

GDOT Guide for Evaluating Highway-Rail Grade Crossing Safety

(Revised 7/1/03)

This document is intended to provide guidance in evaluating highway-rail crossing safety pursuant to State Law and Rule 672-16 of the Georgia Department of Transportation. Data shall be collected and analyzed to determine a numeric value for each of the criteria listed on the Highway-Rail Crossing Evaluation form. Some of the values shall be positive numbers that support elimination of a crossing and some of the values shall be negative numbers that support leaving a crossing open. The numbers shall be added or subtracted to calculate a total score for the crossing under review. This value shall be the deciding factor in determining whether the railroad petition to eliminate the crossing is upheld or denied. Adjustment factors shall be entered, as required, for each set of criteria in this guide. A sum total of adjustment factors greater than or equal to a positive five (+5) shall be justification to eliminate a crossing.

The eleven criteria listed below correspond to the eleven Tables in the Highway-Rail Evaluation form. Likewise, these numbers also correspond with the factors listed in O.C.G.A. Section 32-6-193.1(a), as of March 1, 2003.

1. Maximum number of passenger trains per day (TPD) and maximum speed of passenger trains operated through the crossing: *This information shall be supplied by the railroad. The railroad shall provide the maximum number of passenger trains utilizing the crossing on any given day. The number of trains increases the potential for train-vehicle crashes. Passengers inside the train increase the potential risk of human injury and death. The speed of trains affects the severity of crashes and the perception reaction time for motorists. The adjustment factor ranges from zero to positive 1.8 and shall be entered in Table 1 of the Highway-Rail Evaluation form.*

2. Maximum number of freight trains per day (TPD) and maximum speed of freight trains operated through the crossing: *This information shall be supplied by the railroad. The railroad shall provide the maximum number of freight trains utilizing the crossing on any given day. The number of trains increases the potential for train-vehicle crashes. The speed of trains affects the severity of crashes and the perception reaction time for motorists. The adjustment factor ranges from a positive 1.2 to positive 2.0 and shall be entered in Table 2 of the Highway-Rail Evaluation form.*
3. Distance to alternate crossings: *This information shall be supplied by the railroad. This shall be the distance to the next nearest crossing in either direction and shall be measured in miles to the nearest tenth (i.e. 3.2 mi.) along the rail. The adjustment factor ranges from a negative 2.0 to a maximum 0.5 and shall be entered in Table 3 of the Highway-Rail Evaluation form.*
4. Accident history of the crossing for the immediately preceding five-year period: *This information shall be supplied by the railroad. The most recent 5-year crash data involving only vehicles and trains shall be used. The 5-year crash period shall be the 5 years prior to the date affixed to the original correspondence in which the railroad requests the governing authority to review the crossing (i.e. if the letter is dated 2/4/2003, the 5 year period for accident review shall be 2/4/1998 thru 2/4/2003). The adjustment factor ranges from zero to a positive 4.0 and shall be entered in Table 4 of the Highway-Rail Evaluation form.*
5. Type of warning device present at the crossing, if any: *The railroad shall furnish information as to whether the crossing is signalized by crossbuck signs, bells and lights only or bells, lights and gates. The adjustment factor ranges from a negative 2.0 to a positive 0.50 and shall be entered in Table 5.*
6. The horizontal and vertical alignment of the roadway: *This data shall be entered in Table 6 of the Highway-Rail Evaluation form and will be used in the formula listed in section 11 of this*

document. These geometric factors affect all types of sight distance, humped crossings and the footprint of the trainload and thereby the time/distance a vehicle is within the limits of pathway of the train. The vertical alignment shall be the percent grade for each approach of the road. The horizontal alignment shall be the angle at which the road crosses the railroad tracks. The skew angle is the interior angle measured between a line that projects the roadway centerline perpendicular from the stop bar to the nearest rail. If no stop bar is in place, the assumption shall be that the stop is located 15 feet from the nearest rail and runs perpendicular to the travel way.

7. The average daily traffic volume in proportion to the population of the municipality if the crossing is located within a municipality or the population of the county if the crossing is located within an unincorporated area of a county: *The average daily traffic (ADT) may be obtained from a source for planning data, such as the GDOT Office of Transportation Data Services or by obtaining a sample 24 hour traffic count on a typical day or by applying factors for time of year to arrive at an estimate for the ADT. The population shall be derived from the most recent U. S. Census (<http://www.dca.state.ga.us/snapshots/default.asp>). The appropriate governmental jurisdiction shall obtain this data. The ADT shall be divided by the population with the result used in Table 7 to determine the adjustment factor for a city or county. This adjustment factor ranges from a negative 1.0 to zero.*

8. The posted speed limit over the crossing: *The appropriate governmental jurisdiction shall obtain this data for use in Table 8. At locations where two or more approaching roadways have different posted speed limits, the approach with the highest posted speed limit shall be used for this table. The range is from 0 to a positive 1.0.*

9. The effect of closing the crossing upon access by persons utilizing:

****NOTE: *** An adjustment factor for medical facilities ranges from zero to a negative 2.0. An adjustment factor for government facilities ranges from zero to a negative 1.0. An adjustment factor for commercial facilities ranges from zero to a negative 1.0. Adjustment factors shall be determined for each type of facility listed in Table 9 and then combined into a single overall adjustment factor with a range of zero to a negative 4.0. For example, a major inconvenience on medical (negative 2.0) and commercial facilities (negative 1.0) would combine for an overall adjustment factor of negative 3.0.*

- (A) Hospital or medical facilities and public health departments, specifically including without limitation utilization by medical personnel. The appropriate governmental jurisdiction shall analyze the potential impacts to hospitals to determine whether a closing constitutes an inconvenience or a major inconvenience. Closures that increase travel time for access to certified emergency rooms for ambulances or the public would be examples of a major inconvenience. Increased travel time for non-emergency trips to and from hospitals would typically be considered as an inconvenience rather than a major inconvenience. The impacts to non-emergency medical facilities would typically be considered an inconvenience.*

- (B) Facilities of federal, state, or local government, specifically including without limitation court, postal, library, sanitation, and park facilities: The appropriate governmental jurisdiction shall analyze the impact to these facilities on a case by case basis. An argument for this factor must demonstrate a clear major inconvenience for the facility or the public as opposed to an inconvenience. Examples of major inconvenience might include impact to the military or to emergency response time for firefighters or emergency medical staff who are dispatched from a headquarters. Police are typically dispatched from the field rather than*

the precinct or station and their response time might not be affected by a closing.

- (C) Commercial, industrial, and other areas of public commerce: *The appropriate governmental jurisdiction shall analyze the impact to these facilities on a case by case basis. An argument for this factor must demonstrate a clear major inconvenience for the facility or the public as opposed to an inconvenience.*

10. Any use of the crossing by:

****Note that the factors for 10(A), 10(B) & 10(C) shall be determined for each type of vehicle listed in Table 10-1 and then combined into a single overall adjustment factor with a range of Negative 3.0 to a Positive 3.0. to be entered in Table 10-1.*

(A) Trucks carrying hazardous material: *The appropriate governmental jurisdiction shall determine if trucks bearing warning placards as specified in the current Code of Federal Register Title 49, Chapter III, part 392.10 are effectively prohibited from travel over the crossing under review. The prohibition of hazmat loads over a crossing constitutes an adjustment factor of zero. If vehicles carrying hazardous materials are allowed, it shall be necessary to determine whether it is in the best interest of public safety to re-route these vehicles or allow them to traverse the crossing under review. The proposed alternate route(s) shall be evaluated for safety. Consideration shall be given to sight distance, populated areas, the number and type of unsignalized grade crossings, truck restrictions, width of lanes and other geometric features. An adjustment factor of negative 1.0 shall be assigned if the alternate route(s) are found to be unsatisfactory; otherwise an adjustment factor of positive 1.0 shall be assigned. The appropriate number shall be added to the adjustment factors for items 10(B) and 10(C) below and entered into Table 10-1.*

(B) Vehicles carrying passengers for-hire: *The appropriate governmental jurisdiction shall determine if any intercity passenger buses, shuttle buses or transit buses routinely travel over the crossing under review. Passenger cars used as taxis shall not be considered in this category. If vehicles for hire routinely travel over the crossing under review, the adjustment factor is a positive 1.0. If vehicles for hire are allowed, it shall be necessary to determine whether it is in the best interest of public safety to re-route these vehicles or allow them to traverse the crossing under review. The proposed alternate route(s) shall be evaluated for safety. Consideration shall be given to sight distance, the number and type of unsignalized grade crossings, width of lanes and other geometric features. An adjustment factor of negative 1.0 shall be assigned if the alternate route(s) are found to be unsatisfactory; otherwise an adjustment factor of positive 1.0 shall be assigned. This number shall be added to the adjustment factors for items 10(A), above, and 10(C), below, and entered into Table 10-1.*

(C) School buses: *The appropriate governmental jurisdiction shall determine if the crossing under review is on a school bus route or otherwise experiences school bus traffic on a routine basis. School bus traffic constitutes an adjustment factor of positive 1.0. If school busses are allowed, it shall be necessary to determine whether it is in the best interest of public safety to re-route the buses or allow them to traverse the crossing under review. The proposed alternate route(s) shall be evaluated for safety. Consideration shall be given to sight distance, the number and type of unsignalized grade crossings, width of lanes and other geometric features. An adjustment factor of negative 1.0 shall be assigned if the alternate route(s) are found to be unsatisfactory; otherwise an adjustment factor of positive 1.0 shall be assigned. This number shall be added to the adjustment factors for items 10(A) and 10(B) above and entered into Table 10-1.*

****Note: The factors for 10(D) & 10(E) shall be determined for each type of vehicle listed in Table 10-2 and then combined into a single adjustment factor with a range of zero to a Negative 4.0 and entered in Table 10-2.*

(D) Emergency vehicles: *The appropriate governmental jurisdiction shall determine if emergency vehicles travel over the crossing under review. Emergency vehicle traffic constitutes an adjustment factor of negative 3.0; otherwise the factor is zero. This number shall be added to the adjustment factors for item 10(E) below and entered into Table 10-2.*

(E) Public or private utility vehicles, specifically including without limitation water, sewer, natural gas, and electric utility maintenance and repair vehicles: *The appropriate governmental jurisdiction shall determine the impact to a utility company's ability to respond promptly to emergencies. If utility companies are affected adversely the adjustment factor shall be negative 1.0; otherwise the factor is zero. An argument for this factor must demonstrate a clear major inconvenience for the utility company or the public as opposed to an inconvenience. This number shall be added to the adjustment factors for item 10(D) above and entered into Table 10-2.*

11. Other relevant factors as prescribed by the department.

****NOTE***: Adjustment factors shall be determined for each type of variable listed in Table 11 and then combined into a single overall adjustment factor with a range of negative 8.0 to a Positive 14.0.*

(A) Clearing sight distance: *The clearing sight distance shall be defined as the distance required for a vehicle to safely pass over and clear a crossing when departing from a stopped position as shown in the current edition of the AASHTO Policy on Geometric Design of Highways and Streets.*

- *For crossings signalized by bells, lights and gates the requirements for sight distance shall not be applied and therefore would constitute an adjustment factor of zero for the "clearing sight distance" section of Table 11.*

- *The sight distance for all other at-grade crossings shall be the distance required for a vehicle to safely pass over and clear a crossing when departing from a stopped position as shown in the current edition of the AASHTO Policy on Geometric Design of Highways and Streets with adjustments for grade and skew. The basic formula and figure are reproduced on the following page in Exhibit 9-105:*

AASHTO Formula for Computing Sight Distance Required for Stopped Vehicles to Safely Traverse at Grade Rail Crossings

$$d_T = 1.47V_T \left[\frac{V_G}{a_1} + \frac{L + 2D + W - d_a}{V_G} + J \right]$$

d_T = Sight distance along railroad tracks to allow a stopped vehicle to depart and safely cross the railroad tracks

V_T = Velocity of train in miles per hour

V_G = Maximum speed of vehicle in first gear (for grades > or equal to 4%, assume a V_G of 8.8 fps, for grades < 4%, assume a V_G of 17.6 fps)

a_1 = Acceleration of vehicle in first gear (assumed 1.47 ft)

$d_a = \frac{V_G^2}{2a_1}$ = Or distance vehicle travels while accelerating to maximum speed in 1st gear

D = Distance from stop line to near rail (assumed 15 ft)

W = Distance between outer rails (single track $W = 5$ ft)

L = Length of vehicle (assumed 65 ft)

J = Perception/reaction time (assumed 2.0s)

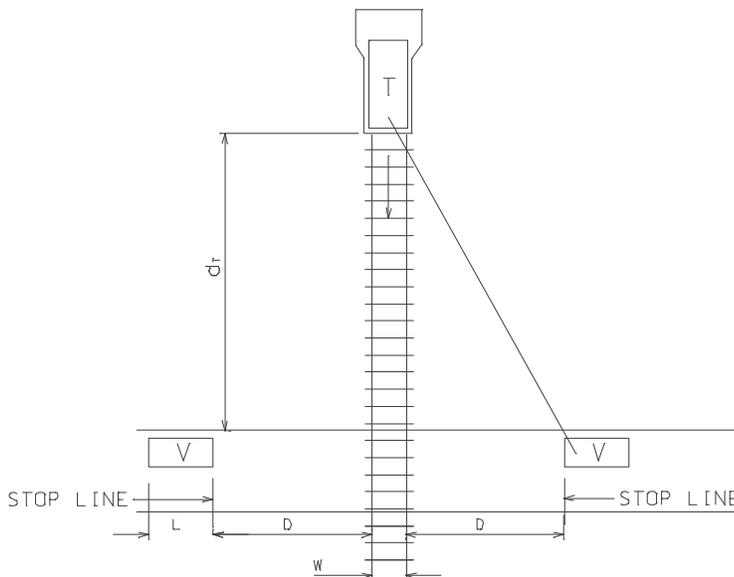


Exhibit 9-105. Case B: Departure of Vehicle From Stopped Position to Cross Single Railroad Track

Exhibit 9-105

➤ *The above assumes flat highway grades adjacent to and at crossings.*

- *The value shown for "W" is for a single track and shall be increased appropriately for multiple tracks. For multiple tracks, "W" shall be the distance (in feet) measured from outside rail to outside rail.*
- *For crossings whose roadway approaches do not cross the tracks at a 90 degree angle, adjustments shall be made for the skew by increasing the value for "D" and adjusting the value of "J".*

The value for "D" shall be calculated for a skewed approach by dividing 15 by the sine of the angle of skew (i.e. a 60 degree skew would yield a value for D of 17.32 feet).

The value for "J" (perception/reaction time) shall be increased for skew as follows:

*90 – 75 degrees J = 2.0 seconds (no change)
 74 – 60 degrees J = 2.5 seconds
 59 – 45 degrees J = 3.0 seconds
 44 – 30 degrees J = 3.5 seconds*

***NOTE** Each 0.5 second increase in the value for "J" would require approximately 30 feet of additional sight distance.*

- *For passive crossings or crossings signalized with bells and lights only (NO GATES) having an approach with a positive grade of 4% or more, the formula in Exhibit 9-105 shall be used to compute the required sight distance.*
- *For passive crossings or crossings signalized with bells and lights only (NO GATES) having an approach with a positive grade of less than 4% the formula in Exhibit 9-105 shall be used to compute the required sight distance using a value of 17.6 feet per second for V_G (for a vehicle in second gear).*

Clearing sight distances shall be calculated for each approach, both looking left and looking right. Where approaching roadways cross the railroad tracks at different angles, different speeds and/or different grades, separate clearing sight distance requirements shall be calculated for each approach. Therefore this may require four separate clearing sight distance values to be calculated.

If the actual sight distance for any approach of the subject crossing, as measured in the field, does not meet minimum sight distance requirements as calculated above, the adjustment factor shall be a positive 4.0; otherwise the adjustment factor shall be zero. This number shall be added to the individual adjustment factors for items 11(B), 11(C), 11(D), 11(E) and 11(F) below and entered as one combined adjustment factor into Table 11.

(B) Traversing the Crossing. Roadways approaching at grade crossings must have sufficient width to allow the safe passage of all legal vehicles. Streets and roads must have a minimum width of nine feet per lane measured along the roadway centerline for a distance of fifty feet from the nearest rail. For crossings in which the approaching lanes are less than nine feet in width the adjustment factor shall be a positive 4.0, otherwise the adjustment factor shall be zero. This number shall be added to the individual adjustment factors for items 11(A) above, along with items 11(C), 11(D), 11(E) and 11(F) below, and entered as one combined adjustment factor into Table 11.

(C) High profile or "hump" crossing. Crossings that have an elevation difference greater than six inches within four feet of the nearest rail shall be considered high profile or "humped". Consideration should be given to any physical indications, such as gouge marks and scrapes, that vehicles are impacting the pavement when traversing the crossing. Crash reports or incident reports are acceptable documentation that a crossing has a high profile. For crossings that meet the criteria above indicating a high profile or "humped" crossing, the adjustment

factor shall be a positive 4.0, otherwise the adjustment factor shall be zero. This number shall be added to the individual adjustment factors for items 11(A) and 11(B), above, along with items 11(D), 11(E) and 11(F) below and entered as one combined adjustment factor into Table 11.

(D) Land locked Property. Any subject crossing shall not be closed if it land locks an adjacent property owner such that the property owner has no alternate access for ingress and egress to their property. If the closure of a crossing would land lock a property owner the adjustment factor shall be a negative 8.0, otherwise the adjustment factor shall be zero. This number shall be added to the individual adjustment factors for items 11(A), 11(B) and 11(C) above, along with items 11(E) and 11(F) below, and entered as one combined adjustment factor into Table 11.

(E) At-Grade Crossing signalized with bells, lights and gates within 0.50 miles. This information shall be provided by the railroad. If a crossing signalized with bells, lights and gates is located within 0.50 miles (distance measured along the railroad tracks) of the subject crossing the adjustment factor shall be a positive 0.5, otherwise the adjustment factor shall be zero. This number shall be added to the individual adjustment factors for items 11(A), 11(B), 11(C) and 11(D) above, along with items 11(F) below, and entered as one combined adjustment factor into Table 11.

(F) Grade Separated Crossing within 0.25 miles. This information shall be provided by the railroad. If a grade separated crossing is located within 0.25 miles (distance to be measure along the railroad tracks) of the subject crossing the adjustment factor shall be a positive 1.5, otherwise the adjustment factor shall be zero. This number shall be added to the individual adjustment factors for items 11(A), 11(B), 11(C), 11(D) and 11(E) above and entered as one combined adjustment factor into Table 11.