Rail Crossing Safety Study

UPRR Nogales Spur Crossings at:

16th Street/Toole Avenue
17th Street
18th Street
19th Street
20th Street

City of Tucson

Prepared by STANTEC CONSULTING SERVICES, INC.

May 2013
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Stantec
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EXECUTIVE SUMMARY

Stantec Consulting Services, Inc. was retained by the City of Tucson, Transportation Department to evaluate five (5) public highway-rail crossings of the Union Pacific Railroad (UPRR) in Tucson, Arizona with regard to improving safety at the crossings. The crossings studied are:

16th Street/Toole Avenue & UPRR
17th Street & UPRR
18th Street & UPRR
19th Street & UPRR
20th Street & UPRR

The five crossings (Exhibit 1) are for a single track spur accommodating freight trains entering Tucson from the south and terminating at the railway classification yard south of the Barraza-Aviation Parkway.

Findings

There are several projects being studied, in design and/or planned by the City of Tucson, the Regional Transportation Authority (RTA), the Arizona Department of Transportation (ADOT) and the Federal Highway Administration (FHA) which are relevant to this study:

- 22nd Street: Kino Parkway To Tucson Boulevard Widening Project
- Park Avenue and 18th Street Traffic Signal Project
- Construction of a UPRR classification yard near Red Rock Arizona
- Construction of a second line (track)/Nogales Branch
- Upgrading of the Nogales Branch (to accommodate heavier vehicles)
- Providing passenger rail service/Nogales to Tucson

However, the project which is anticipated to have the most impact on the crossings studied in the near future is the 22nd Street: Kino Parkway to Tucson Boulevard Project. This project, currently in design, will construct a bridge structure over the UPRR tracks on 22nd Street and widen the roadway to six lanes with a raised median. Construction of this project should increase the capacity of the roadway and thus decrease traffic volumes at the five crossings in the study.

Recommendations

It is recommended that all five crossings be reevaluated in the future based on revisions to traffic patterns resulting from completion of the 22nd Street improvements. At that time consolidation or elimination of one or more of the crossings may be justified. Additionally, the railroad has indicated a willingness to discuss participation in funding the creation of a “Quiet Zone” should the City be willing to close several of the crossings. Presently it is recommended that the pavement markings at each of the crossings be refreshed with thermoplastic material.
The table below gives specific recommendations:

<table>
<thead>
<tr>
<th>Crossing</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>16th Street/Toole Avenue/UPRR Crossing No. 742045F</td>
<td>Install longer gate arms*. Consider installing median curbing to channelize traffic. Replace incandescent lamps with LED lamps on Automated Crossing Gates.</td>
</tr>
<tr>
<td>17th Street/UPRR Crossing No. 742047U</td>
<td>Install longer gate arms. Monitor COT street lighting at crossing.</td>
</tr>
<tr>
<td>18th Street Crossing No. 742049H</td>
<td>Install longer gate arms. Reevaluate in the future based on revisions to traffic patterns resulting from installation of Traffic Signal at Park Avenue. Replace incandescent lamps with LED lamps on Automated Crossing Gates.</td>
</tr>
<tr>
<td>19th Street Crossing No. 742100D</td>
<td>Install W10-1 Highway-Rail Grade Crossing Advanced Warning Sign for westbound traffic. Replace incandescent lamps with LED lamps on Automated Crossing Gates.</td>
</tr>
<tr>
<td>20th Street Crossing No. 742103Y</td>
<td>Install longer gate arms. Consider modifying drainage structure to address pedestrian safety concerns. Replace incandescent lamps with LED lamps on Automated Crossing Gates.</td>
</tr>
</tbody>
</table>

*FRA regulation 49 CFR 234.223: Each gate arm, when in the downward position, shall extend across each lane of approaching highway traffic
INTRODUCTION

Objectives

The objective of this study is to assist the City of Tucson in assessing the safety of the at-grade UPRR rail crossings at 16th Street/Toole Avenue, 17th Street, 18th Street, 19th Street, and 20th Street in Tucson, Arizona. The purpose of the study is to determine what improvement(s) could be implemented at these crossings to improve safety. The study also examines other possible safety enhancements to adjacent local streets and crossings that would further improve public safety, while accommodating current vehicular, pedestrian, school bus, and emergency response traffic.

Preamble

Across America, several hundred people are killed each year in collisions at at-grade roadway/rail crossings. Collisions between trains and vehicles are the principal cause of death in the railroad industry. In 2011, Arizona had fourteen roadway-rail crossing incidents resulting in four deaths and five injuries and ranks 35th in the nation for such incidents. As the number of freight and passenger trains increases and vehicular traffic grows, the need to identify and prioritize safety enhancements will become even more critical.

Existing Conditions and Assumptions

Train Operations

The UPRR Nogales Branch line connects the cities of Tucson and Nogales, Arizona. The single track spur enters Tucson from the south just east of the Nogales Highway and continues north until, at the Toole Avenue crossing, the line changes direction to the southeast terminating at the railway yard south of the Barraza-Aviation Parkway (see Exhibit 2). The Federal Railroad Administration (FRA) reports up to eleven freight trains currently utilize this line daily. The Stantec collected traffic counts indicate from five to eight trains use the line daily.
Traffic Volumes and Conditions
The following table from the U.S. Department of Transportation Federal Railroad Administration (FRA) Crossing Inventory Information gives the 1988 Average Annual Daily Traffic (AADT) count for the study crossings.

<table>
<thead>
<tr>
<th>Crossing</th>
<th>1988 AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>16th Street/Toole Avenue</td>
<td>1,950</td>
</tr>
<tr>
<td>17th Street</td>
<td>2,450</td>
</tr>
<tr>
<td>18th Street</td>
<td>1,500</td>
</tr>
<tr>
<td>19th Street</td>
<td>650</td>
</tr>
<tr>
<td>20th Street</td>
<td>4,700</td>
</tr>
</tbody>
</table>

As part of the study, Stantec collected traffic counts at each crossing location. This information is noted in the table below. These average daily traffic (ADT) counts were used to determine design requirements of recommended improvements. In addition to vehicular traffic, pedestrian and bicycle counts were collected.

<table>
<thead>
<tr>
<th>Crossing</th>
<th>Pedestrians</th>
<th>Bicycles</th>
<th>Passenger Vehicles</th>
<th>Single Unit Trucks</th>
<th>Multi-Unit Trucks</th>
<th>Trains</th>
<th>ADT (Weekday)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16th Street/Toole Avenue</td>
<td>18</td>
<td>53</td>
<td>1454</td>
<td>142</td>
<td>151</td>
<td>6**</td>
<td>1747</td>
</tr>
<tr>
<td>17th Street</td>
<td>26*</td>
<td>24</td>
<td>380</td>
<td>90</td>
<td>10</td>
<td>7**</td>
<td>480</td>
</tr>
<tr>
<td>18th Street</td>
<td>28</td>
<td>40</td>
<td>1073</td>
<td>77</td>
<td>16</td>
<td>8**</td>
<td>1166</td>
</tr>
<tr>
<td>19th Street</td>
<td>21</td>
<td>29</td>
<td>688</td>
<td>86</td>
<td>11</td>
<td>5**</td>
<td>785</td>
</tr>
<tr>
<td>20th Street</td>
<td>37</td>
<td>17</td>
<td>317</td>
<td>11</td>
<td>0</td>
<td>7**</td>
<td>328</td>
</tr>
</tbody>
</table>

* Pedestrians could not be counted from 6:00 P.M. to 6:00 A.M. due to lighting conditions at the crossing
** The number of trains passing through each crossing is dependent on the date/dates on which the counts were collected for the crossing

Weekend traffic counts were also collected for the 20th Street crossing due to its close proximity to Santa Rita Park. This information is tabulated below.

<table>
<thead>
<tr>
<th>Crossing</th>
<th>Pedestrians</th>
<th>Bicycles</th>
<th>Passenger Vehicles</th>
<th>Single Unit Trucks</th>
<th>Multi-Unit Trucks</th>
<th>Trains</th>
<th>ADT (Weekend)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20th Street (Saturday)</td>
<td>49</td>
<td>21</td>
<td>392</td>
<td>30</td>
<td>0</td>
<td>4</td>
<td>422</td>
</tr>
<tr>
<td>20th Street (Sunday)</td>
<td>24</td>
<td>12</td>
<td>248</td>
<td>13</td>
<td>0</td>
<td>4</td>
<td>261</td>
</tr>
</tbody>
</table>
Accident History
Review of the Federal Railroad Administration (FRA) files indicates none of the five crossings have generated an accident or incident report within the last ten (10) years.

The most recent incident reported for any of the five crossings occurred on January 24, 1989 at the 20th Street crossing and did not result in a fatality or injuries.

Accident data was also received from the City of Tucson, Transportation Department, Traffic Engineering Division for the 3-year period from 2008-2010. That period of time was selected as the Tucson Police Department stopped responding to property-damage-only accidents in 2011. Traffic Engineering also provided an accident report from April 20th 2012 which was the only one of the data provided that was related to any of the crossings.

The report on the April 20th accident occurred at the 18th Street railroad crossing on a Saturday morning and involved a single Ryder truck rental attempting to back through the crossing. The driver was unable to clear the crossing before the railroad crossing gate contacted the cab of truck and broke. There were no injuries. A UPRR representative responded to the accident and repaired the crossing gate.

Crossing Locations
Exhibits 3 and 4 show the location of the five crossings studied under this project and the police and fire stations in a one mile area around the crossings.

An inventory of the railroad equipment present at each of the five study crossings is given below. Information on the lamps and type of automated crossing gate present at each location was provided by Wayne Hale (UPRR Tucson Manager Signal Maintenance).

16th Street/Toole Avenue Crossing
Exhibit 5 shows the existing railroad equipment at the Toole Avenue / Nogales Branch Railroad Crossing and is listed below.

Signs:
2 - W10-1 Highway-Rail Grade Crossing Advanced Warning Signs in each direction
1 – R8-8 Do Not Stop On Tracks Sign in each direction
1 – R15-1 Grade Crossing (Crossbuck) in each direction

Pavement Markings:
Stop Lines
RR Xing Symbols

Train Activated Devices:
1 - Automatic Crossing Gate (Western-Cullen-Hayes) (incandescent lamps) in each direction
4 - pair of Cantilevered Flashing Lights Over Travel Lane (one pair for each direction on each cantilevered mast arm
4 - pair of Cantilevered Flashing Lights Not Over Travel Lane (one pair for each direction on each crossing gate post)
1 – railroad crossing warning bell on top of each crossing gate post
Exhibit 3

Police Stations and Police Sectors

TPD Sector
- South Tucson
- Dtn Sect. 1
- Dtn Sect. 2
- Dtn Sect. 3
- Dtn Sect. 4
- Midtown Sect. 3
- Midtown Sect. 6
- South Sect. 1
- South Sect. 2
- South Sect. 3
- South Sect. 7
- West Sect. 7

Study Crossing
Crossing 1 Mile Buffer
Police Station

Stantec Consulting
5151 E Broadway Blvd
Suite 400
Tucson, AZ 85711
520.750.7474
www.stantec.com
Exhibit 4

Fire Stations and Fire Districts

- Study Crossing
- Crossing 1 Mile Buffer
- Fire Station
- Fire District

- SOUTH TUCSON
- TUCSON

Stantec Consulting
5151 E Broadway Blvd
Suite 400
Tucson, AZ 85711
520.750.7474
www.stantec.com
EXHIBIT 5
TOOLE AVENUE CROSSING
Lighting:
1 – wooden pole mounted street light in northeast quadrant

Crossing Surface:
Concrete

17th Street Crossing
Exhibit 6 shows the existing railroad equipment at the 17th Street / Nogales Branch Railroad Crossing and is listed below.

Signs:
1 - W10-1 Highway-Rail Grade Crossing Advanced Warning Signs in each direction
1 – R15-1 Grade Crossing (Crossbuck) in each direction

Pavement Markings:
Stop Lines
RR Xing Symbols

Train Activated Devices:
1 - Automatic Crossing Gate (S-40) (LED Lamps) in each direction
4 - pair of Flashing Lights Not Over Travel Lane (one pair for each direction on each crossing gate post)
1 – railroad crossing warning bell on each crossing gate post

Lighting:
1 – wooden pole mounted street light in southwest quadrant

Crossing Surface:
Concrete

18th Street Crossing
Exhibit 7 shows the existing railroad equipment at the 18th Street / Nogales Branch Railroad Crossing and is listed below.

Signs:
1 - W10-1 Highway-Rail Grade Crossing Advanced Warning Signs in each direction
1 – R15-1 Grade Crossing (Crossbuck) in each direction

Pavement Markings:
Stop Lines
RR Xing Symbols

Train Activated Devices:
1 - Automatic Crossing Gate (Western-Cullen-Hayes) (incandescent lamps) in each direction
4 - pair of Flashing Lights Not Over Travel Lane (one pair for each direction on each crossing gate post)
1 – railroad crossing warning bell on top of each crossing gate post
Lighting:
2 – wooden pole mounted street light one in southwest quadrant & one in northeast quadrant

Crossing Surface:
Concrete

19th Street Crossing
Exhibit 8 shows the existing railroad equipment at the 19th Street / Nogales Branch Railroad Crossing and is listed below.

Signs:
1 - W10-1 Highway-Rail Grade Crossing Advanced Warning Sign eastbound
1 – R15-1 Grade Crossing (Crossbuck) in each direction

Pavement Markings:
Stop Lines
RR Xing Symbols

Train Activated Devices:
1 - Automatic Crossing Gate (Western-Cullen-Hayes) (incandescent lamps) in each direction
4 - pair of Flashing Lights Not Over Travel Lane (one pair for each direction on each crossing gate post)
1 – railroad crossing warning bell on top of each crossing gate post

Lighting:
2 – wooden pole mounted street light one in southwest quadrant & one in northeast quadrant

Crossing Surface:
Concrete

20th Street Crossing
Exhibit 9 shows the existing railroad equipment at the 20th Street / Nogales Branch Railroad Crossing and is listed below.

Signs:
1 - W10-1 Highway-Rail Grade Crossing Advanced Warning Sign in each direction
1 – R15-1 Grade Crossing (Crossbuck) in each direction

Pavement Markings:
Stop Lines
RR Xing Symbols

Train Activated Devices:
1 - Automatic Crossing Gate (Western-Cullen-Hayes) (incandescent lamps) in each direction
EXHIBIT 9
20TH STREET CROSSING
4 - pair of Flashing Lights Not Over Travel Lane (one pair for each direction on each crossing gate post)
1 – railroad crossing warning bell on top of each crossing gate post

**Lighting:**
1 – wooden pole mounted street light one in northwest quadrant

**Crossing Surface:**
Concrete
Other Considerations and Future Projects
The City of Tucson/RTA 22\textsuperscript{nd} Street: Kino Parkway To Tucson Boulevard Widening Project is relevant to this study. The design of the project began in the Fall of 2012 with an anticipated duration of three and a half years. Construction is anticipated to begin in the third period of the RTA funding in 2015. The improvements will widen 22\textsuperscript{nd} Street to six (6) lanes, with a raised landscaped median and a new six lane bridge structure over the Barraza-Aviation Parkway/UPRR tracks. It is anticipated that completion of this project will decrease the traffic volumes for the crossings in this study.

The City of Tucson is also installing a traffic signal at Park Avenue and 18\textsuperscript{th} Street. The purpose of this signal would be to help guide truck traffic on 18th Street south to 22\textsuperscript{nd} Street thus decreasing the traffic volume at the railroad crossing at 18\textsuperscript{th} Street.

The Arizona State Rail Plan issued by the Arizona Department of Transportation in March 2011 provides a long-range vision for the State’s passenger and freight rail systems. One of the major proposals in the plan is a proposed new UPRR classification yard near Red Rock Arizona which would supplement classification activities currently occurring at the Tucson Yard. If a classification yard at Red Rock is built, direct traffic flow between Phoenix and Nogales will be possible thereby opening up capacity at the Tucson Yard for other functions and potentially reducing rail traffic through the crossings in the study.

The Arizona-Sonora Border Master Plan Technical Memorandum No. 3 Future Conditions and Deficiencies November 2012 prepared by the Federal Highway Administration and the Arizona Department of Transportation identified the following potential projects which could impact the study crossings:

- Build a second line (track)/Nogales Branch
- Upgrade Nogales Branch (to accommodate heavier vehicles)
- Passenger rail service/Nogales to Tucson
STUDY CRITERIA/METHODOLOGY

A variety of techniques were used to evaluate the crossing conditions in terms of safety and traffic delay. This section describes the techniques employed in this study.

Study Criteria

The following standard criteria developed for the North Carolina Department of Transportation (NCDOT) rail crossing closure program were used in evaluating the UPRR Nogales Branch crossings:

- Accident History
- Vehicle Traffic
- Train Traffic
- Type roadway (thoroughfare, collector, local access, etc.)
- Type of property being served (residential, industrial, commercial)
- School bus routes
- Emergency routes
- Type of warning devices present
- Redundant crossing
- Potential for grade separation (not considered feasible)
- Feasibility of implementing roadway improvements (not in the scope of this project)
- Economic impact if crossing closed (not addressed in this report)

Accident History

FRA records indicate none of the crossings have generated an accident or incident report within the last ten years. City of Tucson records indicate one property damage only accident in 2012 at the 18th Street crossing.
Vehicles Queuing Across Railroad Tracks

The presence of nearby traffic signals, intersections, or parallel roadways can result in queues of stopped vehicles extending onto or across a railroad crossing. This situation was not observed for any of the crossings in the study and only the 16th Street/Toole Avenue crossing having potential for this problem for southbound traffic turning east on 16th Street.

Traffic Signal Preemption

Standard practice (based on the Manual on Uniform Traffic Control Devices) requires that traffic signals located within 200 feet of a railroad crossing be coordinated with the crossings train detection and warning system to preempt normal operations of the traffic signal. There are no signals within 200 feet of any of the crossings.

Humped Crossings

A "humped" crossing exists where the elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. The severity of this condition can range from discomfort at normal speeds, to "bottoming out" of vehicles with long wheelbases or low clearances. This dragging can damage vehicles, or cause them to become stuck on the crossing, creating a serious traffic safety hazard. Routine track maintenance tends to exacerbate the problem over time, as track ballast typically adds about 3" per occurrence. Over a ten year period, the railroad will rise about one foot as a result of this routine maintenance.

As the Findings section of this report discusses in more detail, several of the crossings in this study were determined to have humped profiles.

Grade Crossing Condition

A poor grade crossing surface can result in a rough, uneven ride. This can increase wear and tear on vehicles, and cause congestion by reducing travel speeds.

The grade crossing surface at all five of the crossings is concrete which appears to be in good condition.

Vehicles Driving Around Automated Gates

Several situations can lead to the circumvention of automated gates by motorists:

- Gates are lowered, but no train is visible
- Gates fail, and remain in the lowered position
- Gates are lowered and train is visible, but motorist is too impatient to wait

All of the crossings currently have automated gates and circumvention of automated gates by motorists has been observed at several of the crossings studied.
Improved Signs and Markings

The effectiveness of required warning signs, signals and other devices depends heavily on proper installation and maintenance by state and municipal transportation departments and the railroads.

Median Island Installation

Median Island installation has been shown to be an effective method of discouraging drivers from driving around the crossing gate when it is down and crossing into opposing traffic. Mountable raised median islands have been utilized when it is necessary to allow emergency vehicles to cross. Several instances of this “crossing gate” violation were observed in the videos of the crossings. However, only the 16th Street/Toole Avenue crossing appears to be wide enough to permit installation of a median island and it is the only crossing for which the mountable raised median should be considered.

Four-Quadrant Traffic Gate Systems

The four-quadrant gate system consists of gates on each side of the road, on both sides of the crossing. The system results in an obstruction across the entire roadway and is an effective deterrent for “crossing gate” violators particularly when there is no space for a median island. This system is not considered a safety improvement by the FRA and costs associated with its installation and maintenance must be borne by the agency. In order to prevent vehicles attempting to go under the gates as they are lowering from becoming trapped on the tracks by the down gates, the exit gates may be delayed or vehicle presence detection may be installed to hold the exit gates up while vehicles are within the crossing zone. The four-quadrant gate system is not recommended since initial installation, upkeep and additional circuitry required is expensive, and the railroad usually will not participate in the funding.

Barrier Systems

Barrier Systems are moveable barriers designed to prevent vehicles from entering the crossing. This system is relatively expensive and more complicated to maintain than crossing gates. It is not recommended for the crossings in this study.
Crossing Warning Device Upgrades

The most common and cost effective way to increase the safety at a railway crossing is to upgrade existing warning devices at the crossing. Typical warning devices include signs, gate arms, flashing lights and bells. **Passive** devices, such as advanced warning signs and crossbucks, merely warn the motorist of the existence of a railroad crossing. These devices are most suitable where train and traffic volumes and speeds are low, and where sight distance is adequate. **Active** devices that warn motorists of approaching trains include flashing lights, bells, and automated gates. Such devices are usually employed at locations exhibiting higher volumes or speeds, or greater potential for accidents. The hierarchy of standard warning treatments, from least to most positive is:

<table>
<thead>
<tr>
<th>Rank</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Unmarked</td>
</tr>
<tr>
<td>2.</td>
<td>Railroad crossbucks</td>
</tr>
<tr>
<td>3.</td>
<td>Standard STOP signs and crossbucks</td>
</tr>
<tr>
<td>4.</td>
<td>Flashing signals and bells</td>
</tr>
<tr>
<td>5.</td>
<td>Flashing signals, bells and gates</td>
</tr>
</tbody>
</table>

All five of the crossings studied have flashing signals, bells and gates.

Crossing Consolidation & Elimination

Many low-volume crossings are unnecessary due to the availability of alternative access across the tracks. These alternative crossings can often be made safer, since many lower-volume crossings lack adequate warning devices. Resources are not available to upgrade warning devices on all existing crossings, and grade separation would be even less feasible. Therefore, consolidation and closure of these minor crossings is an effective strategy in terms of both costs and safety benefits. Typically, a crossing is considered redundant (and therefore a candidate for elimination) if it is within mile of another crossing connected to the same street network. Although there is no requirement for a limit to the number of crossings per mile, and no more than one per mile is preferred, each crossing must be evaluated on a case by case basis.

Crossing consolidations eliminate the potential for train/vehicle collisions. Crossing-related installation and maintenance costs are reduced, and by concentrating traffic at fewer, higher-volume crossings, more expensive active warning treatments and roadway improvements can be justified.

Crossings with high potential for elimination include:

- Redundant crossings near parallel crossings or grade separations, or where traffic can be safely and efficiently diverted to another crossing;
- Skewed crossings, or those where sight distance is limited by horizontal/vertical curvature, vegetation, or permanent obstructions;
- Crossings with a history of frequent accidents;
• Crossings adjacent to a newly constructed crossing or grade separation;
• Private crossings with no identifiable owner, or where the owner is unwilling or unable to fund crossing upgrades (and where alternative access is reasonably available);
• Complex crossings that cannot be effectively served by warning devices due to multiple tracks, extensive switching operations, etc.

Roadway Improvements

Roadway improvements can reduce both accident potential and traffic delay at railroad crossings. Realignment and re-grading can improve visibility and reduce the time required to traverse a crossing. Additional lanes significantly increase capacity, reducing the residual delay following a crossing event. New roadways can provide alternative routes, allowing crossings to occur at more desirable locations, and potentially eliminating some crossing trips.
FINDINGS AND RECOMMENDATIONS

Findings

General:

The crossings studied in this report are all part of the single track UPRR Nogales Branch line which connects the cities of Tucson and Nogales, Arizona. The spur line provides a route for freight traffic from Nogales to the Union Pacific's Pacific Fruit Express classification yard in Tucson. This is the largest classification yard in Arizona and has reached capacity. Stantec collected traffic counts indicate five to eight trains use the line daily. It was observed on occasion a train will remain stopped blocking the roadway at a crossing for up to ten minutes. City of Tucson Police and Fire were contacted but neither agency indicated they had a safety concern/issue with the stopped trains.

The closest schools in the area of the crossings are Borton Elementary School, south of 22nd Street and Drake Alternative Middle School, north of the Barraza Aviation Parkway (see Exhibit 10 Schools by Type). Both schools are in Tucson Unified School District.

There are no bus stops or routes along the crossings. See Exhibit 11 Bus Stops and Bus Routes for the closest stops and routes in the vicinity of the crossings.

None of the roadways are along an Emergency Route.

The eastern boundary of the Armory Park Historic District is along Jacobus Road approximately 200 feet east of the spur line.

The City of Tucson’s Automated Road Analyzer (ARAN) collected data on the condition of the roadway at the crossings in 2006. At that time, each of the roadways received a 7-8 rating on a scale of 1-10 with ten being the best with the exception of 20th Street which had a rating of 5-8 (see Exhibit 12 ARAN Roadway Conditions).

16th Street/Toole Avenue Crossing:

16th Street/Toole Avenue, at this location, is classified as a collector.

FRA accident data indicate no accident or incident report within the last ten (10) years. City of Tucson accident data indicates no accidents at this crossing from January 2008 through December 2010.

Average Daily Traffic Volumes collected by Stantec on the 16th Street/Toole Avenue railroad crossing indicate this crossing is the busiest of the five crossings studied having
Exhibit 10
Schools by Type

- ELEMENTARY SCHOOL
- MIDDLE SCHOOL
- HIGH SCHOOL
- POSTSECONDARY SCHOOL
- OTHER

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Map Document: (V:\52817t\active\181710027 - UPRR At Grade Study\gis\UPRR_school.mxd)
5/28/2013 -- 8:52:57 AM

Stantec Consulting
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Exhibit 10
Schools by Type

- Study Crossing
- Crossing 1 Mile Buffer
- ELEMENTARY SCHOOL
- MIDDLE SCHOOL
- HIGH SCHOOL
- POSTSECONDARY SCHOOL
- OTHER

Map Document: (V:\52817t\active\181710027 - UPRR At Grade Study\gis\UPRR_school.mxd)
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Exhibit 11

Bus Stops and Bus Routes
a traffic volume of more than 2.5 times the average of the other four crossings in the study.

Video of the crossing collected on April 9, 13, and 17, 2012 shows vehicles racing under or going around lowered crossing gates. The frame below was selected from the video of this crossing taken on April 17, 2012 and shows a vehicle crossing the track between the down crossing gates.

For the 24 hours of traffic volume data collected six trains crossed the roadway.

The land use in the vicinity of the crossing is predominantly industrial with residential use beginning approximately 600 feet to the west (see Exhibit 13 Land Use).

Eastbound train’s view of the 16th Street crossing has a sight obstruction due to the close proximity of a building to the rail crossing (see Exhibit 5).

There are two southbound lanes approaching the crossing and a single northbound lane. Exhibit 5 shows both approaches have a double yellow striped “island” separating the two directions of travel.
17th Street Crossing:

17th Street, at this location, is classified as a Local street.

FRA accident data indicate no accident or incident reports within the last ten (10) years. City of Tucson accident data indicates no accidents at this crossing from January 2008 through December 2010.

Average Daily Traffic Volumes collected by Stantec on the 17th Street Crossing indicate it is a low volume crossing (480 vpd).

For the 24 hours of traffic volume data collected seven trains crossed the roadway.

The land use in the vicinity of the crossing is predominantly industrial with residential use beginning approximately 600 feet to the west (see Exhibit 13 Land Use).

Trains approaching the 17th Street crossing have a sight obstruction due to the close proximity of buildings to the rail crossing (see Exhibit 6). Additionally, vehicles exiting parking lots of adjacent buildings may not have a clear sighting of the crossing warning system.

The elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. This condition certainly results in discomfort at normal speeds, and may result in "bottoming out" of vehicles with long wheelbases or low clearances.

At the time of the Stantec traffic volume data collection on November 14, 2012 the City of Tucson street light at the crossing was not functioning.

18th Street Crossing:

18th Street, at this location, is classified as a Local street.

FRA accident data indicate no accident or incident report within the last ten (10) years. City of Tucson accident data indicates no accidents at this crossing from January 2008 through December 2010. However, the City did report one accident at this crossing on April 20, 2012 which involved property damage (broken crossing gate) but no injuries.

Average Daily Traffic Volumes collected by Stantec on the 18th Street Crossing indicate 1166 vehicles utilize the crossing daily. 8.7% (93) of the vehicles were trucks (single and multi-unit) compared to 20.8% of the vehicles on 17th Street and 14.1% on 19th Street.
18th Street is the only crossing which is a Bike Route. Bicycle traffic collected by Stantec during the week indicated 40 bicyclists used the roadway at the crossing in a 24 hour period.

Exhibit 14 shows the bump out and signage just west of the rail crossing installed to deter westbound through vehicular traffic from entering the residential area to the west.

For the 24 hours of traffic volume data collected eight trains crossed the roadway.

The land use in the vicinity of the crossing is predominantly industrial with residential use beginning approximately 300 feet to the west (see Exhibit 13 Land Use).

Trains approaching the 18th Street crossing have a sight obstruction due to the close proximity of buildings to the rail crossing (see Exhibit 7). Additionally, vehicles exiting parking lots of adjacent buildings may not have a clear sighting of the crossing warning system.

The elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. This condition certainly results in discomfort at normal speeds, and may result in "bottoming out" of vehicles with long wheelbases or low clearances.

19th Street Crossing:

19th Street, at this location, is classified as a Local street.

FRA accident data indicate no accident or incident report within the last ten (10) years. City of Tucson accident data indicates no accidents at this crossing from January 2008 through December 2010.

Video of the crossing collected on May 4, 2012 indicated approximately a minute after a train went by and the gates raised the gates then lowered for approximately 20 seconds and no train passed. In discussions with Alexander Popovici (UPRR), the erratic gate operation may indicate a faulty gate or be the result of slack in the train triggering the gate detector.

Average Daily Traffic Volumes collected by Stantec on the 19th Street Crossing indicate it is a low volume crossing (785 vpd).

For the 24 hours of traffic volume data collected five trains crossed the roadway.

The land use in the vicinity of the crossing is predominantly industrial with residential use beginning approximately 300 feet to the west (see Exhibit 13 Land Use).
Exhibit 14
18th Street Bump Out and Signage
Trains approaching the 19th Street crossing have a sight obstruction due to the close proximity of buildings to the rail crossing (see Exhibit 11). Additionally, vehicles exiting parking lots of adjacent buildings may not have a clear sighting of the crossing warning system.

The elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. This condition certainly results in discomfort at normal speeds, and may result in "bottoming out" of vehicles with long wheelbases or low clearances.

Inventory of the existing signs at this crossing indicates only one W10-1 Highway-Rail Grade Crossing Advanced Warning Sign is present for eastbound traffic.

20th Street Crossing:

20th Street, at this location, is classified as a Local street.

FRA accident data indicate no accident or incident report within the last ten (10) years. City of Tucson accident data indicates no accidents at this crossing from January 2008 through December 2010.

Average Daily Traffic Volumes collected by Stantec on the 20th Street Crossing indicate it is a low volume crossing (328 vpd) and the lowest of the five crossings studied. Weekend counts at the crossing were also collected to see if there was a significant difference in the traffic volumes due to the proximity of the crossing to the Santa Rita public park. The weekend ADT for the crossing was also low volume (422 vpd on Saturday and 261 vpd on Sunday). Pedestrian, bicycle, passenger and single unit truck traffic were all higher on Saturday than on the weekday and pedestrian, bicycle, and passenger vehicle traffic were all lower on Sunday than on the weekday.

Video of the crossing collected on May 5, 2012 indicated the crossing gates remained down for more than two minutes after the train passed resulting in two impatient drivers driving around the gates. The gates then raised and approximately 10 seconds later lowered for approximately 20 seconds with no train passing. In discussions with Alexander Popovici (UPRR), the erratic gate operation may indicate a faulty gate, be the result of slack in the train triggering the gate detector, or even be caused by another train or inspection vehicle on the track.

For the 24 hours of traffic volume data collected during the weekday seven trains crossed the roadway. Four trains crossed the roadway on Saturday and four trains crossed the roadway on Sunday.

The land use in the vicinity of the crossing is predominantly industrial to the east with residential use beginning approximately 300 feet to the northwest and municipal Santa Rita Park to the southwest (see Exhibit 13 Land Use).
Trains approaching the 20th Street crossing have a sight obstruction due to the close proximity of buildings to the rail crossing (see Exhibit 9). Additionally, vehicles exiting parking lots of adjacent buildings may not have a clear sighting of the crossing warning system.

The elevation of the railroad is significantly higher than the crossing roadway, causing vehicles to ascend on one side of the tracks and descend on the other. This condition certainly results in discomfort at normal speeds, and may result in "bottoming out" of vehicles with long wheelbases or low clearances.

Exhibit 12 identifies a box culvert is adjacent to the railroad crossing on the east side of the track with guardrail abutting the roadway. This presents a safety hazard for pedestrians forcing them into the roadway to cross the track. This situation is exacerbated due to the crossing’s close proximity to a public park.

Recommendations

General:

It is recommended that all five crossings be reevaluated in the future based on revisions to traffic patterns resulting from completion of the 22nd Street improvements. At that time consolidation or elimination of one or more of the crossings may be justified. Presently it is recommended that the pavement markings at each of the crossings be refreshed.

16th Street/Toole Avenue Crossing:

It is recommended that installation of longer crossing gates be considered at the 16th Street/Toole Avenue crossing. Traffic has been observed circumventing the automated gates without having to swerve around gates but just driving down the center of the roadway.

It is recommended that installation of median curbing to channelize traffic be considered at the 16th Street/Toole Avenue. This would also help alleviate the issue of traffic circumventing the automated gates.

It is recommended that consideration be given to replacing incandescent lamps with LED lamps on the Automated Crossing Gates.

17th Street Crossing:

It is recommended that installation of longer crossing gates be considered at the 17th Street crossing. Additionally, consideration should be given to adding cantilevered signals to alleviate the sight visibility issues.

It is recommended that the City of Tucson street lighting be monitored to be sure it is functioning correctly.
18th Street Crossing:

It is recommended that installation of longer crossing gates be considered at the 18th Street crossing. Additionally, consideration should be given to adding cantilevered signals to alleviate the sight visibility issues.

It is recommended that the crossing be reevaluate in the future based on revisions to traffic patterns resulting from installation of Traffic Signal at Park Avenue.

It is recommended that consideration be given to replacing incandescent lamps with LED lamps on the Automated Crossing Gates.

19th Street Crossing:

It is recommended that a W10-1 Highway-Rail Grade Crossing Advanced Warning Sign for westbound traffic be installed. Additionally, consideration should be given to adding cantilevered signals to alleviate the sight visibility issues.

It is recommended that consideration be given to replacing incandescent lamps with LED lamps on the Automated Crossing Gates.

20th Street Crossing:

It is recommended that installation of longer crossing gates be considered at the 20th Street crossing. Additionally, consideration should be given to adding cantilevered signals to alleviate the sight visibility issues.

It is recommended that modifying the drainage structure be considered to alleviate the potential safety issue discussed above.

It is recommended that consideration be given to replacing incandescent lamps with LED lamps on the Automated Crossing Gates.

“Quiet Zone” Improvements:

It should be noted that this safety study does not address the required improvements to achieve a “Quiet Zone” in the project area. All recommendations made are done so to improve safety at the five at-grade crossings and will not suffice as Quiet Zone improvements. For more information about Quiet Zones please visit www.fra.gov.

However, in a conversation with Alexander Popovici (UPRR) on May 17, 2013, it was indicated that the railroad would be willing to discuss potentially participating with the City in funding creation of a “Quiet Zone” if the City were willing to close the 17th Street, 19th Street, and 20th Street at-grade crossings.