

- Maximum timetable train speed;
- Whether the highway is paved or not;

Number of through trains per day during daylight hours.

The resulting basic prediction is improved in two ways. It is enriched by the particular crossing's collision history for the previous five years and it is calibrated by resetting normalizing constants. The normalizing constants are reset so that the sum of the predicted accidents in each warning device group (passive, flashing lights, gates) for the top twenty percent most hazardous crossings exactly equals the number of accidents which occurred in a recent period for the top twenty percent of that group. This adjustment factor allows the formulas to stay current with collision trends. The calibration also corrects for errors such as data entry errors. The final output is the predicted number of collisions (PC).

The severity formulas answer the question, "What is the chance that a fatality (or casualty) will happen, given that a collision has occurred?" The fatality formula calculates the probability of a fatal collision given that a collision occurs (*i.e.* the probability of a collision in which a fatality occurs)  $P(FC|C)$ . Similarly, the casualty formula calculates the probability of a casualty collision given that a collision occurs  $P(CC|C)$ . As casualties consist of both fatalities and injuries, the probability of a non-fatal injury collision is found by subtracting the probability of a fatal collision from the probability of a casualty collision. To convert the probability of a fatal or casualty collision to the number of expected fatal or casualty collisions, that probability is multiplied by the number of predicted collisions (PC).

For the prediction and severity index formulas, please see the following DOT publications: *Summary of the DOT Rail-Highway Crossings Resource Allocation Procedure—Revised*, June 1987, and the *Rail-Highway Crossing Resource Allocation Procedure: User's Guide, Third Edition*, August 1987. Both documents are in the docket for this rulemaking and also available through the National Technical Information Service located in Springfield, Virginia 22161.

#### Risk Index

The risk index is basically the predicted cost to society of the casualties that are expected to result from the predicted collisions at a crossing. It incorporates three outputs of the DOT prediction formulas. The two components of a risk index are:

1. Predicted Cost of Fatalities =  $PC \times P(FC|C) \times (\text{Average Number of Fatalities Observed In Fatal Collisions}) \times \$3 \text{ million}$
2. Predicted Cost of Injuries =  $PC \times (P(CC|C) - P(FC|C)) \times (\text{Average Number of Injuries in Collisions Involving Injuries}) \times \$1,167,000$

PC,  $P(CC|C)$ , and  $P(FC|C)$  are direct outputs of the DOT prediction formulas.

The average number of fatalities observed in fatal collisions and the average number of injuries in collisions involving injuries were calculated by FRA as follows.

The highway-rail incident files from 1997 through 2001 were matched against a data file containing the list of whistle ban crossings in existence from January 1, 1997 through December 31, 2001 to identify two types of collisions involving trains and motor vehicles (1) those that occurred at crossings where a

whistle ban was in place during the period, and (2) those that occurred at crossings equipped with automatic gates where a whistle ban was not in place. Certain records were excluded. These were incidents where the driver was not in the motor vehicle, or the motor vehicle struck the train beyond the 4th locomotive or rail car that entered the crossing. FRA believes that sounding the train horn would not be very effective at preventing such incidents.<sup>1</sup>

Collisions in the group containing the gated crossings nationwide where horns are routinely sounded were then identified as either fatal, injury only, or no casualty. Collisions were identified as fatal if one or more deaths occurred, regardless of whether or not injuries were also sustained. Collisions were identified as injury only when injuries, but no fatalities resulted.

The collisions (incidents) selected were summarized by year from 1997 through 2001 (see table below). The fatality rate for each year was calculated by dividing the number of fatalities ("Deaths") by the number of fatal incidents ("Number"). The injury rates were calculated by dividing the number of injuries in injury only incidents ("Injured") by the number of injury only incidents ("Number").

The following table lists the results. Note that the number of injuries in the sixth column includes only those injuries resulting from injury only incidents, it excludes any non-fatal injuries sustained in fatal incidents. Non-fatal injuries sustained in fatal incidents are not included in this table. The first line in the table presents information in summary form for the five-year period.

MOTOR VEHICLE INCIDENTS AT NON WB GATED CROSSINGS

	Total incidents	Fatal incidents			Injury incidents		
		Number	Deaths	Rate	Number	Injured	Rate
Total .....	2,028	255	311	<b>1.2196</b>	552	739	<b>1.3388</b>
2001 .....	457	70	78	1.1143	119	156	1.3109
2000 .....	430	48	56	1.1667	109	157	1.4404
1999 .....	395	43	59	1.3721	109	144	1.3211
1998 .....	353	46	57	1.2391	105	131	1.2476
1997 .....	393	48	61	1.2708	110	151	1.3727

The fatality rate and the injury rate for the five-year period appear in bold in the first line.

Per guidance from DOT, \$3 million is the value placed on preventing a fatality. The Abbreviated Injury Scale (AIS) developed by the Association for

the Advancement of Automotive Medicine categorizes injuries into six levels of severity. Each AIS level is assigned a value of injury avoidance as

<sup>1</sup> The data used to make these exclusions is contained in blocks 18—Position of Car Unit in Train; 19—Circumstance: Rail Equipment Struck/

Struck By Highway User; 28—Number of Locomotive Units; and 29—Number of Cars of the

current FRA Form 6180—57 Highway-Rail Grade Crossing Accident/Incident Report.