ORIGINAL

OPEN MEETING AGENDA ITEM

0000135136

Arizona Department of Tr

Intermodal Transportation Division

206 South Seventeenth Avenue Phoenix, Arizona 85007-3213

Janice K. Brewer
Governor

John S. Halikowski
Director

Jennifer Toth
State Engineer

March 13, 2012

Arizona Corporation Commission
Docket Control

RE: Traffic Signal Preemption Timing
Docket RR-02635B-11-0282

Enclosed is a copy of the application to BNSF Railway Company/ Campbell Technology Company (CTC) for approval of advanced preemption of our temporary grade crossing, and a copy of the CTC report accepting the timing and other comments.

ADOT's designer used the Texas DOT worksheet and guide for traffic signal preemption timing at highway-railroad grade crossings. The designer had sealed the request before submittal to BNSF/ CTC.

ADOT has thus met the ACC Staff request for preemption timing evaluation.

Sincerely,

Robert H. Travis, PE
Railroad Liaison
602-712-6193
rtravis@azdot.gov

enc
cc: Vicki Bever, ADOT
Brian Lehman, ACC
Janie Hollingsworth, CTC

Arizona Corporation Commission
DOCKETED
MAR 13 2012
DOCKETED BY

AZ CORP COMMISSION
DOCKET CONTROL
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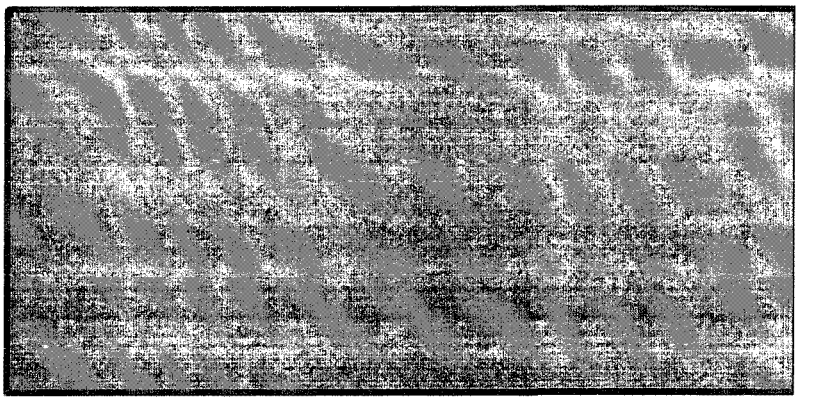
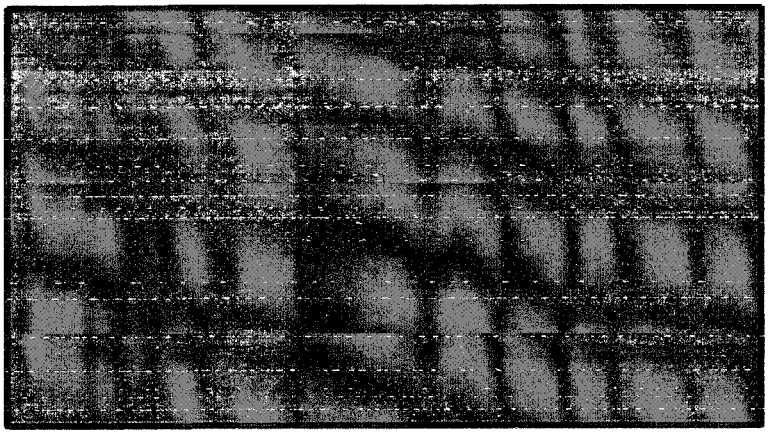
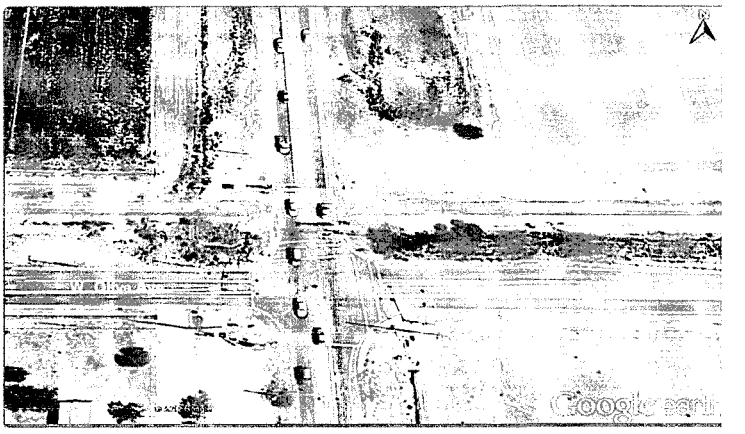
BNSF RAILWAY

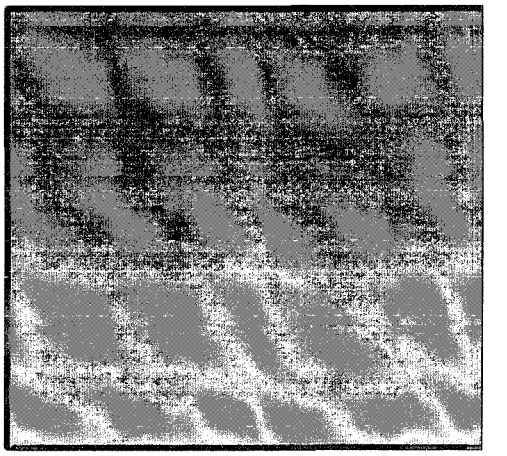


Assessment of Interconnected Highway-Rail Grade Crossing Report
March 12, 2012





AZ, Glendale
SR 303L @ Olive Ave
DOT # 025650C
Ennis Subdivision



Prepared for BNSF Railway
by Campbell Technology Corporation

CTC CAMPBELL TECHNOLOGY CORPORATION
HIGHWAY - RAIL GRADE CROSSING SOLUTIONS

TABLE OF CONTENTS

Executive Summary

Advance Preemption Time is being requested for the Burlington Northern Santa Fe Railway (BNSF) Highway-Rail Grade Crossing (DOT # 250650C) located in Glendale, AZ near the intersection of SR 303L and Olive Avenue. Campbell Technology Corporation (CTC) has been requested to review the advance preemption calculations and to make recommendations for other improvements which may be required by MUTCD and/or general industry practice. Recommended preemption values and design recommendations are summarized below and described in detail along with pertinent references in the final report.

- **Summary of Preemption Operation**

  - BNSF Railway is being requested to provide 15 seconds of Advance Preemption Time (APT) for the crossing. For more details, see the Preemption Calculation Form in Appendix A provided by Arizona Department of Transportation (ADOT).
  - The Minimum Track Clearance Distance (MTCD) is 26 feet. Additional Clearance Time (CT) for wide or angled crossing is not needed.
  - Gate Down will be implemented in the traffic signal controller. BNSF Railway will also provide Gate Down in their signal design.
  - ADOT will be providing a relay for supervised operation for the traffic signal controller.
  - Do Not Stop on Tracks sign will be installed at the crossing.
  - A 12 conductor #14 AWG Interconnect Cable will be provided from the traffic signal controller to the railroad equipment house.
  - A warning label will be provided in the traffic signal cabinet to alert traffic signal technicians to the presence of the interconnection with the railroad control equipment.

- **Summary of Recommended Design Changes**

  - Implement a maximum preemption timer.
  - Implement a traffic signal health circuit.
  - Implement a preemption operation and maintenance program.
  - Implement an all red Emergency/CMU-MMU flash operation
  - Install limited Storage Space Signs

General Information

Arizona Department of Transportation (ADOT) is in the process of designing the widening of SR 303L. As a result, the intersection of SR 303L and Olive Ave will be relocated approximately 200 feet to the east to accommodate the main line of the freeway construction. The relocated intersection of SR 303L and Olive Ave will be utilized for the freeway construction detour for approximately 2 years. Therefore, Advance Preemption Time is being requested for the BNSF Railway Grade Crossing (DOT# 250650C) on the Ennis Subdivision located in Glendale, AZ near the relocated intersection of SR 303L and Olive Avenue.

The traffic control signal plans provided were designed by the Baker Engineering and Arizona Department of Transportation (Agency). The Texas preemption timing form (TXDOT 2304) was provided by the Arizona Department of Transportation.

Contact Information

Agency:
Robert Travis, PE
State Railroad Liason
Arizona Department of Transportation
205 S 17th Ave, Room 357
MD 618E
Phoenix, AZ 85007
602-712-6193
rtravis@azdot.gov

Burlington Northern Santa Fe Railway:
Mr. Melvin Thomas
Manager Public Projects
Burlington Northern Santa Fe Railway
740 East Carnegie Dr.
San Bernardino, CA 92408

This review is being conducted by CTC, Inc. to evaluate the proposed time requirements and to make recommendations for other improvements which may be required by MUTCD and/or general industry practice.

This report consists of five parts in addition to the attached forms:

1. General background information on the project;

2. Site specific information for the grade crossing and the intersection;
3. Analysis of the traffic control signal and the proposed preemption operation;
4. Specific recommendations to the Agency regarding the proposed design, and;
5. Report conclusion.

It should be noted that the *2009 Manual on Uniform Traffic Control Devices (MUTCD)* as published by the Federal Highway Administration has specific requirements in Chapter 8C, Section 8C.09, Paragraph 6 and 8 which apply to the information provided in this report and how it is used:

> **Section 8C.09 Traffic Control Signals at or Near Highway-Rail Grade Crossings**
>
> **Guidance:**
>
> 06 **The highway agency or authority with jurisdiction and the regulatory agency with statutory authority, if applicable, should jointly determine the preemption operation and the timing of traffic control signals interconnected with highway-rail grade crossings adjacent to signalized highway intersections.**
>
> **Standard:**
>
> 08 **Information regarding the type of preemption and any related timing parameters shall be provided to the railroad company so that they can design the appropriate train detection circuitry.**

The report also makes reference to the Institute of Transportation Engineers 2006 Recommended Practice on *Preemption of Traffic Signals Near Railroad Crossings*. In addition, information from NCHRP 271, *"Traffic Signal Operations Near Highway-Rail Grade Crossings"* as published by the Transportation Research Board (TRB), *"Railroad-Highway Grade Crossing Handbook – Revised Second Edition"* as published by Federal Highway Administration and the AREMA 2011 *"Communication & Signal Manual of Recommended Practice"*.

The Information provided in the report consists of recommendations to the Public Agency based on the review of the information provided. BNSF and CTC both recognize that the Public Agency is responsible for the design, operation and maintenance of the traffic control signal as well as any signing, pavement marking and roadway design.

1. Site Specific Grade Crossing and Intersection Information

The Railroad operates on one main line crossing SR 303L adjacent to the signalized intersection with Olive Avenue. Railroad gates will be provided at the crossing.

The Clear Storage Distance (CSD) indicated on the preemption form is 57 feet.

The Minimum Track Clearance Distance (MTCD) indicated on the preemption form is 26 feet.

The roadway grade approaching, over and departing the Minimum Track Clearance Distance (MTCD) is not indicated to exceed 2%.

There is one through lane and a left turn lane over the track approaching the intersection with West Olive Ave.

During the track clearance interval, the traffic signal displays a circular green and a green left turn arrow indication at the intersection.

2. ***Analysis of Proposed Traffic Signal Railroad Preemption:***

Design Vehicle:

The Agency specified a Tractor Trailer 75 Feet long as the design vehicle for the location.

Traffic Signal Preemption Operation:

The proposed interconnection is specified as a 12 conductor # 14 AWG Cable from the traffic signal controller to the railroad equipment.

A gate down circuit will be provided in the current design.

A maximum preemption time circuit is not provided in the current design.

A traffic signal health circuit is not provided in the current design.

Railroad Preemption Operation:

The Railroad is being requested to provide 15 seconds of APT.

The MTCD is 26 feet across which does not require additional seconds of Clearance Time (CT).

Traffic Signal Controller:

The traffic signal controller is an integral part of the operation of the preemption system. The operation of the controller is determined by the firmware installed in the controller unit. It is highly recommended that a thorough inspection of the preemption operation be made to assure that the controller is capable of providing the required preemption features prior to placing the system into operation. The inspection should include a performance test of the preemption sequence under the maximum Right-of-Way Transfer Time condition in order to verify the receipt of the preemption call, the transition to the track clearance interval and the operation of the dwell interval. Many conditions such as, but not limited to coordinated operation, emergency vehicle preemption, transit priority, or manual control will alter the operation of the controller unit when those conditions are in effect. In addition, periodic updates or revisions to firmware may negatively affect the operation and/or programming parameters of the controller unit. Any change in controller unit hardware or firmware should be followed by a performance test in order to assure that the unit is functioning in accordance with the design plans.

The traffic signal controller specified on the plans is an Econolite TS2 ASC3.

The firmware installed in the controller unit is not specified in the plans.

The Agency did provide traffic signal plans.

Traffic Signal Coordination:

The traffic signal is not coordinated with adjacent traffic signals.

Pedestrian Operation:

There are four crosswalks at the intersection.

Pedestrian Treatment:

The existing operation eliminates the pedestrian change interval.

Traffic Control Signal Preemption Timing:

The calculated Right-of-Way Transfer Time (RWTT) is 10.9 seconds as shown below:

	Programmed Value (sec)
Programmed Controller Preemption Delay Time	0
Controller Preemption Response Time	0
Minimum Green before Track Clearance	5
Walk before Track Clearance*	0
Pedestrian Change before Track Clearance*	0
Yellow Change before Track Clearance	4.3
Red Clearance before Track Clearance	1.6
Additional RWTT Due To Overlap	0
Right of Way Transfer Time (RWTT)	**10.9**

Turning Movement Restrictions:

The left turn movement towards the track is prohibited during preemption with a no left turn blank out sign.

The right turn movement toward the track is prohibited during preemption with a no right turn blank out sign.

Yellow Trap (Lagging Yellow Left Turn Condition):

The left turn movement opposing the track clearance phase operates in a permissive only mode. This can create a lagging left turn condition that displays a circular yellow indication for the left turn movement opposing the track clearance phase during the transfer to the track clearance interval. *(Refer to NCHRP Report 3-54, page 16, Heading: Lead-Lag Phasing With PPLT Control).* It was noted in the Pre-PSE Comments that the traffic signal timing plan will be developed by ADOT to prevent the lagging left turn condition from occurring during the transition period to track clearance.

Track Clearance Green Phase(s):

The track clearance green phases are 2 and 5 per timing plan.

Preemption Dwell Operation:

The traffic signal dwell operation provides limited service allowing Phases 4 and 8 to be served during railroad preemption.

Emergency / CMU-MMU Flashing Operation:

The traffic signal operation during a malfunction is not specified in the traffic signal plans.

Vehicle Detection:

From the plans provided, video vehicle detection is located before the crossing.

Back-up Power Supply

From the plans provided, the traffic signal cabinet is equipped with back-up power supply in order to provide operation during power outages. The need for backup power is per the 2009 MUTCD, Chapter 4D, Section 4D.27, Paragraph 11 which recommends that traffic control signals with preemption should be provided with a back-up power supply.

DO NOT STOP ON TRACK Signs:

From the plans provided, DO NOT STOP ON TRACK signs will be installed at this location.

3. ***Recommendations for the Public Agency:***

As a result of the plan review, the following proposed recommendations are being presented to the Public Agency for consideration to enhance the operation of the preemption system. BNSF and CTC recognize that the Public Agency is the final authority regarding the design and operation of the preemption system per the 2009 (MUTCD) Chapter 8C, Section 8C.09, Paragraphs 6 and 8.

The Railroad is available to assist the Agency with any of the proposed recommendations at the Agency's request.

Advance Preemption Time:

The Advance Preemption Time (APT) proposed by the Agency is 15 seconds (See Appendix A – Line 35 of the Preemption Calculation Form). CTC does not object to the proposed APT.

NOTE: APT value does not include Clearance Time (CT), Minimum Warning Time (MT), Buffer Time (BT), Equipment Response Time (ERT), or Propagation Delay Time (PDT).

Traffic Signal Health Circuit:

The traffic signal health circuit is provided by the traffic signal controller unit to the railroad crossing warning system. It is typically connected to the controller cabinet flash bus or similar circuit so that it will de-energize any time the traffic signals are flashing or dark. Consideration should be given to a fail-safe design for the health circuit so that there will be no case in which the circuit will remain energized while the traffic signals are flashing or dark.

It is recommended that the Agency implement a traffic signal health circuit at this location. At the direction of ADOT, Traffic Signal Health Circuit will not be implemented at the intersection.

Maximum Preemption Timer:

A Maximum Preemption Timer is a timing circuit in the traffic signal controller which limits the period of time the preemption can be in effect. The purpose of this timing circuit is to allow the traffic signal to exit the preemption sequence in the event the railroad warning system "fails-safe". Because railroad warning systems are safety critical systems, they are designed in such a manner as to fail in a "safe" state in the event of a non-catastrophic fault. What this means is that the warning devices will operate to indicate that it is not safe to proceed even when no train is present. This is a "safe" failure mode. However, when a fail-safe condition occurs, the traffic control signal will remain in preemption if a maximum preemption timing circuit has not been provided. Because of the limited sequence operation during the dwell interval, non-allowable movements are inhibited. Road users may become frustrated and attempt to make moves against a red traffic signal indication. The maximum preemption timing circuit will cause the traffic signal to transition to an all-red flashing state after a predetermined period of time until the preemption circuit returns to its normal state at which time normal operation of the traffic signal resumes.

It is recommended that the Agency implement a maximum preemption timing circuit at this location. At the direction of ADOT, Maximum Preemption Timer will not be implemented at the intersection.

Track Clearance Green Time:

The Track Clearance Green Time (TCG) is the period of time programmed into the traffic signal controller that the green indication is displayed to vehicles stopped within the Minimum Track Clearance Distance (MTCD). The green indication allows these vehicles to start and to move clear of the track with an approaching train. If there is not a gate down circuit present, this value is a fixed period of time. Where a gate down circuit is used, this value becomes a minimum period of time which is extended until the gate down indication is received.

From the documents provided a gate down circuit will be implemented. Therefore, CTC does not object to the track clearance green time.

Lagging Yellow Condition:

Traffic signal design and operation involves many elements, one of which is the mode of operation for left turn signals. These are engineering decisions made by the Agency at the time the traffic signal is designed for a specific location. The term "Lagging Yellow" is one way to describe a specific condition which occurs during the yellow change sequence operation within a traffic control signal operating under specific left turn signal modes. The condition occurs when a left turn movement that operates in protected-permissive or permissive only left turn signal operation is terminating opposite of a lagging left turn movement. Under this condition, left turning vehicles which have entered the intersection (opposing the lagging left turn movement) expecting to make a permissive left turn on a circular green indication see a circular yellow indication. These drivers are conditioned to clear the intersection when the yellow indication is displayed. What they fail to realize is that the opposing through movement has and continues to have a circular green indication. The result is that in the move to clear the intersection, these drivers can pull into the path of an oncoming vehicle proceeding on a circular green indication incorrectly expecting the oncoming vehicle to also have a yellow indication. This can create a collision which potentially blocks the exit path from the grade crossing when a train is approaching.

Additional information regarding the above described condition is available as a part of NCHRP Project 3-54, *Evaluation of Traffic Signal Displays for Protected/Permitted Left Turn Control.*

This location has been identified as having a lagging yellow condition during the transition to the track clearance interval. However, it has been noted in the documents that ADOT will develop a traffic signal plan to prevent the lagging yellow condition. The following methods may be implemented at this location to resolve this condition:

- Protected only mode left turn operation for the approach opposing the track clearance direction.
- Controller programming to provide a transition through an all-red signal display to eliminate the lagging yellow condition. It should be noted that not all controllers are capable of providing this operation.
- Split phase sequence for the movement where the lagging yellow occurs.
- Implementation of Flashing Yellow Arrow Operation to eliminate the lagging yellow condition and retain the protected/permissive mode left turn operation.

Emergency/CMU-MMU and Maintenance Flash:

In situations where the Clear Storage Distance (CSD) is less than the length of the design vehicle, Emergency/CMU-MMU and maintenance flash should be all-red flash to allow the design vehicle a chance to clear the tracks when a train is approaching.

It is recommended that the Agency provide an all red Emergency/CMU-MMU flash operation.

Limited Storage Space Signs:

Where the CSD is less than the length of the design vehicle, the installation of limited storage space warning signs are helpful to advise motorist of the amount of space available between the railroad tracks and the intersecting street. Section 8B-24 of the 2009 MUTCD provides guidance on where these signs may be installed.

It is recommended that the Agency install limited Storage Space Signs (W10-11A or W10-11b) signs.

Implementation of Preemption Operation and Maintenance Program:

In accordance with the FRA Safety Advisory it is recommended that a joint program be established between the Agency and the Railroad to provide for an annual (minimum) operational test of the preemption system.

- The program should provide for a joint inspection with a representative from the Agency and the Railroad.
- The program should require a live operational test of the system under the worst case (maximum Right-of-Way Transfer Time) condition.
- The program should include review of data recorder logs where available to verify proper operation of the system.
- The program should determine that no operational changes have been made to the grade crossing, warning system, roadway, traffic control signal or other facility that modifies the operation of the system as it is presently functioning.

It is recommended that a plan be developed to notify the Railroad in the event the traffic control signal fails to operate as intended. The plan should include the following elements:

- If the traffic control signal enters flashing mode, notify the Railroad and provide police officers or flaggers to provide for the safe movement of roadway users over the grade crossing.
- If the traffic control signal loses power or all of the signals are dark, notify the Railroad and provide police officers or flaggers to provide for the safe movement of roadway users over the grade crossing.
- Notify the Railroad once the system has been restored to normal operation.

If a signal maintainer is required to perform a joint test of the preemption system, notify the Railroad.

It is recommended that procedures be implemented to provide flagging or other suitable temporary traffic control plan in the event a lane closure downstream from the grade crossing causes roadway users to queue onto the crossing. (See 2009 MUTCD Section 8A.08 for additional information.)

It is recommended that anytime changes are made to the roadway, the traffic control signal, or preemption operation, the Railroad shall be notified in accordance with 2009 MUTCD, Section 8A.02 Paragraph 6.

4. Conclusions:

It is recommended that the Agency follow up with the Railroad to review this report if there are any unresolved issues or comments. If the Agency desires, the Railroad should be contacted to assist with any recommendations, answer any questions or participate in a diagnostic team inspection to resolve any outstanding items.

Appendix A

Michael Baker Jr., Inc.
A Unit of Michael Baker Corporation
2929 N. Central Avenue
Suite 800
Phoenix, AZ 85012
(602) 279-1234
FAX (602) 279-1411

January 25, 2012

Melvin Thomas
Public Projects Manager
Burlington Northern Santa Fe Railway
740 East Carnegie Dr.
San Bernardino, CA 92408

RE: Intersection Improvements at SR 303L Detour & Olive Ave and BNSF RR

Dear Mr. Thomas:

The existing traffic signal at the intersection of SR 303L & Olive Ave is currently owned and operated by the Arizona Department of Transportation (ADOT). This intersection currently operates with advance preemption. ADOT is in the process of designing the widening of SR 303L. The intersection of SR 303L & Olive Ave will be relocated approximately 200 feet to the east to accommodate the main line of the freeway construction. The relocated intersection of SR 303L & Olive Ave will be utilized for the SR 303L detour for approximately 2 years. Given the proximity of the BNSF Rail Road to this intersection, the signal will have to be synchronized with the BNSF's warning device at the RR crossing similarly to its current synchronization.

The calculations for the required traffic signal preemption were 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*. This document has been recently adopted by ADOT. Warning time calculations are attached to this document.

Currently, SR 303L and Olive Avenue experience heavy truck traffic. According to the Arizona Revised Statue 28-1095, the design vehicle permitted on these roadway facilities is 75 feet in length, therefore, 75 feet in length was assumed to calculate a conservative track clearance time value. The posted speed limits on SR 303L detour and Olive Avenue will be 45 mph.

The intersection is designed to utilize Advance Preemption Time (APT). Based on the current calculations, the intersection will require 35 seconds of maximum preemption time to clear the tracks. The required Minimum Warning Time (MWT) at a RR crossing is 20 seconds per MUTCD. Per BNSF standards 20 seconds warning time is provided. Therefore, 15 seconds of advance warning time is needed to clear the tracks. The 35 seconds of preemption time to clear the tracks was calculated based on the worst-case conflicting vehicle phase (phase 4) and time, which are 5 seconds of minimum green time, 4.3 seconds of yellow and 1.6 seconds of red clearance time; queue clearance time (19.9 seconds) and the minimum separation time (4 seconds) values. Subtracting the 20 seconds of BNSF provided warning time from the 35 seconds of maximum preemption time, 15 seconds of additional warning time or advance preemption time is required from the railroad.

Thank you for your assistance in this matter. Please call me at (602) 798-7533 if you have any questions.

Sincerely,

MICHAEL BAKER JR., INC.

Marta Gerber, P.E.
Traffic Engineer

RAILWAY

Version 2/28/2008

Has Form been revised for this request?
☐ YES, Revision Date:
☒ NO

HIGHWAY-RAIL GRADE CROSSING
TRAFFIC SIGNAL PREEMPTION REQUEST FORM

The Road Authority traffic controller circuitry requires railroad preemption contacts to initiate the preemption sequence. Per BNSF standard, we will provide normally closed "dry" preemption relay contacts to interconnect the railroad active warning system to the Road Authority traffic signal controller assembly. These contacts are rated at 4 amps. With no trains in the area, these contacts remain closed. The Road Authority Traffic Department will be responsible for installing the interconnection cable between the traffic signal controller and the crossing warning signal control housing. If exit gates are utilized, the Road Authority Traffic Department will be responsible for installing and maintaining the "in pavement" vehicle detection loops from the street to the cable junction box.

To estimate and or design the crossing warning system, BNSF needs to know certain timing parameters.

Definitions:

"Advance Preemption" – The system will be designed to open the preemption contacts for a predetermined amount of time (Advance Preemption Time) prior to activation of the warning devices (flashing lights).

"Simultaneous Preemption" – The system will be designed to open the preemption contact at the same time the warning devices (flashing lights) are activated.

"Gate Down Logic" – Per BNSF standard, we will provide normally open "dry" gate down relay contacts to interconnect the crossing warning system to the Road Authority traffic signal controller assembly. These contacts are rated at 4 amps. The system will be designed to close the gate down contacts upon the gates arrival in the down position. This logic is normally utilized to hold track clearance green until the gates are down since the time from preemption to gate down will vary depending upon the traffic signal cycle.

"Minimum Warning Time" – Per the MUTCD and FRA regulations, BNSF must provide at least 20 seconds of warning time for through trains (typically main track applications). However, per BNSF standards for constant warning time train detection equipment, the system will be designed to provide a "nominal" warning time of 30 seconds to ensure MUTCD/FRA minimums are met and to compensate for accelerating trains and ballast conditions.

"Minimum Track Clearance Distance" – For standard two-quadrant railroad warning devices, the minimum track clearance distance is the length along a highway at one or more railroad tracks, measured either from the railroad stop line, warning device or 12 ft. perpendicular to the far rail, along the centerline or edge line of the highway, as appropriate, to obtain the longer distance. For locations with exit gate warning devices, the minimum track clearance distance is the length along a highway at one or more railroad tracks, measured either from the railroad stop line or entrance warning device to the point clear of the exit gate. Note that in cases where the exit gate arm is parallel to the track(s) and/or not perpendicular to the roadway, clearance will be either along the centerline or edge line of the highway, as appropriate, to obtain the longer distance.

When (entrance) gates are used they are typically designed to start their decent within 3 to 5 seconds of the warning lights flashing, descend in an additional 10 to 15 seconds, and reach horizontal at least 5 seconds prior to train arrival per FRA regulations.

The length of the railroad's control circuit approach distance is directly related to the amount of requested "Advanced Preemption Time" (APT). Typically, the longer the APT requirement is, the longer the approach distance, and thus the more control equipment that will be required.

With the above items in mind, please provide the following information to help us process your request:

Date: 01/25/2012 Request by (name/title): Velvet Mathew, PE
Crossing Street Name: SR 303L DOT #: 025650C
Parallel Street Name: Olive Avenue District: Phoenix
City: Glendale County: Maricopa State: AZ
Traffic Engineer: Marta Gerber, PE Phone: 6027987533 E-mail: mgerber@mbakercorp.com

1) Is this request for Simultaneous Preemption? ☐ YES ☒ NO

2) Is this request for Advanced Preemption? ☒ YES ☐ NO
If "Yes" what is your requested Advanced Preemption Time? 15 Seconds.

3) Will this location utilize exit gates? ☐ YES ☒ NO

The following questions should be completed if this location utilizes exit gates:

The exit gate arm(s) shall operate in one of the following modes of operation known as the EGOM (exit gate operating mode):

a. Dynamic EGOM – A mode of operation where exit gate operation is based on presence of vehicles within minimum track clearance distance (MTCD).

1) The exit gate arm(s) shall be designed to start downward motion after the vehicle detection system indicates no vehicles are located within the MTCD and any (optional) exit gate clearance time has completed timing. Note that the entrance gate arm(s) and the exit gate arm(s) may start downward motion almost simultaneously if no vehicles are located within the MTCD.

b. Timed EGOM – A mode of operation where exit gate operation is based on a predetermined time interval. This mode may be used if the vehicle detection system (Dynamic EGOM) is unhealthy.

1) The exit gate arm(s) shall be designed to start downward motion a predetermined number of seconds after the entrance gate arm(s) start downward motion. Note that the entrance gate arms(s) may or may not be fully horizontal at the time the exit gate arm(s) start downward motion. This timed value is known as the exit gate clearance time (EGCT).

1) The BNSF standard is to use Dynamic EGOM and revert to Timed EGOM if the vehicle detection system is unhealthy.
Is this operation acceptable? ☐ YES ☐ NO

2) When operating in "Dynamic" exit gate operating mode, how much exit gate clearance time (optional) do you request?
_____ seconds.

3) When operating in "Timed" exit gate operating mode how much exit gate clearance time do you request?
_____ seconds.

Comments: This is a temporary crossing request. It is expected that the temporary crossing will be in service for 2 years. Additional 15s of APT is requested based on the attached calculations.

Please contact the BNSF Signal Engineering office at (913) 551- 4642 with any questions or possible changes to the above requirements.

EXPIRES 9/30/2013

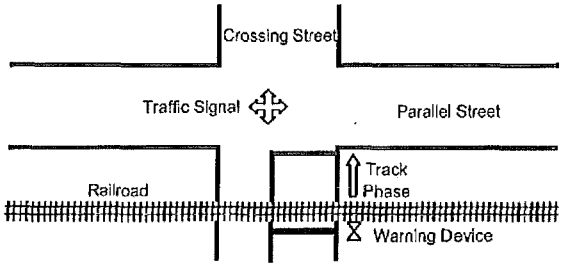
Texas Department of Transportation

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

City: City of Glendale
County: Maricopa
District: ADOT - Phoenix

Date: 01/25/12
Completed by: MHG
District Approval:

Show North Arrow



Parallel Street Name: Olive Avenue
Crossing Street Name: SR 303L

Railroad: BNSF
Crossing DOT#: 0250650C

Railroad Contact: Melvin Thomas
Phone: (909) 386-4472

SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt verification and response time

			Remarks
1. Preempt delay time (seconds)	1.	0.0	
2. Controller response time to preempt (seconds)	2.	0.0	Controller type: TS2 ASC3
3. Preempt verification and response time (seconds): add lines 1 and 2	3.	0.0	

Worst-case conflicting vehicle time

			Remarks
4. Worst-case conflicting vehicle phase number	4.	4	
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.	1.60	
9. Worst-case conflicting vehicle time (seconds): add lines 5 through 8	9.	10.9	

Worst-case conflicting pedestrian time

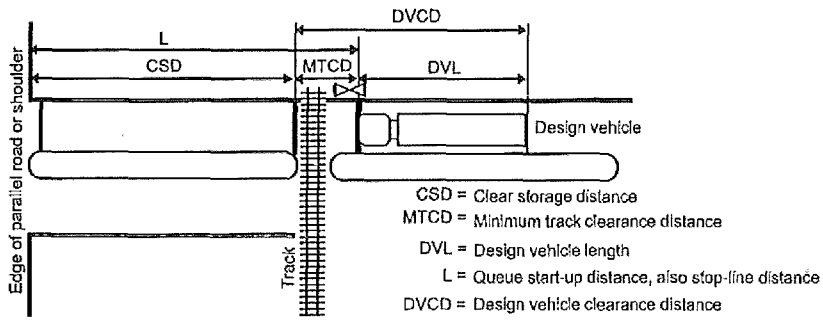
			Remarks
10. Worst-case conflicting pedestrian phase number	10.		
11. Minimum walk time during right-of-way transfer (seconds)	11.		
12. Pedestrian clearance time during right-of-way transfer (seconds)	12.		
13. Vehicle yellow change time, if not included on line 12 (seconds)	13.		
14. Vehicle red clearance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

Worst-case conflicting vehicle or pedestrian time

16. Worst-case conflicting vehicle or pedestrian time (seconds): maximum of lines 9 and 15	16.	10.9
17. Right-of-way transfer time (seconds): add lines 3 and 16	17.	10.9

SECTION 2: QUEUE CLEARANCE TIME CALCULATION

EXPIRES 9/30/2013



			Remarks
18. Clear storage distance (CSD, feet)	18.	57	
19. Minimum track clearance distance (MTCD, feet)	19.	26	
20. Design vehicle length (DVL, feet)	20.	75	Design vehicle type:
21. Queue start-up distance, L (feet): add lines 18 and 19	21.	83	
22. Time required for design vehicle to start moving (seconds): calculate as 2+(L÷20)	22.	6.2	Remarks
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.	13.7	Read from Figure 2 in Instructions.
25. Queue clearance time (seconds): add lines 22 and 24	**25.**	19.9	

SECTION 3: MAXIMUM PREEMPTION TIME CALCULATION

			Remarks
26. Right-of-way transfer time (seconds): line 17	26.	10.9	
27. Queue clearance time (seconds): line 25	27.	19.9	
28. Desired minimum separation time (seconds)	28.	4.0	ITE recomended value
29. Maximum preemption time (seconds): add lines 26 through 28	**29.**	34.8	

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	Excludes buffer time (BT)
33. Advance preemption time, APT, if provided (seconds): get from railroad	33.	0.0	
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.**	15	

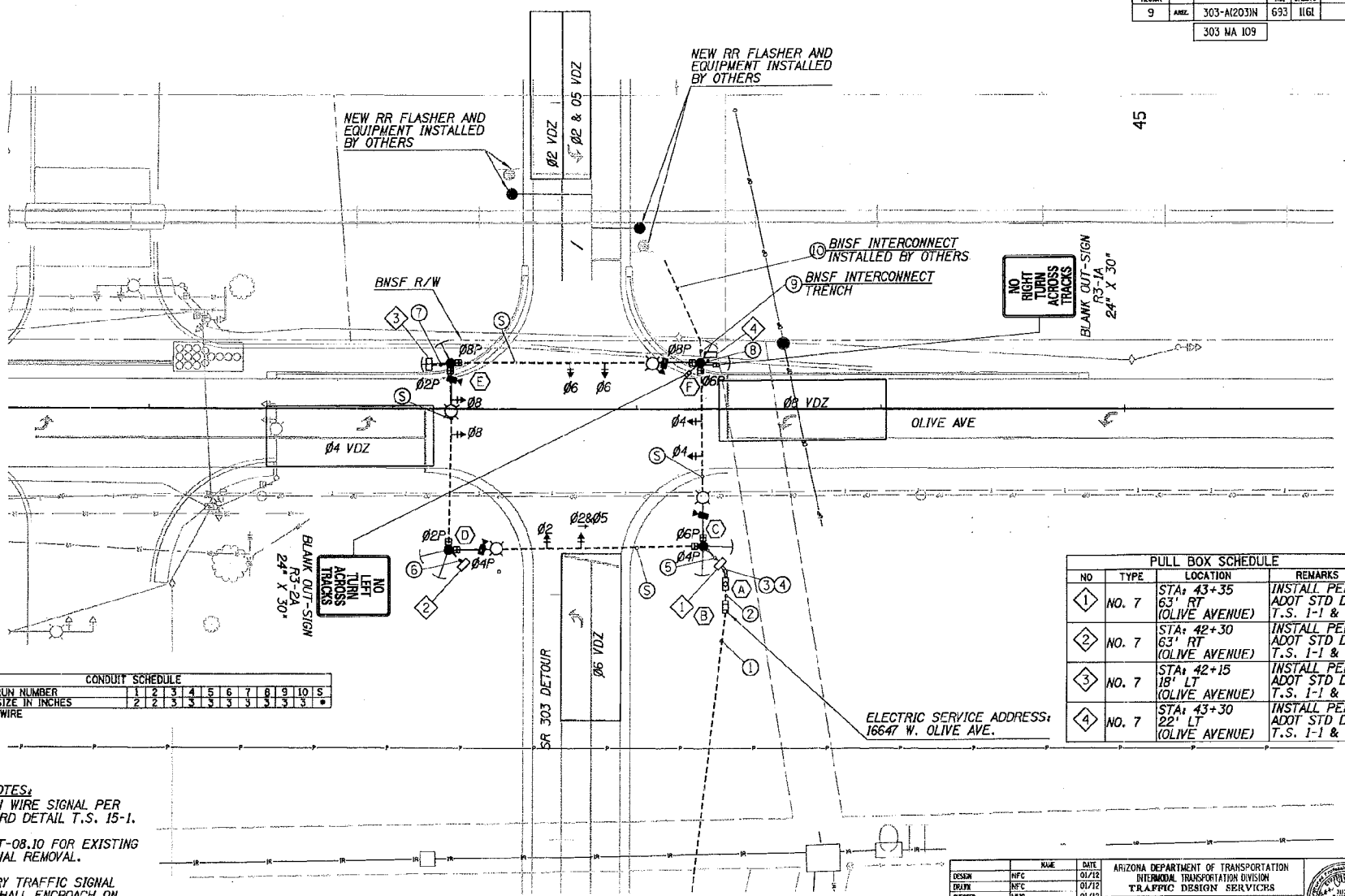
If the additional warning time required (line 35) is greater than zero, additional warning time has to be requested from the railroad. Alternatively, the maximum preemption time (line 29) may be decreased after performing an engineering study to investigate the possibility of reducing the values on lines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

Remarks: _____

REVIEWER	REVIEWER COMMENT NO.	PAGE	COMMENT	INITIAL DISP.	RESPONSE	FINAL DISP.	INIT RESP BY	Company	Who will fix / markup	Done	Discuss at Resolution mtg.
BNSF	1	Revised Pre-emption Request	Advance Pre-emption is recommended to be used at this RR X-ing	A	At the direction of ADOT, advance pre-emption will be used at the temporary intersection of SR 303L and Olive Ave.	A	MGerber	Baker			
BNSF	2	Revised Pre-emption Request	Gate Down must be implemented in the traffic signal controller	A	Gate Down will be implemented, a note in the Specs will be included. BNSF will provide gate down logic in their design.	A	MGerber	Baker			
BNSF	3	Revised Pre-emption Request	Restrict the right turn movement and left turn toward the crossing during pre-emption	A	Blankout signs to restrict left and right turns during pre-emption will be installed.	A	MGerber	Baker			
BNSF	4	Revised Pre-emption Request	Eliminate the lagging yellow condition, also known as the yellow trap, during the transition to track clearance green	C	Signal timing plans and their implementation will be completed by ADOT staff. The signal timing plan will be developed to prevent "yellow trap" during the transition period to track clearance. A reminder note will be included on the signal plans.	A	MGerber	Baker			
BNSF	5	Revised Pre-emption Request	Implement a left turn phase with a protected left turn indication for the track clearance green phase for SB 303L. This left turn indication does not need to be served at any time other than when preempted if desired	A	A left-turn phase will be included for the southbound direction with a 4-section type "G' signal head on the plans.	A	MGerber	Baker			
BNSF	6	Revised Pre-emption Request	Where the clear storage distance is less that the design vehicle length, vehicle detection should be considered upstream of the crossing so that longer vehicles can stop prior to the crossing while still placing a call to the traffic signal controller.	A	Video Detection is included at this intersection.	A	MGerber	Baker			
BNSF	7	Revised Pre-emption Request	Install "DO NOT STOP ON TRACKS" signs at the crossing.	A	Signs are already included on the plans.	A	MGerber	Baker			
BNSF	8	Revised Pre-emption Request	Change interconnection to double break or supervised operation.	A	The relay for supervised operation will be provided by ADOT. A note in the specs will be included	A	MGerber	Baker			
BNSF	9	Revised Pre-emption Request	Implement a traffic signal health circuit.	D	At the direction of ADOT, a traffic signal health circuit will not be installed.	D	MGerber	Baker			
BNSF	10	Revised Pre-emption Request	Ensure interconnect cable is adequate for the preemption operations. A 12C #14 AWG may be needed.	A	Already included on the plans.	A	MGerber	Baker			
BNSF	11	Revised Pre-emption Request	Implement Maximum Preemption Timer	D	At the direction of ADOT Maximum Preemption Timer will not be implemented at the intersection.	D	MGerber	Baker			
BNSF	12	Revised Pre-emption Request	Install battery back up in the traffic signal controller	D	Included on the plans.	D	MGerber	Baker			
BNSF	13	Revised Pre-emption Request	Install a warning label in the traffic signal controller to alert traffic signal technicians to the presence of the interconnection with the railroad	A	A note will be included on the plans and in the SPECs.	A	MGerber	Baker			
BNSF	14	Revised Pre-emption Request	Please verify if pedestrian time will be provided during preemption. If so, adjust values where needed.	D	At the direction of ADOT pedestrian time will not be provided during preemption.	D	MGerber	Baker			
BNSF	15	Revised Pre-emption Request	Please verify value of 57. From the plans provided, it appears the value should be approximately 70 ft.	D	Verified. The distance of 57 feet is correct.	D	MGerber	Baker			
BNSF	16	Revised Pre-emption Request	The design vehicle length should be 65 (Based on ARS 28-1095)	A	The maximum design vehicle length in ARS 28-1095 is 75 feet. 75 feet was used for the calculations.	A	MGerber	Baker			
BNSF	17	Revised Pre-emption Request	Adjust values based on changes above	A	Adjusted values.	A	MGerber	Baker			
BNSF	18	Revised Pre-emption Request	Revise value to 0. The 10 seconds in the Nominal warning time is a buffer to account for accelerating trains and ballast conditions. Therefore, cannot be used in the calculation	A	Revised.	A	MGerber	Baker			
BNSF	19	Revised Pre-emption Request	Revise value to 20 in boxes 32 and 34	A	Revised.	A	MGerber	Baker			
BNSF	20	Revised Pre-emption Request	Revise value in box 35 based on changes above.	A	Revised.	A	MGerber	Baker			

A-Will Comply
B-Consultant to Evaluate
C-Client to Evaluate
D-No Action Required

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	303-A(203)N	693	1161	
		303 MA 109			



CONDUIT SCHEDULE										
CONDUIT RUN NUMBER	1	2	3	4	5	6	7	8	9	10	S
CONDUIT SIZE IN INCHES	2	2	3	3	3	3	3	3	3	3	*

* - SPAN WIRE

PULL BOX SCHEDULE			
NO	TYPE	LOCATION	REMARKS
1	NO. 7	STA: 43+35 63' RT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4
2	NO. 7	STA: 42+30 63' RT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4
3	NO. 7	STA: 42+15 18' LT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4
4	NO. 7	STA: 43+30 22' LT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4

CONSTRUCTION NOTES:

1. INSTALL SPAN WIRE SIGNAL PER ADOT STANDARD DETAIL T.S. 15-1.
2. SEE SHEET T-08.10 FOR EXISTING TRAFFIC SIGNAL REMOVAL.
3. NO TEMPORARY TRAFFIC SIGNAL FACILITIES SHALL ENCROACH ON BNSF RIGHT-OF-WAY.
4. VIDEO DETECTION ZONE FOR Ø2 AND Ø5 SHALL ACCOMMODATE LARGE, SLOW MOVING TRUCKS.

	NAME	DATE
DESIGN	NFC	01/12
DRAWN	NFC	01/12
CHECKED	MRC	01/12

Baker

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

TEMPORARY TRAFFIC SIGNAL
OLIVE AVE
TRAFFIC SIGNAL PLAN

ROUTE	LOCATION
303L	SR 303L, GLENDALE AVENUE TO PEORIA AVENUE

TRACS NO. H7874 01C | 303-A(203)N | DWG. NO. T-08.06 | ___ OF ___

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F.A.P.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	303-A(203)N	694	1161	
		303 MA 109			

POLE SCHEDULE

TRAFFIC SIGNAL CONTROLLER				REMARKS	LOCATION
CABINET	TYPE	CONTROLLER	AUX. CONTROL		
(A)	IV	NEMA 8 PHASE		FURNISH AND INSTALL	STA 43+37, 71' RT (OLIVE AVENUE)
(B) P.E.C.	TYPE I METER PEDESTAL	INSTALL SINGLE 60 AMP SINGLE POLE BREAKER FOR SINGLE AND TWO-POLE 20 AMP BREAKER FOR LIGHTING	INSTALL PEC AND 20 AMP FUSED LIGHTING CONTACTOR	FURNISH AND INSTALL METER AND FOUNDATION PER ADOT T.S. 2-6 AND T.S. 3-5. FURNISH AND INSTALL UPS BATTERY BACKUP SYSTEM. SERVICE ADDRESS: 16647 WEST OLIVE AVENUE	STA 43+37, 79' RT (OLIVE AVENUE)

POLE		MAST ARM		SIGNALS		P.B. SIGN	REMARKS	LOCATION
NO.	TYPE	SIG.	LUM.	MTG.	FACE			
(C) 14' 35' Ø6P Ø4 Ø4 VDC Ø4P	CLASS III WOOD POLE W/DOWN GUYS	-	15'		2-F 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6	STA 43+27, 56' RT (OLIVE AVENUE)
(D) 14' 37' Ø4P Ø2 Ø2&Ø5 VDC Ø2P	CLASS III WOOD POLE W/DOWN GUYS	-	15'		1-F 1-G 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6	STA 42+23, 58' RT (OLIVE AVENUE)
(E) 14' 15' Ø2P Ø8 Ø8 VDC Ø8P	CLASS III WOOD POLE W/DOWN GUYS	-	15'		2-F 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6	STA 42+24, 20' LT (OLIVE AVENUE)
(F) R3-1A BLANK-OUT SIGN 14' 35' Ø8P Ø6 Ø6 VDC Ø6P R3-2A BLANK-OUT SIGN	CLASS III WOOD POLE W/DOWN GUYS	-	15'		2-F 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6 4. INSTALL R3-1A AND R3-2A BLANK-OUT SIGNS ON SIGNAL POLE.	STA 43+26, 20' LT (OLIVE AVENUE)

VDC - VIDEO DETECTION CAMERA
PCS - PEDESTRIAN COUNTDOWN SIGNAL

POLE SCHEDULE NOTES:

1. *THE CONTROL CABINET SHALL BE WIRED AND LABELED WITH THE SAME PHASE NUMBER DESIGNATIONS FOR INITIAL AND FUTURE PHASES, AS SHOWN IN THE PHASE MOVEMENT DIAGRAM OR AS NOTED ON THE PLANS. EACH CONNECTOR SHALL HAVE ALL PINS WITHIN THE CONNECTOR BROUGHT TO CABINET TIE POINTS. ANY CONTROL CABINET NOT WIRED ACCORDINGLY WILL BE REJECTED BY THE ENGINEER.*
2. *THE MPS-8Ø CONTROLLER SHALL HAVE ALL THE SPECIAL PROGRAM APPLICATIONS PER STANDARD SPECIFICATIONS SUB SECTION 734-2.02 (3)(a), EXCEPT FOR THE ARTERIAL MASTER CONTROLLER APPLICATION.*
3. *INSTALL P.E.C., 20 AMP FUSED LIGHTING CONTACTOR AS CALLED FOR ON THE PLANS AND THE SPECIFICATIONS.*
4. *THE CONTRACTOR SHALL SUPPLY ALL TRAFFIC SIGNAL EQUIPMENT MATERIALS, TOOLS AND LABOR INCLUDING THE CONTROLLER CABINET. INSTALL IN FIELD ON FOUNDATION AND TERMINATE FIELD WIRING. ADOT WILL WIRE CABINET INCLUDING PREEMPTION PANEL.*
5. *THE STATIONS AND OFFSETS FOR TRAFFIC SIGNAL POLES WHICH ARE SHOWN ON THE PLANS AND IN THE POLE/EQUIPMENT SCHEDULE ARE APPROXIMATE. THE FINAL LOCATION OF EACH POLE SHALL BE STAKED IN THE FIELD BY THE CONTRACTOR, AND APPROVED BY THE ENGINEER.*
6. *VIDEO DETECTION SHALL BE FURNISHED NEW AND INSTALLED BY THE CONTRACTOR. VIDEO DETECTION TO BE INSTALLED ON LUMINAIRE MAST ARM, UNLESS OTHERWISE SPECIFIED ON THE PLANS.*
7. *INSTALL LUMINAIRE MAST ARMS PER T.S. 4-26, DETAIL A. NO OTHER MAST ARM TYPES SHALL BE MOUNTED ON STRAIN POLES.*

UNDERGROUND CONDUIT AND PULL BOX NOTES:

1. *ALL PULL BOXES SHALL BE NUMBER 7, HEAVY DUTY UNLESS OTHERWISE NOTED ON THE PLANS, AND SHALL BE LOCATED APPROXIMATELY AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.*
2. *ALL PULL BOXES SHALL BE LEFT IN A CLEAN CONDITION, FREE OF DIRT AND DEBRIS, UPON COMPLETION OF THE WORK.*
3. *ALL CONDUIT SHALL BE 3" PVC, UNLESS OTHERWISE NOTED IN THE CONDUCTOR SCHEDULE, WITH A NUMBER 8 BARE BOND WIRE INSTALLED PER SECTION 732-3.01 OF THE STANDARD SPECIFICATIONS.*

	NAME	DATE
DESIGN	NFC	01/12
DRAWN	NFC	01/12
CHECKED	MHG	01/12

Baker

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

TEMPORARY TRAFFIC SIGNAL
OLIVE AVENUE
POLE SCHEDULE

ROUTE	LOCATION	
303L	SR 303L, GLENDALE AVENUE TO PEORIA AVENUE	DWG. NO. T-06.07
TRACS NO. H7874 01C	303-A(203)N	___ OF ___

EXPIRES 06/30/2012

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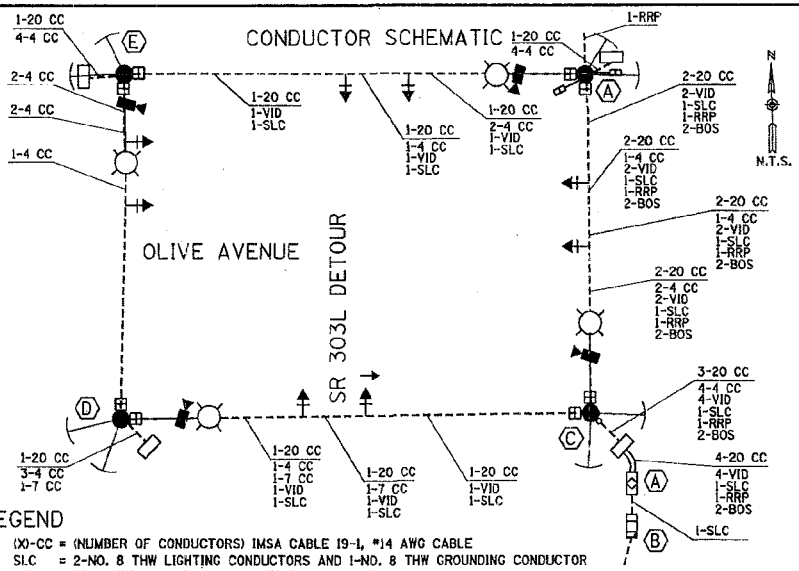
F.A.H.P.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	303-A(203)N	695	1161	
		303 MA 109			

CONDUCTOR SCHEMATIC



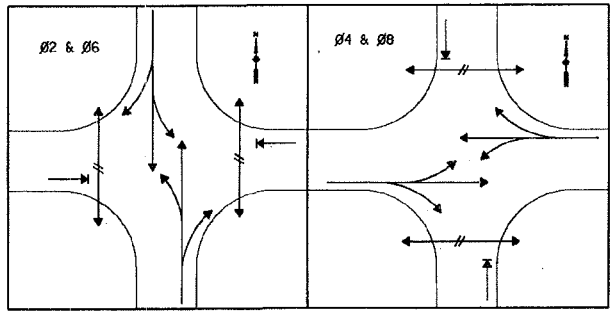
LEGEND

(X)-CC = (NUMBER OF CONDUCTORS) IMSA CABLE 19-1, #14 AWG CABLE
SLC = 2-NO. 8 THW LIGHTING CONDUCTORS AND 1-NO. 8 THW GROUNDING CONDUCTOR
VID = VIDEO DETECTION CABLE (CONTRACTOR FURNISHED)
RRP = IMSA CABLE 19-1, 12 CONDUCTOR #14 AWG RAILROAD PREEMPTION CABLE
BOS = IMSA CABLE 19-1, 4 CONDUCTOR #14 AWG BLANK-OUT SIGN CABLE

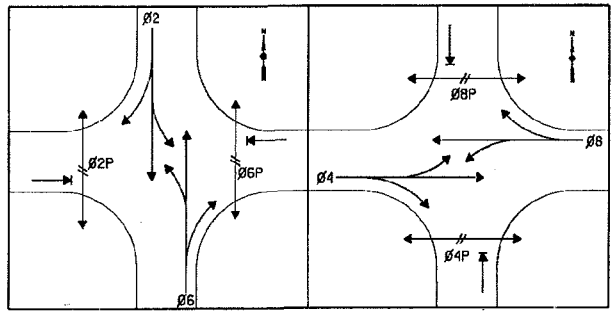
CONDUCTOR SCHEMATIC AND PHASING NOTES:

1. THE 20 CONDUCTOR CABLE SHALL BE CONTINUOUS (NO SPLICES) FROM THE CONTROLLER CABINET TO THE TYPE 7 PULL BOX NEAREST THE POLE. THE 4 CONDUCTOR CABLES SHALL THEN RUN FROM THE PULL BOX TO EACH SIGNAL HEAD. ALL CABLE SPLICING SHALL OCCUR ONLY IN THE PULL BOX NEAREST TO THE POLE.
2. VIDEO DETECTION CABLES SHALL BE TAGGED IN EACH PULL BOX THEY PASS THROUGH, DESIGNATING THE PHASE AND CORNER SERVED.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COIL ENOUGH EXCESS CONDUCTORS TO ACCOMMODATE FOR ANY SIGNAL HEAD REALIGNMENT REQUIRED.
4. ADOT TO DEVELOP SIGNAL TIMING PLANS TO PREVENT "YELLOW TRAP" CONDITION DURING THE TRANSITION PERIOD TO TRACK CLEARANCE.
5. INSTALL A WARNING LABEL IN THE TRAFFIC SIGNAL CONTROLLER TO ALERT SIGNAL TECHNICIANS TO THE PRESENCE OF THE INTERCONNECTION WITH THE RAILROAD.

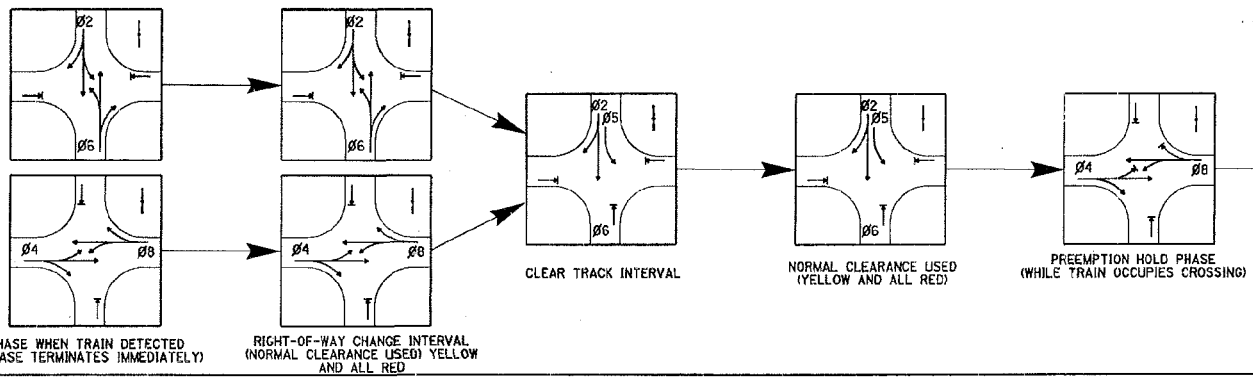
PHASE DIAGRAM



PHASE SEQUENCE



RAILROAD PREEMPTION SEQUENCE



	NAME	DATE
DESIGN	MG	01/12
DRAWN	MG	01/12
CHECKED	MG	01/12

Baker

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

TEMPORARY TRAFFIC SIGNAL
OLIVE AVENUE
CONDUCTOR SCHEDULE

ROUTE	LOCATION	DWG. NO.
303L	SR 303L, GLENDALE AVENUE TO PEORIA AVENUE	T-08.03
TRACS NO. H7874 01C	303-A(203)N	___ OF ___

EXPIRES 03/31/2012

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Arizona Department of Transportation

Intermodal Transportation Division

206 South Seventeenth Avenue Phoenix, Arizona 85007-3213

Janice K. Brewer
Governor

John S. Halikowski
Director

Jennifer Toth
State Engineer

January 31, 2012

Melvin Thomas
Manager Public Projects
Burlington Northern Santa Fe Railway
740 East Carnegie Dr.
San Bernardino, CA 92408

RE: Revised Preemption Request
303 MA 109 H7874 01C
Project 303-A(203)
Existing at-grade crossing DOT # 025 650 C
Temporary at-grade crossing DOT # 929 056 P
Rail mile 8.3 Ennis Spur

ADOT and its Designer, Baker Engineering, have reviewed the comments provided by Campbell Technology Corporation dated December 30, 2011. Please see our final preemption request. Page 6 of the packet shows the questions posed by Campbell Technology Corporation and our Response. I have also included a copy of CTC's redlines to our November 2011 resubmittal.

Please advise this office that this preemption request has been accepted and I will inform the Arizona Corporation Commission accordingly. ADOT is still planning on construction of this temporary crossing this summer.

Thank you and all at BNSF and Campbell Technology Group for your assistance on this grade separation project.

Sincerely,

Robert H. Travis, PE
Railroad Liaison
602-712-6193
rtravis@azdot.gov

cc: Vicki Bever, ADOT
Velvet Mathews, ADOT
Al Zubi, ADOT
Tony Pisano, Baker Engineering
Janie Hollingsworth, Campbell Technology Corporation.

Michael Baker Jr., Inc.
A Unit of Michael Baker Corporation
2929 N. Central Avenue
Suite 800
Phoenix, AZ 85012
(602) 279-1234
FAX (602) 279-1411

January 25, 2012

Melvin Thomas
Public Projects Manager
Burlington Northern Santa Fe Railway
740 East Carnegie Dr.
San Bernardino, CA 92408

RE: Intersection Improvements at SR 303L Detour & Olive Ave and BNSF RR

Dear Mr. Thomas:

The existing traffic signal at the intersection of SR 303L & Olive Ave is currently owned and operated by the Arizona Department of Transportation (ADOT). This intersection currently operates with advance preemption. ADOT is in the process of designing the widening of SR 303L. The intersection of SR 303L & Olive Ave will be relocated approximately 200 feet to the east to accommodate the main line of the freeway construction. The relocated intersection of SR 303L & Olive Ave will be utilized for the SR 303L detour for approximately 2 years. Given the proximity of the BNSF Rail Road to this intersection, the signal will have to be synchronized with the BNSF's warning device at the RR crossing similarly to its current synchronization.

The calculations for the required traffic signal preemption were 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*. This document has been recently adopted by ADOT. Warning time calculations are attached to this document.

Currently, SR 303L and Olive Avenue experience heavy truck traffic. According to the Arizona Revised Statue 28-1095, the design vehicle permitted on these roadway facilities is 75 feet in length, therefore, 75 feet in length was assumed to calculate a conservative track clearance time value. The posted speed limits on SR 303L detour and Olive Avenue will be 45 mph.

The intersection is designed to utilize Advance Preemption Time (APT). Based on the current calculations, the intersection will require 35 seconds of maximum preemption time to clear the tracks. The required Minimum Warning Time (MWT) at a RR crossing is 20 seconds per MUTCD. Per BNSF standards 20 seconds warning time is provided. Therefore, 15 seconds of advance warning time is needed to clear the tracks. The 35 seconds of preemption time to clear the tracks was calculated based on the worst-case conflicting vehicle phase (phase 4) and time, which are 5 seconds of minimum green time, 4.3 seconds of yellow and 1.6 seconds of red clearance time; queue clearance time (19.9 seconds) and the minimum separation time (4 seconds) values. Subtracting the 20 seconds of BNSF provided warning time from the 35 seconds of maximum preemption time, 15 seconds of additional warning time or advance preemption time is required from the railroad.

Thank you for your assistance in this matter. Please call me at (602) 798-7533 if you have any questions.

Sincerely,

MICHAEL BAKER JR., INC.

Marta Gerber, P.E.
Traffic Engineer

BNSF RAILWAY

Version 2/28/2008

Has Form been revised for this request?
☐ YES, Revision Date:
☒ NO

HIGHWAY-RAIL GRADE CROSSING
TRAFFIC SIGNAL PREEMPTION REQUEST FORM

The Road Authority traffic controller circuitry requires railroad preemption contacts to initiate the preemption sequence. Per BNSF standard, we will provide normally closed "dry" preemption relay contacts to interconnect the railroad active warning system to the Road Authority traffic signal controller assembly. These contacts are rated at 4 amps. With no trains in the area, these contacts remain closed. The Road Authority Traffic Department will be responsible for installing the interconnection cable between the traffic signal controller and the crossing warning signal control housing. If exit gates are utilized, the Road Authority Traffic Department will be responsible for installing and maintaining the "in pavement" vehicle detection loops from the street to the cable junction box.

To estimate and or design the crossing warning system, BNSF needs to know certain timing parameters.

Definitions:

"Advance Preemption" – The system will be designed to open the preemption contacts for a predetermined amount of time (Advance Preemption Time) prior to activation of the warning devices (flashing lights).

"Simultaneous Preemption" – The system will be designed to open the preemption contact at the same time the warning devices (flashing lights) are activated.

"Gate Down Logic" – Per BNSF standard, we will provide normally open "dry" gate down relay contacts to interconnect the crossing warning system to the Road Authority traffic signal controller assembly. These contacts are rated at 4 amps. The system will be designed to close the gate down contacts upon the gates arrival in the down position. This logic is normally utilized to hold track clearance green until the gates are down since the time from preemption to gate down will vary depending upon the traffic signal cycle.

"Minimum Warning Time" – Per the MUTCD and FRA regulations, BNSF must provide at least 20 seconds of warning time for through trains (typically main track applications). However, per BNSF standards for constant warning time train detection equipment, the system will be designed to provide a "nominal" warning time of 30 seconds to ensure MUTCD/FRA minimums are met and to compensate for accelerating trains and ballast conditions.

"Minimum Track Clearance Distance" – For standard two-quadrant railroad warning devices, the minimum track clearance distance is the length along a highway at one or more railroad tracks, measured either from the railroad stop line, warning device or 12 ft. perpendicular to the far rail, along the centerline or edge line of the highway, as appropriate, to obtain the longer distance. For locations with exit gate warning devices, the minimum track clearance distance is the length along a highway at one or more railroad tracks, measured either from the railroad stop line or entrance warning device to the point clear of the exit gate. Note that in cases where the exit gate arm is parallel to the track(s) and/or not perpendicular to the roadway, clearance will be either along the centerline or edge line of the highway, as appropriate, to obtain the longer distance.

When (entrance) gates are used they are typically designed to start their decent within 3 to 5 seconds of the warning lights flashing, descend in an additional 10 to 15 seconds, and reach horizontal at least 5 seconds prior to train arrival per FRA regulations.

The length of the railroad's control circuit approach distance is directly related to the amount of requested "Advanced Preemption Time" (APT). Typically, the longer the APT requirement is, the longer the approach distance, and thus the more control equipment that will be required.

With the above items in mind, please provide the following information to help us process your request:

Date: 01/25/2012 Request by (name/title): Velvet Mathew, PE
Crossing Street Name: SR 303L DOT #: 025650C
Parallel Street Name: Olive Avenue District: Phoenix
City: Glendale County: Maricopa State: AZ
Traffic Engineer: Marta Gerber, PE Phone: 6027987533 E-mail: mgerber@mbakercorp.com

1) Is this request for Simultaneous Preemption? ☐ YES ☒ NO

2) Is this request for Advanced Preemption? ☒ YES ☐ NO
If "Yes" what is your requested Advanced Preemption Time? 15 Seconds.

3) Will this location utilize exit gates? ☐ YES ☒ NO

The following questions should be completed if this location utilizes exit gates:

The exit gate arm(s) shall operate in one of the following modes of operation known as the EGOM (exit gate operating mode):

a. Dynamic EGOM – A mode of operation where exit gate operation is based on presence of vehicles within minimum track clearance distance (MTCD).

1) The exit gate arm(s) shall be designed to start downward motion after the vehicle detection system indicates no vehicles are located within the MTCD and any (optional) exit gate clearance time has completed timing. Note that the entrance gate arm(s) and the exit gate arm(s) may start downward motion almost simultaneously if no vehicles are located within the MTCD.

b. Timed EGOM – A mode of operation where exit gate operation is based on a predetermined time interval. This mode may be used if the vehicle detection system (Dynamic EGOM) is unhealthy.

1) The exit gate arm(s) shall be designed to start downward motion a predetermined number of seconds after the entrance gate arm(s) start downward motion. Note that the entrance gate arms(s) may or may not be fully horizontal at the time the exit gate arm(s) start downward motion. This timed value is known as the exit gate clearance time (EGCT).

1) The BNSF standard is to use Dynamic EGOM and revert to Timed EGOM if the vehicle detection system is unhealthy. Is this operation acceptable? ☐ YES ☐ NO

2) When operating in "Dynamic" exit gate operating mode, how much exit gate clearance time (optional) do you request? _____ seconds.

3) When operating in "Timed" exit gate operating mode how much exit gate clearance time do you request? _____ seconds.

Comments: This is a temporary crossing request. It is expected that the temporary crossing will be in service for 2 years. Additional 15s of APT is requested based on the attached calculations.

Please contact the BNSF Signal Engineering office at (913) 551- 4642 with any questions or possible changes to the above requirements.

CERTIFICATE NO 41369 MARTA H. GERBER Date Signed 1/31/2012 ARIZONA U.S.A.

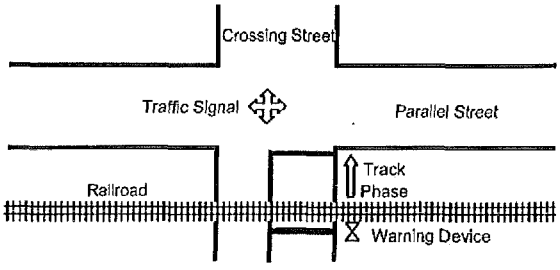
EXPIRES 9/30/2013

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

City: City of Glendale
County: Maricopa
District: ADOT - Phoenix

Date: 01/25/12
Completed by: MHG
District Approval:

Show North Arrow



Parallel Street Name: Olive Avenue
Crossing Street Name: SR 303L

Railroad: BNSF
Crossing DOT#: 0250650C

Railroad Contact: Melvin Thomas
Phone: (909) 386-4472

SECTION 1: RIGHT-OF-WAY TRANSFER TIME CALCULATION

Preempt verification and response time

			Remarks
1. Preempt delay time (seconds)	1.	0.0	
2. Controller response time to preempt (seconds)	2.	0.0	Controller type: TS2 ASC3
3. Preempt verification and response time (seconds): add lines 1 and 2	3.	0.0	

Worst-case conflicting vehicle time

			Remarks
4. Worst-case conflicting vehicle phase number	4.	4	
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.	1.60	
9. Worst-case conflicting vehicle time (seconds): add lines 5 through 8	9.	10.9	

Worst-case conflicting pedestrian time

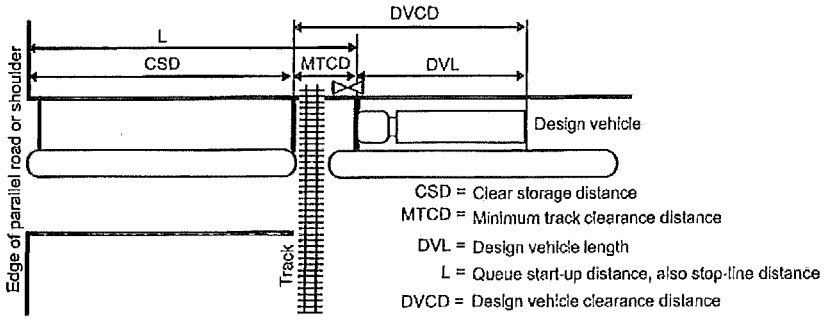
			Remarks
10. Worst-case conflicting pedestrian phase number	10.		
11. Minimum walk time during right-of-way transfer (seconds)	11.		
12. Pedestrian clearance time during right-of-way transfer (seconds)	12.		
13. Vehicle yellow change time, if not included on line 12 (seconds)	13.		
14. Vehicle red clearance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

Worst-case conflicting vehicle or pedestrian time

16. Worst-case conflicting vehicle or pedestrian time (seconds): maximum of lines 9 and 15	16.	10.9
17. Right-of-way transfer time (seconds): add lines 3 and 16	**17.**	10.9

SECTION 2: QUEUE CLEARANCE TIME CALCULATION

EXPIRES 9/30/2013



			Remarks
18. Clear storage distance (CSD, feet)	18.	57	
19. Minimum track clearance distance (MTCD, feet)	19.	26	
20. Design vehicle length (DVL, feet)	20.	75	Design vehicle type:
21. Queue start-up distance, L (feet): add lines 18 and 19	21.	83	
22. Time required for design vehicle to start moving (seconds): calculate as 2+(L÷20)	22.	6.2	Remarks
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.	13.7	Read from Figure 2 in Instructions.
25. Queue clearance time (seconds): add lines 22 and 24	**25.**	19.9	

SECTION 3: MAXIMUM PREEMPTION TIME CALCULATION

			Remarks
26. Right-of-way transfer time (seconds): line 17	26.	10.9	
27. Queue clearance time (seconds): line 25	27.	19.9	
28. Desired minimum separation time (seconds)	28.	4.0	ITE recomended value
29. Maximum preemption time (seconds): add lines 26 through 28	**29.**	34.8	

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	Excludes buffer time (BT)
33. Advance preemption time, APT, if provided (seconds): get from railroad	33.		0.0	
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.**		15	

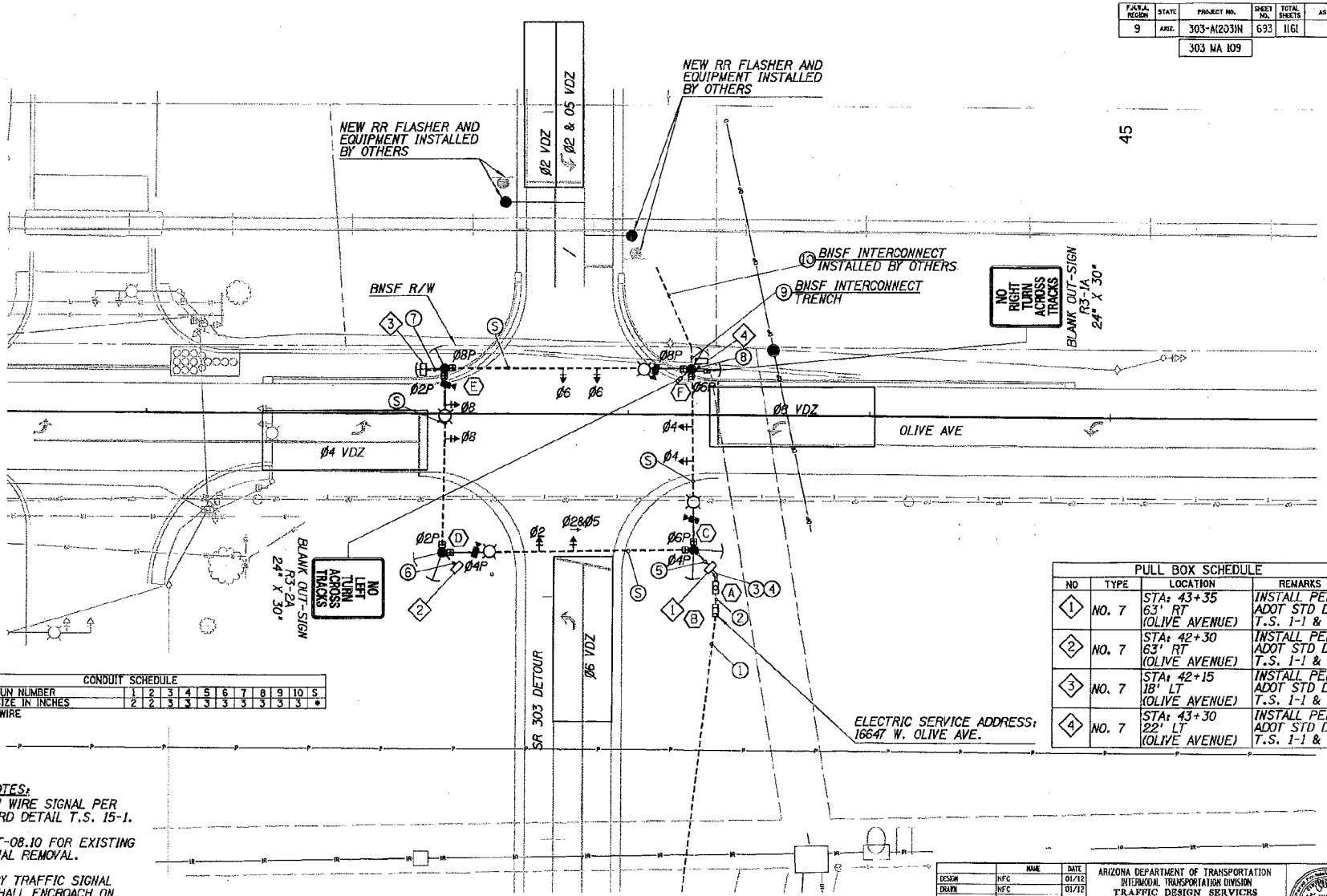
If the additional warning time required (line 35) is greater than zero, additional warning time has to be requested from the railroad. Alternatively, the maximum preemption time (line 29) may be decreased after performing an engineering study to investigate the possibility of reducing the values on lines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

Remarks:

REVIEWER	REVIEWER COMMENT NO.	PAGE	COMMENT	INITIAL DISP.	RESPONSE	FINAL DISP.	INIT RESP BY	Company	Who will fix / markup	Done	Discuss at Resolution mtg.
BNSF	1	Revised Pre-emption Request	Advance Pre-emption is recommended to be used at this RR X-ing	A	At the direction of ADOT, advance pre-emption will be used at the temporary intersection of SR 303L and Olive Ave.	A	MGerber	Baker			
BNSF	2	Revised Pre-emption Request	Gate Down must be implemented in the traffic signal controller	A	Gate Down will be implemented, a note in the Specs will be included. BNSF will provide gate down logic in their design.	A	MGerber	Baker			
BNSF	3	Revised Pre-emption Request	Restrict the right turn movement and left turn toward the crossing during pre-emption	A	Blankout signs to restrict left and right turns during pre-emption will be installed.	A	MGerber	Baker			
BNSF	4	Revised Pre-emption Request	Eliminate the lagging yellow condition, also known as the yellow trap, during the transition to track clearance green	C	Signal timing plans and their implementation will be completed by ADOT staff. The signal timing plan will be developed to prevent "yellow trap" during the transition period to track clearance. A reminder note will be included on the signal plans.	A	MGerber	Baker			
BNSF	5	Revised Pre-emption Request	Implement a left turn phase with a protected left turn indication for the track clearance green phase for SB 303L. This left turn indication does not need to be served at any time other than when preempted if desired	A	A left-turn phase will be included for the southbound direction with a 4-section type "G' signal head on the plans.	A	MGerber	Baker			
BNSF	6	Revised Pre-emption Request	Where the clear storage distance is less that the design vehicle length, vehicle detection should be considered upstream of the crossing so that longer vehicles can stop prior to the crossing while still placing a call to the traffic signal controller.	A	Video Detection is included at this intersection.	A	MGerber	Baker			
BNSF	7	Revised Pre-emption Request	Install "DO NOT STOP ON TRACKS" signs at the crossing.	A	Signs are already included on the plans.	A	MGerber	Baker			
BNSF	8	Revised Pre-emption Request	Change interconnection to double break or supervised operation.	A	The relay for supervised operation will be provided by ADOT. A note in the specs will be included	A	MGerber	Baker			
BNSF	9	Revised Pre-emption Request	Implement a traffic signal health circuit.	D	At the direction of ADOT, a traffic signal health circuit will not be installed.	D	MGerber	Baker			
BNSF	10	Revised Pre-emption Request	Ensure interconnect cable is adequate for the preemption operations. A 12C #14 AWG may be needed.	A	Already included on the plans.	A	MGerber	Baker			
BNSF	11	Revised Pre-emption Request	Implement Maximum Preemption Timer	D	At the direction of ADOT Maximum Preemption Timer will not be implemented at the intersection.	D	MGerber	Baker			
BNSF	12	Revised Pre-emption Request	Install battery back up in the traffic signal controller	D	Included on the plans.	D	MGerber	Baker			
BNSF	13	Revised Pre-emption Request	Install a warning label in the traffic signal controller to alert traffic signal technicians to the presence of the interconnection with the railroad	A	A note will be included on the plans and in the SPECs.	A	MGerber	Baker			
BNSF	14	Revised Pre-emption Request	Please verify if pedestrian time will be provided during preemption. If so, adjust values where needed.	D	At the direction of ADOT pedestrian time will not be provided during preemption.	D	MGerber	Baker			
BNSF	15	Revised Pre-emption Request	Please verify value of 57. From the plans provided, it appears the value should be approximately 70 ft.	D	Verified. The distance of 57 feet is correct.	D	MGerber	Baker			
BNSF	16	Revised Pre-emption Request	The design vehicle length should be 65 (Based on ARS 28-1095)	A	The maximum design vehicle length in ARS 28-1095 is 75 feet. 75 feet was used for the calculations.	A	MGerber	Baker			
BNSF	17	Revised Pre-emption Request	Adjust values based on changes above	A	Adjusted values.	A	MGerber	Baker			
BNSF	18	Revised Pre-emption Request	Revise value to 0. The 10 seconds in the Nominal warning time is a buffer to account for accelerating trains and ballast conditions. Therefore, cannot be used in the calculation	A	Revised.	A	MGerber	Baker			
BNSF	19	Revised Pre-emption Request	Revise value to 20 in boxes 32 and 34	A	Revised.	A	MGerber	Baker			
BNSF	20	Revised Pre-emption Request	Revise value in box 35 based on changes above.	A	Revised.	A	MGerber	Baker			

A-Will Comply C-Client to Evaluate
B-Consultant to Evaluate D-No Action Required

F.A.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	303-A(203)N	693	1161	
		303 MA 109			



CONDUIT SCHEDULE										
CONDUIT RUN NUMBER	1	2	3	4	5	6	7	8	9	10	S
CONDUIT SIZE IN INCHES	2	2	3	3	3	3	3	3	3	3	*

* - SPAN WIRE

PULL BOX SCHEDULE			
NO	TYPE	LOCATION	REMARKS
1	NO. 7	STA: 43+35 63' RT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4
2	NO. 7	STA: 42+30 63' RT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4
3	NO. 7	STA: 42+15 18' LT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4
4	NO. 7	STA: 43+30 22' LT (OLIVE AVENUE)	INSTALL PER ADOT STD DTL T.S. 1-1 & 1-4

ELECTRIC SERVICE ADDRESS: 16647 W. OLIVE AVE.

CONSTRUCTION NOTES:

1. INSTALL SPAN WIRE SIGNAL PER ADOT STANDARD DETAIL T.S. 15-1.
2. SEE SHEET T-08.10 FOR EXISTING TRAFFIC SIGNAL REMOVAL.
3. NO TEMPORARY TRAFFIC SIGNAL FACILITIES SHALL ENCROACH ON BNSF RIGHT-OF-WAY.
4. VIDEO DETECTION ZONE FOR Ø2 AND Ø5 SHALL ACCOMMODATE LARGE, SLOW MOVING TRUCKS.

	NAME	DATE
DESIGN	NFC	01/12
DRAWN	NFC	01/12
CHECKED	MHG	01/12

Baker

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

TEMPORARY TRAFFIC SIGNAL
OLIVE AVE
TRAFFIC SIGNAL PLAN

ROUTE	LOCATION
303L	SR 303L, GLENDALE AVENUE TO PEORIA AVENUE

TRACS NO. H7874 01C | 303-A(203)N | DWG. NO. T-08.06 | ___ OF ___

EXPIRES: 01/31/2013

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	303-A(203)N	694	1161	
		303 MA 109			

POLE SCHEDULE

TRAFFIC SIGNAL CONTROLLER								
CABINET	TYPE	CONTROLLER		AUX. CONTROL		REMARKS	LOCATION	
(A)	IV	NEMA 8 PHASE				FURNISH AND INSTALL	STA 43+37, 71' RT (OLIVE AVENUE)	
(B) P.E.C.	TYPE I METER PEDESTAL	INSTALL SINGLE 60 AMP SINGLE POLE BREAKER FOR SINGLE AND TWO-POLE 20 AMP BREAKER FOR LIGHTING		INSTALL PEC AND 20 AMP FUSED LIGHTING CONTACTOR		FURNISH AND INSTALL METER AND FOUNDATION PER ADOT T.S. 2-6 AND T.S. 3-5. FURNISH AND INSTALL UPS BATTERY BACKUP SYSTEM. SERVICE ADDRESS: 16647 WEST OLIVE AVENUE	STA 43+37, 79' RT (OLIVE AVENUE)	
POLE		MAST ARM		SIGNALS		P.B. SIGN	REMARKS	LOCATION
NO.	TYPE	SIG.	LUM.	MTG.	FACE			
(C) 14' 35' ØVDC Ø4P Ø4 Ø4	CLASS III WOOD POLE W/DOWN GUYS	-	15'		2-F 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6	STA 43+27, 56' RT (OLIVE AVENUE)
(D) 14' 37' Ø2P VDC Ø2P Ø2 Ø2&Ø5	CLASS III WOOD POLE W/DOWN GUYS	-	15'		1-F 1-G 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6	STA 42+23, 58' RT (OLIVE AVENUE)
(E) 14' 15' Ø2P VDC Ø8P Ø8 Ø8	CLASS III WOOD POLE W/DOWN GUYS	-	15'		2-F 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6	STA 42+24, 20' LT (OLIVE AVENUE)
(F) R3-1A BLANK-OUT SIGN 14' 35' Ø6P VDC Ø6P Ø6 Ø6 R3-2A BLANK-OUT SIGN	CLASS III WOOD POLE W/DOWN GUYS	-	15'		2-F 2-PCS		1. REFER TO ADOT SPAN WIRE DETAIL T.S. 15-1 2. INSTALL 250W HPS, 240V LUMINAIRE, TYPE III MEDIUM CUTOFF 3. VIDEO DETECTION CAMERA - SEE NOTE 6 4. INSTALL R3-1A AND R3-2A BLANK-OUT SIGNS ON SIGNAL POLE.	STA 43+26, 20' LT (OLIVE AVENUE)

VDC - VIDEO DETECTION CAMERA
PCS - PEDESTRIAN COUNTDOWN SIGNAL

POLE SCHEDULE NOTES:

1. THE CONTROL CABINET SHALL BE WIRED AND LABELED WITH THE SAME PHASE NUMBER DESIGNATIONS FOR INITIAL AND FUTURE PHASES, AS SHOWN IN THE PHASE MOVEMENT DIAGRAM OR AS NOTED ON THE PLANS. EACH CONNECTOR SHALL HAVE ALL PINS WITHIN THE CONNECTOR BROUGHT TO CABINET TIE POINTS. ANY CONTROL CABINET NOT WIRED ACCORDINGLY WILL BE REJECTED BY THE ENGINEER.
2. THE MPS-8Ø CONTROLLER SHALL HAVE ALL THE SPECIAL PROGRAM APPLICATIONS PER STANDARD SPECIFICATIONS SUB SECTION 734-2.02 C(3Xa), EXCEPT FOR THE ARTERIAL MASTER CONTROLLER APPLICATION.
3. INSTALL P.E.C., 20 AMP FUSED LIGHTING CONTACTOR AS CALLED FOR ON THE PLANS AND THE SPECIFICATIONS.
4. THE CONTRACTOR SHALL SUPPLY ALL TRAFFIC SIGNAL EQUIPMENT MATERIALS, TOOLS AND LABOR INCLUDING THE CONTROLLER CABINET. INSTALL IN FIELD ON FOUNDATION AND TERMINATE FIELD WIRING. ADOT WILL WIRE CABINET INCLUDING PREEMPTION PANEL.
5. THE STATIONS AND OFFSETS FOR TRAFFIC SIGNAL POLES WHICH ARE SHOWN ON THE PLANS AND IN THE POLE/EQUIPMENT SCHEDULE ARE APPROXIMATE. THE FINAL LOCATION OF EACH POLE SHALL BE STAKED IN THE FIELD BY THE CONTRACTOR, AND APPROVED BY THE ENGINEER.
6. VIDEO DETECTION SHALL BE FURNISHED NEW AND INSTALLED BY THE CONTRACTOR. VIDEO DETECTION TO BE INSTALLED ON LUMINAIRE MAST ARM, UNLESS OTHERWISE SPECIFIED ON THE PLANS.
7. INSTALL LUMINAIRE MAST ARMS PER T.S. 4-26, DETAIL A. NO OTHER MAST ARM TYPES SHALL BE MOUNTED ON STRAIN POLES.

UNDERGROUND CONDUIT AND PULL BOX NOTES:

1. ALL PULL BOXES SHALL BE NUMBER 7, HEAVY DUTY UNLESS OTHERWISE NOTED ON THE PLANS, AND SHALL BE LOCATED APPROXIMATELY AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
2. ALL PULL BOXES SHALL BE LEFT IN A CLEAN CONDITION, FREE OF DIRT AND DEBRIS, UPON COMPLETION OF THE WORK.
3. ALL CONDUIT SHALL BE 3" PVC, UNLESS OTHERWISE NOTED IN THE CONDUCTOR SCHEDULE, WITH A NUMBER 8 BARE BOND WIRE INSTALLED PER SECTION 732-3.01 OF THE STANDARD SPECIFICATIONS.

	NAME	DATE
DESIGN	NFC	01/12
DRAWN	NFC	01/12
CHECKED	MHG	01/12

Baker

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

TEMPORARY TRAFFIC SIGNAL
OLIVE AVENUE
POLE SCHEDULE

ROUTE	LOCATION
303L	SR 303L, GLENDALE AVENUE TO PEORIA AVENUE

TRACS NO. H7874 01C | 303-A(203)N | DWG. NO. T-08.07 | OF

EXPIRES 06/30/2012

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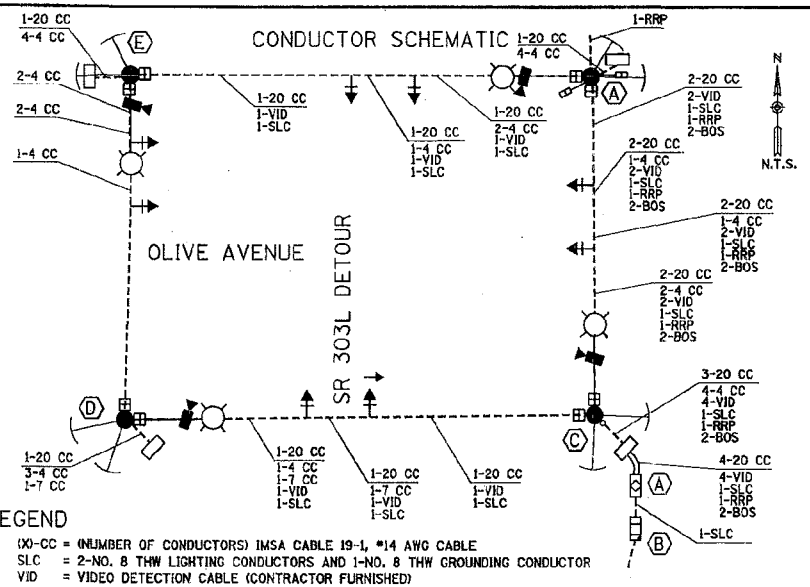
F.A.P.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	303-A(203)N	695	1161	
		303 MA 109			

CONDUCTOR SCHEMATIC



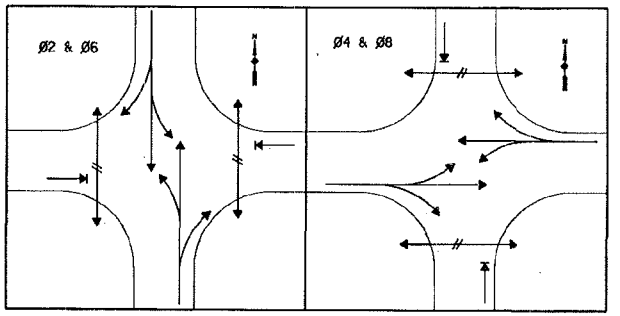
LEGEND

(X)-CC = (NUMBER OF CONDUCTORS) IMSA CABLE 19-1, #14 AWG CABLE
SLC = 2-NO. 8 THW LIGHTING CONDUCTORS AND 1-NO. 8 THW GROUNDING CONDUCTOR
VID = VIDEO DETECTION CABLE (CONTRACTOR FURNISHED)
RRP = IMSA CABLE 19-1, 12 CONDUCTOR #14 AWG RAILROAD PREEMPTION CABLE
BOS = IMSA CABLE 19-1, 4 CONDUCTOR #14 AWG BLANK-OUT SIGN CABLE

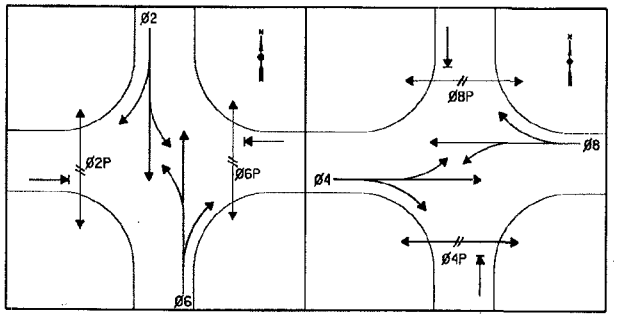
CONDUCTOR SCHEMATIC AND PHASING NOTES:

1. *THE 20 CONDUCTOR CABLE SHALL BE CONTINUOUS (NO SPLICES) FROM THE CONTROLLER CABINET TO THE TYPE 7 PULL BOX NEAREST THE POLE. THE 4 CONDUCTOR CABLES SHALL THEN RUN FROM THE PULL BOX TO EACH SIGNAL HEAD. ALL CABLE SPLICING SHALL OCCUR ONLY IN THE PULL BOX NEAREST TO THE POLE.*
2. *VIDEO DETECTION CABLES SHALL BE TAGGED IN EACH PULL BOX THEY PASS THROUGH, DESIGNATING THE PHASE AND CORNER SERVED.*
3. *IT IS THE CONTRACTOR'S RESPONSIBILITY TO COIL ENOUGH EXCESS CONDUCTORS TO ACCOMMODATE FOR ANY SIGNAL HEAD REALIGNMENT REQUIRED.*
4. *ADOT TO DEVELOP SIGNAL TIMING PLANS TO PREVENT "YELLOW TRAP" CONDITION DURING THE TRANSITION PERIOD TO TRACK CLEARANCE.*
5. *INSTALL A WARNING LABEL IN THE TRAFFIC SIGNAL CONTROLLER TO ALERT SIGNAL TECHNICIANS TO THE PRESENCE OF THE INTERCONNECTION WITH THE RAILROAD.*

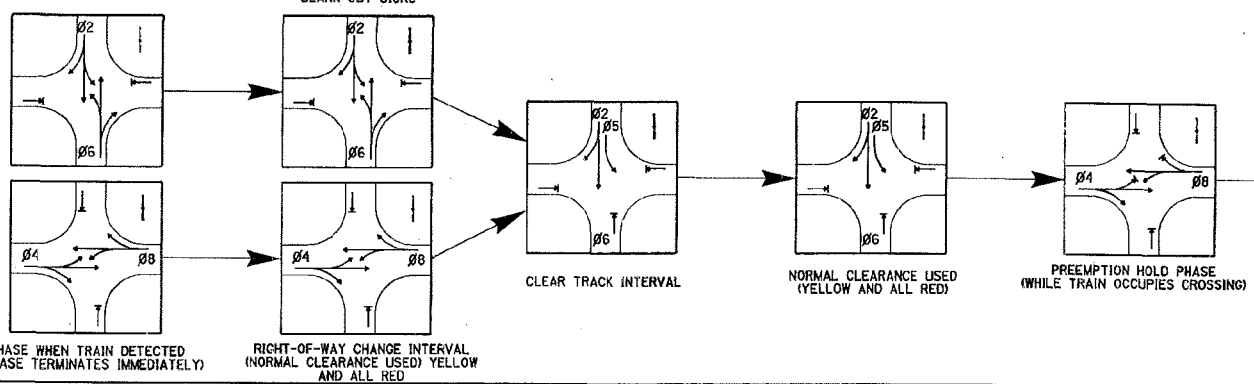
PHASE DIAGRAM



PHASE SEQUENCE



RAILROAD PREEMPTION SEQUENCE



	NAME	DATE
DESIGN	NFC	01/12
DRAWN	NFC	01/12
CHECKED	MAG	01/12

Baker

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
TRAFFIC DESIGN SERVICES

TEMPORARY TRAFFIC SIGNAL
OLIVE AVENUE
CONDUCTOR SCHEDULE

ROUTE	LOCATION
303L	SR 303L, GLENDALE AVENUE TO PEORIA AVENUE

TRACS NO. H7874 01C | 303-A(203)N | DWG. NO. T-08.09 | ___ OF ___

EXPIRES 09/30/2012

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