## NEW CROSSINGS

Similar to crossing closure/consolidation, consideration of opening a new public highway-rail crossing should likewise consider public necessity, convenience, safety and economics. Generally, new grade crossings, particularly on main-line tracks, should not be permitted unless no other viable alternatives exist and, even in those instances, consideration should be given to closing one or more existing crossings. If a new grade crossing is to provide access to any land development, the selection of traffic control devices to be installed at the proposed crossing should be based on the projected needs of the fully completed development.

Communities, developers and highway transportation planners need to be mindful that once a highway-rail grade crossing is established, drivers can develop a low tolerance for the crossing being blocked by a train for an extended period of time. If a new access is proposed to cross a railroad where railroad operation requires temporarily holding trains, only grade separation should be considered.

## GUIDANCE

These treatments are provided for consideration at every public highway-rail grade crossing. Specific MUTCD Signs and treatments are included for easy reference.

1. ***MINIMUM DEVICES*** - all highway-rail grade crossings of railroads and public streets or highways should be equipped with approved passive devices. For street running railroads/transit systems, refer to MUTCD Parts 8 and 10.

2. ***MINIMUM WIDTHS*** - All highway-rail grade crossing surfaces should be a minimum of one foot beyond the edge of the roadway shoulder measured perpendicular to the roadway center line, and should provide for any existing pedestrian facilities.

3. ***PASSIVE*** - Minimum Traffic Control Applications:
   A. A circular Railroad Advance Warning (W10-1) sign shall be used on each roadway in advance of every highway-rail grade crossing except as described in the MUTCD;

   B. An emergency phone number should be posted at the crossing. This posting should include the USDOT highway-rail grade crossing identification number, highway or street name or number, railroad milepost and other pertinent information;

C. Where the roadway approaches to the crossing are paved, pavement markings are to be installed as described in the MUTCD, subject to engineering evaluation;

D. Where applicable, the TRACKS OUT OF SERVICE sign should be placed to notify drivers that track use has been discontinued;

E. One reflectorized crossbuck sign shall be used on each roadway approach to a highway-rail grade crossing;
   1) If there are two or more tracks, the number of tracks shall be indicated on a supplemental sign (R15-2) of inverted T shape mounted below the crossbuck.
   2) Strips of retroreflective white material not less than two inches in width shall be used on the back of each blade of each crossbuck sign for the length of each blade, unless the crossbucks are mounted back-to-back.
   3) A strip of retroreflective white material, not less than two inches in width, shall be used on the full length of the front and back of each support from the crossbuck sign to near ground level or just above the top breakaway hole on the post.

F. Supplemental Passive Traffic Control Applications (subject to engineering evaluation);
   1) Inadequate Stopping Sight Distance:
      a) Improve the roadway geometry;
      b) Install appropriate warning signs (including consideration of active types);
      c) Reduce the posted roadway speed in advance of the crossing:
         i) Advisory signing as a minimum;
         ii) Regulatory posted limit if it can be effectively enforced;
      d) Close the crossing;
      e) Reconfigure/relocate the crossing;
      f) Grade separate the crossing.
   2) Inadequate Approach (Corner) Sight Distance (Assuming Adequate Clearing Sight Distance):
      a) Remove the sight distance obstruction;
      b) Install appropriate warning signs;
      c) Reduce the posted roadway speed in advance of the crossing:
         i) Advisory signing as a minimum;
         ii) Regulatory posted limit if it can be effectively enforced;
      d) Install a YIELD (R1-2) sign, with advance warning sign (W3-2a) where warranted by the MUTCD (restricted visibility reduces safe approach speed to 16- 24 km/h [10-15 mph]);
      e) Install a STOP (R1-1) sign, with advance warning sign (W3-1a) where warranted by the MUTCD (restricted visibility requires drivers to stop at the crossing);

f) Install active devices;
g) Close the crossing;
h) Reconfigure/relocate the crossing;
i) Grade separate the crossing.

3) Deficient Clearing Sight Distances (For One or More Classes of Vehicles):
   a) Remove the sight distance obstruction;
   b) Permanently restrict use of the roadway by the class of vehicle not having sufficient clearing sight distance;
   c) Install active devices with gates;
   d) Close the crossing;
   e) Reconfigure/relocate the crossing;
   f) Grade separate the crossing; and
   g) Multiple railroad tracks and/or two or more highway approach lanes in the same direction should be evaluated with regard to possible sight obstruction from other trains (moving or standing on another track or siding) or highway vehicles.

4) Stopping and corner sight distance deficiencies may be treated immediately with warning or regulatory traffic control signs, such as a STOP sign, with appropriate advance warning signs. However, until such time as permanent corrective measures are implemented to correct deficient **clearing** sight distance, interim measures should be taken which may include:
   a) Temporarily close the crossing; and
   b) Temporarily restrict use of the roadway by the classes of vehicles.

4. ***ACTIVE*** - If active devices are selected, the following devices should be considered:

TABLE 6
GUIDELINES FOR ACTIVE DEVICES

| **Class of Track** | **Maximum Allowable Operating Speed For *Freight* Trains - Minimum Active Devices** | | **Maximum Allowable Operating Speed For *Passenger* Trains - Minimum Active Devices** | |
|---|---|---|---|---|
| Excepted track | 10 mph | Flashers | N/A | N/A |
| Class 1 track | 10 mph | Flashers | 15 mph | Gates * |
| Class 2 track | 25 mph | Flashers | 30 mph | Gates * |
| Class 3 track | 40 mph | Gates | 60 mph ** | Gates ** |
| Class 4 track | 60 mph | Gates | 80 mph | Gates |
| Class 5 track | 80 mph | Gates plus Supplemental Safety Devices | 90 mph | Gates plus Supplemental Safety Devices |
| Class 6 track | 110 mph with conditions | Gates plus Supplemental Safety Devices | 110 mph | Gates plus Supplemental Safety Devices |
| Class 7 track | 125 mph with conditions | Full Barrier Protection | 125 mph | Full Barrier Protection |
| Class 8 track | 160 mph with conditions | Grade Separation | 160 mph | Grade Separation |
| Class 9 track | 200 mph with conditions | Grade Separation | 200 mph | Grade Separation |

* Refer to MUTCD 2000 Edition, Part 10, transit and LRT in medians of city streets.
** Except 35 mph (56 km/h) for transit and LRT. Note: 1 mph = 1.61 km/h

A. Active devices ***with automatic gates*** should be considered at highway-rail grade crossings whenever an engineering study by a diagnostic team determines one or more of the following conditions exist:
   1) All crossings on the National Highway System, “U.S.” marked routes or principal arterials not otherwise grade separated;
   2) If inadequate clearing sight distance exists in one or more approach quadrants, AND it is determined ALL of the following apply:
      a) It is not physically or economically feasible to correct the sight distance deficiency;
      b) An acceptable alternate access does not exist; and
      c) On a life cycle cost basis, the cost of providing acceptable alternate access or grade separation would exceed the cost of installing active devices with gates;

3) Regularly scheduled passenger trains operate in close proximity to industrial facilities, eg. stone quarries, log mills, cement plants, steel mills, oil refineries, chemical plants and land fills;
4) In close proximity to schools, industrial plants or commercial areas where there is substantially higher than normal usage by school buses, heavy trucks or trucks carrying dangerous or hazardous materials;
5) Based upon the number of passenger trains and/or the number and type of trucks, a diagnostic team determines a significantly higher then normal risk exists that a train-vehicle collision could result in death of or serious injury to rail passengers;
6) Multiple main or running tracks through the crossing;
7) The expected accident frequency (EAF) for active devices without gates, as calculated by the USDOT Accident Prediction Formula including 5-year accident history, exceeds 0.1;
8) In close proximity to a highway intersection or other highway-rail crossings and the traffic control devices at the nearby intersection cause traffic to queue on or across the tracks. (In such instances, if a nearby intersection has traffic signal control, it should be interconnected to provide preempted operation, and consider traffic signal control, if none); or
9) As otherwise recommended by an engineering study or diagnostic team.

B. Active devices, with automatic gates should be considered ***as an option*** at public highway-rail grade crossings whenever they can be economically justified based on fully allocated life cycle costs ***and*** one or more of the following conditions exist:
1) Multiple tracks exist at or in the immediate crossing vicinity where the presence of a moving or standing train on one track effectively reduces the clearing sight distance below the minimum relative to a train approaching the crossing on an adjacent track (absent some other acceptable means of warning drivers to be alert for the possibility of a 2nd train); [See Figure 1.]
2) An average of 20 or more trains per day;
3) Posted highway speed exceeds 64 km/h (40mph) in urban areas, or exceeds 88 km/h (55 mph) in rural areas;
4) Annual Average Daily Traffic (AADT) exceeds 2000 in urban areas, or 500 in rural areas;
5) Multiple lanes of traffic in the same direction of travel (usually this will include cantilevered signals);
6) The crossing exposure (the product of the number of trains per day and AADT) exceeds 5,000 in urban areas, or 4,000 in rural areas;
7) The expected accident frequency (EAF) as calculated by the USDOT Accident Prediction formula, including 5-year accident history, exceeds 0.075;

8) An engineering study indicates that the absence of active devices would result in the highway facility performing at a level of service below Level C;
9) Any new project or installation of active devices to significantly replace or upgrade existing non-gated active devices. For purposes of this item, replacements or upgrades should be considered "significant" whenever the cost of the otherwise intended improvement (without gates) equals or exceeds one-half the cost of a comparable new installation, and should exclude maintenance replacement of individual system components and/or emergency replacement of damaged units; or
10) As otherwise recommended by an engineering study or diagnostic team.

C. Warning/Barrier Gate Systems should be considered as supplemental safety devices at:
1) Crossings with passenger trains;
2) Crossings with high-speed trains;
3) Crossings in quiet zones; or
4) As otherwise recommended by an engineering study or diagnostic team.

D. Enhancements for Pedestrian Treatments
1) Design to avoid stranding pedestrians between sets of tracks;
2) Add audible devices, based on an engineering study;
3) Consider swing gates carefully; the operation of the swing gate should be consistent with the requirements of Americans with Disability Act. The gate should be checked for pedestrian safety within the limits of its operation;
4) Provide for crossing control at pedestrian crossings where a station is located within the proximity of a crossing or within crossing approach track circuit for the highway-rail crossing;
5) Utilize a Train to Wayside Controller to reduce traffic delays in areas of stations; and
6) Delay the activation of the gates, flashers and bells for a period of time at the highway-rail grade crossing in station areas, based on an engineering study.

5. ***CLOSURE*** - Highway-rail grade crossings should be considered for closure and vacated across the railroad right-of-way whenever one or more of the following apply:
A. An engineering study determines a nearby crossing otherwise required to be improved or grade separated already has acceptable alternate vehicular access, and pedestrian access can continue at the subject crossing, if existing;

B. On a life cycle cost basis, the cost of implementing the recommended improvement would exceed the cost of providing an acceptable alternate access;

C. If an engineering study determines any of the following apply:
   1) FRA Class 1,2 or 3 track with daily train movements:
      a. AADT less than 500 in urban areas, acceptable alternate access across the rail line exists within .4 km (1/4 mi) and the median trip length normally made over the subject crossing would not increase by more than .8 km (1/2 mi);
      b. AADT less than 50 in rural areas, acceptable alternate access across the rail line exists within .8 km (1/2 mi) and the median trip length normally made over the subject crossing would not increase by more than 2.4 km (1-1/2 mi).
   2) FRA Class 4 or 5 track with active rail traffic:
      a. AADT less than 1000 in urban areas, acceptable alternate access across the rail line exists within .4 km (1/4 mi) and the median trip length normally made over the subject crossing would not increase by more than 1.2 km (3/4 mi);
      b. AADT less than 100 in rural areas, acceptable alternate access across the rail line exists within 1.61 km (1 mi) and the median trip length normally made over the subject crossing would not increase by more than 4.8 km (3 mi).
   3) FRA Class 6 or higher track with active rail traffic, AADT less than 250 in rural areas, an acceptable alternate access across the rail line exists within 2.4 km (1-1/2 mi) and the median trip length normally made over the subject crossing would not increase by more than 6.4 km (4 mi); and

D. An engineering study determines the crossing should be closed to vehicular and pedestrian traffic when railroad operations will occupy or block the crossing for extended periods of time on a routine basis and it is determined that it is not physically or economically feasible to either construct a grade separation or shift the train operation to another location. Such locations would typically include:
   1) Rail yards;
   2) Passing tracks primarily used for holding trains while waiting to meet or be passed by other trains;
   3) Locations where train crews are routinely required to stop their trains because of cross-traffic on intersecting rail lines or to pick up or set out blocks of cars or switch local industries en route;
   4) Switching leads at the ends of classification yards;
   5) Where trains are required to “double” in or out of yards and terminals;

6) In the proximity of stations where long distance passenger trains are required to make extended stops to transfer baggage, pick up or set out equipment or be serviced en route; and
7) Locations where trains must stop or wait for crew changes.

6. ***GRADE SEPARATION***

A. Highway-rail grade crossings should be considered for grade separation or otherwise eliminated across the railroad right-of-way whenever one or more of the following conditions exist:
1) The highway is a part of the designated Interstate Highway System;
2) The highway is otherwise designed to have full controlled access;
3) The posted highway speed equals or exceeds 113 km/h (70 mph);
4) AADT exceeds 100,000 in urban areas or 50,000 in rural areas;
5) Maximum authorized train speed exceeds177 km/h (110 mph);
6) An average of 150 or more trains per day or 300 Million Gross Tons (MGT) per year;
7) An average of 75 or more passenger trains per day in urban areas or 30 or more passenger trains per day in rural areas;
8) Crossing exposure (the product of the number of trains per day and AADT) exceeds 1,000,000 in urban areas or 250,000 in rural areas; or
9) Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 800,000 in urban areas or 200,000 in rural areas.
10) The expected accident frequency (EAF) for active devices with gates, as calculated by the USDOT Accident Prediction Formula including 5-year accident history, exceeds 0.5;
11) Vehicle delay exceeds 40 vehicle hours per day.[1]

B. Highway-rail grade crossings should be considered for grade separation across the railroad right-of-way whenever the cost of grade separation can be economically justified based on fully allocated life cycle costs and one or more of the following conditions exist:
1) The highway is a part of the designated National Highway System;
2) The highway is otherwise designed to have partial controlled access;
3) The posted highway speed exceeds 88 km/h (55 mph);
4) AADT exceeds 50,000 in urban areas or 25,000 in rural areas;
5) Maximum authorized train speed exceeds 161 km/h (100 mph);
6) An average of 75 or more trains per day or 150 MGT per year;
7) An average of 50 or more passenger trains per day in urban areas or 12 or more passenger trains per day in rural areas;

[1] San Gabriel Valley Grade Crossings Study, Final Report. Prepared for San Gabriel Valley Council of Governments. Korve Engineering. January 1997, bogden@korve.com

8) Crossing exposure (the product of the number of trains per day and AADT) exceeds 500,000 in urban areas or 125,000 in rural areas; or
9) Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 400,000 in urban areas or 100,000 in rural areas;
10) The expected accident frequency (EAF) for active devices with gates, as calculated by the USDOT Accident Prediction Formula including 5-year accident history, exceeds 0.2;
11) Vehicle delay exceeding 30 vehicle hours per day;[2]
12) An engineering study indicates that the absence of a grade separation structure would result in the highway facility performing at a level of service below its intended minimum design level 10% or more of the time.

C. Whenever a new grade separation is constructed, whether replacing an existing highway-rail grade crossing or otherwise, consideration should be given to the possibility of closing one or more adjacent grade crossings.

D. Utilize Table 7 for LRT grade separation:

TABLE 7

| **Trains Per Hour** | **Peak Hour Volume (vehicles per lane)** |
|---|---|
| 40 | 900 |
| 30 | 1000 |
| 20 | 1100 |
| 10 | 1180 |
| 5 | 1200 |

Source: *Light Rail Transit Grade Separation Guidelines. An Informational Report*. Institute of Transportation Engineers. Technical Committee 6A-42. March 1993

7. ***NEW CROSSINGS***

A. Should only be permitted to cross existing railroad tracks at-grade when it can be demonstrated:
1. For new public highways or streets where there is a clear and compelling public need (other than enhancing the value or development potential of the adjoining property);
2. Grade separation cannot be economically justified, i.e. benefit to cost ratio on a *fully allocated* cost basis is less than 1.0 (generally, when the crossing exposure exceeds 50,000 in urban areas or exceeds 25,000 in rural areas); and
3. There are no other viable alternatives.

B. If a crossing is permitted, the following conditions should apply:

[2] Ibid.

1. If it is a main track, the crossing will be equipped with active devices with gates;
2. The plans and specifications should be subject to the approval of the highway agency having jurisdiction over the roadway (if other than a State agency), the State DOT or other State agency vested with the authority to approve new crossings, and the operating railroad;
3. All costs associated with the construction of the new crossing should be borne by the party or parties requesting the new crossing, including providing financially for the ongoing maintenance of the crossing surface and traffic control devices where no crossing closures are included in the project;
4. Whenever new public highway-rail crossings are permitted, they should fully comply with all applicable provisions of this proposed recommended practice; and
5. Whenever a new highway-rail crossing is constructed, consideration should be given to closing one or more adjacent crossings.