

ORIGINAL

NEW APPLICATION



Intermodal Transportation



0000166260

Douglas A. Ducey, Governor  
John S. Halikowski, Director  
Dallas Hammit, State Engineer  
Steve Boschen, Division Director

September 24, 2015

RECEIVED  
2015 SEP 24 10 17 AM

Arizona Corporation Commission  
Office of Railroad Safety  
Attn: Chris Watson  
1200 W Washington Street  
Phoenix, AZ 85007

AZ CORP COM  
DOCKET CONTROL

RR-03639A-15-0331

RE: Application to modify existing railroad signal  
Project: Baffert Drive, east of SR 19B in Nogales, Arizona  
Federal Project #NOG-0(204)T  
ADOT TRACS # 0000 SC NOG SR257 01X  
AAR/DOT # 742-036G

Mr. Watson,

This application is being submitted to allow a modification and upgrade of the gate and flasher units and an upgrade of the advance preemption on Baffert Drive.

**1. Project Location and Description**

The project is located at the crossing of Union Pacific Railroad (UPRR) on Baffert Dr. east of 19B in Nogales, Arizona. This crossing currently consists of one mainline track with daily usage. The crossing is at-grade and the roadway is used for two-way traffic consisting of one thru westbound lane and one thru eastbound lane at the tracks. The current crossing protection includes lights and gates on the outside edges of the road, constant warning time train detection and simultaneous preemption.

The project consists of Union Pacific RR constructing the railroad signal improvements.

- Both gate/flasher units will be upgraded
- Advance Preemption equipment will be installed and connected to the traffic signal

Prior to the installation of this railroad signal upgrade, and as part of a separate ADOT project, the following items will be constructed and installed. See "EXHIBIT ADOT PROJECT-PAVEMENT REMOVAL/STRIPING/TRAFFIC PRE-EMPTION".

- Removal of some existing pavement at the road edges
- Road Striping
- Traffic signal pre-emption equipment

Arizona Corporation Commission  
DOCKETED

SEP 24 2015

DOCKETED BY [Signature]

**2. Why the crossing is needed**

Based on the 2012 crossing improvement array, the Baffert Dr. crossing was selected for upgrades to the signal and preemption.

**3. Construction Phasing**

Once the utility, environmental, and right-of-way clearances are obtained, ADOT can apply for and receive FHWA construction authorization and authorize UPRR to order their signal materials. Once an Opinion and Order is issued, UPRR will modify the signal equipment. The railroad signal improvements will be installed by UPRR within 15 months of the receipt of an Opinion and Order from the ACC.

**4. Maintenance of the crossing**

UPRR will be responsible for installing and maintaining the railroad signal equipment. The City of Nogales is responsible for maintaining road approaches, signing and striping outside of UPRR responsibility.

**5. Project Funding**

Project funding will be provided by the Federal Highway Administration thru their Section 130/Railroad-Highway Crossing Safety improvement program.

Signal	
Labor	\$124,690.00
Material	\$144,768.00
Total Project Cost	\$269,458.00

**6. Other information (based on typical Staff Data Requests):**

1. Provide Average Daily Traffic Counts for each of the locations.  
2012 Average Daily Traffic = 4,058 vehicles per day per the May 2014 Safety Assessment Report for this crossing.
2. Please describe the current Level of Service (LOS) at each intersection.  
The City of Nogales has not established a LOS value.
3. Provide any traffic studies done by the road authorities for each area.  
A Safety Assessment Report was produce for ADOT at this location in May 2014.
4. Provide the population of the City the crossing is located in.  
2014 population estimate (SEAGO Transportation Section): 21,647 persons.
5. Provide what warning devices are currently installed at the crossing.  
Currently there are flashing lights and gates on the outside edges of the roadway for both eastbound and westbound traffic.

6. Provide distances in miles to the next public crossing on either side of the proposed project location. Are any of these grade separations?

There is an at-grade crossing at Calle Sonora (742-037N) 0.3 mile to the south. There's an at-grade crossing at Produce Row (742-034T) 0.8 mile to the north. Both of these crossings are along 19B.

7. How and why was grade separation not decided on at this time? Please provide any studies that were done to support these answers.

Grade separation was not considered as part of this Section 130 safety upgrade because the crossing does not meet any of the criteria outlined in the FHWA-Grade Separation Guidelines.

8. If this crossing was grade separated, provide a cost estimate of the project.

Estimate \$30,000,000++.

9. Please describe what the surrounding areas are zoned for near this intersection. i.e. Are there going to be new housing developments, industrial parks etc.

According to the City of Nogales current Zoning Map, the areas around the crossing are zoned Light Industrial.

10. Please supply the following: number of daily train movements through the crossing, speed of the trains, and the type of movements being made (i.e. thru freight or switching). Is this a passenger train route?

Per the FRA, there are 2 day-thru and 3 night-thru trains. Four switching trains are reported. The trains move over the crossing at speeds between 2 mph and 20 mph. There is a maximum time table speed of 25mph.

11. Please provide the names and locations of all schools (elementary, junior high and high school) within the area of the crossing.

- Pinnacle Charter High School                      2055 N Grand Ave, Nogales, AZ
- Challenger Elementary School                      901 E Calle Mayer, Nogales, AZ

12. Please provide school bus route information concerning the crossing, including the number of times a day a school bus crosses this crossing.

Per Santa Cruz Valley Unified District, Santa Cruz Valley Union High School District and Nogales Unified District – school busses cross these tracks 77 times per day.

13. Please provide information about any hospitals in the area and whether the crossing is used extensively by emergency service vehicles.

Carondelet Holy Cross Hospital                      1171 W Target Range Rd, Nogales, AZ  
Baffert Dr. is not a major emergency service route.

14. Please provide total cost of the railroad improvements to each crossing.

Cost described above.

15. Provide any information as to whether vehicles carrying hazardous materials utilize this crossing and the number of times a day they might cross it.

The City of Nogales states that it's not aware of any vehicles carrying hazardous materials utilizing this crossing.

16. Please provide the posted vehicular speed limit for the roadway.

25 MPH

17. Do any buses (other than school buses) utilize the crossing, and how many times a day do they cross the crossing.

ADOT is not aware of any.

18. Please indicate whether any spur lines have been removed within the last three years inside a 10 mile radius of any crossings covered in this application. Please include the reason for the removal, date of the removal and whether an at-grade crossing or crossings were removed in order to remove the spur line.

None.

19. Please fill in the attached FHWA Grade Separation Guidelines Table, (from FHWA's 2007 revised second edition Railroad Highway Grade-Crossing Handbook, page 151) with a yes or no answer as to whether each item applies. Also, please provide all information to support your answers of yes or no (i.e. vehicle delay numbers, any calculations that were performed to get the answers).

20. Based on the current single track configuration at the crossings specified by this application, please provide the current traffic blocking delay per train. Please indicate the time in which vehicular traffic is delayed (1) to allow the train to pass at a crossing and (2) due to trains stopped on the track for any purpose. The delay is measured from the point that the warning devices are activated at the crossing to the time after the train has cleared the crossing and the warning devices are reset.

The City of Nogales has no information or complaints regarding delays however the delay at the crossing is really a function of the average length of the train and the average speed that is traveling.

FOR EXAMPLE: 7,000 ft. train traveling 30mph (44 fps) would result in 160 seconds or a little over 2.5 minutes of delay.

Sincerely,

DocuSigned by:

*Jason Pike*

305F0D5C5F9F42E...

Jason Pike - Railroad and Utility Coordinator

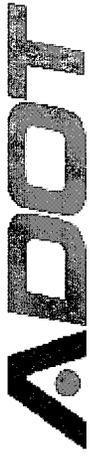
Arizona Department of Transportation

205 S. 17th Ave, Room 357 MD 618E

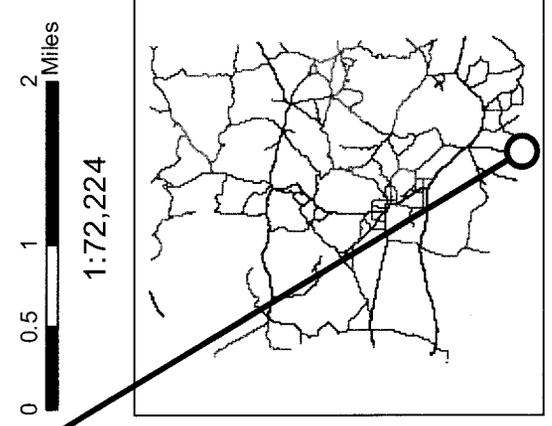
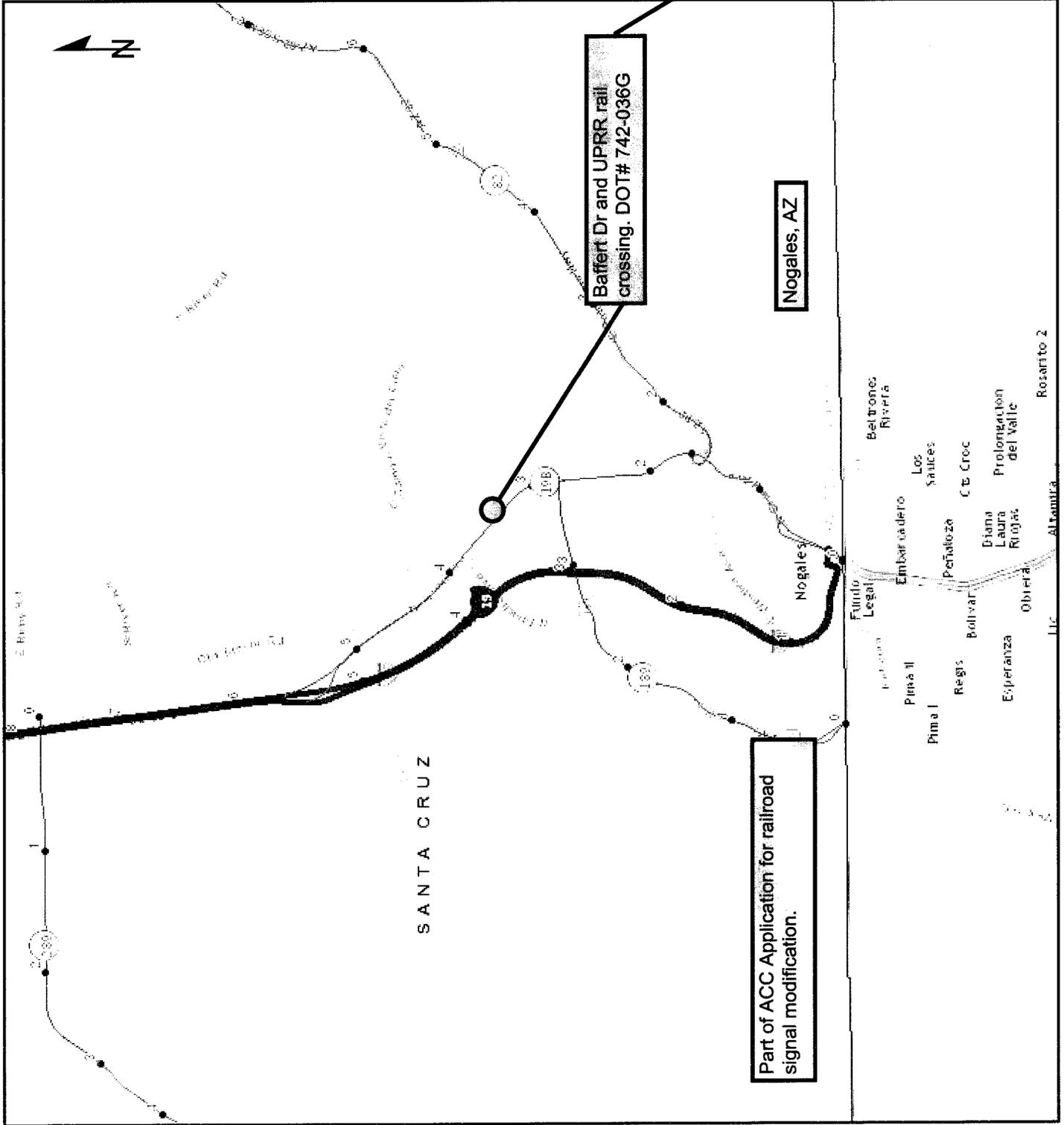
Phoenix, AZ 85007

Phone: 602-712-7149 [jpike@azdot.gov](mailto:jpike@azdot.gov)





# Baffert Drive @ UPRR 742-036G



PRELIMINARY SKETCH FOR ESTIMATING ONLY

TO CHERRY AVENUE

3741' 25" 5-2 (PRE) SEC. 50 M.P.H.

3741' 25" 5-2 (PRE) SEC. 50 M.P.H.

PRE

LOOP 19 / GRAND AVENUE

New flasher/  
gate units

CALLIE SONORA  
M.P. 62.83

BANKARD AVENUE  
APPROACH

M.P. 62.14

NBS (64)

438 NBS

156 NBS

86 HZ

114 HZ

156 HZ

285 NBS

438 NBS

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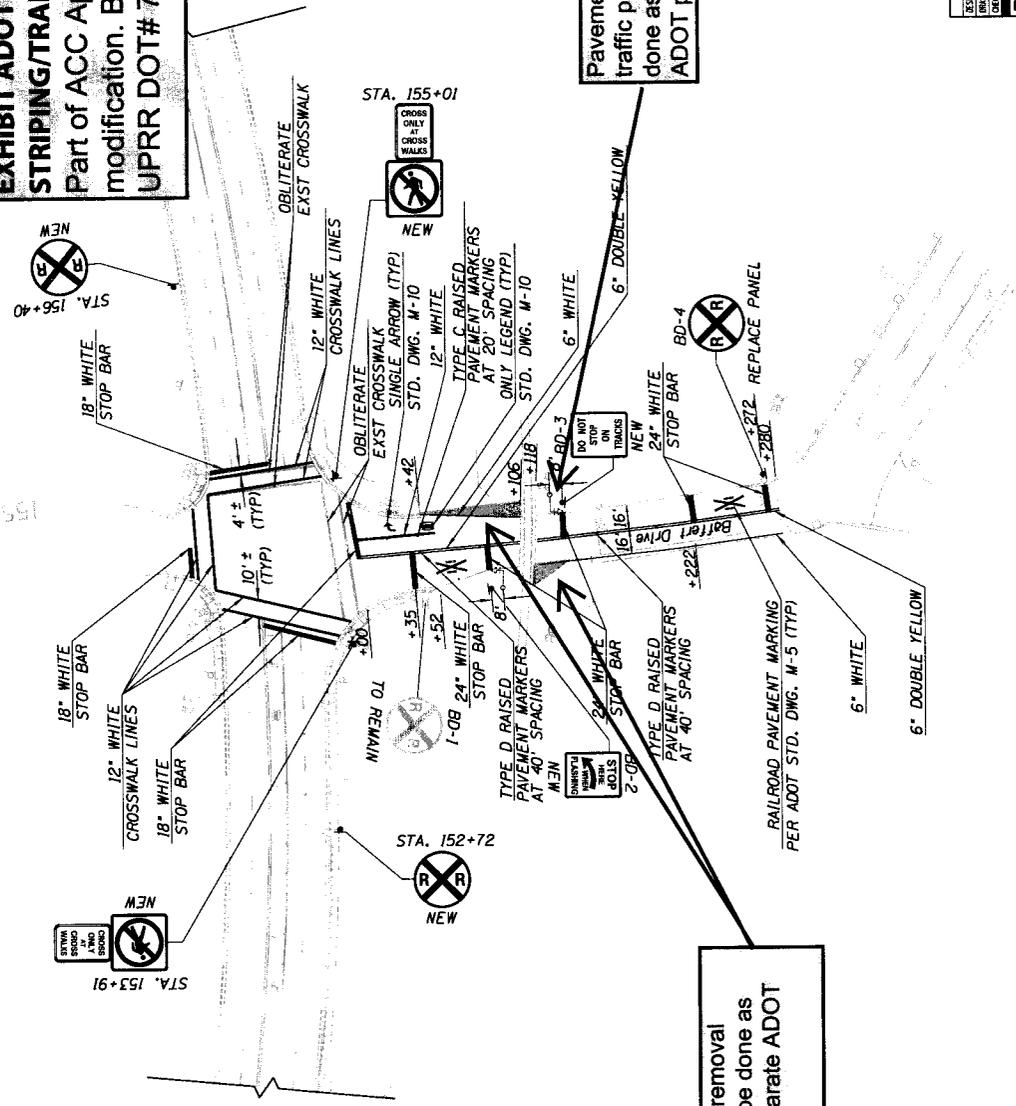
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STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	B19-AZ011	106	134
19B SC 0			

**EXHIBIT ADOT PROJECT-PAVEMENT REMOVAL/  
STRIPING/TRAFFIC PRE-EMPTION**  
Part of ACC Application for railroad signal  
modification. Baffert Dr east of 19B. Nogales, AZ  
UPRR DOT# 742-036G



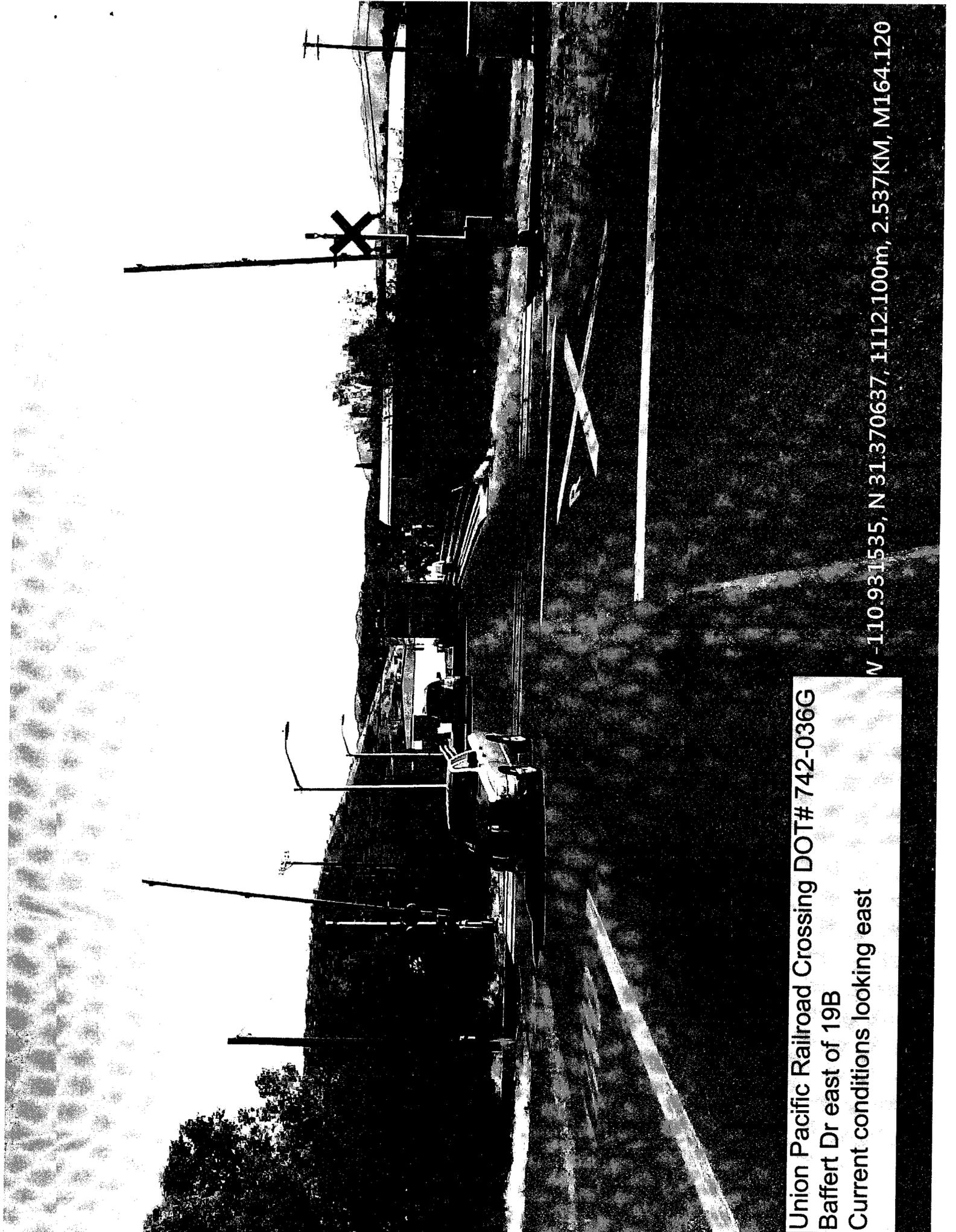
Pavement striping and traffic pre-emption. To be done as part of separate ADOT project.

Pavement removal areas. To be done as part of separate ADOT project.

**CONSTRUCTION NOTES**  
1. CONTRACTOR TO TRIM VEGETATION AROUND EXISTING SIGNS.

DESIGN	DATE	BY	DATE	BY	DATE
DESIGNED	04/15	MDG	04/15	MDG	04/15
CHECKED	04/15	MDG	04/15	MDG	04/15
<b>Baker</b> CONSULTANTS SR 19B INTERNATIONAL BORDER - MARIPOSA ROAD/SR 189 TRACS NO. H8394 01C					
PRELIMINARY <b>STAGE V</b> NOT FOR CONSTRUCTION OR RECORDING				ARIZONA DEPARTMENT OF TRANSPORTATION INTERNAL TRANSPORTATION DIVISION TRAFFIC DESIGN SERVICES PAVEMENT MARKING AND SIGNING BAFFERT DRIVE SR 19B INTERNATIONAL BORDER - MARIPOSA ROAD/SR 189 TRACS NO. H8394 01C B19-AZ011 OF	

4/27/2015 12:45:18 PM  
 PLotted on local traffic design system. \*LocalSheetName:PlanTraffic19B036G.dwg

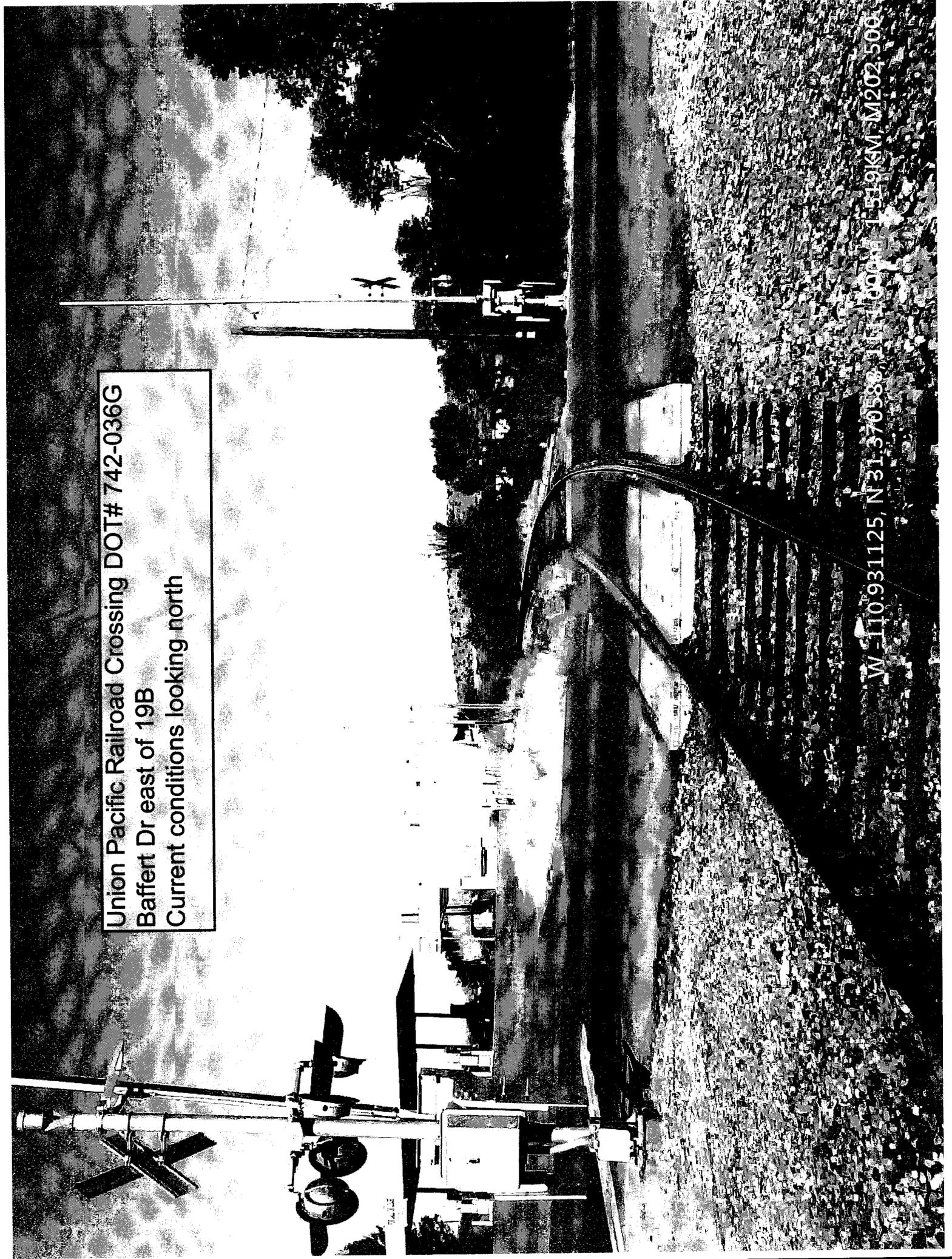


Union Pacific Railroad Crossing DOT# 742-036G  
Baffert Dr east of 19B  
Current conditions looking east

N - 110.931535, N 31.370637, 1112.100m, 2.537KM, M164.120

Union Pacific Railroad Crossing DOT# 742-036G  
Baffert Dr east of 19B  
Current conditions looking north

W-110.931125, N-31.370588, 11-11-00PM, 1-519K/M, M202.500





Intermodal Transportation

Douglas A. Ducey, Governor  
John S. Halikowski, Director  
Dallas Hammit, State Engineer  
Steve Boschen, Division Director

August 28, 2015

## **RAILROAD CROSSING PROJECT**

TRACS No.: 0940 SC NOG SR257 01X  
Project No.: NOG-0(204)T  
Location: Baffert Dr., east of SR 19B in Nogales, Arizona  
DOT No.: 742-036G  
RRMP: 62.58 Nogales Subdivision  
Agreement No: 3579-15-UPRR(1532)

### **RAILROAD AGREEMENT**

**For**

**FEDERAL AID**

**Railroad Crossing Projects**

**THE UNION PACIFIC RAILROAD COMPANY**

**Agreement No. 3579-15-UPRR(1532)**

**RAIL/HIGHWAY SAFETY PROGRAM**

**EXHIBIT A**  
**Agreement 3579-15-UPRR(1532)**  
**TRACS No. 0940 SC NOG SR257 01X**  
**PROJECT NOG-0(204)T**

SUMMARY OF ESTIMATE

**Construction:**

<b>Signal</b>	
Labor	\$124,690.00
Material	<u>\$144,768.00</u>
Signal Subtotal	\$269,458.00
<hr/>	
Total	*\$269,458.00

\* Railroad will invoice ADOT for 100% of total work.  
Railroad will separate Preliminary Engineering costs  
from Construction costs. Costs include installation of  
signals.

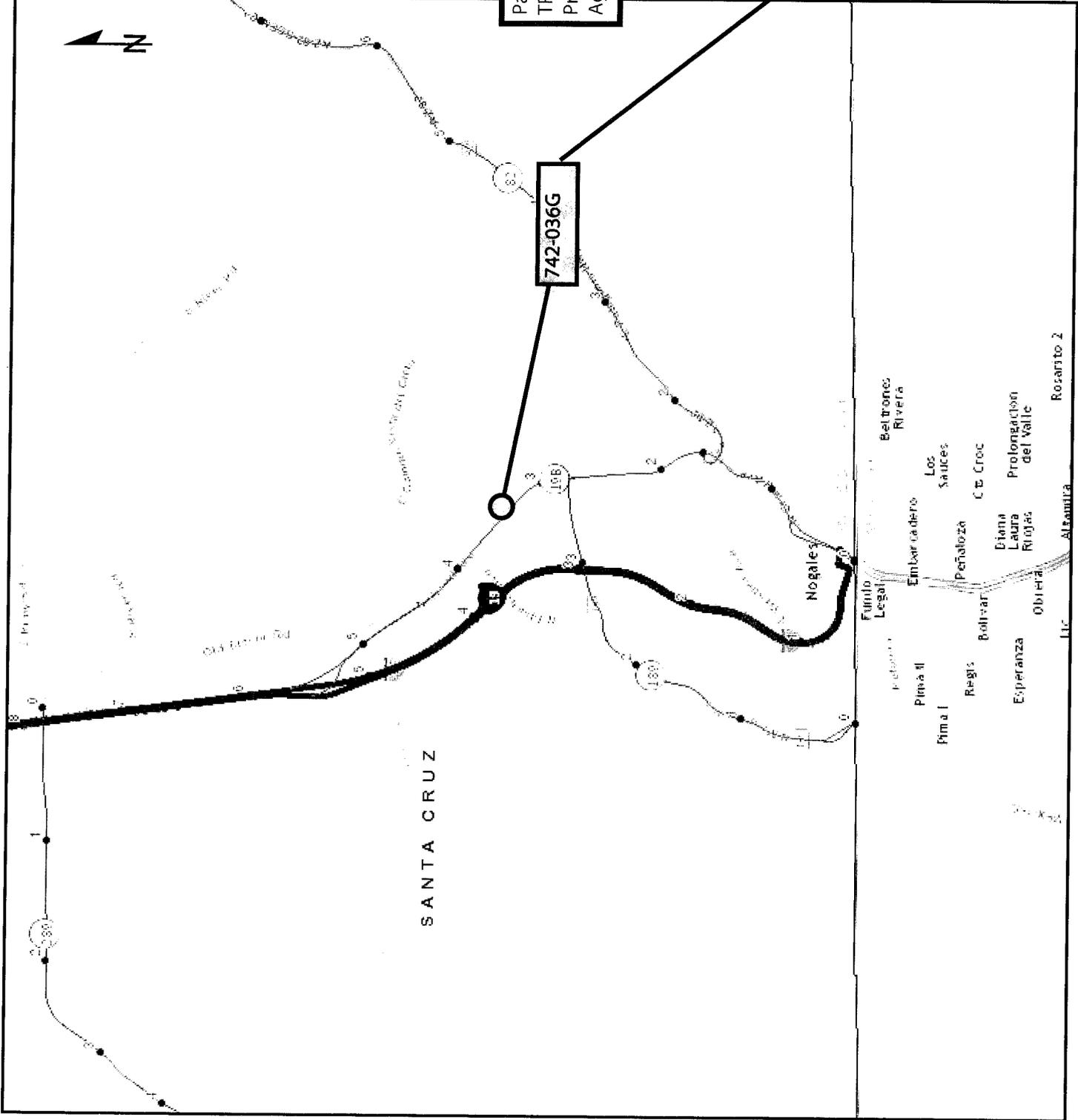
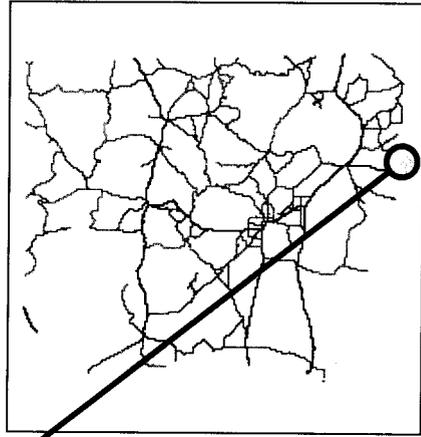


# Baffert Drive @ UPRR 742-036G

Page 3 of 17  
TRACS No.: 0940 SC NOG SR257 01X  
Project No.: N0G-0(204)T  
Agreement No: 3579-15-UPRR(1532)



1:72,224



DATE: 2015-08-24

ESTIMATE OF MATERIAL AND FORCE ACCOUNT WORK  
BY THE  
UNION PACIFIC RAILROAD

THIS ESTIMATE GOOD FOR 6 MONTHS EXPIRATION DATE IS :2016-02-22

DESCRIPTION OF WORK:  
INSTALL AUTOMATIC FLASHING LIGHT CROSSING SIGNALS  
WITH GATES AT NOGALES, AZ. BAFFERT DR. M.P. 62.58  
ON THE NOGALES SUB. DOT #742036G  
WORK TO BE PERFORMED BY RAILROAD WITH EXPENSE AS BELOW:  
SIGNAL - AZDOT - 100%  
ESTIMATED USING FEDERAL LABOR ADDITIVES - 116.95%

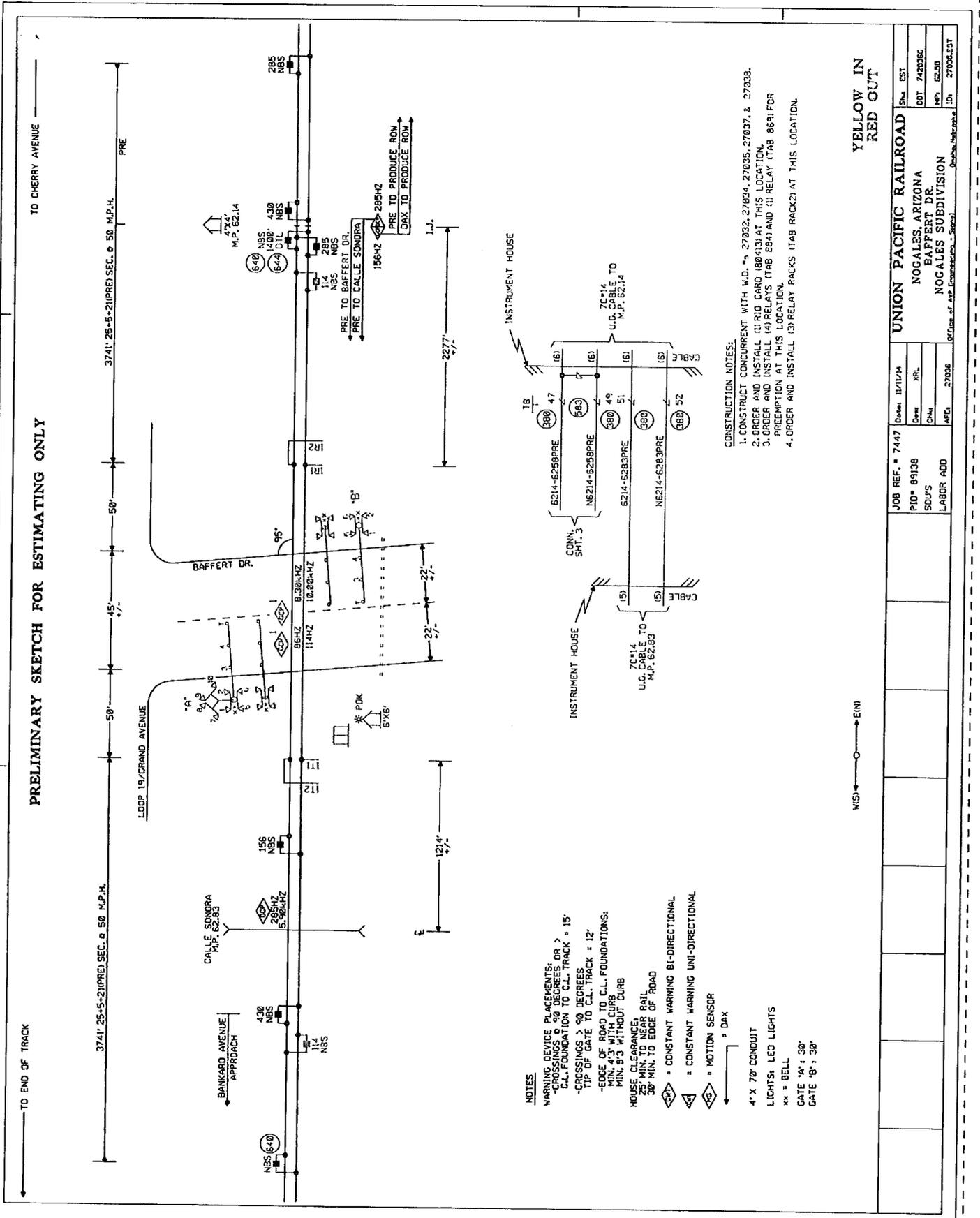
PID: 89138 AWO: 27036 MP,SUBDIV: 62.58, NOGALES  
SERVICE UNIT: 16 CITY: NOGALES STATE: AZ

DESCRIPTION	QTY	UNIT	LABOR	MATERIAL	RECOLL	UPRR	TOTAL
ENGINEERING WORK							
ENGINEERING			4838		4838		4838
LABOR ADDITIVE 116.95%			11204		11204		11204
SIG-HWY XNG			4821		4821		4821
TOTAL ENGINEERING			20863		20863		20863
SIGNAL WORK							
BILL PREP			900		900		900
CONTRACT				6846	6846		6846
LABOR ADDITIVE 116.95%			55969		55969		55969
MATL STORE EXPENSE				14	14		14
METER SERVICE				30000	30000		30000
PERSONAL EXPENSES				21000	21000		21000
RCLW CONTRACT				5717	5717		5717
ROCK/GRAVEL/FILL				5000	5000		5000
SALES TAX				2738	2738		2738
SIGNAL			46958	68466	115424		115424
TRANSP/IB/OB/RCLW CONTR				4977	4977		4977
ENVIRONMENTAL - PERMITS				10	10		10
TOTAL SIGNAL			103827	144768	248595		248595
LABOR/MATERIAL EXPENSE			124690	144768			
RECOLLECTIBLE/UPRR EXPENSE					269458	0	
ESTIMATED PROJECT COST							269458

THE ABOVE FIGURES ARE ESTIMATES ONLY AND SUBJECT TO FLUCTUATION. IN THE EVENT OF AN INCREASE OR DECREASE IN THE COST OR QUANTITY OF MATERIAL OR LABOR REQUIRED, UPRR WILL BILL FOR ACTUAL CONSTRUCTION COSTS AT THE CURRENT EFFECTIVE RATE.

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TRACS No.: 0940 SC NOG SR257 01X  
Project No.: NOG-0(204)T  
Agreement No: 3579-15-UPRR(1532)

PRELIMINARY SKETCH FOR ESTIMATING ONLY



CONSTRUCTION NOTES:

1. CONSTRUCT CONCURRENT WITH W.D.'S 27032, 27034, 27035, 27037, & 27038.
2. ORDER AND INSTALL (1) RID CARD (80413) AT THIS LOCATION.
3. ORDER AND INSTALL (4) RELAYS (TAB 864) AND (1) RELAY (TAB 869) FOR PRE-RECEPTION AT THIS LOCATION.
4. ORDER AND INSTALL (3) RELAY RACKS (TAB RACK2) AT THIS LOCATION.

NOTES

- WARNING DEVICE PLACEMENTS:
  - CROSSING TO C.L. TRACK = 15'
  - C.L. FOUNDATION TO C.L. TRACK = 15'
- CROSSINGS > 90 DEGREES
- TIP OF GATE TO C.L. TRACK = 12'
- EDGE OF ROAD TO C.L. FOUNDATIONS:
  - MIN. 4'3" WITHOUT CURB
  - MIN. 8'3" WITHOUT CURB
- HOUSE CLEARANCE NEAR RAIL
  - 25' MIN. TO NEAR
  - 30' MIN. TO EDGE OF ROAD
- ◊ = CONSTANT WARNING BI-DIRECTIONAL
  - ◊ = CONSTANT WARNING UNI-DIRECTIONAL
  - ◊ = MOTION SENSOR
  - ◊ = DRX
- 4" X 70' CONDUIT
- LIGHTS: LED LIGHTS
- xx = BELL
- GATE 14' : 30'
- GATE 18' : 30'

WIS → ○ ← ENI

YELLOW IN  
RED OUT

JOB REF. # 7447		Date: 11/11/14	UNION PACIFIC RAILROAD		Sta. EST
PID# 89138		Date: N/A	NOGALES, ARIZONA		DOT 742036C
SOU'S		Chk:	BAFFERT DR.		M.P. 62.90
LABOR ADD		APP: 27056	NOGALES SUBDIVISION		27030-E3T
		APP: 27056	NOGALES SUBDIVISION		27030-E3T

**RAILROAD ORIGINAL**

**STATE OF ARIZONA  
DEPARTMENT OF TRANSPORTATION**

Agreement No. 1532-91-SPTC

Agreement Addendum No. 2

Original Agreement AG Contract # KR92-1689-TRN

Railroad's Name The Union Pacific Railroad  
Address 101 S. Watson Road, Arlington, TX 76010

COMPANY hereby agrees to modify the existing referenced Agreement and to do the work hereinafter set forth for the AGENCY in accordance with the original agreement, the modified provisions of this form and of the attached sheets, if any, and COMPANY agrees to receive and accept as full compensation therefore the payment provided in the agreement as modified herein.

WHEREAS: STATE and RAILROAD agree to revise original Agreement to include the current "BUY AMERICA" requirements of 23 CFR 635.410

THEREFORE: The parties hereto agree that Agreement No. 1531-91-ATSF is hereby amended to include the following: All portions of the Project whether performed by the State or Company shall be performed in compliance with 23 CFR 635.410 and 23 USC 313 as amended by Section 1518 of P.L. 112-141 Buy America Requirements. Company shall maintain documentation/certification of all products of iron, steel, or a coating of steel that are incorporated into the Project for a period of three years after completion of all obligations under this Agreement. Within a reasonable time after State's written request, Company shall make such records available for State's audit during Company's regular business hours in Company's headquarters office located in Omaha Nebraska.

The RAILROAD hereby agrees to the terms as above set forth, provided that by mutual consent this agreement may be modified or terminated at any time.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement.

ARIZONA DEPARTMENT OF TRANSPORTATION

UNION PACIFIC RAILROAD COMPANY

By Victoria D. Bever  
Victoria D. Bever, Manager  
Utility & Railroad Engineering Section

By John J. Hovanec  
John J. Hovanec  
Title: AVP Engineering

Date 03/06/2015

Date 2/21/2015

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TRACS No.: 0940 SC NOG SR257 01X

Project No.: N0G-0(204)T

Agreement No: 3579-15-UPRR(1532)

STATE OF ARIZONA  
DEPARTMENT OF TRANSPORTATION

Agreement No. 1532-91-SPTC

Agreement Addendum No. 1

Company's Name: The Union Pacific Railroad Company  
Address: 101 S. Watson Road, Arlington, TX 76010

The purpose of this addendum is to modify the Company name as stated herein:

WHEREAS: Agreement No. 1532-91-SPTC terms the "RAILROAD" as SOUTHERN PACIFIC TRANSPORTATION COMPANY.

WHEREAS: Agreement No. 1532-91-SPTC is revised to term the "RAILROAD" as the UNION PACIFIC RAILROAD COMPANY.

THEREFORE: The parties hereto agree that Agreement No. 1532-91-SPTC is hereby amended as shown herein. All other provisions of Agreement No. 1532-91-SPTC shall remain unabrogated.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement.

ARIZONA DEPARTMENT OF TRANSPORTATION

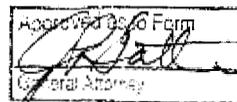
UNION PACIFIC RAILROAD COMPANY

By *William R. Briscoe*  
WILLIAM R. BRISCOE, P.E.  
*J. Patrick Hackett*  
Utility & Railroad Engineering Section

By *Thomas J. Gee*  
CHIEF ENGINEER

Date 2-18-99

Date \_\_\_\_\_



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TRACS No.: 0940 SC NOG SR257 01X  
Project No.: NOG-0(204)T  
Agreement No: 3579-15-UPRR(1532)

A. G. CONTRACT NO. KR95-1689-TF

ARIZONA DEPARTMENT OF TRANSPORTATION  
HIGHWAYS DIVISION  
UTILITY AND RAILROAD ENGINEERING SECTION

MASTER  
RAILROAD AGREEMENT  
For  
FEDERAL AID  
Railroad Crossing Projects

SOUTHERN PACIFIC TRANSPORTATION COMPANY  
Agreement No. 1532-91-SPTC  
RAIL/HIGHWAY SAFETY PROGRAM

THIS AGREEMENT by and between SOUTHERN PACIFIC TRANSPORTATION COMPANY, a Delaware corporation, herein termed "RAILROAD," and STATE OF ARIZONA, DEPARTMENT OF TRANSPORTATION, HIGHWAYS DIVISION, herein termed "STATE".

WITNESSETH:

The parties hereto desire to set forth by this instrument their understanding and agreements with respect to the installation, at various times, of railroad warning devices and/or surface crossing materials with track rehabilitation, if required, throughout the State of Arizona, where a roadway crosses the property and tracks of RAILROAD.

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Agreement No. 1532-91-SPTC

AGREEMENT:

NOW THEREFORE, it is mutually agreed as follows:

1. The work to be performed by RAILROAD under this agreement is hereinafter referred to as "PROJECT".

2. RAILROAD agrees to furnish all labor, materials, tools, and equipment necessary to install such warning devices including necessary actuating and operating circuits and adequate instrument housing and/or roadway crossing materials with track rehabilitation, if required, upon its property at certain designated grade crossings.

Said installation shall comply with the latest standards prescribed by the Association of American Railroads and the Manual On Uniform Traffic Control Devices, Part VIII.

3. RAILROAD will prepare both a cost estimate, marked Exhibit "A" and a location plan marked, Exhibit "B", showing the general details of each PROJECT and send them to STATE for acceptance.

4. It is agreed that the work to be performed by RAILROAD is a part of a Federal-Aid project. Pursuant to the provisions of Federal-Aid Policy Guide Subchapter G, Part 646 Subpart B, there is no ascertainable net benefit to RAILROAD, and STATE agrees to reimburse RAILROAD for one hundred percent (100%) of the cost and expense incurred by RAILROAD in furnishing of materials and performing the work as described in the Cost Estimate, marked EXHIBIT "A", attached to and made a part hereof.

5. It is understood and agreed that the STATE is acting solely as an agent for the project sponsor in securing and administering Federal funds and STATE assumes no other liability hereunder for the project sponsor.

6. Prior to commencing construction of each PROJECT, Railroad agrees to notify STATE, in writing, of the actual construction start date. Upon completion of each PROJECT, RAILROAD agrees to notify STATE, in writing, of the actual completion date. The construction start date shall not be prior to receiving a notice to proceed from STATE. Construction progress payments shall not be made without the actual construction start date. Final payment shall not be made without the actual construction completion date.

7. The work for each PROJECT shall be performed by RAILROAD forces on an actual cost basis, and as supported by the analysis of estimated costs set forth in Exhibit "A". The actual cost shall be payable in payments as follows:

- a. RAILROAD will order the materials for each PROJECT, and may invoice the STATE upon receipt, for materials and related costs, as set forth in Exhibit "A".
- b. RAILROAD may submit monthly invoices for work performed and materials installed unless invoiced under subparagraph a.
- c. Minimum payment, except for final invoice, is \$5,000.
- d. Upon completion of all work under each PROJECT, RAILROAD shall arrange for a joint close-out inspection of the completed PROJECT. Upon determination by STATE that the work has been completed in accordance

with Exhibits "A" and "B", RAILROAD will submit final and complete invoice to the STATE. STATE agrees to pay RAILROAD the difference between the final invoice and any previous payments for PROJECT. Any amount with which STATE disagrees shall be paid under protest, subject to resolution.

e. All invoices will be paid by STATE within sixty (60) days of receipt.

All expenses incurred by RAILROAD for work which STATE is obligated to reimburse RAILROAD hereunder, including all work incidental to such work but not specifically mentioned herein, shall be subject to the provisions of the Federal-Aid Policy Guide Subchapter B Part 140 Subpart I.

8. Pursuant to A.R.S. Sections 35-214, 35-215 and 41-1279.04, the books of RAILROAD shall be open for inspection and audit by authorized representatives of STATE and the Federal Government for a period of not less than five (5) years from the date final payment has been received by RAILROAD. State agrees to pay RAILROAD any sums found to be owing as a result of an audit within sixty (60) days of receipt of the audit by the Utility and Railroad Engineering Section of STATE. RAILROAD agrees to reimburse STATE, within sixty (60) days of notification for any amount STATE disallows as a result of its audit. Any audit exceptions with which RAILROAD disagrees shall be paid to STATE under protest subject to resolution.

9. All invoices shall contain STATE's project number and agreement number. The invoice shall be sent to:

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ARIZONA DEPARTMENT OF TRANSPORTATION  
Utility and Railroad Engineering Section  
225 South 17th Ave. Mail Drop 618E  
Phoenix, Arizona 85007-3212

10. Once installation of railroad warning devices and/or roadway crossing material has been completed, RAILROAD shall maintain, in kind, the railroad warning devices and the crossing material two feet outside of each rail as long as they remain in place. However, RAILROAD shall be entitled to receive any contribution toward the cost of such maintenance as may be now or hereafter made available by means of any law, ordinance, regulation, order, grant or by other means or sources.

11. Claims and disputes between STATE and RAILROAD involving sums less than \$100,000 and arising out of the terms of this Agreement relating to work performed, invoicing and similar matters, shall be subject to arbitration, at the request of either party, in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then obtaining; provided, however, that claims or disputes arising out of personal injury, death, property damage, or environmental incidents shall not be subject to arbitration without the concurrence of both parties, except to the extent otherwise required by the rules of Arizona courts.

12. In compliance with the regulations of the United States Department of Transportation, RAILROAD hereby agrees to comply fully with all of the provisions of Appendix "A", attached hereto and by this reference made a part of this Agreement; provided, however, that Appendix "A" shall be applicable only in those cases where RAILROAD does not perform the work contemplated in this Agreement with its own forces.

13. This Agreement is subject to the budgetary limitations set forth in Arizona Revised Statutes Subsection 28-1823 through 28-1826 inclusive and is further subject to the provisions of Chapter 1 of Title 35, Arizona Revised Statutes.

14. STATE and RAILROAD each agrees to be liable to the other party for its own acts of negligence and the negligence of its own employees.

15. This Agreement shall inure to the benefit of and be binding upon the successors and assigns of RAILROAD and the assigns of STATE.

16. RAILROAD is required to comply with Executive Order 75-5, "Non-Discrimination in Employment by Government Contractors and Subcontractors," which is hereby included in its entirety by reference and considered a part of this Agreement.

17. Pursuant to A.R.S. Subsection 38-511, STATE may cancel this Agreement, without penalty or further obligation, if any person significantly involved in initiating, negotiating, securing, drafting or creating the Agreement on behalf of STATE or any of its departments or agencies is, at any time while this Agreement or any extension of it is in effect, an employee of any other party to this Agreement with respect to the subject matter of this Agreement.

:  
:  
:  
:  
:

IN WITNESS WHEREOF, the parties have executed this Agreement as of the day and year signed by both parties.

SOUTHERN PACIFIC  
TRANSPORTATION COMPANY

ARIZONA DEPART. OF TRANSPORTATION  
HIGHWAY DIVISION

By [Signature]  
Its MANAGER-CONTRACTS

By [Signature]  
Manager of Utility & Railroad  
Engineering Section

Date October 2, 1995

Date 10-17-95

Approved as to form  
[Signature]  
ATTORNEY 10/3/95

STATE OF COLORADO )  
 ) ss.  
COUNTY of DENVER )

The foregoing instrument was acknowledged before me this 2nd day of October, 1995, by Ms. J. I. [Name] the MANAGER-CONTRACTS of SOUTHERN PACIFIC TRANSPORTATION COMPANY, a Delaware corporation, on behalf of the corporation.

My Commission Expires  
2-11-97  
ALISON DILGES  
STATE OF COLORADO

Notary Public Alison Dilges

My Commission Expires 2-11-97

STATE OF ARIZONA )  
 ) ss.  
COUNTY of MARICOPA )

The foregoing instrument was acknowledged before me this 17 day of October, 1995, by William R. Briscoe, the Manager of Utility and Railroad Engineering Section of the Arizona Department of Transportation, on behalf of the STATE.

My Commission Expires:  
[Signature]

[Signature]  
Notary Public

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APPENDIX A  
(Revised)

II EQUAL OPPORTUNITY

1. Selection of Labor:

During the performance of this contract, the contractor shall not discriminate against labor from any other State, possession or territory of the United States.

2. Employment Practices:

During the performance of this contract, the contractor agrees as follows:

a. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the State highway department setting forth the provisions of this nondiscrimination clause.

b. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

c. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the State highway department advising the said labor union or workers' representative of the contractor's commitments under this section II-2 and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

d. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations (41 CFR, Part 60) and relevant orders of the Secretary of Labor.

e. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the Federal Highway Administration and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

f. In the event of the contractor's noncompliance with the non-discrimination clauses of this contract or with any of the said rules, regulations or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or Federally-assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

g. The contractor will include the provisions of this Section II-2 in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the State highway department or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with litigation with a subcontractor or vendor as a result of such direction by the Federal Highway Administration, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

3. Selection of Subcontractors, Procurement of Materials, and Leasing of Equipment:

During the performance of this contract, the contractor, for itself, its assigns and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

a. Compliance With Regulations: The contractor shall comply with the Regulations relative to nondiscrimination in Federally-assisted programs of the Department of Transportation, Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

b. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

c. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations either by competitive bidding or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

d. Information and Reports: The contractor shall provide all information and reports required by the Regulations, or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the State highway department or the Federal Highway Administration to be pertinent to ascertain compliance with such Regulations or directives. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor shall so certify to the State highway department, or the Federal Highway Administration as appropriate, and shall set forth what efforts it has made to obtain the information.

e. Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the State highway department shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:

- (1) withholding of payments to the contractor under the contract until the contractor complies, and/or
- (2) cancellation, termination or suspension of the contract, in whole or in part.

f. Incorporation of Provisions: The contractor shall include the provision of this paragraph 3 in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The contractor shall take such action with respect to any subcontractor or procurement as the State highway department or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the State highway department to enter into such litigation to protect the interests of the State, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

# Baker

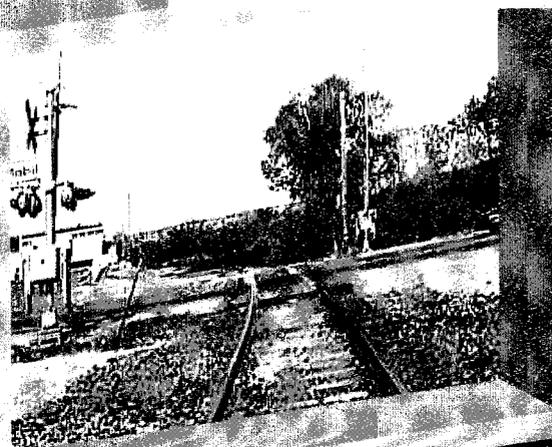
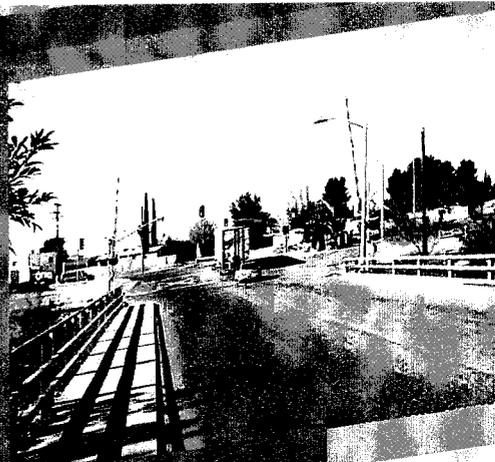
## **SR 19B BORDER to MARICOPA/SR 189 (NB&SB) (EXTENDED TO GOLD CANYON RD/ VALLEY VERDE CIRCLE INTERSECTION)**

Safe and efficient movement of interconnected  
highway/Rail Grade Crossing of  
Baker Road at SR 19B  
(DOT #742 036 G)  
Nogales, AZ

**DRAFT FINAL REPORT**  
May 2014

Prepared for:

# ADOT





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## Appendices

- Appendix A: Federal Railroad Administration Accident Prediction Report
- Appendix B: Existing Traffic Signal Plans and Signal Timing
- Appendix C: Preemption Timing Calculation Worksheet



## 1.0 Executive Summary

Michael Baker Jr., Inc. (Baker) was retained by Arizona Department of Transportation (ADOT) to perform a safety assessment of the interconnected highway-rail grade crossing on Baffert Drive (DOT# 742 036 G) at Nogales Business Route (SR 19B) in Nogales, Arizona. The safety assessment included a comprehensive inventory and review of the Union Pacific Railroad (UPRR) grade crossing's existing signal equipment, railroad equipment and intersection elements such as pedestrian and vehicular signal heads, cabinets, controller hardware, pull boxes, railroad automatic gates, railroad bungalow, signage and pavement markings for consistency with current State and National standards. The safety assessment also included the inspection of the interconnected signals operation.

Based on the specific features of the traffic control devices and operation of the interconnected signals reviewed at the Baffert Drive highway-rail grade crossing for consistency with current industry practice, the following proposed recommendations are being presented to ADOT for consideration to enhance the operation of the preemption system. The proposed recommendations are separated into three categories: Short Term, Mid Term and Long Term based upon a projected implementation time.

### Short Term Improvements:

- Preemption Operation Improvements
  - It is recommended that the track clearance green time be increased from 5 seconds to 36 seconds.
- Site Improvements per 2009 MUTCD compliance
  - It is recommended that the existing W10-1 sign panel located 150 feet east of the railroad automatic gates be replaced. It is recommended that ADOT install Grade Crossing Advance Warning (W10-1) signs in each direction along SR 19B in advance of the grade crossing;
  - It is recommended that ADOT install DO NOT STOP ON TRACKS (R8-8) sign east of the track and a STOP HERE WHEN FLASHING (R8-10a) west of the track;
  - It is recommended that existing Grade Crossing Pavement Marking be refreshed and a new Grade Crossing Pavement Marking be installed along Baffert Drive east of the railroad crossing;
  - It is recommended a new stop line be installed prior to the automatic gates to indicate the point behind which roadway users are required to stop when the railroad automatic gates are activated;
  - It is recommended that crosswalks across the north leg and east leg be removed; and
  - It is recommended that the remaining crosswalk and all stop line pavement markings along SR 19B and all striping along Baffert Drive 280 feet from the intersection be refreshed.

### Mid Term Recommended Improvements:

- Preemption Operation Improvement



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Highway-Rail Grade Crossing  
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- Advance preemption is recommended to be implemented at this location with 21 seconds of additional warning time required from the railroad;
- It is recommended that new interconnect conduit be installed from the traffic signal controller cabinet to the railroad equipment housing;
- It is recommended that a maximum preemption timer circuit be provided for the traffic control signal;
- It is recommended that a gate down circuit be installed at this highway-rail crossing;
- It is recommended that a traffic signal health circuit be installed at this highway-rail crossing;
- ADOT and UPRR should jointly develop an agreement to provide a maintenance program; and
- It is recommended that ADOT develop procedures to handle equipment failure and/or lane closures.
- Traffic Signal Operation Improvements
  - It is recommended that two Type G signal heads be installed for the westbound movement to accommodate a protected left-turn indication during the track clearance interval;
  - It is recommended that the existing southbound to eastbound left-turn movement be restricted during preemption by installing a NO LEFT TURN blank-out sign on the southbound SR 19B mast arm and on the signal pole located in the southeast corner of the intersection;
  - It is recommended that the existing northbound to eastbound right-turn movement be restricted during preemption by installing a NO RIGHT TURN blank-out sign on the signal pole on the southeast corner and on the signal pole on the northeast corner; and
  - It is recommended that a battery back-up system be provided for the traffic control signal.
- Site Improvements
  - It is recommended that vegetation be removed or cut back periodically, improving the visibility of the crossing and associated traffic control devices.

Long Term Recommended Improvements:

- Traffic Signal Operation Improvements
  - It is recommended that the left-turn trap condition during the track clearance interval be eliminated by installing a flashing yellow arrow signal head for the westbound movement.
- Site Improvements
  - It is recommended that an engineering study be completed to determine if better nighttime visibility of trains and a highway-railroad grade crossing is needed; and
  - Because of the variety of factors that may contribute to pedestrian hazards, a detailed study is recommended to determine the most effective measures to provide for pedestrian safety at this location when pedestrian and bicyclist facilities are constructed.



Improvements to be completed by the railroad:

- Installing new equipment housing at the existing location;
- Replacing the automatic gates;
- Installing new interconnect conductors from the traffic signal controller to the railroad bungalow; and
- Install new cantilever warning lights in front of the westbound gate due to sight issues. Cantilever warning lights will address the issue of sight obstructions discussed in Section 5.2.14 of this report and will not require vegetation management in the Nogales Wash.



## 2.0 Introduction

Michael Baker Jr., Inc. (Baker) was retained by Arizona Department of Transportation (ADOT) to perform a safety assessment of the interconnected highway-rail grade crossing on Baffert Drive (DOT# 742 036 G) at Nogales Business Route (SR 19B) in Nogales, Arizona. The safety assessment included a comprehensive inventory and review of the Union Pacific Railroad (UPRR) grade crossing's existing signal equipment, railroad equipment and intersection elements such as pedestrian and vehicular signal heads, cabinets, controller hardware, pull boxes, railroad automatic gates, railroad bungalow, signage and pavement markings for consistency with current State and National standards. The safety assessment also included the inspection of the interconnected signals operation.

### 2.1 Background

ADOT is in the process of updating and working with the UPRR and BNSF in the state to change the existing railroad crossings that are operating in simultaneous preemption to advance preemption. A pavement preservation project was programmed for SR 19B from the border to Calle Sonora/Mariposa Road (SR 189) to maintain pavement structural integrity and improve the ride and safety of the highway. Three of the six crossings currently operating in simultaneous preemption fall within the pavement preservation project limits. Therefore, it was determined to include these three crossings at Banks Bridge, Doe Street and Calle Sonora as well as the three crossings outside of the pavement preservation limits (Baffert Road, Produce Road and Gold Hill Road) to upgrade railroad preemption operation, traffic signal operation and signing and marking to 2009 MUTCD standards to increase safety.

### 2.2 Diagnostic Meeting

On Thursday, November 29, 2012, a diagnostic meeting was conducted to inventory existing conditions at the UPRR grade crossing on Baffert Drive (DOT# 742 036 G) and to reach a consensus among the agencies present as to what improvements are needed at the intersection to improve safety, to meet 2009 MUTCD requirements and update traffic signal and railroad signal equipment. The multi-disciplinary team was led by Robert Travis, the ADOT railroad liaison and included representatives from:

- ADOT;
- Union Pacific Railroad (UPRR);
- Federal Highway Administration (FHWA);
- City of Nogales;
- Baker;
- Campbell Technology Corporation (CTC); and
- HDR, Inc.

### 2.3 Joint Field Inspection

On Wednesday, June 26, 2013, a joint field inspection of the traffic signal preemption system interconnected with the UPRR grade crossing on Baffert Drive was conducted on the preemption systems. The following individuals participated in the joint field inspection:

- Jesus Valdez Jr., ADOT signals operations;



- Tom Meyer, UPRR; and
- BriAnne Turpin, Baker.

The purpose of the inspection was to document whether the existing preemption system is operating in accordance with the current design parameters.

## 2.4 Purpose and Objective

The purpose of this study is to document existing conditions of the intersection of SR 19B and Baffert Drive and the railroad crossing, to identify any deficiencies and to recommend improvements.

As part of the diagnostic meeting in November 2012 and the joint field inspection in June 2013, data was collected at the site to be used to review the operation of the existing system and to prepare recommendations for potential improvements to the system. The objective of this study is provide information to assist ADOT in making improvements to the design and operation of the preemption system and traffic signal, thus ultimately increasing the safety at this highway-railroad grade crossing.

## 2.6 References Listed in the Report

This report makes reference to the following:

- FHWA's 2009 Manual on Uniform Traffic Control Devices (MUTCD);
- Transportation Research Board (TRB) 1996 *Traffic Signal Operations Near Highway-Rail Grade Crossings*;
- FHWA's "Railroad-Highway Grade Crossing Handbook – Revised Second Edition August 2007 Appendix I Preemption Calculation Procedures, Examples from State of Texas";
- ADOT Traffic Engineering Policies, Guides and Procedures (PGP) Chapter 600 Traffic Signal, last updated January 2012; and
- Arizona Supplement to the 2009 Manual on Uniform Traffic Control Devices.

## 2.7 Definitions Used in this Report

**Advance Preemption** - the notification of an approaching train that is forwarded to the highway traffic signal controller unit (or assembly) by the railroad equipment, in advance of the activation of the railroad warning device.

**Advance Preemption Time (APT)** - the period of time that is the difference between the required maximum highway traffic signal preemption time, and the activation of the railroad warning devices.

**Automatic Gates** - a barrier that is lowered across the roadway when a train is approaching or occupying the crossing.

**Buffer Time (BT)** - time added by the railroad to ensure that the minimum warning time is always provided despite inherent variations in warning times.

**Clear Storage Distance (CSD)** - the distance available for vehicle storage measured from a point six feet from the rail nearest the intersection to the intersection stop line, or the normal stopping point on the



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highway. At skewed highway-railroad grade crossings and intersections, the six-foot distance should be measured perpendicular to the nearest rail either along the center line or edge line of the highway, as appropriate, to obtain the shorter distance. Where exit gates are used as part of a four-quadrant gate system, the distance available for vehicle storage is measured from the point where the rear of the vehicle would be clear of the exit gate arm. In cases where the exit gate arm is parallel to the track(s) and is not perpendicular to the highway, the distance is measured either along the center line or edge line of the highway, as appropriate, to obtain the shorter distance.

**Design Vehicle Clearance Distance (DVCD)** - the length, in feet, which the design vehicle must travel in order to enter and completely pass through the railroad crossing's minimum track clearance distance (MTCD).

**Diagnostic Team Review/Meeting** - a group of knowledgeable individuals from the Department, road authorities, railroads, and other relevant affected parties who meet and, using highway-railroad grade crossing safety management principles, evaluate conditions at proposed or existing crossings and assist the Department in making determinations concerning safety needs.

**Equipment Housing** - a box, cabinet or bungalow used by a railroad or road authority to shelter any or all of the hardware elements required to control the operation of active traffic control devices or train control systems.

**Federal Railroad Administration (FRA)** - The FRA is part of the United States Department of Transportation. The FRA was created to publicize and enforce rail safety regulations, administer railroad assistance programs, conduct research and development in support of improved railroad safety and national rail transportation policy, provide for the rehabilitation of Northeast Corridor rail passenger service, and consolidate government support of rail transportation activities.

**Flagger** - a qualified railroad employee who is on the ground at a highway-railroad grade crossing to signal to highway users the impending movement of a train or other railroad on-track equipment over the crossing.

**Flashing-Light Signals** - a warning device consisting of two red signals arranged horizontally that are activated to flash alternately when a train is approaching or present at a highway-railroad grade crossing.

**Gate Down Circuit** - notifies the traffic signal controller unit when the gates controlling access over the tracks on the approach to the intersection have either fully lowered or the train has occupied the crossing.

**Highway** - a general term for denoting a public right-of-way for purposes of travel by vehicle, bicycle, pedestrian and/or non-motorized traffic, including the entire area within the right-of-way.



**Highway-Railroad Grade Crossing** - the general area where a highway and a railroad right-of-way cross at the same level. This area includes the railroad tracks, the highway and the traffic control devices for highway traffic traversing that area.

**Interconnection** - the electrical connection between the railroad active warning system and the highway traffic signal controller for the purpose of preemption.

**Manual on Uniform Traffic Control Devices (MUTCD)** - a document that constitutes the prescribed standards of design, construction, and application of traffic control devices for use on the roads.

**Minimum Track Clearance Distance (MTCD)** - the length, in feet, along the highway at one or more railway tracks, measured from the railroad crossing stop line, warning device, or 12 feet perpendicular to the track centerline, whichever is further away from the tracks, to 6 feet beyond the tracks measured perpendicular to the far rail.

**Preemption** - the transfer of normal operation of highway traffic signals to a special control mode.

**Queue Clearance Time (QCT)** - the time required for the design vehicle of maximum length stopped just inside the minimum track clearance distance to start up and move through and clear the entire minimum track clearance distance. If pre-signals are present, this time shall be long enough to allow the vehicle to move through the intersection, or to clear the track if there is sufficient clear storage distance. If a four-quadrant gate system is present, this time shall be long enough to permit the exit gate arm to lower after the design vehicle is clear of the minimum track clearance distance.

**Retroreflective** - a property of a surface that allows a large portion of the light coming from a point source to be returned directly back to a point near its origin.

**Right-of-Way Transfer Time (RWTT)** - the maximum amount of time needed for the worst case condition, prior to display of the track clearance green interval.

**Stop Line** - a solid white pavement marking line extending across approach lanes to indicate the point at which a stop is intended or required to be made by a vehicle.

**Track Clearance Green (TCG) Time/Phase** - Time/Phase to clear the railroad tracks of highway vehicles before a train arrives.

## 2.8 Organization of the Report

This report consists of four additional parts. Subsequent to this introductory chapter:

- Chapter 3 provides a summary of the existing conditions and site specific information for the grade crossing and the intersection.
- Chapter 4 provides a summary of the existing traffic control signal operation and the railroad preemption operation.
- Chapter 5 provides the results of the preemption operation tests conducted during the joint field inspection in June 2013.



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- Chapter 6 provides specific recommendations to ADOT for short term, mid-term and long term improvements to the intersection and railroad crossing.

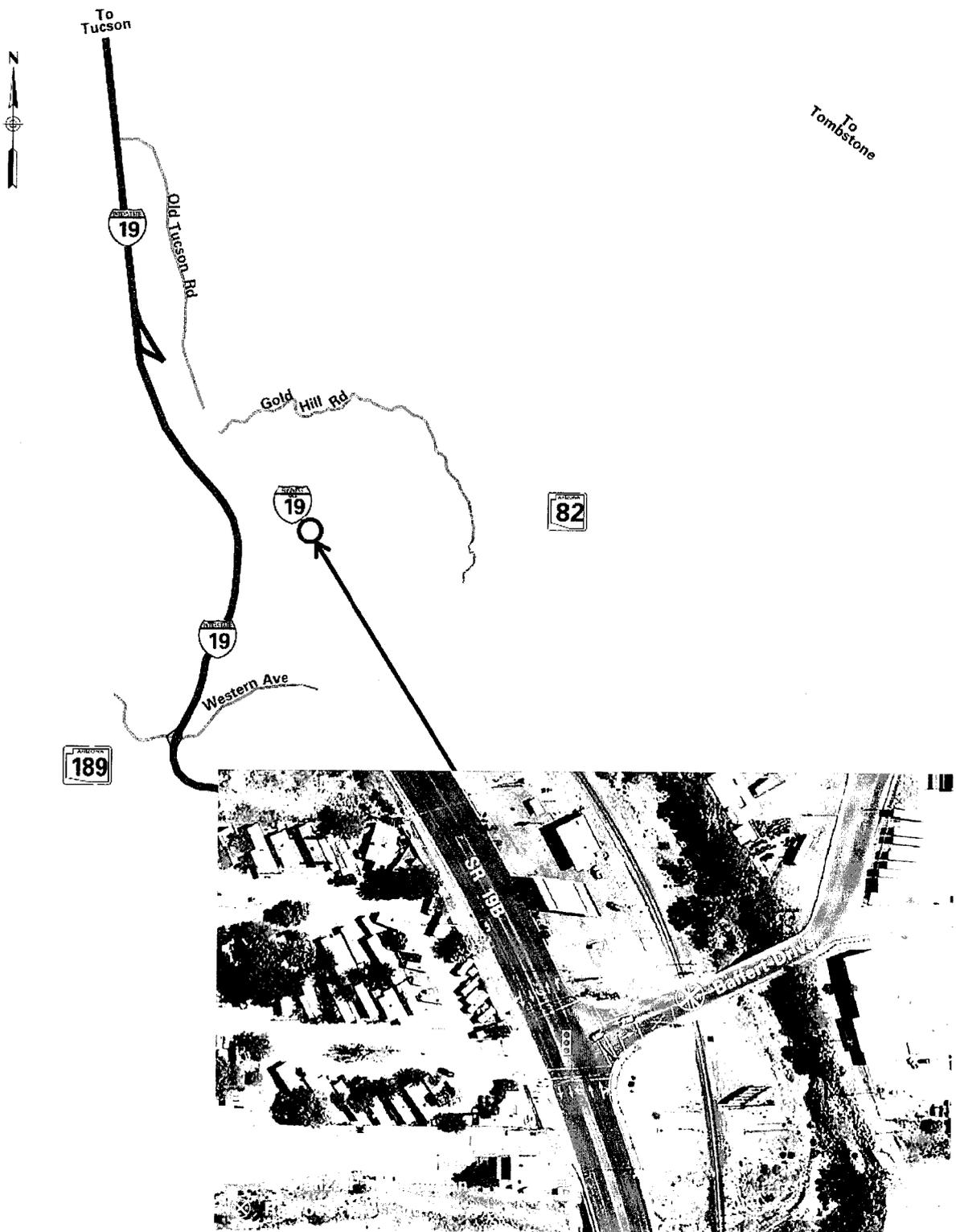


### 3.0 Existing Conditions

The City of Nogales is located at the southern end of Interstate 19 (I-19) at the international border between the United States and Mexico. It is the closest border crossing to the City of Tucson located 70 miles to the north, and the route to the City of Phoenix located approximately 180 miles to the north is entirely via interstate highways, Interstate 10 (I-10) and I-19. There are two Port of Entries (POE) located in the City of Nogales, the Mariposa POE located along State Route 189 (SR 189) and the DeConcini POE/Morley Gate located along SR 19B. The UPRR runs north-south parallel to SR 19B. The highway-rail grade crossing analyzed in this report is located on Baffert Drive, approximately 130 feet east of SR 19B. The intersection of SR 19B and Baffert Drive is located 3 miles north of the DeConcini POE/Morley Gate. The project Vicinity Map and Location Map are shown in **Figure 1**.



Safety Assessment of Interconnected  
Highway-Rail Grade Crossing  
Draft Final Report



Baffert Drive at SR 19B  
DOT # 742 036 G  
Nogales, AZ





### 3.1 Physical Characteristics of the Highway-Rail Crossing

**Baffert Drive** is owned by the City of Nogales and is currently classified as a collector roadway. Baffert Drive is oriented east-west, consisting of one lane in each direction and has a speed limit of 25 mph in the vicinity of SR 19B. Baffert Drive provides access to several industrial developments and residential neighborhoods. The 2012 average annual daily traffic (AADT) along Baffert Drive is 4,058 vehicles per day (vpd). There is one shared left-through lane and one exclusive right-turn lane in both directions at the intersection.

**SR 19B** is an ADOT owned facility that extends from the international border between the United States and Mexico north 5.3 miles to Interstate 19. SR 19B is currently classified as an urban principal arterial roadway, oriented north-south, consisting of two lanes in each direction with a two-way left-turn lane and has a speed limit of 40 mph in the vicinity of Baffert Drive. There are sidewalks on the east and west side of SR 19B, south of Baffert Drive. The 2009 AADT along SR 19B near Baffert Drive is 23,000 vpd. There is an exclusive left-turn lane, one through lane and one shared through-right lane in both directions at the intersection.

An inventory of the existing highway-rail grade crossing signing and pavement markings are shown in **Table 1**. The existing pavement markings at the intersection of SR 19B and Baffert Drive are old and have poor retroreflectivity.

Table 1: Existing Signing and Pavement Markings

Feature	NB Approach	SB Approach	EB Approach	WB Approach
DO NOT STOP ON TRACK signs (R8-8)	No	No	No	No
Grade Crossing Advance Warning signs (W10-1)	No	No	Yes	Yes
Turning Restriction or Blank-out signs	No	No	No	No
Grade Crossing Pavement Markings	No	No	No	Yes
Stop line prior to Railroad Signal Gate	N/A	N/A	N/A	No

There are two W10-1 grade crossing advance warning signs along Baffert Drive east of SR 19B. One sign for EB traffic is located approximately 52 feet prior to the railroad's automatic gate. One sign for WB traffic is located on a light pole approximately 143 feet prior to the railroad's automatic gate. A grade crossing pavement marking is located between SR 19B and the railroad's automatic gate in the eastbound direction.

UPRR operates on one line track crossing at Baffert Drive adjacent to the signalized intersection at SR 19B.

The Clear Storage Distance (CSD) is 125 feet.

The Minimum Track Clearance Distance (MTCD) is 36 feet.

The roadway grade approaching and over the Minimum Track Clearance Distance (MTCD) is -1% and the departing grade is 3%.



Figure 2 illustrates the location and distance of the CSD, MTCD, design vehicle clearance distance, and queue start-up distance.



Figure 2: Site Specific Grade Crossing Information

### 3.2 Accident History

There has been one recorded accident between a train and automobile at the Baffert Drive highway-rail grade crossing at the intersection of SR 19B and Baffert Drive in the last ten years. According to FRA data, in October 2006, a train collided with an automobile at this crossing. The incident occurred at 11:30 a.m., and it was reported that the driver of the vehicle stopped on the tracks.

As determined by the FRA Web Accident Prediction System, the average number of annual accidents that is predicted to occur within the study area at highway/rail crossings is 0.0139 accidents per year. This number takes into consideration FRA data including: the average daily vehicular traffic that crosses railroad intersections; the average daily train traffic at each crossing, and the history of accidents at each location. The FRA Accident Prediction Report is located in **Appendix A**.



## 4.0 Existing Traffic Signal and Railroad Preemption Operation

### 4.1 Traffic Signal Operation

During the November 2012 diagnostic meeting and June 2013 joint field inspection meeting, information was collected on the existing operation of the traffic signal. The traffic signal controller is an Eagle EPAC 300 with Siemens OS 3.33D firmware installed in the controller unit. The traffic signal controller at the intersection of SR 19B and Baffert Drive is shown in **Figure 3**. The traffic signal is coordinated with the intersections along SR 19B from Gold Hill Road/Valley Verde Circle to the north to Doe Street/Bankard Avenue to the south. The cabinets are not equipped with battery backup units. **Table 2** provides a summary of the information gathered during the diagnostic meeting and the joint field inspection meeting on the existing traffic signal operation. The existing traffic signal plans and signal timings are located in **Appendix B**.

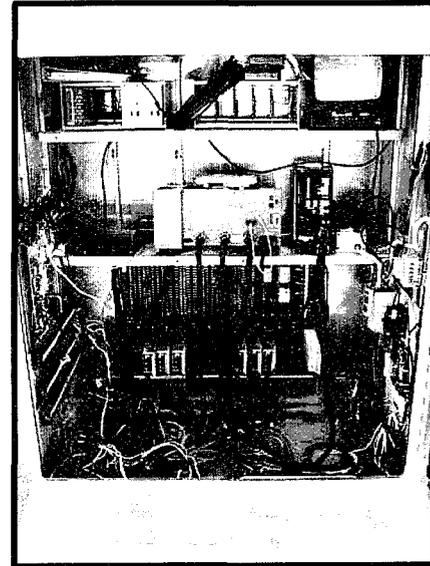


Figure 3: Traffic Signal Controller

Table 2: Summary of Traffic Signal Operation

Description	NB Movement	SB Movement	EB Movement	WB Movement
Vehicle Detection Present?	Video	Video	Video	Video
Emergency/Malfunction Operation	Yellow Flash	Yellow Flash	Red Flash	Red Flash
<b>Pedestrian Operation</b>				
- Pedestrian Signal Present?	Yes	Yes	Yes	Yes
- Pedestrian Phase	2P	2P	8P	4P
- Crosswalk Length (Feet)	56	88	87	76
- Pedestrian Recall during free operation?	N/A	N/A	N/A	N/A
- Pedestrian Rest-in Walk during free operation?	N/A	N/A	N/A	N/A
- Pedestrian Recall during coordinated operation?	Yes	Yes	No	No
- Pedestrian Rest-in Walk during coordinated operation?	Yes	Yes	No	No
<b>Signal Operation</b>				
- Signal Heads	2-Type G 3-Type F	2-Type G 3-Type F	3-Type F	3-Type F
- Left-turn movement operation	Protected-Permissive	Protected-Permissive	Permissive	Permissive



There are four crosswalks at the intersection. Sidewalk ramps are present on the northwest, southwest and southeast corners. Pedestrian push buttons and pedestrian signal heads are installed on all four corners at the intersection.

#### 4.2 Railroad Preemption Operation

Information on the existing railroad preemption operation was collected during the November 2012 diagnostic meeting and June 2013 joint field inspection meeting. **Table 3** provides a summary of the information gathered during the diagnostic meeting and the joint field inspection meeting.

Table 3: Summary of Railroad Preemption Operation

Item	Present	Not Present
Gate Down Circuit		X
Maximum Preemption Time Circuit		X
Traffic Signal Health Circuit		X
Restriction of left-turn movement across tracks during preemption		X
Restriction of right-turn movement across tracks during preemption		X

A two conductor cable is installed for the interconnect circuit. The interconnection is 2-wire single break normally closed. UPRR currently provides constant warning of 20 seconds and 5 seconds of buffer time. The calculated Right-of-Way Transfer Time (RWTT), obtained from the existing preemption timing plans located in **Appendix B**, is 12.0 seconds as shown in **Table 4**.

Table 4: Existing Right-of-Way Transfer Time Calculation

Clearance Timings	Timing Value (sec)
Minimum Green before Track Clearance	5.0
Walk before Track Clearance	5.0
Pedestrian Change before Track Clearance	0.0
Yellow Change before Track Clearance	4.3
Red Clearance before Track Clearance	2.7
<b>Right-of-Way Transfer Time (RWTT)</b>	<b>12.0</b>

The track clearance interval displays a westbound circular green indication at the intersection. The traffic signal dwell operation provides yellow flash for SR 19B and red flash for Baffert Drive during railroad preemption.



## 5.0 Preemption Operation Test Results

When interconnected, the railroad active traffic control device and the traffic control signal operate as one system for the purpose of railroad preemption. Therefore, as part of the June 2013 joint field inspection meeting, the existing preemption system was tested for proper operation in accordance with the current design parameters. The purpose of this test was to verify the proper operation of the preemption system and determine if any operation is incorrect or has been modified from the current design plans. **Table 5** summarizes the preemption operation test results.

Table 5: Preemption Operation Test Results

Operation	Tested	Confirmed	Value Seen in Field
Right-of-Way Transfer Time (RWTT)	X	X	12.0 Seconds
Track Clearance Green (TCG) Phase	X	X	Phase 4
Track Clearance Green (TCG) Time	X	X	5 Seconds*
Preemption Dwell Operation	X	X	Yellow flash operation for SR 19B; Red flash operation for Baffert Dr

\* This value is not adequate for the track clearance green interval at this location.



## 6.0 Recommendations

As a result of the diagnostic meeting, the joint field inspection meeting, and pre-emption analysis, operational and physical improvements are recommended to be completed at the highway-rail grade crossing and on the adjacent roadways. These recommendations are made in accordance with 2009 MUTCD and the Arizona Supplement to the 2009 MUTCD requirements. The recommended improvements may require a significant period of time in order to complete the design, designate a funding source, procure materials and install the equipment. Therefore, the proposed recommendations are separated into three categories: Short Term, Mid Term and Long Term based upon a projected implementation time.

### 6.1 Short Term Recommended Improvements

#### 6.1.1 Preemption Operation Improvements

##### 6.1.1.1 Track Clearance Green (TCG) Time

The existing track clearance green (TCG) time is programmed for 5 seconds. The existing TCG Time is not long enough to prevent premature display of a red traffic signal for traffic clearing the tracks. It is recommended that the track clearance green time be increased from 5 seconds to 36 seconds.

The minimum amount of TCG time that should be programmed into the traffic signal controller was estimated by setting the TCG to the higher of:

- The queue clearance time; or
- The advance preemption time (APT) plus 15 seconds.

The queue clearance time was calculated to be 25 seconds using Figure 2 and Table 2 from the "Guide for Determining Time Requirements for Traffic Signal Preemption at Highway Rail Grade Crossings" located in the ADOT Traffic Engineering PGP Chapter 600, Section 628: Railroad Preemption and assuming a three percent grade. The additional APT for this crossing was calculated to be 21 seconds. The preemption calculation form is located in **Appendix C**. It should be noted that these calculations assumed that a new stop line will be installed 8 feet prior to the railroad automatic gate and that there is no gate down circuit.

#### 6.1.2 Site Improvements

##### 6.1.2.1 Grade Crossing Advance Warning Signs

Currently, there are two grade crossing advance warning signs on Baffert Drive east of SR 19B. It is recommended that the existing W10-1 sign panel located 150 feet east of the railroad automatic gates be replaced. It is recommended that ADOT install Grade Crossing Advance Warning (W10-1) signs in each direction along SR 19B in advance of the grade crossing per the 2009 MUTCD Section 8B.06. The placement of the grade crossing advance warning signs shall be in accordance with the Arizona Supplement to the 2009 MUTCD Section 2C.05 and Table 2C-4.



#### *6.1.2.2 Regulatory Signs*

It is recommended that ADOT install DO NOT STOP ON TRACKS (R8-8) sign east of the track and a STOP HERE WHEN FLASHING (R8-10a) west of the track per the 2009 MUTCD Section 8B.09. Baffert Drive experiences heavy truck traffic; therefore, vehicle queues may extend over the tracks based on the existing preemption system operation. This queuing may be mitigated by providing the roadway user with additional information. The installation of DO NOT STOP ON TRACKS (R8-8) and STOP HERE WHEN FLASHING (R8-10a) signs may mitigate the vehicles queuing over the tracks.

#### *6.1.2.3 Pavement Markings*

There is a grade crossing pavement marking in advance of the grade crossing along Baffert Drive, west of the tracks. It is recommended that existing Grade Crossing Pavement Marking be refreshed and a new Grade Crossing Pavement Marking be installed along Baffert Drive east of the railroad crossing per 2009 MUTCD Section 8B.27.

Currently, no stop line prior to the railroad automatic gates is installed for either approach. It is recommended a new stop line be installed prior to the automatic gates to indicate the point behind which roadway users are required to stop when the railroad automatic gates are activated per 2009 MUTCD Section 8B.28.

The existing pavement markings along SR 19B and Baffert Drive are old, fading in some locations along Baffert Drive and have poor retroreflectivity. It is recommended that all crosswalk and stop line pavement markings along SR 19B and all striping along Baffert Drive 280 feet from the intersection be refreshed.

## **6.2 Mid Term Recommended Improvements**

### **6.2.1 Preemption Operation Improvements**

#### *6.2.1.1 Preemption Operation Changes*

The intersection currently operates with simultaneous preemption. Advance preemption is recommended to be implemented instead of simultaneous preemption at this location to provide sufficient warning time to start and clear the design vehicle from the Minimum Track Clearance Distance.

The Advance Preemption Time (APT) was calculated based on the FHWA document titled "Railroad-Highway Grade Crossing Handbook – Revised Second Edition August 2007 Appendix I Preemption Calculation Procedures, Example from State of Texas". The preemption time needed to clear the tracks was calculated based on the worst-case conflicting vehicle and pedestrian phase (phase 2) and time show below.



Minimum Green Time:	5 seconds
Yellow Time:	4.3 seconds
All Red Time:	2.7 seconds
Queue Clearance Time:	25 seconds
Minimum Separation Time:	+ 4 seconds
<b>Maximum Preemption Time:</b>	<b>41 seconds</b>
UPRR provided Warning Time:	- 20 seconds
<b>Advance Preemption Time:</b>	<b>21 seconds</b>

Based on the current calculations, the intersection will require 41 seconds of maximum preemption time to clear the tracks. Subtracting the 20 seconds of UPRR provided warning time from the 41 seconds of maximum preemption time, 21 seconds of additional warning time or advance preemption time is required from the railroad. Preemption time calculations are included in **Appendix C**.

According to the Arizona Revised Statue 28-1095, a vehicle transporter and the semitrailer it draws shall not exceed 75 feet while a truck-semitrailer combination shall not exceed 65 feet. It was assumed that a vehicle transporter would not be accessing Baffert Drive; therefore, the design vehicle of 65 feet in length was assumed to calculate a conservative track clearance time value. These calculations assumed that a new stop line will be installed 8 feet prior to the railroad automatic gate. The posted speed limit is 40 mph on SR 19B and 25 mph on Baffert Drive.

It is recommended that new interconnect conduit be installed from the traffic signal controller cabinet to the railroad equipment housing.

#### *6.2.1.2 Maximum Preemption Timer*

It is recommended that a maximum preemption timer circuit be provided for the traffic control signal which will allow the traffic signal to exit the preemption sequence in the event the railroad warning system "fails-safe".

#### *6.2.1.3 Gate Down Circuit*

It is recommended that a gate down circuit be installed at this highway-rail crossing to prevent the traffic signal from leaving TCG interval until it is determined that the gates controlling access over the tracks are fully lowered.

#### *6.2.1.4 Traffic Signal Health Circuit*

It is recommended that a traffic signal health circuit be installed at this highway-rail crossing which provides an indication to the railroad active warning system cabinet when the traffic signals are in flashing mode or dark such as when the controller is in failure.

#### *6.2.1.5 Implementation of Preemption Operation and Maintenance Program*

ADOT and UPRR should jointly develop an agreement to provide a maintenance program. The maintenance program should include the following:

- Testing the maximum preemption time and gate lowering times;



- Revising the preemption program if conditions change;
- Providing and updating emergency contact names and telephone numbers in railroad and highway controller cabinets; and
- Annual joint inspection by the highway authority and the railroad.

It is also recommended that ADOT develop procedures to handle equipment failure such as when the traffic control signal enters flash or loses power as well as a temporary traffic control plan for construction activities that could result in queuing across the tracks.

## 6.2.2 Traffic Signal Operation Improvements

### 6.2.2.1 Pedestrian Treatment

It is permitted by the 2009 MUTCD per Section 4D.27 to shorten or omit pedestrian WALK and flashing DON'T WALK intervals for the purpose of beginning the clear track interval earlier. However, by shortening these intervals, some pedestrians may be trapped in the intersection facing oncoming vehicles that are clearing the tracks/crossing. Shortening pedestrian times may not be a viable option at locations where pedestrian traffic is very heavy.

The existing operation has pedestrian detection for each pedestrian movement across SR 19B but eliminates the pedestrian change interval during the existing Right-of-Way Transfer Time. The calculated Right-of-Way Transfer Time continues to not include a pedestrian clearance time due to the limited pedestrian activity at this intersection. The determination as to the appropriate pedestrian timing treatment should be made based on a combination of ADOT policy and engineering judgment and is not an element of this report.

Due to the lack of existing sidewalks north of the Baffert Drive along SR 19B and east of SR 19B along Baffert Drive, it is recommended to remove the existing crosswalk and all necessary pedestrian signal equipment across the east and north legs of intersection. It is also recommended that no pedestrian crossing signals be installed at the intersection to prohibit pedestrians from crossing Baffert Drive along the east leg.

### 6.2.2.2 Track Clearance Arrow

The existing track clearance displays a westbound circular green indication. It is recommended that the track clearance movement should include a protected left-turn indication to minimize delays to traffic clearing the crossing by providing an indication to left-turning drivers that they have a protected left turn. Therefore, it is recommended that two Type G signal heads be installed for the westbound movement.

### 6.2.2.3 Turning Movement Restrictions

According to the ADOT Traffic Engineering PGP Chapter 600 Section 626, restriction of right and left turns on a red traffic signal may be considered when an intersection is within 200 feet of a railroad grade crossing and the signal controller is preempted during train crossings.



It is recommended that the existing southbound to eastbound left-turn movement be restricted during preemption by installing a NO LEFT TURN blank-out sign on the southbound SR 19B mast arm and on the signal pole located in the southeast corner of the intersection.

It is recommended that the existing northbound to eastbound right-turn movement be restricted during preemption by installing a NO RIGHT TURN blank-out sign on the signal pole on the southeast corner and on the signal pole on the northeast corner.

#### *6.2.2.5 Battery Back-up*

The existing traffic signal controller is not equipped with batter backup. It is recommended that a battery back-up system be provided in accordance with 2009 MUTCD Section 4D.27.

### 6.2.3 Site Improvements

#### *6.2.3.1 Sight Obstructions*

Three areas of the crossing should be kept free from obstructions:

- The area on the approach from the driver ahead to the crossing;
- A train occupying the crossing; and
- Active control devices at the crossing.

Existing vegetation can obstruct all three areas of the crossing listed above for motorists along Baffert Drive east of the railroad crossing. It is recommended that vegetation be removed or cut back periodically, improving the visibility of the crossing and associated traffic control devices.

## 6.3 Long Term Recommended Improvements

### 6.3.1 Traffic Signal Operation Improvements

#### *6.3.1.1 Left-Turn Signal Operation*

A left-turn trap condition occurs when traffic is given a circular yellow light display, while the opposing traffic still has a circular green light. The traffic given the circular yellow light believes that the opposing direction is also given a circular yellow light and makes a left-turn in front of on-coming traffic. This is especially critical at railroad crossing because it can lead to a collision that blocks the path from the grade crossing. It is recommended that at this location that an all-red signal be displayed prior to the track green clearance interval.

### 6.3.2 Site Improvements

#### *6.3.2.1 Illumination at Highway-Railroad Grade Crossings*

It is recommended that an engineering study be completed to determine if better nighttime visibility of trains and a highway-railroad grade crossing is needed. The study should review if a substantial amount of railroad operation is conducted at night, train speeds at the highway-railroad grade crossings, and if crash history indicates that drivers experience difficulty in seeing trains or traffic control devices during



hours of darkness. Crossing illumination and increased retroreflectivity on highway signs are possible mitigations that can be recommended from a nighttime visibility review.

#### *6.3.2.2 Pedestrian and Bicycle Improvements*

As the surrounding area continues to develop and pedestrian and bicyclist pathways are constructed to the north along SR 19B and to the east along Baffert Drive, non-motorist safety should be considered at the highway-rail grade crossing. To improve non-motorist safety at highway-rail crossings, passive and active devices may be used to supplement highway-related active control devices. Passive devices include fencing; swing gates; pedestrian barriers; pavement markings and texturing; refuge areas; and fixed message signs. Active devices include flashers; audible active control devices; automated pedestrian gates; pedestrian signals; variable message signs; and blank-out signs. Because of the variety of factors that may contribute to pedestrian hazards, a detailed study is recommended to determine the most effective measures to provide for pedestrian safety at this location when pedestrian and bicyclist facilities are constructed.

### **6.4 Improvements to be Completed by Union Pacific Railroad**

Several improvements were recommended to the highway-rail grade crossing that would be completed by the UPRR. These improvements include:

- Installing new equipment housing at the existing location;
- Replacing the automatic gates;
- Installing new interconnect conductors from the traffic signal controller to the railroad bungalow; and
- Install new cantilever warning lights in front of the westbound gate due to sight issues. Cantilever warning lights will address the issue of sight obstructions discussed in Section 5.2.14 of this report and will not require vegetation management in the Nogales Wash.

### **6.5 Cost**

Preliminary cost estimates for traffic signal, signing and marking and ADA ramp construction were prepared for the short-term, mid-term and long term recommendations. This section summarizes the cost estimate for the recommended improvements. **Table 6** presents the cost estimate for SR 19B/Baffert Drive intersection short-term, mid-term and long term recommended improvements.



Table 6: SR 19B and Baffert Drive Intersection Recommended Improvements Cost Estimate

Recommendations	Costs
<i>Short-Term</i>	
Site Improvements	\$4,300
<i>Mid-Term</i>	
Pre-emption Operation Improvements	\$1,700
Traffic Signal Operation Improvements	\$30,600
Site Improvements	\$13,100
<i>Total Mid-Term Improvements</i>	<i>\$45,400</i>
<i>Long-Term</i>	
Traffic Signal Operation Improvements	\$500
Site Improvements	\$30,000
<i>Total Long-Term Improvements</i>	<i>\$30,500</i>
<b>Total Cost</b>	<b>\$80,200</b>



**Appendix A:**  
**Federal Railroad Administration Accident  
Prediction Report**



# *Annual WBAPS 2013*

WEB ACCIDENT PREDICTION SYSTEM

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## Accident Prediction Report for Public at-Grade Highway-Rail Crossings

*Including:*

Disclaimer/Abbreviation Key  
Accident Prediction List  
Collision History

*Provided by:*

Federal Railroad Administration  
Office of Safety Analysis  
Highway-Rail Crossing Safety & Trespass Prevention

***Data Contained in this Report:***

Crossing: 742036g'

***Date Prepared:*** 7/22/2013



U.S. Department  
of Transportation  
Federal Railroad  
Administration

## USING DATA PRODUCED BY WBAPS (Web Accident Prediction System)

1200 New Jersey Avenue, SE  
Third Floor West  
Washington, DC 20590

WBAPS generates reports listing public highway-rail intersections for a State, County, City or railroad ranked by predicted collisions per year. These reports include brief lists of the Inventory record and the collisions over the last 10 years along with a list of contacts for further information. These data were produced by the Federal Railroad Administration's Web Accident Prediction System (WBAPS).

WBAPS is a computer model which provides the user an analytical tool, which combined with other site-specific information, can assist in determining where scarce highway-rail grade crossing resources can best be directed. This computer model does not rank crossings in terms of most to least dangerous. Use of WBAPS data in this manner is incorrect and misleading.

WBAPS provides the same reports as PCAPS, which is FRA's PC Accident Prediction System. PCAPS was originally developed as a tool to alert law enforcement and local officials of the important need to improve safety at public highway-rail intersections within their jurisdictions. It has since become an indispensable information resource which is helping the FRA, States, railroads, Operation Lifesaver and others, to raise the awareness of the potential dangers at public highway-rail intersections. The PCAPS/WBAPS output enables State and local highway and law enforcement agencies identify public highway-rail crossing locations which may require additional or specialized attention. It is also a tool which can be used by state highway authorities and railroads to nominate particular crossings which may require physical safety improvements or enhancements.

The WBAPS accident prediction formula is based upon two independent factors (variables) which includes (1) basic data about a crossing's physical and operating characteristics and (2) five years of accident history data at the crossing. These data are obtained from the FRA's inventory and accident/incident files which are subject to keypunch and submission errors. Although every attempt is made to find and correct errors, there is still a possibility that some errors still exist. Erroneous, inaccurate and non-current data will alter WBAPS accident prediction values. While approximately 100,000 inventory file changes and updates are voluntarily provided annually by States and railroads and processed by FRA into the National Inventory File, data records for specific crossings may not be completely current. Only the intended users (States and railroads) are really knowledgeable as to how current the inventory data is for a particular State, railroad, or location.

It is important to understand the type of information produced by WBAPS and the limitations on the application of the output data. WBAPS does not state that specific crossings are the most dangerous. Rather, the WBAPS data provides an indication that conditions are such that one crossing may possibly be more hazardous than another based on the specific data that is in the program. It is only one of many tools which can be used to assist individual States, railroads and local highway authorities in determining where and how to initially focus attention for improving safety at public highway-rail intersections. WBAPS is designed to nominate crossings for further evaluation based only upon the physical and operating characteristics of specific crossings as voluntarily reported and updated by States and railroads and five years of accident history data.

PCAPS and WBAPS software are not designed to single out specific crossings without considering the many other factors which may influence accident rates or probabilities. State highway planners may or may not use PCAPS/WBAPS accident prediction model. Some States utilize their own formula or model which may include other geographic and site-specific factors. At best, PCAPS and WBAPS software and data nominates crossings for further on-the-ground review by knowledgeable highway traffic engineers and specialists. The output information is not the end or final product and the WBAPS data should not be used for non-intended purposes.

It should also be noted that there are certain characteristics or factors which are not, nor can be, included in the WBAPS database. These include sight-distance, highway congestion, bus or hazardous material traffic, local topography, and passenger exposure (train or vehicle), etc. Be aware that PCAPS/WBAPS is only one model and that other accident prediction models which may be used by States may yield different, by just as valid, results for ranking crossings for safety improvements.

Finally, it should be noted that this database is not the sole indicator of the condition of a specific public highway-rail intersection. The WBAPS output must be considered as a supplement to the information needed to undertake specific actions aimed at enhancing highway-rail crossing safety at locations across the U.S. The authority and jurisdiction to appropriate resources towards the safety improvement or elimination of specific crossings lies with the individual States.



## ABBREVIATION KEY

for use with WBAPS Reports

The lists produced are only for public at-grade highway-rail intersections for the entity listed at the top of the page. The parameters shown are those used in the collision prediction calculation.

RANK:	Crossings are listed in order and ranked with the highest collision prediction value first.
PRED COLLS:	The accident prediction value is the probability that a collision between a train and a highway vehicle will occur at the crossing in a year.
CROSSING:	The unique sight specific identifying DOT/AAR Crossing Inventory Number.
RR:	The alphabetic abbreviation for the railroad name.
CITY:	The city in (or near) which the crossing is located.
ROAD:	The name of the road, street, or highway (if provided) where the crossing is located.
NUM OF COLLISIONS:	The number of accidents reported to FRA in each of the years indicated. Note: Most recent year is partial year (data is not for the complete calendar year) unless Accidents per Year is 'AS OF DECEMBER 31'.
DATE CHG:	The date of the latest change of the warning device category at the crossing which impacts the collision prediction calculation, e.g., a change from crossbucks to flashing lights, or flashing lights to gates. The accident prediction calculation utilizes three different formulas, on each for (1) passive devices, (2) flashing lights only, and (3) flashing lights with gates. When a date is shown, the collision history prior to the indicated year-month is not included in calculating the accident prediction value.
WD:	The type of warning device shown on the current Inventory record for the crossing where: FQ=Four Quad Gates; GT = All Other Gates; FL = Flashing lights; HS = Wigwags, Highway Signals, Bells, or Other Activated; SP = Special Protection (e.g., a flagman); SS = Stop Signs; XB = Crossbucks; OS = Other Signs or Signals; NO = No Signs or Signals.
TOT TRNS:	Number of total trains per day.
TOT TRKS:	Total number of railroad tracks between the warning devices at the crossing.
TTBL SPD:	The maximum timetable (allowable) speed for trains through the crossing.
HWY PVD:	Is the highway paved on both sides of the crossing?
HWY LNS:	The number of highway traffic lanes crossing the tracks at the crossing.
AADT:	The Average Annual Daily Traffic count for highway vehicles using the crossing.



**PUBLIC HIGHWAY-RAIL CROSSINGS RANKED BY PREDICTED  
ACCIDENTS PER YEAR AS OF 12/31/2012\***

\*Num of Collisions: Most recent year is partial year (data is not for the complete calendar year) unless Accidents per Year is 'AS  
OF DECEMBER 31'.

RANK	PRED COLLS.	CROSSING	RR	STATE	COUNTY	CITY	ROAD	NUM OF COLLISIONS					DATE CHG	W D	TOT TRN	TOT TRK	TTBL SPD	HWY PVD	HWY LNS	AADT
								12*	11	10	09	08								
1	0.013853	742036G	UP	AZ	SANTA CRUZ	NOGALES	BAFFERT DR	0	0	0	0	0	GT	9	1	25	YES	2	4,058	
TTL:		0.013853						0	0	0	0	0								



**TEN YEAR COLLISION HISTORY AT PUBLIC AT-GRADE CROSSINGS ON THE  
ACCIDENT PREDICTION LIST**

Crossing	Date/Time	Railroad	City/hwy	Highway User/ User Speed	Type Track/ Train Speed	Weather	Circumstances/ View of Track Obstructed	Warning Devices/ Operating?	Interc/ Lights	# Killed / # Injured
742036G	10/10/06 11:28AM	UP	NOGALES BAFFERT DRIVE	AUTO 000MPH	YARD 006MPH	90 F CLEAR	TRN STRUCK HWY USR NOT OBSTRUCTED	GATES YES	NO YES	0 0
<b>Total Accidents:</b> <input type="text" value="1"/>										

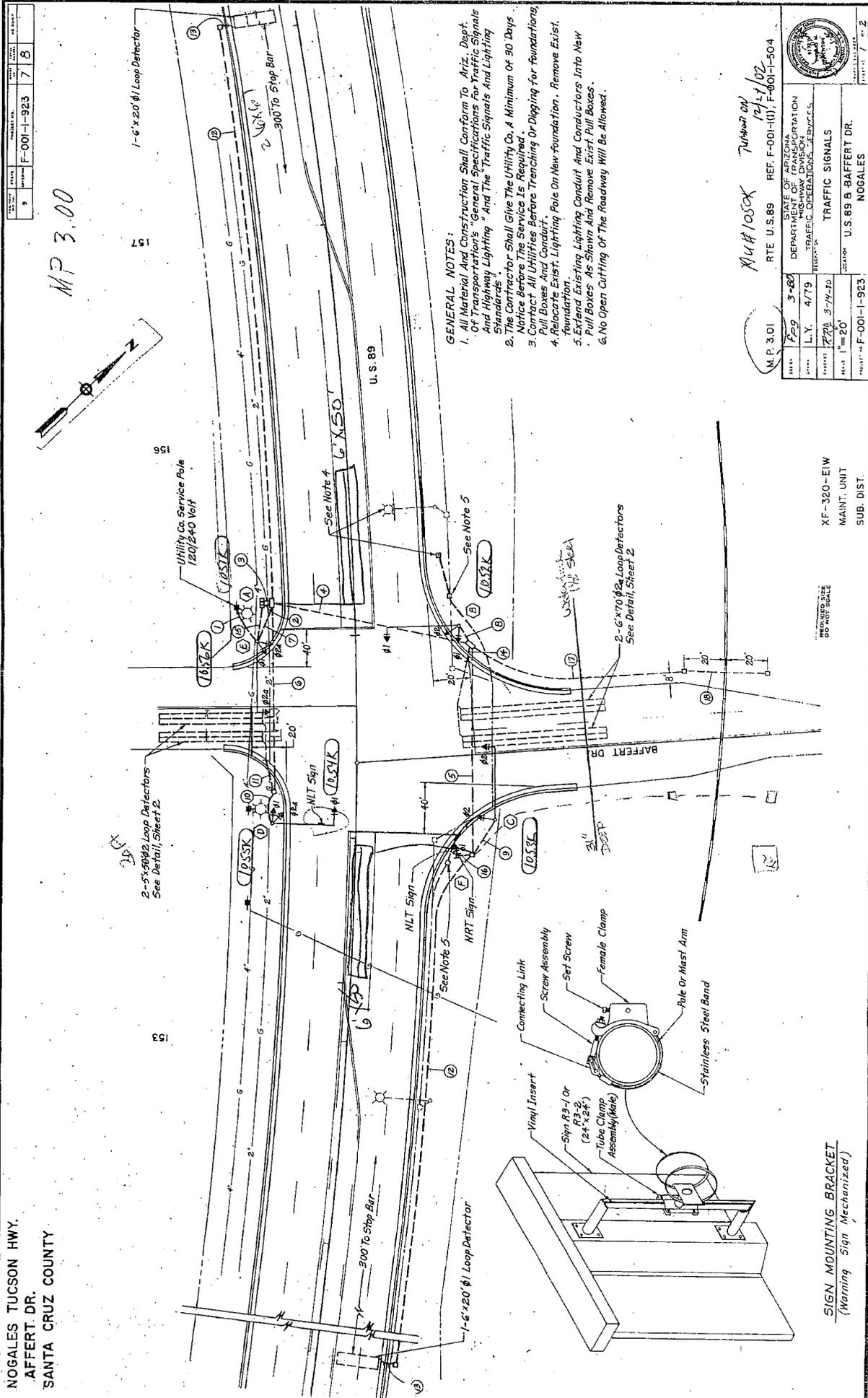
**Total accidents this report:** 1



## Appendix B: Existing Traffic Signal Plans and Signal Timing

NOGALES TUCSON HWY.  
BAFFERT DR.  
SANTA CRUZ COUNTY

MP 3.00



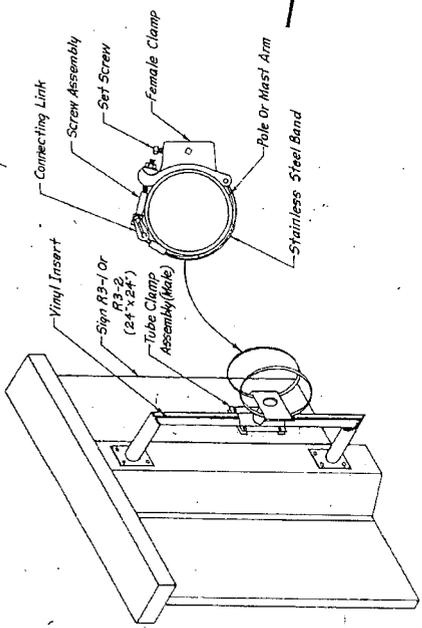
**GENERAL NOTES:**

1. All Material And Construction Shall Conform To Ariz. Dept. Of Transportation's "General Specifications For Traffic Signals And Highway Lighting" And The "Traffic Signals And Lighting Standards".
2. The Contractor Shall Give The Utility Co. A Minimum Of 30 Days Notice Before The Service Is Required.
3. Contract All Utilities Before Trenching Or Digging For Foundations, Pull Boxes And Conduit.
4. Relocate Existing Lighting Pole On New Foundation. Remove Existing Foundation.
5. Extend Existing Lighting Conduit And Conductors Into New Pull Boxes As Shown And Remove Existing Pull Boxes.
6. No Open Cutting Of The Roadway Will Be Allowed.

MP 3.01  
RTE U.S. 89  
REF. F-001-1-923 (U), F-001-1-504

STATE OF ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION TRAFFIC OPERATIONS SERVICES	TRAFFIC SIGNALS
NOGALES	U.S. 89 & BAFFERT DR.
PROJECT: F-001-1-923	DATE: 7/20/02
DESIGNED BY: 3-60	CHECKED BY: 4-79
DRAWN BY: 3-74-20	SCALE: 1" = 20'

XF-320-EIW  
MAINT. UNIT  
SUB. DIST.



**SIGN MOUNTING BRACKET**  
(Warning Sign Mechanized)

100  
106  
133  
234  
377

NOGALES TUCSON HWY.  
BAFFERT DR.  
SANTA CRUZ COUNTY

Red #2  
Blue #2

77102A

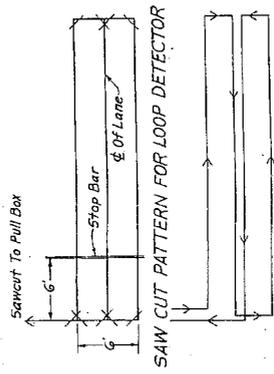
Run #:  
2-105  
3-100  
4-2052  
5-1840  
6-1931  
7-200  
8-100  
9-50  
10-130  
12-1200  
15-80  
16-100  
17-400  
18-100  
5587

F-001-1-923 B B

POLE SCHEDULE

NO.	CABINET	TRAFFIC SIGNAL CONTROLLER		MAST ARM	SIGNALS	P. B. SIGN	REMARKS	LOCATION
		TYPE	AUX. CONTROL					
(A)		IV	Pre-emption Timing: Ø1, Type 1; Ø2, Type 2	35'	II VIII	RD-3(L)		Sta. 155+18 (U.S. 89) 5' Back of Curb
(B)				35'	II VIII	RD-3(L)		Not Used
(C)		J		30'	II VIII	RD-3(L)		Sta. 134+11 (U.S. 89) 5' Back of Curb
(D)		J		35'	II VIII	RD-3(L)		Sta. 134+08 (U.S. 89) 5' Back of Curb
(E)		J		35'	II VIII	RD-3(R)	Install Meter And Disconnects To This Pole.	Sta. 134+98 (U.S. 89) 5' Back of Curb
(F)		A 1/2"			IV	RD-5(R)	See Notes This Sheet	Sta. 153+93 (U.S. 89) 5' Back of Curb

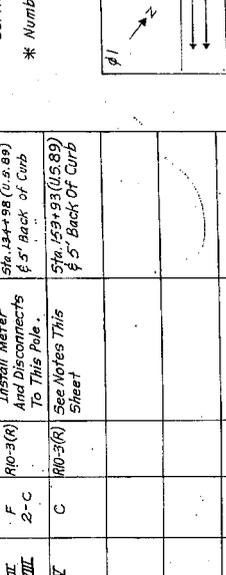
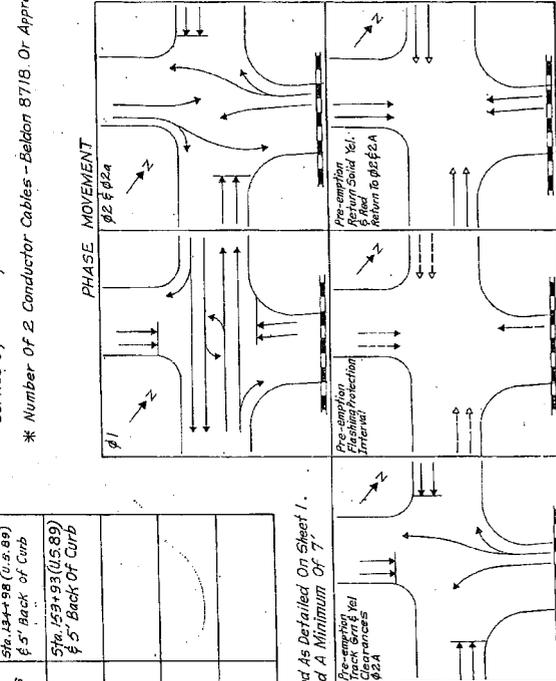
NOTES:  
1. NLT And NRT Signs Shall Be Mounted As Detailed On Sheet 1.  
2. Signs On Pole (E) Shall Be Mounted A Minimum Of 7' Above Foundation.



CONDUCTOR SCHEDULE

CONDUIT RUN NUMBER	CONDUIT SIZE IN INCHES	NUMBER OF WIRES
1	1 1/2	3
2	1 1/2	3
3	1 1/2	3
4	1 1/2	3
5	1 1/2	3
6	1 1/2	3
7	1 1/2	3
8	1 1/2	3
9	1 1/2	3
10	1 1/2	3
11	1 1/2	3
12	1 1/2	3
13	1 1/2	3
14	1 1/2	3
15	1 1/2	3
16	1 1/2	3
17	1 1/2	3
18	1 1/2	3
19	1 1/2	3
20	1 1/2	3
21	1 1/2	3
22	1 1/2	3
23	1 1/2	3
24	1 1/2	3
25	1 1/2	3
26	1 1/2	3
27	1 1/2	3
28	1 1/2	3
29	1 1/2	3
30	1 1/2	3
31	1 1/2	3
32	1 1/2	3
33	1 1/2	3
34	1 1/2	3
35	1 1/2	3
36	1 1/2	3
37	1 1/2	3
38	1 1/2	3
39	1 1/2	3
40	1 1/2	3
41	1 1/2	3
42	1 1/2	3
43	1 1/2	3
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46	1 1/2	3
47	1 1/2	3
48	1 1/2	3
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89	1 1/2	3
90	1 1/2	3
91	1 1/2	3
92	1 1/2	3
93	1 1/2	3
94	1 1/2	3
95	1 1/2	3
96	1 1/2	3
97	1 1/2	3
98	1 1/2	3
99	1 1/2	3
100	1 1/2	3

▲ Aerial Span  
● 1/2 Galvanized Steel Conduit  
\* Service By The Utility Co.  
\* Number Of 2 Conductor Cables - Belden 8718, Or Approved Equal



M.P. 3-80  
L.Y. 6/79  
NONE  
U.S. 89 & BAFFERT DR.  
NOGALES

STATE OF ARIZONA  
DEPARTMENT OF TRANSPORTATION  
TRAFFIC OPERATIONS SERVICES  
POLE AND CONDUCTOR SCHEDULE  
U.S. 89 & BAFFERT DR.  
NOGALES





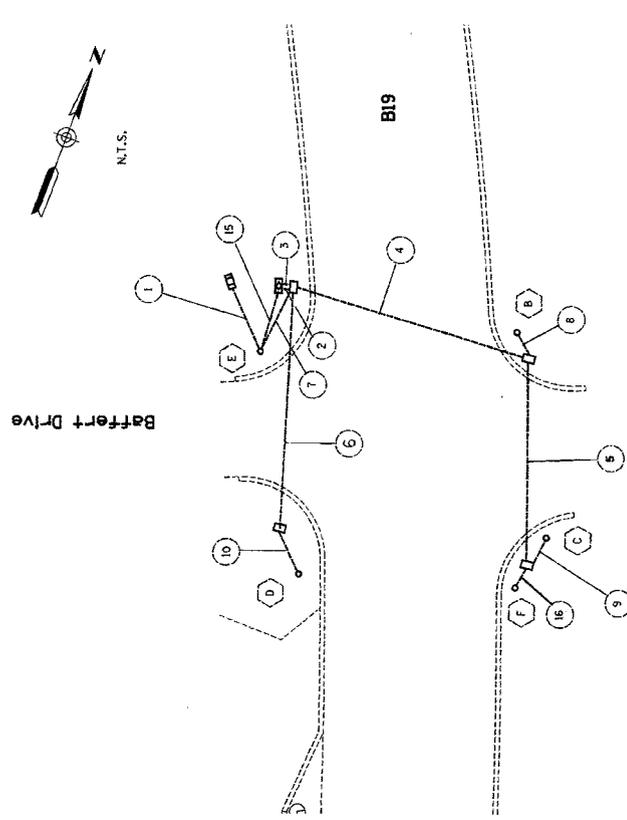
### CONDUCTOR SCHEDULE

AWG	CONDUCTOR	CONDUIT RUN IN INCHES	PHASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
#14	EXISTING CONDUIT	3																	
#14	CONDUIT RUN IN INCHES	3																	
#14	CONDUIT	3																	
#14	NO. OF CABLES	20																	
#14	NO. OF CONDUCTORS	20																	
#14	SIGNAL																		
#14	SIGNAL																		
#14	SIGNAL																		
#14	SIGNAL																		
#14	SIGNAL																		
#14	SIGNAL																		
#14	SIGNAL																		
#14	Push Button																		
#12	PRE-EMPTION																		
#12	VIDEO SENSOR POLE B																		
#12	VIDEO SENSOR POLE C																		
#12	VIDEO SENSOR POLE E																		
#8	SIGNAL COMMON																		
#8	UNSHIELDED ROAD GREEN																		
#8	UNSHIELDED ROAD GREEN																		

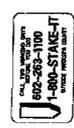
- Video detection cable. See special provisions.
- ◆ Electrical service from Citizens Utility Company
- ▲ Aerial span
- 1/2" Galvanized Steel Conduit

- NOTES:
- THIS DRAWING IS A SCHEMATIC DEPICTION OF RECENT AS-BUILT PLANS. THE LOCATION OF POLES, CONDUITS AND PULL BOXES ARE APPROXIMATE.
  - REFERENCE AS-BUILT PLANS FOR EXISTING TRAFFIC SIGNAL DESIGN, WIRING AND SIGNAL COMPONENTS. CONTRACTOR SHALL CONTACT ADOT TRAFFIC OPERATIONS AT (620) 838-2840 FOR UPDATED SIGNAL PHASING PLAN.
  - REFERENCE SHEET TS-1 FOR INSA CABLE TABLES FOR WIRE CONNECTIONS. DEVIATIONS FROM THE COLOR CODES PROVIDED ON SHEET TS-1 SHALL BE APPROVED BY ADOT ELECTRICAL INSPECTOR FROM ADOT TRAFFIC OPERATIONS AT (620) 838-2840.
  - ABANDON IN-PLACE THE EXISTING CONDUITS AND CONDUCTORS FOR LOOP DETECTION.
  - REMOVE ALL ELECTRICAL CONDUCTORS AND CABLES FROM CONDUITS TO TRAFFIC SIGNALS (CONDUITS 1-10, 15 & 16).
  - EXISTING CONDUITS SHALL BE CLEANED OF DIRT AND DEBRIS IMMEDIATELY PRIOR TO PULLING CABLES.
  - ALL INSA SIGNAL CABLES AND VIDEO DETECTION CABLES SHALL RUN UNSPLICED FROM CONTROL CABINET TO EACH SPECIFIED POLE. AN EXTRA 50' OF VIDEO CABLE SHALL BE COILED IN EACH POLE BASE.
  - RETAIN EXISTING WIRES FOR RAILROAD PRE-EMPTION

PROJECT NO.	DATE	SCALE	SHEET NO.	TOTAL SHEETS	AS BUILT
B19-A-1003M	0189 SC 002		36	40	JW3E09



B-19, MP. 3.01		DATE	BY	SCALE	SHEET NO.	TOTAL SHEETS	AS BUILT
DESIGN	FILE	02/10	JW3E	1/8" = 1'-0"	36	40	JW3E09
CHECKED	FILE	02/10	JW3E	1/8" = 1'-0"	36	40	JW3E09
APPROVED	FILE	02/10	JW3E	1/8" = 1'-0"	36	40	JW3E09
ARIZONA DEPARTMENT OF TRANSPORTATION		REGIONAL TRANSPORTATION DIVISION		INSTALL NEW CONDUCTORS			
DP/PA/HARRIS		JACOM		B-19 & BAFFERT DRIVE			
SR 198		LOCATION		MARIPOSA ROAD TO JCT I-19			
TRACS NO. H 6317 OIC		PROJECT NO.		B19-A-1003M			
		SHEET NO.		36 OF 40			



**ARIZONA DEPARTMENT OF TRANSPORTATION-TRAFFIC SIGNAL TIMING CARD**

Intersection: B19 @ Baffert Drive      Location: Nogales      Timing As Of: **12/10/2012**

MP: 3

Warrant: UPDATE TIMING

MU #: 1050K

	PH 1	PH 2	PH 3	PH 4	PH 5	PH 6	PH 7	PH 8
Mvmnt	--	NS	NS LT	WB	--	--	--	EB
Min Green	--	20	6	6	--	--	--	6
Veh Ext	--	4.5	2.0	3.0	--	--	--	2.0
Max I	--	40	15	25	--	--	--	25
Max 2	--	--	--	--	--	--	--	--
Max 3	--	--	--	--	--	--	--	--
Walk	--	7	--	7	--	--	--	7
Ped Clr	--	10	--	21	--	--	--	22
Max Init	--	20	--	--	--	--	--	--
Sec Act	--	1.0	--	--	--	--	--	--
TBR	--	20.0	--	--	--	--	--	--
TTR	--	20.0	--	--	--	--	--	--
Min Gap	--	3.0	--	--	--	--	--	--
Guar Pass	--	ON	--	--	--	--	--	3.0
Yellow	--	4.3	3.0	3.0	--	--	--	2.4
Red Clr	--	1.2	1.0	2.4	--	--	--	--
CNA	--	--	--	--	--	--	--	--
Det Memory	--	ON	--	--	--	--	--	--
Dual Entry	--	--	--	--	--	--	--	--
Recall Mode	--	MIN	--	--	--	--	--	--
Ext Start	--	YEL	--	--	--	--	--	--

TIME OF DAY FUNCTIONS

PGM	Funct'n	On	Off	Skip Days

VEHICLE DETECTOR DELAY/EXTEND TIMING

Phase(s)	Ctrl/Amp	Type	Sec
3	CTRL	DELAY	3

OVERLAPS TIMING OPTIONAL

O/L(Phases)	Grn	Yel	Red
(A)	--	--	--
(B)	--	--	--
(C)	--	--	--
(D)	--	--	--

PHASE SEQ: R1) 2,3,4 R2) 8

PROTECTED LEFT TURN PHASES:

PROT-PRM LEFT TURN PHASES: 3

RAILROAD PRE-EMPTION:  VIDEO:   
 EMERGENCY VEHICLE PRE-EMPTION:  LOOPS:   
 COORDINATION:

Ring Structure: R1) 1 2 | 3 | 4  
 R2) 5 6 | | 7 8

MU# 1052K

PREEMPTOR PROGRAMMING -EPAC 300

Location ~~2539~~ <sup>BPT</sup> @ BAPTIST (10-1-53)  
*USE THE NUMBER 5 - 02107 7*

ALL PREEMPTS DATA

Ring times	1.....	2.....	3.....	4.....
Min Grn/Wlk	<u>5</u>	<u>5</u>	<u>0</u>	<u>0</u>
Priority	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>

PREEMPT # 5 Miscellaneous

Test Preenpt 0  
Input Memory 0  
Delay time 0

Duration time 0

Ring:	1.....	2.....	3.....	4.....
Exit phases	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>

*2:4:8*

PREEMPT # 5

Interval times

SEL PED CLR 0  
 SEL YEL CHG 4.3  
 SEL RED CLR 2.7  
 TRACK GREEN 8  
 TRK PED CLR 0

TRK YEL CHG 3.0  
 TRK RED CLR 2.7  
 DWELL GREEN 12  
 RET PED CLR 0  
 RET YEL CHG 4.3  
 RET RED CLR 1.1

PREEMPT # 5

VEHICLE STATUS

PHASE	1.....	2.....	3.....	4.....	5.....	6.....	7.....	8.....
TRK GRN	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
DWELL	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>

PREEMPT # 5 PEDESTRIAN STATUS

PHASE	1.....	2.....	3.....	4.....	5.....	6.....	7.....	8.....
TRK GRN	<u>3</u>	<u>3</u>	<u>3</u>	<u>0</u>	<u>3</u>	<u>4</u>	<u>1</u>	<u>3</u>
DWELL	<u>3</u>	<u>0</u>	<u>3</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>3</u>

OVERLAP STATUS

	A	B	C	D
TRK GRN	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
DWELL	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>



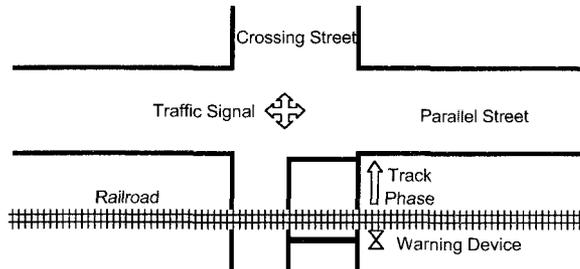
## Appendix C: Preemption Timing Calculation Worksheet



## GUIDE FOR DETERMINING TIME REQUIREMENTS FOR TRAFFIC SIGNAL PREEMPTION AT HIGHWAY RAIL GRADE CROSSINGS

City City of Nogales  
 County Santa Cruz  
 District ADOT - Tucson

Date 01/06/14  
 Completed by BMT  
 District Approval \_\_\_\_\_



Parallel Street Name  
SR 19B (Grand Avenue)  
 Crossing Street Name  
Baffert Drive

Railroad UPRR  
 Crossing DOT# 742 036 G

Railroad Contact Alexander Popovici  
 Phone (602) 322-2510

### SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

#### Preempt verification and response time

- |  |    |     |
|--|----|-----|
| 1. Preempt delay time (seconds) .....  | 1. | 0.0 |
| 2. Controller response time to preempt (seconds) .....                       | 2. | 0.0 |
| 3. Preempt verification and response time (seconds): add lines 1 and 2 ..... | 3. | 0.0 |

Remarks  
 \_\_\_\_\_  
 Controller type: EPAC 300

#### Worst-case conflicting vehicle time

- |   |    |      |
|---|----|------|
| 4. Worst-case conflicting vehicle phase number .....                          | 4. | 2    |
| 5. Minimum green time during right-of-way transfer (seconds) .....            | 5. | 5.00 |
| 6. Other green time during right-of-way transfer (seconds) .....              | 6. | 0.00 |
| 7. Yellow change time (seconds) .....   | 7. | 4.30 |
| 8. Red clearance time (seconds) .....   | 8. | 2.70 |
| 9. Worst-case conflicting vehicle time (seconds): add lines 5 through 8 ..... | 9. | 12.0 |

Remarks  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

#### Worst-case conflicting pedestrian time

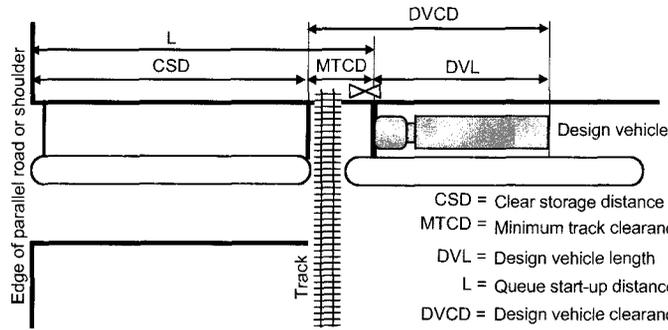
- |   |     |      |
|---|-----|------|
| 10. Worst-case conflicting pedestrian phase number .....                            | 10. | 2    |
| 11. Minimum walk time during right-of-way transfer (seconds) .....                  | 11. | 5.0  |
| 12. Pedestrian clearance time during right-of-way transfer (seconds) .....          | 12. | 0.0  |
| 13. Vehicle yellow change time, if not included on line 12 (seconds) .....          | 13. | 4.3  |
| 14. Vehicle red clearance time, if not included on line 12 (seconds) .....          | 14. | 2.7  |
| 15. Worst-case conflicting pedestrian time (seconds): add lines 11 through 14 ..... | 15. | 12.0 |

Remarks  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

#### Worst-case conflicting vehicle or pedestrian time

- |  |     |      |
|--|-----|------|
| 16. Worst-case conflicting vehicle or pedestrian time (seconds): maximum of lines 9 and 15 ..... | 16. | 12.0 |
| 17. Right-of-way transfer time (seconds): add lines 3 and 16 .....                               | 17. | 12.0 |

**SECTION 2: QUEUE CLEARANCE TIME CALCULATION**



**Remarks**

18. Clear storage distance (CSD, feet) .....	18.	125
19. Minimum track clearance distance (MTCD, feet) .....	19.	36
20. Design vehicle length (DVL, feet) .....	20.	65

Design vehicle type: WB-67

21. Queue start-up distance, L (feet): add lines 18 and 19 .....	21.	161
--	-----	-----

**Remarks**

22. Time required for design vehicle to start moving (seconds): calculate as $2+(L+20)$ .....	22.	10.1
---	-----	------

departing gr. excluded

23. Design vehicle clearance distance, DVCD (feet): add lines 19 and 20 .....	23.	101
---	-----	-----

24. Time for design vehicle to accelerate through the DVCD (seconds) .....	24.	14.5
--	-----	------

Read from Figure 2 in Instructions.

25. Queue clearance time (seconds): add lines 22 and 24 .....	25.	24.6
---	-----	------

**SECTION 3: MAXIMUM PREEMPTION TIME CALCULATION**

**Remarks**

26. Right-of-way transfer time (seconds): line 17 .....	26.	12.0
27. Queue clearance time (seconds): line 25 .....	27.	24.6
28. Desired minimum separation time (seconds) .....	28.	4.0

ITE recommended value

29. Maximum preemption time (seconds): add lines 26 through 28 .....	29.	40.6
--	-----	------

**SECTION 4: SUFFICIENT WARNING TIME CHECK**

**Remarks**

30. Required minimum time, MT (seconds): per regulations .....	30.	20.0
31. Clearance time, CT (seconds): get from railroad .....	31.	0.0
32. Minimum warning time, MWT (seconds): add lines .....	32.	20.0
33. Advance preemption time, APT, if provided (seconds): get from railroad .....	33.	0.0

Excludes buffer time (BT)

34. Warning time provided by the railroad (seconds): add lines 32 and 33 .....	34.	20.0
--	-----	------

35. Additional warning time required from railroad (seconds): subtract line 34 from line 29, round up to nearest full second, enter 0 if less than 0 .....	35.	21
--	-----	----

If the additional warning time required (line 35) is greater than zero, additional warning time has to be requested from the railroad. Alternatively, the maximum preemption time (line 29) may be decreased after performing an engineering study to investigate the possibility of reducing the values on lines 1, 5, 6, 7, 8, 11, 12, 13 and 14.

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_