Chapter 11

SAFE CURVE SPEED STUDY

11.1 PURPOSE

The purpose of the ***Safe Curve Speed Study (Form No. 750-020-12)*** is to determine the safe speed that a vehicle can negotiate a given horizontal curve under ideal conditions and other conditions which may require a recommended advisory speed. The study is also used to determine where turn and curve signs with advisory speed plates are required for horizontal curves. The study shall be sealed by a Florida registered professional engineer taking responsibility for the study recommendations and conclusions.

11.2 EQUIPMENT AND PERSONNEL

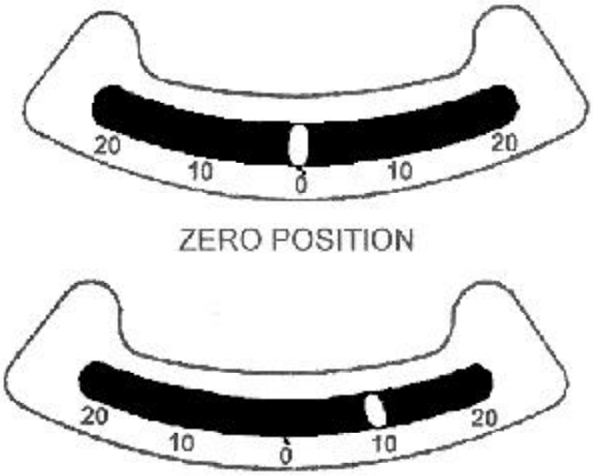
Test vehicle (intermediate size), driver, observer, ball bank indicator (slope meter safe curve indicator), Distance Measuring Instrument (DMI), and the ***Safe Curve Speed Study*** to input data.

11.3 PROCEDURE FOR USE OF EQUIPMENT

(1) The ball bank indicator is used to measure the overturning force (side friction), measured in degrees, on a vehicle negotiating a horizontal curve. The ball bank can be easily mounted to the dashboard by means of rubber suction cups or other stable methods. It should be mounted in such a position as to allow the ball to rest freely at the zero degree position when the vehicle is standing level. The movement of a car around a curve to the left, for example, causes the ball to swing to the right of the zero degree position (see ***Figure 11-1***). The faster the car moves around the curve, or the sharper the curve, the greater distance the ball swings away from the zero degree position. Superelevation, however, tends to bring the ball back to the zero position. The net result is the indicator reading in degrees of deflection.

(2) Beginning well in advance of the curve being checked, the driver should enter the curve at a predetermined speed (mph as stated in the paragraph below), drive the car parallel with the centerline of that travel lane, and *maintain that uniform speed throughout the curve.* The curve should be driven a number of times until at least two identical ball bank readings (degrees) for each direction of travel are obtained. Each direction of travel should be considered separately.

Figure 11-1. Ball Bank Indicator



SPEED (mph)	BALL BANK INDICATOR READING	SIGN
30 mph or less	10 degrees or over	Turn
31 to 55 mph	10 degrees or over	Curve

(3) The maximum negotiable safe speed for the curve is the speed at which the ball bank indicator's reading is 10 degrees or less for 35 mph or greater. The first trial run is made at a speed somewhat below the anticipated maximum safe speed. Subsequent trial runs are conducted at 5 mph speed increments. Readings of 14 degrees for speeds of 20 mph or less, 12 degrees for speeds of 25 mph through 30 mph and 10 degrees for speeds of 35 mph through 50 mph are the usually accepted limits beyond which riding discomfort will be excessive and loss of vehicle control may occur.

(4) The recommended advisory speed should be to the nearest 5 mph less than the maximum negotiable safe speed determined separately for each direction of travel. Considerations of sign distance, intersections, crash records, and other conditions may result in a recommended speed lower than that derived by the ball bank indicator method.

(5) Advisory speed plates (mph) should be used in conjunction with curve and turn signs when the safe operating speed is below the posted or prevailing speed on the roadway. When plates are used with curve and turn signs, the miles-per-hour value shown on each plate should be determined by the use of the ball-bank indicator. The lowest speed (to the nearest 5 mph) obtained during trial runs that creates a reading of 10 degrees or more on the ball-bank indicator shall be used (degrees and mph are stated above). Each direction should be checked independently and may be posted with different speeds.

(6) For turn and curve sign checks the driver should make test runs at 30 mph (or less, for safety). If the ball bank indicator exceeds 10 degrees or more, a Turn sign will be required. If the indicator reading is less than 10 degrees at test run speeds of 30 mph, then test runs should be made at greater speeds. If the indicator exceeds 10 degrees at speeds between 31 and 55 mph, then a curve sign is required (see ***Figure 11-1***).

11.4 PLACEMENT OF WARNING SIGNS

(1) Since warning signs are primarily for the benefit of the driver who is unfamiliar with the road, it is very important that care be given to the placement of such signs. Warning signs should provide adequate time for the driver to perceive, identify, decide, and perform any necessary maneuver to safely negotiate the curve. This total time to perceive and complete a reaction to a sign is the sum of the times necessary for perception, identification/understanding, emotion/ decision-making, and volition/execution of decision. This time may vary from approximately 3-seconds for general warning signs to as much as 10-seconds for high driver judgement condition warning signs. The advance distance for the placement of warning signs is determined by the 85th percentile speed as calculated from speed study data and conditions that exist on the section of roadway being studied. Once the type of warning signs has been selected, the proper sign location can be determined. The advance warning sign placement, shall be in accordance ***Table 6.2-2*** in the Department's ***Traffic Engineering Manual***. This manual is available through Maps and Publications, 605 Suwannee Street, M.S. 12, Tallahassee, Florida, Phone (850) 414-4050.

(2) Additional information on sign placement and establishing safe curve speeds is contained in the ***Traffic Control Devices Handbook, Section II - Signs, Pages 2-20 thru 2-26***. This handbook is available through the U.S. Government Printing Office in Washington, D.C.

(3) Warning signs and advisory speed plates shall be erected in accordance with the general requirements of ***Sections 2A-21 to 30 of the MUTCD***.

11.5 USE OF SAFE CURVE SPEED STUDY FORM *(FIGURE 11-2)*

(1) Enter the *Roadway I.D.* and *Location* so that the safe curve speed study location is thoroughly identified. The street name(s), state road number(s), county, and section number(s) should be included.

(2) Enter the *Posted Speed Limit, Pavement Condition, Date of Study,* and *Observer(s)* in the appropriate spaces. Include any information that may need to be considered in addition to data being collected in the *Remarks* area.

(3) In the *Direction of Travel* column enter *North, East, South,* or *West* indicating the direction of the study vehicle. In the *Milepost* column enter the milepost for the beginning of the curve. In the *Speed on Curve* column enter the constant speed of the study vehicle as the vehicle travels through the curve. In the *Degree of Deflection* column, enter the degree of deflection as shown on the ball bank indicator for constant speed of the study vehicle as the vehicle passed through the curve.

11.6 FORMS ACCESS

A reproducible copy of the ***Safe Curve Speed Study (Form No. 750-020-12)*** is in the ***Appendix***. This form is also available in the Department's Forms Library.

Figure 11-2. Safe Curve Speed Study

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
SAFE CURVE SPEED STUDY
FORM 750-020-12
TRAFFIC ENGINEERING
07/XX

LOCATION ID: S.R. 45 (U.S. 41/27)

COUNTY: Alachua	SECTION: 26030
POSTED SPEED (mph): 55	PAVEMENT CONDITION: Dry
DATE: 3/19/1999	OBSERVERS: Daniel/McGlynn

REMARKS: None

DIRECTION OF TRAVEL	MILEPOST		SPEED ON CURVE	DEGREE OF DEFLECTION
	BEGIN CURVE	END CURVE		
North	8.317	8.428	40	8
South	8.428	8.317	40	7
North	8.317	8.428	45	10
South	8.428	8.317	45	8
North	8.317	8.425	50	12
South	8.428	8.317	50	11
North	8.317	8.428	45	10
South	8.428	8.317	45	9
North	8.317	8.428	45	10
South	8.428	8.317	45	8

RECYCLED PAPER