, compensates for the unsprung weights of the axles, and selects the necessary static spring deflection on each axle to achieve this static load distribution. If different side-to-side spring characteristics are also specified, the static deflections of the springs on the right and left are selected to achieve equal load on both sides of the axle under static conditions.

Next, the DYNAMIC LOAD TRANSFER parameter is entered (F15.3 format). This parameter, in units of percent, describes the fraction of the total brake torque (generated on the rear axles) applied to transfering load from the trailing to the leading axle of the tandem set. That is, the brake torque generated by the rear axles results in a pitch plane moment on the vehicle that must be counteracted by a moment generated either by a dynamic load transfer to the front axle of the vehicle, or by dynamic load transfers to the leading tandem axle. For example, if the total brake torque on a tandem axle set with a 50-in. TANDEM AXLE SEPARATION is 100,000 in-lb, a DYNAMIC LOAD TRANSFER value of +10.0 (percent) would result in an increase/decrease of 200 lbs of vertical load on the leading/trailing axles. The load transfer characteristics are determined by the inherent geometry of the suspension and torque rod systems. With ideal torque rod designs, all brake torque reaction transfers to the vehicle frame, resulting in load transfer to the front axle. In practice, less than that ideal is achieved. Walking-beam and air suspensions are reasonably effective and a zero entry may be appropriate to those cases. However, some four-spring suspensions by the nature of their load equalization systems may transfer load from the leading to the trailing axle, in which case a negative value for the parameter is required.

After entry of these three special tandem parameters, the remainder of the rear suspension and axle parameters are entered as two serial sets of single axles. That is, a single axle data set of 10 parameters, from SUSPENSION SPRING RATE through UNSPRUNG WEIGHT, is entered to describe the

leading axle; followed by a similar data set to describe the trailing axle. Different parametric values, along with the table lookup and side-to-side options, can be used as desired with each axle. More detailed discussion of the 10 parameters is contained in Sections 3.3.2 and 3.3.4.1. These data are echoed, as shown in Figure 9, in a side-by-side format rather than the serial format actually used in the input list.

3.3.5 Truck/Tractor Rear Tires and Wheels. The rear tires and wheels (see Fig. 9) are generally described by the same parametric information needed for the front wheels, that is described in detail in Section 3.3.3. The primary difference arises from the fact that rear axles commonly employ a dual tire arrangement. Hence, the first parameter to be entered is DUAL TIRE SEPARATION (F15.3 format) which is the distance in inches between the center-plane of the two tires in a dual wheel set (see Fig. 10). Thence the parametric data on a per tire basis is entered. If the dual tire separation is input as zero, a single wheel is assumed at that position defined by the track width entered previously. Different values can be assigned for tires on the left and right side of the axle by side-to-side entry format, but both tires in the dual set are assigned the same parameter values. The last entry, the POLAR MOMENT OF INERTIA, is likewise entered on a per tire basis, and hence, with dual wheels should be entered as half the value for the dual wheel set. If tandem axles have been specified, two complete sets of tire data from DUAL TIRE SEPARATION to POLAR MOMENT OF INERTIA should be entered in series, the first set for the leading axle and the second set for the trailing axle.

3.3.6 Truck/Tractor Front and Rear Brakes. The brake systems on the axles of the simulated vehicles are represented by the timing characteristics of the pneumatic system and the pressure torque characteristics of the brakes. Brake system data are entered as the last category of information about each vehicle and are entered only if a Treadle Pressure Table was entered in the Simulation Operation Parameters. Zero lines in that table signals the program to skip over brake data read instructions. One or more lines in the Treadle Pressure Table, even if all values are zero, is considered a table entry.

Brake data are entered for each axle of the vehicle in sequence from front to rear, the number of brake data sets being equal to the number of axles on the vehicle. The brake data sets consist of three entries.

The first entry is the BRAKE LAG in seconds for the left and right brake (2F10.4 format). This parameter describes the time for a pressure signal to proceed from the treadle valve to the brake chamber and is equivalent to the time from the first motion of the treadle valve to the beginning of the pressure rise at the brake chamber. Typical values are in the range of 0.02 to 0.10 sec for truck/tractor air brake systems.

The second entry is brake RISE TIME in seconds for the left and right brakes (2F10.4 format). The rise time is the effective time constant when the chamber pressure rise is characterized by a first-order lag (i.e., time required to reach 63% of the steady-state step response). Typical values are in the range of 0.2 to 0.5 sec.

The last entry in the brake set is the left and right BRAKE TORQUE coefficient in units of in-lb of brake torque/psi (2F10.4 format). The brake torque coefficient characterizes the brake in a linear fashion and, as with the first two entries, can be given a side-to-side difference. (One entry with any of the above parameters, as with any side-to-side parameter, causes the right side to be given the same value as the left side.) In the event it is desired to model the brake with nonlinear characteristics, as, for example, having a nonzero pushout pressure before the brake is actuated, a brake lookup table can be called by entry of a negative whole number for the BRAKE TORQUE coefficient. Immediately thereafter, a brake table should be entered in the following format:

Line #1 Number of Lines, n (max. of 10)	(I2 format)
Line #2, etc. 'n' lines of the table of pressure (psi) versus torque (in-lb)	(2F10.2 format)

If left and right brakes are given separate tables, the left brake table is entered first, followed immediately by the right brake table. The side-to-side and lookup table options may be mixed as desired on each axle or on different axles.

The performance of hydraulic brake systems can be represented as well by the brake models. In that case, the BRAKE LAG and RISE TIME parameters are negligible and may be entered as zero. Effects of proportioning valves are taken into account by assigning nonlinear brake torque characteristics duplicating slopes and break points in the proportioning.

3.4 First Trailer Description

The first trailer is always a semitrailer which is modeled as a rigid body sprung mass supported at the front by the tractor fifth wheel coupling and at the rear by its own suspension and axles. Parametric data for the trailer is shown in Figures 11 and 12.

3.4.1 Trailer Parameters. The basic properties of the trailer are described by sprung mass parameters that constitute the first group of entries. The sprung mass is modeled as a rigid body, shown in Figure 13. The first entry is WHEELBASE, the characteristic length of the trailer defined as the longitudinal distance in inches (F15.3 format) from the kingpin to the center of the rear suspension. For a single-axle trailer, this is the same as the distance to the rear axle centerline, but for a tandem-axle trailer it is the distance to the geometric center of the rear axles.

The rigid body sprung mass is represented by mass properties concentrated at its center of gravity (c.g.). Its mass and fore/aft location are established by input of the BASE VEHICLE KINGPIN STATIC LOAD (lbs., F15.3 format) and CURB WEIGHT ON REAR AXLES (lbs., F15.3 format). The base vehicle weight data defines the mass of the semitrailer only and should exclude loads imposed from other trailers. Rear axle curb weight with tandem axles is the total for both axles.

Thereafter, the sprung mass and payload properties consisting of the following entries are made:

- SPRUNG MASS C.G. HEIGHT
- SPRUNG MASS ROLL MOMENT OF INERTIA
- SPRUNG MASS PITCH MOMENT OF INERTIA

TRAILER NO. 1 PARAMETERS

WHEELBASE - DISTANCE FROM KINGPIN TO CENTER OF REAR SUSPENSION (IN)	383.00
BASE VEHICLE KINGPIN STATIC LOAD (LB)	2815.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	8650.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	74.80
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	66224.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	542486.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	644483.00
PAYLOAD WEIGHT (LB)	46800.00
PAYLOAD DISTANCE AHEAD OF REAR SUSPENSION CENTER(IN)	183.00
PAYLOAD CG HEIGHT (IN. ABOVE GROUND)	60.00
PAYLOAD ROLL MOMENT OF INERTIA(IN-LB-SEC**2)	13000.00
PAYLOAD PITCH MOMENT OF INERTIA(IN-LB-SEC**2)	240000.00
PAYLOAD YAW MOMENT OF INERTIA(IN-LB-SEC**2)	240000.00
LOCATION OF PINTLE HOOK (IN BEHIND REAR SUSP. CENTER)	48.00
HEIGHT OF PINTLE HOOK (IN ABOVE GROUND)	40.00

TRAILER NO. 1 REAR SUSPENSION AND AXLE PARAMETERS

	LEADING TANDEM AXLE			TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE		LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES			1		
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)			48.00		
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)			40.00		
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)			10.00		
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	7818.00	7818.00		7818.00	7818.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00		50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00	2600.00		2600.00	2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4746.00				4746.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60				29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	-0.00				-0.00
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	35490.00				35490.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	38.00				38.00
TRACK WIDTH (IN)	71.25				71.25
UNSPRUNG WEIGHT (LB)	1530.00				1530.00

TRAILER NO. 1 REAR TIRES AND WHEELS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00	212.00	212.00

Figure 11. Example of first page of semitrailer parameters.

HSRI TRUCK AND TRACTOR-TRAILER DYNAMIC RESPONSE SIMULATION - T3DRS,V1
SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR BRAKES

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1000.0000	1000.0000	1000.0000

Figure 12. Example of second page of semitrailer parameters.

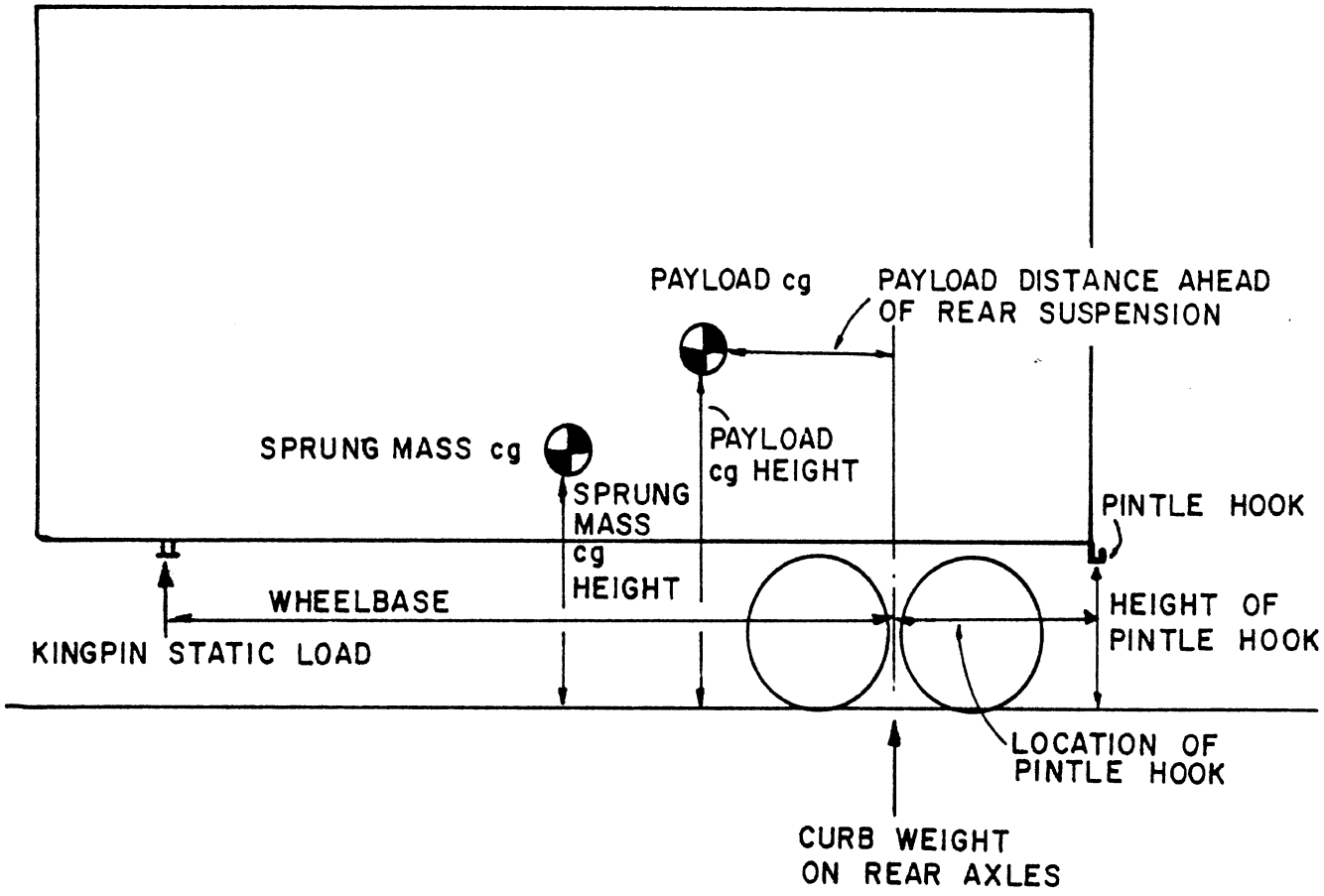


Figure 13. Modeling elements of a semitrailer.

- SPRUNG MASS YAW MOMENT OF INERTIA
- PAYLOAD WEIGHT
  - PAYLOAD DISTANCE AHEAD OF REAR SUSPENSION - Optional
  - PAYLOAD C.G. HEIGHT - Optional
  - PAYLOAD ROLL MOMENT OF INERTIA - Optional
  - PAYLOAD PITCH MOMENT OF INERTIA - Optional
  - PAYLOAD YAW MOMENT OF INERTIA - Optional

Section 3.3.1 gives a detailed description of these parameters for the truck/tractor that is equally applicable here.

If only a tractor-trailer is being simulated, this completes the parameter entries describing the trailer sprung mass. However, if a doubles or triples are to be simulated (i.e., another trailer follows), two more parameters must be entered at this point to locate the pintle hook. The entries required are LOCATION OF PINTLE HOOK (distance in inches behind the rear suspension, F15.3 format), and HEIGHT OF PINTLE HOOK (inches above ground, F15.3 format). The height is taken to be the value when the semitrailer is in its fully loaded static position.

3.4.2 Trailer Suspension, Axle, Tires, Wheels, and Brakes. The parameters to describe these components of the semitrailer follow as shown in Figures 11 and 12. These component entries are identical in format and function to the Truck/Tractor Rear Suspension and Axle Parameters (Section 3.3.4), Truck/Tractor Rear Tires and Wheels (Section 3.3.5), and Truck/Tractor Rear Brakes (Section 3.3.6). The user should refer to these sections to answer questions relating to definitions or format.

3.5 Second and Third (Full) Trailer Descriptions

The second and third trailers are always full trailers consisting of a rigid body sprung mass supported at the front on either a fixed or converter dolly, and at the rear by its own suspension and axles. Parametric data for the second trailer is shown in Figures 14 and 15 and is the same for the third trailer. When a third trailer (triples) is simulated, the complete data set as shown in Figures 14 and 15 (with the exception of the two pintle hook parameters) is entered for the third trailer immediately following the second trailer.

TRAILER NO. 2 PARAMETERS

DOLLY KEY: 1 = CONVERTER DOLLY, 2 = FIXED DOLLY	1
DISTANCE FROM TURNTABLE CENTER TO PINTLE HOOK (IN)	60.00
TURNTABLE LOCATION (IN AHEAD OF SUSP. CENTER)	0.0
TURNTABLE HEIGHT ABOVE GROUND (IN)	52.00
WHEELBASE - DISTANCE FROM CENTER OF FRONT SUSP. TO CENTER OF REAR SUSP. (IN)	300.00
BASE VEHICLE CURB WEIGHT ON FRONT SUSPENSION (LB)	8650.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	8650.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	74.80
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	66224.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	542486.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	644483.00
PAYLOAD WEIGHT (LB)	0.0
*** ZERO ENTRY INDICATES NO PAYLOAD ***	
*** FIVE PAYLOAD DESCRIPTION PARAMETERS ARE NOT ENTERED ***	
LOCATION OF PINTLE HOOK (IN BEHIND REAR SUSP. CENTER)	48.00
HEIGHT OF PINTLE HOOK (IN ABOVE GROUND)	40.00

TRAILER NO. 2 FRONT SUSPENSION AND AXLE PARAMETERS

	LEFT SIDE		RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES		0	
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	7818.00		7818.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00		50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00		2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)		4746.00	
ROLL CENTER HEIGHT (IN. ABOVE GROUND)		29.60	
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)		-0.00	
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)		35490.00	
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)		38.00	
TRACK WIDTH (IN)		71.25	
UNSPRUNG WEIGHT (LB)		1530.00	

TRAILER NO. 2 FRONT TIRES AND WHEELS

	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00

Figure 14. Example of first page of full trailer parameters.

TRAILER NO. 2 REAR SUSPENSION AND AXLE PARAMETERS	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES	1			
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)	48.00			
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)	50.00			
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)	10.00			
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	-3.00	-3.00	-3.00	-3.00
*** NEGATIVE ENTRY INDICATES TABLE ENTERED ***				
*** ECHO WILL APPEAR ON TABLE INDEX PAGE ***				
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00	50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00	2600.00	2600.00	2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4746.00			4746.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60			29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	-0.00			-0.00
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	35490.00			35490.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	38.00			38.00
TRACK WIDTH (IN)	71.25			71.25
UNSPRUNG WEIGHT (LB)	1530.00			1530.00

TRAILER NO. 2 REAR TIRES AND WHEELS	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00	212.00	212.00

TRAILER NO. 2 FRONT BRAKES	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	-5.0000	-5.0000
*** NEGATIVE ENTRY INDICATES TABLE ENTERED ***		
*** ECHO WILL APPEAR ON TABLE INDEX PAGE ***		

TRAILER NO. 2 REAR BRAKES	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1000.0000	1000.0000	1000.0000

Figure 15. Example of second page of full trailer parameters.

3.5.1 Full Trailer Parameters. A full trailer is modeled by a semitrailer setting on a fixed or converter dolly. The two types of dollies are functionally different, as illustrated in Figure 16. The fixed dolly is attached directly to the trailer and is constrained to move with the trailer in all but the yaw direction. Hence, a pitch direction hinge in the dolly tongue is used to decouple pitch motions from the towing vehicle. The converter dolly incorporates a conventional fifth wheel as a coupling to the trailer. This type of dolly has a rigid tongue and is decoupled from the trailer in yaw and pitch.

Kinematically, the dollies are modeled as shown. The assumptions in the models are as follows:

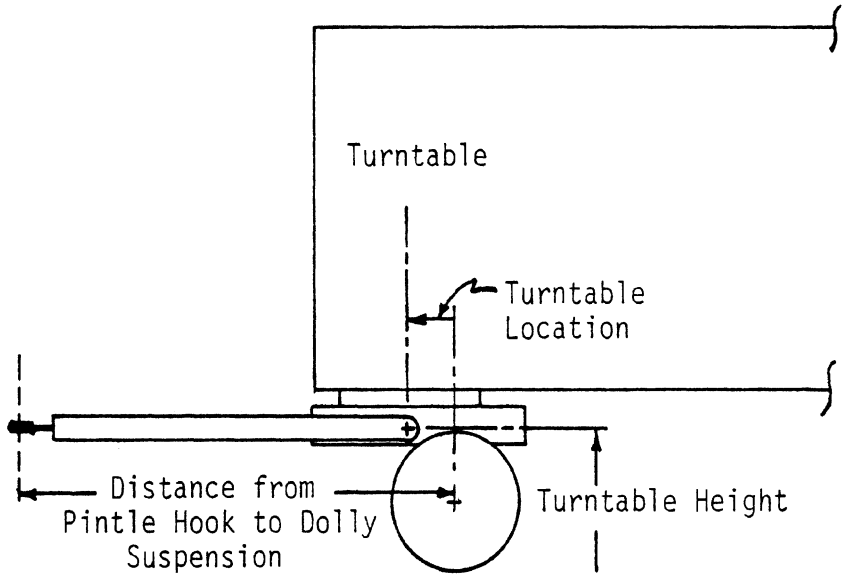
1) The yaw inertia of the dolly is assumed negligible.

2) The effective sprung mass properties of the dolly are lumped in with that of the trailer.

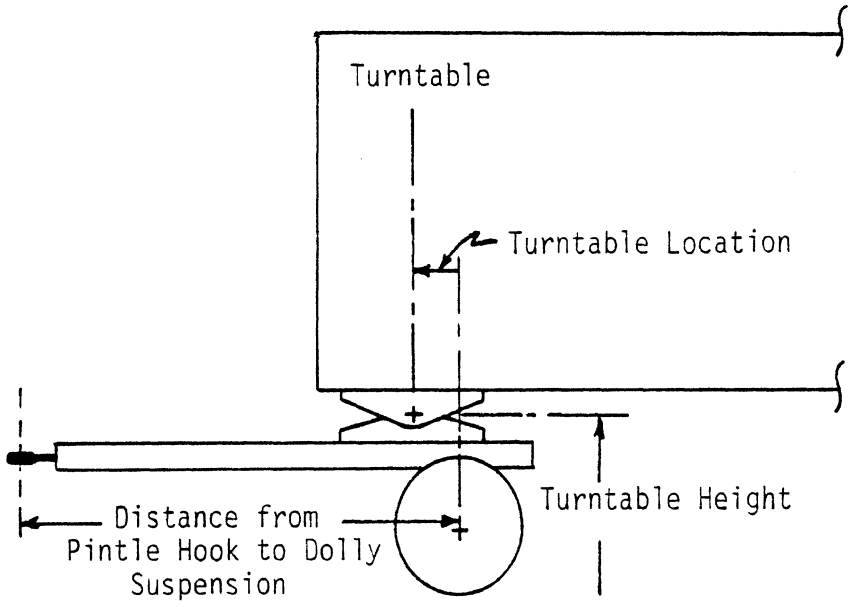
3) Tire longitudinal velocity due to dolly yaw is neglected.

The primary functional difference between the two types of dollies in the simulation is that the converter dolly can exert static load on the rear of the towing trailer, whereas the fixed dolly does not. Like the tractor fifth wheel, the pintle connection is modeled by springs of suitably high stiffness such that they are realistic, yet allow the equations to be coupled by forces rather than displacements. The pintle hitch transmits only longitudinal, lateral and vertical forces, but no moments.

The first parameter entry with a full trailer is the DOLLY KEY (I2 format) for which "01" indicates a converter dolly and "02" a fixed dolly. The next three entries define the geometry for both types of dollies as shown in Figure 16. The first is DISTANCE FROM PINTLE HOOK TO DOLLY SUSPENSION (in., F15.3 format), which defines the effective tongue length of the dolly. For the single-axle dolly this is the distance to the center of the axle, whereas for the tandem axles it is to the midpoint between the two axles. Second is TURNTABLE LOCATION (inches ahead of the suspension center, F15.3 format), which defines the offset between the kingpin or turntable center and suspension system. Last is TURNTABLE HEIGHT (inches above the ground, F15.3 format). By this simplified representation, it is implicitly assumed that the longitudinal tongue forces are applied to the



Fixed Dolly



Converter Dolly

Figure 16. Modeling elements of the fixed and converter dollies.

full trailer at the longitudinal location of the kingpin and at the vertical location defined by the turntable height. Hence, the height should be taken as that of the pitch pivot on the fifth wheel of a converter dolly, and as that of the pitch direction hinge on the tongue of a fixed dolly.

The WHEELBASE (in., F15.3 format) for the full trailer is defined as the distance between the centers of the dolly and the trailer rear suspension systems. The base vehicle sprung mass and longitudinal center of gravity location is then defined by entry of BASE VEHICLE CURB WEIGHT ON FRONT AXLES (lbs., F15.3 format) and BASE VEHICLE CURB WEIGHT ON REAR AXLES (lbs., F15.3 format). In the case of a converter dolly, some weight may be carried on the tongue due to kingpin offset. The front axle curb weight for the converter dolly should include the weight carried on the tongue (i.e., vertical load on the pintle hook). From these static loads, less the unsprung weights that are entered later, sprung mass properties of the trailer are calculated, which include sprung mass contributions from the dolly.

Thereafter, SPRUNG MASS CG HEIGHT, MOMENTS OF INERTIA, and PAYLOAD data, shown in Figure 14, are entered as for a truck/tractor, described in Section 3.3.1.

If the trailer is the second of a three-trailer (triples) combination, pintle hook location data, as follows, appears next.

- LOCATION OF PINTLE HOOK (distance in inches behind the rear suspension, F15.3 format)
- HEIGHT OF PINTLE HOOK (inches above the ground, F15.3 format)

This concludes the trailer parameters.

3.5.2 Full Trailer Suspension, Axles, Tires, Wheels, and Brakes. Input data for these parameters are shown in Figures 14 and 15. The component entries for both the dolly and trailer rear suspensions and axles are identical in format and function to the Truck/Tractor Rear Suspension and Axle Parameters (Section 3.3.4). The tires, wheels and brake component entries are identical to Truck/Tractor Rear Tires and Wheels (Section 3.3.5) and Truck/Tractor Rear Brakes (Section 3.3.6). The user should refer to these sections for definitions and format.

3.6 Antilock Brake Description

After the last entries of parametric data (normally the brake data) for the last vehicle in the combination, the user has the option to enter antilock brake control system data for any wheel on the vehicle train. If no antilock data is to be entered for the vehicle, a "00" entry (I2 format) should be entered for the VEHICLE ANTILOCK KEY at this point in the input stream. If antilock data is to be entered, the VEHICLE ANTILOCK KEY entry should be "01" (I2 format). The "01" entry will activate the antilock subprogram to read and echo antilock data according to the format documented in Appendix D, Antilock Simulation. All antilock data must be entered following the "01" entry for the VEHICLE ANTILOCK KEY.

The antilock simulation is a general-purpose program which requires the user to specify operating characteristics of each antilock system simulated. Because of the program's built-in flexibility, permitting simulation of a wide variety of antilock system characteristics, entry and selection of numerical values defining the desired features may be challenging tasks for some first-time users. Examples appearing in Appendix D should prove helpful in understanding the basic program usage.

3.7 End of Input

The last line entered in the input stream is the RERUN parameter (I2 format). Note that this parameter is never echoed as an element of the input data list. A "00" entry for RERUN will terminate the program following the simulation run by a CALL EXIT system return. A "01" entry for RERUN is used to perform multiple runs. In this case, a second data set beginning with a Title Line should follow immediately in the same input stream. The "01" RERUN parameter will cause the program to read the second data set and execute the simulation. Following execution for the second data set, its RERUN parameter will be read and the program terminated (RERUN = 00) or a third data set read (RERUN = 01). In the event a data set is not entered following an "01" RERUN entry, a system I/O interrupt will occur and the program generally terminated by the specific system executive.

Job Control Language cards, when required at a specific computer installation to terminate/unload the program, should follow the RERUN parameter.

4.0 PROGRAM OUTPUT

4.1 General

Operation of the T3DRS:V1 program generates output in a format compatible with line printer systems with 132 or more characters per line. The output falls in three categories—echo of input data, a Summary Page describing the load conditions of the simulation vehicle(s), and time-based listing of simulation output variables.

Fixed and separate page numbering systems are used with the input echo and simulation output pages. The numbering systems are described in Sections 4.2 and 4.4 where those outputs are discussed. All pages have a two-line heading with the title of the T3DRS:V1 program and the one-line title supplied by the user.

4.1.1 Output Options. Only the simulation output pages can be optionally selected by the user. The Input Echo pages and simulation vehicle Summary Page are always printed if the input data is successfully read. The output page options are specified by a seven-digit key read in the Simulation Operation Parameter input group (see Section 3.2). If a simulation input is submitted with zero SIMULATION TIME and no output options, only the Input Echo pages and simulation vehicle Summary Page are obtained. This technique can be used to check an input list prior to making a simulation run.

4.1.2 Coordinate Systems. In order to interpret the vehicle motion parameters given in the simulation output, it is necessary to define the coordinate systems used. Two coordinate systems are necessary to describe the simulated motion of each vehicle; an inertial coordinate system and a body fixed coordinate system, as shown in Figure 17.

The inertial coordinate system is a right-hand orthogonal system fixed in space that serves as the reference point from which vehicle motions and attitudes are defined. The origin is placed at the truck/tractor sprung mass center of gravity at the beginning of the simulation (time=0). The inertial coordinate system is aligned with the gravity vector and the

horizontal projection of the truck/tractor longitudinal axis. The axes are defined according to SAE convention as follows:

X - horizontal out the front of the vehicle

Y - horizontal out the right side of the vehicle

Z - vertically downward in the direction of gravity

The body fixed coordinate system is located and fixed in the vehicle and defines the vehicle location and attitude. Its origin is at the sprung mass center of gravity and is oriented as follows:

x - longitudinally out the front of the vehicle

y - laterally out the right side of the vehicle

z - vertically in the plane of the vehicle sprung mass

Each vehicle in the simulated combination has a separate body fixed coordinate system.

At the beginning of a simulation run, the origin of the truck/tractor body fixed coordinate system is at the origin of the inertial coordinate system. Furthermore, if the vehicle is on a level surface, the axes of the body fixed system are coincident with those of the inertial system.

Since all vehicles in a combination are aligned on the inertial X axis at the beginning of a simulation, all trailers start off with a negative X coordinate and a zero Y coordinate. Since all vehicles may have a different sprung mass center of gravity height as well as different elevations due to road grade, the height of each vehicle in the inertial system is referenced from its initial height (i.e., the Z coordinate for each vehicle is defined by the change from its initial elevation).

During a simulation, the position and attitude of each vehicle is defined by the position and attitude of its body fixed coordinate system in the inertial coordinate system. The vehicle position is given by the X, Y, and Z coordinates locating the origin of the body fixed system. The attitude is defined by Euler angles which orient the body fixed coordinate system with respect to the inertial coordinate system. That is, at any instant of time, the vehicle attitude is defined by the following three rotations going from the orientation of a translated inertial coordinate system to the orientation of the body fixed system.

1) Heading angle - rotation in the X-Y inertial plane about the Z axis; positive clockwise when viewed from above.

2) Pitch angle - rotation about the y body axis, out of the X-Y inertial plane; positive clockwise looking from left to right on the vehicle.

3) Roll angle - rotation about the x body axis; positive clockwise looking forward on the vehicle.

4.2 Input Echo

The first series of pages in the program output is an echo of the input data used to define the vehicles and simulation to be made. The echo pages are labeled as "Input Page No.___" and are numbered sequentially as follows:

Input Page No.	Content
1	Simulation Operation Parameters
2-3	Truck/Tractor Parameters
4-5	First (Semi-) Trailer Parameters
6-7	Second (Full-) Trailer Parameters
8-9	Third (Full-) Trailer Parameters

As a minimum, pages 1-3 are always printed, while pages 4-9 appear only if a tractor-trailer, doubles, or triples are being simulated.

The input echo is designed to match line for line as much as possible with the input data list so that a copy of the echo can be used as a model for assembling a new input data list. Every line showing a numerical value corresponds to an input line. Blank lines on the echo pages are there only for ease of reading and should not be included in an input list, lest they be read as zero entries. Where multiple numbers are entered on one input line (see discussions in Section 3.0 for format), they appear on one line of echo. Where the side-to-side option is available (see Section 3.1.3) left- and right-side values are shown on a line. Two exceptions to the above rules must be observed:

1) When a table lookup option is used, the tabular data entered beginning on the next line in the input is printed on the Table Pages of the output (see example in Appendix A).

2) When the tandem-axle option is used, data in each group (suspensions and axles; tires and wheels; brakes) which were entered first for the leading axle then for the trailing axle are printed side by side in the echo for ease of reading.

The input echo is produced during the input data reading process, printing after every few lines of read. An error in the input list will at times halt the reading process and prevent the program from running. In those cases, output of the echo up to the point of the reading fault will be produced, serving as an aid in diagnosing the input error.

At the end of the echo on the last vehicle, the various lookup tables that have been entered are printed in an unnumbered series of pages as required. The tables are printed by categories as follows, in the order in which they were entered:

1) Suspension Spring Rate
2) Tire Data
3) Brake Torque

The tables are identified by the number assigned in the call statement.

If antilock brake control systems were used at any wheel in the vehicle configuration, a series of output pages follows at this point to describe the antilock system(s) used. The format and meaning of the antilock echo pages are given in Appendix D.

4.3 Summary Page

At the completion of a successful input data read, the program calculates the necessary composite characteristics of the vehicle combination. These data are printed on the Summary Page, as shown in Figure 18.

The program first calculates the composite center of gravity location and moments of inertia for the vehicle sprung mass with payload, the

	EMPTY	LOADED
TRAILER NO. 3 PAYLOAD = 0.0 LBS.		
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	150.000	150.000
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO GROUND (IN)	74.800	74.800
ROLL MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	66223.938	66223.938
PITCH MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	542485.938	542485.938
YAW MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	644482.938	644482.938

	EMPTY	LOADED
TRAILER NO. 2 PAYLOAD = 0.0 LBS.		
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	168.057	168.057
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO GROUND (IN)	74.800	74.800
ROLL MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	66223.938	66223.938
PITCH MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	542485.938	542485.938
YAW MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	644482.938	644482.938

	EMPTY	LOADED
TRAILER NO. 1 PAYLOAD = 46800.000 LBS.		
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	125.082	174.182
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO GROUND (IN)	74.800	62.253
ROLL MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	66223.938	83267.250
PITCH MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	542485.938	848450.250
YAW MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	644482.938	946404.000

	EMPTY	LOADED
TRACTOR PAYLOAD = 0.0 LBS		
DISTANCE FROM TRACTOR SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	108.519	108.519
DISTANCE FROM TRACTOR SPRUNG MASS CENTER TO GROUND (IN)	40.130	40.130
ROLL MOMENT OF INERTIA OF TRACTOR SPRUNG MASS (IN-LB-SEC**2)	36756.996	36756.996
PITCH MOMENT OF INERTIA OF TRACTOR SPRUNG MASS (IN-LB-SEC**2)	105492.938	105492.938
YAW MOMENT OF INERTIA OF TRACTOR SPRUNG MASS (IN-LB-SEC**2)	241479.000	241479.000

THE STATIC LOADS ON THE AXLES ARE:

AXLE NUMBER	LOAD
NS(1,1,1)	9604.379
NS(1,2,1)	16445.969
NS(1,2,2)	16445.969
NS(2,2,1)	13263.469
NS(2,2,2)	19905.203
NS(3,1,1)	8650.000
NS(3,2,1)	4325.000
NS(3,2,2)	4325.000
NS(4,1,1)	4325.000
NS(4,1,2)	4325.000
NS(4,2,1)	4325.000
NS(4,2,2)	4325.000
TOTAL	110254.938

THE TRACTOR TOTAL MASS CENTER IS 68.600 INCHES BEHIND THE FRONT AXLE
THE TOTAL YAW MOMENT OF INERTIA IS 401381.875 IN-LB-SEC**2

THE FIRST TRAILER TOTAL MASS CENTER IS 217.966 INCHES BEHIND THE KINGPIN
THE TOTAL YAW MOMENT OF INERTIA IS 1188344.000 IN-LB-SEC**2

THE SECOND TRAILER TOTAL MASS CENTER IS 150.000 INCHES BEHIND THE TURNTABLE CENTER
THE TOTAL YAW MOMENT OF INERTIA IS 941574.000 IN-LB-SEC**2

THE THIRD TRAILER TOTAL MASS CENTER IS 150.000 INCHES BEHIND THE TURNTABLE CENTER
THE TOTAL YAW MOMENT OF INERTIA IS 1046017.500 IN-LB-SEC**2

Figure 18. Example of summary page output.

resultant data being listed on the Summary Page by vehicle for the empty and loaded condition. To minimize the program memory requirements, these data are printed in the order by which they are calculated, which is from the last to the first vehicle.

Second, the static loads on each of the axles of the assembled vehicle combination is printed, front to rear, along with the total (gross combination) weight. The axles are identified by the number NS(i,j,k) where i is the number of the vehicle (numbered consecutively front to rear), j indicates front (1) or rear (2) suspension, and K indicates the axle number on that suspension. These data serve as a good check to ensure that the desired vehicle has been produced by the input data list.

Last, the longitudinal center of gravity location and yaw moment of inertia for the total mass of each vehicle is printed. The longitudinal c.g. location determines the overall axle loads resulting from the vehicle with payload. The total vehicle yaw moment of inertia is the overall resultant from contributions of the sprung mass, payload and axles.

4.4 Simulation Output

The simulation output pages are the product of the simulation run, providing a description of what happens to the vehicle combination in the course of the simulated maneuver. The output pages present lists of the selected vehicle motion variables and operating conditions at specified intervals of time throughout the maneuver. The variables and conditions are presented in columns with each line representing a point in time, measured in seconds, from the beginning of the simulation.

The output is identified by the "Output Page Number" appearing in the upper right-hand corner of each page. The numbering code is as follows:

x.yy.z

where

x = time block
yy = variable page number
z = vehicle number (1 - truck or tractor, 2 - semitrailer, 3 - first full trailer, 4 - second full trailer)

The time block code arises from the need to minimize computer memory requirements. Each page of output contains up to 41 time increments of output. If the duration of the maneuver and selected time interval for printing results in more than 41 lines of output, to minimize the number of output devices, output for the first 41 time increments (time block 1), is printed; then it continues with the second block of 41 (time block 2), etc. In order to minimize the number of time blocks and hence the bulk of the output pages, the user may want to choose carefully the TIME INCREMENT OF OUTPUT specified in the Simulation Operation Parameters (Section 3.2), using the following information for guidance:

Manuever Duration	Time Increment of Output	No. of Time Blocks
2 sec.	.05 sec.	1
4	.10	1
4	.05	2
6	.15	1
6	.10	2
6	.05	3
8	.20	1
8	.15	2
8	.10	3
8	.05	4

Up to nineteen output variable pages can be requested for each vehicle. The page numbering system and contents of each page are shown in Table I. All pages are printed for each vehicle, with the vehicles taken in sequence. Variable pages are printed in ascending order by page number, but are not necessarily consecutive since output printing can be suppressed by choice of the OUTPUT PAGE OPTION KEYS. In addition, the numbering system allows for four pages in the last four groups since one page is required per axle and some vehicles can have up to four axles. If the vehicle has less than four axles, certain output page numbers will not appear.

4.4.1 Sprung Mass Position Page. Variable page 01, Sprung Mass Position, shown in Figure 19, describes the simulated vehicle motion by its position and rotational attitude in the inertial coordinate system. The

Table I. Simulation Output Page Contents.

Page No.	Title	Variables
01	Sprung Mass Position (Inertial Coordinate System)	Forward, Lateral and Vertical Translation Roll, Pitch and Heading Angles Turn Radius Body Sideslip Angle Articulation Angle
02	Sprung Mass Velocity (Inertial Coordinate System)	Forward, Lateral and Vertical Roll, Pitch, Heading and Articulation Rate
03	Sprung Mass Accelerations (Inertial & Body Fixed Coordinate Systems)	Forward, Lateral and Vertical Roll, Pitch and Heading Vehicle Longitudinal and Lateral
04-07	Tire Forces* (Tire Axis System)	Vertical, Longitudinal and Lateral Longitudinal and Lateral Coefficient of Friction Steer Angle (First Vehicle Front Axle Only)
08-11	Brake Data Summary* (Tire Axis System)	Treadle Pressure, Brake Pressure and Brake Torque Wheel Slip and Brake Force Wheel Angular Velocity and Acceleration
12-15	Lateral Tire Forces and Moment Summary* (Tire Axis System)	Tire Sideslip Angle Lateral Force and Coefficient of Friction Aligning Torque
16-19	Unsprung Mass Summary* (Inertial Coordinate System)	Axle Position and Velocity (Vertical and Roll) Auxiliary Roll Torque Spring Deflection, Velocity and Force

*One page per axle, up to four axles per vehicle.

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 SPRUNG MASS POSITION

TIME (SEC)	FORWARD (FT)	LATERAL (FT)	VERTICAL (FT)	ROLL (DEG)	PITCH (DEG)	HEADING (DEG)	TURN RADIUS (FT)	SIDE SLIP (DEG)	ARTICULATION ANGLE (DEG)
0.0	-26.3614	0.0	0.0	0.0	0.0	0.0	**********	0.0	0.0
0.05	-24.0514	0.0000	-0.0000	-0.0001	-0.0000	0.0000	**********	0.0001	0.0305
0.10	-21.9518	0.0000	-0.0000	-0.0021	-0.0000	0.0002	**********	-0.0001	0.2301
0.15	-19.6534	0.0000	-0.0001	-0.0070	-0.0002	0.0007	**********	-0.0006	0.7438
0.20	-17.4573	0.0000	-0.0003	-0.0137	-0.0010	0.0017	115360.5000	-0.0010	1.7002
0.25	-15.2643	0.0001	-0.0007	-0.0229	-0.0026	0.0034	45376.5859	-0.0008	3.1998
0.30	-13.0763	0.0002	-0.0011	-0.0342	-0.0029	0.0062	23647.0859	0.0004	5.2750
0.35	-10.8971	0.0006	-0.0012	-0.0479	0.0016	0.0107	14629.0703	0.0028	7.9971
0.40	-8.7305	0.0013	-0.0009	-0.0643	0.0078	0.0173	9802.0938	0.0067	11.3604
0.45	-6.5790	0.0024	-0.0003	-0.0836	0.0095	0.0266	6999.1914	0.0124	15.3872
0.50	-4.4442	0.0042	0.0003	-0.1059	0.0098	0.0393	5222.6172	0.0202	20.0705
0.55	-2.3269	0.0069	0.0011	-0.1311	0.0102	0.0558	4024.0713	0.0304	25.4032
0.60	-0.2280	0.0106	0.0018	-0.1590	0.0104	0.0766	3192.2388	0.0433	31.3764
0.65	1.8518	0.0156	0.0024	-0.1894	0.0110	0.1023	2588.1990	0.0593	37.9776
0.70	3.9114	0.0223	0.0029	-0.2219	0.0121	0.1335	2140.2341	0.0785	45.1949
0.75	5.9506	0.0308	0.0033	-0.2561	0.0134	0.1704	1799.2827	0.1014	53.0143
0.80	7.9689	0.0415	0.0038	-0.2915	0.0146	0.2137	1534.7043	0.1280	61.4235
0.85	9.9663	0.0547	0.0043	-0.3279	0.0155	0.2636	1326.0334	0.1586	70.3961
0.90	11.9426	0.0707	0.0049	-0.3649	0.0164	0.3206	1157.7603	0.1933	79.9233
0.95	13.8975	0.0899	0.0055	-0.4023	0.0172	0.3850	1020.8491	0.2322	89.9836
1.00	15.8310	0.1125	0.0062	-0.4398	0.0177	0.4572	908.1868	0.2754	100.5552
1.05	17.7428	0.1390	0.0068	-0.4771	0.0182	0.5374	815.3914	0.3227	111.5760
1.10	19.6328	0.1695	0.0074	-0.5117	0.0189	0.6258	733.5667	0.3747	122.8550
1.15	21.5009	0.2045	0.0081	-0.5424	0.0197	0.7223	668.8652	0.4315	134.2190
1.20	23.3468	0.2441	0.0086	-0.5703	0.0204	0.8270	615.9939	0.4919	145.5311
1.25	25.1706	0.2888	0.0092	-0.5947	0.0212	0.9398	571.7632	0.5557	156.6915
1.30	26.9722	0.3386	0.0098	-0.6163	0.0221	1.0605	535.7036	0.6218	167.6282
1.35	28.7516	0.3937	0.0105	-0.6351	0.0228	1.1890	504.2910	0.6898	178.2852
1.40	30.5085	0.4543	0.0111	-0.6509	0.0234	1.3249	478.0874	0.7592	188.6298
1.45	32.2431	0.5205	0.0117	-0.6640	0.0241	1.4679	455.2134	0.8297	198.6335
1.50	33.9552	0.5923	0.0124	-0.6740	0.0248	1.6176	435.8127	0.9006	208.2916
1.55	35.6445	0.6698	0.0130	-0.6810	0.0254	1.7736	418.1902	0.9719	217.5818
1.60	37.3115	0.7529	0.0137	-0.6851	0.0260	1.9354	403.0615	1.0431	226.5048
1.65	38.9556	0.8417	0.0143	-0.6864	0.0267	2.1028	390.3254	1.1138	235.0562
1.70	40.5771	0.9361	0.0150	-0.6852	0.0274	2.2752	378.6699	1.1838	243.2332
1.75	42.1760	1.0360	0.0156	-0.6820	0.0280	2.4522	368.1350	1.2528	251.0339
1.80	43.7520	1.1413	0.0162	-0.6768	0.0287	2.6335	359.5647	1.3204	258.4602
1.85	45.3053	1.2519	0.0169	-0.6699	0.0293	2.8186	351.7068	1.3865	265.5134
1.90	46.8359	1.3677	0.0175	-0.6616	0.0299	3.0071	344.5557	1.4510	272.2046
1.95	48.3433	1.4884	0.0182	-0.6519	0.0305	3.1986	338.0251	1.5137	278.5354
2.00	49.8281	1.6139	0.0189	-0.6411	0.0312	3.3927	331.9617	1.5748	284.5134

Figure 19. Example of sprung mass position page.

inertial coordinate system is located at the truck/tractor sprung mass center of gravity at time zero in the simulation (see Section 4.1.2). The vehicle position is defined by X (forward), Y (lateral), and Z (vertical) inertial coordinates of the vehicle sprung mass center of gravity during the simulation. For the truck/tractor, the initial coordinates are always zero. Trailers are always aligned behind the tractor so that they start from a negative forward position and zero lateral. Positive lateral is to the right of the vehicle. To avoid confusion from the differing sprung mass heights and road slopes, the vertical position always begins at zero and indicates relative change in elevation. Note that, by SAE convention, positive values of vertical position are downward, in the direction of gravity.

The attitude of the vehicle is given in the next three columns as defined by the Euler angle rotations (roll, pitch and heading) of the body fixed coordinate system (see Section 4.1.2) in the inertial coordinate system.

In addition, the position page contains lists of the instantaneous radius of turn (positive is right turn); the body sideslip angle (arc-tangent of the lateral over forward velocity at the center of gravity); and with articulated combinations, the articulation angle which is the difference between the heading angles of the leading and trailing vehicles (leading minus trailing).

4.4.2 Sprung Mass Velocity Page. Variable page 02, Sprung Mass Velocity, shown in Figure 20, describes the velocity of the sprung mass in the body fixed coordinate system. Forward velocity is along the longitudinal axis of the vehicle (x), Lateral velocity is positive to the right along the y-axis, and Vertical velocity is positive through the bottom of the vehicle. The velocity components given are the time rate of change of the vehicle position vector resolved into components along the body axis system. The forward velocity is the component along the vehicle longitudinal axis which may be interpreted as vehicle speed.

The Roll, Pitch, and Heading rates are obtained by resolving the vehicle rotation vector into components in the body fixed axis system. The user may note that the frequently used term "yaw rate" is the same as heading rate.

HSRI TRUCK AND TRACTOR-TRAILER DYNAMIC RESPONSE SIMULATION - T3DRS,V1 OUTPUT PAGE NO. 1.01.2
SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED
TRAILER NO. 1 SPRUNG MASS VELOCITY (BODY AXES)

TIME (SEC)	FORWARD (FT/SEC)	LATERAL (FT/SEC)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	PITCH (DEG/SEC)	HEADING (DEG/SEC)	ARTICULATION RATE (DEG/SEC)
0.0	44.00	0.0	0.0	0.0	0.0	0.0	0.0
0.05	44.00	0.00	-0.00	-0.01	-0.00	0.00	1.78
0.10	44.00	-0.00	-0.00	-0.07	-0.00	0.01	6.67
0.15	43.98	-0.00	-0.00	-0.12	-0.01	0.01	14.32
0.20	43.94	-0.00	-0.01	-0.16	-0.03	0.03	24.24
0.25	43.85	-0.00	-0.01	-0.21	-0.03	0.04	35.58
0.30	43.70	0.00	-0.01	-0.25	0.03	0.07	47.92
0.35	43.48	0.00	0.00	-0.30	0.14	0.11	60.82
0.40	43.20	0.01	0.02	-0.36	0.08	0.16	73.94
0.45	42.88	0.01	0.02	-0.41	0.01	0.22	87.12
0.50	42.54	0.01	0.02	-0.48	0.01	0.29	100.19
0.55	42.18	0.02	0.02	-0.53	0.01	0.37	113.11
0.60	41.80	0.03	0.02	-0.59	0.01	0.46	125.80
0.65	41.41	0.04	0.02	-0.63	0.02	0.57	138.24
0.70	41.01	0.06	0.02	-0.67	0.02	0.68	150.43
0.75	40.60	0.07	0.02	-0.70	0.02	0.80	162.33
0.80	40.19	0.09	0.02	-0.72	0.02	0.93	173.89
0.85	39.77	0.11	0.02	-0.74	0.01	1.07	185.10
0.90	39.34	0.13	0.02	-0.75	0.01	1.21	195.96
0.95	38.91	0.16	0.03	-0.75	0.00	1.37	206.40
1.00	38.48	0.18	0.03	-0.75	-0.00	1.52	216.40
1.05	38.05	0.21	0.03	-0.73	-0.00	1.69	223.65
1.10	37.61	0.25	0.03	-0.65	-0.00	1.85	226.94
1.15	37.17	0.28	0.03	-0.59	-0.00	2.01	227.16
1.20	36.73	0.32	0.03	-0.52	-0.01	2.18	224.99
1.25	36.29	0.35	0.03	-0.46	-0.01	2.34	221.21
1.30	35.85	0.39	0.03	-0.41	-0.01	2.49	216.11
1.35	35.40	0.43	0.03	-0.35	-0.02	2.65	210.14
1.40	34.96	0.46	0.03	-0.29	-0.02	2.79	203.64
1.45	34.51	0.50	0.03	-0.23	-0.02	2.93	196.72
1.50	34.07	0.54	0.03	-0.17	-0.02	3.06	189.49
1.55	33.62	0.57	0.03	-0.11	-0.03	3.18	182.19
1.60	33.17	0.60	0.04	-0.06	-0.02	3.29	174.78
1.65	32.73	0.64	0.04	-0.00	-0.03	3.40	167.34
1.70	32.28	0.67	0.04	0.04	-0.03	3.50	159.89
1.75	31.83	0.70	0.04	0.08	-0.03	3.58	152.43
1.80	31.38	0.72	0.04	0.12	-0.03	3.67	144.95
1.85	30.93	0.75	0.04	0.15	-0.03	3.74	137.66
1.90	30.49	0.77	0.04	0.18	-0.03	3.80	130.43
1.95	30.04	0.79	0.04	0.20	-0.03	3.86	123.32
2.00	29.59	0.81	0.04	0.22	-0.03	3.90	116.42

Figure 20. Example of sprung mass velocity page.

With articulated vehicles, the rate of change of the articulation angle is also shown.

4.4.3 Sprung Mass Acceleration Page. Variable page 03, Sprung Mass Acceleration, shown in Figure 21, describes the acceleration of the sprung mass in the body fixed coordinate system. The accelerations in a moving, rotating coordinate system referenced to an inertial system are given by the expressions

$$\dot{u} = \Sigma F_x / M + r \cdot v - q \cdot w$$

$$\dot{v} = \Sigma F_y / M + p \cdot w - r \cdot u$$

$$\dot{w} = \Sigma F_z / M - q \cdot u + p \cdot v$$

where

F_x, F_y, F_z = forces in the longitudinal, lateral, and vertical directions

M = vehicle mass

u = velocity along the x (forward) axis

v = velocity along the y (lateral) axis

w = velocity along the z (vertical) axis

p, q, r = rotation rates about the x, y, z axes

The dot denotes differentiation with respect to time.

The Forward, Lateral and Vertical accelerations on the left side of the page are the time derivatives of the velocities shown on the preceding page, and hence represent the velocity derivatives ($\dot{u}$, $\dot{v}$, $\dot{w}$) defined by the above equations. Most users, however, are interested in the total or inertial acceleration of the simulated vehicle (i.e., the first term on the right-hand side in the above equations). Therefore, a set of Longitudinal and Lateral inertial accelerations resolved into the body axis coordinate system are given on the right side of the page. In effect, these are equivalent to those accelerations felt while in the vehicle. The Longitudinal and Forward accelerations are effectively equivalent because of the small velocities and rotation rates normally involved in the longitudinal equation. (The same would be true for vertical acceleration if it were shown.) The lateral accelerations will differ in turning maneuvers, however, because of the "r · u" term, which is the centripetal acceleration.

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 SPRUNG MASS ACCELERATION (BODY AXES) | INERTIAL ACCEL. ALONG BODY AXES

TIME (SEC)	FORWARD (FT/SEC**2)	LATERAL (FT/SEC**2)	VERTICAL (FT/SEC**2)	ROLL (DEG/SEC**2)	PITCH (DEG/SEC**2)	HEADING (DEG/SEC**2)	LONGITUDINAL (FT/SEC**2)	LATERAL (FT/SEC**2)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0
0.05	-0.0053	0.0014	-0.0014	-0.7340	-0.0048	0.0628	-0.0053	0.0026
0.10	-0.1170	-0.0065	-0.0205	-1.2932	-0.0571	0.1348	-0.1170	-0.0016
0.15	-0.4767	-0.0083	-0.0642	-0.6240	-0.2060	0.1730	-0.4767	0.0027
0.20	-1.2013	-0.0023	-0.1025	-1.0644	-0.4522	0.2867	-1.2013	0.0169
0.25	-2.3833	0.0092	-0.0398	-0.7832	0.4662	0.4621	-2.3833	0.0428
0.30	-3.7605	0.0268	0.1531	-0.9514	2.2635	0.6434	-3.7605	0.0812
0.35	-5.0349	0.0467	0.3026	-1.1605	0.8304	0.8694	-5.0349	0.1295
0.40	-5.9390	0.0713	0.1165	-1.0603	-2.3535	1.0838	-5.9390	0.1905
0.45	-6.5658	0.0991	0.0649	-1.2705	-0.4939	1.3142	-6.5658	0.2623
0.50	-7.0437	0.1302	0.0401	-1.1464	0.1038	1.5391	-7.0437	0.3451
0.55	-7.4167	0.1657	-0.0237	-1.1035	-0.0877	1.7511	-7.4169	0.4394
0.60	-7.6551	0.2039	-0.0399	-1.0041	0.1658	1.9587	-7.6554	0.5429
0.65	-7.8874	0.2457	-0.0235	-0.9078	0.1750	2.1536	-7.8878	0.6559
0.70	-8.0774	0.2898	-0.0011	-0.6934	0.0743	2.3367	-8.0781	0.7764
0.75	-8.2367	0.3355	0.0170	-0.5114	-0.1496	2.5104	-8.2377	0.9031
0.80	-8.3271	0.3825	0.0366	-0.3736	-0.1477	2.6780	-8.3285	1.0353
0.85	-8.4204	0.4295	0.0455	-0.2529	-0.0404	2.8318	-8.4225	1.1711
0.90	-8.5725	0.4766	0.0366	-0.1461	-0.0153	2.9718	-8.5753	1.3099
0.95	-8.5909	0.5225	0.0173	-0.0532	-0.1734	3.1103	-8.5946	1.4501
1.00	-8.6004	0.5669	0.0069	0.0391	-0.1176	3.2365	-8.6053	1.5908
1.05	-8.6830	0.6083	0.0102	1.0449	0.0560	3.2593	-8.6893	1.7286
1.10	-8.7364	0.6594	0.0065	1.7376	-0.0365	3.2368	-8.7443	1.8733
1.15	-8.7902	0.6961	0.0078	0.9782	-0.0895	3.2831	-8.8001	2.0015
1.20	-8.7965	0.7213	0.0179	1.5118	0.0596	3.2405	-8.8085	2.1163
1.25	-8.8675	0.7392	0.0262	1.0488	0.0423	3.1745	-8.8818	2.2189
1.30	-8.8145	0.7431	0.0179	1.0950	-0.2424	3.1079	-8.8315	2.3032
1.35	-8.8587	0.7442	0.0214	1.2356	-0.0822	2.9801	-8.8783	2.3789
1.40	-8.8979	0.7362	0.0220	1.0467	-0.0138	2.8414	-8.9204	2.4389
1.45	-8.9023	0.7241	0.0166	1.2358	-0.0938	2.6904	-8.9279	2.4884
1.50	-8.8932	0.7064	0.0112	1.2367	-0.0904	2.5105	-8.9218	2.5249
1.55	-8.9517	0.6852	0.0114	1.1343	0.0200	2.3554	-8.9834	2.5512
1.60	-8.9227	0.6599	0.0148	1.0970	0.0405	2.1948	-8.9574	2.5668
1.65	-8.9240	0.6300	0.0096	0.9942	-0.0858	2.0205	-8.9618	2.5712
1.70	-8.9704	0.5992	0.0114	0.9222	0.0487	1.8746	-9.0111	2.5684
1.75	-8.9871	0.5661	0.0136	0.7052	0.0227	1.7276	-9.0306	2.5574
1.80	-8.9377	0.5263	0.0090	0.6867	-0.0206	1.5213	-8.9840	2.5338
1.85	-8.9814	0.4896	0.0072	0.5499	0.0111	1.3734	-9.0303	2.5072
1.90	-8.9134	0.4504	0.0081	0.5195	-0.0045	1.2121	-8.9647	2.4726
1.95	-8.9524	0.4108	0.0044	0.5078	0.0570	1.0063	-9.0059	2.4327
2.00	-8.9501	0.3717	0.0002	0.4372	-0.0390	0.8514	-9.0055	2.3980

Figure 21. Example of sprung mass acceleration page.

The Roll, Pitch and Heading accelerations are the resolution of the total rotational acceleration vector into the body fixed coordinate system. (The time derivatives of the rotational velocities appearing on the preceding page.)

4.4.4 Tire Forces Page. Variable pages 04-07, Tire Forces, shown in Figure 22, provide a summary of the vertical, longitudinal and lateral forces exerted on the tires at the tire/road interface. The forces are presented for tires on both the left and right sides of the axle, with each axle on a separate page. The forces are defined in the axis system of the wheel according to SAE convention (see Figure 23). All forces and moments acting on the tire are measured relative to the center of the tire/road contact patch which may be defined as the point of intersection of the road plane, wheel plane and a perpendicular plane through the wheel spin axis.

The Vertical force is the instantaneous force in the center of tire/road contact patch normal to the road. Vertical force on the tire in the upward direction is defined by SAE convention as positive. The Longitudinal force is the force in the road plane in the direction of the wheel heading. Negative values correspond to a braking force. Lateral force is the force in the road plane perpendicular to the wheel heading with positive values corresponding to a force on the tire to the right, when looking in the direction of wheel heading. A positive Lateral force results when the tire is steered to the right.

Two variables, "MU-X" and "MU-Y" are also printed. These variables are the respective ratios of the longitudinal and lateral forces to the vertical force, and represent the normalized friction levels being utilized in each direction.

4.4.5 Brake Data Summary Page. Variable pages 08-11, Brake Summary, provide detailed information on the brake function on the left and right wheels of each axle. The page, shown in Figure 24, lists the treadle pressure being applied by interpolation of the Treadle Pressure Table input for the simulation, and the brake pressure in the chamber that results from action of the time lags and rise times for each brake. Next is listed the actual brake torque produced at the wheel. If the wheel is moving,

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION TIRE FORCES

LEADING TANDEM AXLE

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	6631.73	-0.0	0.0	0.0	0.0	6631.73	-0.0	0.0	0.0	0.0
0.05	6631.82	-0.02	-0.47	-0.0000	-0.0001	6631.64	0.04	-0.47	0.0000	-0.0001
0.10	6633.20	0.78	-3.05	0.0001	-0.0005	6630.26	0.93	-3.04	0.0001	-0.0005
0.15	6640.73	2.05	-3.06	0.0003	-0.0005	6622.74	2.26	-3.05	0.0003	-0.0005
0.20	6651.25	-81.77	-1.92	-0.0123	-0.0003	6612.21	-81.26	-1.91	-0.0123	-0.0003
0.25	6666.18	-289.64	0.68	-0.0434	0.0001	6597.28	-283.29	0.67	-0.0437	0.0001
0.30	6696.63	-506.42	5.87	-0.0756	0.0009	6588.65	-504.29	5.78	-0.0765	0.0009
0.35	6807.78	-669.17	12.16	-0.0983	0.0018	6653.11	-666.37	11.89	-0.1002	0.0018
0.40	6963.82	-789.81	21.22	-0.1134	0.0030	6750.75	-786.39	20.58	-0.1165	0.0030
0.45	7125.03	-880.09	32.34	-0.1235	0.0045	6843.77	-876.15	31.08	-0.1280	0.0045
0.50	7291.95	-947.17	45.83	-0.1299	0.0063	6931.07	-942.70	43.59	-0.1360	0.0063
0.55	7464.41	-996.82	61.98	-0.1335	0.0083	7012.84	-991.97	58.29	-0.1415	0.0083
0.60	7641.70	-1033.87	80.20	-0.1353	0.0105	7089.77	-1028.68	74.50	-0.1451	0.0105
0.65	7823.71	-1061.15	100.82	-0.1356	0.0129	7161.98	-1055.72	92.42	-0.1474	0.0129
0.70	8009.32	-1081.00	123.24	-0.1350	0.0154	7230.52	-1075.43	111.45	-0.1487	0.0154
0.75	8197.94	-1095.16	147.19	-0.1336	0.0180	7296.04	-1089.50	131.27	-0.1493	0.0180
0.80	8388.90	-1106.44	172.49	-0.1319	0.0206	7359.23	-1100.71	151.68	-0.1496	0.0206
0.85	8581.38	-1114.31	198.63	-0.1299	0.0231	7420.89	-1108.60	172.25	-0.1494	0.0232
0.90	8774.76	-1119.36	225.23	-0.1276	0.0257	7481.66	-1113.70	192.65	-0.1489	0.0258
0.95	8969.47	-1123.35	251.93	-0.1253	0.0281	7542.09	-1117.73	212.63	-0.1482	0.0282
1.00	9162.14	-1126.68	278.58	-0.1230	0.0304	7602.56	-1121.08	232.10	-0.1475	0.0305
1.05	9355.21	-1128.62	305.72	-0.1206	0.0327	7663.64	-1123.21	251.59	-0.1466	0.0328
1.10	9546.36	-1129.66	335.70	-0.1183	0.0352	7726.64	-1124.58	273.08	-0.1455	0.0353
1.15	9727.22	-1130.45	358.62	-0.1162	0.0369	7799.91	-1125.92	289.17	-0.1444	0.0371
1.20	9903.02	-1131.11	378.58	-0.1142	0.0382	7878.27	-1126.82	303.02	-0.1430	0.0385
1.25	10071.76	-1130.88	394.47	-0.1123	0.0392	7963.66	-1127.09	313.98	-0.1415	0.0394
1.30	10233.25	-1131.38	404.60	-0.1106	0.0395	8056.32	-1127.84	320.82	-0.1400	0.0398
1.35	10390.34	-1131.32	412.72	-0.1089	0.0397	8153.37	-1128.17	326.36	-0.1384	0.0400
1.40	10540.21	-1130.89	415.66	-0.1073	0.0394	8257.65	-1128.15	328.33	-0.1366	0.0398
1.45	10684.59	-1130.64	415.19	-0.1058	0.0389	8367.41	-1128.20	328.00	-0.1348	0.0392
1.50	10823.01	-1130.73	411.44	-0.1045	0.0380	8483.14	-1129.69	325.48	-0.1331	0.0384
1.55	10954.93	-1130.02	403.60	-0.1032	0.0368	8605.36	-1128.32	320.13	-0.1311	0.0372
1.60	11081.15	-1129.96	392.47	-0.1020	0.0354	8733.29	-1128.56	312.48	-0.1292	0.0358
1.65	11201.87	-1129.75	378.12	-0.1009	0.0338	8866.71	-1128.60	302.50	-0.1273	0.0341
1.70	11317.50	-1129.28	360.67	-0.0998	0.0319	9005.20	-1128.39	290.19	-0.1253	0.0322
1.75	11428.76	-1129.06	340.68	-0.0988	0.0298	9148.06	-1128.39	275.86	-0.1233	0.0302
1.80	11536.39	-1129.17	318.71	-0.0979	0.0276	9294.54	-1128.70	259.87	-0.1214	0.0280
1.85	11640.26	-1128.63	294.46	-0.0970	0.0253	9444.80	-1128.36	241.89	-0.1195	0.0256
1.90	11741.21	-1128.69	268.60	-0.0961	0.0229	9597.98	-1129.60	222.38	-0.1176	0.0232
1.95	11839.79	-1128.39	241.74	-0.0953	0.0204	9753.50	-1128.48	201.76	-0.1157	0.0207
2.00	11935.42	-1127.81	212.97	-0.0945	0.0178	9912.00	-1128.06	179.25	-0.1138	0.0181

Figure 22. Example of tire forces page.

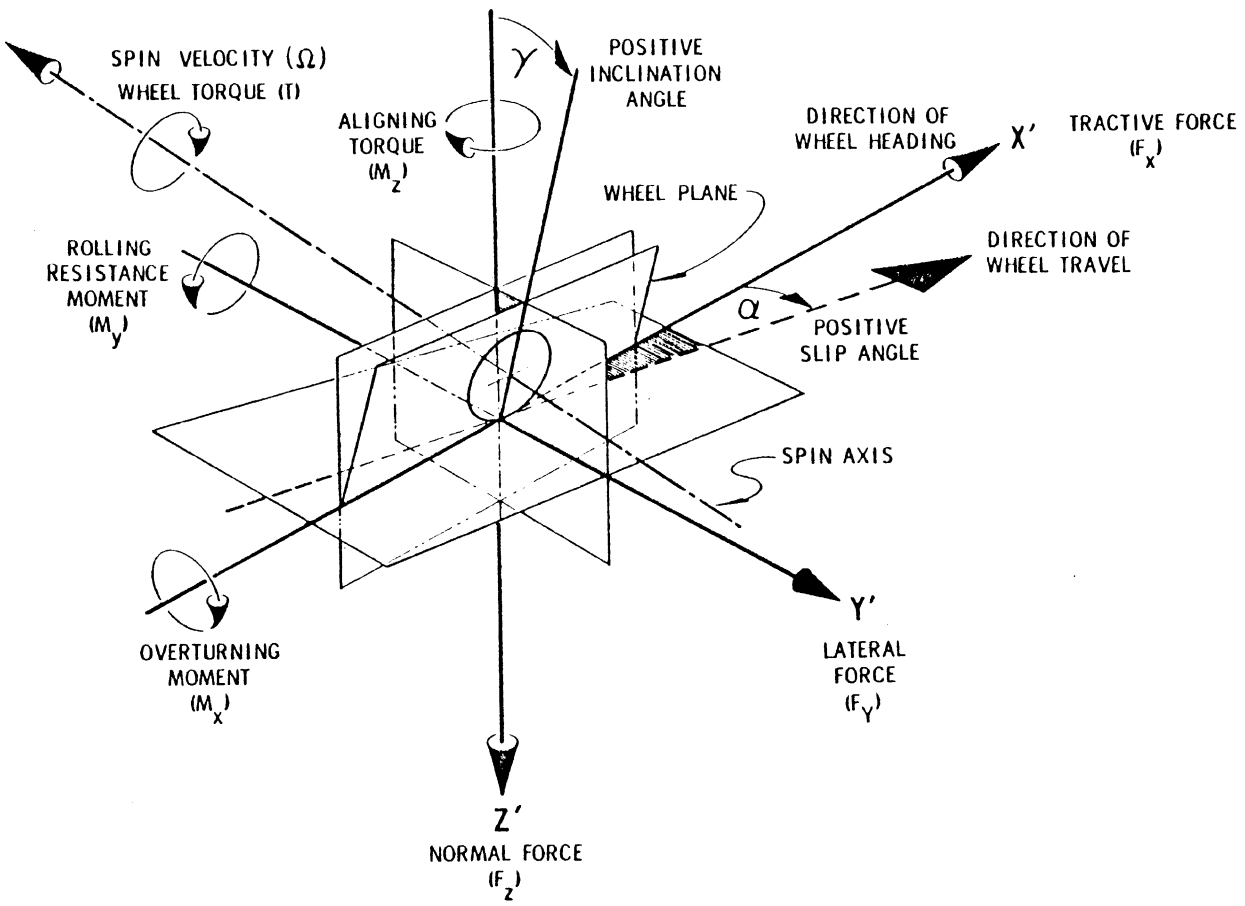


Figure 23. SAE Tire Axis System

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - BRAKE SUMMARY

LEADING TANDEM AXLE

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	13.12	0.0	0.0	-0.02	0.0000	26.14	0.00	0.0	0.0	0.04	-.0000	26.14	-0.00
0.10	25.00	0.0	0.0	0.78	-.0000	26.14	-0.04	0.0	0.0	0.93	-.0000	26.14	-0.04
0.15	25.00	0.13	134.22	2.05	-.0000	26.13	-0.41	0.13	134.22	2.26	-.0001	26.13	-0.42
0.20	25.00	2.65	2646.26	-81.77	0.0019	26.05	-2.35	2.65	2646.26	-81.26	0.0019	26.05	-2.37
0.25	25.00	7.57	7569.21	-289.64	0.0069	25.87	-4.05	7.57	7569.21	-288.29	0.0069	25.87	-4.12
0.30	25.00	12.01	12010.79	-506.42	0.0119	25.65	-4.20	12.01	12010.79	-504.28	0.0121	25.65	-4.30
0.35	25.00	15.32	15320.59	-669.17	0.0155	25.43	-4.25	15.32	15320.59	-666.37	0.0158	25.42	-4.39
0.40	25.00	17.79	17786.92	-789.81	0.0179	25.20	-4.32	17.79	17786.92	-786.39	0.0184	25.19	-4.49
0.45	25.00	19.62	19624.78	-880.09	0.0195	24.98	-4.36	19.62	19624.78	-876.15	0.0202	24.96	-4.54
0.50	25.00	20.99	20994.32	-947.17	0.0205	24.75	-4.39	20.99	20994.32	-942.70	0.0215	24.73	-4.60
0.55	25.00	22.01	22014.90	-996.82	0.0211	24.53	-4.43	22.01	22014.90	-991.97	0.0223	24.50	-4.66
0.60	25.00	22.78	22775.41	-1033.87	0.0214	24.30	-4.46	22.78	22775.41	-1028.68	0.0229	24.26	-4.71
0.65	25.00	23.34	23342.18	-1061.15	0.0214	24.07	-4.50	23.34	23342.18	-1055.72	0.0233	24.03	-4.76
0.70	25.00	23.76	23764.52	-1081.00	0.0213	23.84	-4.55	23.76	23764.52	-1075.43	0.0235	23.79	-4.81
0.75	25.00	24.08	24079.23	-1095.16	0.0211	23.61	-4.62	24.08	24079.23	-1089.50	0.0236	23.55	-4.89
0.80	25.00	24.31	24313.73	-1106.44	0.0208	23.38	-4.63	24.31	24313.73	-1100.71	0.0236	23.31	-4.90
0.85	25.00	24.49	24488.51	-1114.31	0.0205	23.14	-4.67	24.49	24488.51	-1108.60	0.0236	23.07	-4.94
0.90	25.00	24.62	24618.74	-1119.36	0.0201	22.90	-4.74	24.62	24618.74	-1113.70	0.0235	22.82	-5.00
0.95	25.00	24.72	24715.77	-1123.35	0.0198	22.66	-4.77	24.72	24715.77	-1117.73	0.0234	22.58	-5.04
1.00	25.00	24.79	24788.08	-1126.69	0.0194	22.42	-4.79	24.79	24788.08	-1121.08	0.0233	22.33	-5.05
1.05	25.00	24.84	24841.96	-1128.62	0.0190	22.17	-4.82	24.84	24841.96	-1123.21	0.0231	22.08	-5.09
1.10	25.00	24.88	24882.11	-1129.66	0.0187	21.93	-4.87	24.88	24882.11	-1124.58	0.0230	21.83	-5.11
1.15	25.00	24.91	24912.01	-1130.45	0.0184	21.68	-4.90	24.91	24912.01	-1125.92	0.0228	21.58	-5.11
1.20	25.00	24.93	24934.28	-1131.11	0.0180	21.43	-4.92	24.93	24934.28	-1126.82	0.0226	21.33	-5.12
1.25	25.00	24.95	24950.91	-1130.88	0.0177	21.18	-4.97	24.95	24950.91	-1127.09	0.0223	21.08	-5.15
1.30	25.00	24.96	24963.31	-1131.38	0.0175	20.92	-4.97	24.96	24963.31	-1127.84	0.0221	20.82	-5.14
1.35	25.00	24.97	24972.55	-1131.32	0.0172	20.67	-5.00	24.97	24972.55	-1128.17	0.0218	20.57	-5.15
1.40	25.00	24.98	24979.43	-1130.88	0.0169	20.42	-5.04	24.98	24979.43	-1128.15	0.0216	20.32	-5.17
1.45	25.00	24.98	24984.55	-1130.64	0.0167	20.16	-5.06	24.98	24984.55	-1128.20	0.0213	20.07	-5.18
1.50	25.00	24.99	24988.37	-1130.73	0.0165	19.90	-5.07	24.99	24988.37	-1128.69	0.0210	19.81	-5.16
1.55	25.00	24.99	24991.21	-1130.02	0.0163	19.65	-5.11	24.99	24991.21	-1128.32	0.0207	19.56	-5.19
1.60	25.00	24.99	24993.33	-1129.96	0.0161	19.39	-5.11	24.99	24993.33	-1128.56	0.0204	19.31	-5.18
1.65	25.00	24.99	24994.93	-1129.75	0.0159	19.13	-5.13	24.99	24994.93	-1128.60	0.0201	19.05	-5.18
1.70	25.00	25.00	24996.09	-1129.28	0.0158	18.87	-5.15	25.00	24996.09	-1128.39	0.0198	18.80	-5.19
1.75	25.00	25.00	24996.99	-1129.06	0.0156	18.61	-5.17	25.00	24996.99	-1128.39	0.0195	18.54	-5.20
1.80	25.00	25.00	24997.60	-1129.17	0.0155	18.35	-5.16	25.00	24997.60	-1128.70	0.0192	18.29	-5.18
1.85	25.00	25.00	24998.10	-1128.63	0.0153	18.10	-5.19	25.00	24998.10	-1128.36	0.0189	18.03	-5.20
1.90	25.00	25.00	24998.41	-1128.69	0.0152	17.84	-5.19	25.00	24998.41	-1128.60	0.0186	17.77	-5.19
1.95	25.00	25.00	24998.71	-1128.39	0.0150	17.58	-5.20	25.00	24998.71	-1128.48	0.0183	17.52	-5.20
2.00	25.00	25.00	24999.02	-1127.81	0.0149	17.32	-5.23	25.00	24999.02	-1128.06	0.0180	17.26	-5.22

Figure 24. Example output of brake summary page.

the torque corresponds to that of the brake torque coefficient or table value input at the applied pressure. However, if the wheel reaches lock-up, the actual torque is limited by the tire friction and may be less than the attempted value. In addition to brake torque, the tire brake force is listed which, in effect, is an indication of the portion of the brake torque applied to decelerating the vehicle. In the simulation, the torque is actually applied to the wheel causing it to decelerate, with the tire brake force resulting from longitudinal slip in the tire model. Hence, at any instant of time a portion of the brake torque may be devoted to decelerating the wheel rather than to developing actual braking force. The wheel slip, angular wheel velocity and angular wheel acceleration are also listed for their utility in investigating antilock braking system performance.

4.4.6 Lateral Pages. Variable pages 12-15, Lateral Tire Force and Moment Summary, shown in Figure 25, provide detailed information on the cornering performance of each tire on the vehicle combination. Each page lists the left and right side cornering parameters for an axle on the vehicle. The first parameter is tire sideslip angle, which by SAE convention is positive when the tire is sideslipping to the right of its heading direction (see Fig. 23). Next is listed the tire lateral force, which is the force on the tire in the road plane perpendicular to the wheel heading, positive force being to the right. The parameter "MU-Y" is the lateral force value normalized by the instantaneous vertical load. Finally, the aligning torque developed on the tire is listed. The aligning torque is perpendicular to the road plane and is positive clockwise looking down on the tire.

On axles with dual wheel assemblies, the values listed on this page are the total for the two tires.

4.4.7 Unsprung Mass Summary Page. Variable pages 16-19, Unsprung Mass Summary, provide detailed information as to what is happening to each of the axles and suspensions on the simulated vehicle. On the left side of the page, shown in Figure 26, are given axle motion parameters; specifically, the position and velocity for the axle's two degrees of freedom (vertical and roll). The axle vertical and roll positions are measured relative to the inertial coordinate system. Positive vertical is down and is the

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0004	-0.4723	-0.0001	0.0	0.0004	-0.4723	-0.0001	0.0
0.10	0.0025	-3.0457	-0.0005	0.0	0.0025	-3.0444	-0.0005	0.0
0.15	0.0025	-3.0589	-0.0005	0.0	0.0025	-3.0507	-0.0005	0.0
0.20	0.0016	-1.9208	-0.0003	0.0	0.0016	-1.9096	-0.0003	0.0
0.25	-0.0006	0.6778	0.0001	0.0	-0.0006	0.6708	0.0001	0.0
0.30	-0.0048	5.8730	0.0009	0.0	-0.0048	5.7792	0.0009	0.0
0.35	-0.0099	12.1583	0.0018	0.0	-0.0099	11.8851	0.0018	0.0
0.40	-0.0168	21.2247	0.0030	0.0	-0.0169	20.5830	0.0030	0.0
0.45	-0.0251	32.3371	0.0045	0.0	-0.0251	31.0767	0.0045	0.0
0.50	-0.0347	45.8300	0.0063	0.0	-0.0348	43.5923	0.0063	0.0
0.55	-0.0459	61.9841	0.0083	0.0	-0.0459	58.2870	0.0083	0.0
0.60	-0.0580	80.2044	0.0105	0.0	-0.0581	74.4966	0.0105	0.0
0.65	-0.0712	100.8151	0.0129	0.0	-0.0713	92.4183	0.0129	0.0
0.70	-0.0850	123.2435	0.0154	0.0	-0.0852	111.4496	0.0154	0.0
0.75	-0.0992	147.1950	0.0180	0.0	-0.0994	131.2674	0.0180	0.0
0.80	-0.1136	172.4881	0.0206	0.0	-0.1139	151.6775	0.0206	0.0
0.85	-0.1279	198.6342	0.0231	0.0	-0.1283	172.2474	0.0232	0.0
0.90	-0.1419	225.2343	0.0257	0.0	-0.1423	192.6528	0.0258	0.0
0.95	-0.1552	251.9317	0.0281	0.0	-0.1558	212.6296	0.0282	0.0
1.00	-0.1680	278.5791	0.0304	0.0	-0.1687	232.1034	0.0305	0.0
1.05	-0.1806	305.7227	0.0327	0.0	-0.1814	251.5879	0.0328	0.0
1.10	-0.1943	335.6958	0.0352	0.0	-0.1953	273.0833	0.0353	0.0
1.15	-0.2037	358.6191	0.0369	0.0	-0.2049	289.1694	0.0371	0.0
1.20	-0.2113	378.5803	0.0382	0.0	-0.2126	303.0171	0.0385	0.0
1.25	-0.2164	394.4719	0.0392	0.0	-0.2179	313.9775	0.0394	0.0
1.30	-0.2185	404.6030	0.0395	0.0	-0.2201	320.8179	0.0398	0.0
1.35	-0.2195	412.7163	0.0397	0.0	-0.2212	326.3584	0.0400	0.0
1.40	-0.2179	415.6582	0.0394	0.0	-0.2197	328.3271	0.0398	0.0
1.45	-0.2148	415.1943	0.0389	0.0	-0.2166	327.9983	0.0392	0.0
1.50	-0.2101	411.4404	0.0380	0.0	-0.2120	325.4766	0.0384	0.0
1.55	-0.2036	403.6021	0.0368	0.0	-0.2056	320.1328	0.0372	0.0
1.60	-0.1957	392.4668	0.0354	0.0	-0.1977	312.4790	0.0358	0.0
1.65	-0.1865	378.1211	0.0338	0.0	-0.1885	302.5024	0.0341	0.0
1.70	-0.1761	360.6746	0.0319	0.0	-0.1781	290.1882	0.0322	0.0
1.75	-0.1647	340.6843	0.0298	0.0	-0.1667	275.8623	0.0302	0.0
1.80	-0.1527	318.7136	0.0276	0.0	-0.1545	259.8665	0.0280	0.0
1.85	-0.1398	294.4583	0.0253	0.0	-0.1415	241.8901	0.0256	0.0
1.90	-0.1264	268.5969	0.0229	0.0	-0.1280	222.3804	0.0232	0.0
1.95	-0.1128	241.7359	0.0204	0.0	-0.1143	201.7634	0.0207	0.0
2.00	-0.0986	212.9695	0.0178	0.0	-0.0999	179.2546	0.0181	0.0

Figure 25. Example of tire lateral force and moment summary page.

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - UNSPRUNG MASS SUMMARY

LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.0
0.05	0.0	-0.0000	0.0	-0.0006	4.57	-0.0000	-0.0034	-0.61	0.0000	0.0041	0.75
0.10	0.0	-0.0002	0.0	-0.0129	66.57	-0.0004	-0.0117	-4.72	0.0007	0.0273	8.48
0.15	0.0	-0.0015	0.0	-0.0343	193.11	-0.0004	0.0202	-3.27	0.0030	0.0748	29.65
0.20	0.0	-0.0034	0.0	-0.0418	366.02	0.0024	0.1054	-13.45	0.0090	0.1823	46.80
0.25	0.0	-0.0060	0.0	-0.0627	598.30	0.0091	0.1362	-39.57	0.0200	0.2319	56.24
0.30	0.0001	-0.0094	0.0069	-0.0744	874.61	0.0139	0.0266	-88.94	0.0299	0.1405	48.95
0.35	0.0008	-0.0135	0.0224	-0.0925	1211.50	0.0101	-0.1958	-199.01	0.0324	-0.0568	-8.57
0.40	0.0020	-0.0187	0.0235	-0.1125	1611.20	-0.0001	-0.1220	-311.14	0.0295	0.0396	-61.20
0.45	0.0032	-0.0247	0.0235	-0.1300	2076.61	-0.0018	0.0299	-338.03	0.0365	0.2188	-17.47
0.50	0.0044	-0.0318	0.0235	-0.1519	2615.09	-0.0014	-0.0235	-363.51	0.0469	0.1915	38.24
0.55	0.0055	-0.0398	0.0235	-0.1696	3220.49	-0.0030	-0.0313	-394.21	0.0566	0.2088	98.49
0.60	0.0067	-0.0488	0.0235	-0.1872	3892.17	-0.0042	-0.0199	-414.89	0.0679	0.2441	179.42
0.65	0.0079	-0.0585	0.0235	-0.2026	4621.61	-0.0055	-0.0343	-435.79	0.0803	0.2492	266.22
0.70	0.0091	-0.0689	0.0235	-0.2142	5399.75	-0.0075	-0.0439	-459.44	0.0928	0.2568	358.27
0.75	0.0103	-0.0799	0.0235	-0.2242	6218.99	-0.0099	-0.0486	-484.40	0.1057	0.2655	454.72
0.80	0.0114	-0.0913	0.0235	-0.2310	7068.79	-0.0123	-0.0452	-506.47	0.1193	0.2788	558.26
0.85	0.0126	-0.1030	0.0235	-0.2356	7941.62	-0.0149	-0.0574	-530.84	0.1331	0.2740	662.68
0.90	0.0138	-0.1148	0.0235	-0.2378	8830.68	-0.0183	-0.0735	-561.68	0.1463	0.2628	762.82
0.95	0.0150	-0.1267	0.0235	-0.2384	9730.11	-0.0222	-0.0720	-593.79	0.1593	0.2672	863.05
1.00	0.0161	-0.1386	0.0235	-0.2375	10634.04	-0.0258	-0.0615	-621.47	0.1727	0.2784	968.20
1.05	0.0173	-0.1504	0.0235	-0.2349	11531.94	-0.0291	-0.0662	-648.85	0.1863	0.2629	1071.72
1.10	0.0185	-0.1619	0.0235	-0.2164	12349.68	-0.0323	-0.0505	-672.82	0.1986	0.2370	1164.26
1.15	0.0197	-0.1717	0.0235	-0.1792	13090.37	-0.0346	-0.0323	-689.39	0.2103	0.2374	1255.34
1.20	0.0208	-0.1804	0.0235	-0.1677	13765.42	-0.0358	-0.0117	-697.04	0.2219	0.2246	1343.91
1.25	0.0220	-0.1880	0.0235	-0.1339	14359.80	-0.0366	-0.0137	-703.60	0.2324	0.2000	1423.03
1.30	0.0232	-0.1942	0.0235	-0.1178	14903.00	-0.0373	0.0046	-706.81	0.2420	0.1966	1497.82
1.35	0.0244	-0.1996	0.0235	-0.0965	15376.51	-0.0367	0.0209	-700.86	0.2516	0.1861	1571.13
1.40	0.0256	-0.2037	0.0235	-0.0711	15788.77	-0.0357	0.0227	-693.08	0.2604	0.1676	1637.94
1.45	0.0267	-0.2069	0.0235	-0.0540	16139.91	-0.0346	0.0288	-683.71	0.2682	0.1474	1696.69
1.50	0.0279	-0.2090	0.0235	-0.0294	16420.03	-0.0327	0.0513	-666.64	0.2754	0.1441	1752.85
1.55	0.0291	-0.2099	0.0235	-0.0081	16632.55	-0.0299	0.0636	-643.00	0.2824	0.1312	1805.69
1.60	0.0303	-0.2098	0.0235	0.0119	16779.67	-0.0266	0.0687	-616.79	0.2885	0.1122	1851.57
1.65	0.0314	-0.2087	0.0235	0.0311	16864.57	-0.0230	0.0823	-586.95	0.2938	0.1034	1892.07
1.70	0.0326	-0.2067	0.0235	0.0481	16894.21	-0.0184	0.0964	-549.97	0.2990	0.0984	1931.88
1.75	0.0338	-0.2040	0.0235	0.0622	16876.77	-0.0137	0.0966	-512.73	0.3035	0.0815	1965.19
1.80	0.0350	-0.2005	0.0235	0.0752	16815.39	-0.0085	0.1109	-471.07	0.3075	0.0805	1996.60
1.85	0.0361	-0.1964	0.0235	0.0881	16717.14	-0.0028	0.1143	-426.00	0.3115	0.0713	2026.25
1.90	0.0373	-0.1918	0.0235	0.0974	16586.13	0.0030	0.1167	-380.17	0.3149	0.0618	2051.87
1.95	0.0385	-0.1867	0.0235	0.1061	16423.63	0.0091	0.1239	-332.13	0.3179	0.0580	2075.16
2.00	0.0397	-0.1811	0.0235	0.1155	16238.18	0.0152	0.1233	-284.10	0.3206	0.0494	2095.36

Figure 26. Example of unsprung mass summary page.

elevation relative to its starting position. Roll is positive in the clockwise direction facing forward on the vehicle. Roll angle is always measured relative to the horizontal X-Y plane in the inertial coordinate system.

Suspension motions and forces are given on a side-to-side basis (at the suspension spring locations). The auxiliary roll torque arising from the auxiliary roll stiffness is listed first since it is associated with both sides of the suspension. A positive torque corresponds to a positive roll moment exerted on the vehicle sprung mass.

Thence the relative suspension deflection, velocity and force is listed for each side of the suspension. The deflection is indicated in terms of its change from the static loaded deflection, with positive values equivalent to extension of the suspension. The suspension force is actually the change in force from its static value. Positive force is a downward force on the sprung mass. The suspension force is the total of contributions from the springs, coulomb and viscous friction and braking load transfer effects.

5.0 PROGRAM DIAGNOSTICS

Errors in operation of T3DRS:V1 occur basically in two categories—Input Errors and Simulation Run Errors. Only a few error messages are contained within the program so that the user needs to be aware of some of the pitfalls that may be experienced in order to identify the proper corrective action. In the normal batch running mode, the user will find the error only by the fact that the program fails to run properly and a correction and resubmission is required.

5.1 Input Errors

The most critical operation and most likely source of errors in using the program occurs in the process of reading input data describing the vehicle and maneuver desired. Since the data type is only identified by its location in a sequence of input lines, one data line missing, out of place, or with incorrect format can confound the entire data reading process. For this reason, the users should consult Section 3 of this Manual and the numerous examples of input provided when preparing an input list. The severity of any error depends on its meaning to the program when read, and the type of computer system on which the simulation is operating. The most common error is a simple format error. Systems that allow a free read format can significantly reduce this type of problem.

Two error messages are incorporated in the input subroutine of the program. Tables in the table lookup option are identified by the whole number value following the negative sign keying the table lookup. Unique numbers must be used for each table, unless the table is to be used at multiple points on the vehicle. If the number identifying a table for one type of parameter (e.g., suspension spring rate) is inadvertently assigned for a second type of parameter (e.g., brake torque), an error message to this effect is printed and execution terminates.

The second error message relates to the value for the DRIVER TRANSPORT LAG parameter, included in the path-follower model. If the value assigned is greater than one second, the simulated vehicle is certain to be unstable and unable to run. Hence, an error message is printed indicating that the value is too large and program execution is terminated.

Recognizing that errors will occur, several scenarios of possible consequences are given below.

1) Non-Fatal Errors - In simple cases where a parametric value is misread (due to a forgivable format error) or values are interchanged (due to lines being out of order), the program may not recognize that an error has occurred. In that case, the program may successfully complete the read process and execute the simulation even though with an erroneous vehicle description. To discover such errors, the user should continually review the input echo pages and vehicle summary page to ensure that the proper vehicle conditions have been obtained.

2) Fatal Errors - The more common case is an error that is incompatible with the input reading process resulting in a system interrupt and termination of the program execution. Since the input echo is printed after every few lines of reading, the major portion of the input successfully read is reflected in the output obtained. For diagnosis of the problem, the user should review the echoed portion of the input, then the lines immediately following the termination point as the likely locations of the error.

5.2 Simulation Run Errors

Once the calculation process constituting the vehicle simulation has begun, only one type of error will occur that will halt the execution. Normal job termination occurs by either the vehicle reaching a full stop, or simulation to the MAXIMUM SIMULATION TIME limit specified in the input. Otherwise, the simulation may terminate with the message "IHLF=11." The message derives from the inability of the integration process (the IBM Scientific Subroutine Package HPCG) to converge on a solution at a particular point in time. Integration is normally carried out at 0.0025-second time steps with the option of halving the time step when necessary to meet an error criteria. The integration algorithm is allowed to halve the time step eleven times in an effort to achieve a satisfactory integration, and

if unsuccessful, the execution is terminated with the above error message. As a general rule to prevent this error, the user should ensure that all dynamic systems being simulated have a natural frequency of less than 20 Hz. In particular, this error most commonly occurs when inertia values are inordinately low or stiffness values (especially spring and tire rates) are too high. In general, a simple check for this is to ensure that the smallest mass connected to any spring has a mass (in pounds) to spring rate (pounds/inch) ratio greater than 0.025 inches.

Finally, the simulation is only expected to be valid in maneuvers up to the severity point where a wheel lifts off the ground. The above error will often occur after a prolonged period of wheel lift-off or when the vehicle has reached a divergent rollover condition. The accuracy of the calculations up to this point is limited by the small angle assumptions used in the programming. However, it should be found that the wheel lift-off condition occurs at body roll angles of 8-10 degrees with most heavy vehicles simulated, whereas the small angle assumptions should not create significant error until angles approach 20 degrees.

6.0 REFERENCES

1. Murphy, R.W., Bernard, J.E., and Winkler, C.B. A Computer-Based Mathematical Method for Predicting the Braking Performance of Trucks and Tractor-Trailers. Phase I Report, Motor Truck Braking and Handling Performance Study, Highway Safety Research Institute, The University of Michigan, Ann Arbor, September 15, 1972. (Available from the National Technical Information Service, Springfield, Va., 22151; Report PB-212-805.)

2. Bernard, J.E., Winkler, C.B., and Fancher, P.S. A Computer-Based Mathematical Method for Predicting the Directional Response of Trucks and Tractor-Trailers. Phase II Technical Report, Motor Truck Braking and Handling Performance Study, Highway Safety Research Institute, The University of Michigan, Ann Arbor, June 1, 1973. (Available from the National Technical Information Service, Springfield, Va., 22151; Report PB-221-630.)

3. Winkler, C.B., et al. Predicting the Braking Performance of Trucks and Tractor-Trailers. Phase III Technical Report, Motor Truck Braking and Handling Performance Study, Highway Safety Research Institute, The University of Michigan, Ann Arbor, June 1976. (Available from the National Technical Information Service, Springfield, Va., 22151; Report PB-263216; Appendices PB-266706.)

4. Gurney, J.W. and Bernard J.E. "Utilization of a Computer Simulation as an Aid to Predict Compliance with FMVSS 121." SAE Paper No. 740137, March 1974.

5. Gillespie, T.D. Validation of the MVMA/HSRI Phase II Straight Truck Directional Response Simulation. Final Report, MVMA Project #1.29, Motor Truck Braking and Handling Performance Study, Highway Safety Research Institute, The University of Michigan, Ann Arbor, Report #UM-HSRI-78-46, October 1978.

6. Fancher, P.S., Mallikarjunarao, C., and Nisonger, R.L. Simulation of the Directional Response Characteristics of Tractor-Semitrailers Vehicles. Final Report, MVMA Project #1.39, Highway Safety Research Institute, The University of Michigan, Ann Arbor, Report #UM-HSRI-79-9, March 1979.

7. Ervin, R.D., et al. Ad Hoc Study of Certain Safety-Related Aspects of Double-Bottom Tankers. Final Report, Contract No. MPA-78-002A, Highway Safety Research Institute, The University of Michigan, Ann Arbor, Report #UM-HSRI-78-18, May 7, 1978.

8. Fancher, P. and MacAdam, C. "Computer Analysis of Antilock System Performance in the Braking of Commercial Vehicles." Proceedings of a Conference on Braking of Road Vehicles, The Inst. of Mech. Engrs., March 23-25, 1976.

9. MacAdam, C.C. "A General Purpose Simulation for Antilock Braking Systems." Proceedings, The Symposium on Commercial Vehicle Braking and Handling, Highway Safety Research Institute, The University of Michigan, Ann Arbor, May 5-7, 1975.

10. Fancher, P.S. "Prediction of Braking and Directional Responses of Commercial Vehicles." Proceedings, Symposium on Commercial Vehicle Braking and Handling, Highway Safety Research Institute, The University of Michigan, Ann Arbor, May 5-7, 1975.

11. Fancher, P.S. "Braking Performance of Commercial Vehicles Equipped with Antilock Systems." Proceedings, An Overview of Simulation in Highway Transportation, Part 2, Simulation Council Proceeding Series, Vol. 7, N. 2, p. 167.

12. Bernard, J.E., Starr, D., and Gupta, R. Programs for Estimating Inertial Properties of Trucks and Trailers. Highway Safety Research Institute, The University of Michigan, Ann Arbor, August 9, 1973.

13. Ervin, R.D. and Fancher, P.S. "Preliminary Measurements of the Longitudinal Traction Properties of Truck Tires." SAE Paper No. 741139, November 1974.

14. Ervin, R.D., MacAdam, C.C., and Fancher, P.S. The Longitudinal Traction Characteristics of Truck Tires as Measured on Dry Pavements. Highway Safety Research Institute, The University of Michigan, Ann Arbor, Report No. UM-HSRI-PF-75-3, February 1975.

15. Ervin, R.D., et al. Effects of Tire Properties on Truck and Bus Handling, Vol. II, Appendix C. Final Report, Contract No. DOT-HS-4-00943, Highway Safety Research Institute, The University of Michigan, Report No. UM-HSRI-76-11-3, December 1976. (Available from National Technical Information Service, Springfield, Va., 22151; Report No. PB-263879/9.)

16. Bird, K.D. and Schuring, D.J. "Truck Tire Testing on TIRF." Proceedings of a Symposium on Commercial Vehicle Braking and Handling, Highway Safety Research Institute, The University of Michigan, Ann Arbor, May 5-7, 1975.

17. Ervin, R.D. "Mobile Measurements of Truck Tire Traction." Proceedings of a Symposium on Commercial Vehicle Braking and Handling, Highway Safety Research Institute, The University of Michigan, May 5-7, 1975.

18. Ervin, R.D. Mechanical Properties of Leaf Springs. MVMA Project #1.50, Third Quarterly Report, Highway Safety Research Institute, The University of Michigan, March 31, 1979.

19. MacAdam, C.C. "An Optimal Preview Control for Linear Systems and Its Application in Closed-Loop Vehicle Simulation." Paper submitted for publication in the Journal of Dynamic Systems, Measurement and Control.

20. Bernard, J.E. "Some Time-Saving Methods for the Digital Simulation of Highway Vehicles." Simulation, Vol. 21, No. 6, December 1973.

21. Bernard, J.E. "An Alternative to the Roll Axis for Use in Commercial Vehicle Simulation." Vehicle Systems Dynamics, No. 4, 1975, pp. 211-222.

APPENDIX A

SAMPLE RUN OF A TRUCK

The following pages are copies of the complete computer output package obtained from a four-second simulation of a straight truck in a step-steer maneuver. The first four pages are an echo of the input with a summary of composite vehicle characteristics. These pages are normally reviewed to ensure that the desired vehicle and maneuver is being simulated. The remaining 12 pages are all the output pages (excluding the Brake Data Summary Page, since no braking is applied) indicating the vehicle's response in the maneuver.

The maneuver is a right-hand step-steer of 8 degrees at the front wheels, applied at 0.1 seconds into the run. The vehicle responds by turning to the right with some initial transients that effectively settle out after a few seconds into the run. The vehicle is stable and assumes a steady-state turn at about 0.25 g's (8 ft/sec^2) lateral acceleration.

SIMULATION OPERATION PARAMETERS:

VEHICLE CONFIGURATION (NUMBER OF TRAILERS - ENTER 0 FOR A STRAIGHT TRUCK) 0
INITIAL VELOCITY (FT/SEC) 30.00
STEER TABLE (NUMBER OF LINES): POSITIVE -STEER ANGLE TABLE, NEGATIVE - PATH FOLLOWER TABLE 3
TABLE ENTRIES:

TIME (SEC)	LEFT WHEEL (DEG)	RIGHT WHEEL (DEG)
0.0	0.0	0.0
0.10	8.00	8.00
8.00	8.00	8.00

TREADLE PRESSURE TABLE (NUMBER OF LINES) 0
* ZERO ENTRY INDICATES NO FURTHER TABLE DATA IS NECESSARY - THE FOLLOWING TABLE IS ASSIGNED INTERNALLY *
TABLE ENTRIES:

TIME (SEC)	PRESSURE (PSI)
0.0	0.0

MAXIMUM SIMULATION TIME (SEC) 3.90
TIME INCREMENT OF OUTPUT (SEC) 0.10

ROAD KEY = 0 ; FLAT ROAD.

OUTPUT PAGE OPTION KEYS: 0 DELETES PAGES

SPRUNG MASS POSITION	SPRUNG MASS VELOCITY	SPRUNG MASS ACCELERATION	TIRE FORCES PAGES	BRAKE SUMMARY PAGES	LATERAL PAGES	UNSPRUNG MASS PAGES
1	1	1	1	0	1	1

TRUCK PARAMETERS

WHEELBASE - DISTANCE FROM FRONT AXLE TO CENTER OF REAR SUSPENSION (IN)	142.00
BASE VEHICLE CURB WEIGHT ON FRONT SUSPENSION (LB)	9073.80
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	10519.20
SPRUNG MASS CG HEIGHT (IN, ABOVE GROUND)	47.90
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	33852.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	120000.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	120000.00
PAYLOAD WEIGHT (LB)	24907.00
PAYLOAD DISTANCE AHEAD OF REAR SUSPENSION CENTER(IN)	6.00
PAYLOAD CG HEIGHT (IN, ABOVE GROUND)	70.25
PAYLOAD ROLL MOMENT OF INERTIA(IN-LB-SEC**2)	7485.00
PAYLOAD PITCH MOMENT OF INERTIA(IN-LB-SEC**2)	50896.00
PAYLOAD YAW MOMENT OF INERTIA(IN-LB-SEC**2)	54422.00

TRUCK FRONT SUSPENSION AND AXLE PARAMETERS

	LEFT SIDE	RIGHT SIDE
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	1012.50	1012.50
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	15.00	15.00
COULOMB FRICTION (LB/SIDE/AXLE)	500.00	500.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	5307.00	
ROLL CENTER HEIGHT (IN, ABOVE GROUND)	24.55	
ROLL STEER COEFFICIENT (DEG, STEER/DEG, ROLL)	0.0	
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	4000.00	
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	32.00	
TRACK WIDTH (IN)	80.50	
UNSPRUNG WEIGHT (LB)	1190.00	

TRUCK FRONT TIRES AND WHEELS

	LEFT SIDE	RIGHT SIDE
CORNERING STIFFNESS (LB/DEG/TIRE)	612.00	612.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	40000.00	40000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	1200.00	1200.00
TIRE SPRING RATE (LB/IN/TIRE)	5700.00	5700.00
TIRE LOADED RADIUS (IN)	20.30	20.30
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	244.60	244.60

TRUCK REAR SUSPENSION AND AXLE PARAMETERS	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES	1			
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)	50.00			
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)	50.00			
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)	0.0			
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	3000.00	3000.00	3000.00	3000.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	15.00	15.00	15.00	15.00
COULOMB FRICTION (LB/SIDE/AXLE)	100.00	100.00	100.00	100.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	11088.00			11088.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	22.00			22.00
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	0.0			0.0
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	0.0			78000.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	35.00			35.00
TRACK WIDTH (IN)	72.00			72.00
UNSPRUNG WEIGHT (LB)	2340.00			2170.00

TRUCK REAR TIRES AND WHEELS	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	13.00	13.00	13.00	13.00
CORNERING STIFFNESS (LB/DEG/TIRE)	565.00	565.00	565.00	565.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	40000.00	40000.00	40000.00	40000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	900.00	900.00	900.00	900.00
TIRE SPRING RATE (LB/IN/TIRE)	5700.00	5700.00	5700.00	5700.00
TIRE LOADED RADIUS (IN)	20.30	20.30	20.30	20.30
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	196.60	196.60	196.60	196.60

*** ZERO LINES IN TREADLE PRESSURE TABLE INDICATES NO BRAKING ***
*** THREE BRAKE PARAMETERS PER AXLE ARE DELETED AT THIS POINT ***

ANTILOCK KEY: 1 INDICATES ANTILOCK WILL BE USED -1

HSRI TRUCK AND TRACTOR-TRAILER DYNAMIC RESPONSE SIMULATION - T3DRS,V1 SUMMARY PAGE
STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK PAYLOAD = 24907.000 LBS	EMPTY	LOADED
DISTANCE FROM TRUCK SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	80.580	32.705
DISTANCE FROM TRUCK SPRUNG MASS CENTER TO GROUND (IN)	47.900	62.247
ROLL MOMENT OF INERTIA OF TRUCK SPRUNG MASS (IN-LB-SEC**2)	33852.000	52878.234
PITCH MOMENT OF INERTIA OF TRUCK SPRUNG MASS (IN-LB-SEC**2)	120000.000	310949.438
YAW MOMENT OF INERTIA OF TRUCK SPRUNG MASS (IN-LB-SEC**2)	120000.000	302934.375

THE STATIC LOADS ON THE AXLES ARE:

AXLE NUMBER	LOAD
NS(1,1,1)	10126.215
NS(1,2,1)	17186.891
NS(1,2,2)	17186.891
TOTAL	44499.996

THE TRUCK TOTAL MASS CENTER IS 109.687 INCHES BEHIND THE FRONT AXLE
THE TOTAL YAW MOMENT OF INERTIA IS 386314.313 IN-LB-SEC**2

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK SPRUNG MASS POSITION

TIME (SEC)	FORWARD (FT)	LATERAL (FT)	VERTICAL (FT)	ROLL (DEG)	PITCH (DEG)	HEADING (DEG)	TURN RADIUS (FT)	SIDE SLIP (DEG)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	**********	0.0
0.10	3.0743	0.0068	-0.0000	-0.3121	-0.0043	0.2251	279.0068	0.1345
0.20	6.0691	0.0382	-0.0000	-1.3414	-0.0286	1.2489	255.0396	-0.3333
0.30	9.0590	0.1050	0.0003	-2.5608	-0.0422	2.7127	159.2781	-0.9215
0.40	12.0426	0.2277	0.0012	-3.7494	-0.0354	4.3331	116.6549	-1.2599
0.50	15.0165	0.4262	0.0020	-4.6925	-0.0261	5.9992	95.6426	-1.2812
0.60	17.9763	0.7165	0.0017	-5.2365	-0.0291	7.6701	86.0439	-1.0438
0.70	20.9178	1.1083	0.0007	-5.3560	-0.0387	9.3356	83.5666	-0.6741
0.80	23.8377	1.6034	-0.0008	-5.1513	-0.0489	10.9953	85.5666	-0.3155
0.90	26.7335	2.1986	-0.0009	-4.7393	-0.0387	12.6517	90.3943	-0.0309
1.00	29.6040	2.8876	0.0002	-4.2842	-0.0216	14.3013	97.3436	0.1313
1.10	32.4478	3.6627	0.0009	-3.9060	-0.0159	15.9455	104.7338	0.1655
1.20	35.2643	4.5168	0.0005	-3.6669	-0.0241	17.5898	110.2085	0.0942
1.30	38.0533	5.4452	-0.0001	-3.5784	-0.0324	19.2386	112.2409	-0.0369
1.40	40.8134	6.4456	-0.0000	-3.6221	-0.0315	20.8909	111.1061	-0.1788
1.50	43.5422	7.5176	0.0006	-3.7539	-0.0256	22.5429	108.0340	-0.2914
1.60	46.2368	8.6620	0.0011	-3.9166	-0.0230	24.1919	104.4773	-0.3530
1.70	48.8943	9.8799	0.0010	-4.0581	-0.0260	25.8374	101.4768	-0.3613
1.80	51.5115	11.1723	0.0006	-4.1457	-0.0303	27.4801	99.5214	-0.3286
1.90	54.0855	12.5391	0.0003	-4.1708	-0.0316	29.1200	98.7027	-0.2727
2.00	56.6139	13.9796	0.0003	-4.1431	-0.0296	30.7565	98.8731	-0.2111
2.10	59.0950	15.4919	0.0004	-4.0815	-0.0274	32.3892	99.7476	-0.1579
2.20	61.5274	17.0738	0.0004	-4.0063	-0.0269	34.0187	100.9610	-0.1222
2.30	63.9097	18.7229	0.0003	-3.9356	-0.0277	35.6460	102.1451	-0.1068
2.40	66.2408	20.4369	0.0003	-3.8823	-0.0282	37.2719	103.0144	-0.1092
2.50	68.5193	22.2135	0.0004	-3.8523	-0.0279	38.8964	103.4293	-0.1226
2.60	70.7440	24.0509	0.0004	-3.8444	-0.0271	40.5191	103.4031	-0.1395
2.70	72.9133	25.9473	0.0005	-3.8520	-0.0268	42.1400	103.0576	-0.1534
2.80	75.0256	27.9013	0.0005	-3.8664	-0.0272	43.7588	102.5605	-0.1607
2.90	77.0792	29.9107	0.0005	-3.8799	-0.0276	45.3755	102.0676	-0.1602
3.00	79.0723	31.9742	0.0004	-3.8870	-0.0277	46.9901	101.6925	-0.1528
3.10	81.0035	34.0896	0.0004	-3.8854	-0.0275	48.6022	101.4900	-0.1407
3.20	82.8710	36.2560	0.0004	-3.8753	-0.0273	50.2120	101.4598	-0.1268
3.30	84.6737	38.4712	0.0004	-3.8589	-0.0273	51.8195	101.5624	-0.1135
3.40	86.4108	40.7335	0.0004	-3.8393	-0.0273	53.4247	101.7427	-0.1026
3.50	88.0813	43.0407	0.0004	-3.8194	-0.0272	55.0278	101.9312	-0.0949
3.60	89.6841	45.3908	0.0004	-3.8017	-0.0271	56.6289	102.0796	-0.0902
3.70	91.2184	47.7814	0.0004	-3.7876	-0.0270	58.2275	102.1637	-0.0875
3.80	92.6832	50.2106	0.0004	-3.7769	-0.0269	59.8238	102.1772	-0.0857
3.90	94.0777	52.6765	0.0004	-3.7690	-0.0269	61.4182	102.1361	-0.0838

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK SPRUNG MASS VELOCITY (BODY AXES)

TIME (SEC)	FORWARD (FT/SEC)	LATERAL (FT/SEC)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	PITCH (DEG/SEC)	HEADING (DEG/SEC)
0.0	30.00	0.0	0.0	0.0	0.0	0.0
0.10	29.98	0.07	-0.00	-7.71	-0.19	6.24
0.20	29.93	-0.17	-0.02	-11.67	-0.55	13.13
0.30	29.88	-0.48	-0.04	-12.39	-0.72	15.67
0.40	29.83	-0.66	-0.05	-10.98	-0.96	16.48
0.50	29.77	-0.67	-0.06	-7.59	-1.32	16.61
0.60	29.71	-0.54	-0.07	-3.21	-1.59	16.55
0.70	29.65	-0.35	-0.07	0.60	-1.66	16.46
0.80	29.59	-0.16	-0.05	3.40	-1.48	16.47
0.90	29.55	-0.02	-0.01	4.57	-1.19	16.44
1.00	29.51	0.07	0.01	4.32	-1.09	16.39
1.10	29.47	0.09	-0.00	3.14	-1.14	16.36
1.20	29.43	0.05	-0.02	1.63	-1.16	16.39
1.30	29.40	-0.02	-0.02	0.18	-1.07	16.45
1.40	29.36	-0.09	-0.02	-0.96	-0.99	16.47
1.50	29.32	-0.15	-0.02	-1.56	-1.02	16.45
1.60	29.27	-0.18	-0.02	-1.59	-1.13	16.40
1.70	29.23	-0.18	-0.03	-1.17	-1.20	16.36
1.80	29.18	-0.17	-0.03	-0.55	-1.21	16.33
1.90	29.14	-0.14	-0.03	0.05	-1.18	16.30
2.00	29.10	-0.11	-0.02	0.49	-1.15	16.27
2.10	29.05	-0.08	-0.02	0.72	-1.14	16.23
2.20	29.01	-0.06	-0.02	0.76	-1.14	16.21
2.30	28.97	-0.05	-0.02	0.64	-1.12	16.19
2.40	28.93	-0.06	-0.02	0.43	-1.10	16.18
2.50	28.89	-0.06	-0.02	0.19	-1.08	16.17
2.60	28.85	-0.07	-0.02	-0.01	-1.08	16.15
2.70	28.81	-0.08	-0.02	-0.12	-1.08	16.13
2.80	28.77	-0.08	-0.02	-0.14	-1.09	16.11
2.90	28.73	-0.08	-0.02	-0.10	-1.09	16.09
3.00	28.69	-0.08	-0.02	-0.02	-1.09	16.06
3.10	28.65	-0.07	-0.02	0.07	-1.08	16.04
3.20	28.61	-0.06	-0.02	0.14	-1.08	16.02
3.30	28.57	-0.06	-0.02	0.19	-1.08	16.00
3.40	28.53	-0.05	-0.02	0.21	-1.07	15.97
3.50	28.49	-0.05	-0.02	0.20	-1.06	15.95
3.60	28.45	-0.04	-0.02	0.17	-1.06	15.94
3.70	28.42	-0.04	-0.02	0.13	-1.05	15.92
3.80	28.38	-0.04	-0.02	0.10	-1.05	15.90
3.90	28.34	-0.04	-0.02	0.08	-1.04	15.88

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TIME (SEC)	TRUCK SPRUNG MASS ACCELERATION (BODY AXES)						INERTIAL ACCEL. ALONG BODY AXES	
	FORWARD (FT/SEC**2)	LATERAL (FT/SEC**2)	VERTICAL (FT/SEC**2)	ROLL (DEG/SEC**2)	PITCH (DEG/SEC**2)	HEADING (DEG/SEC**2)	LONGITUDINAL (FT/SEC**2)	LATERAL (FT/SEC**2)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0
0.10	-0.6090	-0.0840	-0.0787	-105.8050	-5.3286	106.6932	-0.6166	3.1818
0.20	-0.4171	-3.3477	-0.1991	-17.8276	-2.1635	40.5839	-0.3770	3.5082
0.30	-0.4788	-2.5385	-0.1566	1.8220	-1.7272	14.1787	-0.3469	5.6242
0.40	-0.5632	-0.9160	-0.1403	24.6765	-3.1832	3.6591	-0.3737	7.6534
0.50	-0.6072	0.6681	-0.1369	40.7966	-3.6409	-0.2217	-0.4127	9.2906
0.60	-0.6021	1.6986	0.0286	44.4834	-1.3044	-0.6312	-0.4438	10.2740
0.70	-0.5536	2.0054	0.0352	31.4345	-0.3888	-0.8052	-0.4515	10.5254
0.80	-0.4848	1.7320	0.4039	21.4505	4.3661	-0.0195	-0.4367	10.2421
0.90	-0.4183	1.1734	0.3133	3.8798	2.1565	-0.6351	-0.4135	9.6535
1.00	-0.3766	0.4965	0.0648	-8.4139	-0.0290	-0.5585	-0.3960	8.9354
1.10	-0.3539	-0.1298	-0.1535	-14.5039	-0.6451	0.0232	-0.3782	8.2846
1.20	-0.3527	-0.5649	-0.1115	-15.3238	0.5058	0.5712	-0.3663	7.8570
1.30	-0.3665	-0.7405	0.0105	-13.4971	1.0608	0.4531	-0.3607	7.6989
1.40	-0.3878	-0.6785	0.0389	-8.9799	0.2647	-0.0343	-0.3612	7.7603
1.50	-0.4098	-0.4533	-0.0249	-3.0839	-0.8140	-0.4072	-0.3667	7.9608
1.60	-0.4267	-0.1701	-0.0770	2.2985	-1.0496	-0.4531	-0.3747	8.2080
1.70	-0.4352	0.0791	-0.0549	5.6121	-0.4472	-0.3250	-0.3819	8.4243
1.80	-0.4347	0.2441	0.0104	6.4175	0.2124	-0.2626	-0.3863	8.5623
1.90	-0.4273	0.3147	0.0535	5.3489	0.3825	-0.3168	-0.3873	8.6059
2.00	-0.4167	0.3029	0.0484	3.4036	0.1824	-0.3612	-0.3858	8.5642
2.10	-0.4058	0.2316	0.0196	1.3239	0.0242	-0.3025	-0.3828	8.4635
2.20	-0.3970	0.1300	0.0008	-0.4942	0.0875	-0.1854	-0.3791	8.3376
2.30	-0.3911	0.0292	0.0005	-1.7946	0.2230	-0.1069	-0.3755	8.2180
2.40	-0.3885	-0.0455	0.0051	-2.3922	0.2318	-0.1101	-0.3726	8.1265
2.50	-0.3885	-0.0817	0.0024	-2.2540	0.0975	-0.1569	-0.3707	8.0720
2.60	-0.3901	-0.0810	-0.0057	-1.5733	-0.0444	-0.1950	-0.3700	8.0521
2.70	-0.3922	-0.0545	-0.0099	-0.6764	-0.0852	-0.2067	-0.3701	8.0568
2.80	-0.3937	-0.0159	-0.0062	0.1264	-0.0382	-0.2081	-0.3707	8.0735
2.90	-0.3940	0.0225	0.0009	0.6606	0.0189	-0.2163	-0.3711	8.0897
3.00	-0.3931	0.0521	0.0056	0.8902	0.0384	-0.2287	-0.3713	8.0966
3.10	-0.3911	0.0684	0.0062	0.8590	0.0343	-0.2334	-0.3710	8.0899
3.20	-0.3884	0.0708	0.0050	0.6430	0.0385	-0.2257	-0.3704	8.0694
3.30	-0.3855	0.0622	0.0044	0.3309	0.0584	-0.2108	-0.3694	8.0385
3.40	-0.3828	0.0470	0.0044	0.0132	0.0753	-0.1954	-0.3683	8.0021
3.50	-0.3806	0.0310	0.0042	-0.2329	0.0747	-0.1899	-0.3671	7.9654
3.60	-0.3788	0.0183	0.0028	-0.3572	0.0580	-0.1899	-0.3660	7.9321
3.70	-0.3775	0.0108	0.0013	-0.3607	0.0400	-0.1898	-0.3651	7.9041
3.80	-0.3765	0.0088	0.0004	-0.2788	0.0313	-0.1902	-0.3644	7.8817
3.90	-0.3756	0.0111	0.0006	-0.1561	0.0308	-0.1899	-0.3639	7.8639

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK FRONT AXLE TIRE FORCES

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	STEER ANGLE LEFT (DEG)	RIGHT (DEG)
0.0	5063.11	-0.0	0.0	0.0	0.0	5063.11	-0.0	0.0	0.0	0.0	0.0	0.0
0.10	7020.89	-39.13	4409.31	-0.0056	0.6280	3135.85	45.06	1943.20	0.0144	0.6197	8.00	8.00
0.20	6512.71	-15.24	2550.94	-0.0023	0.3917	3737.16	21.03	1350.86	0.0056	0.3615	8.00	8.00
0.30	6611.50	-3.84	2400.45	-0.0006	0.3631	3636.87	8.92	1181.93	0.0025	0.3250	8.00	8.00
0.40	6852.76	0.97	2674.48	0.0001	0.3903	3353.81	4.39	1180.03	0.0013	0.3518	8.00	8.00
0.50	7094.73	2.98	3036.38	0.0004	0.4280	3104.57	2.89	1215.85	0.0009	0.3916	8.00	8.00
0.60	7259.02	3.43	3302.31	0.0005	0.4549	2976.40	2.86	1251.36	0.0010	0.4204	8.00	8.00
0.70	7292.72	3.57	3358.29	0.0005	0.4605	2978.81	2.85	1270.39	0.0010	0.4265	8.00	8.00
0.80	7225.38	3.01	3268.09	0.0004	0.4523	3058.81	3.35	1277.58	0.0011	0.4177	8.00	8.00
0.90	7067.63	3.19	3067.86	0.0005	0.4341	3171.46	2.77	1263.04	0.0009	0.3983	8.00	8.00
1.00	6916.79	3.05	2858.62	0.0004	0.4133	3293.48	2.62	1238.89	0.0008	0.3762	8.00	8.00
1.10	6814.13	2.70	2690.65	0.0004	0.3949	3403.36	2.70	1213.39	0.0008	0.3565	8.00	8.00
1.20	6760.43	2.38	2586.64	0.0004	0.3826	3474.83	2.85	1193.02	0.0008	0.3433	8.00	8.00
1.30	6740.19	2.37	2542.50	0.0004	0.3772	3495.63	2.77	1179.39	0.0008	0.3374	8.00	8.00
1.40	6748.95	2.57	2552.23	0.0004	0.3782	3472.44	2.57	1174.74	0.0007	0.3383	8.00	8.00
1.50	6785.24	2.77	2603.93	0.0004	0.3838	3426.69	2.44	1179.73	0.0007	0.3443	8.00	8.00
1.60	6837.33	2.86	2674.89	0.0004	0.3912	3380.19	2.47	1190.77	0.0007	0.3523	8.00	8.00
1.70	6880.58	2.86	2738.73	0.0004	0.3978	3345.41	2.57	1202.13	0.0008	0.3593	8.00	8.00
1.80	6910.40	2.86	2777.12	0.0004	0.4019	3325.83	2.64	1209.56	0.0008	0.3637	8.00	8.00
1.90	6911.74	2.89	2785.85	0.0004	0.4031	3321.08	2.63	1212.07	0.0008	0.3650	8.00	8.00
2.00	6896.70	2.90	2771.38	0.0004	0.4018	3329.69	2.60	1210.98	0.0008	0.3637	8.00	8.00
2.10	6875.22	2.86	2743.30	0.0004	0.3990	3348.64	2.60	1207.85	0.0008	0.3607	8.00	8.00
2.20	6853.21	2.78	2709.83	0.0004	0.3954	3372.41	2.62	1203.48	0.0008	0.3569	8.00	8.00
2.30	6833.30	2.72	2677.65	0.0004	0.3919	3394.36	2.63	1198.37	0.0008	0.3530	8.00	8.00
2.40	6817.36	2.70	2652.07	0.0004	0.3890	3409.73	2.61	1193.39	0.0008	0.3500	8.00	8.00
2.50	6807.60	2.71	2636.45	0.0004	0.3873	3417.23	2.58	1189.61	0.0008	0.3481	8.00	8.00
2.60	6804.79	2.72	2630.94	0.0004	0.3866	3418.48	2.56	1187.64	0.0007	0.3474	8.00	8.00
2.70	6807.29	2.72	2632.73	0.0004	0.3868	3416.18	2.55	1187.26	0.0007	0.3475	8.00	8.00
2.80	6811.85	2.73	2637.67	0.0004	0.3872	3412.70	2.55	1187.73	0.0007	0.3480	8.00	8.00
2.90	6815.44	2.73	2642.01	0.0004	0.3877	3409.76	2.55	1188.28	0.0007	0.3485	8.00	8.00
3.00	6816.44	2.74	2643.51	0.0004	0.3878	3408.60	2.55	1188.47	0.0007	0.3487	8.00	8.00
3.10	6814.63	2.74	2641.31	0.0004	0.3876	3409.91	2.55	1188.14	0.0007	0.3484	8.00	8.00
3.20	6810.52	2.73	2635.55	0.0004	0.3870	3413.74	2.54	1187.25	0.0007	0.3478	8.00	8.00
3.30	6804.77	2.72	2627.05	0.0004	0.3861	3419.43	2.54	1185.87	0.0007	0.3468	8.00	8.00
3.40	6798.21	2.71	2617.15	0.0004	0.3850	3425.90	2.54	1184.14	0.0007	0.3456	8.00	8.00
3.50	6791.56	2.69	2607.01	0.0004	0.3839	3432.21	2.54	1182.22	0.0007	0.3444	8.00	8.00
3.60	6785.62	2.69	2597.81	0.0004	0.3828	3437.69	2.53	1180.35	0.0007	0.3434	8.00	8.00
3.70	6780.85	2.68	2590.19	0.0004	0.3820	3442.12	2.52	1178.71	0.0007	0.3424	8.00	8.00
3.80	6777.21	2.68	2584.11	0.0004	0.3813	3445.60	2.52	1177.35	0.0007	0.3417	8.00	8.00
3.90	6774.40	2.67	2579.29	0.0004	0.3807	3448.34	2.51	1176.23	0.0007	0.3411	8.00	8.00

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK REAR SUSPENSION TIRE FORCES

LEADING TANDEM AXLE

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	8593.45	-0.0	0.0	0.0	0.0	8593.45	-0.0	0.0	0.0	0.0
0.10	8143.41	-55.16	-915.37	-0.0068	-0.1124	9040.35	68.49	-1038.61	0.0076	-0.1149
0.20	8808.45	-21.46	-784.76	-0.0024	-0.0891	8352.36	30.07	-779.16	0.0036	-0.0933
0.30	9657.69	-5.08	-163.64	-0.0005	-0.0169	7510.63	13.01	-134.45	0.0017	-0.0179
0.40	10481.05	1.87	510.46	0.0002	0.0487	6745.59	6.67	348.14	0.0010	0.0516
0.50	11149.36	4.79	1120.01	0.0004	0.1005	6129.00	4.63	652.85	0.0008	0.1065
0.60	11518.35	5.46	1533.90	0.0005	0.1332	5722.21	4.65	807.95	0.0008	0.1412
0.70	11526.95	5.68	1623.25	0.0005	0.1408	5655.47	4.65	844.27	0.0008	0.1493
0.80	11343.26	4.87	1538.62	0.0004	0.1356	5777.20	5.30	830.81	0.0009	0.1438
0.90	11068.38	5.08	1285.85	0.0005	0.1162	6054.97	4.45	745.74	0.0007	0.1232
1.00	10798.98	4.87	990.16	0.0005	0.0917	6403.65	4.24	622.40	0.0007	0.0972
1.10	10562.97	4.34	741.17	0.0004	0.0702	6690.57	4.34	497.63	0.0006	0.0744
1.20	10391.94	3.86	598.41	0.0004	0.0576	6807.33	4.54	415.60	0.0007	0.0611
1.30	10329.58	3.85	550.62	0.0004	0.0533	6824.19	4.42	385.77	0.0006	0.0565
1.40	10378.98	4.14	570.52	0.0004	0.0550	6786.99	4.13	395.70	0.0006	0.0583
1.50	10492.08	4.43	634.99	0.0004	0.0605	6713.26	3.96	430.94	0.0006	0.0642
1.60	10608.74	4.56	720.68	0.0004	0.0679	6615.36	4.01	476.62	0.0006	0.0720
1.70	10691.84	4.57	802.53	0.0004	0.0751	6519.16	4.17	518.95	0.0006	0.0796
1.80	10733.33	4.58	858.34	0.0004	0.0800	6456.12	4.26	547.54	0.0007	0.0848
1.90	10739.59	4.62	876.50	0.0004	0.0816	6442.63	4.25	557.62	0.0007	0.0866
2.00	10718.12	4.63	859.65	0.0004	0.0802	6471.53	4.20	550.43	0.0006	0.0851
2.10	10675.95	4.57	820.54	0.0004	0.0769	6521.94	4.20	531.55	0.0006	0.0815
2.20	10623.45	4.46	774.02	0.0004	0.0729	6574.49	4.23	507.95	0.0006	0.0773
2.30	10574.13	4.37	731.29	0.0004	0.0692	6618.83	4.24	485.41	0.0006	0.0733
2.40	10539.10	4.33	698.72	0.0004	0.0663	6651.29	4.20	467.63	0.0006	0.0703
2.50	10522.19	4.34	678.79	0.0004	0.0645	6670.47	4.15	456.35	0.0006	0.0684
2.60	10520.09	4.35	671.06	0.0004	0.0638	6676.26	4.12	451.65	0.0006	0.0676
2.70	10526.21	4.36	672.65	0.0004	0.0639	6671.25	4.11	452.12	0.0006	0.0678
2.80	10534.82	4.37	679.04	0.0004	0.0645	6661.13	4.12	455.34	0.0006	0.0684
2.90	10541.83	4.38	685.39	0.0004	0.0650	6652.27	4.12	458.69	0.0006	0.0690
3.00	10544.80	4.39	688.16	0.0004	0.0653	6649.00	4.11	460.19	0.0006	0.0692
3.10	10542.18	4.39	685.77	0.0004	0.0651	6652.34	4.11	458.93	0.0006	0.0690
3.20	10533.88	4.38	678.44	0.0004	0.0644	6661.17	4.11	454.99	0.0006	0.0683
3.30	10521.23	4.36	667.50	0.0004	0.0634	6673.44	4.10	449.01	0.0006	0.0673
3.40	10506.66	4.33	654.69	0.0004	0.0623	6687.34	4.10	441.93	0.0006	0.0661
3.50	10492.54	4.32	641.71	0.0004	0.0612	6701.20	4.09	434.65	0.0006	0.0649
3.60	10480.41	4.31	629.85	0.0004	0.0601	6713.66	4.08	427.91	0.0006	0.0637
3.70	10470.77	4.30	619.90	0.0004	0.0592	6723.81	4.07	422.18	0.0006	0.0628
3.80	10463.30	4.29	612.02	0.0004	0.0585	6731.43	4.06	417.58	0.0006	0.0620
3.90	10457.46	4.28	605.81	0.0004	0.0579	6737.14	4.05	413.93	0.0006	0.0614

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK REAR SUSPENSION TIRE FORCES

TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	8593.45	-0.0	0.0	0.0	0.0	8593.45	-0.0	0.0	0.0	0.0
0.10	8959.23	-55.63	4.46	-0.0062	0.0005	8209.97	67.85	4.18	0.0083	0.0005
0.20	10921.88	-21.28	1596.29	-0.0019	0.1462	6118.62	30.11	936.36	0.0049	0.1530
0.30	12931.56	-4.97	3399.70	-0.0004	0.2629	4060.36	13.01	1127.76	0.0032	0.2777
0.40	14812.13	1.91	5083.36	0.0001	0.3432	2268.54	6.45	824.94	0.0028	0.3636
0.50	16271.43	4.80	6474.88	0.0003	0.3979	900.07	3.67	379.74	0.0041	0.4219
0.60	17017.88	5.46	7320.86	0.0003	0.4302	74.03	0.75	33.76	0.0101	0.4561
0.70	17156.33	5.68	7496.97	0.0003	0.4370	0.00	0.00	0.00	0.0232	0.4632
0.80	16662.51	4.90	7203.86	0.0003	0.4323	268.60	9.57	123.10	0.0356	0.4583
0.90	16175.23	5.09	6675.48	0.0003	0.4127	851.71	12.77	372.60	0.0150	0.4375
1.00	15600.29	4.87	6047.72	0.0003	0.3877	1554.41	5.49	638.70	0.0035	0.4109
1.10	15065.39	4.33	5515.62	0.0003	0.3661	2133.07	4.52	827.73	0.0021	0.3880
1.20	14663.53	3.86	5198.57	0.0003	0.3545	2424.73	4.57	911.31	0.0019	0.3758
1.30	14508.48	3.85	5100.30	0.0003	0.3515	2505.84	4.44	934.11	0.0018	0.3728
1.40	14600.29	4.14	5167.25	0.0003	0.3539	2440.26	4.13	915.94	0.0017	0.3753
1.50	14835.45	4.44	5332.43	0.0003	0.3594	2270.84	3.92	865.65	0.0017	0.3812
1.60	15085.42	4.56	5528.95	0.0003	0.3665	2044.64	3.93	794.70	0.0019	0.3887
1.70	15270.42	4.57	5702.10	0.0003	0.3734	1829.18	4.07	724.31	0.0022	0.3960
1.80	15371.09	4.58	5814.06	0.0003	0.3782	1689.80	4.21	677.77	0.0025	0.4011
1.90	15397.17	4.62	5847.77	0.0003	0.3798	1655.33	4.25	666.65	0.0026	0.4027
2.00	15360.75	4.63	5809.18	0.0003	0.3782	1709.45	4.24	685.50	0.0025	0.4010
2.10	15274.92	4.57	5722.73	0.0003	0.3746	1811.64	4.25	719.66	0.0023	0.3972
2.20	15162.48	4.46	5619.59	0.0003	0.3706	1923.92	4.27	756.05	0.0022	0.3930
2.30	15054.32	4.37	5525.96	0.0003	0.3671	2022.98	4.27	787.38	0.0021	0.3892
2.40	14976.16	4.33	5457.47	0.0003	0.3644	2097.25	4.23	810.40	0.0020	0.3864
2.50	14937.34	4.34	5418.89	0.0003	0.3628	2141.02	4.17	823.63	0.0019	0.3847
2.60	14931.12	4.35	5407.01	0.0003	0.3621	2154.00	4.12	827.17	0.0019	0.3840
2.70	14943.79	4.36	5413.86	0.0003	0.3623	2142.93	4.11	823.26	0.0019	0.3842
2.80	14963.01	4.37	5429.51	0.0003	0.3629	2120.43	4.11	815.93	0.0019	0.3848
2.90	14979.98	4.38	5444.32	0.0003	0.3634	2100.01	4.12	809.36	0.0020	0.3854
3.00	14988.86	4.39	5451.13	0.0003	0.3637	2090.70	4.11	806.30	0.0020	0.3857
3.10	14985.83	4.39	5446.53	0.0003	0.3634	2095.31	4.11	807.56	0.0020	0.3854
3.20	14970.28	4.38	5430.97	0.0003	0.3628	2112.08	4.11	812.54	0.0019	0.3847
3.30	14944.87	4.36	5407.43	0.0003	0.3618	2137.22	4.11	820.04	0.0019	0.3837
3.40	14914.78	4.33	5379.99	0.0003	0.3607	2166.56	4.11	828.75	0.0019	0.3825
3.50	14885.25	4.32	5352.73	0.0003	0.3596	2196.16	4.10	837.48	0.0019	0.3813
3.60	14859.67	4.31	5328.39	0.0003	0.3586	2222.67	4.09	845.19	0.0018	0.3803
3.70	14839.29	4.30	5308.34	0.0003	0.3577	2244.09	4.07	851.30	0.0018	0.3794
3.80	14823.72	4.29	5292.75	0.0003	0.3570	2260.05	4.06	855.74	0.0018	0.3786
3.90	14811.81	4.28	5280.64	0.0003	0.3565	2271.84	4.06	858.93	0.0018	0.3781

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK FRONT SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	-5.1957	4409.3125	0.6280	-8645.6953	-5.1266	1943.1987	0.6197	-3810.1875
0.20	-3.2404	2550.9424	0.3917	-5001.8398	-2.9904	1350.8638	0.3615	-2648.7488
0.30	-3.0037	2400.4546	0.3631	-4706.7656	-2.6886	1181.9329	0.3250	-2317.5125
0.40	-3.2288	2674.4824	0.3903	-5244.0742	-2.9109	1180.0342	0.3518	-2313.7893
0.50	-3.5407	3036.3818	0.4280	-5953.6758	-3.2400	1215.8481	0.3916	-2384.0127
0.60	-3.7636	3302.3086	0.4549	-6475.1016	-3.4782	1251.3606	0.4204	-2453.6450
0.70	-3.8097	3358.2886	0.4605	-6584.8633	-3.5283	1270.3933	0.4265	-2490.9639
0.80	-3.7420	3268.0862	0.4523	-6408.0000	-3.4554	1277.5789	0.4177	-2505.0532
0.90	-3.5911	3067.8645	0.4341	-6015.4102	-3.2948	1263.0408	0.3983	-2476.5471
1.00	-3.4192	2858.6238	0.4133	-5605.1367	-3.1120	1238.8923	0.3762	-2429.1973
1.10	-3.2667	2690.6479	0.3949	-5275.7695	-2.9496	1213.3936	0.3565	-2379.2000
1.20	-3.1654	2586.6438	0.3826	-5071.8398	-2.8404	1193.0220	0.3433	-2339.2559
1.30	-3.1207	2542.5049	0.3772	-4985.2969	-2.7913	1179.3928	0.3374	-2312.5320
1.40	-3.1286	2552.2349	0.3782	-5004.3750	-2.7988	1174.7446	0.3383	-2303.4177
1.50	-3.1749	2603.9280	0.3838	-5105.7305	-2.8482	1179.7319	0.3443	-2313.1970
1.60	-3.2366	2674.8948	0.3912	-5244.8828	-2.9144	1190.7664	0.3523	-2334.8328
1.70	-3.2911	2738.7290	0.3978	-5370.0469	-2.9728	1202.1255	0.3593	-2357.1057
1.80	-3.3247	2777.1245	0.4019	-5445.3320	-3.0088	1209.5593	0.3637	-2371.6819
1.90	-3.3345	2785.8479	0.4031	-5462.4375	-3.0193	1212.0664	0.3650	-2376.5977
2.00	-3.3245	2771.3826	0.4018	-5434.0742	-3.0088	1210.9756	0.3637	-2374.4587
2.10	-3.3011	2743.3000	0.3990	-5379.0117	-2.9841	1207.8513	0.3607	-2368.3330
2.20	-3.2712	2709.8281	0.3954	-5313.3789	-2.9523	1203.4773	0.3569	-2359.7563
2.30	-3.2418	2677.6536	0.3919	-5250.2930	-2.9208	1198.3704	0.3530	-2349.7427
2.40	-3.2184	2652.0723	0.3890	-5200.1328	-2.8955	1193.3853	0.3500	-2339.9678
2.50	-3.2040	2636.4456	0.3873	-5169.4922	-2.8800	1189.6069	0.3481	-2332.5593
2.60	-3.1986	2630.9392	0.3866	-5158.6953	-2.8742	1187.6384	0.3474	-2328.6995
2.70	-3.1996	2632.7292	0.3868	-5162.2031	-2.8752	1187.2612	0.3475	-2327.9600
2.80	-3.2035	2637.6670	0.3872	-5171.8867	-2.8793	1187.7302	0.3480	-2328.8796
2.90	-3.2071	2642.0137	0.3877	-5180.4102	-2.8831	1188.2795	0.3485	-2329.9570
3.00	-3.2084	2643.5149	0.3878	-5183.3555	-2.8846	1188.4722	0.3487	-2330.3342
3.10	-3.2066	2641.3123	0.3876	-5179.0352	-2.8826	1188.1392	0.3484	-2329.6814
3.20	-3.2015	2635.5513	0.3870	-5167.7383	-2.8773	1187.2520	0.3478	-2327.9419
3.30	-3.1939	2627.0474	0.3861	-5151.0625	-2.8691	1185.8660	0.3468	-2325.2244
3.40	-3.1849	2617.1467	0.3850	-5131.6523	-2.8595	1184.1370	0.3456	-2321.8337
3.50	-3.1757	2607.0139	0.3839	-5111.7813	-2.8496	1182.2185	0.3444	-2318.0725
3.60	-3.1673	2597.8101	0.3828	-5093.7344	-2.8406	1180.3477	0.3434	-2314.4041
3.70	-3.1602	2590.1863	0.3820	-5078.7891	-2.8330	1178.7100	0.3424	-2311.1929
3.80	-3.1545	2584.1125	0.3813	-5066.8789	-2.8269	1177.3459	0.3417	-2308.5183
3.90	-3.1499	2579.2949	0.3807	-5057.4336	-2.8219	1176.2322	0.3411	-2306.3342

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	0.8548	-915.3735	-0.1124	1458.1157	0.8737	-1038.6055	-0.1149	1654.4143
0.20	0.6775	-784.7585	-0.0891	1250.0566	0.7094	-779.1567	-0.0933	1241.1331
0.30	0.1289	-163.6390	-0.0169	260.6636	0.1361	-134.4535	-0.0179	214.1735
0.40	-0.3704	510.4553	0.0487	-813.1138	-0.3925	348.1379	0.0516	-554.5554
0.50	-0.7639	1120.0051	0.1005	-1784.0771	-0.8100	652.8462	0.1065	-1039.9307
0.60	-1.0127	1533.9011	0.1332	-2443.3799	-1.0738	807.9539	0.1412	-1287.0046
0.70	-1.0709	1623.2510	0.1408	-2585.7070	-1.1353	844.2710	0.1493	-1344.8550
0.80	-1.0315	1538.6208	0.1356	-2450.8982	-1.0936	830.8066	0.1438	-1323.4072
0.90	-0.8835	1285.8496	0.1162	-2048.2539	-0.9366	745.7407	0.1232	-1187.9041
1.00	-0.6973	990.1602	0.0917	-1577.2449	-0.7391	622.3987	0.0972	-991.4299
1.10	-0.5336	741.1736	0.0702	-1180.6292	-0.5656	497.6313	0.0744	-792.6863
1.20	-0.4379	598.4077	0.0576	-953.2148	-0.4643	415.5991	0.0611	-662.0156
1.30	-0.4054	550.6174	0.0533	-877.0886	-0.4299	385.7703	0.0565	-614.5005
1.40	-0.4180	570.5200	0.0550	-908.7920	-0.4434	395.7009	0.0583	-630.3188
1.50	-0.4603	634.9941	0.0605	-1011.4937	-0.4882	430.9365	0.0642	-686.4465
1.60	-0.5166	720.6770	0.0679	-1147.9797	-0.5479	476.6208	0.0720	-759.2183
1.70	-0.5708	802.5295	0.0751	-1278.3640	-0.6054	518.9485	0.0796	-826.6423
1.80	-0.6082	858.3403	0.0800	-1367.2661	-0.6450	547.5391	0.0848	-872.1848
1.90	-0.6207	876.5022	0.0816	-1396.1968	-0.6582	557.6201	0.0866	-888.2432
2.00	-0.6099	859.6519	0.0802	-1369.3552	-0.6468	550.4314	0.0851	-876.7920
2.10	-0.5845	820.5439	0.0769	-1307.0596	-0.6198	531.5537	0.0815	-846.7214
2.20	-0.5541	774.0173	0.0729	-1232.9465	-0.5876	507.9478	0.0773	-809.1191
2.30	-0.5259	731.2852	0.0692	-1164.8774	-0.5577	485.4092	0.0733	-773.2170
2.40	-0.5042	698.7151	0.0663	-1112.9963	-0.5347	467.6321	0.0703	-744.8997
2.50	-0.4906	678.7871	0.0645	-1081.2527	-0.5203	456.3506	0.0684	-726.9290
2.60	-0.4851	671.0637	0.0638	-1068.9500	-0.5145	451.6472	0.0676	-719.4370
2.70	-0.4860	672.6533	0.0639	-1071.4819	-0.5154	452.1174	0.0678	-720.1860
2.80	-0.4902	679.0354	0.0645	-1081.6482	-0.5199	455.3450	0.0684	-725.3271
2.90	-0.4944	685.3923	0.0650	-1091.7744	-0.5244	458.6924	0.0690	-730.6592
3.00	-0.4963	688.1621	0.0653	-1096.1860	-0.5263	460.1897	0.0692	-733.0404
3.10	-0.4947	685.7698	0.0651	-1092.3752	-0.5246	458.9333	0.0690	-731.0435
3.20	-0.4898	678.4402	0.0644	-1080.6997	-0.5194	454.9861	0.0683	-724.7556
3.30	-0.4825	667.5000	0.0634	-1063.2729	-0.5117	449.0137	0.0673	-715.2422
3.40	-0.4739	654.6912	0.0623	-1042.8694	-0.5026	441.9280	0.0661	-703.9548
3.50	-0.4651	641.7087	0.0612	-1022.1895	-0.4933	434.6501	0.0649	-692.3621
3.60	-0.4570	629.8499	0.0601	-1003.2993	-0.4847	427.9092	0.0637	-681.6243
3.70	-0.4502	619.8989	0.0592	-987.4485	-0.4775	422.1768	0.0628	-672.4929
3.80	-0.4448	612.0171	0.0585	-974.8933	-0.4718	417.5820	0.0620	-665.1741
3.90	-0.4406	605.8098	0.0579	-965.0056	-0.4672	413.9309	0.0614	-659.3579

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	-0.0038	4.4622	0.0005	-7.1079	-0.0039	4.1792	0.0005	-6.6571
0.20	-1.1115	1596.2927	0.1462	-2542.7646	-1.1638	936.3650	0.1530	-1491.5532
0.30	-1.9993	3399.6960	0.2629	-5415.4375	-2.1122	1127.7571	0.2777	-1796.4253
0.40	-2.6099	5083.3594	0.3432	-8097.3750	-2.7654	824.9417	0.3636	-1314.0647
0.50	-3.0262	6474.8789	0.3979	-10313.9531	-3.2085	379.7397	0.4219	-604.8940
0.60	-3.2715	7320.8555	0.4302	-11661.5273	-3.4682	33.7605	0.4561	-53.7778
0.70	-3.3232	7496.9727	0.4370	-11942.0625	-3.5224	0.0000	0.4632	-0.0000
0.80	-3.2879	7203.8633	0.4323	-11475.1641	-3.4854	123.1009	0.4583	-196.0897
0.90	-3.1385	6675.4766	0.4127	-10633.4883	-3.3269	372.6021	0.4375	-593.5242
1.00	-2.9481	6047.7188	0.3877	-9633.5195	-3.1248	638.7004	0.4109	-1017.3977
1.10	-2.7842	5515.6172	0.3661	-8785.9219	-2.9510	827.7312	0.3880	-1318.5083
1.20	-2.6961	5198.5742	0.3545	-8280.9023	-2.8582	911.3127	0.3758	-1451.6470
1.30	-2.6734	5100.3008	0.3515	-8124.3555	-2.8349	934.1138	0.3728	-1487.9670
1.40	-2.6915	5167.2461	0.3539	-8230.9961	-2.8544	915.9443	0.3753	-1459.0249
1.50	-2.7335	5332.4297	0.3594	-8494.1250	-2.8990	865.6521	0.3812	-1378.9133
1.60	-2.7872	5528.9492	0.3665	-8807.1602	-2.9558	794.6997	0.3887	-1265.8918
1.70	-2.8397	5702.1016	0.3734	-9082.9805	-3.0113	724.3059	0.3960	-1153.7603
1.80	-2.8765	5814.0625	0.3782	-9261.3281	-3.0503	677.7739	0.4011	-1079.6384
1.90	-2.8883	5847.7656	0.3798	-9315.0117	-3.0627	666.6519	0.4027	-1061.9219
2.00	-2.8760	5809.1758	0.3782	-9253.5391	-3.0496	685.5005	0.4010	-1091.9460
2.10	-2.8491	5722.7266	0.3746	-9115.8398	-3.0210	719.6616	0.3972	-1146.3625
2.20	-2.8185	5619.5938	0.3706	-8951.5547	-2.9885	756.0549	0.3930	-1204.3337
2.30	-2.7915	5525.9570	0.3671	-8802.3906	-2.9599	787.3765	0.3892	-1254.2266
2.40	-2.7713	5457.4727	0.3644	-8693.3008	-2.9386	810.4038	0.3864	-1290.9070
2.50	-2.7588	5418.8906	0.3628	-8631.8477	-2.9255	823.6311	0.3847	-1311.9771
2.60	-2.7539	5407.0078	0.3621	-8612.9219	-2.9204	827.1660	0.3840	-1317.6082
2.70	-2.7551	5413.8594	0.3623	-8623.8320	-2.9216	823.2615	0.3842	-1311.3884
2.80	-2.7595	5429.5078	0.3629	-8648.7578	-2.9263	815.9285	0.3848	-1299.7078
2.90	-2.7639	5444.3203	0.3634	-8672.3555	-2.9310	809.3608	0.3854	-1289.2456
3.00	-2.7657	5451.1289	0.3637	-8683.1992	-2.9329	806.3032	0.3857	-1284.3752
3.10	-2.7639	5446.5313	0.3634	-8675.8750	-2.9310	807.5593	0.3854	-1286.3762
3.20	-2.7589	5430.9688	0.3628	-8651.0859	-2.9256	812.5354	0.3847	-1294.3025
3.30	-2.7516	5407.4336	0.3618	-8613.5977	-2.9179	820.0366	0.3837	-1306.2512
3.40	-2.7432	5379.9922	0.3607	-8569.8867	-2.9090	828.7478	0.3825	-1320.1277
3.50	-2.7347	5352.7344	0.3596	-8526.4609	-2.9000	837.4792	0.3813	-1334.0361
3.60	-2.7269	5328.3867	0.3586	-8487.6797	-2.8918	845.1914	0.3803	-1346.3210
3.70	-2.7204	5308.3359	0.3577	-8455.7383	-2.8849	851.3000	0.3794	-1356.0515
3.80	-2.7153	5292.7461	0.3570	-8430.9063	-2.8795	855.7424	0.3786	-1363.1279
3.90	-2.7112	5280.6367	0.3565	-8411.6250	-2.8752	858.9331	0.3781	-1368.2104

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK FRONT SUSPENSION - UNSPRUNG MASS SUMMARY

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	0.0002	-0.4816	0.0069	-1.0849	-674.18	0.0476	-2.0390	-91.81	-0.0576	1.6638	55.96
0.20	0.0009	-0.3415	0.0033	-1.5308	3978.83	-0.3131	-3.0928	-529.45	0.2290	2.5699	408.39
0.30	0.0009	-0.3676	-0.0026	-1.1639	8727.46	-0.6769	-2.9368	-887.01	0.5307	3.3312	766.13
0.40	0.0006	-0.4341	-0.0025	-0.8619	13193.04	-0.9941	-2.2943	-1164.04	0.8422	3.3478	1082.66
0.50	0.0005	-0.4964	0.0013	-0.5574	16697.57	-1.2345	-1.4980	-1352.78	1.0984	2.4207	1278.34
0.60	0.0008	-0.5341	0.0031	-0.2170	18712.51	-1.3773	-0.6489	-1439.07	1.2445	1.0194	1330.02
0.70	0.0011	-0.5390	0.0025	0.1032	19168.59	-1.4142	0.0894	-1425.72	1.2769	-0.1805	1280.47
0.80	0.0012	-0.5211	-0.0020	0.2624	18425.24	-1.3646	0.7657	-1329.11	1.2261	-0.9731	1174.55
0.90	0.0008	-0.4877	-0.0031	0.3557	16918.84	-1.2445	1.1444	-1181.44	1.1365	-1.1956	1068.56
1.00	0.0006	-0.4535	-0.0009	0.3325	15243.40	-1.1091	1.0242	-1052.61	1.0364	-1.1914	967.51
1.10	0.0007	-0.4267	0.0013	0.2331	13845.61	-1.0066	0.6238	-976.31	0.9411	-0.9909	884.78
1.20	0.0008	-0.4106	0.0009	0.1147	12957.90	-0.9524	0.2496	-947.15	0.8686	-0.5935	838.66
1.30	0.0008	-0.4052	-0.0007	0.0096	12627.57	-0.9370	-0.0031	-948.88	0.8356	-0.0914	839.76
1.40	0.0007	-0.4089	-0.0011	-0.0741	12786.63	-0.9484	-0.1805	-972.60	0.8449	0.3175	877.29
1.50	0.0006	-0.4190	-0.0002	-0.1200	13270.79	-0.9790	-0.3116	-1012.65	0.8814	0.4965	926.49
1.60	0.0007	-0.4313	0.0008	-0.1202	13869.40	-1.0209	-0.3597	-1058.32	0.9235	0.4624	966.80
1.70	0.0008	-0.4417	0.0008	-0.0841	14391.14	-1.0614	-0.2879	-1094.45	0.9567	0.3226	990.86
1.80	0.0008	-0.4475	0.0001	-0.0330	14716.54	-1.0879	-0.1266	-1110.20	0.9768	0.1672	1000.47
1.90	0.0008	-0.4484	-0.0005	0.0121	14812.79	-1.0944	0.0415	-1105.26	0.9846	0.0267	998.74
2.00	0.0007	-0.4455	-0.0004	0.0420	14714.02	-1.0842	0.1478	-1087.57	0.9816	-0.0964	987.27
2.10	0.0007	-0.4405	-0.0000	0.0558	14488.50	-1.0652	0.1797	-1066.20	0.9692	-0.1883	968.42
2.20	0.0007	-0.4348	0.0002	0.0566	14212.05	-1.0450	0.1647	-1046.70	0.9508	-0.2242	947.26
2.30	0.0007	-0.4296	0.0001	0.0471	13951.77	-1.0274	0.1320	-1031.20	0.9316	-0.1955	929.83
2.40	0.0007	-0.4256	-0.0001	0.0311	13755.47	-1.0143	0.0924	-1020.65	0.9169	-0.1238	919.82
2.50	0.0007	-0.4234	-0.0002	0.0131	13644.98	-1.0064	0.0478	-1015.74	0.9089	-0.0459	917.11
2.60	0.0007	-0.4228	-0.0001	-0.0014	13615.61	-1.0040	0.0049	-1016.19	0.9070	0.0114	919.09
2.70	0.0007	-0.4234	0.0001	-0.0092	13643.52	-1.0059	-0.0245	-1020.20	0.9088	0.0404	922.90
2.80	0.0007	-0.4244	0.0001	-0.0102	13697.04	-1.0102	-0.0319	-1024.97	0.9120	0.0469	926.65
2.90	0.0007	-0.4252	0.0000	-0.0061	13747.16	-1.0141	-0.0199	-1028.15	0.9152	0.0378	929.20
3.00	0.0007	-0.4255	-0.0000	0.0002	13774.23	-1.0161	0.0017	-1028.64	0.9171	0.0184	929.85
3.10	0.0007	-0.4252	-0.0000	0.0068	13769.34	-1.0154	0.0227	-1026.55	0.9172	-0.0066	928.21
3.20	0.0007	-0.4242	-0.0000	0.0122	13733.30	-1.0125	0.0384	-1022.55	0.9151	-0.0305	924.48
3.30	0.0007	-0.4228	-0.0000	0.0156	13673.73	-1.0081	0.0475	-1017.45	0.9113	-0.0469	919.44
3.40	0.0007	-0.4211	-0.0000	0.0165	13601.87	-1.0029	0.0505	-1011.98	0.9064	-0.0528	914.11
3.50	0.0007	-0.4195	-0.0000	0.0153	13529.25	-0.9977	0.0480	-1006.84	0.9014	-0.0493	909.32
3.60	0.0007	-0.4181	-0.0000	0.0128	13464.71	-0.9930	0.0412	-1002.56	0.8970	-0.0404	905.46
3.70	0.0007	-0.4169	-0.0000	0.0100	13412.87	-0.9892	0.0326	-999.34	0.8935	-0.0301	902.56
3.80	0.0007	-0.4160	-0.0000	0.0077	13374.03	-0.9864	0.0249	-997.06	0.8907	-0.0210	900.43
3.90	0.0007	-0.4153	-0.0000	0.0062	13345.39	-0.9844	0.0200	-995.36	0.8887	-0.0146	898.81

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK REAR SUSPENSION - UNSPRUNG MASS SUMMARY

LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.0
0.10	-0.0000	0.0603	-0.0005	0.7221	0.0	-0.1074	-2.5289	-460.26	0.1085	2.6249	464.73
0.20	-0.0001	-0.0282	-0.0007	-1.1073	0.0	-0.3890	-3.0185	-1312.22	0.3954	3.4338	1337.73
0.30	-0.0001	-0.1451	0.0013	-1.4654	0.0	-0.7271	-3.0159	-2326.56	0.7296	3.6555	2343.69
0.40	0.0001	-0.2566	0.0025	-1.2887	0.0	-1.0670	-2.5667	-3339.42	1.0499	3.3437	3299.82
0.50	0.0003	-0.3478	0.0009	-0.8201	0.0	-1.3381	-1.6604	-4139.14	1.3043	2.4652	4049.76
0.60	0.0002	-0.4037	-0.0058	-0.2761	0.0	-1.4878	-0.6488	-4540.54	1.4594	1.1398	4495.15
0.70	-0.0000	-0.4104	-0.0027	0.1656	0.0	-1.5139	0.2416	-4513.05	1.5080	-0.0156	4522.22
0.80	-0.0002	-0.3895	-0.0001	0.2830	0.0	-1.4433	0.8420	-4229.79	1.4707	-1.0472	4296.43
0.90	-0.0002	-0.3514	0.0022	0.4325	0.0	-1.3307	0.9106	-3883.75	1.3568	-1.6019	3946.24
1.00	0.0000	-0.3082	0.0033	0.4380	0.0	-1.2161	0.8351	-3549.18	1.2192	-1.5238	3534.75
1.10	0.0002	-0.2713	0.0008	0.3168	0.0	-1.1181	0.7039	-3270.57	1.1070	-1.0112	3205.93
1.20	0.0001	-0.2506	-0.0024	0.1263	0.0	-1.0468	0.4546	-3086.40	1.0426	-0.4605	3073.07
1.30	-0.0001	-0.2446	-0.0007	-0.0137	0.0	-1.0143	0.0835	-3032.91	1.0225	-0.0273	3064.27
1.40	-0.0001	-0.2504	0.0012	-0.1058	0.0	-1.0256	-0.2662	-3108.49	1.0326	0.2592	3128.60
1.50	0.0001	-0.2633	0.0013	-0.1487	0.0	-1.0680	-0.4315	-3255.24	1.0619	0.4349	3237.42
1.60	0.0001	-0.2783	0.0001	-0.1444	0.0	-1.1182	-0.3896	-3400.83	1.1019	0.4949	3364.57
1.70	0.0001	-0.2909	-0.0008	-0.1035	0.0	-1.1572	-0.2382	-3500.04	1.1422	0.4176	3476.18
1.80	0.0000	-0.2984	-0.0006	-0.0449	0.0	-1.1780	-0.0851	-3544.12	1.1713	0.2289	3541.13
1.90	-0.0000	-0.3000	0.0001	0.0118	0.0	-1.1823	0.0256	-3543.81	1.1823	0.0092	3548.05
2.00	0.0000	-0.2966	0.0004	0.0525	0.0	-1.1745	0.1013	-3511.57	1.1759	-0.1594	3508.76
2.10	0.0000	-0.2902	0.0002	0.0718	0.0	-1.1586	0.1526	-3457.60	1.1585	-0.2401	3446.84
2.20	0.0000	-0.2829	-0.0001	0.0718	0.0	-1.1382	0.1718	-3394.20	1.1374	-0.2443	3383.30
2.30	0.0000	-0.2763	-0.0002	0.0579	0.0	-1.1181	0.1493	-3336.68	1.1182	-0.2022	3330.52
2.40	0.0000	-0.2715	-0.0000	0.0369	0.0	-1.1029	0.0946	-3297.53	1.1034	-0.1382	3293.88
2.50	0.0000	-0.2689	0.0001	0.0152	0.0	-1.0949	0.0330	-3280.81	1.0944	-0.0682	3274.96
2.60	0.0000	-0.2683	0.0001	-0.0020	0.0	-1.0935	-0.0121	-3281.82	1.0910	-0.0054	3272.46
2.70	0.0000	-0.2691	-0.0000	-0.0117	0.0	-1.0961	-0.0324	-3292.12	1.0924	0.0372	3281.64
2.80	0.0000	-0.2704	-0.0001	-0.0132	0.0	-1.1001	-0.0331	-3304.24	1.0964	0.0512	3295.25
2.90	0.0000	-0.2715	-0.0000	-0.0085	0.0	-1.1036	-0.0226	-3313.40	1.1005	0.0391	3306.13
3.00	0.0000	-0.2719	0.0000	-0.0005	0.0	-1.1054	-0.0062	-3316.90	1.1028	0.0117	3309.93
3.10	0.0000	-0.2716	0.0000	0.0080	0.0	-1.1050	0.0129	-3313.43	1.1026	-0.0184	3305.75
3.20	0.0000	-0.2704	0.0000	0.0149	0.0	-1.1023	0.0308	-3303.18	1.1001	-0.0429	3295.09
3.30	0.0000	-0.2687	-0.0000	0.0191	0.0	-1.0977	0.0429	-3288.05	1.0957	-0.0582	3280.33
3.40	0.0000	-0.2667	-0.0000	0.0201	0.0	-1.0922	0.0465	-3270.99	1.0905	-0.0642	3263.88
3.50	0.0000	-0.2647	0.0000	0.0187	0.0	-1.0866	0.0427	-3254.83	1.0851	-0.0616	3247.92
3.60	0.0000	-0.2630	0.0000	0.0156	0.0	-1.0818	0.0348	-3241.32	1.0801	-0.0528	3234.09
3.70	0.0000	-0.2616	0.0000	0.0121	0.0	-1.0780	0.0263	-3230.92	1.0761	-0.0410	3223.30
3.80	0.0000	-0.2605	0.0000	0.0091	0.0	-1.0752	0.0193	-3223.20	1.0730	-0.0300	3215.42
3.90	0.0000	-0.2597	-0.0000	0.0072	0.0	-1.0730	0.0149	-3217.32	1.0708	-0.0223	3209.66

STRAIGHT TRUCK TEST FILE 30 FT/SEC 8 DEG STEP STEER.

TRUCK REAR SUSPENSION - UNSPRUNG MASS SUMMARY

TRAILING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	-0.0001	-0.0466	-0.0020	-1.8297	20607.88	-0.0720	-1.6304	-340.39	0.0787	1.9646	365.49
0.20	-0.0005	-0.3267	-0.0043	-2.7365	78739.31	-0.2786	-2.3487	-970.91	0.3235	3.1084	1117.14
0.30	-0.0007	-0.6107	0.0009	-2.7251	********	-0.5559	-2.6130	-1806.80	0.6164	3.2889	1998.66
0.40	-0.0004	-0.8680	0.0043	-2.4058	********	-0.8555	-2.3024	-2701.12	0.8878	2.9256	2807.26
0.50	-0.0001	-1.0677	0.0015	-1.6857	********	-1.1000	-1.4233	-3421.42	1.1025	2.1735	3440.21
0.60	-0.0003	-1.1806	-0.0067	-0.6816	********	-1.2318	-0.4705	-3748.13	1.2408	1.0704	3838.47
0.70	-0.0019	-1.2331	-0.0284	-0.3906	********	-1.2524	0.1973	-3735.00	1.2670	-0.3997	3756.09
0.80	-0.0011	-1.1499	0.0440	1.7569	********	-1.1783	0.9166	-3432.02	1.2712	-0.0723	3805.36
0.90	-0.0006	-1.0746	0.0149	1.5748	********	-1.0803	0.5570	-3178.32	1.1653	-1.2577	3377.10
1.00	-0.0001	-0.9843	0.0092	1.2093	********	-0.9929	0.5443	-2917.47	1.0295	-1.3435	2968.40
1.10	0.0000	-0.9051	0.0002	0.7676	********	-0.9131	0.5781	-2674.32	0.9249	-0.8615	2677.80
1.20	-0.0003	-0.8554	-0.0041	0.3410	********	-0.8461	0.4593	-2486.67	0.8739	-0.3247	2585.21
1.30	-0.0006	-0.8379	-0.0009	0.0046	********	-0.8111	0.1074	-2421.10	0.8634	0.0078	2590.95
1.40	-0.0005	-0.8481	0.0022	-0.2275	********	-0.8210	-0.2613	-2492.34	0.8721	0.1898	2637.59
1.50	-0.0003	-0.8760	0.0020	-0.3351	********	-0.8627	-0.4143	-2634.78	0.8929	0.3382	2716.55
1.60	-0.0002	-0.9093	-0.0002	-0.3255	********	-0.9095	-0.3356	-2766.25	0.9251	0.4383	2824.59
1.70	-0.0003	-0.9375	-0.0016	-0.2339	********	-0.9421	-0.1701	-2845.27	0.9624	0.4061	2932.78
1.80	-0.0005	-0.9547	-0.0010	-0.1079	********	-0.9568	-0.0456	-2875.53	0.9916	0.2300	3000.69
1.90	-0.0005	-0.9593	0.0003	0.0124	********	-0.9590	0.0185	-2875.05	1.0028	0.0024	3008.73
2.00	-0.0004	-0.9532	0.0008	0.1020	********	-0.9533	0.0645	-2852.68	0.9960	-0.1659	2969.39
2.10	-0.0004	-0.9403	0.0003	0.1499	********	-0.9410	0.1138	-2810.13	0.9790	-0.2313	2910.92
2.20	-0.0004	-0.9246	-0.0003	0.1564	********	-0.9236	0.1443	-2754.62	0.9600	-0.2201	2855.35
2.30	-0.0004	-0.9101	-0.0003	0.1296	********	-0.9055	0.1304	-2701.77	0.9437	-0.1774	2811.19
2.40	-0.0004	-0.8993	0.0000	0.0837	********	-0.8917	0.0780	-2666.24	0.9312	-0.1262	2779.47
2.50	-0.0004	-0.8934	0.0003	0.0350	********	-0.8849	0.0191	-2652.49	0.9229	-0.0699	2760.96
2.60	-0.0004	-0.8919	0.0002	-0.0036	********	-0.8842	-0.0187	-2654.72	0.9194	-0.0129	2756.63
2.70	-0.0004	-0.8935	-0.0000	-0.0257	********	-0.8868	-0.0307	-2663.86	0.9203	0.0304	2764.17
2.80	-0.0004	-0.8964	-0.0001	-0.0302	********	-0.8901	-0.0276	-2673.51	0.9239	0.0464	2777.02
2.90	-0.0004	-0.8990	-0.0001	-0.0213	********	-0.8928	-0.0193	-2680.70	0.9279	0.0346	2787.53
3.00	-0.0004	-0.9003	0.0000	-0.0048	********	-0.8943	-0.0081	-2683.79	0.9301	0.0072	2791.05
3.10	-0.0004	-0.8999	0.0001	0.0138	********	-0.8940	0.0067	-2681.32	0.9298	-0.0212	2787.02
3.20	-0.0004	-0.8977	0.0000	0.0293	********	-0.8918	0.0224	-2672.81	0.9274	-0.0424	2777.40
3.30	-0.0004	-0.8942	-0.0000	0.0391	********	-0.8878	0.0337	-2659.63	0.9236	-0.0551	2764.49
3.40	-0.0004	-0.8900	-0.0000	0.0421	********	-0.8829	0.0368	-2644.64	0.9190	-0.0604	2750.12
3.50	-0.0004	-0.8859	0.0000	0.0394	********	-0.8781	0.0330	-2630.54	0.9142	-0.0587	2735.96
3.60	-0.0004	-0.8822	0.0000	0.0329	********	-0.8739	0.0257	-2618.92	0.9097	-0.0513	2723.44
3.70	-0.0004	-0.8793	0.0000	0.0254	********	-0.8707	0.0186	-2610.01	0.9060	-0.0406	2713.58
3.80	-0.0004	-0.8771	0.0000	0.0189	********	-0.8683	0.0134	-2603.29	0.9033	-0.0308	2706.47
3.90	-0.0004	-0.8754	-0.0000	0.0145	********	-0.8664	0.0100	-2598.08	0.9013	-0.0228	2701.36

APPENDIX B

SAMPLE RUN OF A TRIPLES COMBINATION

The following pages are copies of the complete computer output package obtained from a two-second simulation of a triples combination in a braking-in-a-turn maneuver. The example illustrates use of optional spring tables, tire tables and brake torque tables. Antilock brake control systems are used on the tractor tandem rear axles, and cycling of the trailing axle can be observed on output page numbers 1.06.1, 1.10.1, and 1.14.1.

The first 20 pages are echo of the input data illustrating parameters for a triples combination; tables for suspensions, tires and brakes; an antilock system; and the vehicle summary page. These pages are normally reviewed to ensure that the desired vehicle and maneuver is being simulated.

The 60 remaining pages are the output indicating the response of each vehicle in the maneuver. In the process of exercising all options, however, the vehicle obtained is not representative and the performance indicated here should not be viewed as typical.

SIMULATION OPERATION PARAMETERS:

VEHICLE CONFIGURATION (NUMBER OF TRAILERS - ENTER 0 FOR A STRAIGHT TRUCK) - 3
INITIAL VELOCITY (FT/SEC) 44.00
STEER TABLE (NUMBER OF LINES): POSITIVE -STEER ANGLE TABLE, NEGATIVE - PATH FOLLOWER TABLE 2
TABLE ENTRIES:

TIME (SEC)	LEFT WHEEL (DEG)	RIGHT WHEEL (DEG)
0.0	0.0	0.0
1.00	2.00	2.00

TREADLE PRESSURE TABLE (NUMBER OF LINES) 2
TABLE ENTRIES:

TIME (SEC)	PRESSURE (PSI)
0.0	0.0
0.10	50.00

MAXIMUM SIMULATION TIME (SEC) 2.00
TIME INCREMENT OF OUTPUT (SEC) 0.05

ROAD KEY = 0 : FLAT ROAD.

OUTPUT PAGE OPTION KEYS: 0 DELETES PAGES

SPRUNG MASS POSITION	SPRUNG MASS VELOCITY	SPRUNG MASS ACCELERATION	TIRE FORCES PAGES	BRAKE SUMMARY PAGES	LATERAL PAGES	UNSPRUNG MASS PAGES
1	1	1	1	1	1	1

TRACTOR PARAMETERS

WHEELBASE - DISTANCE FROM FRONT AXLE TO CENTER OF REAR SUSPENSION (IN)	150.00
BASE VEHICLE CURB WEIGHT ON FRONT SUSPENSION (LB)	9437.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	7953.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	40.13
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	36757.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	105493.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	241479.00
PAYLOAD WEIGHT (LB)	0.0
*** ZERO ENTRY INDICATES NO PAYLOAD ***	
*** FIVE PAYLOAD DESCRIPTION PARAMETERS ARE NOT ENTERED ***	
FIFTH WHEEL LOCATION (IN. AHEAD OF REAR SUSP. CENTER)	1.00
FIFTH WHEEL HEIGHT ABOVE GROUND (IN)	47.50
5TH WHEEL STIFFNESS (IN-LB/DEG)	250000.00

TRACTOR FRONT SUSPENSION AND AXLE PARAMETERS	LEFT SIDE	RIGHT SIDE
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	1380.00	1500.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	670.00	670.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	5307.00	
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	20.00	
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	0.17	
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	9900.00	
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	36.00	
TRACK WIDTH (IN)	79.50	
UNSPRUNG WEIGHT (LB)	1450.00	

TRACTOR FRONT TIRES AND WHEELS	LEFT SIDE	RIGHT SIDE
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	100.00	100.00
ALIGNING MOMENT (IN-LB/DEG/TIRE)	500.00	500.00
TIRE SPRING RATE (LB/IN/TIRE)	4700.00	4700.00
TIRE LOADED RADIUS (IN)	20.00	20.00
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	245.00	245.00

TRACTOR REAR SUSPENSION AND AXLE PARAMETERS

	LEADING TANDEM AXLE LEFT SIDE	LEADING TANDEM AXLE RIGHT SIDE	TRAILING TANDEM AXLE LEFT SIDE	TRAILING TANDEM AXLE RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES		1		
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)		48.00		
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)		50.00		
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)		10.00		
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	3880.00	3880.00	3880.00	3880.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00	50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	1741.00	1741.00	1741.00	1741.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	12230.00			12230.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60			29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	0.01			0.01
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	30000.00			30000.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	40.75			40.75
TRACK WIDTH (IN)	72.00			72.00
UNSPRUNG WEIGHT (LB)	2450.00			2450.00

TRACTOR REAR TIRES AND WHEELS

	LEADING TANDEM AXLE LEFT SIDE	LEADING TANDEM AXLE RIGHT SIDE	TRAILING TANDEM AXLE LEFT SIDE	TRAILING TANDEM AXLE RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.80	12.80	12.80	12.80
CORNERING STIFFNESS (LB/DEG/TIRE)	-1.00	-1.00	-1.00	-1.00
*** NEGATIVE ENTRY INDICATES TABLE ENTERED ***				
*** ECHO WILL APPEAR ON TABLE INDEX PAGE ***				
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	-2.00	-2.00	-2.00	-2.00
*** NEGATIVE ENTRY INDICATES TABLE ENTERED ***				
*** ECHO WILL APPEAR ON TABLE INDEX PAGE ***				
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.00	20.00	20.00	20.00
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	229.00	229.00	229.00	190.00

TRACTOR FRONT BRAKES

	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.0200	0.0200
RISE TIME (SEC)	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1200.0000

TRACTOR REAR BRAKES

	LEADING TANDEM AXLE LEFT SIDE	LEADING TANDEM AXLE RIGHT SIDE	TRAILING TANDEM AXLE LEFT SIDE	TRAILING TANDEM AXLE RIGHT SIDE
TIME LAG (SEC)	0.0500	0.0500	0.0500	0.0500
RISE TIME (SEC)	0.4000	0.4000	0.4000	0.4000
BRAKE TORQUE (IN-LB/PSI/BRAKE)	2000.0000	2000.0000	1500.0000	1500.0000

TRAILER NO. 1 PARAMETERS

WHEELBASE - DISTANCE FROM KINGPIN TO CENTER OF REAR SUSPENSION (IN)	383.00
BASE VEHICLE KINGPIN STATIC LOAD (LB)	2815.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	8650.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	74.80
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	66224.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	5424E6.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	644483.00
PAYLOAD WEIGHT (LB)	46800.00
PAYLOAD DISTANCE AHEAD OF REAR SUSPENSION CENTER(IN)	183.00
PAYLOAD CG HEIGHT (IN. ABOVE GROUND)	60.00
PAYLOAD ROLL MOMENT OF INERTIA(IN-LB-SEC**2)	130000.00
PAYLOAD PITCH MOMENT OF INERTIA(IN-LB-SEC**2)	2400000.00
PAYLOAD YAW MOMENT OF INERTIA(IN-LB-SEC**2)	2400000.00
LOCATION OF PINTLE HOOK (IN BEHIND REAR SUSP. CENTER)	48.00
HEIGHT OF PINTLE HOOK (IN ABOVE GROUND)	40.00

TRAILER NO. 1 REAR SUSPENSION AND AXLE PARAMETERS

	LEADING TANDEM AXLE			TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE		LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES			1		
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)			48.00		
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)			40.00		
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)			10.00		
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	7818.00	7818.00		7818.00	7818.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00		50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00	2600.00		2600.00	2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4746.00				4746.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60				29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	-0.00				-0.00
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	35490.00				35490.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	38.00				38.00
TRACK WIDTH (IN)	71.25				71.25
UNSPRUNG WEIGHT (LB)	1530.00				1530.00

TRAILER NO. 1 REAR TIRES AND WHEELS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00	212.00	212.00

TRAILER NO. 1 REAR BRAKES

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1000.0000	1000.0000	1000.0000

TRAILER NO. 2 PARAMETERS

DOLLY KEY: 1 = CONVERTER DOLLY, 2 = FIXED DOLLY	1
DISTANCE FROM TURNTABLE CENTER TO PINTLE HOOK (IN)	60.00
TURNTABLE LOCATION (IN AHEAD OF SUSP. CENTER)	0.0
TURNTABLE HEIGHT ABOVE GROUND (IN)	52.00
WHEELBASE - DISTANCE FROM CENTER OF FRONT SUSP. TO CENTER OF REAR SUSP. (IN)	300.00
BASE VEHICLE CURB WEIGHT ON FRONT SUSPENSION (LB)	8650.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	8650.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	74.80
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	66224.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	542486.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	644483.00
PAYLOAD WEIGHT (LB)	0.0
*** ZERO ENTRY INDICATES NO PAYLOAD ***	
*** FIVE PAYLOAD DESCRIPTION PARAMETERS ARE NOT ENTERED ***	
LOCATION OF PINTLE HOOK (IN BEHIND REAR SUSP. CENTER)	48.00
HEIGHT OF PINTLE HOOK (IN ABOVE GROUND)	40.00

TRAILER NO. 2 FRONT SUSPENSION AND AXLE PARAMETERS

	LEFT SIDE		RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES		0	
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	7818.00		7818.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00		50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00		2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)		4746.00	
ROLL CENTER HEIGHT (IN. ABOVE GROUND)		29.60	
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)		-0.00	
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)		35490.00	
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)		38.00	
TRACK WIDTH (IN)		71.25	
UNSPRUNG WEIGHT (LB)		1530.00	

TRAILER NO. 2 FRONT TIRES AND WHEELS

	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00

TRAILER NO. 2 REAR SUSPENSION AND AXLE PARAMETERS	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES	1			
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)	48.00			
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)	50.00			
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)	10.00			
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	-3.00	-3.00	-3.00	-3.00
*** NEGATIVE ENTRY INDICATES TABLE ENTERED ***				
*** ECHO WILL APPEAR ON TABLE INDEX PAGE ***				
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00	50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00	2600.00	2600.00	2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4746.00			4746.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60			29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	-0.00			-0.00
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	35490.00			35490.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	38.00			38.00
TRACK WIDTH (IN)	71.25			71.25
UNSPRUNG WEIGHT (LB)	1530.00			1530.00

TRAILER NO. 2 REAR TIRES AND WHEELS	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00	212.00	212.00

TRAILER NO. 2 FRONT BRAKES	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	-5.0000	-5.0000
*** NEGATIVE ENTRY INDICATES TABLE ENTERED ***		
*** ECHO WILL APPEAR ON TABLE INDEX PAGE ***		

TRAILER NO. 2 REAR BRAKES	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1000.0000	1000.0000	1000.0000

TRAILER NO. 3 PARAMETERS

DOLLY KEY: 1 = CONVERTER DOLLY, 2 = FIXED DOLLY	2
DISTANCE FROM TURNTABLE CENTER TO FIFTH HOOK (IN)	60.00
TURNTABLE LOCATION (IN AHEAD OF SUSP. CENTER)	0.0
TURNTABLE HEIGHT ABOVE GROUND (IN)	52.00
WHEELBASE - DISTANCE FROM CENTER OF FRONT SUSP. TO CENTER OF REAR SUSP. (IN)	300.00
BASE VEHICLE CURB WEIGHT ON FRONT SUSPENSION (LB)	8650.00
BASE VEHICLE CURB WEIGHT ON REAR SUSPENSION (LB)	8650.00
SPRUNG MASS CG HEIGHT (IN. ABOVE GROUND)	74.80
SPRUNG MASS ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	66224.00
SPRUNG MASS PITCH MOMENT OF INERTIA (IN-LB-SEC**2)	542486.00
SPRUNG MASS YAW MOMENT OF INERTIA (IN-LB-SEC**2)	644483.00
PAYLOAD WEIGHT (LB)	0.0

*** ZERO ENTRY INDICATES NO PAYLOAD ***
*** FIVE PAYLOAD DESCRIPTION PARAMETERS ARE NOT ENTERED ***

TRAILER NO. 3 FRONT SUSPENSION AND AXLE PARAMETERS

	LEADING TANDEM AXLE			TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE		LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES			1		
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)			48.00		
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)			50.00		
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)			100.00		
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	7818.00	7818.00		7818.00	7818.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00		50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00	2600.00		2600.00	2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4746.00				4746.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60				29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	-0.00				-0.00
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	35490.00				35490.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	38.00				38.00
TRACK WIDTH (IN)	71.25				71.25
UNSPRUNG WEIGHT (LB)	1530.00				1530.00

TRAILER NO. 3 FRONT TIRES AND WHEELS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00	212.00	212.00

TRAILER NO. 3 REAR SUSPENSION AND AXLE PARAMETERS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
SUSPENSION KEY - 0 INDICATES SINGLE AXLE, 1 INDICATES TANDEM AXLES	1			
TANDEM AXLE SEPARATION (IN BETWEEN LEADING AND TRAILING AXLES)	48.00			
STATIC LOAD TRANSFER (PERCENT LOAD ON LEAD AXLE)	50.00			
DYNAMIC LOAD TRANSFER (PERCENT OF BRAKE TORQUE TRANSFERRED ONTO LEADING AXLE)	10.00			
SUSPENSION SPRING RATE (LB/IN/SIDE/AXLE)	7818.00	7818.00	7818.00	7818.00
SUSPENSION VISCOUS DAMPING (LB-SEC/IN/SIDE/AXLE)	50.00	50.00	50.00	50.00
COULOMB FRICTION (LB/SIDE/AXLE)	2600.00	2600.00	2600.00	2600.00
AXLE ROLL MOMENT OF INERTIA (IN-LB-SEC**2)	4746.00			4746.00
ROLL CENTER HEIGHT (IN. ABOVE GROUND)	29.60			29.60
ROLL STEER COEFFICIENT (DEG. STEER/DEG. ROLL)	-0.00			-0.00
AUXILIARY ROLL STIFFNESS (IN-LB/DEG/AXLE)	35490.00			35490.00
LATERAL DISTANCE BETWEEN SUSPENSION SPRINGS (IN)	38.00			38.00
TRACK WIDTH (IN)	71.25			71.25
UNSPRUNG WEIGHT (LB)	1530.00			1530.00

TRAILER NO. 3 REAR TIRES AND WHEELS

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
DUAL TIRE SEPARATION (IN)	12.40	12.40	12.40	12.40
CORNERING STIFFNESS (LB/DEG/TIRE)	600.00	600.00	600.00	600.00
LONGITUDINAL STIFFNESS (LB/SLIP/TIRE)	21000.00	21000.00	21000.00	21000.00
CAMBER STIFFNESS (LB/DEG/TIRE)	0.0	0.0	0.0	0.0
ALIGNING MOMENT (IN-LB/DEG/TIRE)	0.0	0.0	0.0	0.0
TIRE SPRING RATE (LB/IN/TIRE)	4500.00	4500.00	4500.00	4500.00
TIRE LOADED RADIUS (IN)	20.20	20.20	20.20	20.20
POLAR MOMENT OF INERTIA (IN-LB-SEC**2/WHEEL)	212.00	212.00	212.00	212.00

TRAILER NO. 3 FRONT BRAKES

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1000.0000	1000.0000	1000.0000

TRAILER NO. 3 REAR BRAKES

	LEADING TANDEM AXLE		TRAILING TANDEM AXLE	
	LEFT SIDE	RIGHT SIDE	LEFT SIDE	RIGHT SIDE
TIME LAG (SEC)	0.1400	0.1400	0.1400	0.1400
RISE TIME (SEC)	0.1700	0.1700	0.1700	0.1700
BRAKE TORQUE (IN-LB/PSI/BRAKE)	1000.0000	1000.0000	1000.0000	1000.0000

ANTILOCK KEY: 1 INDICATES ANTILOCK WILL BE USED 1

SPRING TABLES

NO. OF LINES	DEFLECTION (IN)	FORCE (LB)	TABLE NO.
5	-5.00	-4000.00	-3
	0.0	0.0	
	0.50	3000.00	
	1.00	9000.00	
	4.00	32000.00	

ML-Y VS ALPHA TABLES

NO. OF LOADS	NO. OF VELOCITIES	TABLE NO.
3	3	-1

VELOCITY = 25.00 FT/SEC LOAD = 3000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.50
10.00	0.80

VELOCITY = 25.00 FT/SEC LOAD = 5000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.40
10.00	0.70

VELOCITY = 25.00 FT/SEC LOAD = 7000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.30
10.00	0.60

VELOCITY = 50.00 FT/SEC LOAD = 3000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.50
10.00	0.80

VELOCITY = 50.00 FT/SEC LOAD = 5000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.40
10.00	0.70

VELOCITY = 50.00 FT/SEC LOAD = 7000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.30
10.00	0.60

VELOCITY = 75.00 FT/SEC LOAD = 3000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.50
10.00	0.80

VELOCITY = 75.00 FT/SEC LOAD = 5000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.40
10.00	0.70

VELOCITY = 75.00 FT/SEC LOAD = 7000.00 LB

ALPHA (DEG)	MU - Y
0.0	0.0
5.00	0.30
10.00	0.60

ROLL-COEF TABLE

SLIP	ALPHA 0.0	1.00
0.0	1.00	0.35
20.00	1.00	0.35

MU-X VS. SLIP TABLES

NO. OF LOADS	NO. OF VELOCITIES		TABLE NO.
3	2		-2

VELOCITY = 30.00 FT/SEC LOAD = 2000.00 LB

SLIP	MU - X
0.0	0.0
0.20	1.00
1.00	0.60

VELOCITY = 30.00 FT/SEC LOAD = 5000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.80
1.00	0.40

VELOCITY = 30.00 FT/SEC LOAD = 8000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.60
1.00	0.20

VELOCITY = 45.00 FT/SEC LOAD = 2000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.90
1.00	0.50

VELOCITY = 45.00 FT/SEC LOAD = 5000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.70
1.00	0.30

VELOCITY = 45.00 FT/SEC LOAD = 8000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.50
1.00	0.10

VELOCITY = 60.00 FT/SEC LOAD = 2000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.80
1.00	0.40

VELOCITY = 60.00 FT/SEC LOAD = 5000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.60
1.00	0.20

VELOCITY = 60.00 FT/SEC LOAD = 8000.00 LB

SLIP	MU - X
0.0	0.0
0.20	0.40
1.00	0.05

ROLL-OFF TABLE

	ALPHA	
SLIP	0.0	1.00
0.0	1.00	1.00
20.00	0.50	1.00

PRESSURE VS TORQUE TABLES

NO. OF LINES	PRESSURE (PSI)	TORQUE (IN-LB)	TABLE NO
5			-5
	0.0	0.0	
	10.00	0.0	
	20.00	20000.00	
	30.00	25000.00	
	100.00	150000.00	

DICTIONARY OF ANTI-LOCK VARIABLES/PARAMETERS AVAILABLE TO USER.

VARIABLE I.D.	DESCRIPTION	VARIABLE I.D.	DESCRIPTION
1	1.0	45	WMAX1
2	TIME	46	WMAX2
3	OMEGA	47	TWMAX1
4	OMEGADOT	48	TWMAX2
5	XDOT	49	WMIN
6	XDDOT	50	TWMIN
7	DCFF1	51	TPMAX2
8	DCFF2	52	TPMIN2
9	DCN1	53	GPV1
10	DCN2	54	GPV2
11	TCFF1	55	GPV3
12	TCN1	56	GPV4
13	XDCFF	57	GPV5
14	XDCN	58	FCS4
15	WCFF	59	FCS5
16	WCN	60	OMEGDIF
17	WDOFF		
18	WDON		
19	WDMAX		
20	WDMIN		
21	TPMAX1		
22	TPMIN1		
23	WLOCK		
24	TLOCK		
25	SLON		
26	SLOFF		
27	PMAX1		
28	PMAX2		
29	PMIN1		
30	PMIN2		
31	PC		
32	CA		
33	TMOD		
34	SLIP		
35	P		
36	CYCNT		
37	SQUARE		
38	SQUARA		
39	TCFF2		
40	TCN2		
41	FCS1		
42	FCS2		
43	FCS3		
44	CPCNT		

*** UNIT 1 SUSPENSION 1 AXLE 1 LEFT SIDE WILL HAVE NO ANTIL-LOCK SYSTEM

*** UNIT 1 SUSPENSION 1 AXLE 1 RIGHT SIDE WILL HAVE NO ANTIL-LOCK SYSTEM

*** ANTI-LOCK SUBROUTINE INPUT PARAMETER TABLE 6 --- UNIT 1 SUSPENSION 2 AXLE 1 LEFT SIDE ***

SYMBOL	DESCRIPTION	INITIAL VALUE	FIRST ADAPTIVE VALUE	SECOND ADAPTIVE VALUE	INITIAL VALUE VARIABLE	FIRST ADAPTIVE VARIABLE	SECOND ADAPTIVE VARIABLE	FIRST BREAK-PT	SECOND BREAK-PT
INEQUALITY EXPRESSION: 1									
C(1)	COEFFICIENT(1)	-1.0000			4				
C(2)	COEFFICIENT(2)	-30.0000			1				
INEQUALITY EXPRESSION: 2									
C(1)	COEFFICIENT(1)	0.5000			45				
C(2)	COEFFICIENT(2)	-1.0000			3				
C(3)	COEFFICIENT(3)	-20.0000			2				
C(4)	COEFFICIENT(4)	20.0000			47, 1				
INEQUALITY EXPRESSION: 3									
C(1)	COEFFICIENT(1)	1.0000			23				
C(2)	COEFFICIENT(2)	-0.1000			1				
INEQUALITY EXPRESSION: 5									
C(1)	COEFFICIENT(1)	1.0000			3				
C(2)	COEFFICIENT(2)	-1.0000			15				
C(3)	COEFFICIENT(3)	12.0000			2				
C(4)	COEFFICIENT(4)	-12.0000			11, 1				
C(5)	COEFFICIENT(5)	0.1000			1, 1				
INEQUALITY EXPRESSION: 6									
C(1)	COEFFICIENT(1)	1.0000			4				
C(2)	COEFFICIENT(2)	-1.0000			1				
EPSILION 1:									
H(1)	COEFFICIENT(1)	1.0000			35				
H(2)	COEFFICIENT(2)	-1.0000			55				
H(3)	COEFFICIENT(3)	0.0	-1000.0000		1	36		1.500	
EPSILION 2:									
G(1)	COEFFICIENT(1)	0.0	1.0000		35	41		0.500	
G(2)	COEFFICIENT(2)	-1.0000			27				

G(3)	COEFFICIENT(3)	1.000C		2		
G(4)	COEFFICIENT(4)	-1.000C		21, 1		
EPSILON 3:						
R(1)	COEFFICIENT(1)	5.000C		1		
EPSILON 4:						
S(1)	COEFFICIENT(1)	0.0	1.0CCC	35	41	0.500
S(2)	COEFFICIENT(2)	-1.000C		27		
S(3)	COEFFICIENT(3)	1.000C		2		
S(4)	COEFFICIENT(4)	-1.000C		21, 1		
CAE-SHCT 1:						
CS1(1)	COEFFICIENT(1)	1.000C		12		
CS1(2)	COEFFICIENT(2)	-1.000C		11		
CS1(3)	COEFFICIENT(3)	-0.100C		1		
CS1(1)	COEFFICIENT(1)	0.500C		1		
CS1(2)	COEFFICIENT(2)	-1.0000		32		
CEN. PUPP. VARIB. 3:						
CPV(1)	COEFFICIENT(1)	0.620C		27		

** NON-ADAPTIVE ANTI-LOCK PARAMETERS. **

TAU1	LOGIC TIME DELAY	0.0
TAU2	"	0.0
TAU3	"	0.0
TAU4	"	0.0
X1	EPSILON 1 BREAK-PT	0.0
X2	"	0.10CC
X3	EPSILON 2 BREAK-PT	-5.00CC
X4	"	2.00CC
PFE1	EXP. PRESSURE FALL RATE	18.00CC
PFE2	"	6.50CC
PFE3	"	6.50CC
PRE1	EXP. PRESSURE RISE RATE	11.50CC
PRE2	"	11.5000
PRE3	"	0.0
X5	EPSILON 3 BREAK-PT	0.0
X6	"	50.0000
X7	EPSILON 4 BREAK-PT	-5.00CC
X8	"	2.5000
PFL1	LIN. PRESSURE FALL RATE	0.0
PFL2	"	0.0
PFL3	"	0.0
PRL1	LIN. PRESSURE RISE RATE	0.0
PRL2	"	0.0
PRL3	"	45.00CC
TAUON	PRESSURE-ON TIME DELAY	0.02CC

TAUOFF	PRESSURE-OFF TIME DELAY	0.0200
TAUW	TIME CONSTANT-WHEEL RATE	0.0100
TAUWD	TIME CONSTANT-WHEEL ACCEL.	0.0100
CP12	LOGICAL OPERATOR SWITCH	1
CP23	"	0
CP34	"	0
CP56	LOGICAL OPERATOR SWITCH	1
CP67	"	0
CP78	"	0
TOS1	ONE-SHOT TIME DURATION	2.0000
TSAMPLE	ANTI-LOCK SAMPLING RATE	0.0200
OPTION	SIDE-TO-SIDE	1
OMEGDIF	SIDE-TO-SIDE TOLERANCE	100.0000

*** UNIT 1 SUSPENSION 2 AXLE 1 RIGHT SIDE WILL HAVE THE SAME ANTI-LOCK SYSTEM AS
UNIT 1 SUSPENSION 2 AXLE 1 LEFT SIDE

*** UNIT 1 SUSPENSION 2 AXLE 2 LEFT SIDE WILL HAVE THE SAME ANTI-LOCK SYSTEM AS
UNIT 1 SUSPENSION 2 AXLE 1 LEFT SIDE

*** UNIT 1 SUSPENSION 2 AXLE 2 RIGHT SIDE WILL HAVE THE SAME ANTI-LOCK SYSTEM AS
UNIT 1 SUSPENSION 2 AXLE 1 LEFT SIDE

*** UNIT 2 SUSPENSION 2 AXLE 1 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 2 SUSPENSION 2 AXLE 1 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 2 SUSPENSION 2 AXLE 2 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 2 SUSPENSION 2 AXLE 2 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 3 SUSPENSION 1 AXLE 1 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 3 SUSPENSION 1 AXLE 1 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 3 SUSPENSION 2 AXLE 1 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 3 SUSPENSION 2 AXLE 1 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 3 SUSPENSION 2 AXLE 2 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 3 SUSPENSION 2 AXLE 2 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 1 AXLE 1 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 1 AXLE 1 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 1 AXLE 2 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 1 AXLE 2 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 2 AXLE 1 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 2 AXLE 1 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 2 AXLE 2 LEFT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

*** UNIT 4 SUSPENSION 2 AXLE 2 RIGHT SIDE WILL HAVE NO ANTI-LOCK SYSTEM

TRAILER NO. 3 PAYLOAD = 0.0 LBS.	EMPTY	LOADED
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	150.000	150.000
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO GROUND (IN)	74.800	74.800
ROLL MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	66223.938	66223.938
PITCH MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	542485.938	542485.938
YAW MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	644482.938	644482.938

TRAILER NO. 2 PAYLOAD = 0.0 LBS.	EMPTY	LOADED
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	168.057	168.057
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO GROUND (IN)	74.800	74.800
ROLL MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	66223.938	66223.938
PITCH MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	542485.938	542485.938
YAW MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	644482.938	644482.938

TRAILER NO. 1 PAYLOAD = 46800.000 LBS.	EMPTY	LOADED
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	125.082	174.182
DISTANCE FROM TRAILER SPRUNG MASS CENTER TO GROUND (IN)	74.800	62.253
ROLL MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	66223.938	83267.250
PITCH MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	542485.938	684850.250
YAW MOMENT OF INERTIA OF TRAILER SPRUNG MASS (IN-LB-SEC**2)	644482.938	946404.000

TRACTOR PAYLOAD = 0.0 LBS	EMPTY	LOADED
DISTANCE FROM TRACTOR SPRUNG MASS CENTER TO REAR SUSPENSION (IN)	108.519	108.519
DISTANCE FROM TRACTOR SPRUNG MASS CENTER TO GROUND (IN)	40.130	40.130
ROLL MOMENT OF INERTIA OF TRACTOR SPRUNG MASS (IN-LB-SEC**2)	36756.996	36756.996
PITCH MOMENT OF INERTIA OF TRACTOR SPRUNG MASS (IN-LB-SEC**2)	105492.938	105492.938
YAW MOMENT OF INERTIA OF TRACTOR SPRUNG MASS (IN-LB-SEC**2)	241479.000	241479.000

THE STATIC LOADS ON THE AXLES ARE:

AXLE NUMBER	LOAD
WS(1,1,1)	9604.379
WS(1,2,1)	16445.969
WS(1,2,2)	16445.969
WS(2,2,1)	13263.469
WS(2,2,2)	19895.203
WS(3,1,1)	8650.000
WS(3,2,1)	4325.000
WS(3,2,2)	4325.000
WS(4,1,1)	4325.000
WS(4,1,2)	4325.000
WS(4,2,1)	4325.000
WS(4,2,2)	4325.000
TOTAL	110254.938

THE TRACTOR TOTAL MASS CENTER IS 68.690 INCHES BEHIND THE FRONT AXLE
THE TOTAL YAW MOMENT OF INERTIA IS 401321.875 IN-LB-SEC**2

THE FIRST TRAILER TOTAL MASS CENTER IS 217.966 INCHES BEHIND THE KINGPIN
THE TOTAL YAW MOMENT OF INERTIA IS 1188344.000 IN-LB-SEC**2

THE SECOND TRAILER TOTAL MASS CENTER IS 150.000 INCHES BEHIND THE TURNTABLE CENTER
THE TOTAL YAW MOMENT OF INERTIA IS 941574.000 IN-LB-SEC**2

THE THIRD TRAILER TOTAL MASS CENTER IS - 150.000 INCHES BEHIND THE TURNTABLE CENTER
THE TOTAL YAW MOMENT OF INERTIA IS 1046017.500 IN-LB-SEC**2

TRACTOR SPRUNG MASS POSITION

TIME (SEC)	FORWARD (FT)	LATERAL (FT)	VERTICAL (FT)	ROLL (DEG)	PITCH (DEG)	HEADING (DEG)	TURN RADIUS (FT)	SIDE SLIP (DEG)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	**********	0.0
0.05	2.3100	0.0001	0.0000	-0.0010	-0.0002	0.0005	8696.0586	0.0072
0.10	4.5092	0.0008	0.0004	-0.0042	-0.0077	0.0043	4445.2305	0.0251
0.15	6.7044	0.0025	0.0030	-0.0087	-0.0420	0.0143	2981.2686	0.0505
0.20	8.8903	0.0058	0.0107	-0.0162	-0.1189	0.0334	2213.1108	0.0807
0.25	11.0641	0.0113	0.0251	-0.0250	-0.2356	0.0641	1740.3245	0.1139
0.30	13.2265	0.0194	0.0443	-0.0363	-0.3852	0.1087	1427.2600	0.1484
0.35	15.3777	0.0306	0.0642	-0.0505	-0.5592	0.1690	1198.1235	0.1827
0.40	17.5141	0.0456	0.0815	-0.0675	-0.7152	0.2466	1028.3337	0.2158
0.45	19.6283	0.0647	0.0930	-0.0877	-0.8297	0.3425	899.4089	0.2462
0.50	21.7110	0.0884	0.0973	-0.1095	-0.9001	0.4569	797.4507	0.2729
0.55	23.7544	0.1168	0.0955	-0.1327	-0.9288	0.5899	712.7769	0.2953
0.60	25.7530	0.1503	0.0904	-0.1563	-0.9288	0.7409	638.4070	0.3139
0.65	27.7046	0.1889	0.0853	-0.1801	-0.9170	0.9096	570.6362	0.3305
0.70	29.6093	0.2330	0.0827	-0.2043	-0.9105	1.0955	508.8486	0.3472
0.75	31.4689	0.2830	0.0838	-0.2292	-0.9205	1.2986	453.9731	0.3661
0.80	33.2853	0.3391	0.0882	-0.2556	-0.9477	1.5191	406.0881	0.3886
0.85	35.0603	0.4018	0.0950	-0.2834	-0.9852	1.7570	365.8088	0.4154
0.90	36.7948	0.4714	0.1022	-0.3122	-1.0242	2.0123	332.4077	0.4460
0.95	38.4884	0.5481	0.1081	-0.3413	-1.0580	2.2844	304.8418	0.4796
1.00	40.1402	0.6319	0.1118	-0.3695	-1.0821	2.5727	281.3193	0.5154
1.05	41.7486	0.7227	0.1131	-0.3944	-1.0949	2.8753	280.4375	0.5406
1.10	43.3118	0.8198	0.1123	-0.4138	-1.0979	3.1876	274.6852	0.5511
1.15	44.8280	0.9226	0.1103	-0.4282	-1.0930	3.5057	264.4082	0.5558
1.20	46.2962	1.0305	0.1081	-0.4356	-1.0872	3.8262	252.9919	0.5617
1.25	47.7162	1.1429	0.1065	-0.4388	-1.0841	4.1468	242.5656	0.5707
1.30	49.0882	1.2596	0.1059	-0.4377	-1.0859	4.4652	234.6504	0.5834
1.35	50.4134	1.3800	0.1065	-0.4333	-1.0915	4.7791	228.4512	0.5992
1.40	51.6929	1.5037	0.1081	-0.4268	-1.1005	5.0869	222.7903	0.6181
1.45	52.9275	1.6301	0.1100	-0.4179	-1.1106	5.3872	218.1857	0.6408
1.50	54.1178	1.7588	0.1119	-0.4067	-1.1191	5.6789	215.0329	0.6663
1.55	55.2637	1.8890	0.1132	-0.3925	-1.1239	5.9607	212.9410	0.6937
1.60	56.3652	2.0201	0.1136	-0.3747	-1.1221	6.2318	194.5854	0.7266
1.65	57.4236	2.1522	0.1120	-0.3536	-1.0929	6.4982	148.5358	0.8228
1.70	58.4404	2.2860	0.1063	-0.3278	-1.0414	6.7630	193.5673	0.9293
1.75	59.4152	2.4198	0.0988	-0.2986	-0.9960	7.0055	209.3100	0.9584
1.80	60.3387	2.5509	0.0936	-0.2773	-0.9687	7.2289	202.2103	0.9955
1.85	61.2080	2.6783	0.0930	-0.2557	-0.9709	7.4342	195.7654	1.0436
1.90	62.0265	2.8020	0.0965	-0.2206	-1.0042	7.6248	207.1635	1.0906
1.95	62.7991	2.9218	0.1041	-0.1813	-1.0594	7.8047	212.0431	1.1211

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR SPRUNG MASS VELOCITY (BODY AXES)

TIME (SEC)	FORWARD (FT/SEC)	LATERAL (FT/SEC)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	PITCH (DEG/SEC)	HEADING (DEG/SEC)
0.0	44.00	0.0	0.0	0.0	0.0	0.0
0.05	44.00	0.01	0.00	-0.05	-0.03	0.03
0.10	43.96	0.02	0.01	-0.07	-0.34	0.13
0.15	43.83	0.04	0.06	-0.12	-1.09	0.28
0.20	43.60	0.06	0.13	-0.17	-1.97	0.45
0.25	43.26	0.09	0.18	-0.19	-2.66	0.75
0.30	43.14	0.11	0.12	-0.25	-3.33	1.04
0.35	42.90	0.14	-0.03	-0.30	-3.45	1.37
0.40	42.54	0.16	-0.23	-0.35	-2.72	1.73
0.45	42.00	0.19	-0.45	-0.39	-1.86	2.10
0.50	41.29	0.20	-0.63	-0.41	-0.97	2.47
0.55	40.43	0.21	-0.73	-0.43	-0.24	2.84
0.60	39.51	0.22	-0.75	-0.42	0.17	3.20
0.65	38.57	0.22	-0.70	-0.42	0.22	3.55
0.70	37.65	0.23	-0.61	-0.43	-0.03	3.89
0.75	36.78	0.24	-0.53	-0.44	-0.40	4.23
0.80	35.95	0.24	-0.47	-0.47	-0.70	4.58
0.85	35.14	0.25	-0.46	-0.48	-0.82	4.93
0.90	34.33	0.27	-0.48	-0.49	-0.77	5.27
0.95	33.51	0.28	-0.52	-0.47	-0.62	5.60
1.00	32.67	0.29	-0.57	-0.44	-0.41	5.92
1.05	31.79	0.30	-0.60	-0.32	-0.19	6.16
1.10	30.88	0.30	-0.62	-0.23	-0.01	6.32
1.15	29.93	0.29	-0.61	-0.09	0.07	6.40
1.20	28.98	0.28	-0.59	0.02	0.05	6.42
1.25	28.02	0.28	-0.55	0.09	-0.03	6.40
1.30	27.09	0.28	-0.51	0.18	-0.13	6.33
1.35	26.17	0.27	-0.47	0.23	-0.20	6.22
1.40	25.28	0.27	-0.45	0.27	-0.25	6.08
1.45	24.40	0.27	-0.43	0.32	-0.24	5.92
1.50	23.52	0.27	-0.42	0.36	-0.18	5.74
1.55	22.64	0.27	-0.42	0.43	-0.09	5.53
1.60	21.76	0.28	-0.43	0.50	0.23	5.34
1.65	20.93	0.30	-0.47	0.56	0.85	5.36
1.70	20.14	0.33	-0.51	0.67	1.01	5.09
1.75	19.20	0.32	-0.47	0.62	0.73	4.66
1.80	18.12	0.31	-0.37	0.42	0.27	4.29
1.85	17.06	0.31	-0.25	0.65	-0.39	3.95
1.90	16.10	0.31	-0.16	0.83	-0.94	3.70
1.95	15.22	0.30	-0.12	0.89	-1.25	3.51

TIME (SEC)	TRACTOR SPRUNG MASS ACCELERATION (BODY AXES)						INERTIAL ACCEL. ALONG BODY AXES	
	FORWARD (FT/SEC**2)	LATERAL (FT/SEC**2)	VERTICAL (FT/SEC**2)	ROLL (DEG/SEC**2)	PITCH (DEG/SEC**2)	HEADING (DEG/SEC**2)	LONGITUDINAL (FT/SEC**2)	LATERAL (FT/SEC**2)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0
0.05	-0.1423	0.2026	0.0682	-1.0966	-2.2435	1.2780	-0.1423	0.2274
0.10	-1.4593	0.3413	0.5861	-0.2851	-10.8560	2.5144	-1.4994	0.4387
0.15	-3.8396	0.4285	1.3205	-1.5213	-17.8964	3.6803	-3.8410	0.6444
0.20	-4.5166	0.4812	1.2775	-0.2377	-16.3858	4.6497	-4.9217	0.8549
0.25	-4.5039	0.5087	0.1118	-1.0788	-12.3983	5.5252	-4.5131	1.0731
0.30	-4.3165	0.5085	-2.2746	-1.0482	-12.0466	6.2876	-4.3256	1.2931
0.35	-5.7172	0.4878	-3.5738	-0.5058	8.6745	6.9237	-5.7187	1.5150
0.40	-8.9553	0.4364	-4.3060	-1.1210	17.0792	7.2919	-8.8493	1.7191
0.45	-12.6052	0.3581	-4.2147	-0.3630	17.6075	7.4235	-12.5973	1.8943
0.50	-15.8619	0.2658	-2.9611	-0.2415	17.1385	7.3871	-15.8598	2.0435
0.55	-17.9769	0.1782	-1.2414	0.1204	11.4885	7.1864	-17.9841	2.1780
0.60	-18.8105	0.1150	0.4400	0.3304	4.7312	6.9622	-18.8248	2.3157
0.65	-18.6327	0.0877	1.5202	0.1352	-2.4175	6.7769	-18.6492	2.4709
0.70	-17.9032	0.0950	1.8003	0.1347	-7.0347	6.6567	-17.9184	2.6469
0.75	-16.9811	0.1228	1.4580	-0.0830	-7.2414	6.7518	-16.9947	2.8371
0.80	-16.3649	0.1622	0.7495	-0.0549	-4.2393	6.7977	-16.3786	3.0320
0.85	-16.0698	0.1950	-0.0355	0.2273	-0.6288	6.7472	-16.0852	3.2137
0.90	-16.1621	0.2130	-0.6610	0.5907	2.1528	6.5482	-16.1802	3.3684
0.95	-16.5635	0.2139	-0.9680	1.1239	3.8259	6.1895	-16.5853	3.4876
1.00	-17.1750	0.2061	-0.9057	1.6324	4.5348	5.7353	-17.2013	3.5755
1.05	-17.9189	-0.0555	-0.5676	2.2994	4.2280	3.5931	-17.9492	3.3611
1.10	-18.5762	-0.1854	-0.1061	2.4755	2.6362	1.9148	-18.6088	3.2161
1.15	-18.9991	-0.2124	0.3324	4.0703	0.5611	0.5901	-19.0322	3.1284
1.20	-19.1417	-0.1917	0.6514	2.1669	-1.1284	-0.3479	-19.1740	3.0557
1.25	-18.9862	-0.1593	0.8158	2.7385	-1.8949	-1.2878	-19.0171	2.9714
1.30	-18.5249	-0.1221	0.8057	2.1580	-1.7631	-2.2192	-18.5542	2.9614
1.35	-18.0806	-0.1108	0.6500	1.5944	-1.1725	-2.8562	-18.1086	2.7327
1.40	-17.6958	-0.0865	0.4208	1.8844	-0.3871	-3.3845	-17.7228	2.5998
1.45	-17.5258	-0.0682	0.2001	1.6430	0.6751	-3.8492	-17.5522	2.4561
1.50	-17.5480	-0.0629	0.0504	1.9690	1.6157	-4.2922	-17.5741	2.2953
1.55	-17.6675	-0.0682	-0.0039	2.2244	2.0344	-4.7236	-17.6933	2.1207
1.60	-16.8571	0.1385	-0.3705	1.9600	15.8746	-1.7891	-16.8845	2.1687
1.65	-16.8030	0.6961	-1.1181	2.5015	9.9488	1.3846	-16.8380	2.6580
1.70	-16.0625	-0.0348	-0.1757	2.4578	-4.0648	-11.3122	-16.1006	1.7613
1.75	-20.7633	-0.1991	1.6879	-3.7453	-6.6377	-7.6146	-20.7954	1.3664
1.80	-21.8388	-0.1650	2.2943	0.2443	-12.3149	-7.6606	-21.8640	1.1943
1.85	-20.3397	-0.1101	2.1488	7.3367	-12.7475	-6.2143	-20.3593	1.0680
1.90	-18.2830	-0.1836	1.3944	1.0967	-8.7758	-4.4558	-18.3001	0.8573
1.95	-16.9781	-0.2082	0.2713	3.1568	-3.0456	-3.7001	-16.9937	0.7251

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR FRONT AXLE TIRE FORCES

	LEFT SIDE					RIGHT SIDE					STEER ANGLE	
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	LEFT (DEG)	RIGHT (DEG)
0.0	4802.19	-0.0	0.0	0.0	0.0	4802.19	-0.0	0.0	0.0	0.0	0.0	0.0
0.05	4823.53	-39.70	53.64	-0.0082	0.0111	4781.94	-46.64	53.17	-0.0098	0.0111	0.10	0.10
0.10	4873.68	-320.06	99.48	-0.0657	0.0204	4777.93	-380.80	97.49	-0.0797	0.0204	0.20	0.20
0.15	5010.91	-803.16	135.58	-0.1603	0.0275	4988.28	-960.37	136.09	-0.1965	0.0278	0.30	0.30
0.20	5320.51	-1238.07	181.53	-0.2327	0.0341	5159.39	-1483.66	175.86	-0.2876	0.0341	0.40	0.40
0.25	5764.95	-1573.96	228.04	-0.2730	0.0396	5571.49	-1887.84	220.04	-0.3388	0.0395	0.50	0.50
0.30	6262.84	-1818.87	276.42	-0.2904	0.0441	6034.06	-2181.53	265.68	-0.3615	0.0440	0.60	0.60
0.35	6710.45	-1983.51	324.22	-0.2956	0.0483	6447.02	-2380.66	310.42	-0.3693	0.0481	0.70	0.70
0.40	7012.80	-2084.89	365.47	-0.2973	0.0521	6718.03	-2506.10	348.45	-0.3730	0.0519	0.80	0.80
0.45	7135.12	-2146.20	398.83	-0.3008	0.0559	6811.36	-2584.61	378.37	-0.3795	0.0555	0.90	0.90
0.50	7102.59	-2186.99	425.58	-0.3079	0.0599	6751.50	-2638.06	401.37	-0.3907	0.0594	1.00	1.00
0.55	6981.22	-2220.32	448.51	-0.3180	0.0642	6602.16	-2681.22	420.12	-0.4061	0.0636	1.10	1.10
0.60	6854.05	-2253.35	472.71	-0.3288	0.0690	6443.59	-2722.44	439.41	-0.4225	0.0682	1.20	1.20
0.65	6798.86	-2287.21	501.06	-0.3369	0.0738	6342.46	-2763.61	462.05	-0.4357	0.0729	1.30	1.30
0.70	6819.34	-2319.28	535.02	-0.3401	0.0785	6332.26	-2802.01	489.44	-0.4425	0.0773	1.40	1.40
0.75	6939.47	-2346.07	573.15	-0.3381	0.0826	6408.70	-2833.78	520.34	-0.4422	0.0812	1.50	1.50
0.80	7113.65	-2364.37	611.44	-0.3324	0.0860	6539.55	-2855.50	551.14	-0.4367	0.0843	1.60	1.60
0.85	7294.65	-2374.74	645.90	-0.3255	0.0885	6680.94	-2867.89	578.25	-0.4293	0.0866	1.70	1.70
0.90	7442.55	-2378.61	673.47	-0.3196	0.0905	6795.47	-2872.88	598.95	-0.4228	0.0881	1.80	1.80
0.95	7534.32	-2378.28	693.30	-0.3157	0.0920	6860.82	-2873.21	612.47	-0.4188	0.0893	1.90	1.90
1.00	7566.13	-2375.34	706.28	-0.3139	0.0933	6872.40	-2870.84	619.61	-0.4177	0.0902	2.00	2.00
1.05	7521.78	-2369.09	695.00	-0.3150	0.0844	6868.07	-2870.41	555.32	-0.4179	0.0809	2.00	2.00
1.10	7446.41	-2366.22	561.77	-0.3178	0.0781	6842.55	-2866.65	508.16	-0.4189	0.0743	2.00	2.00
1.15	7386.12	-2364.21	546.35	-0.3201	0.0740	6795.99	-2866.13	474.73	-0.4217	0.0695	2.00	2.00
1.20	7333.91	-2364.54	515.70	-0.3224	0.0703	6772.77	-2868.01	446.85	-0.4235	0.0660	2.00	2.00
1.25	7311.43	-2366.84	487.27	-0.3237	0.0666	6772.29	-2871.28	420.48	-0.4240	0.0621	2.00	2.00
1.30	7315.80	-2371.07	464.53	-0.3241	0.0635	6799.92	-2876.65	399.54	-0.4230	0.0588	2.00	2.00
1.35	7340.79	-2374.92	442.84	-0.3235	0.0603	6847.75	-2881.10	379.52	-0.4207	0.0554	2.00	2.00
1.40	7374.02	-2377.68	422.88	-0.3224	0.0573	6904.57	-2884.24	361.11	-0.4177	0.0523	2.00	2.00
1.45	7402.61	-2378.75	402.54	-0.3213	0.0544	6958.22	-2885.55	342.76	-0.4147	0.0493	2.00	2.00
1.50	7416.02	-2378.36	383.09	-0.3207	0.0517	6998.88	-2885.30	324.58	-0.4123	0.0464	2.00	2.00
1.55	7410.46	-2376.99	365.72	-0.3208	0.0494	7020.23	-2884.03	308.82	-0.4108	0.0440	2.00	2.00
1.60	7392.98	-2380.48	343.11	-0.3224	0.0465	7020.13	-2885.83	287.83	-0.4111	0.0410	2.00	2.00
1.65	7230.40	-2380.70	228.90	-0.3293	0.0317	6963.16	-2885.35	177.58	-0.4144	0.0255	2.00	2.00
1.70	6944.69	-2383.55	149.71	-0.3432	0.0216	6837.54	-2895.63	103.85	-0.4235	0.0152	2.00	2.00
1.75	6817.63	-2357.04	160.54	-0.3457	0.0235	6648.52	-2863.43	116.05	-0.4307	0.0175	2.00	2.00
1.80	6767.40	-2348.23	135.49	-0.3470	0.0200	6645.57	-2859.60	92.75	-0.4303	0.0140	2.00	2.00
1.85	6851.86	-2361.14	137.12	-0.3446	0.0200	6750.76	-2869.19	94.92	-0.4250	0.0141	2.00	2.00
1.90	7025.30	-2376.08	132.81	-0.3382	0.0189	6942.89	-2884.00	89.73	-0.4154	0.0129	2.00	2.00
1.95	7207.67	-2385.57	126.60	-0.3310	0.0176	7178.94	-2891.78	82.46	-0.4028	0.0115	2.00	2.00

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION TIRE FORCES

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	8222.98	-0.0	0.0	0.0	0.0	8222.98	-0.0	0.0	0.0	0.0
0.05	8221.55	-0.05	-2.21	-0.0000	-0.0003	8222.30	1.10	-2.21	0.0001	-0.0003
0.10	8213.76	-96.28	-4.49	-0.0109	-0.0005	8211.78	-83.39	-4.49	-0.0102	-0.0005
0.15	8226.02	-410.93	-5.55	-0.0500	-0.0007	8217.37	-406.33	-5.55	-0.0494	-0.0007
0.20	8301.02	-898.68	-3.49	-0.1083	-0.0004	8274.72	-892.34	-3.49	-0.1078	-0.0004
0.25	8455.06	-1378.85	2.25	-0.1631	0.0003	8404.03	-1370.91	2.25	-0.1631	0.0003
0.30	8606.77	-1806.80	11.71	-0.2099	0.0014	8523.38	-1797.19	11.69	-0.2109	0.0014
0.35	8660.96	-2164.57	25.99	-0.2517	0.0030	8469.13	-2152.93	25.86	-0.2542	0.0031
0.40	8629.14	-2463.55	44.86	-0.2855	0.0052	8440.12	-2450.90	44.53	-0.2904	0.0053
0.45	8619.35	-2706.14	68.82	-0.3140	0.0080	8359.03	-2691.35	68.05	-0.3220	0.0081
0.50	8518.81	-2915.18	97.79	-0.3422	0.0115	8177.32	-2898.80	96.20	-0.3545	0.0118
0.55	8412.24	-3109.91	131.27	-0.3697	0.0156	7983.39	-3092.34	128.34	-0.3873	0.0161
0.60	8335.10	-3296.55	168.75	-0.3955	0.0202	7811.91	-3278.24	163.83	-0.4196	0.0210
0.65	8328.50	-3476.67	209.38	-0.4174	0.0251	7708.57	-3458.75	201.87	-0.4487	0.0262
0.70	8389.80	-3644.10	252.25	-0.4343	0.0301	7668.83	-3626.83	241.63	-0.4729	0.0315
0.75	8497.79	-3795.16	296.74	-0.4466	0.0349	7671.93	-3778.72	282.55	-0.4925	0.0368
0.80	8642.52	-3926.90	342.46	-0.4544	0.0396	7707.74	-3911.39	324.34	-0.5075	0.0421
0.85	8807.50	-4038.44	389.01	-0.4585	0.0442	7759.01	-4023.80	366.62	-0.5186	0.0473
0.90	8963.27	-4130.39	435.66	-0.4608	0.0486	7799.59	-4116.48	408.63	-0.5278	0.0524
0.95	9082.43	-4205.83	481.80	-0.4631	0.0530	7804.48	-4192.23	449.57	-0.5372	0.0576
1.00	9152.72	-4268.25	527.04	-0.4663	0.0576	7764.39	-4254.98	488.90	-0.5480	0.0630
1.05	9184.49	-4320.38	574.96	-0.4704	0.0626	7691.35	-4309.30	529.83	-0.5603	0.0689
1.10	9192.11	-4366.13	621.78	-0.4750	0.0676	7605.76	-4358.33	569.13	-0.5730	0.0748
1.15	9186.96	-4408.41	665.52	-0.4799	0.0724	7521.84	-4396.75	605.31	-0.5845	0.0805
1.20	9174.19	-4441.04	701.73	-0.4841	0.0765	7454.86	-4439.75	635.10	-0.5956	0.0852
1.25	9165.33	-4480.58	729.49	-0.4889	0.0796	7409.55	-4482.46	658.18	-0.6050	0.0888
1.30	9170.42	-4520.39	749.43	-0.4929	0.0816	7392.93	-4525.79	674.29	-0.6122	0.0912
1.35	9187.03	-4556.55	758.66	-0.4960	0.0826	7408.60	-4564.73	684.01	-0.6161	0.0923
1.40	9214.08	-4587.96	762.06	-0.4979	0.0827	7441.50	-4597.66	688.23	-0.6178	0.0925
1.45	9237.34	-4613.48	758.23	-0.4994	0.0821	7485.62	-4624.84	686.69	-0.6178	0.0917
1.50	9250.46	-4633.87	747.57	-0.5009	0.0809	7533.21	-4646.09	679.81	-0.6167	0.0902
1.55	9250.82	-4650.00	732.45	-0.5027	0.0792	7578.37	-4663.03	668.32	-0.6153	0.0882
1.60	9197.11	-4666.96	713.38	-0.5074	0.0776	7584.67	-4675.46	653.28	-0.6164	0.0861
1.65	9033.46	-4691.01	694.27	-0.5193	0.0769	7484.86	-4694.19	636.81	-0.6272	0.0851
1.70	8932.79	-4717.15	665.72	-0.5281	0.0678	7520.13	-4744.75	560.16	-0.6309	0.0745
1.75	8863.45	-4670.88	533.01	-0.5270	0.0601	7669.99	-4692.11	501.08	-0.6117	0.0653
1.80	8857.36	-4662.57	474.35	-0.5264	0.0536	7714.69	-4678.11	447.60	-0.6064	0.0580
1.85	8830.20	-4694.29	424.44	-0.5305	0.0481	7802.57	-4701.16	403.88	-0.6025	0.0518
1.90	8798.29	-4719.11	391.62	-0.5364	0.0445	7908.20	-4731.11	376.56	-0.5983	0.0476
1.95	8800.27	-4743.67	378.70	-0.5390	0.0430	7984.85	-4752.59	366.35	-0.5952	0.0459

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION TIRE FORCES

TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	8222.98	-0.0	0.0	0.0	0.0	8222.98	-0.0	0.0	0.0	0.0
0.05	8221.93	-0.03	-0.06	-0.0000	-0.0000	8220.45	1.01	-0.06	0.0001	-0.0000
0.10	8166.52	-61.99	3.93	-0.0076	0.0005	8152.25	-67.42	3.93	-0.0083	0.0005
0.15	7954.04	-295.64	12.91	-0.0372	0.0016	7918.38	-315.98	12.89	-0.0399	0.0016
0.20	7641.47	-646.86	27.82	-0.0847	0.0036	7569.93	-675.46	27.68	-0.0892	0.0037
0.25	7350.75	-996.43	48.23	-0.1356	0.0066	7233.66	-1023.27	47.81	-0.1415	0.0066
0.30	7010.36	-1306.79	72.89	-0.1864	0.0104	6839.29	-1328.88	71.85	-0.1943	0.0105
0.35	6475.71	-1557.26	99.98	-0.2405	0.0154	6237.73	-1576.58	97.66	-0.2527	0.0157
0.40	6088.68	-1773.32	130.60	-0.2912	0.0214	5780.21	-1792.26	124.77	-0.3101	0.0216
0.45	5792.21	-1945.61	163.14	-0.3359	0.0282	5401.66	-1965.16	152.40	-0.3638	0.0282
0.50	5508.62	-2093.42	196.61	-0.3800	0.0357	5034.88	-2115.62	179.92	-0.4202	0.0357
0.55	5319.73	-2240.10	234.06	-0.4211	0.0440	4759.07	-2263.28	209.49	-0.4756	0.0440
0.60	5216.04	-2385.62	276.26	-0.4574	0.0530	4559.77	-2407.73	241.38	-0.5280	0.0529
0.65	5196.08	-2529.98	324.13	-0.4869	0.0624	4441.48	-2550.50	276.65	-0.5742	0.0623
0.70	5219.01	-2661.97	376.17	-0.5101	0.0721	4358.19	-2678.57	313.35	-0.6146	0.0719
0.75	5242.89	-2778.09	429.81	-0.5295	0.0820	4273.93	-2790.72	349.12	-0.6530	0.0817
0.80	5269.16	-2880.77	485.04	-0.5467	0.0921	4190.34	-2889.82	383.88	-0.6896	0.0916
0.85	5306.90	-2969.41	542.78	-0.5595	0.1023	4112.21	-2975.81	417.99	-0.7237	0.1016
0.90	5346.57	-3041.83	602.11	-0.5689	0.1126	4034.25	-3047.48	450.86	-0.7554	0.1118
0.95	5372.77	-3099.04	661.07	-0.5768	0.1230	3944.76	-3101.48	480.84	-0.7862	0.1219
1.00	5377.80	-3144.78	718.07	-0.5848	0.1335	3840.79	-3147.34	506.91	-0.8195	0.1320
1.05	5372.02	-3183.21	773.78	-0.5926	0.1440	3736.65	-3191.04	530.60	-0.8540	0.1420
1.10	5362.66	-3216.81	824.48	-0.5999	0.1537	3648.07	-3233.99	551.50	-0.8865	0.1512
1.15	5353.50	-3248.01	870.18	-0.6067	0.1625	3571.84	-3267.03	569.44	-0.9147	0.1594
1.20	5335.91	-3270.24	906.88	-0.6125	0.1700	3511.58	-3302.75	583.90	-0.9405	0.1663
1.25	5313.67	-3299.36	934.34	-0.6209	0.1758	3462.61	-3324.58	594.55	-0.9601	0.1717
1.30	5294.68	-3330.70	952.94	-0.6291	0.1800	3431.01	-3269.84	597.71	-0.9530	0.1742
1.35	5277.77	-3360.04	963.19	-0.6366	0.1825	3424.21	-3219.04	592.71	-0.9401	0.1731
1.40	5266.67	-3385.52	967.68	-0.6429	0.1837	3430.82	-3158.21	578.00	-0.9205	0.1685
1.45	5251.25	-3406.04	964.88	-0.6486	0.1837	3451.90	-3081.56	552.34	-0.8927	0.1600
1.50	5230.71	-3421.57	955.55	-0.6542	0.1827	3486.47	-2977.40	513.58	-0.8540	0.1473
1.55	5205.11	-3434.07	940.64	-0.6597	0.1807	3534.15	-2825.79	457.54	-0.7996	0.1295
1.60	5209.79	-2723.79	951.54	-0.5228	0.1826	3633.02	-2737.11	416.29	-0.7534	0.1146
1.65	5575.04	-1217.82	1078.08	-0.2184	0.1934	3877.52	-3396.25	592.64	-0.8759	0.1528
1.70	5829.59	-1311.77	1051.28	-0.2250	0.1803	3901.04	-1523.20	707.04	-0.3905	0.1812
1.75	5514.41	-2209.59	895.22	-0.4007	0.1623	3991.22	-2289.82	650.14	-0.5737	0.1629
1.80	5436.16	-2768.67	814.93	-0.5093	0.1499	4016.36	-2823.22	602.12	-0.7029	0.1499
1.85	5354.53	-3088.22	750.43	-0.5767	0.1401	3957.98	-3153.29	552.34	-0.7967	0.1396
1.90	5131.22	-3286.60	688.71	-0.6405	0.1342	3963.58	-3351.88	530.54	-0.8457	0.1339
1.95	4969.82	-3407.85	656.13	-0.6857	0.1320	3867.03	-3450.09	508.84	-0.8922	0.1316

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR FRONT SUSPENSION - BRAKE SUMMARY

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.40	-0.0	0.0	0.0	-0.0	0.0	26.40	-0.0
0.05	26.25	1.57	1567.37	-39.70	0.0019	26.35	-3.16	1.57	1880.84	-46.64	0.0022	26.34	-3.87
0.10	50.00	8.81	8808.70	-320.06	0.0150	25.98	-9.83	8.81	10570.44	-380.80	0.0182	25.90	-12.06
0.15	50.00	19.01	19007.76	-803.16	0.0367	25.33	-12.02	19.01	22809.32	-960.37	0.0449	25.12	-14.70
0.20	50.00	26.91	26905.01	-1238.07	0.0532	24.77	-8.75	26.91	32286.01	-1483.66	0.0658	24.44	-10.66
0.25	50.00	32.79	32789.97	-1573.96	0.0624	24.39	-5.35	32.79	39347.97	-1887.84	0.0775	24.00	-6.49
0.30	50.00	37.18	37179.18	-1818.87	0.0664	24.17	-3.26	37.18	44610.22	-2181.53	0.0827	23.75	-4.00
0.35	50.00	40.44	40442.94	-1983.51	0.0676	24.00	-3.15	40.44	48531.54	-2380.66	0.0844	23.57	-3.75
0.40	50.00	42.88	42878.07	-2084.89	0.0680	23.79	-4.82	42.88	51453.66	-2506.10	0.0853	23.35	-5.44
0.45	50.00	44.69	44692.71	-2146.20	0.0688	23.47	-7.22	44.69	53631.23	-2584.61	0.0868	23.01	-7.91
0.50	50.00	46.04	46044.95	-2186.99	0.0704	23.03	-9.41	46.04	55253.91	-2638.06	0.0894	22.56	-10.17
0.55	50.00	47.05	47052.59	-2220.32	0.0727	22.50	-10.80	47.05	56463.09	-2681.22	0.0929	22.01	-11.59
0.60	50.00	47.80	47803.51	-2253.35	0.0752	21.92	-11.17	47.80	57364.17	-2722.44	0.0966	21.41	-11.90
0.65	50.00	48.36	48363.06	-2287.21	0.0773	21.36	-10.69	48.36	58035.66	-2763.61	0.0996	20.83	-11.28
0.70	50.00	48.78	48780.05	-2319.28	0.0778	20.83	-9.77	48.78	58536.05	-2802.01	0.1012	20.31	-10.19
0.75	50.00	49.09	49090.80	-2346.07	0.0773	20.36	-8.85	49.09	58908.94	-2833.78	0.1011	19.84	-9.12
0.80	50.00	49.32	49322.34	-2364.37	0.0760	19.93	-8.31	49.32	59186.81	-2855.50	0.0999	19.41	-8.48
0.85	50.00	49.49	49494.85	-2374.74	0.0744	19.51	-8.16	49.45	59393.86	-2867.89	0.0982	19.01	-8.31
0.90	50.00	49.62	49623.52	-2378.61	0.0731	19.09	-8.37	49.62	59548.22	-2872.88	0.0967	18.61	-8.53
0.95	50.00	49.72	49719.28	-2378.28	0.0722	18.66	-8.79	49.72	59663.16	-2873.21	0.0958	18.18	-8.98
1.00	50.00	49.79	49790.72	-2375.34	0.0718	18.19	-9.32	49.79	59748.84	-2870.84	0.0955	17.73	-9.52
1.05	50.00	49.84	49843.92	-2369.09	0.0720	17.70	-10.05	49.84	59812.69	-2870.41	0.0956	17.25	-9.81
1.10	50.00	49.88	49883.53	-2366.22	0.0727	17.18	-10.45	49.88	59860.27	-2866.65	0.0958	16.75	-10.32
1.15	50.00	49.91	49913.11	-2364.21	0.0732	16.65	-10.73	49.91	59895.75	-2866.13	0.0964	16.23	-10.50
1.20	50.00	49.94	49935.09	-2364.54	0.0737	16.11	-10.79	49.94	59922.09	-2868.01	0.0968	15.70	-10.46
1.25	50.00	49.95	49951.50	-2366.84	0.0740	15.57	-10.67	49.95	59941.78	-2871.28	0.0970	15.18	-10.27
1.30	50.00	49.96	49963.73	-2371.07	0.0741	15.05	-10.38	49.96	59956.50	-2876.65	0.0967	14.68	-9.89
1.35	50.00	49.97	49972.83	-2374.92	0.0740	14.54	-10.10	49.97	59967.42	-2881.10	0.0962	14.19	-9.57
1.40	50.00	49.98	49979.63	-2377.68	0.0737	14.05	-9.90	49.98	59975.58	-2884.24	0.0955	13.72	-9.35
1.45	50.00	49.98	49984.69	-2378.75	0.0735	13.56	-9.84	49.98	59981.63	-2885.55	0.0948	13.25	-9.27
1.50	50.00	49.99	49988.48	-2378.36	0.0733	13.08	-9.88	49.99	59986.17	-2885.30	0.0943	12.78	-9.31
1.55	50.00	49.99	49991.30	-2376.99	0.0734	12.59	-10.01	49.99	59989.55	-2884.03	0.0939	12.31	-9.42
1.60	50.00	49.99	49993.38	-2380.48	0.0737	12.09	-9.72	49.99	59992.03	-2885.83	0.0940	11.83	-9.29
1.65	50.00	49.99	49994.95	-2390.70	0.0753	11.61	-9.72	49.99	59993.95	-2885.35	0.0948	11.37	-9.34
1.70	50.00	50.00	49996.08	-2383.55	0.0785	11.13	-9.49	50.00	59995.31	-2895.63	0.0968	10.91	-8.50
1.75	50.00	50.00	49996.97	-2357.04	0.0791	10.61	-11.66	50.00	59996.39	-2863.43	0.0985	10.39	-11.13
1.80	50.00	50.00	49997.58	-2348.23	0.0793	10.01	-12.38	50.00	59997.14	-2859.60	0.0984	9.80	-11.45
1.85	50.00	50.00	49999.09	-2361.14	0.0788	9.43	-11.33	50.00	59997.70	-2869.19	0.0972	9.24	-10.67
1.90	50.00	50.00	49998.38	-2376.09	0.0773	8.91	-10.11	50.00	59998.08	-2884.00	0.0950	8.74	-9.46
1.95	50.00	50.00	49999.70	-2385.57	0.0757	8.44	-9.34	50.00	59998.45	-2891.78	0.0921	8.29	-8.83

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION - BRAKE SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	TREADLE PRESSURE (PSI)	LEFT SIDE BRAKE PRESSURE (PSI)	LEFT SIDE BRAKE TORQUE (IN-LB)	LEFT SIDE TIRE BRAKE FORCE (LB)	LEFT SIDE WHEEL SLIP	LEFT SIDE ANGULAR WHEEL VEL. (RAD/SEC)	LEFT SIDE ANGULAR WHEEL ACCEL. (RAD/SEC)	RIGHT SIDE BRAKE PRESSURE (PSI)	RIGHT SIDE BRAKE TORQUE (IN-LB)	RIGHT SIDE TIRE BRAKE FORCE (LB)	RIGHT SIDE WHEEL SLIP	RIGHT SIDE ANGULAR WHEEL VEL (RAD/SEC)	RIGHT SIDE ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.40	-0.0	0.0	0.0	-0.0	0.0	26.40	-0.0
0.05	26.25	0.01	15.58	-0.05	0.0000	26.40	-0.03	0.01	15.58	1.10	-.0000	26.40	-0.08
0.10	50.00	1.73	3453.09	-86.28	0.0027	26.31	-3.77	1.73	3453.09	-83.39	0.0026	26.31	-3.90
0.15	50.00	6.17	12346.34	-410.93	0.0130	25.95	-9.01	6.17	12346.34	-406.33	0.0129	25.96	-9.21
0.20	50.00	11.32	22646.14	-898.68	0.0283	25.42	-10.20	11.32	22646.14	-892.34	0.0281	25.42	-10.48
0.25	50.00	15.87	31735.75	-1378.85	0.0428	24.90	-9.08	15.87	31735.75	-1370.91	0.0427	24.91	-9.43
0.30	50.00	19.88	39757.23	-1806.80	0.0553	24.45	-7.91	19.88	39757.23	-1797.19	0.0553	24.45	-8.33
0.35	50.00	23.42	46836.14	-2164.57	0.0662	24.04	-7.74	23.42	46836.14	-2152.93	0.0664	24.03	-8.25
0.40	50.00	26.54	53083.27	-2463.95	0.0751	23.61	-8.31	26.54	53083.27	-2450.90	0.0756	23.59	-8.88
0.45	50.00	29.30	58596.38	-2706.14	0.0822	23.13	-9.77	29.30	58596.38	-2691.35	0.0832	23.10	-10.41
0.50	50.00	31.73	63461.63	-2915.18	0.0888	22.57	-11.26	31.73	63461.63	-2898.80	0.0904	22.53	-11.98
0.55	50.00	33.88	67755.25	-3109.91	0.0949	21.96	-12.13	33.88	67755.25	-3092.34	0.0974	21.90	-12.90
0.60	50.00	35.77	71543.88	-3296.55	0.1006	21.32	-12.26	35.77	71543.88	-3278.24	0.1041	21.24	-13.05
0.65	50.00	37.44	74887.19	-3476.67	0.1054	20.70	-11.69	37.44	74887.19	-3458.75	0.1101	20.59	-12.47
0.70	50.00	38.92	77837.81	-3644.10	0.1093	20.12	-10.82	38.92	77837.81	-3626.83	0.1152	19.99	-11.57
0.75	50.00	40.22	80441.75	-3795.16	0.1122	19.59	-9.91	40.22	80441.75	-3778.72	0.1193	19.44	-10.63
0.80	50.00	41.37	82739.63	-3926.90	0.1143	19.10	-9.17	41.37	82739.63	-3911.39	0.1224	18.93	-9.85
0.85	50.00	42.38	84767.50	-4038.44	0.1155	18.65	-8.73	42.38	84767.50	-4023.80	0.1247	18.45	-9.37
0.90	50.00	43.28	86557.13	-4130.39	0.1162	18.20	-8.62	43.28	86557.13	-4116.48	0.1264	17.99	-9.23
0.95	50.00	44.07	88136.44	-4205.83	0.1168	17.76	-8.78	44.07	88136.44	-4192.23	0.1280	17.53	-9.37
1.00	50.00	44.77	89530.25	-4268.25	0.1173	17.30	-9.09	44.77	89530.25	-4254.98	0.1297	17.06	-9.67
1.05	50.00	45.38	90760.00	-4320.38	0.1178	16.83	-9.50	45.38	90760.00	-4309.30	0.1316	16.56	-9.99
1.10	50.00	45.92	91845.38	-4366.13	0.1183	16.33	-9.88	45.92	91845.38	-4359.33	0.1334	16.06	-10.22
1.15	50.00	46.40	92803.13	-4408.41	0.1187	15.83	-10.12	46.40	92803.13	-4396.75	0.1352	15.53	-10.63
1.20	50.00	46.82	93648.38	-4441.04	0.1196	15.31	-10.54	46.82	93648.38	-4439.75	0.1376	14.99	-10.60
1.25	50.00	47.20	94394.25	-4480.58	0.1208	14.78	-10.44	47.20	94394.25	-4482.46	0.1397	14.47	-10.36
1.30	50.00	47.52	95052.75	-4520.39	0.1219	14.27	-10.14	47.53	95052.75	-4525.79	0.1413	13.95	-9.91
1.35	50.00	47.82	95633.63	-4556.55	0.1228	13.77	-9.83	47.82	95633.63	-4564.73	0.1424	13.47	-9.47
1.40	50.00	48.07	96146.31	-4587.96	0.1234	13.29	-9.58	48.07	96146.31	-4597.66	0.1429	13.00	-9.16
1.45	50.00	48.30	96598.81	-4613.48	0.1239	12.82	-9.45	48.30	96598.81	-4624.84	0.1432	12.54	-8.96
1.50	50.00	48.50	96998.19	-4633.87	0.1243	12.36	-9.43	48.50	96998.19	-4646.09	0.1431	12.09	-8.90
1.55	50.00	48.68	97350.56	-4650.00	0.1247	11.89	-9.50	48.68	97350.56	-4663.03	0.1430	11.64	-8.93
1.60	50.00	48.83	97661.56	-4666.96	0.1255	11.42	-9.44	48.83	97661.56	-4675.46	0.1432	11.19	-9.07
1.65	50.00	48.97	97936.06	-4691.01	0.1275	10.96	-9.99	48.97	97936.06	-4694.19	0.1451	10.74	-8.85
1.70	50.00	49.09	98178.19	-4717.15	0.1288	10.53	-8.37	49.09	98178.19	-4744.75	0.1457	10.32	-7.17
1.75	50.00	49.20	98392.00	-4670.88	0.1279	10.05	-10.86	49.20	98392.00	-4692.11	0.1418	9.89	-9.93
1.80	50.00	49.29	98580.75	-4662.57	0.1275	9.49	-11.64	49.29	98580.75	-4678.11	0.1405	9.35	-10.96
1.85	50.00	49.37	98747.19	-4684.29	0.1282	8.93	-11.09	49.37	98747.19	-4701.16	0.1399	8.81	-10.31
1.90	50.00	49.45	98894.06	-4719.11	0.1293	8.41	-9.85	49.45	98894.06	-4731.11	0.1393	8.31	-9.33
1.95	50.00	49.51	99023.75	-4743.67	0.1299	7.95	-9.06	49.51	99023.75	-4752.59	0.1389	7.86	-8.67

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION - BRAKE SUMMARY

TRAILING TANDEM AXLE

TIME (SEC)	TREADLE PRESSURE (PSI)	LEFT SIDE BRAKE PRESSURE (PSI)	LEFT SIDE BRAKE TORQUE (IN-LB)	LEFT SIDE TIRE BRAKE FORCE (LB)	LEFT SIDE WHEEL SLIP	LEFT SIDE ANGULAR WHEEL VEL. (RAD/SEC)	LEFT SIDE ANGULAR WHEEL ACCEL. (RAD/SEC)	RIGHT SIDE BRAKE PRESSURE (PSI)	RIGHT SIDE BRAKE TORQUE (IN-LB)	RIGHT SIDE TIRE BRAKE FORCE (LB)	RIGHT SIDE WHEEL SLIP	RIGHT SIDE ANGULAR WHEEL VEL (RAD/SEC)	RIGHT SIDE ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.40	-0.0	0.0	0.0	-0.0	0.0	26.40	-0.0
0.05	26.25	0.01	11.68	-0.03	0.0000	26.40	-0.02	0.01	11.68	1.01	-.0000	26.40	-0.08
0.10	50.00	1.73	2589.82	-61.99	0.0020	26.33	-2.95	1.73	2589.82	-67.42	0.0022	26.32	-3.27
0.15	50.00	6.17	9259.76	-295.64	0.0096	26.05	-7.31	6.17	9259.76	-315.98	0.0103	26.03	-7.74
0.20	50.00	11.32	16984.61	-646.86	0.0215	25.60	-8.84	11.32	16984.61	-675.46	0.0226	25.57	-9.15
0.25	50.00	15.87	23801.81	-996.43	0.0340	25.13	-8.46	15.87	23801.81	-1023.27	0.0353	25.10	-8.78
0.30	50.00	19.88	29817.92	-1306.79	0.0460	24.69	-8.04	19.88	29817.92	-1328.88	0.0476	24.65	-8.53
0.35	50.00	23.42	35127.11	-1557.26	0.0561	24.25	-8.69	23.42	35127.11	-1576.58	0.0604	24.19	-9.46
0.40	50.00	26.54	39812.48	-1773.32	0.0692	23.76	-9.49	26.54	39812.48	-1792.26	0.0726	23.67	-10.44
0.45	50.00	29.30	43947.30	-1945.61	0.0787	23.22	-10.59	29.30	43947.30	-1965.16	0.0838	23.09	-12.22
0.50	50.00	31.73	47596.25	-2093.42	0.0877	22.60	-12.51	31.73	47596.25	-2115.62	0.0951	22.42	-13.91
0.55	50.00	33.88	50816.44	-2240.10	0.0961	21.93	-13.13	33.88	50816.44	-2263.28	0.1061	21.69	-14.61
0.60	50.00	35.77	53657.95	-2385.62	0.1035	21.25	-12.98	35.77	53657.95	-2407.73	0.1164	20.95	-14.48
0.65	50.00	37.44	56165.44	-2529.98	0.1096	20.60	-12.15	37.44	56165.44	-2550.50	0.1254	20.24	-13.57
0.70	50.00	38.92	58378.41	-2661.97	0.1144	20.01	-11.22	38.92	58378.41	-2678.57	0.1333	19.58	-12.65
0.75	50.00	40.22	60331.31	-2778.09	0.1185	19.45	-10.41	40.22	60331.31	-2790.72	0.1406	18.97	-11.89
0.80	50.00	41.37	62054.77	-2880.77	0.1220	18.94	-9.69	41.37	62054.77	-2889.82	0.1475	18.39	-11.21
0.85	50.00	42.38	63575.67	-2969.41	0.1246	18.45	-9.14	42.38	63575.67	-2975.81	0.1538	17.84	-10.68
0.90	50.00	43.28	64917.89	-3041.83	0.1265	17.99	-8.91	43.28	64917.89	-3047.48	0.1596	17.31	-10.44
0.95	50.00	44.07	66102.38	-3099.04	0.1279	17.54	-9.00	44.07	66102.38	-3101.48	0.1654	16.78	-10.72
1.00	50.00	44.77	67147.69	-3144.78	0.1293	17.07	-9.28	44.77	67147.69	-3147.34	0.1718	16.23	-11.05
1.05	50.00	45.38	68070.00	-3183.21	0.1305	16.58	-9.62	45.38	68070.00	-3191.04	0.1784	15.67	-11.18
1.10	50.00	45.92	68884.00	-3216.81	0.1315	16.09	-9.93	45.92	68884.00	-3233.99	0.1844	15.11	-11.06
1.15	50.00	46.40	69602.31	-3248.01	0.1324	15.58	-10.14	46.40	69602.31	-3267.03	0.1899	14.55	-11.22
1.20	50.00	46.82	70236.25	-3270.24	0.1331	15.06	-10.55	46.82	70236.25	-3302.75	0.1956	13.99	-11.00
1.25	50.00	47.20	70795.69	-3299.36	0.1355	14.54	-10.50	47.20	70795.69	-3324.58	0.2009	13.44	-11.33
1.30	50.00	47.53	71289.56	-3330.70	0.1373	14.02	-10.21	47.53	71289.56	-3269.84	0.2151	12.76	-15.51
1.35	50.00	47.82	71725.25	-3360.04	0.1390	13.52	-9.88	47.82	71725.25	-3219.04	0.2438	11.87	-19.33
1.40	50.00	48.07	72109.69	-3385.92	0.1403	13.04	-9.59	48.07	72109.69	-3158.21	0.2884	10.79	-23.54
1.45	50.00	48.30	72449.06	-3406.04	0.1415	12.57	-9.45	48.30	72449.06	-3081.56	0.3525	9.48	-28.47
1.50	50.00	48.50	72748.63	-3421.97	0.1426	12.10	-9.41	48.50	72748.63	-2977.40	0.4413	7.88	-34.74
1.55	50.00	48.68	73012.94	-3434.07	0.1436	11.63	-9.46	48.68	73012.94	-2825.79	0.5644	5.92	-43.41
1.60	50.00	32.53	48789.16	-2723.79	0.1139	11.57	12.42	32.53	48789.16	-2737.11	0.6674	4.34	15.67
1.65	50.00	15.27	22905.53	-1217.82	0.0484	11.95	3.17	15.27	22905.53	-3396.25	0.3919	7.64	118.47
1.70	50.00	23.26	34890.29	-1311.77	0.0501	11.48	-18.90	23.26	34890.29	-1523.20	0.0817	11.09	-11.65
1.75	50.00	34.95	52428.00	-2209.59	0.0878	10.51	-17.98	34.95	52428.00	-2289.82	0.1194	10.15	-17.45
1.80	50.00	41.53	62297.20	-2768.67	0.1110	9.67	-15.12	41.53	62297.20	-2823.22	0.1458	9.29	-15.35
1.85	50.00	45.23	67851.25	-3088.22	0.1250	8.96	-13.29	45.23	67851.25	-3153.29	0.1647	8.55	-12.59
1.90	50.00	47.32	70976.81	-3286.60	0.1375	8.33	-11.45	47.32	70976.81	-3351.88	0.1746	7.97	-10.37
1.95	50.00	48.49	72735.75	-3407.85	0.1463	7.80	-10.00	48.49	72735.75	-3450.09	0.1840	7.45	-9.83

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR FRONT SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	-0.0899	93.6414	0.0111	-44.7011	-0.0899	53.1735	0.0111	-44.3112
0.10	-0.1657	99.4814	0.0204	-82.9012	-0.1657	97.4915	0.0204	-81.2429
0.15	-0.2259	139.5815	0.0279	-116.3179	-0.2258	136.0855	0.0278	-113.4046
0.20	-0.2767	181.5339	0.0341	-151.2782	-0.2766	175.8576	0.0341	-146.5479
0.25	-0.3207	228.0424	0.0396	-190.0353	-0.3203	220.0411	0.0395	-183.3675
0.30	-0.3577	276.4160	0.0441	-230.3465	-0.3570	265.6824	0.0440	-221.4018
0.35	-0.3915	324.2202	0.0483	-270.1831	-0.3903	310.4231	0.0481	-258.6855
0.40	-0.4222	369.4668	0.0521	-304.5554	-0.4205	348.4504	0.0519	-290.3752
0.45	-0.4529	398.8340	0.0555	-332.3613	-0.4504	378.3689	0.0555	-315.3071
0.50	-0.4856	425.5764	0.0595	-354.6467	-0.4822	401.3689	0.0594	-334.4735
0.55	-0.5208	448.5095	0.0642	-373.7576	-0.5163	420.1155	0.0636	-350.0959
0.60	-0.5593	472.7070	0.0690	-393.9221	-0.5536	439.4136	0.0682	-366.1775
0.65	-0.5987	501.0649	0.0738	-417.5537	-0.5917	462.0527	0.0729	-385.0437
0.70	-0.6366	535.0217	0.0785	-445.8511	-0.6280	489.4407	0.0773	-407.8669
0.75	-0.6704	573.1541	0.0826	-477.6282	-0.6595	520.3369	0.0812	-433.6135
0.80	-0.6978	611.4424	0.0860	-509.5356	-0.6852	551.1379	0.0843	-459.2813
0.85	-0.7190	645.8975	0.0885	-538.2476	-0.7040	579.2505	0.0866	-481.8750
0.90	-0.7349	673.4705	0.0905	-561.2251	-0.7171	598.9497	0.0881	-499.1243
0.95	-0.7474	693.3030	0.0920	-577.7520	-0.7265	612.4670	0.0893	-510.3889
1.00	-0.7583	706.2778	0.0933	-588.5645	-0.7340	619.6072	0.0902	-516.3389
1.05	-0.6865	635.0042	0.0844	-529.1697	-0.6589	555.3232	0.0809	-462.7690
1.10	-0.6353	581.7749	0.0781	-484.8120	-0.6052	508.1567	0.0743	-423.4636
1.15	-0.6019	546.3523	0.0740	-455.2932	-0.5698	474.7256	0.0699	-395.6042
1.20	-0.5722	515.6995	0.0703	-429.7493	-0.5383	446.8477	0.0660	-372.3728
1.25	-0.5425	487.2729	0.0666	-406.0605	-0.5067	420.4822	0.0621	-350.4016
1.30	-0.5169	464.5278	0.0635	-387.1062	-0.4796	399.5449	0.0588	-332.9539
1.35	-0.4911	442.8428	0.0603	-369.0354	-0.4524	379.5151	0.0554	-316.2625
1.40	-0.4668	422.8848	0.0573	-352.4038	-0.4270	361.1125	0.0523	-300.9270
1.45	-0.4431	402.9443	0.0544	-335.7869	-0.4021	342.7559	0.0493	-285.6296
1.50	-0.4204	383.0916	0.0517	-319.2427	-0.3785	324.5784	0.0464	-270.4819
1.55	-0.4015	365.7163	0.0494	-304.7634	-0.3589	308.8162	0.0440	-257.3467
1.60	-0.3780	343.1128	0.0465	-285.9272	-0.3345	287.8264	0.0410	-239.8552
1.65	-0.2581	228.8957	0.0317	-190.7464	-0.2090	177.5800	0.0255	-147.9833
1.70	-0.1745	149.7128	0.0216	-124.7606	-0.1236	103.8534	0.0152	-86.5445
1.75	-0.1914	160.5434	0.0235	-133.7861	-0.1427	116.0528	0.0175	-96.7106
1.80	-0.1626	135.4093	0.0200	-112.9077	-0.1141	92.7524	0.0140	-77.2937
1.85	-0.1620	137.1202	0.0200	-114.2668	-0.1143	94.9189	0.0141	-79.0990
1.90	-0.1528	132.8110	0.0189	-110.6758	-0.1050	89.7257	0.0129	-74.7714
1.95	-0.1411	126.6002	0.0176	-105.5001	-0.0925	82.4638	0.0115	-68.7198

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0030	-2.2077	-0.0003	0.0	0.0030	-2.2079	-0.0003	0.0
0.10	0.0062	-4.4895	-0.0005	0.0	0.0062	-4.4905	-0.0005	0.0
0.15	0.0077	-5.5508	-0.0007	0.0	0.0077	-5.5519	-0.0007	0.0
0.20	0.0048	-3.4893	-0.0004	0.0	0.0048	-3.4878	-0.0004	0.0
0.25	-0.0031	2.2533	0.0003	0.0	-0.0031	2.2506	0.0003	0.0
0.30	-0.0162	11.7131	0.0014	0.0	-0.0163	11.6853	0.0014	0.0
0.35	-0.0363	25.9771	0.0030	0.0	-0.0364	25.8565	0.0031	0.0
0.40	-0.0629	44.8627	0.0052	0.0	-0.0632	44.5321	0.0053	0.0
0.45	-0.0971	68.8176	0.0080	0.0	-0.0976	68.0498	0.0081	0.0
0.50	-0.1394	97.7922	0.0115	0.0	-0.1403	96.2009	0.0118	0.0
0.55	-0.1891	131.2715	0.0156	0.0	-0.1905	128.3401	0.0161	0.0
0.60	-0.2453	168.7515	0.0202	0.0	-0.2473	163.8287	0.0210	0.0
0.65	-0.3055	209.3765	0.0251	0.0	-0.3084	201.8727	0.0262	0.0
0.70	-0.3676	252.2480	0.0301	0.0	-0.3716	241.6325	0.0315	0.0
0.75	-0.4304	296.7354	0.0345	0.0	-0.4357	282.5510	0.0368	0.0
0.80	-0.4932	342.4553	0.0396	0.0	-0.4998	324.3381	0.0421	0.0
0.85	-0.5555	389.0117	0.0442	0.0	-0.5638	366.6169	0.0473	0.0
0.90	-0.6172	435.6628	0.0486	0.0	-0.6273	408.6252	0.0524	0.0
0.95	-0.6786	481.7991	0.0530	0.0	-0.6907	449.5698	0.0576	0.0
1.00	-0.7400	527.0400	0.0576	0.0	-0.7542	488.9048	0.0630	0.0
1.05	-0.8063	574.9583	0.0626	0.0	-0.8229	529.8320	0.0689	0.0
1.10	-0.8719	621.7769	0.0676	0.0	-0.8908	569.1313	0.0748	0.0
1.15	-0.9338	665.5229	0.0724	0.0	-0.9550	605.3137	0.0805	0.0
1.20	-0.9858	701.7332	0.0765	0.0	-1.0090	635.0991	0.0852	0.0
1.25	-1.0262	729.4854	0.0796	0.0	-1.0510	658.1760	0.0888	0.0
1.30	-1.0534	748.4348	0.0816	0.0	-1.0795	674.2896	0.0912	0.0
1.35	-1.0675	758.6592	0.0826	0.0	-1.0945	684.0129	0.0923	0.0
1.40	-1.0714	762.0613	0.0827	0.0	-1.0988	688.2280	0.0925	0.0
1.45	-1.0651	758.2344	0.0821	0.0	-1.0926	686.6858	0.0917	0.0
1.50	-1.0504	747.9744	0.0809	0.0	-1.0776	679.8093	0.0902	0.0
1.55	-1.0288	732.4541	0.0792	0.0	-1.0559	668.3191	0.0882	0.0
1.60	-1.0053	713.3840	0.0776	0.0	-1.0314	653.2837	0.0861	0.0
1.65	-0.9879	694.2715	0.0765	0.0	-1.0147	636.8135	0.0851	0.0
1.70	-0.8672	605.7178	0.0678	0.0	-0.8905	560.1577	0.0745	0.0
1.75	-0.7655	533.0110	0.0601	0.0	-0.7852	501.0803	0.0653	0.0
1.80	-0.6813	474.3528	0.0536	0.0	-0.6984	447.6030	0.0580	0.0
1.85	-0.6108	424.4277	0.0481	0.0	-0.6258	403.8777	0.0518	0.0
1.90	-0.5650	391.6199	0.0445	0.0	-0.5788	376.5591	0.0476	0.0
1.95	-0.5465	378.7017	0.0430	0.0	-0.5595	366.3513	0.0459	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TRAILING TANDEM AXLE

	LEFT SIDE				RIGHT SIDE			
TIME (SEC)	TIRE SIDESLIP ANGLE (DEG)	TIRE LATERAL FORCE (LB)	MU-Y	ALIGNING TORQUE (IN-LB)	TIRE SIDESLIP ANGLE (DEG)	TIRE LATERAL FORCE (LB)	MU-Y	ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0001	-0.0646	-0.0000	0.0	0.0001	-0.0646	-0.0000	0.0
0.10	-0.0054	3.9280	0.0005	0.0	-0.0054	3.9250	0.0005	0.0
0.15	-0.0181	12.9148	0.0016	0.0	-0.0181	12.8852	0.0016	0.0
0.20	-0.0402	27.8235	0.0036	0.0	-0.0403	27.6834	0.0037	0.0
0.25	-0.0720	48.2303	0.0066	0.0	-0.0721	47.9054	0.0066	0.0
0.30	-0.1129	72.8846	0.0104	0.0	-0.1132	71.8529	0.0105	0.0
0.35	-0.1644	99.9843	0.0154	0.0	-0.1645	97.6591	0.0157	0.0
0.40	-0.2256	130.5596	0.0214	0.0	-0.2266	124.7709	0.0216	0.0
0.45	-0.2968	163.1400	0.0282	0.0	-0.2984	152.4036	0.0282	0.0
0.50	-0.3785	196.6088	0.0357	0.0	-0.3809	179.9155	0.0357	0.0
0.55	-0.4693	234.0632	0.0440	0.0	-0.4728	209.4877	0.0440	0.0
0.60	-0.5678	276.2550	0.0530	0.0	-0.5727	241.3779	0.0529	0.0
0.65	-0.6717	324.1305	0.0624	0.0	-0.6782	276.6487	0.0623	0.0
0.70	-0.7787	376.1659	0.0721	0.0	-0.7872	313.3486	0.0719	0.0
0.75	-0.8882	429.8130	0.0820	0.0	-0.8990	349.1216	0.0817	0.0
0.80	-0.9998	485.0430	0.0921	0.0	-1.0133	383.8792	0.0916	0.0
0.85	-1.1129	542.7771	0.1023	0.0	-1.1294	417.9946	0.1016	0.0
0.90	-1.2270	602.1104	0.1126	0.0	-1.2465	450.8584	0.1118	0.0
0.95	-1.3420	661.0732	0.1230	0.0	-1.3657	480.8352	0.1219	0.0
1.00	-1.4578	719.0735	0.1335	0.0	-1.4857	506.9102	0.1320	0.0
1.05	-1.5739	773.7800	0.1440	0.0	-1.6062	530.6030	0.1420	0.0
1.10	-1.6812	824.4827	0.1537	0.0	-1.7176	551.4966	0.1512	0.0
1.15	-1.7785	870.1838	0.1625	0.0	-1.8188	569.4436	0.1594	0.0
1.20	-1.8613	906.8755	0.1700	0.0	-1.9050	583.9041	0.1663	0.0
1.25	-1.9282	934.3352	0.1758	0.0	-1.9745	594.5520	0.1717	0.0
1.30	-1.9762	952.9365	0.1800	0.0	-2.0252	597.7102	0.1742	0.0
1.35	-2.0063	963.1929	0.1825	0.0	-2.0568	592.7139	0.1731	0.0
1.40	-2.0218	967.6780	0.1837	0.0	-2.0734	578.0002	0.1685	0.0
1.45	-2.0236	964.8821	0.1831	0.0	-2.0757	552.3408	0.1600	0.0
1.50	-2.0134	955.5515	0.1827	0.0	-2.0655	513.5801	0.1473	0.0
1.55	-1.9932	940.6404	0.1807	0.0	-2.0449	457.5376	0.1295	0.0
1.60	-1.9725	951.5437	0.1826	0.0	-2.0238	416.2891	0.1146	0.0
1.65	-1.9566	1078.0754	0.1934	0.0	-2.0508	592.6440	0.1528	0.0
1.70	-1.9641	1051.2813	0.1803	0.0	-1.9141	707.0442	0.1812	0.0
1.75	-1.7217	895.2209	0.1622	0.0	-1.7660	650.1375	0.1629	0.0
1.80	-1.6156	814.9258	0.1499	0.0	-1.6561	602.1196	0.1499	0.0
1.85	-1.5254	750.4299	0.1401	0.0	-1.5628	552.3381	0.1396	0.0
1.90	-1.4739	688.7124	0.1342	0.0	-1.5095	530.5383	0.1339	0.0
1.95	-1.4590	656.1321	0.1320	0.0	-1.4947	509.8438	0.1316	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR FRONT SUSPENSION - UNSPRUNG MASS SUMMARY

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0000	-0.0055	0.0009	-0.2214	-44.20	0.0013	0.0339	5.58	-0.0016	-0.0741	-10.60
0.10	0.0003	-0.0143	0.0177	-0.0963	-95.57	-0.0020	-0.2680	-32.58	-0.0085	-0.2847	-44.37
0.15	0.0023	-0.0184	0.0672	-0.1032	-95.60	-0.0326	-1.1179	-169.22	-0.0399	-1.1060	-181.25
0.20	0.0073	-0.0243	0.1275	-0.1118	-79.36	-0.1212	-2.5635	-452.06	-0.1265	-2.5291	-470.76
0.25	0.0147	-0.0293	0.1650	-0.0989	-42.18	-0.2886	-4.1500	-859.40	-0.2916	-4.0909	-891.95
0.30	0.0232	-0.0346	0.1690	-0.1119	16.40	-0.5265	-5.2849	-1313.75	-0.5258	-5.1924	-1365.69
0.35	0.0310	-0.0400	0.1554	-0.1012	103.60	-0.8009	-5.5095	-1717.42	-0.7948	-5.3794	-1769.88
0.40	0.0363	-0.0448	0.0752	-0.0931	223.52	-1.0623	-4.7179	-1990.22	-1.0486	-4.5412	-2077.55
0.45	0.0384	-0.0493	0.0127	-0.0861	377.69	-1.2642	-3.1885	-2098.83	-1.2407	-2.9763	-2191.81
0.50	0.0378	-0.0535	-0.0341	-0.0833	551.98	-1.3814	-1.4299	-2065.17	-1.3469	-1.1988	-2153.49
0.55	0.0355	-0.0578	-0.0537	-0.0892	737.94	-1.4157	0.0278	-1950.62	-1.3694	0.2680	-2024.32
0.60	0.0329	-0.0625	-0.0448	-0.1020	922.97	-1.3919	0.8270	-1828.99	-1.3337	1.0600	-1882.83
0.65	0.0313	-0.0680	-0.0165	-0.1165	1103.98	-1.3468	0.8615	-1762.81	-1.2771	1.0889	-1794.63
0.70	0.0314	-0.0742	0.0180	-0.1303	1281.53	-1.3155	0.2938	-1782.74	-1.2345	0.5200	-1793.99
0.75	0.0330	-0.0808	0.0454	-0.1353	1461.54	-1.3210	-0.5538	-1864.46	-1.2265	-0.3181	-1878.12
0.80	0.0357	-0.0875	0.0580	-0.1298	1654.97	-1.3687	-1.3342	-2037.06	-1.2640	-1.0753	-2015.44
0.85	0.0385	-0.0936	0.0545	-0.1144	1868.40	-1.4486	-1.7960	-2158.67	-1.3303	-1.5109	-2163.37
0.90	0.0409	-0.0988	0.0395	-0.0934	2101.23	-1.5417	-1.8462	-2332.74	-1.4086	-1.5350	-2283.91
0.95	0.0424	-0.1030	0.0152	-0.0727	2347.10	-1.6281	-1.5370	-2417.59	-1.4793	-1.2201	-2354.51
1.00	0.0429	-0.1062	-0.0001	-0.0547	2593.76	-1.6930	-1.0097	-2448.46	-1.5283	-0.7002	-2370.31
1.05	0.0425	-0.1082	-0.0138	0.2453	2887.45	-1.7314	-0.5063	-2445.66	-1.5479	-0.0795	-2330.76
1.10	0.0416	-0.0928	-0.0196	0.0541	3160.89	-1.7432	0.0335	-2401.91	-1.5421	0.2870	-2281.29
1.15	0.0407	-0.0908	-0.0175	0.0720	3323.26	-1.7333	0.3239	-2356.02	-1.5217	0.5036	-2226.56
1.20	0.0400	-0.0864	-0.0098	0.0809	3439.12	-1.7147	0.3882	-2323.20	-1.4955	0.5009	-2187.57
1.25	0.0397	-0.0829	0.0002	0.0664	3505.01	-1.6976	0.2653	-2313.26	-1.4741	0.3236	-2175.16
1.30	0.0400	-0.0794	0.0093	0.0716	3529.21	-1.6896	0.0423	-2326.95	-1.4644	0.0469	-2191.32
1.35	0.0406	-0.0759	0.0149	0.0705	3520.29	-1.6935	-0.1999	-2359.30	-1.4688	-0.2229	-2227.96
1.40	0.0414	-0.0723	0.0161	0.0734	3491.96	-1.7082	-0.3705	-2398.52	-1.4852	-0.4216	-2274.67
1.45	0.0421	-0.0685	0.0130	0.0803	3441.24	-1.7287	-0.4258	-2432.94	-1.5089	-0.5019	-2319.07
1.50	0.0426	-0.0643	0.0069	0.0842	3371.79	-1.7489	-0.3560	-2453.07	-1.5334	-0.4600	-2351.25
1.55	0.0428	-0.0602	-0.0001	0.0816	3272.30	-1.7629	-0.1824	-2453.04	-1.5536	-0.3305	-2367.11
1.60	0.0426	-0.0560	-0.0114	0.0987	3138.83	-1.7659	0.1639	-2418.79	-1.5651	-0.0200	-2349.85
1.65	0.0419	-0.0429	-0.0568	0.4744	3060.19	-1.7440	0.7965	-2318.23	-1.5481	0.8066	-2232.47
1.70	0.0373	-0.0174	-0.0762	0.2307	3057.90	-1.6818	1.7191	-2129.91	-1.4859	1.5033	-2061.74
1.75	0.0344	-0.0252	-0.0367	-0.1920	2692.82	-1.5816	1.9864	-1961.92	-1.4090	1.5260	-1943.89
1.80	0.0337	-0.0197	0.0096	0.2548	2537.55	-1.5022	1.0824	-1952.74	-1.3398	1.0272	-1895.49
1.85	0.0352	-0.0153	0.0495	-0.0492	2368.06	-1.4709	0.1071	-2017.89	-1.3189	-0.2905	-2010.64
1.90	0.0384	-0.0133	0.0727	0.1683	2041.39	-1.4934	-1.0292	-2175.22	-1.3619	-1.4039	-2198.91
1.95	0.0421	-0.0048	0.0718	0.1064	1738.45	-1.5648	-1.7194	-2350.49	-1.4526	-2.1721	-2420.26

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION - UNSPRUNG MASS SUMMARY

LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.0
0.05	-0.0000	0.0001	-0.0006	0.0010	31.88	-0.0002	0.0039	-0.41	0.0005	0.0398	7.75
0.10	-0.0001	-0.0001	-0.0013	-0.0085	120.66	0.0033	0.2291	-2.30	0.0060	0.2726	15.10
0.15	-0.0000	-0.0007	0.0051	-0.0168	238.26	0.0195	0.4990	-27.21	0.0250	0.5738	5.54
0.20	0.0005	-0.0022	0.0175	-0.0407	418.68	0.0414	0.4290	-103.18	0.0511	0.5186	-51.78
0.25	0.0018	-0.0043	0.0326	-0.0450	616.13	0.0515	0.0743	-251.57	0.0658	0.1795	-179.67
0.30	0.0031	-0.0071	0.0109	-0.0705	871.18	0.0517	0.1233	-260.29	0.0720	0.2575	-260.80
0.35	0.0029	-0.0113	-0.0067	-0.0931	1169.96	0.0629	0.3312	-287.92	0.0902	0.4843	-258.23
0.40	0.0029	-0.0163	0.0028	-0.1098	1528.75	0.0834	0.3839	-291.31	0.1192	0.5721	-223.47
0.45	0.0025	-0.0225	-0.0188	-0.1367	1944.30	0.1081	0.5188	-255.10	0.1536	0.7230	-146.72
0.50	0.0013	-0.0296	-0.0283	-0.1472	2384.79	0.1434	0.7641	-251.23	0.1994	0.9803	-0.45
0.55	-0.0001	-0.0373	-0.0270	-0.1609	2846.66	0.1877	0.8697	-125.41	0.2547	1.0906	168.66
0.60	-0.0013	-0.0456	-0.0185	-0.1692	3304.54	0.2309	0.7630	-29.63	0.3088	0.9789	306.00
0.65	-0.0019	-0.0542	-0.0042	-0.1735	3757.92	0.2631	0.4954	5.12	0.3518	0.7123	382.78
0.70	-0.0018	-0.0631	0.0059	-0.1823	4214.82	0.2791	0.1861	-23.36	0.3787	0.4051	396.80
0.75	-0.0013	-0.0723	0.0133	-0.1878	4683.57	0.2800	-0.0866	-100.03	0.3907	0.1430	364.95
0.80	-0.0005	-0.0819	0.0185	-0.1968	5182.20	0.2686	-0.3112	-212.34	0.3912	-0.0657	300.99
0.85	0.0005	-0.0919	0.0201	-0.2032	5712.73	0.2485	-0.4529	-341.83	0.3837	-0.1933	222.56
0.90	0.0014	-0.1021	0.0160	-0.2035	6269.52	0.2249	-0.4709	-462.53	0.3732	-0.2015	154.76
0.95	0.0020	-0.1122	0.0077	-0.2003	6836.08	0.2041	-0.3579	-548.68	0.3660	-0.0899	120.80
1.00	0.0022	-0.1220	-0.0006	-0.1905	7385.94	0.1914	-0.1724	-589.77	0.3664	0.0813	128.56
1.05	0.0020	-0.1313	-0.0057	-0.1802	7950.82	0.1885	0.0278	-587.92	0.3748	0.2079	162.78
1.10	0.0017	-0.1397	-0.0080	-0.1535	8179.49	0.1939	0.1549	-562.97	0.3882	0.2941	212.40
1.15	0.0012	-0.1468	-0.0081	-0.1252	8399.75	0.2041	0.2382	-524.71	0.4035	0.3013	260.20
1.20	0.0009	-0.1517	-0.0066	-0.0762	8470.73	0.2166	0.2550	-485.90	0.4183	0.2708	299.07
1.25	0.0006	-0.1550	-0.0035	-0.0583	8469.79	0.2282	0.2184	-457.42	0.4300	0.1957	322.01
1.30	0.0005	-0.1571	0.0008	-0.0195	8375.57	0.2370	0.1415	-444.91	0.4367	0.0820	320.76
1.35	0.0007	-0.1573	0.0044	0.0050	8238.68	0.2411	0.0413	-452.72	0.4376	-0.0314	298.56
1.40	0.0009	-0.1568	0.0061	0.0181	8059.19	0.2411	-0.0283	-471.11	0.4334	-0.1256	260.10
1.45	0.0013	-0.1551	0.0062	0.0502	7843.07	0.2385	-0.0648	-493.18	0.4258	-0.1724	216.78
1.50	0.0015	-0.1521	0.0051	0.0671	7597.46	0.2355	-0.0577	-509.91	0.4165	-0.1876	174.22
1.55	0.0018	-0.1482	0.0035	0.0906	7291.18	0.2337	-0.0205	-516.12	0.4080	-0.1822	135.25
1.60	0.0016	-0.1430	-0.0249	0.1123	6916.36	0.2294	-0.5712	-418.45	0.3949	-0.7697	193.08
1.65	0.0004	-0.1374	-0.0185	0.1242	6452.41	0.1987	-0.5535	-321.53	0.3533	-0.7911	241.52
1.70	-0.0000	-0.1264	0.0120	0.3976	6011.84	0.1916	0.4510	-295.71	0.3359	0.3253	244.70
1.75	0.0004	-0.1065	0.0067	0.2476	5733.92	0.2227	0.6478	-292.58	0.3603	0.4394	209.17
1.80	0.0006	-0.1013	0.0065	0.0761	5253.63	0.2501	0.4847	-295.37	0.3759	0.2952	163.50
1.85	0.0008	-0.0919	0.0048	0.2773	4889.85	0.2667	0.3090	-305.83	0.3842	0.0908	116.56
1.90	0.0012	-0.0754	0.0085	0.1951	4213.66	0.2782	0.2481	-297.74	0.3800	-0.1640	33.48
1.95	0.0016	-0.0726	0.0051	0.1249	3246.45	0.2882	0.2197	-279.15	0.3671	-0.2805	-50.40

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRACTOR REAR SUSPENSION - UNSPRUNG MASS SUMMARY

TRAILING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	-0.0000	-0.0001	-0.0014	-0.0094	27.07	-0.0000	0.0237	3.63	0.0005	0.0530	10.32
0.10	-0.0005	-0.0011	-0.0225	-0.0311	90.77	0.0044	0.2642	83.24	0.0065	0.2917	95.40
0.15	-0.0025	-0.0030	-0.0526	-0.0453	170.17	0.0242	0.7162	254.66	0.0281	0.7708	317.99
0.20	-0.0055	-0.0060	-0.0626	-0.0755	303.21	0.0661	1.1344	596.99	0.0731	1.1992	633.88
0.25	-0.0084	-0.0100	-0.0544	-0.0928	446.07	0.1229	1.2677	904.12	0.1332	1.3461	956.15
0.30	-0.0117	-0.0147	-0.0880	-0.1082	644.03	0.1923	1.7425	1305.13	0.2072	1.8498	1375.47
0.35	-0.0169	-0.0206	-0.1032	-0.1207	892.97	0.2897	2.0966	1789.18	0.3104	2.2300	1890.23
0.40	-0.0210	-0.0268	-0.0632	-0.1319	1216.01	0.3946	1.8776	2207.94	0.4229	2.0501	2344.44
0.45	-0.0241	-0.0340	-0.0648	-0.1507	1602.20	0.4840	1.5276	2541.02	0.5214	1.7218	2716.24
0.50	-0.0271	-0.0413	-0.0524	-0.1451	2035.58	0.5589	1.2703	2827.30	0.6066	1.4880	3046.02
0.55	-0.0293	-0.0490	-0.0365	-0.1626	2499.05	0.6190	0.9524	3042.74	0.6777	1.1720	3304.48
0.60	-0.0308	-0.0574	-0.0213	-0.1707	2953.52	0.6597	0.5814	3171.25	0.7253	0.7963	3474.27
0.65	-0.0315	-0.0660	-0.0079	-0.1791	3403.20	0.6806	0.2559	3226.48	0.7609	0.4687	3570.72
0.70	-0.0318	-0.0754	-0.0051	-0.1920	3846.87	0.6867	0.0696	3242.64	0.7775	0.2817	3627.71
0.75	-0.0321	-0.0850	-0.0058	-0.1904	4306.20	0.6861	0.0089	3250.03	0.7878	0.2365	3679.82
0.80	-0.0323	-0.0946	-0.0046	-0.1989	4802.35	0.6839	-0.0254	3253.03	0.7974	0.2186	3731.01
0.85	-0.0325	-0.1049	-0.0033	-0.2079	5327.42	0.6808	-0.0670	3249.22	0.8067	0.1892	3777.46
0.90	-0.0327	-0.1153	-0.0041	-0.2073	5877.70	0.6769	-0.0859	3244.09	0.8159	0.1809	3824.73
0.95	-0.0330	-0.1255	-0.0074	-0.2013	6440.20	0.6741	-0.0467	3250.83	0.8265	0.2206	3883.60
1.00	-0.0334	-0.1352	-0.0101	-0.1858	6993.01	0.6745	0.0225	3273.53	0.8402	0.2796	3956.03
1.05	-0.0339	-0.1440	-0.0095	-0.1611	7473.30	0.6786	0.0911	3308.86	0.8559	0.2948	4026.76
1.10	-0.0344	-0.1511	-0.0085	-0.1290	7838.27	0.6847	0.1115	3343.63	0.8709	0.2682	4090.14
1.15	-0.0348	-0.1571	-0.0075	-0.1056	8090.00	0.6913	0.1410	3380.67	0.8837	0.2181	4139.08
1.20	-0.0352	-0.1611	-0.0071	-0.0562	8191.38	0.6987	0.1591	3418.38	0.8937	0.1891	4179.71
1.25	-0.0355	-0.1635	-0.0060	-0.0431	8216.64	0.7063	0.1670	3454.62	0.9021	0.1551	4212.31
1.30	-0.0357	-0.1648	-0.0036	-0.0015	8146.14	0.7137	0.1468	3485.03	0.9080	0.1002	4231.46
1.35	-0.0358	-0.1640	-0.0013	0.0249	8038.20	0.7193	0.0969	3503.14	0.9110	0.0384	4238.06
1.40	-0.0359	-0.1625	0.0001	0.0410	7889.64	0.7228	0.0582	3514.53	0.9111	-0.0228	4232.62
1.45	-0.0358	-0.1594	0.0009	0.0816	7713.86	0.7248	0.0232	3520.10	0.9090	-0.0620	4221.55
1.50	-0.0358	-0.1546	0.0014	0.1080	7521.65	0.7256	0.0026	3523.10	0.9053	-0.0981	4204.71
1.55	-0.0357	-0.1483	0.0024	0.1495	7288.50	0.7258	-0.0130	3524.03	0.9001	-0.1328	4181.61
1.60	-0.0353	-0.1399	0.0324	0.1298	7008.53	0.7253	-0.1115	3406.99	0.8930	-0.2975	4028.97
1.65	-0.0326	-0.1483	0.0555	-0.4871	6127.93	0.7241	-0.1862	3284.14	0.8709	-0.8585	3750.05
1.70	-0.0311	-0.1707	-0.0071	0.0520	4689.17	0.7094	-0.5265	3225.69	0.8222	-0.8979	3605.85
1.75	-0.0321	-0.1376	-0.0148	0.7841	4803.65	0.6801	-0.3631	3211.21	0.7956	-0.1895	3685.87
1.80	-0.0324	-0.1249	-0.0044	-0.1611	4548.88	0.6756	0.1987	3222.53	0.7847	-0.1594	3690.18
1.85	-0.0330	-0.1247	-0.0184	0.3156	3912.00	0.6853	0.3327	3404.64	0.7796	0.1418	3740.83
1.90	-0.0340	-0.1044	-0.0208	0.3053	3467.77	0.7050	0.6277	3540.03	0.7850	0.3011	3815.48
1.95	-0.0351	-0.0978	-0.0268	0.0705	2494.11	0.7420	0.8920	3722.57	0.8029	0.3541	3885.78

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 SPRUNG MASS POSITION

TIME (SEC)	FORWARD (FT)	LATERAL (FT)	VERTICAL (FT)	ROLL (DEG)	PITCH (DEG)	HEADING (DEG)	TURN RADIUS (FT)	SIDE SLIP (DEG)	ARTICULATION ANGLE (DEG)
0.0	-26.3614	0.0	0.0	0.0	0.0	0.0	**********	0.0	0.0
0.05	-24.0514	0.0000	-0.0000	-0.0001	0.0000	0.0000	**********	0.0000	0.0005
0.10	-21.8522	0.0000	-0.0000	-0.0020	0.0002	0.0002	**********	-0.0001	0.0041
0.15	-19.6570	0.0000	-0.0004	-0.0067	0.0014	0.0006	**********	-0.0008	0.0136
0.20	-17.4711	-0.0000	-0.0014	-0.0130	0.0036	0.0013	**********	-0.0015	0.0321
0.25	-15.2973	-0.0000	-0.0033	-0.0214	0.0017	0.0025	75191.0000	-0.0018	0.0616
0.30	-13.1349	0.0001	-0.0065	-0.0318	0.0061	0.0046	30994.5938	-0.0011	0.1041
0.35	-10.9836	0.0003	-0.0113	-0.0452	0.0260	0.0081	17681.0703	0.0008	0.1609
0.40	-8.8472	0.0007	-0.0173	-0.0621	0.0471	0.0137	11280.0625	0.0041	0.2329
0.45	-6.7330	0.0016	-0.0240	-0.0819	0.0671	0.0219	7669.6523	0.0091	0.3206
0.50	-4.6501	0.0030	-0.0305	-0.1042	0.0883	0.0330	5475.6563	0.0164	0.4239
0.55	-2.6065	0.0052	-0.0360	-0.1277	0.1093	0.0476	4060.4783	0.0268	0.5423
0.60	-0.6077	0.0083	-0.0400	-0.1516	0.1251	0.0659	3124.3364	0.0409	0.6750
0.65	1.3444	0.0126	-0.0423	-0.1756	0.1329	0.0884	2479.1394	0.0589	0.8212
0.70	3.2496	0.0182	-0.0430	-0.1997	0.1348	0.1155	2017.1440	0.0811	0.9801
0.75	5.1098	0.0255	-0.0423	-0.2245	0.1342	0.1476	1674.5898	0.1075	1.1511
0.80	6.9271	0.0347	-0.0408	-0.2507	0.1324	0.1851	1412.0679	0.1383	1.3340
0.85	8.7032	0.0459	-0.0392	-0.2784	0.1290	0.2284	1202.9475	0.1736	1.5285
0.90	10.4391	0.0594	-0.0390	-0.3073	0.1245	0.2778	1031.3032	0.2140	1.7344
0.95	12.1344	0.0754	-0.0375	-0.3367	0.1211	0.3336	887.8547	0.2602	1.9509
1.00	13.7882	0.0941	-0.0378	-0.3654	0.1208	0.3957	768.5828	0.3132	2.1770
1.05	15.3990	0.1157	-0.0386	-0.3919	0.1230	0.4643	671.0388	0.3735	2.4110
1.10	16.9650	0.1404	-0.0398	-0.4129	0.1266	0.5389	588.3108	0.4420	2.6488
1.15	18.4844	0.1684	-0.0411	-0.4267	0.1303	0.6192	523.2026	0.5190	2.8865
1.20	19.9561	0.1997	-0.0423	-0.4348	0.1341	0.7051	471.7708	0.6032	3.1211
1.25	21.3799	0.2344	-0.0430	-0.4374	0.1376	0.7965	431.9783	0.6933	3.3504
1.30	22.7561	0.2724	-0.0434	-0.4358	0.1400	0.8928	399.4634	0.7874	3.5724
1.35	24.0858	0.3137	-0.0433	-0.4310	0.1407	0.9938	371.4270	0.8849	3.7853
1.40	25.3699	0.3581	-0.0430	-0.4236	0.1399	1.0991	347.9719	0.9850	3.9877
1.45	26.6095	0.4055	-0.0425	-0.4143	0.1383	1.2082	327.1606	1.0870	4.1789
1.50	27.8050	0.4556	-0.0420	-0.4026	0.1366	1.3205	308.1414	1.1910	4.3583
1.55	28.9562	0.5082	-0.0416	-0.3880	0.1349	1.4352	291.0168	1.2970	4.5255
1.60	30.0631	0.5631	-0.0413	-0.3698	0.1333	1.5514	276.5706	1.4048	4.6804
1.65	31.1272	0.6198	-0.0410	-0.3470	0.1314	1.6682	270.1460	1.5107	4.8300
1.70	32.1497	0.6781	-0.0403	-0.3200	0.1283	1.7846	240.7737	1.6187	4.9784
1.75	33.1302	0.7378	-0.0393	-0.2958	0.1261	1.9036	211.8769	1.7500	5.1019
1.80	34.0594	0.7990	-0.0387	-0.2737	0.1255	2.0256	212.5477	1.8808	5.2033
1.85	34.9341	0.8610	-0.0398	-0.2476	0.1244	2.1459	222.8593	1.9929	5.2883
1.90	35.7579	0.9231	-0.0395	-0.2125	0.1233	2.2616	222.6418	2.0919	5.3633
1.95	36.5356	0.9844	-0.0407	-0.1665	0.1257	2.3716	221.9917	2.1864	5.4331

TRAILER NO. 1 SPRUNG MASS VELOCITY (BODY AXES)

TIME (SEC)	FORWARD (FT/SEC)	LATERAL (FT/SEC)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	PITCH (DEG/SEC)	HEADING (DEG/SEC)	ARTICULATION RATE (DEG/SEC)
0.0	44.00	0.0	0.0	0.0	0.0	0.0	0.0
0.05	44.00	0.00	-0.00	-0.01	0.00	0.00	0.03
0.10	44.00	-0.00	-0.00	-0.07	0.01	0.01	0.12
0.15	43.98	-0.00	-0.01	-0.11	0.04	0.01	0.27
0.20	43.92	-0.00	-0.03	-0.14	0.02	0.02	0.47
0.25	43.77	-0.00	-0.05	-0.19	-0.07	0.03	0.72
0.30	43.48	-0.00	-0.08	-0.23	0.28	0.05	0.99
0.35	43.05	0.00	-0.09	-0.30	0.44	0.09	1.29
0.40	42.51	0.00	-0.10	-0.37	0.40	0.14	1.60
0.45	41.88	0.01	-0.09	-0.42	0.41	0.19	1.91
0.50	41.17	0.01	-0.06	-0.46	0.44	0.26	2.22
0.55	40.38	0.02	-0.02	-0.48	0.38	0.33	2.51
0.60	39.55	0.03	0.02	-0.48	0.23	0.41	2.79
0.65	38.69	0.04	0.06	-0.48	0.08	0.49	3.05
0.70	37.81	0.05	0.09	-0.49	0.00	0.59	3.30
0.75	36.94	0.07	0.11	-0.51	-0.03	0.70	3.54
0.80	36.09	0.09	0.12	-0.54	-0.05	0.81	3.78
0.85	35.24	0.11	0.11	-0.57	-0.09	0.93	4.01
0.90	34.39	0.13	0.09	-0.59	-0.09	1.05	4.23
0.95	33.54	0.15	0.07	-0.59	-0.05	1.18	4.43
1.00	32.67	0.18	0.06	-0.56	0.01	1.31	4.61
1.05	31.77	0.21	0.05	-0.49	0.05	1.43	4.73
1.10	30.85	0.24	0.04	-0.35	0.06	1.55	4.77
1.15	29.92	0.27	0.04	-0.22	0.06	1.66	4.73
1.20	28.99	0.31	0.05	-0.11	0.06	1.77	4.65
1.25	28.06	0.34	0.06	-0.01	0.05	1.88	4.52
1.30	27.13	0.37	0.07	0.06	0.02	1.97	4.35
1.35	26.22	0.40	0.07	0.12	-0.02	2.07	4.16
1.40	25.31	0.44	0.07	0.16	-0.04	2.15	3.94
1.45	24.40	0.46	0.07	0.20	-0.05	2.22	3.71
1.50	23.50	0.49	0.07	0.26	-0.05	2.27	3.47
1.55	22.60	0.51	0.06	0.32	-0.05	2.31	3.22
1.60	21.69	0.53	0.06	0.40	-0.05	2.33	3.00
1.65	20.78	0.55	0.06	0.50	-0.07	2.33	3.02
1.70	19.89	0.56	0.07	0.54	-0.08	2.34	2.75
1.75	19.02	0.58	0.06	0.43	-0.04	2.42	2.23
1.80	18.15	0.60	0.05	0.47	-0.02	2.44	1.85
1.85	17.24	0.60	0.03	0.58	-0.04	2.37	1.58
1.90	16.29	0.59	0.02	0.83	-0.01	2.26	1.44
1.95	15.33	0.59	0.01	0.96	0.09	2.15	1.36

TRAILER NO. 1 SPRUNG MASS ACCELERATION (BODY AXES) | INERTIAL ACCEL. ALONG BODY AXES

TIME (SEC)	FORWARD (FT/SEC**2)	LATERAL (FT/SEC**2)	VERTICAL (FT/SEC**2)	ROLL (DEG/SEC**2)	PITCH (DEG/SEC**2)	HEADING (DEG/SEC**2)	LONGITUDINAL (FT/SEC**2)	LATERAL (FT/SEC**2)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0
0.05	-0.0035	0.0008	-0.0082	-0.7040	0.0412	0.0519	-0.0035	0.0015
0.10	-0.0981	-0.0067	-0.0955	-1.2735	0.4108	0.1284	-0.0981	-0.0023
0.15	-0.5648	-0.0123	-0.2523	-0.5039	0.6865	0.1041	-0.5649	-0.0033
0.20	-1.9488	-0.0094	-0.3572	-0.8942	-1.9305	0.1662	-1.9488	0.0041
0.25	-4.3052	0.0026	-0.5793	-0.7744	2.5803	0.3609	-4.3051	0.0259
0.30	-7.1841	0.0203	-0.4278	-1.1832	7.1076	0.5915	-7.1845	0.0613
0.35	-9.7799	0.0376	-0.1803	-1.4559	-0.5155	0.8276	-9.7806	0.1047
0.40	-11.7845	0.0585	-0.0034	-1.1631	-0.5484	1.0158	-11.7852	0.1594
0.45	-13.4678	0.0869	0.3733	-1.0361	0.6730	1.2163	-13.4684	0.2267
0.50	-14.9671	0.1215	0.7117	-0.4707	0.0492	1.3720	-14.9676	0.3058
0.55	-16.2020	0.1636	0.8558	-0.1370	-2.2212	1.4968	-16.2022	0.3952
0.60	-17.0277	0.2087	0.8053	-0.0193	-3.3746	1.6490	-17.0278	0.4901
0.65	-17.4235	0.2536	0.6847	-0.0123	-2.4345	1.8239	-17.4237	0.5877
0.70	-17.4435	0.2961	0.5182	-0.3342	-0.8821	2.0166	-17.4440	0.6862
0.75	-17.2723	0.3357	0.2725	-0.5495	-0.4587	2.1808	-17.2732	0.7849
0.80	-16.9996	0.3740	-0.0224	-0.6307	-0.7282	2.3080	-17.0009	0.8837
0.85	-16.8682	0.4132	-0.2673	-0.5308	-0.5159	2.4311	-16.8701	0.9838
0.90	-16.9442	0.4551	-0.3755	-0.1798	0.4752	2.5351	-16.9467	1.0865
0.95	-17.2401	0.5007	-0.3518	0.2714	1.2402	2.5865	-17.2432	1.1913
1.00	-17.6717	0.5482	-0.2605	0.8122	1.0658	2.5705	-17.6757	1.2943
1.05	-18.1058	0.5935	-0.1509	2.2202	0.4500	2.4372	-18.1109	1.3887
1.10	-18.4689	0.6430	-0.0356	3.0613	0.0400	2.2664	-18.4752	1.4783
1.15	-18.6630	0.6757	0.0745	2.1074	-0.0067	2.2629	-18.6708	1.5446
1.20	-18.6820	0.6879	0.1509	2.3356	-0.1146	2.1627	-18.6914	1.5861
1.25	-18.5854	0.6786	0.1666	1.6097	-0.4685	1.9827	-18.5964	1.5985
1.30	-18.4274	0.6553	0.1302	1.2735	-0.7339	1.8784	-18.4402	1.5905
1.35	-18.2349	0.6242	0.0718	1.0345	-0.6018	1.7232	-18.2495	1.5690
1.40	-18.1073	0.5817	0.0113	0.7099	-0.2972	1.5245	-18.1237	1.5297
1.45	-18.0353	0.5346	-0.0444	0.9757	-0.0569	1.2523	-18.0532	1.4783
1.50	-18.0436	0.4860	-0.0906	1.1694	0.0030	0.9481	-18.0630	1.4174
1.55	-18.1147	0.4338	-0.1186	1.4226	0.0710	0.6430	-18.1354	1.3450
1.60	-18.1714	0.3713	-0.0472	1.8256	-0.1253	0.2446	-18.1931	1.2547
1.65	-18.0093	0.2782	0.1281	1.9573	-0.5441	-0.3094	-18.0316	1.1232
1.70	-17.5942	0.1403	0.0381	-1.6265	0.4040	1.2978	-17.6072	1.1517
1.75	-17.3054	0.3744	-0.1968	-0.9474	0.8517	1.3445	-17.3300	1.1786
1.80	-17.7685	0.1920	-0.3203	1.6581	-0.3238	-0.7770	-17.7939	0.9633
1.85	-18.5704	-0.0256	-0.3489	3.5385	-0.0697	-1.8886	-18.5951	0.6860
1.90	-19.1259	-0.1476	-0.2204	5.1222	1.5416	-2.3479	-19.1493	0.4941
1.95	-19.1709	-0.2481	-0.0444	-0.1811	2.0886	-1.9205	-19.1928	0.3265

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION TIRE FORCES

LEADING TANDEM AXLE

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	6631.73	-0.0	0.0	0.0	0.0	6631.72	-0.0	0.0	0.0	0.0
0.05	6631.74	-0.00	-0.53	-0.0000	-0.0001	6631.72	0.04	-0.53	0.0000	-0.0001
0.10	6632.85	0.61	-3.09	0.0001	-0.0005	6630.24	0.76	-3.08	0.0001	-0.0005
0.15	6636.60	0.22	-3.30	0.0000	-0.0005	6619.72	0.37	-3.29	0.0001	-0.0005
0.20	6651.62	-168.95	-2.82	-0.0254	-0.0004	6615.91	-168.41	-2.80	-0.0255	-0.0004
0.25	6615.04	-583.18	-1.28	-0.0882	-0.0002	6553.20	-581.30	-1.27	-0.0887	-0.0002
0.30	6604.04	-1016.56	2.63	-0.1539	0.0004	6506.91	-1013.31	2.59	-0.1557	0.0004
0.35	6677.68	-1339.57	7.54	-0.2006	0.0011	6536.02	-1335.12	7.38	-0.2043	0.0011
0.40	6666.44	-1573.00	15.24	-0.2360	0.0023	6466.67	-1566.97	14.79	-0.2423	0.0023
0.45	6609.59	-1746.68	25.10	-0.2643	0.0038	6341.36	-1739.23	24.09	-0.2743	0.0038
0.50	6586.59	-1877.24	37.40	-0.2850	0.0057	6240.50	-1868.87	35.45	-0.2995	0.0057
0.55	6612.52	-1973.26	51.79	-0.2984	0.0078	6183.23	-1964.91	49.46	-0.3178	0.0078
0.60	6647.00	-2043.39	66.55	-0.3074	0.0100	6133.71	-2034.97	61.48	-0.3318	0.0100
0.65	6672.21	-2097.52	81.61	-0.3144	0.0122	6074.68	-2089.03	74.40	-0.3439	0.0122
0.70	6715.46	-2143.17	96.67	-0.3191	0.0144	6033.64	-2135.03	87.00	-0.3539	0.0144
0.75	6802.00	-2180.85	111.85	-0.3206	0.0164	6033.43	-2173.38	99.41	-0.3602	0.0165
0.80	6911.13	-2209.17	127.04	-0.3197	0.0184	6051.99	-2202.05	111.50	-0.3639	0.0184
0.85	7001.50	-2227.77	141.66	-0.3182	0.0202	6048.43	-2220.35	122.71	-0.3671	0.0203
0.90	7055.79	-2239.20	156.06	-0.3174	0.0221	6006.00	-2231.26	133.26	-0.3715	0.0222
0.95	7089.29	-2245.49	170.10	-0.3167	0.0240	5942.61	-2237.67	143.10	-0.3765	0.0241
1.00	7118.89	-2248.03	182.78	-0.3158	0.0257	5879.50	-2241.02	151.58	-0.3812	0.0258
1.05	7143.23	-2247.79	193.61	-0.3147	0.0271	5820.50	-2241.91	158.49	-0.3852	0.0272
1.10	7153.65	-2246.45	203.41	-0.3140	0.0284	5764.15	-2242.25	164.75	-0.3890	0.0286
1.15	7146.57	-2246.21	203.43	-0.3143	0.0285	5722.63	-2244.16	163.83	-0.3922	0.0286
1.20	7140.73	-2248.14	198.19	-0.3148	0.0278	5702.35	-2247.52	155.27	-0.3941	0.0279
1.25	7139.88	-2250.81	186.69	-0.3152	0.0261	5709.05	-2252.16	150.31	-0.3945	0.0263
1.30	7137.63	-2253.70	168.34	-0.3157	0.0236	5733.59	-2255.96	136.24	-0.3935	0.0238
1.35	7129.16	-2256.45	147.43	-0.3165	0.0207	5762.33	-2259.23	120.13	-0.3921	0.0208
1.40	7111.87	-2258.52	121.90	-0.3176	0.0171	5795.09	-2261.87	100.19	-0.3903	0.0173
1.45	7090.29	-2259.80	93.74	-0.3187	0.0132	5831.69	-2263.57	77.82	-0.3882	0.0133
1.50	7062.77	-2259.14	62.52	-0.3200	0.0089	5872.51	-2264.12	52.83	-0.3855	0.0090
1.55	7023.68	-2258.80	28.80	-0.3216	0.0041	5914.45	-2263.67	24.50	-0.3827	0.0041
1.60	6971.98	-2257.71	-7.77	-0.3238	-0.0011	5957.07	-2263.16	-6.73	-0.3799	-0.0011
1.65	6909.43	-2258.87	-50.05	-0.3269	-0.0072	6009.45	-2265.50	-44.05	-0.3770	-0.0073
1.70	6851.65	-2265.01	-89.40	-0.3306	-0.0130	6078.36	-2269.50	-80.29	-0.3734	-0.0132
1.75	6832.76	-2270.75	-114.33	-0.3323	-0.0167	6150.25	-2273.31	-104.29	-0.3696	-0.0170
1.80	6798.43	-2263.59	-158.06	-0.3330	-0.0232	6231.58	-2270.03	-146.92	-0.3643	-0.0236
1.85	6696.99	-2252.39	-219.85	-0.3363	-0.0328	6288.29	-2259.85	-209.40	-0.3594	-0.0333
1.90	6566.95	-2244.82	-259.04	-0.3418	-0.0394	6307.57	-2252.37	-252.42	-0.3571	-0.0400
1.95	6441.89	-2244.68	-304.06	-0.3485	-0.0472	6274.37	-2252.65	-305.28	-0.3534	-0.0479

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION TIRE FORCES

TRAILING TANDEM AXLE

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	9947.60	-0.0	0.0	0.0	0.0	9947.60	-0.0	0.0	0.0	0.0
0.05	9947.66	-0.00	-0.43	-0.0000	-0.0000	9947.54	0.04	-0.43	0.0000	-0.0000
0.10	9945.83	0.61	-2.46	0.0001	-0.0002	9946.41	0.76	-2.46	0.0001	-0.0002
0.15	9958.27	0.22	-2.02	0.0000	-0.0002	9939.73	0.37	-2.01	0.0000	-0.0002
0.20	9926.74	-168.51	-0.87	-0.0170	-0.0001	9888.61	-168.09	-0.87	-0.0170	-0.0001
0.25	9753.15	-580.01	2.04	-0.0595	0.0002	9687.12	-578.54	2.03	-0.0597	0.0002
0.30	9637.29	-1012.11	8.36	-0.1050	0.0009	9532.94	-1009.47	8.27	-0.1059	0.0009
0.35	9699.63	-1336.40	17.07	-0.1378	0.0018	9545.93	-1332.72	16.81	-0.1396	0.0018
0.40	9696.25	-1572.29	29.76	-0.1622	0.0031	9478.23	-1567.39	29.10	-0.1654	0.0031
0.45	9662.04	-1747.82	45.82	-0.1809	0.0047	9367.89	-1741.87	44.45	-0.1859	0.0047
0.50	9681.28	-1878.95	65.78	-0.1941	0.0068	9299.85	-1872.35	63.23	-0.2013	0.0068
0.55	9758.16	-1974.71	89.23	-0.2024	0.0091	9282.46	-1968.02	84.95	-0.2120	0.0092
0.60	9830.42	-2044.11	114.40	-0.2079	0.0116	9258.04	-2037.31	107.85	-0.2201	0.0116
0.65	9870.57	-2097.41	141.24	-0.2125	0.0143	9199.71	-2090.37	131.81	-0.2272	0.0143
0.70	9914.17	-2142.05	169.70	-0.2161	0.0171	9143.00	-2134.96	156.75	-0.2335	0.0171
0.75	9998.37	-2178.97	200.26	-0.2179	0.0200	9122.18	-2172.02	183.07	-0.2381	0.0201
0.80	10104.38	-2207.24	232.74	-0.2184	0.0230	9117.30	-2200.32	210.49	-0.2413	0.0231
0.85	10187.97	-2226.37	266.37	-0.2185	0.0261	9084.87	-2219.16	238.18	-0.2443	0.0262
0.90	10234.14	-2238.51	301.40	-0.2187	0.0295	9010.61	-2230.98	266.21	-0.2476	0.0295
0.95	10266.77	-2245.48	337.51	-0.2187	0.0329	8920.84	-2238.12	294.68	-0.2509	0.0330
1.00	10308.32	-2248.58	375.05	-0.2181	0.0364	8842.17	-2241.92	323.04	-0.2535	0.0365
1.05	10354.91	-2248.74	411.89	-0.2172	0.0398	8776.31	-2243.07	350.73	-0.2556	0.0400
1.10	10391.67	-2247.68	448.17	-0.2163	0.0431	8717.00	-2243.38	377.90	-0.2574	0.0434
1.15	10412.27	-2247.59	475.88	-0.2159	0.0457	8672.66	-2244.76	398.65	-0.2588	0.0460
1.20	10435.56	-2249.38	500.22	-0.2155	0.0479	8648.70	-2247.50	417.20	-0.2599	0.0482
1.25	10463.12	-2251.90	519.00	-0.2152	0.0496	8650.34	-2251.41	432.06	-0.2603	0.0499
1.30	10485.61	-2254.63	531.57	-0.2150	0.0507	8665.12	-2254.75	442.60	-0.2602	0.0511
1.35	10495.88	-2257.26	541.89	-0.2151	0.0516	8677.59	-2257.80	451.68	-0.2602	0.0521
1.40	10492.43	-2259.27	547.30	-0.2153	0.0522	8689.21	-2260.34	457.23	-0.2601	0.0526
1.45	10482.39	-2260.50	549.46	-0.2156	0.0524	8702.66	-2262.08	460.47	-0.2599	0.0529
1.50	10465.55	-2260.47	547.60	-0.2160	0.0523	8720.50	-2262.75	460.87	-0.2595	0.0528
1.55	10436.54	-2259.61	540.68	-0.2165	0.0518	8740.10	-2262.49	457.61	-0.2589	0.0524
1.60	10394.71	-2258.59	529.01	-0.2173	0.0509	8761.91	-2262.17	450.90	-0.2582	0.0515
1.65	10339.02	-2259.63	506.18	-0.2196	0.0490	8794.44	-2264.46	435.63	-0.2575	0.0495
1.70	10282.64	-2265.62	490.31	-0.2203	0.0477	8837.88	-2268.19	426.58	-0.2566	0.0483
1.75	10238.23	-2271.35	513.38	-0.2208	0.0499	8870.45	-2272.05	448.51	-0.2561	0.0506
1.80	10273.33	-2264.70	501.46	-0.2204	0.0488	8929.98	-2269.57	441.98	-0.2542	0.0495
1.85	10175.40	-2253.33	446.16	-0.2214	0.0438	8974.36	-2260.05	399.12	-0.2518	0.0445
1.90	10042.39	-2245.81	402.05	-0.2236	0.0400	8989.14	-2252.93	365.07	-0.2506	0.0406
1.95	9930.24	-2245.78	353.13	-0.2262	0.0356	9063.80	-2252.97	327.03	-0.2486	0.0361

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - BRAKE SUMMARY

LEADING TANDEM AXLE

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	-0.00	0.0000	26.14	0.00	0.0	0.0	0.04	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.61	-.0000	26.14	-0.03	0.0	0.0	0.76	-.0000	26.14	-0.04
0.15	50.00	0.27	268.45	0.22	-.0000	26.13	-0.64	0.27	268.45	0.37	-.0000	26.13	-0.65
0.20	50.00	5.29	5292.59	-168.95	0.0040	25.99	-4.43	5.29	5292.59	-168.41	0.0040	25.99	-4.46
0.25	50.00	15.14	15138.39	-583.18	0.0139	25.64	-7.92	15.14	15138.39	-581.30	0.0140	25.64	-8.01
0.30	50.00	24.02	24021.62	-1016.56	0.0243	25.20	-8.22	24.02	24021.62	-1013.31	0.0246	25.20	-8.38
0.35	50.00	30.64	30641.29	-1339.57	0.0317	24.77	-8.45	30.64	30641.29	-1335.12	0.0323	24.75	-8.66
0.40	50.00	35.57	35574.09	-1573.00	0.0373	24.31	-8.96	35.57	35574.09	-1566.97	0.0382	24.29	-9.25
0.45	50.00	39.25	39249.84	-1746.68	0.0417	23.84	-9.36	39.25	39249.84	-1739.23	0.0433	23.80	-9.71
0.50	50.00	41.99	41988.98	-1877.24	0.0450	23.35	-9.60	41.99	41988.98	-1868.87	0.0473	23.30	-9.99
0.55	50.00	44.03	44030.18	-1973.36	0.0471	22.86	-9.83	44.03	44030.18	-1964.91	0.0502	22.79	-10.23
0.60	50.00	45.55	45551.23	-2043.39	0.0485	22.35	-10.08	45.55	45551.23	-2034.97	0.0524	22.26	-10.48
0.65	50.00	46.68	46684.67	-2097.52	0.0496	21.84	-10.18	46.68	46684.67	-2089.03	0.0543	21.73	-10.58
0.70	50.00	47.53	47529.34	-2143.17	0.0504	21.33	-9.99	47.53	47529.34	-2135.03	0.0559	21.21	-10.38
0.75	50.00	48.16	48158.78	-2180.85	0.0506	20.84	-9.68	48.16	48158.78	-2173.38	0.0569	20.70	-10.04
0.80	50.00	48.63	48627.82	-2205.17	0.0505	20.36	-9.44	48.63	48627.82	-2202.05	0.0575	20.21	-9.78
0.85	50.00	48.98	48977.33	-2227.77	0.0502	19.88	-9.38	48.98	48977.33	-2220.35	0.0580	19.72	-9.73
0.90	50.00	49.24	49237.78	-2239.20	0.0501	19.41	-9.45	49.24	49237.78	-2231.26	0.0587	19.23	-9.83
0.95	50.00	49.43	49431.89	-2245.49	0.0500	18.93	-9.61	49.43	49431.89	-2237.67	0.0595	18.74	-9.98
1.00	50.00	49.58	49576.55	-2248.03	0.0499	18.44	-9.83	49.58	49576.55	-2241.02	0.0602	18.24	-10.16
1.05	50.00	49.68	49684.31	-2247.79	0.0497	17.94	-10.09	49.68	49684.31	-2241.91	0.0608	17.73	-10.37
1.10	50.00	49.76	49764.61	-2246.45	0.0496	17.42	-10.35	49.76	49764.61	-2242.25	0.0614	17.20	-10.55
1.15	50.00	49.82	49824.47	-2246.21	0.0496	16.89	-10.50	49.82	49824.47	-2244.16	0.0619	16.68	-10.60
1.20	50.00	49.87	49869.05	-2248.14	0.0497	16.37	-10.51	49.87	49869.05	-2247.52	0.0622	16.15	-10.54
1.25	50.00	49.90	49902.28	-2250.81	0.0498	15.84	-10.46	49.90	49902.28	-2252.16	0.0623	15.63	-10.40
1.30	50.00	49.93	49927.03	-2253.70	0.0499	15.31	-10.38	49.93	49927.03	-2255.96	0.0621	15.12	-10.28
1.35	50.00	49.95	49945.50	-2256.45	0.0500	14.79	-10.30	49.95	49945.50	-2259.23	0.0619	14.61	-10.16
1.40	50.00	49.96	49959.23	-2258.52	0.0501	14.28	-10.23	49.96	49959.23	-2261.87	0.0616	14.11	-10.07
1.45	50.00	49.97	49969.50	-2259.80	0.0503	13.77	-10.19	49.97	49969.50	-2263.57	0.0613	13.61	-10.01
1.50	50.00	49.98	49977.14	-2259.74	0.0505	13.26	-10.21	49.98	49977.14	-2264.12	0.0609	13.11	-10.00
1.55	50.00	49.98	49982.81	-2258.80	0.0508	12.74	-10.27	49.98	49982.81	-2263.67	0.0604	12.61	-10.04
1.60	50.00	49.99	49987.08	-2257.71	0.0511	12.23	-10.33	49.99	49987.08	-2263.16	0.0600	12.11	-10.07
1.65	50.00	49.99	49990.27	-2258.87	0.0516	11.71	-10.29	49.99	49990.27	-2265.50	0.0595	11.61	-9.97
1.70	50.00	49.99	49992.61	-2265.01	0.0522	11.20	-10.00	49.99	49992.61	-2269.50	0.0590	11.12	-9.78
1.75	50.00	49.99	49994.34	-2270.75	0.0525	10.71	-9.73	49.99	49994.34	-2273.31	0.0584	10.64	-9.61
1.80	50.00	50.00	49995.66	-2273.99	0.0526	10.21	-10.05	50.00	49995.66	-2270.03	0.0575	10.16	-9.77
1.85	50.00	50.00	49996.64	-2252.39	0.0531	9.70	-10.61	50.00	49996.64	-2259.85	0.0567	9.66	-10.25
1.90	50.00	50.00	49997.34	-2244.82	0.0540	9.16	-10.97	50.00	49997.34	-2252.37	0.0564	9.13	-10.61
1.95	50.00	50.00	49997.95	-2244.68	0.0550	8.61	-10.98	50.00	49997.95	-2252.65	0.0558	8.60	-10.60

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - BRAKE SUMMARY

TRAILING TANDEM AXLE

	LEFT SIDE							RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	-0.00	0.0000	26.14	0.00	0.0	0.0	0.04	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.61	-.0000	26.14	-0.03	0.0	0.0	0.76	-.0000	26.14	-0.04
0.15	50.00	0.27	268.45	0.22	-.0000	26.13	-0.64	0.27	268.45	0.37	-.0000	26.13	-0.65
0.20	50.00	5.29	5292.55	-168.51	0.0040	25.99	-4.45	5.29	5292.59	-168.08	0.0040	25.99	-4.48
0.25	50.00	15.14	15138.39	-580.01	0.0141	25.64	-8.07	15.14	15138.39	-578.54	0.0141	25.63	-8.14
0.30	50.00	24.02	24021.62	-1012.11	0.0249	25.19	-8.44	24.02	24021.62	-1009.47	0.0251	25.18	-8.56
0.35	50.00	30.64	30641.29	-1336.40	0.0326	24.74	-8.60	30.64	30641.29	-1332.72	0.0331	24.73	-8.77
0.40	50.00	35.57	35574.09	-1572.29	0.0384	24.28	-9.00	35.57	35574.09	-1567.39	0.0392	24.27	-9.23
0.45	50.00	39.25	39249.84	-1747.92	0.0428	23.81	-9.30	39.25	39249.84	-1741.87	0.0440	23.78	-9.59
0.50	50.00	41.99	41988.98	-1878.95	0.0460	23.33	-9.51	41.99	41988.98	-1872.35	0.0477	23.29	-9.83
0.55	50.00	44.03	44030.18	-1974.71	0.0479	22.84	-9.77	44.03	44030.18	-1968.02	0.0502	22.79	-10.09
0.60	50.00	45.55	45551.23	-2044.11	0.0492	22.34	-10.05	45.55	45551.23	-2037.31	0.0521	22.27	-10.37
0.65	50.00	46.68	46684.67	-2097.41	0.0503	21.83	-10.18	46.68	46684.67	-2090.37	0.0538	21.75	-10.52
0.70	50.00	47.53	47529.34	-2142.05	0.0512	21.31	-10.05	47.53	47529.34	-2134.96	0.0553	21.22	-10.39
0.75	50.00	48.16	48158.78	-2178.97	0.0516	20.81	-9.77	48.16	48158.78	-2172.02	0.0564	20.71	-10.10
0.80	50.00	48.63	48627.82	-2207.24	0.0517	20.33	-9.53	48.63	48627.82	-2200.32	0.0572	20.21	-9.86
0.85	50.00	48.98	48977.33	-2226.37	0.0518	19.85	-9.45	48.98	48977.33	-2219.16	0.0575	19.72	-9.79
0.90	50.00	49.24	49237.78	-2238.51	0.0518	19.37	-9.48	49.24	49237.78	-2230.98	0.0586	19.23	-9.84
0.95	50.00	49.43	49431.89	-2245.48	0.0518	18.89	-9.61	49.43	49431.89	-2238.12	0.0594	18.74	-9.96
1.00	50.00	49.58	49576.55	-2248.58	0.0517	18.40	-9.80	49.58	49576.55	-2241.92	0.0601	18.24	-10.12
1.05	50.00	49.68	49684.31	-2248.74	0.0514	17.90	-10.05	49.68	49684.31	-2243.07	0.0605	17.73	-10.32
1.10	50.00	49.76	49764.61	-2247.68	0.0512	17.39	-10.29	49.76	49764.61	-2243.38	0.0610	17.21	-10.49
1.15	50.00	49.82	49824.47	-2247.59	0.0511	16.87	-10.43	49.82	49824.47	-2244.76	0.0613	16.69	-10.57
1.20	50.00	49.87	49869.05	-2249.38	0.0511	16.34	-10.45	49.87	49869.05	-2247.50	0.0615	16.16	-10.54
1.25	50.00	49.90	49902.28	-2251.90	0.0510	15.82	-10.41	49.90	49902.28	-2251.41	0.0616	15.64	-10.43
1.30	50.00	49.93	49927.03	-2254.63	0.0509	15.30	-10.34	49.93	49927.03	-2254.75	0.0616	15.12	-10.33
1.35	50.00	49.95	49945.50	-2257.26	0.0509	14.78	-10.26	49.95	49945.50	-2257.80	0.0616	14.61	-10.23
1.40	50.00	49.96	49959.23	-2259.27	0.0510	14.27	-10.19	49.96	49959.23	-2260.34	0.0616	14.11	-10.14
1.45	50.00	49.97	49969.50	-2260.50	0.0511	13.76	-10.16	49.97	49969.50	-2262.08	0.0616	13.60	-10.08
1.50	50.00	49.98	49977.14	-2260.47	0.0512	13.25	-10.18	49.98	49977.14	-2262.75	0.0615	13.10	-10.07
1.55	50.00	49.98	49982.81	-2259.61	0.0513	12.74	-10.23	49.98	49982.81	-2262.49	0.0613	12.60	-10.10
1.60	50.00	49.99	49987.08	-2258.59	0.0515	12.22	-10.29	49.99	49987.08	-2262.17	0.0611	12.10	-10.12
1.65	50.00	49.99	49990.27	-2259.63	0.0518	11.71	-10.25	49.99	49990.27	-2264.46	0.0610	11.59	-10.02
1.70	50.00	49.99	49992.61	-2265.62	0.0522	11.20	-9.97	49.99	49992.61	-2268.19	0.0608	11.10	-9.85
1.75	50.00	49.99	49994.34	-2271.39	0.0523	10.71	-9.70	49.99	49994.34	-2272.05	0.0607	10.61	-9.67
1.80	50.00	50.00	49995.66	-2264.70	0.0522	10.22	-10.02	50.00	49995.66	-2269.57	0.0602	10.13	-9.79
1.85	50.00	50.00	49996.64	-2253.43	0.0524	9.70	-10.56	50.00	49996.64	-2260.05	0.0596	9.63	-10.24
1.90	50.00	50.00	49997.34	-2245.61	0.0530	9.17	-10.52	50.00	49997.34	-2252.53	0.0594	9.10	-10.59
1.95	50.00	50.00	49997.95	-2245.78	0.0536	8.62	-10.53	50.00	49997.95	-2252.57	0.0589	8.57	-10.58

TRAILER NO. 1 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY
LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0004	-0.5349	-0.0001	0.0	0.0004	-0.5349	-0.0001	0.0
0.10	0.0026	-3.0851	-0.0005	0.0	0.0026	-3.0839	-0.0005	0.0
0.15	0.0027	-3.3006	-0.0005	0.0	0.0027	-3.2923	-0.0005	0.0
0.20	0.0023	-2.8182	-0.0004	0.0	0.0023	-2.8022	-0.0004	0.0
0.25	0.0011	-1.2778	-0.0002	0.0	0.0011	-1.2659	-0.0002	0.0
0.30	-0.0022	2.6282	0.0004	0.0	-0.0022	2.5399	0.0004	0.0
0.35	-0.0062	7.5403	0.0011	0.0	-0.0062	7.3819	0.0011	0.0
0.40	-0.0126	15.2387	0.0023	0.0	-0.0126	14.7869	0.0023	0.0
0.45	-0.0210	25.0954	0.0038	0.0	-0.0210	24.0883	0.0038	0.0
0.50	-0.0314	37.3950	0.0057	0.0	-0.0314	35.4528	0.0057	0.0
0.55	-0.0433	51.7859	0.0078	0.0	-0.0433	48.4644	0.0078	0.0
0.60	-0.0553	66.5505	0.0100	0.0	-0.0554	61.4765	0.0100	0.0
0.65	-0.0676	81.6146	0.0122	0.0	-0.0677	74.4033	0.0122	0.0
0.70	-0.0796	96.6722	0.0144	0.0	-0.0797	86.9966	0.0144	0.0
0.75	-0.0909	111.8522	0.0164	0.0	-0.0911	99.4060	0.0165	0.0
0.80	-0.1016	127.0368	0.0184	0.0	-0.1018	111.5010	0.0184	0.0
0.85	-0.1118	141.6637	0.0202	0.0	-0.1121	122.7115	0.0203	0.0
0.90	-0.1222	156.0573	0.0221	0.0	-0.1226	133.2566	0.0222	0.0
0.95	-0.1326	170.0974	0.0240	0.0	-0.1331	143.1009	0.0241	0.0
1.00	-0.1419	182.7751	0.0257	0.0	-0.1425	151.5772	0.0258	0.0
1.05	-0.1498	193.6103	0.0271	0.0	-0.1505	158.4928	0.0272	0.0
1.10	-0.1571	203.4124	0.0284	0.0	-0.1580	164.7518	0.0286	0.0
1.15	-0.1573	203.4267	0.0285	0.0	-0.1582	163.8297	0.0286	0.0
1.20	-0.1534	198.1914	0.0278	0.0	-0.1544	159.2683	0.0279	0.0
1.25	-0.1445	186.6917	0.0261	0.0	-0.1455	150.3092	0.0263	0.0
1.30	-0.1303	168.3433	0.0236	0.0	-0.1313	136.2419	0.0238	0.0
1.35	-0.1143	147.4328	0.0207	0.0	-0.1152	120.1328	0.0208	0.0
1.40	-0.0947	121.8974	0.0171	0.0	-0.0955	100.1936	0.0173	0.0
1.45	-0.0731	93.7430	0.0132	0.0	-0.0737	77.8199	0.0133	0.0
1.50	-0.0492	62.9164	0.0089	0.0	-0.0497	52.8273	0.0090	0.0
1.55	-0.0227	28.7994	0.0041	0.0	-0.0229	24.4965	0.0041	0.0
1.60	0.0062	-7.7718	-0.0011	0.0	0.0062	-6.7284	-0.0011	0.0
1.65	0.0400	-50.0463	-0.0072	0.0	0.0405	-44.0500	-0.0073	0.0
1.70	0.0721	-89.3983	-0.0130	0.0	0.0730	-80.2946	-0.0132	0.0
1.75	0.0925	-114.3293	-0.0167	0.0	0.0937	-104.2913	-0.0170	0.0
1.80	0.1285	-158.0556	-0.0232	0.0	0.1303	-146.9209	-0.0236	0.0
1.85	0.1814	-219.8487	-0.0328	0.0	0.1840	-209.4027	-0.0333	0.0
1.90	0.2180	-259.0444	-0.0394	0.0	0.2212	-252.4229	-0.0400	0.0
1.95	0.2609	-304.0605	-0.0472	0.0	0.2647	-305.2808	-0.0479	0.0

TRAILER NO. 1 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY
TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0004	-0.4332	-0.0000	0.0	0.0004	-0.4331	-0.0000	0.0
0.10	0.0021	-2.4625	-0.0002	0.0	0.0021	-2.4617	-0.0002	0.0
0.15	0.0017	-2.0156	-0.0002	0.0	0.0017	-2.0119	-0.0002	0.0
0.20	0.0007	-0.8717	-0.0001	0.0	0.0007	-0.8684	-0.0001	0.0
0.25	-0.0017	2.0410	0.0002	0.0	-0.0017	2.0273	0.0002	0.0
0.30	-0.0072	8.3637	0.0009	0.0	-0.0072	8.2742	0.0009	0.0
0.35	-0.0146	17.0719	0.0018	0.0	-0.0146	16.8050	0.0018	0.0
0.40	-0.0254	29.7555	0.0031	0.0	-0.0254	29.0960	0.0031	0.0
0.45	-0.0393	45.8220	0.0047	0.0	-0.0393	44.4480	0.0047	0.0
0.50	-0.0563	65.7810	0.0068	0.0	-0.0564	63.2301	0.0068	0.0
0.55	-0.0758	89.2269	0.0091	0.0	-0.0759	84.9485	0.0092	0.0
0.60	-0.0965	114.3992	0.0116	0.0	-0.0966	107.8528	0.0116	0.0
0.65	-0.1186	141.2355	0.0143	0.0	-0.1188	131.8101	0.0143	0.0
0.70	-0.1419	169.6953	0.0171	0.0	-0.1421	156.7478	0.0171	0.0
0.75	-0.1660	200.2617	0.0200	0.0	-0.1664	183.0675	0.0201	0.0
0.80	-0.1909	232.7447	0.0230	0.0	-0.1914	210.4942	0.0231	0.0
0.85	-0.2167	266.3716	0.0261	0.0	-0.2173	238.1761	0.0262	0.0
0.90	-0.2441	301.4023	0.0295	0.0	-0.2449	266.2068	0.0295	0.0
0.95	-0.2728	337.9097	0.0329	0.0	-0.2738	294.6790	0.0330	0.0
1.00	-0.3016	375.0505	0.0364	0.0	-0.3029	323.0400	0.0365	0.0
1.05	-0.3297	411.8914	0.0398	0.0	-0.3313	350.7297	0.0400	0.0
1.10	-0.3575	448.1672	0.0431	0.0	-0.3594	377.8999	0.0434	0.0
1.15	-0.3789	475.8777	0.0457	0.0	-0.3810	398.6541	0.0460	0.0
1.20	-0.3974	500.2209	0.0479	0.0	-0.3995	417.2000	0.0482	0.0
1.25	-0.4112	519.0027	0.0496	0.0	-0.4140	432.0618	0.0499	0.0
1.30	-0.4202	531.5728	0.0507	0.0	-0.4234	442.5994	0.0511	0.0
1.35	-0.4280	541.8538	0.0516	0.0	-0.4315	451.6807	0.0521	0.0
1.40	-0.4324	547.2988	0.0522	0.0	-0.4362	457.2329	0.0526	0.0
1.45	-0.4345	549.4573	0.0524	0.0	-0.4386	460.4729	0.0529	0.0
1.50	-0.4337	547.5952	0.0523	0.0	-0.4381	460.8708	0.0528	0.0
1.55	-0.4295	540.6846	0.0518	0.0	-0.4340	457.6121	0.0524	0.0
1.60	-0.4219	529.0083	0.0505	0.0	-0.4266	450.9036	0.0515	0.0
1.65	-0.4059	506.1804	0.0490	0.0	-0.4106	435.6272	0.0495	0.0
1.70	-0.3953	490.3079	0.0477	0.0	-0.4001	426.5752	0.0483	0.0
1.75	-0.4137	513.3828	0.0495	0.0	-0.4191	448.5115	0.0506	0.0
1.80	-0.4046	501.4556	0.0488	0.0	-0.4103	441.9832	0.0495	0.0
1.85	-0.3635	446.1558	0.0438	0.0	-0.3687	399.1226	0.0445	0.0
1.90	-0.3319	402.0459	0.0400	0.0	-0.3367	365.0747	0.0406	0.0
1.95	-0.2948	353.1343	0.0356	0.0	-0.2991	327.0264	0.0361	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - UNSPRUNG MASS SUMMARY

LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.0
0.05	0.0	-0.0000	0.0	-0.0001	4.34	-0.0000	-0.0036	-0.64	0.0000	0.0035	0.66
0.10	-0.0000	-0.0002	-0.0001	-0.0125	64.05	-0.0005	-0.0190	-5.98	0.0006	0.0189	6.75
0.15	-0.0000	-0.0014	-0.0010	-0.0320	187.24	-0.0012	-0.0056	-14.21	0.0022	0.0470	17.70
0.20	0.0000	-0.0031	-0.0000	-0.0364	350.98	0.0042	0.2533	-27.61	0.0105	0.3251	30.03
0.25	-0.0004	-0.0054	-0.0152	-0.0554	565.72	0.0247	0.5310	-0.17	0.0350	0.6192	90.26
0.30	-0.0007	-0.0085	0.0071	-0.0685	824.86	0.0474	0.2497	-2.40	0.0625	0.3590	127.86
0.35	-0.0002	-0.0124	0.0043	-0.0903	1158.72	0.0562	0.1301	-56.82	0.0775	0.2717	125.14
0.40	-0.0006	-0.0175	-0.0144	-0.1130	1573.37	0.0654	0.2536	-53.74	0.0943	0.4230	191.35
0.45	-0.0014	-0.0236	-0.0164	-0.1298	2059.57	0.0791	0.2609	-6.76	0.1171	0.4561	311.88
0.50	-0.0020	-0.0305	-0.0070	-0.1454	2602.86	0.0893	0.1302	13.02	0.1375	0.3408	412.63
0.55	-0.0022	-0.0379	-0.0009	-0.1498	3171.65	0.0924	0.0214	-9.19	0.1512	0.2375	474.40
0.60	-0.0022	-0.0454	-0.0024	-0.1505	3750.67	0.0917	0.0022	-42.13	0.1613	0.2205	526.68
0.65	-0.0024	-0.0529	-0.0029	-0.1504	4330.62	0.0907	-0.0098	-70.34	0.1712	0.2078	583.59
0.70	-0.0024	-0.0605	0.0035	-0.1517	4914.04	0.0877	-0.0972	-117.11	0.1792	0.1248	622.88
0.75	-0.0020	-0.0682	0.0109	-0.1582	5518.15	0.0797	-0.2107	-203.13	0.1825	0.0220	626.48
0.80	-0.0014	-0.0763	0.0113	-0.1645	6157.37	0.0675	-0.2504	-310.56	0.1823	-0.0022	614.25
0.85	-0.0010	-0.0847	0.0049	-0.1704	6839.82	0.0557	-0.1996	-402.91	0.1832	0.0645	623.51
0.90	-0.0009	-0.0933	-0.0014	-0.1741	7557.67	0.0475	-0.1290	-463.59	0.1885	0.1448	669.08
0.95	-0.0011	-0.1019	-0.0033	-0.1712	8289.15	0.0423	-0.0967	-504.28	0.1970	0.1775	735.88
1.00	-0.0012	-0.1103	-0.0030	-0.1599	9007.86	0.0379	-0.0895	-539.97	0.2062	0.1744	804.93
1.05	-0.0014	-0.1178	-0.0036	-0.1394	9677.46	0.0340	-0.0659	-569.89	0.2149	0.1663	870.70
1.10	-0.0016	-0.1239	-0.0047	-0.0961	10203.76	0.0318	-0.0176	-583.01	0.2229	0.1464	929.19
1.15	-0.0018	-0.1271	-0.0039	-0.0406	10576.27	0.0313	0.0005	-585.54	0.2296	0.1176	977.81
1.20	-0.0019	-0.1285	-0.0010	-0.0123	10815.09	0.0311	-0.0048	-588.23	0.2341	0.0575	1005.56
1.25	-0.0019	-0.1279	0.0016	0.0333	10929.31	0.0303	-0.0210	-597.11	0.2355	0.0036	1010.02
1.30	-0.0018	-0.1256	0.0022	0.0555	10951.14	0.0289	-0.0192	-607.98	0.2348	-0.0251	1000.45
1.35	-0.0017	-0.1224	0.0016	0.0771	10897.20	0.0281	-0.0037	-612.98	0.2330	-0.0354	985.44
1.40	-0.0017	-0.1179	0.0014	0.0970	10793.25	0.0280	0.0055	-612.80	0.2311	-0.0404	969.32
1.45	-0.0016	-0.1128	0.0014	0.1102	10647.32	0.0285	0.0133	-608.84	0.2288	-0.0512	950.33
1.50	-0.0015	-0.1067	0.0009	0.1323	10447.46	0.0295	0.0285	-599.49	0.2261	-0.0574	928.66
1.55	-0.0015	-0.0996	-0.0003	0.1546	10183.98	0.0315	0.0556	-580.35	0.2234	-0.0578	906.87
1.60	-0.0015	-0.0912	-0.0011	0.1805	9836.01	0.0351	0.0853	-549.24	0.2205	-0.0637	883.96
1.65	-0.0016	-0.0811	-0.0005	0.2248	9390.12	0.0398	0.1019	-511.03	0.2170	-0.0847	853.82
1.70	-0.0016	-0.0697	0.0026	0.2016	8838.90	0.0446	0.0833	-475.41	0.2115	-0.1426	804.65
1.75	-0.0013	-0.0615	0.0061	0.1631	8273.80	0.0475	0.0137	-460.39	0.2036	-0.1660	740.40
1.80	-0.0011	-0.0514	0.0014	0.2492	7847.97	0.0484	0.0421	-449.96	0.1966	-0.1064	692.21
1.85	-0.0013	-0.0374	-0.0083	0.2806	7422.13	0.0535	0.1820	-394.84	0.1939	-0.0205	680.24
1.90	-0.0018	-0.0240	-0.0099	0.2828	6655.50	0.0663	0.2988	-281.69	0.1927	-0.0647	666.10
1.95	-0.0021	-0.0072	-0.0005	0.2771	5625.34	0.0805	0.2196	-179.35	0.1878	-0.1697	616.11

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 1 REAR SUSPENSION - UNSPRUNG MASS SUMMARY

TRAILING TANDEM AXLE

	AXLE MOTION				DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE	
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0000	-0.0000	0.0000	-0.0006	4.06	-0.0000	-0.0037	-0.64	0.0000	0.0031	0.58
0.10	0.0000	-0.0003	0.0002	-0.0142	61.68	-0.0005	-0.0230	-6.79	0.0005	0.0138	5.47
0.15	0.0000	-0.0016	-0.0003	-0.0332	182.11	-0.0017	-0.0324	-14.51	0.0016	0.0195	16.55
0.20	-0.0003	-0.0033	-0.0016	-0.0383	343.58	-0.0028	0.0334	25.97	0.0034	0.1039	82.39
0.25	-0.0020	-0.0057	-0.0062	-0.0595	552.93	0.0044	0.2147	184.61	0.0145	0.3002	272.86
0.30	-0.0034	-0.0091	-0.0016	-0.0752	802.78	0.0115	-0.0901	280.17	0.0262	0.0148	406.70
0.35	-0.0030	-0.0134	0.0042	-0.1002	1121.79	0.0024	-0.2366	247.66	0.0229	-0.1016	423.46
0.40	-0.0033	-0.0191	-0.0126	-0.1251	1517.05	-0.0056	-0.0576	246.61	0.0223	0.1037	482.54
0.45	-0.0040	-0.0259	-0.0114	-0.1449	1979.39	-0.0063	-0.0162	275.65	0.0301	0.1691	581.41
0.50	-0.0042	-0.0336	0.0012	-0.1635	2493.26	-0.0095	-0.1315	260.69	0.0365	0.0670	642.87
0.55	-0.0040	-0.0420	0.0069	-0.1705	3027.43	-0.0188	-0.1992	197.61	0.0373	0.0029	658.47
0.60	-0.0037	-0.0506	0.0015	-0.1743	3566.75	-0.0290	-0.1409	137.04	0.0372	0.0615	677.08
0.65	-0.0038	-0.0594	-0.0031	-0.1771	4102.11	-0.0355	-0.0744	103.48	0.0408	0.1256	721.88
0.70	-0.0039	-0.0684	0.0015	-0.1820	4635.36	-0.0405	-0.1145	66.90	0.0458	0.0874	763.73
0.75	-0.0036	-0.0777	0.0087	-0.1925	5182.29	-0.0489	-0.2065	-3.55	0.0476	0.0035	774.21
0.80	-0.0031	-0.0876	0.0065	-0.2023	5757.72	-0.0604	-0.2281	-92.64	0.0468	-0.0050	770.70
0.85	-0.0029	-0.0979	0.0012	-0.2112	6370.79	-0.0707	-0.1585	-162.14	0.0480	0.0786	792.40
0.90	-0.0030	-0.1087	-0.0048	-0.2178	7014.16	-0.0766	-0.0832	-198.13	0.0541	0.1616	851.50
0.95	-0.0033	-0.1196	-0.0045	-0.2184	7665.54	-0.0798	-0.0674	-219.77	0.0632	0.1756	925.34
1.00	-0.0034	-0.1304	-0.0024	-0.2106	8297.80	-0.0832	-0.0848	-246.98	0.0717	0.1454	989.92
1.05	-0.0035	-0.1405	-0.0017	-0.1919	9875.81	-0.0873	-0.0781	-277.29	0.0786	0.1192	1041.70
1.10	-0.0036	-0.1492	-0.0024	-0.1487	9309.69	-0.0903	-0.0354	-295.00	0.0840	0.0938	1082.02
1.15	-0.0037	-0.1551	-0.0014	-0.0972	9586.34	-0.0916	-0.0164	-302.78	0.0881	0.0632	1111.04
1.20	-0.0038	-0.1594	0.0013	-0.0718	9722.00	-0.0926	-0.0198	-310.42	0.0899	0.0030	1118.46
1.25	-0.0036	-0.1619	0.0035	-0.0271	9726.68	-0.0941	-0.0298	-322.91	0.0886	-0.0452	1103.76
1.30	-0.0035	-0.1626	0.0031	-0.0070	9644.06	-0.0956	-0.0140	-332.98	0.0857	-0.0614	1078.89
1.35	-0.0033	-0.1625	0.0014	0.0145	9479.57	-0.0958	0.0170	-331.24	0.0824	-0.0563	1054.39
1.40	-0.0033	-0.1612	0.0004	0.0345	9265.24	-0.0946	0.0366	-319.58	0.0797	-0.0507	1033.55
1.45	-0.0033	-0.1592	0.0002	0.0488	9009.75	-0.0926	0.0482	-301.97	0.0770	-0.0570	1012.20
1.50	-0.0033	-0.1561	-0.0002	0.0731	8703.49	-0.0898	0.0634	-278.76	0.0741	-0.0618	988.92
1.55	-0.0033	-0.1519	-0.0014	0.0979	8337.45	-0.0860	0.0893	-246.11	0.0711	-0.0617	965.76
1.60	-0.0034	-0.1463	-0.0021	0.1279	7892.32	-0.0808	0.1168	-202.45	0.0681	-0.0673	941.40
1.65	-0.0035	-0.1385	-0.0022	0.1646	7364.06	-0.0746	0.1372	-151.20	0.0646	-0.0761	913.14
1.70	-0.0036	-0.1295	0.0004	0.1961	6728.59	-0.0677	0.1354	-97.40	0.0596	-0.1406	867.19
1.75	-0.0034	-0.1268	0.0056	0.0504	5966.11	-0.0618	0.0632	-59.48	0.0510	-0.1913	794.12
1.80	-0.0032	-0.1206	0.0011	0.1998	5403.55	-0.0592	0.0642	-39.05	0.0431	-0.1172	740.51
1.85	-0.0034	-0.1081	-0.0054	0.2673	4923.95	-0.0532	0.1989	22.81	0.0403	-0.0124	720.03
1.90	-0.0040	-0.0950	-0.0058	0.2843	4150.93	-0.0398	0.2972	138.25	0.0395	-0.0653	718.34
1.95	-0.0042	-0.0785	0.0026	0.3528	3107.58	-0.0263	0.1860	231.75	0.0337	-0.2194	655.66

TRAILER NO. 2 SPRUNG MASS POSITION

TIME (SEC)	FORWARD (FT)	LATERAL (FT)	VERTICAL (FT)	ROLL (DEG)	PITCH (DEG)	HEADING (DEG)	TURN RADIUS (FT)	SIDE SLIP (DEG)	ARTICULATION ANGLE (DEG)
0.0	-60.8718	0.0	0.0	0.0	0.0	0.0	**********	0.0	0.0
0.05	-58.5619	0.0000	0.0000	-0.0000	0.0000	0.0000	**********	0.0000	0.0000
0.10	-56.3626	0.0000	-0.0000	-0.0000	-0.0000	0.0000	**********	0.0000	0.0002
0.15	-54.1674	0.0000	-0.0000	-0.0000	-0.0000	0.0000	**********	0.0000	0.0006
0.20	-51.9815	0.0000	-0.0001	-0.0000	-0.0017	0.0000	**********	0.0000	0.0013
0.25	-49.8077	0.0000	-0.0003	0.0000	-0.0133	0.0000	**********	-0.0001	0.0025
0.30	-47.6453	-0.0000	0.0015	0.0002	-0.0340	-0.0001	-198633.8125	-0.0005	0.0046
0.35	-45.4941	-0.0001	0.0054	0.0008	-0.0546	-0.0003	-94731.3750	-0.0012	0.0084
0.40	-43.3576	-0.0001	0.0078	0.0019	-0.0691	-0.0008	-54914.0273	-0.0024	0.0145
0.45	-41.2434	-0.0003	0.0085	0.0035	-0.0717	-0.0017	-35852.3672	-0.0043	0.0236
0.50	-39.1605	-0.0006	0.0087	0.0056	-0.0689	-0.0031	-25545.1094	-0.0068	0.0362
0.55	-37.1169	-0.0010	0.0098	0.0081	-0.0681	-0.0051	-19698.8320	-0.0100	0.0527
0.60	-35.1180	-0.0016	0.0120	0.0105	-0.0703	-0.0077	-16619.9219	-0.0138	0.0737
0.65	-33.1660	-0.0025	0.0143	0.0124	-0.0719	-0.0108	-15265.0156	-0.0178	0.0992
0.70	-31.2607	-0.0036	0.0155	0.0133	-0.0693	-0.0142	-15176.0625	-0.0216	0.1297
0.75	-29.4005	-0.0048	0.0154	0.0128	-0.0629	-0.0178	-16443.3789	-0.0249	0.1654
0.80	-27.5832	-0.0063	0.0151	0.0108	-0.0568	-0.0213	-20133.2656	-0.0273	0.2064
0.85	-25.8070	-0.0079	0.0154	0.0074	-0.0542	-0.0245	-31476.1445	-0.0283	0.2529
0.90	-24.0711	-0.0095	0.0165	0.0029	-0.0545	-0.0272	-147194.3125	-0.0275	0.3050
0.95	-22.3757	-0.0111	0.0175	-0.0023	-0.0549	-0.0293	39933.0234	-0.0245	0.3629
1.00	-20.7218	-0.0126	0.0180	-0.0078	-0.0537	-0.0306	15689.8750	-0.0190	0.4263
1.05	-19.1108	-0.0139	0.0180	-0.0132	-0.0519	-0.0310	9143.9648	-0.0107	0.4952
1.10	-17.5446	-0.0149	0.0179	-0.0182	-0.0509	-0.0302	6211.0859	0.0006	0.5690
1.15	-16.0250	-0.0155	0.0181	-0.0226	-0.0516	-0.0280	4559.7969	0.0150	0.6472
1.20	-14.5529	-0.0155	0.0184	-0.0263	-0.0529	-0.0243	3550.8384	0.0325	0.7294
1.25	-13.1287	-0.0150	0.0186	-0.0295	-0.0533	-0.0188	2885.0195	0.0527	0.8153
1.30	-11.7520	-0.0139	0.0185	-0.0321	-0.0524	-0.0114	2405.2510	0.0755	0.9041
1.35	-10.4218	-0.0120	0.0182	-0.0343	-0.0508	-0.0019	2049.2102	0.1006	0.9957
1.40	-9.1370	-0.0094	0.0180	-0.0362	-0.0498	0.0098	1767.0205	0.1280	1.0894
1.45	-7.8967	-0.0059	0.0181	-0.0376	-0.0499	0.0235	1535.4143	0.1576	1.1848
1.50	-6.7004	-0.0017	0.0184	-0.0387	-0.0504	0.0394	1341.7256	0.1897	1.2812
1.55	-5.5482	0.0034	0.0185	-0.0392	-0.0506	0.0574	1179.3542	0.2242	1.3778
1.60	-4.4403	0.0094	0.0185	-0.0391	-0.0503	0.0773	1043.7197	0.2614	1.4741
1.65	-3.3751	0.0162	0.0185	-0.0381	-0.0500	0.0993	929.4189	0.3012	1.5689
1.70	-2.3513	0.0238	0.0185	-0.0362	-0.0501	0.1230	836.9556	0.3435	1.6616
1.75	-1.3694	0.0323	0.0186	-0.0331	-0.0503	0.1484	787.0603	0.3866	1.7552
1.80	-0.4288	0.0414	0.0187	-0.0283	-0.0503	0.1751	746.0271	0.4291	1.8505
1.85	0.4375	0.0513	0.0188	-0.0218	-0.0502	0.2028	700.7849	0.4715	1.9431
1.90	1.2629	0.0617	0.0188	-0.0144	-0.0504	0.2312	672.1379	0.5133	2.0303
1.95	2.0422	0.0724	0.0187	-0.0067	-0.0511	0.2603	658.3425	0.5528	2.1113

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 SPRUNG MASS VELOCITY (BODY AXES)

TIME (SEC)	FORWARD (FT/SEC)	LATERAL (FT/SEC)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	PITCH (DEG/SEC)	HEADING (DEG/SEC)	ARTICULATION RATE (DEG/SEC)
0.0	44.00	0.0	0.0	0.0	0.0	0.0	0.0
0.05	44.00	0.00	-0.00	-0.00	-0.00	0.00	0.00
0.10	44.00	0.00	-0.00	-0.00	-0.00	0.00	0.01
0.15	43.99	0.00	-0.00	-0.00	-0.00	0.00	0.01
0.20	43.95	0.00	-0.00	0.00	-0.10	0.00	0.02
0.25	43.77	-0.00	-0.01	0.00	-0.37	-0.00	0.03
0.30	43.31	-0.00	0.04	0.01	-0.43	-0.00	0.06
0.35	42.75	-0.00	0.03	0.02	-0.38	-0.01	0.10
0.40	42.13	-0.00	-0.02	0.03	-0.17	-0.01	0.15
0.45	41.45	-0.00	-0.05	0.04	0.04	-0.02	0.21
0.50	40.77	-0.00	-0.04	0.05	0.05	-0.03	0.29
0.55	40.11	-0.01	-0.01	0.05	-0.02	-0.05	0.37
0.60	39.44	-0.01	0.00	0.04	-0.05	-0.06	0.46
0.65	38.73	-0.01	-0.01	0.03	0.00	-0.07	0.56
0.70	37.97	-0.01	-0.04	0.00	0.10	-0.07	0.66
0.75	37.14	-0.02	-0.05	-0.03	0.14	-0.07	0.77
0.80	36.27	-0.02	-0.04	-0.05	0.09	-0.07	0.87
0.85	35.35	-0.02	-0.02	-0.08	0.02	-0.06	0.99
0.90	34.42	-0.02	-0.01	-0.10	-0.02	-0.05	1.10
0.95	33.48	-0.01	-0.02	-0.11	0.01	-0.03	1.21
1.00	32.55	-0.01	-0.03	-0.11	0.04	-0.02	1.32
1.05	31.64	-0.01	-0.03	-0.10	0.03	0.00	1.43
1.10	30.75	0.00	-0.03	-0.09	0.00	0.03	1.52
1.15	29.87	0.01	-0.02	-0.08	-0.03	0.06	1.60
1.20	29.00	0.02	-0.02	-0.07	-0.02	0.09	1.68
1.25	28.11	0.03	-0.03	-0.06	0.01	0.13	1.75
1.30	27.21	0.04	-0.03	-0.05	0.03	0.17	1.81
1.35	26.30	0.05	-0.03	-0.04	0.03	0.21	1.85
1.40	25.37	0.06	-0.02	-0.03	0.01	0.25	1.89
1.45	24.43	0.07	-0.02	-0.03	-0.01	0.30	1.92
1.50	23.49	0.08	-0.02	-0.02	-0.01	0.34	1.93
1.55	22.56	0.09	-0.02	-0.00	0.00	0.38	1.93
1.60	21.63	0.10	-0.02	0.01	0.01	0.42	1.92
1.65	20.72	0.11	-0.02	0.03	0.00	0.46	1.87
1.70	19.82	0.12	-0.02	0.05	-0.00	0.49	1.85
1.75	18.95	0.13	-0.01	0.08	-0.00	0.52	1.90
1.80	18.09	0.14	-0.01	0.11	0.00	0.54	1.89
1.85	17.24	0.14	-0.01	0.14	-0.00	0.56	1.81
1.90	16.36	0.15	-0.02	0.15	-0.01	0.58	1.68
1.95	15.45	0.15	-0.02	0.15	-0.01	0.59	1.56

TRAILER NO. 2 SPRUNG MASS ACCELERATION (BODY AXES) INERTIAL ACCEL. ALONG BODY AXES

TIME (SEC)	FORWARD (FT/SEC**2)	LATERAL (FT/SEC**2)	VERTICAL (FT/SEC**2)	ROLL (DEG/SEC**2)	PITCH (DEG/SEC**2)	HEADING (DEG/SEC**2)	LONGITUDINAL (FT/SEC**2)	LATERAL (FT/SEC**2)
0.0	0.0	0.0	0.0000	0.0	0.0001	0.0	-0.0	0.0
0.05	-0.0012	0.0000	-0.0000	-0.0004	-0.0002	0.0001	-0.0012	0.0000
0.10	-0.0140	0.0005	-0.0006	-0.0087	-0.0086	0.0031	-0.0140	0.0005
0.15	-0.1642	0.0000	-0.0151	0.0006	-0.2773	0.0018	-0.1642	0.0002
0.20	-1.8346	-0.0012	-0.1845	0.0273	-4.1241	-0.0084	-1.8346	-0.0012
0.25	-6.4135	-0.0031	0.6072	0.0597	-4.1523	-0.0237	-6.4134	-0.0036
0.30	-10.7117	-0.0075	0.6980	0.1304	0.2622	-0.0583	-10.7120	-0.0095
0.35	-11.6458	-0.0142	-1.0907	0.2066	2.0740	-0.1105	-11.6460	-0.0192
0.40	-13.1349	-0.0219	-0.8566	0.2449	5.3730	-0.1645	-13.1348	-0.0320
0.45	-13.7104	-0.0304	-0.1804	0.2181	2.1458	-0.2086	-13.7104	-0.0471
0.50	-13.4090	-0.0394	0.4625	0.1260	-1.1075	-0.2340	-13.4090	-0.0637
0.55	-13.1912	-0.0473	0.5224	-0.0191	-1.3819	-0.2364	-13.1912	-0.0795
0.60	-13.6612	-0.0510	-0.0045	-0.2153	0.2654	-0.2026	-13.6612	-0.0904
0.65	-14.6744	-0.0492	-0.4783	-0.4164	1.8462	-0.1344	-14.6744	-0.0937
0.70	-15.8739	-0.0422	-0.4388	-0.5584	1.6218	-0.0500	-15.8740	-0.0888
0.75	-17.0052	-0.0303	0.0008	-0.6040	-0.1501	0.0333	-17.0053	-0.0762
0.80	-17.9667	-0.0138	0.3674	-0.5564	-1.5420	0.1094	-17.9668	-0.0564
0.85	-18.5511	0.0070	0.3393	-0.4441	-1.2657	0.1814	-18.5511	-0.0300
0.90	-18.7456	0.0311	0.0173	-0.2903	0.0011	0.2513	-18.7456	0.0016
0.95	-18.6317	0.0572	-0.2337	-0.1154	0.7539	0.3178	-18.6317	0.0368
1.00	-18.4046	0.0843	-0.1568	0.0485	0.3256	0.3847	-18.4046	0.0744
1.05	-18.0082	0.1116	0.0216	0.1709	-0.4047	0.4592	-18.0082	0.1136
1.10	-17.6234	0.1374	0.1524	0.2458	-0.6881	0.5400	-17.6234	0.1528
1.15	-17.4676	0.1617	0.0841	0.2494	-0.2704	0.6313	-17.4676	0.1919
1.20	-17.5712	0.1811	-0.0690	0.2332	0.3730	0.7150	-17.5712	0.2275
1.25	-17.8289	0.1948	-0.1289	0.2123	0.6151	0.7761	-17.8289	0.2581
1.30	-18.1090	0.2043	-0.0406	0.1735	0.3059	0.8237	-18.1091	0.2846
1.35	-18.4591	0.2087	0.0903	0.1547	-0.2822	0.8476	-18.4593	0.3055
1.40	-18.7045	0.2106	0.1395	0.1470	-0.4793	0.8559	-18.7047	0.3229
1.45	-18.8061	0.2110	0.0732	0.1603	-0.2021	0.8521	-18.8064	0.3374
1.50	-18.7667	0.2108	-0.0240	0.2026	0.1478	0.8364	-18.7671	0.3496
1.55	-18.5933	0.2096	-0.0566	0.2672	0.2272	0.8101	-18.5938	0.3592
1.60	-18.3868	0.2065	-0.0107	0.3454	-0.0034	0.7713	-18.3875	0.3648
1.65	-18.0882	0.2019	0.0506	0.3893	-0.1481	0.7322	-18.0890	0.3672
1.70	-17.7015	0.1930	0.0630	0.4313	-0.0690	0.6843	-17.7025	0.3635
1.75	-17.2594	0.1665	0.0288	0.6918	0.1045	0.5117	-17.2605	0.3395
1.80	-16.9690	0.1395	-0.0116	0.7133	0.0891	0.3621	-16.9703	0.3118
1.85	-17.2311	0.1135	-0.0295	0.4043	-0.1910	0.3190	-17.2325	0.2823
1.90	-17.9199	0.0731	-0.0255	0.0629	-0.2124	0.2534	-17.9213	0.2375
1.95	-18.5862	0.0248	-0.0162	-0.2679	0.1557	0.1518	-18.5876	0.1828

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 FRONT AXLE TIRE FORCES

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	4325.00	-0.0	0.0	0.0	0.0	4325.00	-0.0	0.0	0.0	0.0
0.05	4325.00	0.01	0.01	0.0000	0.0000	4324.99	0.01	0.01	0.0000	0.0000
0.10	4325.08	0.09	0.14	0.0000	0.0000	4324.91	0.09	0.14	0.0000	0.0000
0.15	4325.33	1.09	0.07	0.0003	0.0000	4325.10	1.09	0.07	0.0003	0.0000
0.20	4339.14	14.95	-0.35	0.0034	-0.0001	4339.42	14.95	-0.35	0.0034	-0.0001
0.25	4449.52	-244.73	-1.06	-0.0550	-0.0002	4450.70	-244.79	-1.06	-0.0550	-0.0002
0.30	4773.63	-918.53	-2.72	-0.1924	-0.0006	4777.30	-918.75	-2.72	-0.1923	-0.0006
0.35	5181.02	-1112.89	-5.19	-0.2148	-0.0010	5189.19	-1113.23	-5.20	-0.2145	-0.0010
0.40	5412.52	-1511.76	-7.94	-0.2793	-0.0015	5426.88	-1512.41	-7.96	-0.2787	-0.0015
0.45	5436.43	-1838.42	-10.42	-0.3382	-0.0019	5458.32	-1839.31	-10.46	-0.3370	-0.0019
0.50	5405.73	-2097.07	-12.32	-0.3879	-0.0023	5435.82	-2098.10	-12.39	-0.3860	-0.0023
0.55	5463.68	-2299.50	-13.46	-0.4209	-0.0025	5501.89	-2300.42	-13.56	-0.4181	-0.0025
0.60	5610.05	-2442.65	-13.36	-0.4354	-0.0024	5654.65	-2443.22	-13.48	-0.4321	-0.0024
0.65	5735.59	-2533.27	-12.02	-0.4417	-0.0021	5783.47	-2533.52	-12.13	-0.4381	-0.0021
0.70	5750.54	-2589.57	-9.77	-0.4503	-0.0017	5797.71	-2589.53	-9.86	-0.4466	-0.0017
0.75	5674.21	-2630.27	-6.82	-0.4635	-0.0012	5716.00	-2629.86	-6.89	-0.4601	-0.0012
0.80	5605.07	-2664.72	-3.10	-0.4754	-0.0006	5636.48	-2663.80	-3.13	-0.4726	-0.0006
0.85	5615.88	-2695.23	1.61	-0.4799	0.0003	5632.04	-2693.87	1.60	-0.4783	0.0003
0.90	5690.02	-2718.70	7.16	-0.4778	0.0013	5687.03	-2717.13	7.15	-0.4778	0.0013
0.95	5756.70	-2735.37	13.15	-0.4752	0.0023	5732.32	-2733.72	13.09	-0.4769	0.0023
1.00	5772.51	-2747.90	19.29	-0.4760	0.0033	5726.11	-2746.21	19.14	-0.4796	0.0033
1.05	5757.04	-2761.74	25.44	-0.4797	0.0044	5689.28	-2760.05	25.14	-0.4851	0.0044
1.10	5754.43	-2775.39	31.26	-0.4823	0.0054	5667.22	-2773.83	30.78	-0.4895	0.0054
1.15	5784.08	-2784.82	36.95	-0.4815	0.0064	5679.58	-2783.41	36.27	-0.4901	0.0064
1.20	5824.34	-2788.07	41.91	-0.4787	0.0072	5705.27	-2786.80	41.01	-0.4885	0.0072
1.25	5840.91	-2786.53	45.90	-0.4771	0.0079	5710.40	-2785.31	44.79	-0.4878	0.0078
1.30	5824.18	-2783.19	49.37	-0.4780	0.0085	5684.30	-2782.58	48.04	-0.4895	0.0085
1.35	5795.09	-2781.66	51.92	-0.4800	0.0090	5648.38	-2780.57	50.36	-0.4923	0.0089
1.40	5782.37	-2781.10	53.59	-0.4810	0.0093	5631.05	-2780.18	51.79	-0.4937	0.0092
1.45	5793.43	-2781.41	54.16	-0.4801	0.0093	5639.93	-2780.67	52.15	-0.4930	0.0092
1.50	5812.02	-2782.35	53.27	-0.4787	0.0092	5659.40	-2781.75	51.04	-0.4915	0.0090
1.55	5818.29	-2783.82	50.74	-0.4785	0.0087	5670.11	-2783.35	48.32	-0.4909	0.0085
1.60	5808.93	-2786.25	46.49	-0.4797	0.0080	5669.34	-2785.93	43.88	-0.4914	0.0077
1.65	5795.88	-2790.04	41.02	-0.4814	0.0071	5669.07	-2789.86	38.19	-0.4921	0.0067
1.70	5789.29	-2794.77	33.82	-0.4827	0.0058	5679.56	-2794.78	30.71	-0.4921	0.0054
1.75	5784.38	-2800.29	26.65	-0.4841	0.0046	5702.64	-2800.79	17.30	-0.4911	0.0030
1.80	5775.37	-2804.00	8.16	-0.4855	0.0014	5725.95	-2804.54	4.45	-0.4898	0.0008
1.85	5761.84	-2801.58	0.27	-0.4862	0.0000	5743.38	-2802.07	-4.02	-0.4879	-0.0007
1.90	5746.95	-2794.07	-6.48	-0.4862	-0.0011	5761.01	-2794.55	-11.53	-0.4851	-0.0020
1.95	5731.94	-2785.70	-12.24	-0.4860	-0.0021	5777.41	-2786.10	-18.22	-0.4822	-0.0032

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION TIRE FORCES

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	2162.50	-0.0	0.0	0.0	0.0	2162.50	-0.0	0.0	0.0	0.0
0.05	2162.50	0.01	-0.00	0.0000	-0.0000	2162.50	0.01	-0.00	0.0000	-0.0000
0.10	2162.49	0.08	-0.02	0.0000	-0.0000	2162.50	0.09	-0.02	0.0000	-0.0000
0.15	2162.52	-3.48	-0.03	-0.0016	-0.0000	2162.52	-3.48	-0.03	-0.0016	-0.0000
0.20	2196.48	-173.40	0.05	-0.0789	0.0000	2196.38	-173.40	0.05	-0.0789	0.0000
0.25	2254.38	-576.32	0.17	-0.2556	0.0001	2254.22	-576.33	0.17	-0.2557	0.0001
0.30	2420.88	-997.88	0.45	-0.4122	0.0002	2420.72	-997.94	0.45	-0.4122	0.0002
0.35	2577.20	-1330.37	0.90	-0.5162	0.0003	2577.19	-1330.52	0.90	-0.5163	0.0003
0.40	2636.73	-1572.34	1.35	-0.5963	0.0005	2637.53	-1572.65	1.35	-0.5963	0.0005
0.45	2723.02	-1758.49	1.65	-0.6458	0.0006	2725.45	-1758.96	1.66	-0.6454	0.0006
0.50	2784.17	-1901.83	1.69	-0.6831	0.0006	2789.11	-1902.43	1.69	-0.6821	0.0006
0.55	2837.02	-2012.41	1.46	-0.7093	0.0005	2844.97	-2013.05	1.46	-0.7076	0.0005
0.60	2886.17	-2087.09	0.96	-0.7231	0.0003	2897.18	-2087.66	0.96	-0.7206	0.0003
0.65	2919.26	-2133.09	0.24	-0.7307	0.0001	2932.79	-2133.48	0.24	-0.7275	0.0001
0.70	2936.62	-2161.09	-0.48	-0.7359	-0.0002	2951.30	-2161.20	-0.48	-0.7323	-0.0002
0.75	2946.09	-2179.63	-0.96	-0.7398	-0.0003	2960.00	-2179.42	-0.97	-0.7363	-0.0003
0.80	2955.57	-2192.07	-1.12	-0.7417	-0.0004	2966.62	-2191.57	-1.12	-0.7387	-0.0004
0.85	2969.87	-2202.72	-0.99	-0.7417	-0.0003	2976.31	-2201.99	-1.00	-0.7398	-0.0003
0.90	2986.98	-2212.97	-0.69	-0.7409	-0.0002	2987.59	-2212.10	-0.69	-0.7404	-0.0002
0.95	2999.60	-2223.27	-0.36	-0.7412	-0.0001	2993.83	-2222.32	-0.36	-0.7423	-0.0001
1.00	3002.87	-2232.20	-0.21	-0.7434	-0.0001	2990.96	-2231.25	-0.20	-0.7460	-0.0001
1.05	3000.14	-2242.40	-0.51	-0.7474	-0.0002	2983.12	-2241.49	-0.51	-0.7514	-0.0002
1.10	2999.51	-2251.63	-1.43	-0.7507	-0.0005	2978.93	-2250.78	-1.42	-0.7556	-0.0005
1.15	3001.93	-2257.28	-3.13	-0.7519	-0.0010	2979.63	-2256.50	-3.11	-0.7573	-0.0010
1.20	3004.54	-2258.57	-5.62	-0.7519	-0.0019	2982.43	-2258.21	-5.59	-0.7572	-0.0019
1.25	3004.95	-2257.51	-8.67	-0.7513	-0.0029	2984.42	-2256.77	-8.62	-0.7562	-0.0029
1.30	3003.08	-2254.98	-12.34	-0.7509	-0.0041	2985.59	-2254.27	-12.27	-0.7550	-0.0041
1.35	3000.58	-2251.95	-16.48	-0.7505	-0.0055	2987.31	-2251.25	-16.42	-0.7536	-0.0055
1.40	2998.86	-2249.82	-21.06	-0.7502	-0.0070	2990.82	-2249.15	-21.02	-0.7520	-0.0070
1.45	2994.10	-2248.92	-26.10	-0.7501	-0.0087	2996.45	-2248.28	-26.12	-0.7503	-0.0087
1.50	2996.34	-2249.59	-31.61	-0.7508	-0.0105	3002.25	-2249.00	-31.72	-0.7491	-0.0106
1.55	2992.48	-2251.42	-37.57	-0.7524	-0.0126	3007.34	-2250.90	-37.83	-0.7485	-0.0126
1.60	2985.75	-2254.01	-43.98	-0.7549	-0.0147	3011.09	-2253.57	-44.45	-0.7484	-0.0148
1.65	2978.05	-2257.65	-50.94	-0.7581	-0.0171	3015.71	-2257.29	-51.71	-0.7485	-0.0171
1.70	2971.29	-2262.15	-58.58	-0.7613	-0.0197	3023.63	-2261.88	-59.77	-0.7481	-0.0198
1.75	2966.26	-2267.87	-65.47	-0.7646	-0.0221	3033.86	-2267.69	-67.15	-0.7475	-0.0221
1.80	2960.92	-2271.54	-72.23	-0.7672	-0.0244	3045.16	-2271.64	-74.62	-0.7460	-0.0245
1.85	2949.23	-2268.84	-80.90	-0.7693	-0.0274	3054.96	-2269.04	-84.09	-0.7427	-0.0275
1.90	2931.80	-2261.12	-90.00	-0.7712	-0.0307	3060.45	-2261.25	-94.29	-0.7389	-0.0308
1.95	2915.35	-2252.86	-98.86	-0.7728	-0.0339	3066.07	-2252.93	-104.38	-0.7348	-0.0340

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION TIRE FORCES

TRAILING TANDEM AXLE

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	2162.50	-0.0	0.0	0.0	0.0	2162.50	-0.0	0.0	0.0	0.0
0.05	2162.50	0.01	-0.00	0.0000	-0.0000	2162.50	0.01	-0.00	0.0000	-0.0000
0.10	2162.49	0.08	-0.01	0.0000	-0.0000	2162.49	0.09	-0.01	0.0000	-0.0000
0.15	2161.99	-3.48	-0.00	-0.0016	-0.0000	2161.96	-3.48	-0.00	-0.0016	-0.0000
0.20	2116.74	-170.19	0.05	-0.0804	0.0000	2116.62	-170.19	0.05	-0.0804	0.0000
0.25	1935.98	-547.77	0.08	-0.2830	0.0000	1935.86	-547.79	0.08	-0.2830	0.0000
0.30	1848.23	-953.85	0.09	-0.5161	0.0000	1848.58	-953.97	0.09	-0.5161	0.0000
0.35	1833.77	-1287.67	-0.01	-0.7022	-0.0000	1835.12	-1288.05	-0.01	-0.7019	-0.0000
0.40	1774.23	-1536.20	-0.37	-0.8658	-0.0002	1777.62	-1537.03	-0.37	-0.8647	-0.0002
0.45	1797.16	-1737.94	-1.12	-0.9725	-0.0006	1793.80	-1739.21	-1.13	-0.9696	-0.0006
0.50	1785.27	-1882.73	-2.24	-1.0546	-0.0013	1796.19	-1884.41	-2.26	-1.0491	-0.0013
0.55	1780.93	-1998.35	-3.63	-1.1221	-0.0020	1796.51	-2000.22	-3.66	-1.1134	-0.0020
0.60	1785.68	-2080.18	-5.16	-1.1649	-0.0029	1806.02	-2081.86	-5.22	-1.1527	-0.0029
0.65	1792.06	-2131.65	-6.61	-1.1895	-0.0037	1816.01	-2132.77	-6.69	-1.1744	-0.0037
0.70	1797.30	-2162.89	-7.69	-1.2034	-0.0043	1822.93	-2163.21	-7.80	-1.1867	-0.0043
0.75	1799.41	-2182.43	-8.20	-1.2129	-0.0046	1824.25	-2181.89	-8.31	-1.1960	-0.0046
0.80	1799.15	-2194.84	-8.08	-1.2206	-0.0045	1819.68	-2193.51	-8.17	-1.2054	-0.0045
0.85	1798.99	-2206.54	-7.37	-1.2265	-0.0041	1814.99	-2204.56	-7.43	-1.2146	-0.0041
0.90	1806.14	-2218.60	-6.14	-1.2284	-0.0034	1814.89	-2216.14	-6.17	-1.2211	-0.0034
0.95	1815.83	-2229.67	-4.41	-1.2279	-0.0024	1816.10	-2226.98	-4.41	-1.2262	-0.0024
1.00	1820.46	-2237.64	-2.27	-1.2292	-0.0012	1811.62	-2234.98	-2.26	-1.2336	-0.0012
1.05	1818.56	-2246.83	0.17	-1.2355	0.0001	1800.54	-2244.07	0.17	-1.2463	0.0001
1.10	1816.93	-2256.16	2.90	-1.2417	0.0016	1789.94	-2253.47	2.86	-1.2590	0.0016
1.15	1818.38	-2262.75	5.93	-1.2444	0.0033	1782.71	-2260.17	5.81	-1.2678	0.0033
1.20	1823.15	-2265.55	9.38	-1.2427	0.0051	1778.86	-2263.03	9.15	-1.2722	0.0051
1.25	1829.64	-2264.64	13.35	-1.2377	0.0073	1776.58	-2262.19	12.97	-1.2733	0.0073
1.30	1835.92	-2262.19	17.76	-1.2322	0.0097	1774.02	-2259.81	17.17	-1.2738	0.0097
1.35	1840.91	-2258.78	22.64	-1.2270	0.0123	1769.92	-2256.45	21.78	-1.2749	0.0123
1.40	1845.08	-2256.53	27.95	-1.2230	0.0151	1764.83	-2254.31	26.76	-1.2774	0.0152
1.45	1850.25	-2255.65	33.66	-1.2191	0.0182	1760.59	-2253.57	32.07	-1.2800	0.0182
1.50	1856.11	-2256.28	39.74	-1.2156	0.0214	1757.02	-2254.39	37.67	-1.2831	0.0214
1.55	1861.98	-2257.95	46.12	-1.2127	0.0248	1753.68	-2256.28	43.51	-1.2866	0.0248
1.60	1865.52	-2260.02	52.66	-1.2115	0.0282	1748.63	-2258.58	49.48	-1.2916	0.0283
1.65	1867.65	-2263.44	59.32	-1.2119	0.0318	1743.09	-2262.31	55.49	-1.2979	0.0318
1.70	1870.89	-2267.85	66.11	-1.2122	0.0353	1739.59	-2267.03	61.63	-1.3032	0.0354
1.75	1876.13	-2273.54	73.29	-1.2118	0.0391	1738.92	-2273.20	68.11	-1.3072	0.0392
1.80	1880.93	-2276.99	79.34	-1.2106	0.0422	1741.22	-2277.56	73.68	-1.3080	0.0423
1.85	1879.28	-2273.96	83.86	-1.2100	0.0446	1741.13	-2274.87	77.96	-1.3065	0.0448
1.90	1871.23	-2266.23	88.30	-1.2111	0.0472	1735.06	-2267.11	82.17	-1.3066	0.0474
1.95	1864.53	-2258.44	93.29	-1.2113	0.0500	1729.17	-2259.36	86.86	-1.3066	0.0502

TRAILER NO. 2 FRONT SUSPENSION - BRAKE SUMMARY

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.01	-.0000	26.14	-0.00	0.0	0.0	0.01	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.08	-.0000	26.14	-0.00	0.0	0.0	0.09	-.0000	26.14	-0.00
0.15	50.00	0.27	0.0	1.09	-.0000	26.14	-0.05	0.27	0.0	1.09	-.0000	26.14	-0.05
0.20	50.00	5.29	0.0	14.95	-.0004	26.12	-0.71	5.29	0.0	14.95	-.0004	26.12	-0.71
0.25	50.00	15.14	10276.79	-244.73	0.0057	25.85	-12.58	15.14	10276.79	-244.79	0.0057	25.85	-12.58
0.30	50.00	24.02	22010.80	-518.53	0.0198	25.22	-8.15	24.02	22010.80	-518.75	0.0198	25.22	-8.14
0.35	50.00	30.64	26145.16	-1112.89	0.0221	24.83	-8.64	30.64	26145.16	-1113.23	0.0221	24.84	-8.63
0.40	50.00	35.57	34953.74	-1511.76	0.0288	24.31	-10.42	35.57	34953.74	-1512.41	0.0287	24.31	-10.38
0.45	50.00	39.25	41517.57	-1838.42	0.0348	23.77	-10.33	39.25	41517.57	-1839.31	0.0347	23.77	-10.29
0.50	50.00	41.99	46408.88	-2097.07	0.0399	23.25	-9.55	41.99	46408.88	-2098.10	0.0397	23.26	-9.50
0.55	50.00	44.03	50053.88	-2299.50	0.0433	22.79	-8.50	44.03	50053.88	-2300.42	0.0431	22.80	-8.46
0.60	50.00	45.55	52770.05	-2442.65	0.0448	22.38	-8.05	45.55	52770.05	-2443.22	0.0445	22.39	-8.06
0.65	50.00	46.68	54794.02	-2533.27	0.0455	21.96	-8.54	46.68	54794.02	-2533.52	0.0451	21.97	-8.53
0.70	50.00	47.53	56302.36	-2589.57	0.0464	21.51	-9.42	47.53	56302.36	-2589.53	0.0460	21.52	-9.42
0.75	50.00	48.16	57426.38	-2630.27	0.0477	21.01	-10.13	48.16	57426.38	-2629.86	0.0474	21.02	-10.15
0.80	50.00	48.63	58263.94	-2664.72	0.0490	20.49	-10.46	48.63	58263.94	-2663.80	0.0487	20.50	-10.51
0.85	50.00	48.98	58888.08	-2695.23	0.0494	19.96	-10.48	48.98	58888.08	-2693.87	0.0493	19.97	-10.55
0.90	50.00	49.24	59353.22	-2718.70	0.0492	19.44	-10.46	49.24	59353.22	-2717.13	0.0492	19.44	-10.54
0.95	50.00	49.43	59699.81	-2735.37	0.0489	18.92	-10.48	49.43	59699.81	-2733.72	0.0491	18.91	-10.56
1.00	50.00	49.58	59958.09	-2747.90	0.0490	18.39	-10.50	49.58	59958.09	-2746.21	0.0494	18.38	-10.58
1.05	50.00	49.68	60150.56	-2761.74	0.0494	17.87	-10.29	49.68	60150.56	-2760.05	0.0500	17.86	-10.37
1.10	50.00	49.76	60293.91	-2775.39	0.0497	17.36	-9.98	49.76	60293.91	-2773.83	0.0504	17.35	-10.05
1.15	50.00	49.82	60400.83	-2784.82	0.0496	16.87	-9.78	49.82	60400.83	-2783.41	0.0505	16.85	-9.85
1.20	50.00	49.87	60480.42	-2788.07	0.0493	16.38	-9.81	49.87	60480.42	-2786.80	0.0503	16.36	-9.88
1.25	50.00	49.90	60539.81	-2786.53	0.0491	15.88	-10.03	49.90	60539.81	-2785.31	0.0502	15.86	-10.09
1.30	50.00	49.93	60584.02	-2783.79	0.0492	15.37	-10.26	49.93	60584.02	-2782.58	0.0504	15.35	-10.32
1.35	50.00	49.95	60616.97	-2781.66	0.0494	14.85	-10.44	49.95	60616.97	-2780.57	0.0507	14.83	-10.49
1.40	50.00	49.96	60641.53	-2781.10	0.0495	14.32	-10.53	49.96	60641.53	-2780.18	0.0508	14.30	-10.57
1.45	50.00	49.97	60659.86	-2781.41	0.0494	13.80	-10.56	49.97	60659.86	-2780.67	0.0508	13.78	-10.59
1.50	50.00	49.98	60673.50	-2782.35	0.0493	13.27	-10.54	49.98	60673.50	-2781.75	0.0506	13.25	-10.57
1.55	50.00	49.98	60683.63	-2783.82	0.0493	12.74	-10.50	49.98	60683.63	-2783.35	0.0505	12.72	-10.52
1.60	50.00	49.99	60691.22	-2786.25	0.0494	12.22	-10.40	49.99	60691.22	-2785.93	0.0506	12.20	-10.41
1.65	50.00	49.99	60696.89	-2790.04	0.0496	11.70	-10.23	49.99	60696.89	-2789.86	0.0507	11.68	-10.24
1.70	50.00	49.99	60701.11	-2794.77	0.0497	11.19	-10.02	49.99	60701.11	-2794.78	0.0507	11.18	-10.02
1.75	50.00	49.99	60704.20	-2800.29	0.0499	10.70	-9.76	49.99	60704.20	-2800.79	0.0506	10.69	-9.74
1.80	50.00	50.00	60706.59	-2804.00	0.0500	10.21	-9.55	50.00	60706.59	-2804.54	0.0504	10.21	-9.56
1.85	50.00	50.00	60708.33	-2801.58	0.0501	9.73	-9.71	50.00	60708.33	-2802.07	0.0502	9.73	-9.69
1.90	50.00	50.00	60709.59	-2794.07	0.0501	9.23	-10.07	50.00	60709.59	-2794.55	0.0500	9.23	-10.05
1.95	50.00	50.00	60710.67	-2785.70	0.0500	8.72	-10.47	50.00	60710.67	-2786.10	0.0497	8.72	-10.45

HSRI TRUCK AND TRACTOR-TRAILER DYNAMIC RESPONSE SIMULATION - T3DRS,V1
SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED
TRAILER NO. 2 REAR SUSPENSION - BRAKE SUMMARY
LEADING TANDEM AXLE

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.01	-.0000	26.14	-0.00	0.0	0.0	0.01	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.09	-.0000	26.14	-0.00	0.0	0.0	0.09	-.0000	26.14	-0.00
0.15	50.00	0.27	268.45	-3.48	0.0001	26.13	-0.47	0.27	268.45	-3.48	0.0001	26.13	-0.47
0.20	50.00	5.29	5292.59	-173.40	0.0041	26.00	-4.22	5.29	5292.59	-173.40	0.0041	26.00	-4.22
0.25	50.00	15.14	15138.39	-576.32	0.0132	25.66	-8.25	15.14	15138.39	-576.33	0.0132	25.66	-8.25
0.30	50.00	24.02	24021.62	-997.88	0.0212	25.18	-9.11	24.02	24021.62	-997.94	0.0212	25.18	-9.11
0.35	50.00	30.64	30641.29	-1330.37	0.0266	24.72	-8.89	30.64	30641.29	-1330.52	0.0266	24.72	-8.88
0.40	50.00	35.57	35574.09	-1572.34	0.0307	24.26	-8.99	35.57	35574.09	-1572.65	0.0307	24.26	-8.98
0.45	50.00	39.25	39249.84	-1758.49	0.0333	23.81	-8.79	39.25	39249.84	-1758.96	0.0332	23.81	-8.77
0.50	50.00	41.99	41988.98	-1901.83	0.0352	23.37	-8.42	41.99	41988.98	-1902.43	0.0351	23.37	-8.40
0.55	50.00	44.03	44030.18	-2012.41	0.0365	22.96	-7.97	44.03	44030.18	-2013.05	0.0364	22.96	-7.94
0.60	50.00	45.55	45551.23	-2087.09	0.0372	22.56	-8.00	45.55	45551.23	-2087.66	0.0371	22.56	-7.97
0.65	50.00	46.68	46684.67	-2133.09	0.0376	22.14	-8.49	46.68	46684.67	-2133.48	0.0375	22.15	-8.46
0.70	50.00	47.53	47529.34	-2161.09	0.0379	21.70	-9.14	47.53	47529.34	-2161.20	0.0377	21.70	-9.13
0.75	50.00	48.16	48158.78	-2179.63	0.0381	21.23	-9.74	48.16	48158.78	-2179.42	0.0379	21.23	-9.75
0.80	50.00	48.63	48627.82	-2192.07	0.0382	20.72	-10.25	48.63	48627.82	-2191.57	0.0380	20.73	-10.28
0.85	50.00	48.98	48977.33	-2202.72	0.0382	20.20	-10.57	48.98	48977.33	-2201.99	0.0381	20.20	-10.61
0.90	50.00	49.24	49237.78	-2212.97	0.0381	19.67	-10.70	49.24	49237.78	-2212.10	0.0381	19.67	-10.74
0.95	50.00	49.43	49431.89	-2223.27	0.0382	19.13	-10.66	49.43	49431.89	-2222.32	0.0382	19.13	-10.71
1.00	50.00	49.58	49576.55	-2232.20	0.0383	18.60	-10.58	49.58	49576.55	-2231.25	0.0384	18.60	-10.63
1.05	50.00	49.68	49684.31	-2242.40	0.0385	18.07	-10.35	49.68	49684.31	-2241.49	0.0387	18.07	-10.39
1.10	50.00	49.76	49764.61	-2251.63	0.0387	17.56	-10.10	49.76	49764.61	-2250.78	0.0389	17.56	-10.14
1.15	50.00	49.82	49824.47	-2257.28	0.0387	17.06	-9.97	49.82	49824.47	-2256.50	0.0390	17.05	-10.01
1.20	50.00	49.87	49869.05	-2258.97	0.0387	16.56	-10.00	49.87	49869.05	-2258.21	0.0390	16.55	-10.03
1.25	50.00	49.90	49902.28	-2257.51	0.0387	16.05	-10.14	49.90	49902.28	-2256.77	0.0389	16.05	-10.18
1.30	50.00	49.93	49927.03	-2254.98	0.0387	15.54	-10.32	49.93	49927.03	-2254.27	0.0389	15.54	-10.36
1.35	50.00	49.95	49945.50	-2251.95	0.0386	15.02	-10.51	49.95	49945.50	-2251.25	0.0388	15.02	-10.54
1.40	50.00	49.96	49959.23	-2249.82	0.0386	14.49	-10.64	49.96	49959.23	-2249.15	0.0387	14.49	-10.68
1.45	50.00	49.97	49969.50	-2248.92	0.0386	13.95	-10.71	49.97	49969.50	-2248.28	0.0386	13.95	-10.74
1.50	50.00	49.98	49977.14	-2249.59	0.0387	13.42	-10.70	49.98	49977.14	-2249.00	0.0386	13.42	-10.72
1.55	50.00	49.98	49982.81	-2251.42	0.0387	12.89	-10.62	49.98	49982.81	-2250.90	0.0385	12.88	-10.65
1.60	50.00	49.99	49987.08	-2254.01	0.0389	12.35	-10.51	49.99	49987.08	-2253.57	0.0385	12.35	-10.53
1.65	50.00	49.99	49990.27	-2257.65	0.0390	11.83	-10.34	49.99	49990.27	-2257.29	0.0385	11.83	-10.36
1.70	50.00	49.99	49992.61	-2262.15	0.0392	11.31	-10.13	49.99	49992.61	-2261.88	0.0385	11.32	-10.15
1.75	50.00	49.99	49994.34	-2267.87	0.0394	10.81	-9.87	49.99	49994.34	-2267.69	0.0385	10.82	-9.88
1.80	50.00	50.00	49995.66	-2271.54	0.0395	10.32	-9.69	50.00	49995.66	-2271.64	0.0384	10.34	-9.69
1.85	50.00	50.00	49996.64	-2268.84	0.0396	9.84	-9.83	50.00	49996.64	-2269.04	0.0382	9.85	-9.82
1.90	50.00	50.00	49997.34	-2261.12	0.0397	9.33	-10.20	50.00	49997.34	-2261.25	0.0380	9.35	-10.19
1.95	50.00	50.00	49997.95	-2252.86	0.0398	8.81	-10.59	50.00	49997.95	-2252.93	0.0378	8.83	-10.59

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION - BRAKE SUMMARY

TRAILING TANDEM AXLE

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.01	-.0000	26.14	-0.00	0.0	0.0	0.01	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.08	-.0000	26.14	-0.00	0.0	0.0	0.09	-.0000	26.14	-0.00
0.15	50.00	0.27	268.45	-3.48	0.0001	26.13	-0.47	0.27	268.45	-3.48	0.0001	26.13	-0.47
0.20	50.00	5.29	5292.59	-170.19	0.0041	26.00	-4.37	5.29	5292.59	-170.19	0.0041	26.00	-4.37
0.25	50.00	15.14	15138.39	-547.77	0.0146	25.62	-9.61	15.14	15138.39	-547.79	0.0146	25.62	-9.61
0.30	50.00	24.02	24021.62	-953.85	0.0266	25.05	-11.21	24.02	24021.62	-953.97	0.0266	25.05	-11.21
0.35	50.00	30.64	30641.29	-1287.67	0.0362	24.48	-10.92	30.64	30641.29	-1288.05	0.0361	24.48	-10.90
0.40	50.00	35.57	35574.09	-1536.20	0.0446	23.91	-10.71	35.57	35574.09	-1537.03	0.0445	23.91	-10.67
0.45	50.00	39.25	39249.84	-1737.94	0.0501	23.39	-9.77	39.25	39249.84	-1739.21	0.0499	23.40	-9.71
0.50	50.00	41.99	41988.98	-1882.73	0.0543	22.91	-9.22	41.99	41988.98	-1884.41	0.0540	22.91	-9.25
0.55	50.00	44.03	44030.18	-1998.35	0.0578	22.45	-8.64	44.03	44030.18	-2000.22	0.0573	22.46	-8.55
0.60	50.00	45.55	45551.23	-2080.18	0.0600	22.02	-8.33	45.55	45551.23	-2081.86	0.0594	22.04	-8.25
0.65	50.00	46.68	46684.67	-2131.65	0.0612	21.60	-8.55	46.68	46684.67	-2132.77	0.0605	21.62	-8.50
0.70	50.00	47.53	47529.34	-2162.89	0.0620	21.16	-9.05	47.53	47529.34	-2163.21	0.0611	21.18	-9.04
0.75	50.00	48.16	48158.78	-2182.43	0.0624	20.69	-9.61	48.16	48158.78	-2181.89	0.0616	20.71	-9.63
0.80	50.00	48.63	48627.82	-2194.84	0.0628	20.19	-10.12	48.63	48627.82	-2193.51	0.0621	20.21	-10.19
0.85	50.00	48.98	48977.33	-2206.54	0.0632	19.68	-10.39	48.98	48977.33	-2204.56	0.0625	19.69	-10.48
0.90	50.00	49.24	49237.78	-2218.60	0.0632	19.15	-10.43	49.24	49237.78	-2216.14	0.0629	19.16	-10.55
0.95	50.00	49.43	49431.89	-2225.67	0.0632	18.63	-10.36	49.43	49431.89	-2226.98	0.0631	18.63	-10.49
1.00	50.00	49.58	49576.55	-2237.64	0.0633	18.11	-10.32	49.58	49576.55	-2234.88	0.0635	18.11	-10.45
1.05	50.00	49.68	49684.31	-2246.83	0.0636	17.60	-10.14	49.68	49684.31	-2244.07	0.0642	17.59	-10.27
1.10	50.00	49.76	49764.61	-2256.16	0.0639	17.10	-9.88	49.76	49764.61	-2253.47	0.0648	17.08	-10.01
1.15	50.00	49.82	49824.47	-2262.75	0.0641	16.61	-9.71	49.82	49824.47	-2260.17	0.0653	16.59	-9.83
1.20	50.00	49.87	49869.05	-2265.55	0.0640	16.12	-9.68	49.87	49869.05	-2263.03	0.0655	16.10	-9.80
1.25	50.00	49.90	49902.28	-2264.64	0.0637	15.64	-9.80	49.90	49902.28	-2262.19	0.0656	15.61	-9.92
1.30	50.00	49.93	49927.03	-2262.19	0.0634	15.14	-9.98	49.93	49927.03	-2259.81	0.0656	15.11	-10.09
1.35	50.00	49.95	49945.50	-2258.78	0.0632	14.64	-10.18	49.95	49945.50	-2256.45	0.0656	14.60	-10.30
1.40	50.00	49.96	49959.23	-2256.53	0.0630	14.12	-10.32	49.96	49959.23	-2254.31	0.0658	14.08	-10.43
1.45	50.00	49.97	49969.50	-2255.65	0.0628	13.60	-10.39	49.97	49969.50	-2253.57	0.0659	13.56	-10.49
1.50	50.00	49.98	49977.14	-2256.28	0.0626	13.08	-10.38	49.98	49977.14	-2254.39	0.0661	13.03	-10.47
1.55	50.00	49.98	49982.81	-2257.95	0.0624	12.56	-10.31	49.98	49982.81	-2256.28	0.0662	12.51	-10.39
1.60	50.00	49.99	49987.08	-2260.02	0.0624	12.05	-10.22	49.99	49987.08	-2258.58	0.0665	12.00	-10.29
1.65	50.00	49.99	49990.27	-2263.44	0.0624	11.54	-10.07	49.99	49990.27	-2262.31	0.0668	11.49	-10.12
1.70	50.00	49.99	49992.61	-2267.85	0.0624	11.04	-9.88	49.99	49992.61	-2267.03	0.0671	10.99	-9.90
1.75	50.00	49.99	49994.34	-2273.54	0.0624	10.55	-9.60	49.99	49994.34	-2273.20	0.0673	10.50	-9.61
1.80	50.00	50.00	49995.66	-2276.99	0.0623	10.08	-9.44	50.00	49995.66	-2277.56	0.0673	10.02	-9.41
1.85	50.00	50.00	49996.64	-2273.96	0.0623	9.60	-9.58	50.00	49996.64	-2274.87	0.0673	9.55	-9.54
1.90	50.00	50.00	49997.34	-2266.23	0.0624	9.11	-9.95	50.00	49997.34	-2267.11	0.0673	9.07	-9.91
1.95	50.00	50.00	49997.95	-2256.44	0.0624	8.61	-10.32	50.00	49997.95	-2259.36	0.0673	8.56	-10.28

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 FRONT SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	-0.0000	0.0069	0.0000	0.0	-0.0000	0.0069	0.0000	0.0
0.10	-0.0001	0.1409	0.0000	0.0	-0.0001	0.1409	0.0000	0.0
0.15	-0.0001	0.0739	0.0000	0.0	-0.0001	0.0739	0.0000	0.0
0.20	0.0003	-0.3527	-0.0001	0.0	0.0003	-0.3527	-0.0001	0.0
0.25	0.0009	-1.0575	-0.0002	0.0	0.0009	-1.0578	-0.0002	0.0
0.30	0.0021	-2.7204	-0.0006	0.0	0.0021	-2.7226	-0.0006	0.0
0.35	0.0036	-5.1944	-0.0010	0.0	0.0036	-5.2027	-0.0010	0.0
0.40	0.0053	-7.9378	-0.0015	0.0	0.0053	-7.9592	-0.0015	0.0
0.45	0.0069	-10.4174	-0.0019	0.0	0.0069	-10.4606	-0.0019	0.0
0.50	0.0082	-12.3150	-0.0023	0.0	0.0082	-12.3863	-0.0023	0.0
0.55	0.0089	-13.4568	-0.0025	0.0	0.0089	-13.5559	-0.0025	0.0
0.60	0.0086	-13.3633	-0.0024	0.0	0.0086	-13.4775	-0.0024	0.0
0.65	0.0076	-12.0155	-0.0021	0.0	0.0076	-12.1269	-0.0021	0.0
0.70	0.0061	-9.7668	-0.0017	0.0	0.0061	-9.8600	-0.0017	0.0
0.75	0.0043	-6.8232	-0.0012	0.0	0.0043	-6.8871	-0.0012	0.0
0.80	0.0020	-3.1019	-0.0006	0.0	0.0020	-3.1319	-0.0006	0.0
0.85	-0.0010	1.6079	0.0003	0.0	-0.0010	1.6020	0.0003	0.0
0.90	-0.0045	7.1644	0.0013	0.0	-0.0045	7.1531	0.0013	0.0
0.95	-0.0082	13.1531	0.0023	0.0	-0.0082	13.0934	0.0023	0.0
1.00	-0.0120	19.2927	0.0033	0.0	-0.0120	19.1366	0.0033	0.0
1.05	-0.0159	25.4391	0.0044	0.0	-0.0159	25.1396	0.0044	0.0
1.10	-0.0196	31.2612	0.0054	0.0	-0.0196	30.7840	0.0054	0.0
1.15	-0.0230	36.9525	0.0064	0.0	-0.0230	36.2706	0.0064	0.0
1.20	-0.0259	41.9113	0.0072	0.0	-0.0259	41.0148	0.0072	0.0
1.25	-0.0283	45.9008	0.0079	0.0	-0.0283	44.7915	0.0078	0.0
1.30	-0.0306	49.3741	0.0085	0.0	-0.0305	48.0354	0.0085	0.0
1.35	-0.0323	51.9235	0.0090	0.0	-0.0321	50.3554	0.0089	0.0
1.40	-0.0334	53.5857	0.0093	0.0	-0.0332	51.7944	0.0092	0.0
1.45	-0.0337	54.1622	0.0093	0.0	-0.0333	52.1466	0.0092	0.0
1.50	-0.0330	53.2655	0.0092	0.0	-0.0325	51.0437	0.0090	0.0
1.55	-0.0314	50.7363	0.0087	0.0	-0.0307	48.3182	0.0085	0.0
1.60	-0.0288	46.4866	0.0080	0.0	-0.0279	43.8755	0.0077	0.0
1.65	-0.0255	41.0177	0.0071	0.0	-0.0243	38.1855	0.0067	0.0
1.70	-0.0211	33.8182	0.0058	0.0	-0.0195	30.7135	0.0054	0.0
1.75	-0.0129	20.6474	0.0036	0.0	-0.0109	17.3029	0.0030	0.0
1.80	-0.0051	8.1583	0.0014	0.0	-0.0028	4.4456	0.0008	0.0
1.85	-0.0002	0.2726	0.0000	0.0	0.0025	-4.0156	-0.0007	0.0
1.90	0.0041	-6.4818	-0.0011	0.0	0.0072	-11.5341	-0.0020	0.0
1.95	0.0077	-12.2417	-0.0021	0.0	0.0114	-18.2169	-0.0032	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0000	-0.0002	-0.0000	0.0	0.0000	-0.0002	-0.0000	0.0
0.10	0.0000	-0.0162	-0.0000	0.0	0.0000	-0.0162	-0.0000	0.0
0.15	0.0000	-0.0269	-0.0000	0.0	0.0000	-0.0269	-0.0000	0.0
0.20	-0.0000	0.0456	0.0000	0.0	-0.0000	0.0456	0.0000	0.0
0.25	-0.0001	0.1709	0.0001	0.0	-0.0001	0.1709	0.0001	0.0
0.30	-0.0003	0.4463	0.0002	0.0	-0.0003	0.4463	0.0002	0.0
0.35	-0.0006	0.8985	0.0003	0.0	-0.0006	0.8989	0.0003	0.0
0.40	-0.0009	1.3487	0.0005	0.0	-0.0009	1.3491	0.0005	0.0
0.45	-0.0011	1.6543	0.0006	0.0	-0.0011	1.6557	0.0006	0.0
0.50	-0.0011	1.6876	0.0006	0.0	-0.0011	1.6904	0.0006	0.0
0.55	-0.0009	1.4604	0.0005	0.0	-0.0009	1.4643	0.0005	0.0
0.60	-0.0006	0.9596	0.0003	0.0	-0.0006	0.9631	0.0003	0.0
0.65	-0.0001	0.2402	0.0001	0.0	-0.0001	0.2412	0.0001	0.0
0.70	0.0003	-0.4765	-0.0002	0.0	0.0003	-0.4788	-0.0002	0.0
0.75	0.0006	-0.9640	-0.0003	0.0	0.0006	-0.9684	-0.0003	0.0
0.80	0.0007	-1.1200	-0.0004	0.0	0.0007	-1.1240	-0.0004	0.0
0.85	0.0006	-0.9935	-0.0003	0.0	0.0006	-0.9955	-0.0003	0.0
0.90	0.0004	-0.6935	-0.0002	0.0	0.0004	-0.6936	-0.0002	0.0
0.95	0.0002	-0.3560	-0.0001	0.0	0.0002	-0.3553	-0.0001	0.0
1.00	0.0001	-0.2054	-0.0001	0.0	0.0001	-0.2046	-0.0001	0.0
1.05	0.0003	-0.5099	-0.0002	0.0	0.0003	-0.5070	-0.0002	0.0
1.10	0.0009	-1.4278	-0.0005	0.0	0.0009	-1.4182	-0.0005	0.0
1.15	0.0019	-3.1331	-0.0010	0.0	0.0019	-3.1105	-0.0010	0.0
1.20	0.0034	-5.6248	-0.0019	0.0	0.0034	-5.5853	-0.0019	0.0
1.25	0.0052	-8.6735	-0.0029	0.0	0.0052	-8.6189	-0.0029	0.0
1.30	0.0074	-12.3374	-0.0041	0.0	0.0074	-12.2736	-0.0041	0.0
1.35	0.0099	-16.4808	-0.0055	0.0	0.0099	-16.4218	-0.0055	0.0
1.40	0.0127	-21.0554	-0.0070	0.0	0.0127	-21.0210	-0.0070	0.0
1.45	0.0157	-26.1028	-0.0087	0.0	0.0157	-26.1216	-0.0087	0.0
1.50	0.0190	-31.6063	-0.0105	0.0	0.0190	-31.7165	-0.0106	0.0
1.55	0.0226	-37.5737	-0.0126	0.0	0.0227	-37.8266	-0.0126	0.0
1.60	0.0265	-43.9832	-0.0147	0.0	0.0266	-44.4464	-0.0148	0.0
1.65	0.0308	-50.9421	-0.0171	0.0	0.0309	-51.7051	-0.0171	0.0
1.70	0.0355	-58.5848	-0.0197	0.0	0.0356	-59.7711	-0.0198	0.0
1.75	0.0398	-65.4674	-0.0221	0.0	0.0395	-67.1520	-0.0221	0.0
1.80	0.0440	-72.3281	-0.0244	0.0	0.0442	-74.6188	-0.0245	0.0
1.85	0.0494	-80.9025	-0.0274	0.0	0.0496	-84.0866	-0.0275	0.0
1.90	0.0553	-89.9958	-0.0307	0.0	0.0555	-94.2929	-0.0308	0.0
1.95	0.0611	-98.8557	-0.0339	0.0	0.0613	-104.3762	-0.0340	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0000	-0.0002	-0.0000	0.0	0.0000	-0.0002	-0.0000	0.0
0.10	0.0000	-0.0089	-0.0000	0.0	0.0000	-0.0089	-0.0000	0.0
0.15	0.0000	-0.0011	-0.0000	0.0	0.0000	-0.0011	-0.0000	0.0
0.20	-0.0000	0.0531	0.0000	0.0	-0.0000	0.0531	0.0000	0.0
0.25	-0.0001	0.0807	0.0000	0.0	-0.0001	0.0807	0.0000	0.0
0.30	-0.0001	0.0924	0.0000	0.0	-0.0001	0.0924	0.0000	0.0
0.35	0.0000	-0.0084	-0.0000	0.0	0.0000	-0.0084	-0.0000	0.0
0.40	0.0004	-0.3718	-0.0002	0.0	0.0004	-0.3725	-0.0002	0.0
0.45	0.0011	-1.1223	-0.0006	0.0	0.0011	-1.1264	-0.0006	0.0
0.50	0.0023	-2.2428	-0.0013	0.0	0.0023	-2.2563	-0.0013	0.0
0.55	0.0037	-3.6261	-0.0020	0.0	0.0037	-3.6576	-0.0020	0.0
0.60	0.0052	-5.1585	-0.0029	0.0	0.0052	-5.2165	-0.0029	0.0
0.65	0.0066	-6.6064	-0.0037	0.0	0.0066	-6.6935	-0.0037	0.0
0.70	0.0077	-7.6871	-0.0043	0.0	0.0077	-7.7952	-0.0043	0.0
0.75	0.0082	-8.1585	-0.0046	0.0	0.0082	-8.3100	-0.0046	0.0
0.80	0.0081	-8.0750	-0.0045	0.0	0.0081	-8.1701	-0.0045	0.0
0.85	0.0074	-7.3702	-0.0041	0.0	0.0074	-7.4344	-0.0041	0.0
0.90	0.0061	-6.1383	-0.0034	0.0	0.0061	-6.1671	-0.0034	0.0
0.95	0.0044	-4.4115	-0.0024	0.0	0.0044	-4.4117	-0.0024	0.0
1.00	0.0023	-2.2730	-0.0012	0.0	0.0022	-2.2619	-0.0012	0.0
1.05	-0.0002	0.1689	0.0001	0.0	-0.0002	0.1673	0.0001	0.0
1.10	-0.0029	2.8983	0.0016	0.0	-0.0029	2.8555	0.0016	0.0
1.15	-0.0059	5.9281	0.0033	0.0	-0.0059	5.8129	0.0033	0.0
1.20	-0.0093	9.3754	0.0051	0.0	-0.0093	9.1545	0.0051	0.0
1.25	-0.0131	13.3486	0.0073	0.0	-0.0132	12.9676	0.0073	0.0
1.30	-0.0174	17.7595	0.0097	0.0	-0.0174	17.1717	0.0097	0.0
1.35	-0.0222	22.6386	0.0123	0.0	-0.0222	21.7836	0.0123	0.0
1.40	-0.0273	27.9453	0.0151	0.0	-0.0273	26.7574	0.0152	0.0
1.45	-0.0328	33.6567	0.0182	0.0	-0.0328	32.0659	0.0182	0.0
1.50	-0.0386	39.7382	0.0214	0.0	-0.0386	37.6728	0.0214	0.0
1.55	-0.0446	46.1200	0.0248	0.0	-0.0447	43.5132	0.0248	0.0
1.60	-0.0509	52.6790	0.0282	0.0	-0.0510	49.4774	0.0283	0.0
1.65	-0.0572	59.3214	0.0318	0.0	-0.0574	55.4916	0.0318	0.0
1.70	-0.0637	66.1088	0.0353	0.0	-0.0638	61.6274	0.0354	0.0
1.75	-0.0704	73.2798	0.0391	0.0	-0.0706	68.1148	0.0392	0.0
1.80	-0.0760	79.3466	0.0422	0.0	-0.0763	73.6802	0.0423	0.0
1.85	-0.0804	83.8646	0.0446	0.0	-0.0807	77.9619	0.0448	0.0
1.90	-0.0850	88.2998	0.0472	0.0	-0.0853	82.1731	0.0474	0.0
1.95	-0.0902	93.2905	0.0500	0.0	-0.0905	86.8583	0.0502	0.0

TRAILER NO. 2 FRONT SUSPENSION - UNSPRUNG MASS SUMMARY

TIME (SEC)	AXLE MOTION: POSITION VERTICAL (FT)	AXLE MOTION: POSITION ROLL (DEG)	AXLE MOTION: VELOCITY VERTICAL (FT/SEC)	AXLE MOTION: VELOCITY ROLL (DEG/SEC)	DYNAMIC SUSPENSION MOTIONS AND FORCES: AUXILIARY ROLL TORQUE (IN-LB)	LEFT SIDE: SUSP. DEFLECT. (IN)	LEFT SIDE: SUSP. VELOCITY (IN/SEC)	LEFT SIDE: SUSP. FORCE (LB)	RIGHT SIDE: SUSP. DEFLECT. (IN)	RIGHT SIDE: SUSP. VELOCITY (IN/SEC)	RIGHT SIDE: SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0	-0.0000	0.0	-0.0000	-0.00	-0.0000	-0.0000	-0.00	-0.0000	-0.0000	-0.00
0.10	0.0	-0.0000	0.0000	-0.0005	-0.35	0.0000	-0.0000	0.02	-0.0000	-0.0002	-0.06
0.15	0.0000	-0.0000	0.0001	0.0005	0.08	-0.0000	-0.0031	-0.49	-0.0000	-0.0024	-0.41
0.20	0.0001	0.0000	0.0071	0.0010	2.17	-0.0014	-0.1040	-22.47	-0.0014	-0.1034	-22.08
0.25	0.0011	0.0001	0.0347	0.0025	2.94	-0.0123	-0.4481	-145.90	-0.0122	-0.4479	-145.42
0.30	0.0039	0.0003	0.0768	0.0061	3.00	-0.0462	-0.8960	-460.44	-0.0461	-0.8965	-459.96
0.35	0.0079	0.0007	0.0668	0.0094	-2.20	-0.0947	-0.9227	-843.07	-0.0948	-0.9266	-843.64
0.40	0.0101	0.0012	0.0241	0.0124	-19.97	-0.1310	-0.4358	-1072.68	-0.1314	-0.4455	-1076.33
0.45	0.0104	0.0019	-0.0051	0.0141	-54.52	-0.1421	-0.0117	-1112.07	-0.1430	-0.0281	-1121.40
0.50	0.0101	0.0026	-0.0003	0.0149	-105.69	-0.1404	0.0170	-1095.69	-0.1423	-0.0047	-1113.00
0.55	0.0107	0.0034	0.0209	0.0137	-167.65	-0.1445	-0.2133	-1153.45	-0.1476	-0.2377	-1180.12
0.60	0.0120	0.0040	0.0298	0.0093	-232.65	-0.1596	-0.3603	-1287.82	-0.1639	-0.3839	-1324.02
0.65	0.0132	0.0043	0.0157	0.0030	-288.23	-0.1760	-0.2377	-1402.00	-0.1813	-0.2549	-1445.86
0.70	0.0134	0.0042	-0.0071	-0.0048	-315.97	-0.1816	0.0351	-1416.05	-0.1876	0.0291	-1463.64
0.75	0.0127	0.0038	-0.0175	-0.0135	-317.76	-0.1751	0.1971	-1347.12	-0.1811	0.2050	-1393.24
0.80	0.0120	0.0029	-0.0085	-0.0225	-278.65	-0.1659	0.1224	-1283.56	-0.1712	0.1437	-1322.81
0.85	0.0120	0.0015	0.0073	-0.0308	-206.37	-0.1641	-0.0723	-1291.29	-0.1682	-0.0397	-1319.01
0.90	0.0126	-0.0002	0.0135	-0.0365	-107.71	-0.1709	-0.1821	-1356.68	-0.1731	-0.1410	-1369.22
0.95	0.0131	-0.0021	0.0065	-0.0391	9.06	-0.1794	-0.1292	-1417.03	-0.1794	-0.0832	-1412.00
1.00	0.0132	-0.0040	-0.0029	-0.0392	133.78	-0.1831	-0.0137	-1432.94	-0.1809	0.0333	-1409.51
1.05	0.0130	-0.0059	-0.0050	-0.0371	256.44	-0.1821	0.0342	-1420.00	-0.1775	0.0789	-1378.74
1.10	0.0128	-0.0077	0.0005	-0.0328	370.19	-0.1812	-0.0143	-1417.92	-0.1744	0.0262	-1360.29
1.15	0.0130	-0.0093	0.0060	-0.0293	469.68	-0.1836	-0.0818	-1444.08	-0.1749	-0.0474	-1372.34
1.20	0.0133	-0.0106	0.0051	-0.0232	559.62	-0.1881	-0.0846	-1479.85	-0.1778	-0.0541	-1395.77
1.25	0.0134	-0.0116	-0.0008	-0.0188	631.18	-0.1910	-0.0170	-1454.94	-0.1792	0.0090	-1400.12
1.30	0.0133	-0.0125	-0.0058	-0.0148	694.75	-0.1901	0.0530	-1479.98	-0.1771	0.0753	-1376.11
1.35	0.0129	-0.0131	-0.0052	-0.0104	750.76	-0.1869	0.0612	-1454.32	-0.1729	0.0810	-1342.39
1.40	0.0128	-0.0135	-0.0006	-0.0065	800.22	-0.1848	0.0111	-1443.68	-0.1698	0.0285	-1324.66
1.45	0.0129	-0.0137	0.0033	-0.0017	844.18	-0.1856	-0.0406	-1455.32	-0.1698	-0.0249	-1329.94
1.50	0.0131	-0.0136	0.0031	0.0043	883.39	-0.1880	-0.0480	-1475.21	-0.1714	-0.0343	-1344.18
1.55	0.0131	-0.0133	0.0003	0.0110	915.79	-0.1898	-0.0167	-1485.62	-0.1726	-0.0062	-1350.03
1.60	0.0131	-0.0125	-0.0015	0.0185	937.59	-0.1899	0.0116	-1483.12	-0.1722	0.0171	-1344.68
1.65	0.0130	-0.0114	-0.0007	0.0256	942.54	-0.1892	0.0120	-1477.53	-0.1714	0.0097	-1339.00
1.70	0.0130	-0.0095	0.0012	0.0364	926.54	-0.1890	-0.0064	-1478.06	-0.1715	-0.0148	-1342.25
1.75	0.0131	-0.0075	0.0018	0.0585	902.41	-0.1897	-0.0155	-1484.50	-0.1720	-0.0276	-1352.19
1.80	0.0132	-0.0046	0.0006	0.0558	837.71	-0.1900	0.0053	-1485.22	-0.1741	-0.0332	-1364.95
1.85	0.0132	-0.0018	0.0002	0.0561	707.12	-0.1893	0.0229	-1477.25	-0.1758	-0.0342	-1377.90
1.90	0.0132	0.0011	0.0003	0.0589	545.60	-0.1880	0.0264	-1466.57	-0.1775	-0.0365	-1391.43
1.95	0.0132	0.0029	-0.0003	0.0538	376.11	-0.1865	0.0344	-1454.08	-0.1792	-0.0284	-1403.88

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION - UNSPRUNG MASS SUMMARY

LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.00
0.05	0.0	-0.0000	0.0	0.0000	0.00	-0.0000	0.0000	0.00	-0.0000	0.0000	0.00
0.10	-0.0000	0.0000	-0.0000	0.0000	0.14	0.0000	0.0002	0.02	0.0000	0.0003	0.04
0.15	-0.0000	0.0000	0.0004	-0.0001	0.88	0.0001	0.0122	-3.07	0.0001	0.0125	-3.03
0.20	0.0003	-0.0000	0.0105	-0.0002	1.10	0.0078	0.4070	-38.07	0.0078	0.4067	-38.09
0.25	0.0008	-0.0000	0.0134	-0.0000	-0.96	0.0443	1.0657	-105.79	0.0443	1.0642	-105.96
0.30	0.0023	-0.0000	0.0413	-0.0000	-8.46	0.0926	0.7282	-260.40	0.0925	0.7237	-261.00
0.35	0.0038	-0.0000	0.0153	0.0007	-27.08	0.1160	0.3044	-402.82	0.1155	0.2947	-404.21
0.40	0.0044	0.0001	0.0140	0.0021	-61.68	0.1315	0.2629	-479.75	0.1303	0.2465	-482.29
0.45	0.0052	0.0002	0.0149	0.0036	-114.83	0.1413	0.0588	-557.36	0.1392	0.0355	-561.28
0.50	0.0057	0.0004	0.0100	0.0050	-184.00	0.1399	-0.1013	-621.68	0.1365	-0.1296	-626.97
0.55	0.0063	0.0007	0.0102	0.0055	-262.26	0.1312	-0.2317	-675.68	0.1264	-0.2615	-682.08
0.60	0.0067	0.0010	0.0083	0.0053	-338.19	0.1161	-0.3563	-724.53	0.1098	-0.3825	-731.46
0.65	0.0071	0.0012	0.0049	0.0037	-396.69	0.0974	-0.3888	-759.00	0.0900	-0.4056	-765.59
0.70	0.0072	0.0013	0.0023	0.0007	-423.03	0.0797	-0.3327	-778.14	0.0718	-0.3351	-783.48
0.75	0.0073	0.0013	0.0014	-0.0031	-406.84	0.0654	-0.2529	-788.92	0.0577	-0.2381	-792.20
0.80	0.0074	0.0010	0.0017	-0.0066	-344.58	0.0539	-0.2048	-794.76	0.0473	-0.1730	-799.42
0.85	0.0075	0.0006	0.0026	-0.0094	-235.27	0.0432	-0.2106	-812.03	0.0386	-0.1639	-809.80
0.90	0.0076	0.0001	0.0024	-0.0110	-98.99	0.0317	-0.2400	-826.98	0.0297	-0.1821	-821.85
0.95	0.0077	-0.0005	0.0011	-0.0115	64.86	0.0197	-0.2351	-837.32	0.0208	-0.1707	-829.51
1.00	0.0077	-0.0010	-0.0007	-0.0104	239.58	0.0096	-0.1687	-839.84	0.0139	-0.1026	-828.75
1.05	0.0077	-0.0015	-0.0009	-0.0080	413.48	0.0033	-0.0855	-835.43	0.0109	-0.0215	-823.49
1.10	0.0077	-0.0018	-0.0001	-0.0051	577.43	0.0002	-0.0408	-833.83	0.0105	0.0180	-820.47
1.15	0.0077	-0.0020	0.0005	-0.0014	726.06	-0.0018	-0.0365	-835.63	0.0117	0.0164	-821.14
1.20	0.0077	-0.0020	0.0005	0.0015	858.95	-0.0039	-0.0445	-838.57	0.0121	0.0024	-823.13
1.25	0.0077	-0.0018	0.0000	0.0039	975.72	-0.0059	-0.0416	-840.12	0.0123	-0.0006	-823.92
1.30	0.0077	-0.0016	-0.0001	0.0065	1078.62	-0.0076	-0.0298	-840.28	0.0126	0.0066	-823.35
1.35	0.0077	-0.0012	-0.0001	0.0083	1169.78	-0.0088	-0.0204	-840.34	0.0131	0.0118	-822.77
1.40	0.0077	-0.0007	0.0003	0.0103	1250.48	-0.0100	-0.0224	-841.53	0.0134	0.0061	-823.39
1.45	0.0077	-0.0002	0.0005	0.0123	1321.76	-0.0115	-0.0346	-844.03	0.0132	-0.0097	-825.44
1.50	0.0077	0.0005	0.0003	0.0145	1382.44	-0.0135	-0.0412	-846.14	0.0124	-0.0207	-827.29
1.55	0.0078	0.0012	-0.0000	0.0172	1429.48	-0.0154	-0.0337	-846.60	0.0115	-0.0191	-827.83
1.60	0.0077	0.0022	-0.0004	0.0200	1457.78	-0.0165	-0.0124	-845.04	0.0109	-0.0061	-826.83
1.65	0.0077	0.0033	-0.0001	0.0238	1461.59	-0.0167	0.0053	-843.22	0.0108	0.0018	-826.04
1.70	0.0077	0.0046	0.0003	0.0277	1438.69	-0.0164	0.0059	-843.01	0.0107	-0.0082	-827.26
1.75	0.0078	0.0060	0.0006	0.0266	1377.91	-0.0163	-0.0039	-844.09	0.0097	-0.0371	-831.16
1.80	0.0078	0.0074	0.0004	0.0338	1261.68	-0.0167	-0.0089	-844.90	0.0072	-0.0618	-835.51
1.85	0.0079	0.0093	-0.0007	0.0408	1100.50	-0.0167	0.0173	-842.02	0.0042	-0.0500	-836.13
1.90	0.0077	0.0114	-0.0013	0.0404	909.06	-0.0146	0.0685	-835.04	0.0027	-0.0067	-832.31
1.95	0.0077	0.0134	-0.0007	0.0387	709.69	-0.0103	0.0983	-828.97	0.0033	0.0255	-828.37

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 2 REAR SUSPENSION - UNSPRUNG MASS SUMMARY

TRAILING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.00
0.05	0.0	-0.0000	0.0	0.0000	0.00	-0.0000	0.0000	0.00	-0.0000	0.0000	0.00
0.10	-0.0000	0.0000	-0.0000	-0.0000	0.12	0.0000	0.0002	0.03	0.0000	0.0004	0.05
0.15	-0.0000	-0.0000	-0.0005	-0.0001	0.75	0.0001	0.0042	2.74	0.0001	0.0044	2.78
0.20	-0.0004	-0.0000	-0.0184	-0.0001	1.03	0.0012	0.1411	60.55	0.0013	0.1410	60.54
0.25	-0.0020	-0.0000	-0.0395	0.0004	-0.60	0.0212	0.7328	220.97	0.0212	0.7315	220.83
0.30	-0.0029	0.0000	0.0031	0.0010	-6.97	0.0580	0.6260	306.67	0.0575	0.6221	306.16
0.35	-0.0030	0.0001	-0.0125	0.0026	-23.00	0.0793	0.2911	338.30	0.0789	0.2826	337.10
0.40	-0.0036	0.0003	-0.0031	0.0046	-53.75	0.0938	0.1992	378.47	0.0928	0.1844	376.21
0.45	-0.0035	0.0006	0.0025	0.0068	-101.87	0.0980	-0.1151	376.93	0.0962	-0.1363	373.40
0.50	-0.0034	0.0010	-0.0012	0.0082	-165.45	0.0873	-0.2799	374.61	0.0842	-0.3061	369.77
0.55	-0.0035	0.0014	0.0006	0.0087	-238.16	0.0714	-0.3293	376.03	0.0670	-0.3571	370.14
0.60	-0.0034	0.0018	0.0016	0.0078	-309.03	0.0531	-0.3922	370.02	0.0474	-0.4168	363.64
0.65	-0.0033	0.0021	0.0014	0.0052	-362.96	0.0328	-0.4344	361.80	0.0260	-0.4501	355.71
0.70	-0.0033	0.0023	0.0008	0.0012	-388.54	0.0117	-0.4344	355.36	0.0044	-0.4364	350.48
0.75	-0.0032	0.0022	-0.0001	-0.0034	-372.29	-0.0087	-0.3882	352.71	-0.0157	-0.3737	349.82
0.80	-0.0033	0.0019	-0.0007	-0.0078	-311.40	-0.0266	-0.3108	353.78	-0.0325	-0.2797	353.43
0.85	-0.0033	0.0015	0.0001	-0.0114	-208.89	-0.0411	-0.2530	353.82	-0.0452	-0.2075	356.27
0.90	-0.0033	0.0010	0.0011	-0.0141	-73.01	-0.0536	-0.2420	349.22	-0.0552	-0.1861	354.43
0.95	-0.0032	0.0005	0.0008	-0.0158	84.36	-0.0656	-0.2421	343.16	-0.0642	-0.1806	350.88
1.00	-0.0032	-0.0007	-0.0006	-0.0165	245.90	-0.0766	-0.1968	342.38	-0.0721	-0.1347	352.15
1.05	-0.0033	-0.0016	-0.0013	-0.0163	411.18	-0.0845	-0.1156	347.25	-0.0769	-0.0571	358.56
1.10	-0.0033	-0.0024	-0.0009	-0.0158	558.36	-0.0887	-0.0492	352.58	-0.0784	0.0025	364.92
1.15	-0.0034	-0.0031	-0.0003	-0.0153	685.34	-0.0905	-0.0197	355.19	-0.0778	0.0239	368.17
1.20	-0.0033	-0.0039	0.0003	-0.0155	790.76	-0.0915	-0.0224	354.66	-0.0767	0.0132	368.02
1.25	-0.0033	-0.0047	0.0004	-0.0157	875.16	-0.0927	-0.0357	352.67	-0.0764	-0.0077	366.21
1.30	-0.0033	-0.0055	0.0002	-0.0160	940.83	-0.0945	-0.0431	350.88	-0.0769	-0.0216	364.51
1.35	-0.0033	-0.0063	-0.0001	-0.0164	990.28	-0.0966	-0.0369	350.40	-0.0781	-0.0210	364.00
1.40	-0.0033	-0.0071	-0.0002	-0.0167	1025.49	-0.0983	-0.0247	350.77	-0.0791	-0.0140	364.23
1.45	-0.0033	-0.0080	0.0002	-0.0169	1047.16	-0.0996	-0.0211	350.45	-0.0800	-0.0155	363.60
1.50	-0.0033	-0.0088	0.0003	-0.0168	1054.44	-0.1007	-0.0234	349.55	-0.0805	-0.0236	362.16
1.55	-0.0033	-0.0096	0.0001	-0.0161	1044.46	-0.1018	-0.0225	349.00	-0.0822	-0.0300	360.70
1.60	-0.0033	-0.0104	-0.0003	-0.0147	1012.72	-0.1025	-0.0065	350.33	-0.0835	-0.0232	360.64
1.65	-0.0033	-0.0111	-0.0002	-0.0129	959.68	-0.1024	0.0139	352.74	-0.0844	-0.0140	361.12
1.70	-0.0033	-0.0117	0.0001	-0.0115	863.47	-0.1015	0.0208	354.08	-0.0852	-0.0194	360.04
1.75	-0.0033	-0.0122	0.0006	-0.0090	735.51	-0.1007	0.0108	353.52	-0.0867	-0.0461	356.11
1.80	-0.0033	-0.0125	0.0005	-0.0003	559.07	-0.1004	0.0011	352.61	-0.0897	-0.0745	351.06
1.85	-0.0033	-0.0124	-0.0006	0.0038	335.02	-0.0999	0.0284	355.96	-0.0934	-0.0634	349.94
1.90	-0.0033	-0.0122	-0.0015	0.0029	77.56	-0.0971	0.0875	364.29	-0.0954	-0.0125	354.29
1.95	-0.0034	-0.0121	-0.0007	0.0000	-188.76	-0.0917	0.1215	371.55	-0.0950	0.0231	358.53

TIME (SEC)	FORWARD (FT)	LATERAL (FT)	VERTICAL (FT)	ROLL (DEG)	PITCH (DEG)	HEADING (DEG)	TURN RADIUS (FT)	SIDE SLIP (DEG)	ARTICULATION ANGLE (DEG)
0.0	-96.3765	0.0	0.0	0.0	0.0	0.0	**********	0.0	0.0
0.05	-94.0666	-0.0000	-0.0000	0.0000	-0.0000	-0.0000	**********	0.0000	0.0000
0.10	-91.8673	0.0000	-0.0000	-0.0000	-0.0000	0.0000	**********	0.0000	0.0000
0.15	-89.6721	0.0000	-0.0000	-0.0000	-0.0000	0.0000	**********	0.0000	0.0000
0.20	-87.4863	-0.0000	-0.0001	0.0000	-0.0018	-0.0000	**********	-0.0000	0.0000
0.25	-85.3124	-0.0000	-0.0004	0.0000	-0.0130	-0.0000	**********	-0.0000	0.0000
0.30	-83.1500	-0.0000	-0.0010	0.0000	-0.0311	-0.0000	**********	-0.0000	-0.0001
0.35	-80.9988	-0.0000	-0.0014	-0.0000	-0.0403	-0.0000	**********	0.0000	-0.0003
0.40	-78.8624	0.0000	-0.0015	-0.0000	-0.0417	0.0000	**********	0.0000	-0.0008
0.45	-76.7481	0.0000	-0.0017	-0.0000	-0.0472	0.0000	**********	0.0001	-0.0017
0.50	-74.6652	0.0000	-0.0019	-0.0001	-0.0536	0.0001	**********	0.0002	-0.0032
0.55	-72.6216	0.0000	-0.0020	-0.0002	-0.0545	0.0001	**********	0.0004	-0.0053
0.60	-70.6228	0.0000	-0.0020	-0.0002	-0.0550	0.0002	**********	0.0005	-0.0080
0.65	-68.6707	0.0001	-0.0020	-0.0001	-0.0583	0.0003	**********	0.0005	-0.0111
0.70	-66.7655	0.0001	-0.0021	0.0000	-0.0600	0.0004	**********	0.0004	-0.0146
0.75	-64.9053	0.0001	-0.0021	0.0003	-0.0599	0.0004	-163801.8125	-0.0001	-0.0182
0.80	-63.0879	0.0001	-0.0021	0.0006	-0.0609	0.0002	-88295.8750	-0.0009	-0.0215
0.85	-61.3117	0.0001	-0.0022	0.0010	-0.0623	-0.0001	-58100.4297	-0.0020	-0.0244
0.90	-59.5758	-0.0000	-0.0022	0.0013	-0.0623	-0.0006	-43351.3086	-0.0035	-0.0266
0.95	-57.8804	-0.0002	-0.0022	0.0014	-0.0621	-0.0014	-35612.5625	-0.0053	-0.0279
1.00	-56.2265	-0.0004	-0.0022	0.0014	-0.0625	-0.0023	-31891.7969	-0.0071	-0.0283
1.05	-54.6154	-0.0007	-0.0022	0.0012	-0.0626	-0.0035	-30913.3828	-0.0089	-0.0275
1.10	-53.0493	-0.0011	-0.0022	0.0008	-0.0623	-0.0048	-32149.8438	-0.0104	-0.0254
1.15	-51.5296	-0.0015	-0.0022	0.0004	-0.0624	-0.0062	-35541.6094	-0.0115	-0.0218
1.20	-50.0576	-0.0020	-0.0022	0.0001	-0.0626	-0.0077	-41115.8164	-0.0122	-0.0166
1.25	-48.6334	-0.0025	-0.0022	-0.0002	-0.0627	-0.0093	-48905.1406	-0.0125	-0.0095
1.30	-47.2567	-0.0031	-0.0022	-0.0004	-0.0627	-0.0108	-59207.4453	-0.0125	-0.0006
1.35	-45.9265	-0.0036	-0.0022	-0.0005	-0.0629	-0.0123	-73183.8125	-0.0122	0.0104
1.40	-44.6417	-0.0042	-0.0022	-0.0005	-0.0630	-0.0136	-98029.9375	-0.0117	0.0234
1.45	-43.4014	-0.0047	-0.0022	-0.0006	-0.0630	-0.0149	-180777.7500	-0.0110	0.0384
1.50	-42.2050	-0.0053	-0.0022	-0.0007	-0.0630	-0.0160	**********	-0.0100	0.0554
1.55	-41.0529	-0.0058	-0.0022	-0.0008	-0.0630	-0.0170	87561.8750	-0.0087	0.0743
1.60	-39.9449	-0.0063	-0.0022	-0.0010	-0.0629	-0.0177	40334.1133	-0.0068	0.0950
1.65	-38.8797	-0.0067	-0.0022	-0.0012	-0.0628	-0.0181	24327.9414	-0.0043	0.1174
1.70	-37.8559	-0.0071	-0.0022	-0.0014	-0.0628	-0.0184	16897.4336	-0.0012	0.1414
1.75	-36.8740	-0.0074	-0.0022	-0.0014	-0.0628	-0.0183	12869.4023	0.0025	0.1667
1.80	-35.9434	-0.0076	-0.0022	-0.0013	-0.0627	-0.0179	10298.0938	0.0068	0.1931
1.85	-35.0671	-0.0077	-0.0022	-0.0011	-0.0627	-0.0173	8561.1211	0.0116	0.2201
1.90	-34.2417	-0.0078	-0.0022	-0.0008	-0.0627	-0.0164	7398.7227	0.0167	0.2476
1.95	-33.4623	-0.0077	-0.0022	-0.0005	-0.0628	-0.0152	6590.3867	0.0221	0.2754

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 SPRUNG MASS VELOCITY (BODY AXES)

TIME (SEC)	FORWARD (FT/SEC)	LATERAL (FT/SEC)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	PITCH (DEG/SEC)	HEADING (DEG/SEC)	ARTICULATION RATE (DEG/SEC)
0.0	44.00	0.0	0.0	0.0	0.0	0.0	0.0
0.05	44.00	0.00	-0.00	0.00	-0.00	-0.00	0.00
0.10	44.00	0.00	-0.00	-0.00	-0.00	0.00	0.00
0.15	44.00	0.00	-0.00	-0.00	-0.00	0.00	0.00
0.20	43.95	-0.00	-0.00	0.00	-0.11	-0.00	0.00
0.25	43.70	-0.00	-0.02	0.00	-0.34	-0.00	-0.00
0.30	43.20	-0.00	-0.03	-0.00	-0.32	-0.00	-0.00
0.35	42.53	0.00	-0.03	-0.00	-0.06	0.00	-0.01
0.40	41.81	0.00	-0.03	-0.00	-0.05	0.00	-0.01
0.45	41.12	0.00	-0.04	-0.00	-0.15	0.00	-0.02
0.50	40.50	0.00	-0.04	-0.00	-0.07	0.00	-0.04
0.55	39.92	0.00	-0.04	-0.00	0.01	0.00	-0.05
0.60	39.35	0.00	-0.04	0.00	-0.05	0.00	-0.06
0.65	38.75	0.00	-0.04	0.00	-0.06	0.00	-0.07
0.70	38.08	0.00	-0.04	0.00	-0.01	0.00	-0.07
0.75	37.31	-0.00	-0.04	0.01	-0.00	-0.00	-0.07
0.80	36.42	-0.00	-0.04	0.01	-0.03	-0.00	-0.06
0.85	35.46	-0.00	-0.04	0.01	-0.01	-0.01	-0.05
0.90	34.45	-0.00	-0.04	0.00	0.01	-0.01	-0.04
0.95	33.43	-0.00	-0.04	0.00	-0.00	-0.02	-0.02
1.00	32.46	-0.00	-0.04	-0.00	-0.01	-0.02	0.00
1.05	31.54	-0.00	-0.03	-0.01	0.00	-0.03	0.03
1.10	30.67	-0.01	-0.03	-0.01	0.00	-0.03	0.06
1.15	29.83	-0.01	-0.03	-0.01	-0.00	-0.03	0.09
1.20	29.00	-0.01	-0.03	-0.01	-0.00	-0.03	0.12
1.25	28.15	-0.01	-0.03	-0.00	0.00	-0.03	0.16
1.30	27.28	-0.01	-0.03	-0.00	-0.00	-0.03	0.20
1.35	26.37	-0.01	-0.03	-0.00	-0.00	-0.03	0.24
1.40	25.42	-0.01	-0.03	-0.00	-0.00	-0.03	0.28
1.45	24.46	-0.00	-0.03	-0.00	0.00	-0.02	0.32
1.50	23.49	-0.00	-0.03	-0.00	-0.00	-0.02	0.36
1.55	22.53	-0.00	-0.02	-0.00	0.00	-0.02	0.40
1.60	21.59	-0.00	-0.02	-0.00	0.00	-0.01	0.43
1.65	20.67	-0.00	-0.02	-0.00	0.00	-0.01	0.46
1.70	19.78	-0.00	-0.02	-0.00	0.00	-0.00	0.49
1.75	18.91	0.00	-0.02	0.00	0.00	0.00	0.52
1.80	18.06	0.00	-0.02	0.00	0.00	0.01	0.53
1.85	17.22	0.00	-0.02	0.00	0.00	0.02	0.55
1.90	16.39	0.00	-0.02	0.01	-0.00	0.02	0.55
1.95	15.52	0.01	-0.02	0.01	-0.00	0.03	0.56

TRAILER NO. 3 SPRUNG MASS ACCELERATION (BODY AXES) | INERTIAL ACCEL. ALONG BODY AXES

TIME (SEC)	FORWARD (FT/SEC**2)	LATERAL (FT/SEC**2)	VERTICAL (FT/SEC**2)	ROLL (DEG/SEC**2)	PITCH (DEG/SEC**2)	HEADING (DEG/SEC**2)	LONGITUDINAL (FT/SEC**2)	LATERAL (FT/SEC**2)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0
0.05	-0.0009	0.0000	-0.0000	-0.0000	-0.0002	0.0000	-0.0009	0.0000
0.10	-0.0024	0.0000	-0.0000	-0.0000	0.0003	0.0000	-0.0024	0.0000
0.15	-0.0919	-0.0000	-0.0195	0.0001	-0.2655	-0.0000	-0.0919	-0.0000
0.20	-2.4733	-0.0000	-0.2062	0.0005	-4.1154	-0.0003	-2.4733	-0.0000
0.25	-7.4991	-0.0000	-0.3862	-0.0001	-3.5431	-0.0002	-7.4990	-0.0000
0.30	-12.1243	0.0001	-0.1605	-0.0017	4.4365	0.0004	-12.1241	0.0000
0.35	-14.3444	0.0003	0.0834	-0.0042	3.6651	0.0020	-14.3444	0.0003
0.40	-14.2678	0.0007	-0.0515	-0.0073	-2.4347	0.0050	-14.2678	0.0008
0.45	-12.9990	0.0013	-0.1456	-0.0081	-0.4038	0.0089	-12.9989	0.0017
0.50	-11.8599	0.0018	0.0024	-0.0018	2.7767	0.0115	-11.8598	0.0026
0.55	-11.4090	0.0019	0.0572	0.0119	-0.0151	0.0102	-11.4091	0.0030
0.60	-11.5041	0.0012	-0.0356	0.0279	-1.4004	0.0031	-11.5041	0.0025
0.65	-12.4580	-0.0007	-0.0441	0.0412	0.8121	-0.0107	-12.4579	0.0005
0.70	-14.3943	-0.0038	0.0258	0.0446	0.8814	-0.0304	-14.3943	-0.0032
0.75	-16.6287	-0.0078	0.0265	0.0333	-0.6277	-0.0527	-16.6287	-0.0086
0.80	-18.5624	-0.0121	-0.0096	0.0081	-0.1586	-0.0727	-18.5624	-0.0145
0.85	-19.8805	-0.0158	0.0084	-0.0264	0.6679	-0.0861	-19.8805	-0.0210
0.90	-20.3837	-0.0185	0.0340	-0.0573	0.0534	-0.0908	-20.3837	-0.0262
0.95	-19.9849	-0.0195	0.0237	-0.0733	-0.3155	-0.0874	-19.9849	-0.0296
1.00	-18.9474	-0.0185	0.0125	-0.0715	0.1587	-0.0775	-18.9474	-0.0307
1.05	-17.8904	-0.0156	0.0197	-0.0526	0.1797	-0.0623	-17.8904	-0.0294
1.10	-17.0477	-0.0113	0.0234	-0.0217	-0.1691	-0.0446	-17.0477	-0.0261
1.15	-16.6092	-0.0063	0.0175	0.0105	-0.0915	-0.0270	-16.6092	-0.0216
1.20	-16.6479	-0.0014	0.0148	0.0350	0.1126	-0.0104	-16.6479	-0.0168
1.25	-17.1143	0.0026	0.0179	0.0446	0.0000	0.0046	-17.1143	-0.0124
1.30	-17.8569	0.0056	0.0197	0.0365	-0.0397	0.0189	-17.8569	-0.0086
1.35	-18.5937	0.0077	0.0194	0.0166	0.0348	0.0327	-18.5937	-0.0055
1.40	-19.1436	0.0092	0.0158	-0.0060	0.0750	0.0467	-19.1436	-0.0027
1.45	-19.4146	0.0107	0.0212	-0.0221	-0.0109	0.0606	-19.4146	0.0005
1.50	-19.3331	0.0127	0.0220	-0.0258	-0.0088	0.0741	-19.3331	0.0042
1.55	-19.0102	0.0153	0.0215	-0.0157	0.0336	0.0864	-19.0102	0.0088
1.60	-18.5244	0.0184	0.0204	0.0043	0.0072	0.0969	-18.5244	0.0135
1.65	-18.0494	0.0216	0.0200	0.0266	-0.0294	0.1051	-18.0494	0.0191
1.70	-17.6175	0.0242	0.0199	0.0448	-0.0019	0.1105	-17.6175	0.0237
1.75	-17.2153	0.0258	0.0193	0.0526	0.0183	0.1129	-17.2153	0.0272
1.80	-16.8562	0.0267	0.0186	0.0418	-0.0086	0.1166	-16.8562	0.0298
1.85	-16.6434	0.0267	0.0182	0.0263	-0.0304	0.1199	-16.6434	0.0314
1.90	-16.8931	0.0253	0.0184	0.0204	-0.0305	0.1157	-16.8931	0.0314
1.95	-17.7074	0.0225	0.0187	0.0208	-0.0180	0.1022	-17.7074	0.0298

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT AXLE TIRE FORCES

LEADING TANDEM AXLE

	LEFT SIDE					RIGHT SIDE				
TIME (SEC)	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	2162.50	-0.0	0.0	0.0	0.0	2162.50	-0.0	0.0	0.0	0.0
0.05	2162.50	0.00	0.00	0.0000	0.0000	2162.50	0.00	0.00	0.0000	0.0000
0.10	2162.50	0.03	0.00	0.0000	0.0000	2162.50	0.03	0.00	0.0000	0.0000
0.15	2162.89	-4.23	-0.00	-0.0020	-0.0000	2162.89	-4.23	-0.00	-0.0020	-0.0000
0.20	2220.85	-169.83	-0.01	-0.0765	-0.0000	2220.86	-169.83	-0.01	-0.0765	-0.0000
0.25	2446.23	-576.76	-0.00	-0.2358	-0.0000	2446.24	-576.76	-0.00	-0.2358	-0.0000
0.30	2741.04	-994.77	0.01	-0.3629	0.0000	2741.03	-994.77	0.01	-0.3629	0.0000
0.35	2881.29	-1302.00	0.05	-0.4519	0.0000	2881.24	-1301.99	0.05	-0.4519	0.0000
0.40	2928.48	-1555.36	0.13	-0.5311	0.0000	2928.30	-1555.34	0.13	-0.5311	0.0000
0.45	3036.62	-1768.19	0.24	-0.5823	0.0001	3036.23	-1768.16	0.24	-0.5824	0.0001
0.50	3131.22	-1921.35	0.29	-0.6136	0.0001	3130.63	-1921.32	0.29	-0.6137	0.0001
0.55	3145.38	-2028.93	0.24	-0.6451	0.0001	3144.70	-2028.91	0.24	-0.6452	0.0001
0.60	3167.73	-2111.48	0.03	-0.6666	0.0000	3167.24	-2111.51	0.03	-0.6667	0.0000
0.65	3221.32	-2161.77	-0.37	-0.6711	-0.0001	3221.41	-2161.84	-0.37	-0.6711	-0.0001
0.70	3242.90	-2180.07	-0.93	-0.6723	-0.0003	3244.02	-2180.21	-0.93	-0.6721	-0.0003
0.75	3242.85	-2185.33	-1.54	-0.6739	-0.0005	3245.34	-2185.51	-1.54	-0.6734	-0.0005
0.80	3262.26	-2186.92	-2.06	-0.6704	-0.0006	3266.21	-2187.11	-2.06	-0.6696	-0.0006
0.85	3280.98	-2186.37	-2.33	-0.6664	-0.0007	3286.10	-2186.54	-2.33	-0.6654	-0.0007
0.90	3279.24	-2190.63	-2.26	-0.6680	-0.0007	3284.89	-2190.75	-2.26	-0.6669	-0.0007
0.95	3278.71	-2204.61	-1.82	-0.6724	-0.0006	3284.06	-2204.66	-1.82	-0.6713	-0.0006
1.00	3287.04	-2224.19	-1.04	-0.6767	-0.0003	3291.16	-2224.17	-1.04	-0.6758	-0.0003
1.05	3289.18	-2241.99	0.00	-0.6816	0.0000	3291.31	-2241.91	-0.00	-0.6812	-0.0000
1.10	3286.70	-2256.87	1.14	-0.6867	0.0003	3286.41	-2256.77	1.13	-0.6867	0.0003
1.15	3289.86	-2266.53	2.24	-0.6889	0.0007	3287.10	-2266.41	2.23	-0.6895	0.0007
1.20	3294.87	-2268.95	3.19	-0.6896	0.0010	3289.94	-2268.85	3.18	-0.6896	0.0010
1.25	3295.91	-2265.40	3.93	-0.6873	0.0012	3289.36	-2265.33	3.91	-0.6887	0.0012
1.30	3297.00	-2258.28	4.47	-0.6850	0.0014	3289.38	-2258.23	4.46	-0.6865	0.0014
1.35	3300.29	-2250.16	4.86	-0.6818	0.0015	3292.06	-2250.12	4.84	-0.6835	0.0015
1.40	3302.06	-2243.50	5.14	-0.6794	0.0016	3293.48	-2243.45	5.12	-0.6812	0.0016
1.45	3301.65	-2240.21	5.34	-0.6785	0.0016	3292.79	-2240.15	5.32	-0.6803	0.0016
1.50	3301.69	-2241.14	5.46	-0.6788	0.0017	3292.51	-2241.06	5.44	-0.6807	0.0017
1.55	3302.02	-2245.15	5.47	-0.6799	0.0017	3292.51	-2245.06	5.45	-0.6819	0.0017
1.60	3301.20	-2251.04	5.32	-0.6819	0.0016	3291.50	-2250.94	5.30	-0.6839	0.0016
1.65	3300.03	-2257.08	4.93	-0.6840	0.0015	3290.50	-2256.98	4.92	-0.6859	0.0015
1.70	3299.40	-2262.54	4.27	-0.6857	0.0013	3290.61	-2262.46	4.25	-0.6876	0.0013
1.75	3298.38	-2267.43	3.29	-0.6874	0.0010	3291.07	-2267.37	3.28	-0.6889	0.0010
1.80	3296.54	-2271.54	2.09	-0.6892	0.0006	3291.37	-2271.88	2.09	-0.6903	0.0006
1.85	3294.66	-2274.93	0.61	-0.6905	0.0002	3292.27	-2274.88	0.61	-0.6910	0.0002
1.90	3293.39	-2272.47	-1.25	-0.6900	-0.0004	3294.47	-2272.43	-1.26	-0.6898	-0.0004
1.95	3292.94	-2263.29	-3.41	-0.6873	-0.0010	3297.97	-2263.26	-3.43	-0.6863	-0.0010

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT AXLE TIRE FORCES

TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	2162.50	-0.0	0.0	0.0	0.0	2162.50	-0.0	0.0	0.0	0.0
0.05	2162.50	0.00	0.00	0.0000	0.0000	2162.50	0.00	0.00	0.0000	0.0000
0.10	2162.50	0.03	0.00	0.0000	0.0000	2162.50	0.03	0.00	0.0000	0.0000
0.15	2162.34	-4.23	-0.00	-0.0020	-0.0000	2162.34	-4.23	-0.00	-0.0020	-0.0000
0.20	2158.09	-167.47	-0.01	-0.0776	-0.0000	2158.10	-167.47	-0.01	-0.0776	-0.0000
0.25	2211.04	-560.02	-0.01	-0.2533	-0.0000	2211.05	-560.02	-0.01	-0.2533	-0.0000
0.30	2312.94	-973.25	0.01	-0.4208	0.0000	2312.94	-973.25	0.01	-0.4208	0.0000
0.35	2335.07	-1283.25	0.05	-0.5496	0.0000	2335.02	-1283.24	0.05	-0.5496	0.0000
0.40	2312.90	-1538.75	0.13	-0.6653	0.0001	2312.72	-1538.72	0.13	-0.6653	0.0001
0.45	2347.65	-1756.01	0.25	-0.7480	0.0001	2347.24	-1755.95	0.25	-0.7481	0.0001
0.50	2382.19	-1912.61	0.36	-0.8029	0.0002	2381.50	-1912.55	0.36	-0.8031	0.0002
0.55	2368.31	-2021.75	0.40	-0.8537	0.0002	2367.44	-2021.71	0.40	-0.8540	0.0002
0.60	2367.32	-2107.56	0.29	-0.8903	0.0001	2366.50	-2107.58	0.29	-0.8906	0.0001
0.65	2392.47	-2160.97	-0.03	-0.9032	-0.0000	2392.13	-2161.08	-0.03	-0.9034	-0.0000
0.70	2397.39	-2180.22	-0.57	-0.9094	-0.0002	2398.07	-2180.45	-0.57	-0.9092	-0.0002
0.75	2389.73	-2186.60	-1.31	-0.9150	-0.0005	2391.94	-2186.92	-1.31	-0.9143	-0.0005
0.80	2398.10	-2189.69	-2.16	-0.9131	-0.0009	2402.18	-2190.06	-2.16	-0.9117	-0.0009
0.85	2406.91	-2189.15	-2.98	-0.9095	-0.0012	2412.84	-2189.49	-2.98	-0.9074	-0.0012
0.90	2401.83	-2192.80	-3.64	-0.9130	-0.0015	2409.22	-2193.07	-3.66	-0.9103	-0.0015
0.95	2398.69	-2206.76	-4.09	-0.9200	-0.0017	2406.87	-2206.92	-4.11	-0.9169	-0.0017
1.00	2402.67	-2226.33	-4.29	-0.9266	-0.0018	2410.85	-2226.36	-4.30	-0.9235	-0.0018
1.05	2402.58	-2243.90	-4.22	-0.9340	-0.0018	2409.97	-2243.93	-4.24	-0.9311	-0.0018
1.10	2399.54	-2258.50	-3.97	-0.9414	-0.0017	2405.60	-2258.75	-3.98	-0.9390	-0.0017
1.15	2401.00	-2269.02	-3.63	-0.9450	-0.0015	2405.54	-2268.84	-3.64	-0.9432	-0.0015
1.20	2404.09	-2271.72	-3.26	-0.9449	-0.0014	2407.18	-2271.55	-3.27	-0.9437	-0.0014
1.25	2404.42	-2268.37	-2.92	-0.9434	-0.0012	2406.37	-2268.24	-2.92	-0.9426	-0.0012
1.30	2404.88	-2261.52	-2.59	-0.9404	-0.0011	2406.04	-2261.41	-2.59	-0.9399	-0.0011
1.35	2407.11	-2253.56	-2.25	-0.9362	-0.0009	2407.72	-2253.47	-2.25	-0.9359	-0.0009
1.40	2408.39	-2246.81	-1.85	-0.9329	-0.0008	2409.45	-2246.69	-1.85	-0.9328	-0.0008
1.45	2408.19	-2243.42	-1.34	-0.9316	-0.0006	2407.62	-2243.27	-1.34	-0.9317	-0.0006
1.50	2408.47	-2244.24	-0.70	-0.9318	-0.0003	2406.94	-2244.06	-0.70	-0.9323	-0.0003
1.55	2409.16	-2248.14	0.06	-0.9332	0.0000	2406.37	-2247.93	0.06	-0.9342	0.0000
1.60	2409.18	-2253.92	0.91	-0.9356	0.0004	2404.96	-2253.70	0.91	-0.9371	0.0004
1.65	2409.05	-2259.89	1.81	-0.9381	0.0008	2403.42	-2259.68	1.81	-0.9402	0.0008
1.70	2409.42	-2265.34	2.70	-0.9402	0.0011	2402.60	-2265.15	2.69	-0.9428	0.0011
1.75	2409.59	-2270.17	3.55	-0.9421	0.0015	2402.00	-2270.01	3.53	-0.9451	0.0015
1.80	2409.24	-2274.63	4.42	-0.9441	0.0018	2401.24	-2274.50	4.40	-0.9472	0.0018
1.85	2408.93	-2277.67	5.31	-0.9455	0.0022	2400.78	-2277.55	5.29	-0.9487	0.0022
1.90	2409.18	-2275.40	6.12	-0.9445	0.0025	2401.17	-2275.31	6.10	-0.9476	0.0025
1.95	2410.08	-2266.47	6.82	-0.9404	0.0028	2402.48	-2266.41	6.79	-0.9434	0.0028

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 REAR SUSPENSION TIRE FORCES

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	2162.50	-C.C	C.C	C.C	C.C	2162.5C	-0.0	0.0	0.C	0.C
0.05	2162.50	0.00	-0.00	0.0000	-C.C000	2162.50	0.00	-0.00	C.0000	-0.0000
0.10	2162.50	C.03	-C.CC	C.0000	-C.C000	2162.5C	0.03	-0.00	C.C000	-0.CCCO
0.15	2162.83	-4.23	-C.CC	-C.0020	-C.C000	2162.83	-4.23	-0.00	-0.0020	-0.0000
0.20	2177.63	-168.04	C.CO	-C.C772	C.C000	2177.62	-168.04	0.0C	-0.C772	0.0000
0.25	2126.51	-549.96	C.CC	-0.2586	C.C000	2126.52	-549.96	0.00	-0.2586	0.CCCO
0.30	2002.77	-941.82	-C.CC	-C.4703	-C.C000	2CC2.78	-941.82	-0.00	-C.4703	-0.0000
0.35	1976.40	-1273.C9	-0.C1	-0.6441	-C.C000	1976.41	-1273.09	-C.01	-0.6441	-0.00C0
0.40	2015.55	-1537.48	-0.C3	-C.7628	-C.C000	2C15.54	-1537.47	-0.03	-0.7628	-0.C0C0
0.45	1982.46	-1732.15	-C.C5	-C.8737	-C.C000	1982.37	-1732.13	-0.05	-0.8738	-0.0000
0.50	1938.06	-1896.81	-C.C5	-0.9787	-C.C000	1937.83	-1896.76	-0.05	-C.9788	-0.0000
0.55	1953.07	-2026.78	-0.C1	-1.C377	-C.C000	1952.65	-2026.72	-0.01	-1.C379	-0.0000
0.60	196C.68	-2102.85	0.07	-1.C725	C.C000	1960.12	-2102.81	0.07	-1.C728	0.0000
0.65	1934.35	-2149.45	C.18	-1.1112	C.C001	1933.81	-2149.47	C.18	-1.1115	0.0001
0.70	1925.13	-2181.53	C.29	-1.1332	C.C001	1924.90	-2181.66	C.29	-1.1334	0.0001
0.75	1932.73	-2190.81	C.35	-1.1335	C.C002	1933.15	-2191.06	C.35	-1.1334	0.0002
0.80	1925.19	-2187.41	C.34	-1.1362	C.C002	1926.57	-2187.75	0.34	-1.1356	0.0002
0.85	1914.32	-2189.50	0.24	-1.1438	C.C001	1916.75	-2189.86	C.24	-1.1425	0.C001
0.90	1916.92	-2197.73	0.08	-1.1465	C.C000	1920.34	-2198.02	0.08	-1.1446	0.C000
0.95	1919.82	-2209.21	-C.C7	-1.1507	-C.C000	1923.76	-2209.38	-C.07	-1.1485	-0.C000
1.00	1916.71	-2227.C9	-0.15	-1.1619	-C.C001	1920.58	-2227.11	-C.15	-1.1596	-0.0001
1.05	1917.32	-2246.74	-C.14	-1.1718	-C.C001	1920.53	-2246.62	-C.14	-1.1698	-0.0001
1.10	1921.05	-2261.92	-C.C2	-1.1774	-C.C000	1923.13	-2261.70	-C.02	-1.1761	-0.00C0
1.15	1921.16	-2270.65	C.17	-1.1819	C.0001	1921.85	-2270.40	0.17	-1.1813	0.0001
1.20	1919.82	-2273.78	C.38	-1.1844	C.0002	1919.3C	-2273.56	C.38	-1.1846	0.0002
1.25	1920.46	-2271.38	C.56	-1.1827	C.C003	1919.98	-2271.23	0.56	-1.1836	0.0003
1.30	1920.39	-2264.20	C.66	-1.1790	C.C003	1918.35	-2264.12	C.66	-1.1802	0.00C3
1.35	1918.61	-2256.10	C.66	-1.1759	C.C003	1916.37	-2256.06	0.66	-1.1773	0.C0C3
1.40	1917.80	-2249.84	C.58	-1.1731	C.C003	1915.56	-2249.81	0.58	-1.1745	0.0003
1.45	1918.28	-2246.58	C.48	-1.1711	C.0002	1916.02	-2246.51	0.48	-1.1725	0.0002
1.50	1918.43	-2247.10	C.38	-1.1713	C.C002	1915.98	-2246.98	0.38	-1.1728	0.0002
1.55	1918.61	-2250.96	0.31	-1.1732	C.C002	1915.77	-2250.81	0.31	-1.1749	0.0002
1.60	1919.68	-2256.81	C.26	-1.1756	C.C001	1916.32	-2256.65	0.26	-1.1776	0.C0C1
1.65	1920.69	-2262.61	0.21	-1.1780	C.C001	1916.88	-2262.46	0.21	-1.1803	0.0001
1.70	1920.94	-2267.92	0.10	-1.1806	C.C001	1916.94	-2267.81	0.10	-1.1830	C.CCC1
1.75	1921.06	-2272.75	-C.11	-1.1831	-C.C001	1917.33	-2272.69	-0.11	-1.1853	-0.C001
1.80	1921.27	-2277.19	-C.47	-1.1853	-C.C002	1918.34	-2277.19	-0.47	-1.1871	-0.0002
1.85	192C.96	-2280.15	-1.00	-1.1870	-C.C005	1919.34	-2280.17	-1.00	-1.1880	-0.0005
1.90	1919.83	-2277.94	-1.58	-1.1865	-C.C008	1919.75	-2277.97	-1.58	-1.1866	-0.0008
1.95	1917.91	-2269.17	-2.17	-1.1831	-C.C011	1919.51	-2269.20	-2.17	-1.1822	-0.0011

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 REAR SUSPENSION TIRE FORCES

TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y	RIGHT SIDE VERTICAL (LB)	LONG. (LB)	LATERAL (LB)	MU-X	MU-Y
0.0	2162.50	-0.0	0.0	0.0	0.0	2162.50	-0.0	0.0	0.0	0.0
0.05	2162.50	0.00	-0.00	0.0000	-0.0000	2162.50	0.00	-0.00	0.0000	-0.0000
0.10	2162.50	0.03	-0.00	0.0000	-0.0000	2162.50	0.03	-0.00	0.0000	-0.0000
0.15	2162.27	-4.23	0.00	-0.0020	0.0000	2162.27	-4.23	0.00	-0.0020	0.0000
0.20	2114.86	-165.62	0.00	-0.0783	0.0000	2114.86	-165.62	0.00	-0.0783	0.0000
0.25	1891.32	-527.74	-0.00	-0.2790	-0.0000	1891.32	-527.74	-0.00	-0.2790	-0.0000
0.30	1574.67	-888.53	-0.00	-0.5643	-0.0000	1574.68	-888.53	-0.00	-0.5643	-0.0000
0.35	1430.19	-1216.71	-0.01	-0.8507	-0.0000	1430.19	-1216.71	-0.01	-0.8507	-0.0000
0.40	1395.98	-1492.54	-0.01	-1.0661	-0.0000	1399.94	-1492.51	-0.01	-1.0661	-0.0000
0.45	1293.51	-1666.64	0.01	-1.2885	0.0000	1293.35	-1666.56	0.01	-1.2886	0.0000
0.50	1189.04	-1821.05	0.04	-1.5399	0.0000	1188.69	-1830.89	0.04	-1.5403	0.0000
0.55	1175.98	-1995.11	0.10	-1.6999	0.0001	1175.42	-1998.92	0.10	-1.7006	0.0001
0.60	1160.18	-2077.45	0.17	-1.7906	0.0001	1159.48	-2077.33	0.17	-1.7916	0.0001
0.65	1105.30	-2112.10	0.22	-1.9109	0.0002	1104.71	-2112.17	0.22	-1.9120	0.0002
0.70	1079.35	-2166.52	0.21	-2.0072	0.0002	1079.22	-2166.93	0.21	-2.0079	0.0002
0.75	1079.31	-2194.06	0.12	-2.0328	0.0001	1080.05	-2194.87	0.12	-2.0322	0.0001
0.80	1060.81	-2183.26	-0.10	-2.0581	-0.0001	1062.77	-2184.40	-0.10	-2.0554	-0.0001
0.85	1040.22	-2187.51	-0.42	-2.1029	-0.0004	1043.55	-2188.80	-0.42	-2.0974	-0.0004
0.90	1039.80	-2208.06	-0.82	-2.1235	-0.0008	1044.39	-2209.13	-0.82	-2.1152	-0.0008
0.95	1040.46	-2218.29	-1.24	-2.1320	-0.0012	1045.90	-2218.97	-1.24	-2.1216	-0.0012
1.00	1033.45	-2231.23	-1.60	-2.1590	-0.0015	1039.16	-2231.45	-1.61	-2.1474	-0.0015
1.05	1032.25	-2254.75	-1.89	-2.1843	-0.0018	1037.66	-2254.46	-1.90	-2.1726	-0.0018
1.10	1035.77	-2272.30	-2.09	-2.1938	-0.0020	1040.44	-2271.63	-2.10	-2.1833	-0.0020
1.15	1034.48	-2278.78	-2.18	-2.2028	-0.0021	1038.15	-2277.98	-2.18	-2.1943	-0.0021
1.20	1031.45	-2282.63	-2.19	-2.2130	-0.0021	1034.13	-2281.68	-2.20	-2.2066	-0.0021
1.25	1031.52	-2283.17	-2.18	-2.2134	-0.0021	1033.44	-2282.59	-2.18	-2.2087	-0.0021
1.30	1030.92	-2276.27	-2.15	-2.2080	-0.0021	1032.37	-2275.91	-2.16	-2.2045	-0.0021
1.35	1028.12	-2267.88	-2.12	-2.2059	-0.0021	1029.33	-2267.67	-2.13	-2.2030	-0.0021
1.40	1026.82	-2262.79	-2.07	-2.2037	-0.0020	1027.87	-2262.59	-2.08	-2.2013	-0.0020
1.45	1027.45	-2260.05	-1.98	-2.1997	-0.0019	1028.22	-2259.76	-1.98	-2.1977	-0.0019
1.50	1027.69	-2259.76	-1.80	-2.1999	-0.0017	1027.92	-2259.30	-1.80	-2.1979	-0.0017
1.55	1028.00	-2263.25	-1.51	-2.2016	-0.0015	1027.35	-2262.64	-1.51	-2.2023	-0.0015
1.60	1029.55	-2269.18	-1.13	-2.2041	-0.0011	1027.88	-2269.51	-1.13	-2.2070	-0.0011
1.65	1031.14	-2274.53	-0.66	-2.2058	-0.0006	1028.37	-2273.90	-0.65	-2.2112	-0.0006
1.70	1031.81	-2279.30	-0.12	-2.2090	-0.0001	1028.07	-2278.80	-0.12	-2.2166	-0.0001
1.75	1032.48	-2284.01	0.43	-2.2122	0.0004	1028.05	-2283.69	0.43	-2.2214	0.0004
1.80	1033.45	-2288.35	0.99	-2.2143	0.0010	1028.71	-2288.22	0.98	-2.2244	0.0010
1.85	1033.94	-2291.13	1.55	-2.2159	0.0015	1029.14	-2291.09	1.54	-2.2262	0.0015
1.90	1033.42	-2289.24	2.17	-2.2152	0.0021	1028.66	-2289.24	2.16	-2.2255	0.0021
1.95	1031.94	-2281.17	2.82	-2.2108	0.0027	1027.24	-2281.23	2.81	-2.2207	0.0027

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT SUSPENSION - BRAKE SUMMARY

LEADING TANDEM AXLE

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.00	-.0000	26.14	-0.00	0.0	0.0	0.00	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.03	-.0000	26.14	-0.00	0.0	0.0	0.03	-.0000	26.14	-0.00
0.15	50.00	0.27	268.45	-4.23	0.0001	26.13	-0.43	0.27	268.45	-4.23	0.0001	26.13	-0.43
0.20	50.00	5.29	5292.59	-169.83	0.0039	26.00	-4.39	5.29	5292.59	-169.83	0.0039	26.00	-4.39
0.25	50.00	15.14	15138.39	-576.76	0.0121	25.65	-8.23	15.14	15138.39	-576.76	0.0121	25.65	-8.23
0.30	50.00	24.02	24021.62	-994.77	0.0187	25.19	-9.26	24.02	24021.62	-994.77	0.0187	25.19	-9.26
0.35	50.00	30.64	30641.29	-1302.00	0.0233	24.68	-10.24	30.64	30641.29	-1301.99	0.0233	24.68	-10.24
0.40	50.00	35.57	35574.09	-1555.36	0.0273	24.16	-9.80	35.57	35574.09	-1555.34	0.0273	24.16	-9.80
0.45	50.00	39.25	39249.84	-1768.19	0.0300	23.70	-8.33	39.25	39249.84	-1768.16	0.0300	23.70	-8.33
0.50	50.00	41.99	41988.98	-1921.35	0.0316	23.30	-7.49	41.99	41988.98	-1921.32	0.0316	23.30	-7.50
0.55	50.00	44.03	44030.18	-2028.93	0.0332	22.93	-7.18	44.03	44030.18	-2028.91	0.0332	22.93	-7.18
0.60	50.00	45.55	45551.23	-2111.48	0.0343	22.57	-6.84	45.55	45551.23	-2111.51	0.0343	22.57	-6.84
0.65	50.00	46.68	46684.67	-2161.77	0.0346	22.23	-7.12	46.68	46684.67	-2161.84	0.0346	22.23	-7.11
0.70	50.00	47.53	47529.34	-2180.07	0.0346	21.84	-8.24	47.53	47529.34	-2180.21	0.0346	21.84	-8.23
0.75	50.00	48.16	48158.78	-2185.33	0.0347	21.39	-9.47	48.16	48158.78	-2185.51	0.0347	21.39	-9.46
0.80	50.00	48.63	48627.82	-2186.92	0.0345	20.89	-10.50	48.63	48627.82	-2187.11	0.0345	20.89	-10.49
0.85	50.00	48.98	48977.33	-2186.37	0.0343	20.34	-11.35	48.98	48977.33	-2186.54	0.0343	20.34	-11.34
0.90	50.00	49.24	49237.78	-2190.63	0.0344	19.76	-11.76	49.24	49237.78	-2190.75	0.0343	19.76	-11.76
0.95	50.00	49.43	49431.89	-2204.61	0.0346	19.17	-11.55	49.43	49431.89	-2204.66	0.0346	19.18	-11.55
1.00	50.00	49.58	49576.55	-2224.19	0.0348	18.61	-10.96	49.58	49576.55	-2224.17	0.0348	18.61	-10.96
1.05	50.00	49.68	49684.31	-2241.99	0.0351	18.08	-10.37	49.68	49684.31	-2241.91	0.0351	18.08	-10.37
1.10	50.00	49.76	49764.61	-2256.87	0.0354	17.57	-9.85	49.76	49764.61	-2256.77	0.0354	17.57	-9.85
1.15	50.00	49.82	49824.47	-2266.53	0.0355	17.09	-9.54	49.82	49824.47	-2266.41	0.0355	17.09	-9.54
1.20	50.00	49.87	49869.05	-2268.95	0.0355	16.61	-9.52	49.87	49869.05	-2268.85	0.0355	16.61	-9.52
1.25	50.00	49.90	49902.28	-2265.40	0.0354	16.13	-9.77	49.90	49902.28	-2265.33	0.0355	16.13	-9.77
1.30	50.00	49.93	49927.03	-2258.28	0.0353	15.63	-10.16	49.93	49927.03	-2258.23	0.0353	15.63	-10.17
1.35	50.00	49.95	49945.50	-2250.16	0.0351	15.11	-10.59	49.95	49945.50	-2250.12	0.0352	15.11	-10.60
1.40	50.00	49.96	49959.23	-2243.50	0.0350	14.57	-10.94	49.96	49959.23	-2243.45	0.0351	14.57	-10.95
1.45	50.00	49.97	49969.50	-2240.21	0.0349	14.02	-11.13	49.97	49969.50	-2240.15	0.0350	14.02	-11.13
1.50	50.00	49.98	49977.14	-2241.14	0.0349	13.46	-11.10	49.98	49977.14	-2241.06	0.0350	13.46	-11.10
1.55	50.00	49.98	49982.81	-2245.15	0.0350	12.91	-10.92	49.98	49982.81	-2245.06	0.0351	12.91	-10.93
1.60	50.00	49.99	49987.08	-2251.04	0.0351	12.37	-10.65	49.99	49987.08	-2250.94	0.0352	12.37	-10.66
1.65	50.00	49.99	49990.27	-2257.09	0.0352	11.85	-10.37	49.99	49990.27	-2256.98	0.0353	11.85	-10.38
1.70	50.00	49.99	49992.61	-2262.54	0.0353	11.34	-10.12	49.99	49992.61	-2262.46	0.0354	11.34	-10.12
1.75	50.00	49.99	49994.34	-2267.43	0.0354	10.84	-9.89	49.99	49994.34	-2267.37	0.0355	10.84	-9.89
1.80	50.00	50.00	49995.66	-2271.94	0.0355	10.35	-9.68	50.00	49995.66	-2271.88	0.0355	10.35	-9.68
1.85	50.00	50.00	49996.64	-2274.93	0.0356	9.87	-9.54	50.00	49996.64	-2274.88	0.0356	9.87	-9.54
1.90	50.00	50.00	49997.34	-2272.47	0.0355	9.39	-9.65	50.00	49997.34	-2272.43	0.0355	9.39	-9.66
1.95	50.00	50.00	49997.95	-2263.29	0.0354	8.90	-10.09	50.00	49997.95	-2263.26	0.0353	8.90	-10.09

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT SUSPENSION - BRAKE SUMMARY

TRAILING TANDEM AXLE

	LEFT SIDE							RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.00	-.0000	26.14	-0.00	0.0	0.0	0.00	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.03	-.0000	26.14	-0.00	0.0	0.0	0.03	-.0000	26.14	-0.00
0.15	50.00	0.27	268.45	-4.23	0.0001	26.13	-0.43	0.27	268.45	-4.23	0.0001	26.13	-0.43
0.20	50.00	5.29	5292.59	-167.47	0.0040	26.00	-4.50	5.29	5292.59	-167.47	0.0040	26.00	-4.50
0.25	50.00	15.14	15138.39	-560.02	0.0130	25.62	-9.02	15.14	15138.39	-560.02	0.0130	25.62	-9.02
0.30	50.00	24.02	24021.62	-973.25	0.0217	25.11	-10.29	24.02	24021.62	-973.25	0.0217	25.11	-10.29
0.35	50.00	30.64	30641.29	-1283.25	0.0283	24.55	-11.13	30.64	30641.29	-1283.24	0.0283	24.55	-11.13
0.40	50.00	35.57	35574.09	-1538.75	0.0343	23.98	-10.59	35.57	35574.09	-1538.72	0.0343	23.98	-10.59
0.45	50.00	39.25	39249.84	-1756.01	0.0385	23.49	-8.91	39.25	39249.84	-1755.55	0.0385	23.49	-8.91
0.50	50.00	41.99	41988.98	-1912.61	0.0413	23.07	-7.91	41.99	41988.98	-1912.55	0.0413	23.06	-7.91
0.55	50.00	44.03	44030.18	-2021.75	0.0440	22.67	-7.53	44.03	44030.18	-2021.71	0.0440	22.67	-7.53
0.60	50.00	45.55	45551.23	-2107.56	0.0458	22.30	-7.02	45.55	45551.23	-2107.58	0.0459	22.30	-7.02
0.65	50.00	46.68	46684.67	-2160.97	0.0465	21.95	-7.15	46.68	46684.67	-2161.08	0.0465	21.95	-7.15
0.70	50.00	47.53	47529.34	-2180.22	0.0468	21.57	-8.22	47.53	47529.34	-2180.45	0.0468	21.57	-8.22
0.75	50.00	48.16	48158.78	-2186.60	0.0471	21.12	-9.41	48.16	48158.78	-2186.92	0.0471	21.12	-9.39
0.80	50.00	48.63	48627.82	-2189.69	0.0470	20.62	-10.37	48.63	48627.82	-2190.06	0.0469	20.62	-10.35
0.85	50.00	48.98	48977.33	-2189.15	0.0468	20.08	-11.22	48.98	48977.33	-2189.49	0.0467	20.08	-11.20
0.90	50.00	49.24	49237.78	-2192.80	0.0470	19.50	-11.66	49.24	49237.78	-2193.07	0.0469	19.50	-11.65
0.95	50.00	49.43	49431.89	-2206.76	0.0474	18.92	-11.45	49.43	49431.89	-2206.92	0.0472	18.92	-11.44
1.00	50.00	49.58	49576.55	-2226.33	0.0477	18.36	-10.86	49.58	49576.55	-2226.36	0.0475	18.37	-10.86
1.05	50.00	49.68	49684.31	-2243.90	0.0481	17.83	-10.28	49.68	49684.31	-2243.83	0.0479	17.84	-10.28
1.10	50.00	49.76	49764.61	-2258.90	0.0485	17.33	-9.75	49.76	49764.61	-2258.75	0.0483	17.34	-9.76
1.15	50.00	49.82	49824.47	-2269.02	0.0487	16.86	-9.41	49.82	49824.47	-2268.84	0.0486	16.86	-9.42
1.20	50.00	49.87	49869.05	-2271.72	0.0487	16.39	-9.39	49.87	49869.05	-2271.55	0.0486	16.39	-9.40
1.25	50.00	49.90	49902.28	-2268.37	0.0486	15.91	-9.63	49.90	49902.28	-2268.24	0.0485	15.91	-9.63
1.30	50.00	49.93	49927.03	-2261.52	0.0484	15.42	-10.01	49.93	49927.03	-2261.41	0.0484	15.42	-10.02
1.35	50.00	49.95	49945.50	-2253.56	0.0482	14.91	-10.43	49.95	49945.50	-2253.47	0.0482	14.91	-10.44
1.40	50.00	49.96	49959.23	-2246.81	0.0480	14.38	-10.79	49.96	49959.23	-2246.69	0.0480	14.38	-10.79
1.45	50.00	49.97	49969.50	-2243.42	0.0480	13.83	-10.97	49.97	49969.50	-2243.27	0.0480	13.83	-10.98
1.50	50.00	49.98	49977.14	-2244.24	0.0480	13.28	-10.95	49.98	49977.14	-2244.06	0.0480	13.28	-10.96
1.55	50.00	49.98	49982.81	-2248.14	0.0480	12.74	-10.78	49.98	49982.81	-2247.93	0.0481	12.74	-10.79
1.60	50.00	49.99	49987.08	-2253.92	0.0482	12.21	-10.51	49.99	49987.08	-2253.70	0.0482	12.21	-10.52
1.65	50.00	49.99	49990.27	-2259.89	0.0483	11.69	-10.24	49.99	49990.27	-2259.68	0.0484	11.69	-10.25
1.70	50.00	49.99	49992.61	-2265.34	0.0484	11.18	-9.98	49.99	49992.61	-2265.15	0.0485	11.18	-9.99
1.75	50.00	49.99	49994.34	-2270.17	0.0485	10.69	-9.76	49.99	49994.34	-2270.01	0.0487	10.69	-9.76
1.80	50.00	50.00	49995.66	-2274.63	0.0486	10.21	-9.55	50.00	49995.66	-2274.50	0.0488	10.21	-9.55
1.85	50.00	50.00	49996.64	-2277.67	0.0487	9.73	-9.41	50.00	49996.64	-2277.55	0.0488	9.73	-9.41
1.90	50.00	50.00	49997.34	-2275.40	0.0486	9.26	-9.51	50.00	49997.34	-2275.31	0.0488	9.26	-9.52
1.95	50.00	50.00	49997.95	-2266.47	0.0484	8.78	-9.94	50.00	49997.95	-2266.41	0.0486	8.77	-9.94

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 REAR SUSPENSION - BRAKE SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	TREADLE PRESSURE (PSI)	LEFT SIDE BRAKE PRESSURE (PSI)	LEFT SIDE BRAKE TORQUE (IN-LB)	LEFT SIDE TIRE BRAKE FORCE (LB)	LEFT SIDE WHEEL SLIP	LEFT SIDE ANGULAR WHEEL VEL. (RAD/SEC)	LEFT SIDE ANGULAR WHEEL ACCEL. (RAD/SEC)	RIGHT SIDE BRAKE PRESSURE (PSI)	RIGHT SIDE BRAKE TORQUE (IN-LB)	RIGHT SIDE TIRE BRAKE FORCE (LB)	RIGHT SIDE WHEEL SLIP	RIGHT SIDE ANGULAR WHEEL VEL (RAD/SEC)	RIGHT SIDE ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.00	-.0000	26.14	-0.00	0.0	0.0	0.00	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.03	-.0000	26.14	-0.00	0.0	0.0	0.03	-.0000	26.14	-0.00
0.15	50.00	0.27	268.45	-4.23	0.0001	26.13	-0.43	0.27	268.45	-4.23	0.0001	26.13	-0.43
0.20	50.00	5.29	5292.59	-168.04	0.0040	26.00	-4.48	5.29	5292.59	-168.04	0.0040	26.00	-4.48
0.25	50.00	15.14	15138.39	-549.96	0.0133	25.62	-9.50	15.14	15138.39	-549.96	0.0133	25.62	-9.50
0.30	50.00	24.02	24021.62	-941.82	0.0242	25.04	-11.78	24.02	24021.62	-941.82	0.0242	25.04	-11.78
0.35	50.00	30.64	30641.29	-1273.09	0.0332	24.43	-11.62	30.64	30641.29	-1273.09	0.0332	24.43	-11.62
0.40	50.00	35.57	35574.09	-1537.48	0.0393	23.86	-10.65	35.57	35574.09	-1537.47	0.0393	23.86	-10.65
0.45	50.00	39.25	39249.84	-1732.15	0.0450	23.33	-10.05	39.25	39249.84	-1732.13	0.0450	23.33	-10.05
0.50	50.00	41.99	41988.98	-1896.81	0.0504	22.85	-8.66	41.99	41988.98	-1896.76	0.0504	22.85	-8.67
0.55	50.00	44.03	44030.18	-2026.78	0.0534	22.45	-7.29	44.03	44030.18	-2026.72	0.0534	22.45	-7.29
0.60	50.00	45.55	45551.23	-2102.85	0.0552	22.08	-7.25	45.55	45551.23	-2102.81	0.0552	22.08	-7.25
0.65	50.00	46.68	46684.67	-2149.45	0.0572	21.70	-7.70	46.68	46684.67	-2149.47	0.0572	21.70	-7.70
0.70	50.00	47.53	47529.34	-2181.53	0.0583	21.30	-8.17	47.53	47529.34	-2181.66	0.0584	21.30	-8.16
0.75	50.00	48.16	48158.78	-2190.81	0.0584	20.87	-9.21	48.16	48158.78	-2191.06	0.0584	20.87	-9.20
0.80	50.00	48.63	48627.82	-2187.41	0.0585	20.37	-10.48	48.63	48627.82	-2187.75	0.0585	20.37	-10.46
0.85	50.00	48.98	48977.33	-2189.50	0.0589	19.82	-11.20	48.98	48977.33	-2189.86	0.0588	19.83	-11.18
0.90	50.00	49.24	49237.78	-2197.73	0.0590	19.26	-11.42	49.24	49237.78	-2198.02	0.0589	19.26	-11.41
0.95	50.00	49.43	49431.89	-2209.21	0.0592	18.68	-11.33	49.43	49431.89	-2209.38	0.0591	18.69	-11.33
1.00	50.00	49.58	49576.55	-2227.09	0.0598	18.13	-10.82	49.58	49576.55	-2227.11	0.0597	18.13	-10.82
1.05	50.00	49.68	49684.31	-2246.74	0.0603	17.60	-10.14	49.68	49684.31	-2246.62	0.0602	17.61	-10.15
1.10	50.00	49.76	49764.61	-2261.92	0.0606	17.11	-9.61	49.76	49764.61	-2261.70	0.0606	17.11	-9.62
1.15	50.00	49.82	49824.47	-2270.65	0.0609	16.64	-9.33	49.82	49824.47	-2270.40	0.0608	16.64	-9.35
1.20	50.00	49.87	49869.05	-2273.78	0.0610	16.17	-9.29	49.87	49869.05	-2273.56	0.0610	16.17	-9.30
1.25	50.00	49.90	49902.28	-2271.38	0.0609	15.71	-9.48	49.90	49902.28	-2271.23	0.0609	15.71	-9.49
1.30	50.00	49.93	49927.03	-2264.20	0.0607	15.22	-9.88	49.93	49927.03	-2264.12	0.0608	15.22	-9.89
1.35	50.00	49.95	49945.50	-2256.10	0.0605	14.72	-10.31	49.95	49945.50	-2256.06	0.0606	14.71	-10.31
1.40	50.00	49.96	49955.23	-2249.84	0.0604	14.19	-10.64	49.96	49955.23	-2249.81	0.0605	14.19	-10.64
1.45	50.00	49.97	49969.50	-2246.58	0.0603	13.65	-10.82	49.97	49969.50	-2246.51	0.0604	13.65	-10.83
1.50	50.00	49.98	49977.14	-2247.10	0.0603	13.11	-10.82	49.98	49977.14	-2246.98	0.0604	13.11	-10.82
1.55	50.00	49.98	49982.81	-2250.96	0.0604	12.57	-10.64	49.98	49982.81	-2250.81	0.0605	12.57	-10.65
1.60	50.00	49.99	49987.08	-2256.81	0.0605	12.05	-10.38	49.99	49987.08	-2256.65	0.0606	12.05	-10.38
1.65	50.00	49.99	49990.27	-2262.61	0.0607	11.54	-10.11	49.99	49990.27	-2262.46	0.0608	11.53	-10.11
1.70	50.00	49.99	49992.61	-2267.92	0.0608	11.04	-9.86	49.99	49992.61	-2267.81	0.0609	11.04	-9.87
1.75	50.00	49.99	49994.34	-2272.75	0.0609	10.55	-9.63	49.99	49994.34	-2272.69	0.0610	10.55	-9.64
1.80	50.00	50.00	49995.66	-2277.19	0.0610	10.07	-9.43	50.00	49995.66	-2277.15	0.0611	10.07	-9.43
1.85	50.00	50.00	49996.64	-2280.15	0.0611	9.61	-9.29	50.00	49996.64	-2280.17	0.0612	9.61	-9.29
1.90	50.00	50.00	49997.34	-2277.94	0.0611	9.14	-9.39	50.00	49997.34	-2277.97	0.0611	9.14	-9.39
1.95	50.00	50.00	49997.95	-2269.17	0.0609	8.66	-9.81	50.00	49997.95	-2269.20	0.0609	8.66	-9.81

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 REAR SUSPENSION - BRAKE SUMMARY

TRAILING TANDEM AXLE

		LEFT SIDE						RIGHT SIDE					
TIME (SEC)	TREADLE PRESSURE (PSI)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL. (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)	BRAKE PRESSURE (PSI)	BRAKE TORQUE (IN-LB)	TIRE BRAKE FORCE (LB)	WHEEL SLIP	ANGULAR WHEEL VEL (RAD/SEC)	ANGULAR WHEEL ACCEL. (RAD/SEC)
0.0	0.0	0.0	0.0	-0.0	0.0	26.14	-0.0	0.0	0.0	-0.0	0.0	26.14	-0.0
0.05	26.25	0.0	0.0	0.00	-.0000	26.14	-0.00	0.0	0.0	0.00	-.0000	26.14	-0.00
0.10	50.00	0.0	0.0	0.03	-.0000	26.14	-0.00	0.0	0.0	0.03	-.0000	26.14	-0.00
0.15	50.00	0.27	269.45	-4.23	0.0001	26.13	-0.43	0.27	268.45	-4.23	0.0001	26.13	-0.43
0.20	50.00	5.29	5292.59	-165.62	0.0040	26.00	-4.59	5.29	5292.59	-165.62	0.0040	26.00	-4.59
0.25	50.00	15.14	15138.39	-527.74	0.0144	25.59	-10.56	15.14	15138.39	-527.74	0.0144	25.59	-10.56
0.30	50.00	24.02	24021.62	-888.53	0.0291	24.92	-14.32	24.02	24021.62	-888.53	0.0291	24.92	-14.32
0.35	50.00	30.64	30641.29	-1216.71	0.0438	24.16	-14.30	30.64	30641.29	-1216.71	0.0438	24.16	-14.30
0.40	50.00	35.57	35574.09	-1492.54	0.0549	23.47	-12.79	35.57	35574.09	-1492.51	0.0549	23.47	-12.80
0.45	50.00	39.25	39249.84	-1666.64	0.0663	22.81	-13.17	39.25	39249.84	-1666.56	0.0663	22.81	-13.17
0.50	50.00	41.99	41988.98	-1831.05	0.0793	22.15	-11.80	41.99	41988.98	-1830.89	0.0793	22.15	-11.80
0.55	50.00	44.03	44030.18	-1999.11	0.0875	21.64	-8.60	44.03	44030.18	-1998.92	0.0876	21.64	-8.61
0.60	50.00	45.55	45551.23	-2077.45	0.0922	21.22	-8.46	45.55	45551.23	-2077.33	0.0922	21.22	-8.46
0.65	50.00	46.69	46684.67	-2112.10	0.0984	20.76	-9.48	46.68	46684.67	-2112.17	0.0984	20.76	-9.48
0.70	50.00	47.53	47529.34	-2166.52	0.1033	20.29	-8.88	47.53	47529.34	-2166.93	0.1034	20.29	-8.86
0.75	50.00	48.16	48158.78	-2194.06	0.1047	19.84	-9.05	48.16	48158.78	-2194.87	0.1046	19.84	-9.02
0.80	50.00	48.63	48627.82	-2183.26	0.1060	19.35	-10.67	48.63	48627.82	-2184.40	0.1058	19.35	-10.62
0.85	50.00	48.98	48977.33	-2187.51	0.1083	18.78	-11.30	48.98	48977.33	-2188.80	0.1080	18.79	-11.24
0.90	50.00	49.24	49237.78	-2208.06	0.1093	18.23	-10.93	49.24	49237.78	-2209.13	0.1089	18.24	-10.88
0.95	50.00	49.43	49431.89	-2218.29	0.1098	17.68	-10.90	49.43	49431.89	-2218.97	0.1092	17.69	-10.87
1.00	50.00	49.58	49576.55	-2231.23	0.1112	17.14	-10.63	49.58	49576.55	-2231.45	0.1106	17.15	-10.62
1.05	50.00	49.68	49684.31	-2254.75	0.1125	16.63	-9.76	49.68	49684.31	-2254.46	0.1119	16.64	-9.77
1.10	50.00	49.76	49764.61	-2272.30	0.1130	16.16	-9.11	49.76	49764.61	-2271.63	0.1124	16.17	-9.15
1.15	50.00	49.82	49824.47	-2278.78	0.1134	15.71	-8.95	49.82	49824.47	-2277.58	0.1130	15.72	-8.98
1.20	50.00	49.87	49869.05	-2282.63	0.1139	15.26	-8.87	49.87	49869.05	-2281.88	0.1136	15.27	-8.90
1.25	50.00	49.90	49902.28	-2283.17	0.1140	14.82	-8.92	49.90	49902.28	-2282.59	0.1137	14.82	-8.95
1.30	50.00	49.93	49927.03	-2276.27	0.1137	14.36	-9.31	49.93	49927.03	-2275.91	0.1135	14.37	-9.32
1.35	50.00	49.95	49945.50	-2267.89	0.1136	13.88	-9.75	49.95	49945.50	-2267.67	0.1134	13.89	-9.76
1.40	50.00	49.96	49959.23	-2262.79	0.1135	13.39	-10.03	49.96	49959.23	-2262.59	0.1133	13.39	-10.04
1.45	50.00	49.97	49969.50	-2260.05	0.1133	12.88	-10.18	49.97	49969.50	-2259.76	0.1132	12.88	-10.19
1.50	50.00	49.98	49977.14	-2259.76	0.1132	12.37	-10.21	49.98	49977.14	-2259.30	0.1132	12.37	-10.23
1.55	50.00	49.98	49982.81	-2263.25	0.1134	11.86	-10.06	49.98	49982.81	-2262.64	0.1134	11.86	-10.09
1.60	50.00	49.99	49987.08	-2269.18	0.1135	11.37	-9.79	49.99	49987.08	-2268.51	0.1136	11.37	-9.82
1.65	50.00	49.99	49990.27	-2274.53	0.1136	10.89	-9.54	49.99	49990.27	-2273.90	0.1138	10.88	-9.57
1.70	50.00	49.99	49992.61	-2279.30	0.1137	10.42	-9.32	49.99	49992.61	-2278.80	0.1141	10.41	-9.34
1.75	50.00	49.99	49994.34	-2284.01	0.1139	9.95	-9.10	49.99	49994.34	-2283.69	0.1144	9.95	-9.11
1.80	50.00	50.00	49995.66	-2288.35	0.1140	9.51	-8.89	50.00	49995.66	-2288.22	0.1145	9.50	-8.90
1.85	50.00	50.00	49996.64	-2291.13	0.1141	9.06	-8.76	50.00	49996.64	-2291.09	0.1146	9.06	-8.77
1.90	50.00	50.00	49997.34	-2289.24	0.1141	8.62	-8.66	50.00	49997.34	-2289.24	0.1146	8.62	-8.86
1.95	50.00	50.00	49997.95	-2281.17	0.1138	8.17	-9.24	50.00	49997.95	-2281.23	0.1143	8.17	-9.24

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	-0.0000	0.0000	0.0000	0.0	-0.0000	0.0000	0.0000	0.0
0.10	-0.0000	0.0004	0.0000	0.0	-0.0000	0.0004	0.0000	0.0
0.15	0.0000	-0.0008	-0.0000	0.0	0.0000	-0.0008	-0.0000	0.0
0.20	0.0000	-0.0062	-0.0000	0.0	0.0000	-0.0062	-0.0000	0.0
0.25	0.0000	-0.0037	-0.0000	0.0	0.0000	-0.0037	-0.0000	0.0
0.30	-0.0000	0.0122	0.0000	0.0	-0.0000	0.0122	0.0000	0.0
0.35	-0.0000	0.0535	0.0000	0.0	-0.0000	0.0535	0.0000	0.0
0.40	-0.0001	0.1345	0.0000	0.0	-0.0001	0.1345	0.0000	0.0
0.45	-0.0001	0.2360	0.0001	0.0	-0.0001	0.2359	0.0001	0.0
0.50	-0.0002	0.2944	0.0001	0.0	-0.0002	0.2944	0.0001	0.0
0.55	-0.0001	0.2394	0.0001	0.0	-0.0001	0.2394	0.0001	0.0
0.60	-0.0000	0.0270	0.0000	0.0	-0.0000	0.0270	0.0000	0.0
0.65	0.0002	-0.3713	-0.0001	0.0	0.0002	-0.3713	-0.0001	0.0
0.70	0.0005	-0.9262	-0.0003	0.0	0.0005	-0.9265	-0.0003	0.0
0.75	0.0009	-1.5372	-0.0005	0.0	0.0005	-1.5384	-0.0005	0.0
0.80	0.0011	-2.0560	-0.0006	0.0	0.0011	-2.0606	-0.0006	0.0
0.85	0.0013	-2.3285	-0.0007	0.0	0.0013	-2.3328	-0.0007	0.0
0.90	0.0012	-2.2563	-0.0007	0.0	0.0012	-2.2608	-0.0007	0.0
0.95	0.0010	-1.8198	-0.0006	0.0	0.0010	-1.8240	-0.0006	0.0
1.00	0.0006	-1.0353	-0.0003	0.0	0.0006	-1.0387	-0.0003	0.0
1.05	-0.0000	0.0026	0.0000	0.0	0.0000	-0.0003	-0.0000	0.0
1.10	-0.0006	1.1385	0.0003	0.0	-0.0006	1.1345	0.0003	0.0
1.15	-0.0012	2.2358	0.0007	0.0	-0.0012	2.2293	0.0007	0.0
1.20	-0.0017	3.1857	0.0010	0.0	-0.0017	3.1756	0.0010	0.0
1.25	-0.0021	3.9255	0.0012	0.0	-0.0021	3.9121	0.0012	0.0
1.30	-0.0024	4.4721	0.0014	0.0	-0.0024	4.4560	0.0014	0.0
1.35	-0.0027	4.8623	0.0015	0.0	-0.0027	4.8445	0.0015	0.0
1.40	-0.0028	5.1405	0.0016	0.0	-0.0028	5.1222	0.0016	0.0
1.45	-0.0029	5.3378	0.0016	0.0	-0.0029	5.3189	0.0016	0.0
1.50	-0.0030	5.4585	0.0017	0.0	-0.0030	5.4400	0.0017	0.0
1.55	-0.0030	5.4701	0.0017	0.0	-0.0030	5.4517	0.0017	0.0
1.60	-0.0029	5.3154	0.0016	0.0	-0.0029	5.2983	0.0016	0.0
1.65	-0.0027	4.9341	0.0015	0.0	-0.0027	4.9193	0.0015	0.0
1.70	-0.0023	4.2659	0.0013	0.0	-0.0023	4.2545	0.0013	0.0
1.75	-0.0018	3.2873	0.0010	0.0	-0.0018	3.2798	0.0010	0.0
1.80	-0.0011	2.0921	0.0006	0.0	-0.0011	2.0874	0.0006	0.0
1.85	-0.0003	0.6130	0.0002	0.0	-0.0003	0.6085	0.0002	0.0
1.90	0.0007	-1.2530	-0.0004	0.0	0.0007	-1.2620	-0.0004	0.0
1.95	0.0019	-3.4064	-0.0010	0.0	0.0019	-3.4267	-0.0010	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

TRAILING TANDEM AXLE

	LEFT SIDE				RIGHT SIDE			
TIME (SEC)	TIRE SIDESLIP ANGLE (DEG)	TIRE LATERAL FORCE (LB)	MU-Y	ALIGNING TORQUE (IN-LB)	TIRE SIDESLIP ANGLE (DEG)	TIRE LATERAL FORCE (LB)	MU-Y	ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	-0.0000	0.0000	0.0000	0.0	-0.0000	0.0000	0.0000	0.0
0.10	-0.0000	0.0005	0.0000	0.0	-0.0000	0.0005	0.0000	0.0
0.15	0.0000	-0.0007	-0.0000	0.0	0.0000	-0.0007	-0.0000	0.0
0.20	0.0000	-0.0067	-0.0000	0.0	0.0000	-0.0067	-0.0000	0.0
0.25	0.0000	-0.0056	-0.0000	0.0	0.0000	-0.0056	-0.0000	0.0
0.30	-0.0000	0.0084	0.0000	0.0	-0.0000	0.0084	0.0000	0.0
0.35	-0.0000	0.0481	0.0000	0.0	-0.0000	0.0481	0.0000	0.0
0.40	-0.0001	0.1316	0.0001	0.0	-0.0001	0.1316	0.0001	0.0
0.45	-0.0002	0.2525	0.0001	0.0	-0.0002	0.2524	0.0001	0.0
0.50	-0.0003	0.3643	0.0002	0.0	-0.0003	0.3642	0.0002	0.0
0.55	-0.0003	0.3960	0.0002	0.0	-0.0003	0.3958	0.0002	0.0
0.60	-0.0002	0.2864	0.0001	0.0	-0.0002	0.2863	0.0001	0.0
0.65	0.0000	-0.0250	-0.0000	0.0	0.0000	-0.0250	-0.0000	0.0
0.70	0.0004	-0.5700	-0.0002	0.0	0.0004	-0.5701	-0.0002	0.0
0.75	0.0010	-1.3114	-0.0005	0.0	0.0010	-1.3126	-0.0005	0.0
0.80	0.0016	-2.1574	-0.0009	0.0	0.0016	-2.1611	-0.0009	0.0
0.85	0.0022	-2.9761	-0.0012	0.0	0.0022	-2.9836	-0.0012	0.0
0.90	0.0027	-3.6441	-0.0015	0.0	0.0027	-3.6558	-0.0015	0.0
0.95	0.0031	-4.0936	-0.0017	0.0	0.0031	-4.1084	-0.0017	0.0
1.00	0.0032	-4.2868	-0.0018	0.0	0.0032	-4.3026	-0.0018	0.0
1.05	0.0032	-4.2233	-0.0018	0.0	0.0032	-4.2381	-0.0018	0.0
1.10	0.0030	-3.9722	-0.0017	0.0	0.0030	-3.9846	-0.0017	0.0
1.15	0.0027	-3.6278	-0.0015	0.0	0.0027	-3.6375	-0.0015	0.0
1.20	0.0024	-3.2621	-0.0014	0.0	0.0024	-3.2695	-0.0014	0.0
1.25	0.0022	-2.9165	-0.0012	0.0	0.0022	-2.9224	-0.0012	0.0
1.30	0.0019	-2.5887	-0.0011	0.0	0.0019	-2.5935	-0.0011	0.0
1.35	0.0017	-2.2505	-0.0009	0.0	0.0017	-2.2546	-0.0009	0.0
1.40	0.0014	-1.8466	-0.0008	0.0	0.0014	-1.8520	-0.0008	0.0
1.45	0.0010	-1.3389	-0.0006	0.0	0.0010	-1.3414	-0.0006	0.0
1.50	0.0005	-0.7001	-0.0003	0.0	0.0005	-0.7019	-0.0003	0.0
1.55	-0.0000	0.0605	0.0000	0.0	-0.0000	0.0598	0.0000	0.0
1.60	-0.0007	0.9129	0.0004	0.0	-0.0007	0.9104	0.0004	0.0
1.65	-0.0014	1.8110	0.0008	0.0	-0.0014	1.8064	0.0008	0.0
1.70	-0.0020	2.7011	0.0011	0.0	-0.0020	2.6934	0.0011	0.0
1.75	-0.0027	3.5456	0.0015	0.0	-0.0027	3.5343	0.0015	0.0
1.80	-0.0033	4.4181	0.0018	0.0	-0.0033	4.4025	0.0018	0.0
1.85	-0.0040	5.3129	0.0022	0.0	-0.0040	5.2924	0.0022	0.0
1.90	-0.0046	6.1249	0.0025	0.0	-0.0046	6.0992	0.0025	0.0
1.95	-0.0051	6.8227	0.0028	0.0	-0.0051	6.7919	0.0028	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY

LEADING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	C.0	0.0	0.0	0.0	C.0	0.0
0.05	0.0000	-C.0CCC	-0.0CC0	0.0	0.000C	-0.00C0	-C.0000	0.0
0.10	0.0000	-0.0001	-C.0CCC	0.0	0.000C	-0.0001	-C.0000	0.0
0.15	0.C000	-G.CC0C	-0.000C	0.0	0.00CC	-0.00C0	-C.0000	0.0
0.20	-0.0000	0.0015	C.00CC	0.0	-0.000C	0.0015	C.0000	0.0
0.25	-0.0000	C.0017	C.00CC	C.0	-C.00CC	0.0017	0.0000	0.0
0.30	0.0000	-0.0027	-C.0CCC	0.0	0.000C	-0.0027	-C.00C0	0.0
0.35	0.0000	-C.0125	-C.00C0	0.0	0.00CC	-0.0125	-C.0000	0.0
0.40	C.0000	-0.03C7	-C.0CC0	0.0	C.000C	-0.03C7	-0.0000	0.0
0.45	0.0000	-C.C499	-0.0CCC	0.0	0.00CC	-0.0499	-C.0000	C.0
0.50	0.0000	-0.0515	-C.00C0	0.0	0.00C0	-0.0515	-0.0000	0.0
0.55	C.C000	-0.0142	-C.0CC0	0.0	0.00CC	-0.0142	-C.00C0	0.0
0.60	-0.0001	C.0666	C.0CCC	0.0	-0.0001	0.0665	C.0000	C.0
0.65	-0.0002	0.1756	C.0CC1	0.0	-C.0002	0.1756	C.0001	C.0
0.70	-0.0003	C.2863	0.0001	C.0	-0.0003	0.2862	C.00C1	C.0
0.75	-0.0003	0.3547	C.0CC2	0.0	-0.0003	0.3548	C.0002	0.0
0.80	-0.0C03	0.3437	C.0CC2	C.0	-0.0003	0.3439	C.0002	0.0
0.85	-0.0002	0.2442	C.0001	0.0	-0.0002	0.2445	C.0001	0.0
0.90	-0.0001	0.0843	C.0CCC	0.0	-C.0001	0.0845	C.00C0	C.0
0.95	0.0001	-C.0681	-0.0000	0.0	0.0001	-0.0682	-0.0000	0.0
1.00	0.0001	-0.1537	-C.0CC1	0.0	0.0001	-0.1540	-C.0001	C.0
1.05	0.0001	-C.1425	-C.00C1	0.0	0.00C1	-0.1427	-C.0001	0.0
1.10	C.0000	-0.0239	-C.0000	0.0	0.00CC	-0.0239	-C.00C0	0.0
1.15	-0.0002	C.1705	0.0001	C.0	-0.0002	0.1705	0.0001	C.0
1.20	-0.0004	0.3819	C.0002	C.0	-C.0004	0.3818	0.0002	C.0
1.25	-C.0005	0.5611	0.0003	0.0	-0.0005	0.5606	C.0003	0.0
1.30	-0.0006	C.66CC	C.0003	C.0	-C.0006	0.6593	C.0003	0.0
1.35	-0.0006	C.66CC	C.0003	0.0	-0.0006	0.6591	0.0003	0.0
1.40	-C.0005	C.5845	C.00C3	0.0	-0.0005	0.5838	C.0003	C.0
1.45	-C.0004	0.4765	0.0002	0.0	-C.0004	0.4759	C.0002	0.0
1.50	-C.0004	C.3759	0.0002	0.0	-C.0004	0.3753	0.0002	0.0
1.55	-C.0003	0.3059	0.0002	0.0	-0.0003	0.3054	0.0002	0.0
1.60	-0.0002	C.2615	C.0001	0.0	-C.0002	0.2610	C.0001	0.0
1.65	-0.0002	0.2084	C.0CC1	C.0	-0.0002	0.2080	C.0001	0.0
1.70	-0.0001	C.C991	C.0CC1	C.0	-0.0001	0.0989	0.0001	0.0
1.75	0.0001	-C.1064	-0.0001	C.0	0.C0C1	-0.1062	-C.0001	0.0
1.80	0.0004	-C.4718	-C.0CC2	0.0	0.0004	-0.4711	-C.0002	0.0
1.85	0.0009	-C.9957	-C.0CC5	C.0	0.0009	-0.9950	-0.0005	0.0
1.90	0.0015	-1.5845	-0.0008	0.0	0.0015	-1.5846	-C.0008	0.0
1.95	C.0020	-2.16EE	-C.0011	C.0	0.C020	-2.1710	-C.0011	C.0

TRAILER NO. 3 REAR SUSPENSION - LATERAL TIRE FORCE AND MOMENT SUMMARY
TRAILING TANDEM AXLE

TIME (SEC)	LEFT SIDE TIRE SIDESLIP ANGLE (DEG)	LEFT SIDE TIRE LATERAL FORCE (LB)	LEFT SIDE MU-Y	LEFT SIDE ALIGNING TORQUE (IN-LB)	RIGHT SIDE TIRE SIDESLIP ANGLE (DEG)	RIGHT SIDE TIRE LATERAL FORCE (LB)	RIGHT SIDE MU-Y	RIGHT SIDE ALIGNING TORQUE (IN-LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0000	-0.0000	-0.0000	0.0	0.0000	-0.0000	-0.0000	0.0
0.10	0.0000	-0.0000	-0.0000	0.0	0.0000	-0.0000	-0.0000	0.0
0.15	-0.0000	0.0001	0.0000	0.0	-0.0000	0.0001	0.0000	0.0
0.20	-0.0000	0.0008	0.0000	0.0	-0.0000	0.0008	0.0000	0.0
0.25	0.0000	-0.0004	-0.0000	0.0	0.0000	-0.0004	-0.0000	0.0
0.30	0.0000	-0.0034	-0.0000	0.0	0.0000	-0.0034	-0.0000	0.0
0.35	0.0000	-0.0062	-0.0000	0.0	0.0000	-0.0062	-0.0000	0.0
0.40	0.0000	-0.0060	-0.0000	0.0	0.0000	-0.0060	-0.0000	0.0
0.45	-0.0000	0.0060	0.0000	0.0	-0.0000	0.0060	0.0000	0.0
0.50	-0.0001	0.0384	0.0000	0.0	-0.0001	0.0384	0.0000	0.0
0.55	-0.0002	0.0985	0.0001	0.0	-0.0002	0.0985	0.0001	0.0
0.60	-0.0003	0.1698	0.0001	0.0	-0.0003	0.1698	0.0001	0.0
0.65	-0.0004	0.2163	0.0002	0.0	-0.0004	0.2162	0.0002	0.0
0.70	-0.0004	0.2123	0.0002	0.0	-0.0004	0.2123	0.0002	0.0
0.75	-0.0002	0.1175	0.0001	0.0	-0.0002	0.1176	0.0001	0.0
0.80	0.0002	-0.0956	-0.0001	0.0	0.0002	-0.0958	-0.0001	0.0
0.85	0.0007	-0.4151	-0.0004	0.0	0.0007	-0.4165	-0.0004	0.0
0.90	0.0014	-0.8166	-0.0008	0.0	0.0014	-0.8201	-0.0008	0.0
0.95	0.0021	-1.2353	-0.0012	0.0	0.0021	-1.2417	-0.0012	0.0
1.00	0.0028	-1.6017	-0.0015	0.0	0.0028	-1.6104	-0.0015	0.0
1.05	0.0033	-1.8926	-0.0018	0.0	0.0033	-1.9024	-0.0018	0.0
1.10	0.0036	-2.0870	-0.0020	0.0	0.0036	-2.0962	-0.0020	0.0
1.15	0.0038	-2.1752	-0.0021	0.0	0.0038	-2.1827	-0.0021	0.0
1.20	0.0038	-2.1926	-0.0021	0.0	0.0038	-2.1981	-0.0021	0.0
1.25	0.0038	-2.1795	-0.0021	0.0	0.0038	-2.1833	-0.0021	0.0
1.30	0.0038	-2.1548	-0.0021	0.0	0.0038	-2.1576	-0.0021	0.0
1.35	0.0037	-2.1234	-0.0021	0.0	0.0037	-2.1257	-0.0021	0.0
1.40	0.0036	-2.0749	-0.0020	0.0	0.0036	-2.0768	-0.0020	0.0
1.45	0.0035	-1.9782	-0.0019	0.0	0.0035	-1.9795	-0.0019	0.0
1.50	0.0032	-1.7976	-0.0017	0.0	0.0032	-1.7978	-0.0017	0.0
1.55	0.0027	-1.5142	-0.0015	0.0	0.0027	-1.5132	-0.0015	0.0
1.60	0.0020	-1.1282	-0.0011	0.0	0.0020	-1.1263	-0.0011	0.0
1.65	0.0011	-0.6553	-0.0006	0.0	0.0011	-0.6535	-0.0006	0.0
1.70	0.0002	-0.1245	-0.0001	0.0	0.0002	-0.1241	-0.0001	0.0
1.75	-0.0008	0.4330	0.0004	0.0	-0.0008	0.4311	0.0004	0.0
1.80	-0.0017	0.9857	0.0010	0.0	-0.0017	0.9812	0.0010	0.0
1.85	-0.0027	1.5504	0.0015	0.0	-0.0027	1.5433	0.0015	0.0
1.90	-0.0038	2.1684	0.0021	0.0	-0.0038	2.1587	0.0021	0.0
1.95	-0.0049	2.8225	0.0027	0.0	-0.0049	2.8108	0.0027	0.0

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT SUSPENSION - UNSPRUNG MASS SUMMARY

LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.0
0.05	0.0	0.0000	0.0	-0.0000	0.00	-0.0000	-0.0000	-0.00	-0.0000	-0.0000	-0.00
0.10	0.0	-0.0000	0.0	-0.0000	-0.00	-0.0000	-0.0000	-0.01	-0.0000	-0.0000	-0.01
0.15	0.0000	-0.0000	0.0006	0.0000	0.00	0.0000	-0.0037	-3.91	0.0000	0.0037	-3.91
0.20	0.0005	0.0000	0.0226	0.0000	0.02	0.0017	-0.0098	-76.18	0.0017	-0.0098	-76.18
0.25	0.0025	0.0000	0.0556	-0.0000	-0.02	-0.0024	-0.2289	-296.59	-0.0024	-0.2289	-296.59
0.30	0.0052	-0.0000	0.0458	-0.0000	-0.10	-0.0172	-0.2752	-565.27	-0.0172	-0.2752	-565.29
0.35	0.0066	-0.0000	0.0126	-0.0001	-0.13	-0.0256	0.0109	-709.99	-0.0256	0.0106	-710.01
0.40	0.0071	-0.0000	0.0121	-0.0003	-0.01	-0.0235	0.0160	-774.75	-0.0235	0.0161	-774.74
0.45	0.0080	-0.0000	0.0235	-0.0004	0.50	-0.0262	-0.1372	-874.37	-0.0262	-0.1365	-874.27
0.50	0.0085	-0.0001	0.0106	-0.0003	1.63	-0.0325	-0.0543	-960.26	-0.0325	-0.0536	-959.97
0.55	0.0091	-0.0001	0.0061	0.0000	3.24	-0.0327	0.0456	-984.27	-0.0326	0.0462	-983.74
0.60	0.0093	-0.0000	0.0083	0.0006	4.59	-0.0316	-0.0341	-1009.69	-0.0315	-0.0338	-1008.97
0.65	0.0098	0.0000	0.0089	0.0014	4.73	-0.0346	-0.0678	-1056.10	-0.0345	-0.0681	-1055.41
0.70	0.0100	0.0001	0.0007	0.0022	2.73	-0.0367	0.0031	-1078.83	-0.0367	0.0018	-1078.51
0.75	0.0100	0.0002	0.0013	0.0026	-2.01	-0.0361	0.0066	-1083.83	-0.0361	0.0043	-1084.31
0.80	0.0102	0.0003	0.0049	0.0025	-9.27	-0.0367	-0.0352	-1101.16	-0.0368	-0.0383	-1102.77
0.85	0.0104	0.0005	0.0017	0.0017	-18.00	-0.0383	-0.0140	-1117.34	-0.0386	-0.0173	-1120.27
0.90	0.0104	0.0005	-0.0010	0.0003	-26.37	-0.0382	0.0169	-1117.66	-0.0387	0.0141	-1121.79
0.95	0.0104	0.0005	0.0005	-0.0013	-32.45	-0.0376	0.0010	-1117.51	-0.0382	-0.0007	-1122.44
1.00	0.0104	0.0004	0.0013	-0.0029	-35.08	-0.0379	-0.0087	-1123.31	-0.0385	-0.0090	-1128.52
1.05	0.0104	0.0002	-0.0006	-0.0040	-34.02	-0.0380	0.0065	-1124.71	-0.0387	0.0076	-1129.66
1.10	0.0104	-0.0000	-0.0004	-0.0045	-29.83	-0.0376	0.0068	-1122.57	-0.0382	0.0088	-1126.83
1.15	0.0104	-0.0002	0.0006	-0.0043	-23.94	-0.0375	-0.0063	-1124.55	-0.0380	-0.0040	-1127.91
1.20	0.0105	-0.0004	0.0004	-0.0035	-18.03	-0.0379	-0.0057	-1128.23	-0.0383	-0.0037	-1130.73
1.25	0.0105	-0.0006	-0.0001	-0.0024	-13.42	-0.0381	0.0003	-1129.22	-0.0383	0.0016	-1131.10
1.30	0.0105	-0.0007	0.0004	-0.0015	-10.81	-0.0381	-0.0033	-1130.20	-0.0383	-0.0027	-1131.75
1.35	0.0105	-0.0007	0.0006	-0.0008	-9.87	-0.0383	-0.0061	-1132.82	-0.0385	-0.0059	-1134.27
1.40	0.0105	-0.0008	0.0001	-0.0005	-9.52	-0.0386	-0.0014	-1134.34	-0.0387	-0.0012	-1135.73
1.45	0.0105	-0.0008	-0.0001	-0.0005	-8.44	-0.0386	0.0011	-1134.19	-0.0387	0.0018	-1135.37
1.50	0.0105	-0.0008	0.0001	-0.0006	-5.61	-0.0385	-0.0006	-1134.30	-0.0386	0.0009	-1134.99
1.55	0.0105	-0.0008	-0.0000	-0.0005	-0.64	-0.0396	-0.0003	-1134.70	-0.0386	0.0019	-1134.60
1.60	0.0105	-0.0009	-0.0002	-0.0001	6.06	-0.0386	0.0015	-1134.40	-0.0385	0.0042	-1133.26
1.65	0.0105	-0.0009	-0.0001	0.0007	13.46	-0.0385	0.0007	-1133.98	-0.0382	0.0035	-1131.75
1.70	0.0105	-0.0008	-0.0000	0.0019	20.33	-0.0385	-0.0005	-1134.13	-0.0381	0.0019	-1130.90
1.75	0.0105	-0.0007	-0.0001	0.0032	25.63	-0.0385	0.0005	-1134.14	-0.0380	0.0021	-1130.19
1.80	0.0105	-0.0005	-0.0001	0.0043	28.54	-0.0384	0.0015	-1133.63	-0.0379	0.0021	-1129.33
1.85	0.0105	-0.0002	-0.0000	0.0055	29.81	-0.0384	0.0004	-1133.29	-0.0378	0.0007	-1128.81
1.90	0.0105	0.0001	0.0002	0.0066	30.84	-0.0384	-0.0023	-1133.86	-0.0378	-0.0019	-1129.21
1.95	0.0105	0.0004	0.0004	0.0073	31.60	-0.0386	-0.0044	-1135.38	-0.0380	-0.0043	-1130.63

SAMPLE RUN - TRIPLES BRAKING IN A TURN, ALL OPTIONS EXERCISED

TRAILER NO. 3 FRONT SUSPENSION - UNSPRUNG MASS SUMMARY

TRAILING TANDEM AXLE

	AXLE MOTION				DYNAMIC SUSPENSION MOTIONS AND FORCES						
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	C.0	0.0	C.0	0.C	0.0	0.0	C.0	0.0	G.0	0.C	0.0
0.05	C.0	0.COCC	0.0	-0.C000	0.00	-0.0000	-C.0000	-0.00	-0.0000	-C.C000	-0.CC
0.10	C.0	-0.00C0	0.C	-C.C000	-C.00	-0.0000	-C.0000	-0.00	-0.00CC	-0.C000	-0.00
0.15	-C.00C0	-0.0000	-0.0CC2	C.0000	C.00	-0.0000	-C.0047	1.62	-0.00CC	-C.C047	1.62
0.20	-0.0000	0.0000	0.CC1S	C.0000	C.02	-0.0032	-C.1746	-0.44	-0.0032	-C.1746	-C.44
0.25	C.0004	0.00C0	0.C161	-0.0000	-0.02	-0.0170	-C.4205	-53.08	-0.0170	-0.4206	-53.08
0.30	0.0013	0.COCC	0.C15S	-C.0000	-C.08	-0.0383	-C.3694	-140.51	-0.0383	-0.3694	-14C.52
0.35	C.0016	-0.COC0	-0.C03S	-C.C001	-C.11	-0.0521	-C.1285	-166.46	-0.0521	-C.1285	-166.48
0.40	C.0014	-0.0000	-0.0CC4	-C.C003	-C.C1	-0.0566	-C.0935	-156.31	-0.0566	-C.C935	-156.3C
0.45	C.0017	-0.0000	0.CC97	-C.0005	C.43	-0.0630	-C.1737	-184.95	-0.0630	-0.1734	-184.87
0.50	C.0020	-0.0001	0.CC1E	-C.C005	1.37	-0.0707	-C.0929	-213.52	-0.07C7	-C.C925	-213.28
0.55	C.0019	-0.0001	-0.CC37	-0.0002	2.64	-0.0732	-C.0096	-206.67	-0.0732	-0.C092	-206.24
0.60	C.0019	-0.00C1	0.CC32	C.C004	3.60	-0.0743	-C.0573	-207.67	-0.0742	-0.C571	-207.12
0.65	0.0021	-0.0000	0.C041	0.0013	3.40	-0.0779	-C.0716	-227.70	-0.0778	-0.0720	-227.22
0.70	C.0022	0.00C1	-0.C012	0.0023	1.34	-0.0804	-C.0141	-233.67	-0.08C3	-0.C153	-233.56
0.75	0.0021	0.0002	-0.CCC2	0.0031	-2.92	-0.0806	-C.0084	-229.84	-0.08C7	-0.0104	-230.41
0.80	C.C022	0.0004	C.CC27	0.C034	-8.95	-0.0816	-C.0355	-237.00	-0.0818	-0.C37S	-238.50
0.85	0.0023	0.0005	0.CCC5	0.0031	-15.58	-0.0832	-C.0170	-244.50	-0.0835	-0.0194	-246.9E
0.90	0.0023	0.0007	-C.CC13	0.0021	-21.08	-0.0835	C.0069	-241.55	-0.0839	0.0053	-244.7E
0.95	C.0022	0.00C7	0.00C3	C.C008	-23.71	-0.0832	-C.0039	-239.32	-0.0837	-0.C042	-242.82
1.00	0.0023	0.C007	C.CCCE	-C.C007	-22.53	-0.0837	-C.0102	-242.14	-0.0841	-0.0090	-245.34
1.05	0.0023	0.00C7	-0.0CCE	-0.C019	-17.62	-0.0840	C.0018	-242.17	-0.0843	0.0042	-244.55
1.10	0.0022	C.CCC5	-C.CCC4	-0.C026	-9.95	-0.0838	C.0025	-239.94	-0.084C	0.0057	-241.14
1.15	C.0022	0.0004	0.CCC9	-0.C028	-1.09	-0.0838	-C.C067	-241.01	-0.0839	-0.C034	-240.90
1.20	C.0023	C.0003	0.CCC2	-0.C024	7.14	-0.0842	-C.CC58	-243.46	-0.0841	-0.0031	-242.18
1.25	0.C022	0.0002	-0.CCC2	-0.C018	13.33	-0.0844	-C.0009	-243.96	-0.0841	0.C010	-241.8E
1.30	C.0022	0.0001	0.00C2	-0.C012	16.83	-0.0844	-C.0030	-244.44	-0.0841	-0.C022	-241.91
1.35	C.C023	0.00C1	0.CCC4	-0.0009	18.00	-0.0847	-C.0048	-246.14	-0.0843	-C.C047	-243.50
1.40	C.0023	0.C000	0.CCCC	-0.C010	17.91	-0.0848	-C.C013	-247.06	-0.0845	-0.C014	-244.45
1.45	0.0023	-0.00C0	-0.CCC1	-0.C014	17.80	-0.0848	C.0008	-246.75	-0.0845	C.0009	-244.15
1.50	C.C023	-0.0001	0.CCCC	-0.C020	18.67	-0.0848	-C.0003	-246.63	-0.0845	C.C002	-243.8E
1.55	C.0023	-0.0002	-C.CCCC	-0.C024	20.78	-0.0848	-C.0001	-246.74	-0.0845	0.C00S	-243.63
1.60	C.0023	-0.0004	-0.00C2	-0.C02E	23.61	-0.0848	C.C014	-246.31	-0.0844	C.C025	-242.78
1.65	0.0023	-C.00C5	-0.CCC1	-0.0024	2E.09	-0.0847	C.0011	-245.74	-0.0842	0.C01E	-241.88
1.70	0.0023	-0.0006	-0.CCCC	-0.C01E	2E.95	-0.0847	C.0005	-245.48	-0.0842	0.C003	-241.5E
1.75	C.C023	-0.00C7	-0.CCC1	-0.C01C	2S.19	-0.0847	C.0015	-245.04	-0.0842	C.C002	-241.4E
1.80	C.0022	-0.0007	-0.CCC1	-C.C005	20.11	-0.0845	C.0025	-244.09	-0.0842	C.00C0	-241.38
1.85	0.0022	-0.C0C7	-0.00CC	-C.C00C	12.20	-0.0844	C.C020	-243.16	-0.0842	-0.C013	-241.67
1.90	0.0022	-0.0007	0.CCC1	0.0005	2.80	-0.0844	C.0003	-242.79	-0.0843	-0.0034	-242.72
1.95	0.0023	-0.C0C7	0.CCC2	C.C00S	-7.61	-0.0844	-C.C011	-243.07	-0.0845	-C.0053	-244.56

TRAILER NO. 3 REAR SUSPENSION - UNSPRUNG MASS SUMMARY
LEADING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.0
0.05	0.0	-0.0000	0.0	-0.0000	-0.00	0.0000	0.0000	0.00	0.0000	0.0000	0.00
0.10	0.0	0.0000	0.0	-0.0000	0.00	0.0000	0.0000	0.00	0.0000	0.0000	0.00
0.15	0.0000	-0.0000	0.0005	-0.0000	0.00	0.0000	0.0092	-3.23	0.0000	0.0092	-3.23
0.20	0.0001	-0.0000	0.0005	-0.0000	-0.01	0.0059	0.2850	-10.41	0.0059	0.2850	-10.42
0.25	-0.0003	0.0000	-0.0177	0.0000	-0.05	0.0283	0.6550	41.70	0.0283	0.6545	41.69
0.30	-0.0014	0.0000	-0.0201	0.0000	-0.06	0.0616	0.5912	146.71	0.0616	0.5912	146.71
0.35	-0.0017	0.0000	0.0055	-0.0000	0.07	0.0843	0.2562	176.76	0.0843	0.2563	176.78
0.40	-0.0014	-0.0000	0.0031	-0.0001	0.51	0.0932	0.1611	153.95	0.0932	0.1613	154.04
0.45	-0.0016	-0.0000	-0.0112	-0.0002	1.44	0.1032	0.2525	180.80	0.1032	0.2525	181.05
0.50	-0.0021	-0.0000	-0.0031	-0.0003	2.80	0.1149	0.1650	216.84	0.1150	0.1655	217.29
0.55	-0.0020	-0.0000	0.0045	-0.0003	4.10	0.1200	0.0435	209.49	0.1201	0.0435	210.13
0.60	-0.0019	-0.0000	-0.0024	-0.0002	4.45	0.1223	0.0768	205.40	0.1224	0.0766	206.04
0.65	-0.0021	-0.0000	-0.0045	0.0002	2.86	0.1270	0.0996	226.10	0.1271	0.0986	226.42
0.70	-0.0022	-0.0000	0.0005	0.0008	-1.40	0.1309	0.0386	235.45	0.1309	0.0364	235.06
0.75	-0.0021	0.0000	0.0007	0.0014	-8.41	0.1320	0.0201	231.88	0.1315	0.0170	230.38
0.80	-0.0022	0.0001	-0.0025	0.0019	-17.29	0.1335	0.0443	238.40	0.1332	0.0408	235.56
0.85	-0.0023	0.0002	-0.0006	0.0019	-26.36	0.1356	0.0289	247.41	0.1352	0.0257	243.27
0.90	-0.0023	0.0003	0.0012	0.0014	-33.53	0.1364	0.0021	246.33	0.1358	0.0000	241.23
0.95	-0.0022	0.0004	-0.0001	0.0005	-37.06	0.1365	0.0069	244.16	0.1358	0.0064	238.68
1.00	-0.0023	0.0003	-0.0006	-0.0006	-36.11	0.1370	0.0105	246.03	0.1363	0.0117	240.83
1.05	-0.0023	0.0003	0.0005	-0.0016	-30.87	0.1373	-0.0014	245.34	0.1367	0.0013	241.03
1.10	-0.0022	0.0002	0.0004	-0.0023	-22.58	0.1371	-0.0033	242.32	0.1367	0.0002	239.29
1.15	-0.0022	0.0001	-0.0004	-0.0024	-13.11	0.1371	0.0040	241.94	0.1368	0.0075	240.31
1.20	-0.0022	-0.0000	-0.0002	-0.0021	-4.29	0.1373	0.0032	242.86	0.1372	0.0062	242.48
1.25	-0.0022	-0.0001	0.0001	-0.0014	2.46	0.1374	-0.0000	242.55	0.1374	0.0020	243.08
1.30	-0.0023	-0.0002	-0.0002	-0.0007	6.69	0.1374	0.0030	242.77	0.1376	0.0042	243.84
1.35	-0.0023	-0.0002	-0.0003	-0.0001	8.95	0.1376	0.0046	244.22	0.1378	0.0052	245.58
1.40	-0.0023	-0.0002	0.0001	0.0000	10.40	0.1378	0.0010	244.88	0.1380	0.0015	246.46
1.45	-0.0023	-0.0002	0.0001	-0.0001	12.32	0.1378	-0.0009	244.46	0.1380	0.0001	246.35
1.50	-0.0023	-0.0002	-0.0001	-0.0005	15.61	0.1378	-0.0003	244.10	0.1381	0.0012	246.53
1.55	-0.0023	-0.0003	0.0001	-0.0008	20.43	0.1377	-0.0015	243.63	0.1381	0.0006	246.80
1.60	-0.0023	-0.0003	0.0002	-0.0009	26.15	0.1376	-0.0031	242.48	0.1381	-0.0009	246.51
1.65	-0.0023	-0.0003	0.0001	-0.0007	31.65	0.1375	-0.0021	241.39	0.1381	-0.0003	246.20
1.70	-0.0023	-0.0004	0.0000	-0.0000	35.66	0.1374	-0.0008	240.90	0.1381	0.0003	246.23
1.75	-0.0023	-0.0003	0.0001	0.0009	37.15	0.1374	-0.0009	240.53	0.1381	-0.0009	246.00
1.80	-0.0022	-0.0003	0.0001	0.0019	35.87	0.1373	-0.0008	240.11	0.1380	-0.0017	245.32
1.85	-0.0022	-0.0002	0.0000	0.0026	32.52	0.1373	0.0005	240.08	0.1379	-0.0010	244.75
1.90	-0.0022	-0.0000	-0.0001	0.0029	27.57	0.1374	0.0027	240.83	0.1379	0.0006	244.72
1.95	-0.0023	0.0001	-0.0002	0.0031	21.20	0.1375	0.0045	242.36	0.1379	0.0018	245.28

TRAILER NO. 3 REAR SUSPENSION - UNSPRUNG MASS SUMMARY

TRAILING TANDEM AXLE

	AXLE MOTION					DYNAMIC SUSPENSION MOTIONS AND FORCES					
	POSITION		VELOCITY			LEFT SIDE			RIGHT SIDE		
TIME (SEC)	VERTICAL (FT)	ROLL (DEG)	VERTICAL (FT/SEC)	ROLL (DEG/SEC)	AUXILIARY ROLL TORQUE (IN-LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)	SUSP. DEFLECT. (IN)	SUSP. VELOCITY (IN/SEC)	SUSP. FORCE (LB)
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0	-0.0000	0.0	-0.0000	-0.00	0.0000	0.0000	0.00	0.0000	0.0000	0.00
0.10	0.0	0.0000	0.0	-0.0000	0.00	0.0000	0.0000	0.01	0.0000	0.0000	0.01
0.15	-0.0000	-0.0000	-0.0003	-0.0000	0.00	-0.0000	0.0008	2.30	-0.0000	0.0008	2.30
0.20	-0.0004	-0.0000	-0.0202	0.0000	-0.01	0.0010	0.1202	65.32	0.0010	0.1202	65.32
0.25	-0.0023	0.0000	-0.0571	0.0000	-0.04	0.0138	0.4633	285.21	0.0138	0.4633	285.20
0.30	-0.0053	0.0000	-0.0501	0.0000	-0.05	0.0404	0.4970	571.48	0.0404	0.4970	571.48
0.35	-0.0068	0.0000	-0.0100	-0.0000	0.05	0.0578	0.1169	720.30	0.0578	0.1170	720.31
0.40	-0.0070	-0.0000	-0.0054	-0.0001	0.42	0.0601	0.0515	772.40	0.0602	0.0517	772.48
0.45	-0.0080	-0.0000	-0.0250	-0.0003	1.21	0.0664	0.2160	870.23	0.0664	0.2164	870.44
0.50	-0.0090	-0.0000	-0.0113	-0.0004	2.43	0.0767	0.1264	963.58	0.0767	0.1265	963.98
0.55	-0.0091	-0.0000	0.0011	-0.0004	3.63	0.0795	-0.0118	987.08	0.0796	-0.0114	987.64
0.60	-0.0093	-0.0001	-0.0079	-0.0001	4.01	0.0795	0.0535	1007.37	0.0796	0.0534	1007.94
0.65	-0.0098	-0.0001	-0.0056	0.0004	2.68	0.0837	0.0958	1054.40	0.0838	0.0948	1054.71
0.70	-0.0100	-0.0000	-0.0010	0.0011	-1.12	0.0872	0.0213	1080.47	0.0872	0.0194	1080.15
0.75	-0.0100	0.0001	-0.0008	0.0019	-7.46	0.0875	0.0050	1085.74	0.0873	0.0023	1084.41
0.80	-0.0102	0.0002	-0.0047	0.0024	-15.51	0.0886	0.0442	1102.47	0.0883	0.0410	1099.53
0.85	-0.0104	0.0003	-0.0020	0.0024	-23.69	0.0907	0.0262	1120.27	0.0903	0.0233	1116.56
0.90	-0.0104	0.0004	0.0005	0.0020	-29.91	0.0912	-0.0074	1122.61	0.0907	-0.0091	1118.09
0.95	-0.0104	0.0005	-0.0007	0.0011	-32.40	0.0909	0.0024	1122.71	0.0903	0.0023	1117.96
1.00	-0.0104	0.0005	-0.0012	0.0000	-30.37	0.0913	0.0096	1127.76	0.0907	0.0112	1123.45
1.05	-0.0104	0.0005	0.0004	-0.0009	-23.98	0.0915	-0.0057	1128.64	0.0910	-0.0026	1125.39
1.10	-0.0104	0.0004	0.0003	-0.0016	-14.49	0.0911	-0.0072	1125.86	0.0908	-0.0033	1124.07
1.15	-0.0104	0.0003	-0.0007	-0.0018	-3.92	0.0909	0.0039	1126.52	0.0908	0.0078	1126.28
1.20	-0.0105	0.0002	-0.0004	-0.0016	5.78	0.0912	0.0033	1128.77	0.0913	0.0066	1129.90
1.25	-0.0105	0.0002	0.0001	-0.0011	13.19	0.0912	-0.0010	1129.00	0.0915	0.0012	1131.13
1.30	-0.0105	0.0001	-0.0004	-0.0006	17.72	0.0912	0.0033	1129.76	0.0916	0.0045	1132.46
1.35	-0.0105	0.0001	-0.0005	-0.0003	19.86	0.0915	0.0058	1132.14	0.0919	0.0063	1135.10
1.40	-0.0105	0.0001	-0.0000	-0.0003	20.83	0.0917	0.0011	1133.40	0.0921	0.0014	1136.48
1.45	-0.0105	0.0001	0.0001	-0.0007	21.95	0.0917	-0.0013	1133.10	0.0921	-0.0007	1136.37
1.50	-0.0105	0.0000	-0.0001	-0.0012	24.13	0.0916	-0.0003	1132.91	0.0921	0.0008	1136.53
1.55	-0.0105	-0.0000	0.0001	-0.0017	27.56	0.0916	-0.0016	1132.60	0.0921	-0.0001	1136.76
1.60	-0.0105	-0.0001	0.0002	-0.0020	31.61	0.0915	-0.0037	1131.40	0.0921	-0.0022	1136.15
1.65	-0.0105	-0.0002	0.0001	-0.0019	35.07	0.0913	-0.0024	1130.24	0.0920	-0.0014	1135.46
1.70	-0.0105	-0.0003	0.0000	-0.0015	36.61	0.0912	-0.0006	1129.87	0.0919	-0.0005	1135.23
1.75	-0.0105	-0.0004	0.0001	-0.0009	35.16	0.0912	-0.0008	1129.65	0.0919	-0.0020	1134.70
1.80	-0.0105	-0.0004	0.0001	-0.0003	30.36	0.0912	-0.0007	1129.33	0.0917	-0.0030	1133.57
1.85	-0.0105	-0.0004	0.0000	0.0000	22.76	0.0912	0.0012	1129.53	0.0916	-0.0021	1132.57
1.90	-0.0105	-0.0004	-0.0002	0.0001	13.11	0.0913	0.0041	1130.77	0.0915	0.0002	1132.34
1.95	-0.0105	-0.0004	-0.0003	0.0004	1.90	0.0915	0.0065	1133.07	0.0916	0.0021	1132.95

APPENDIX C

INPUT PARAMETER REFERENCE LIST

TRUCK AND TRACTOR/TRAILER DYNAMIC RESPONSE SIMULATION PROGRAM - T3DRS:V1

Parameter Name	Description	Engineering Units	Format*	Program Symbol	Options Available	User Manual Section	Comments
Title Line	User Identification of Run	———	20A4	HEAD		3.1, 3.2	First line of input list
Simulation Operation Parameters							
Vehicle Configuration	Number of trailers	———	I2	NVEH		3.2	Zero=Truck or bobtail tractor; 3 max.
Initial Velocity	Vehicle speed at beginning of simulation	ft/sec	F15.3	VEL		3.2	
Steer Input Table	Number of lines in table	———	I3	ISTEER		3.2	Zero lines=Straight ahead
	Pos. - Path-Follwer Table	ft. long., ft. lat.	2F10.2	XP,YP		3.2, App. G.	Max. of 25 lines
	Neg. - Steer Angle Table	sec, LW deg., RW deg.	3F10.2	TURNX, TURNY	side-to side	3.2	
End of Preview Interval	Driver's view distance ahead (in time)	sec	F10.4	TFF		3.2, App. G	Typ. 1-3 sec } Appear only with
Driver Transport Lag	Pure time lag in driver model	sec	F10.4	TAUMEM		3.2, App. G	1 sec. max. } path-follower mode
Treadle Pressure Table	Number of lines in table		I2	NTP		3.2	
	Time-pressure table entries	sec, psi	2F10.2	XTP,YTP			Maximum of 10 lines
Max. Simulation Time	Length of time of simulation run	sec	F15.3	TIMF		3.2	
Time Increment of Output	Simulation time interval of print-out lines	sec	F15.3	TINC		3.2	
Road Key	Choice of following road options					3.2	
	Neg. - User written road sub-routine call		I2	IROAD		App. H	May be used for rough roads, etc.
	Zero - Flat, horizontal road		I2	IROAD			
	Pos. - Planar road w/downgrade & cross-slope	-, %, %	I2, 2F10.2	IROAD, OZDXO, OZDYO			
Output Page Option Keys	Seven digits key for seven page types (0=no print, 1=print) as follows -Sprung Mass Position Page -Sprung Mass Velocity Page -Sprung Mass Acceleration Page -Tire Forces Page -Brake Summary Page -Lateral Pages -Unsprung Mass Page						
Truck/Tractor/Trailer Parameters							
Wheelbase	Center-to-center distance, front-to-rear suspensions on trucks/tractors/full trailers; kingpin to center of rear suspension on semitrailers	in.	F15.3	WHBS		3.3.1, 3.4.1, 3.5.1	

*All formats begin in Column 1, additional columns may be used for users' comments, labels, etc.

Base Vehicle Curb Wt. on FA	Front axle curb weight on trucks/ tractors/full trailers w/o payload or hitch load	lb	F15.3	SNL(_,1)		3.3.1, 3.5.1	Payload may be included in base vehicle
Base Vehicle Kingpin Static Load	Weight at kingpin of semitrailer w/o payload or hitch loads	lb	F15.3	SNL(_,1)		3.4.1	Payload may be included in base vehicle
Base Vehicle Curb Wt. on RA	Rear axle curb weight w/o payload or hitch loads	lb	F15.3	SNL(_,2)		3.3.1, 3.4.1, 3.5.1	Payload may be included in base vehicle
Sprung Mass CG Height	Distance above ground (at final load conditions)	in.	F15.3	DELTA		3.3.1	
Sprung Mass	Moment of inertia properties of sprung mass only					3.3.1	
-Roll Moment of Inertia		in-lb-sec^2	F15.3	VJ(_,1)			
-Pitch Moment of Inertia		in-lb-sec^2	F15.3	VJ(_,2)			
-Yaw Moment of Inertia		in-lb-sec^2	F15.3	VJ(_,3)			
Payload Weight		lb	F15.3	PW		3.3.1, 3.4.1	May be lumped in with base vehicle
-Dist. Ahead of Rear Susp.	Long. location ahead of rear susp.	in.	F15.3	PX		3.3.1, 3.4.1	
-CG Height	Height above ground (at full load condition)	in.	F15.3	PZ		3.3.1, 3.4.1	
-Roll Moment of Inertia	Payload moment of inertia properties	in-lb-sec^2	F15.3	PJ(_,1)		3.3.1, 3.4.1	Entries only when payload is not zero
-Pitch Moment of Inertia	" " " " "	in-lb-sec^2	F15.3	PJ(_,2)		3.3.1, 3.4.1	
-Yaw Moment of Inertia	" " " " "	in-lb-sec^2	F15.3	PJ(_,3)		3.3.1, 3.4.1	
Fifth Wheel Location	Long. distance ahead of rear susp.	in.	F15.3	BB1		3.3.1	Entries in tractor parameters only when trailers are specified in configuration
Fifth Wheel Height	Height above ground at pitch articulation	in.	F15.3	D		3.3.1	
Fifth Wheel Stiffness	Roll stiffness (Typ. ≈ 250,000)	in-lb/deg	F15.3	MC5		3.3.1	
Dolly Key	Choice of converter (1) or fixed (2) dolly	————	I2	KDOLLY		3.5.1	Entries only with a full trailer (enter preceding full trailer wheelbase)
Dist. from Turntable Center to Pintle Hook	Length of dolly tongue	in.	F15.3	APHI		3.5.1	
Turntable Location	Dist. ahead of dolly susp. center	in.	F15.3	BB1		3.5.1	
Turntable Height Above Ground	Height of pitch articuation on dolly	in.	F15.3	D		3.5.1	
Location of Pintle Hook	Dist. behind rear susp. of towing vehicle	in.	F15.3	A3		3.4.1, 3.5.1	Entries for trailer towing a full trailer
Height of Pintle Hook	Dist. above ground on towing veh.	in.	F15.3	PH		3.4.1, 3.5.1	

Suspension and Axle Parameters							
Suspension Key	Choice of single (0) or tandem (1) axles	———	I2	KEY		3.3.4.2	
Tandem Separation	Center-to-center dist. between tandem axles	in.	F15.3	TD		3.3.4.2	Entries only if tandem axles are specified
Static Load Transfer	Percent load on leading tandem axle	%	F15.3	FSPLIT		3.3.4.2	
Dynamic Load Transfer	Percent of tandem axle brake torque acting to transfer load onto leading tandem axle	%	F15.3	FSHIFT		3.3.4.2	
Suspension Spring Rate	Stiffness of each susp. spring (L&R)	lb/in	F15.3	K(_,_,_,1&2)	Side-to side, table lookup	3.3.2	Serial entry of this data set when tandem axles are specified (leading tandem, trailing tandem)
Suspension Viscous Damping	Shock absorber damping coefficients (L&R)	lb-sec²/in	F15.3	C(_,_,_,1&2)	Side-to side	3.3.2	
Coulomb Friction	One-half the force hysteresis in each spring (L&R)	lb	F15.3	CF(_,_,_,1&2)	Side-to side	3.3.2	
Axle Roll Moment of Inertia	Roll inertia properties of total unsprung mass	in-lb-sec²	F15.3	IA		3.3.2	
Roll Center Height	Height of roll center above ground	in.	F15.3	RCI		3.3.2	
Roll Steer Coeff.	Axle roll steer effects	deg steer/ deg roll	F15.3	RST		3.3.2	
Auxiliary Roll Stiffness	Roll stiffness not due to spring forces	in-lb/deg	F15.3	KRS		3.3.2	
Lat. Dist. between Susp. Springs	Suspension lateral spacing	in.	F15.3	SYI		3.3.2	
Track Width	Center-to-center dist. between wheel sets	in.	F15.3	TRA		3.3.2, 3.3.4.1	
Unsprung Weight	Total weight of axle, brakes, wheels, etc.	lb	F15.3	ASW		3.3.2	
Dual Tire Separation	Center-to-center dist. between tires in a dual set	in.	F15.3	DTS	Side-to side	3.3.5	Deleted on truck/tractor front axle
Cornering Stiffness	Initial slope of tire lateral force-slip angle curve at loaded cond.	lb/deg	F15.3	CALF	Side-to-side, Table Lookup	3.3.3, 3.3.5	Data on per tire basis
Long. Stiffness	Initial slope of tire brake force-slip curve at loaded condition	lb/slip	F15.3	CS	Side-to side, Table Lookup	3.3.3, 3.3.5	Data on per tire basis
Camber Stiffness	Initial slope of tire lateral force-camber angle curve at loaded cond.	lb/deg	F15.3	CAM	Side-to side	3.3.3, 3.3.5	Data on per tire basis
Aligning Moment	Initial slope of tire aligning moment-slip angle curve at loaded condition	in-lb/deg	F15.3	CAT	Side-to side	3.3.3, 3.3.5	Data on per tire basis
Tire Spring Rate	Force-deflection rate at loaded cond	lb/in	F15.3	KT	Side-to side	3.3.3, 3.3.5	Data on per tire basis

Tire Loaded Radius	Tire radius at loaded condition	in.	F15.3	SRAD	Side-to side	3.3.3, 3.3.5	
Polar Moment of Inertia	Spin inertia of wheel assembly	in-lb-sec^2	F15.3	WHEELI	Side-to side	3.3.3, 3.3.5	Use one-half of total for a dual wheel set
Brake Parameters							
Time Lag	Time from treadle valve motion to beginning of pressure rise at brake	sec.	F15.3	TQ(_,_,_,_,1)	Side-to side	3.3.6	Entries deleted if no lines in treadle pressure table
Rise Time	First-order time constant of pressure rise at brake	sec.	F15.3	TQ(_,_,_,_,2)	Side-to side	3.3.6	
Brake Torque	Torque-pressure coefficient of brake	in-lb/psi	F15.3	BTQ	Side-to side, Table lookup	3.3.6	Max. of 10 lines
Antilock Parameters							
Vehicle Antilock Key	Vehicle antilock key, 0-no antilock, 01-indicates antilocks used	———	I2	ILOCK		3.6, App. D	
Antilock Parameters	See Appendix D						
Rerun Parameter							
Rerun	Key at end of data input list 00 - ends simulation runs 01 - indicates another run follows	———	I2	RERUN		3.7	Last line of input list

APPENDIX D

ANTILOCK SIMULATION

The documentation presented in this appendix represents the most recent version of the HSRI antilock program. The simulation concentrates on the three areas common to most antilock systems: (1) wheel speed sensor, (2) control logic module, and (3) pressure modulator. Axle-by-axle systems are allowed for, as well as four side-to-side options: (1) worst wheel, (2) best wheel, (3) average wheel, and (4) independent wheel.

A block diagram showing the relationship between the antilock elements and the main program is shown in Figure D-1. The wheel speed signal, ω, is received from the main program and processed by the wheel sensor wherein an effective time delay occurs resulting in delayed wheel speed and acceleration signals ω_d and $\dot{\omega}_d$. These signals, along with vehicle velocity, $\dot{x}$, vehicle acceleration, $\ddot{x}$, and feedback from the pressure modulator, are input to the control logic module. The control logic module outputs an ON/OFF solenoid command signal to the pressure modulator which in turn generates the brake pressure, P, returned to the main program.

A complete description of the antilock simulation and explanation of its use is presented in the following sections.

D.1. User Dictionary of Variables/Parameters. In order to offer much greater flexibility to the program user as regards variable and parameter programming choices, a table or dictionary of such variables/parameters has been added. This dictionary, as shown in Figure D-2 , is simply a listing of various variables and parameters which might be considered to be of some importance or interest to an antilock system. A user selects, for programming purposes, a particular variable/parameter by referring to its variable I.D. numeral shown in Figure D-2 . Each of these variables/parameters are defined in Table D-1 and Figure D-3 . If a user has need for additional variables or parameters not included in the dictionary, they can be added by rather simple additions to the FORTRAN code.

The purpose of the dictionary is to allow the program user to select, from a wide variety of possible antilock variables/parameters, only those which are of interest to the particular

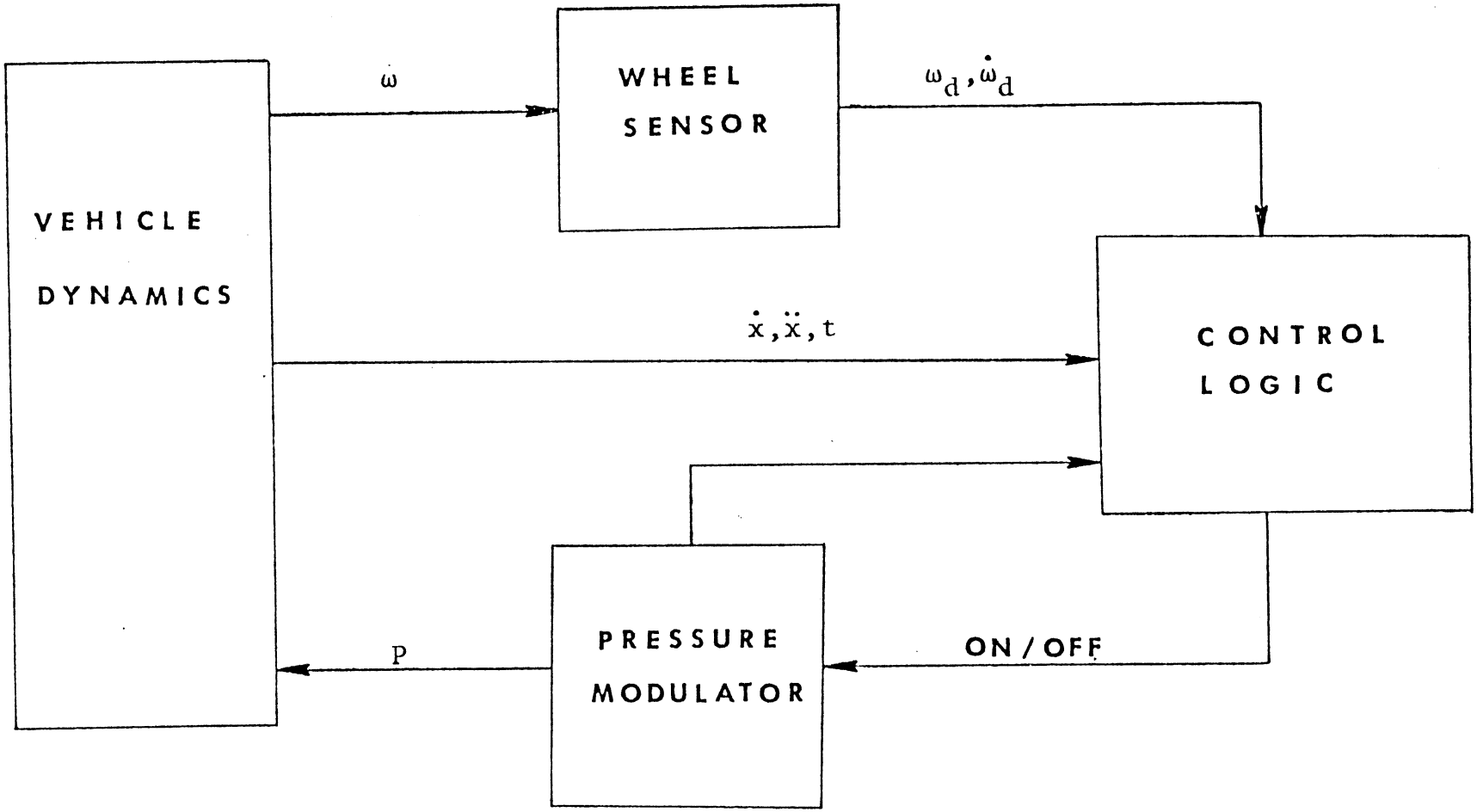


Figure D-1. Antilock block diagram.

DICTIONARY OF ANTI-LOCK VARIABLES/PARAMETERS AVAILABLE TO USER.

VARIABLE I.D.	DESCRIPTION	VARIABLE I.D.	DESCRIPTION
1	1.0	45	WMAX1
2	TIME	46	WMAX2
3	OMEGA	47	TWMAX1
4	OMEGADOT	48	TWMAX2
5	XDOT	49	WMIN
6	XDDOT	50	TWMIN
7	POFF1	51	TPMAX2
8	POFF2	52	TPMIN2
9	PON1	53	GPV1
10	PON2	54	GPV2
11	TOFF1	55	GPV3
12	TON1	56	GPV4
13	XDOFF	57	GPV5
14	XDON	58	EOS4
15	WOFF	59	EOS5
16	WON	60	OMEGDIF
17	WDOFF		
18	WDON		
19	WDMAX		
20	WDMIN		
21	TPMAX1		
22	TPMIN1		
23	WLOCK		
24	TLOCK		
25	SLON		
26	SLOFF		
27	PMAX1		
28	PMAX2		
29	PMIN1		
30	PMIN2		
31	PD		
32	ON		
33	TMOD		
34	SLIP		
35	P		
36	CYCNT		
37	SQUARE		
38	SQUARN		
39	TOFF2		
40	TON2		
41	EOS1		
42	EOS2		
43	EOS3		
44	GPCNT		

Figure D-2

Table D-1. Variable/Parameter Definitions

Symbol	I.D. Code	Definition	Units
1.0	1	Constant; Unity Parameter	
TIMF	2	Time in simulation	(sec)
OMEGA	3	Wheel speed at tire-road interface (expressed as an equivalent translational velocity)	(ft/sec)
OMEGADOT	4	Wheel acceleration at tire-road interface (expressed as an equivalent translational acceleration)	(ft/sec^2)
XDOT	5	Vehicle velocity	(ft/sec)
XDDOT	6	Vehicle acceleration	(ft/sec^2)
POFF1	7	Brake pressure at last "OFF" signal	(psi)
POFF2	8	Brake pressure at "OFF" signal in next to last cycle	(psi)
PON1	9	Brake pressure at last "ON" signal	(psi)
PON2	10	Brake pressure at "ON" signal in next to last cycle	(psi)
TOFF1	11	Time at last "OFF" signal	(sec)
TON1	12	Time at last "ON" signal	(sec)
XDOFF	13	Vehicle velocity at last "OFF" signal	(ft/sec)
XDON	14	Vehicle velocity at last "ON" signal	(ft/sec)
WOFF	15	Wheel speed at last "OFF" signal	(ft/sec)
WON	16	Wheel speed at last "ON" signal	(ft/sec)
WDOFF	17	Wheel acceleration at last "OFF" signal	(ft/sec^2)
WDON	18	Wheel acceleration at last "ON" signal	(ft/sec^2)
WDMAX	19	Maximum wheel acceleration in last cycle	(ft/sec^2)
WDMIN	20	Minimum wheel acceleration in last cycle	(ft/sec^2)

Table D-1 (Cont.)

Symbol	I.D. Code	Definition	Units
TPMAX1	21	Time of maximum pressure in last cycle	(sec)
TPMIN1	22	Time of minimum pressure in last cycle	(sec)
WLOCK	23	Parameter having value 1.0 if wheel is locked; otherwise having value of 0.0	
TLOCK	24	Time ramp beginning at start of any wheel lock	(sec)
SLON	25	Wheel slip at last "ON" signal	
SLOFF	26	Wheel slip at last "OFF" signal	
PMAX1	27	Maximum pressure from last cycle	(psi)
PMAX2	28	Maximum pressure from cycle before last	(psi)
PMIN1	29	Minimum pressure from last cycle	(psi)
PMIN2	30	Minimum pressure from cycle before last	(psi)
PD	31	Treadle pressure	(psi)
ON	32	Parameter having value of 1.0 during "ON" signal; otherwise 0.0	
TMOD	33	Time of modulation for the pulse-width modulated square wave	(sec)
SLIP	34	Wheel slip	
P	35	Brake pressure	(psi)
CYCNT	36	Cycle counter beginning at 0 and incrementing its count by 1 every "OFF" signal	
SQUARE	37	Pulse-width modulated square wave having value 1.0 or 0.0	
SQUARN	38	SQUARE - 1.0	
TOFF2	39	Time of "OFF" signal in cycle before last	(sec)
TON2	40	Time of "ON" signal in cycle before last	(sec)
FOS1	41	First one-shot variable having value 1.0 during one-shot firing; otherwise having value of 0.0	

Table D-1 (Cont.)

Symbol	I.D. Code	Definition	Units
FOS2	42	Second one-shot variable	
FOS3	43	Third one-shot variable	
GPCNT	44	General purpose counter	
WMAX1	45	Maximum wheel speed in last cycle	(ft/sec)
WMAX2	46	Maximum wheel speed in cycle before last	(ft/sec)
TWMAX1	47	Time of maximum wheel speed in last cycle	(sec)
TWMAX2	48	Time of maximum wheel speed in cycle before last	(sec)
WMIN	49	Minimum wheel speed in last cycle	(ft/sec)
TWMIN	50	Time of minimum wheel speed in last cycle	(sec)
TPMAX2	51	Time of maximum brake pressure in cycle before last	(sec)
TPMIN2	52	Time of minimum brake pressure in cycle before last	(sec)
GPV1	53	First general purpose variable	
GPV2	54	Second general purpose variable	
GPV3	55	Third general purpose variable	
GPV4	56	Fourth general purpose variable	
GPV5	57	Fifth general purpose variable	
FOS4	58	Fourth one-shot variable	
FOS5	59	Fifth one-shot variable	
IMEGDIF	60	Side-to-side wheel speed difference indicator having the value 1.0 (otherwise 0.0) when the same axle side-to-side wheel speed difference (ft/sec) is greater than the input parameter, WWDIF.	

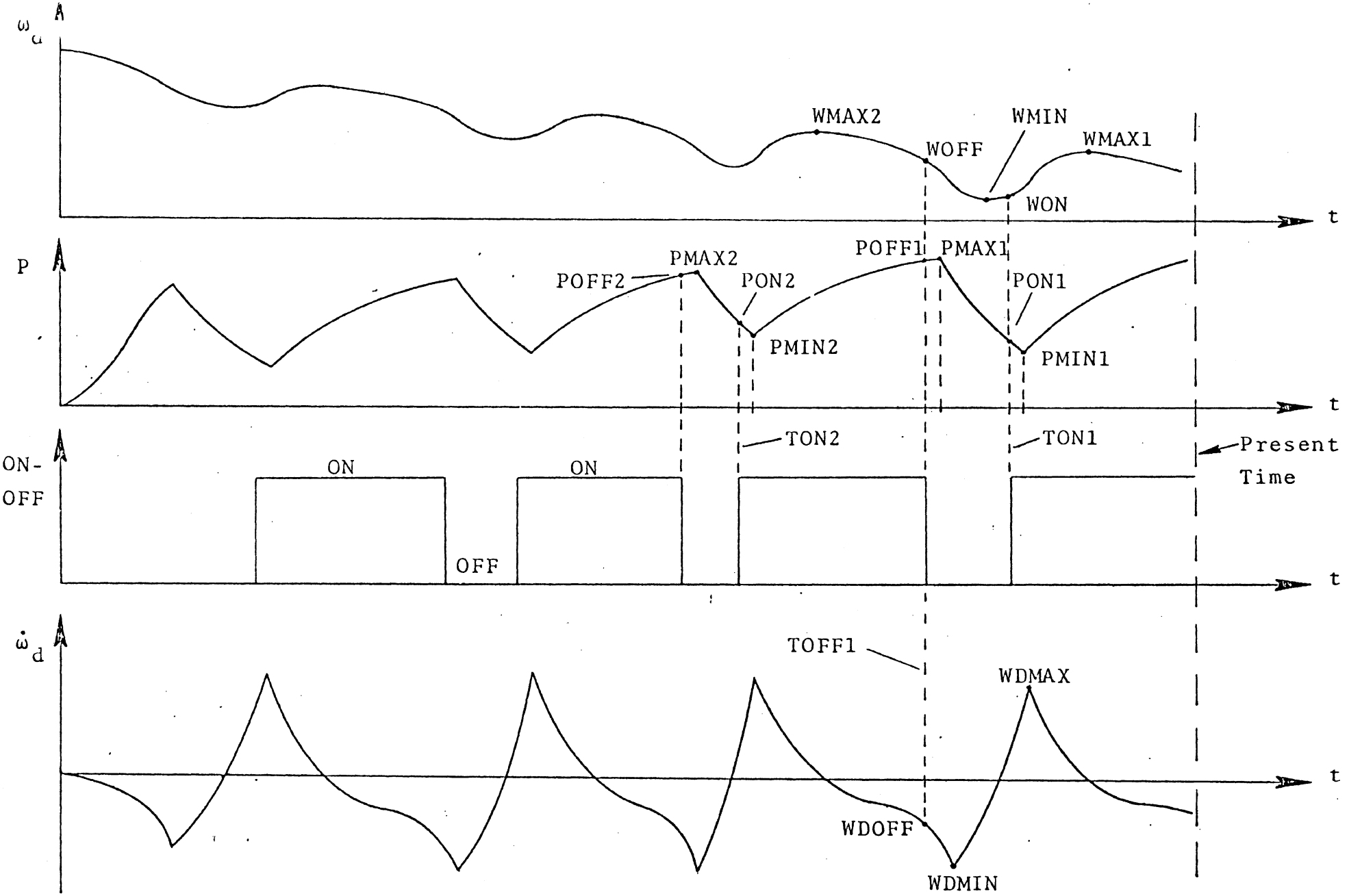

ω_d
WMAX2
WMIN
WMAX1
WOFF
WON
t
P
POFF2
PMAX2
PON2
POFF1
PMAX1
PON1
PMIN2
PMIN1
t
TON2
TON1
Present
Time
ON-
OFF
ON
ON
OFF
t
$\dot{\omega}_d$
TOFF1
WDMAX
t
WDOFF
WDMIN

Figure D-3

system he is attempting to simulate. Those familiar with the previous antilock simulation may recall that such variable/parameter choices were fixed and limited to wheel speed, acceleration, and four or five other variables. Thus, the present approach should eliminate most problems where the user was handicapped with the previous program because a particular variable or parameter was not available.

Within the antilock variables/parameters are stored in an array of dimension 60 called VARIB(J), J=1,60. Therefore, VARIB(1) contains the constant 1.0, VARIB(2) contains the present value of the time, t, and so on as defined in Table D-1.

D.2. General Expression Form. Throughout the remainder of this discussion a particular algebraic expression will be encountered repeatedly. It would therefore be helpful beforehand to define each term in the expression and then discuss its purpose. The expression referred to is of the general form:

$$C_1x_1 + C_2x_2 + C_3x_3 + C_4x_4y_4 + C_5x_5y_5 \qquad \text{(D-1)}$$

The C_i (i=1,...,5) are constant coefficients for each term. Any of these coefficients may be adaptive to as many as two different variables. This adaptive feature will be discussed in detail in Section D-4. The x_i, (i=1,...,5) and y_i, (i=4,5) are variables or parameters available in the user dictionary. Note that the fourth and fifth terms are quadratic in form. During execution of the program the x_i and y_i, which the user has selected from the dictionary to form some relationship, are actually assigned values from the array VARIB(J).

The purpose of these expressions is to allow the user to form various algebraic relationships between the variables and parameters available in the dictionary, subject to the form of the general expression (D-1). A form of this general expression appears in almost every section of the program from control logic inequality expressions to evaluation of one-shot conditions. Only those terms necessary to form a desired expression are required. Some simple examples illustrating the use of these general expressions are presented in the following sections.

D.3. Wheel Sensor Module. The primary effect of a wheel sensor is a phase shift and/or time delay between the actual wheel rate and the derived wheel rate. This input-output relationship can often be described adequately by transfer functions of various order and/or transport time delay expressions. The present version assumes a general first-order filter of the form $1/\tau_\omega p + 1$ relating actual wheel rate to derived wheel rate, where τ_ω is the time constant of the filter and p is an operator denoting differentiation with respect to time.

Many antilock systems make use of wheel acceleration derived from the output of the wheel sensor. This normally involves additional delays along with a differentiation process. The assumed transfer function here was taken as $p/\tau_{\omega d}p + 1$ relating derived wheel rate to derived wheel acceleration. The derived wheel acceleration calculation normally takes place within the electronic control unit. However, since it, along with wheel rate, is a primary input to the control unit logic, it is included here within the wheel sensor module so that the control unit can be characterized by logical or decision-making processes only. The wheel sensor module can then be described by the input-output relationships shown in Figure D-4.

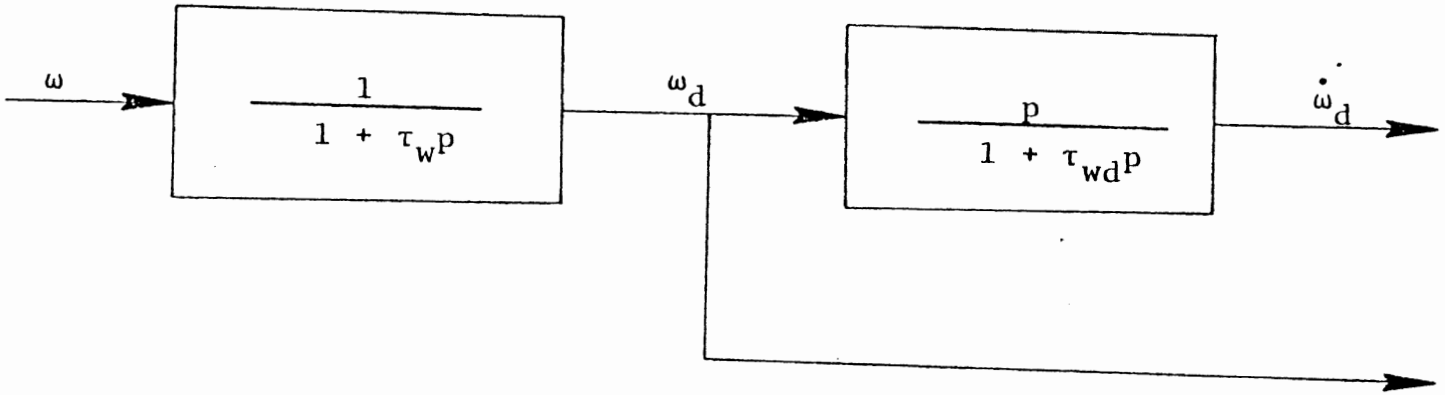


Figure D-4. Wheel sensor module.

The delayed wheel speed and acceleration signals, ω_d and $\dot{\omega}_d$, are used as the primary inputs to the control logic module. The assumed wheel sensor and derivative circuit input-output relationships are therefore described by two input parameters, τ_ω and $\tau_{\omega d}$, which represent the first-order filter time constants of the wheel sensor and its derivative circuit. The variables, ω_d and $\dot{\omega}_d$, appear in the user dictionary as OMEGA and OMEGADOT, I.D. codes 3 and 4. (The symbols ω and $\dot{\omega}$ are used interchangeably throughout this section for ω_d and $\dot{\omega}_d$.)

Other variables are provided as possible inputs to the control logic module, however, no similar operations are attempted on these other input variables.

D.4. Control Logic Module. The control logic is characterized by a set of eight inequality expressions which the user forms as conditions for generating "ON" and "OFF" signals. Associated with each arithmetic inequality expression is a logical variable. These logical variables, reflecting the state or polarity of the inequality expressions, are logically combined to generate the "ON" and "OFF" signals. "ON" is defined here as air being applied to, or "ON," the brake air chambers. Figure D-5 summarizes the overall structure of the control logic module.

Inequality Expressions.

Each of the eight arithmetic inequalities has the general form:

$$F_i \triangleq c_{i1}v_{i1} + c_{i2}v_{i2} + c_{i3}v_{i3} + c_{i4}v_{i4}w_{i4} + c_{i5}v_{i5}w_{i5} \geq 0 \quad , \quad i=1,8 \qquad \text{(D-2)}$$

where

Inequality Expression	Logical Variable	Logical Operator	Solenoid Command
$F_1 \geq 0$	L_1		
$F_2 \geq 0$	L_2	OP_{12}	
$F_3 \geq 0$	L_3	OP_{23}	OFF
$F_4 \geq 0$	L_4	OP_{34}	
.	.	.	
.	.	.	
.	.	.	
.	.	.	ON
.	.	.	
		OP_{78}	
$F_8 \geq 0$	L_8		

Figure D-5. Control logic module.

c_{ij} , (j=1,5) are the constant coefficients of each term.

v_{ij}, w_{ik} , (j=1,5; k=4,5) are the variables/ parameters selected from the user dictionary.

The first four inequalities, F_1 through F_4, are used for generating the "OFF" signal; the last four inequalities for the "ON" signal.

As an example, suppose the condition

$$\dot{\omega} \leq -100 \text{ ft/sec}^2*$$

or

$$-\dot{\omega} - 100 \geq 0$$

was used as the first "OFF" condition. Then F_1 would become

$$F_1 \triangleq (-1.0)\dot{\omega} + (-100.)1.0 \geq 0 \ ,$$

with -1.0 and -100. required as c_{11} and c_{12}. OMEGADOT, ($\dot{\omega}$), would be selected from the user dictionary for v_{11} and the unity parameter, 1.0, would be selected as v_{12}. As will be described in detail in Section D.7 , five numbers would be required as program input for forming this expression: (a) the number of terms involved in the expression, (2); (b) two coefficients, (-1.0) and (-100.); and (c) two variable I.D. codes from the user dictionary, '4' and '1' for OMEGADOT and the unity parameter, respectively.

---

*See definition of OMEGADOT in Table D-1.

A simple description of the sequence of operations taking place within the antilock control logic module is as follows:

During a braking maneuver, the variables/parameters selected by the user are substituted in the user-defined inequality expressions. These expressions are evaluated, and based upon their polarity, OFF signals or ON signals are sent to the pressure modulator. At the beginning of the braking maneuver, evaluation of the inequalities associated with generating the "OFF" signal takes place until an "OFF" signal is generated. Attention then is focused on the inequalities associated with generating an "ON" signal until an "ON" signal is generated. This sequence continues until either the treadle valve pressure demanded by the driver falls to near zero, or until the vehicle velocity decreases to below some cut-off velocity.

Logical Variables

Each of the eight inequalities has assigned to it a logical variable that is defined as TRUE if the inequality is satisfied as shown; FALSE if not. In other words, if $F_i \geq 0$, then the logical variable L_i associated with F_i assumes the value TRUE. If $F_i < 0$, then L_i assumes the value FALSE. Since there are four inequalities for the generation of the "OFF" signal, there are four logical variables associated with the "OFF" signal. The purpose of these logical variables is to facilitate the generation of an "OFF" signal by allowing them to be "AND"-ed and "OR"-ed together by the program user. If, for example, the user had decided that F_1 and F_2 must be satisfied or else F_3 or F_4 be satisfied (F_1, F_2, F_3, and F_4 having been previously defined by the data set selected by the user), the proper "OFF" signal would be defined by the following expression:

$$\text{OFF} = (L_1 \text{ AND } L_2) \quad \text{OR} \quad (L_3 \text{ OR } L_4) \ .$$

The same discussion applies to the "ON" signal and associated logical variables L_5, L_6, L_7, and L_8.

The user specifies the logical operations between L_1 and L_2, L_3, and L_4, and between the bracketed expressions by means of three logical operator switches, OP_{12}, OP_{34}, and OP_{23}, respectively. Input values of 0 imply logical "OR" operations; values of 1 imply logical "AND" operations. The same rules apply to logical variables L_5, L_6, L_7, L_8 and their logical operator switches OP_{56}, OP_{78}, and OP_{67}. The general forms of these logical equations are:

$$OFF = (L_1\ OP_{12}\ L_2)\ OP_{23}\ (L_3\ OP_{34}\ L_4) \qquad (D\text{-}3)$$

and

$$ON = (L_5\ OP_{56}\ L_6)\ OP_{67}\ (L_7\ OP_{78}\ L_8) \qquad (D\text{-}4)$$

The user is required to input data only for the number of inequality expressions needed. The details relating to data input for the inequality expressions and logical operators are explained in Section D.7 .

Time Delays

Four programmable time delays are available in the control logic. The first time delay, τ_1, is the delay between the evaluations of F_1 and the evaluations of either F_2, F_3, or F_4. The second time delay, τ_2, is the delay between the time of generation of the "OFF" signal and the time that F_5 may be evaluated in the generation of the next "ON" signal. τ_3 is the delay between the time of evaluation of F_5 and the time of evaluation of either F_6, F_7, or F_8. τ_4 is the delay between the time of generation of the "ON" signal and the time that F_1 may be evaluated in the generation of the next "OFF" signal. For time delay effects other than those described here, the one-shot variables (Section D.6) may be employed.

Example

A brief example covering the above outlined features should prove helpful. Consider an antilock system which generates an "OFF" signal subject to the following laws:

1) $\dot{\omega} \leq -50$ ft/sec^2

and 2) at a time .05 second after (1) is satisfied, $\omega \leq .9\ \dot{x}$ must also be satisfied.

Suppose the corresponding "ON" signal must satisfy the following requirements

3) $\dot{\omega} \geq -.5$ ft/sec^2

and 4) at a time .02 second after (3) is satisfied, $\omega \geq .8\ \dot{x}$ must also be satisfied.

Suppose also that once the "ON" signal is generated during any cycle, the test for the next "OFF" signal must not take place for at least 0.1 second, guaranteeing a certain amount of brake on-time.

Rewriting (1) as

$$F_1 = -\dot{\omega} - 50 \geq 0$$

$$c_{11} = -1.0$$

$$c_{12} = -50.$$

The variable I.D. codes for v_{11} and v_{12} would be "4" and "1," corresponding to OMEGADOT and the unity parameter from the user dictionary.

Similarly, for (2),

$$F_2 = -\omega + .9\ \dot{x} \geq 0$$

$$c_{21} = -1.0$$

$$c_{22} = .90$$

The variable I.D. codes for v_{21} and v_{11} would be "3" and "5".

Since F_3 and F_4 are not required, no input for these expressions would be needed. OP_{12} should be entered as 1 since OFF = L_1 AND L_2. OP_{23} and OP_{24} have no meaning here and can therefore be either 0 or 1. The time delay between F_1 and F_2 implies $\tau_1 = 0.05$. Since there is no time delay specified between the generation of the "OFF" signal and the evaluation for the next "ON" signal, $\tau_2 = 0.0$.

Similarly, for the "ON" criteria, (3) may be rewritten as

$$F_5 = \dot{\omega} + 5 \geq 0$$

$$c_{51} = 1.0$$

$$c_{52} = 5.0$$

With variable I.D. codes for v_{51} and v_{52} of "4" and "1".

Likewise

$$F_6 = \omega - .8\,\dot{x} \geq 0$$

$$c_{61} = 1.0$$

$$c_{62} = -.8$$

With variable I.D. codes for v_{61} and v_{62} of "3" and "5".

Since F_7 and F_8 are not required, no input for these expressions would be needed. OP_{56} should be entered as 1 for the required "AND" operation, while OP_{67} and OP_{78} are meaningless here and can be either 0 or 1. The time delay between F_5 and F_6 requires $\tau_3 = 0.02$. The time delay between the "ON" signal and the test for the next "OFF" signal requires $\tau_4 = 0.10$.

Adaptive Coefficients

Many antilock systems possess adaptive capabilities for changing coefficients involved in their control logic. For this reason, and increased programming flexibility, an adaptive coefficient feature is provided for in this program. Each coefficient, C_{ij}, involved in the inequality expressions may be altered to change its value as a function of one or two dictionary variables in the manner shown in Figures D-6 and D-7.

In Figure D-6 , the value of C_{ij} is A_o (its initial value), if $u_{ij} < b_1$. If u_{ij}, the adaptive variable, is greater than its breakpoint value of b_1, C_{ij} is equal to A_1.

If two adaptive variables are involved, as illustrated in Figure D-7,

$$C_{ij} = \begin{cases} A_o & \text{if } u_{ij} \leq b_1 \text{ and } z_{ij} \leq b_2 \\ A_1 & \text{if } u_{ij} > b_1 \text{ and } z_{ij} \leq b_2 \\ A_2 & \text{if } z_{ij} > b_2 \end{cases} \qquad \text{(D-5)}$$

By including an additional numerical switch in the input, the two adaptive variable case may be altered to:

$$C_{ij} = \begin{cases} A_o & \text{if } u_{ij} \leq b_1 \\ A_1 & \text{if } u_{ij} > b_1 \text{ and } z_{ij} \leq b_2 \\ A_2 & \text{if } u_{ij} > b_1 \text{ and } z_{ij} > b_2 \end{cases} \qquad \text{(D-6)}$$

as illustrated in Figure D-8.

The details of the numerical input format are explained in Section D.7.

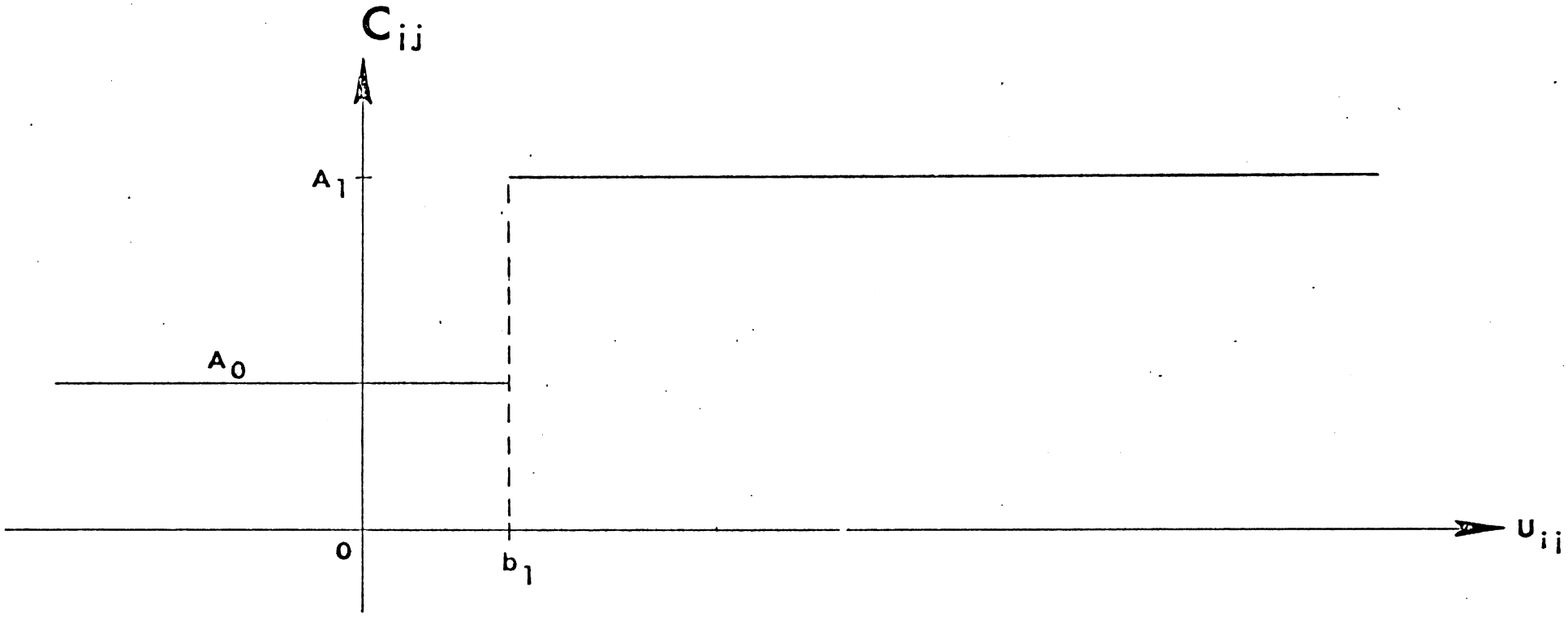


Figure D-6.

$$C_{ij} = \begin{cases} A_0 \text{ , if } u_{ij} \leq b_1 \text{ and } z_{ij} \leq b_2 \\ A_1 \text{ , if } u_{ij} > b_1 \text{ and } z_{ij} \leq b_2 \\ A_2 \text{ , if } z_{ij} > b_2 \end{cases}$$

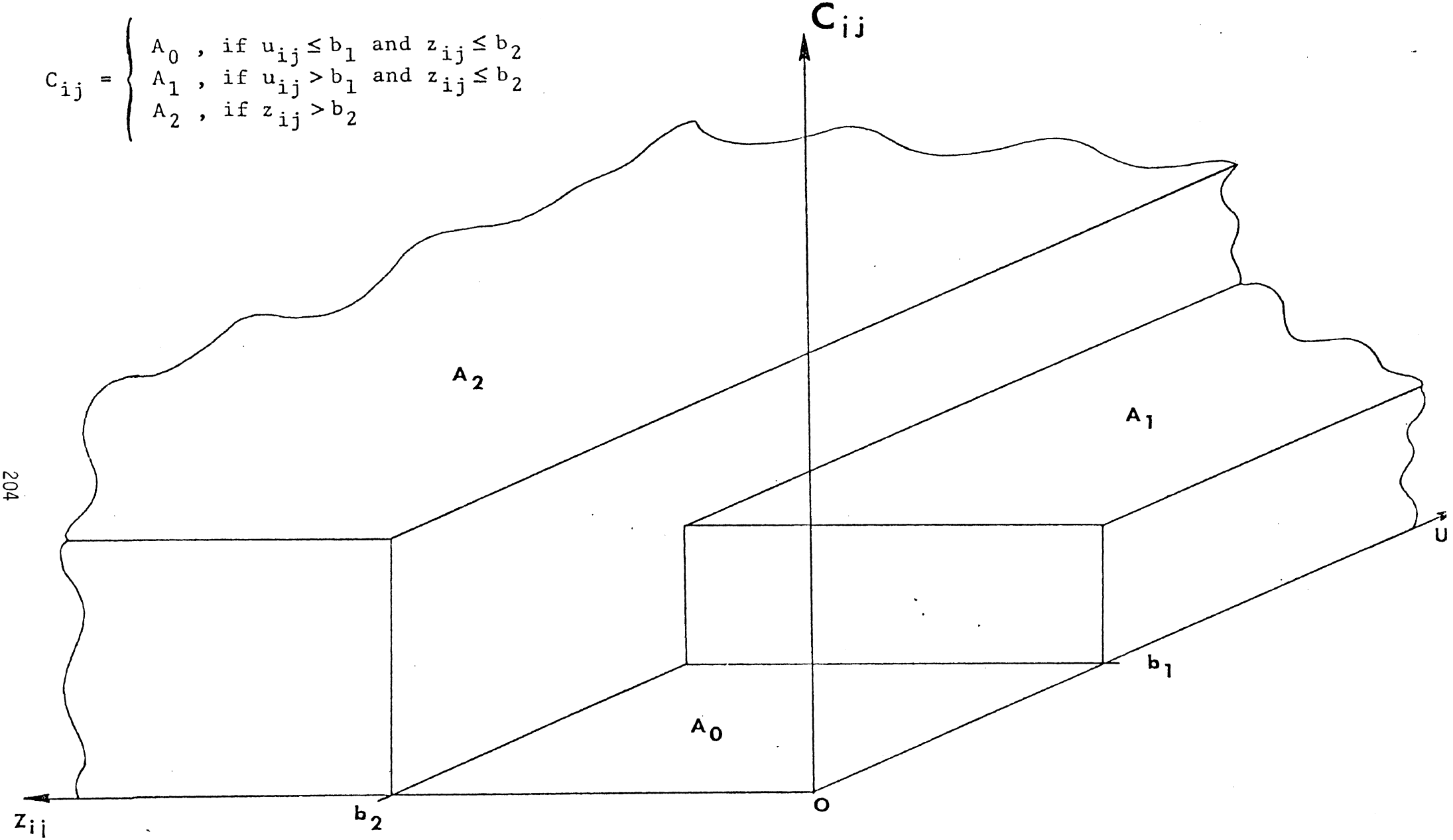


Figure D-7. Adaptive coefficient feature.

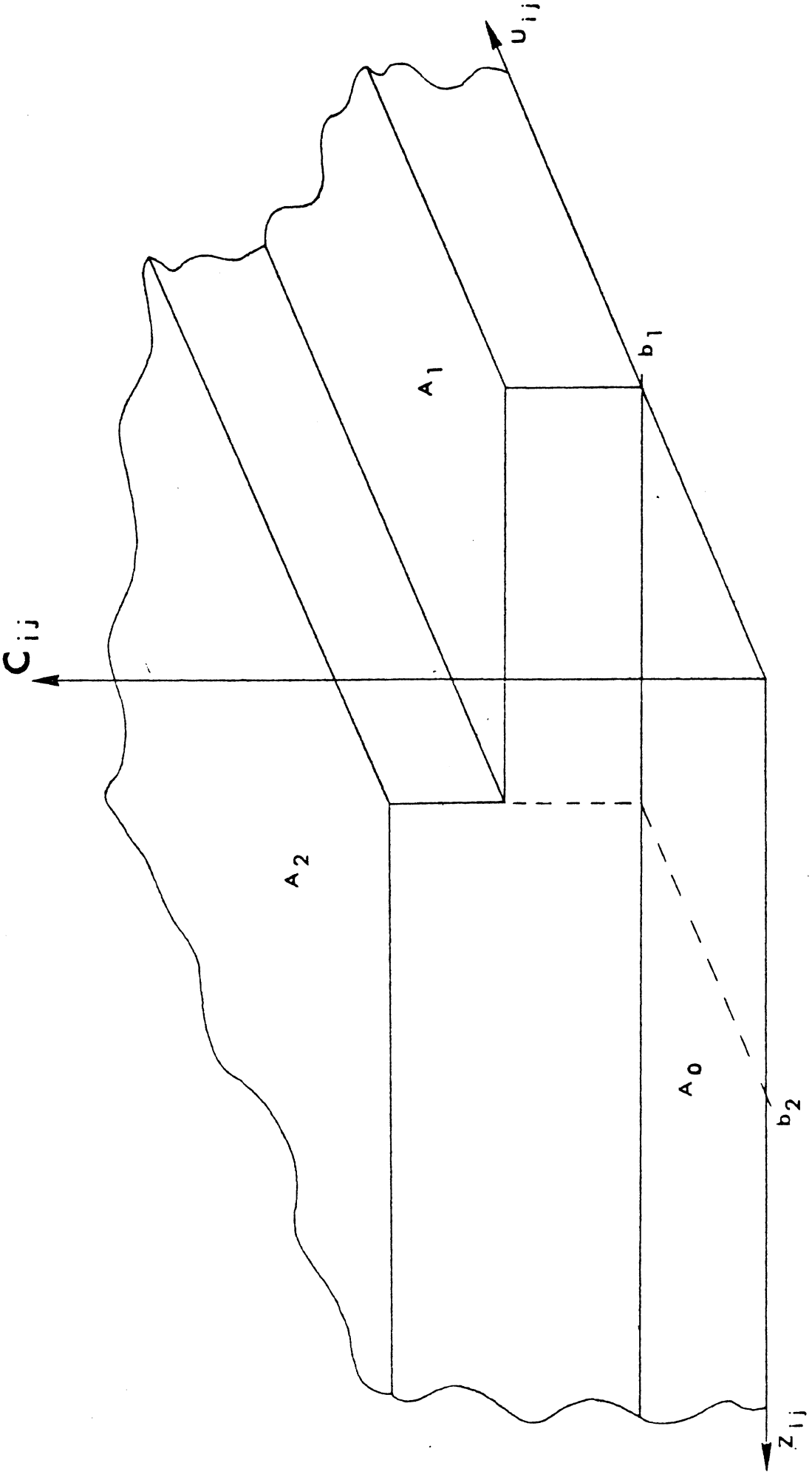


Figure D-8.

Side-to-Side Options

Three different side-to-side options per axle are available. One antilock system is allowed for each axle with the same pressure being returned to both sides for each of the available options. These are summarized below:

OPTION 1 - Worst Wheel. The wheel having the lowest rotational rate (omega) for a given axle is selected by the control logic as its input. The same pressure is returned to both sides based on this input.

OPTION 2 - Best Wheel. Same as Option 1 except that the wheel with the highest rotational rate is selected as input.

OPTION 3 - Average Wheel. Both wheel rates are averaged by the control logic module and used as input. The same pressure is returned to both sides.

See Section D.7 for the numerical input and format required for each option.

Logic Sampling Rate Control

The program user is asked to specify a logic sampling period, TSMPLE, which controls the rate at which the antilock logic is interrogated. If TSMPLE is specified to be less than or equal to the digital simulation time step, then no sampling rate control is in effect. If, however, a logic sampling period greater than the digital simulation time step is called for, all control logic and special option features pertaining to the control logic module are interrogated at time intervals set by the logic sampling period, TSMPLE. Wheel sensor computations and pressure modulator activities are not affected.

For vehicle velocities less than 7 ft/sec, the antilock simulation is inactivated and line pressures will follow the treadle pressure.

D.5. Pressure Modulator. The pressure modulator valve is simulated by two time delays and several programmable rise and fall rates for both exponential and linear characteristics. The programmable rise and fall rates make possible the simulation of relatively complex pressure modulator activity including designs involving pneumatic logic or pulse-width modulators.

Time Delays

The input received by the pressure modulator is simply the "ON" and "OFF" signals generated in the control logic module. Once a control signal is received there is normally a time delay before actual pressure reduction or increase takes place. These time lags are denoted in the simulation as τ_{ON} and τ_{OFF} and are program inputs specified by the user.

Exponential Fall and Rise Rates

The pressure rise is defined to be exponential in time with the upper pressure limit set by the treadle valve output or by a programmable limit PDRSE offered as a special option and explained in Section D.6. Likewise, the pressure fall is exponential in time with its lower limit as zero pressure or by a programmable lower limit, PDFALL, offered as a special option and defined in Section D.6. As many as three pressure fall rates and three rise rates can be programmed. The fall and rise rates referred to are defined as the inverse of the time constants associated with the exponential pressure rise and fall.

The three exponential fall rates are denoted as PFE_i, (i=1,3); the three exponential rise rates are defined as PRE_i, (i=1,3). For reasons of flexibility these fall and rise rates are defined to be functions of variables denoted as ε_1 and ε_2, respectively. ε_1 and ε_2 are defined by the general form expressions:

$$\varepsilon_1 \triangleq H_1v_1 + H_2v_2 + H_3v_3 + H_4v_4w_4 + H_5v_5w_5$$

$$\varepsilon_2 \triangleq G_1v_1 + G_2v_2 + G_3v_3 + G_4v_4w_4 + G_5v_5w_5$$

where H_i and G_i, (i=1,5) are the constant coefficients of each term, and v_j and w_k, (j=1,5; k=4,5) are variables/parameters available in the user dictionary.

These relationships are shown in Figures D-9 and D-10. The break-points X_1, X_2, X_3, and X_4 along the ε_1 and ε_2 axes separate the fall and rise rate regions.

In terms of transfer function notation, the above relationships can be expressed as:

Pressure Fall:

PDFALL or $0 \rightarrow \boxed{\dfrac{PFE_{1,2,3}}{p + PFE_{1,2,3}}} \rightarrow P$

Pressure Rise:

PDRISE or $P_d \rightarrow \boxed{\dfrac{PRE_{1,2,3}}{p + PRE_{1,2,3}}} \rightarrow P$

where $PFE_{1,2,3}$ and $PRE_{1,2,3}$ defined above are functions of ε_1 and ε_2, respectively, and p is an operator denoting differentiation with respect to time.

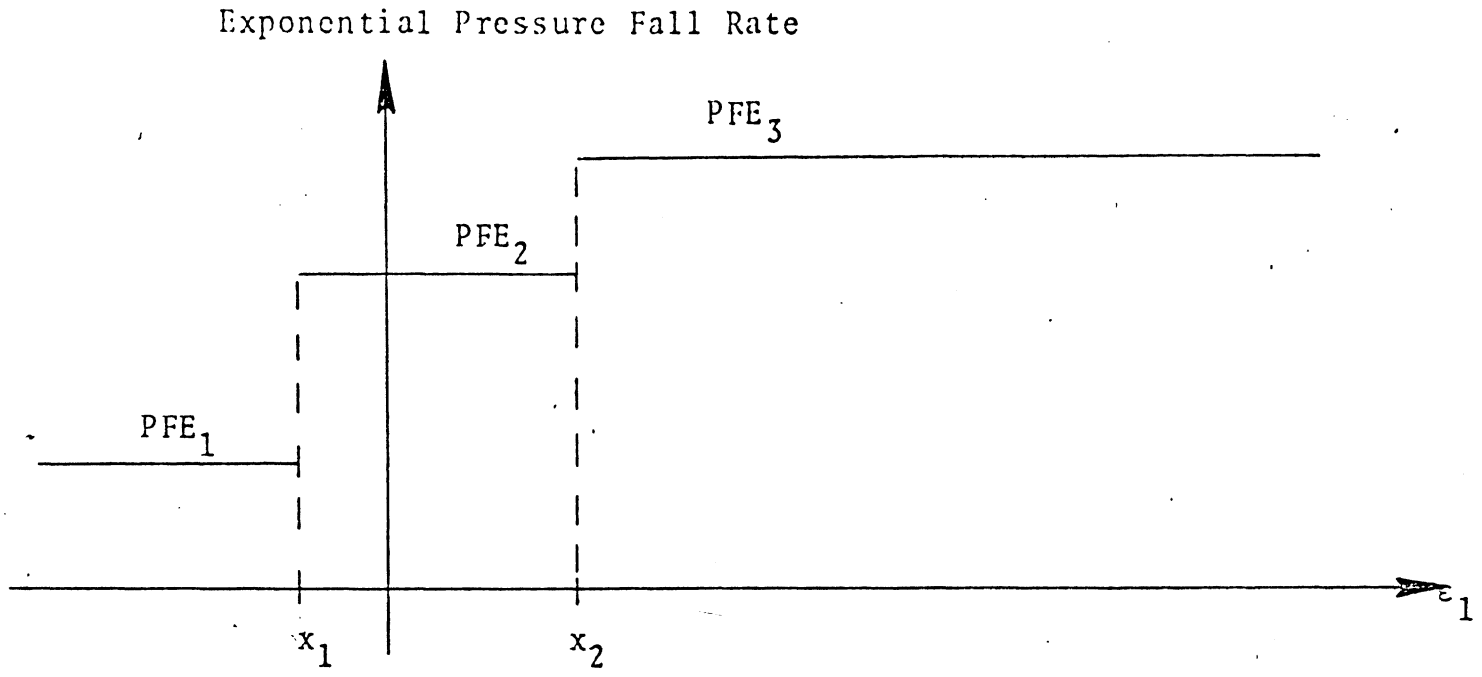


Figure D-9.

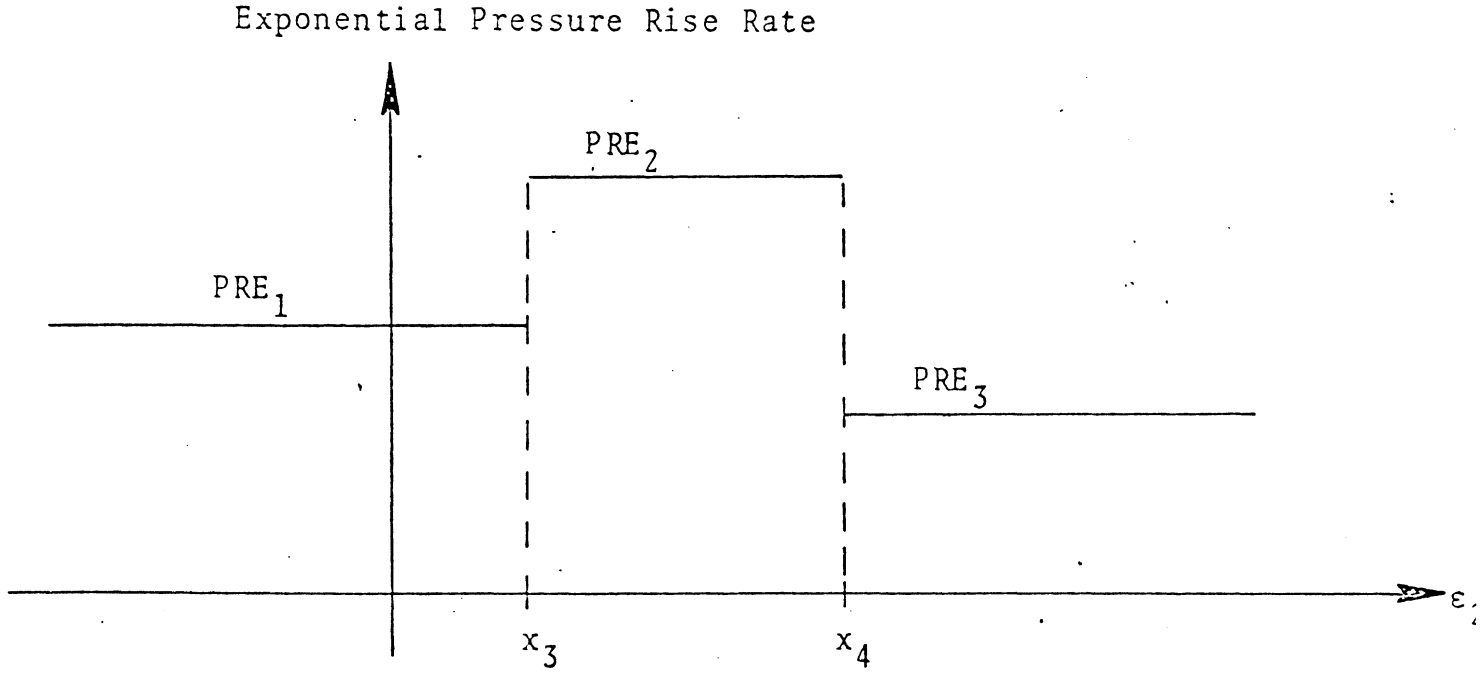


Figure D-10.

Linear Fall and Rise Rates

The pressure fall and rise, under this option, is linear in time with an upper limit as treadle pressure, P_d, and a lower limit as zero pressure. Three fall rates and three rise rates may be specified as in the exponential case. The linear fall and rise rates are denoted as PFL_i and PRL_i , (i=1,3), respectively. Again, for programming flexibility, the linear fall and rise rates are defined as functions of variables denoted as ε_3 and ε_4, respectively. ε_3 and ε_4 are defined by the general form expressions:

$$\varepsilon_3 \triangleq R_1v_1 + R_2v_2 + R_3v_3 + R_4v_4w_4 + R_5v_5w_5$$

$$\varepsilon_4 \triangleq S_1v_1 + S_2v_2 + S_3v_3 + S_4v_4w_4 + S_5v_5w_5$$

where R_j and S_j , (j=1,5) are the constant coefficients of each term, and v_j w_k , (j=1,5; k=4,5) are variables/parameters available in the user dictionary. These relationships are illustrated in Figures D-11 and D-12. The pressure returned is given simply by the following two equations:

$$P(t-t_o) = [PFL_i(\varepsilon_3)] \cdot (t-t_o) + P(t_o) \quad ; \quad \text{(fall)}$$

$$P(t-t_o) = [PRL_i(\varepsilon_4)] \cdot (t-t_o) + P(t_o) \quad ; \quad \text{(rise)}$$

X_5, X_6, X_7, and X_8 are the associated break-points similar to the exponential case.

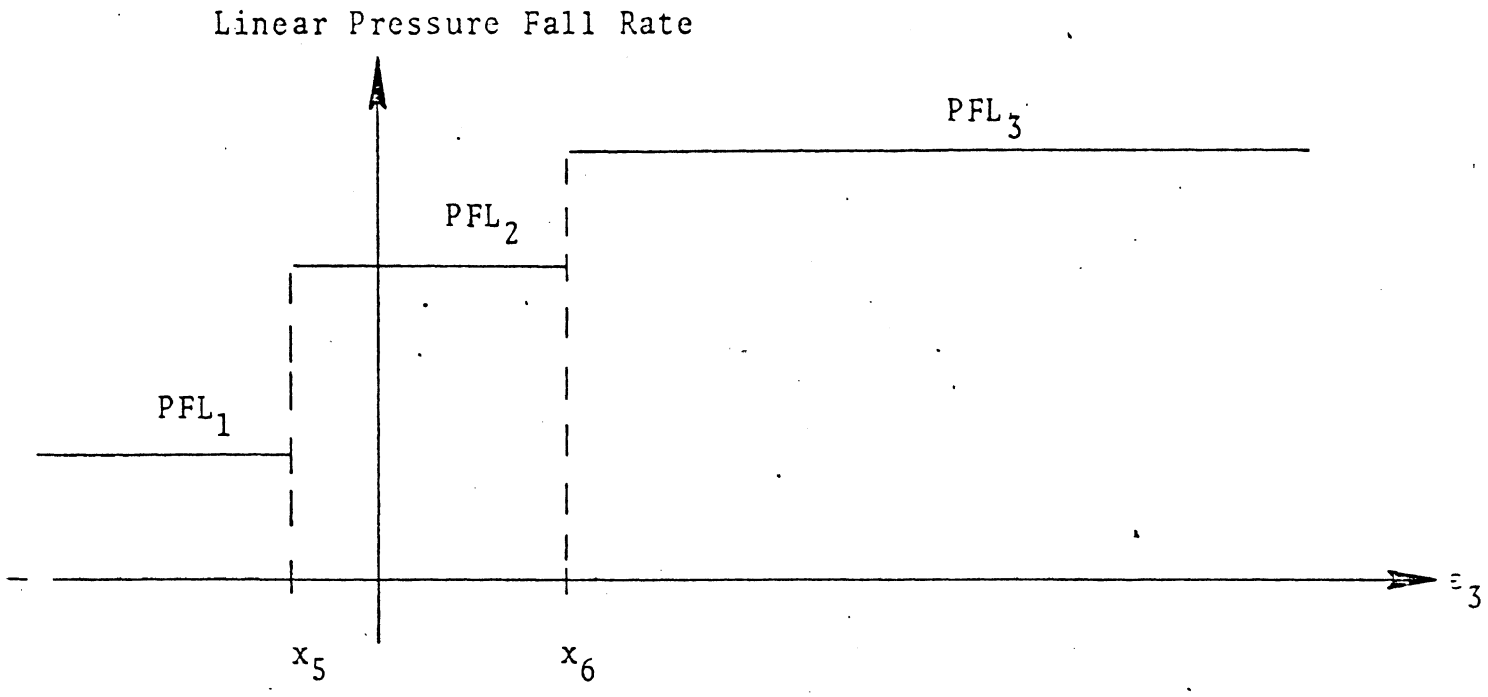


Figure D-11

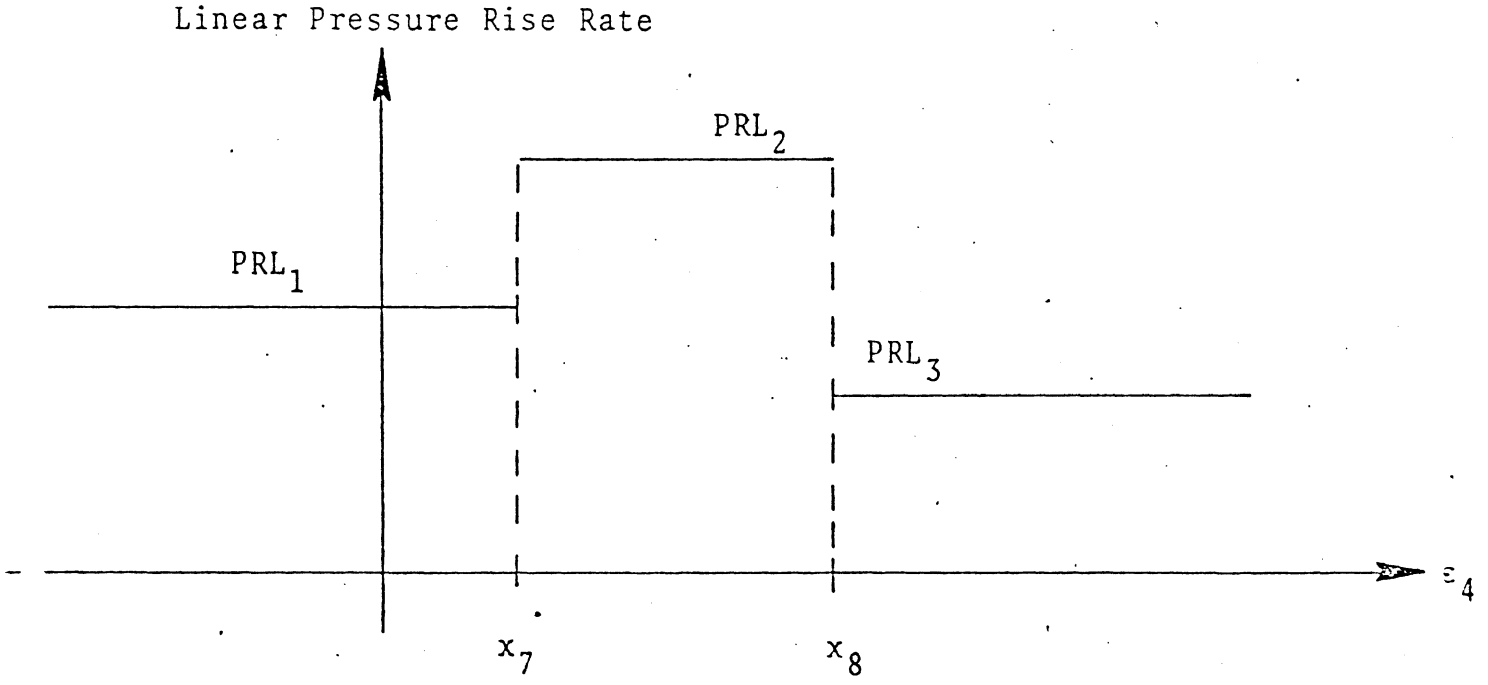


Figure D-12

Pressure Modulator Key

A pressure modulator key, IPKEY, is read during input just prior to any data related to the pressure modulator. The value of this key distinguishes for the program whether exponential, linear, or both exponential and linear characteristics will be computed. The following key defines the IPKEY values required for each case:

$$\text{IPKEY} = \begin{cases} 0, & \text{exponential} \\ 1, & \text{linear} \\ 2, & \text{exponential and linear} \end{cases}$$

The exponential and linear option (IPKEY=2) returns a pressure representing the summation of the exponential and linear pressure computations.

Finally, all coefficients appearing in the general form expressions for the pressure modulator possess the adaptive coefficient feature.

Example

Consider the following example of a certain pressure modulator having only exponential pressure fall and rise characteristics:

1) "ON" delay = "OFF" delay = 0.05 seconds.

2) The exponential pressure rise rate assumes an approximate value of $(0.2)^{-1} = 5.0$ for differences between treadle valve output pressure and line pressure of 50 psi or more, and an approximate exponential rise rate of $(0.33)^{-1} = 3.0$ for pressure differences of less than 50 psi.

3) The exponential pressure fall rate is approximately constant for all line pressure values with a fall rate equal to $(0.25)^{-1} = 4.0$.

This could be simulated by the following choice of input parameters:

$IPKEY = 0$

$\tau_{ON} = 0.05$

$\tau_{OFF} = 0.05$

$H_1 = 1.0$ } => $\varepsilon_1 = 1.0$

$G_1 = -1.0$, $G_2 = 1.0$ } => $\varepsilon_2 = P_d - P$

Variable I.D. code for P_d = 31.

Variable I.D. code for P = 35. See User Diectionary

$X_1 = X_2 = 0.0$

$PFE_1 = PFE_2 = PFE_3 = 4.0$

$X_3 = 0.0$, $X_4 = 50.0$

$PRE_1 = PRE_2 = 3.0$, $PRE_3 = 5.0$

The number of terms required for ε_1, (1 term) and ε_2 (2 terms) would also be required as input as explained in Section D.7.

D.6. Special Options. Five special options have been included in the model in order to facilitate simulation of certain features displayed in some actual antilock systems while also providing increased programming flexibility. The five options referred to are: (1) treadle pressure modulation/programming, (2) pulse-width modulated square wave, (3) five programmable one-shots, (4) general purpose counter, and (5) general purpose variables. Each of these options will be explained in the following sections.

Treadle Pressure Modulation/Programming

Most pressure valves operating without antilock interruption, and many under antilock cycling, follow or are limited above by the treadle pressure application; while similarly, the output pressure of these valves fall to treadle pressure or zero

pressure when treadle pressure is decreased or removed. However, in some valves, during antilock cycling, pressure may rise to some limiting pressure less than treadle and/or fall to some pressure greater than zero. Such treadle modulation or programming of demanded pressure is a feature which is allowed for under this option.

Prior to any input for this option, a key, IPDKEY, for treadle pressure modulation, is read. A value of -1 or less negates the use of this option, while values greater than or equal to 0 activate the option. Variables PDFALL and PDRISE become the demanded pressure during pressure fall and rise periods, respectively. These variables are defined by the following general form expressions:

$$\text{PDFALL} \triangleq V_1 v_1 + V_2 v_2 + V_3 v_3 + V_4 v_4 w_4 + V_5 v_5 w_5$$

$$\text{PDRISE} \triangleq W_1 v_1 + W_2 v_2 + W_3 v_3 + W_4 v_4 w_4 + W_5 v_5 w_5$$

where,

V_j and W_j , (j=1,5) are constant coefficients for each term. The adaptive coefficient feature is provided for these coefficients.

v_j, w_k , (j=1,5; k=4,5) are variables/parameters selected from the user dictionary.

As an example, suppose an antilock system operated so as to always rise to the maximum pressure attained in the previous cycle rather than to treadle pressure. PDRSE would then be defined as simply

PDRSE = (1.0) POFF1

where 1.0 is W_1 and POFF1, the maximum pressure from the last cycle, is selected from the user dictionary for v_1. In this case, the coefficient, 1.0, and the variable I.D. code for POFF1, 7, would be required as input for the option.

Pulse-Width Modulated Square Wave

A time, or pulse-width, modulated square wave is provided as an option for general use. This option was motivated by a particular antilock system known to possess such a feature for purposes of treadle pressure modulation. The square wave generated under this option can be used in any portion of the program and is available in the user dictionary under the name SQUARE. Figure D-13 illustrates the parameter and variable relationships which define the square wave. The period of the suqare wave, PERIOD, is constant. The amount of time modulation, represented by TMOD, may be variable and programmable. This is accomplished in the program by allowing the ratio, TMOD/PERIOD, to be a tabular function of a variable, ε_5, as shown in Figure D-14 ε_5 is defined as a general form expression:

$$\varepsilon_5 = PW_1v_1 + PW_2v_2 + PW_3v_3 + PW_4v_4w_4 + PW_5v_5w_5$$

where

PW_i , (i=1,5) are constant coefficients for each term. The adaptive coefficient feature is provided for these coefficients.

v_i, w_k , (i=1,5; k=4,5) are variables/parameters selected from the user dictionary.

Note that the FZ_i values in the TMOD/PERIOD table should not be greater than 1.0 or less than 0.0. Values of 1.0 ideally signify 100% modulation; values of 0.0, no modulation. (In

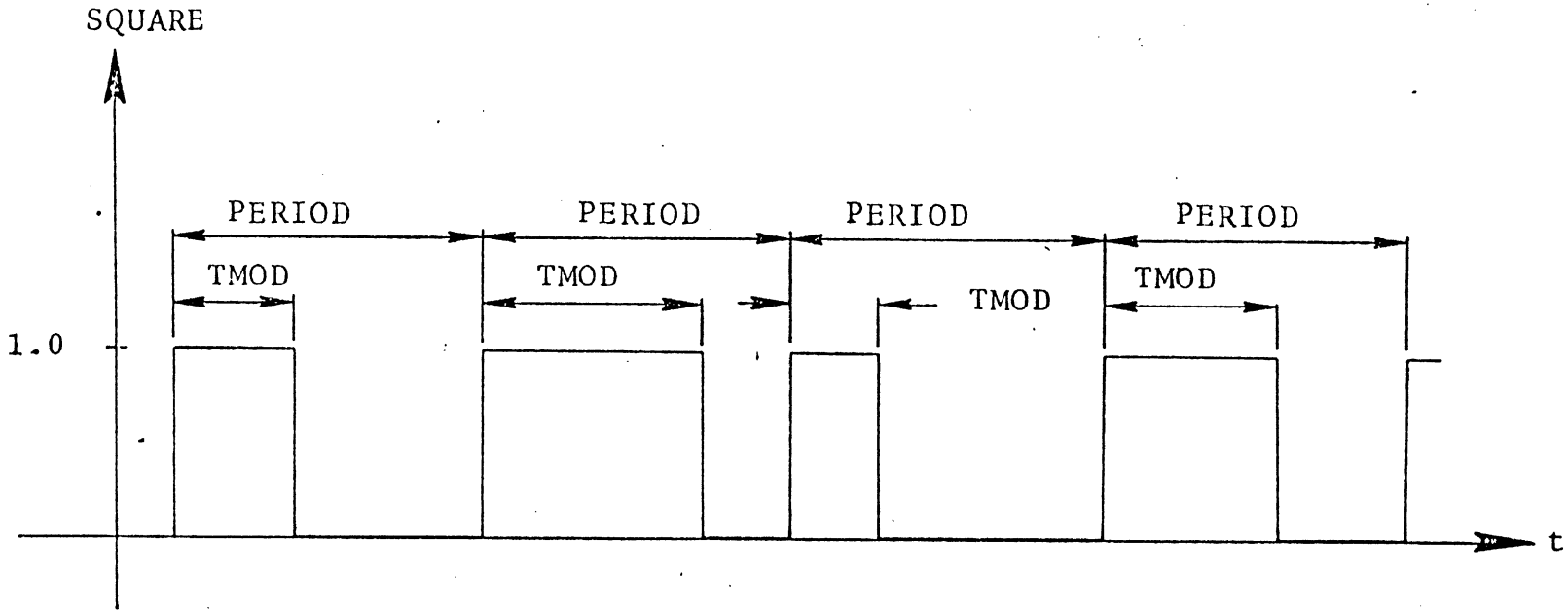


Figure D-13. Pulse-width modulated square wave.

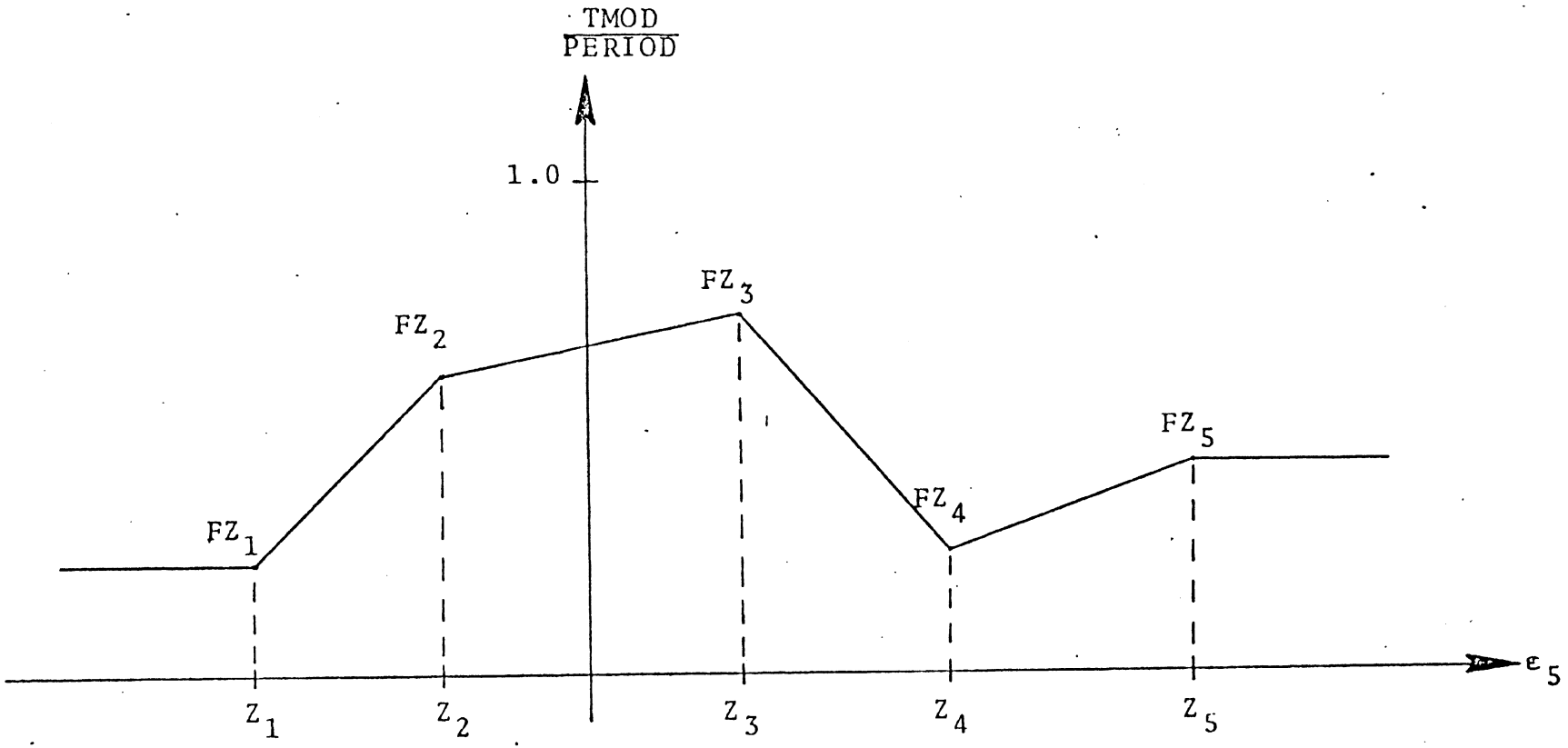


Figure D-14. Pulse-width table.

actuality, the degree of modulation attainable depends on the simulation time step used and the period chosen for the square wave.)

Input data required for this option includes: (a) five pairs of FZ_i and Z_i, (b) PERIOD, and (c) coefficient values and variable I.D. codes used in the general form expression for ε_5. As before, a key for the pulse-width modulation option, IPWMKY, is read prior to any input for this option. IPWMKY values greater than or equal to 0 enable the option.

If desired, two additional sets of FZ_i values may be input. Each set is associated with a specific variable/parameter chosen by the user from the dictionary and a break-point for that variable/parameter. If the specified variable exceeds the break-point value for the given FZ_i set, that FZ_i set replaces the original or previous set used by the program. The purpose of this is to allow for some adaptive capability within the FZ_i table, if desired. The details of the numerical input for this adaptive option are explained in Section D.7.

One-Shots

Three programmable one-shots are provided under this option and can be used for several different purposes. Two common uses are: (1) simulating time delay effects and (2) as auxiliary binary variables for use in any general purpose expressions. The three one-shots, as defined in this document, are binary variables having the numerical value of 1.0 or 0.0. These are available in the user dictionary under the names FOS1, FOS2, and FOS3.

The one-shots used in the program operate according to the following rule: If a trigger or input condition (inequality) changes from negative to positive, the one-shot will change its value from 0.0 to 1.0 for a fixed length of time, specified by the user, then return to 0.0. During a one-shot firing (1.0

value), the trigger input is disabled and cannot effect recurrent firings from this state. The one-shot is reset for another firing by two necessary occurrences: (1) the time duration of the present one-shot firing has been exceeded, followed by or concurrent with, (2) the trigger condition being negative. A trigger condition value of 0.0 is interpreted by the program as positive. See Figure D-15.

The one-shot can also be reset by a clear command which is programmed similarly as the trigger condition. It may be used to override any current trigger command to clear or reset the one-shot. The one-shot is reset whenever the clear condition is positive or zero. The clear condition is always evaluated after the trigger condition at each program time step.

The trigger condition is defined by the general form expression:

$$OS_1v_1 + OS_2v_2 + OS_3v_3 + OS_4v_4w_4 + OS_5v_5w_5 \geq 0$$

where

OS_i (i=1,5) are constant coefficients for each term and possess the adaptive coefficient feature.

v_i, w_k (i=1,5; k-4,5) are variables/parameters from the user dictionary.

The clear condition is defined by the general form expression:

$$RIDCL_1V_1 + RIDCL_2V_2 + RIDCL_3V_3 + RIDCL_4V_4W_4 + RIDCL_5V_5W_5 \geq 0$$

where

$RIDCL_i$ (i=1,5) are constant coefficients for each term and possess the adaptive coefficient feature.

V_i, W_k (i-1,5; K=4,5) are variables/parameters from the user dictionary.

Each one-shot trigger and clear command is programmable by a general form expression as shown above. The one-shot time durations are denoted as TOS1,.....,TOS5 and are required as input for each one-shot used.

General Purpose Counter

This option allows the user to generate a count sequence by incrementing a counter by 1 every digital time step, if a particular inequality expression is greater than or equal to 0. The variable

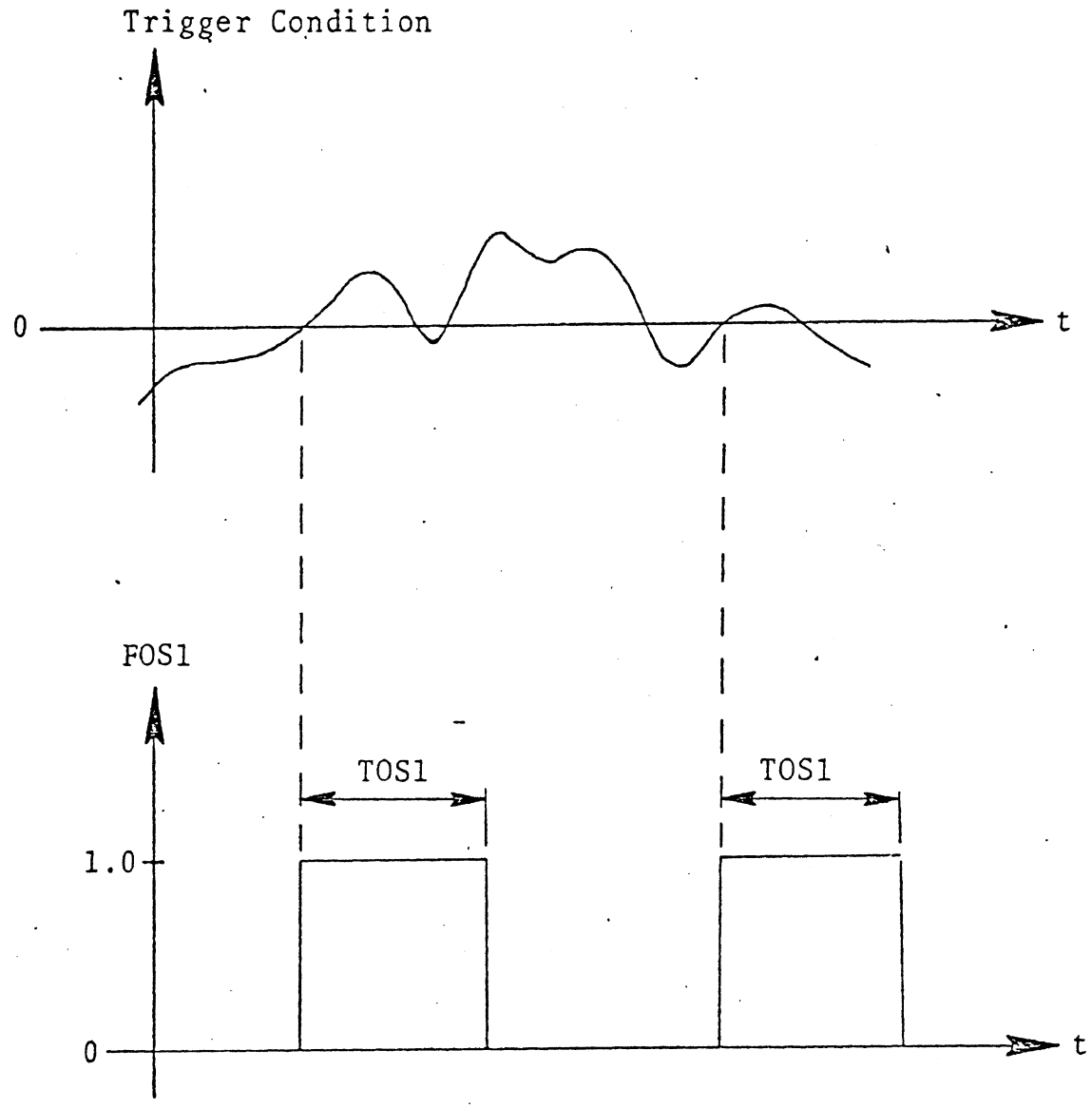


Figure D-15. One-shot operation. (Clear condition < 0)

containing the count is called GPCNT and is in the user dictionary with the I.D. code 44. The general form expression is given by

$$GP_1v_1 + GP_2v_2 + GP_3v_3 + GP_4v_4w_4 + GP_5v_5w_5 > 0$$

where

GP_i (i=1,5) are constant coefficients for each term and can be adaptive.

v_i, w_k (i=1,5; k-4,5) are variables/parameters from the user dictionary.

If the above inequality is satisfied, the GPCNT count is incremented each time step. If only a one count increment is desired whenever a particular condition is satisfied, then a one-shot could be fired for a time period equal to or less than the digital time step, with the general purpose counter incrementing itself every one-shot firing.

The above discussion applies whenever the logic sampling period is specified as less than or equal to the digital simulation time step. If the user specifies a larger logic sampling period (slower sampling rate), then the general purpose counter will be incremented only each logic sampling period.

The counter can be reset to zero by allowing the inequality expression to become less than or equal to -10,000.

General Purpose Variables

This option allows the program user to define new dictionary variables as linear combinations and products of any other variables available in the dictionary. Each general purpose variable is defined by a general form expression:

$$GPV = GPVV_1v_1 + GPVV_2v_2 + GPVV_3v_3 + GPVV_4v_4w_4 + GPVV_5v_5w_5$$

where

GPV is the general purpose variable

$GPVV_i$ (i=1,5) are constant coefficients for each term and possess the adaptive coefficient feature.

D.7. Input Data Format - General Form Expressions. The most frequently occurring form enountered by the program user is the general form expression which appears in almost every program segment and special

option. As discussed in Section D.2, it has the form

$$C_1x_1 + C_2x_2 + C_3x_3 + C_4x_4y_4 + C_5x_5y_5$$

where

C_i (i=1,5) are the constant coefficients of each term.

x_i, y_k (i=1,5; k-4,5) are variables/parameters available in the user dictionary.

The user defines a given general form expression for the program by inputting three different pieces of information: (1) the number of terms in the expression required (1 to 5), (2) the variable I.D. codes corresponding to the x_i, y_k from the user dictionary for each variable/parameter used in constructing the expression, and (3) the coefficients of each term, C_i, used in the expression. The following data input sequence is what would be required for defining a general form expression:

NT , number of terms	; I1 format
(I.D. code of x_1)	; F10.4 format
(I.D. code of x_2)	; F10.4 format
(I.D. code of x_3)	; F10.4 format
(I.D. code of x_4),(I.D. code of y_4)	; 2F10.4 format
(I.D. code of x_5),(I.D. code of y_5)	; 2F10.4 format
Coefficient of x_1	; F10.4 format
Coefficient of x_2	; F10.4 format
Coefficient of x_3	; F10.4 format
Coefficient of x_4y_4	; F10.4 format
Coefficient of x_5y_5	; F10.4 format

If NT is 5, the above format is used. If NT = M < 5, only M I.D. code cards and M coefficient cards are required. Note that the second fields of the I.D. code cards are used only for the 4th and 5th terms. The 4th and 5th terms allow for quadratic representations, but can be linear if one of the two variable I.D. codes is selected as 1.0 (unity parameter).

Constant terms are represented by the unity parameter, 1.0, and the desired constant coefficient.

As an example, consider the general form expression, $\dot{x} - \omega - 10$. The required input for this would be:

3	number of terms required; I1 format
5.	variable I.D. codes from the user
3.	dictionary corresponding to $\dot{x}$, ω,
1.	and the constant; F10.4 format
1.	the C_i coefficients for each of
-1.	the terms; F10.4 format
-10.	

Adaptive Coefficient Input Format

As explained in Section D.4, an adaptive coefficient feature exists to allow the coefficients appearing in the general form expressions to change value as a function of one or two variables from the user dictionary and their associated break-points. The third and fourth fields (columns 21-30, 31-40) of each variable I.D. input card are used to identify the variable(s) to which the corresponding term's coefficient is adaptive. Similarly, the fourth and fifth fields (columns 31-40, 41-50) of each coefficient card are used for specifying their associated break-points. The alternate coefficients are specified in the second and third fields (columns 11-20, 21-30) of each coefficient card. Consider the example from the previous section and suppose it was desired to alter the coefficient of $\dot{x}$, i.e., 1., to values of .5, and .2 according to the following rule:

$$\text{Coefficient of } \dot{x} = \begin{cases} 1.0 & \text{initial or nominal value} \\ 0.5 & \text{whenever } \dot{\omega} > 25 \text{ and } t \leq 2.0 \\ 0.2 & \text{if } t > 2.0 \end{cases}$$

The input required would now become:

```
3
5.        ,      ;     4.      ,     2.      ,
3.
1.
1.        , 0.5  ,  0.2         ,  25.        ,     2.0      ,
-1.
-10.
```

where the numbers 4. and 2. are the I.D. codes for $\dot{\omega}$ and t, respectively, and occur on the I.D. card for $\dot{x}$ in fields 3 and 4.

If only one adaptive variable is required, then field 4 of the I.D. code card and fields 3 and 5 of the coefficient card should not be used. Negative I.D. codes are permitted for the adaptive variables. This will cause the program to invert the sign of the adaptive variable. It would be used if one found it more convenient to have the adaptive condition, $u_{ij} > b_1$, interpreted as

$$-u_{ij} > -b_1 \quad , \quad (u_{ij} < b_1).$$

Reference was made in Section D.4 to a numerical switch which allows the adaptive coefficient feature to be defined by Equation (D-6) rather than by Equation (D-5). If this optional

definition is desired, any negative number should be entered in field 2 (columns 11-20) of the variable I.D. card. Normally, this field is not used except when 4 or 5 terms are needed in a general form expression. In the case of a 4th or 5th term and the optional definition, the negative of the variable I.D. code should be used in field 2.

Pulse-Width Modulation Table - Adaptive Capability

The adaptive capability for the FZ_i table is implemented by the following numerical input procedure: If field 6 (column 51-60) of the first FZ_i card is non-zero, two more FZ_i cards are read. Each of these cards maintain the same five fields for the alternate FZ_i input. However, two additional fields are included (columns 51-60, 61-70) and are used to specify the adaptive variable I.D. code and its associated break-point for that card (alternate table). The second alternate card takes precedence over the first alternate in the event both break-points are exceeded. The following sample input is an example:

Z_i card:	-30.	-10.	0.	10.	50.		
1st FZ_i card:	0.	.10	.20	.50	.90	99.	
1st alternate FZ_i card:	0.	.05	.10	.25	.45	5.	50.
2nd alternate FZ_i card:	0.	.025	.05	.12	.22	5.	70.

The number 99. in field 6 for the 1st FZ_i card simply causes the next two cards to be read. Both alternate cards are adaptive in this case to the same variable, vehicle velocity (I.D. code 5; field 6). The respective break-points are 50. ft/sec and 70. ft/sec. The effect of this input is to cause the program to use table 3 for speeds above 70 ft/sec, table 2 for speeds between 70 ft/sec and 50 ft/sec, and table 1 for speeds less than 50 ft/sec. The adaptive variables do not have to be the same, as in the example.

Antilock Input Stream

Before any input data for the antilock subroutine is read, a key parameter (ILOCK) is read to indicate whether or not any wheel of the vehicle possesses an antilock system (see Section 3.6 of the Users Manual). If any or all wheels do, the key parameter (ILOCK) in the input stream should be set to 01 (I2 format). If no antilock system at all is desired, ILOCK should be set to 0. No antilock data should follow ILOCK if ILOCK is 0. For ILOCK set to 01, the following table number and input parameter discussion applies for each wheel on the vehicle train.

A table number not currently in use for a tire, spring, or other antilock table, causes the program to read antilock data for the specified table number. Subsequent wheels on the vehicle train requiring the same antilock data as one previously read, need only enter the same table number. An entry of 0 for any antilock table number implies no antilock system for that wheel.

The following example illustrates the antilock table number usage for a tractor-trailer with tandem rear suspensions on the tractor and trailer. Following an 01 ILOCK entry indicating antilock systems on the vehicle train:

0 0	No antilock on the tractor front axle (left and right wheels)
05	New table number of tractor rear suspension, front tandem axle, left side
. . . . .	Antilock data for front tandem axle, left side
05	Same antilock data requested for front tandem, right side
05 05	Same antilock data requested for rear tandem, left and right sides
06	New table number for trailer rear suspensions, front tandem, left side
. . . . .	Antilock data for trailer front tandem, left side
06	Same antilock data requested for trailer front tandem, right side
0 0	No antilock data for trailer rear tandem axle, left and right wheels

The numerical inputs for OPTION, the side-to-side option key, are as follows:

OPTION

01 => Worst Wheel

02 => Best Wheel

03 => Average Wheel

04 => Independent Wheel

(I2 format)

The following list defines all the input parameters available for each antilock system used. The parameters required should be entered in the order given below.

It should be noted that this complete listing is presented to define the order and format of any required input data. The program, however, requires only that amount of input data needed to define a particular system.

Input	Description	Format
ILOCK	global antilock key	I2
TN_1	Table number entry for 1st wheel (front axle, left side)	I2
$OPTION_1$	side-to-side option, 1st wheel	I2
WWDIF	side-to-side wheel speed difference operator (see variable I.D. 60 definition)	F10.2
$NOFF_1$	No. of 'OFF' inequalities to follow	I1
M1	No. of terms in 1st inequality	I1
ID_1 ⋮ ID_{M1}	M1 variable I.D. code cards for logic inequality 1	4F10.4
$C_{1,1}$ ⋮ $C_{1,M1}$	M1 coefficient cards	5F10.4
M_2	No. of terms in 2nd inequality	I1
ID_1 ⋮ ID_{M2}	M2 variable I.D. code cards for logic inequality 2	4F10.4
$C_{2,1}$ ⋮ $C_{2,M2}$	M2 coefficient cards	5F10.4
M_3	No. of terms in 3rd inequality	I1
⋮	⋮	

For $NOFF_1$ inequality expressions, $NOFF_1 \leq 4$.

NON_1	No. of 'ON' inequalities to follow	I1
M5	No. of terms in 5th inequality	I1
ID_1 ⋮ ID_{M5}	M5 variable I.D. code cards for logic inequality 5	4F10.4
$C_{5,1}$ ⋮ $C_{5,M5}$	M5 coefficient cards	5F10.4
M6 ⋮	No. of terms in 6th inequality ⋮	I1 ⋮

For NON_1 inequality expressions, $NON_1 \leq 4$.

$\tau_1, \tau_2, \tau_3, \tau_4$	Logic time delays	4F10.4
IPKEY	Pressure modulator key	I1
N1	No. of terms in ε_1 expression (IPKEY=0,2)	I1
ID_1 ⋮ ID_{N1}	N1 variable I.D. code cards	4F10.4
H_1 ⋮ H_{N1}	N1 coefficient cards	5F10.4

N2	No. of terms in the ε_2 expressions	I1
ID_1 . . . ID_{N2}	N2 variable I.D. code cards	4F10.4
G_1 . . . G_{N2}	N2 coefficient cards	5F10.4
X_1 X_2	ε_1 break-points	2F10.4
X_3 X_4	ε_2 break-points	2F10.4
PFE1 PFE2 PFE3	exponential fall rates	3F10.4
PRE1 PRE2 PRE3	exponential rise rates	3F10.4
N3	No. of terms in ε_3 expression (IPKEY=1,2)	I1
ID_1 . . . ID_{N3}	N3 variable I.D. code cards	4F10.4
R_1 . . . R_{N3}	N3 coefficient cards	5F10.4
N4	No. of terms in ε_4 expression	I1
ID_1 . . . ID_{N4}	N4 variable I.D. code cards	4F10.4

S_1 ⋮ S_{N4}	N4 coefficient cards	5F10.4
X_5 X_6	ε_3 break-points	2F10.4
X_7 X_8	ε_4 break-points	2F10.4
PFL1 PFL2 PFL3	linear fall rates	3F10.4
PRL1 PRL2 PRL3	linear rise rates	3F10.4
τ_{ON}, τ_{OFF}	pressure modulator time delays	2F10.4
τ_W, τ_{WD}	wheel rate, acceleration time constants	2F10.4
OP_{12}, OP_{23}, OP_{34}	logical operator switches	3I1
OP_{56}, OP_{67}, OP_{78}	logical operator switches	3I1
IPDKEY	treadle pressure modulator key	I2
N5	No. of terms for PDRISE	I1
ID_1 ⋮ ID_{N5}	N5 variable I.D. code cards	4F10.4
W_1 ⋮ W_{N5}	N5 coefficient cards	5F10.4
N6	No. of terms in PDFALL expression	I1
ID_1 ⋮ ID_{N6}	N6 variable I.D. code cards	4F10.4

V_1 ⋮ V_{N6}	N6 coefficient cards	5F10.4
IPWMKY	pulse-width modulation key	I2
PERIOD	period of pulse-width modulated square wave	F10.4
N7	No. of terms in ε_5 expression	I1
ID_1 ⋮ ID_{N7}	N7 variable I.D. code cards	4F10.4
PW_1 ⋮ PW_{N7}	N7 coefficient cards	5F10.4
Z_1, Z_2, Z_3, Z_4, Z_5	$\frac{TMOD}{PERIOD}$ table break-points	5F10.4
$FZ_1, FZ_2, FZ_3, FZ_4, FZ_5$	$\frac{TMOD}{PERIOD}$ table input	6F10.4
	alternate/adaptive FZ_i input (see Section)	7F10.4 7F10.4
IOSKEY	one-shot option key	I2
N1	No. of terms for 1st one-shot expression	I1
ID_1 ⋮ ID_{N1}	N1 variable I.D. code cards	4F10.4

OS_1 . . . OS_{N1}	N1 coefficient cards	5F10.4
NC1	no. of terms for 1st one-shot 'clear' expression	I1
ID_1 . . . ID_{NC1}	NC1 variable I.D. code cards	4F10.4
$RIDCL_1$ . . . $RIDCL_{NC1}$	NC1 coefficient cards	5F10.4
TOS_1	time duration of 1st one-shot	F10.4
N2	no. of terms in 2nd one-shot expression	I1
ID_1 . . . ID_{N2}	N2 variable I.D. code cards	4F10.4
OS_1 . . . OS_{N2}	N2 coefficient cards	5F10.4
NC2	no. of terms for 2nd one-shot 'clear' expression	I1
ID_1 . . . ID_{N2}	NC2 variable I.D. code cards	4F10.4
$RIDCL_1$ . . . $RIDCL_{NC2}$	NC2 coefficient cards	5F10.4

TOS2	time duration of 2nd one-shot expression	F10.4
N3	no. of terms in 3rd one-shot expression	I1
ID_1 . . . ID_{N3}	N3 variable I.D. code cards	4F10.4
OS_1 . . . OS_{N3}	N3 coefficient cards	5F10.4
NC3	no. of terms for 3rd one-shot 'clear' expression	I1
ID_1 . . . ID_{NC3}	NC3 variable I.D. code cards	4F10.4
$RIDCL_1$ . . . $RIDCL_{NC3}$	NC3 coefficient cards	5F10.4
TOS3	time duration of 3rd one-shot	F10.4
N4	no. of terms for 4th one-shot expression	I1
ID_1 . . . ID_{N4}	N4 variable I.D. code cards	4F10.4
OS_1 . . . OS_{N4}	N4 coefficient cards	5F10.4

NC4	no. of terms for 4th one-shot 'clear' expression	I1
ID_1 . . . ID_{NC4}	NC4 variable I.D. code cards	4F10.4
$RIDCL_1$ . . . $RIDCL_{NC4}$	NC4 coefficient cards	5F10.4
TOS4	time duration of 4th one-shot	F10.4
N5	no. of terms for 5th one-shot expression	I1
ID_1 . . . ID_{N5}	N5 variable I.D. code cards	4F10.4
OS_1 . . . OS_{N5}	N5 coefficient cards	5F10.4
NC5	no. of terms for 5th one-shot 'clear' expression	I1
ID_1 . . . ID_{NC5}	NC5 variable I.D. code cards	4F10.4
$RIDCL_1$ . . . $RIDCL_{NC5}$	NC5 coefficient cards	5F10.4
TOS5	time duration of 5th one-shot	F10.4

IGPKEY	general purpose counter key	I2
NG	no. of terms in general purpose counter expression	I1
ID_1 ⋮ ID_{NG}	NG variable I.D. code cards	4F10.4
GP_1 ⋮ GP_{NG}	NG coefficient cards	5F10.4
IGPVKY	general purpose variable option key	I2
NV_1	no. of terms in first general purpose expression	I1
ID_1 ⋮ ID_{NV1}	NV1 variable I.D. code cards	4F10.4
GPV_1 ⋮ GPV_{NV1}	NV1 coefficient cards	5F10.4
NV2	no. of terms in 2nd general purpose expression	I1
ID_2 ⋮ ID_{NV2}	NV2 variable I.D. code cards	4F10.4
GPV_1 ⋮ GPV_{NV2}	NV2 coefficient cards	5F10.4
NV3	no. of terms in 3rd general purpose expression	I1

ID_3 ⋮ ID_{NV3}	NV3 variable I.D. code cards	4F10.4
GPV_3 ⋮ GPV_{NV3}	NV3 coefficient cards	5F10.0
NV4	no. of terms in 4th general purpose variable expression	I1
ID_1 ⋮ ID_{NV4}	NV4 variable I.D. code cards	4F10.4
GPV_1 ⋮ GPV_{NV4}	NV4 coefficient cards	5F10.4
NV5	no. of terms in 5th general purpose variable expression	I1
ID_1 ⋮ ID_{NV5}	NV5 variable I.D. code cards	4F10.4
GPV_1 ⋮ GPV_{NV5}	NV5 coefficient cards	5F10.4
TSMPLE	control logic sampling period	F10.4
TN_2	Table number entry for 2nd wheel (front axle, right side)	I2
$OPTION_2$	OPTION for 2nd wheel	I2
{ Same input format as for wheel 1 }		

TN_3	Table number entry for 3rd wheel	I2
$OPTION_3$	OPTION for 3rd wheel	I2
	{Same input format as for wheel 1}	
.	.	
.	.	
.	.	

End of antilock input

The following section provides two example problems and their associated input lists.

Example Problems

EXAMPLE 1.

Suppose an antilock system possesses the following features: (1) a wheel sensor time delay effect of 10 ms. and another 20 ms. delay in the derivation of wheel acceleration; (2) control logic which generates an "OFF" signal once the wheel acceleration falls below -50.0 ft/sec^2 and an "ON" signal for wheel accelerations greater than -10.0 ft/sec^2; (3) pressure modulator time delays of 40 ms. for "OFF" signals and 60 ms. for "ON" signals. The supposed exponential pressure rates are functions of wheel acceleration defined as follows:

$$\text{Pressure Fall Rate} \equiv \begin{cases} (0.1)^{-1} = 10.0 \text{ for } \dot{\omega} \leq -100 \text{ ft/sec}^2 \\ (0.2)^{-1} = 5.0 \text{ for } \dot{\omega} > -100 \text{ ft/sec}^2 \end{cases}$$

$$\text{Pressure Rise Rate} \equiv \begin{cases} (0.2)^{-1} = 5.0 \text{ for } \dot{\omega} \leq 50 \text{ ft/sec}^2 \\ (0.1)^{-1} = 10.0 \text{ for } \dot{\omega} > 50 \text{ ft/sec}^2 \end{cases}$$

The following choice of input parameters would describe the above antilock system:

$\tau_{\omega} = 0.01$

$\tau_{\omega d} = 0.02$

$C_{11} = -1.0$

$C_{12} = -50.0$ $\rightarrow F_1 = -\dot{\omega} - 50.0 \geq 0$

$C_{51} = 1.0$

$C_{52} = 10.0$ $\rightarrow F_5 = \dot{\omega} + 10.0 \geq 0$

I.D. Code for $\dot{\omega} = 4.$

I.D. Code for 1.0 = 1.

$\tau_1 = \tau_3 = \tau_4 = 0.0$

$\tau_2 = 0.2$

$H_1 = 1.0$

$H_2 = 100.0$ $\rightarrow \varepsilon_1 = \dot{\omega} + 100$

$X_1 = -10000.0$

$X_2 = 0.0$

PFE1 = 10.0

PFE2 = 5.0

$G_1 = 1.0$

$G_2 = -50.0$ $\rightarrow \varepsilon_2 = \dot{\omega} - 50.0$

$X_3 = -10000.0$

$X_4 = 0.0$

PRE1 = 5.0

PRE2 = 10.0

$OP_{12} = OP_{23} = OP_{34} = OP_{56} = OP_{67} = OP_{78}$ = either 0 or 1

τ_{ON} = 0.06

τ_{OFF} = 0.04

The following input list would be required:

01		ILOCK
01		TN_1
01		worst-wheel side-to-side option
0.0		WWDIF
1		NOFF1
2		M1
4.		I.D. code for $\dot{\omega}$
1.		I.D. code for 1.0
-1.		1st term coefficient, C_{11}
-50.		2nd term coefficient, C_{12}
1		NON_1
2		M5
4.		I.D. code for $\dot{\omega}$
1.		I.D. code for 1.0
1.		1st term coefficient, C_{51}
10.		2nd term coefficient, C_{52}
0. 0. 0. 0.		τ_i
0		IPKEY
2		N1
4.	ε_1	I.D. for $\dot{\omega}$
1.		I.D. for 1.0
1.		1st term coefficient for ε_1
100.		2nd term coefficient for ε_1
2		N2
4.	ε_2	I.D. for $\dot{\omega}$
1.		I.D. for 1.0
1.		1st term coefficient for ε_2
-50.		2nd term coefficient for ε_2
-10000. 0.		X_1, X_2
-10000. 0.		X_3, X_4

10.	10.	5.	PFE1, PFE2, PFE3
5.	5.	10.	PRE1, PRE2, PRE3
.06	.04		τ_{ON}, τ_{OFF}
.01	.02		τ_{W}, τ_{WD}
000			OP_{12}, OP_{23}, OP_{34}
000			OP_{56}, OP_{67}, OP_{78}
-1			IPDKEY
-1			IPWMKY
-1			IOSKEY
-1			IGPKEY
-1			IGPVKY
.0001			TSMPLE
01			TN_2
01			TN_3
.			.
.			.
.			.

EXAMPLE 2.

Simulation of an antilock system having the following features:

Wheel Sensor: τ_ω , $\tau_{\omega d}$ = .010 seconds

Control Logic:

OFF signal given by

$$F_1 = \dot{x} - \omega - 14 \geq 0, \quad \text{for } \dot{X} > 50 \text{ ft/sec}$$
$$= \dot{x} - \omega - 11 \geq 0, \quad \text{for } \dot{X} \leq 50$$

AND

$$F_2 = -\dot{\omega} - 12 \geq 0$$

OR

$$F_3 = \text{SLIP} - .50 \geq 0$$

ON signal generated when

$$F_5 = -\dot{x} + \omega + 10 \geq 0$$

AND

$$F_6 = \dot{\omega} - 20. \geq 0$$

OR

$$F_7 = \dot{\omega} - 250. \geq 0$$

Pressure Modulator:

a) τ_{ON} = .015 sec. ; τ_{OFF} = .010 sec.

b) One exponential fall rate of 14. sec^{-1}.

c) One exponential rise rate of 14. sec^{-1}.
and one linear rise rate of 45. sec^{-1}.

The exponential and linear pressure rise regions are determined by a decaying time ramp from the maximum pressure in the previous cycle. For pressure below this time ramp, the pressure rise is exponential; for pressure greater than the time ramp, the pressure rise is linear (see Figure D-16). The decaying time ramp can be written as

$$PMAX1 - 85. \ (t - TPMAX1)$$

where

PMAX1 is the maximum pressure in the last cycle

t is time

TPMAX1 is the time of the maximum pressure in the last cycle

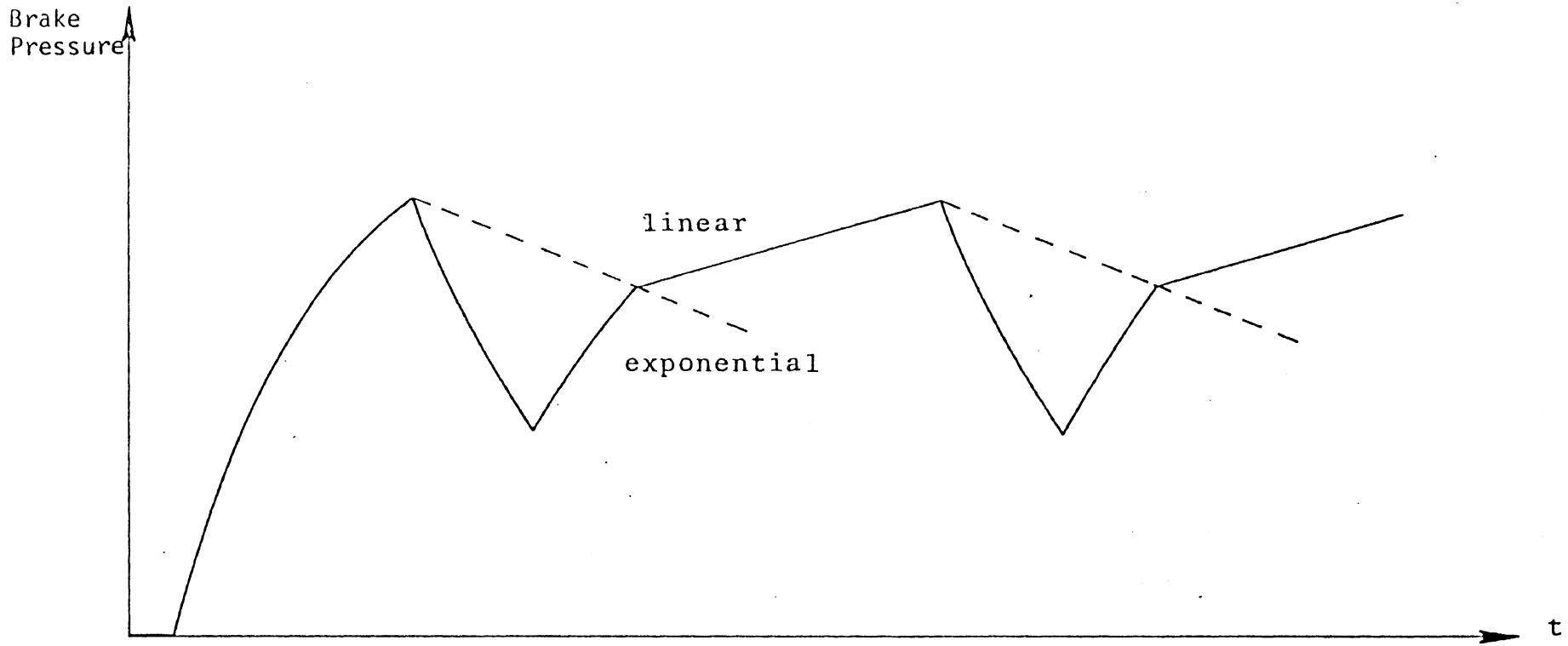
and 85. is the rate of decay. (psi/sec)

By subtracting the above expression from brake pressure, P, the ε_2 and ε_4 general expressions become:

$$\varepsilon_2 = P - PMAX1 + 85\ T - 85\ TPMAX1$$

and

$$\varepsilon_4 = P - PMAX1 + 85\ T - 85\ TPMAX1,$$



PRESSURE MODULATOR CHARACTERISTIC --- SYSTEM #2.

Figure D-16.

the switching point occurring at $\varepsilon_2 = \varepsilon_4 = 0$. Therefore, the desired rise characteristic can be simulated by the following set of pressure inputs:

$$X_3 = X_4 = X_7 = X_8 = 0$$

$$PRE1 = PRE2 = 14. \quad , \quad PRE3 = 0$$

$$PRL1 = PRL2 = 0. \quad , \quad PRL3 = 45.$$

The following input list would be required:

01	ILOCK
01	TN_1
01	$OPTION_1$
0.0	WWDIF
3	$NOFF_1$
3	M1
5.	
3.	
1. , , 5. , ,	
1.	C_{11}
-1.	C_{12}
-11. , -14. , , 50., ,	C_{13}
2	M2
4.	
1.	
-1.	C_{21}
-120.	C_{22}
2	M3
34.	
1.	
1.	C_{31}
-.50	C_{32}
3	NON_1
3	M5
5.	
3.	
1.	

-1.	C_{51}
1.	C_{52}
10.	C_{53}
2	M6
4.	
1.	
1.	C_{61}
-20.	C_{62}
2	M7
4.	
1.	
1.	C_{71}
-250.	C_{72}
0. 0. 0. 0.	τ_i
2	IPKEY
1	N1
1.	ε_1
5.	ε_1
4	N2
35.	ε_2
27.	ε_2
2.	ε_2
21. 1.	ε_2
1.	ε_2
-1.	ε_2
85.	ε_2
85.	ε_2

0.	0.			X_1, X_2
0.	0.			X_3, X_4
14.	14.	14.		PFE1, PFE2, PFE3
14.	14.	0.		PRE1, PRE2, PRE3
1				N3
1.			ε_3	
5.				
4				N4
35.			ε_4	
27.				
2.				
21.	1.			
1.				
-1.				
85.				
85.				
0.	0.			X_5, X_6
0.	0.			X_7, X_8
0.	0.	0.		PFL1, PFL2, PFL3
0.	0.	45.		PRL1, PRL2, PRL3
.015	.010			τ_{ON}, τ_{OFF}
.010	.010			τ_{ω} , $\tau_{\omega D}$
100				OP_{12}, OP_{23}, OP_{34}
100				OP_{56}, OP_{67}, OP_{78}
-1				IPDKEY
-1				IPWMKY
-1				IOSKEY

-1	IGPKEY
-1	IGPVKY
.0001	TSMPLE
01	TN_2
01	TN_3
.	.
.	.
.	.
.	.

Output-Echo Format

Figures D-17 through D-20 show an example of the kind of output-echo produced by the antilock subroutine. The first output page is simply the user dictionary of variables/parameters. The succeeding pages represent a computer echo of the antilock input. The "First" and "Second Adaptive Value" columns refer to the alternate coefficients available with the adaptive coefficient feature. The "First" and "Second Adaptive Variable" columns echo the variable I.D. codes for the two adaptive variables, while the columns labeled "First" and "Second Break-Point" contain their associated break-points. If the secondary adaptive coefficient definition (Figure D-8) is used, the word "AND" appears between the First and Second Adaptive Variable columns in the output echo for that coefficient. Any input not associated with a general form expression is listed under "Non-Adaptive Antilock Parameters."

DICTIONARY OF ANTI-LOCK VARIABLES/PARAMETERS AVAILABLE TO USER.

VARIABLE I.D.	DESCRIPTION
1	1.0
2	TIME
3	OMEGA
4	OMEGADOT
5	XDOT
6	XDDOT
7	POFF1
8	POFF2
9	PON1
10	PON2
11	TOFF1
12	TON1
13	XDOFF
14	XDON
15	WOFF
16	WON
17	WDOFF
18	WDON
19	WDMAX
20	WDMIN
21	TPMAX1
22	TPMIN1
23	WLOCK
24	TLOCK
25	SLON
26	SLOFF
27	PMAX1
28	PMAX2
29	PMIN1
30	PMIN2
31	PD
32	ON
33	TMOD
34	SLIP
35	P
36	CYCNT
37	SQUARE
38	SQUARN
39	TOFF2
40	TON2
41	FOS1
42	FOS2
43	FOS3
44	GPCNT
45	WMAX1
46	WMAX2
47	TWMAX1
48	TWMAX2
49	WMIN
50	TWMIN
51	TPMAX2
52	TPMIN2
53	GPV1
54	GPV2
55	GPV3
56	GPV4
57	GPV5
58	FOS4
59	FOS5
60	OMEGDIF

Figure D-17. Antilock Output Echo

*** ANTI-LOCK SUBROUTINE INPUT PARAMETER TABLE --- AXLE 1. ***

SYMBOL	DESCRIPTION	INITIAL VALUE	FIRST ADAPTIVE VALUE	SECOND ADAPTIVE VALUE	INITIAL VALUE VARIABLE	FIRST ADAPTIVE VARIABLE	SECOND ADAPTIVE VARIABLE	FIRST BREAK-PT	SECOND BREAK-PT
INEQUALITY EXPRESSION: 1									
C(1)	COEFFICIENT(1)	-1.0000			3				
C(2)	COEFFICIENT(2)	1.0000			45				
C(3)	COEFFICIENT(3)	-20.0000	-10.0000		2	6		-16.000	
C(4)	COEFFICIENT(4)	20.0000	10.0000		47, 1	6		-16.000	
C(5)	COEFFICIENT(5)	-4.0000	-7.0000		1, 1	36		0.500	
INEQUALITY EXPRESSION: 2									
C(1)	COEFFICIENT(1)	-1.0000			4				
C(2)	COEFFICIENT(2)	-70.0000			1				
INEQUALITY EXPRESSION: 3									
C(1)	COEFFICIENT(1)	1.0000			42				
C(2)	COEFFICIENT(2)	-0.1000			1				
C(3)	COEFFICIENT(3)	1000.0000			23				
INEQUALITY EXPRESSION: 5									
C(1)	COEFFICIENT(1)	1.0000			3				
C(2)	COEFFICIENT(2)	-1.0000			45				
C(3)	COEFFICIENT(3)	20.0000	10.0000		2	6		-16.000	
C(4)	COEFFICIENT(4)	-20.0000	-10.0000		47, 1	6		-16.000	
C(5)	COEFFICIENT(5)	7.0000			1, 1				
INEQUALITY EXPRESSION: 6									
C(1)	COEFFICIENT(1)	1.0000			4				
C(2)	COEFFICIENT(2)	-20.0000			1				
INEQUALITY EXPRESSION: 7									
C(1)	COEFFICIENT(1)	1.0000			42				
C(2)	COEFFICIENT(2)	-0.1000			1				

EPSILION 1:

Figure D-18. Antilock output echo.

F(1)	COEFFICIENT(1) .	5.0000		1				
EPSILION 2:								
G(1)	COEFFICIENT(1)	1.0000		35				
G(2)	COEFFICIENT(2)	-1.0000		27				
G(3)	COEFFICIENT(3)	200.0000	100.0000	2		36		1.500
G(4)	COEFFICIENT(4)	-200.0000	-100.0000	21,	1	36		1.500
EPSILION 3:								
B(1)	COEFFICIENT(1)	5.0000		1				
EPSILION 4:								
S(1)	COEFFICIENT(1)	1.0000		35				
S(2)	COEFFICIENT(2)	-1.0000		27				
S(3)	COEFFICIENT(3)	200.0000	100.0000	2		36		1.500
S(4)	COEFFICIENT(4)	-200.0000	-100.0000	21,	1	36		1.500
ONE-SHOT 1:								
OS1(1)	COEFFICIENT(1)	-1.0000		3				
OS1(2)	COEFFICIENT(2)	1.0000		45				
OS1(3)	COEFFICIENT(3)	-20.0000	-10.0000	2		6		-16.000
OS1(4)	COEFFICIENT(4)	20.0000	10.0000	47,	1	6		-16.000
OS1(5)	COEFFICIENT(5)	-6.0000		1,	1			
ONE-SHOT 2:								
OS2(1)	COEFFICIENT(1)	0.0		1				
OS2(2)	COEFFICIENT(2)	-0.1000		1				
OS2(3)	COEFFICIENT(3)	50.0000		41				
OS2(4)	COEFFICIENT(4)	1.0000		41,	4			

** NON-ADAPTIVE ANTI-LOCK PARAMETERS. **

TAU1	LOGIC TIME DELAY	0.0
TAU2	"	0.0
TAU3	"	0.0
TAU4	"	0.0
X1	EPSILON 1 BREAK-PT	0.0
X2	"	50.0000
X3	EPSILON 2 BREAK-PT	-5.0000
X4	"	2.5000
PFE1	EXP. PRESSURE FALL RATE	12.5000
PFE2	"	12.5000
PFE3	"	12.5000
PRE1	EXP. PRESSURE RISE RATE	14.0000
PRE2	"	14.0000
PRE3	"	0.0
X5	EPSILON 3 BREAK-PT	0.0
X6	"	50.0000
X7	EPSILON 4 BREAK-PT	-5.0000

Figure D-19. Antilock output echo.

X8	"	2.
PFL1	LIN. PRESSURE FALL RATE	0.0
PFL2	"	0.0
PPL3	"	0.0
PRL1	LIN. PRESSURE RISE RATE	0.0
PRL2	"	0.0
PRL3	"	40.0000
TAUON	PRESSURE-ON TIME DELAY	0.0150
TAUOFF	PRESSURE-OFF TIME DELAY	0.0100
TAUW	TIME CONSTANT-WHEEL RATE	0.0100
TAUWD	TIME CONSTANT-WHEEL ACCEL.	0.0100
OP12	LOGICAL OPERATOR SWITCH	1
OP23	"	0
OP34	"	0
OP56	LOGICAL OPERATOR SWITCH	1
OP67	"	0
OP78	"	0
TOS1	ONE-SHOT TIME DURATION	0.0200
TOS2	ONE-SHOT TIME DURATION	0.0200
TSAMPLE	ANTI-LOCK SAMPLING RATE	0.0010
OPTION	SIDE-TO-SIDE	1

Figure D-20. Antilock output echo.

APPENDIX E

THE EQUATIONS OF MOTION

To explain the equations of motion of the system, it is convenient to describe several subsystems and their interconnections. These subsystems are described in an orthogonal coordinate system which will be defined first.

E.1 The Coordinate Systems

The coordinates systems used are unchanged from the Phase II HSRI/MVMA program [2],* and details can be found in Section 4.1.2 of this manual. To briefly summarize:

Each sprung mass has a set of body axes fixed to the sprung mass origin at the sprung mass center designated as x, y, z, where x goes toward the front, y goes to the right, and z goes down.

A second set of axes is the inertial set designated as X, Y, Z. These are fixed and never change direction. In the initial condition for any simulation run, the sprung mass c.g. of the truck/tractor is at the origin of X, Y, Z, facing in the X direction.

A third set of axes, called the yaw plane system, is required. These are designated as $\overline{x}$, $\overline{y}$, $\overline{z}$, and have an origin which follows the sprung mass c.g. The direction of $\overline{z}$ remains normal to the road, and $\overline{x}$ and $\overline{y}$ follow the rotation of the vehicle around the $\overline{z}$ axis. Thus, $\overline{x}$ faces along the projection of x in the road plane.

There is frequent need to rotate forces and moments from one coordinate system to another. These are done using the "A" matrix, which rotates vectors between body and inertial, and the "BZ" matrix, which rotates vectors between body and yaw plane. The cosine and sine of the yaw angle, ψ, is used to go between the yaw plane and inertial systems.

---

*Numbers in brackets designate references appearing in Section 6.0.

E.2 General Equations

Each sprung mass has body axes x, y, z. All forces are rotated into these directions, resulting in ΣF_x, ΣF_y, ΣF_z which in the computer code are called FSUM(1), FSUM(2), and FSUM(3). As is typical in the vehicle dynamics literature, the velocity in the x direction is u, the velocity in the y direction is v, and the velocity in the z direction is w. The rotation rate about the x axis is p, the rotation rate about the y axis is q, and the rotation rate about the z axis is r.

The translational equations of motion are then:

$$M(\dot{u} - vr + wq) = \Sigma F_x$$
$$M(\dot{v} + ur - wp) = \Sigma F_y$$
$$M(\dot{w} + uq - vp) = \Sigma F_z$$

where M is the sprung mass and the dot indicates differentiation with respect to time. In the computer program these equations are solved for $\dot{u}$, $\dot{v}$, and $\dot{w}$ at the beginning of each integration time step.

There are also the equations of rotational motion about each body axis. All moments on the sprung mass are rotated into the x, y, and z directions, thus resulting in ΣM_x, ΣM_y, and ΣM_z which in the computer code are called TSUM(1), TSUM(2), and TSUM(3). The equations of rotational motion are Euler's equations with zero cross-products of inertia, namely:

$$I_{xx}\dot{p} + qr(I_{zz}-I_{yy}) = \Sigma M_x$$
$$I_{yy}\dot{q} + pr(I_{xx}-I_{zz}) = \Sigma M_y$$
$$I_{zz}\dot{r} + pq(I_{yy}-I_{xx}) = \Sigma M_z$$

where p is the rotation rate about x, q about y, and r about z. The program solves for $\dot{p}$, $\dot{q}$, and $\dot{r}$ at the beginning of each integration time step.

The accelerations of the sprung mass motions depend on the forces FSUM(I) and the moments TSUM(I). Each of those forces and moments will be discussed in the next sections.

E.3 Forces on the Sprung Mass

There are several forces on the sprung mass. These forces are applied either through the suspensions or the fifth wheel (pintle hook). Consider first the suspension forces.

E.3.1 Suspension Forces. There are suspension forces in the x, y, and z directions. The force in the z direction is the most straightforward. For a single axle, the calculations are unchanged from Phase II [2], i.e., the force, SF, in the z direction is the deflection of the spring times the spring rate plus the force of coulomb and viscous friction. Some notes:

1) Tension is positive. Zero force is at static equilibrium. Thus the preload in the spring, which is the weight on that spring at static equilibrium, drops out of the calculations.

2) The springs may be made nonlinear by using a table lookup.

3) The coulomb friction break-point is set based on the masses, coulomb friction, and integration time step. Details of the theory are presented in [20].

4) Suspension force calculations take place in subroutine LINE.

For tandem axles, the SF use the same algorithms as the single axle. But, if braking occurs, suspension force is added to the lead axle and subtracted from the trailing axle according to the rule

```
SF(LEAD) = SF(LEAD) + FSHIFT*BTORQ/TD
SF(TRAIL) = SF(TRAIL) - FSHIFT*BTORQ/TD
```

where

BTORQ is the total brake torque of all four brakes on the tandem set, FSHIFT comes from the dynamic load transfer and TD is the fore-aft separation distance of the tandem axles.

The load transfer calculations are found in subroutine LINE.

The lateral and longitudinal suspension forces are also calculated using the Phase II [2] procedure. To explain briefly, the lateral forces at the suspensions may be viewed as constraint forces which hold sprung and unsprung masses together. To calculate these forces, the following procedure is used:

1) The sprung and unsprung masses are assumed to move as a unit with yawing but no rolling or pitching. Thus an estimated acceleration for the vehicle can be calculated using the entire mass and the known forces at the tire-road interface.

2) The unsprung mass acceleration is assumed to be a simple function of the gross acceleration calculated in (1). Then, since the yaw plane forces on the tires are known, the yaw plane constraint forces can be found.

3) These yaw plane constraint forces are applied to the sprung mass in the full blown equations of motion.

The user should note that the purpose of the method is to avoid dynamic coupling which requires matrix inversions each Δt. The height of the constraint point is the roll center height given as an input parameter. Finally, the accuracy of the method is quite good. (See [21] for details.)

E.3.2 The Forces at the Fifth Wheel. The T3DRS:V1 simulation, like Phase II [2], uses a spring-dashpot for the fifth wheel and pintle hook connection. Two advantages accrue:

1) removal of dynamic coupling

2) the ability to simulate roll compliance at the hitch.

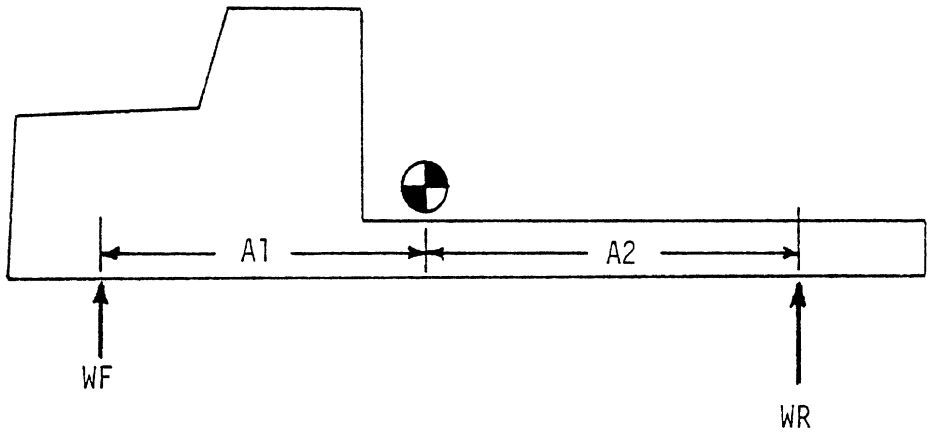
The method works as follows. At each integration time step the position of the tractor fifth wheel, a point located on the tractor, is calculated and the position of the trailer fifth wheel, a point on the trailer, is calculated. A force is assumed to act along the line between these points. The magnitude of the force is assumed to be a spring rate, PIN, times the distance between the points plus a damping rate, CFW, times the relative velocity between the points.

APPENDIX F
PARAMETER ESTIMATION METHOD

This appendix describes simplified methods for estimating the mass moments of inertia for heavy vehicles with as little user time and energy as possible.

In the simulation program, the static loads on the tires are entered, along with the unsprung weights and the wheelbase. Note that the fore-aft mass center location is implicitly input by the user.

From this same data, one may find the total weight supported by the front and rear suspensions. Referring to these as WF and WR, and locating the mass center leads to the vehicle representation shown in the figure below.



Schematic diagram of sprung mass

It is obvious that for conventional vehicles one must expect the sprung mass pitch moment of inertia, I_{yy}, to be limited by

$$I_{yy} < \frac{1}{g}(WF \cdot A1^2 + WR \cdot A2^2) \tag{1}$$

Since one expects (at least in the unloaded condition)

$$A2 > A1 \tag{2}$$

we were led to try the formulation

$$I_{yy} = \frac{1}{g}([WF + a \cdot WR]A1^2 + WR(1-a)A2^2) \tag{3}$$

A comparison between empirical data and computed results has led to the conclusion that the value a = .4 leads to reasonable pitch inertia values for unloaded vehicles. Furthermore, even in the case of loaded vehicles, Equation (3) leads to very reasonable results.

Given the pitch inertia from Equation (3), empirical data has shown it reasonable to assume that the sprung mass yaw moment of inertia, I_{zz}, is equal to the pitch inertia, and the roll inertia may be related to the pitch and yaw inertias by a multiple of the vehicle dimensions. In particular

$$I_{zz} = I_{yy} \tag{4}$$

$$I_{xx} = 2\left[\frac{(TRACK)}{(Total\ Length)}\right]^2 I_{yy} \tag{5}$$

APPENDIX G

PATH-FOLLOWER, CLOSED-LOOP DRIVER MODEL

Section 3.2 of the Users Manual explains the input requirements for the closed-loop driver model. This appendix will outline the manner in which the model works and demonstrate its use in simulating a closed-loop double lane-change maneuver with a tractor-trailer.

The driver model is based on a technique, discussed more completely in Reference [19], which selects a steering control at each point in time by minimizing the current preview error (squared error). Referring to Figure G-1, the solid line shows the desired path trajectory input by the program user (table values), and the dashed line the estimated trajectory of the vehicle using the current steering control. The preview interval (user input), over which the path estimates are made, extends from the current vehicle position, time t, to the end of the interval, time t + T. This interval is divided into ten equal parts and position errors, ε_i, between the desired and estimated trajectories are calculated for each. The current steering control is then selected to minimize the sum of the squares,

$$\sum_{i=1}^{10} \varepsilon_i^2 \ .$$

Estimates of the vehicle position over the preview interval (t, t+T) are obtained from an internal linear model representation of the truck/tractor vehicle.

Example Usage

The following discussion demonstrates the use of the driver model in simulating a closed-loop double lane-change maneuver measured on an actual tractor-trailer. The input data describing the experimentally measured vehicle path, and the necessary driver model parameters are shown in Table G-1. The format corresponds to the requirements discussed in the Users Manual, Section 3.2.

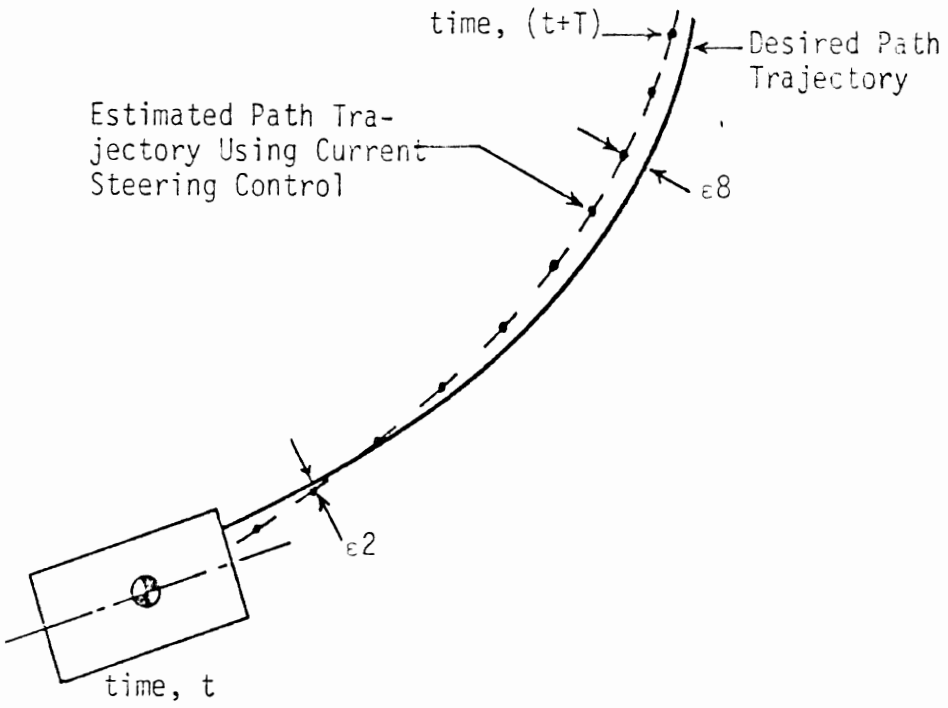


Figure G.1. Closed-loop steering model.

Table G-1

-16		Closed-loop key (- sign) 16 points in path table.
0.0	0.0	x-y path table
70.0	0.0	
85.0	-1.0	
100.0	-4.2	
115.0	-6.7	
130.0	-9.0	
145.0	-10.7	
160.0	-11.3	
175.0	-11.3	
190.0	-10.3	
205.0	-8.7	
220.0	-6.2	
235.0	-3.3	
250.0	-1.3	
265.0	0.0	
900.0	0.0	
0.0		Transport lag
1.10		Preview interval

The two driver model parameters following the path table input are the driver transport lag and the preview interval parameter, T, discussed above. In this example, the driver transport lag was selected as zero and the preview interval parameter value varied to find the best match between simulated and measured responses for the maneuver.

Simulation results for this data set are shown in Figure G-2, along with corresponding measured vehicle responses. The first time history is tractor lateral acceleration (simulated and measured), followed by tractor yaw rate and front-wheel steering angle. Excellent agreement between the simulated and measured responses is demonstrated in Figure G-2 even though estimates of tire cornering stiffness had to be used in this case.

Very similar responses can be obtained for non-zero driver transport lags (more accurate representations of human operator limitations) by increasing the value of the preview interval parameter. For example, a transport lag of 0.25 seconds would require an increase of the preview interval parameter value from 1.1 to about 1.5 in order to obtain responses similar to those shown in Figure G-2. The principal effect would be somewhat decreased damping in each of the simulated time histories responses.

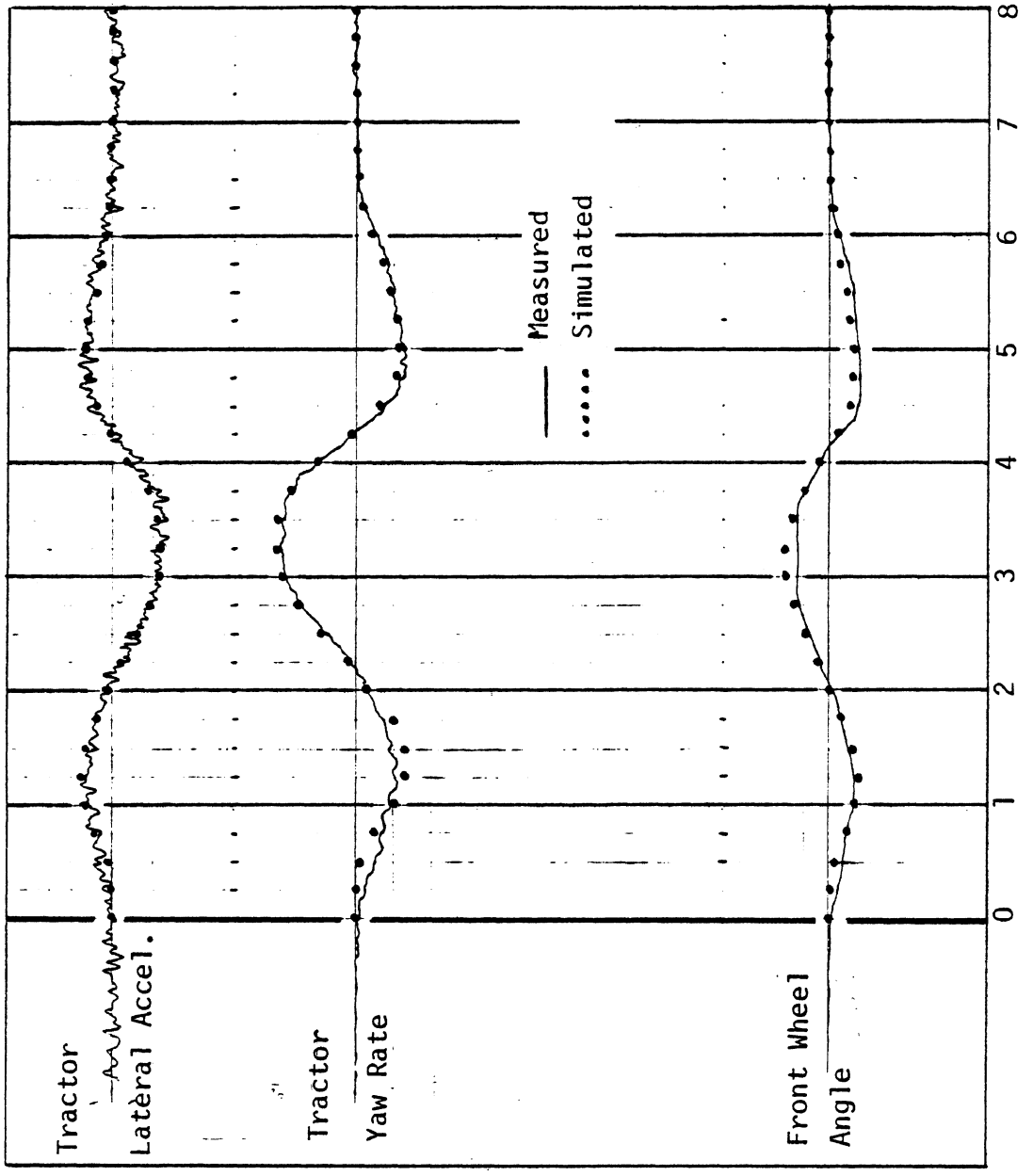


Figure G.2. Path-follower replication of an actual maneuver.

APPENDIX H

USER-WRITTEN ROAD SUBROUTINE

Entry of a negative value for the road key, IROAD, referred to in Section 3.2 of the Users Manual, allows the program user to define an alternate road surface for use in the simulation. By entering code (e.g., FORTRAN) in SUBROUTINE ROAD, which calculates the road elevations, Z, at each wheel as a function of X and Y inertial coordinates, the user is free to define nearly any road surface desired. The only restrictions are that (1) the complete vehicle train starts from a flat or horizontal surface and (2) all gradients (cross-slopes, downgrades) encountered by the vehicle train during the simulation remain less than about 0.10 (rise/ run).

The vehicle train is assumed to start at time zero pointing in a straight line along the X inertial coordinate axis as shown in Figure H-1. Since the vehicle train starts from a flat horizontal plane, the code defining the road surface must guarantee that the road surface elevation is zero for negative values of the inertial X-coordinate.

The user-written subroutine (SUBROUTINE ROAD) must use the following FORTRAN format (or alternate equivalent):

```
SUBROUTINE ROAD(X,Y,Z,T)

      Codes for the calculation of road elevation, Z
      (in feet) as a function of X, Y (in feet) inertial
      coordinates—supplied by the main calling program.

RETURN

ENTRY ROADDZ(X,Y,DZDX,DZDY)

      Code for the calculation of road gradients
      dz/dx(DZDX) and dz/dy(DZDY) consistent with the
      elevation definition above.

RETURN

END
```

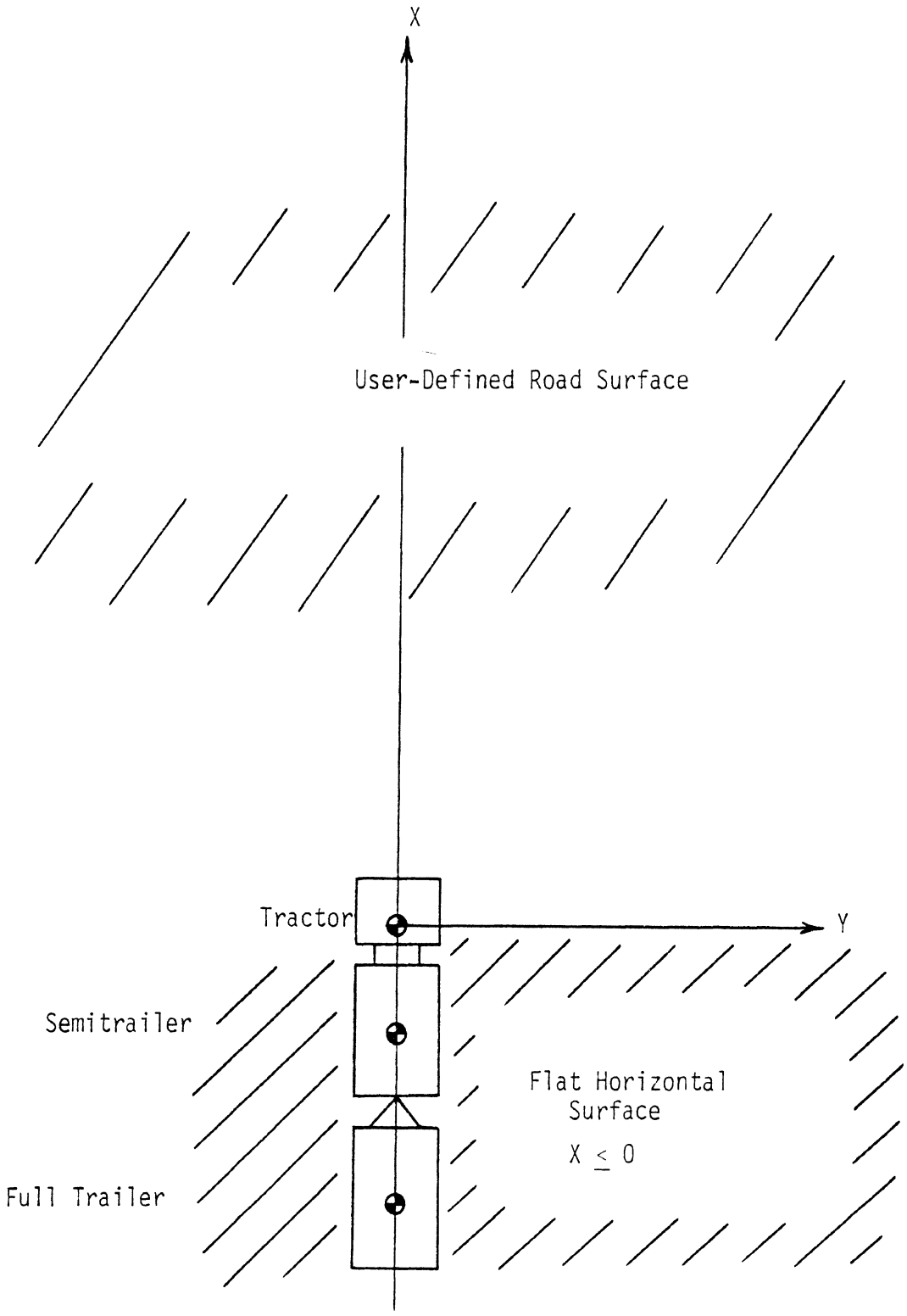


Figure H-1. Vehicle position at zero time.

The argument list for SUBROUTINE ROAD is defined as

X forward inertial coordinate of the wheel, supplied by the calling program

Y lateral inertial coordinate of the wheel, supplied by the calling program

Z vertical road elevation (in feet) calculated by the user code using X and Y—returned to the calling program

T simulation time supplied by the calling program for possible use in the subroutine calculations.

The argument list for ENTRY ROADDZ is:

X same as above

Y same as above

DZDX user=calculated gradient (dz/dx) of the road surface along the X inertial coordinate direction

DZDY user-calculated gradient (dz/dy) of the road surface along the Y inertial coordinate direction.

The DZDX and DZDY calculations should be consistent with the definition of $Z = f(X,Y)$. For example, if $Z = X^2Y + Y^2$ in ROAD,

$$DZDX = 2XY$$
$$DZDY = X^2 + 2Y$$

should be calculated in ROADDZ. The derivatives are used to establish the yaw plane coordinate system in the simulation procedure. In the case of a rough, but essentially horizontal road, the derivatives may be arbitrarily set to zero.

Example Road

The following code should be used to describe a super-elevated, 500-foot circular roadway (cone): The roadway is horizontal for values of $X \leq 0$. The super-elevation, E, is increased linearly between X=0

and X=200 to a maximum value of 0.08. For values of X > 200, the super-elevation is fixed at 0.08 (Figure H-2). R is the actual radius (calculated) of the (X,Y) point supplied by the calling program.

```
SUBROUTINE ROAD(X,Y,Z,T)
R = SQRT(X**2 + (Y+500)**2)
E = 0.08 * X/200.
IF(X.GT. 200.) E = 0.08
IF(X.LT. 0.)   E = 0.0
Z = E * (500-R)
RETURN
ENTRY ROADDZ(X,Y,DZDX,DZDY)
DZDX = - E * X/R
DZDY = - E * (Y+500)/R
RETURN
END
```

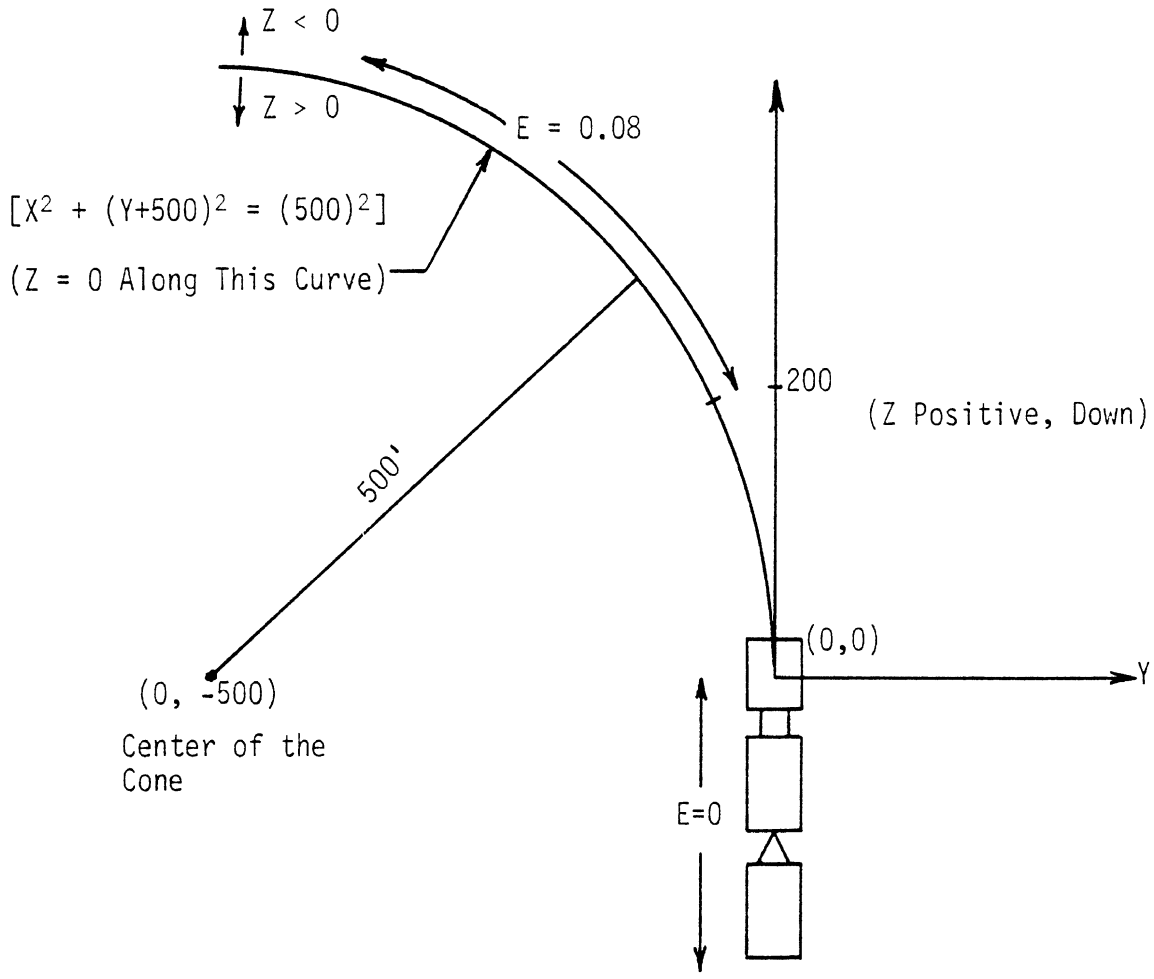


Figure H-2. Circular super-elevated roadway example.