4.5 Ride and Roll Kinematics — Front Suspension

4.5.1 Ride-Steer Coefficient Description

This is a measure of the change in wheel steer angle due to vertical suspension travel. Data is obtained by moving both wheels of an axle up and down with respect to their equilibrium positions while measuring wheel steer angle change and vertical roadway position relative to the chassis. The tires are supported so they are free to move both laterally and longitudinally. In a typical plot, roadway motion is plotted along the x-axis, with jounce to the right and rebound to the left. The y-axis on the plot is wheel steer angle change, with positive (right turn) upward. The steer scale is generally not the total steer angle but merely the change in steer from the static position (at the + in the plot). Thus, static toe measurements are also required.

Three options are available — second order coefficients and two types of tabular data.

Second order coefficients of steer angle change with wheel position are entered on records #40 (front) and #50 (rear). Coefficients for the left side wheel only are required if the vehicle is symmetric. Shown in the sketch below is a typical toe-out response. That is, wheels steer out with jounce. Note that the left suspension steer angle increases (right turn) with positive (rebound) motion and therefore has a positive linear coefficient.

Tabular data are supplied on records #200 (front) and #300 (rear). If tabular data are supplied, all coefficient data on records #40 (front) and #50 (rear) are ignored.

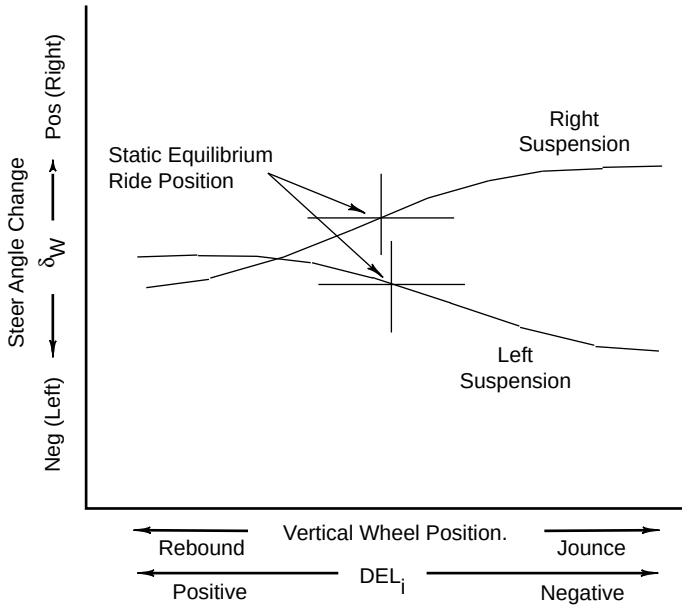

Figure 4.6: Ride-Steer, sample data

4.5.2 Front Ride-Steer Coefficients

General form of expression for independent front suspension, ISUS = 0.0 or 1.0:

$$\delta_{wi} = C_{1i} + C_{2i}\,DEL_i + C_{3i}\,DEL_i^2$$

Record (line) Number 40:3

$CPSIDZ_{1,2}$	Left front toe setting (+ for toe in)	deg	9:0.0
$CPSIDZ_{2,2}$	Coefficient for left front wheel steer change as a function of wheel ride position	deg/in	17:0.10
$CPSIDZ_{3,2}$	Third coefficient for left front wheel steer	deg/in^2	25:0.0
$CPSIDZ_{1,1}$*	Right front toe setting (- for toe in)	deg	33:
$CPSIDZ_{2,1}$*	Coefficient for right front wheel steer change as a function of wheel ride position	deg/in	41:
$CPSIDZ_{3,1}$*	Third coefficient for right front wheel steer	deg/in^2	49:

* Required only for ISYM = 1

4.5.3 Ride-Inclination Coefficient Description

This is a measure of the change in wheel inclination (camber) angle due to vertical suspension travel. Data is obtained by moving both wheels of an axle up and down with respect to their equilibrium positions while measuring wheel camber angle change and vertical wheel position relative to the chassis. In a typical response plot, roadway travel is plotted along the x-axis with jounce to the right and rebound to the left. The y-axis is wheel camber angle change, with positive camber (wheel leaning out at the top) upward.

Note that the distinction between camber and inclination angles is important in the interpretation of these data and in preparation of input coefficients. A positive inclination angle occurs when the top of the wheel leans toward the right side of the vehicle. This is also a positive camber angle for the right side wheel but is a negative camber angle for the left side. Therefore, care must be taken to insure that the data described on the following pages is supplied as inclination angle as a function of roadway vertical position.

As with ride steer, three options are available — second order coefficients and two types of tabular data. Second order coefficient data are supplied on records #41 (front) and #51 (rear).

Tabular data are supplied on records #200 (front) and #300 (rear). If tabular data are supplied, all coefficient data on records #41 (front) and #51 (rear) are ignored.

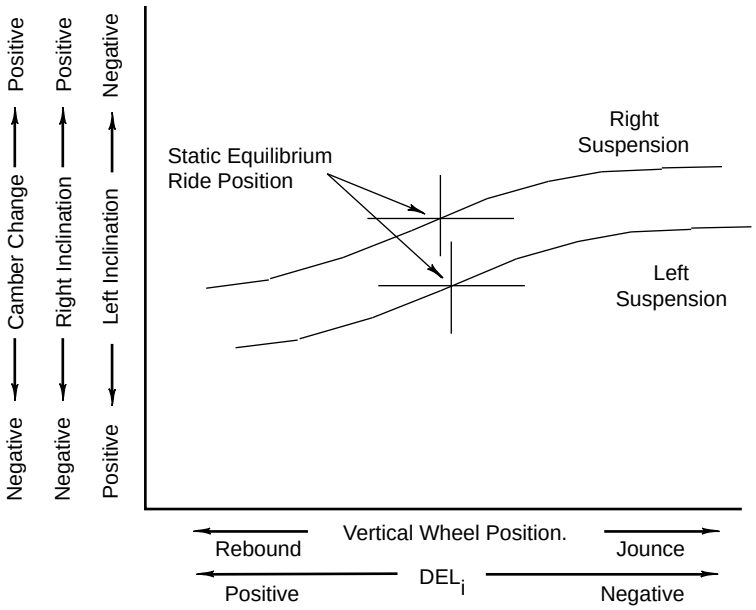

Figure 4.7: Ride-Inclination, sample data

4.5.4 Front Ride-Inclination Angle Coefficients

General form of expression for independent front suspension, ISUS = 0.0 or 1.0:

$$\gamma_{wi} = C_{1i} + C_{2i}\,DEL_i + C_{3i}\,DEL_i^2$$

Record (line) Number 41:3

$CPHIDZ_{1,2}$	Left front static inclination angle	deg	9:0.0
$CPHIDZ_{2,2}$	Coefficient for inclination angle change of left front wheel as a function of wheel ride position	deg/in	17:-0.213
$CPHIDZ_{3,2}$	Coefficient for inclination angle change	deg/in^2	25:-0.07
$CPHIDZ_{1,1}$*	Right front static inclination angle	deg	33:
$CPHIDZ_{2,1}$*	Coefficient for inclination angle change of right front wheel as a function of wheel ride position	deg/in	41:
$CPHIDZ_{3,1}$*	Coefficient for inclination angle change	deg/in^2	49:

* Required only for ISYM = 1

4.5.5 Axle Roll Steer Description

By convention, a positive roll angle is a rotation about a longitudinal axis such that the right side moves down and the left, up. A solid axle roll angle is defined relative to the chassis of the vehicle according to that convention. Thus a positive axle roll angle occurs when the right side wheel is further away from the chassis (rebound) than the left side wheel (jounce). Note that a positive axle roll angle occurs in a right hand turn but also that the chassis roll angle in a right hand turn is negative (left side down).

The axle roll steer coefficients are defined as function of axle roll angle, not chassis roll angle.

- A positive angular coefficient is an understeer effect at the rear. That is, a positive axle roll angle (right turn) produces a positive axle steer angle (right steer).

4.5.6 Front Axle Roll Steer — Not allowed in LTS 3.x

(Required Only For Solid Front Axle)

General form of expression:

$$\delta_a = C_1\phi_a + C_2\phi_a \, DEL_a$$

Record (line) Number _42:3

$CPHPSI_{1,1}$	Front axle roll steer coefficient (negative for roll understeer)	deg/deg	9:_xxxx__
$CPHPSI_{2,1}$	Front axle roll steer coefficient as a function of axle ride travel	deg/deg/in	17:_xxxx__