

MARICOPA ASSOCIATION OF GOVERNMENTS
**BICYCLE AND PEDESTRIAN
PATHWAY/RAILROAD CROSSING
RECOMMENDATIONS**

Final Report – February 2014



Prepared for:
 MARICOPA
ASSOCIATION of
GOVERNMENTS

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Regional Bicycle and Pedestrian Pathway / Railroad Crossing Recommendations

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CHAPTER 1 – INTRODUCTION AND DOCUMENT PURPOSE

1.1 STUDY PURPOSE

Throughout Maricopa County there are several existing and planned pedestrian/bicycle shared-use paths that cross railroad tracks that are not located on public streets or at intersections. At present, no regional guidelines exist for the treatment of these unique pedestrian/bicycle shared-use paths crossings of railroads. The MAG Regional Bicycle and Pedestrian Rail Crossing Recommendations establish regional recommendations that may be applied to both existing and future pedestrian/bicycle shared-use paths crossings of active railroad lines.

The Guidelines consult current United States Department Transportation (USDOT) Federal Highway Administration (FHWA) and Federal Railroad Administration (FRA) requirements and guidance, Arizona Corporation Commission (ACC) regulations, and Arizona Department of Transportation (ADOT) and Union Pacific Railroad (UPRR) standards for grade crossing equipment and signage, in order to comply with industry approved best-practices.

1.2 Background

In various instances within the East Valley of Maricopa County, existing or future planned pedestrian/bicycle shared-use paths cross or intersect railroads at locations other than existing roadways and streets. Safety is a major concern at these crossings, specifically at private roadways, canal crossings, and pathway crossings. In most cases, these crossings do not provide signage or grade crossing protection beyond what is legally required of the railroad.



A bicyclist at the Western Canal Crossing

The Western Canal/UPRR Crossing at the Chandler/Gilbert border (between Country Club Drive/Arizona Ave and McQueen Rd, south of Guadalupe Road) is an example of a pathway/railroad crossing. The Western Canal (owned by Salt River Project (SRP), which permits public access to the canal banks) is a major link in the region's bicycle/ pedestrian pathway system and is a part of the Maricopa Trail. Consequently,

this pathway is frequented by a large number of bicycle riders and pedestrians. The path along the Western Canal ends abruptly as the canal approaches the UPRR. Currently, only a stop sign warns people of the railroad crossing; there is no additional active advance warning signage to warn bicyclists or pedestrians of approaching trains. Since this crossing is recognized by federal and state agencies as a

‘private’ crossing, the existing signage present is the only component that the UPRR is legally required to install.



Western Canal Crossing of the Union Pacific Railroad, (Typical Private Crossing Sign and Emergency Notification Sign (ENS) with Crossing ID#)

The Western Canal Crossing represents one of many pedestrian/bicycle shared use path railroad crossings in the region. Others that are a specific focus of this study are:

1. Western Canal (Country Club-Guadalupe Road, Chandler and Gilbert)
2. Alameda X-Crossing (Alameda Road and Mill Ave, Tempe)
3. Consolidated Canal (Riggs Road/Arizona Avenue, Chandler)
4. Consolidated Canal - Heritage Trail (Lindsay Road/ Elliot Road, Gilbert)

5. Eastern Canal - Santan Vista Trail (Warner Road/Knox Crossroads Park, Gilbert)
6. Roosevelt Water Conservation District, East Maricopa Floodway (North of Pecos Road at Power Road/Recker Road, Gilbert)
7. Western Canal Grade Separation (Neely Road, between Guadalupe Road and Elliot Rd, Gilbert)

The locations of these seven crossings are show on the map on Error! Reference source not found.. These seven locations are referred to as the study locations within this report.

1.3 Study Stakeholders

The following stakeholders participated in development of these Guidelines: Maricopa Association of Governments (MAG), City of Chandler, Town of Gilbert, City of Tempe, UPRR, SRP, Roosevelt Water Conservation District (RWCD), Arizona Operation Lifesaver (AZOL), Arizona Bicycle Club (ABC), FRA, ACC – Railroad Safety Division and ADOT – Utilities and Railroad Engineering. The Guidelines are applicable to bicycle/pedestrian shared use path crossings throughout Maricopa County.

1.4 Project Parameters

During project scoping discussions with the UPRR, the following parameters were identified and agreed to by study stakeholders:

1. The UPRR affirms their desire to assist MAG and local agencies to find safe solutions for pedestrian and bicycle shared use path crossings with railways, particularly the seven crossings identified in the scope of work (Section 1.2).
2. In order to implement MAG Regional Bicycle and Pedestrian Pathway/Railroad Crossing Recommendations at the seven identified crossings, and the formal establishment of these crossings with appropriate safety infrastructure, two existing public crossings should be closed before one new crossing can be formally established and improved. Closure candidates do not need to be in the vicinity of the municipality that is seeking the new crossing improvement, but do need to be located within Arizona. UPRR agrees to collaborate with the MAG Region and individual jurisdictions to remedy the crossing solutions on a case by case basis.
3. Some of the seven study locations have existing private crossings on both sides of the canal bank. One side of the canal serves the pedestrian/bicycle shared use path while the other serves a maintenance vehicle access road. These are viewed as two separate crossings. The UPRR is receptive to working with communities and SRP to explore closing crossings on the maintenance vehicle side of the canal. This would require SRP maintenance vehicles to use the remaining open crossing at the pedestrian/bicycle shared use path. This closure would allow for the closed crossing to count as one (1) of the two needed closures required for credit towards improving the study at-grade crossing candidate locations. The cost of bridging that may be needed to connect one canal bank to the other for the SRP maintenance vehicles is born by the crossing improvement package.
4. UPRR supports development of a white paper that identifies the legal, indemnity, liability, and jurisdictional issues facing the regional “private crossings”.

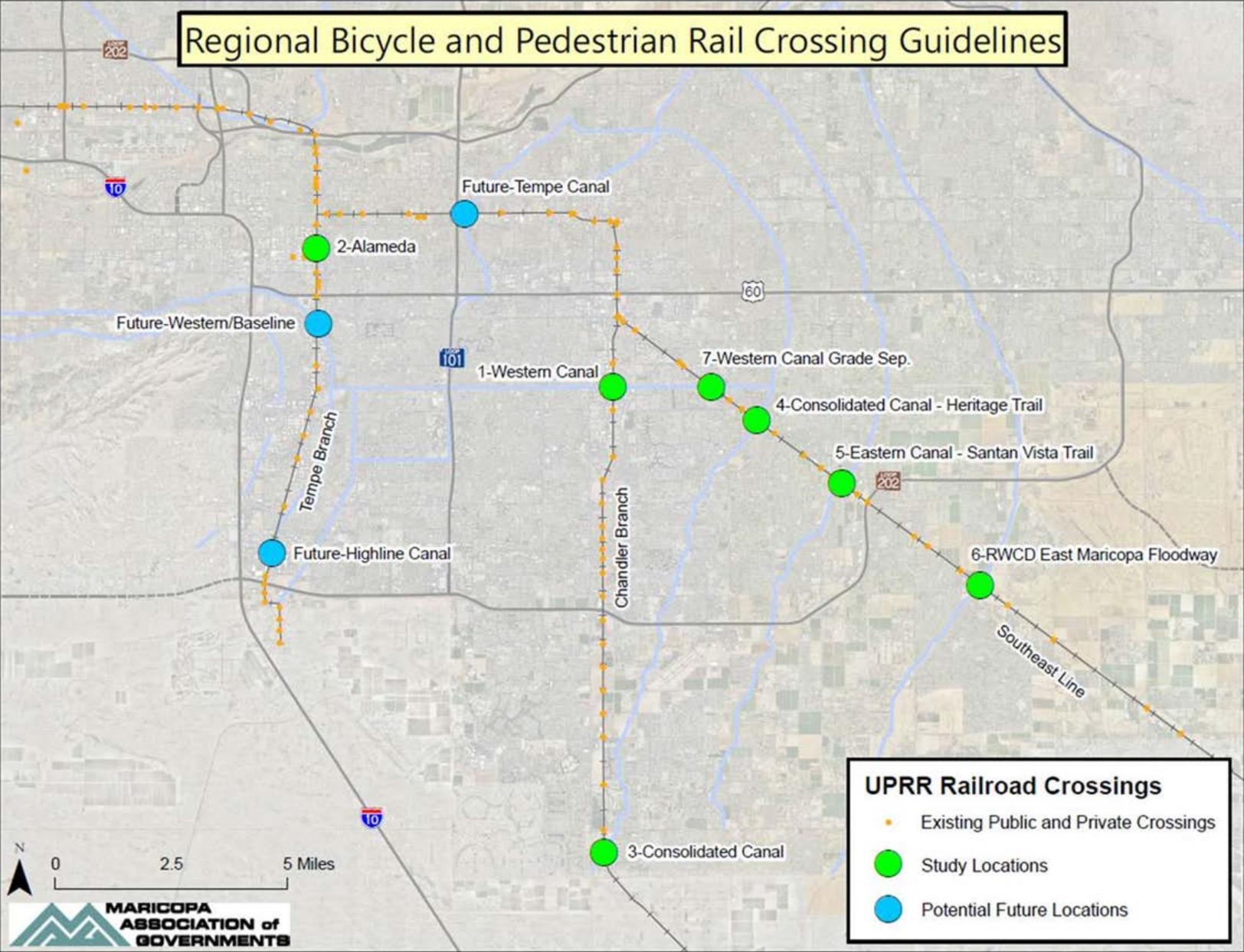
5. UPRR's official position is a preference for grade separated crossings at all crossing locations.

1.5 Regional Bicycle and Pedestrian Rail Crossing Recommendations

This recommendations document is organized into the following chapters:

- Chapter 1 Introduction and Study Background Information
- Chapter 2 Legal Context and Framework
- Chapter 3 Pedestrian/Bicycle Shared Use Path Railroad Crossing Recommendations
- Chapter 4 Field Review Observations and Site Recommendations
- Chapter 5 Improvement Crossing Process

Figure 1-1. Existing and Future Pedestrian/Bicycle Railroad Crossings Locations



CHAPTER 2 – LEGAL CONTEXT AND FRAMEWORK

2.0 LEGAL CONTEXT AND FRAMEWORK

Union Pacific Corporation is one of the largest transportation companies in the United States. Its principal operating company, UPRR serves 23 states across the western United States.

SRP is a quasi-governmental utility serving Central Arizona. SRP is one of the largest raw-water suppliers in Arizona, delivering approximately 1 million acre-feet of water annually to a 375-square-mile service area. SRP manages an extensive system of reservoirs, wells, canals, and irrigation laterals.

East Valley incorporated cities and towns provide services to their residents. Cities and towns have an interest in providing services, recreational opportunities, and transportation facilities to their residents. They also have an interest in providing for public safety.

The ACC is a state agency charged with oversight and regulation of public utilities. This includes oversight of railroads when they interact with City streets and public spaces.

These four entities all have vested interests in and legal history with these specific study location crossings, as well as crossings state wide.

2.1 Arizona Corporation Commission

Title 40-337 of the Arizona Revised Statutes grants the ACC power of commission over railway crossings with public roadways. The ACC determines the manner, location and terms of railroad crossings. Further, the ACC can order the establishment of new railroad crossings if such a crossing is found that

ARS. 40-337. Power of commission over railway crossings

A. No public highway or street shall be constructed across the track of any railroad at grade, nor shall the track of any railroad corporation be constructed across the track of any other railroad at grade, without the permission of the commission, but this provision shall not apply to the replacement of lawfully existing tracks. The commission may refuse permission or grant it upon such terms and conditions as it prescribes.

B. The commission shall have the exclusive power:

1. To determine and prescribe the manner, including the particular point of crossing, and the terms of installation, operation, maintenance, use and protection of each of the crossings.
2. To alter or abolish crossings.
3. To prescribe the terms upon which and the proportions in which the expense of the alteration or abolition of the crossing shall be divided between the parties affected or in interest.

C. When the commission finds that public convenience and necessity demands establishment, creation or construction of a crossing of a street or highway over, under or upon the tracks or lines of any public service corporation, the commission may by order require the establishment, construction or creation of the crossing, and the crossing shall thereupon become a public crossing. The commission shall have the exclusive power to prescribe the character of crossings to be constructed and maintained by railroads where their lines cross public roads or streets of a town or city.

“public convenience and necessity demands it”.

However, the regulatory authority of the ACC has not yet been applied to multi-use pathway railroad crossings. The ACC has found in the past that trail and pathway crossings are built for non-motorized vehicles, and therefore don't fall into the ACC jurisdiction over “public highway or street[s]”. This finding by the ACC was concerning a City of Flagstaff application to the ACC to commission an underpass under the BNSF railroad

In project meetings conducted for this study, ACC representatives expressed a willingness to re-examine their jurisdiction over pathway/railroad crossings. They acknowledge that these crossings are a question of public safety and therefore may, in the future, fall within the regulatory authority of the ACC.

As an example, the California Public Utility Commission does have jurisdiction over non-motorized crossings in California, and have written a set of crossing safety standards. However, as of the writing of this report, The ACC does not recognize pathways that are built for non-motorized users to be within their jurisdiction. **As a result, in Arizona, each municipality that wants to develop a pathway railroad improvement must work directly with the railroads to develop a Private Crossing Agreement.**

2.2 Union Pacific Railroad

Founded in 1862, “One of America's most recognized companies, Union Pacific Railroad links 23 states in the western two-thirds of the country by rail, providing a critical link in the global supply chain. From 2007-2012, Union Pacific invested \$18 billion in its network and operations to support America's transportation infrastructure, including \$3.7 billion in 2012. Union Pacific serves many of the fastest-growing U.S. population centers, operates from all major West Coast and Gulf Coast ports to eastern gateways, connects with Canada's rail systems and is the only railroad serving all six major Mexico gateways.”¹

The railroad lines in the East Valley of metropolitan Phoenix have been in existence since the 1880's, and have been continually operating since their construction. Towns and cities grew around rail lines as they are a source of economic activity and material goods. While not often recognized as a part of the urban transportation network, the railroad lines are integrally woven into each city's urban fabric. Since MAG is the regional transportation planning organization, the relationship between the UPRR and MAG and its member municipalities have a long history typically oriented to vehicular traffic and rail crossings. Such crossings and vehicular/ railroad interface also have well defined legal procedures.

The subject of this study, the seven pathway/railroad crossings locations, exists in a unique legal realm still being formed and explored by all parties. The lack of legal clarity needs to be recognized by municipalities as they consider making improvements to pathway/railroad crossings.

UPRR views that any non-recognized railroad crossing is an illegal crossing, and the pathway user who crosses a railroad at a non-recognized crossing is trespassing. UPRR recommends each crossing obtain a Private Use Agreement between the City and the UPRR specific only to each crossing, for each case when they have Prior Rights.

¹ http://www.up.com/aboutup/corporate_info/uprrover/index.htm¹

It is the policy of the UPRR to not issue a permit for a new crossing agreement until two other existing crossings are removed from the system. The existing crossings that can be removed do not have to be adjacent or even near the planned new crossing. However, they need to be within the same state, and the closure of an illegal crossing does not constitute a crossing closure. The crossing closures must close crossings that are currently recognized by UPRR (a list of which is included in the appendix).

Railroads in Arizona, including the UPRR, are rightfully concerned with liability and safety. Their perspective is that if a crossing is authorized and someone is injured in the future, they are at risk of liability for having authorized the crossing. Authorization of additional crossings, in their view, increases the likelihood of unwanted harm or death. These two concerns have served to coalesce UPRR's position against authorizing new non-motorized crossings.

2.3 Salt River Project

SRP is “. . .one of the nation's largest public power utilities, SRP provides reliable, reasonably priced electricity and water to more than 2 million people in Central Arizona.”² Like the railroads, the irrigation canals have been in existence for many years, their alignments often date back to pre-Columbian native inhabitants. In their current iteration, these canals have been continually operating since their reconstruction, beginning in the 1890s.³

The subject pathways primarily follow the banks of the SRP irrigation water canals. SRP is supportive of allowing recreational use on their canal banks. Recreation has been allowed for a number of years, and SRP has been permissive of it and now whole-heartedly endorses it. While allowing such recreation may present a liability hazard, they continue to allow access for the purposes of recreation.

The question of who has prior rights at each of these crossing locations is not categorically answered. In some cases the SRP has prior rights over the railroad, and in other cases the railroad has prior rights. The rights holder generally has the ability to provide the final recommendation for the crossing method and allowable uses at the intersection.

2.4 Cities and Towns

The study locations are typically at canals or sidewalks that intersect UPRR lines. The seven study locations all reside within one of three municipalities: City of Chandler, Town of Gilbert, or City of Tempe. These municipalities have an interest in providing services, recreational opportunities, and transportation facilities to their residents. They also have an interest in providing for public safety.

Increased emphasis is being placed on multimodal transportation facilities, including bicycle and pedestrian access. To respond to demands and needs of their citizens, municipalities must examine their existing and potential infrastructure for opportunities to provide for enhanced bicycle and pedestrian facilities. Some municipalities have previously engaged the UPRR and have acquired Private Use Agreements for specific crossings. A systematic, predictable, and regionally approved approach to pathway/railroad crossings would be beneficial to all municipalities.

² <http://www.srpnet.com/menu/About/generalinformation.aspx>

³ <http://www.srpnet.com/about/history/timeline.aspx>

2.5 Other Indemnification Models

Throughout the United States, a number of examples exist of pathway/railroad crossings. An increasing number of “rails-with-trails” projects provide indemnification models and examples that could be considered in Arizona and the MAG region.

As noted in *California Rails with Trails: A Survey of Trails Along Active Rail Lines*, a majority of rails-with-trails are insured by local municipality insurance and many of the railroad companies require trail/pathway managers to indemnify them against liability.

Private landowners are afforded liability protection in many states due to recreational use statutes. These statutes reduce the liability of landowners and managers who provide free public access on their land for recreational uses such as trails.

In Arizona, the Arizona Recreational Use Statute, shown in the text box on the following page, provides land owners protection for allowing recreational access to their land. The Recreational Use Statute aids the UPRR and SRP by limiting the liability of an owner or lessee from litigation from an educational or recreational user, except in the cases of “malicious or grossly negligent conduct”. In this way the Statue does protect the railroad and the utility, but it cannot stop nuisance claims.

Federally funded rail crossing improvements also have liability protections for railroads, as was decided in the supreme court decision known as the “Shanklin Decision”: The Shanklin Decision of 2000: [*Norfolk Southern Railway Co. v. Shanklin* (No. 99-312, decided April 17, 2000)] is a Supreme Court of the U.S. decision that removes liability from the railroads over allegedly inadequate warning devices at rail crossings if the equipment installed was federally funded. Justice O’Conner wrote for the Court that “[o]nce the FHWA approved the project and the signs were installed using federal funds, the federal standard for adequacy displaced Tennessee statutory and common law addressing the same subject, thereby pre-empting [Shanklin's] claim.”

Insurance can also be a means to reduce railroad liability. Of the 61 Rails With Trails operators surveyed for the paper “California Rails with Trails, a Survey of Trails Along Active Rail Lines”, all of the trail managers responded that the trails are covered by existing insurance policies that cover the city, open space, or transit entity that operates the trail”.

Arizona could follow the examples in neighboring states, and include pathway/railroad crossings intersections into their current insurance coverage. Claims are few, and the added protection could be a gesture of goodwill for the railroad.

The Arizona Recreational Use Statute (A.R.U.S.) does provide legal coverage for the UPRR from major lawsuits that can’t prove gross negligence. A recommendation of this study is to amend the A.R.U.S. in ways that UPRR and cities find advantageous to the development of more pathway/ railroad crossings.

2.6 Arizona Recreational Use Statute

The Arizona Recreational Use Statute is clearly meant to provide legal protection to owners from nuisance lawsuits brought by incidental users of their facilities, and is provided herein.

Title 33 Property

Chapter 12. Liabilities and Duties on Property Use for Education and Recreation

33-1551. Duty of owner, lessee or occupant of premises to recreational or educational users; liability; definitions

A. A public or private owner, easement holder, lessee or occupant of premises is not liable to a recreational or educational user except upon a showing that the owner, easement holder, lessee or occupant was guilty of willful, malicious or grossly negligent conduct which was a direct cause of the injury to the recreational or educational user.

B. This section does not limit the liability which otherwise exists for maintaining an attractive nuisance, except with respect to dams, channels, canals and lateral ditches used for flood control, agricultural, industrial, metallurgical or municipal purposes.

C. As used in this section:

1. "Educational user" means a person to whom permission has been granted or implied without the payment of an admission fee or any other consideration to enter upon premises to participate in an educational program, including but not limited to, the viewing of historical, natural, archaeological or scientific sights. A nominal fee that is charged by a public entity or a nonprofit corporation to offset the cost of providing the educational or recreational premises and associated services does not constitute an admission fee or any other consideration as prescribed by this section.

2. "Grossly negligent" means a knowing or reckless indifference to the health and safety of others.

3. "Premises" means agricultural, range, open space, park, flood control, mining, forest or railroad lands, and any other similar lands, wherever located, which are available to a recreational or educational user, including, but not limited to, paved or unpaved multi-use trails and special purpose roads or trails not open to automotive use by the public and any building, improvement, fixture, water conveyance system, body of water, channel, canal or lateral, road, trail or structure on such lands.

4. "Recreational user" means a person to whom permission has been granted or implied without the payment of an admission fee or any other consideration to travel across or to enter upon premises to hunt, fish, trap, camp, hike, ride, exercise, swim or engage in similar pursuits. The purchase of a state hunting, trapping or fishing license is not the payment of an admission fee or any other consideration as provided in this section. A nominal fee that is charged by a public entity or a nonprofit corporation to offset the cost of providing the educational or recreational premises and associated services does not constitute an admission fee or any other consideration as prescribed by this section

CHAPTER 3 – PEDESTRIAN/BICYCLE PATHWAY/RAILROAD CROSSING RECOMMENDATIONS

3.0 PEDESTRIAN/BICYCLE PATHWAY RAILROAD CROSSING RECOMMENDATIONS

This chapter presents general recommendations for the design of public pedestrian/bicycle pathway crossings with railroads. The recommendations document the level of and type of infrastructure that should be considered at each candidate shared use path railroad crossing location. The recommendations are based on best practice research and input from study Project Management Team.



Crossing infrastructure consists of *passive* or *active* warning systems to improve non-motorist safety at highway-rail crossings. Guidance for traffic control and warning devices at public crossings is provided by the Federal Highway Administration (FHWA) and the Federal Railroad Administration (FRA)⁴.

Passive Infrastructure

Passive warning systems generally consist of static signs, pavement markings and texturing, fencing, pedestrian barriers, manual swing gates and refuge areas.

Active infrastructure



Active warning systems provide advance notice of the approach of a train, and are activated by the passage of the train over a detection circuit in the railroad track. *Active warning systems* contain elements such as flashers, warning lights, gate arms, variable message signs, and audible devices to attract the attention of the driver or pathway user, slow them down, or stop them for the crossing.

Active warning devices should be considered at crossings with high pedestrian traffic volumes, high train speeds or frequency, extremely wide crossings, complex highway-rail grade crossing geometry with complex right-of-way assignment, school zones, inadequate sight distance, and/or multiple tracks. The

*Active At-grade crossing,
Automatic Pedestrian Gate
Source: Rails-with-Trails: A Preliminary
Assessment of Safety and Grade Crossings, Nov.*

⁴Guidance of Traffic Control at Highway Rail Grade Crossings, U.S. Department of Transportation, Federal Highway Administration, November 2002

guidance states that all pedestrian facilities should be designed to minimize pedestrian crossing time and devices should be designed to avoid trapping pedestrians between sets of tracks.

The *Manual of Uniform Traffic Control Devices (MUTCD)*⁵ establishes design standards and guidance for both active and passive infrastructure. Selection of passive or active infrastructure at public pathway/railroad crossings must consider a number of factors including cost, geometric conditions, surrounding land use, frequency of trains, frequency of bicyclists and pedestrians, and available right of way.

3.1 Shared Use Path Railroad Crossings Infrastructure Selection Flowchart

As mentioned, a number of factors must be considered when deciding upon the appropriate safety warning equipment. Error! Reference source not found. presents a decision-matrix flowchart to help one to determine the level of improvements at the pedestrian/bicycle pathway crossing with a railroad. The decision-matrix flowchart is based upon a similar flowchart; FHWA Guidance of Traffic Control at Highway Rail Grade Crossings. The flowchart herein is developed more fully and specifically to meet local considerations. The flowchart begins with a review of selection criteria or warrants for crossing infrastructure. Warrants consider:

1. High Train Speed
2. Restricted Sight Distance or Geometry Constraints
3. Train Frequency or Multiple Tracks
4. School Zone
5. High Pedestrian Activity Level

The flowchart links each of the above criteria with recommended infrastructure. Potential pedestrian and bicycle shared use path railroad crossing elements include:

- Signage
 - *Regulatory* (i.e. Yield, Stop, Crossbuck), *Advance Warning* (i.e. RR ahead)
- Pavement Marking – (i.e. Stop/Yield Lines, RR Grade Crossing symbol)
- Channelization –
 - *Paving* (i.e. Sidewalk)
 - *Delineation* (i.e. Change of pavement texture or pavement materials, landscaping, painted lines on pavement)
 - *Barrier*
 - Separation(vegetation, vertical slope, ditch/berm)
 - Fencing (bollard, railing, post & cable, concrete wall)
 - Controlled Access (i.e. Bedstead barrier or Z crossings)
- Flashing Lights, Audible Signals
- Automatic Pedestrian Gates

⁵ Manual of Uniform Traffic Control Devices, Chapter 8D. Pathway Grade Crossings, Federal Highway Administration, 2009

Figure 3-1. At Grade Crossing Infrastructure Selection Flowchart

3.2 Warrants

Warrants for at-grade and grade-separated crossing infrastructure are discussed in the following sections.

3.2.1 High Train Speed

A primary consideration in the selection of a control system is the train operating speed. A general design guideline presented herein and in the flowchart is that if the maximum operating speed for the train exceeds 25 mph, pathway/railway crossings should be equipped with active warning systems.

UPRR specifically requires active warnings on any improved crossing, regardless of train speed. Therefore active warnings are recommended for all the study crossings. However, different railroads in different communities may have different requirements and guidance. Without direction from the specific railroad, the 25 mph threshold is the suggested recommendation.

3.2.2 Restricted Sight Distance, Skewed Geometry

Another important consideration is the sight distance of the pathway user when approaching the railroad track crossing. Sight distance pertains to the visibility available to a pathway user along the track when stopped in advance of the grade crossing. This open area provides the pathway user with a view of the approaching train. Sight distance obstructions could result from signs, utility and lighting poles, vegetation, adjacent buildings, a curve in track alignment, or other obstructions. Many of these obstructions are commonly outside of the railroad or pathway right of way. These obstructions restrict the pathway users' view of the railroad upstream and downstream of the crossing.

On the approach to the pathway/railroad crossing, a pathway user should be able to see an approaching train, from either the left or right, in sufficient time to stop safely 15 ft. before the near rail. This requires an unobstructed field of vision along the approach sight triangle, the extent of which is dependent upon train speed as specified in **Table 3-1**.

In some cases, sight triangle distance restrictions cannot be corrected because obstructions within the sight triangle are on private property, or it is economically infeasible to correct the sight line deficiency. If available clearing sight distance is less than that specified below in **Table 3-1**, a combination of passive and active warning systems should be considered.

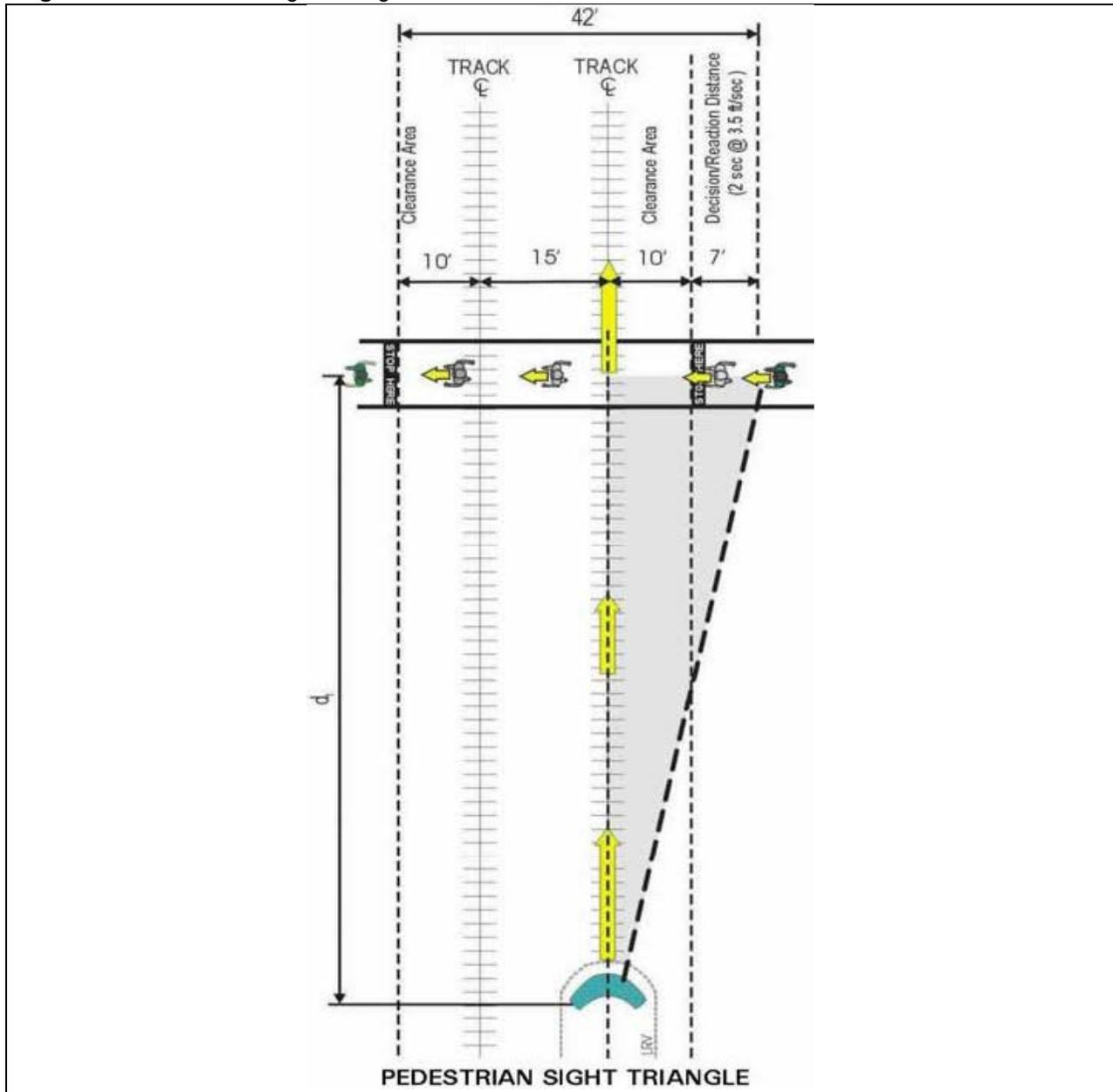
Table 3-1. Pedestrian Clearing Sight Distance Requirements

Train Speed	Pedestrian Clearing Sight Distance*
10	180
20	355
25	440
30	530
40	705
50	880
60	1060

*Walking 3.5 feet per second across two sets of tracks 15 feet apart, with a 2-second reaction time to reach a decision point 10 feet before the center of the first track, and clearing 10 feet beyond the centerline of the track.

Source: Guidance of Traffic Control at Highway Rail Grade Crossings, U.S. Department of Transportation, Federal Highway Administration, November 2002

Figure 3-2. Pedestrian Sight Triangle



Source: Guidance of Traffic Control at Highway Rail Grade Crossings, U.S. Department of Transportation, Federal Highway Administration, November 2002

Skewed Angle

The ideal crossing geometry of a pathway/railroad track crossing is a 90-degree intersection. When geometric constraints make the ideal geometry difficult to achieve because of topography or other right of way limitations, active warning systems or grade separation should be considered. Bicycle users are particularly at risk of serious crash and injury when crossings at skewed angles because of the likelihood of a wheel being caught in the flange groove, resulting in total loss of control.

3.2.3 Train Frequency or Multiple Tracks

The frequency of trains is another consideration. Pathway/railroad crossings with a high number of trains should be considered for active warning systems. High train frequency is defined as a railroad line that experiences more than 20 trains per day. Medium train frequency is defined as 10-20 train per day. Fewer than 10 trains per day is considered low train frequency. Rail lines with just 1-2 trains per day are considered very low and considered a local train.

The FHWA guidance states that at multiple track rail grade crossings of two or more in-service railroad tracks through the crossing, and where two or more trains can operate simultaneously over or in close proximity to the crossing, the presence of a train on one track can restrict or obscure the view of a second train approaching on an adjacent track. Multiple track crossings must be treated the same as any other crossing having insufficient clearing sight distance. Even where there is only one track through the crossing, but additional tracks (such as a siding) are located adjacent to, but terminate before reaching the crossing, the sight distance to the limit of where railroad cars or equipment could be stored should be evaluated.

3.2.4 School Zone

If the pathway/railroad crossing is within a school zone (defined as the area within 600' of a school boundary), or the pathway is designated as a safe walking route to school, active warning devices or grade separation should be provided.

3.2.5 High Pedestrian Activity Level

High pedestrian activity level is defined as locations where 60 pedestrians use the crossings during each of any 2 hours of a normal day or at locations where at least 40 school pedestrians use the crossings during each of any 2 hours of a normal school day.

3.3 Treatments

The following sections define specific passive warning and active warning system elements.

3.3.1 Passive Warning Systems

The design of passive warning systems is specified in the Manual of Uniform Traffic Control Devices. Section 8D specifies at-grade pathway intersections with rail. Passive crossing equipment typically consists of signing and pavement markings. General equipment required at passive rail crossings is described below. These diagrams are drawn from the MUTCD 2009. The planner/designer should consult with the latest edition of the MUTCD to confirm all signs, dimensions, and criteria.

Passive Crossing Signing

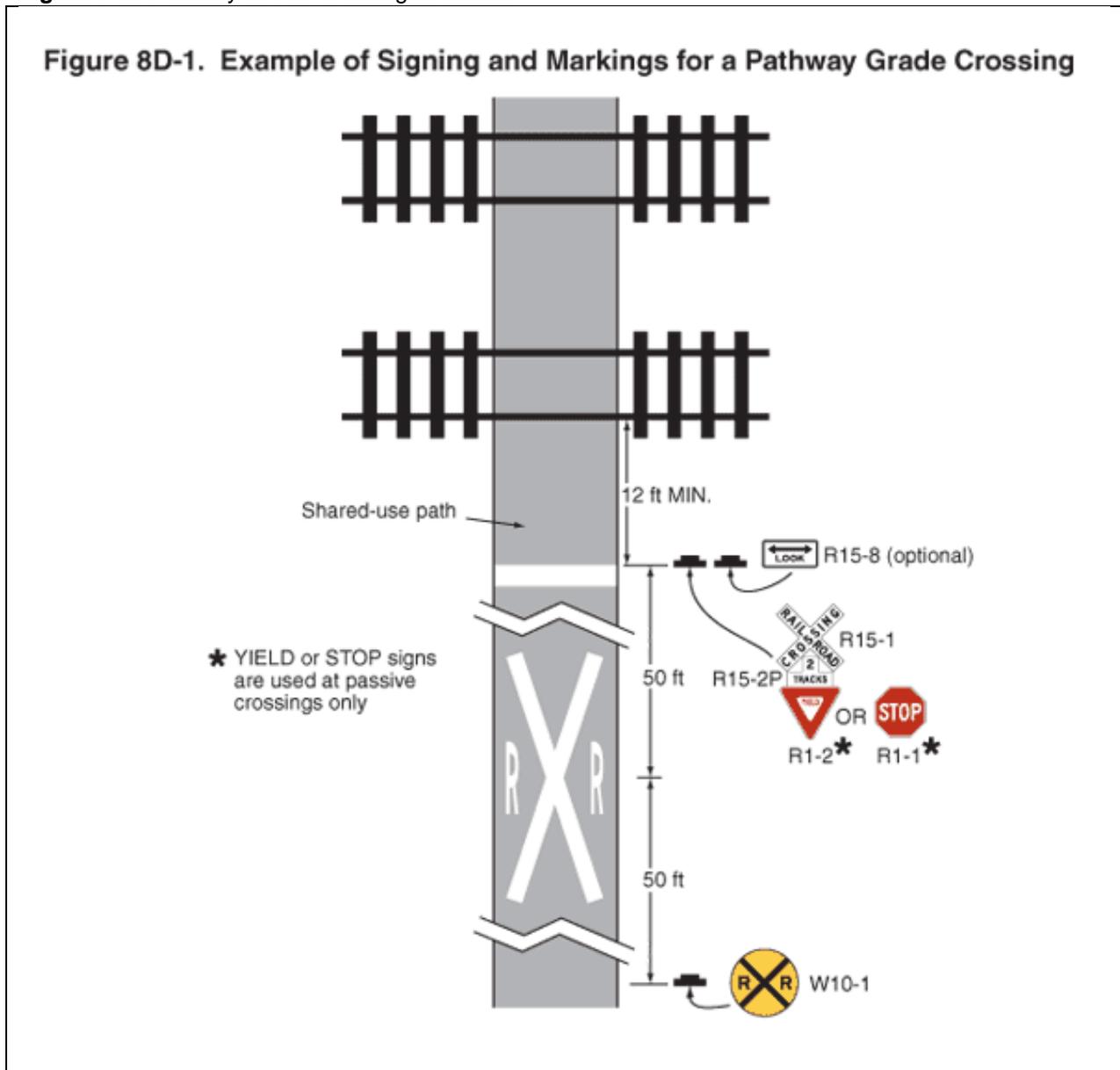
Yield Sign

Yield signs are generally installed on shared-use paths at points where bicyclist and other users have an adequate view of the railroad as they approach the sign. The MUTCD recommends that “Yield” signs be considered the default choice for traffic control at a passive crossing unless an engineering study or judgment determines that a “Stop” sign is appropriate.

Stop Sign

A “Stop” sign establishes a legal requirement for each and every vehicle to come to a full stop. Indiscriminate use of the “Stop” sign at all or a majority of passive grade crossings can cause poor compliance. Therefore, the use of “Stop” signs at passive crossings should be limited to unusual conditions where requiring all vehicles to make a full stop is deemed essential.

Figure 3-3. Pathway Grade Crossing Elements



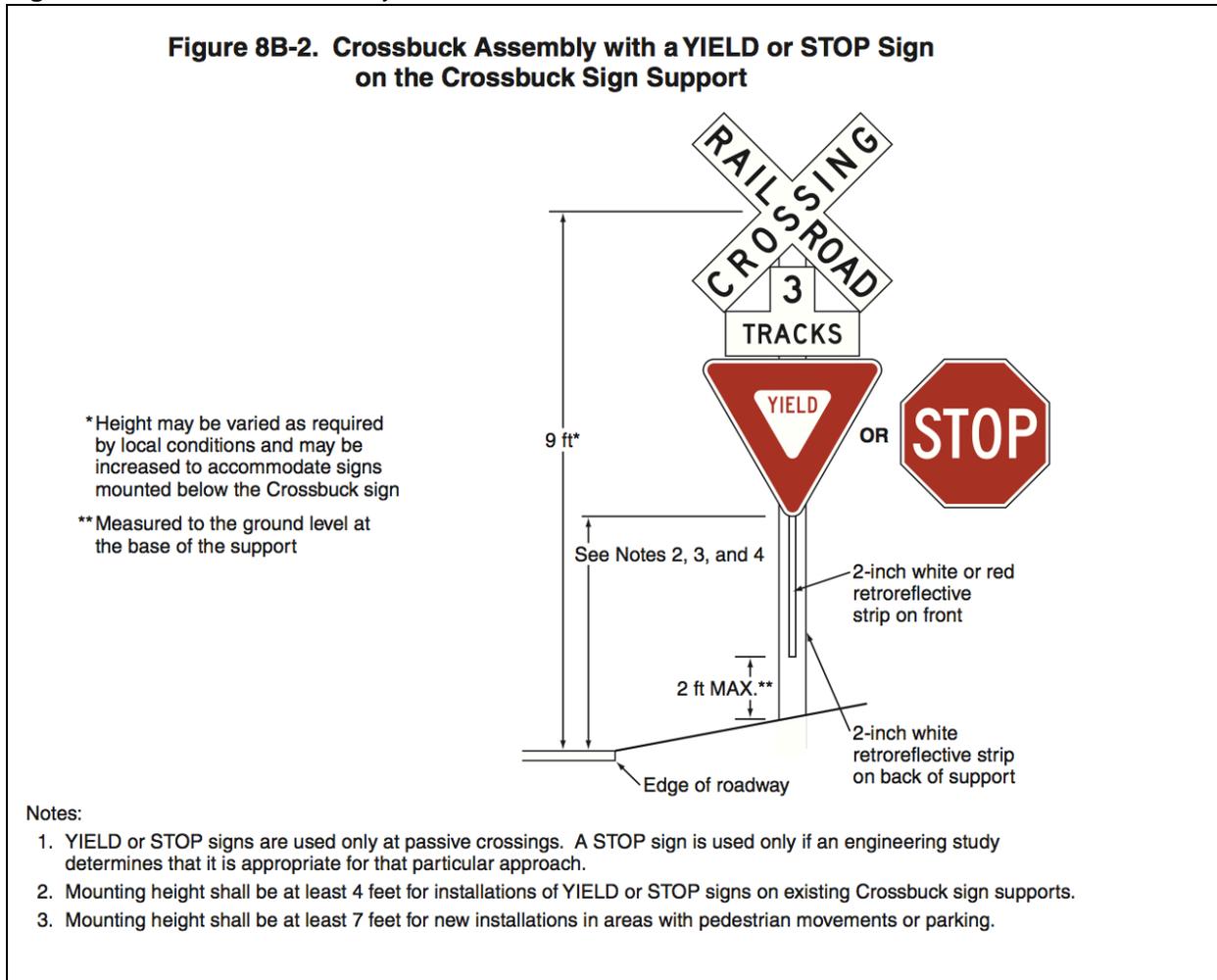
Source: Manual of Uniform Traffic Control Devices, 2009, Figure 8D-1

Crossbuck Assembly

The crossbuck assembly (**Figure 3-4**) is a basic warning sign required at all public railroad crossings that are typically installed and maintained by the railway. MUTCD Section 8D.05 states “where active traffic

control devices are not used, a crossbuck assembly shall be installed on each approach to a pathway grade crossing.”

Figure 3-4. Crossbuck Assembly



Source: *Manual of Uniform Traffic Control Devices, 2009, Figure 8B-2*

Advance Warning Sign

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”. (MUTCD 8D.03)

Crossing Pavement Markings

Pavement markings, striping and tactile warning surfaces are basic passive safety treatments that can be used by themselves or in combination with more elaborate safety elements. These are the most common solutions for shared use paths at non-signal-equipped crossings where traffic comprises a low volume of low-speed freight trains.

Striping

Colored striping is used to improve visual separation of multiple pathway users, define pathway edges, inform users of upcoming safety hazards and clearly delineate stopping or boundary locations. Striping and markings should be reflective if nighttime use is expected.

“Stop Here” Pavement Markings

The “Stop Here” pavement marking is intended to identify the safe pathway-user stopping location that is outside the RR dynamic envelope, the clearance required for the train-equipment overhang under “any combination of loading, lateral motion, or suspension failure” (MUTCD 8B.29).

“Stop Here” pavement markings should be considered where railway speeds are greater than 15 mph, in non-city environments, and/or if the safe pedestrian/bicyclist stopping site is ambiguous.



*Pavement marking example, Madison WI
Source: Rails-with-Trails: A Preliminary Assessment of Safety and Grade Crossings, Nov. 2005.*



*Pavement marking and low ground warning signage, Salt Lake City
Source: Compilation of Pedestrian Safety Devices in Use at Grade Crossings, Federal Railroad A, Jan 2008.*

Tactile Warning Treatments

Tactile warning strips provide textural difference between the treatment and the surrounding surface, and also contrast visually with adjoining surfaces, with either light-on-dark or dark-on-light contrast. Warning strips are typically used as a visual queue for the safe stopping location. The tactile-warning treatment can be used in conjunction with “Stop Here” markings or wherever detectable warning is required. The visually impaired community should be consulted when settling on a standard tactile warning design.



Tactile Warning Strip - Study Site #1
Source: Kimley-Horn and Associates, Inc.



Channelization, Burlington VT
Source: Rails-with-Trails:
A Preliminary Assessment of Safety and Grade Crossings

Channelization

Many studies on pedestrian safety at railroad crossings have noted that pedestrians tend to take the shortest route to their destination. If no pre-existing physical barriers such as buildings or walls are on site, channelization can be used to direct pedestrians and bicyclists to the preferred/designated railroad crossing. Channelization of pedestrians and bicyclists can be accomplished in a number of ways and with increasing levels of pedestrian control. Paving, such as a sidewalk, is the least restrictive and provides an area for pedestrian use. The delineation of the pathway with white edge line markings, contrasting pavement color and/or texture, in combination with directional signage can also assist in pedestrian/bicycle channelization. Barriers can include fencing, vegetation, vertical slope changes and ditches/berms. Fencing, railing, or bollards are the most restrictive and have the greatest control of pedestrian movement.

When using channelization, it is recommended to extend at least 25 feet beyond the crossing. Fencing is used along the railroad right-of-way or along the pedestrian walkway and located as close as possible to any additional warning device to minimize gaps. This would include at least 200 feet on each side of the legal crossing to discourage pathway users from taking short cuts across the tracks. To prevent trespassing onto the railroad right-of-way, fence heights are recommended to be a minimum of 4 feet, although 8 feet is the preferable pedestrian barrier height. If sight lines along the railroad tracks are limited, fence height may be restricted by other considerations. Vandal resistance, climb-ability, construction and maintenance costs are all considerations in selection of appropriate fence type and material. Fencing styles can vary considerably, from simple wood picket fence, post and cable type, chain link type, wrought-iron picket fence, wire mesh tubular steel, to non-climbable style steel fence. Some fencing examples are illustrated in Error! Reference source not found.5.

Figure 3-5. Fencing Examples



Primary arguments⁶ cited against installing fencing at crossings are installation and maintenance costs, visual impact, and the lack of effectiveness. Other reports have suggested that the use of a fence to channel trail users toward legal crossings is effective.

Fencing can also be used to create ‘Z-Crossings’ or ‘Pedestrian Barriers’. These are most commonly used when crossing a pair or more of tracks, and are designed to slow the pathway user and focus attention on the railway crossing. Fencing and the pathway are laid out in a Z pattern in an effort to slow the user and improve train awareness. Z-Crossings are **not** recommended on single tracks where trains operate in both directions. Z Crossings do not use operating elements or moving parts, and therefore offer a maintenance advantage over crossings with moving parts.

The use of a pedestrian barrier may be especially appropriate where train sight lines are restricted or in areas where users have been observed to wander or dash across the railway. As they make the turns while navigating the Z, the crossing users are forced to look in the direction of oncoming trains. Schematic for a typical Pedestrian Barrier is shown in **Figure 3-6**.

The examples and diagrams drawn from existing projects or from MUTCD are focused specifically for pedestrian use. Use of channelization and barriers in a high bicycling area will necessitate specific bicycling considerations. For example, a bicyclist crossing the tracks on a skew and not perpendicular to the rails is a recognized safety hazard. Further, fencing widths should be wide enough to accommodate both a bicycle and a pedestrian at the same time without compromising safety for either user.

⁶ Rails-with-Trails:Design, Management and Operating Characteristics of 61 Trails Along Active Rail Lines

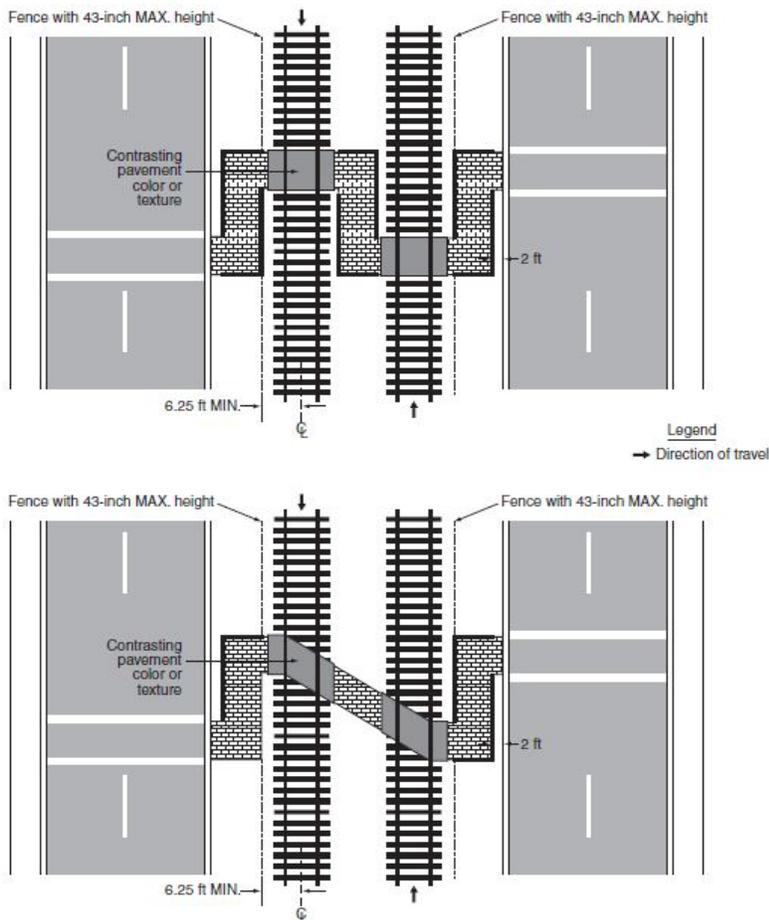
Figure 3-6. Pedestrian Barrier Example



Z-Gate

Source: *Compilation of Pedestrian Safety Devices in Use at Grade Crossings*, Federal Railroad Administration, Jan. 2008.

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



Source: *Manual of Uniform Traffic Control Devices*, 2009, Figure 8C-10

Swing Gate

Swing gates are another option to improve pathway/railroad crossing safety. Swing gates require the user to actively open the gate before proceeding across the tracks. Manual swing gates are designed to open away from the tracks, requiring users to pull the gate open to cross, but also permitting a quick exit from the track area, and to automatically close. They should also be designed to automatically return to the closed position after each use.⁷



Swing Gate

Source: Compilation of Pedestrian Safety Devices in Use at Grade Crossings, Federal Railroad Administration, Jan. 2008.

The use of swing gates may be appropriate where pedestrian and pathway sight lines are restricted or in crossing areas where pathway users have a tendency to rush. The MUTCD states that “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.”

There are several hinge designs for manual swing gates, each with specific maintenance issues. Self-closing springs incorporated in hinges can fatigue with time,

allowing gates to remain fully or partially open, thereby compromising safety. Designs that make use of an angle-cut hinge rely on gravity to return the gate to the closed position. Degradation of the contact surfaces in the angled hinges, through fatigue and distortion, can prevent the gate from closing completely and in some cases make opening difficult. Manual swing gate hinges and/or the gates themselves may also become distorted from people hanging or riding on the gate.

3.3.2 Crossing Surfaces

The path crossing’s condition, which may provide for an uneven rolling surface, needs to be considered. The AASHTO Guide for the Design of Bicycle Facilities notes, “The crossing surface itself should have a riding quality equivalent to that of the approach roadway. If the crossing surface is in poor condition, the rider’s attention may be devoted to choosing the smoothest path over the crossing. This effort may well reduce the attention given to observance of the warning devices or to the primary hazard of the crossing, which is the approaching train.”

Pathway/railroad crossings should be developed to make sure that they are compatible with all types of pathway users. ADA-accessible pathways could include tactile warning strips prior to at-grade track crossings. Pathway surface smoothness, angle of railroad crossing, and flangeway opening are all important design features to consider.

⁷ Manual of Uniform Traffic Control Devices, Section 8D.05

- The pathway approach and crossing should intersect the tracks as close to perpendicular as possible. This will help to minimize hazards associated with the flangeway gap.
- Flangeway gaps should be reduced as much as possible to prevent problems for wheelchairs, strollers and bicyclists. Use of flangeway filler material should be considered particularly in high-use areas and wherever feasible.
- The surface of the pedestrian pathway should be level and flush with the tops of the rails so as not to create a tripping hazard.
- The crossing surface should be smooth and be free of holes and gaps.
- The surface of the pathway at and in between the rails should comprise a material that is firm and stable, and will not expand, buckle or contract (e.g. textured rubber railroad crossing pad).
- The pathway approach to the tracks should be ramped with minimum possible grades, and be flat and free of any obstructions for a minimum of 5 feet on both sides of the rails.
- A solid surface is preferred to reduce the risk of errant debris being scattered onto the tracks and pathway.

Figure 3-7. Railroad Crossing Angle

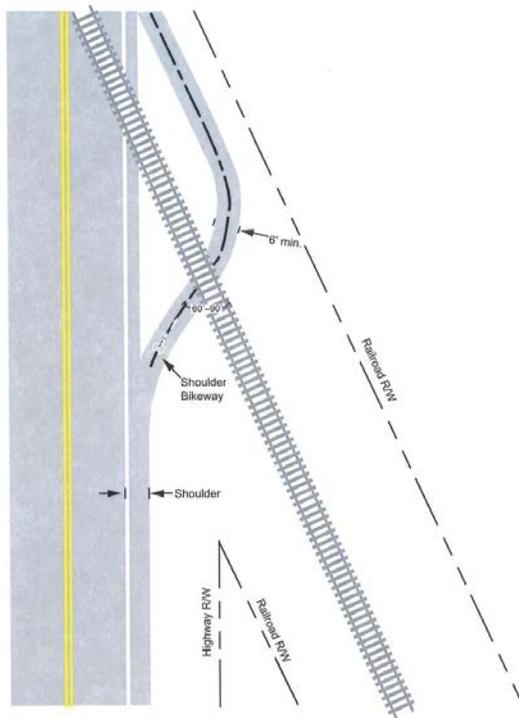


Figure 4-28. Correction for Skewed Railroad Grade Crossing—Separate Pathway

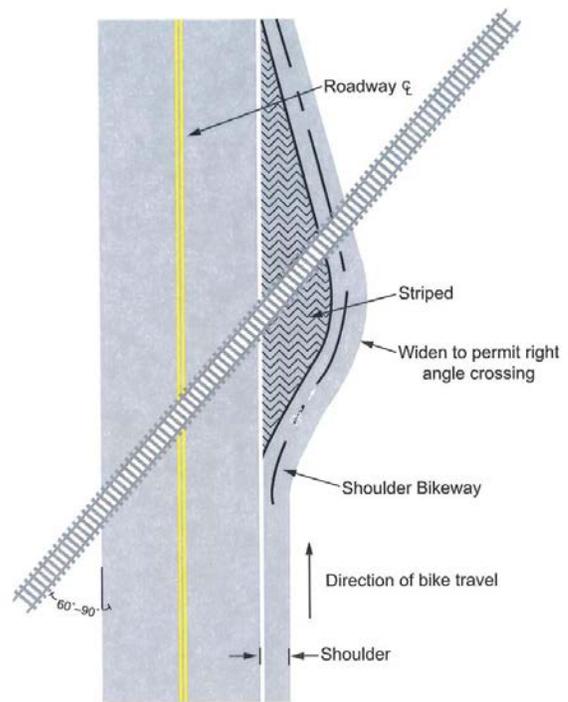


Figure 4-29. Correction for Skewed Railroad Grade Crossing—Widened Shoulder

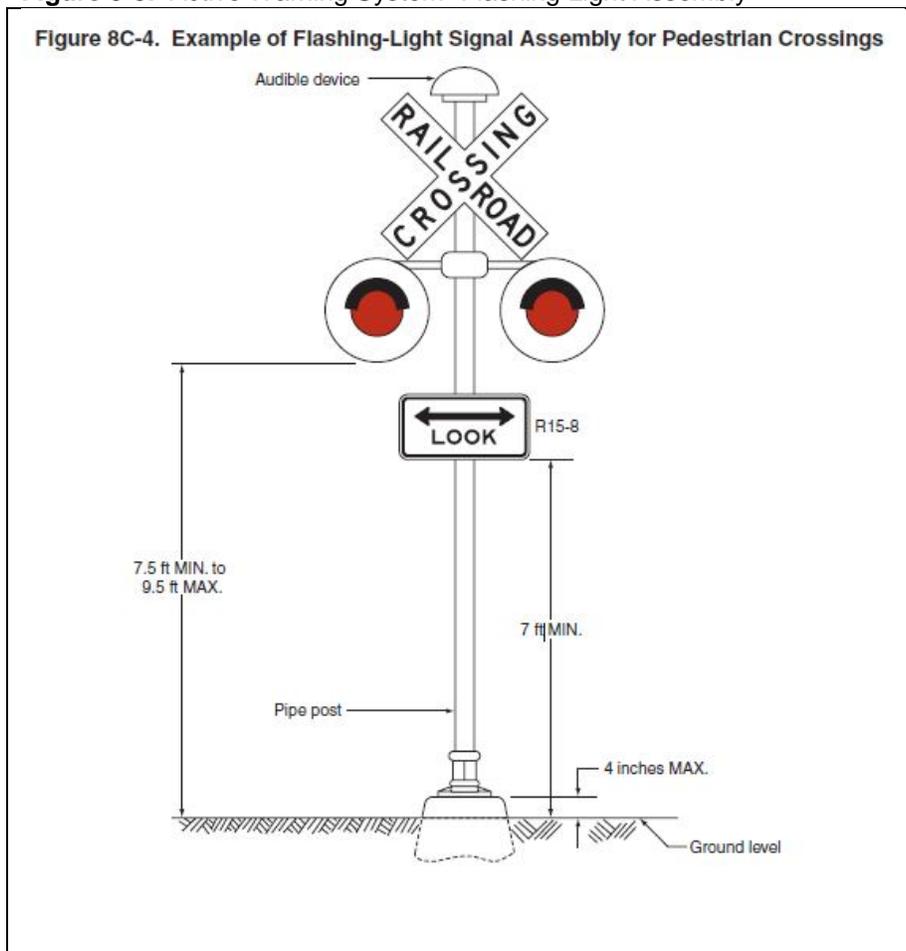
Source: AASHTO Guide for the Development of Bicycle Facilities, 2012

3.3.3 Active Warning Systems

Active warning systems are comprised of devices that are automatically activated by an approaching train and advise pathway users of the approach or imminent presence of a train at railroad crossings. These treatments may consist of flashing lights, warning signs, audible signals and automatic gates as shown in **Figure 3-8** and **Figure 3-9**. Active warning system elements are specified in the MUCTD Section 8C and Section 8D.

Individual analysis of each pathway-rail crossing is required to determine the best combinations of active safety devices. Issues to consider include train speed and frequency, sight distance, train operating characteristics and the volume of trail users.

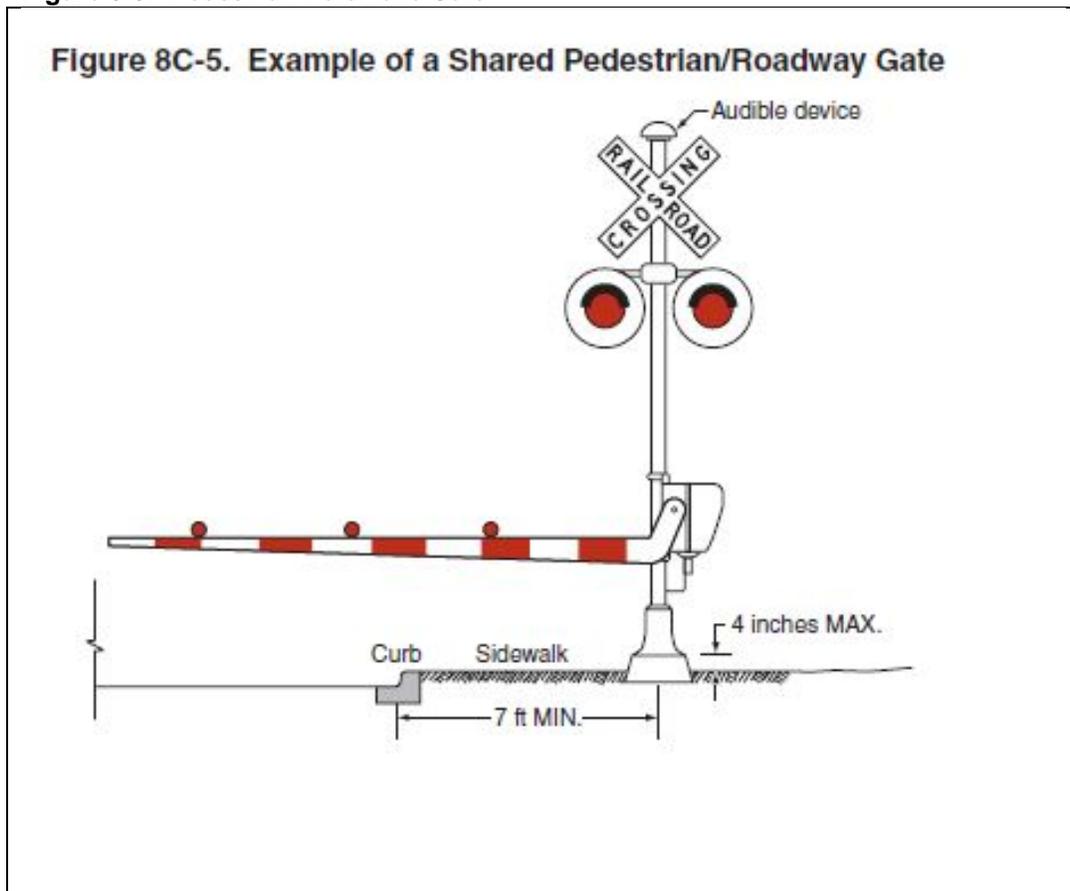
Figure 3-8. Active Warning System- Flashing Light Assembly



Source: *Manual of Uniform Traffic Control Devices, 2009, Figure 8C4*

A pedestrian gate is an automatic gate that provides an active barrier to prevent or discourage pedestrian/bicyclists from entering the right-of-way during train activity. These gates are electrically connected to and are activated by a train detection system. These gates should only be used when there are severe safety hazards or risks involved, typically when train speeds are greater than 35 mph or when pedestrian-to-train sight distance or visibility is severely limited.

Figure 3-9. Pedestrian Automatic Gate



Source: *Manual of Uniform Traffic Control Devices, 2009, Figure 8C-5*

3.4 Grade Separated Crossings

Safety at rail crossings is of utmost priority to railroad companies and state and local transportation departments. Eliminating at-grade crossings has been a priority of the Federal Railroad Administration to improve public safety. Many state governments and railroad companies have adopted a policy of not allowing new at-grade crossings. Consistent with USDOT policy, railroad companies are pursuing efforts to close existing at-grade crossings to reduce maintenance costs, improve operational efficiency, and improve safety and to reduce exposure to liability.

Under these circumstances, local agencies and railroad companies may decide that grade separation of the bicycle and pedestrian pathway/railroad crossing should be considered. Grade-separated crossings are expensive to construct and should be reserved for locations where there are high pedestrian/bicycle crossing demands and the hazards of an at-grade crossing are great. The decisions to construct must be based on long-term, fully allocated life cycle costs, rather than on initial construction costs alone.

The purpose of this section is to summarize grade separated crossing issues and design options.

3.4.1 Primary Considerations

There are many issues to consider before deciding to use a grade-separated structure.

- Is the grade-separated structure necessary?

- Have all alternate options been considered?
- How will the structure relate to the existing pathway alignment and overall network?
- What is the time/distance needed to access and cross the structure?
- What kind of approach access and clearance can be provided?
- Does the existing site topography better suit a bridge or a tunnel?
- What are the potential impacts to adjacent property?
- Are there existing site constraints, such as underground and overhead utilities, buildings, canals, etc. that would make excavation difficult and expensive?
- Can the proposed structure location provide a safe and secure environment for the user?

3.4.2 Types of Grade Separated Crossings, Cost and Constructability

Grade separated crossings can either be underpasses (tunnels) or overpasses (bridges) and should be designed to take advantage of the existing site topography. There are three basic types of structures utilized for underpasses: pre-cast concrete, cast in place or corrugated steel.

Underpasses are advantageous for convenience to the users, but are at a disadvantage when it comes to constructability. Costs of an underpass project can vary greatly. The variability of costs is generally dependent on the difficulty of the site conditions, choice of structure and aesthetic treatments.

The most common bridge (overpass) designs used today for foot and non-vehicular traffic are girder bridges, truss bridges, arch bridges, cable stay and suspension bridges. Overpasses have clear advantages in safety, minimal environmental impacts, constructability and costs. Costs for overpasses vary widely, dependent on bridge structure and material, the site size and conditions and aesthetic treatments.



Grade-Separated Underpass-Precast Arch System
Source: www.conteches.com



Grade Separated Pedestrian Overpass, Stanley Park, Vancouver, British Columbia
Source: K. Furenlid

3.4.3 Safe, Security, ADA Compliance and Functionality of All Users

Grade separated crossings should be conveniently located so that pedestrians/bicyclists are not forced to go out of their way to use them. These structures typically require extensive ramping to accommodate wheelchairs and bicyclists and when a long detour is necessary, pedestrians will often choose to cross at-grade regardless of the safety conditions. The structure must be carefully designed to meet both the existing and future railroad operational needs, meet the minimum requirements for train clearances and rail corridors, provide adequate drainage and lighting, handrails, surveillance to satisfy pedestrians' requirements of security and comfort. Grade separated structures must accommodate all persons as

required by the ADA. Information on the specifications for these structures can be found in the Revised Draft Guidelines for Accessible Public Right of Ways, United States Access Board.



*Kyrene Monte Vista Elementary School Pedestrian Grade-separated Bridge and Approach, Ahwatukee/Phoenix
Source: Google Maps*

Several studies have shown that if the travel time on the grade-separated structure were equal to the at-grade crossing time most pedestrians would use the structure. But if travel time to use the grade-separated structure were 50% longer than the at-grade crossing, the tunnel/bridge would see lower usage. To be a successful and well-used structure, the structure needs to be integrated into the overall at-grade network. A stand-alone element will not get used.

A well-lit underpass that is designed to feel open and safe is key to a successful and well-used structure. If feasible, a combination of natural and artificial lighting is preferred. Adequate approach lighting should be incorporated to balance and ease the transition from exterior to interior lit spaces. The lighting system should be designed to be vandal resistant, yet provide easy maintenance access.

3.4.4 Operational Impacts on Vehicular Movements

In designing the grade-separated structure it is important to account for clearance and loads of all potential users and scenarios: pedestrians, equestrians, bicycles, maintenance and emergency vehicles and climate effects such as wind, thermal expansion, and earthquakes. It is also important to consider impacts to railroad operations, vehicular traffic, and pedestrian movements during construction of grade separated projects.

3.4.5 Sight Line Aesthetics

Grade Separated Crossings, if above grade bridges, can dramatically impact an adjacent user's viewshed and resulting feelings of privacy.

3.4.6 Maintenance Costs

Grade separated structures require regular inspections and maintenance.

CHAPTER 4 – FIELD REVIEW OBSERVATIONS AND SITE RECOMMENDATIONS

On April 22, 2013, members of the Project Management Team visited the seven study locations. A brief review of existing conditions and illustrative site photos are presented below. An aerial photo of each site is also provided. Recommended safety elements for each site are included. UPRR conducted their own field review of all crossing locations during the Fall of 2013 and their recommendations are also included.

4.1 Site 1: – Western Canal (Country Club/Guadalupe Road, Chandler and Gilbert)

Site #1 is located where UPRR's Chandler Branch spur line intersects SRP's Western Canal. A segment of the multi-use pathway known as the Western Power line segment crosses here. The Western Power line Trail is part of the greater Sun Circle Trail that circles the Valley. The site is removed from major roads, and is halfway between N. Arizona Ave and N. McQueen Road. It can be accessed by the pathway or from the end of Nevada St. (south of Guadalupe Rd and east of N. Arizona Ave.).

The surrounding area could be characterized as mixed use, with residential and commercial developments. A wide undeveloped area is adjacent to the trail that provides a buffer to the large



Figure 4-1. Site 1 – Aerial View of Western Canal (County Club/Guadalupe Road, Chandler and Gilbert)

warehouses on the fenced properties to south. Residences line Nevada St. and parallel the railroad tracks to the north. They are visually buffered from the track by a large hedge of tamarisk trees. A large commercial storage yard filled with containers and vehicles is on the northeast side. An electrical substation is located east of the large storage yard and large (30'+) power poles line both sides of the canal.

The 8' wide concrete pathway runs along the south bank of the Western Canal and ends with tactile striping at the western edge of the UPRR right of way. The concrete pathway continues

on the east side of the tracks, but is not in alignment, and pathway users must traverse unpaved sections to meet up with the continuing concrete pathway away from the power lines, or continue along the dirt path on the canal bank. The MAG Bikeways Map shows the multi-use pathway as unpaved. The pathway is also used by utility maintenance vehicles. An unimproved roadway runs along the north bank of the Western Canal but has no official RR crossing identification number.

This railroad crossing (DOT#741663C) is an active private crossing with lumber cants/railroad ties. The surface is officially listed as asphalt with a width of 15’ (DOT RR Crossing Data). “Stop”, railroad “No Trespassing” and Emergency Notification Signs (ENS) are currently posted at the railroad right-of-way. Three bicyclists were observed on the pathway during the site visit. Per UPRR, train travel is minimal with 1 train/day operating at a maximum speed of 20 mph.

Table 4-1. Site No. 1 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed (>25 mph)	No
Restricted Sight Distance	Yes, vegetated, but not in future condition
Skewed Angle	No
High Train Frequency (> 20/day)	No (approximately 1 train per day)
Multiple Tracks	No
School Zone	No
High Pedestrian Activity Levels	No
RECOMMENDATION	Regulatory and Advance Warning Signage, Pavement Marking, Striping, Channelization, Flashing Lights, Audible Device, and Clear vegetation to open up site distance.

15% design plans of this site were prepared and are included in Appendix A. The improvements reflected in the plans represent a compromise between the Flowchart Recommendations and the UPRR general recommendations that follow. The purpose of the 15% design plans for this site is to serve as an example of design improvements that can be implemented at the other sites.

The plans reflect general recommendations identified by the UPRR as a minimum set of improvements that should be included at each site. These include:

- Install new concrete crossing surface
- Install flashing lights and audible device
- Install additional signage warning pathway users of train crossing
- Install signage directing users to stay on the pathway and not cross onto UPRR private property
- Remove vegetation on the quadrant of the crossing
- Install new crossing approaches that include tactile warning devices such as tactile warning strips or similar to warn the public and discourage bicyclists from riding their vehicles without stopping.
- Maintain and enhance ‘no vehicles’ signage
- UPRR guidelines state that improvements or designation of a new crossing requires closure of two existing legal crossings; however UPRR states that this guideline only applies to installation of new crossings. This rule does not apply to established private crossings such as Site #1.
- Execute a four-party agreement for a private crossing with public characteristics between UPRR, SRP, and the two cities.

Figure 4-2. Site 1 – Field Review Photos of Western Canal (Country Club/Guadalupe Road, Chandler and Gilbert)



4.2 Site 2: – Alameda Crossing (Alameda and Mill Avenue, Tempe, Arizona)

Site #2 is the Tempe Branch railroad crossing located where W. Alameda Dr. dead-ends west of S. Mill Ave. The tracks are flanked by residential housing to the east and commercial properties to the west. There are several schools in the vicinity; Tempe High School is 1 mile north at Mill Ave and Broadway,

and is adjacent to the Tempe Branch. Just beyond the school, the Tempe Branch is joined by the Chandler Branch.

Figure 4-3. Site 2 – Aerial View of Alameda Crossing (Alameda and Mill Avenue, Tempe)



This crossing is listed as part of a designated bike route on MAG Bikeways Map. An 8'-wide concrete pathway extends across the 150' RR easement from the end of Alameda Dr. to the commercial parking to the west. Large power poles and an unpaved utility service road run parallel along the east side of the tracks on this segment. This crossing has a set of eight concrete and steel vertical bollards at each end of the crossing. The bollards are painted

yellow, and are spaced too tightly to comfortably allow a bicyclist to ride through them without stopping or dismounting.

This is an active public pedestrian crossing (DOT #748300H). Cross bucks, ENS and "Stop" signs are currently present at the RR right of way. The surface material is officially listed as a 10-ft-wide section of asphalt and appears to be in fair condition. The bollards were installed in the late 1980's. Train travel on the Tempe Branch is limited to 1 train/day with a maximum operating speed of 20 mph. Three bicyclists and 1 pedestrian were observed using the crossing during the site visit.

Table 4-2. Site No. 2 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed (>25 mph)	No
Restricted Sight Distance	No
Skewed Angle	No
High Train Frequency (> 20/day)	No
Multiple Tracks	No
School Zone	No
High Pedestrian Activity Levels	Yes
RECOMMENDATION	Regulatory and Advance Warning Signage, Pavement Marking, Striping Channelization, Flashing lights, Audible Device. When the recommendations are implemented, the existing bollards will become obsolete and should be removed.

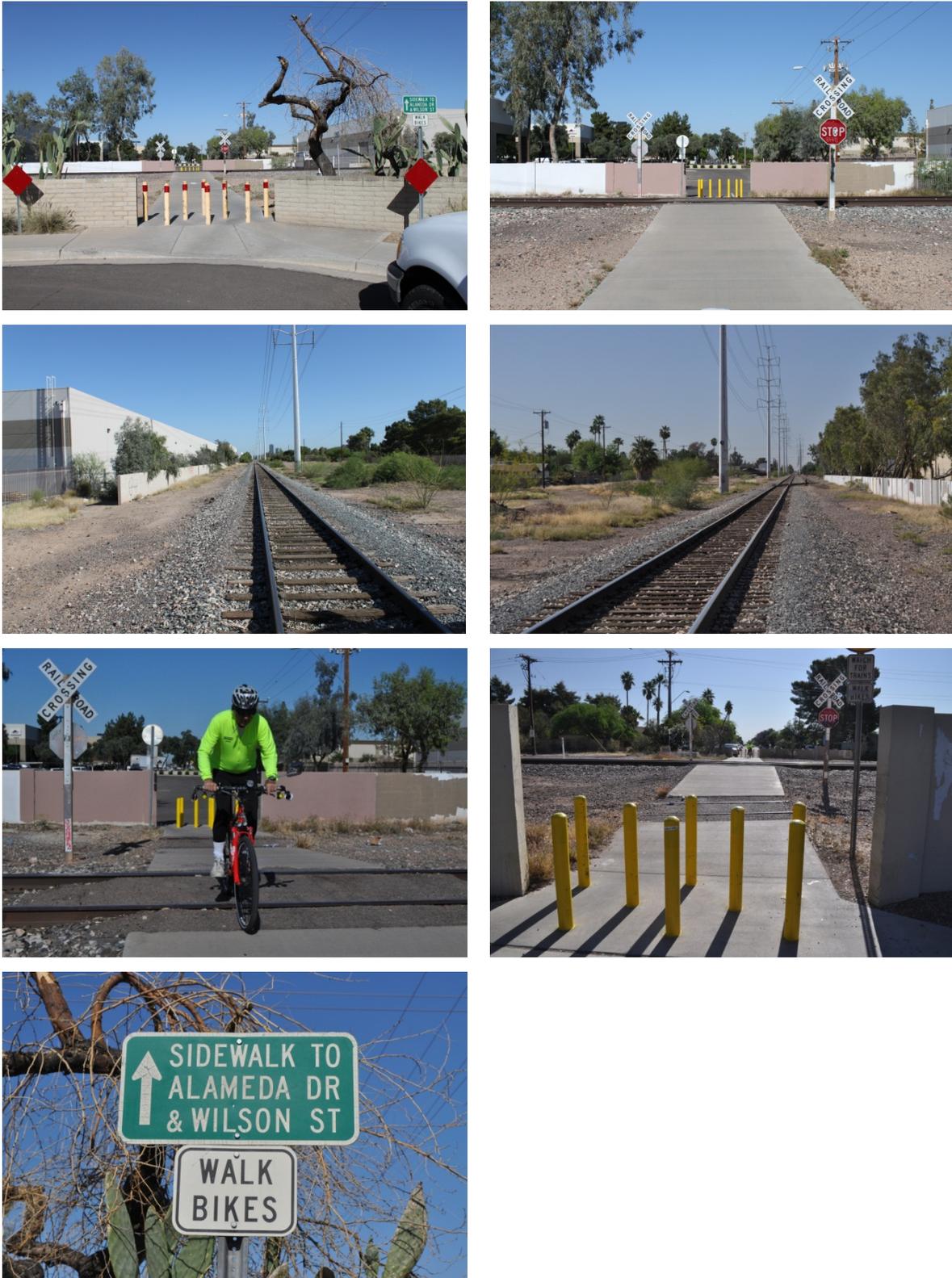
The general recommendations listed below are a minimum set of improvements suggested by **UPRR based on site visit:**

Alameda crossing, Tempe AZ

DOT 748300H - Existing public pedestrian crossing at MP 925.51 Tempe Ind Lead

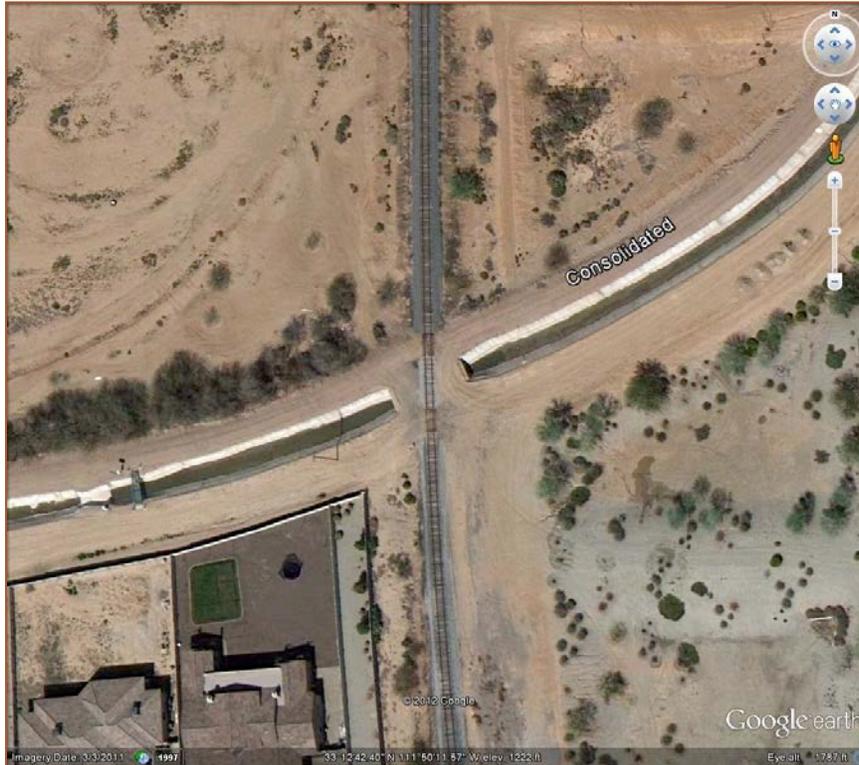
- Execute a two-party agreement for a private crossing with public characteristics between UPRR, and City of Tempe
- Install flashing lights and audible device
- Refresh/install new crossing signage and advance warning signs
- Refresh/install new pavement advance warning markings
- Replace the surface with new
- Install asphalt approaches

Figure 4-4. Site 2– Field Review Photos of Alameda Crossing (Alameda and Mill Avenue, Tempe)



4.3 Site 3: – Consolidated Canal (Riggs Road/Arizona Avenue, Chandler)

Site #3 is located where the Chandler Branch railroad tracks cross the Consolidated Canal, south of Riggs Road and east of Arizona Ave. The closest access point is at the west end of E. Santan Ct. Residential neighborhoods are along the tracks south of the canal and several commercial warehouses border the tracks on the northwest quadrant, north of the canal. The northeast section of the intersection is currently vacant but shows evidence of site earthwork and street improvements in preparation for development. A large retention basin along the residential neighborhood also serves as a buffer to the railroad tracks. The pathway along the canal bank is a designated bike route on MAG Bikeways Map and is unpaved along this segment of the Consolidated Canal. An unpaved utility service road also runs along the



opposite bank of the canal.

This crossing location is a private railroad crossing with “Stop” and “No Trespassing” signs posted at the railroad right-of-way. There are two railroad crossings, one on each side of the canal. No DOT number is posted at either crossing. The crossing surface material is a 10 ft. wide section of wood planks that are in fair condition. Currently, 1 train/day travels along this track segment operating at a maximum speed of 20 mph. No pedestrians or bicyclists were seen on the pathway during the site visit.

In order to enable closure of one of the two railroad crossings so that the other could be improved, the existing canal culvert could be extended to create room for service vehicle cross overs. This would enable service vehicles on the north side service road to cross the canal to the south side, cross the railroad at the improved crossing, and then cross back to the north side of the canal. The north side existing crossing with the railroad could then be closed and the southern crossing will be the only crossing at this location.

While it appears that these two existing crossings are not public crossings and do not have DOT numbers, (and are therefore private crossings), closing the northern private crossing will enable the southern crossing to be improved.

Table 4-3. Site No. 3 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed (>25 mph)	No
Restricted Sight Distance	No
Skewed Angle	Yes
High Train Frequency (>20/day)	No
Multiple Tracks	No
School Zone	No
High Pedestrian Activity Levels	No
RECOMMENDATION	Regulatory and Advance Warning Signage, Pavement Marking, Striping Channelization, Flashing lights, Audible Device,

The general recommendations listed below are a minimum set of improvements suggested by **UPRR based on site visit:**

Consolidated Canal (Riggs Rd/AZ Avenue) Chandler AZ

Approximately MP 935.65 Chandler Ind Lead

- UPRR views these as two illegal crossings, one located on each side of the canal
- Close one of the two crossings (per UPRR guidelines, improvement or designation of a new crossing requires closure of two existing legal crossings)
- Execute a two-party agreement for a private crossing with public characteristics between UPRR, and City of Chandler
- Install channelization devices
- Install new surface
- Install asphalt approaches, pavement markings and advance warning devices
- Install flashing lights and bell
- Perform vegetation control

Figure 4-6. Site 3– Field Review Photos of Consolidated Canal (Riggs Road/Arizona Avenue, Chandler)



4.4 Site 4: – Consolidated Canal – Heritage Trail (Gilbert)

Site #4 is located where the Southeast Line (UPRR Phoenix Subdivision) railroad tracks cross SRP's Consolidated Canal, south of E. Elliot Road and west of S. Lindsay Road in the Town of Gilbert. This

Figure 4-7. Site 4 – Aerial View of Consolidated Canal – Heritage Trail (Gilbert)



area is primarily residential with neighborhoods all along the Southeast Line tracks between Elliot and Lindsay Roads. A charter school is located south along the canal near Warner Road. The Heritage Trail is a well-used pathway located on the west bank of the Consolidated Canal. It is a designated bike route on MAG Bikeways Map and is unpaved along this segment of the Consolidated Canal. A concrete-lined lateral irrigation ditch with water-delivery gates is located between the Heritage Trail and adjacent neighborhood. An unpaved SRP service road runs along the opposite canal bank and is signed and fenced at the

Elliot and Warner Road access points. Approximately 300 ft. south of the railroad crossing is a pedestrian bridge that provides a safe option for crossing the canal.

This is an active private railroad crossing with “Stop”, “No Trespassing” and ENS signs posted at the railroad right-of-way. There are two railroad crossings, one on each side of the canal (DOT#741-822G east side and DOT #741-821A west side). The crossing surface material is officially listed as 20-ft. wide sections of sectional timber. However, current site photos show improvements have been made to the crossings. The surface material is now concrete slab with colored edge markings and asphalt approach ramps. Per UPRR, train travel along the Southeast Mainline is listed as 6-10 trains/day with a maximum operating speed of 60 mph. Three bicyclists and two joggers were observed using the pathway during the site visit.

Table 4-4. Site No. 4 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed (>25 mph)	Yes
Restricted Sight Distance	Yes
Skewed Angle	No
High Train Frequency (> 20/day)	No
Multiple Tracks	No
School Zone	No
High Pedestrian Activity Levels	No, but high weekend Heritage Trail use
RECOMMENDATION	Regulatory and Advance Warning Signage, Pavement and Pavement Marking, Striping Channelization, Flashing lights, Audible Device

The general recommendations listed below are a minimum set of improvements suggested by **UPRR based on site visit:**

Consolidated Canal (Heritage Trail) Gilbert AZ

Two existing private crossings, one on each side of the canal: DOT 741882G MP 927.72 and DOT 741821A MP 927.70 Phoenix Sub

- Execute a two-party agreement for a private crossing with public characteristics between UPRR, and Town of Gilbert
- Close one of the two crossings (per UPRR guidelines, improvement or designation of a new crossing requires closure of two existing crossings)
- Install channelization devices
- Install new surface
- Install asphalt approaches with pavement markings and advance warning devices
- Perform vegetation control
- Install flashing lights and audible device

Figure 4-8. Site 4– Field Review Photos of Consolidated Canal – Heritage Trail (Gilbert)



4.5 Site 5: – Eastern Canal – Santan Vista Trail (Gilbert)

Site #5 is located where the Southeast Line (UPRR Phoenix Subdivision) crosses SRP’s Eastern Canal. The site is removed from major roads, and is located halfway between S. Val Vista Dr. and S. Greenfield Road, just south of Warner Road.

Figure 4-9. Site 5 – Aerial View of Consolidated Canal – Heritage Trail (Gilbert)



just south of Warner Road. The closest access point is at the west end of E. Knox Road.

The surrounding area could be characterized as mixed use, with residential and commercial developments. Residential neighborhoods parallel the railroad tracks to the south. An electrical substation and the Crossroads District Park border the tracks on the north side. Crossroads District Park is a regional park with many amenities: ball fields, soccer fields, basketball, sand volleyball, tennis courts, shaded playground, Dog Park, various sized ramadas and picnic areas, a small lake used as a retention basin,

and a large amphitheater suitable for outdoor concerts. Power lines from the substation cross both the tracks and canal at precisely this intersection. The largest power poles parallel the eastern edge of railroad tracks south of the canal. Although no lines parallel along the track segment north of the canal, an unpaved utility service road does. Midsized power poles run west from the substation along the northern canal bank. Smaller power poles run the entire length of the north canal bank and along the south side of the canal, west of the of the rail/canal crossing. There are two pathways along the canal banks designated as bike routes on MAG Bikeways Map. The Eastern Canal Trail is an improved 8’ wide asphalt pathway on the north bank. The Santan Vista Trail is currently unpaved along this segment of the Eastern Canal’s southern bank. A concrete-lined lateral irrigation ditch with water-delivery gates is located between the Santan Vista Trail and adjacent neighborhood and District Park. A smaller irrigation lateral also parallels the south side of railroad tracks north of the canal. There are also two pedestrian bridges approximately 300 ft. south and 400 ft. north of the railroad crossing, which give pathway users a safe option for crossing the canal

This is an active private railroad crossing with “Stop”, “No Trespassing” and ENS signs posted at the railroad right-of-way. This crossing has two railroad crossings, one for each pathway (DOT #741827R Eastern Canal Trail and DOT #741828X Santan Vista Trail). Both surface materials are officially listed as 20-ft-wide sections of concrete slab and have asphalt approach ramps. The concrete slabs associated with the unpaved Santan Vista Trail have additional pavement marking. Per UPRR, train travel is

moderate with 6-10 trains/day operating at a maximum speed of 60 mph. Two bicyclists were seen on the paved Eastern Canal Trail during the site visit.

Table 4-5. Site No. 5 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed (> 25 mph)	Yes
Restricted Sight Distance	No
Skewed Angle	No
High Train Frequency (> 20/day)	No
Multiple Tracks	No
School Zone	No
High Pedestrian Activity Levels	No
RECOMMENDATION	Regulatory and Advance Warning Signage, Pavement and Pavement Marking, Striping Channelization, Flashing lights, Audible Device, Close Santan Vista Crossing with gates, use Eastern Canal Trail (north side) as the crossing, pedestrian bridges east and west of crossing.

The general recommendations listed below are a minimum set of improvements suggested by **UPRR based on site visit:**

Eastern Canal (Santan Vista Trail) Gilbert, AZ

Two existing private crossings, one on each side of the canal: DOT 741827R MP 921.91 and DOT 748789H MP 933.62 Phoenix Sub

- Execute a two-party agreement for a private crossing with public characteristics between UPRR, and Town of Gilbert
- Close one of the two crossings (per UPRR guidelines, improvement or designation of a new crossing requires closure of two existing crossings)
- Install channelization devices
- Install flashing lights and audible device
- Install asphalt approaches with pavement markings and advance warning devices

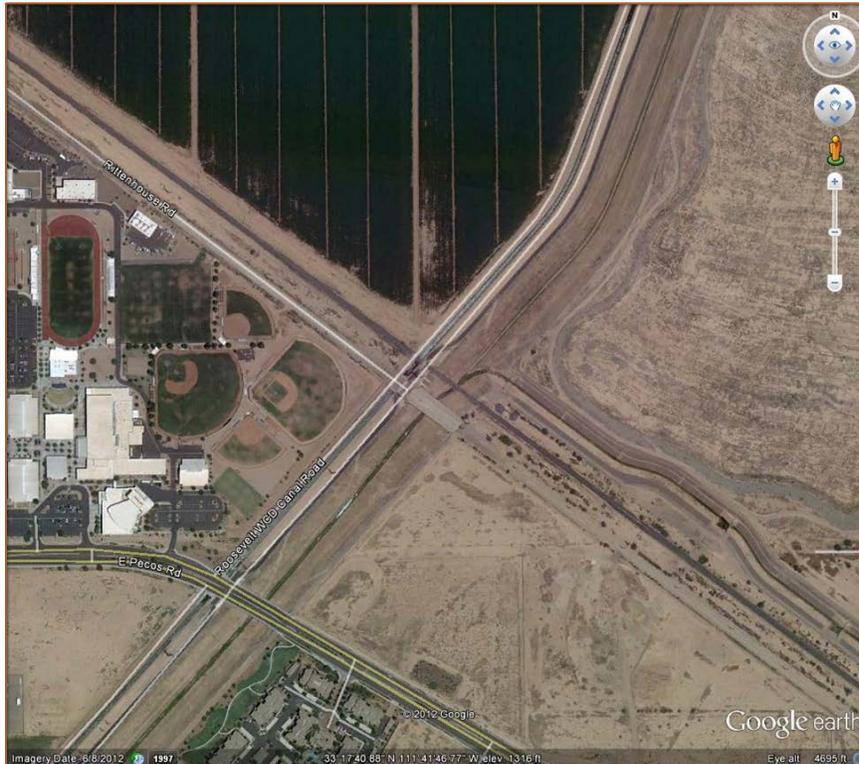
Figure 4-10. Site 5 – Field Review Photos of Eastern Canal – Santan Vista Trail (Gilbert)



4.6 Site 6: – Roosevelt Water Conservation District/East Maricopa Floodway (Gilbert)

Site #6 is located where the Southeast Line (UPRR Phoenix Subdivision) crosses the RWCD Canal, north of E. Pecos Road and west of S. Power Rd. The site is accessed by the pathway or from WCD Canal Road just off of E. Pecos Road.

Figure 4-11. Site 6 – Aerial View of RWCD/East Maricopa Floodway (Gilbert)



The surrounding area is a mixture of residential developments and agriculture fields. The residential area is primarily west of the railroad tracks. Large agricultural fields extend to the north. Higley High School and the Performing Arts Center complex are located directly west of the railroad crossing. South of the railroad crossing, the tracks run between the abandoned Rittenhouse Road and a large secondary floodway that feeds into the larger floodway along the canal. A diversion channel and the Maricopa Floodway parallel the RWCD Canal

to the south. A large tract of undeveloped land, south and east of the RWCD canal, extends east to S. Power Road. Both banks of the canal have unpaved named roadways, the RWCD Canal Road on the north bank and Main Canal Road along the south bank. Large power poles have been placed down the center of Rittenhouse Road and extend all the way to the intersection of E. Pecos and S. Power Roads. Large overhead power lines are also present along the south side of the RWCD canal beginning at the railroad crossing and continuing to the west. The unpaved multi-use pathway adjacent to Main Canal Road is a designated bike route on MAG Bikeways Map.

This railroad crossing (DOT #748790C) is an active private crossing with concrete slabs and gravel. The concrete slabs have additional contrasting edge markings but no approach ramp. While both roadways cross the tracks, only Main Canal Road has the assigned DOT #. The surface material is officially listed as plank and gravel with a width of 20' (DOT RR Crossing Data). "Stop", "No Trespassing" and ENS signs are currently posted at the railroad right-of-way. Per UPRR, train travel is moderate with 6-10 trains/day operating at a maximum speed of 60 mph. One jogger was observed on the pathway during the site visit.

This crossing is unique in that it is enclosed by residential or commercial development, and therefore presents an opportunity to build a grade separated underpass crossing on the north side of the canal. The

agriculture field north of the crossing is approximately 15’ lower than the rail grade, and enough area exists to ramp down below the tracks. This grade separated crossing could enable the existing crossing to be closed, and could be built wide enough to allow RWCD maintenance vehicles their necessary access.

Table 4-6. Site No. 6 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed (> 25 mph)	Yes
Restricted Sight Distance	No
Skewed Angle	No
High Train Frequency (> 20/day)	No
Multiple Tracks	No
School Zone	Within School Zone, not a designated safe walking route
High Pedestrian Activity Levels	no
RECOMMENDATION	Regulatory and Advance Warning Signage, Pavement Marking, Striping Channelization, Flashing lights, Audible Device

The general recommendations listed below are a minimum set of improvements suggested by **UPRR based on site visit:**

RWCD/East Maricopa Floodway, Gilbert, AZ

Two existing private crossings, one on each side of the canal: DOT 748790C MP 933.63 and DOT 748789H MP 933.62 Phoenix Sub

- Execute a two-party agreement for a private crossing with public characteristics between UPRR, and Town of Gilbert
- Close one of the two crossings (per UPRR guidelines, improvement or designation of a new crossing requires closure of two existing crossings)
- Install asphalt approaches with pavement markings and advance warning devices
- Install channelization devices
- Install flashing lights and audible device

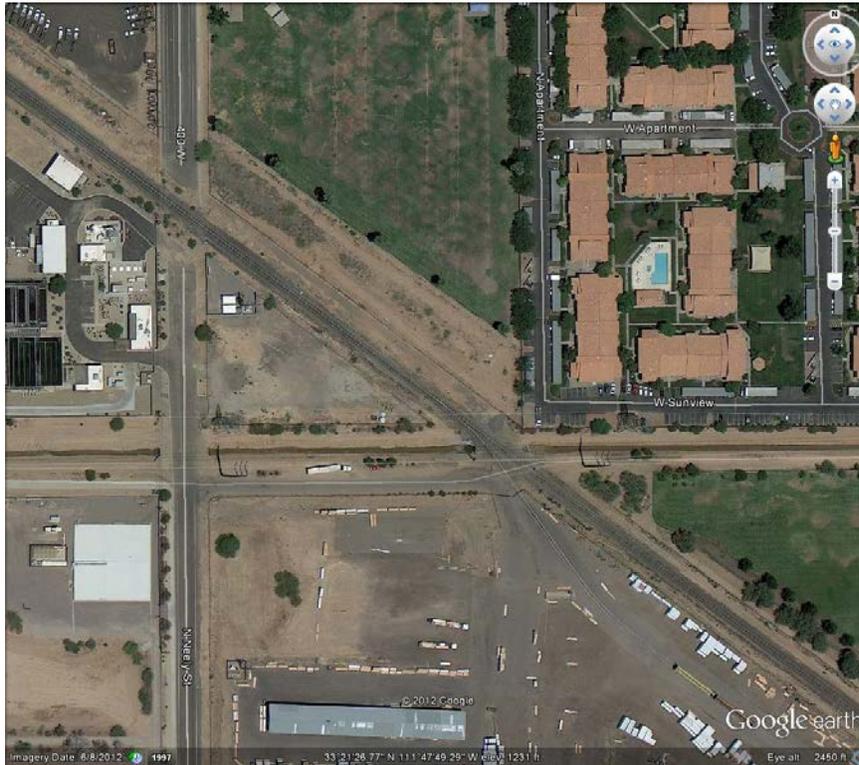
Figure 4-12. Site 6 – Field Review Photos of RWCD/East Maricopa Floodway (Gilbert)



4.7 Site 7: – Western Canal – Neely Road (Gilbert) – Grade Separated Crossing

The existing conditions review for crossing #7 is included for informational purposes only. This particular railroad crossing has become a safety concern for the Town Of Gilbert who desires to construct

Figure 4-13. Site 7 – Aerial View of Western Canal – Neely Road (Gilbert) – Grade Separated Crossing



an at-grade or grade-separated solution. The Town is currently working with a consultant for a proposed solution. Site #7 is located where UPRR's Southeast Line (UPRR Phoenix Subdivision) intersects SRP's Western Canal near Neely Road, between Guadalupe Rd and Elliot Rd in Gilbert. The multi-use Western Powerline pathway runs along the south bank of the canal and crosses both the railroad tracks and Neely Rd. The Western Canal is unlined and carries very little water in this area. Closest access to the railroad crossing is from Neely Rd. Large overhead power poles flank both

sides of the Western Canal.

The surrounding area could be characterized as mixed use, with residential and commercial developments. A public elementary school, a residential neighborhood, a town-owned retention basin, and the Town's downtown restaurant and entertainment district are all along the east side of the railroad tracks. A four-year university campus approximately one thousand feet east of the crossing is scheduled to open in 2015. The continued growth of the adjacent entertainment district and the addition of the university are projected to substantially increase trail activity at this site. The Town of Gilbert also owns the adjacent vacant property to the northwest and operates the water treatment plant located at the end of Neely St. A large lumberyard with an active railroad spur is located southwest of the railroad crossing.

From Neely St. to the active railroad spur for the lumberyard the multi-use pathway combines with a 15-foot wide asphalt frontage road, which is used by freight hauling trucks to access the lumber yard. Beyond the railroad crossing, the pathway continues unpaved for approximately 500 ft. At this point there is a pedestrian bridge giving pathway users an option for crossing the canal. The pathway also becomes a defined 8' wide concrete pathway. Just beyond the retention basin where the canal goes underground, the Western Powerline Trail passes through a small pocket park that has access to the adjacent residential neighborhood.

This railroad track segment is considered a main line and has moderate train activity with 6-10 trains/day operating at a maximum speed of 60 mph. A ‘Stop’ sign by the lumberyard was the only warning device posted. There were no UPRR informational signs present. The crossing surface material at the spur line tracks is asphalt. No crossing material was present on the main line. One bicyclist and one train were observed on the crossing during the site visit.

Table 4-7. Site No. 7 Decision Matrix Flowchart Recommendations Summary

Warrant	Description
High Train Speed	Yes
Restricted Sight Distance	No
Skewed Angle	Yes
High Train Frequency	No
Multiple Tracks	No
School Zone	Yes
High Pedestrian Activity Levels	Moderate current traffic and potentially high if a crossing were built.
RECOMMENDATION	Town of Gilbert prefers an at-grade solution but is considering a Grade Separated Crossing.

The general recommendations listed below are a minimum set of improvements suggested by **UPRR based on site visit:**

Western Canal (Near Neely Rd) Gilbert, AZ

Not a legal crossing, formally private crossing DOT 741818S MP 926.65 Phoenix Sub.

- Close one of the two crossings (per UPRR guidelines, improvement or designation of a new crossing requires closure of two existing crossings)
- Town of Gilbert is evaluating the possibility to build an overpass; UPRR strongly encourages the grade separation due to the proximity of this location of a school which have proven to attract trespassers on UPRR property
- Execute a two-party agreement for a private crossing with public characteristics between UPRR, and Town of Gilbert
- Install channelization devices
- Install asphalt approaches with pavement markings and advance warning devices
- Install flashing lights and audible device
- Install new crossing surface
- Install fencing along UPRR right of way to completely block trespassers access to UPRR property.

Figure 4-14. Site 7 – Field Review Photos of Western Canal – Neely Road (Gilbert) – Grade Separated Crossing



See Appendix A.6 for preliminary conceptual crossing plans of this crossing location.

CHAPTER 5 – IMPROVEMENT CROSSING PROCESS

This chapter describes a checklist and flowchart for improving at-grade bicycle and pedestrian pathway/railroad crossing. The checklist and flow chart are based upon the existing federal process of improving vehicular traffic safety signals at railroad crossings.

Public Crossings

Public crossings are defined as locations where a public-authority maintained highway, road, or street, including associated sidewalks or pathways, crosses one or more railroad tracks at grade. Guidance for selection of traffic/warning control devices at public crossings is provided by the FHWA and the FRA. The MUTCD (Manual for Uniform Traffic Control Devices) provides guidance for the size, colors and placement of signs, pavement markings, and traffic control devices. Further, the location of railroad crossings and the type of crossing signals required are administered by the federal or state government. (in Arizona's case by the ACC).

Public crossing signal installations and improvements are eligible for federal safety funds. Each year each state receives an apportionment of federal safety funds for the elimination of hazards at railway-highway crossings through Moving Ahead for Progress in the 21st Century Act (MAP-21) annual set-aside under 23 USC 130. The funds are set-aside from the Highway Safety Improvement Program (HSIP) apportionment. The funds are apportioned to States by formula.

The Section 130 program funds are eligible for projects at all public crossings including roadways, bike trails and pedestrian paths. Fifty percent of a State's apportionment is dedicated for the installation of protective devices at crossings. In accordance with 23 USC 130(i), the funds can be used as incentive payments for local agencies to close public crossings provided there are matching funds from the railroad. Also, in accordance with 23 USC 130(h), the funds can be used for local agencies to provide matching funds for State-funded projects. Typically Section 130 projects are funded at a 90% federal share, however certain projects under 23 USC 120(c)(1) allow for up to a 100% federal share. These include the closure of a grade crossing and the installation of traffic signs and signals.

MAP-21 requires each state to conduct and systematically maintain a survey of all highways to identify those railroad crossings that may require separation, relocation, or protective devices, and establish and implement a schedule of projects for this purpose. At a minimum this schedule is to provide signs for all railway-highway crossings.⁸

States develop the prioritized list and schedule based on criteria such as volume and type of vehicular traffic at crossing, number of daily trains, and crash history. Discussions with the railroad company begin only after the state has determined exactly which crossings are to be improved. The railroad then produces an appropriate design and cost estimate. After the state has reviewed the design and approved the estimate, the state issues an agreement to the railroad for installation. After installation, the railroad is responsible for infrastructure maintenance. The railroad cannot, on its own, install crossing signals; they must obtain permission from the state (State of Arizona Rail Safety & Security Resource Guide, November 2007).

⁸ <http://safety.fhwa.dot.gov/xings/>

Private Crossings

Private crossings occur on private roadways or property that are not open to public use and not maintained by a public entity. Consequently, these crossings are not required to have advance warning devices or other markings. In most cases, there is an agreement between the parties that governs the use of the crossing. However, if the general public is making use of a private crossing, then the FHWA recommends that the agencies review the crossing classification, make necessary changes and install the appropriate safety control devices for warning and guidance. (FHWA – Railroad-Highway Grade Crossing Handbook, August 2007).

According to the 2005 U.S. Department National Highway-Rail Crossing Inventory, there are over 97,000 private crossings in the United States. The lack of institutional oversight at private crossing has impeded implementation of federal safety improvement programs and led to unclear or inconsistently applied responsibilities. In addition, state and federal funds are not usually available for improvements at private crossings.

In response, many railroads and states have established minimum signing requirements at private crossings. These requirements typically include a crossbuck, a regulatory sign and a trespassing sign. Changes to the MUTCD in 2000 also prompted UPRR to establish an initiative to bring their public passive at-grade crossings into compliance and upgrade private crossing signage to current Union Pacific standards. New signage (crossbucks and ENS signs at public crossings and ENS and private crossing signs at private crossings) were installed at more than 18,000 crossings in 23 states.

In 2007, the State of Arizona created the Rail Safety & Security Resource Guide intended to provide information at the state level, on railroad safety and procedures, resources and contacts for coordination efforts by transportation planners.

Process Flowchart

The following Process Flowchart for pedestrian and bicycle crossings improvements at private railroad-pathway crossings are based on the procedures described in Special Issues Section 9 of FHWA – Railroad - Highway Grade Crossing Handbook, Arizona Rail Safety & Security Resource Guide, and from the UPRR website.

Before beginning a dialog with the railroad, a comprehensive inventory of existing railroad crossing infrastructure is prudent. Information to be noted in **Step 1** includes details of the railroad crossing location and type, crossing #, crossing surface and approach material, types of warning devices and signage present, location of nearest mass transit and schools, nearby development and current railroad activity. Much of the information can be obtained from a site visit and a review of a relevant aerial. For specific railroad data such as train speed, branch and movements, contact the railroad directly or visit the FRA website.

Figure 5-1. Bicycle and Pedestrian Pathway Crossing Development Process Checklist

BICYCLE AND PEDESTRIAN PATHWAY CROSSING DEVELOPMENT PROCESS CHECKLIST (PAGE 1 OF 4):

Your Name/ Agency: _____

Date: _____

Describe proposed change to Crossing: _____

STEP 1: Gather Existing Railroad Crossing Information

Crossing ID Number: _____

(This is a 7 character identification number, six numbers followed by one letter. If the crossing has a Crossing ID Number, it will be posted at the current intersection)

Is there another Crossing within ¼ mile? If so, what is the Crossing ID Number? _____

(For example, one canal may create two crossings, each with a unique Crossing ID Number and within the same corridor)

City in or near: _____

For the following information, visit the FRA website and enter the Crossing ID Number into the online query tool found here: <http://safetydata.fra.dot.gov/OfficeofSafety/PublicSite/Crossing/Crossing.aspx>

Crossing Easement Holder: *(if known)* _____

Crossing Position: ___ At-Grade | ___ RR under Roadway | ___ RR over Roadway

Crossing Type: ___ Public | ___ Private | ___ Pedestrian

Signs/Signals: ___ None | Signs: _____ | Signals: _____

Type of Warning Devices:

___ None

___ Stop Sign

___ Yield Sign

___ ENS *(Emergency Notification Sign, a blue sign with white letters providing an emergency phone number to contact and providing the crossing number)*

___ Crossbuck *(Typical railroad crossing sign in an 'X' configuration)*

___ RR Advance Warning Sign

___ Pavement Markings – Stopline

___ Pavement Marking – RR Xing Symbols

___ Gates

___ Barrier Fencing

___ Flashing Lights

___ Audible Device

___ Other

Railroad Crossing Approach Surface: ___ Asphalt | ___ Concrete | ___ Unpaved

(The approach is the area leading to the crossing, not the material directly in the crossing)

Railroad Crossing Surface:

___ Timber

___ Asphalt

___ Concrete

___ Rubber

___ Gravel

___ Other (specify): _____

Is Crossing Illuminated? _____

(Street lights within 50 feet from nearest rail)

BICYCLE AND PEDESTRIAN PATHWAY CROSSING DEVELOPMENT PROCESS CHECKLIST (PAGE 2 OF 4):

- What type of development is within 1000 feet of Crossing?**
 - Open Space (sparsely developed, lightly populated, and/or agricultural)
 - Residential (single family or multi-family residential area)
 - Commercial (retail stores, businesses, offices, and/or personal services)
 - Industrial (manufacturing, construction, factories, and/or warehouses)
 - Institutional (schools, churches, hospitals, parks, and/or community facilities)
- How near is the next available bicycle and pedestrian Crossing?** _____
- Are any schools within 1 mile of Crossing?** _____

(provide name, location and distance from Crossing)

- List the Transit Stops within ¼ mile of Crossing:** _____
(bus stops, shuttle stops, or light rails stops – name, location, and distance)

Railroad Information:

Check FRA website for additional information about this Crossing –

<http://safetydata.fra.dot.gov/OfficeofSafety/PublicSite/Crossing/Crossing.aspx>

- **Branch or Line Name:** _____
- **Quiet Zone:** Yes | No | Unknown
- **Type of Service:** _____
(AMTRAK, other - commuter, tourist, no passenger service)
- **Average Train Count Per Day:** _____
- **# Of Daily Train Movements:** _____
- **Speed of Train at Crossing:** _____
- **Type and Number of Tracks** *(main, spur, etc.):* _____
- **Does any other RR operate on this track?** Yes | No | Don't know

STEP 2: Determine if Crossing is Public or Private

- Does Railroad Crossing have a Crossing ID Number?**
 - Yes – Continue to next question
 - No – this crossing is, in the view of the Railroad, not a legal Crossing. Unfortunately this project can't continue with improvements until crossing is legally recognized by the Railroad. Proceed to **STEP 5**
- Is the Crossing Public or Private?**
 - Public – Contact Arizona Corporation Commission (ACC) to discuss modifications to railroad crossing.
<http://www.cc.state.az.us/divisions/Safety/railroad.asp>
 - Private – Proceed to **STEP 3**

STEP 3: Determine Recommended Crossing Infrastructure

Determine Recommended Crossing Elements

Apply the Crossing information collected in STEP 1 to the At-Grade Crossing Infrastructure Flowchart found in this same document (“[Bicycle and Pedestrian Pathway/Railroad Crossing Recommendations](#)”) to determine recommended infrastructure.

(Note that the UPRR prefers Grade Separated Crossings in all occasions)

- Circle the Flowchart Recommended Treatments:** _____
Signage/Crossbuck | Pavement Markings | Channelization - Paving/Delineation | Channelization - Barrier
Flashing Lights, Audible Signal | Automatic Pedestrian Gate
- Develop Preliminary Design Plans**

BICYCLE AND PEDESTRIAN PATHWAY CROSSING DEVELOPMENT PROCESS CHECKLIST (PAGE 3 OF 4):

STEP 4: Preliminary Cost Estimate

Costs below are preliminary ranges and depend on site conditions

_____	Crossbuck/Emergency Notification Sign (ENS) (\$2500 - \$5000)
_____	Active Warning and Surfacing (\$185,000 to \$400,000)
_____	Grade Separated Railroad Crossing (\$750,000 to \$4,000,000+) <i>(Cost varies on local site conditions and design)</i>
_____	Project Scoping (\$4,500 - \$25,000) <i>(This will not be a "0". May include: Survey, Environmental Determination, Hazardous Materials Assessment, and Railroad Preliminary Engineering Service Fees)</i>
_____	NEPA Compliance (\$5,000 - \$20,000) <i>(This will not be a "0". This is required whenever federal funds are a component of project construction. Complexity will be determined in the scoping document)</i>
_____	Design (\$20,000 – \$75,000) <i>(Depends on complexity, and includes Plans, Special Provisions, and Cost Estimate. Also includes Geotechnical Report, Drainage Report, Storm Water Pollution Plan – SWPPP – if disturbance is over 1 acre.)</i>
_____	Construction of At-Grade Crossing (\$20,000 - \$1,000,000) <i>(Greatly depends on project elements and complexity. Includes: Right-Of-Way acquisitions, SWPPP, site preparation, demolition, hazardous materials abatement, utility relocation, earthwork, pathway materials, pavement marking, pedestrian ADA ramp, pedestrian lighting, and signs)</i>
_____	Mobilization and Administration (\$12,000 - \$125,000) <i>(Contractor mobilization, traffic control, construction survey & layout, construction contingencies, construction administration)</i>
_____	Basic Annual Maintenance (\$4,000 to \$10,000)
Total Anticipated Project Cost	
Your Project Budget	

Proceed?

_____ Continue to **STEP 5**

STEP 5: Identify Partners

Contact Public Affairs Office or Public Project Managers at the agencies:

- Railroad, UPRR: http://www.up.com/aboutup/community/community_contacts/index.htm#13
- Railroad, BNSF: <http://www.bnsf.com/communities/contact-us/>
- Utilities, SRP: www.srpnet.com/menu/community.aspx
- Utilities, APS: <http://www.aps.com/en/communityandenvironment/Pages/home.aspx>
- Maricopa County Flood Control District *(if within a river or floodway):*
<http://www.fcd.maricopa.gov/PIO/contactUs.aspx>
- Adjacent City, Town, or County
- Arizona Department of Transportation
- Arizona Corporation Commission
- Commercial or Private Entity

BICYCLE AND PEDESTRIAN PATHWAY CROSSING DEVELOPMENT PROCESS CHECKLIST (PAGE 4 OF 4):

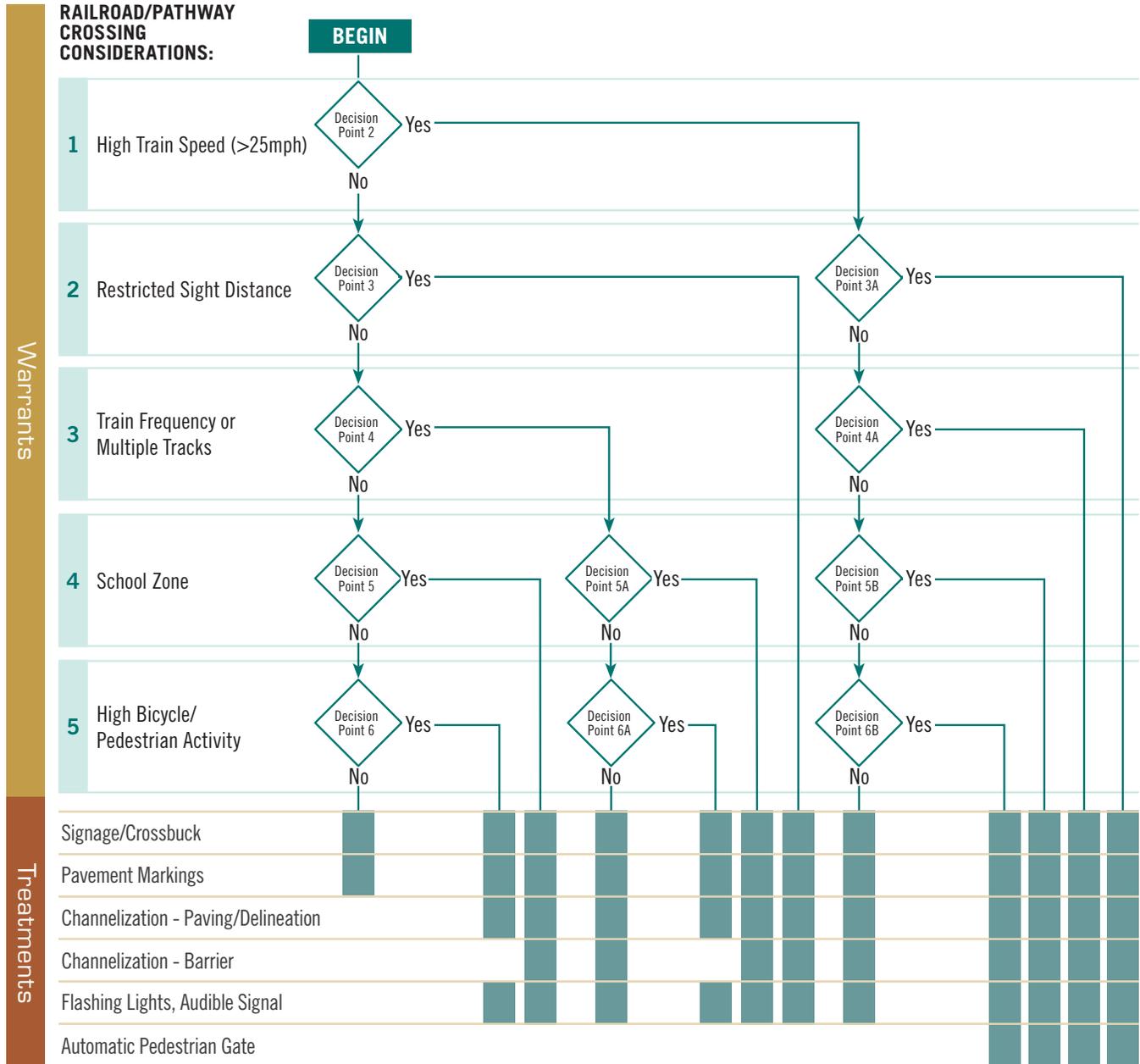
STEP 6: Official Dialog

- Start official dialog with the Railroad about Crossing Improvements**
- Setup agreement with Railroad for 'Preliminary Engineering Services'**
(This agreement includes RR field review of crossing, RR determination of required crossing safety infrastructure, design review of preliminary plans, development of cost estimates)
- Involve Partners in Design Discussions**
- Negotiate terms of liability, responsibilities and financing**

STEP 7: Construction Phase

- Before construction, set up agreements for:**
 - ___ License
 - ___ Rights of Entry
 - ___ Construction and Maintenance
(Involves Railroad, Partners, and Initiating Entity)
(Railroad will expect the City to pay for maintenance of this facility)
 - ___ Execute close out agreements between all agencies that govern use of the Crossing.

AT GRADE CROSSING INFRASTRUCTURE SELECTION FLOWCHART



APPENDIX

A.1 Benefit Cost Equation

The benefit-cost equation is an approach to inform when it becomes economically feasible to construct a grade separated crossing as opposed to an at-grade crossing. This equation was a discussion topic at a Project Management Team meeting, and part of an early iteration of this document, but has been removed from the flowchart and the report. It is shown here in the Appendix as a record of the project history, and could possibly be customized and used to study a benefit cost equation of rail crossings as well as other pathway infrastructure.

A benefit-cost equation provides a quantifiable justification for at-grade infrastructure or grade-separated infrastructure. The purpose of the benefit-cost equation is to provide a quantitative method to evaluate the question of “when do we need grade separated crossings, and when can we stick with at-grade crossings?”

The benefit-cost equation also serves as a methodology for a City/Town to assign a budgetary priority on a grade separated crossings. The proposed benefit-cost equation is:

$\$N \times (\text{Annual Crossings}) \times Y \text{ Time (years)}$

Cost of Grade Separated Crossing

- $N = \text{Value assigned to each user crossing, per event (e.g. \$2.00 per crossing event)}$
- $\text{Annual Crossings} = \text{Estimated annual number of bicyclists, pedestrians, and other users of the candidate crossing.}$
- $Y \text{ Time (years)} = \text{Number of years over which the benefit of the crossing should be considered in benefit/cost analysis}$
- $\text{Cost of Grade Separated Crossing} = \text{Estimate of probable cost of grade separated crossing.}$

If the benefit-cost ratio is **greater** than 1, a grade-separated crossing may be justified. If the ratio is less than 1, other justification should be provided for a grade-separated crossing. Other justification considerations could include:

- The pathway is on a designated safe route to school
- The crossing location has experienced serious injury or a fatality
- The site contains other geometric constraints that cannot be addressed through at-grade infrastructure

In action, the benefit-cost question asks a City/Town:

- How much is each citizen crossing worth, to you? Is each user crossing valued at \$1.00, \$2.00?
- How much use is the crossing expected to receive?
- What is the anticipated/acceptable benefit period for the grade separated crossing

Application Example No. 1:

The City/Town analyst estimates the following input variables:

- N = \$5.00 per crossing
- Annual Crossings = 10,000 per year
- Y = anticipated benefit period of 10 years
- Cost of Grade Separated Crossing = \$680,000.00.

$\frac{\$5.00 \times (10,000 \text{ crossings/year}) \times 10 \text{ years}}{\text{Cost of Grade Separated Crossing}} = \frac{\$500,000}{\$680,000} = 0.74$
--

The benefit-cost ratio is less than 1. An at-grade crossing would be recommended.

Application Example No. 2:

The City/Town analyst estimates the following input variables:

- N = \$2.50 per crossing
- Annual Crossings = 28,450 per year
- Y = anticipated benefit period of 20 years
- Cost of Grade Separated Crossing = \$750,000.00.

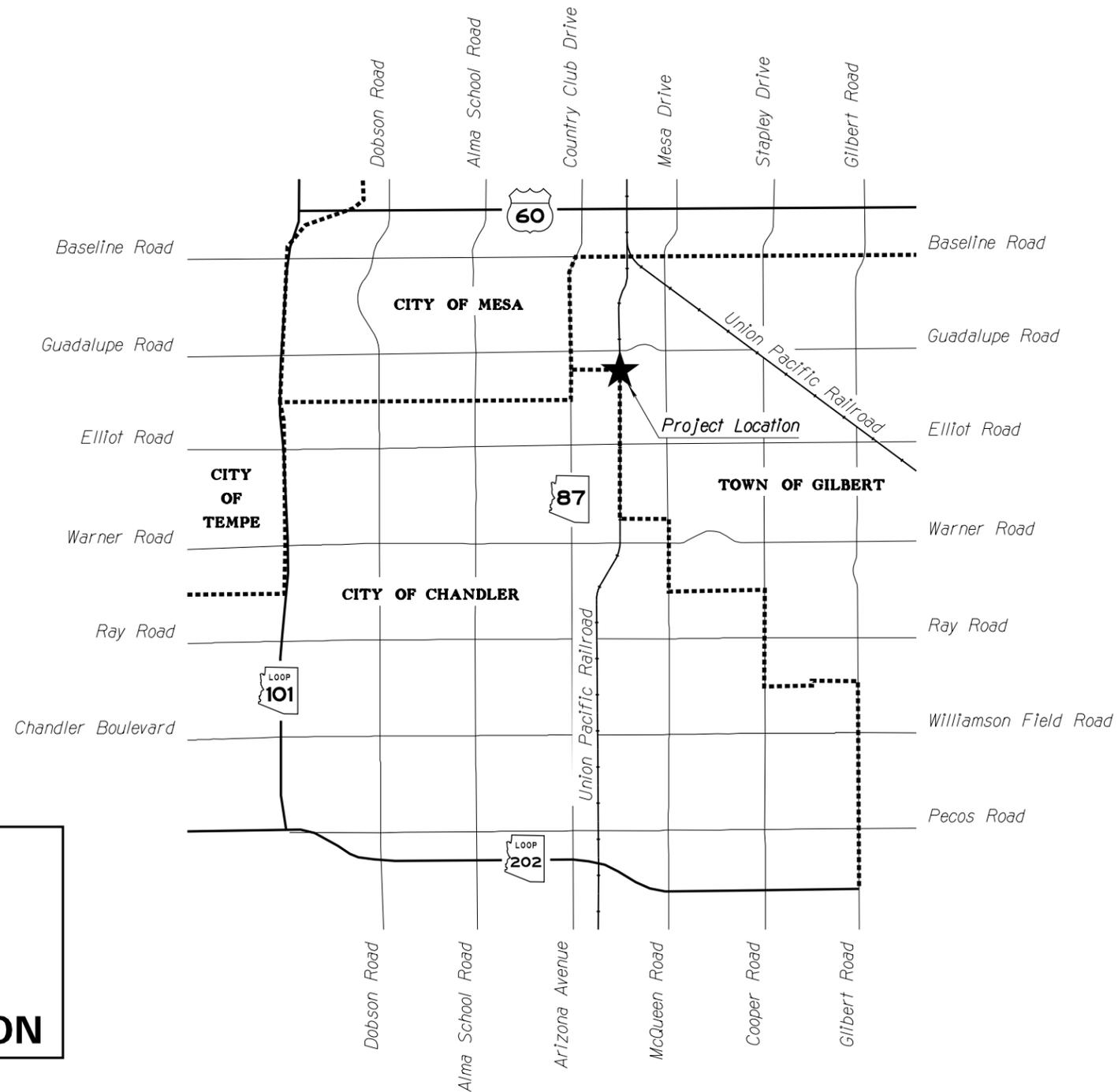
$\frac{\$2.50 \times (28,450 \text{ crossings/year}) \times 20 \text{ years}}{\text{Cost of Grade Separated Crossing}} = \frac{\$500,000}{\$750,000} = 1.90$
--

The benefit-cost ratio is greater than 1. A grade-separated crossing would be recommended.

A.2 Test Case 15% Plans and Estimate

BICYCLE AND PEDESTRIAN PATHWAY/ RAILROAD CROSSING RECOMMENDATIONS

CONCEPT PLANS
TASK ORDER: C-01-444-01



LEGEND

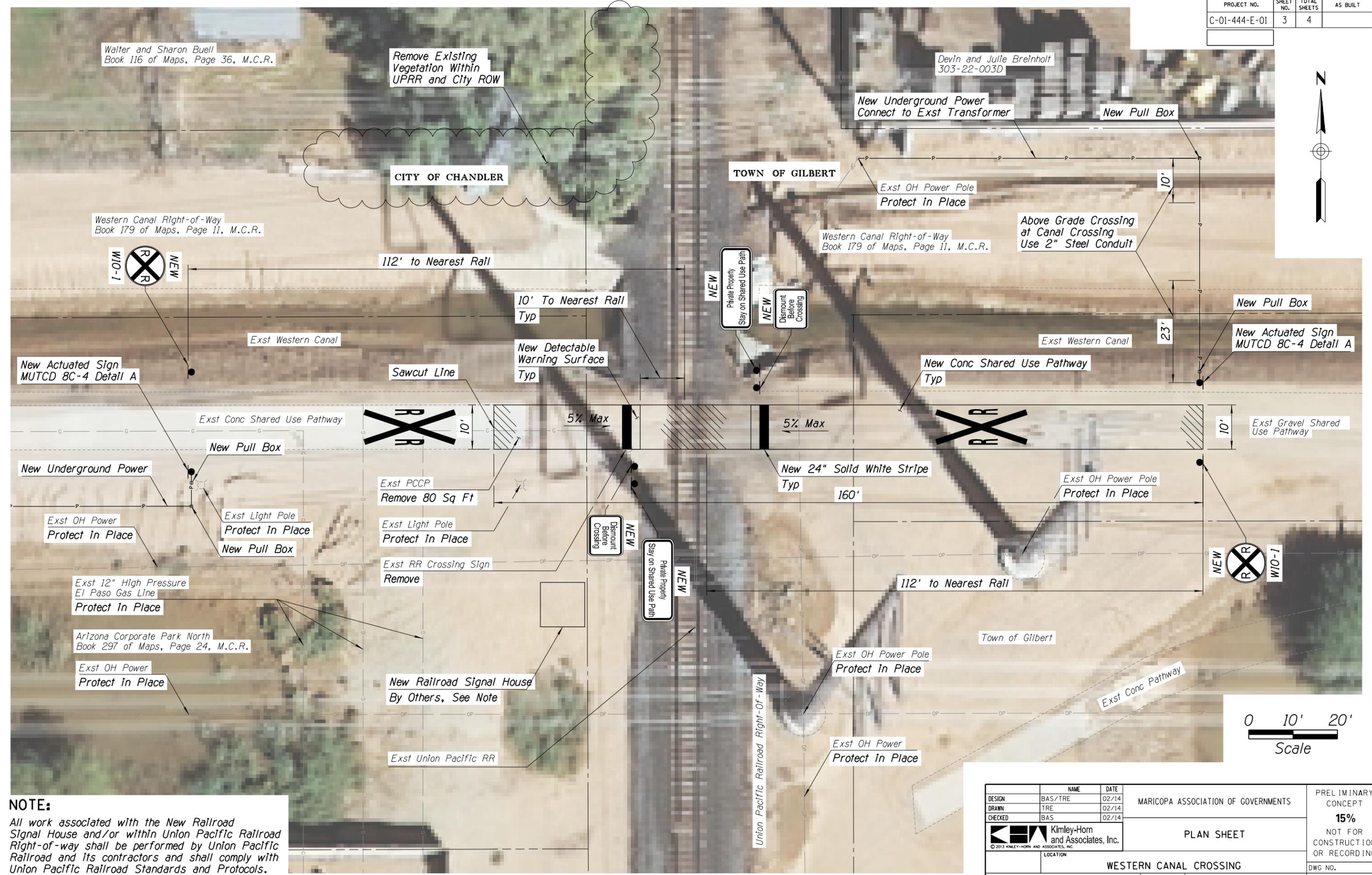
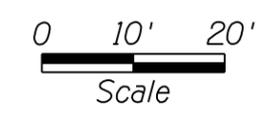
- OP— Existing Overhead Power Line
- G— Existing Gas Line
- - - Existing Property Line
- ⊙ Existing Sign
- ⊙ Existing Light Pole
- ⊙ Existing Utility Pole
- P— New Underground Power Line
- ⬤ New Sign
- ▨ New Concrete Pavement
- ▬ New Striping

PRELIMINARY
15%
NOT FOR CONSTRUCTION

FEBRUARY 28, 2014



PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
C-01-444-E-01	3	4	



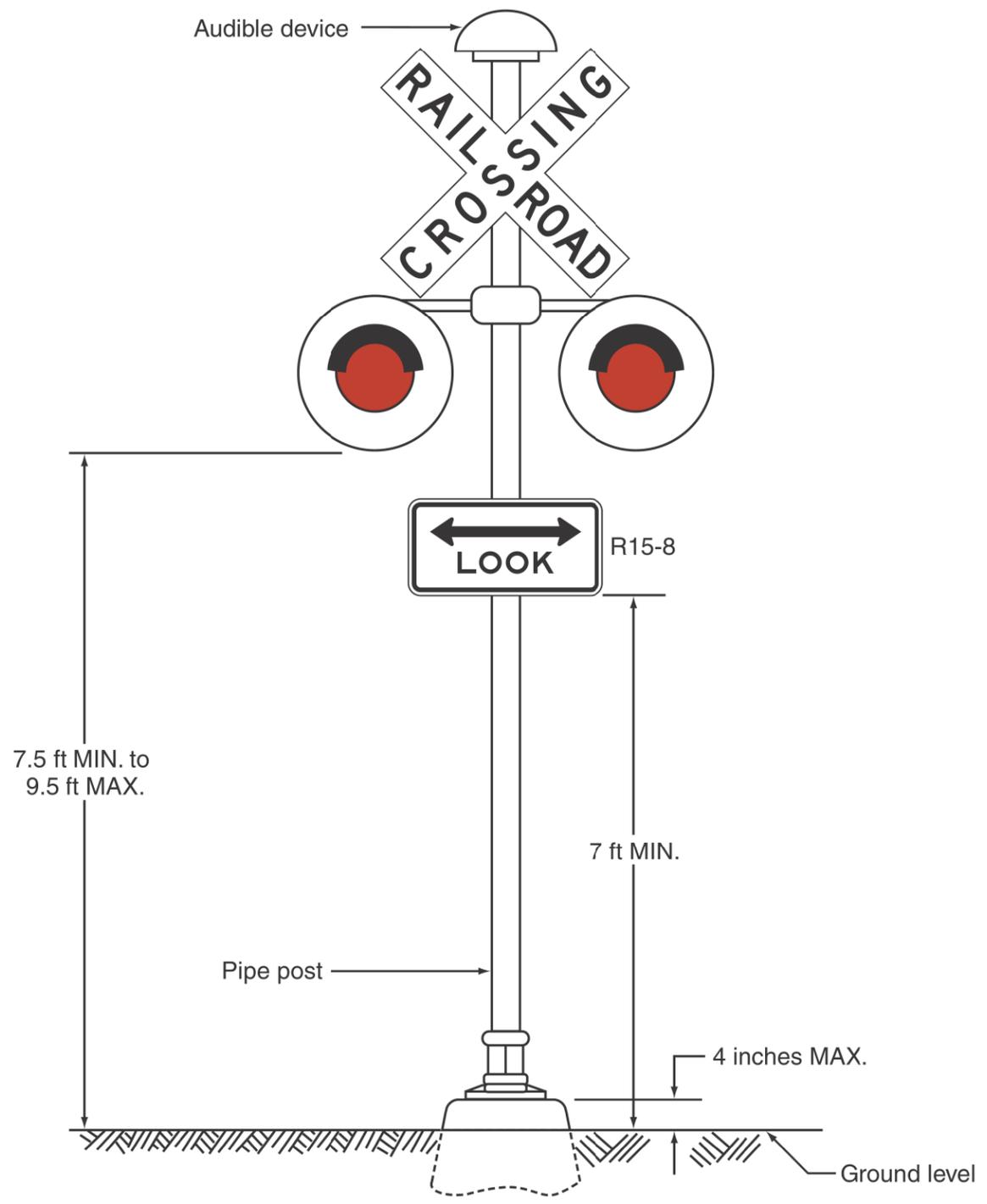
NOTE:
 All work associated with the New Railroad Signal House and/or within Union Pacific Railroad Right-of-way shall be performed by Union Pacific Railroad and its contractors and shall comply with Union Pacific Railroad Standards and Protocols.

DESIGN	BAS/TRE	02/14	MARICOPA ASSOCIATION OF GOVERNMENTS	PRELIMINARY CONCEPT 15% NOT FOR CONSTRUCTION OR RECORDING
DRAWN	TRE	02/14		
CHECKED	BAS	02/14		
			PLAN SHEET	
LOCATION WESTERN CANAL CROSSING				DWG NO. 03 OF 04

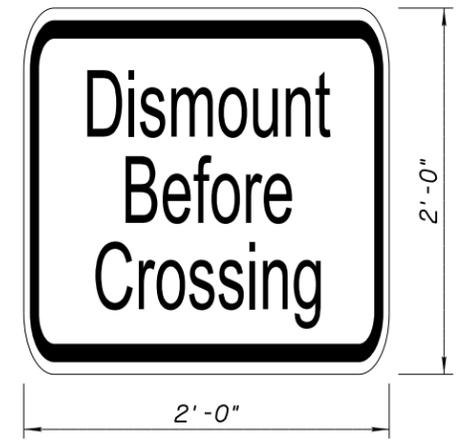
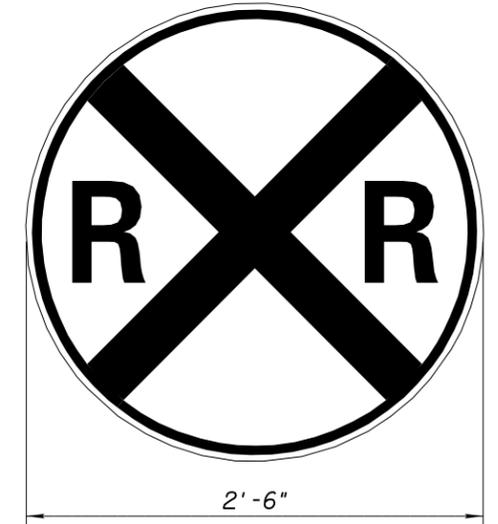
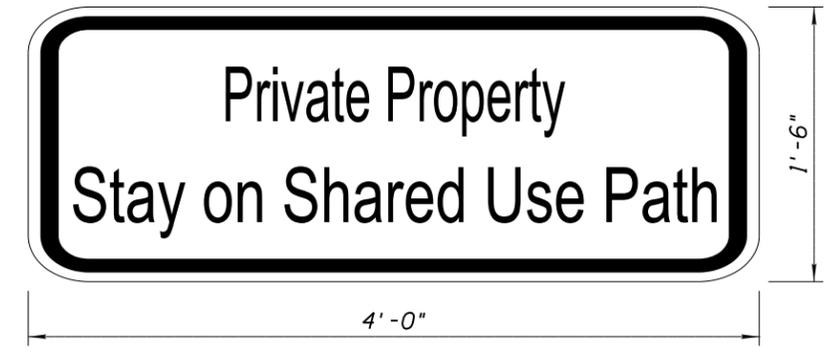
DATE: _____ LOCATION: _____ REVISIONS: _____ FINISHED PLANS: _____ SURVEY NO.: _____ DATE: _____ LOCATION: _____ REVISIONS: _____ FINISHED PLANS: _____ SURVEY NO.: _____

PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
C-01-444-E-01	4	4	

SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY NO. | FINISHED PLANS | REVISIONS | LOCATION | DATE



DETAIL A
MUTCD FIGURE 8C-4



DETAIL B
MISCELLANEOUS SIGNS

DESIGN	BAS/TRE	DATE	02/14	MARICOPA ASSOCIATION OF GOVERNMENTS	PRELIMINARY CONCEPT 15% NOT FOR CONSTRUCTION OR RECORDING
DRAWN	TRE	DATE	02/14		
CHECKED	BAS	DATE	02/14		
				DETAIL SHEET	DWG. NO. 04 OF 04
LOCATION: WESTERN CANAL CROSSING					

A.3 UPRR Phoenix Subdivision - Train Speed and Frequency

Line Section – Mainline	Max. Speed Limit	Trains Per Day (24 hours)
Phoenix Yard (MP 907) to Tempe Jct (MP 915.30) <i>(Downtown Phoenix to Downtown Tempe)</i>	25 mph	8-12 (7 days per week)
Tempe Jct (MP 915.30) to McQueen Jct (MP 923.60) <i>(Downtown Tempe to Mesa/Gilbert)</i>	25-40 mph	7-11 (7 days per week)
McQueen Jct (MP 923.60) to Magma Jct (MP 948) <i>(Mesa/Gilbert to Queen Creek)</i>	60 mph	6-10 (7 days per week)
Line Section – Branch Lines	Max. Speed Limit	Trains Per Day (24 hours)
<i>Tempe Indust. Lead</i> Tempe Jct (MP 915.30) to West Chandler (MP 923) <i>(Downtown Tempe to I-10/Gila River IC)</i>	20 mph	1 (Mon-Fri)
<i>Chandler Indust. Lead</i> McQueen Jct (MP 923.60) to Dock (MP 943.20) <i>(Mesa/Gilbert to Sun Lakes/Gila River IC)</i>	20 mph	1 (Mon-Fri)

A.4 Definitions, Abbreviations and Acronyms

ABC	Arizona Bicycle Club – www.azbikeclub.com
ACC	Arizona Corporation Commission - www.cc.state.az.us/safety/index-rr.htm
ADOT	Arizona Department of Transportation- www.azdot.gov/index.asp
AZOL	Arizona Operation Lifesaver - www.azol.org
BNSF	Burlington Northern Santa Fe Railroad – bnsf.com
ENS	Emergency Notification Sign
FHWA	Federal Highway Administration (FHWA-USDOT) - www.fhwa.dot.gov
FRA	Federal Railroad Administration (FRA-USDOT) - www.fra.dot.gov
MAG	Maricopa Association of Governments - http://www.azmag.gov/
MUTCD	Manual of Uniform Traffic Control Devices – mutcd.fhwa.dot.gov/
RTC	Rails-to-Trails Conservancy – www.railtotrails.org
SRP	Salt River Project - http://www.srpnet.com
UPRR	Union Pacific Railroad - www.up.com
USDOT	United States Department of Transportation - http://www.dot.gov/
Main Line	Track used for through trains, principal artery of system, trains typically operate at higher speeds and built to higher standards than branch lines
Branch Line	Secondary railway line, branches off a main line
Spur Line	Short branch line, secondary track used for loading/unloading railcars
Crossing ID#	A six digit number followed by an alphabetic character assigned by the US DOT, typically posted on both sides of railroad crossing on a signpost or pole. Railroad crossings having an ID # are recognized crossings. States/Railroads maintain an inventory of public, private and pedestrian crossings at both at-grade and grade-separated crossings.

CROSSING SURFACE -

Timber – sectional treated timber prefabricated sections) or full wood plank (timber surface that covers the entire crossing area)

Asphalt and Flange – asphalt surface between flange timber planks

Concrete and Rubber – crossing surface consisting of both concrete and rubber materials.

Unconsolidated – ballast (crushed stone)

Other – surfaces other than the above described surfaces

CROSSING TYPE -

Private Crossing

Private crossings are typically found on private property or roadways not maintained by public authority, and are not required to have advance-warning devices. “Private Crossing” signs are typically posted at railroad crossing.

Public Crossing

Public crossings are defined as locations where a public-authority maintained highway, road, or street, including associated sidewalks or pathways, crosses one or more railroad tracks at grade. Guidance for selection of traffic/warning control devices at public crossings is mostly provided by the Federal Highway Administration (FHWA) and the Federal Railroad Administration (FRA).

Crossbuck

A crossbuck is a sign composed of two slats of wood or metal of equal length fastened together on a pole in a saltire formation. Crossbucks usually are a traffic sign to indicate level railway crossings sometimes supplemented by electrical warnings of flashing lights a bell or a gate that descends to block the road and prevent traffic from crossing the tracks.

Grade separated

A Grade Separated Crossing is a crossing that is either raised (overpass) or lowered (underpass) to cross rail lines without crossing the railroad at grade.

Quiet Zone

Designated rail grade crossings where railroads are restricted from sounding routine warning horns. These crossings must be equipped with supplementary Safety Measures to mitigate the additional risk. Quiet Zone Designations are not on FRA RR crossing inventory.

A.5 UPRR List of Crossings in Maricopa County

DOT List Report

Search Criteria

FRA Crossings Only: Yes Quiet Zone Details: No Region: Western State: Arizona County Name: MARICOPA Track Aband Status: Active (Not Considered Aband) (N) UP Maintained
 Tracks: No Classification: Active Public Char Only: No Sort Order: County ASC,Subdivision ASC,Mile Post ASC,Track Type ASC

Record Count: 229

Rec Nbr	Subdivision	Segm	Mile Post	Track Type	DOT NBR	Warning Device	4-Quad	Yield Sign	Surface Matl Type	Classification	Crossing Type	Grade	Surface Width (feet)	Street Name	City	Nearest City Ind	County
1	Chandler Ind Ld	4987-0	923.990	INDL	741661N	GATES/CANTS	N	0	Rubber	Active	Public	Grade	64	BASELINE ROAD	MESA	Y	MARICOPA
2	Chandler Ind Ld	4987-0	925.010	INDL	741662V	GATES	N	0	Rubber	Active	Public	Grade	64	GUADALUPE ROAD	GILBERT	Y	MARICOPA
3	Chandler Ind Ld	4987-0	925.510	INDL	741663C	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	15	FEED MILL	MESA	Y	MARICOPA
4	Chandler Ind Ld	4987-0	926.010	INDL	741664J	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	80	ELLIOT ROAD	CHANDLER	Y	MARICOPA
5	Chandler Ind Ld	4987-0	927.010	INDL	741665R	GATES	N	0	Concrete Slab	Active	Public	Grade	80	WARNER ROAD	CHANDLER	Y	MARICOPA
6	Chandler Ind Ld	4987-0	927.570	INDL	741667E	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	64	KNOX ROAD	CHANDLER	Y	MARICOPA
7	Chandler Ind Ld	4987-0	928.070	INDL	741668L	GATES	N	0	Concrete Slab	Active	Public	Grade	80	RAY ROAD	CHANDLER	N	MARICOPA
8	Chandler Ind Ld	4987-0	928.570	INDL	741669T	GATES	N	0	Concrete Slab	Active	Public	Grade	40	GALVESTON STREET	CHANDLER	N	MARICOPA
9	Chandler Ind Ld	4987-0	928.820	INDL	741670M	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	40	EAST ERIE STREET	CHANDLER	N	MARICOPA
10	Chandler Ind Ld	4987-0	929.080	INDL	741671U	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	80	CHANDLER BLVD	CHANDLER	N	MARICOPA
11	Chandler Ind Ld	4987-0	929.250	INDL	741672B	GATES	N	0	Concrete Slab	Active	Public	Grade	60	COMMONWEALTH AVE	CHANDLER	N	MARICOPA
12	Chandler Ind Ld	4987-0	929.570	INDL	741673H	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	55	FRYE ROAD	CHANDLER	N	MARICOPA
13	Chandler Ind Ld	4987-0	930.070	INDL	741674P	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	24	PECOS ROAD	CHANDLER	N	MARICOPA
14	Chandler Ind Ld	4987-0	930.590	INDL	741675W	GATES	N	0	Asphalt	Active	Public	Grade	24	WILLIS ROAD	CHANDLER	Y	MARICOPA
15	Chandler Ind Ld	4987-0	931.100	INDL	741676D	GATES	N	0	Concrete Slab	Active	Public	Grade	88	GERMANN ROAD	CHANDLER	Y	MARICOPA
16	Chandler Ind Ld	4987-0	931.590	INDL	741677K	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	RYAN STREET	CHANDLER	Y	MARICOPA
17	Chandler Ind Ld	4987-0	932.090	INDL	741678S	GATES	N	0	Wood Plank	Active	Public	Grade	32	QUEEN CREEK ROAD	CHANDLER	Y	MARICOPA
18	Chandler Ind Ld	4987-0	932.600	INDL	741679Y	XBUCKS/YIELD SIGNS	N	2	Gravel	Active	Public	Grade	24	APPLEBY ROAD	CHANDLER	Y	MARICOPA
19	Chandler Ind Ld	4987-0	933.100	INDL	741680T	GATES	N	0	Wood Plank	Active	Public	Grade	32	OCOTILLO ROAD	CHANDLER	Y	MARICOPA

20	Chandler Ind Ld	4987-0	934.100	INDL	741681A	GATES	N	0	Asphalt	Active	Public	Grade	24	CHANDLER HEIGHTS	CHANDLER	Y	MARICOPA
21	Chandler Ind Ld	4987-0	935.100	INDL	741682G	GATES/CANTS	N	0	Sectional Timber	Active	Public	Grade	32	RIGGS ROAD	CHANDLER	Y	MARICOPA
22	Chandler Ind Ld	4987-0	942.190	YARD	922547P	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	20	PRIVATE	CHANDLER	N	MARICOPA
23	Chandler Ind Ld	4987-0	942.590	YARD	922545B	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	24	PRIVATE	CHANDLER	N	MARICOPA
24	Chandler Ind Ld	4987-0	942.600	YARD	922546H	XBUCKS/YIELD SIGNS	N	1	Asphalt	Active	Private	Grade	24	PRIVATE	CHANDLER	N	MARICOPA
25	Gila	4954-0	844.630	SIMN	742092N	NONE	N	0	Wood Plank	Active	Private	Grade	1	PALOMA RANCH #3-P	GILA BEND	N	MARICOPA
26	Gila	4954-0	845.240	SIMN	742093V	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	30	PALOMA RANCH #1-P	GILA BEND	Y	MARICOPA
27	Gila	4954-0	847.260	SIMN	742094C	STOP SIGNS	N	0	Wood Plank	Active	Private	Grade	30	PALOMA RANCH #4-P	GILA BEND	Y	MARICOPA
28	Gila	4956-0	854.350	SIMN	742098E	NONE	N	0	RR Under	Active	Public	Under Grade	1	IH 8 OVERPASS	GILA BEND	N	MARICOPA
29	Gila	4956-0	854.660	SIMN	742099L	NONE	N	0	RR Over	Active	Public	Over Grade	1	SR 85 UNDERPASS	GILA BEND	N	MARICOPA
30	Gila	4956-0	855.550	SIMN	741081X	NONE	N	0	RR Over	Active	Public	Over Grade	1	SCOTT AVE UNDERPA	GILA BEND	N	MARICOPA
31	Gila	4956-0	855.780	SIMN	741082E	GATES	N	0	Concrete Slab	Active	Public	Grade	24	MARTIN AVENUE	GILA BEND	N	MARICOPA
32	Gila	4956-0	856.930	SIMN	741083L	BELLS	N	0	RR Under	Active	Public	Under Grade	1	SR 84 OVERPASS	GILA BEND	N	MARICOPA
33	Gila	4956-0	860.300	SIMN	741339M	NONE	N	0	RR Over	Active	Private	Over Grade	1	US ARMY PVT UNDER	GILA BEND	N	MARICOPA
34	Gila	4956-0	869.500	SIDE	748786M	STOP SIGNS	N	0	Plank and Gravel	Active	Private	Grade	20	PRIVATE	GILA BEND	Y	MARICOPA
35	Phoenix	4980-0	860.230	SIMN	741762A	STOP SIGNS	N	0	Wood Plank	Active	Private	Grade	25	YOUNGSTERS FARMS	ARLINGTON	Y	MARICOPA
36	Phoenix	4980-0	862.010	SIMN	741763G	GATES	N	0	Asphalt	Active	Public	Grade	40	355 TH. STREET	ARLINGTON	N	MARICOPA
37	Phoenix	4980-0	866.570	SIMN	741764N	GATES	N	0	Asphalt	Active	Public	Grade	40	TONOPAH RD SALOME	ARLINGTON	Y	MARICOPA
38	Phoenix	4982-0	868.290	SIMN	741765V	GATES	N	0	Concrete Slab	Active	Public	Grade	32	JOHNSON ROAD	PALO VERDE	Y	MARICOPA
39	Phoenix	4982-0	870.330	SIMN	741766C	GATES	N	0	Asphalt	Active	Public	Grade	32	PALO VERDE ROAD	PALO VERDE	Y	MARICOPA
40	Phoenix	4982-0	871.350	SIMN	741767J	GATES	N	0	Wood Plank	Active	Public	Grade	32	WILSON ROAD	BUCKEYE	N	MARICOPA
41	Phoenix	4982-0	872.350	SIMN	741768R	GATES	N	0	Asphalt	Active	Public	Grade	30	TURNER ROAD	BUCKEYE	N	MARICOPA
42	Phoenix	4982-0	873.250	SIMN	922558C	GATES	N	0	Concrete Slab	Active	Public	Grade	48	SR85 NORTHBOUND	BUCKEYE	Y	MARICOPA
43	Phoenix	4982-0	873.360	SIMN	741769X	GATES	N	0	Concrete Slab	Active	Public	Grade	56	SR85 SOUTHBOUND	BUCKEYE	Y	MARICOPA
44	Phoenix	4982-0	874.340	SIMN	741770S	GATES	N	0	Wood Plank	Active	Public	Grade	32	ROOKS ROAD	BUCKEYE	N	MARICOPA
45	Phoenix	4982-0	875.340	SIMN	741771Y	GATES	N	0	Concrete Slab	Active	Public	Grade	48	MILLER ROAD	BUCKEYE	N	MARICOPA

46	Phoenix	4982-0	875.510	INDU	741772F	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	56	MILLER ROAD	BUCKEYE	N	MARICOPA
47	Phoenix	4982-0	875.600	SIMN	741773M	GATES	N	0	Concrete Slab	Active	Public	Grade	40	4 TH AVENUE	BUCKEYE	N	MARICOPA
48	Phoenix	4982-0	876.240	SIMN	741774U	GATES	N	0	Wood Plank	Active	Public	Grade	40	BASELINE ROAD	BUCKEYE	N	MARICOPA
49	Phoenix	4982-0	876.360	SIMN	741775B	GATES	N	0	Wood Plank	Active	Public	Grade	40	APACHE ROAD	BUCKEYE	N	MARICOPA
50	Phoenix	4982-0	878.530	SIMN	741776H	GATES	N	0	Concrete Slab	Active	Public	Grade	32	RAINBOW ROAD	BUCKEYE	N	MARICOPA
51	Phoenix	4982-0	879.500	SIMN	748157A	GATES	N	0	Asphalt	Active	Public	Grade	24	DEAN ROAD	BUCKEYE	N	MARICOPA
52	Phoenix	4982-0	880.530	SIMN	741778W	GATES	N	0	Concrete Slab	Active	Public	Grade	32	AIRPORT ROAD	BUCKEYE	N	MARICOPA
53	Phoenix	4982-0	882.020	SIMN	741779D	GATES	N	0	Sectional Timber	Active	Public	Grade	24	JACKRABBIT ROAD	BUCKEYE	N	MARICOPA
54	Phoenix	4982-0	883.040	SIMN	741780X	GATES	N	0	Concrete Slab	Active	Public	Grade	32	PERRYVILLE ROAD	BUCKEYE	N	MARICOPA
55	Phoenix	4982-0	885.040	SIMN	741781E	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	24	COTTON LANE	GOODYEAR	N	MARICOPA
56	Phoenix	4982-0	886.070	SIMN	741782L	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	96	SARIVAL ROAD	GOODYEAR	N	MARICOPA
57	Phoenix	4982-0	887.060	SIMN	741783T	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	100	ESTRELLA PKWY	GOODYEAR	N	MARICOPA
58	Phoenix	4982-0	887.330	SIMN	411741W	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	20	PRIVATE	GOODYEAR	Y	MARICOPA
59	Phoenix	4984-0	889.360	SIMN	741784A	GATES	N	0	Sectional Timber	Active	Public	Grade	100	LITCHFIELD ROAD	GOODYEAR	N	MARICOPA
60	Phoenix	4984-0	889.950	SIMN	741795M	GATES/CANTS	N	0	Rubber	Active	Public	Grade	80	SOUTH CENTRAL AVE	AVONDALE	N	MARICOPA
61	Phoenix	4984-0	890.250	SIMN	741796U	GATES	N	0	Rubber	Active	Public	Grade	40	4 TH STREET	AVONDALE	N	MARICOPA
62	Phoenix	4984-0	890.580	SIMN	741797B	GATES	N	0	Asphalt	Active	Public	Grade	70	DYSART ROAD	AVONDALE	N	MARICOPA
63	Phoenix	4984-0	892.570	SIMN	741799P	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	70	AVONDALE BLVD.	AVONDALE	N	MARICOPA
64	Phoenix	4984-0	893.520	SIMN	741800G	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	70	107 TH AVENUE	CASHION	N	MARICOPA
65	Phoenix	4984-0	894.650	INDU	748499A	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	60	104TH AVENUE	TOLLESON	Y	MARICOPA
66	Phoenix	4984-0	894.720	SIMN	741802V	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	64	99 TH AVENUE	TOLLESON	N	MARICOPA
67	Phoenix	4984-0	895.720	SIMN	741804J	GATES	N	0	Asphalt	Active	Public	Grade	64	91ST AVENUE	TOLLESON	N	MARICOPA
68	Phoenix	4984-0	896.480	INDU	920123B	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	64	WASHINGTON STREET	TOLLESON	N	MARICOPA
69	Phoenix	4984-0	896.710	SIMN	741806X	GATES	N	0	Rubber	Active	Public	Grade	64	83RD AVENUE	TOLLESON	N	MARICOPA
70	Phoenix	4984-0	897.700	SIMN	741808L	GATES	N	0	Asphalt	Active	Public	Grade	24	75 TH AVENUE	TOLLESON	Y	MARICOPA
71	Phoenix	4984-0	898.720	SIMN	741809T	GATES	N	0	Asphalt	Active	Public	Grade	24	67 TH AVENUE	PHOENIX	N	MARICOPA
72	Phoenix	4984-0	899.700	SIMN	741811U	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	72	59 TH AVENUE	PHOENIX	N	MARICOPA
73	Phoenix	4984-0	899.750	INDU	748385M	NONE	N	0	Asphalt	Active	Public	Grade	50	JEFFERSON STREET	PHOENIX	N	MARICOPA
74	Phoenix	4984-0	899.890	INDU	748384F	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	WASHINGTON STREET	PHOENIX	N	MARICOPA
75	Phoenix	4984-0	899.970	INDU	748334C	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	48	ROOSEVELT STREET	PHOENIX	N	MARICOPA

76	Phoenix	4984-0	899.980	INDU	748167F	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	48	ROOSEVELT	PHOENIX	N	MARICOPA
77	Phoenix	4984-0	900.050	INDU	748168M	XBUCKS	N	0	Asphalt	Active	Public	Grade	40	BUCHANAN STREET	PHOENIX	Y	MARICOPA
78	Phoenix	4984-0	900.280	INDU	748792R	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	50	47TH AVENUE	PHOENIX	N	MARICOPA
79	Phoenix	4984-0	900.500	INDU	748165S	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	48	47TH AVENUE	PHOENIX	N	MARICOPA
80	Phoenix	4984-0	900.500	INDU	748166Y	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	BUCHANAN STREET	PHOENIX	N	MARICOPA
81	Phoenix	4984-0	900.600	INDU	411747M	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	48	47TH AVENUE	PHOENIX	N	MARICOPA
82	Phoenix	4984-0	900.640	INDU	741024J	GATES	N	0	Rubber	Active	Public	Grade	64	VAN BUREN STREET	PHOENIX	N	MARICOPA
83	Phoenix	4984-0	900.640	INDU	748169U	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	HADLEY STREET	PHOENIX	N	MARICOPA
84	Phoenix	4984-0	900.690	SIMN	741022V	GATES	N	0	Concrete Slab	Active	Public	Grade	72	51ST AVENUE	PHOENIX	N	MARICOPA
85	Phoenix	4984-0	901.200	INDU	748793X	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	48	45TH AVENUE	PHOENIX	N	MARICOPA
86	Phoenix	4984-0	901.700	SIMN	741026X	GATES	N	0	Concrete Slab	Active	Public	Grade	64	43 RD AVENUE	PHOENIX	N	MARICOPA
87	Phoenix	4984-0	901.770	INDU	748796T	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	30	WEST WASHINGTON	PHOENIX	N	MARICOPA
88	Phoenix	4984-0	901.840	INDU	748740Y	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	JEFFERSON STREET	PHOENIX	N	MARICOPA
89	Phoenix	4984-0	902.070	INDU	748794E	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	41ST AVENUE	PHOENIX	N	MARICOPA
90	Phoenix	4984-0	902.120	INDU	920407F	XBUCKS/YIELD SIGNS	N	1	Asphalt	Active	Public	Grade	40	39TH AVENUE	PHOENIX	N	MARICOPA
91	Phoenix	4984-0	902.200	INDU	748795L	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	41ST AVENUE	PHOENIX	N	MARICOPA
92	Phoenix	4984-0	902.400	INDU	741028L	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	80	BUCKEYE RD (SR 85	PHOENIX	N	MARICOPA
93	Phoenix	4984-0	902.400	INDU	748290E	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	37TH AVENUE	PHOENIX	Y	MARICOPA
94	Phoenix	4984-0	902.700	SIMN	741448R	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	60	35TH AVENUE	PHOENIX	N	MARICOPA
95	Phoenix	4984-0	903.200	SIMN	741449X	GATES	N	0	Asphalt	Active	Public	Grade	24	31ST AVENUE	PHOENIX	N	MARICOPA
96	Phoenix	4984-0	903.700	SIMN	741451Y	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	70	27 TH AVENUE	PHOENIX	N	MARICOPA
97	Phoenix	4984-0	903.870	INDU	741443G	GATES	N	0	Concrete Slab	Active	Public	Grade	24	LOWER BUCKEYE RD	PHOENIX	N	MARICOPA
98	Phoenix	4984-0	904.200	SIMN	741452F	GATES	N	0	Concrete Slab	Active	Public	Grade	24	I 17 SB FRONTAGE	PHOENIX	N	MARICOPA
99	Phoenix	4984-0	904.220	SIMN	741453M	NONE	N	0	RR Over	Active	Public	Over Grade	1	I 17 UNDERPASS	PHOENIX	N	MARICOPA
100	Phoenix	4984-0	904.250	SIMN	741454U	GATES	N	0	Concrete Slab	Active	Public	Grade	24	I 17 NB FRONTAGE	PHOENIX	N	MARICOPA
101	Phoenix	4984-0	904.680	SIMN	741457P	GATES/CANTS	N	0	Rubber	Active	Public	Grade	64	19 TH AVENUE	PHOENIX	N	MARICOPA
102	Phoenix	4984-0	904.910	SIMN	741458W	NONE	N	0	RR Over	Active	Public	Over Grade	1	17TH AVE UNDERPAS	PHOENIX	N	MARICOPA
103	Phoenix	4984-0	905.180	SIMN	741459D	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	65	15 TH AVENUE	PHOENIX	N	MARICOPA

104	Phoenix	4984-0	905.420	SIMN	741461E	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	40	11TH AVENUE	PHOENIX	N	MARICOPA
105	Phoenix	4984-0	905.560	SIMN	741464A	GATES	N	0	Asphalt	Active	Public	Grade	63	9TH AVENUE	PHOENIX	N	MARICOPA
106	Phoenix	4984-0	905.710	SIMN	741465G	NONE	N	0	RR Under	Active	Public	Under Grade	1	7 TH AVE OVERPASS	PHOENIX	N	MARICOPA
107	Phoenix	4984-0	905.980	SIMN	741466N	GATES	N	0	Concrete Slab	Active	Public	Grade	64	3RD AVENUE	PHOENIX	N	MARICOPA
108	Phoenix	4984-0	906.050	SIMN	741471K	GATES/CANTS	N	0	Wood Plank	Active	Public	Grade	72	2ND AVENUE	PHOENIX	N	MARICOPA
109	Phoenix	4984-0	906.120	SIMN	741472S	FLASHERS	N	0	Asphalt	Active	Pedestrian	Grade	4	1ST AVE PED CROSS	PHOENIX	N	MARICOPA
110	Phoenix	4984-0	906.130	SIMN	912028K	NONE	N	0	RR Over	Active	Public	Over Grade	1	1ST AVE UNDERPASS	PHOENIX	N	MARICOPA
111	Phoenix	4984-0	906.190	SIMN	741473Y	NONE	N	0	RR Over	Active	Public	Over Grade	1	CENTRAL AV UNDERP	PHOENIX	N	MARICOPA
112	Phoenix	4984-0	906.280	SIMN	741474F	GATES/CANTS	N	0	Wood Plank	Active	Public	Grade	63	1ST STREET	PHOENIX	N	MARICOPA
113	Phoenix	4984-0	906.360	SIMN	741475M	GATES/CANTS	N	0	Wood Plank	Active	Public	Grade	63	2ND STREET	PHOENIX	N	MARICOPA
114	Phoenix	4984-0	906.430	SIMN	741476U	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	64	3RD STREET	PHOENIX	N	MARICOPA
115	Phoenix	4984-0	906.500	SIMN	741477B	GATES/CANTS	N	0	Wood Plank	Active	Public	Grade	64	4TH STREET	PHOENIX	N	MARICOPA
116	Phoenix	4984-0	906.510	SIMN	920405S	NONE	N	0	RR Under	Active	Pedestrian	Under Grade	0	4TH ST. PED	PHOENIX	N	MARICOPA
117	Phoenix	4984-0	906.640	YARD	741480J	FLASHERS	N	0	Asphalt	Active	Public	Grade	60	5TH STREET	PHOENIX	N	MARICOPA
118	Phoenix	4984-0	906.700	SIMN	741482X	NONE	N	0	RR Under	Active	Public	Under Grade	1	7TH ST OVERPASS	PHOENIX	N	MARICOPA
119	Phoenix	4984-0	906.940	YARD	741514B	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	30	HADLEY STREET	PHOENIX	N	MARICOPA
120	Phoenix	4984-0	907.020	YARD	741484L	GATES	N	0	Asphalt	Active	Public	Grade	40	BUCHANAN	PHOENIX	N	MARICOPA
121	Phoenix	4984-0	907.120	YARD	741492D	CANTS	N	0	Asphalt	Active	Public	Grade	60	LINCOLN & 6TH ST.	PHOENIX	N	MARICOPA
122	Phoenix	4984-0	907.460	YARD	748781D	NONE	N	0	Concrete Slab	Active	Private	Grade	1	S.P. DRIVE	PHOENIX	N	MARICOPA
123	Phoenix	4984-0	907.700	SIMN	741533F	NONE	N	0	RR Under	Active	Public	Under Grade	1	16 TH ST OVERPASS	PHOENIX	N	MARICOPA
124	Phoenix	4984-0	908.230	SIMN	741534M	GATES	N	0	Rubber	Active	Public	Grade	40	20 TH STREET	PHOENIX	N	MARICOPA
125	Phoenix	4984-0	908.270	SIMN	748191G	NONE	N	0	RR Under	Active	Public	Under Grade	42	S.B. FRONT. OVERP	PHOENIX	N	MARICOPA
126	Phoenix	4984-0	908.310	SIMN	748172C	NONE	N	0	RR Under	Active	Public	Under Grade	1	I 10 OVERPASS	PHOENIX	N	MARICOPA
127	Phoenix	4984-0	908.350	SIMN	748192N	NONE	N	0	RR Under	Active	Public	Under Grade	1	N.B. FRONT. OVERP	PHOENIX	N	MARICOPA
128	Phoenix	4984-0	908.710	SIMN	741535U	GATES	N	0	Concrete Slab	Active	Public	Grade	128	24 TH STREET	PHOENIX	N	MARICOPA
129	Phoenix	4984-0	909.760	SIMN	741536B	GATES	N	0	Concrete Slab	Active	Public	Grade	72	32 ND STREET	PHOENIX	N	MARICOPA
130	Phoenix	4984-0	910.110	SIMN	741537H	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	30	AIR RESEARCH MFG	PHOENIX	N	MARICOPA

131	Phoenix	4984-0	910.280	SIMN	741538P	GATES	N	0	Concrete Slab	Active	Public	Grade	48	36TH STREET	PHOENIX	N	MARICOPA
132	Phoenix	4984-0	910.740	SIMN	741539W	GATES	N	0	Concrete Slab	Active	Public	Grade	48	40 TH STREET	PHOENIX	N	MARICOPA
133	Phoenix	4984-0	911.190	SIMN	748808K	NONE	N	0	RR Over	Active	Public	Over Grade	1	SKY HARBOR EXPWY	PHOENIX	N	MARICOPA
134	Phoenix	4984-0	911.550	SIMN	748730T	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	30	CANAL ROAD	PHOENIX	N	MARICOPA
135	Phoenix	4984-0	911.560	SIMN	748731A	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	20	CANAL ROAD	PHOENIX	N	MARICOPA
136	Phoenix	4984-0	911.600	SIMN	748193V	NONE	N	0	RR Under	Active	Public	Under Grade	1	HOHOKAM FWY OVERP	PHOENIX	N	MARICOPA
137	Phoenix	4984-0	911.730	SIMN	741542E	GATES	N	0	Concrete Slab	Active	Public	Grade	32	48TH STREET	PHOENIX	N	MARICOPA
138	Phoenix	4984-0	912.320	SIMN	748184W	NONE	N	0	RR Under	Active	Public	Under Grade	1	SR 202 OP	PHOENIX	N	MARICOPA
139	Phoenix	4984-0	912.780	SIMN	922168P	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	48	OLD 56 STREET	TEMPE	N	MARICOPA
140	Phoenix	4984-0	912.820	SIMN	922169W	STOP SIGNS	N	0	Sectional Timber	Active	Private	Grade	45	CANAL ROAD	TEMPE	N	MARICOPA
141	Phoenix	4984-0	912.830	SIMN	748164K	NONE	N	0	RR Under	Active	Public	Under Grade	1	PRIEST DR OVERPAS	PHOENIX	N	MARICOPA
142	Phoenix	4984-0	912.860	SIMN	922170R	STOP SIGNS	N	0	Sectional Timber	Active	Private	Grade	45	CANAL ROAD	TEMPE	N	MARICOPA
143	Phoenix	4984-0	913.510	SIMN	748383Y	NONE	N	0	RR Under	Active	Public	Under Grade	1	CENTER PARKWAY O.	TEMPE	N	MARICOPA
144	Phoenix	4984-0	913.860	SIMN	753711Y	NONE	N	0	RR Under	Active	Public	Under Grade	1	SR 202 OVERPASS	TEMPE	Y	MARICOPA
145	Phoenix	4984-0	914.150	SIMN	741546G	NONE	N	0	RR Over	Active	Public	Over Grade	1	RIO SALADO UNDERP	TEMPE	N	MARICOPA
146	Phoenix	4984-0	914.290	SIMN	741547N	GATES/CANTS	N	0	Rubber	Active	Public	Grade	64	1ST STREET	TEMPE	N	MARICOPA
147	Phoenix	4984-0	914.570	SIMN	741561J	GATES	N	0	Rubber	Active	Public	Grade	80	5TH STREET	TEMPE	N	MARICOPA
148	Phoenix	4984-0	914.820	SIMN	741560C	GATES	N	0	Concrete Slab	Active	Public	Grade	80	UNIVERSITY DR.	TEMPE	N	MARICOPA
149	Phoenix	4984-0	914.920	SIMN	741562R	GATES	N	0	Asphalt	Active	Public	Grade	50	9TH STREET	TEMPE	N	MARICOPA
150	Phoenix	4984-0	915.020	SIMN	741563X	GATES	N	0	Asphalt	Active	Public	Grade	40	10TH STREET	TEMPE	N	MARICOPA
151	Phoenix	4986-0	915.310	SIMN	741564E	GATES	N	0	Concrete Slab	Active	Public	Grade	50	13 TH STREET	TEMPE	N	MARICOPA
152	Phoenix	4986-0	915.660	SIMN	741584R	NONE	N	0	RR Over	Active	Public	Over Grade	1	MILL ST UNDERPASS	TEMPE	N	MARICOPA
153	Phoenix	4986-0	915.970	SIMN	741583J	GATES	N	0	Concrete Slab	Active	Public	Grade	48	COLLEGE AVENUE	TEMPE	N	MARICOPA
154	Phoenix	4986-0	916.460	SIMN	741645E	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	104	RURAL ROAD	TEMPE	N	MARICOPA
155	Phoenix	4986-0	917.430	SIMN	741646L	NONE	N	0	RR Over	Active	Public	Over Grade	1	MCCLINTOCK UNDERP	TEMPE	N	MARICOPA
156	Phoenix	4986-0	917.540	INDU	748738X	NONE	N	0	Wood Plank	Active	Public	Grade	40	ENCANTO DRIVE	TEMPE	N	MARICOPA
157	Phoenix	4986-0	917.960	INDU	748739E	XBUCKS/YIELD SIGNS	N	1	Asphalt	Active	Public	Grade	40	ENCANTO DR	TEMPE	N	MARICOPA
158	Phoenix	4986-0	918.450	SIMN	741647T	GATES	N	0	Rubber	Active	Public	Grade	30	SR101 (S.B.FRTG.R	TEMPE	N	MARICOPA

159	Phoenix	4986-0	918.490	SIMN	748174R	NONE	N	0	RR Over	Active	Public	Over Grade	37	SR 101 UNDERPASS	TEMPE	N	MARICOPA
160	Phoenix	4986-0	918.540	SIMN	748176E	GATES	N	0	Rubber	Active	Public	Grade	30	SR101 (NB FNTGE.R	TEMPE	N	MARICOPA
161	Phoenix	4986-0	918.650	SIMN	741648A	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	15	PRIVATE CROSSING	TEMPE	N	MARICOPA
162	Phoenix	4986-0	918.660	SIMN	748752T	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	15	CANAL ROAD	TEMPE	N	MARICOPA
163	Phoenix	4986-0	919.450	SIMN	741649G	GATES	N	0	Concrete Slab	Active	Public	Grade	96	DOBSON ROAD	MESA	N	MARICOPA
164	Phoenix	4986-0	920.470	SIMN	741650B	GATES	N	0	Rubber	Active	Public	Grade	70	ALMA SCHOOL ROAD	MESA	N	MARICOPA
165	Phoenix	4986-0	920.950	SIMN	741651H	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	88	SOUTH EXTENSION R	MESA	N	MARICOPA
166	Phoenix	4986-0	921.450	SIMN	741652P	NONE	N	0	RR Over	Active	Public	Over Grade	1	COUNTRY CLUB DR U	MESA	N	MARICOPA
167	Phoenix	4986-0	921.800	SIMN	741653W	GATES	N	0	Concrete Slab	Active	Public	Grade	120	MCDONALD STREET	MESA	N	MARICOPA
168	Phoenix	4986-0	921.960	SIMN	741657Y	GATES/CANTS	N	0	Asphalt	Active	Public	Grade	60	BROADWAY ROAD	MESA	N	MARICOPA
169	Phoenix	4986-0	922.070	INDU	741654D	GATES	N	0	Concrete Slab	Active	Public	Grade	88	CENTER STREET	MESA	N	MARICOPA
170	Phoenix	4986-0	922.460	SIMN	741658F	GATES	N	0	Concrete Slab	Active	Public	Grade	40	WEST 8 TH AVENUE	MESA	N	MARICOPA
171	Phoenix	4986-0	922.710	SIMN	748736J	FLASHERS	N	0	Rubber	Active	Public	Grade	10	PED XING (10TH AV	MESA	N	MARICOPA
172	Phoenix	4986-0	922.960	SIMN	741659M	GATES/CANTS	N	0	Rubber	Active	Public	Grade	64	SOUTHERN AVENUE	MESA	N	MARICOPA
173	Phoenix	4986-0	923.470	SIMN	748240B	NONE	N	0	RR Under	Active	Public	Under Grade	0	US - 60 FWY	MESA	N	MARICOPA
174	Phoenix	4988-0	923.990	SIMN	741812B	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	100	BASELINE ROAD	MESA	N	MARICOPA
175	Phoenix	4988-0	924.120	SIMN	741813H	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	32	SAMUEL HALL	GILBERT	N	MARICOPA
176	Phoenix	4988-0	924.450	SIMN	741814P	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	110	MCQUEEN ROAD	GILBERT	N	MARICOPA
177	Phoenix	4988-0	925.650	SIMN	741815W	GATES/CANTS	N	0	Rubber	Active	Public	Grade	100	GUADALUPE ROAD	GILBERT	N	MARICOPA
178	Phoenix	4988-0	925.730	SIMN	741816D	GATES/CANTS	N	0	Rubber	Active	Public	Grade	100	COOPER ROAD	GILBERT	N	MARICOPA
179	Phoenix	4988-0	926.960	SIMN	741819Y	GATES	N	0	Concrete Slab	Active	Public	Grade	72	GILBERT ROAD	GILBERT	N	MARICOPA
180	Phoenix	4988-0	927.280	SIMN	741820T	GATES	N	0	Concrete Slab	Active	Public	Grade	120	ELLIOT ROAD	GILBERT	N	MARICOPA
181	Phoenix	4988-0	927.700	SIMN	741821A	STOP SIGNS	N	0	Sectional Timber	Active	Private	Grade	20	PRIVATE CROSSING	GILBERT	N	MARICOPA
182	Phoenix	4988-0	927.720	SIMN	741822G	STOP SIGNS	N	0	Sectional Timber	Active	Private	Grade	20	PRIVATE CROSSING	GILBERT	N	MARICOPA
183	Phoenix	4988-0	928.190	SIMN	741823N	GATES	N	0	Concrete Slab	Active	Public	Grade	100	LINDSAY ROAD	GILBERT	N	MARICOPA
184	Phoenix	4988-0	928.950	SIMN	741824V	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	160	WARNER ROAD	GILBERT	Y	MARICOPA

185	Phoenix	4988-0	929.390	SIMN	741825C	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	120	VALVISTA DR	GILBERT	Y	MARICOPA
186	Phoenix	4988-0	929.910	SIMN	741827R	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	20	PRIVATE CROSSING	HIGLEY	N	MARICOPA
187	Phoenix	4988-0	929.920	SIMN	741828X	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	20	PRIVATE CROSSING	HIGLEY	N	MARICOPA
188	Phoenix	4988-0	930.310	SIMN	922449Y	NONE	N	0	RR Over	Active	Public	Over Grade	0	GREENFIELD ROAD	GILBERT	N	MARICOPA
189	Phoenix	4988-0	930.520	SIMN	922180W	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	184	RAY ROAD	GILBERT	N	MARICOPA
190	Phoenix	4988-0	930.570	SIMN	922450T	NONE	N	0	RR Over	Active	Public	Over Grade	0	SANTAN FWY	GILBERT	N	MARICOPA
191	Phoenix	4988-0	931.830	SIMN	741830Y	GATES	N	0	Concrete Slab	Active	Public	Grade	40	HIGLEY ROAD	GILBERT	N	MARICOPA
192	Phoenix	4988-0	932.220	SIMN	741831F	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	80	WILLIAMS FIELD RD	GILBERT	N	MARICOPA
193	Phoenix	4988-0	933.090	SIMN	741832M	GATES	N	0	Concrete Slab	Active	Public	Grade	32	RECKER ROAD	GILBERT	Y	MARICOPA
194	Phoenix	4988-0	933.620	SIMN	748789H	STOP SIGNS	N	0	Plank and Gravel	Active	Private	Grade	20	PRIVATE	HIGLEY	N	MARICOPA
195	Phoenix	4988-0	933.630	SIMN	748790C	STOP SIGNS	N	0	Plank and Gravel	Active	Private	Grade	20	PRIVATE	HIGLEY	Y	MARICOPA
196	Phoenix	4988-0	934.380	SIMN	741833U	GATES	N	0	Concrete Slab	Active	Public	Grade	240	POWER/PECOS ROAD	GILBERT	Y	MARICOPA
197	Phoenix	4988-0	935.630	SIMN	741834B	GATES	N	0	Concrete Slab	Active	Public	Grade	40	SOSSMAN ROAD	QUEEN CREEK	N	MARICOPA
198	Phoenix	4988-0	938.210	SIMN	741835H	GATES	N	0	Concrete Slab	Active	Public	Grade	96	ELLSWORTH AVENUE	QUEEN CREEK	Y	MARICOPA
199	Phoenix	4988-0	939.070	SIMN	741837W	GATES	N	0	Concrete Slab	Active	Public	Grade	80	OCOTILLO ROAD	QUEEN CREEK	N	MARICOPA
200	Phoenix	4988-0	941.740	YARD	741840E	GATES	N	0	Asphalt	Active	Public	Grade	24	RITTENHOUSE ROAD	QUEEN CREEK	N	MARICOPA
201	Phoenix	4988-0	942.020	SIMN	741841L	GATES	N	0	Concrete Slab	Active	Public	Grade	40	COMBS ROAD	QUEEN CREEK	N	MARICOPA
202	Phoenix	4988-0	943.760	SIMN	176281Y	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	48	GANTZEL ROAD	QUEEN CREEK	Y	MARICOPA
203	Phoenix	4988-0	947.220	SIMN	741411B	GATES	N	0	Concrete Slab	Active	Public	Grade	40	BELLA VISTA ROAD	QUEEN CREEK	N	MARICOPA
204	Tempe Ind Ld	4985-0	0.620	INDL	741565L	GATES/CANTS	N	0	Rubber	Active	Public	Grade	96	BROADWAY ROAD	TEMPE	N	MARICOPA
205	Tempe Ind Ld	4985-0	0.671	INDU	748572V	STOP SIGNS	N	0	Wood Plank	Active	Private	Grade	18	CATELLUS	TEMPE	N	MARICOPA
206	Tempe Ind Ld	4985-0	0.801	INDU	741566T	GATES	N	0	Rubber	Active	Public	Grade	50	ROOSEVELT AVENUE	TEMPE	N	MARICOPA
207	Tempe Ind Ld	4985-0	0.810	INDU	748170N	XBUCKS/YIELD SIGNS	N	2	Asphalt	Active	Public	Grade	60	ALAMEDA DRIVE	TEMPE	N	MARICOPA
208	Tempe Ind Ld	4985-0	1.051	INDU	741567A	GATES	N	0	Rubber	Active	Public	Grade	50	HARDY DRIVE	TEMPE	N	MARICOPA
209	Tempe Ind Ld	4985-0	1.090	INDL	748300H	XBUCKS/STOP SIGNS	N	0	Asphalt	Active	Pedestrian	Grade	10	PEDESTRIAN CROSSI	TEMPE	N	MARICOPA

210	Tempe Ind Ld	4985-0	1.630	INDL	741568G	GATES	N	0	Rubber	Active	Public	Grade	80	SOUTHERN AVENUE	TEMPE	N	MARICOPA
211	Tempe Ind Ld	4985-0	2.130	INDL	741569N	NONE	N	0	RR Over	Active	Public	Over Grade	1	SUPERSTITION FWY	TEMPE	N	MARICOPA
212	Tempe Ind Ld	4985-0	2.660	INDL	741570H	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	104	BASELINE ROAD	TEMPE	Y	MARICOPA
213	Tempe Ind Ld	4985-0	2.690	INDL	741571P	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	20	BUREAU RCLMTION	TEMPE	Y	MARICOPA
214	Tempe Ind Ld	4985-0	3.130	INDL	741572W	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	30	JULIE DR.	TEMPE	Y	MARICOPA
215	Tempe Ind Ld	4985-0	3.630	INDL	741573D	GATES/CANTS	N	0	Rubber	Active	Public	Grade	80	GUADALUPE ROAD	TEMPE	Y	MARICOPA
216	Tempe Ind Ld	4985-0	4.140	INDL	741574K	STOP SIGNS	N	0	Asphalt	Active	Private	Grade	30	S.R.P.KYRENE PLNT	TEMPE	Y	MARICOPA
217	Tempe Ind Ld	4985-0	4.650	INDL	741575S	TRAFFIC SIGNALS	N	0	Concrete Slab	Active	Public	Grade	400	ELLIOTT/KYRENE RO	TEMPE	N	MARICOPA
218	Tempe Ind Ld	4985-0	5.190	INDL	748318T	GATES	N	0	Concrete Slab	Active	Public	Grade	56	CARVER ROAD	TEMPE	Y	MARICOPA
219	Tempe Ind Ld	4985-0	5.700	INDL	741578M	GATES/CANTS	N	0	Concrete Slab	Active	Public	Grade	80	WARNER ROAD	TEMPE	Y	MARICOPA
220	Tempe Ind Ld	4985-0	6.750	INDL	741579U	GATES/CANTS	N	0	Rubber	Active	Public	Grade	80	RAY ROAD	CHANDLER	Y	MARICOPA
221	Tempe Ind Ld	4985-0	7.800	INDL	741580N	GATES/CANTS	N	0	Rubber	Active	Public	Grade	80	CHANDLER BLVD	CHANDLER	N	MARICOPA
222	Tempe Ind Ld	4985-0	7.920	INDL	411019C	GATES	N	0	Asphalt	Active	Public	Grade	60	FRYE ROAD	CHANDLER	Y	MARICOPA
223	Tempe Ind Ld	4985-0	8.470	YARD	920154A	GATES	N	0	Concrete Slab	Active	Public	Grade	72	RYAN STREET	CHANDLER	Y	MARICOPA
224	Tempe Ind Ld	4985-0	8.490	YARD	748494R	NONE	N	0	RR Under	Active	Public	Under Grade	0	SAN TAN FREEWAY	CHANDLER	Y	MARICOPA
225	Tempe Ind Ld	4985-0	8.790	YARD	412493D	STOP SIGNS	N	0	Concrete Slab	Active	Private	Grade	20	PR-AZDOT	CHANDLER	Y	MARICOPA
226	Tempe Ind Ld	4985-0	9.160	YARD	741581V	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	36	ALLISON ROAD	TEMPE	Y	MARICOPA
227	Tempe Ind Ld	4985-0	9.410	YARD	741582C	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	36	WILLIS ROAD	TEMPE	Y	MARICOPA
228	Tempe Ind Ld	4985-0	9.680	YARD	748747W	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	40	SUNDUST ROAD	CHANDLER	N	MARICOPA
229	Tempe Ind Ld	4985-0	9.900	YARD	748748D	XBUCKS/YIELD SIGNS	N	2	Concrete Slab	Active	Public	Grade	40	GERMANN ROAD	CHANDLER	N	MARICOPA

A.6 Gilbert: Site 7 – Western Canal – Neely Road Crossing Plans

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ	PR011			



SCALE: 1" = 40'
0 10 20 40'



NO.	DESCRIPTION	REV BY	CHK BY	DATE

CALL TWO WORKING DAYS BEFORE YOU DO
CALL FOR THE BLUE STAKES!
602-263-1100
1-800-STAKE-IT
OUTSIDE MARICOPA COUNTY

GEOMETRIC LAYOUT
GILBERT
ARIZONA
WPT/UPRR CROSSING
ALTERNATIVE 2
UPRR AT-GRADE CROSSING

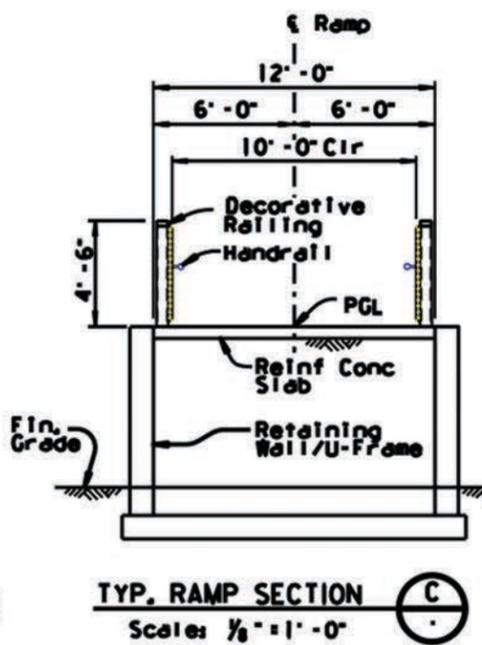
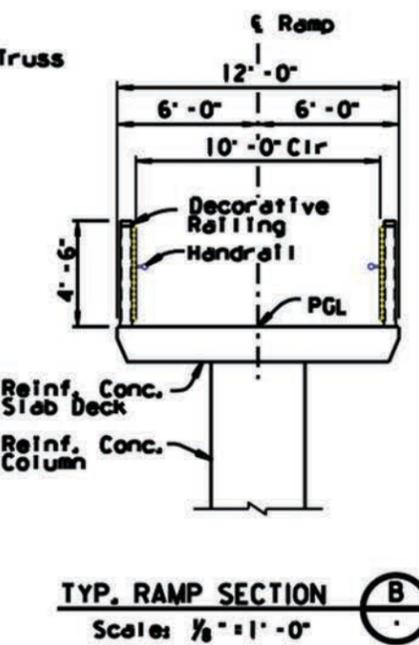
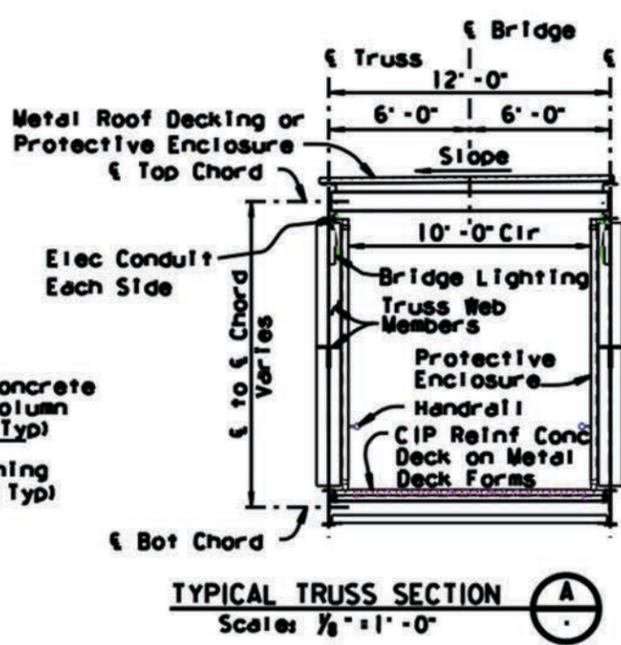
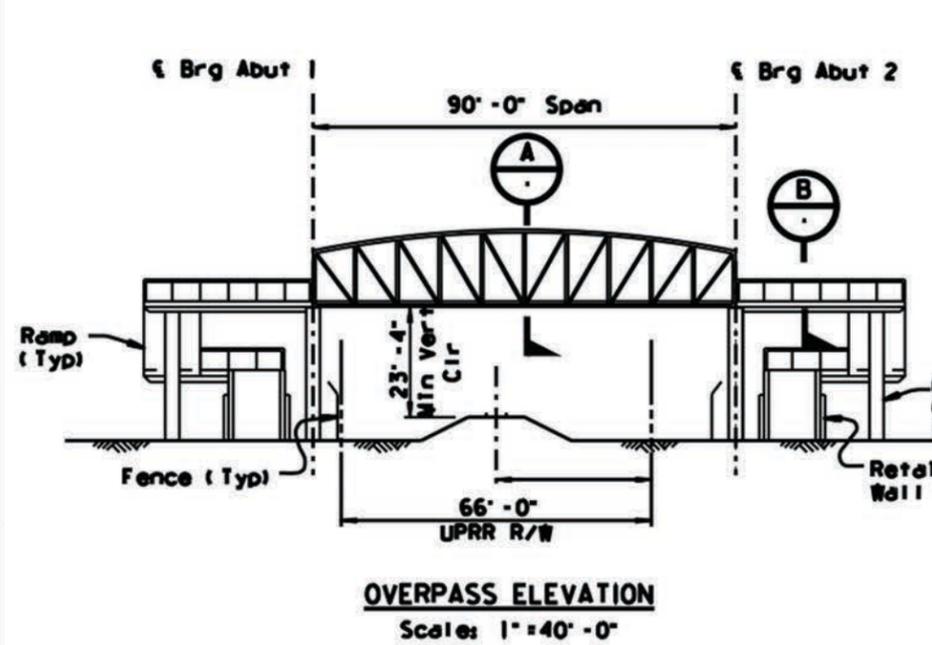
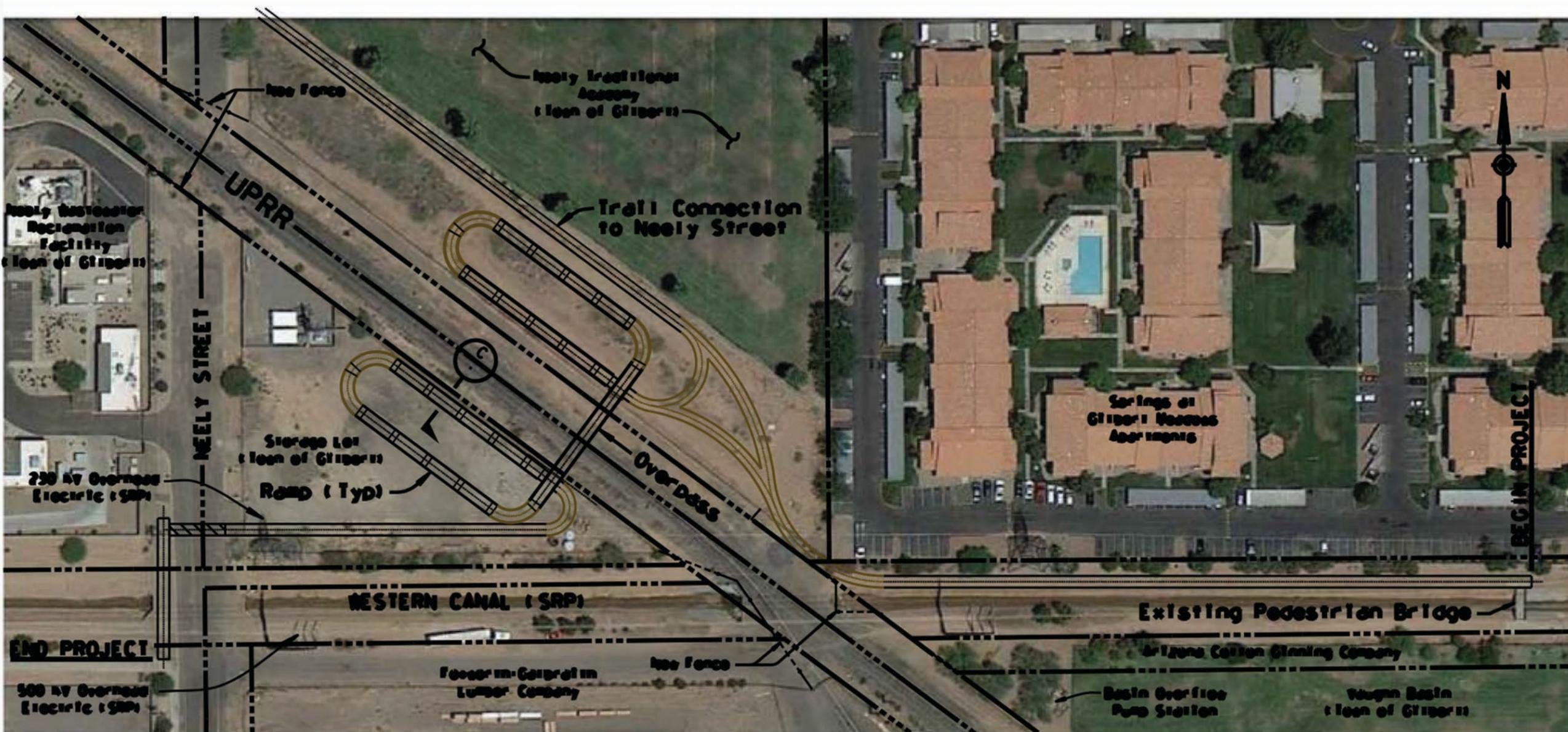
DR: NKP JDS: NKPICK: SMO
DATE: 07/13/13 DATE: 07/13/13 DATE: 07/13/13
DWG. NO. T-1.01

SCALE: AS SHOWN _____ OF _____

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ	PR011			



REVISION BY	TOWN OF GILBERT	DESCRIPTION	NO.	DATE



SCALE: 1" = 100'

 CALL THE WORKING DAYS BEFORE YOU DIG
 CALL FOR THE BLUE STAKES
 602-263-1100
 1-800-STAKE-IT
 OUTSIDE MARICOPA COUNTY

GEOMETRIC LAYOUT
GILBERT
 ARIZONA
 WPT/UPRR CROSSING
 ALTERNATIVE 3 (PREFERRED)
 UPRR OVERPASS - NORTH

DATE: 07/13/2013	DATE: 07/13/2013	DWG. NO. S-1.01
SCALE: AS SHOWN		OF

