2016 Railroad
Improvement Summary
CFE, CSX, IORY, NS,
RJ Corman, & SPEG Railroads
Allen County, Ohio

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EXECUTIVE SUMMARY

There are six (6) major rail lines that serve the LACRPC region including the: CSX, CFE, N/S, IORY, RJ Corman, and the SPEG railroads using total of 141 public at-grade crossings in Allen County. These railroads and crossings were analyzed and documented, noting deficiencies and recommendations for improvement, from 2008 to 2015.

The objective of this report is to: (1) conduct a field review of each of the crossings previously reported; (2) determine which of the recommended improvements from previous studies were implemented; and, (3) summarize the findings. The report is intended to provide valuable information for policy, planning, and roadway operations/maintenance personnel concerned with at-grade crossing safety concerns, liability issues, and the expenditure of public monies, as well as the rationale and justification for programmatic support.

There are several reasons for conducting such studies, as they pertain to railroad crossing safety. First and foremost, they are useful in the planning, monitoring, and analysis of transportation improvement programming. Secondly, they have proven to be useful tools in helping to maintain and increase fiscal appropriations in the face of competition while providing the means to efficiently utilize the limited resources already available. In addition, they are used to establish linkages between the various governmental and private commercial concerns, influencing and promoting aspects of highway/railway safety, and proactive transportation systems management. The following points highlight the overall findings of this report.

1. There were a total of 455 recommendations made in the studies of the at-grade crossing between 2008 and 2015.

2. There were 218.5, or 48%, of the recommend improvements implemented. Approximately 52% of the low cost improvements were implemented, 32% of the medium cost improvements, and 31 % of the high cost improvements.

3. There were 17 crossings that had major upgrades implemented since the time of the initial study including, but not limited to, the addition of gates to the crossings at Defiance Trail (CFE), Cool Road (CFE), Hardin Road (CFE), Shawnee Road (N/S), Eastown Road (SPEG), and Wapak Road. (SPEG).

4. There were a total of seven (7) crossings suggested to be considered for closure; none of which were closed.

5. Since the time of the previous studies there have been a total of five (5) vehicle-train crashes at the at-grade crossings. These include Begg Road (CSX-2014), St. John's Road (CSX-2015), Fourth Street (CSX-2016), Wapak Road (SPEG-2012), and Conant Road (SPEG-2013).

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INTRODUCTION

Trains travel along a fixed guide way rail, with a limited amount of freedom of movement. Given their speed, mass and the defined traveled way; they have limited ability to alter their course of travel. Motorists and pedestrians alike must rely on information presented to them; in the form of traffic control devices, geometric design elements or other features, to intelligently discern the ability to cross a rail safely. It is therefore imperative to provide the operator of a motor vehicle or a pedestrian with the adequate information necessary to make an accurate and informed decision. When the sights and sounds of devices such as signs, markings, and trains are unrecognizable, missing or obstructed, crash probability increases.

There are currently 141 public highway railroad at-grade crossings located on the various main line, regional and short line railroads in Allen County; and there are numerous other private crossings. The safety, design, and maintenance of the crossings are a shared responsibility of the roadway owner and the railroad owner. Therefore; periodic reviews should be conducted of the conditions of the various crossings and the surveillance and maintenance activities of both the railroads and the local political subdivisions at such crossings. Such action will allow both public and private concerns for safety to be addressed.

1.1 Rationale & Objectives

Since 2008 The Lima-Allen County Regional Planning Commission (LACRPC), as the Metropolitan Planning Organization (MPO) for the Lima Urbanized Area, undertook an analysis of the public at-grade crossings located along the class 1 and 2 railroad lines that traverse Allen County, including the: Chicago, Ft. Wayne & Eastern (CFE), CSX, Indiana & Ohio Railway (IORY), Norfolk Southern (N/S), RJ Corman, and Spencerville-Elgin (SPEG) railroads in order to address public concerns and traffic safety. Map 1 shows the railroads in Allen County.

The specific objectives of these past reports were threefold: (1) analyze the at-grade rail crossings along the N/S Railroad; (2) determine deficiencies for such locations; and, (3) to offer recommendations to improve the overall safety of specific at-grade rail crossings.

In a continued effort to improve at-grade railroad crossing safety, the LACRPC has reviewed the current status of the crossings and compared it to the status at the time it was studied. In addition, a determination was made as to which of the recommended improvements were implemented. This document can serve as a reference for future programming activities pertinent to rail crossing safety, including: (1) further study of at-grade rail crossings in Allen County, including private crossings; (2) establishing priorities for future safety improvements; (3) justifying requests for the installation of more restrictive traffic control devices; (4) support for improvements that offer effective incident reduction or prevention; and, (5) the provision of a benchmark for assessing the success or failure of future at-grade improvements, as well as the community's traffic safety programming.

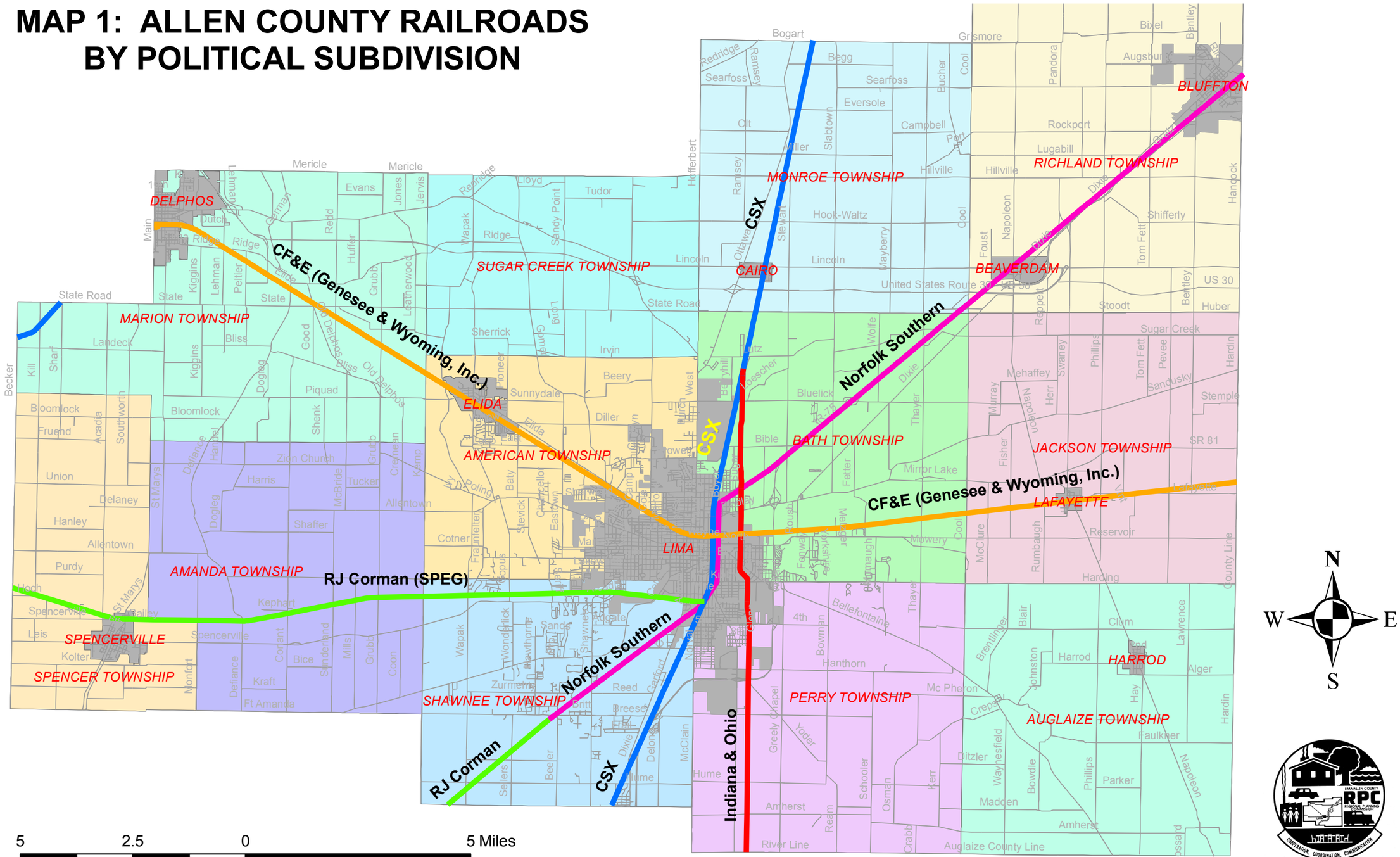
1.2 Overview

Information contained in this report is largely summary in nature. Railroad and rail crossing information such as trains per day, speed of trains, type of traffic control devices, and etc. were obtained from the Ohio Rail Development Commission (ORDC), the Public Utilities Commission of Ohio (PUCO), and the Federal Railroad Administration (FRA). Much of the technical engineering material and reference information was liberally taken from the Ohio Manual of Uniform Traffic Control Devices (OMUTCD - 2012) as approved by the Federal Highway Administration (FHWA), the Railroad-Highway Grade Crossing Handbook published by FHWA (1986) and Traffic Control

Devices and Rail Highway Crossings published by the Transportation Research Board (1986). Additional sources utilized/referenced include: A Policy on Geometric Design of Highways and Streets (AASHTO, 2001); Highway Accident Report (National Transportation Safety Board/1995); and various technical publications of Northwestern University's Traffic Institute (3204, 3205 and 3406).

The Introduction is followed by a section outlining the various components and characteristics of the at-grade rail crossing. Section 3 provides an overview of crossing traffic control devices and related rail safety programs. Section 4 identifies and evaluates the improvements made at each of the at-grade crossings studied in Allen County. The report concludes with summary and recommendations. Appendices, maps, and tables are included.

MAP 1: ALLEN COUNTY RAILROADS BY POLITICAL SUBDIVISION



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SECTION 2
THE HIGHWAY-RAILROAD GRADE CROSSING

A highway-railroad grade crossing should be seen as a special type of highway intersection where the traveled path of motor vehicles, including cars, trucks, and buses, intersect with the traveled path of trains. Trains have virtually no degree of freedom since they cannot change the path they are following (tracks) and the ability to accelerate or decelerate (change speed) quickly is extremely limited due to their mass. Therefore; the driver of the motor vehicle must accept the primary responsibility to avoid collisions with trains.

Highway-railroad grade crossings are equipped with numerous and different types of devices in order to communicate with the drivers of the motor vehicles. These include Crossbucks, Stop Bars, Yield signs, Stop signs, Flashing Signals, Gates, Pavement Markings, and Advance Warning signs and markings. The appropriate application of devices utilized is established by the OMUTCD and the Ohio Traffic Engineering Manual (TEM) based on traffic type, volume, and speed, train volume and speed, and physical characteristics of the road / rail intersection including sight-distance obstructions, angle of approach, and elevation.

2.1 The Highway

The components of a highway-railroad grade crossing are divided into two categories: highway and railroad. The highway component consists of the roadway, the driver, the vehicle and the pedestrian.

2.1.1 Roadway

A major component of the rail crossing includes the physical aspects of the highway on the approach and in the crossing itself. The functional classification of the roadway including its urban/rural characteristics establishes certain driver expectations especially speed. Traffic volume also has a direct bearing at rail crossings as accident frequency exposure with the increasing number of motor vehicles. Geometric design features that can affect crossing safety include: the number of lanes, pavement width, the horizontal and vertical alignment, the crossing angle, and crossing elevation. The unevenness of a crossing's surface and its approaches are often a major concern to the driver. A rough surface may contribute to a crash by diverting the driver's attention from the oncoming train. Illumination at crossings will aid the motorist and should be considered depending upon the availability of a power source.

Traffic control devices are utilized to provide the motorists with information concerning the respective crossing. Typically, an advance warning sign and pavement markings inform the motorists that a crossing lies ahead. The crossing itself is identified through the use of the Crossbuck (See Illustrations 1-3/Appendix A). Traffic control devices such as the Advance Warning Signs, pavement markings, and the Crossbuck are termed "passive" because their message remains constant over time and relationship with the crossing. "Active" traffic control devices inform the motorists whether or not a train is approaching or occupying the crossing and thus give a variable message. Typical active traffic control devices utilize flashing lights, bells, and/or automatic gates.

2.1.2 Driver

The motor vehicle operator is the most critical safety component of the highway-railroad grade crossing issue since he/she can make informed decisions and take corrective actions. As such, the driver is responsible for obeying traffic control devices, traffic laws, and the rules of the road as required by the Ohio Revised Code. In summary, (1) drivers approaching a crossing must be prudent

and travel at a reasonable speed; (2) no vehicle shall travel on the left side of the roadway when approaching within 100 feet of, or traversing any rail crossing; (3) yield to an oncoming train; and, (4) stop if required by a regulatory sign, signal, or gate within 50 feet but not less than 15 feet from the nearest rail.

The decisions faced by a driver approaching a rail crossing are said to occur in three areas or zones. These include the approach zone, the non-recovery zone and the hazard zone. Motor vehicle drivers use the approach zone to search for a train or signal and recognize warning devices and potential hazards. The approach zone precedes the non-recovery zone. The non-recovery zone begins at the last point in which the driver can make the decision and have sufficient time to safely stop the vehicle before entering the hazard zone. The beginning point of the non-recovery zone is shown in the sight distance aerials of the crossings as the “Required Sight Distance”. There is a corresponding distance also shown from this point along the rails which is determined by a combination of the vehicle speed and the train speed as described in Section II “Assessment of Crossing Safety and Operation” of the Federal Railroad-Highway Grade Crossing Handbook. The hazard zone is the area where a collision between the train and the vehicle can occur if both are present simultaneously. This zone is approximately 15 feet on either side of the rails.

2.1.3 Vehicle

The design and operation of a highway-railroad grade crossing must take into account the variety of vehicles that are likely to traverse the crossing. Typically, crossings must be able to service all modes of land transportation. Such vehicles have widely different characteristics, which greatly influence design elements of the crossing. Equally important is the cargo contained in the vehicles traversing the crossing especially school buses with children and tractor trailers carrying hazardous materials.

Several physical and performance characteristics of vehicles influence the safety of vehicles at crossings. These include vehicle dimensions, braking performance and acceleration performance. The length of a vehicle has a direct bearing on the inherent safety of a vehicle at a crossing. Long vehicles and vehicles carrying heavy loads have slower acceleration capabilities; hence, longer vehicles may be exposed to a crossing for a greater period of time in proportion to their length. Another vehicle dimension that is important to the design of crossings is the combination of under clearance and wheelbase. This is particularly relevant to long truck trailers with low clearances, which become lodged on a crossing if the grade is excessive. One component of stopping sight distance is a function of the vehicles braking performance. If a crossing experiences a significant percentage of heavy vehicles, sight distance will dictate a slower speed of operation to allow for the braking performances of such vehicles. Since some of these vehicles are required to stop at all railroad crossings, acceleration of vehicles is important in order to clear the crossing before a train that was just out of sight, or just beyond the train detection system reaches the crossing.

There are other special needs vehicles, which warrant further consideration at rail grade crossings. Accidents involving hazardous material cargo are potentially the most dangerous because of the compounded effects over a wide area. All crossings, which are heavily used by these vehicles, should be considered for active traffic control device improvements. Since buses have many of the same performance characteristics as large trucks and carry many

passengers, they need special consideration as well with respect to routing schemes and driver training. Although motorcycles and bicycles travel at different speeds, they can incur the same problems at crossings. Depending on the angle and type of a crossing a cyclist may lose control if the vehicle wheel becomes lodged in the flange-way.

2.1.4 Pedestrians

The safety of pedestrians at rail crossings is the most difficult to control because of the relative ease with which a pedestrian can ignore the warnings. Pedestrians typically seek the shortest path and, therefore, do not always cross the tracks at the highway or designated pedestrian crossing. Nonetheless there are several preventive measures, which may be employed, including: (1) fencing of the right-of-way; (2) separated crossings; (3) safety education; (4) improved signage; and, (5) increased surveillance and enforcement.

2.2 The Railroad

The railroad component of an at-grade crossing is comprised of the train and the track. Trains vary in size and function but are comprised of at least one locomotive and attached railcars. Track is constructed of hardened steel rails that are either welded, “clipped” and bolted or nailed down. The gauge of the track is standardized (4’8”) and its quality is classified and determines train speeds.

2.2.1 Train

Statistics as to the average length and overall speed of freight trains made available by the PUCO do not adequately begin to describe the variety of operations involved in local railroad movements. Thus the design of traffic control devices must adequately allow for a wide variation in train length, train speed, net lading and train occurrence. The train length has directly affected the operation and safety at local crossings. Unit trains consisting of as many as one hundred cars containing coal, iron or grain, typically traverse Allen County. More common locally, however, are merchandise trains, serving the large automobile manufacturing centers in Michigan and Tennessee.

2.2.2 Track

In the United States, railroad traction lines are classified into six categories based upon the maximum permissible operating speed. The speed on the studied Norfolk/Southern Railway (N/S) line ranged from 15 to 40 mph. The FRA monitors safety standards and establish maximum train speeds for each class of track. Locally, the operating speed varies: from 25 to 60 mph on the CSX Lines; 15 to 50 mph on the IORY tracks; 10 to 25 mph on the SPEG Line currently operated by RJ Corman; and, 15 to 40 mph on the IORY.

The rolling resistance that provides many of the technological advantages for railroads as a means of transportation is made possible by the steel wheels rolling on a steel rail. This steel wheel to steel rail contact involve pressures of over 50,000 pounds per square inch, that are often then reduced to pressures acceptable to the underlying soil. This is done by a series of steps going from the rail to a steel plate under the rail tie, that spreads the load over a wooden tie, that spreads the load over road ballast, that spreads it over to a sub-ballast (usually gravel, cinders or sand), that spreads the load to the sub grade consisting of either the native soils below or the some superior material obtained off site.

Rail is rolled from high quality steel and weighs from 115 to 140 lbs. per yard and is six to eight inches high. As track, the rails are held together by bolted joint bars or are welded together end to end in long segments. Bolted joints are less rigid and tend to wear more quickly. The steel rails are spiked to ties that are typically made of wood with preservative impregnated to prevent decay. The ties hold the rails to gauge, support the rail, distribute the load to the ballast and provide some flexibility to cushion the impact of the wheel on the rail. Ballast is used to hold the ties in place, to prevent lateral deflection and to spread out the average 100 psi beneath the tie. Ballast must be able to resist degradation from the effects of the tie motion and provide good drainage to the sub grade.

Railway track is normally maintained by sophisticated, high production, mechanized equipment. The track surface is maintained by tamping machines that raise the rails and compact the ballast beneath the ties. In the process it is often necessary to raise the level of the track several inches, which over time results in a raising of the vertical profile of the track at the highway-railroad grade crossing and creating dangerous conditions. However, lowering a track is a very costly operation and can lead to sub grade instability problems.[1]

[1] Railroad-Highway Grade Crossing Handbook, Second Edition, FHWA-TS-86-215, September 1986, p.46-47.

SECTION 3
CROSSING SAFETY & PROTECTION

The potential danger at each highway railroad grade crossing provides the rationale and justification for local political subdivisions to consider the various characteristics of each crossing and investigate the full range of potential traffic information and control devices to ensure optimum safety for the motoring public as well as rail traffic. As current rail service in Allen County is limited to that normally referred to as heavy rail or freight rail, this section will focus on existing passive and active traffic control devices. The section is intended to provide an overview of available traffic control and warning device options.

Data suggests generally risky decisions made by motor vehicle operators are not exclusively that of daredevils or thrill seekers, but rather because motorists are unaware of the real danger. Trains are much larger objects and therefore they often appear to be moving much slower than they actually are. Add the various speeds experienced on the rail lines throughout Allen County, which currently range anywhere from 10 mph to 60 mph, the track crossing decision for the motorist becomes more complicated. Unfortunately miscalculations regarding speed, time and distance can be catastrophic for the crossing motorist and their passengers.

Communication to the drivers to help aid an informed and safe decision is classified into two types, Passive and Active. The Passive devices include signs and pavement markings. Active devices are flashing lights, automatic gates, warning bells, and illumination.

3.1 Passive Traffic Control Devices

Passive traffic control devices provide static messages of warning, guidance, and in some instances, mandatory action for the driver. Their purpose is to identify and direct attention to the location of a crossing in order to permit drivers and pedestrians to take appropriate action. Passive traffic control devices consist of regulatory, warning and guide signs, and supplemental pavement markings. They are basic devices and are incorporated into the design of active traffic control devices. Signs and pavement markings are to be in conformance with the OMUTCD (Ohio Manual of Uniform Traffic Control Devices), Part 8 “Traffic Controls for Highway – Rail Grade Crossings”. Traffic controls at highway-railroad grade crossings during construction and maintenance operations are detailed in Part 6 of the OMUTCD.

3.1.1 Signs

Federal law requires that as a minimum each state shall provide signs at all crossings. The railroad signs attached to the Crossbuck mast are usually installed and maintained by the railroad company. The agency responsible for maintenance of the roadway is normally responsible for Advance Warning Signs and pavement markings.

In general, the OMUTCD specifies that signs should be located on the right-hand side of the highway where the driver is looking for them. Signs should be located to optimize visibility. Signs should not be located in a highway dip nor beyond the crest of a hill. Care should be taken so that parked cars and/or foliage do not obscure the sign or cover it by snow accumulation.

Sign materials are usually aluminum, wood, galvanized, or non-galvanized steel. Signs are to be reflectorized or illuminated to provide visibility at night.

3.1.1.1 Railroad Crossbuck (R15-1)

The standard railroad crossing sign or "Crossbuck" is a regulatory sign that has, as a minimum, a black legend on a white reflectorized

background. The sign is typically installed on the right side of the roadway on each approach to the crossing. The recommended lateral clearances, 6 feet from the edge of the highway shoulder or 12 feet from the curb in urban areas, will usually be attainable. Where conditions warrant, such as limited sight distance, these signs may be placed back to back on a single post. (See Figure 8B-1; page A-13/Appendix A). Passive Crossbucks are also required to include either a Yield or Stop sign.

3.1.1.2 Number of Track Signs (R15-2)

If there are two or more tracks at a crossing, the number of tracks is to be indicated on an auxiliary sign mounted below the Crossbuck. The use of this auxiliary is optional at crossings with automatic gates (See Figure 8B-1; page A-13/Appendix A).

3.1.1.3 Advance Warning Signs (W10-1, W10-2, W10-3, W10-4)

A railroad Advance Warning sign (W10-1) is a warning sign (See Figure 8B-2; page A-13/Appendix A) that has a black border and legend on a yellow reflectorized background, and has a minimum diameter of 36 inches. The sign is to be located in advance of the crossing and serves to alert the motorist that a crossing is ahead. Railroad Advance Warning signs shall be used on each roadway approach in advance of every grade crossing except: (1) on low volume, low speed roadways crossing over minor spurs or other tracks that are infrequently used and which are flagged by train crews; (2) in the business districts of urban areas where active grade crossing traffic control devices are used; and, (3) where physical conditions do not permit even a partially effective display of the sign.

The distance from the Advance Warning sign to the track is dependent upon the highway speed, but in no case should it be less than 100 feet in advance of the nearest rail. This distance should allow the driver sufficient time to comprehend and react to the sign's message and to perform any necessary maneuver. Where a road runs parallel to a railroad and the perpendicular distance between the two is less than 100 feet, for traffic turning from the parallel road, one of three other warning signs (W10-2, W10-3, or W10-4) can be used.

3.1.1.4 No Passing Zone Signs (W14-3)

The "No Passing Zone" sign may be installed at crossings to supplement no passing pavement markings. The sign consists of black letters and border on a yellow background and is in the shape of a pennant with dimensions of 36" x 48" x 48". The sign is to be placed on the left side of the highway at the beginning of the no passing zone (See Figure 8B-6; page A-22/Appendix A).

3.1.1.5 Warning Signs (W10-1a, W10-5, W10-8, W10-9, W10-10, W10-11, W10-11a, W10-11b, W10-12, W10-13, W10-14, W10-14a, W10-15)

These signs are utilized to warn drives of specific hazards or conditions that may exist at crossings to raise drive awareness (See Figure 8B-5; page A-19/Appendix A).

3.1.1.6 Regulatory Signs (R1-1, R1-2, R3-1a, R3-2a, R8-8, R8-9, R8-10, R10-6, R10-11a, R15-3, R15-8)

These signs are utilized informing the drivers of selected traffic laws or regulations and indicate the applicability of the legal requirements that are found at railroad crossings (See Figure 8B-3; page A-15/Appendix A).

3.1.1.7 Emergency Notification Sign (I-13, I-13a)

These signs are installed to provide information related to the crossing and a telephone number so an emergency can properly be communicated (See Figure 8B-4; page A-17/Appendix A).

3.1.2 Pavement Markings

Pavement markings are used to supplement the regulatory and warning messages presented by crossing signs and signals. Pavement markings have limitations in that they may be obliterated by snow, may not be clearly visible when wet, and may not be very durable when subjected to heavy traffic.

Pavement markings in advance of railroad-highway grade crossings consist of an "X", the letters "RR", a no passing marking for 2-lane roads and certain transverse lines. These pavement markings shall be placed on each approach lane on all paved approaches to crossings where signals or automatic gates are located, and at all other crossings where the prevailing speed of highway traffic is 40 mph or greater. These markings are also to be placed at crossings where engineering studies indicate there is a significant potential conflict between vehicles and trains. These markings may be omitted at minor crossings or in urban areas if an engineering study indicates that other crossing devices provide suitable control.

The most common pavement marking material is paint; however, a wide variety of other materials are available. Pavement markings are to be reflectorized by mixing glass beads in wet paint or thermoplastic. Raised pavement markers can be used to supplement pavement markings in advance of crossings. The "X" lane lines and the stop line can be delineated by raised reflective markers to provide improved guidance at night and during periods of rain and fog. See figure 8B-6; page A-22/Appendix A).

All pavement markings are to be reflectorized white except for the No Passing demarcations that are to be reflectorized yellow. The stop line is to be 2 feet in width and extend across the approach lanes. The stop line should be located perpendicular to the highway centerline and approximately 15 feet from the nearest rail. Where automatic gates are installed, the stop line should be located approximately eight feet in advance of where the gate arm crosses the highway surface.

3.2 Active Control Devices

Active crossing traffic control devices are those that provide warning of the approach or presence of a train. They are activated by the passage of a train over an electronic detection circuit in the track except in those few situations where manual control or manual operation is used. Active control devices are supplemented with the same signs and pavement markings that are used for passive control. Active traffic control devices include flashing light signals; both post-mounted and cantilevered bells, automatic gates, active advance warning devices, and highway traffic signals.

Numerous research studies have documented the operational and safety performance of traffic control devices at highway railroad grade crossings. It has been estimated that only one half of one percent (.05%) of all at-grade highway railroad crossing crashes take place at locations where traffic warning signals fail to operate. Data suggests that more than half of all motor vehicle-train crashes occur at sites that are equipped with either flashing lights and/or gates.

What causes motorists to disregard train-warning signals and drive through flashers or drive around gates? Driver impatience has been cited as a possible explanation. Although a 100-car freight train takes approximately 2 minutes to traverse a crossing, most people perceive to it to take much longer. Additional delays are experienced when active railroad warning devices provide anything longer than 30 seconds of advance notice of a train presence, thus compounding motorist frustrations. Low speed trains, backing, switching movements and/or inadequate track storage can result in additional delays and added driver frustrations. Repeated experiences of delay at such crossings may prompt motorists into a false sense of security in the factors involved in the crossing procedure. Repetitive successful crossings under such circumstances can also provide justification and rationale for continued at-risk behavior.

3.2.1 Flashing Light Signals

Flashing Light Signals consist of two light units that flash alternately at a rate of 35 to 65 times per minute. Thus, like its predecessor, the wigwag, it simulates a watchman swinging a red lantern (See Figure 8D-1; page A-30/Appendix A).

Proper alignment of the light is essential. The lamp must be precisely aligned to direct the narrow intense beam toward the approaching motorist. The flashing light unit on the right hand side of the highway is usually aligned to cover a distance far from the crossing. The light units that are mounted on the back of the signals on the opposing approach, and thus on the left, are usually aligned to cover the near approach to the crossing. The OMUTCD requires that two sets of flashing lights be mounted on each supporting post, back-to-back, such that two sets of flashing lights face the motorist, one set on the right, near side of the crossing, and one set on the left, far side. Back-to-back light units may not be required on one-way highways.

The Crossbuck sign is always used in conjunction with the Flashing Light Signal and is usually mounted on the same post above the light units. Other supplementary signs may be mounted on the post such as the “Do Not Stop on Tracks” sign and the Number of Tracks sign.

National warrants for the installation of Flashing Light Signals have not been developed. Some states have established criteria based on exposure factors or priority indices. Other considerations include the following: volume of vehicular traffic; volume of railroad traffic; speed of vehicular traffic; speed of railroad traffic; volume of pedestrian traffic; accident records; and sight distance restrictions.

Flashing Light Signals are generally post-mounted, but where improved visibility to approaching traffic is required, cantilevered Flashing Light Signals are used (See Figure 8D-1; page A-30/Appendix A). Cantilevered flashing lights may be appropriate when any of the following conditions exists: multi-lane highways (two or more lanes in one direction); highways with paved shoulders or a parking lane that would require a post-mounted light to be more than 10 feet from the edge of the travel lane; roadside foliage obstructing the view of post-mounted Flashing

Light Signals; line of roadside obstacles such as utility poles (when minor lateral adjustment of the poles would not solve the problem); distracting backgrounds such as excessive number of neon signs (conversely, cantilevered flashing lights should not distract from nearby highway traffic signals); and/or, horizontal or vertical curves at locations where extension of flashing lights over the traffic lane will provide sufficient visibility for the required stopping sight distance.

A typical installation consists of one pair of cantilevered lights on each highway approach supplemented with a pair of lights mounted on the supporting mast. However, two or more pairs of cantilevered flashing lights may be desirable for multi-lane approaches, as determined by an engineering study. The cantilevered lights can be placed over each lane so that the lights are mutually visible from adjacent driving lanes. Cantilevers are available with fixed, rotatable or walkout supports.

Post-mounted Flashing Light Signals are normally located on the right side of the highway on all highway approaches to the crossing. Additional pairs of light units may also be installed for side roads intersecting the approach highway near the crossing or for horizontal curves. Placing another roadside flashing light unit on the opposite side of the highway may cover a horizontal curve to the right.

3.2.2 Automatic Gates

An Automatic Gate (See Figure 8D-1; page A-30/Appendix A) serves as a barrier across the highway when a train is approaching or occupying the crossing. The gate is reflectorized with 16-inch diagonal red on white stripes. To enhance visibility during darkness, three red lights are placed on the gate arm. The light nearest to the tip burns steadily while the other two flash alternately. The gate is combined with a standard flashing light signal that provides additional warning before the arm starts to descend and remains across the roadway as long as the train occupies the crossing. When the train clears the crossing, and no other train is approaching, the gate arm returns to its upright position normally in not more than 12 seconds, following which the flashing lights and the lights on the gate arm cease operation. In the design of individual installations, consideration should be given to timing the operation of the gate arm to accommodate slow moving trucks.

In determining the need for Automatic Gates the following factors should be considered: multiple main line railroad tracks; multiple tracks where a train on or near the crossing can obscure the movement of another train approaching the crossing; high speed train operation combined with limited sight distance; a combination of high speed and moderately high volume highway and railroad traffic; presence of school buses, transit buses, or farm vehicles in the traffic flow; presence of trucks carrying hazardous materials, particularly when the view down the track from a stopped vehicle is obstructed (curve in track, etc.); continuance of accidents after installation of flashing lights; and, presence of passenger trains. In addition to the above factors, some states utilize a specified level of exposure or a priority index as a guideline for the selection of automatic gates.

3.2.3 Warning Bell

A crossing bell is an audible warning device used to supplement other active traffic control devices. A bell is most effective as a warning to pedestrians and bicyclists. When used, the bell is usually mounted on top of one of the signal support masts. The bell is usually activated whenever the flashing light signals are operating. Bell circuitry may be designed so that the bell stops ringing when

the lead end of the train reaches the crossing. When gates are used, the bell may be silenced when the gate arms descend to within 10 degrees of the horizontal position. Silencing the bell when the train reaches the crossing or when the gates are down may be desired to accommodate residents of suburban areas.

3.2.4 Illumination

Illumination at a crossing may be effective in reducing nighttime accidents. Illuminating most crossings is technically feasible since commercial power is available at approximately 90% of all public crossings. Illumination may be effective under the following conditions: nighttime train operations; low train speeds; blockage of crossings for long periods at night; accident history that indicates that motorists often fail to detect trains or traffic control devices at night; horizontal and/or vertical alignment of highway approach such that vehicle headlight beam does not fall on the train until the vehicle has passed safe stopping distance; long dark trains (e.g. unit coal/grain trains); restricted sight or stopping distance in rural areas; humped crossings where oncoming vehicle headlights are visible under train; low ambient light levels; and, a highly reliable source of power.

3.3 Miscellaneous Improvements

There are several other site improvements that can be made to enhance safety and operations at railroad-highway grade crossings. These include: (1) crossing closure; (2) speed reduction; and, (3) additional warnings.

3.3.1 Crossing Closure

Whenever the traveled paths of vehicular traffic and trains intersect, railroad crossings, a risk of collision exists. Therefore; closure of crossings should be considered. This decision should be based on a study that analyzes characteristics such as vehicular volume, train volume, access management to private property or residences, prolonged blockage of crossings as a result of low train speeds or numerous switching movements, and sight distance restrictions.

3.3.2 Speed Reduction

The distance a driver can easily see a train (sight distance) is an important factor in determining the safety of a railroad crossing. If the minimum sight distance requirements cannot be satisfied a reduction of vehicle speed may be justified in order to lower the required sight distance. This is accomplished by either adding a speed advisory plate to the advance warning railroad sign (preferred in most cases) or lowering the journalized speed limit of the road.

3.3.3 Additional Warnings

In the event sight distance concerns exist, additional driver warnings may be necessary. These include, but not limited to: (1) additional crossbucks to left side of roadway; (2) the addition of a yield or stop sign at the crossings; (3) addition of an advance warning sign for the yield or stop sign; and, (4) the installation of rumble strips in the pavement.

3.3.4 Zoning

Zoning regulations should be developed to prevent new construction within sight distance triangles at railroad crossings. Such restrictions should also include the planting of vegetation that would reduce the drivers' sight distance to approaching trains.

3.4 Maintenance & Improvement Responsibilities at Grade Crossings

The at-grade rail-highway crossing is somewhat unique in that it reflects the intersection of two motorized transportation modes that differ in both physical and operational characteristics. They also differ in that one mode is public, the other - private. In most cases, historical precedent has established the expectations of at-grade maintenance and improvement responsibilities. Legal precedent has evolved over the last 150 years; and, today at-grade crossing maintenance and improvement responsibilities are complicated and often times contentious.

Safety at rail-highway grade crossing locations is of real concern not only when collisions occur between a train and a highway user, but also when a crash does not involve a train. Common non-train collisions locally include rear-end collisions in which a vehicle that has stopped at a crossing is hit from the rear, collisions with fixed objects such as signal equipment or signs, and non-collision accidents in which a driver loses control of the vehicle. These non-train collisions are a particular concern with regard to the transportation of hazardous materials by truck and the transportation of passengers, especially on school buses.

In some communities, the presence of at-grade railroad crossings is divisive, pitting the benefits of long distance rail service against the concerns of local delays created while trains move through blocking many street crossings, resulting in congestion, and deteriorating emergency vehicle response times. The condition of the crossings can also serve to elevate the animosity – where poor crossing conditions raise the level of hostility and rancor. But, the State transportation and regulatory agencies have the responsibility to assure that crossings meet the minimum standards, as established in the in Ohio Manual of Uniform Traffic Control Devices (OMUTCD) and elsewhere in federal regulations. The following summation is offered to frame the maintenance responsibilities for maintaining the local at-grade crossings in good repair.

3.4.1 Highway Agency Responsibilities

The highway agency having jurisdiction at the crossing is the only entity that can legally control traffic. As per Section 4955.33 of the Ohio Revised Code (ORC), railroads retain the responsibility for the installation and maintenance of crossbuck signs at “passive” crossings and for the design, construction, operation, and maintenance of railroad crossing signals, as per the standards set forth in the OMUTCD. The street or highway agency is also responsible for 1) the installation and maintenance of all traffic control devices on the approaches to the crossing; 2) the design, construction, operation, and maintenance of highway traffic signals that may be interconnected with the grade crossing signals; and 3) for the installation and maintenance of certain passive signs at the crossing, such as stop signs, yield signs, or “Do Not Stop on Tracks” signs. As per ORC Section 4511.61, yield signs shall only be installed at highway-rail grade crossings with the approval of the Ohio Department of Transportation.

3.4.2 Railroad Responsibilities

Pursuant to ORC Section 5561.16, the railroads bear the responsibility for the construction, reconstruction, and maintenance of the track structure and the riding surface at the highway-rail intersection. Their obligation for the roadway usually ends within a few inches of the outside ends of the ties that support the rails and the crossing surface. Therefore, railroads are responsible for the costs associated with the maintenance of crossbucks, active traffic control devices, and crossing surface. The street or highway agency has responsibility for the design, construction, and maintenance of the roadway approaches to the crossing, even though these approaches may lie within the railroad’s property and/or right of

way. And as presented in ORC Section 4955.20, railroads are to build and keep in repair good and sufficient crossings over, or approaches to, such railroad - its tracks, sidetracks, and switches, at all points where any public highway, street, lane, avenue, alley, or road, is intersected by such railroad - its tracks, sidetracks, or switches. Moreover, railroads are to build and keep in repair good and sufficient sidewalks on both sides of streets intersected by their railroads, the full width of the right of way owned, claimed, or occupied by them.

SECTION 4
RAILROAD REPORT IMPROVEMENT SUMMAY

In performing an evaluation of the existing conditions of the crossings and the improvements implemented since the time they were studied, field visits to each crossing was conducted. The crossings were evaluated and current conditions were compared to that at the time of the study coupled with the recommendations for improvement. Each recommendation was evaluated and a determination made as to whether it was implemented or not, or in some cases partially implemented. There were a few instances, it seemed possible the recommendation might have been completed; however, since the time have deteriorated once again. The findings were summarized and tabulated indicating the recommended improvements and noting the completed items in Blue, the incomplete items in Red, the partially completed items in Yellow, and those that are unknown in Green. A determination of the % completion was made for each previous study.

4.1 Methodology

The information gathered in the summaries were completed by printing the applicable section of each of the reports issued from 2008 to 2015. A field visit was made to each railroad crossing and each recommendation from the report was reviewed and evaluated to determine if it had been implemented or not. This information was tabulated and progress calculated.

4.2 Highway-Railroad Grade Crossing Analysis

The LACRPC staff analyzed the crossings of the class 1 and 2 railroads that traverse through Allen County including the: Chicago, Ft Wayne, & Eastern (CFE) railroad, CSX railroad, Norfolk/Southern railroad, Indiana & Ohio railway (IORY), and the Spencerville-Elgin (SPEG) railroad. During the past 8 years these railroads were broken into smaller segments to ensure the corridors could be studied within specific fiscal, temporal, and staff limitations. The following subsections review each of the previous studies and recommendations.

4.2.1 CFE West - Railroad Improvement Summary

The CFE Railroad, which is owned by Genesee & Wyoming, Inc, traverses a NW / SE direction from Delphos to Lima. There were a total of 27 crossings analyzed and reported in October 2009.

Current train volumes are 4 per day. Average Daily Traffic (ADT) ranged from a low of 47 Vehicles per Day (VPD) at Baugh Road to a high of 23,002 VPD at Eastown Road with an average of 1,697 VPD at the 27 crossings. Eight (8) of the crossings are in the City of Delphos, one (1) is in the City of Lima, eight (8) in American Township, and eight (8) in Marion Township. One (1) crossing is in both American and Marion townships. Eleven (11) of the crossings are on county roads, ten (10) are on municipal streets, and the remaining six (6) are on township roads.

Eighteen (18) of the (27) crossing were equipped with flashing light and gates. Based on traffic volumes and sight distance limitations the LACRPC recommended upgrading two (2) the crossings at Greenlawn Ave. and Piquad Road to included gates. Neither were upgraded; however, the Defiance Trail crossing was upgraded to include flashing signals and gates. It was also recommended to consider the closure of two crossings (Baugh and Old Delphos roads); neither of which were closed.

There were a total of 117 specific recommendations on the corridor, in addition to speed enforcement; 45 (38%) of which were implemented. The percentage of improvements implemented at individual crossings ranged from none at six (6) crossings, four (4) of which were in the City of Delphos, to 100% at one (1) crossing (Cole Street in the City of Lima). Eight (8) crossings had at least 50% of the recommendations completed. The overall crossing condition was upgraded at five (5) crossings, including the Eastown Road crossing that was under construction at the time of the study, and an active warning system, including flashing lights and gates, was installed at the Defiance Road crossing in Marion Township.

Since the time of the study there were no vehicle / train crashes along this railroad.

Table 1 summarizes the recommendations made and those completed. Map 2 indicates and references each crossing studied in the report.

4.2.2 CFE Lima - Railroad Improvement Summary

The CFE Railroad, which is owned by Genesee & Wyoming, Inc, traverses an East-West direction through the City of Lima. There were a total of 8 crossings analyzed and reported in January of 2012..

Current train volumes range between 4 and 8 per day with traffic Average Daily Traffic (ADT) ranging from a low of 866 VPD at Pine Street to a high of 12,180 VPD at Jackson Street with an average of 4,099 VPD at the 8 crossings. All eight (8) of the crossings are in the City of Lima. The roads are the responsibility of the City of Lima; however, two of the roads, Elizabeth and Jackson streets, are also state routes, SR 65 & SR 81.

Five (5) of the eight (8) crossings are equipped with active warning devices including flashing signals and gates. The remaining three (3) only have flashing signals. It was recommended to upgrade these crossing to include gates; none of which were implemented. It was also recommended to consider the closure of the Pine Street crossing which not implemented.

There were a total of 31 recommendations made, only 6 (19%) of which were implemented. Of the six (6) recommended improvements made, four (4) upgraded the condition of the crossing (Metcalf, Elizabeth, Main, and Jackson streets) and are higher cost improvements. The percentage of improvements implemented at individual crossings ranged from none at three (3) crossings (Baxter, McDonel, and Pine streets) to 50% at one (1) crossing (Jackson).

Since the time of the study there were no vehicle / train crashes along this railroad.

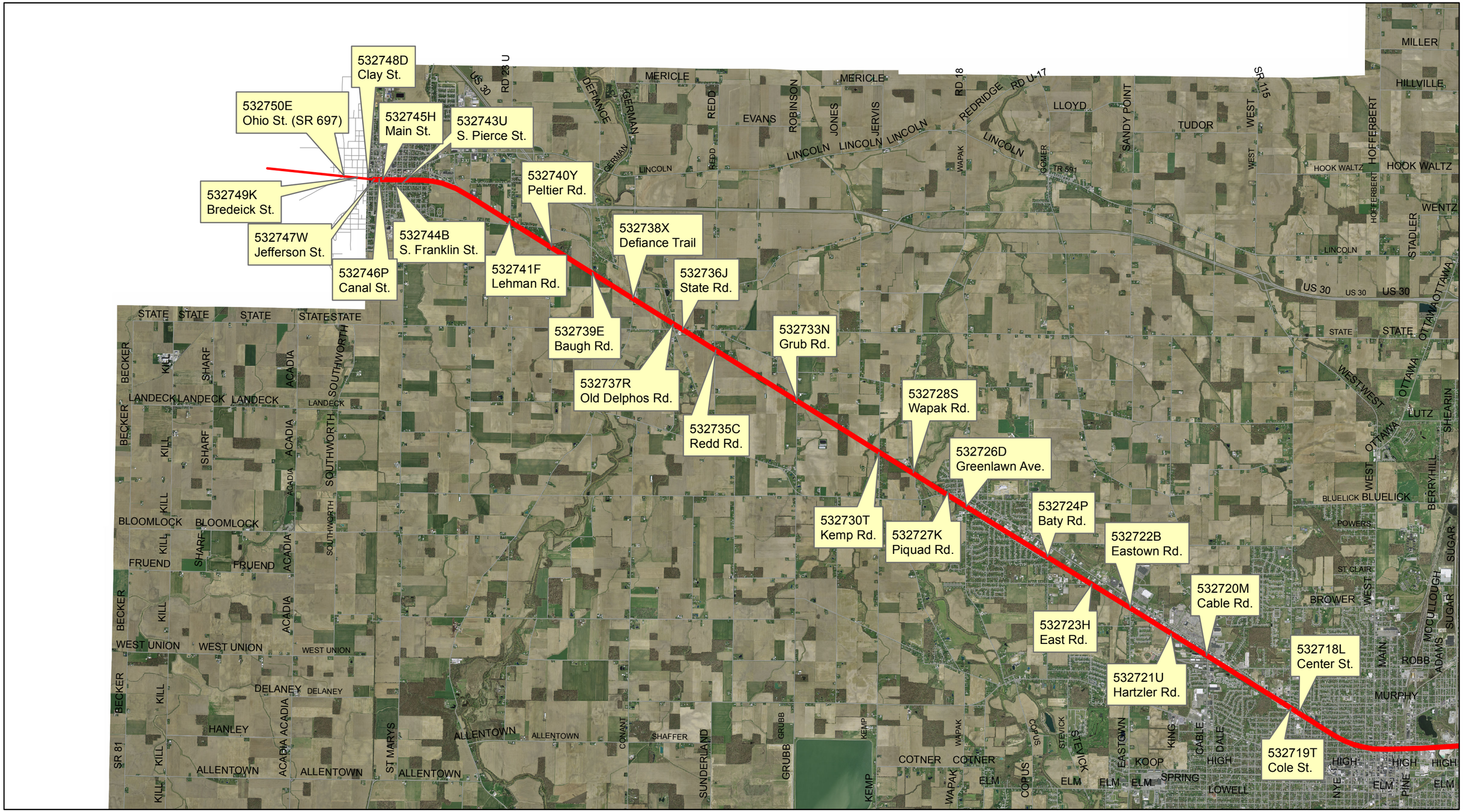
Table 2 summarizes the specific recommendations made and those completed. Map 3 indicates and references each crossing studied in the report.

Table 1: CFE West Railroad Improvement Summary
(CFE Railroad Lima-Delphos: Original Report Issued October 2009)

							Low Cost Improvements ($100-$500)										Medium Cost Improvements ($600-$5,000)			High Cost Improvements (>$5,000)			Other	Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Update AAR/FRA Placards (Railroad Responsibility)	Add Speed Advisory Plaque (Roadway Responsibility)	Remove unnecessary Warning Signs (Roadway Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Install Stop / Yield Sign (Roadway Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Centerlines in Roadway (Roadway Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Uipgrade Crossbuck (Railroad Responsibility)	Closure or Privatize Crossing (Shared Responsibility)	Install Sidewalk (Shared Responsibility)	Upgrade Crossing Condition (Railroad Responsibility)	Upgrade Warning System (Railroad Responsibility)	Selective Speed Enforcement	Number of recommendations	Recommendations completed	% Completed
Center Street (Lima)	532718L	Lima	Municipal	Flashing Signals	8	1,959				X		X	X		X		X	X						6	3	50%
Cole Street (Lima)	532719T	American	County	Gates	8	5,274				X			X				X							3	3	100%
Cable Road (Lima)	532720M	Lima/American	County	Gates	8	15,100						X	X		X								X	3	2	67%
Hartzler Road	532721U	American	Township	Gates	4	2,051					X		X		X	X							X	4	2	50%
Eastown Road	532722B	American	County	Gates	4	10,229																		0	0	0%
East Road	532723H	American	Township	Gates	4	3,544		X		X							X				X			4	3	75%
Baty Road	532724P	American	Township	Gates	4	4,247		X		X					X		X							4	3	75%
Greenlawn Avenue	532726D	American	County	Flashing Signals	4	3,328																X		1	0	0%
Piquad Road	532727K	American	County	Flashing Signals	4	2,265		X					X				X					X		4	1	25%
Wapak Road	532728S	American	County	Gates	4	373		X			X			X			X				X			5	1	20%
Kemp Road	532730T	American/Marion	County	Gates	4	630		X			X			X	X		X							5	1	20%
Grubb Road	532733N	Marion	County	Yield	4	319	X	X			X			X			X	X						6	5	83%
Redd Road	532735C	Marion	Township	Yield	4	196	X	X			X			X		X	X	X						7	3	43%
State Road	532736J	Marion	County	Gates	4	940	X				X	X		X			X				X			6	3	50%
Old Delphos Road	532737R	Marion	County	Flashing Signals	4	503					X			X			X		X		X			5	0	0%
Defiance Trail	732738X	Marion	County	Gates	4	358		X (n/a)			X (n/a)			X (n/a)			X							4	3	75%
Baugh Road	532739E	Marion	Township	Yield	4	47		X		X	X						X		X					5	2	40%
Peltier Road	532740Y	Marion	Township	Crossbuck	4	77		X	X					X			X	X						5	2	40%
Lehman Road	532741F	Marion	County	Gates	8	1,551		X						X		X	X							4	3	75%
Pierce Street (Delphos)	532743U	Delphos	Municipal	Gates	8	2,471				X						X	X				X			4	1	25%
Franklin Street (Delphos)	532744B	Delphos	Municipal	Gates	8	1,953				X		X			X	X	X				X		X	6	1	17%
Main Street (Delphos)	532745H	Delphos	Municipal	Gates	8	4,260				X		X				X		X					X	4	2	50%
Canal Street (Delphos)	532746P	Delphos	Municipal	Gates	8	1164			X	X		X		X			X	X		X			X	7	1	14%
Jefferson Street (Delphos)	532747W	Delphos	Municipal	Gates	5	2,387				X		X				X	X							4	0	0%
Clay Street (Delphos)	532748D	Delphos	Municipal	Gates	3	582				X		X				X	X	X						5	0	0%
Bredeick Street (Delphos)	532749K	Delphos	Municipal	Gates	2	1,372				X		X				X	X							4	0	0%
Ohio Street (SR 697; Delphos)	532750E	Delphos	Municipal	Gates	2	9,388						X				X								2	0	0%
				Average or % Complete	5	1,723	100%	55%	0%	46%	56%	10%	60%	30%	50%	25%	14%	86%	0%	0%	67%	0%		117	45	38%
				Number of Items Recommended:			3	11	2	12	9	10	5	10	6	10	21	7	2	1	6	2	0			
				Number of Items Completed:			3	6	0	5.5	5	1	3	3	3	2.5	3	6	0	0	4	0	0			

Completed
1/2 Complete
Not Completed
Unknown

Map 2: CFE West Railroad Crossings



1 0.5 0 1 Miles

N W E S

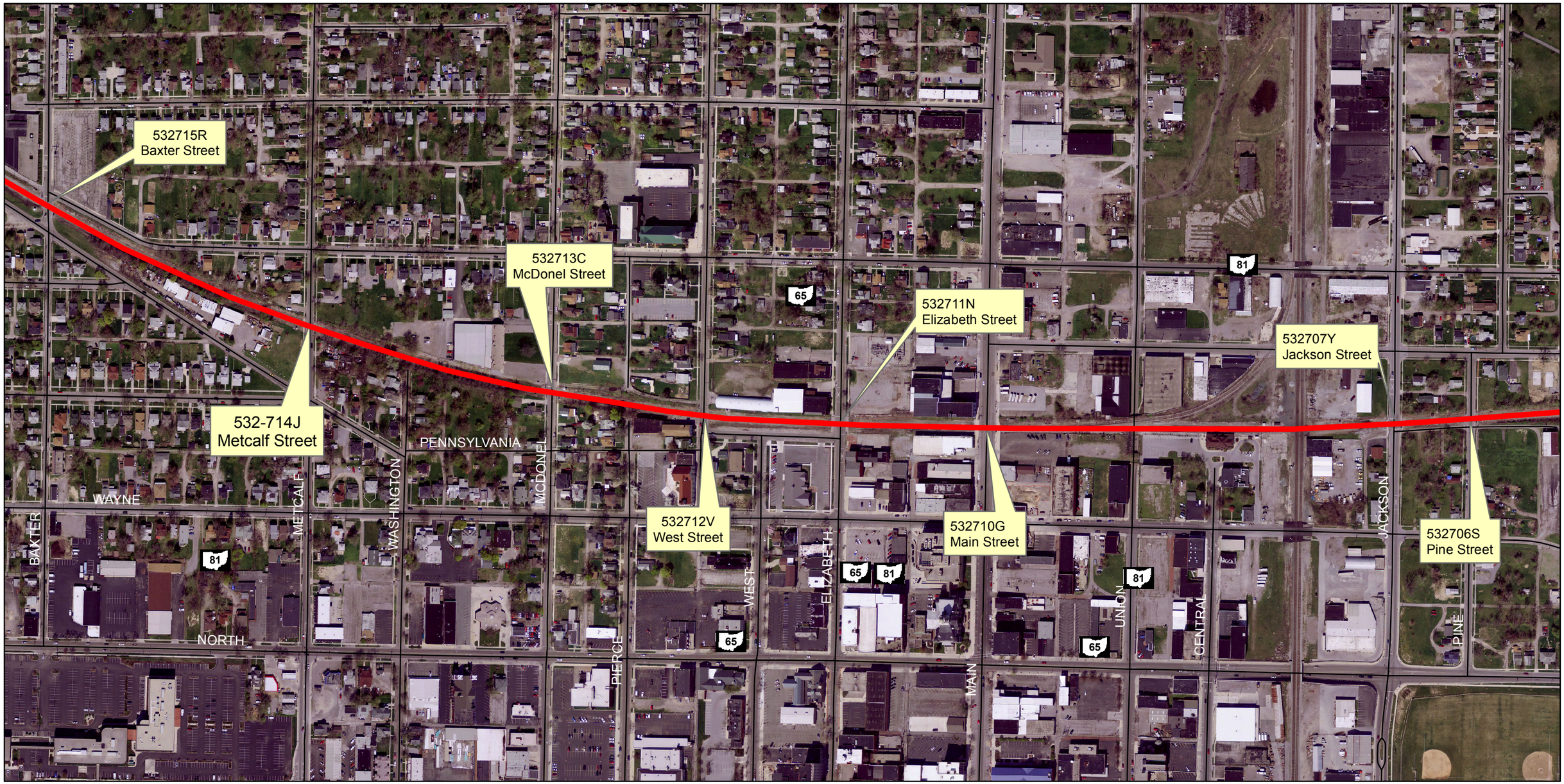
5/1/2016

Table 2: CFE Lima Railroad Improvement Summary
(CFE Railroad Within City of Lima: Original Report Issued January 2012)

							Low Cost Improvements $100-$500						Medium Cost Improvements ($600-$1,000)		High Cost Improvements (>$ 5,000)			Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Upgrade Stop Bars (Roadway Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Centerlines in Roadway (Roadway Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Closure or Privatize Crossing (Shared Responsibility)	Install Sidewalk (Shared Responsibility)	Upgrade Crossing Condition (Railroad Responsibility)	Upgrade Warning System (Railroad Responsibility)	Number of recommendations	Number of recommendations Completed	% Completed
Baxter Street	532715R	Lima	Municipal	Gates	8	1,736	X			X			X		X			4	0	0%
Metcalf Street	532714J	Lima	Municipal	Gates	8	5,167	X				X		X			X		4	1	25%
McDonel Street	532713C	Lima	Municipal	Gates	8	1,038										X		1	0	0%
West Street	532712V	Lima	Municipal	Flashing Signals	8	2,306	X		X				X			X	X	5	1	20%
Elizabeth Street	532711N	Lima	Municipal	Flashing Signals	8	2,131		X	X				X			X	X	5	2	40%
Main Street	532710G	Lima	Municipal	Gates	8	7,369	X					X	X			X		4	1	25%
Jackson Street	532707Y	Lima	Municipal	Gates	4	12,180										X	X	2	1	50%
Pine Street	532706S	Lima	Municipal	Flashing Signals	4	866	X					X	X	X		X	X	6	0	0%
				Average or % Complete	7	4,099	0%	0%	100%	0%	0%	0%	0%	0%	0%	57%	0%	31	6	19%
				Number of Recommendations:			5	1	2	1	1	2	6	1	1	7	4			
				Number of Recommendations Completed:			0	0	2	0	0	0	0	0	0	4	0			

Completed
1/2 Complete
Not Completed
Unknown

Map 3: CFE Lima Railroad Crossings



0 400 800 1,200 1,600 Feet

N

5/1/2016

4.2.3 CFE East - Railroad Improvement Summary

The CFE Railroad, which is owned by Genesee & Wyoming, Inc, traverses an east-west direction from the city of Lima to Hardin County. There were a total of 18 crossings analyzed and reported in June of 2010.

Current train volumes reflect 4 trains per day with traffic Average Daily Traffic (ADT) ranging from a low of 18 VPD at Vint Road to a high of 5,061 VPD at Roush Road with an average of 733 VPD at the 18 crossings. Nine (9) of the crossings are in Jackson Township, four (4) are in Bath Township and three (3) are in the Village of Lafayette. One (1) crossing is collocated in Jackson and Bath townships and one (1) in Jackson Township and Hardin County. Thirteen (13) of the crossings are on township roads, three (3) are on municipal roads, and 2 are on county roads.

At the time of the study, eight (8) of the crossings were equipped with flashing lights and gates. Due to a combination of train and traffic volumes at the time the crossbucks were deemed acceptable at the remaining crossings. No recommendation to upgrade to active warning systems was made. Two (2) crossings (Cool Road and Hardin Road); however, were upgraded to include flashing lights and gates. It was also recommended to privatize the Vint Road crossing which not implemented.

There were a total of 57 recommendations, in addition to selective speed enforcement, made in the report, 39 or 68%, of which were implemented. The percentage of improvements implemented at individual crossings ranged from none at one (1) crossing, Vint Road, to 100% at five (5) crossings (Fetter, Thayer, Cool, McClure, and Fisher roads). Fifteen (15) crossings had at least 50% of the recommendations completed.

Since the time of the study there were no vehicle / train crashes along this railroad.

Table 3 summarizes the recommendations made and those completed. Map 4 indicates and references each crossing studied in the report.

4.2.4 CSX South - Railroad Improvement Summary

The CSX South Railroad traverses a N / S direction from Auglaize County into the City of Lima. There were a total of 8 crossings analyzed and reported in August of 2013.

Current train volumes range between 22 and 25 per day, Average Daily Traffic (ADT) ranged from a low of 789 VPD at Eureka Street in Lima to a high of 10,343 VPD at Breese Road in Shawnee Township with an average of 4,707 VPD at the eight (8) crossings. Five (5) of the crossings are in the City of Lima while the remaining three (3) crossings are in Shawnee Township. Five (5) crossings are on municipal streets, two (2) are on county roads, and one (1) on a township road.

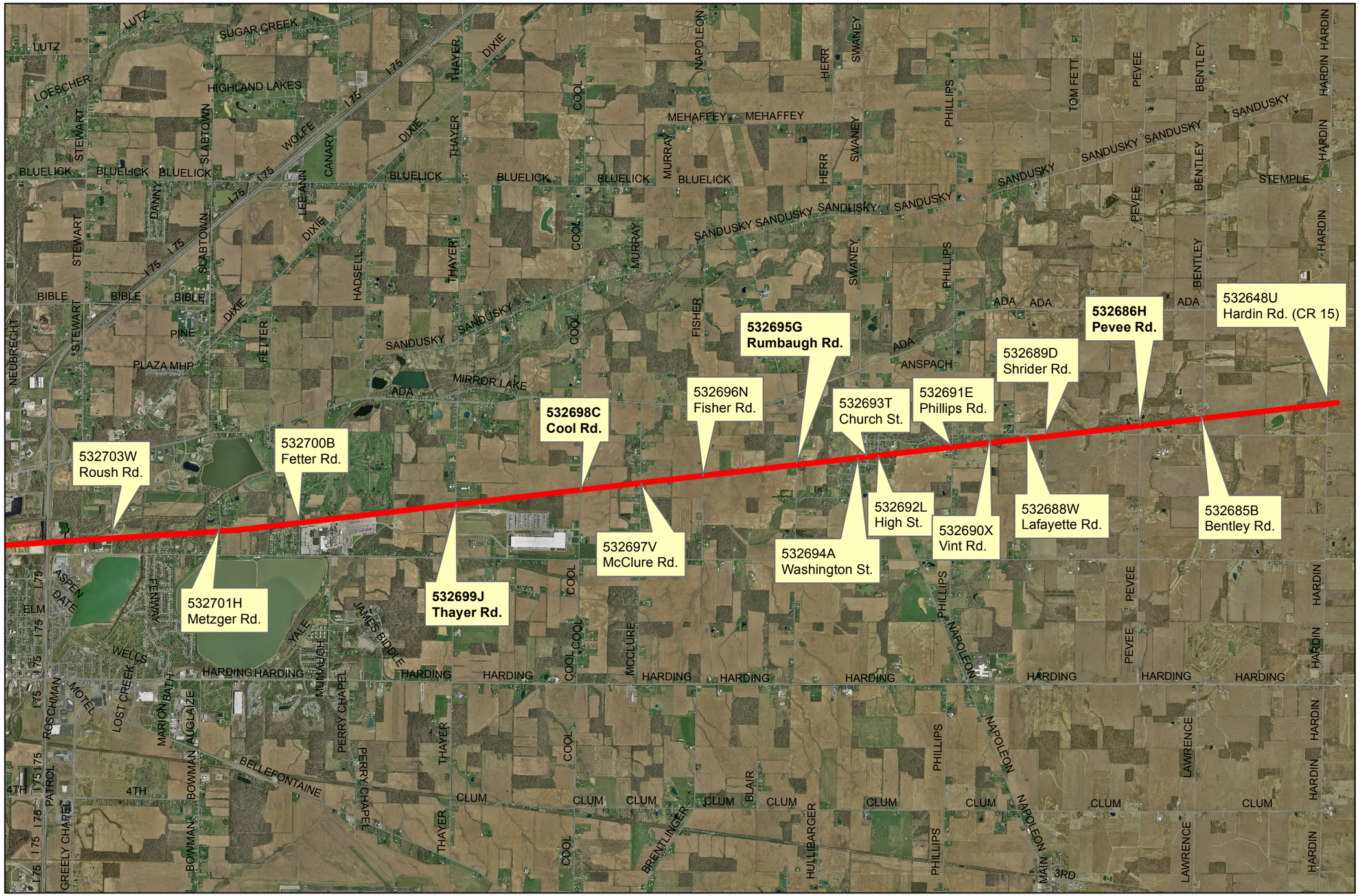
The study made a total of 22 specific recommendations; 6.5, or 30%, of which were implemented. The percentage of improvements implemented at individual crossings ranged from none at two (2) crossings (Hume Road and Kibby Street) to 100% at the Buckeye Road crossing. Only two (2) crossings had at least 50% of the recommendations completed.

Table 3: CFE East Railroad Improvement Summary
(CFE Railroad East of Lima: Original Report Issued June 2010)

							Low Cost Improvements (<$500)							Medium Cost Improvements ($600-$5,000)			High Cost Improvements (>$5,000)	Other	Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Update AAR/FRA Placards (Railroad Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Install Stop / Yield Sign (Roadway Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Upgrade Centerlines in Roadway (Roadway Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Uipgrade Crossbuck (Railroad Responsibility)	Closure or Privatize Crossing (Shared Responsibility)	Upgrade Crossing Condition (Railroad Responsibility)	Selective Speed Enforcement	Number of recommendations	Number of Recommendations Completed	% Completed
Roush Road	532703W	Bath	Township	Gates	4	5,061				X					X				2	2	100%
Metzger Road	432701H	Bath	Township	Stop	4	100		X	X	X	X				X				5	3	60%
Fetter Road	432700B	Bath	Township	Gates	4	806				X								X	1	1	100%
Thayer Road	432699J	Bath	County	Gates	4	3,028	X												1	1	100%
Cool Road	532698C	Bath/Jackson	Township	Gates	4	379	X		X (n/a)		X (n/a)				X (n/a)				4	4	100%
McClure Road	532697V	Jackson	Township	Gates	4	216							X						1	1	100%
Fisher Road	532696N	Jackson	Township	Crossbucks	4	65				X					X				2	2	100%
Rumbaugh Road	532695G	Jackson	Township	Crossbucks	4	710			X		X				X				3	1.5	50%
Washington Street (Lafayette)	532694A	Lafayette	Municipal	Gates	4	547		X					X	X	X				4	2	50%
Church Street (Lafayette)	532693T	Lafayette	Municipal	Gates	4	62		X		X			X	X					4	2	50%
High Street (Lafayette)	532692L	Lafayette	Municipal	Gates	4	679		X		X			X	X					4	1	25%
Phillips Road	532691E	Jackson	County	Crossbucks	4	431		X	X		X	X			X		X		6	3	50%
Vint Road	532690X	Jackson	Township	Crossbucks	4	18										X			1	0	0%
Shrider Road	532689D	Jackson	Township	Crossbucks	4	34	X		X	X					X				4	3.5	88%
Lafayette Road	532688W	Jackson	Township	Gates	4	143													0	0	0%
Pevee Road	532686H	Jackson	Township	Crossbucks	4	183			X	X	X		X		X				5	4.5	90%
Bentley Road	532685B	Jackson	Township	Crossbucks	4	81			X	X	X				X				4	2.5	63%
Hardin Road	532648U	Jackson/Hardin Co.	Township	Gates	4	646	X	X	X (n/a)		X			X	X (n/a)				6	5	83%
				Average or % Complete	4	733	100%	33%	100%	89%	43%	100%	100%	25%	64%		0%		57	39	68%
				Number of Recommendations:			4	6	8	9	7	1	5	4	11	1	1	0			
				Number of Recommendations Completed:			4	2	8	8	3	1	5	1	7	0	0	0			

Completed
1/2 Complete
Not Completed
Unknown

Map 4: CFE East Railroad Crossings



Since the time of the study there were two (2) vehicle / train crashes along this railroad; one (1) at the St. Johns Road crossing in 2015 and one (1) at the Fourth Street crossing in 2016. Both crashes were property damage only and both were in the City of Lima.

Table 4 summarizes the recommendations made and those completed. Map 5 indicates and references each crossing studied in the report.

4.2.5 CSX North - Railroad Improvement Summary

The CSX North Railroad traverses a North / South direction from within the City of Lima to Putnam County. There were a total of 15 crossings analyzed in April 2011.

Current train volumes reflect 4 trains per day. Average Daily Traffic (ADT) ranged from a low of 79 VPD at the Hook-Waltz Road crossing in Monroe Township to a high of 15,124 VPD at the Market Street crossing in the City of Lima. Six (6) of the crossings are in the City of Lima, five (5) are in Monroe Township, two (2) are in Bath Township, one (1) is collocated in Bath and Monroe townships, and one (1) is in the Village of Cairo. Seven (7) crossings are on municipal streets, six (6) are on township roads, and two (2) are on county roads.

There were a total of 32 recommendations made; 11.5, or 36%, were implemented. The percentage of improvements implemented at individual crossings ranged from none at five (5) crossings (Wayne, McKibben, State, Hook-Waltz, and Miller) to 100% at one (1) crossing (Main Street in Cairo). Five (5) crossings had at least 50% of the recommendations completed. The overall crossing condition was upgraded at one (1) crossing, High Street in the City of Lima. Two (2) crossing were recommended to be considered for closure, neither was implemented.

Since the time of the study there was vehicle / train crash in 2014 along this railroad at the Begg Road crossing in Monroe Township. The crash was property damage only.

Table 5 summarizes the recommendations made and those completed. Map 6 indicates and references each crossing studied in the report.

4.2.6 IORY - Railroad Improvement Summary

The IORY Railroad traverses a North / South direction from Auglaize County to north of Lima. There were a total of 18 crossings analyzed and reported in June 2014.

Current train volumes reflect 4 to 6 per day. Average Daily Traffic (ADT) ranged from a low of 81 VPD at the Hume Road crossing in Perry Township to a high of 18,342 VPD the Bellefontaine Avenue crossing in the City of Lima with an average of 4,155 VPD at the 18 crossings. Seven (7) of the crossings are in the City of Lima, five (5) in Bath Township, five (5) in Perry Township, and one (1) is collocated in Bath Township and the City of Lima and another one (1) is collocated in Perry Township and the City of Lima. Seven (7) crossings are on municipal streets, seven (7) are on county roads, three (3) are on township roads, and one (1) is on a state route.

Table 4: CSX South Railroad Improvement Summary
(CSX Railroad; South of Lima: Original Report Issued August 2013)

							Low Cost Improvements (<$500)						Medium Cost Improvements ($600-$5,000)	Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Upgrade Stop Bars (Roadway Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Centerlines in Roadway (Roadway Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Number of Recommendations Made	Number of Recommendations Complted	% Completed
Hume Road	155658P	Shawnee	Township	Gates	22	1,120	X	X						2	0	0%
Breese Road	155661X	Shawnee	County	Gates	22	10,343	X	X		X			X	4	2	50%
Buckeye Road	155662E	Shawnee	County	Gates	22	4,732	X							1	1	100%
Fourth Street	155655A	Lima	Municipal	Gates	22	5,265	X	X	X	X		X	X	6	2	33%
Main Street	155668V/476911U	Lima	Municipal	Gates	25	4,193								0	0	0%
St. Johns Road	155675F/476909T	Lima	Municipal	Gates	25	3,568	X				X		X	3	1	33%
Kibby Street	155676M/476908L	Lima	Municipal	Gates	25	7,642	X						X	2	0	0%
Eureka Street	155677U/476907E	Lima	Municipal	Gates	25	789	X				X	X	X	4	0.5	13%
				Average or % Complete	**24**	**4,707**	**29%**	**67%**	**0%**	**0%**	**75%**	**50%**	**0%**	**22**	**6.5**	**30%**
				Number of Recommendations:			**7**	**3**	**1**	**2**	**2**	**2**	**5**			
				Number of Recommendations Completed:			**2**	**2**	**0**	**0**	**1.5**	**1**	**0**			

Completed
1/2 Complete
Not Completed
Unknown

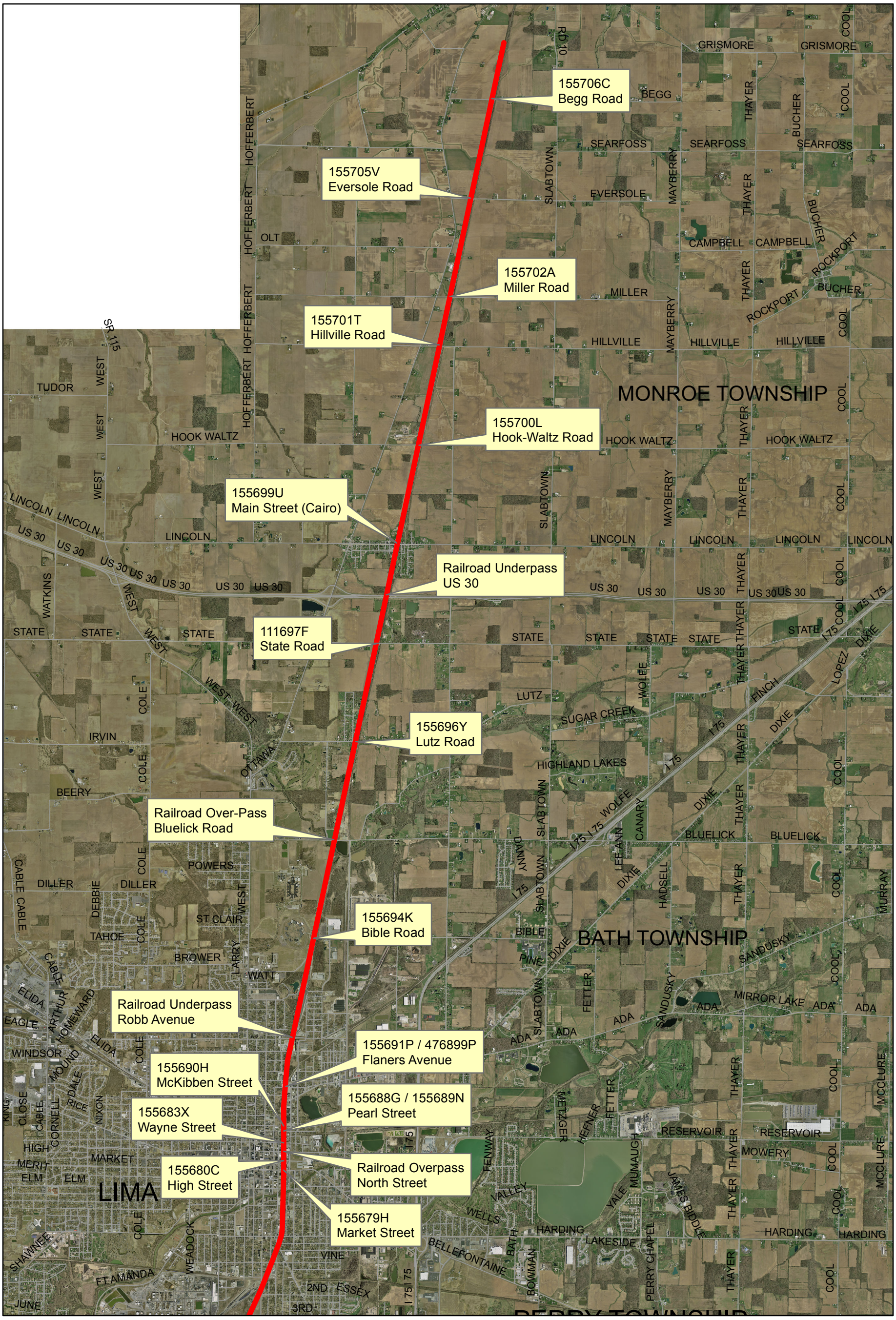
Map 5: CSX South Railroad Crossings

Table 5: CSX North Railroad Improvement Summary
(CSX Railroad North of Lima: Original Report Issued April 2011)

							Low Cost Improvements (<$500)						Medium Cost Improvements ($600-$5,000)				High Cost Improvements (>$5,000)	Other	Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Upgrade Mutipule Track Signs (Railroad Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Centerlines in Roadway (Roadway Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Closure or Privatize Crossing (Shared Responsibility)	Install left side crossbuck (Railraod Responsibility)	Uipgrade Crossbuck (Railroad Responsibility)	Upgrade Crossing Condition (Railroad Responsibility)	Selective Speed Enforcement	Number of Recommendations	Number of Recommendations Completed	% Completed
Market Street (Lima)	155679H	Lima	Municipal	Gates	25	15,124	X	X			X		X			X		X	5	3	60%
High Street (Lima)	155680C	Lima	Municipal	Gates	25	1681	X	X					X				X		4	3	75%
Wayne Street (Lima)	155683X	Lima	Municipal	Gates	25	1,619		X					X						2	0	0%
Pearl Street (Lima)	155688G/155689N	Lima	Municipal	Gates	25	691	X	X					X	X				X	4	1	25%
McKibben Street (Lima)	155690H	Lima	Municipal	Gates	25	2,193		X				X	X						3	0	0%
Flanders Avenue (Lima)	155691P/476899P	Lima	Municipal	Gates	25	2,381	X	X				X	X						4	1	25%
Bible Road	155694K	Bath	County	Gates	22	1,579		X	X	X									3	1.5	50%
Lutz Road	155696Y	Bath	Township	Gates	22	746													0	0	0%
State Road	155697F	Bath/Monroe	Township	Gates	22	777					X								1	0	0%
Main Street (Cairo)	155699U	Cairo	Municipal	Gates	22	1,471						X							1	1	100%
Hook-Waltz Road	155700L	Monroe	Township	Gates	22	79					X								1	0	0%
Hillville Road	155701T	Monroe	County	Gates	22	170													0	0	0%
Miller Road	155702A	Monroe	Township	Crossbucks	22	93								X	X		X		3	0	0%
Eversole Road	155705V	Monroe	Township	Gates	22	320													0	0	0%
Begg Road	155706C	Monroe	Township	Gates	22	541					X								1	1	100%
Average or % Complete					**23**	**1,964**	**100%**	**29%**	**50%**	**0%**	**50%**	**33%**	**0%**	**0%**	**0%**	**100%**	**50%**		**32**	**11.5**	**36%**
Number of Recommendations:							**4**	**7**	**1**	**1**	**4**	**3**	**6**	**2**	**1**	**1**	**2**	**0**			
Number of Recommendations Completed:							**4**	**2**	**0.5**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**1**	**0**			

Completed
1/2 Complete
Not Completed
Unknown

Map 6: CSX North Railroad Crossings



1 0.5 0 1 Miles

5/1/2016

There were a total of 70 recommendations made; 37, or 53%, of which were implemented. The percentage of improvements implemented at individual crossings ranged from 25% at three (3) crossings to 100% at two (2) crossings. Eight (8) crossings had at least 50% of the recommendations completed. The overall condition of Kibby Street crossing was upgraded and the pavement at the Hume Road was upgraded. The Yoder Road crossing is currently in a state of disrepair due to the IR 75 construction activities; however, it is fully expected this will be upgraded with the project. It was recommended the Wayne Street crossing to be considered for closure; however, this was not implemented.

Since the time of the study there were no vehicle / train crashes along this railroad.

Table 6 summarizes the recommendations made and those completed. Map 7 indicates and references each crossing studied in the report.

4.2.7 NS South & RJ Corman - Railroad Improvement Summary

The NS South & RJ Corman Railroad traverses a Northeast / Southwest direction from Auglaize County to within the City of Lima. There were a total of 9 crossings analyzed and reported in June 2012.

Current train volumes reflect 2 per day. Average Daily Traffic (ADT) ranged from a low of 27 VPD at the Bowsher Road crossing in Shawnee Township to a high of 10,488 VPD at the Shawnee Road crossing, also in Shawnee Township. An average of 3,247 VPD were experienced at the 9 crossings. Eight (8) of the crossings are in Shawnee Township with the remaining one (1) in the City of Lima. Four (4) crossings are on township roads, three (3) are on county roads, one (1) on a municipal street, and one (1) on a state route.

There were a total of 24 recommendations made; 14, or 58%, of which were implemented. The percentage of improvements implemented at individual crossings ranged from 0% at one (1) crossing (Main Street in the City of Lima) to 100% at three (3) crossings..Five (5) crossings had at least 50% of the recommendations completed. The Shawnee Road crossing was upgraded to included flashing signals and gates.

Since the time of the study there were no vehicle / train crashes along this railroad.

Table 7 summarizes the recommendations made and those completed. Map 8 indicates and references each crossing studied in the report.

4.2.8 NS North - Railroad Improvement Summary

The NS Railroad traverses a NE / SW direction from within the City of Lima through the Village of Bluffton to Hancock County. There were a total of 13 crossings analyzed and reported in August 2015.

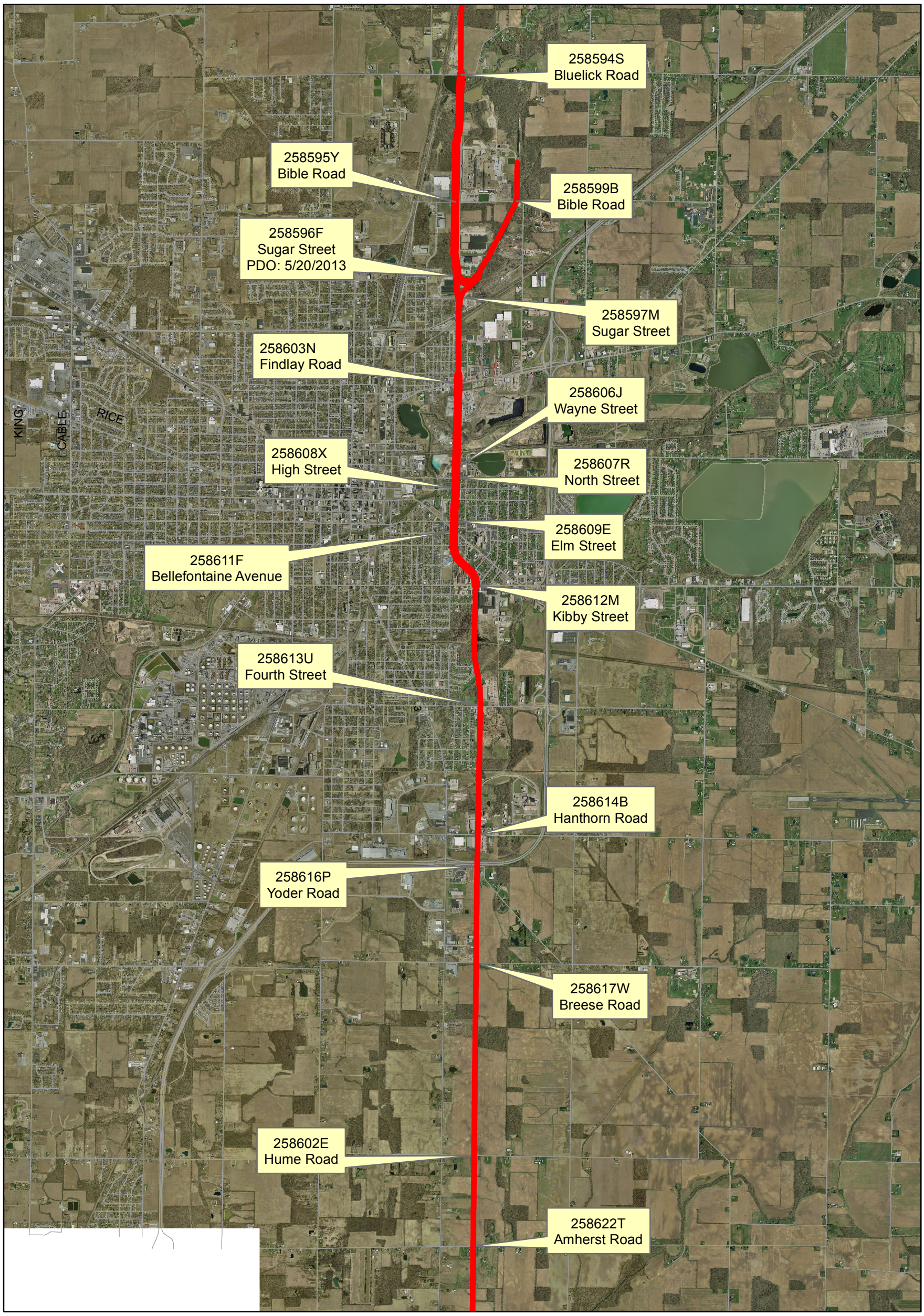
Current train volumes reflect 3 per day. Average Daily Traffic (ADT) ranged from a low of 161 VPD at the Hancock CR 33 Road to a high of 4,963 VPD at the Jefferson Street (SR 103) crossing in the Village of Bluffton with an average of 2,154 at the 13 crossings. Five (5) of the crossings are in the Village of Bluffton

Table 6: IORY Railroad Improvement Summary
(IORY Railroad South of Lima: Original Report Issued June 2014)

							Low Cost Improvements (<%500)										Medium Cost Improvements ($600-$5,000)		High Cost Improvements (>$5,000)			Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Update AAR/FRA Placards (Railroad Responsibility)	Upgrade Mutipule Track Signs (Railroad Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Install Stop / Yield Sign (Roadway Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Centerlines in Roadway (Roadway Responsibility)	Install a Bell (Railroad Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Closure or Privatize Crossing (Shared Responsibility)	Upgrade Crossing Condition (Railroad Responsibility)	Upgrade Approach Pavement (Roadway Responsibility)	Upgrade Warning System (Railroad Responsibility)	Number of Recommendations	Number of Recommendations Completed	% Completed
Amherst Road	258622T	Perry	Township	Gates	6	673	X		X													2	2	100%
Hume Road	258602E	Perry	Township	Yield	6	81	X		X	X					X		X			X	X	7	3	43%
Breese Road	258617W	Perry	Township	Gates	6	1,298	X		X							X	X					4	3	75%
Yoder Road	258616P	Perry	County	Gates	6	479	X						X						X			1	1	100%
Hanthorn Road	258614B	Perry	County	Gates	6	2,557	X		X							X						3	2	67%
Fourth Street	258613U	Perry/Lima	Municipal	Gates	6	5,681	X		X		X						X					4	1	25%
Kibby Street	258612M	Lima	Municipal	Gates	6	8,019	X		X			X					X		X			5	4	80%
Bellefonatine Avenue	258611F	Lima	Municipal	Gates	8	18,342	X				X			X								3	2	67%
Elm Street	258609E	Lima	Municipal	Gates	8	1,991	X				X								X			3	1	33%
High Street	258608X	Lima	Municipal	Gates	8	1,006	X		X		X	X					X		X			6	2	33%
North Street	258607R	Lima	Municipal	Gates	8	7,012	X		X		X	X		X	X		X					7	5	71%
Wayne Street	258606J	Lima	Municipal	Yield	8	154	X		X			X					X	X	X			6	2	33%
Findlay Road	258603N	Lima/Bath	ODOT	Gates	8	7,581	X				X				X							3	1	33%
Sugar Street, South	258597M	Bath	County	Gates	8	2,843	X					X		X			X					4	1	25%
Sugar Street, North	258596F	Bath	County	Gates	8	5,734																0	0	0%
Bible Road, West	258595Y	Bath	County	Gates	8	1,539	X	X				X								X		4	1	25%
Bible Road, East	258599B	Bath	County	Gates	8	1,539	X		X		X						X					4	2	50%
Bluelick Road	258594S	Bath	County	Gates	8	8,266	X				X			X			X					4	4	100%
Average or % Complete					7	4,155	94%	0%	70%	0%	25%	33%	0%	50%	33%	0%	50%	0%	25%	50%	0%	70	37	53%
Number of Recommendations:							17	1	10	1	8	6	0	4	3	1	10	1	4	2	2			
Number of Recommendations Completed:							16	0	7	0	2	2	0	2	1	0	5	0	1	1	0			

Completed
1/2 Complete
Not Completed
Unknown

Map 7: IORY Railroad Crossings



N
W E
S

1.5 0.75 0 1.5 Miles

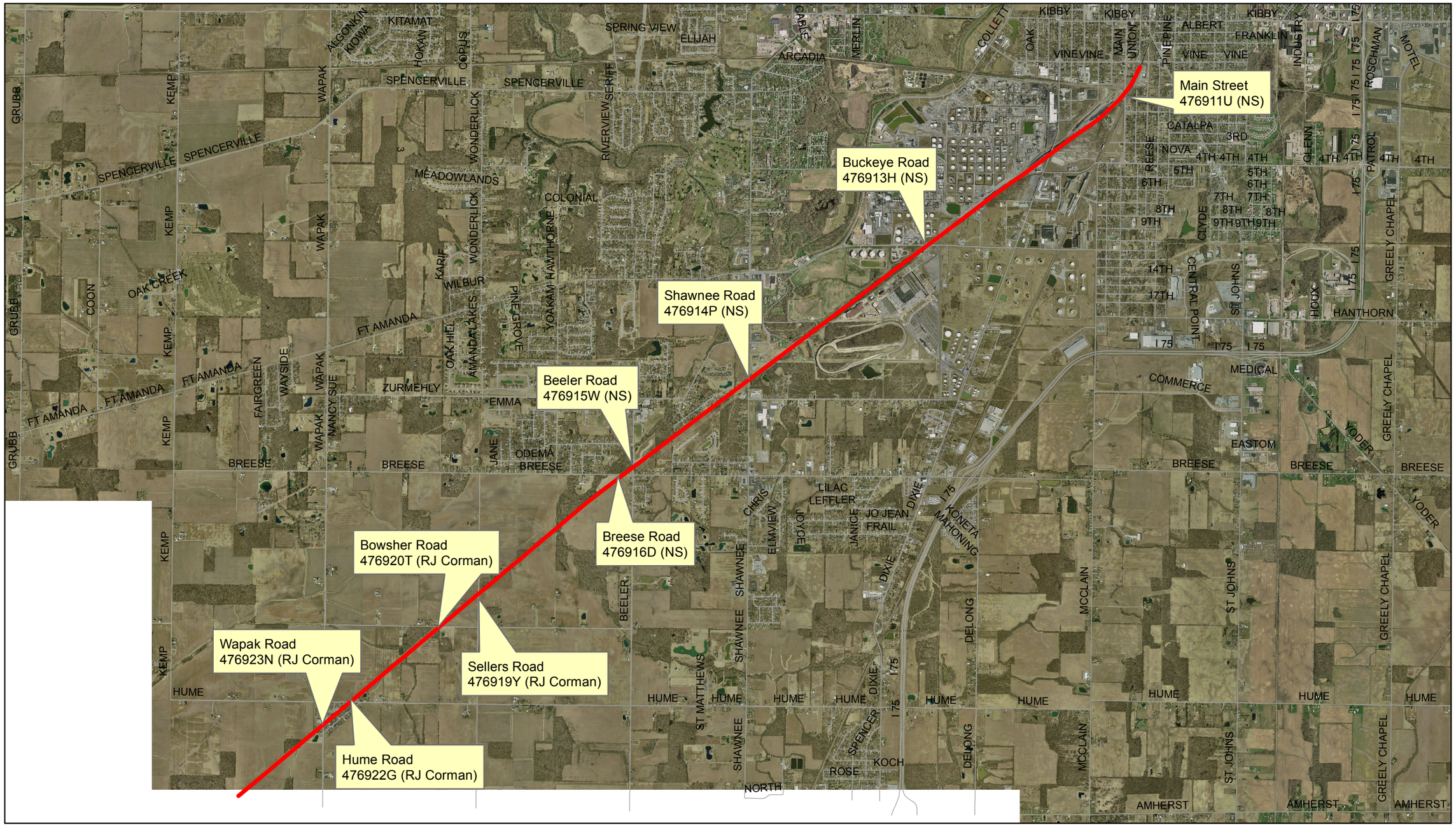
5/1/2016

Table 7: NS South Railroad Improvement Summary
(RJ Corman / NS Railroad Southwest of Lima Original Report Issued June 2012)

							Low Cost Improvements (<$500)							Medium Cost Improvements ($600-$5,000)		Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Update AAR/FRA Placards (Railroad Responsibility)	Add Speed Advisory Plaque (Roadway Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Install Stop / Yield Sign (Roadway Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Uipgrade Crossbuck (Railroad Responsibility)	Number of Recommendations	Number of Recommendations Completed	% Completed
Wapak Road	476923N	Shawnee	ODOT	Gates	2	3,305										0	0	0%
Hume Road	476922G	Shawnee	Township	Yield	2	223		X		X					X	3	1	33%
Bowsher Road	476920T	Shawnee	Township	Yield	2	27		X		X	X		X		X	5	1	20%
Sellers Road	476919Y	Shawnee	Township	Yield	2	238		X		X			X		X	4	2	50%
Breese Road	476916D	Shawnee	County	Gates	2	3,299	X				X					2	2	100%
Beeler Road	476915W	Shawnee	Township	Gates	2	1,052	X		X		X		X	X		5	4	80%
Shawnee Road	476914P	Shawnee	County	Gates	2	10,488								X		1	1	100%
Buckeye Road	476913H	Shawnee	County	Gates	2	6,534	X		X					X		3	3	100%
Main Street	476911U	Lima	Municipal	Gates	2	4,057						X				1	0	0%
Average or % Complete					**2**	**3,247**	**100%**	**0%**	**100%**	**100%**	**67%**	**0%**	**33%**	**100%**	**0%**	**24**	**14**	**58%**
Number of Recommendations:							**3**	**3**	**2**	**3**	**3**	**1**	**3**	**3**	**3**			
Number of Recommendations Completed:							**3**	**0**	**2**	**3**	**2**	**0**	**1**	**3**	**0**			

Completed
1/2 Complete
Not Completed
Unknown

Map 8: NS South Railroad Crossings



05/1/2016

and/or Hancock County. Two (2) crossing each are in Richland and Bath townships and the Village of Beaverdam. One (1) crossing is in the City of Lima and one (1) crossing is collocated in the City of Lima and Bath Township. Eight (8) crossings are on municipal streets, three (3) are on county roads, one (1) is on a township road, and one (1) is on a state route.

There were a total of 34 recommendations made; six (6), or 18%, of which were implemented. The percentage of improvements implemented at individual crossings ranged from none at eight (8) crossings to 100% at one (1) crossing. Only one (1) had at least 50% of the recommendations completed. The overall crossing condition was upgraded at one (1) crossing (SR 696 in Beaverdam).

Since the time of the study there were no vehicle / train crashes along this railroad.

Table 8 summarizes the recommendations made and those completed. Map 9 indicates and references each crossing studied in the report.

4.2.9 SPEG (RJ Corman) - Railroad Improvement Summary

The SPEG Railroad, operated by RJ Corman, traverses an East / West direction from Van Wert County through the Village of Spencerville and on to the City of Lima. There were a total of 16 crossings analyzed and reported in January 2008. In addition, the crossing at Eastown Road was constructed after the 2008 report.

Current train volumes reflect 1 per day and very seasonal with transporting crops in the fall. The Average Daily Traffic (ADT) ranged from a low of 25 VPD at Hoch Road in Spencer Township to a high of 8,465 VPD at Eastown Road in Shawnee Township with an average of 1,365 VPD at the 17 crossings. Six (6) of the crossings are in Amanda Township, five (5) in Spencer Township, three (3) in Shawnee Township, one (1) in the Village of Spencerville, one (1) is collocated in Spencer Township and the Village of Spencerville, and one (1) is collocated in Amanda and Shawnee townships. Eight (8) crossing are on townships roads, eight (8) are county roads, and one (1) is on a municipal street.

There were a total of 68 recommendations made; 53.5, or 79%, of which were implemented. The percentage of improvements implemented at individual crossings ranged from 50% at one (1) crossing to 100% at eight (8) crossings. All sixteen (16) crossing studied had at least 50% of the recommendations completed. The overall crossing condition was upgraded at five (5) crossings, including the Eastown Road crossing that was under construction at the time of the study, and an active warning system, including flashing lights and gates, were installed at the Wapak Road in Shawnee Township.

Since the time of the study there were two (2) vehicle / train crashes along this railroad. An injury crash occurred at the Wapak Road crossing in 2012 and a property damage only crash at the Conant Road crossing in 2013.

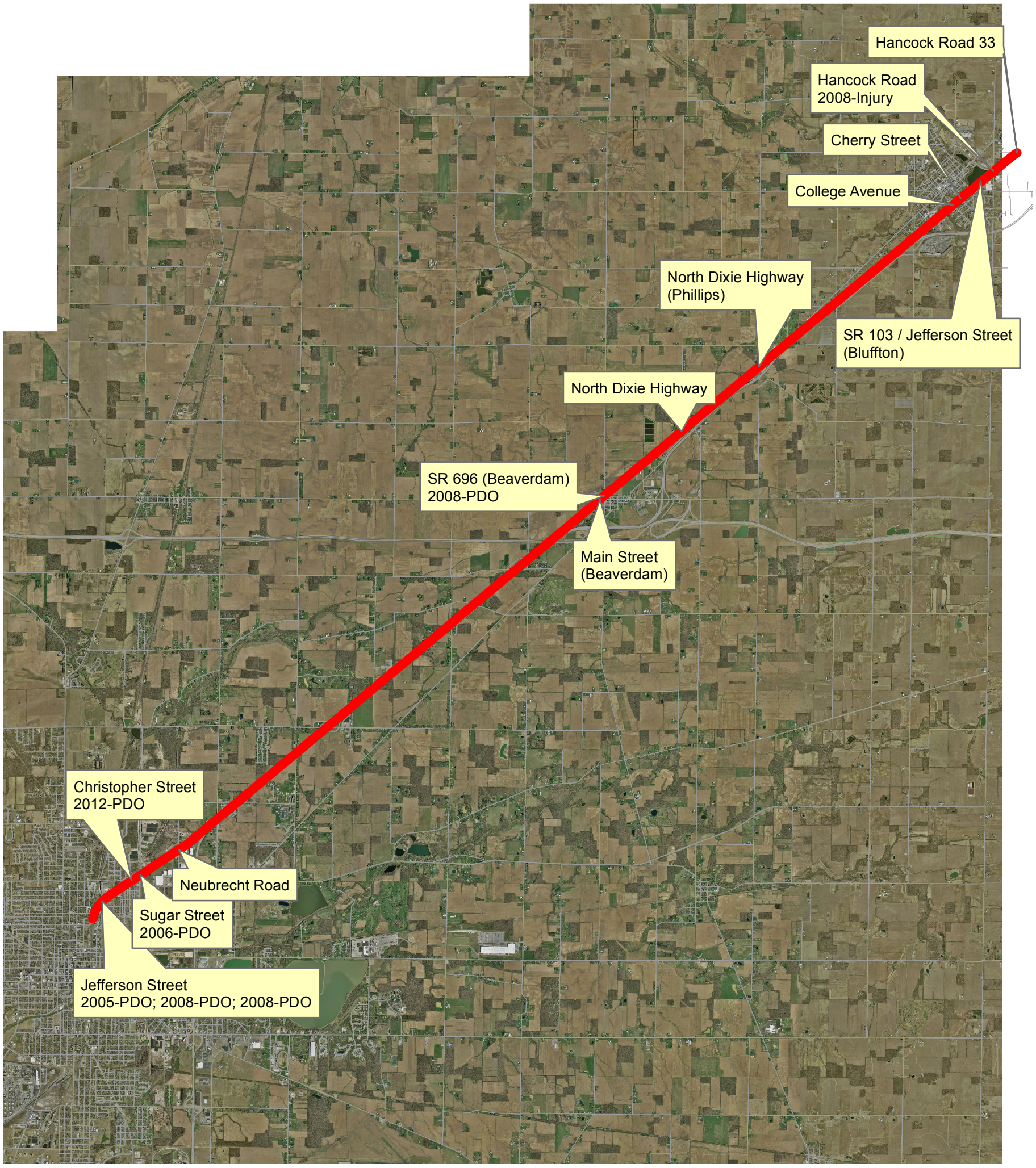
Table 9 summarizes the recommendations made and those completed. Map 10 indicates and references each crossing studied in the report.

Table 8: NS Northeast Railroad Improvement Summary
(N/S Railroad Northeast of Lima: Original; Report Issued August 2015)

							Low Cost Improvements (<$500)									Medium Cost Improvements ($600-$5,000)		High Cost Improvements (>$5,000)			Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Update AAR/FRA Placards (Railroad Responsibility)	Upgrade Mutipule Track Signs (Railroad Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Install Stop / Yield Sign (Roadway Responsibility)	Install additional signs (Shared Responsibility)	Upgrade Advance Warning Signs (Roadway Responsibility)	Upgrade Side Street Warning Signs (Roadway Responsibility)	Install a Bell (Railroad Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Uipgrade Crossbuck (Railroad Responsibility)	Upgrade Crossing Condition (Railroad Responsibility)	Upgrade Approach Pavement (Roadway Responsibility)	Upgrade Warning System (Railroad Responsibility)	Number of Recommendations	Number of Recommendations Completed	% Completed
Jefferson Street	476898H	Lima	Municipal	Gates	3	1,547	X		X							X					3	1	33%
Christopher Street	258602G	Lima/Bath	Municipal	Gates	3	4,335		X													1	0	0%
Sugar Street	258601A	Bath	County	Gates	3	4,771													X		1	0	0%
Nuebrecht Road	476896U	Bath	Township	Gates	3	1,861	X														1	1	100%
Main Street (Beaverdam)	476885G	Beaverdam	Municipal	Flashing Signal	3	1,398						X		X	X			X			4	0	0%
SR 696 (Beaverdam)	476688A	Beaverdam	Municipal	Flashing Signal	3	1,614							X			X		X			3	1	33%
North Dixie Highway	476881E	Richland	County	Yield	3	183				X											1	0	0%
N. Dixie Highway (Phillips)	476877P	Richland	County	Flashing Signal	3	706											X				1	0	0%
College Avenue (Bluffton)	476872F	Bluffton	Municipal	Flashing Signal	3	1,379			X			X	X			X					4	0	0%
Cherry Street (Bluffton)	476871Y	Bluffton	Municipal	Gates	3	967			X			X				X					3	0	0%
SR 103 (Jefferson St.-Bluffton)	476898H	Bluffton	ODOT	Flashing Signal	3	4,963	X						X							X	3	1	33%
Hancock Road	476869X	Bluffton/Hancock Co.	Municipal/Township	Stop	3	4,122	X		X		X		X			X				X	6	2	33%
Hancock CR 33	476868R	Bluffton/Hancock Co.	Municipal/Township	Yield	3	161				X					X			X			3	0	0%
				Average or % Complete	**3**	**2,154**	**100%**	**0%**	**25%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**33%**	**0%**	**0%**	**34**	**6**	**18%**
				Number of Recommendation			**4**	**1**	**4**	**2**	**1**	**3**	**4**	**1**	**2**	**5**	**1**	**3**	**1**	**2**			
				Number of Recommendations Completed			**4**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**			

Completed
1/2 Complete
Not Completed
Unknown

Map 9: NS Northeast Railroad Crossings



N
W E
S

2.5 1.25 0 2.5 Miles

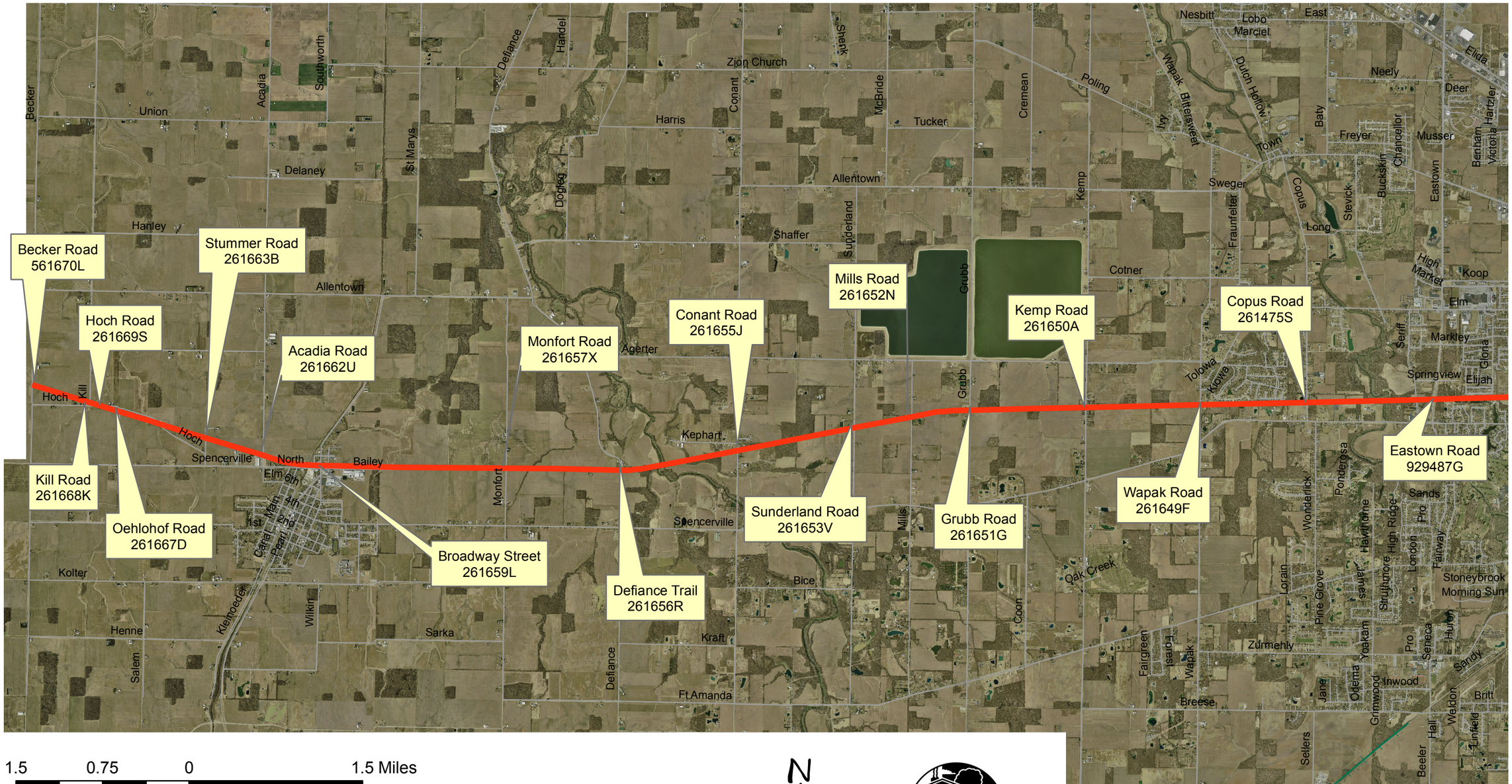
5/1/2016

Table 9: SPEG Railroad Improvement Summary
(SPEG Railroad: Original Report Issued January 2008)

							Low Cost Improvements (< $500)							Medium Cost Improvements ($600-$5,000)			Total		
Crossing Roadway	Crossing Number	Political Jurisdiction	Roadway Responsibility	Current Highest Level of Warning	Number of Trains	Number of Vehicles, ADT	Update AAR/FRA Placards (Railroad Responsibility)	Upgrade Mutipule Track Signs (Railroad Responsibility)	Add Speed Advisory Plaque (Roadway Responsibility)	Remove unnecessary Warning Signs (Roadway Responsibility)	Upgrade Stop Bars (Roadway Responsibility)	Install Stop / Yield Sign (Roadway Responsibility)	Clear / Trim Vegetation and/or obstructions (Shared Responsibility)	Upgrade Pavement Markings (Roadway Responsibility)	Uipgrade Crossbuck (Railroad Responsibility)	Install left side crossbuck (Railraod Responsibility)	Number of Recommendations	Number of Recommendations Completed	% Completed
Becker Road	561670L	Spencer	Township	Yield	1	437	X	X	X								3	3	100%
Kill Road	261668K	Spencer	County	Yield	1	92	X	X			X						3	3	100%
Hoch Road	261669S	Spencer	Township	Yield	1	25	X		X			X		X			4	4	100%
Oehlohof Road	261667D	Spencer	Township	Yield	1	71	X				X			X	X		4	4	100%
Stummer Road	261663B	Spencer	Township	Yield	1	38	X	X		X	X			X			5	4	80%
Acadia Road	261662U	Spencer/Spencerville	County	Signals	1	677	X			X	X						3	3	100%
Broadway Street	261659L	Spencerville	Municipal	Signals	1	3,532	X				X			X			3	3	100%
Monfort Road	261657X	Amanda	County	Yield	1	341	X			X							2	2	100%
Defiance Trail	261656R	Amanda	County	Signals	1	468	X			X	X		X				3	3	100%
Connant Road	261655J	Amanda	County	Yield	1	1,212	X	X	X			X				X	5	3	60%
Sunderland Road	261653V	Amanda	Township	Yield	1	302	X		X	X		X	X			X	6	3.5	58%
Mills Road	261652N	Amanda	Township	Yield	1	153	X		X	X	X	X				X	6	4	67%
Grubb Road	261651G	Amanda	County	Yield	1	482	X		X			X				X	4	3	75%
Kemp Road	261650A	Amanda/Shawnee	County	Yield	1	915	X	X	X	X	X					X	6	3	50%
Wapak Road	261649F	Shawnee	Township	Gates	1	2,815	X		X (n/a)	X		X (n/a)				X (n/a)	5	4	80%
Copus Road	261647S	Shawnee	Township	Yield	1	3,179	X	X	X			X		X		X	6	4	67%
Eastown Road	929487G	Shawnee	County	Gates	1	8,465											0	0	0%
				Average or % Complete	1	1,365	97%	83%	56%	75%	88%	100%	100%	100%	100%	14%	68	53.5	79%
				# of Recommendations:			16	6	9	8	8	7	1	5	1	7			
				# of Recommendations Completed:			15.5	5	5	6	7	7	1	5	1	1			

Completed
1/2 Complete
Not Completed
Unknown

Map 10: SPEG Railroad Crossings



1.5 0.75 0 1.5 Miles

N

5/1/2016

SECTION 5
SUMMARY

Although this summary report is offered as a preliminary planning and engineering analysis, traffic and rail safety should be reviewed and discussed from three (3) distinct but related aspects: Engineering, Education and Enforcement. For, only through an integrated approach involving the three aspects can a comprehensive response be developed to address local conditions. These and several additional areas, which merit further consideration, are presented in the following subsections.

5.1 Report Summary

The study is actually a summary of previous studies conducted between 2008 and 2015 that examined issues related to the unique operational considerations present at railroad highway grade crossings. This report identifies the specific recommendations made for improvement at each railroad crossing in those studies and provides an assessment to which such improvements were implemented.

The community currently has some 141 public active at-grade crossings. The previous studies, and this summary, are limited to those at-grade crossings along the major railroad lines that pass the LACRPC region. Site assessments conducted in the fall of 2015 and the spring of 2016 provide the basis for evaluation of the recommendations.

5.2 Recommendations

Based on the information contained herein the various improvements sited in Section 4.2 are summarized in Table 10 by railroad and crossing and should be reviewed by the responsible roadway and rail authorities for further action. In addition, some general recommendations are also suggested which include: (1) continue to support and expand local educational programming in the schools; (2) undertake the necessary steps to increase enforcement awareness activities at rail crossings; and, (3) continue to support and expand open communications between local political subdivisions, state agencies and the railroads. The following sections offer additional insights pertinent to the recommendations.

TABLE 10
CROSSING RECOMMENDATIONS

Railroad	Date of Study	Recommendations			# of Crossings with Major Upgrades
		# Made	# Completed	% Completed	
CFE West Railroad	October 2009	117	45	38%	1
CFE Lima Railroad	January 2012	31	6	19%	4
CFE East Railroad	June 2010	57	39	68%	2
CSX South Railroad	August 2013	22	6.5	30%	0
CSX North Railroad	April 2011	32	11.5	36%	1
IORY Railway	June 2014	70	37	53%	2
NS South & RJ Corman Railroad	June 2012	24	14	58%	1
NS North Railroad	August 2015	34	6	18%	1
SPEG (RJ Corman) Railroad	January 2008	68	53.5	79%	5
TOTAL		**455**	**218.5**	**48%**	**17**

5.2.1 Expand Educational Programming

There are a number of available educational initiatives that address the problem of rail crossing safety. These include “Safety City” which has been organized and operated by the Lima Police Department. Safety City targets younger children and addresses the whole range of community safety issues, such as

proper use of crosswalks, proper pedestrian procedures, at-grade rail safety, etc. This program has been extremely successful and has a tremendous potential to reach children in the larger community.

Other educational efforts have included addressing the issue of at-grade crossing safety in the elementary school grades. This initiative has included materials supplied by Operation Lifesaver. This initiative has not been implemented in all schools nor in all local school systems; its inclusion left to the discretion of the individual teachers. This is not a consistently applied, included, or administrated program. Increased support of such programming is recommended in order to provide our community's youth a holistic exposure to rail safety. There is also a module on rail crossing safety included as part of the driver's education programs conducted throughout the County. Currently, the LACRPC provides age appropriate education and awareness to some local programs. However, exposure is not uniform across all driving curriculums or in all schools.

Locally there exists a need to develop a comprehensive education program to address the subject of rail crossing safety within the County. A consistent approach must be applied and managed and must address the unique challenges which each age group faces regarding rail crossing safety. For instance, a much different educational approach must be used for elementary age children (who are generally pedestrians, bicycle riders, and passengers) than middle-aged adults (who are generally drivers). Also, different educational approaches must be developed for the various categories within particular user groups. For instance, within the driver user group different approaches must be employed to reach beginning, young, middle-aged and older drivers.

5.2.2 Increase Enforcement Awareness

A key element in the reduction of local train/motor vehicle crashes is enforcement. It is essential that, as part of a comprehensive approach to crash mitigation, the enforcement component be strategically organized and implemented. The primary multi-jurisdictional activity focusing on the problem to date has been the "Officer on the Train" program. This program includes a media blitz and is a cooperative effort between the area law enforcement agencies, the railroads, the media and Operation Lifesaver. In a highly publicized effort the area enforcement agencies are invited to ride a special train. This train monitors the crossings as it proceeds down the track and when a violation occurs (a vehicle is driven around activated gates or proceeds through a crossing with activated flashers) a chase car is sent after the violator to issue a citation.

Beyond the "Officer on the Train" program, there is little multi-jurisdictional cooperative effort focused solely on the problem of rail crossing crashes. Currently, we have independent enforcement activities. These single department efforts consist of monitoring individual crossings when a reported problem is found. Another routinely implemented means of enforcement occurs when an officer witnesses an individual motor vehicle violation at a crossing during routine patrol and issues a citation.

The "Officer on the Train" program has been successful. The activity receives strong media attention and positive publicity. The larger community however, needs to experience the rail safety issue over a longer period and local agencies must maintain a focused and selective enforcement presence at the areas rail crossings in order to alter at-risk behaviors. Local law enforcement agencies should consult with local engineering and public works departments to assess localized traffic and crash patterns.

5.2.3 Improve Lines of Communications

Local political subdivisions should be very much aware of the various agencies, which play a critical part in supporting the community's level of rail safety. The Ohio Rail Development Commission (ORDC), Ohio Department of Transportation (ODOT), Ohio Department of Public Safety (ODPS), Public Utilities Commission of Ohio (PUCO) and the railroads themselves, all have access to important information on rail activity and crash record data and support rail safety in various manners and methods. An understanding of each of the entities can better enable a community to take advantage of their individual and collective resources. The lines of communication between the railroads and the various state/local agencies must be opened in order to further local rail safety initiatives.

5.2.3.1 The Ohio Rail Development Commission (ORDC)

The ORDC can provide timely information and technical assistance on safety issues and economic development initiatives. The ORDC participates in various rail related activities including: railroad acquisition programs; rail rehabilitation programs; rail (re)construction programs; grade crossing upgrades; and crossing consolidation programs. The ORDC works closely with a number of state agencies to help stimulate economic development by providing incentives for business to locate and expand in local communities. The ORDC provides funding assistance to help construct and/or rehabilitate needed industrial tracks and rail spurs. The ORDC also works with local communities to preserve branch lines threatened with the potential loss of service through acquisition and rehabilitation assistance. The ORDC can also provide loans to help smaller Class I railroads in order to improve branch line safety and efficiency. Most importantly the ORDC can aggressively identify and implement highway-rail safety initiatives including the upgrading of advance warning and traffic control devices, as well as the closing of rail crossings.

5.2.3.2 The Ohio Department of Transportation (ODOT)

The ODOT has responsibility for statewide coordination of the entire state highway system. This includes the state highway system lying outside municipal corporate limits. Routine maintenance of the state highway system involves a broad range of activities including: pavement work; snow and ice removal; repair and replacement of guard rails; installation and maintenance of traffic control signs, signals and highway lighting; and improving the safety of the existing state highway system. Safety improvement projects target locations where there is documented safety deficiency and/or where new technology can upgrade traffic control.

5.2.3.3 The Ohio Department of Public Safety (ODPS)

The mission of ODPS is to save lives, reduce injuries and economic loss, to administer Ohio's motor vehicle laws, and to preserve the safety and well being of all citizens. The ODPS has been charged with various responsibilities including but not limited to the management of the Motor Carrier Enforcement program, state Emergency Management and Hazardous Materials planning and response are the Selective Traffic Enforcement Program, the Traffic Project, as well as management of the Integrated Traffic Crash Records System. ODPS has the ability to program and deploy technical and financial assistance to communities

where a significant traffic problem exists and should be considered an important advocate of highway-railroad crossing safety.

5.2.3.4 The Public Utilities Commission of Ohio (PUCO)

The PUCO participates with a number of other State agencies (ORDC, ODOT, and ODPS) to develop and implement various traffic safety strategies and implement specific initiatives to achieve quantifiable improvements in overall safety and system performance. While other state agencies have missions related to economic development, construction or enforcement, the PUCO has a broader role of creating the regulatory framework that governs commercial transportation in Ohio. One of these many tasks is the administration of state and federal monies for grade crossing safety improvements and commercial vehicle safety activities. The PUCO's rail program is the oldest area of the Commission's responsibilities. The Commission enforces FRA regulations and has FRA certified inspectors in the disciplines of track, motive power and equipment, operating practices and hazardous materials. The PUCO also makes funds available for various educational awareness programs.

5.2.3.5 Railroads

Local railroads are a critical resource to improving informational exchanges and local conditions. The Class I carriers (CSX, N/S) both operate at least one large yard in Lima. Rail operations conducted by the smaller Class II Indiana & Ohio Railway are managed in a large yard at the Robb Avenue overpass and two smaller yards, the Ford Motor Yard and the East Ford Park Yard. Railroad employees at the local yards have extensive knowledge of area railroad operations, rail conditions and maintenance schedules. The cooperation and involvement of these local resources are critical to fully understand the concerns and issues of the rail industry and for the further development and improvement of traffic safety initiatives in the community.

The Association of American Railroads (AAR), a voluntary, unincorporated, non-profit organization composed of member railroad companies operating in the United States, Canada and Mexico also has a wealth of rail industry information and may prove valuable as a resource. The AAR is a joint representative and agent of the railroads in connection with Federal regulatory matters of common concern to the industry as a whole. In the area of crossings, the AAR works closely with the U.S. DOT, and U.S. Congress, National Transportation Safety Board (NTSB), the National Safety Council (NSC), the Railway Progress Institute (RPI) and others. The AAR has crossing representatives in each State. These state representatives, who are railroad employees, provide liaison with groups and government agencies having interests in crossings within that State. They hold meetings when deemed necessary to ensure that a cooperative approach is established and maintained. The AAR provides some of the financial support for Operation Lifesaver, Inc and works closely with the NSC in promoting the continued development of this program. The AAR also conducts research pertaining to crossings. Some of this research is conducted jointly with other organizations, including AASHTO and the U.S. DOT.

Appendix A

(OMUTCD)

PART 8. TRAFFIC CONTROLS FOR RAILROAD AND LIGHT RAIL TRANSIT GRADE CROSSINGS

CHAPTER 8A. GENERAL

Section 8A.01 Introduction

Support:

01 Whenever the acronym "LRT" is used in Part 8, it refers to "light rail transit."

02 Part 8 describes the traffic control devices that are used at highway-rail and highway-LRT grade crossings. Unless otherwise provided in the text or on a figure or table, the provisions of Part 8 are applicable to both highway-rail and highway-LRT grade crossings. When the phrase "grade crossing" is used by itself without the prefix "highway-rail" or "highway-LRT," it refers to both highway-rail and highway-LRT grade crossings.

03 Traffic control for grade crossings includes all signs, signals, markings, other warning devices, and their supports along highways approaching and at grade crossings. The function of this traffic control is to promote safety and provide effective operation of rail and/or LRT and highway traffic at grade crossings.

04 For purposes of design, installation, operation, and maintenance of traffic control devices at grade crossings, it is recognized that the crossing of the highway and rail tracks is situated on a right-of-way available for the joint use of both highway traffic and railroad or LRT traffic.

05 The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable, jointly determine the need and selection of devices at a grade crossing.

06 In Part 8, the combination of devices selected or installed at a specific grade crossing is referred to as a "traffic control system."

Standard:

07 **The traffic control devices, systems, and practices described in this Manual shall be used at all grade crossings open to public travel, consistent with Federal, State, and local laws and regulations.**

Support:

08 Part 8 also describes the traffic control devices that are used in locations where light rail LRT vehicles are operating along streets and highways in mixed traffic.

09 LRT is a mode of metropolitan transportation that employs LRT vehicles (commonly known as light rail vehicles, streetcars, or trolleys) that operate on rails in the pavement in mixed traffic, and LRT traffic that operates in semi-exclusive rights-of-way, or in exclusive rights-of-way. Grade crossings with LRT can occur at intersections or at midblock locations, including public and private driveways.

10 An initial educational campaign along with an ongoing program to continue to educate new drivers is beneficial when introducing LRT operations to an area and, hence, new traffic control devices.

11 LRT alignments can be grouped into one of the following three types:

A. Exclusive: An LRT right-of-way that is grade-separated or protected by a fence or traffic barrier. Motor vehicles, pedestrians, and bicycles are prohibited within the right-of-way. Subways and aerial structures are included within this group. This type of alignment does not have grade crossings and is not further addressed in Part 8.
B. Semi-exclusive: An LRT alignment that is in a separate right-of-way or along a street or railroad right-of-way where motor vehicles, pedestrians, and bicycles have limited access and cross at designated locations only.
C. Mixed-Use: An alignment where LRT operates in mixed traffic with all types of road users. This includes streets, transit malls, and pedestrian malls where the right-of-way is shared.

Standard:

12 **Where LRT and railroads use the same tracks or adjacent tracks, the traffic control devices, systems, and practices for highway-rail grade crossings shall be used.**

Support:

13 To promote an understanding of common terminology between highway and railroad and LRT signaling issues, definitions and acronyms pertaining to Part 8 are provided in Sections 1A.13 and 1A.14.

Section 8A.02 Use of Standard Devices, Systems, and Practices at Highway-Rail Grade Crossings

Support:

01 Because of the large number of significant variables to be considered, no single standard system of traffic control devices is universally applicable for all highway-rail grade crossings.

Standard:

02 **The highway agency or authority with jurisdiction, the regulatory agency with statutory authority and the railroad, as applicable, shall, based on an engineering study, determine the need and selection of devices, or the modification of devices, at a highway-rail grade crossing in accordance with Sections 4511.61, 4513.40, 4907.47, 4907.471, 4907.476, 4907.48, 4907.49, 4907.52 and 4955.33 of the Ohio Revised Code.**

Option:

03 The engineering study may include the Highway-Rail Intersection (HRI) components of the National Intelligent Transportation Systems (ITS) architecture, which is a USDOT accepted method for linking the highway, vehicles, and traffic management systems with rail operations and wayside equipment.

Support:

04 More detail on Highway-Rail Intersection components is available from USDOT's Federal Railroad Administration, 1200 New Jersey Avenue, SE, Washington, DC 20590, or www.fra.dot.gov.

Standard:

05 **Traffic control devices, systems, and practices shall be consistent with the design and application of the Standards contained in this Manual.**

Guidance:

06 *To stimulate effective responses from road users, these devices, systems, and practices should use the five basic considerations employed generally for traffic control devices and described fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.*

Support:

07 Many other details of highway-rail grade crossing traffic control systems that are not set forth in Part 8 are contained in the publications listed in Section 1A.11, including the "2009 AREMA Communications & Signals Manual" published by the American Railway Engineering & Maintenance-of-Way Association (AREMA) and the 2006 edition of "Preemption of Traffic Signals Near Railroad Crossings" published by the Institute of Transportation Engineers (ITE).

Section 8A.03 Use of Standard Devices, Systems, and Practices at Highway-LRT Grade Crossings

Support:

01 The combination of devices selected or installed at a specific highway-LRT grade crossing is referred to as a Light Rail Transit Traffic Control System.

02 Because of the large number of significant variables to be considered, no single standard system of traffic control devices is universally applicable for all highway-LRT grade crossings.

03 For the safety and integrity of operations by highway and LRT users, the highway agency with jurisdiction, the regulatory agency with statutory authority, if applicable, and the LRT authority jointly determine the need and selection of traffic control devices and the assignment of priority to LRT at a highway-LRT grade crossing.

04 The normal rules of the road and traffic control priority identified in the Ohio Revised Code (ORC) govern the order assigned to the movement of vehicles at an intersection unless the local agency determines that it is appropriate to assign a higher priority to LRT. Examples of different types of LRT priority control include separate traffic control signal phases for LRT movements, restriction of movement of roadway

vehicles in favor of LRT operations, and preemption of highway traffic signal control to accommodate LRT movements (see Section 8B.08).

Guidance:

05 *The appropriate traffic control system to be used at a highway-LRT grade crossing should be determined by an engineering study conducted by the transit or highway agency in cooperation with other appropriate State and local organizations.*

Standard:

06 **Traffic control devices, systems, and practices shall be consistent with the design and application of the Standards contained in this Manual.**

07 **The traffic control devices, systems, and practices described in this Manual shall be used at all highway-LRT grade crossings.**

08 **Before any new highway-LRT grade crossing traffic control system is installed or modifications are made to an existing system, approval shall be obtained from the highway agency with the jurisdictional and/or statutory authority, and from the LRT agency** (see ORC Sections 4951.02 and 4951.14 (Appendix B2)) **.**

Guidance:

09 *To stimulate effective responses from road users, these devices, systems, and practices should use the five basic considerations employed generally for traffic control devices and described fully in Section 1A.02: design, placement, operation, maintenance, and uniformity.*

Support:

10 Many other details of highway-LRT grade crossing traffic control systems that are not set forth in Part 8 are contained in the publications listed in Section 1A.11.

Standard:

11 **Highway-LRT grade crossings in semi-exclusive alignments shall be equipped with a combination of automatic gates and flashing-light signals, or flashing-light signals only, or traffic control signals, unless an engineering study indicates that the use of Crossbuck Assemblies, STOP signs, or YIELD signs alone would be adequate.**

Option:

12 Highway-LRT grade crossings in mixed-use alignments may be equipped with traffic control signals unless an engineering study indicates that the use of Crossbuck Assemblies, STOP signs, or YIELD signs alone would be adequate.

Support:

13 Sections 8B.03 and 8B.04 contain provisions regarding the use and placement of Crossbuck signs and Crossbuck Assemblies. Section 8B.05 describes the appropriate conditions for the use of STOP or YIELD signs alone at a highway-LRT grade crossing. Sections 8C.10 and 8C.11 contain provisions regarding the use of traffic control signals at highway-LRT grade crossings.

Section 8A.04 Uniform Provisions

Standard:

01 **All signs used in grade crossing traffic control systems shall be retroreflectorized or illuminated as described in Section 2A.07 to show the same shape and similar color to an approaching road user during both day and night.**

02 **No sign or signal shall be located in the center of an undivided highway, unless it is crashworthy (breakaway, yielding, or shielded with a longitudinal barrier or crash cushion) or unless it is placed on a raised island.**

Guidance:

03 *Any signs or signals placed on a raised island in the center of an undivided highway should be installed with a clearance of at least 2 feet from the outer edge of the raised island to the nearest edge of the sign or signal, except as permitted in Section 2A.19.*

04 *Where the distance between tracks, measured along the highway between the inside rails, exceeds 100 feet, additional signs or other appropriate traffic control devices should be used to inform approaching road users of the long distance to cross the tracks.*

Section 8A.05 Grade Crossing Elimination

Guidance:

01 *Because grade crossings are a potential source of crashes and congestion, agencies should conduct engineering studies to determine the cost and benefits of eliminating these crossings.*

Standard:

02 **When a grade crossing is eliminated, the traffic control devices for the crossing shall be removed.**

03 **If the existing traffic control devices at a multiple-track grade crossing become improperly placed or inaccurate because of the removal of some of the tracks, the existing devices shall be relocated and/or modified.**

Guidance:

04 *Any grade crossing that cannot be justified should be eliminated.*

05 *Where a roadway is removed from a grade crossing, the roadway approaches in the railroad or LRT right-of-way should also be removed and appropriate signs and object markers should be placed at the roadway end in accordance with Section 2C.66.*

06 *Where a railroad or LRT is eliminated at a grade crossing, the tracks should be removed or covered.*

Standard:

07 **When a grade crossing is removed, the space previously occupied by the rail bed shall be filled with the same material that comprises the road or highway at the crossing.**

Option:

08 Based on engineering judgment, the TRACKS OUT OF SERVICE (R8-9) sign (see Figure 8B-1) may be temporarily installed until the tracks are removed or covered. The length of time before the tracks will be removed or covered may be considered in making the decision as to whether to install the sign.

Section 8A.06 Illumination at Grade Crossings

Support:

01 Illumination is sometimes installed at or adjacent to a grade crossing, in order to provide better nighttime visibility of trains or LRT equipment and the grade crossing (for example, where a substantial amount of railroad or LRT operations are conducted at night, where grade crossings are blocked for extended periods of time, or where crash history indicates that road users experience difficulty in seeing trains or LRT equipment or traffic control devices during hours of darkness).

02 Recommended types and locations of luminaires for illuminating grade crossings are contained in the American National Standards Institute's (ANSI) "Practice for Roadway Lighting RP-8" which is available from the Illuminating Engineering Society (see Section 1A.11).

Section 8A.07 Quiet Zone Treatments at Highway-Rail Grade Crossings

Support:

01 49 CFR Part 222 (Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule) prescribes Quiet Zone requirements and treatments.

Standard:

02 **Any traffic control device and its application where used as part of a Quiet Zone shall comply with all applicable provisions of this Manual.**

Section 8A.08 Temporary Traffic Control Zones

Support:

01 Temporary traffic control planning provides for continuity of operations (such as movement of traffic, pedestrians and bicycles, transit operations, and access to property/utilities) when the normal function of a roadway at a grade crossing is suspended because of temporary traffic control operations.

Standard:

02 **Traffic controls for temporary traffic control zones that include grade crossings shall be as outlined in Part 6.**

03 **When a grade crossing exists either within or in the vicinity of a temporary traffic control zone, lane restrictions, flagging (see Chapter 6E), or other operations shall not be performed in a manner that would cause highway vehicles to stop on the railroad or LRT tracks, unless a flagger or uniformed law enforcement officer is provided at the grade crossing to minimize the possibility of highway vehicles stopping on the tracks, even if automatic warning devices are in place.**

Guidance:

04 *Public and private agencies, including emergency services, businesses, and railroad or LRT companies, should meet to plan appropriate traffic detours and the necessary signing, marking, and flagging requirements for operations during temporary traffic control zone activities. Consideration should be given to the length of time that the grade crossing is to be closed, the type of rail or LRT and highway traffic affected, the time of day, and the materials and techniques of repair.*

05 *The agencies responsible for the operation of the LRT and highway should be contacted when the initial planning begins for any temporary traffic control zone that might directly or indirectly influence the flow of traffic on mixed-use facilities where LRT and road users operate.*

06 *Temporary traffic control operations should minimize the inconvenience, delay, and crash potential to affected traffic. Prior notice should be given to affected public or private agencies, emergency services, businesses, railroad or LRT companies, and road users before the free movement of road users or rail traffic is infringed upon or blocked.*

07 *Temporary traffic control zone activities should not be permitted to extensively prolong the closing of the grade crossing.*

08 *The width, grade, alignment, and riding quality of the highway surface at a grade crossing should, at a minimum, be restored to correspond with the quality of the approaches to the grade crossing.*

Support:

09 Section 6G.18 contains additional information regarding temporary traffic control zones in the vicinity of grade crossings, and Figure 6H-46 shows an example of a typical situation that might be encountered.

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CHAPTER 8B. SIGNS AND MARKINGS

Section 8B.01 Purpose

Support:

01 Passive traffic control systems, consisting of signs and pavement markings only, identify and direct attention to the location of a grade crossing and advise road users to slow down or stop at the grade crossing as necessary in order to yield to any rail traffic occupying, or approaching and in proximity to, the grade crossing.

02 Signs and markings regulate, warn, and guide the road users so that they, as well as LRT vehicle operators on mixed-use alignments, can take appropriate action when approaching a grade crossing.

Standard:

03 **The design and location of signs shall comply with the provisions of Part 2. The design and location of pavement markings shall comply with the provisions of Part 3.**

Section 8B.02 Sizes of Grade Crossing Signs

Standard:

01 **The sizes of grade crossing signs shall be as shown in Table 8B-1.**

Option:

02 Signs larger than those shown in Table 8B-1 may be used (see Section 2A.11).

Section 8B.03 Grade Crossing (Crossbuck) Sign (R15-1) and Number of Tracks Plaque (R15-2P) at Active and Passive Grade Crossings

Standard:

01 **As provided in Section 4955.33 of the Ohio Revised Code (see Appendix B2):**

02 **"At all points where its railroad crosses a public road at a common grade, each company shall erect crossbuck signing at positions at each such crossing that are in accordance with the department of transportation manual for uniform traffic control devices, adopted under section 4511.09 of the Revised Code, to give notice of the proximity of the railroad and warn persons to be on the lookout for the locomotive."**

Standard:

03 **The Grade Crossing (R15-1) sign (see Figure 8B-1), commonly identified as the Crossbuck sign, shall be retroreflectorized white with the words RAILROAD CROSSING in black lettering, mounted as shown in Figure 8B-2.**

Support:

04 In Ohio, and most other states, the Crossbuck sign requires road users to yield the right-of-way to rail traffic at a grade crossing.

Standard:

05 **As a minimum, one Crossbuck sign shall be used on each highway approach to every highway-rail grade crossing, alone or in combination with other traffic control devices.**

Option:

06 A Crossbuck sign may be used on a highway approach to a highway-LRT grade crossing on a semi-exclusive or mixed-use alignment, alone or in combination with other traffic control devices.

Standard:

07 **If automatic gates are not present and if there are two or more tracks at a grade crossing, the number of tracks shall be indicated on a supplemental Number of Tracks (R15-2P) plaque (see Figure 8B-1) of inverted T shape mounted below the Crossbuck sign in the manner shown in Figure 8B-2.**

08 **On each approach to a highway-rail grade crossing and, if used, on each approach to a highway-LRT grade crossing, the Crossbuck sign shall be installed on the right-hand side of the highway on each approach to the grade crossing. Where restricted sight distance or unfavorable highway geometry exists on an approach to a grade crossing, an additional Crossbuck sign shall be installed on**

Table 8B-1. Sign Sizes for Grade Crossing Signs[1, 2] (Sheet 1 of 2)

Sign or Plaque	Sign Designation	Section	Conventional Road		Expressway	Minimum	Oversized
			Single Lane	Multi-Lane			
STOP	R1-1	8B.04, 8B.05	30 x 30	36 x 36	36 x 36	—	48 x 48
YIELD	R1-2	8B.04, 8B.05	36 x 36 x 36	36 x 36 x 36	48 x 48 x 48	30 x 30 x 30	—
NO RIGHT TURN ACROSS TRACKS	R3-1a	8B.08	24 x 30	30 x 36	—	—	—
NO LEFT TURN ACROSS TRACKS	R3-2a	8B.08	24 x 30	30 x 36	—	—	—
DO NOT STOP ON TRACKS	R8-8	8B.09	24 x 30		36 x 48	—	36 x 48
TRACKS OUT OF SERVICE	R8-9	8B.10	24 x 24		36 x 36	—	36 x 36
STOP HERE WHEN FLASHING (arrow)	R8-10	8B.11	24 x 36		—	—	36 x 48
Stop Here When Flashing	R8-10a	8B.11	24 x 30		—	—	36 x 42
STOP HERE ON RED (arrow)	R10-6	8B.12	24 x 36		—	—	36 x 48
Stop Here On Red	R10-6a	8B.12	24 x 30		—	—	36 x 42
Grade Crossing (Crossbuck)	R15-1	8B.03	48 x 9		48 x 9	—	—
Number of Tracks (plaque)	R15-2P	8B.03	27 x 18		27 x 18	—	—
EXEMPT (plaque)	R15-3P	8B.07	24 x 12		24 x 12	—	—
LIGHT RAIL ONLY RIGHT LANE	R15-4a	8B.13	24 x 30		—	—	—
LIGHT RAIL ONLY LEFT LANE	R15-4b	8B.13	24 x 30		—	—	—
LIGHT RAIL ONLY CENTER LANE	R15-4c	8B.13	24 x 30		—	—	—
LIGHT RAIL DO NOT PASS	R15-5	8B.14	24 x 30		—	—	—
DO NOT PASS STOPPED TRAIN	R15-5a	8B.14	24 x 30		—	—	—
No Motor Vehicles on Tracks Symbol	R15-6	8B.15	24 x 24		—	—	—
DO NOT DRIVE ON TRACKS	R15-6a	8B.15	24 x 30		—	—	—
Divided Highway with LRT Crossing	R15-7	8B.16	24 x 24		—	—	—
Divided Highway with LRT Crossing (T-intersection)	R15-7a	8B.16	24 x 24		—	—	—
LOOK	R15-8	8B.17	36 x 18		—	—	—
Grade Crossing Advance Warning	W10-1	8B.06	36 Dia		48 Dia.	—	48 Dia.
EXEMPT (plaque)	W10-1aP	8B.07	24 x 12		36 x 18	—	—
Grade Crossing and Interseciton Advance Warning	W10-2, 3, 4	8B.06	36 x 36		48 x 48	—	48 x 48
Low Ground Clearance Grade Crossing	W10-5	8B.23	36 x 36		48 x 48	—	48 x 48

Table 8B-1. Sign Sizes for Grade Crossing Signs[1, 2] (Sheet 2 of 2)

Sign or Plaque	Sign Designation	Section	Conventional Road		Expressway	Minimum	Oversized
			Single Lane	Multi-Lane			
LOW GROUND CLEARANCE (plaque)	W10-5P	8B.23	30 x 24		—	—	—
LRT Approaching Activated Blank-Out	W10-7	8B.19	24 x 24		—	—	—
TRAINS MAY EXCEED 80 MPH	W10-8	8B.20	36 x 36		48 x 48	—	48 x 48
NO TRAIN HORN	W10-9	8B.21	36 x 36		48 x 48	—	48 x 48
NO TRAIN HORN (plaque)	W10-9P	8B.21	30 x 24		—	—	—
Storage Space Symbol	W10-11	8B.24	36 x 36		48 x 48	—	48 x 48
XX FEET BETWEEN TRACKS & HIGHWAY	W10-11a	8B.24	30 x 36		—	—	—
XX FEET BETWEEN HIGHWAY & TRACKS BEHIND YOU	W10-11b	8B.24	30 x 36		—	—	—
Skewed Crossing	W10-12	8B.25	36 x 36		48 x 48	—	48 x 48
NO GATES OR LIGHTS (plaque)	W10-13P	8B.22	30 x 24		—	—	—
NEXT CROSSING (plaque)	W10-14P	8B.23	30 x 24		—	—	—
USE NEXT CROSSING (plaque)	W10-14aP	8B.23	30 x 24		—	—	—
ROUGH CROSSING (plaque)	W10-15P	8B.23	30 x 24		—	—	36 x 30

Notes:
1. a.) Larger signs may be used when appropriate;
   b.) Dimensions in inches are shown as width x height.
2. Section 2A.11 contains information regarding the applicability of the various columns in this table.
3. Table 9B-1 shows the minimum sizes that may be used for grade-crossing signs and plaques that face shared-use paths and pedestrian facilities.

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the left-hand side of the highway, possibly placed back-to-back with the Crossbuck sign for the opposite approach, or otherwise located so that two Crossbuck signs are displayed for that approach.

09 **A strip of retroreflective white material not less than 2 inches in width shall be used on the back of each blade of each Crossbuck sign for the length of each blade, at all grade crossings where Crossbuck signs have been installed, except those where Crossbuck signs have been installed back-to-back.**

Guidance:

10 *Crossbuck signs should be located with respect to the highway pavement or shoulder in accordance with the criteria in Chapter 2A and Figures 2A-2 and 2A-3, and should be located with respect to the nearest track in accordance with Figures 8C-2 and 8D-1.*

11 *The minimum lateral offset for the nearest edge of the Crossbuck sign should be 6 feet from the edge of the shoulder or 12 feet from the edge of the traveled way in rural areas (whichever is greater), and 2 feet from the face of the curb in urban areas.*

12 *Where unusual conditions make variations in location and lateral offset appropriate, engineering judgment should be used to provide the best practical combination of view and safety clearances.*

Figure 8B-1. Regulatory Signs and Plaques for Grade Crossings

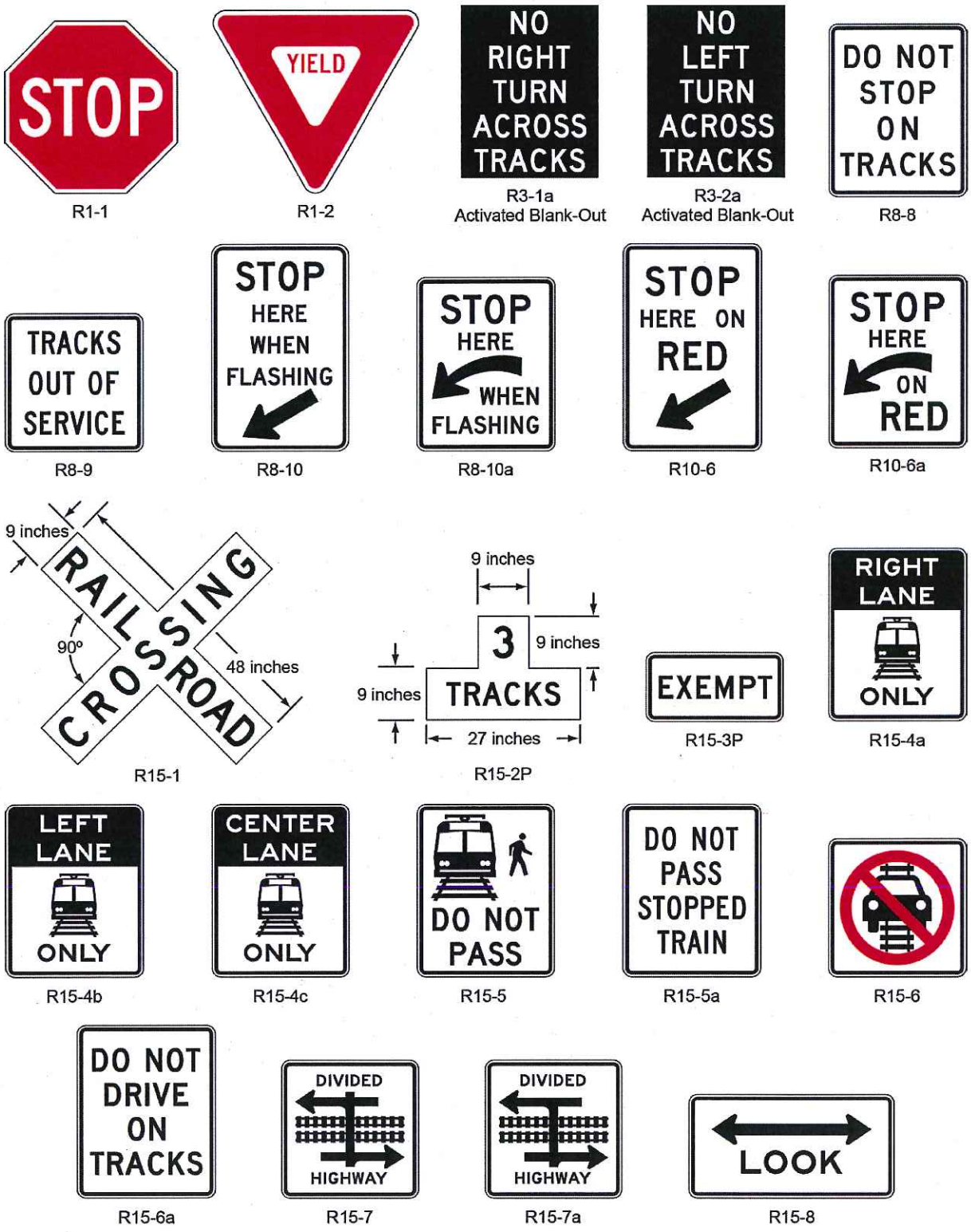
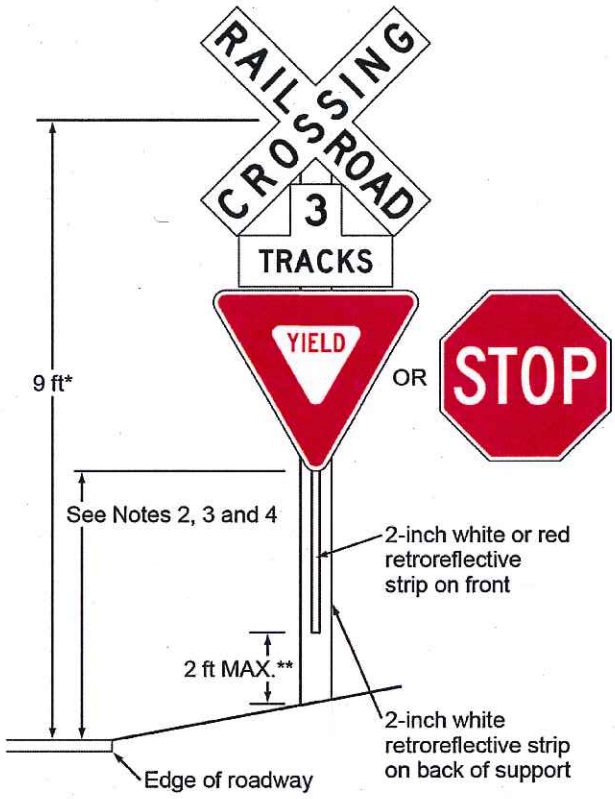


Figure 8B-2. Crossbuck Assembly with a YIELD or STOP Sign on the Crossbuck Sign Support



*Height may be varied as required by local conditions and may be increased to accommodate signs mounted below the Crossbuck sign

**Measured to the ground level at the base of the support

Notes:

1. YIELD or STOP signs are used only at passive crossings. A STOP sign is used only if an engineering study determines that it is appropriate for that particular approach.
2. Mounting height shall be at least 4 feet for installations of YIELD or STOP signs on existing Crossbuck sign supports.
3. Mounting height shall be at least 7 feet for new installations in areas with pedestrian movements or parking, and on expressways.
4. Mounting height shall be at least 5 feet for new installations on conventional roads in rural areas.

Section 8B.04 Crossbuck Assemblies with YIELD or STOP Signs at Passive Grade Crossings

Standard:

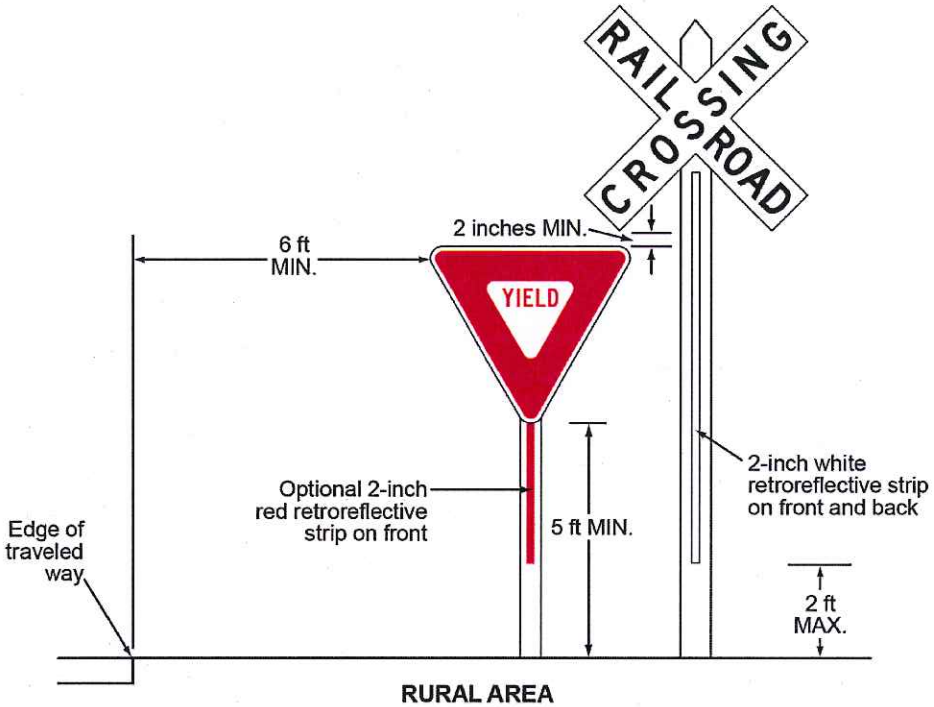
01 **In accordance with Section 4511.61 of the Ohio Revised Code, STOP signs shall be installed at highway-rail grade crossings only with the approval of the Ohio Department of Transportation.**

02 **A grade crossing Crossbuck Assembly shall consist of a Crossbuck (R15-1) sign, and a Number of Tracks (R15-2P) plaque if two or more tracks are present, that complies with the provisions of Section 8B.03, and either a YIELD (R1-2) or STOP (R1-1) sign installed on the same support, except as provided in Paragraph 9. If used at a passive grade crossing, a YIELD or STOP sign shall be installed in compliance with the provisions of Part 2, Section 2B.10, and Figures 8B-2 and 8B-3.**

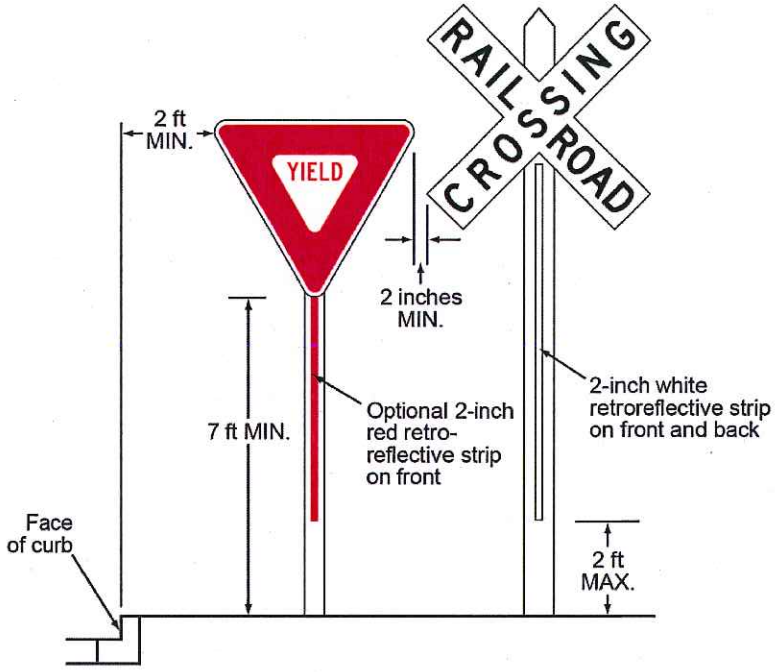
03 **At all public highway-rail grade crossings that are not equipped with the active traffic control systems that are described in Chapter 8C, except crossings where road users are directed by an authorized person on the ground to not enter the crossing at all times that an approaching train is about to occupy the crossing, a Crossbuck Assembly shall be installed on the right-hand side of the highway on each approach to the highway-rail grade crossing.**

04 **If a Crossbuck sign is used on a highway approach to a public highway-LRT grade crossing that is not equipped with the active traffic control systems that are described in Chapter 8C, a Crossbuck**

Figure 8B-3. Crossbuck Assembly with a YIELD or STOP Sign on a Separate Sign Support (Sheet 1 of 2)



RURAL AREA

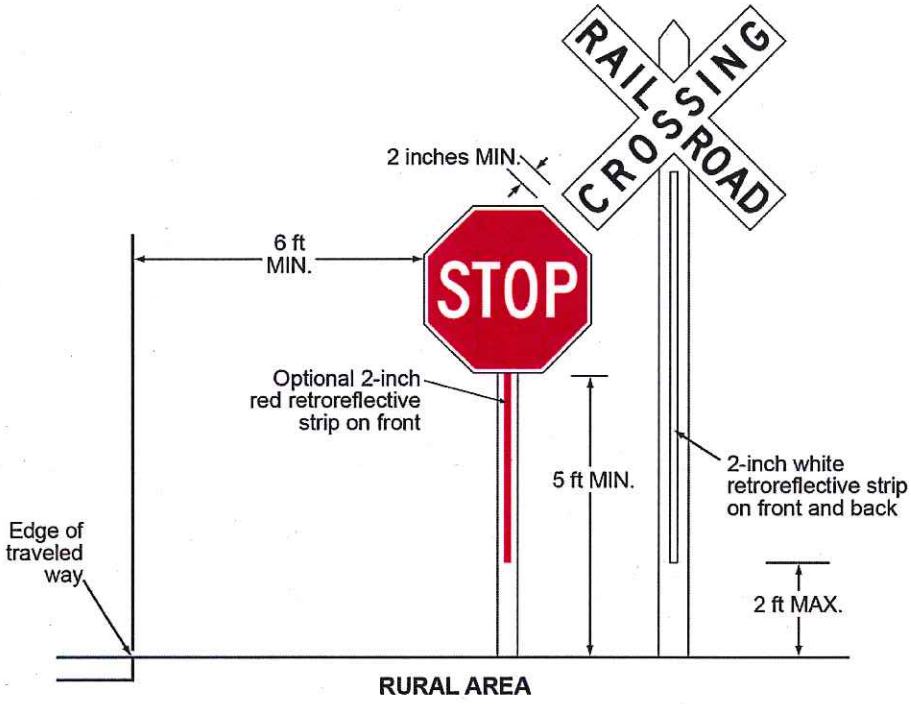


AREA WITH PEDESTRIAN MOVEMENTS OR PARKING

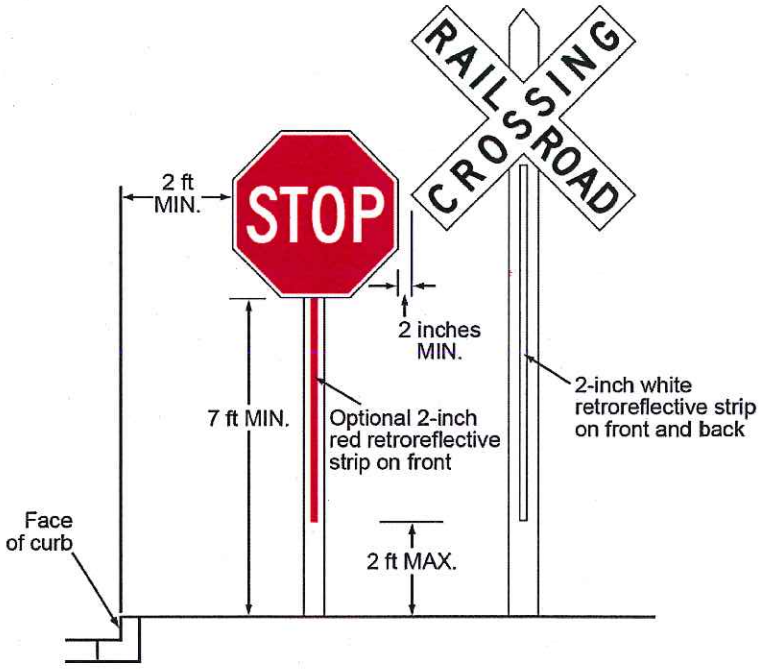
Notes:

1. YIELD signs are used only at passive crossings.
2. Place the face of the signs in the same plane and place the YIELD sign closest to the traveled way. Provide a 2-inch minimum separation between the edge of the Crossbuck sign and the edge of the YIELD sign.

Figure 8B-3. Crossbuck Assembly with a YIELD or STOP Sign on a Separate Sign Support (Sheet 2 of 2)



RURAL AREA



AREA WITH PEDESTRIAN MOVEMENTS OR PARKING

Notes:

1. STOP signs are used only at passive crossings and only if an engineering study determines that it is appropriate for that particular approach.
2. Place the face of the signs in the same plane and place the STOP sign closest to the traveled way. Provide a 2-inch minimum separation between the edge of the Crossbuck sign and the edge of the STOP sign.

Assembly shall be installed on the right-hand side of the highway on each approach to the highway-LRT grade crossing.

05 **Where restricted sight distance or unfavorable highway geometry exists on an approach to a grade crossing that has a Crossbuck Assembly, or where there is a one-way multi-lane approach, an additional Crossbuck Assembly shall be installed on the left-hand side of the highway.**

06 **A YIELD sign shall be the default traffic control device for Crossbuck Assemblies on all highway approaches to passive grade crossings unless, per ORC Section 4511.61 (see Paragraph 1), an engineering study performed by the regulatory agency or highway authority having jurisdiction over the roadway approach determines that a STOP sign is appropriate.**

Guidance:

07 *The use of STOP signs at passive grade crossings should be limited to unusual conditions where requiring all highway vehicles to make a full stop is deemed essential by an engineering study. Among the factors that should be considered in the engineering study are the line of sight to approaching rail traffic (giving due consideration to seasonal crops or vegetation beyond both the highway and railroad or LRT rights-of-ways), the number of tracks, the speeds of trains or LRT equipment and highway vehicles, and the crash history at the grade crossing.*

Support:

08 Sections 8A.02 and 8A.03 contain information regarding the responsibilities of the highway agency and the railroad company or LRT agency regarding the selection, design, and operation of traffic control devices placed at grade crossings.

Option:

09 If a YIELD or STOP sign is installed for a Crossbuck Assembly at a grade crossing, it may be installed on the same support as the Crossbuck sign or it may be installed on a separate support at a point where the highway vehicle is to stop, or as near to that point as practical, but in either case, the YIELD or STOP sign is considered to be a part of the Crossbuck Assembly.

Standard:

10 **If a YIELD or STOP sign is installed on an existing Crossbuck sign support, the minimum height, measured vertically from the bottom of the YIELD or STOP sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the YIELD or STOP sign to the elevation of the near edge of the traveled way, shall be 4 feet (see Figure 8B-2).**

11 **If a Crossbuck Assembly is installed on a new sign support (see Figure 8B-2) or if the YIELD or STOP sign is installed on a separate support (see Figure 8B-3), the minimum height, measured vertically from the bottom of the YIELD or STOP sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the YIELD or STOP sign to the elevation of the near edge of the traveled way, shall be 7 feet if the Crossbuck Assembly is installed in an area where parking or pedestrian movements are likely to occur.**

Guidance:

12 *If a YIELD or STOP sign is installed for a Crossbuck Assembly at a grade crossing on a separate support than the Crossbuck sign (see Figure 8B-3), the YIELD or STOP sign should be placed at a point where the highway vehicle is to stop, or as near to that point as practical, but no closer than 15 feet measured perpendicular from the nearest rail.*

Support:

13 The meaning of a Crossbuck Assembly that includes a YIELD sign is that a road user approaching the grade crossing needs to be prepared to decelerate, and when necessary, yield the right-of-way to any rail traffic that might be occupying the crossing or might be approaching and in such close proximity to the crossing that it would be unsafe for the road user to cross.

14 Certain commercial motor vehicles and school buses are required to stop at all grade crossings in accordance with 49 CFR 392.10 even if a YIELD sign (or just a Crossbuck sign) is posted (see ORC Section 4511.63 (Appendix B2)).

15 The meaning of a Crossbuck Assembly that includes a STOP sign is that a road user approaching the grade crossing must come to a full and complete stop not less than 15 feet short of the nearest rail, and remain stopped while the road user determines if there is rail traffic either occupying the crossing or

approaching and in such close proximity to the crossing that the road user must yield the right-of-way to rail traffic. The road user is permitted to proceed when it is safe to cross.

Standard:

16 **A vertical strip of retroreflective white material, not less than 2 inches in width, shall be used on each Crossbuck support at passive grade crossings for the full length of the back of the support from the Crossbuck sign or Number of Tracks plaque to within 2 feet above the ground, except as provided in Paragraph 17.**

Option:

17 The vertical strip of retroreflective material may be omitted from the back sides of Crossbuck sign supports installed on one-way streets.

18 If a YIELD or STOP sign is installed on the same support as the Crossbuck sign, a vertical strip of red (see Section 2A.21) or white retroreflective material that is at least 2 inches wide may be used on the front of the support from the YIELD or STOP sign to within 2 feet above the ground.

Standard:

19 **If a Crossbuck sign support at a passive grade crossing does not include a YIELD or STOP sign (either because the YIELD or STOP sign is placed on a separate support or because a YIELD or STOP sign is not present on the approach), a vertical strip of retroreflective white material, not less than 2 inches in width, shall be used for the full length of the front of the support from the Crossbuck sign or Number of Tracks plaque to within 2 feet above the ground.**

20 **At all grade crossings where YIELD or STOP signs are installed, Yield Ahead (W3-2) or Stop Ahead (W3-1) signs shall also be installed if the criteria for their installation in Section 2C.36 is met.**

Support:

21 Section 8B.28 contains provisions regarding the use of stop lines or yield lines at grade crossings.

Section 8B.05 Use of STOP (R1-1) or YIELD (R1-2) Signs without Crossbuck Signs at Highway-LRT Grade Crossings

Standard:

01 **For all highway-LRT grade crossings where only STOP (R1-1) or YIELD (R1-2) signs are installed, the placement shall comply with the requirements of Section 2B.10. Stop Ahead (W3-1) or Yield Ahead (W3-2) Advance Warning signs (see Figure 2C-6) shall also be installed if the criteria for their installation given in Section 2C.36 is met.**

Guidance:

02 *The use of only STOP or YIELD signs for road users at highway-LRT grade crossings should be limited to those crossings where the need and feasibility is established by an engineering study. Such crossings should have all of the following characteristics:*

A. The crossing roadways should be secondary in character (such as a minor street with one lane in each direction, an alley, or a driveway) with low traffic volumes and low speed limits. The specific thresholds of traffic volumes and speed limits should be determined by the local agencies.

B. LRT speeds do not exceed 25 mph.

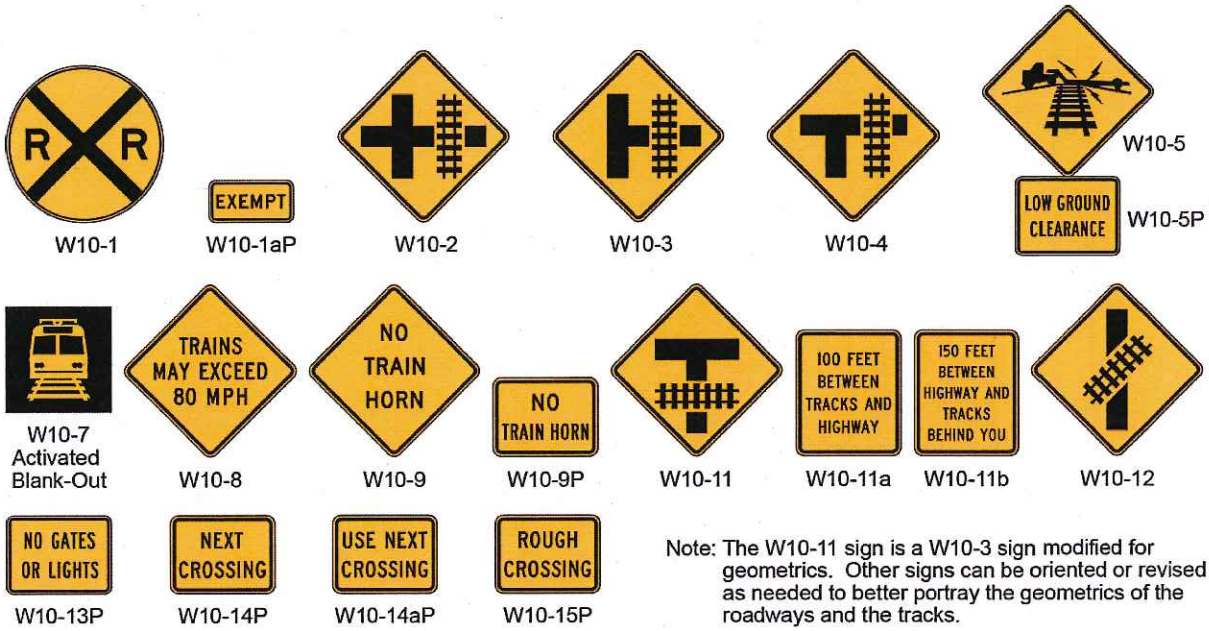
C. The line of sight for an approaching LRT operator is adequate from a sufficient distance such that the operator can sound an audible signal and bring the LRT equipment to a stop before arriving at the crossing.

D. The road user has sufficient sight distance at the stop line to permit the vehicle to cross the tracks before the arrival of the LRT equipment.

E. If at an intersection of two roadways, the intersection does not meet the warrants for a traffic control signal as provided in Chapter 4C.

F. The LRT tracks are located such that highway vehicles are not likely to stop on the tracks while waiting to enter a cross street or highway.

Figure 8B-4. Warning Signs and Plaques for Grade Crossings



Note: The W10-11 sign is a W10-3 sign modified for geometrics. Other signs can be oriented or revised as needed to better portray the geometrics of the roadways and the tracks.

Section 8B.06 Grade Crossing Advance Warning Signs (W10 Series)

Standard:

01 **A Grade Crossing Advance Warning (W10-1) sign (see Figure 8B-4) shall be used on each highway in advance of every highway-rail grade crossing, and every highway-LRT grade crossing in semi-exclusive alignments, except in the following circumstances:**

- **A. On an approach to a grade crossing from a T-intersection with a parallel highway, if the distance from the edge of the track to the edge of the parallel roadway is less than 100 ft, and W10-3 signs are used on both approaches of the parallel highway; or**
- **B. On low-volume, low-speed highways crossing minor spurs or other tracks that are infrequently used and road users are directed by an authorized person on the ground to not enter the crossing at all times that approaching rail traffic is about to occupy the crossing; or**
- **C. In business or commercial areas where active grade crossing traffic control devices are in use; or**
- **D. Where physical conditions do not permit even a partially effective display of the sign.**

02 **The placement of the Grade Crossing Advance Warning sign shall be in accordance with Section 2C.05 and Table 2C-4.**

03 **A Yield Ahead (W3-2) or Stop Ahead (W3-1) Advance Warning sign (see Figure 2C-6) shall also be installed if the criteria for their installation given in Section 2C.36 is met. If a Yield Ahead or Stop Ahead sign is installed on the approach to the crossing, the W10-1 sign shall be installed upstream from the Yield Ahead or Stop Ahead sign. The Yield Ahead or Stop Ahead sign shall be located in accordance with Table 2C-4. The minimum distance between the signs shall be in accordance with Section 2C.05 and Table 2C-4.**

Option:

04 On divided highways and one-way streets, an additional W10-1 sign may be installed on the left-hand side of the roadway.

05 If a grade crossing is rough, a ROUGH CROSSING (W10-15P) plaque may be used with the Grade Crossing Advance Warning sign.

Standard:

06 **If the distance between the tracks and a parallel highway, from the edge of the tracks to the edge of the parallel roadway, is less than 100 feet, W10-2, W10-3, or W10-4 signs (see Figure 8B-4) shall be installed on each approach of the parallel highway to warn road users making a turn that they will encounter a grade crossing soon after making a turn, and a W10-1 sign for the approach to the tracks shall not be required to be between the tracks and the parallel highway.**

07 **If the W10-2, W10-3, or W10-4 signs are used, sign placement in accordance with the guidelines for Intersection Warning signs in Table 2C-4 using the speed of through traffic shall be measured from the highway intersection.**

Guidance:

08 *If the distance between the tracks and the parallel highway, from the edge of the tracks to the edge of the parallel roadway, is 100 ft or more, a W10-1 sign should be installed in advance of the grade crossing, and the W10-2, W10-3, or W10-4 signs should not be used on the parallel highway.*

Section 8B.07 EXEMPT Grade Crossing Plaques (R15-3P, W10-1aP)

Option:

01 When authorized by the Public Utilities Commission of Ohio, a supplemental EXEMPT (R15-3P) plaque (see Figure 8B-1) with a white background may be used below the Crossbuck sign or Number of Tracks plaque, if present, at the grade crossing, and a supplemental EXEMPT (W10-1aP) plaque (see Figure 8B-4) with a yellow background may be used below the Grade Crossing Advance Warning (W10 series) sign.

02 Where neither the Crossbuck sign nor the advance warning signs exist for a particular highway-LRT grade crossing, an EXEMPT (R15-3P) plaque with a white background may be placed on its own post on the near right-hand side of the approach to the crossing.

Support:

03 Section 4511.63 of the Ohio Revised Code (O.R.C.) requires certain vehicles to stop, look and listen at highway-rail grade crossings (see Appendix B2). Supplemental EXEMPT signs (R15-3, W10-1a) inform drivers of these vehicles that a stop is not required at certain designated grade crossings, except when rail traffic is approaching or occupying the grade crossing, or the driver's view is blocked.

Section 8B.08 Turn Restrictions During Preemption

Guidance:

01 *At a signalized intersection where the intersection traffic control signals are preempted by the approach of a train, all existing turning movements toward the highway-rail grade crossing should be prohibited during the signal preemption sequences. (See Section 8C.09 for additional information about preemption of traffic control signals near grade crossings.)*

Option:

02 A blank-out or changeable message sign and/or appropriate highway traffic signal indication or other similar type sign may be used to prohibit turning movements toward the highway-rail grade crossing during preemption. The R3-1a and R3-2a signs shown in Figure 8B-1 may be used for this purpose.

Support:

03 LRT operations can include the use of activated blank-out sign technology for turn prohibition signs. The signs are typically used on roads paralleling a semi-exclusive or mixed-use LRT alignment where road users might turn across the LRT tracks. A blank-out sign displays its message only when activated. When not activated, the sign face is blank.

Guidance:

04 *An LRT-activated blank-out turn prohibition (R3-1a or R3-2a) sign should be used where an intersection adjacent to a highway-LRT crossing is controlled by STOP signs, or is controlled by traffic control signals with permissive turn movements for road users crossing the tracks.*

Option:

05 An LRT-activated blank-out turn prohibition (R3-1a or R3-2a) sign may be used for turning movements that cross the tracks.

06 As an alternative to LRT-activated blank-out turn prohibition signs at intersections with traffic control signals, exclusive traffic control signal phases such that all movements that cross the tracks have a steady red indication may be used in combination with NO TURN ON RED (R10-11, R10-11a, or R10-11b) signs (see Section 2B.54).

Standard:

07 **Turn prohibition signs that are associated with preemption shall be visible or activated only when the grade crossing restriction is in effect.**

Section 8B.09 DO NOT STOP ON TRACKS Sign (R8-8)

Guidance:

01 *A DO NOT STOP ON TRACKS (R8-8) sign (see Figure 8B-1) should be installed whenever an engineering study determines that the potential for highway vehicles stopping on the tracks at a grade crossing is significant. Placement of the R8-8 sign should be determined as part of the engineering study. The sign, if used, should be located on the right-hand side of the highway on either the near or far side of the grade crossing, depending upon which position provides better visibility to approaching drivers.*

02 *If a STOP or YIELD sign is installed at a location, including at a circular intersection, that is downstream from the grade crossing such that highway vehicle queues are likely to extend beyond the tracks, a DO NOT STOP ON TRACKS sign (R8-8) should be used.*

Option:

03 DO NOT STOP ON TRACKS signs may be placed on both sides of the track.

04 On divided highways and one-way streets, a second DO NOT STOP ON TRACKS sign may be placed on the near or far left-hand side of the highway at the grade crossing to further improve visibility of the sign.

Section 8B.10 TRACKS OUT OF SERVICE Sign (R8-9)

Option:

01 The TRACKS OUT OF SERVICE (R8-9) sign (see Figure 8B-1) may be used at a grade crossing instead of a Crossbuck (R15-1) sign and a Number of Tracks (R15-2P) plaque when the abandonment of the railroad tracks has been approved by the regulatory authority with statutory authority, but only until such time that the tracks are removed or covered and the space previously occupied by the rails filled with the same material that comprises the road or highway at the crossing.

Standard:

02 **When tracks are abandoned, traffic control devices, signal heads and gate arms shall be removed.**

03 **The R8-9 sign shall be removed when the tracks have been removed and the space previously occupied by the rail bed filled with the same material that comprises the road or highway at the crossing or when the grade crossing is returned to service.**

Section 8B.11 STOP HERE WHEN FLASHING Signs (R8-10, R8-10a)

Option:

01 *The STOP HERE WHEN FLASHING (R8-10, R8-10a) sign (see Figure 8B-1) may be used at a grade crossing to inform drivers of the location of the stop line or the point at which to stop when the flashing-light signals (see Section 8C.02) are activated.*

Section 8B.12 STOP HERE ON RED Signs (R10-6, R10-6a)

Support:

01 The STOP HERE ON RED (R10-6, R10-6a) sign (see Figure 8B-1) defines and facilitates observance of stop lines at traffic control signals.

Option:

02 A STOP HERE ON RED sign may be used at locations where highway vehicles frequently violate the stop line or where it is not obvious to road users where to stop.

Guidance:

03 *If possible, stop lines should be placed at a point where the highway vehicle driver has adequate sight distance along the track.*

Section 8B.13 Light Rail Transit Only Lane Signs (R15-4 Series)

Support:

01 The Light Rail Transit Only Lane (R15-4 series) signs (see Figure 8B-1) are used for multi-lane operations, where road users might need additional guidance on lane use and/or restrictions.

Option:

02 Light Rail Transit Only Lane signs may be used on a roadway lane limited to only LRT use to indicate the restricted use of a lane in semi-exclusive and mixed alignments.

Guidance:

03 *If used, the R15-4a, R15-4b, and R15-4c signs should be installed on posts adjacent to the roadway containing the LRT tracks or overhead above the LRT only lane.*

Option:

04 If the trackway is paved, preferential lane markings (see Chapter 3D) may be installed but only in combination with Light Rail Transit Only Lane signs.

Support:

05 The trackway is the continuous way designated for LRT, including the entire dynamic envelope. Section 8B.29 contains more information regarding the dynamic envelope.

Section 8B.14 Do Not Pass Light Rail Transit Signs (R15-5, R15-5a)

Support:

01 A Do Not Pass Light Rail Transit (R15-5) sign (see Figure 8B-1) is used to indicate that motor vehicles are not allowed to pass LRT vehicles that are loading or unloading passengers where there is no raised platform or physical separation from the lanes upon which other motor vehicles are operating.

Option:

02 The R15-5 sign may be used in mixed-use alignments and may be mounted overhead where there are multiple lanes.

03 Instead of the R15-5 symbol sign, a regulatory sign with the word message DO NOT PASS STOPPED TRAIN (R15-5a) may be used (see Figure 8B-1).

Guidance:

04 *If used, the R15-5 sign should be located immediately before the LRT boarding area.*

Section 8B.15 No Motor Vehicles On Tracks Signs (R15-6, R15-6a)

Support:

01 The No Motor Vehicles On Tracks (R15-6) sign (see Figure 8B-1) is used where there are adjacent traffic lanes separated from the LRT lane by a curb or pavement markings.

Guidance:

02 *The DO NOT ENTER (R5-1) sign should be used where a road user could wrongly enter an LRT only street.*

Option:

03 A No Motor Vehicles On Tracks sign may be used to deter motor vehicles from driving on the trackway. It may be installed on a 3-foot flexible post between double tracks, on a post alongside the tracks, or overhead.

04 Instead of the R15-6 symbol sign, a regulatory sign with the word message DO NOT DRIVE ON TRACKS (R15-6a) may be used (see Figure 8B-1).

05 A reduced size of 12 x 12 inches may be used if the R15-6 sign is installed between double tracks.

Standard:

06 **The smallest size for the R15-6 sign shall be 12 x 12 inches.**

Section 8B.16 Divided Highway with Light Rail Transit Crossing Signs (R15-7 Series)

Option:

01 The Divided Highway with Light Rail Transit Crossing (R15-7) sign (see Figure 8B-1) may be used as a supplemental sign on the approach legs of a roadway that intersects with a divided highway where LRT equipment operates in the median. The sign may be placed beneath a STOP sign or mounted separately.

Guidance:

02 *The number of tracks displayed on the R15-7 sign should be the same as the actual number of tracks.*

Standard:

03 **When the Divided Highway with Light Rail Transit Crossing sign is used at a four-legged intersection, the R15-7 sign shall be used. When used at a T-intersection, the R15-7a sign shall be used.**

Section 8B.17 LOOK Sign (R15-8)

Option:

01 At grade crossings, the LOOK (R15-8) sign (see Figure 8B-1) may be mounted as a supplemental plaque on the Crossbuck (R15-1) support, or on a separate post in the immediate vicinity of the grade crossing on the railroad or LRT right-of-way.

Guidance:

02 *A LOOK sign should not be mounted as a supplemental plaque on a Crossbuck Assembly that has a YIELD or STOP sign mounted on the same support as the Crossbuck.*

Section 8B.18 Emergency Notification Sign (I-13)

Guidance:

01 *Emergency Notification (I-13) signs (see Figure 8B-5) should be installed at all highway-rail grade crossings, and at all highway-LRT grade crossings on semi-exclusive alignments, to provide information to road users so that they can notify the railroad company or LRT agency about emergencies or malfunctioning traffic control devices.*

Standard:

02 **When Emergency Notification signs are used at a highway-rail grade crossing, they shall, at a minimum, include the USDOT grade crossing inventory number and the emergency contact telephone number.**

03 **When Emergency Notification signs are used at a highway-LRT grade crossing, they shall, at a minimum, include a unique crossing identifier and the emergency contact telephone number.**

04 **Emergency Notification Signs shall have a white legend and border on a blue background.**

05 **The Emergency Notification signs shall be positioned so as to not obstruct any traffic control devices or limit the view of rail traffic approaching the grade crossing.**

Guidance:

06 *Emergency Notification signs should be retroreflective.*

07 *Emergency Notification signs should be oriented so as to face highway vehicles stopped on or at the grade crossing or on the traveled way near the grade crossing.*

08 *At station crossings, Emergency Notification signs or information should be posted in a conspicuous location.*

09 *Emergency Notification signs mounted on Crossbuck Assemblies or signal masts should only be large enough to provide the necessary contact information. Use of larger signs that might obstruct the view of rail traffic or other highway vehicles should be avoided.*

Figure 8B-5. Example of an Emergency Notification Sign

I-13

Section 8B.19 Light Rail Transit Approaching-Activated Blank-Out Warning Sign (W10-7)

Support:

01 The Light Rail Transit Approaching-Activated Blank-Out (W10-7) warning sign (see Figure 8B-4) supplements the traffic control devices to warn road users crossing the tracks of approaching LRT equipment.

Option:

02 A Light Rail Transit Approaching-Activated Blank-Out warning sign may be used at signalized intersections near highway-LRT grade crossings or at crossings controlled by STOP signs or automatic gates.

Section 8B.20 TRAINS MAY EXCEED 80 MPH Sign (W10-8)

Guidance:

01 *Where trains are permitted to travel at speeds exceeding 80 mph, a TRAINS MAY EXCEED 80 MPH (W10-8) sign (see Figure 8B-4) should be installed facing road users approaching the grade crossing.*

02 *If used, the TRAINS MAY EXCEED 80 MPH signs should be installed between the Grade Crossing Advance Warning (W10 series) sign (see Figure 8B-4) and the highway-rail grade crossing on all approaches to the highway-rail grade crossing. The locations should be determined based on specific site conditions.*

Section 8B.21 NO TRAIN HORN Sign or Plaque (W10-9, W10-9P)

Standard:

01 **Either a NO TRAIN HORN (W10-9) sign (see Figure 8B-4) or a NO TRAIN HORN (W10-9P) plaque shall be installed in each direction at each highway-rail grade crossing where a quiet zone has been established in compliance with 49 CFR Part 222. If a W10-9P plaque is used, it shall supplement and be mounted directly below the Grade Crossing Advance Warning (W10 series) sign (see Figure 8B-4).**

Section 8B.22 NO GATES OR LIGHTS Plaque (W10-13P)

Option:

01 The NO GATES OR LIGHTS (W10-13P) plaque (see Figure 8B-4) may be mounted below the Grade Crossing Advance Warning (W10 series) sign at grade crossings that are not equipped with automated signals.

Section 8B.23 Low Ground Clearance Grade Crossing Sign (W10-5)

Guidance:

01 *If the highway profile conditions are sufficiently abrupt to create a hang-up situation for long wheelbase vehicles or for trailers with low ground clearance, the Low Ground Clearance Grade Crossing (W10-5) sign (see Figure 8B-4) should be installed in advance of the grade crossing.*

Standard:

02 **Because this symbol might not be readily recognizable by the public, the Low Ground Clearance Grade Crossing (W10-5) warning sign shall be accompanied by an educational plaque, LOW GROUND CLEARANCE. The LOW GROUND CLEARANCE educational plaque shall remain in place for at least 3 years after the initial installation of the W10-5 sign (see Section 2A.12).**

Guidance:

03 *Auxiliary plaques such as AHEAD, NEXT CROSSING, or USE NEXT CROSSING (with appropriate arrows), or a supplemental distance plaque should be placed below the W10-5 sign at the nearest intersecting highway where a vehicle can detour or at a point on the highway wide enough to permit a U-turn.*

04 *If engineering judgment of roadway geometric and operating conditions confirms that highway vehicle speeds across the tracks should be below the posted speed limit, a W13-1P advisory speed plaque should be posted.*

Option:

05 If the grade crossing is rough, word message signs such as BUMP, DIP, or ROUGH CROSSING may be installed. A W13-1P advisory speed plaque may be installed below the word message sign in advance of rough crossings.

Support:

06 Information on ground clearance requirements at grade crossings is available in the "American Railway Engineering and Maintenance-of-Way Association's Engineering Manual," or the American Association of State Highway and Transportation Officials' "A Policy on Geometric Design of Highways and Streets" (see Section 1A.11).

Section 8B.24 Storage Space Signs (W10-11, W10-11a, W10-11b)

Guidance:

01 *A Storage Space (W10-11) sign supplemented by a word message storage distance (W10-11a) sign (see Figure 8B-4) should be used where there is a highway intersection in close proximity to the grade crossing and an engineering study determines that adequate space is not available to store a design vehicle(s) between the highway intersection and the train or LRT equipment dynamic envelope.*

02 *The Storage Space (W10-11 and W10-11a) signs should be mounted in advance of the grade crossing at an appropriate location to advise drivers of the space available for highway vehicle storage between the highway intersection and the grade crossing.*

Option:

03 A Storage Space (W10-11b) sign (see Figure 8B-4) may be mounted beyond the grade crossing at the highway intersection under the STOP or YIELD sign or just prior to the signalized intersection to remind drivers of the storage space between the tracks and the highway intersection.

Section 8B.25 Skewed Crossing Sign (W10-12)

Option:

01 The Skewed Crossing (W10-12) sign (see Figure 8B-4) may be used at a skewed grade crossing to warn road users that the tracks are not perpendicular to the highway.

Guidance:

02 *If the Skewed Crossing sign is used, the symbol should show the direction of the crossing (near left to far right as shown in Figure 8B-4, or the mirror image if the track goes from far left to near right). If the Skewed Crossing sign is used where the angle of the crossing is significantly different than 45 degrees, the symbol should show the approximate angle of the crossing.*

Standard:

03 **The Skewed Crossing sign shall not be used as a replacement for the required Advance Warning (W10-1) sign. If used, the Skewed Crossing sign shall supplement the W10-1 sign and shall be mounted on a separate post.**

Section 8B.26 Light Rail Transit Station Sign (I-12)

Option:

01 The Light Rail Transit Station (I-12) sign (see Figure 2H-1) may be used to direct road users to an LRT station or boarding location. It may be supplemented by the name of the transit system and by arrows as provided in Section 2D.08.

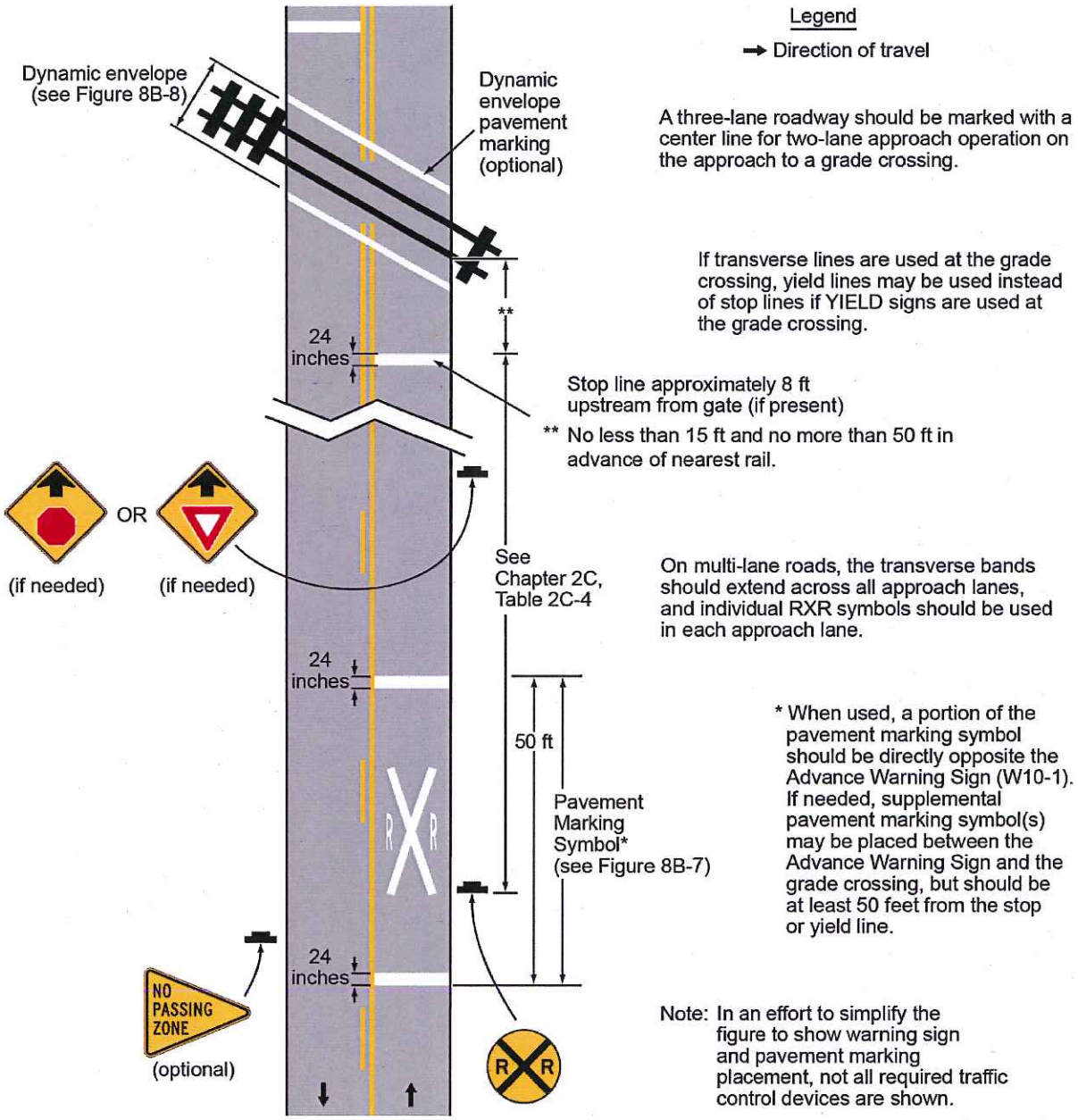
Section 8B.27 Pavement Markings

Standard:

01 **All grade crossing pavement markings shall be retroreflectorized white. All other markings shall be in accordance with Part 3.**

02 **On paved roadways, pavement markings in advance of a grade crossing shall consist of an X, the letters RR, a no-passing zone marking (on two-lane, two-way highways with center line markings in compliance with Section 3B.01), and certain transverse lines as shown in Figures 8B-6 and 8B-7.**

Figure 8B-6. Example of Placement of Warning Signs and Pavement Markings at Highway-Rail Grade Crossings

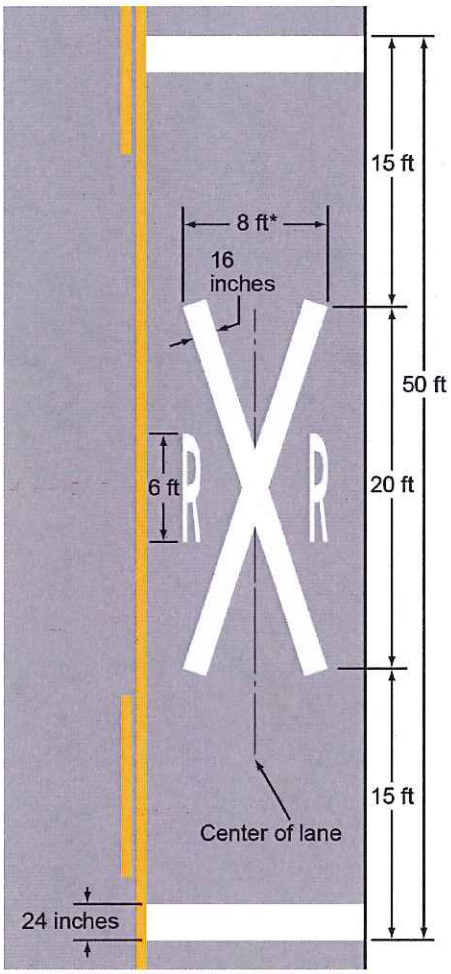


03 **Identical markings shall be placed in each approach lane on all paved approaches to grade crossings where signals or automatic gates are located, and at all other grade crossings where the posted or statutory highway speed is 40 mph or greater.**

04 **Pavement markings shall not be required at grade crossings where the posted or statutory highway speed is less than 40 mph if an engineering study indicates that other installed devices provide suitable warning and control. Pavement markings shall not be required at grade crossings in urban areas if an engineering study indicates that other installed devices provide suitable warning and control. Pavement markings at grade crossings on shared-use paths shall be in accordance with Section 8D.27.**

Figure 8B-7. Grade Crossing Pavement Markings

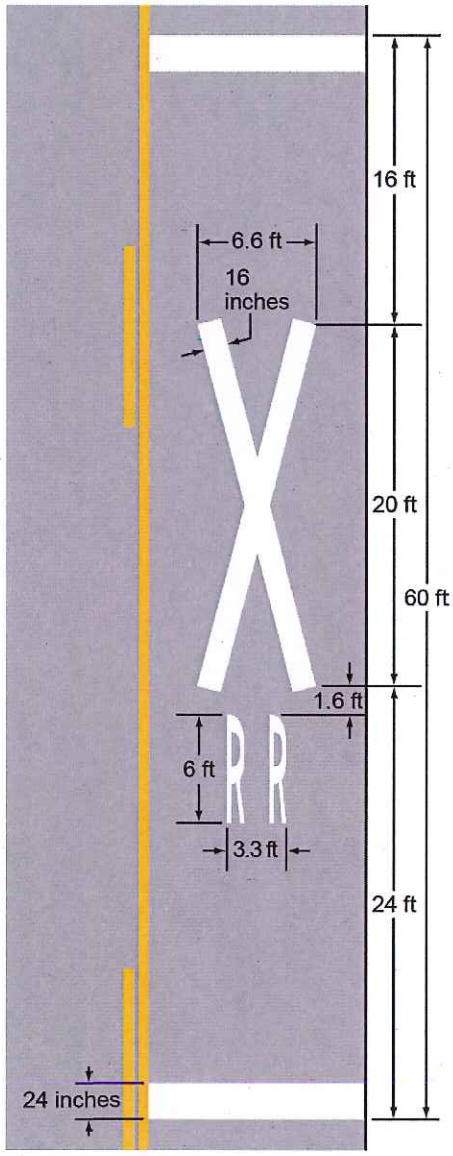
A - Grade crossing pavement marking symbol



*Width may vary according to lane width.

Note: Refer to Figure 8B-6 for placement.

B - Grade crossing alternative (narrow) pavement marking symbol



Guidance:

05 *When pavement markings are used, a portion of the X symbol should be directly opposite the Grade Crossing Advance Warning sign. The X symbol and letters should be elongated to allow for the low angle at which they will be viewed.*

Option:

06 When justified by engineering judgment, supplemental pavement marking symbol(s) may be placed between the Grade Crossing Advance Warning sign and the grade crossing.

Section 8B.28 Stop and Yield Lines

Standard:

01 **On paved roadways at grade crossings that are equipped with active control devices such as flashing-light signals, gates, or traffic control signals, a stop line (see Section 3B.16) shall be installed to indicate the point behind which highway vehicles are or might be required to stop.**

Guidance:

02 *On paved roadway approaches to passive grade crossings where a STOP sign is installed in conjunction with the Crossbuck sign, a stop line should be installed to indicate the point behind which highway vehicles are required to stop or as near to that point as practical.*

03 *If a stop line is used, it should be a transverse line at a right angle to the traveled way and should be placed approximately 8 feet in advance of the gate (if present), but no closer than 15 feet nor more than 50 feet in advance of the nearest rail.*

Option:

04 On paved roadway approaches to passive grade crossing where a YIELD sign is installed in conjunction with the Crossbuck sign, a yield line (See Section 3B.16) or a stop line may be installed to indicate the point behind which highway vehicles are required to yield or stop or as near to that point as practical.

Guidance:

05 *If a yield line is used, it should be a transverse line (see Figure 3B-16) at a right angle to the traveled way and should be placed no closer than 15 feet nor more than 50 feet in advance of the nearest rail (see Figure 8B-6).*

Section 8B.29 Dynamic Envelope Markings

Support:

01 The dynamic envelope (see Figures 8B-8 and 8B-9) markings indicate the clearance required for the train or LRT equipment overhang resulting from any combination of loading, lateral motion, or suspension failure.

Option:

02 Dynamic envelope markings may be installed at all grade crossings, unless a Four-Quadrant Gate system (see Section 8C.06) is used.

Figure 8B-8. Example of Dynamic Envelope Pavement Markings at Grade Crossings

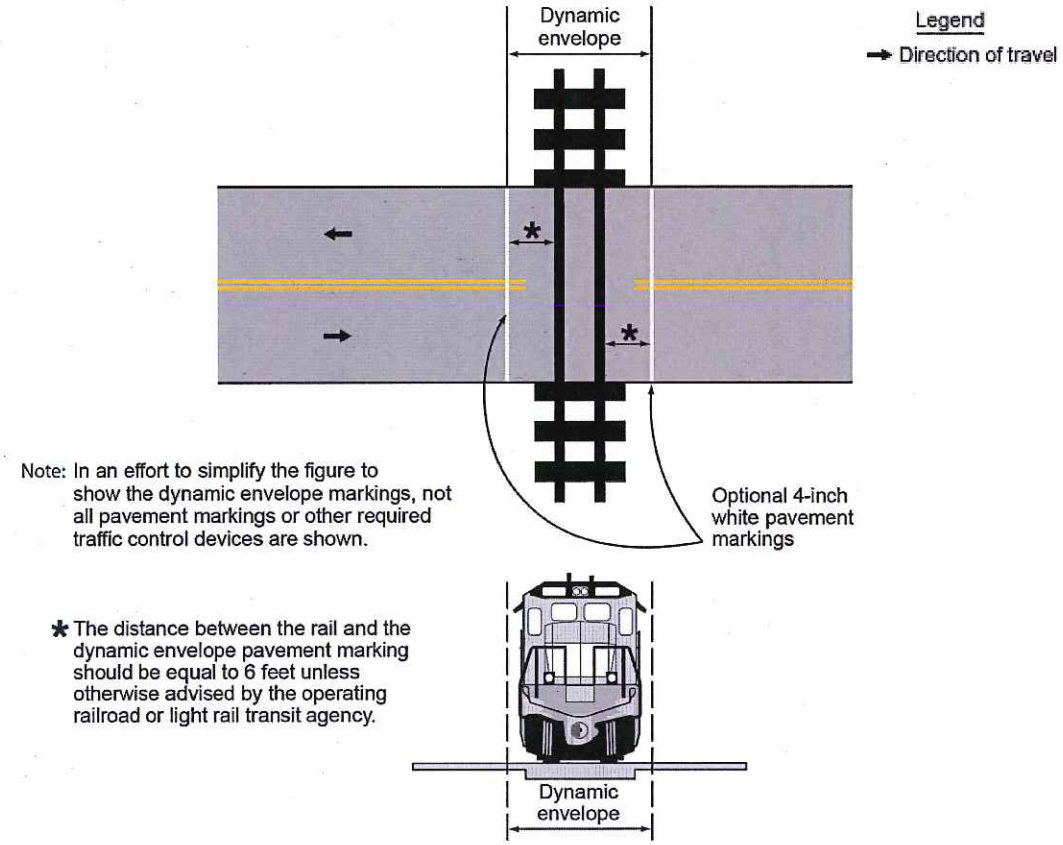
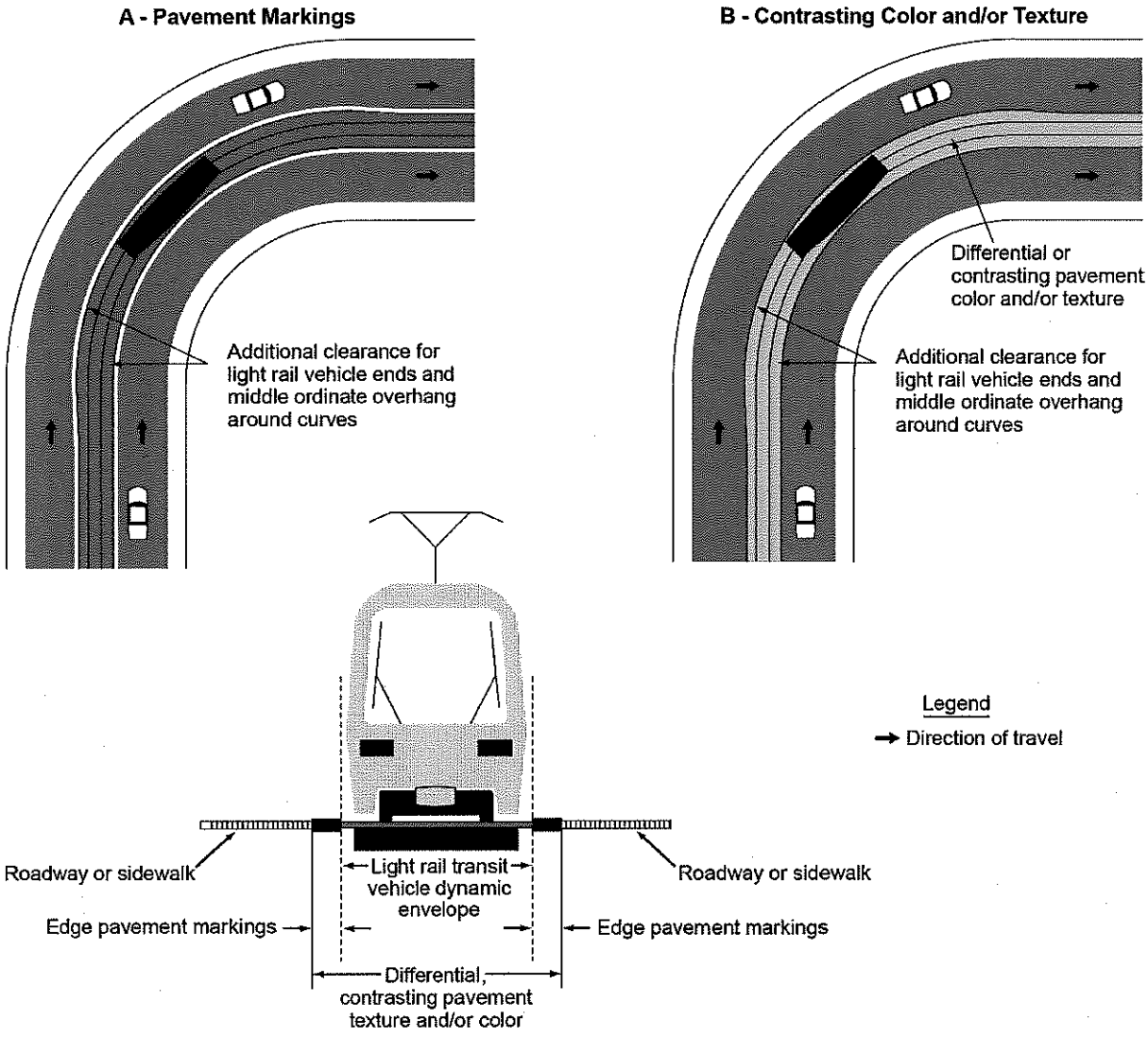


Figure 8B-9. Examples of Light Rail Transit Vehicle Dynamic Envelope Markings for Mixed-Use Alignments



Standard:

03 **If used, pavement markings for indicating the dynamic envelope shall comply with the provisions of Part 3 and shall be a 4-inch normal solid white line or contrasting pavement color and/or contrasting pavement texture.**

Guidance:

04 *If pavement markings are used to convey the dynamic envelope, they should be placed completely outside of the dynamic envelope. If used, dynamic envelope pavement markings should be placed on the highway 6 feet from and parallel to the nearest rail, unless the operating railroad company or LRT agency advises otherwise. The pavement markings should extend across the roadway as shown in Figure 8B-8. The dynamic envelope pavement markings should not be placed perpendicular to the roadway at skewed grade crossings.*

Option:

05 In semi-exclusive LRT alignments, the dynamic envelope markings may be along the LRT trackway between intersections where the trackway is immediately adjacent to travel lanes and no physical barrier is present.

06 In mixed-use LRT alignments, the dynamic envelope markings may be continuous between intersections (see Figure 8B-9).

07 In mixed-use LRT alignments, pavement markings for adjacent travel or parking lanes may be used instead of dynamic markings if the lines are outside the dynamic envelope.

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CHAPTER 8C. FLASHING-LIGHT SIGNALS, GATES, AND TRAFFIC CONTROL SIGNALS

Section 8C.01 Introduction

Support:

01 Active traffic control systems inform road users of the approach or presence of rail traffic at grade crossings. These systems include four-quadrant gate systems, automatic gates, flashing-light signals, traffic control signals, actuated blank-out and variable message signs, and other active traffic control devices.

02 A composite drawing (see Figure 8C-1) shows a post-mounted flashing-light signal (two light units mounted in a horizontal line), a flashing-light signal mounted on an overhead structure, and an automatic gate assembly.

Option:

03 Post-mounted and overhead flashing-light signals may be used separately or in combination with each other as determined by an engineering study. Also, flashing-light signals may be used without automatic gate assemblies, as determined by an engineering study.

Standard:

04 **The meaning of flashing-light signals and gates shall be as defined in Section 4511.62 and 4511.64 of the Ohio Revised Code. Requirements for the erection and operation of the signal equipment, gates, bells and related traffic control devices at railroad grade crossings are contained in Sections, 4513.40, 4907.47, 4907.48, 4907.49, 4907.52 and 4907.476 of the Ohio Revised Code (see Appendix B2).**

05 **Location and clearance dimensions for flashing-light signals and gates shall be as shown in Figure 8C-1.**

06 **When there is a curb, a horizontal offset of at least 2 feet shall be provided from the face of the vertical curb to the closest part of the signal or gate arm in its upright position. When a cantilevered-arm flashing-light signal is used, the vertical clearance shall be at least 17 feet above the crown of the highway to the lowest point of the signal unit.**

07 **Where there is a shoulder, but no curb, a horizontal offset of at least 2 feet from the edge of a paved or surfaced shoulder shall be provided, with an offset of at least 6 feet from the edge of the traveled way.**

08 **Where there is no curb or shoulder, the minimum horizontal offset shall be 6 feet from the edge of the traveled way.**

Guidance:

09 *Equipment housings (controller cabinets) should have a lateral offset of at least 30 ft from the edge of the highway, and where railroad or LRT property and conditions allow, at least 25 feet from the nearest rail.*

10 *If a pedestrian route is provided, sufficient clearance from supports, posts, and gate mechanisms should be maintained for pedestrian travel.*

11 *When determined by an engineering study, a lateral escape route to the right of the highway in advance of the grade crossing traffic control devices should be kept free of guardrail or other ground obstructions. Where guardrail is not deemed necessary or appropriate, barriers should not be used for protecting signal supports.*

12 *The same lateral offset and roadside safety features should apply to flashing-light signal and automatic gate locations on both the right-hand and left-hand sides of the roadway.*

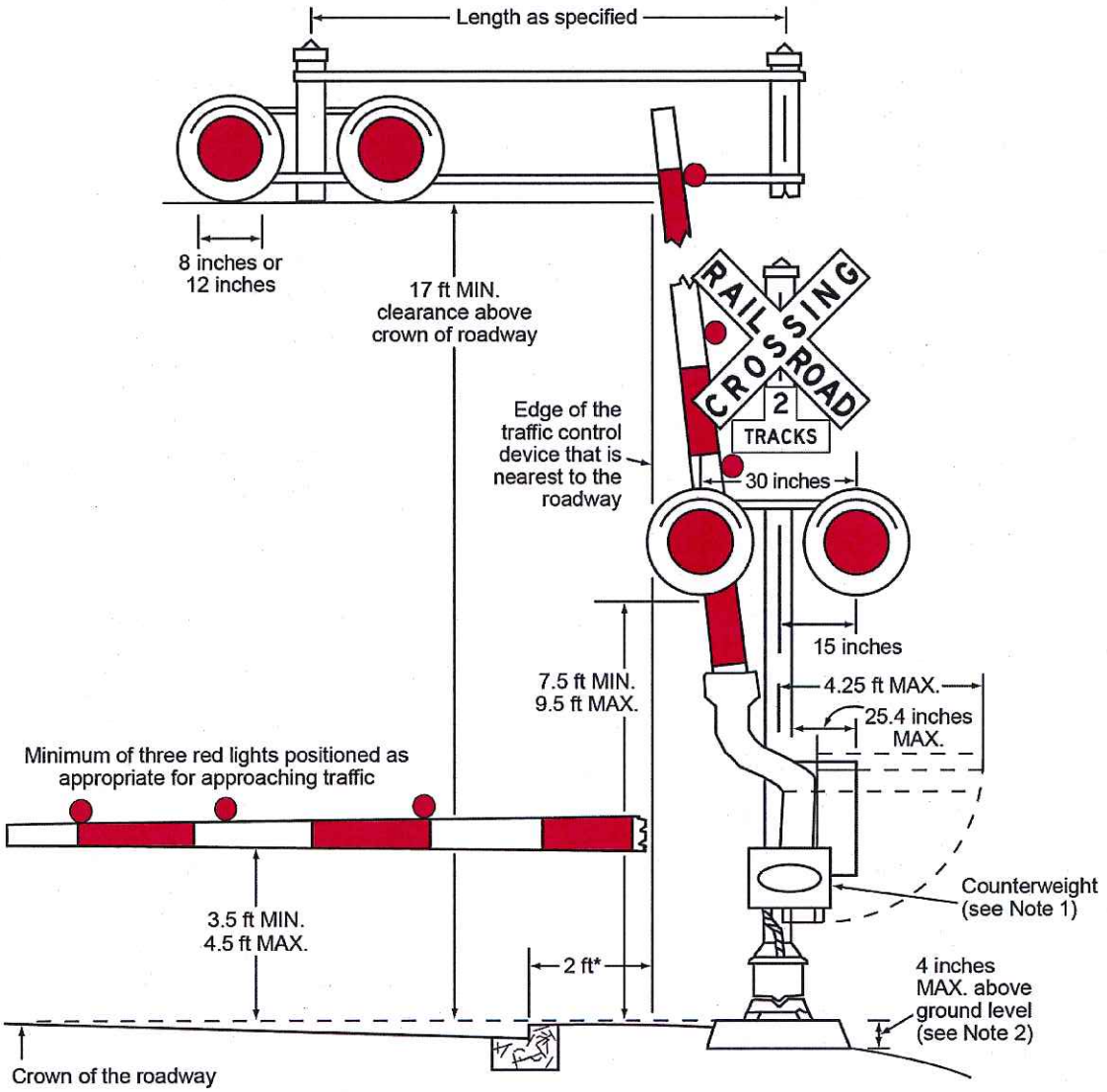
Option:

13 In industrial or other areas involving only low-speed highway traffic or where signals are vulnerable to damage by turning truck traffic, guardrail may be installed to provide protection for the signal assembly.

Guidance:

14 *Where both traffic control signals and flashing – light signals (with or without automatic gates) are in operation at the same highway-LRT grade crossing, the operation of the devices should be coordinated to avoid any display of conflicting signal indications.*

Figure 8C-1. Composite Drawing of Active Traffic Control Devices for Grade Crossings Showing Clearances



*For locating this reference line on an approach that does not have a curb, see Section 8C.01.

Notes:

1. Where gates are located in the median, additional median width may be required to provide the minimum clearance for the counterweight supports.
2. The top of the signal foundation should be no more than 4 inches above the surface of the ground and should be at the same elevation as the crown of the roadway. Where site conditions would not allow this to be achieved, the shoulder side slope should be re-graded or the height of the signal post should be adjusted to meet the 17-foot vertical clearance requirement.

Support:

15 LRT typically operates through grade crossings in semi-exclusive and mixed-use alignments at speeds between 10 and 65 mph.

16 When LRT speed is cited in this Part, it refers to the maximum speed at which LRT equipment is permitted to traverse a particular grade crossing.

Section 8C.02 Flashing-Light Signals

Support:

01 Section 8C.03 contains additional information regarding flashing-light signals at highway-LRT grade crossings in semi-exclusive and mixed-use alignments.

Standard:

02 **If used, the flashing-light signal assembly (shown in Figure 8C-1) on the side of the highway shall include a standard Crossbuck (R15-1) sign, and where there is more than one track, a supplemental Number of Tracks (R15-2P) plaque, all of which indicate to motorists, bicyclists, and pedestrians the location of a grade crossing.**

Option:

03 At highway-rail grade crossings, bells or other audible warning devices may be included in the assembly and may be operated in conjunction with the flashing lights to provide additional warning for pedestrians, bicyclists, and/or other non-motorized road users.

Standard:

04 **When indicating the approach or presence of rail traffic, the flashing-light signal shall display toward approaching highway traffic two red lights mounted in a horizontal line flashing alternately.**

05 **If used, flashing-light signals shall be placed to the right of approaching highway traffic on all highway approaches to a grade crossing. They shall be located laterally with respect to the highway in compliance with Figure 8C-1 except where such location would adversely affect signal visibility.**

06 **If used at a grade crossing with highway traffic in both directions, back-to-back pairs of lights shall be placed on each side of the tracks. On multi-lane one-way streets and divided highways, flashing light signals shall be placed on the approach side of the grade crossing on both sides of the roadway or shall be placed above the highway.**

07 **Each red signal unit in the flashing-light signal shall flash alternately. The number of flashes per minute for each lamp shall be 35 minimum and 65 maximum. Each lamp shall be illuminated approximately the same length of time. Total time of illumination of each pair of lamps shall be the entire operating time. Flashing-light units shall use either 8-inch or 12-inch nominal diameter lenses.**

Guidance:

08 *In choosing between the 8-inch or 12-inch nominal diameter lenses for use in grade crossing flashing-light signals, consideration should be given to the principles stated in Section 4D.07.*

Standard:

09 **Grade crossing flashing-light signals shall operate at a low voltage using storage batteries either as a primary or stand-by source of electrical energy. Provision shall be made to provide a source of energy for charging batteries.**

Option:

10 Additional pairs of flashing-light units may be mounted on the same supporting post and directed toward vehicular traffic approaching the grade crossing from other than the principal highway route, such as where there are approaching routes on highways closely adjacent to and parallel to the track(s).

Standard:

11 **References to lenses in this Section shall not be used to limit flashing-light signal optical units to incandescent lamps within optical assemblies that include lenses.**

Support:

12 Research has resulted in flashing-light signal optical units that are not lenses, such as, but not limited to, light emitting diode (LED) flashing-light signal modules.

Option:

13 Flashing-light signals may be installed on overhead structures or cantilevered supports as shown in Figure 8C-1 where needed for additional emphasis, or for better visibility to approaching traffic, particularly on multi-lane approaches or highways with profile restrictions.

14 If it is determined by an engineering study that one set of flashing lights on the cantilever arm is not sufficiently visible to road users, one or more additional sets of flashing lights may be mounted on the supporting post and/or on the cantilever arm.

Standard:

15 **Breakaway or frangible bases shall not be used for overhead structures or cantilevered supports.**

16 **Except as otherwise provided in Paragraphs 13 through 15, flashing-light signals mounted overhead shall comply with the applicable provisions of this Section.**

Section 8C.03 Flashing-Light Signals at Highway-LRT Grade Crossings

Support:

01 Section 8C.02 contains additional provisions regarding the design and operation of flashing-light signals, including those installed at highway-LRT grade crossings.

Standard:

02 **Highway-LRT grade crossings in semi-exclusive alignments shall be equipped with flashing-light signals where LRT speeds exceed 35 mph. Flashing-light signals shall be clearly visible to motorists, pedestrians, and bicyclists.**

03 **If flashing-light signals are in operation at a highway-LRT crossing that is used by pedestrians, bicyclists, and/or other non-motorized road users, an audible device such as a bell shall also be provided and shall be operated in conjunction with the flashing-light signals.**

Guidance:

04 *Where the crossing is at a location other than an intersection and LRT speeds exceed 25 mph, flashing-light signals should be installed.*

Option:

05 Traffic control signals may be used instead of flashing-light signals at highway-LRT grade crossings within highway-highway intersections where LRT speeds do not exceed 35 mph. Traffic control signals or flashing-light signals may be used where the crossing is at a location other than an intersection, where LRT speeds do not exceed 25 mph, and when the roadway is a low-volume street where prevailing speeds do not exceed 25 mph.

Section 8C.04 Automatic Gates

Support:

01 An automatic gate is a traffic control device used in conjunction with flashing-light signals.

Standard:

02 **The automatic gate (see Figure 8C-1) shall consist of a drive mechanism and a fully retroreflectorized red- and white-striped gate arm with lights. When in the down position, the gate arm shall extend across the approaching lanes of highway traffic.**

03 **In the normal sequence of operation, unless constant warning time detection or other advanced system requires otherwise, the flashing-light signals and the lights on the gate arm (in its normal upright position) shall be activated immediately upon detection of approaching rail traffic. The gate arm shall start its downward motion not less than 3 seconds after the flashing-light signals start to operate, shall reach its horizontal position at least 5 seconds before the arrival of the rail traffic, and shall remain in the down position as long as the train occupies the grade crossing.**

04 **When the rail traffic clears the grade crossing, and if no other rail traffic is detected, the gate arm shall ascend to its upright position, following which the flashing-light signals and the lights on the gate arm shall cease operation.**

05 **Gate arms shall be fully retroreflectorized on both sides, and shall have vertical stripes alternately red and white at 16-inch intervals measured horizontally.**

Support:

06 It is acceptable to replace a damaged gate with a gate having vertical stripes even if the other existing gates at the same grade crossing have diagonal stripes; however, it is also acceptable to replace a damaged gate with a gate having diagonal stripes if the other existing gates at the same grade crossing have diagonal stripes in order to maintain consistency per the provisions of Paragraph 24 of the Introduction.

Standard:

07 **Gate arms shall have at least three red lights as provided in Figure 8C-1.**

08 **When activated, the gate arm light nearest the tip shall be illuminated continuously and the other lights shall flash alternately in unison with the flashing-light signals.**

09 **The entrance lane gate arm mechanism shall be designed to fail safe in the down position.**

Guidance:

10 *The gate arm should ascend to its upright position in 12 seconds or less.*

11 *In its normal upright position, when no rail traffic is approaching or occupying the grade crossing, the gate arm should be either vertical or nearly so (see Figure 8C-1).*

12 *In the design of individual installations, consideration should be given to timing the operation of the gate arm to accommodate large and/or slow-moving highway vehicles.*

13 *The gates should cover the approaching highway to block all highway vehicles from being driven around the gate without crossing the centerline.*

Option:

14 The effectiveness of gates may be enhanced by the use of channelizing devices or raised median islands to discourage driving around lowered automatic gates.

15 Where gates are located in the median, additional median width may be required to provide the minimum clearance for the counterweight supports.

16 Automatic gates may be supplemented by cantilevered flashing-light signals (see Figure 8C-1) where there is a need for additional emphasis or better visibility.

Section 8C.05 Use of Automatic Gates at LRT Grade Crossings

Guidance:

01 *Highway-LRT grade crossings in semi-exclusive alignments should be equipped with automatic gates and flashing-light signals (see Section 8C.02 and 8C.03) where LRT speeds exceed 35 mph.*

Option:

02 Where a highway-LRT grade crossing is at a location other than an intersection, where LRT speeds exceed 25 mph, automatic gates and flashing-light signals may be installed.

03 Traffic control signals may be used instead of automatic gates at highway-LRT grade crossings within highway-highway intersections where LRT speeds do not exceed 35 mph. Traffic control signals or flashing-light signals without automatic gates may be used where the crossing is at a location other than an intersection and where LRT speeds do not exceed 25 mph and the roadway is a low-volume street where prevailing speeds do not exceed 25 mph.

Section 8C.06 Four-Quadrant Gate Systems

Option:

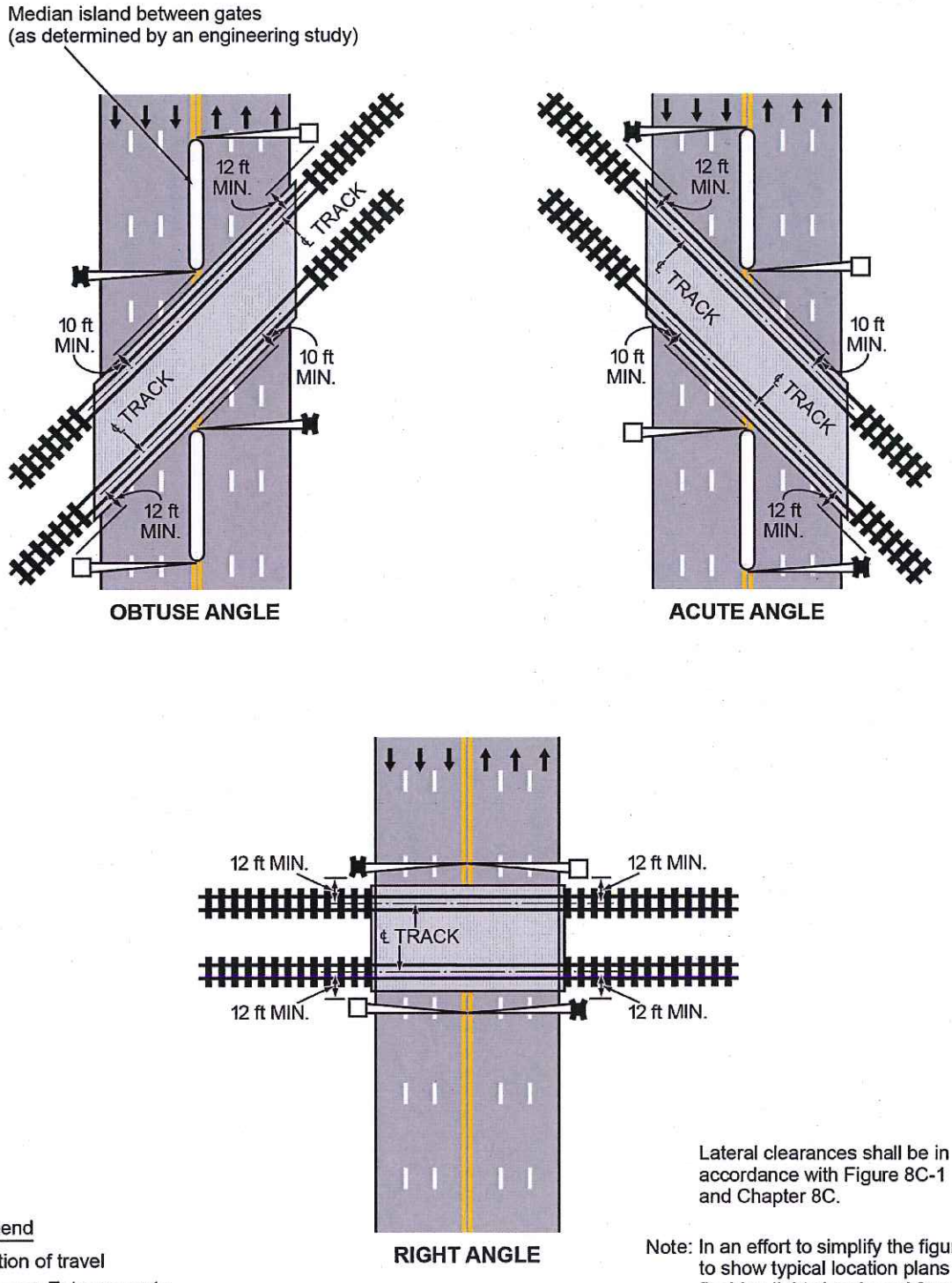
01 Four-Quadrant Gate systems may be installed to improve safety at grade crossings based on an engineering study when less restrictive measures, such as automatic gates and median islands, are not effective.

Standard:

02 **A Four-Quadrant Gate system shall consist of entrance and exit gates that control and block road users on all lanes entering and exiting the grade crossing.**

03 **The Four-Quadrant Gate system shall use a series of drive mechanisms and fully retroreflectorized red- and white-striped gate arms with lights, and when in the down position the gate arms extend**

Figure 8C-2. Example of Location Plan for Flashing-Light Signals and Four-Quadrant Gates



Lateral clearances shall be in accordance with Figure 8C-1 and Chapter 8C.

Note: In an effort to simplify the figure to show typical location plans for flashing-light signals and four-quadrant gates, not all traffic control devices are shown on this figure.

individually across the entrance and exit lanes of the roadway as shown in Figure 8C-2. Standards contained in Sections 8C.01 through 8C.03 for flashing-light signals shall be followed for signal specifications, location, and clearance distances.

04 **In the normal sequence of operation, unless constant warning time detection or other advanced system requires otherwise, the flashing-light signals and the lights on the gate arms (in their normal upright positions) shall be activated immediately upon the detection of approaching rail traffic. The gate arms for the entrance lanes of traffic shall start their downward motion not less than 3 seconds after the flashing-light signals start to operate and shall reach their horizontal position at least 5 seconds before the arrival of the rail traffic. Exit gate arm activation and downward motion shall be based on detection or timing requirements established by an engineering study of the individual site. The gate arms shall remain in the down position as long as the rail traffic occupies the grade crossing.**

05 **When the rail traffic clears the grade crossing, and if no other rail traffic is detected, the gate arms shall ascend to their upright positions, following which the flashing light signals and the lights on the gate arms shall cease operation.**

06 **Gate arm design, colors, and lighting requirements shall be in accordance with the Standards contained in Section 8C.04.**

07 **Except as provided in Paragraph 19, the exit gate arm mechanism shall be designed to fail-safe in the up position.**

08 **At locations where gate arms are offset a sufficient distance for highway vehicles to drive between the entrance and exit gate arms, median islands (see Figure 8C-2) shall be installed in accordance with the needs established by an engineering study.**

Guidance:

09 *The gate arm should ascend to its upright position in 12 seconds or less.*

10 *Four-Quadrant Gate systems should only be used in locations with constant-warning-time detection.*

11 *The operating mode of the exit gates should be determined based upon an engineering study, with input from the affected railroad company or LRT agency.*

12 *If the Timed Exit Gate Operating Mode is used, the engineering study, with input from the affected railroad company or LRT agency, should also determine the Exit Gate Clearance Time (see definition in Section 1A.13).*

13 *If the Dynamic Exit Gate Operating Mode is used, highway vehicle intrusion detection devices that are part of a system that incorporates processing logic to detect the presence of highway vehicles within the minimum track clearance distance should be installed to control exit gate operation.*

14 *Regardless of which exit gate operating mode is used, the Exit Gate Clearance Time should be considered when determining additional time requirements for the Minimum Warning Time.*

15 *If a Four-Quadrant Gate system is used at a location that is adjacent to an intersection that could cause highway vehicles to queue within the minimum track clearance distance, the Dynamic Exit Gate Operating Mode should be used unless an engineering study indicates otherwise.*

16 *If a Four-Quadrant Gate system is interconnected with a highway traffic signal, backup or standby power should be considered for the highway traffic signal. Also, circuitry should be installed to prevent the highway traffic signal from leaving the track clearance green interval until all of the gates are lowered.*

17 *At locations where sufficient space is available, exit gates should be positioned downstream from the track a distance that provides a safety zone long enough to accommodate at least one design vehicle between the exit gate and the nearest rail.*

18 *Four-Quadrant Gate systems should include remote health (status) monitoring capable of automatically notifying railroad or LRT signal maintenance personnel when anomalies have occurred within the system.*

Option:

19 Exit gate arms may fail in the down position if the grade crossing is equipped with remote health (status) monitoring.

20 Four-Quadrant Gate installations may include median islands between opposing lanes on an approach to a grade crossing.

Guidance:

21 *Where sufficient space is available, median islands should be at least 60 feet in length.*

Section 8C.07 Wayside Horn Systems

Option:

01 A wayside horn system (see definition in Section 1A.13) may be installed in compliance with 49 CFR Part 222 to provide audible warning directed toward the road users at a highway-rail or highway-LRT grade crossing or at a pathway grade crossing.

Standard:

02 **Wayside horn systems used at grade crossings where the locomotive horn is not sounded shall be equipped and shall operate in compliance with the requirements of Appendix E to 49 CFR Part 222.**

Guidance:

03 *The same lateral clearance and roadside safety features should apply to wayside horn systems as described in the Standards contained in Section 8C.01. Wayside horn systems, when mounted on a separate pole assembly, should be installed no closer than 15 feet from the center of the nearest track and should be positioned to not obstruct the motorists' line of sight of the flashing-light signals.*

Section 8C.08 Rail Traffic Detection

Standard:

01 **The devices employed in active traffic control systems shall be actuated by some form of rail traffic detection.**

02 **Rail traffic detection circuits, insofar as practical, shall be designed on the fail-safe principle.**

03 **Flashing-light signals shall operate for at least 20 seconds before the arrival of any rail traffic, except as noted in Paragraph 4.**

Option:

04 On tracks where all rail traffic operates at less than 20 mph and where road users are directed by an authorized person on the ground to not enter the crossing at all times that approaching rail traffic is about to occupy the crossing, a shorter signal operating time for the flashing-light signals may be used.

05 Additional warning time may be provided when determined by an engineering study.

Guidance:

06 *Where the speeds of different rail traffic on a given track vary considerably under normal operation, special devices or circuits should be installed to provide reasonably uniform notice in advance of all rail traffic movements over the grade crossing. Special control features should be used to eliminate the effects of station stops and switching operations within approach control circuits to prevent excessive activation of the traffic control devices while rail traffic is stopped on or switching upon the approach track control circuits.*

Section 8C.09 Traffic Control Signals at or Near Highway-Rail Grade Crossings

Option:

01 Traffic control signals may be used instead of flashing-light signals to control road users at industrial highway-rail grade crossings and other places where train movements are very slow, such as in switching operations.

Standard:

02 **The appropriate provisions of Part 4 relating to traffic control signal design, installation, and operation shall be applicable where traffic control signals are used to control road users instead of flashing-light signals at highway-rail grade crossings.**

03 **Traffic control signals shall not be used instead of flashing-light signals to control road users at a mainline highway-rail grade crossing.**

Guidance:

04 *If a highway-rail grade crossing is equipped with a flashing-light signal system and is located within 200 feet of an intersection or midblock location controlled by a traffic control signal, the traffic control signal should be provided with preemption in accordance with Section 4D.27.*

05 *Coordination with the flashing-light signal system, queue detection, or other alternatives should be considered for traffic control signals located farther than 200 feet from the highway-rail grade crossing. Factors to be considered should include traffic volumes, highway vehicle mix, highway vehicle and train approach speeds, frequency of trains, and queue lengths.*

06 *The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable should jointly determine the preemption operation and the timing of traffic control signals interconnected with highway-rail grade crossings adjacent to signalized highway intersections.*

Support:

07 Section 4D.27 includes a recommendation that traffic control signals that are adjacent to highway-rail grade crossings and that are coordinated with the flashing-light signals or that include railroad preemption features be provided with a back-up power supply.

Standard:

08 **Information regarding the type of preemption and any related timing parameters shall be provided to the railroad company so that they can design the appropriate train detection circuitry.**

09 **If preemption is provided, the normal sequence of traffic control signal indications shall be preempted upon the approach of trains to avoid entrapment of vehicles on the highway-rail grade crossing.**

10 **This preemption feature shall have an electrical circuit of the closed-circuit principle, or a supervised communication circuit between the control circuits of the highway-rail grade crossing warning system and the traffic control signal controller. The traffic control signal controller preemptor shall be activated via the supervised communication circuit or the electrical circuit that is normally energized by the control circuits of the highway-rail grade crossing warning system. The approach of a train to a highway-rail grade crossing shall de-energize the electrical circuit or activate the supervised communication circuit, which in turn shall activate the traffic control signal controller preemptor. This shall establish and maintain the preemption condition during the time the highway-rail grade crossing warning system is activated, except that when crossing gates exist, the preemption condition shall be maintained until the crossing gates are energized to start their upward movement. When multiple or successive preemptions occur, train activation shall receive first priority.**

Guidance:

11 *If a highway-rail grade crossing is located within 50 feet (or within 75 feet for a highway that is regularly used by multi-unit highway vehicles) of an intersection controlled by a traffic control signal, the use of pre-signals to control traffic approaching the grade crossing should be considered.*

Standard:

12 **If used, the pre-signals shall display a steady red signal indication during the track clearance portion of a signal preemption sequence to prohibit additional highway vehicles from crossing the railroad track.**

Guidance:

13 *Consideration should be given to using visibility-limited signal faces (see definition in Section 1A.13) at the intersection for the downstream signal faces that control the approach that is equipped with pre-signals.*

Option:

14 The pre-signal phase sequencing may be timed with an offset from the downstream signalized intersection such that the railroad track area and the area between the railroad track and the downstream signalized intersection is generally kept clear of stopped highway vehicles.

Standard:

15 **If a pre-signal is installed at an interconnected highway-rail grade crossing near a signalized intersection, a STOP HERE ON RED (R10-6) sign shall be installed near the pre-signal or at the stop line if used. If there is a nearby signalized intersection with insufficient clear storage distance for a design vehicle, or the highway-rail grade crossing does not have gates, a NO TURN ON RED (R10-11, R10-11a, or R10-11b) sign (see Section 2B.53) shall be installed for the approach that crosses the railroad track, if applicable.**

Option:

16 At locations where a highway-rail grade crossing is located more than 50 feet (or more than 75 feet for a highway regularly used by multi-unit highway vehicles) from an intersection controlled by a traffic control signal, a pre-signal may be used if an engineering study determines a need.

17 If highway traffic signals must be located within close proximity to the flashing-light signal system, the highway traffic signals may be mounted on the same overhead structure as the flashing-light signals.

Support:

18 Section 4C.10 describes the Intersection Near a Grade Crossing signal warrant that is intended for use at a location where the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

19 Section 4D.27 describes additional considerations regarding preemption of traffic control signals at or near highway-rail grade crossings.

Section 8C.10 Traffic Control Signals at or Near Highway-LRT Grade Crossings

Support:

01 There are two types of traffic control signals for controlling vehicular and LRT movements at interfaces of the two modes. The first is the standard traffic control signal described in Part 4, which is the focus of this section. The other type of signal is referred to as an LRT signal and is discussed in Section 8C.11.

Standard:

02 **The provisions of Part 4 and Section 8C.09 relating to traffic control signal design, installation, and operation, including interconnection with nearby automatic gates or flashing-light signals, shall be applicable as appropriate where traffic control signals are used at highway-LRT grade crossings.**

03 **If traffic control signals are in operation at a crossing that is used by pedestrians, bicyclists, and/or other non-motorized road users, an audible device such as a bell shall also be provided and shall be operated in conjunction with the traffic control signals.**

Guidance:

04 *When a highway-LRT grade crossing equipped with a flashing-light signal system is located within 200 feet of an intersection or midblock location controlled by a traffic control signal, the traffic control signal should be provided with preemption in accordance with Section 4D.27.*

05 *Coordination with the flashing-light signal system should be considered for traffic control signals located more than 200 feet from the crossing. Factors to be considered should include traffic volumes, highway vehicle mix, highway vehicle and LRT approach speeds, frequency of LRT traffic, and queue lengths.*

06 *If the highway traffic signal has emergency vehicle preemption capability, it should be coordinated with LRT operation.*

07 *Where LRT operates in a wide median, highway vehicles crossing the tracks and being controlled by both near and far side traffic signal faces should receive a protected left-turn green phase from the far side signal face to clear highway vehicles from the crossing when LRT equipment is approaching the crossing.*

Option:

08 Green indications may be provided during LRT phases for highway vehicle, pedestrian, and bicycle movements that do not conflict with LRT movements.

09 Traffic control signals may be installed in addition to four-quadrant gate systems and automatic gates at a highway-LRT crossing if the crossing occurs within a highway-highway intersection and if the traffic control signals meet the warrants described in Chapter 4C.

10 At a location other than an intersection, when LRT speeds are less than 25 mph, traffic control signals alone may be used to control road users at highway-LRT grade crossings only when justified by an engineering study.

11 Typical circumstances may include:

A. Geometric conditions preclude the installation of highway-LRT grade crossing warning devices.

B. LRT vehicles share the same roadway with road users.
C. Traffic control signals already exist.

Support:

12 Section 4D.27 contains information regarding traffic control signals at or near highway-LRT grade crossings that are not equipped with highway-LRT grade crossing warning devices.

13 Section 4C.10 describes the Intersection Near a Grade Crossing signal warrant that is intended for use at a location where the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Guidance:

14 *When a highway-LRT grade crossing exists within a signalized intersection, consideration should be given to providing separate turn signal faces (see definition in Section 1A.13) for the movements crossing the tracks.*

Standard:

15 **Separate turn signal faces that are provided for turn movements toward the crossing shall display a steady red indication during the approach and/or passage of LRT traffic.**

Guidance:

16 *When a signalized intersection that is located within 200 feet of a highway-LRT grade crossing is preempted, all existing turning movements toward the highway-LRT grade crossing should be prohibited.*

Support:

17 Section 8B.08 contains information regarding the prohibition of turning movements toward the crossing during preemption.

18 Part 4 contains information regarding signal phasing and timing requirements.

Section 8C.11 Use of Traffic Control Signals for Control of LRT Vehicles at Grade Crossings

Guidance:

01 *LRT movements in semi-exclusive alignments at non-gated grade crossings that are equipped with traffic control signals should be controlled by special LRT signal indications.*

02 *LRT traffic control signals that are used to control LRT movements only should display the signal indications illustrated in Figure 8C-3.*

Support:

03 Section 4D.27 contains information about the use of the signal indications shown in Figure 8C-3 for the control of exclusive bus movements at "queue jumper lanes" and for the control of exclusive bus rapid transit movements on semi-exclusive or mixed-use alignments.

Option:

04 Standard traffic control signals may be used instead of LRT traffic control signals to control the movement of LRT vehicles (see Section 8C.10).

Standard:

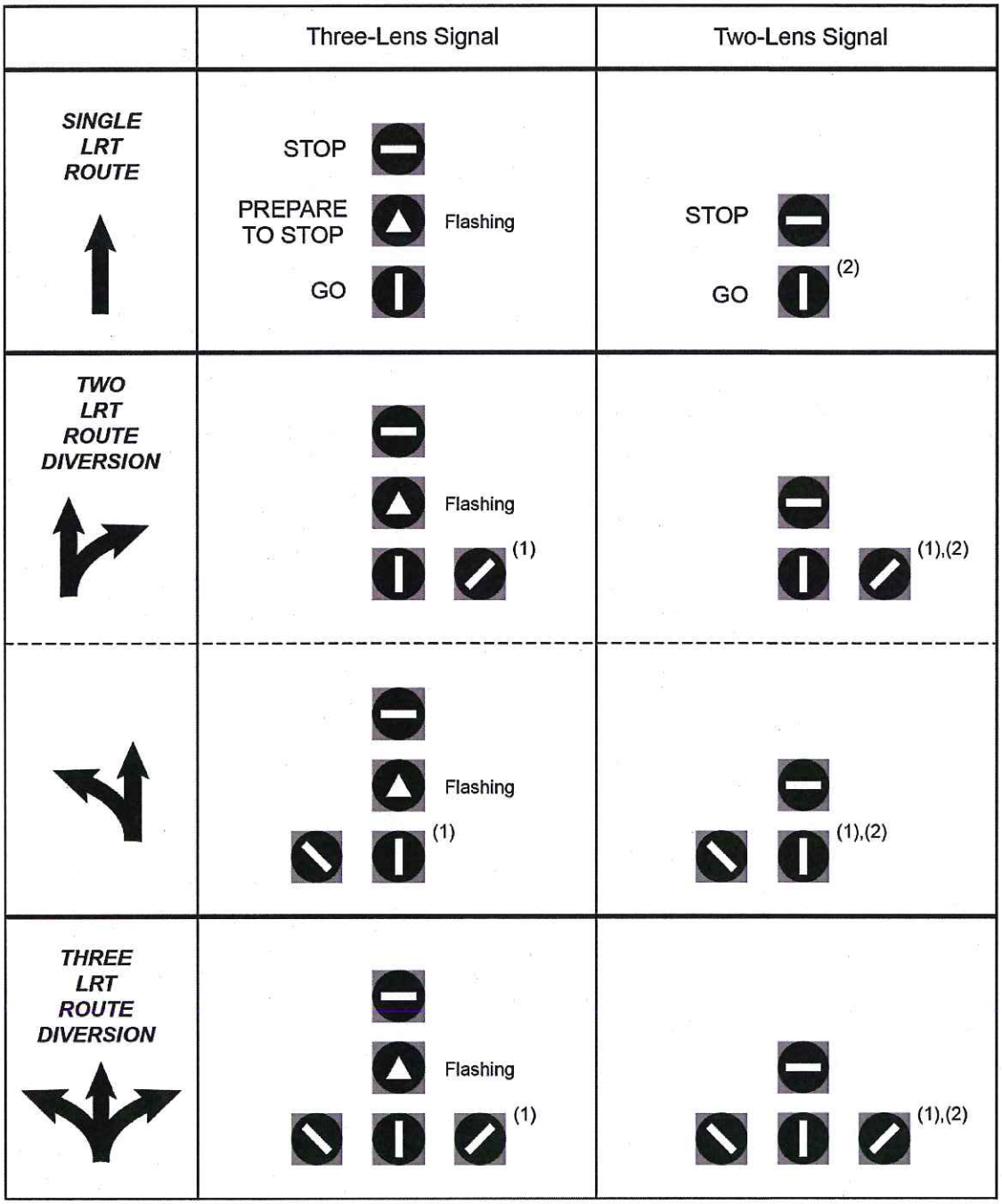
05 **If a separate set of standard traffic control signal indications (red, yellow, and green circular and arrow indications) is used to control LRT movements, the indications shall be positioned so they are not visible to motorists, pedestrians, and bicyclists (see Section 4D.12).**

06 **If the LRT crossing control is separate from the intersection control, the two shall be interconnected. The LRT signal phase shall not be terminated until after the LRT vehicle has cleared the crossing.**

Option:

07 LRT signals may be used at grade crossings and at intersections in mixed-use alignments in conjunction with standard traffic control signals where special LRT signal phases are used to accommodate turning LRT vehicles or where additional LRT clearance time is desirable.

Figure 8C-3. Light Rail Transit Signals



Notes:
All aspects (or signal indications) are white.
(1) Could be in single housing.
(2) "Go" lens may be used in flashing mode to indicate "prepare to stop".

Guidance:

08 *LRT signal faces should be separated vertically or horizontally from the nearest highway traffic signal face for the same approach by at least 3 feet.*

Section 8C.12 Grade Crossings Within or In Close Proximity to Circular Intersections

Support:

01 At circular intersections, such as roundabouts and traffic circles, that include or are within close proximity to a grade crossing, a queue of vehicular traffic could cause highway vehicles to stop on the grade crossing.

Standard:

02 **Where circular intersections include or are within 200 feet of a grade crossing, an engineering study shall be made to determine if queuing could impact the grade crossing. If traffic queues impact the grade crossing, provisions shall be made to clear highway traffic from the grade crossing prior to the arrival of rail traffic.**

Support:

03 Among the actions that can be taken to keep the grade crossing clear of traffic or to clear traffic from the grade crossing prior to the arrival of rail traffic are the following:

A. Elimination of the circular intersection,
B. Geometric design revisions,
C. Grade crossing regulatory and warning devices,
D. Highway traffic signals,
E. Traffic metering devices,
F. Activated signs, or
G. A combination of these or other actions.

Section 8C.13 Pedestrian and Bicycle Signals and Crossings at LRT Grade Crossings

Guidance:

01 *Where LRT tracks are immediately adjacent to other tracks or a road, pedestrian signalization should be designed to avoid having pedestrians wait between sets of tracks or between the tracks and the road. If adequate space exists for a pedestrian refuge and is justified based on engineering judgment, additional pedestrian signal heads, signing, and detectors should be installed (see Section 4E.08).*

Standard:

02 **When used at LRT crossings, pedestrian signal heads shall comply with the provisions of Section 4E.04.**

Guidance:

03 *Flashing-light signals (see Figure 8C-4) with a Crossbuck (R15-1) sign and an audible device should be installed at pedestrian and bicycle crossings where an engineering study has determined that the sight distance is not sufficient for pedestrians and bicyclists to complete their crossing prior to the arrival of the LRT traffic at the crossing, or where LRT speeds exceed 35 mph.*

04 *If an engineering study shows that flashing-light signals with a Crossbuck sign and an audible device would not provide sufficient notice of an approaching LRT traffic, the LOOK (R15-8) sign (see Figure 8C-4) and/or pedestrian gates should be considered (see Figures 8C-5 through 8C-7).*

Support:

05 A pedestrian gate is similar to an automatic gate except the gate arm is shorter.

06 The swing gate alerts pedestrians to the LRT tracks that are to be crossed. Swing gates are designed to open away from the tracks, requiring users to pull the gate open to cross, but permitting a quick exit from the trackway, and to automatically close.

Option:

07 Swing gates may be installed across pedestrian and bicycle walkways (see Figure 8C-8).

08 Pedestrian barriers at offset crossings may be used at pedestrian and bicycle crossings as passive devices that force users to face approaching LRT before entering the trackway (see Figures 8C-9 and 8C-10).

Figure 8C-4. Example of Flashing-Light Signal Assembly for Pedestrian Crossings

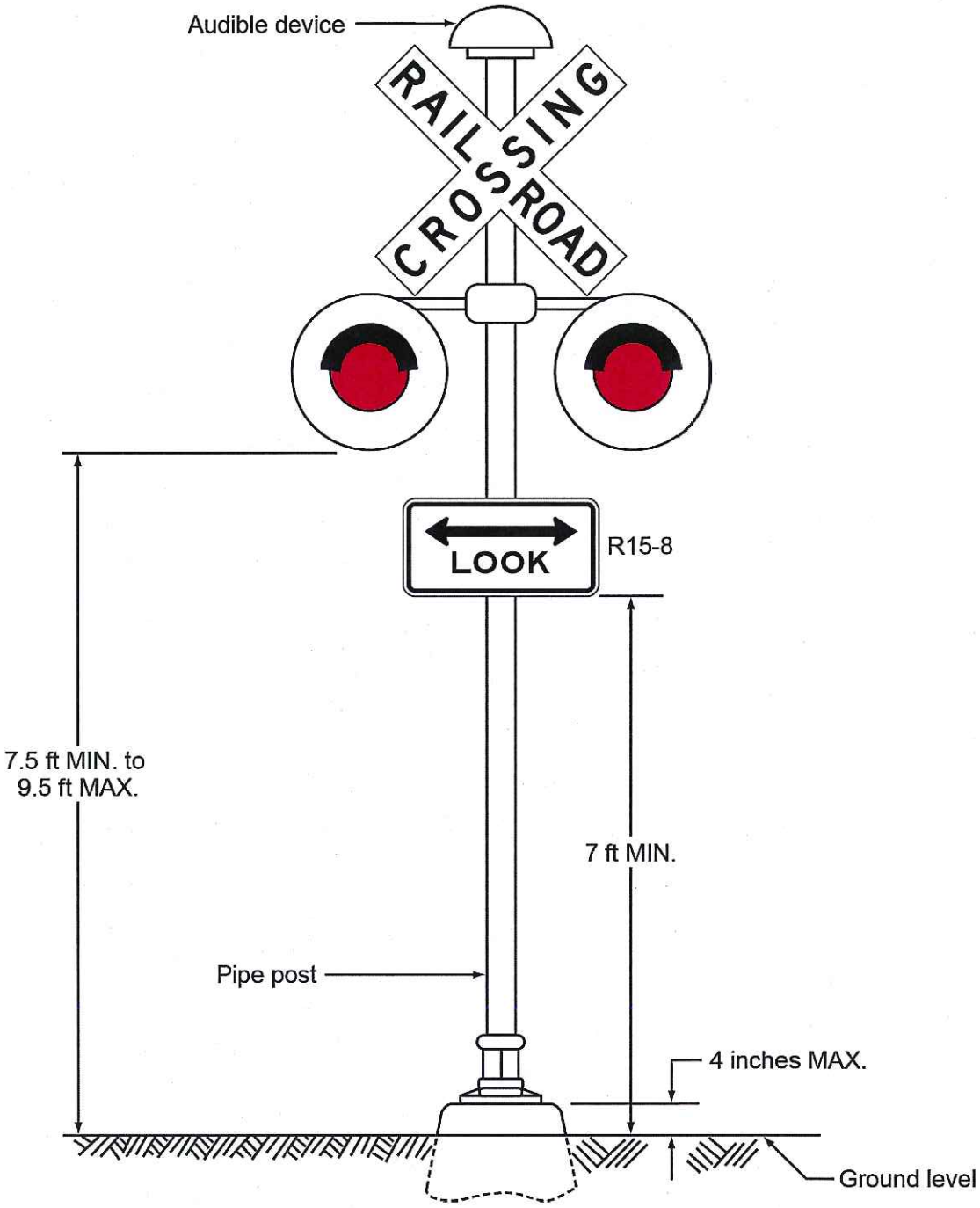


Figure 8C-5. Example of a Shared Pedestrian/Roadway Gate

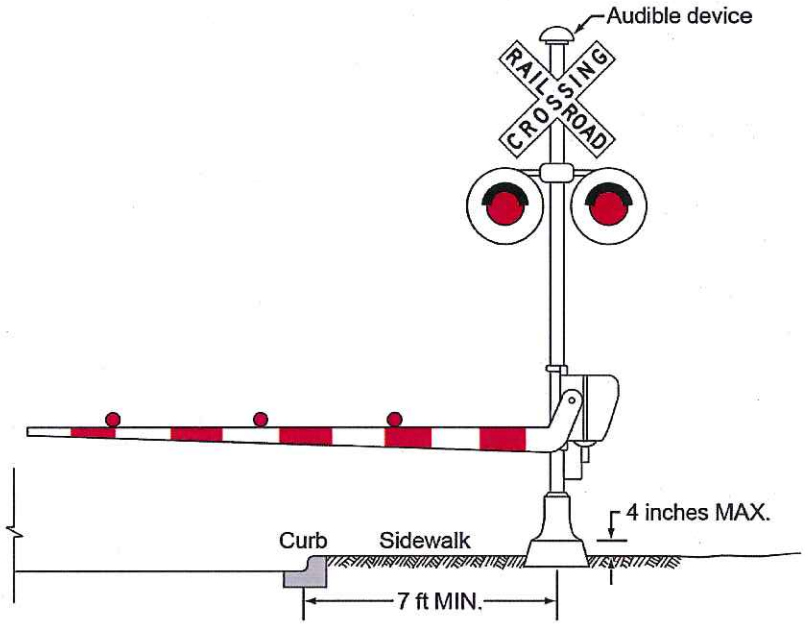
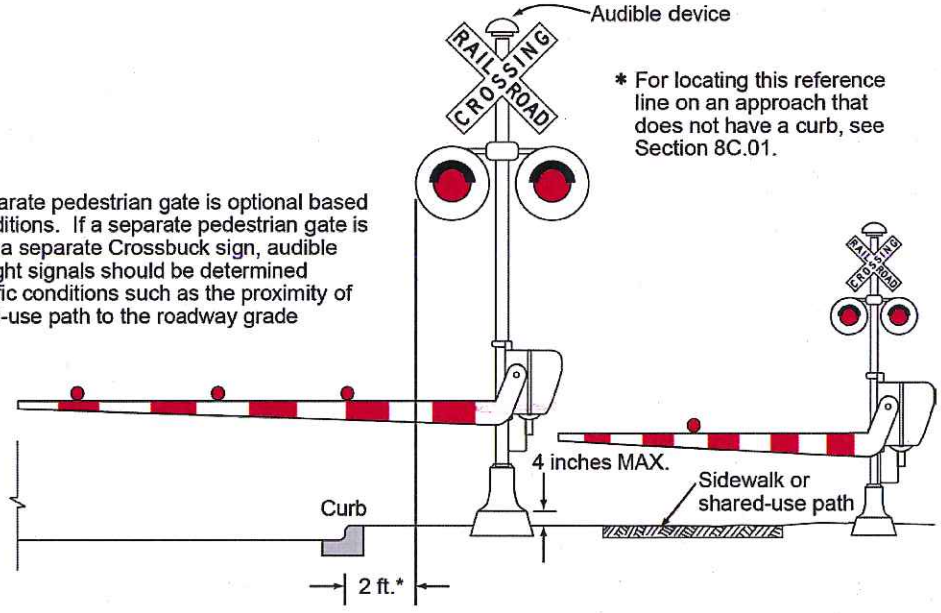
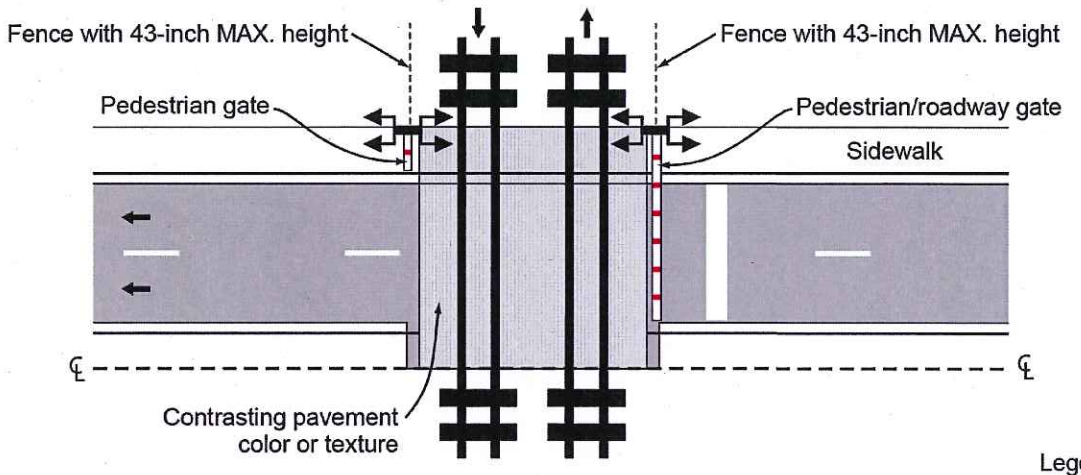


Figure 8C-6. Example of a Separate Pedestrian Gate

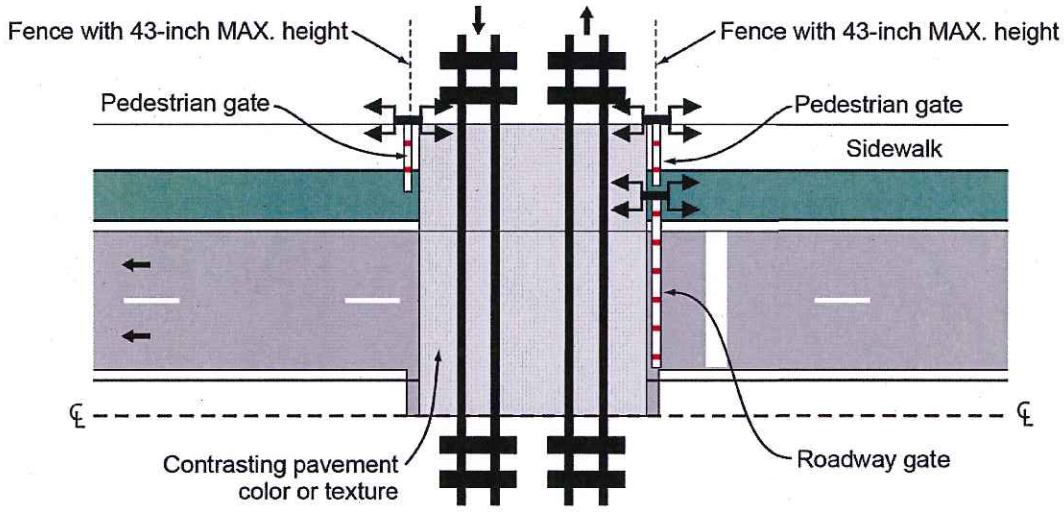


Note: The provision of a separate pedestrian gate is optional based upon site-specific conditions. If a separate pedestrian gate is provided, the need for a separate Crossbuck sign, audible device, and flashing-light signals should be determined based upon site-specific conditions such as the proximity of the sidewalk or shared-use path to the roadway grade crossing devices.

Figure 8C-7. Examples of Placement of Pedestrian Gates



GATE SUPPORT BEHIND SIDEWALK



GATE SUPPORT BETWEEN SIDEWALK AND ROADWAY

Figure 8C-8. Example of Swing Gates

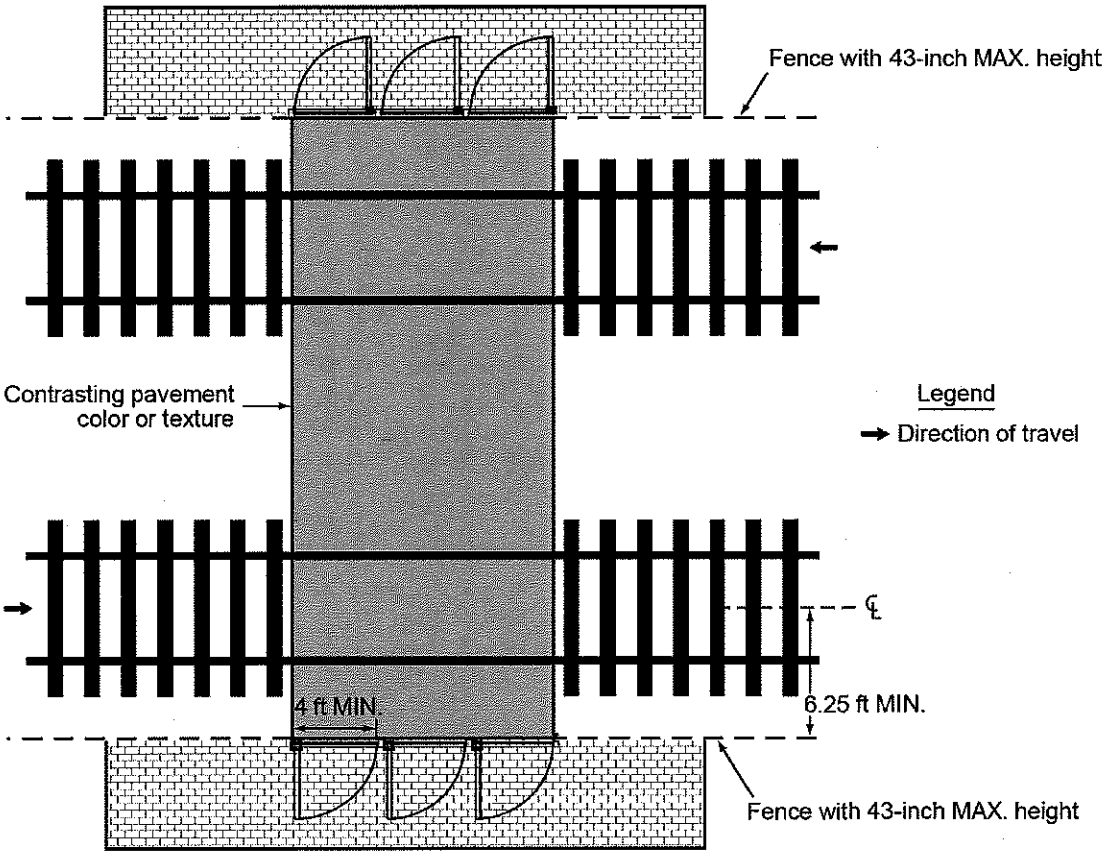


Figure 8C-9. Example of Pedestrian Barriers at an Offset Grade Crossing

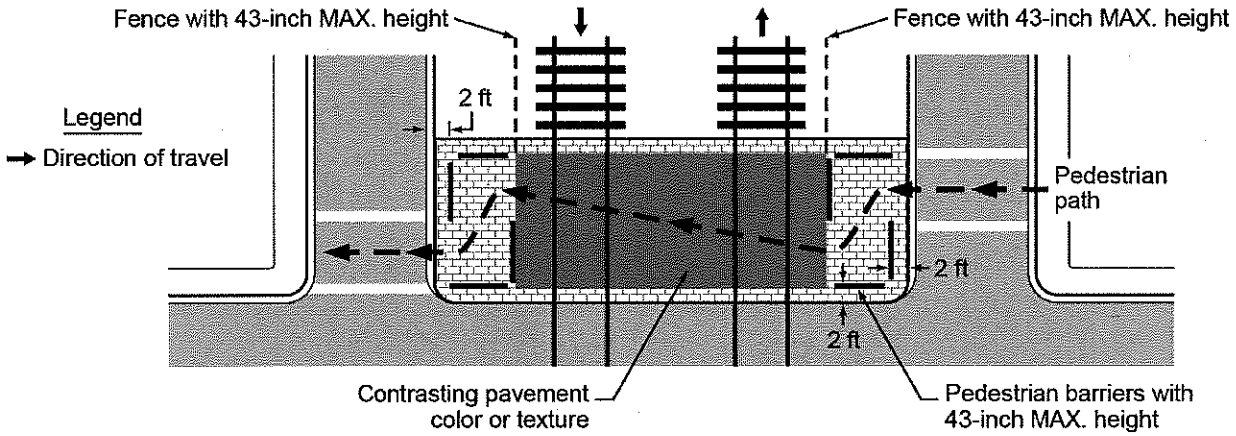
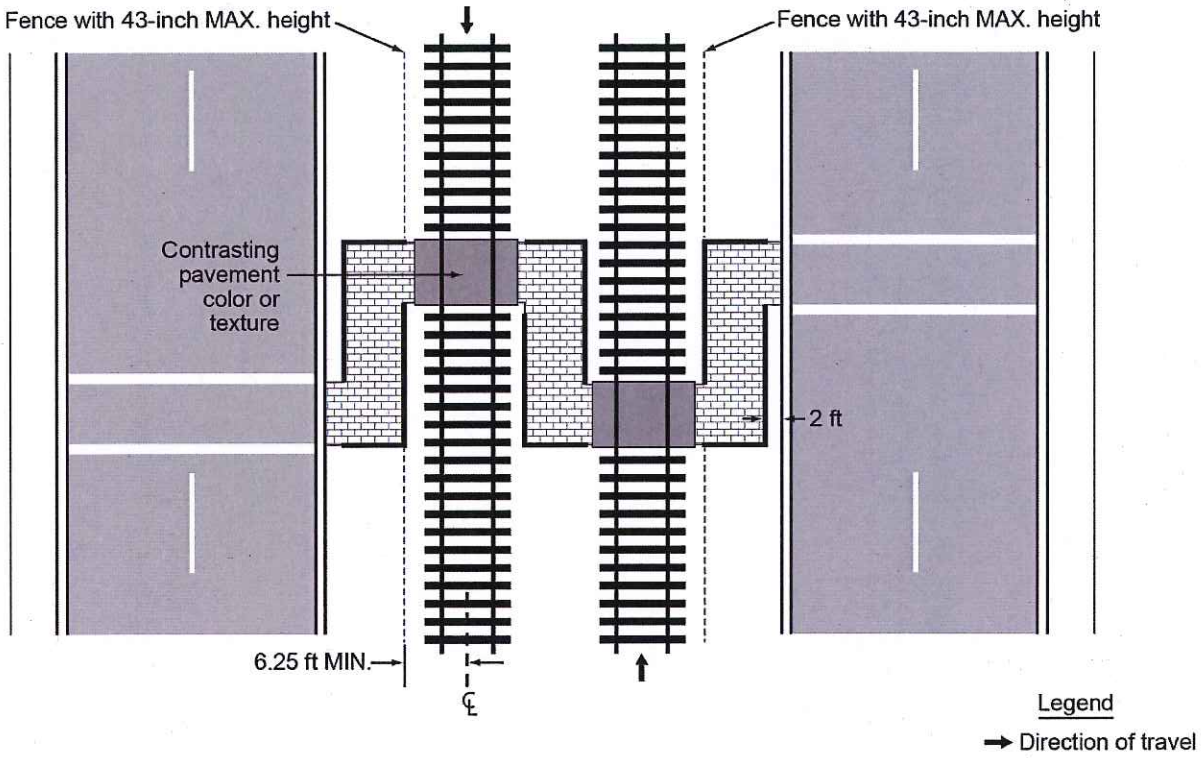
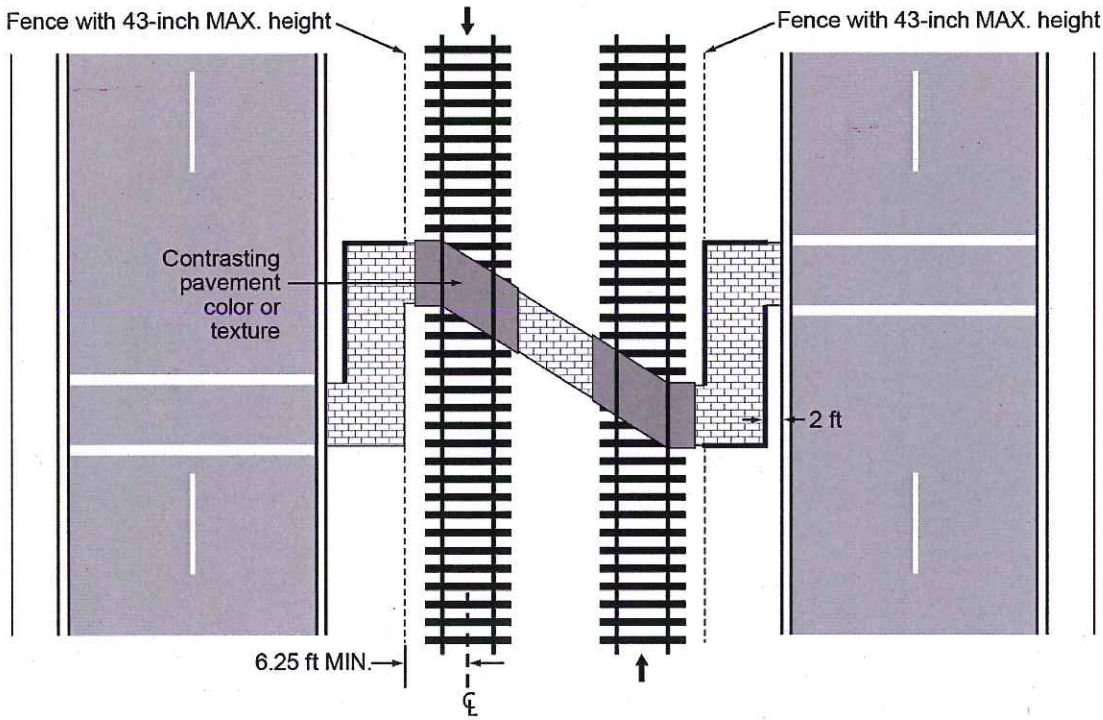


Figure 8C-10. Examples of Pedestrian Barrier Installation at an Offset Non-Intersection Grade Crossing





CHAPTER 8D. PATHWAY GRADE CROSSINGS

Section 8D.01 Purpose

Support:

01 Traffic control for pathway grade crossings includes all signs, signals, markings, other warning devices, and their supports at pathway grade crossings and along pathway approaches to grade crossings. The function of this traffic control is to promote safety and provide effective operation of both rail and pathway traffic at pathway grade crossings.

02 Except as specifically provided in this Chapter, sidewalks are considered to be part of a highway-rail or highway-LRT grade crossing rather than a pathway grade crossing, and are covered by the provisions of Chapters 8B and 8C rather than by the provisions of this Chapter. However, many of the treatments outlined in this Chapter are applicable to sidewalks adjacent to highway-rail or highway-LRT grade crossings, including detectable warnings, swing gates, and automatic gates.

03 Crosswalks at intersections where pedestrians cross LRT tracks in mixed-use alignments are covered by the provisions of Section 3B.18 rather than by the provisions of this Chapter.

Section 8D.02 Use of Standard Devices, Systems, and Practices

Guidance:

01 *The public agency with jurisdiction over the pathway and the regulatory agency with statutory authority, if applicable, should jointly determine the need and selection of devices at a pathway grade crossing, including the appropriate traffic control system to be used.*

Section 8D.03 Pathway Grade Crossing Signs and Markings

Guidance:

01 *If pathway users include those who travel faster than pedestrians, such as bicyclists or skaters, the use of warning signs and pavement markings in advance of the pathway grade crossing (see Figure 8D-1) should be considered.*

Standard:

02 **Pathway grade crossing signs shall be standard in shape, legend, and color.**

03 **Traffic control devices mounted adjacent to pathways at a height of less than 8 feet measured vertically from the bottom edge of the device to the elevation of the near edge of the pathway surface shall have a minimum lateral offset of 2 feet from the near edge of the device to the near edge of the pathway (see Figure 9B-1).**

04 **The minimum mounting height for post-mounted signs on pathways shall be 4 feet, measured vertically from the bottom edge of the sign to the elevation of the near edge of the pathway surface (see Figure 9B-1).**

05 **Pathway grade crossing traffic control devices shall be located a minimum of 12 feet from the center of the nearest track.**

06 **The minimum sizes of pathway grade crossing signs shall be as shown in the shared-use path column in Table 9B-1.**

07 **When overhead traffic control devices are used on pathways, the clearance from the bottom edge of the device to the pathway surface directly under the sign or device shall be at least 8 feet.**

Section 8D.04 Stop Lines, Edge Lines, and Detectable Warnings

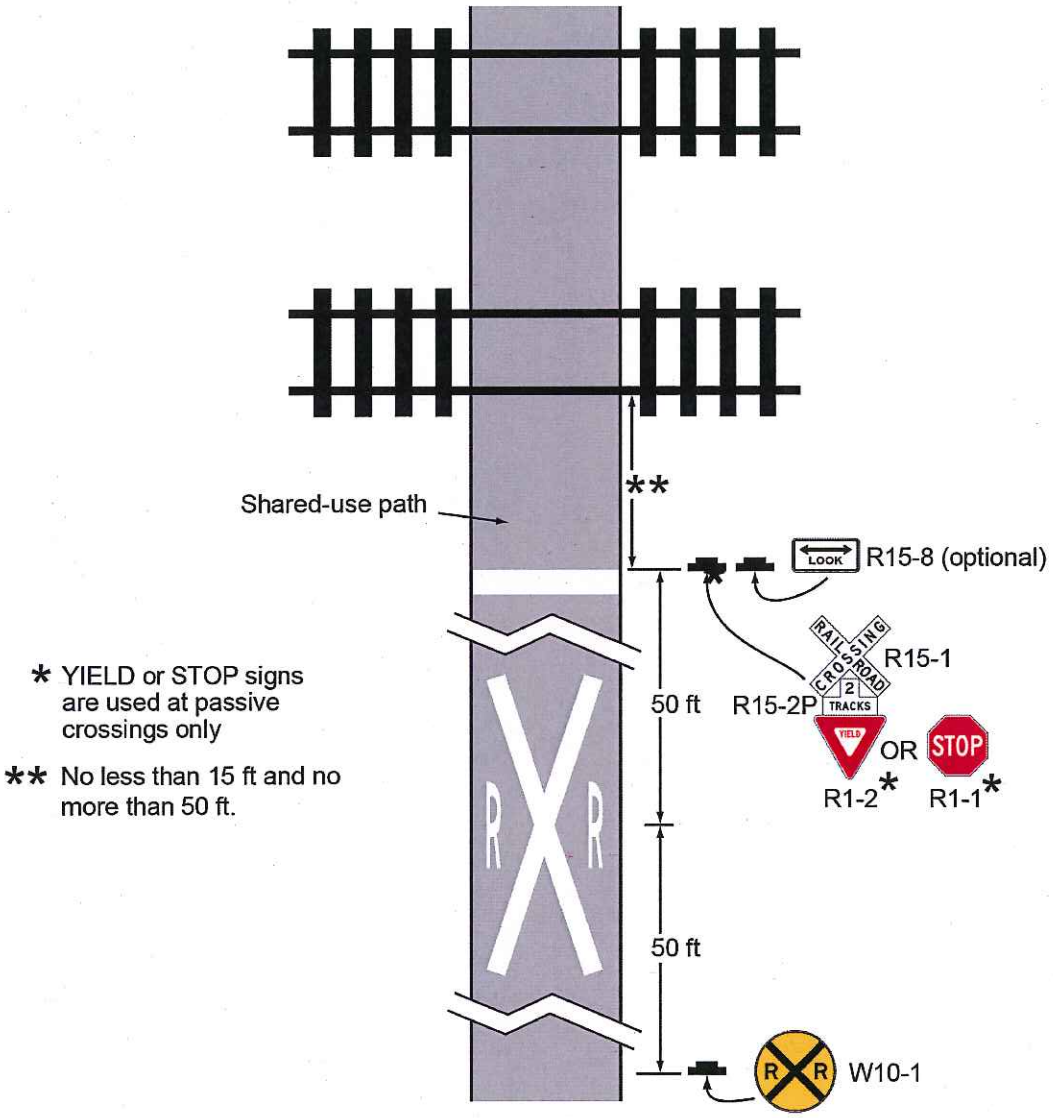
Guidance:

01 *If used at pathway grade crossings, the pathway stop line should be a transverse line at the point where a pathway user is to stop. The pathway stop line should be placed at least 2 feet further from the nearest rail than the gate, counterweight, or flashing-light signals (if any of these are present) is placed, but no less than 15 feet nor more than 50 feet in advance of the nearest rail (see Figure 8D-1).*

Option:

02 Edge lines (see Section 3B.06) may be used on approach to and across the tracks at a pathway grade crossing, a sidewalk at a highway-rail or highway-LRT grade crossing, or a station crossing to delineate the designated pathway user route.

Figure 8D-1. Example of Signing and Markings for a Pathway Grade Crossing



Support:

03 Edge line delineation can be beneficial where the distance across the tracks is long, commonly because of a skewed grade crossing or because of multiple tracks, or where the pathway surface is immediately adjacent to a traveled way.

04 Detectable warning surfaces (see Section 3B.18) that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light, can be used to warn pedestrians about the locations of the tracks at a grade crossing. The "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11) contains specifications for design and placement of detectable warning surfaces.

Section 8D.05 Passive Devices for Pathway Grade Crossings

Standard:

01 **Except as provided in Paragraph 2, where active traffic control devices are not used, a Crossbuck Assembly shall be installed on each approach to a pathway grade crossing.**

Option:

02 The Crossbuck Assembly may be omitted at station crossings and on the approaches to a pathway grade crossing that is located within 25 feet of the traveled way at a highway-rail or highway-LRT grade crossing.

Guidance:

03 *The pathway user's ability to detect the presence of approaching rail traffic should be considered in determining the type and placement of traffic control devices or design features (such as fencing or swing gates).*

04 *Nighttime visibility should be considered if design features (such as fencing or swing gates) are used to channelize pathway users.*

05 *If automatic gates and swing gates are used, the pathway should be channelized to direct users to the entrance to and exit from the pathway grade crossing.*

Standard:

06 **If used, swing gates shall be designed to open away from the track(s) so that pathway users can quickly push the gate open when moving away from the track(s). If used, swing gates shall be designed to automatically return to the closed position after each use.**

Option:

07 When used in conjunction with automatic gates at pathway grade crossings, swing gates may be equipped with a latching device that permits the gate to be opened only from the track side of the gate.

Support:

08 The "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11) contains information regarding spring hinges and door and gate opening forces for swing gates.

Section 8D.06 Active Traffic Control Systems for Pathway Grade Crossings

Standard:

01 **If used at a pathway grade crossing, an active traffic control system shall include flashing-light signals for each direction of the pathway. A bell or other audible warning device shall also be provided.**

Option:

02 Separate active traffic control devices may be omitted at a pathway grade crossing that is located within 25 feet of the traveled way of a highway-rail or highway-LRT grade crossing that is equipped with an active traffic control system.

Standard:

03 **If used at pathway grade crossings, alternately flashing red lights shall be aligned horizontally and the light units shall have a diameter of at least 4 inches. The minimum mounting height of the flashing red lights shall be 4 feet, measured vertically from the bottom edge of the lights to the elevation of the near edge of the pathway surface.**

Option:

04 Traffic control devices may be installed between the tracks at multiple track crossings at stations.

Standard:

05 **The mounting height for flashing lights that are installed between the tracks at multiple track crossings at stations shall be a minimum of 1 foot, measured vertically from the bottom edge of the lights to the elevation of the near edge of the pathway surface.**

Option:

06 Automatic gates may be used at pathway grade crossings.

Guidance:

07 *If used at a pathway grade crossing, the height of the automatic gate arm when in the down position should be a minimum of 2.5 feet and a maximum of 4 feet above the sidewalk.*

08 *If used, the gate configuration, which might include a combination of automatic gates and swing gates, should provide for full width coverage of the pathway on both approaches to the track.*

Standard:

09 **Where a sidewalk is located between the edge of a roadway and the support for a gate arm that extends across the sidewalk and into the roadway, the location, placement, and height prescribed for vehicular gates shall be used (see Section 8C.04).**

Guidance:

10 *If a separate automatic gate is used for a sidewalk, the height of the gate arm when in the down position should be a minimum of 2.5 feet and a maximum of 4 feet above the sidewalk.*

11 *If a separate automatic gate is used for a sidewalk at a highway-rail or highway-LRT grade crossing, instead of a supplemental or auxiliary gate arm installed as a part of the same mechanism as the vehicular gate, a separate mechanism should be provided for the sidewalk gate to prevent a pedestrian from raising the vehicular gate.*