Conceptual Design Report

I-244/Arkansas River Multimodal Bridge
Tulsa, Oklahoma

Prepared for the
Oklahoma Department of Transportation

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1.0 Introduction

The I-244 / Arkansas River Multimodal Bridge project represents an ambitious endeavor to provide long term infrastructure improvements for the City of Tulsa. This project provides for the development of alternate modes of transportation that will serve to reduce congestion on the current highway system. To assist in the discussion of this project, Figure 1 is included to define the various components of the existing conditions and proposed improvements.

This report summarizes the findings of the Conceptual Design Study for the I-244 / Arkansas River Multimodal Bridge project. An essential component of this study involved the development of a plan for the incorporation of both Commuter Rail and High Speed Rail beneath the I-244 structures. To accommodate the railways and satisfy current design standards, the project includes the replacement of the existing southbound and northbound bridges. The Conceptual Design Study also evaluated the impacts of the proposed improvements on the adjacent interchange facilities, developed a concept plan for maintaining traffic during construction, developed a plan for the incorporation of bicycle / pedestrian traffic, and developed a preliminary construction cost estimate.

2.0 Existing Conditions

Approximately 68,000 vehicles per day travel across the Arkansas River by means of the existing I-244 bridges. This magnitude of traffic makes these structures a critical component of the infrastructure system within the City of Tulsa. The existing structures have deteriorated to the degree that significant annual maintenance is required to keep the bridges in service. In addition, the existing bridges are functionally deficient as the shoulder widths do not satisfy current standards for an interstate facility with the amount of traffic that utilizes the bridges.

I-244 crosses the Arkansas River in a highly congested corridor with a total of five bridges clustered together within a distance of approximately 400'. As shown in Figure 2, the I-244 bridges are flanked by the Burlington Northern Railroad Bridge to the west and the historic Route 66 and Southwest Boulevard bridges to the east. Further constricting the corridor is Southwest Boulevard which lies immediately adjacent to the 17th Street entrance ramp on the southeast side of the northbound bridge. The presence of these adjacent facilities presents a challenge in achieving the project objectives.

The existing I-244 bridges each carry a minimum of three lanes of traffic. Both the northbound and southbound bridges have entrance and / or exit ramp connections that require additional auxiliary lanes along portions of each structure. The southbound bridge carries an auxiliary lane extending from the north end of the bridge to the 17^{th} Street exit ramp. The northbound bridge widens to accommodate the 17^{th} Street entrance ramp which results in an auxiliary lane that extends from the entrance ramp to the north end of the bridge. Figures 4 and 4a illustrate the existing and proposed bridge typical sections for the three-lane and four-lane sections, respectively.

3.0 Proposed Improvements

The Design Team was tasked with the development of a Conceptual Design that achieves the following objectives:

- Develop a conceptual plan for reconstruction of the existing southbound and northbound bridges with improved shoulders meeting current design standards
- Develop a plan that accommodates the incorporation of commuter rail and high speed rail traveling beneath the southbound bridge
- Review the hydraulic design considerations and develop a track vertical profile to accommodate the 100-year flood stage
- Develop a schematic plan for the accommodation of bicycle / pedestrian traffic
- Develop a Maintenance of Traffic Plan that accommodates four lanes of traffic, two in each direction, throughout the duration of construction
- Develop Construction Cost Estimates for the proposed improvements

Figure 3 shows the proposed improvements overlaid atop the existing facility. As shown in Figures 4 and 4a, the proposed lane configurations match the existing conditions in that a minimum of three continuous travel lanes are provided throughout the length of both bridges. Figure 4a illustrates the four-lane section where the fourth auxiliary lane is provided to facilitate the proposed entrance and exit ramp connections.

In the areas where the auxiliary ramps are provided, a full 12' shoulder is proposed. This approach allows for the conversion of the proposed auxiliary lane to a continuous through travel lane for future four-lane improvements of I-244. However, when the future continuous four-lane improvements are undertaken, it is anticipated that the entrance and exit ramps connecting to 17th Street will be eliminated in order to fit the widened four lane improvements within the available right-of-way on the southern end of the bridge.

4.0 Proposed Horizontal Alignment

The first step taken during the conceptual design phase was to determine how to align the proposed improvements within the constraints of the existing corridor. Figure 4 illustrates the existing typical section for the three-lane section near the south end of the existing structures. In this area of I-244, the configuration of the existing bridge decks provides approximately 6' between the southbound and northbound bridge decks.

The proposed improvements require 12' shoulders on the bridges to satisfy AASHTO design standards. The limited space between the existing bridge decks does not provide sufficient room for the proposed shoulder improvements. This problem is compounded by additional restrictions associated with the 17th Street entrance ramp and Southwest Boulevard.

In order to provide adequate space for the proposed improvements, the CRL of the southbound and northbound lanes was shifted as shown in Figures 5 and 6. The CRL of the southbound and northbound lanes was shifted westward as much as 21'and 9', respectively. These offset dimensions were established by holding the location of the eastern most edge of the existing 17th Street entrance ramp structure in order to maintain the horizontal buffer from Southwest Boulevard. The modified horizontal alignment accommodates the construction of the new entrance ramp and the improved southbound and northbound bridges.

The offset alignments were transitioned to merge with the existing alignments near both ends of the bridges. On the south end, reverse curves were utilized for the transition to the existing centerline. The north end transitions were accommodated by shifting the PI's of the horizontal curves to tie back to the existing centerline.

As a result of modifying the alignments, a portion of the proposed improvements falls outside the existing right-of-way. Figure 7 illustrates the amount of additional right-of-way that will be required. Further discussion on the need for additional right-of-way is contained in Section 7.0 of this report.

Retaining walls will be required for a significant portion of the roadway approaches in order to minimize the impacts of the revised alignments on adjacent properties. The retaining walls on the south end will generally match the location of the existing retaining walls. However, the limits of the walls on the southwest side will be extended due to the shifted horizontal alignments. Retaining walls will also be required on the north end of the southbound bridge and along the 7th Street Entrance Ramp in order to make room for the transit rail facility. The existing embankment will be removed and retaining walls added to allow for the required alignment of the transit system.

5.0 Proposed Transit Rail Design

Currently, the local transit authority has not established design criteria for use in this conceptual design phase. Therefore, the Design Team has taken an approach of utilizing the upper limits of several different types of transit vehicles to capture the extreme parameters in order to develop a design that will accommodate a wide range of potential conditions. As part of this study, the Design Team developed a separate report outlining design guidelines for use on this project. The following is a summary of the critical design parameters used for the proposed transit system design:

- Vertical Clearance – The future means of propulsion that will be utilized for the transit vehicles has not been established. Therefore, the design was developed to accommodate the use of an overhead catenary electrification system as a means of powering the trains. The accommodation of this system requires a minimum vertical clearance of 19'. This is an important variable as it dictates the amount that the I-244 southbound bridge profile needs to be raised to provide sufficient vertical clearance.

- Horizontal Clearance – The proposed track alignment beneath the I-244 structures will maneuver through the columns supporting the overhead structure. The horizontal clearance requirement for the commuter rail is a function of the radius of curvature of the tracks, the track superelevation, and the end overhang of the transit vehicle. Accounting for these variables, a minimum horizontal clearance of 10' was determined to be adequate for use in the development of the bridge layouts.

- Horizontal Alignment – The track alignments of the commuter and high speed rails swing beneath the southbound structure to align with the vehicular bridge. A minimum radius of 200' is used for the commuter rail alignment on the south end of the project. Spiral transition curves are provided at all horizontal curve locations to improve the geometry of the alignment and allow for superelevation transitions.

- Design Speed – It is common practice for commuter rail systems to be designed utilizing a design speed as high as 65 mph. In contrast, a high speed rail system would be designed for speeds well in excess of 100 mph. Due to the tight curves of the proposed horizontal railway alignment; a significant speed reduction through the limits of the bridges will be required. The design speed required to negotiate a 200' radius curve for commuter rail falls between 15 and 20 mph. The alignment of the high speed rail is not as restrictive; however, the train speed will be required to be reduced to near 30 mph in order to negotiate the alignment.

- Commuter Rail Design Loading – Since the actual transit vehicle is not known at this time, an assumed design loading that is representative of transit systems currently in use in other areas of the country was selected. The overall magnitude of the selected loading falls between the range of a Cooper E80 loading typically used for freight rail and the standard HS20 loading used for highway structures. For the span lengths considered on this project, the transit loading is roughly 20% greater than the standard HS20 loading which indicates that a structural system typically employed for vehicular structures is applicable to the transit structure.

- High Speed Rail Loading – The criteria used to simulate the high speed trains is similar to the magnitude of loading for the commuter rail. High speed trains travel at speeds that require the trains to remain relatively light in order to accelerate and decelerate at the level of speeds attained in this form of transit. Therefore, the loading condition used for the commuter rail will also be used for the high speed tracks.

- Maintenance Loading – It is common practice to include a heavier vehicle in the design of a transit structure to allow for periodic maintenance. The recommended maintenance loading consists of a 45 ton locomotive pulling a series of 20 ton ballast cars. This loading represents the passage of a heavy train crossing the structure for the purposes of transporting the ballast needed for maintenance of the approach track on either side of the bridge. This loading is heavier than the commuter rail loading and will govern portions of the design.

- Selection of Bridge Deck – Rail structures are commonly constructed using two alternate types of deck construction, ballasted deck and direct fixation deck. The ballasted deck is utilized for bridges less than 300’ in length and adds considerable dead load to the supporting structure. In contrast, direct fixation deck construction reduces dead load, provides for an improved quality of ride, and requires less maintenance. Direct fixation deck construction is the accepted standard for this type of structure and will be utilized on this project.

6.0 Vertical Profile Adjustment

As noted in Section 5.0, an allowance of 19’ vertically is required to accommodate the potential for future overhead electrification of the railway. This parameter is the most significant design consideration in regards to incorporating the rail transit system into the project. The vertical clearance requirements dictate the amount the profile of the southbound lanes must be raised; further dictating the impacts the project will have on the adjacent facilities.

In order to achieve the necessary vertical clearance, the vertical profile was raised by as much as 7’ in the critical area of the project. Figure 8 shows a section of the rail structure as it passes through the supporting intermediate bents. The vertical profile is controlled by maintaining vertical clearance beneath the overhead cap beam of the intermediate bents. The profile grade in this area is established by the addition of the depth of the cap beam and the depth of the superstructure members.

Raising the vertical profile 7’ has little impact on the project limits to the south. However, the increased profile impacts the flyover structure for the east to south (E-S) entrance ramp. This flyover structure will be replaced due to the required raising of the profile grade. Since the flyover bridge will be reconstructed, in preparation for future improvements to the interchange, the structure will be upgraded to a width consistent with a two-lane structure even though the conceptual plan only shows a single lane ramp connection.

7.0 Proposed Bridge Structure

The reconstruction of the southbound and northbound bridges will comprise a significant portion of the project cost. The existing bridges are approximately 3000’ in length and have a variable width ranging from 49’ to 53.5’. Both existing bridges have aerial ramp connections which further complicate the bridge replacement and increase the cost of the proposed replacement structures. The existing bridge superstructure consists of a combination of prestressed concrete girders and steel plate girders with spans ranging from 45’ to 78’ in length.

The proposed superstructure will also consist of a combination of prestressed concrete girders and steel plate girders. Prestressed concrete girders will be utilized predominantly along the entire length of the bridge except in areas where the use of steel girders is dictated due to span length limitations or vertical clearance considerations. The proposed substructure consists of multi-column bents founded on drilled shaft foundations. Typical sections of the southbound and northbound pier configurations for the portion of the bridge crossing the river are shown in Figures 8 and 8a, respectively.

The proposed spans were established to provide adequate horizontal clearance at the location of local roads and at the existing and proposed trackwork. The existing spur track that crosses beneath the proposed structures presents a challenge in regards to maintaining adequate horizontal clearance. The spans in this area of the project were arranged to provide a minimum horizontal clearance of 22' which is less than the 25' minimum clearance required for the elimination of crashwalls.

The critical location for the horizontal clearance adjacent to the existing spur is shown in Figure 9. At this location, the proposed commuter rail transitions to the spur track alignment. Providing room for this future connection requires the placement of a substructure between the two diverging alignments of the spur and commuter rail tracks. The elimination of this substructure would require a considerably longer span and a resulting deeper superstructure that would encroach into the vertical clearance envelope above the spur track. The vertical profile of the northbound lanes in this area cannot be adjusted without affecting the 17th Street entrance ramp which currently has grades near maximum values. Therefore, a crashwall is proposed at this and other locations where the horizontal clearance is less than 25'.

Likewise, there are many locations where the transit rail maneuvers through the columns of the proposed substructure. As mentioned above, a horizontal clearance requirement of 10' was established as a minimum value for the transit system. Figure 10 illustrates the span arrangement and the placement of the columns to accommodate the rail system. As the track alignments diverge from the southbound CRL alignment, the spacing of the proposed columns is modified to provide sufficient horizontal clearance. In some cases, the exterior columns are pulled outside the western edge of the southbound bridge to act as "outrigger" columns to provide for the passage of the High Speed tracks. The placement of the columns beyond the limits of the bridge requires the acquisition of additional right-of-way in some areas of the project.

As the track alignments approach the river, the two independent alignments become parallel. The parallel alignments cross the river on an aerial track structure that is supported by the substructures of the overhead vehicular bridge. As shown in Figure 11, the spans in this area of the project are set to match the span lengths of the existing bridge but are offset to miss the existing foundations. The maximum span length for this portion of the project, including the aerial track structure, is 78'. Type III and Type IV prestressed girders are proposed for the vehicular and track structures, respectively.

8.0 Hydraulic Considerations

As with any bridge project that crosses a significant waterway, an important consideration in the conceptual plan development is establishing the bridge length and vertical profile to accommodate the necessary hydraulic considerations. Figure 12 shows a Flood Insurance Rate Map (FIRM) of the project area. From a review of the map, the 100 year water surface elevation is approximately 636.5. The new profile of the transit rail was set at the grade of the top of levee on the south bank of the river. At this elevation, adequate freeboard between the 100 year water surface elevation and the proposed improvements is obtained. The proposed profile of the track is similar in elevation to the freight rail bridge on the west side of the proposed structure. The new bridge will span the existing floodway and should not adversely impact the floodplain limits.

9.0 Bicycle / Pedestrian Trail System

To further enhance the transportation capacity, this project incorporates a multi-use trail system transporting both pedestrian and bicycle traffic across the river. The plan calls for a new bicycle / pedestrian bridge to be added to the east of the commuter rail structure, along with the construction of pedestrian trails that will connect the proposed bicycle / pedestrian bridge to the existing trail system. The location of the bicycle / pedestrian structure is shown in Figure 8.

The proposed trail system begins at the existing pedestrian facility that spans across the Burlington Northern railway. This structure will be modified by adding a prefabricated truss to extend the structure across the proposed commuter and high speed tracks. The ADA ramp facility will then be reconstructed between the commuter rail and the southbound bridge to provide the required vertical grade adjustment to allow the pedestrian bridge to pass beneath the southbound structure.

Once beneath the southbound structure, the pedestrian trail will maneuver to the south and cross the river by means of the new bicycle / pedestrian bridge structure. On the south side of the river, the pedestrian trail will follow the general alignment of the commuter rail and terminate on the east side of Southwest Boulevard. Figure 1 illustrates a schematic layout of the proposed pedestrian trail.

10.0 Construction Phasing

The completion of this project will be conducted within three separate phases of work. Phase 1 consists of the reconstruction of the southbound bridge and approach roadway and includes the shift of the southbound lanes required to make room for the future northbound lane improvements. Phase 1 also includes the construction of the transit rail and bicycle / pedestrian bridge structures; however, the trackwork on and connecting to the transit rail structures and the pedestrian trail system will be constructed in a separate phase of work.

The construction of Phase 1 will require the acquisition of additional right-of-way due to the horizontal shift of the southbound lanes. The amount of right-of-way required for this phase is not a significant contribution to the cost of the project; however, the acquisition and appraisal process will need to begin as quickly as possible in order to expedite the project schedule.

Phase 2 consists of the construction of the northbound bridge and approach roadway. This phase will include the reconstruction of the entrance ramp from 17th Street along with the exit ramp on the north end of the project.

Phase 3 consists of the installation of the transit rail system including the trackwork leading to and across the bridge structure installed during Phase 1. The modification of the existing pedestrian overpass facility located between the southbound lanes and the freight rail tracks, along with the construction of the pedestrian trail system, will be included in Phase 3.

11.0 Maintenance of Traffic

The minimum clear roadway width of the existing southbound and northbound structures is 49' and will accommodate two lanes of opposing traffic separated by a precast concrete barrier. Temporary widening, shoulder reconstruction, and temporary crossovers will be utilized in order to maintain two lanes of traffic in each direction. Following is a brief discussion of the maintenance of traffic scheme.

Phase 1 - Figure 13 provides an overall view of the temporary traffic control for this phase of work. Crossover 2, constructed just north of Third Street, will bring southbound traffic over to the northbound lanes. Existing northbound traffic will merge to two lanes and be shifted over prior to Crossover 1. Figures 14 and 15 provide a more detailed view of the crossover locations. With southbound and northbound traffic on the existing northbound lanes, the proposed southbound bridge will be constructed along with a new southbound exit ramp to West 17th Street and a new E-S flyover ramp. This scheme will require the I-444 westbound to I-244 northbound ramp to be closed during this phase. Therefore, I-444 westbound would essentially be closed from the last exit ramp at South Houston Avenue.

Phase 2 - Southbound traffic will be moved back over to the southbound lanes allowing for the construction of the new northbound bridge. After Crossovers 3 and 4 have been constructed (See Figures 16-18), northbound traffic will be detoured to the southbound lanes similar to Phase 1. The proposed northbound bridge will be built along with a new entrance ramp from 17th Street. I-444 westbound from the exit ramp at South Houston Avenue would again be closed in Phase 2. The entrance ramp from West First Street to I-244 northbound would also be closed along with the I-244 southbound to I-444 eastbound. These closures are required to improve unsafe weaving conditions between Crossover 4 and exits to the north. Refer to Figure 16 for all ramp closures during this phase. Construction can be staged during both Phase 1 and Phase 2 to minimize the length of time that any ramp will have to be closed.

12.0 Anticipated Construction Cost

An important factor in considering a project's feasibility is a comparison of the anticipated construction cost versus the benefits to the traveling public. The replacement of three significant bridge structures, along with the reconstruction of approximately 2 lane-miles of interstate and the construction of a commuter rail and high speed rail transit system results in significant capital expenditure. However, accompanying this investment is a greatly enhanced multimodal transportation system. An itemized breakdown of the anticipated construction cost is included in the Appendix of this report. Following is a summarized breakdown by phase:

Phase 1 – Anticipated Construction Cost (2009 Dollars)

Item Description	Construction Cost
Grading	$1,079,600
Drainage	$635,000
Base and Surfacing	$1,278,000
Southbound Bridge	$38,758,800
Transit Rail Bridge Structures	$5,724,200
Bicycle / pedestrian Bridge	$2,144,800
Retaining Walls	$1,997,000
Roadside Safety	$485,800
Signing and Striping	$231,340
Miscellaneous	$1,886,200
Mobilization (5%)	$2,711,100
Contingency (20%)	$11,386,400
PHASE 1 TOTAL	$68,318,240

Phase 2 – Anticipated Construction Cost (2009 Dollars)

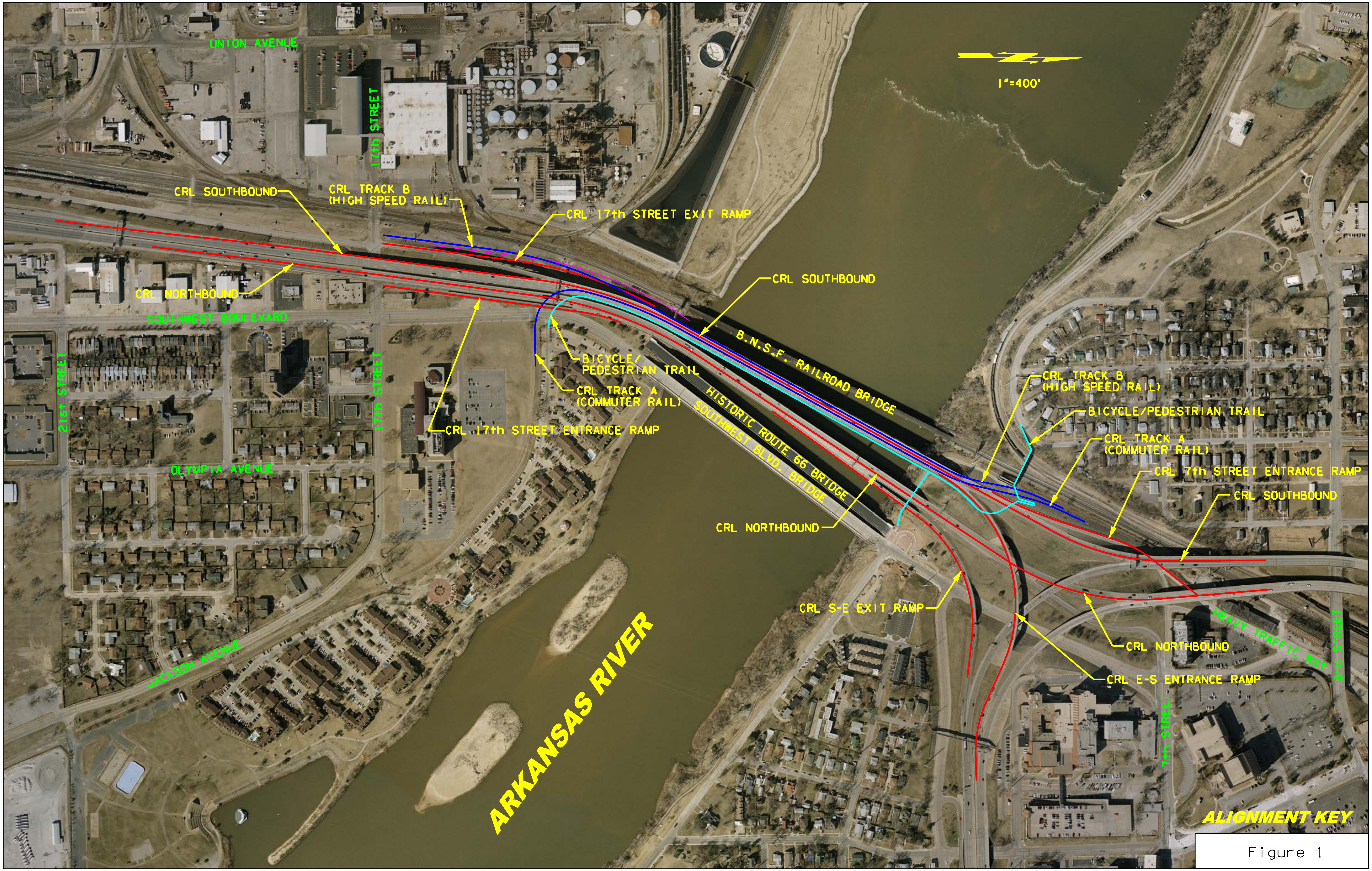
Item Description	Construction Cost
Grading	$81,600
Drainage	$410,100
Base and Surfacing	$736,200
Northbound Bridge	$28,628,800
Retaining Walls	$733,000
Roadside Safety	$355,150
Signing and Striping	$155,280
Miscellaneous	$1,782,750
Mobilization (5%)	$1,644,200
Contingency (20%)	$6,905,500
PHASE 2 TOTAL	$41,432,580

Phase 3 – Anticipated Construction Cost (2009 Dollars)

Item Description	Construction Cost
Commuter Rail Trackwork	$3,564,500
High Speed Trackwork	$3,265,100
Bicycle / Pedestrian Trail System	$937,500
Mobilization (5%)	$388,400
Contingency (30%)	$2,446,700
PHASE 3 TOTAL	$10,602,200

Project Summary – Anticipated Construction Cost (2009 Dollars)

Construction Phase	Construction Cost
Phase 1	$68,318,240
Phase 2	$41,432,580
Phase 3	$10,602,200
PROJECT TOTAL	$120,353,020

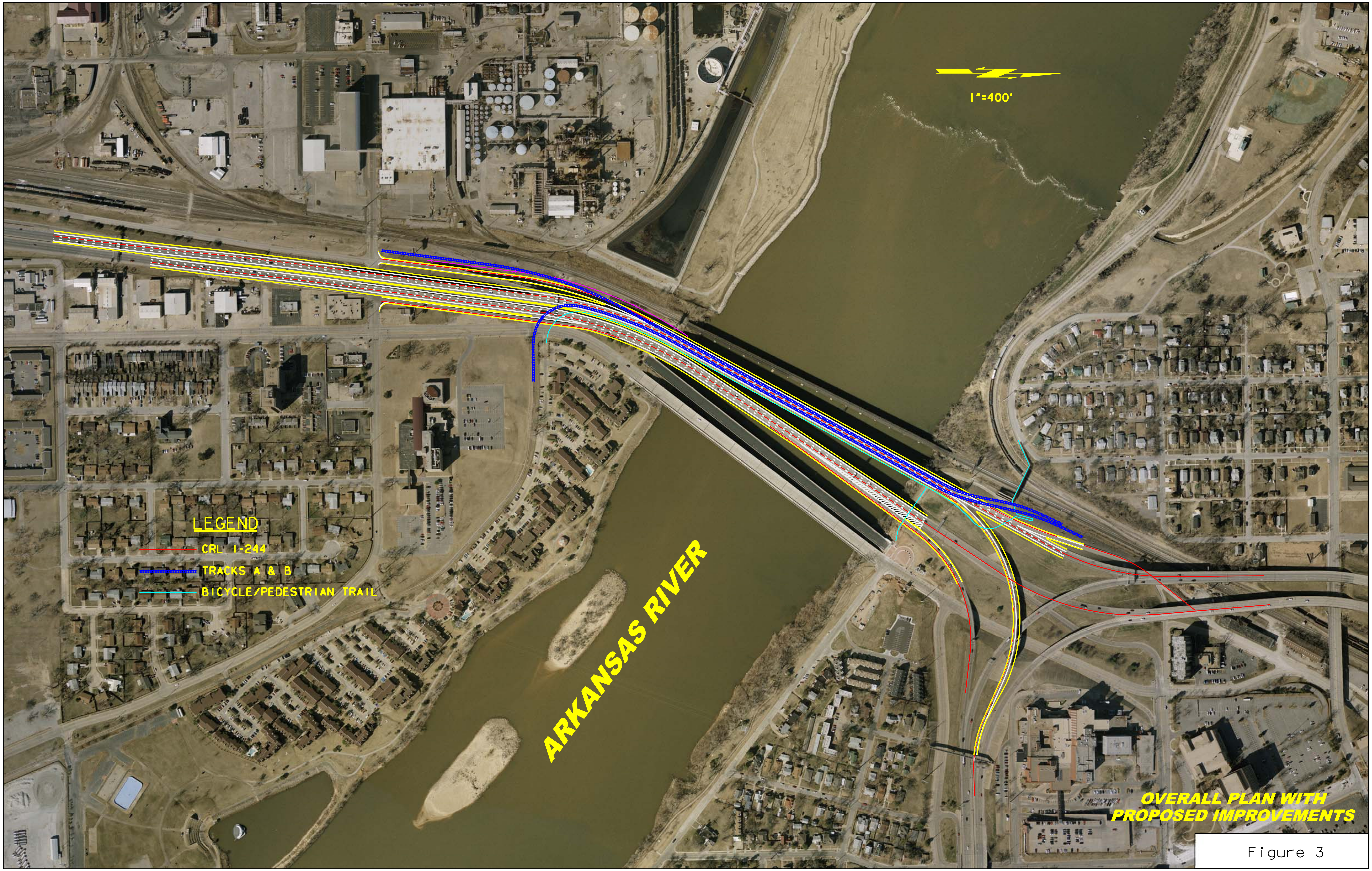


UNION AVENUE
17th STREET
1"=400'
CRL SOUTHBOUND
CRL TRACK B (HIGH SPEED RAIL)
CRL 17th STREET EXIT RAMP
CRL NORTHBOUND
SOUTHWEST BOULEVARD
CRL SOUTHBOUND
B.N.S.F. RAILROAD BRIDGE
BICYCLE/ PEDESTRIAN TRAIL
CRL TRACK A (COMMUTER RAIL)
CRL 17th STREET ENTRANCE RAMP
HISTORIC ROUTE 66 BRIDGE
SOUTHWEST BLVD. BRIDGE
21st STREET
17th STREET
OLYMPIA AVENUE
CRL TRACK B (HIGH SPEED RAIL)
BICYCLE/PEDESTRIAN TRAIL
CRL TRACK A (COMMUTER RAIL)
CRL 7th STREET ENTRANCE RAMP
CRL SOUTHBOUND
CRL NORTHBOUND
CRL S-E EXIT RAMP
CRL NORTHBOUND
CRL E-S ENTRANCE RAMP
HEAVY TRAFFIC WAY
3rd STREET
7th STREET
JACKSON AVENUE
ARKANSAS RIVER
ALIGNMENT KEY

Figure 1

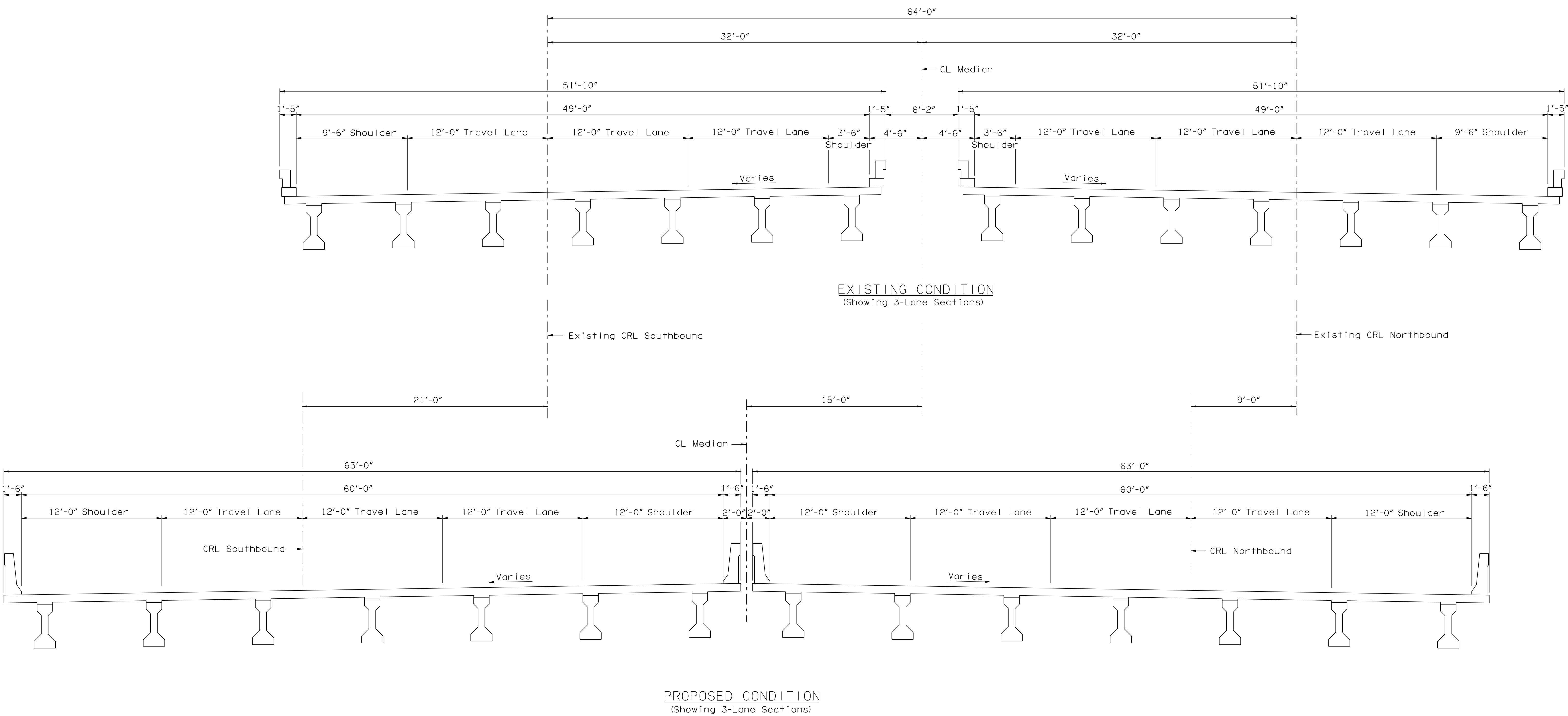

B.N.S.F. RAILROAD
I-244 SOUTHBOUND
I-244 NORTHBOUND
APPROX. 400 FT.
HISTORIC ROUTE 66 BRIDGE
SOUTHWEST BOULEVARD BRIDGE
CHOKE POINT BETWEEN SOUTHWEST
BOULEVARD AND 17TH STREET ENTRANCE RAMP
17TH ST. ENTRANCE RAMP
ARKANSAS RIVER
PLAN VIEW OF
BRIDGE LOCATIONS

Figure 2



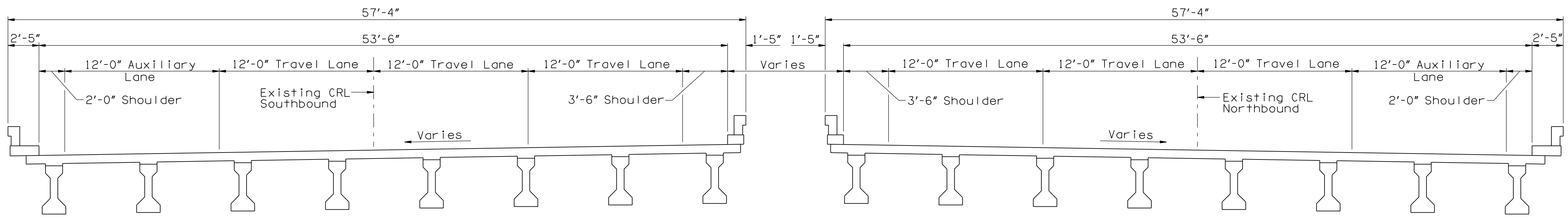
1"=400'
LEGEND
CRL I-244
TRACKS A & B
BICYCLE/PEDESTRIAN TRAIL
ARKANSAS RIVER
OVERALL PLAN WITH
PROPOSED IMPROVEMENTS

Figure 3

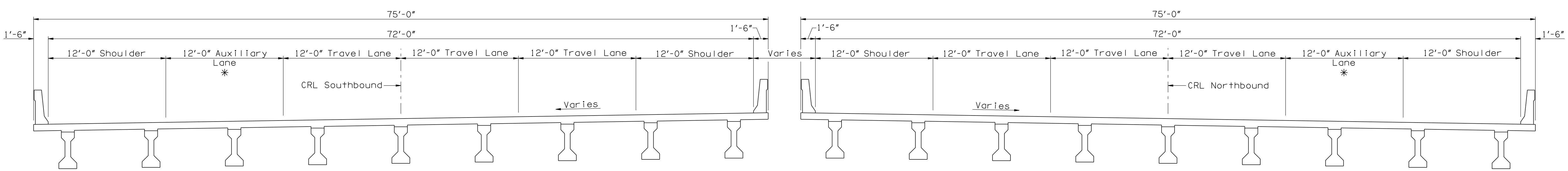


BRIDGE TYPICAL SECTION

Figure 4



EXISTING CONDITION
(Showing 4-Lane Sections)



* Auxiliary Lanes can be converted to continuous Travel Lanes in future four-lane improvements.

PROPOSED CONDITION
(Showing 4-Lane Sections)

BRIDGE TYPICAL SECTION

Figure 4a

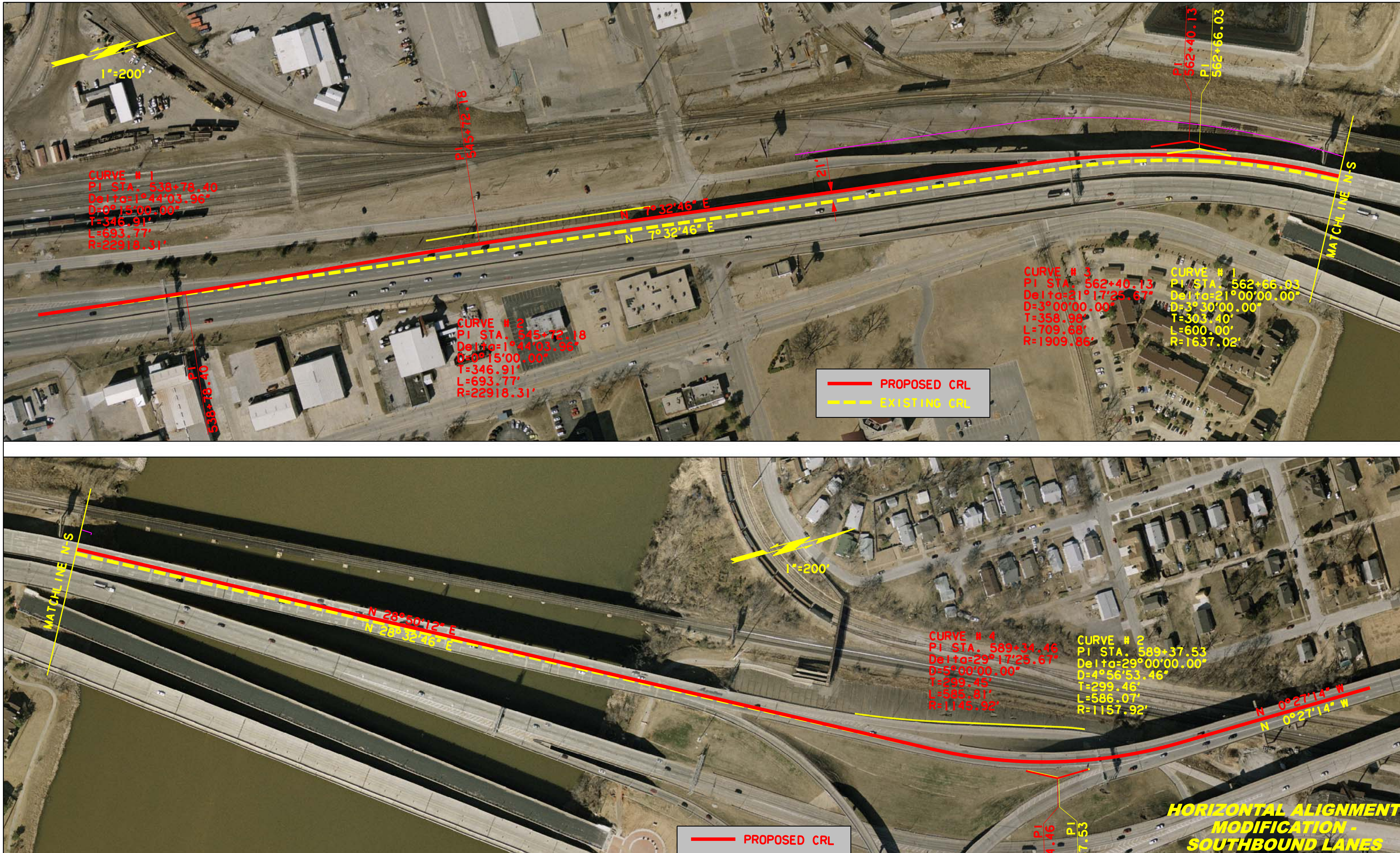
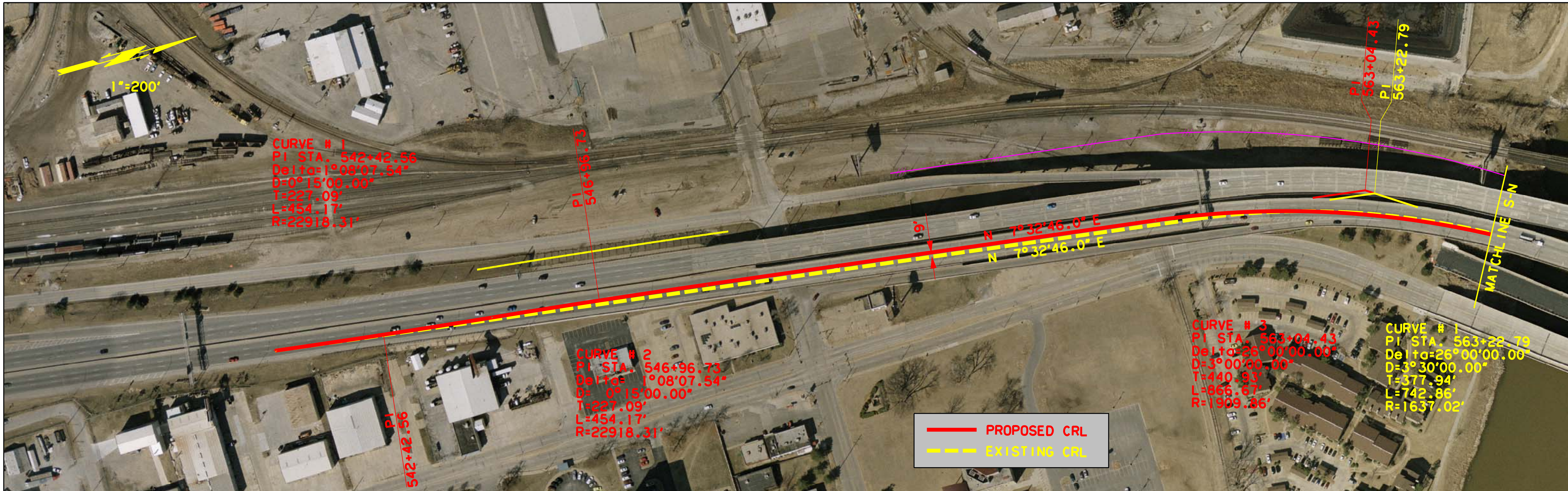

1"=200'
CURVE # 1
PI STA. 538+78.40
Delta=1°44'03.96"
D=0°15'00.00"
T=346.91'
L=693.77'
R=22918.31'
PI 545+72.18
N 7°32'46" E
N 7°32'46" E
21'
PI 538+78.40
CURVE # 2
PI STA. 545+72.18
Delta=1°44'03.96"
D=0°15'00.00"
T=346.91'
L=693.77'
R=22918.31'
PI 562+40.13
PI 562+66.03
CURVE # 3
PI STA. 562+40.13
Delta=21°17'25.67"
D=3°00'00.00"
T=358.98'
L=709.68'
R=1909.86'
CURVE # 1
PI STA. 562+66.03
Delta=21°00'00.00"
D=3°30'00.00"
T=303.40'
L=600.00'
R=1637.02'
MATCHLINE N-S
PROPOSED CRL
EXISTING CRL
MATCHLINE N-S
1"=200'
N 28°50'12" E
N 28°32'46" E
CURVE # 4
PI STA. 589+34.46
Delta=29°17'25.67"
D=5°00'00.00"
T=299.45'
L=585.81'
R=1145.92'
CURVE # 2
PI STA. 589+37.53
Delta=29°00'00.00"
D=4°56'53.46"
T=299.46'
L=586.07'
R=1157.92'
N 0°27'14" W
N 0°27'14" W
PI 589+34.46
PI 589+37.53
PROPOSED CRL
EXISTING CRL
HORIZONTAL ALIGNMENT MODIFICATION - SOUTHBOUND LANES

Figure 5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R=22918.31'
PI 546+96.73
PI 542+42.56
CURVE # 2
PI STA. 546+96.73
Delta= 1°08'07.54"
D= 0°15'00.00"
T=227.09'
L=454.17'
R=22918.31'
9'
N 7°32'46.0" E
N 7°32'46.0" E
PI 563+04.43
PI 563+22.79
CURVE # 3
PI STA. 563+04.43
Delta=26°00'00.00"
D=3°00'00.00"
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L=866.67'
R=1909.86'
CURVE # 1
PI STA. 563+22.79
Delta=26°00'00.00"
D=3°30'00.00"
T=377.94'
L=742.86'
R=1637.02'
MATCHLINE S-N
PROPOSED CRL
EXISTING CRL

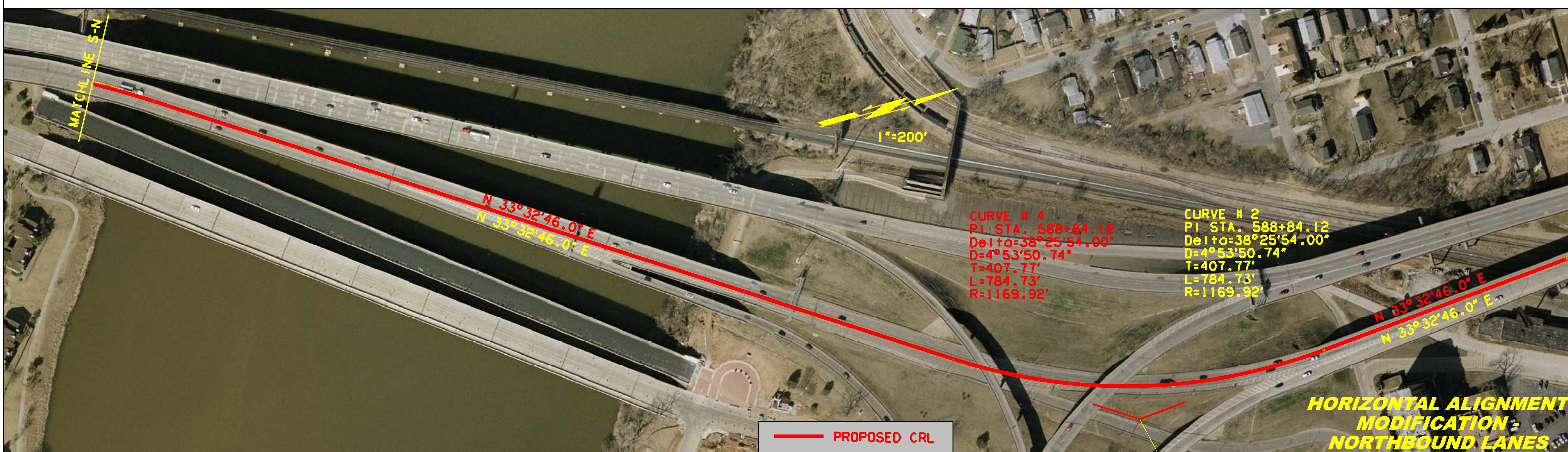

MATCHLINE S-N
1"=200'
N 33°32'46.0" E
N 33°32'46.0" E
CURVE # 4
PI STA. 588+84.12
Delta=38°25'54.00"
D=4°53'50.74"
T=407.77'
L=784.73'
R=1169.92'
CURVE # 2
PI STA. 588+84.12
Delta=38°25'54.00"
D=4°53'50.74"
T=407.77'
L=784.73'
R=1169.92'
N 33°32'46.0" E
N 33°32'46.0" E
PI 588+84.12
PI 588+84.12
PROPOSED CRL
EXISTING CRL
HORIZONTAL ALIGNMENT MODIFICATION - NORTHBOUND LANES

Figure 6

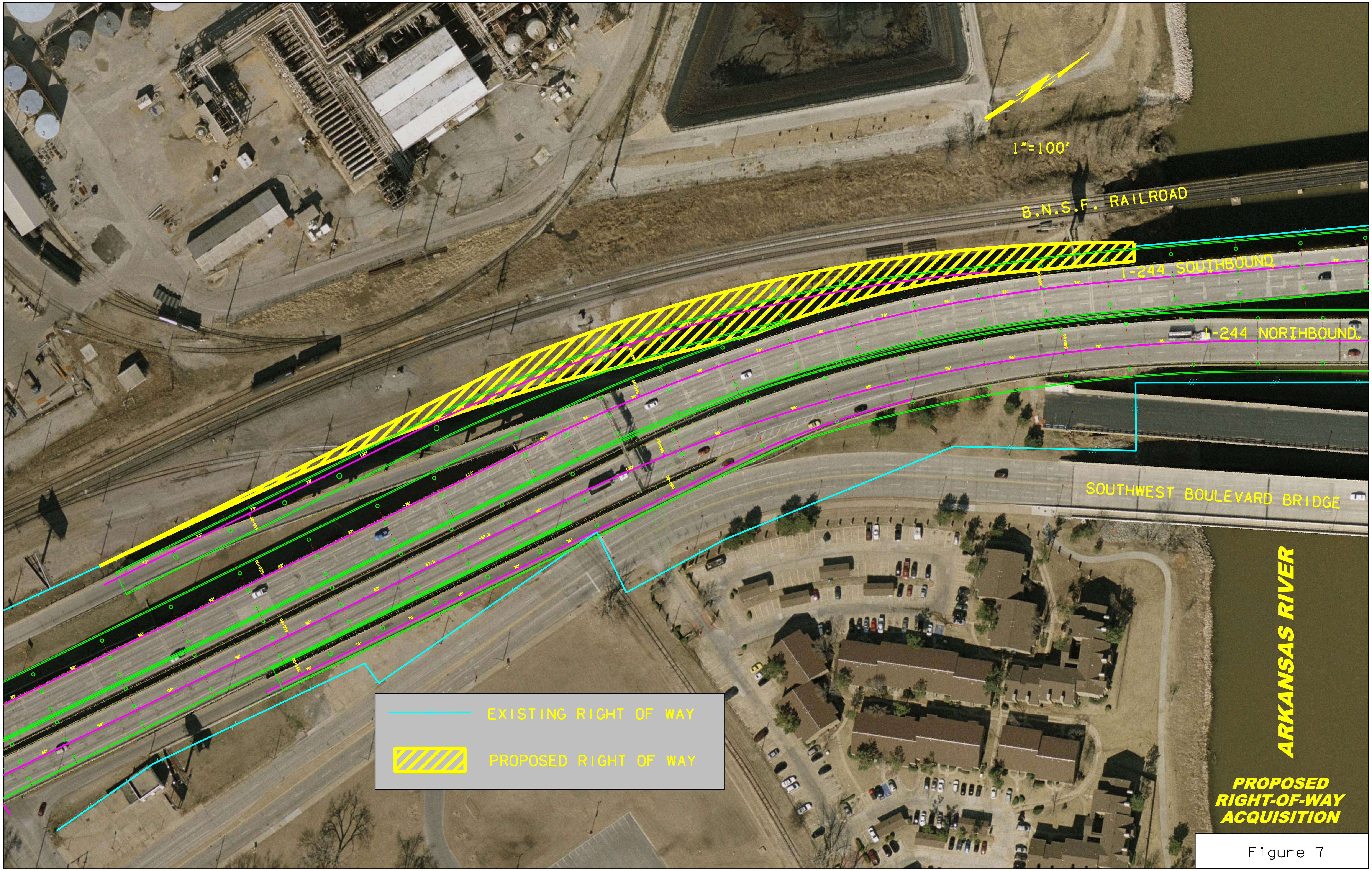
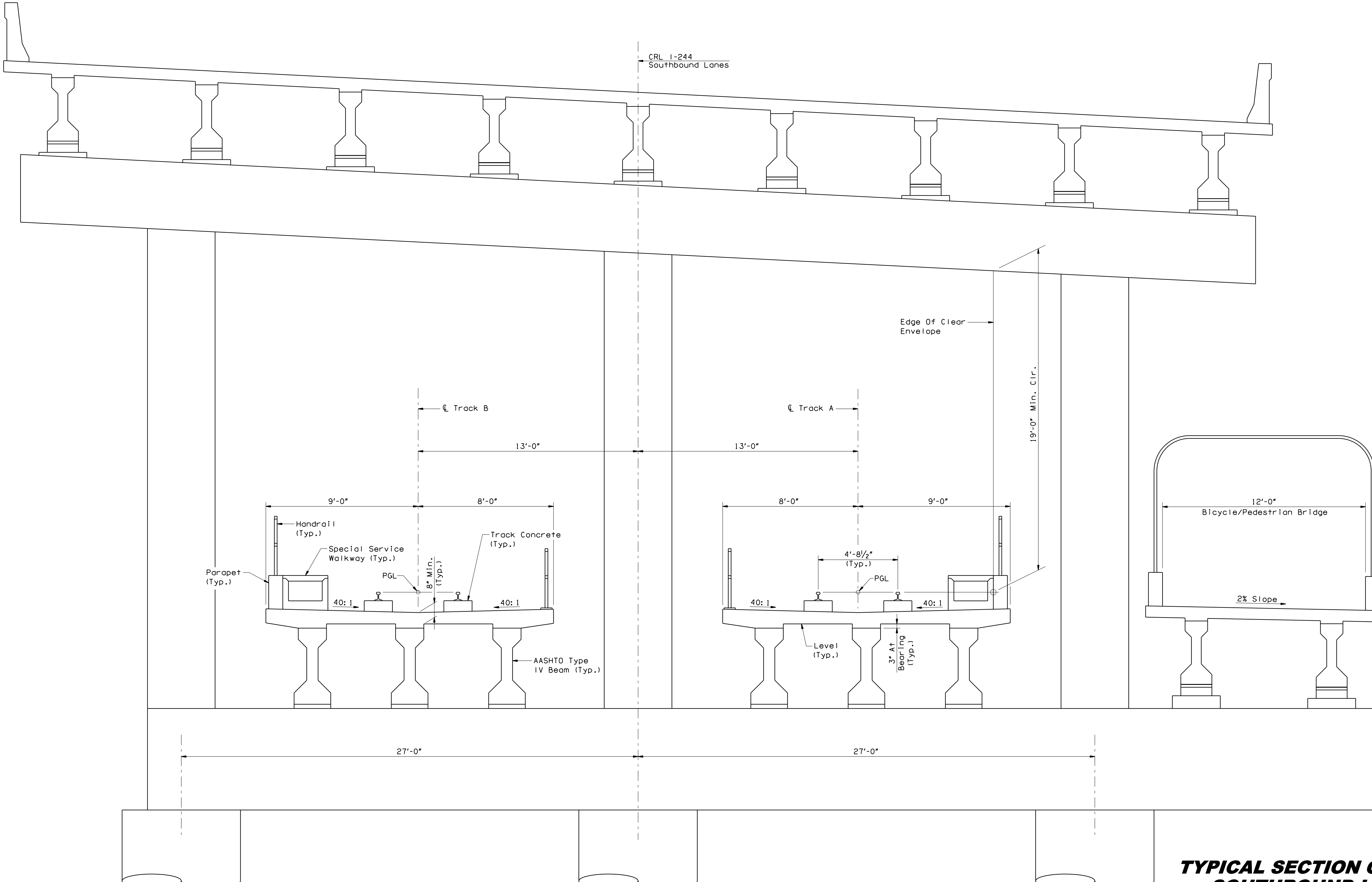

1"=100'
B.N.S.F. RAILROAD
I-244 SOUTHBOUND
I-244 NORTHBOUND
SOUTHWEST BOULEVARD BRIDGE
ARKANSAS RIVER
EXISTING RIGHT OF WAY
PROPOSED RIGHT OF WAY
PROPOSED RIGHT-OF-WAY ACQUISITION

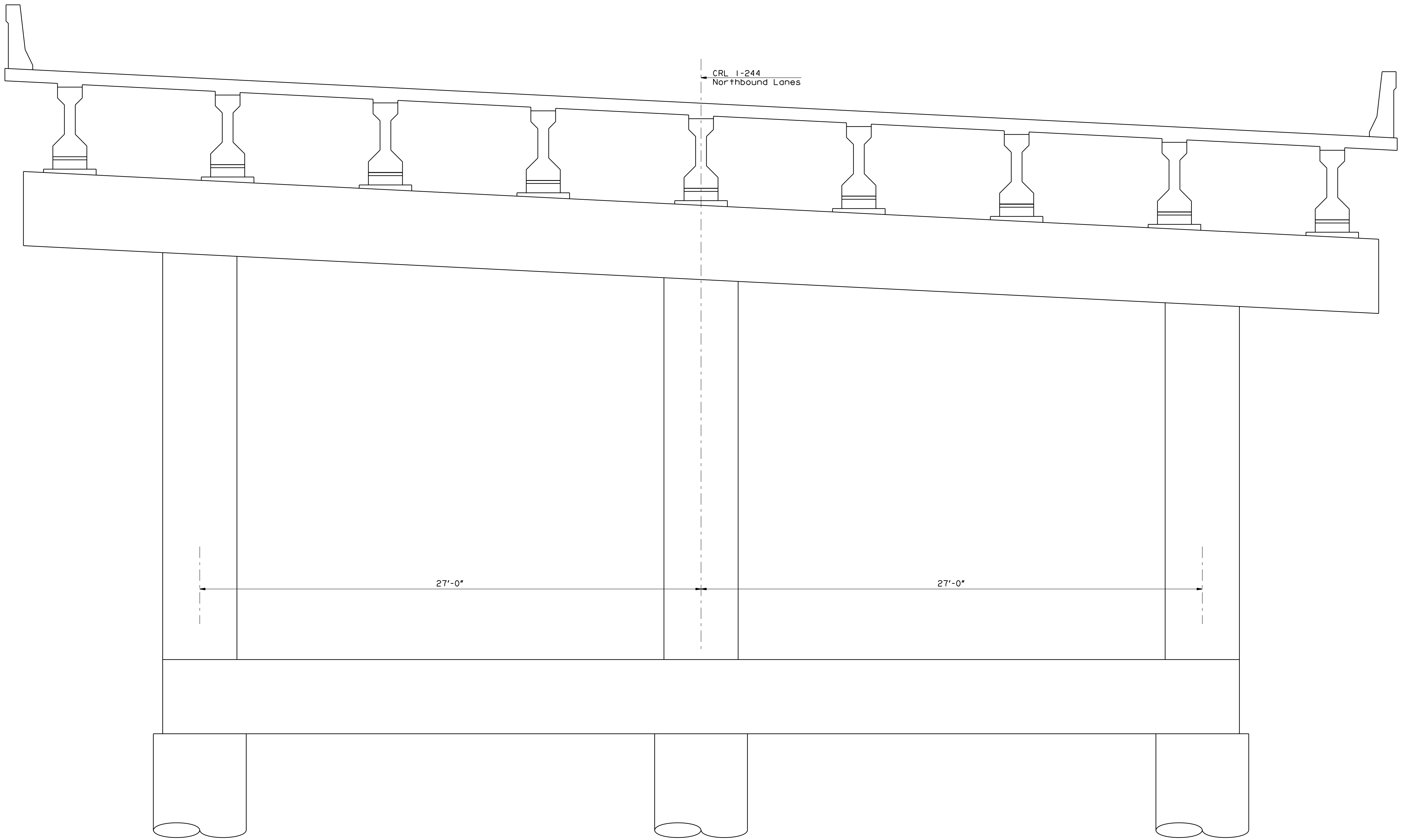
Figure 7



TYPICAL PIER DETAIL
Southbound Lanes
(Looking Forward)

TYPICAL SECTION OF PIER - SOUTHBOUND LANES

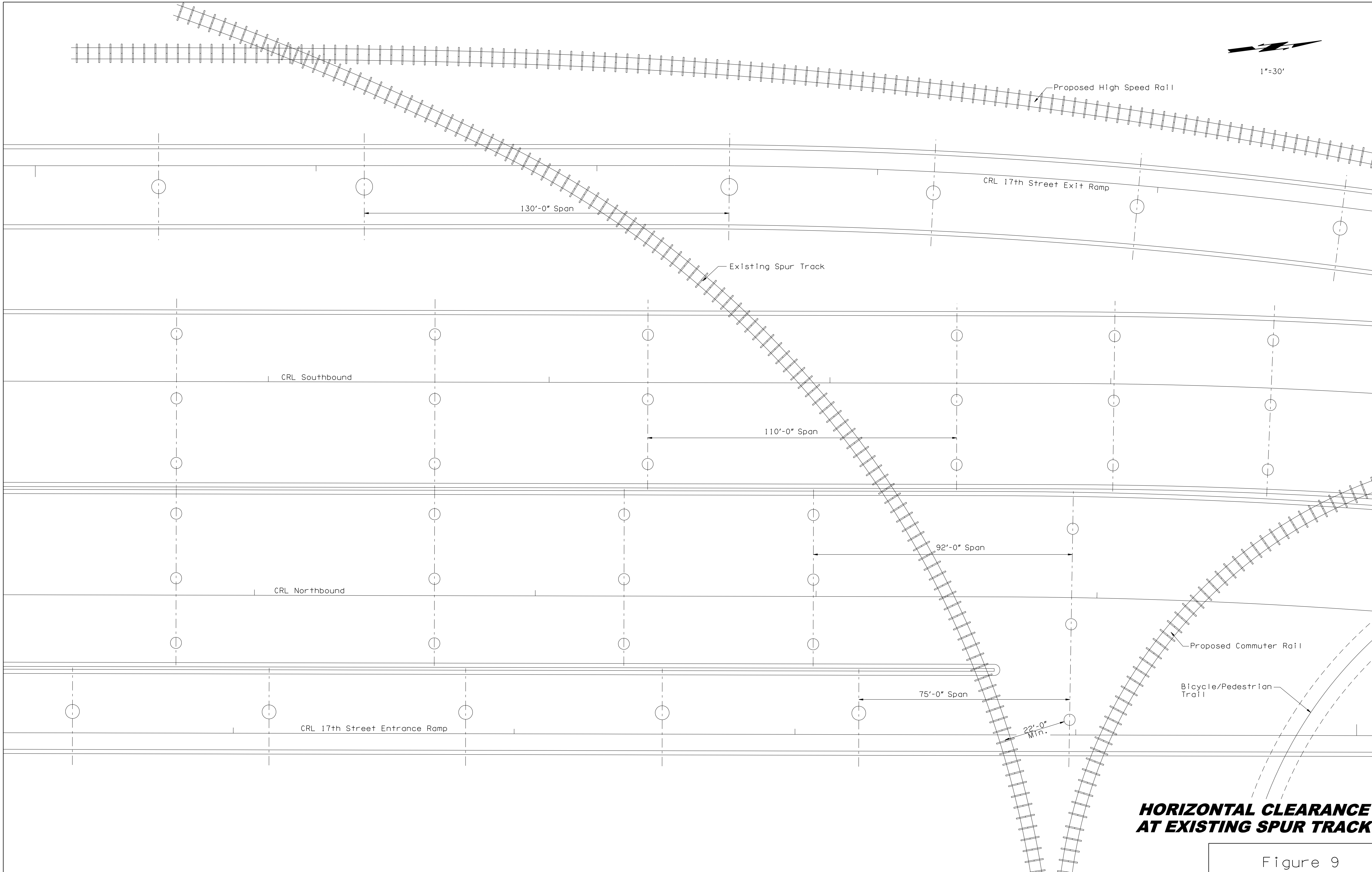
Figure 8



TYPICAL PIER DETAIL
Northbound Lanes
(Looking Forward)

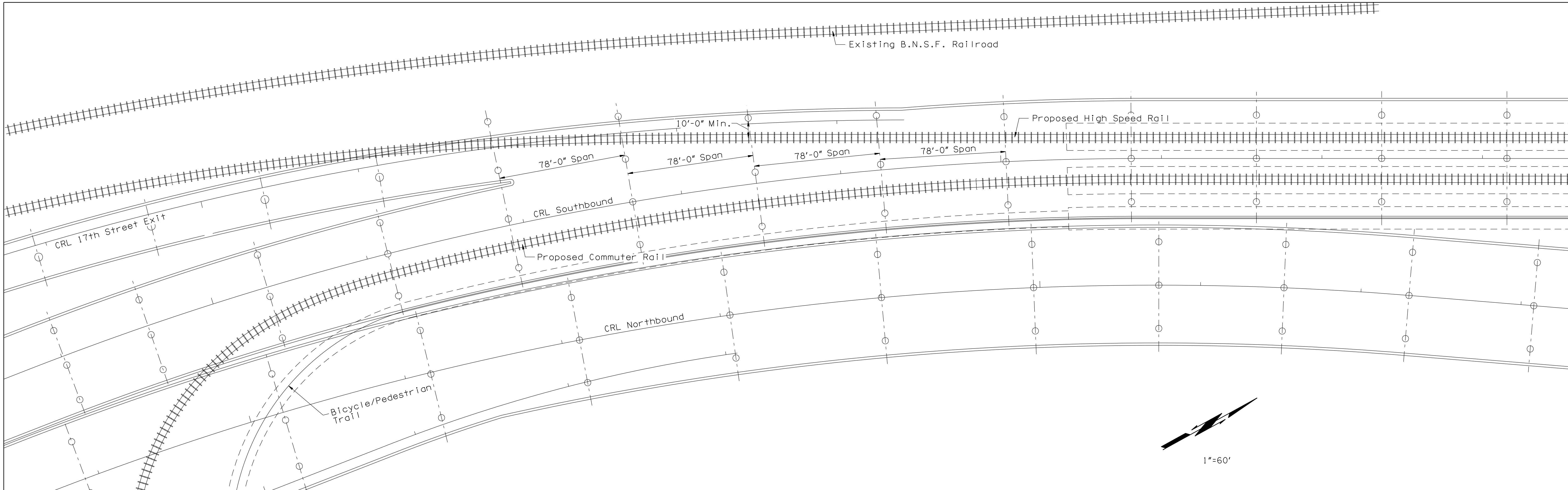
TYPICAL SECTION OF PIER - NORTHBOUND LANES

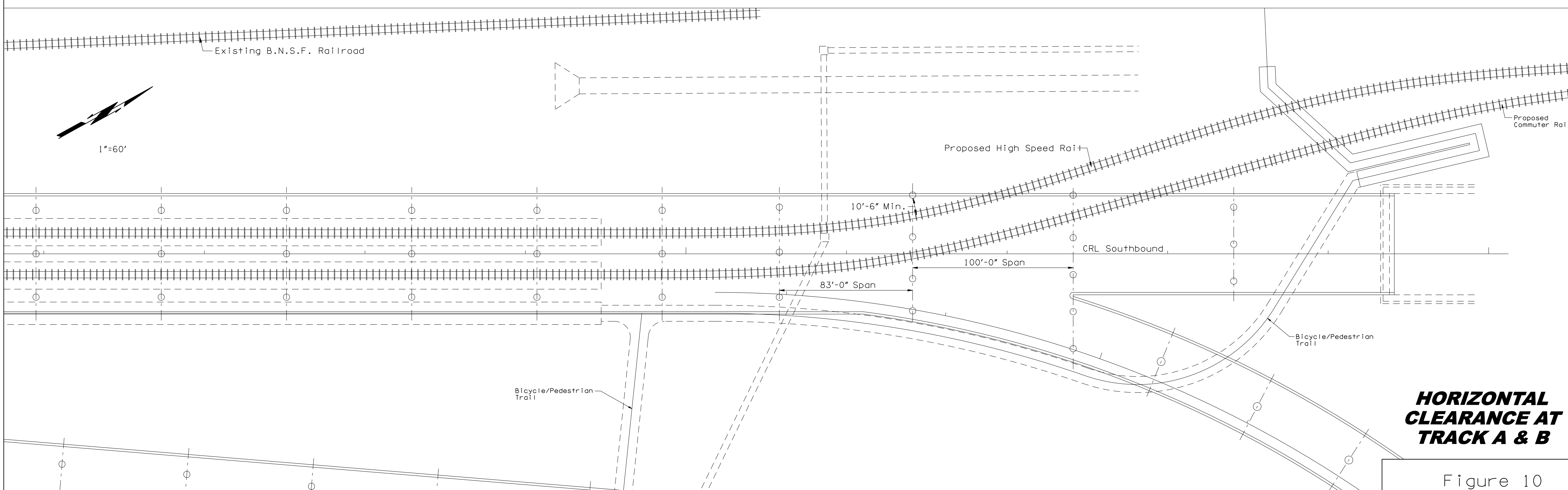
Figure 8a



HORIZONTAL CLEARANCE AT EXISTING SPUR TRACK

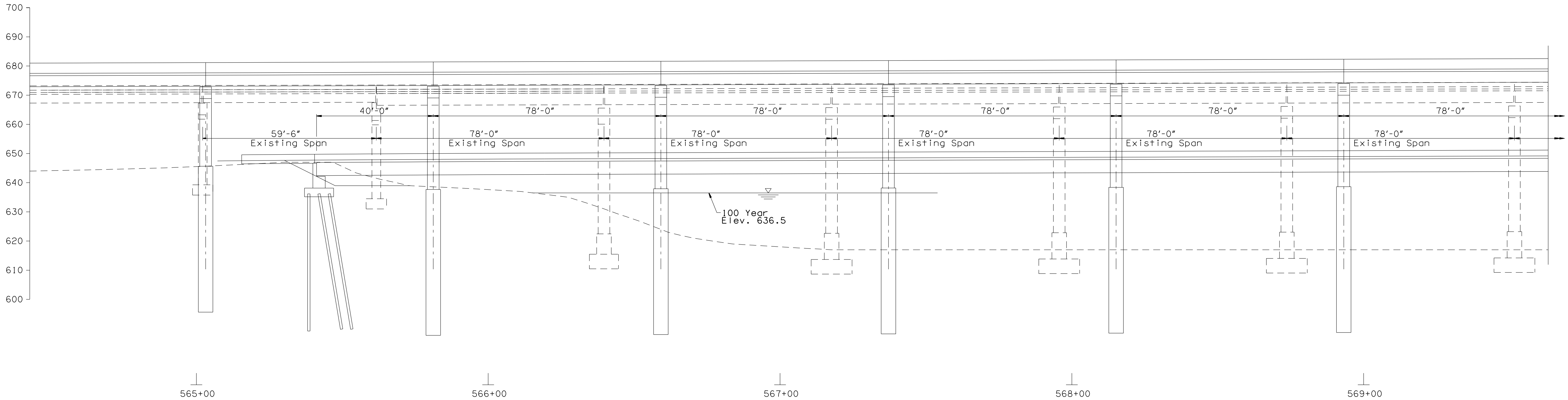
Figure 9

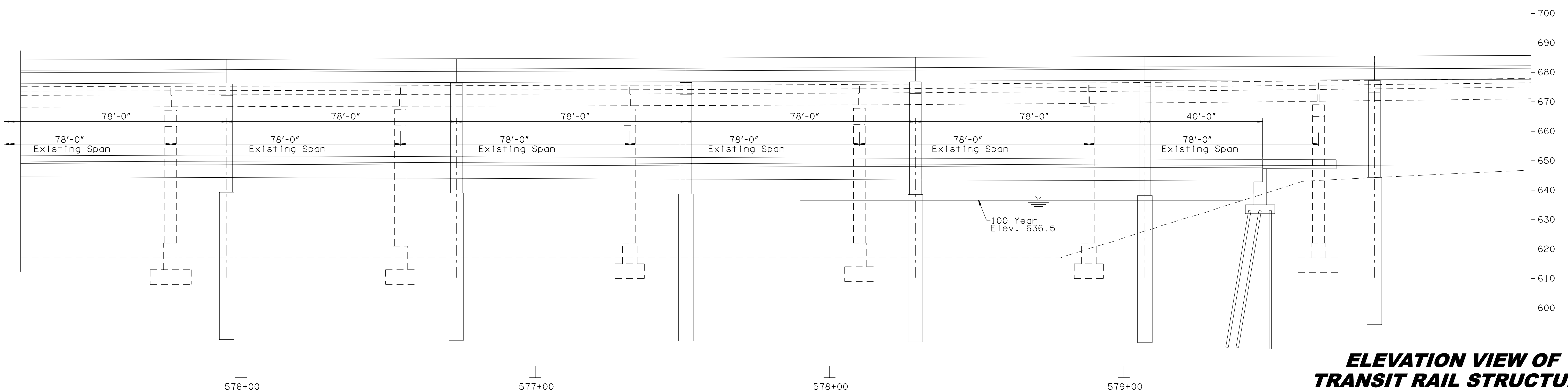




HORIZONTAL CLEARANCE AT TRACK A & B

Figure 10

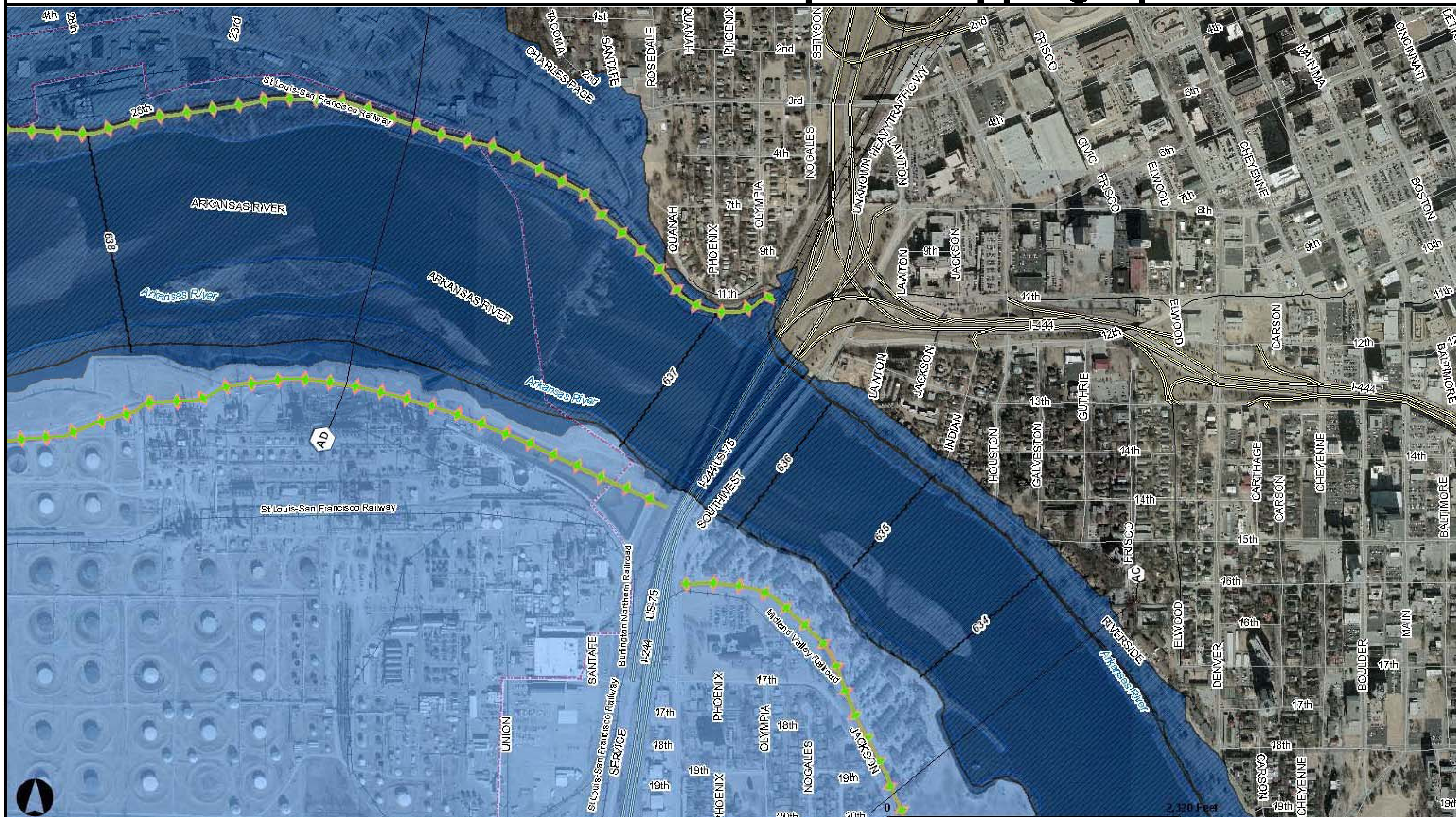




ELEVATION VIEW OF TRANSIT RAIL STRUCTURE

Figure 11

2007 DFIRM Floodplain Mapping Update



LEGEND

2007 Revised Preliminary Cross-Sections

2007 Revised Preliminary BFEs

2007 Revised Preliminary General Structures
STRUCT_TYP
DAM
LEVEE

2007 Revised Preliminary Floodplains
FLD_ZONE, FLOODWAY
AE, FLOODWAY
AE
A
0.2 PCT ANNUAL CHANCE FLOOD HAZARD

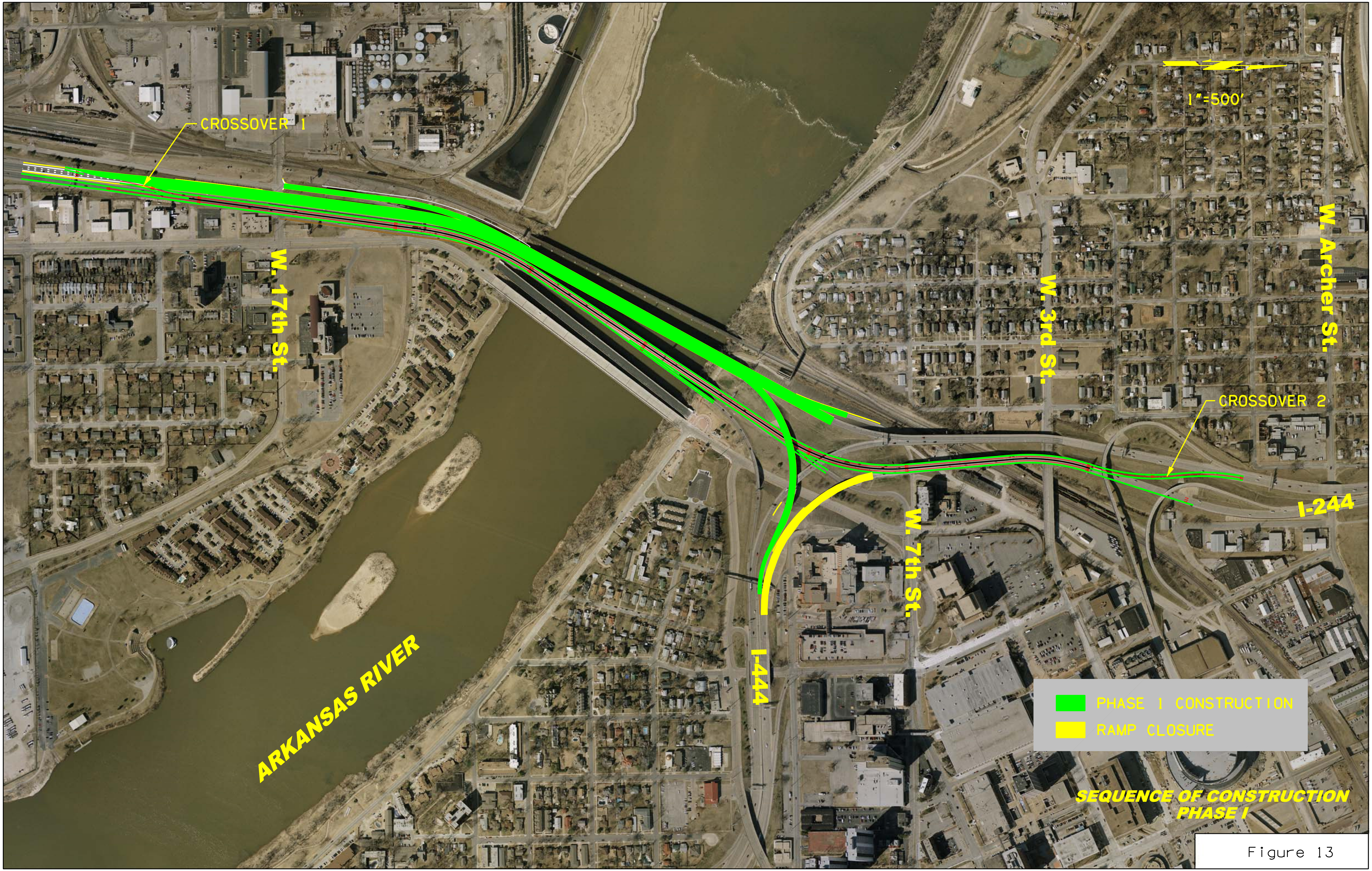
2007 Revised Preliminary Streams

This map is for informational purposes only and is not guaranteed as an accurate and true-scale representation of the depicted features and installations, and does not represent survey-grade data. Use of this map is without warranty or representation by Tulsa County or any affiliated party. All features and installations shown must be confirmed. It is the responsibility of the user to verify existence of items depicted on this map.

(C)

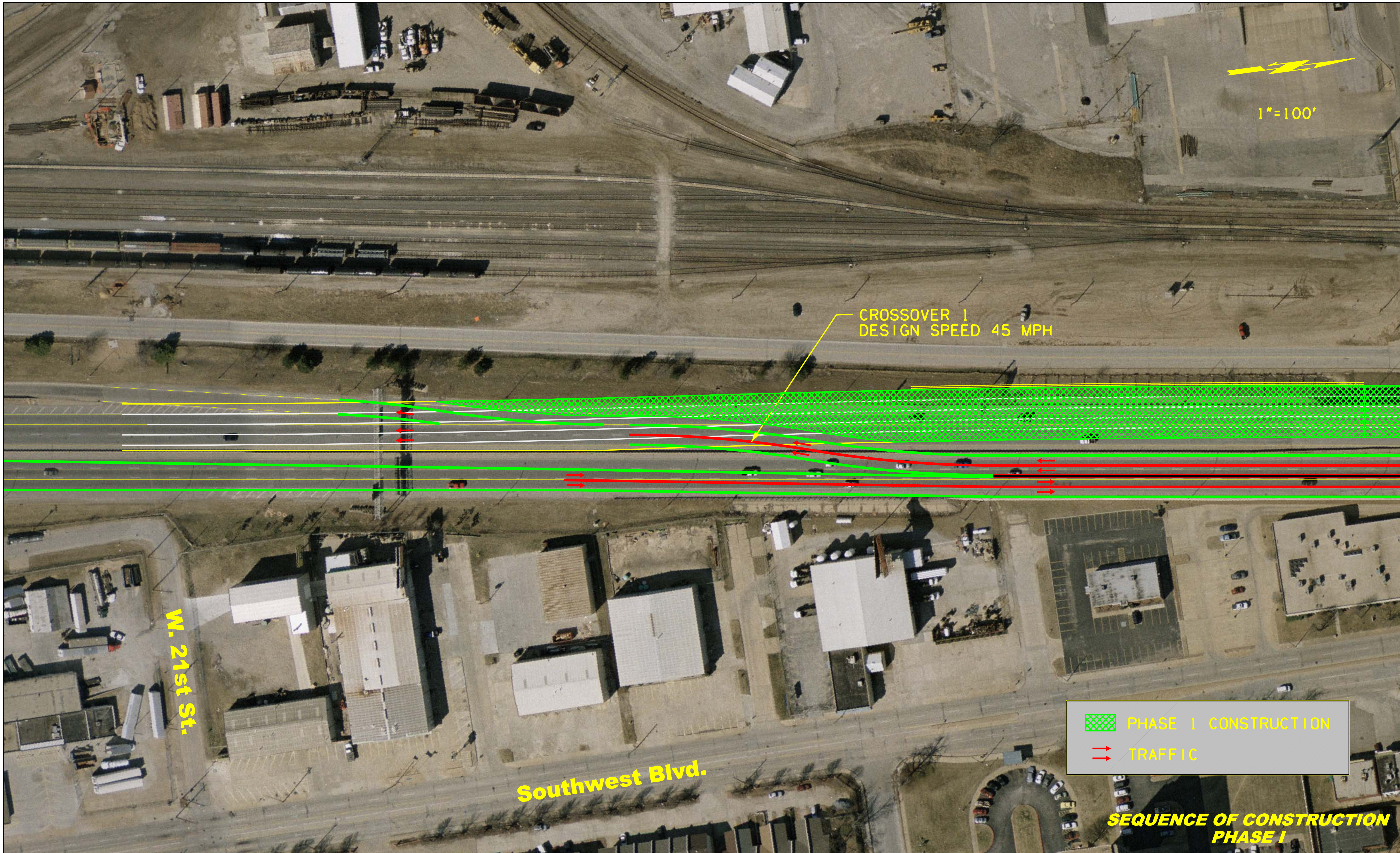
FLOOD INSURANCE RATE MAP

Figure 12



CROSSOVER 1
1"=500'
W. 17th St.
W. 3rd St.
W. Archer St.
CROSSOVER 2
I-244
W. 7th St.
I-444
ARKANSAS RIVER
PHASE I CONSTRUCTION
RAMP CLOSURE
SEQUENCE OF CONSTRUCTION
PHASE I

Figure 13


1"=100'
CROSSOVER 1
DESIGN SPEED 45 MPH
W. 21st St.
Southwest Blvd.
PHASE 1 CONSTRUCTION
TRAFFIC
SEQUENCE OF CONSTRUCTION
PHASE I
Figure 14

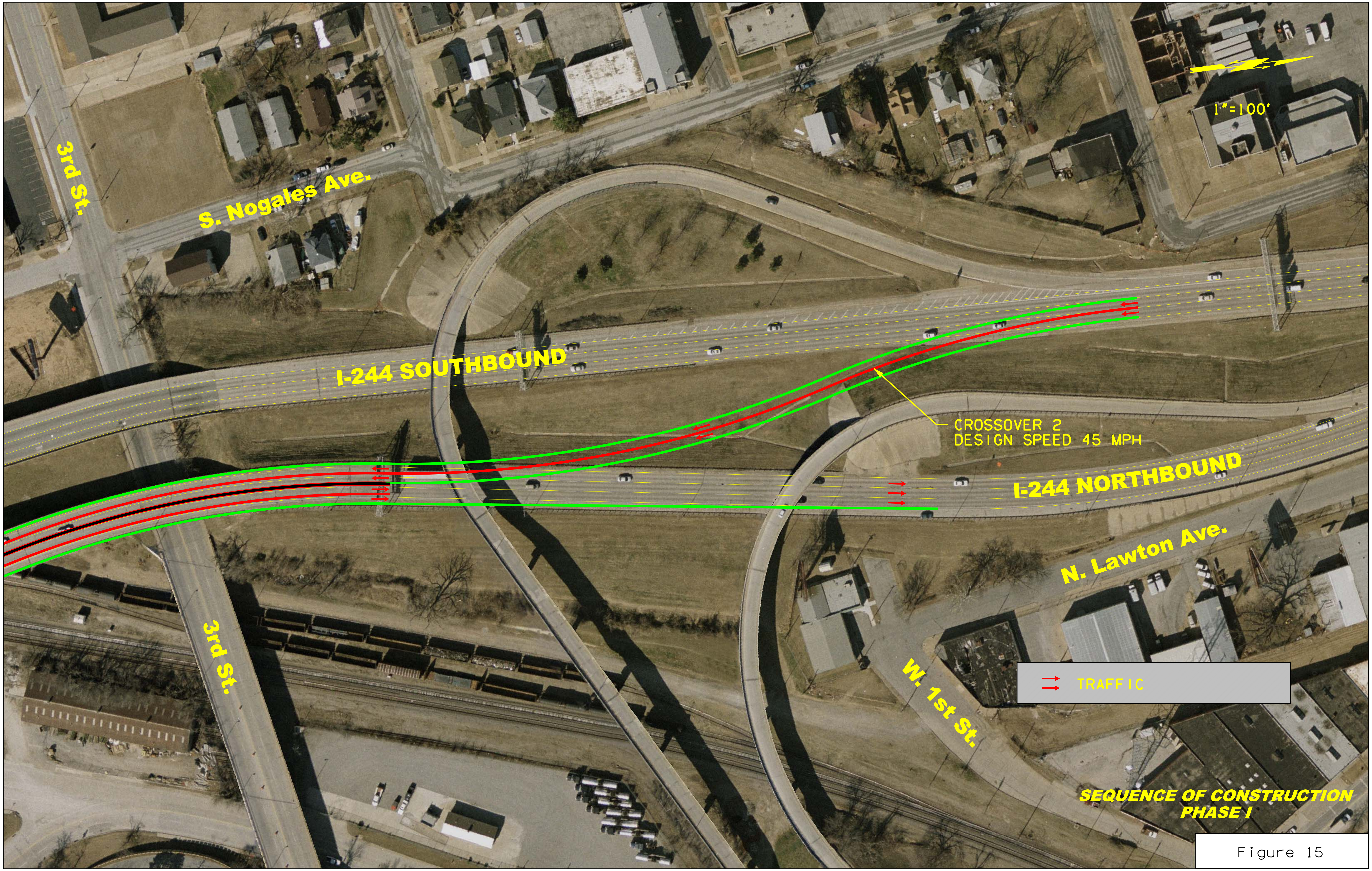
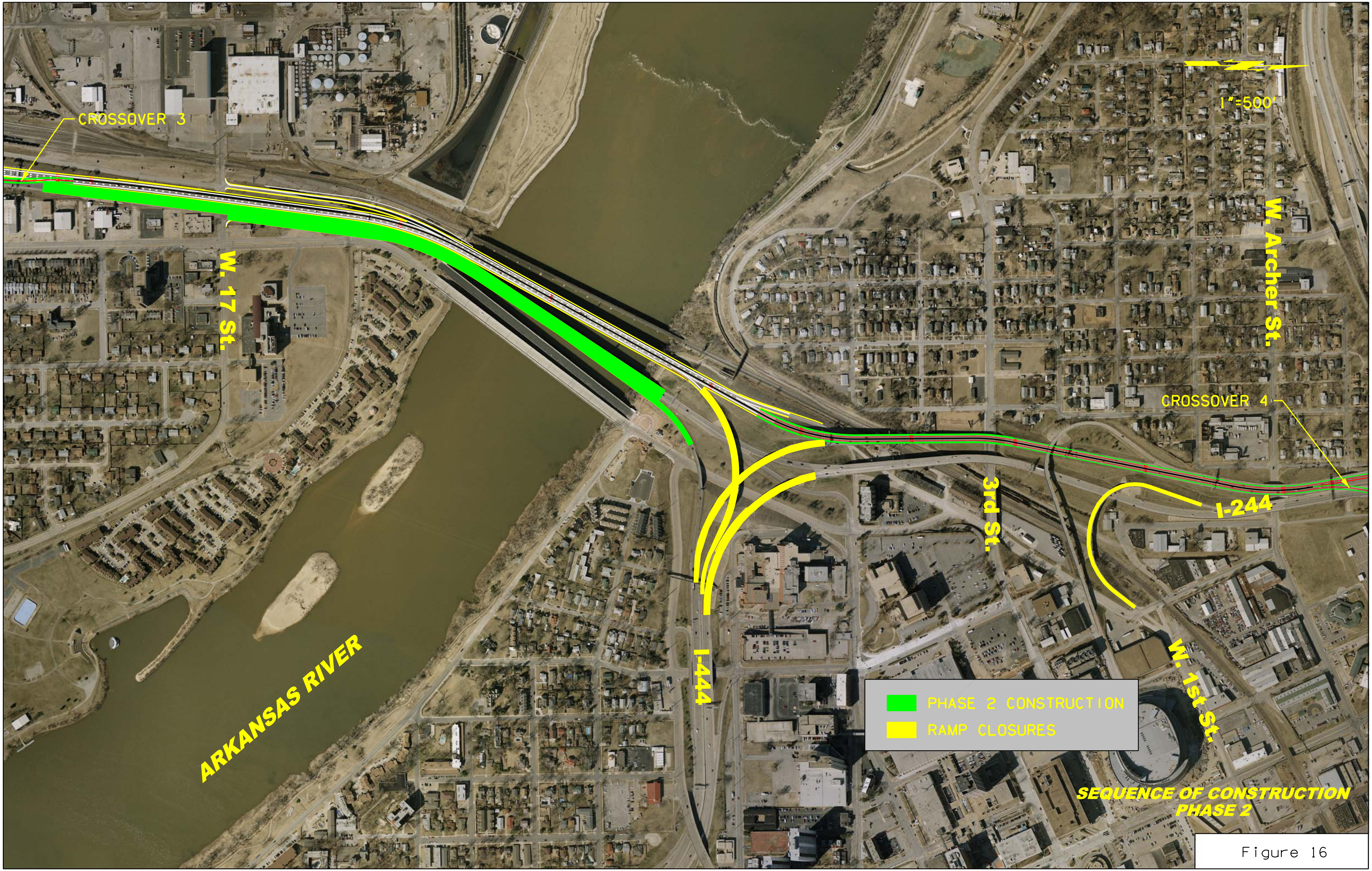
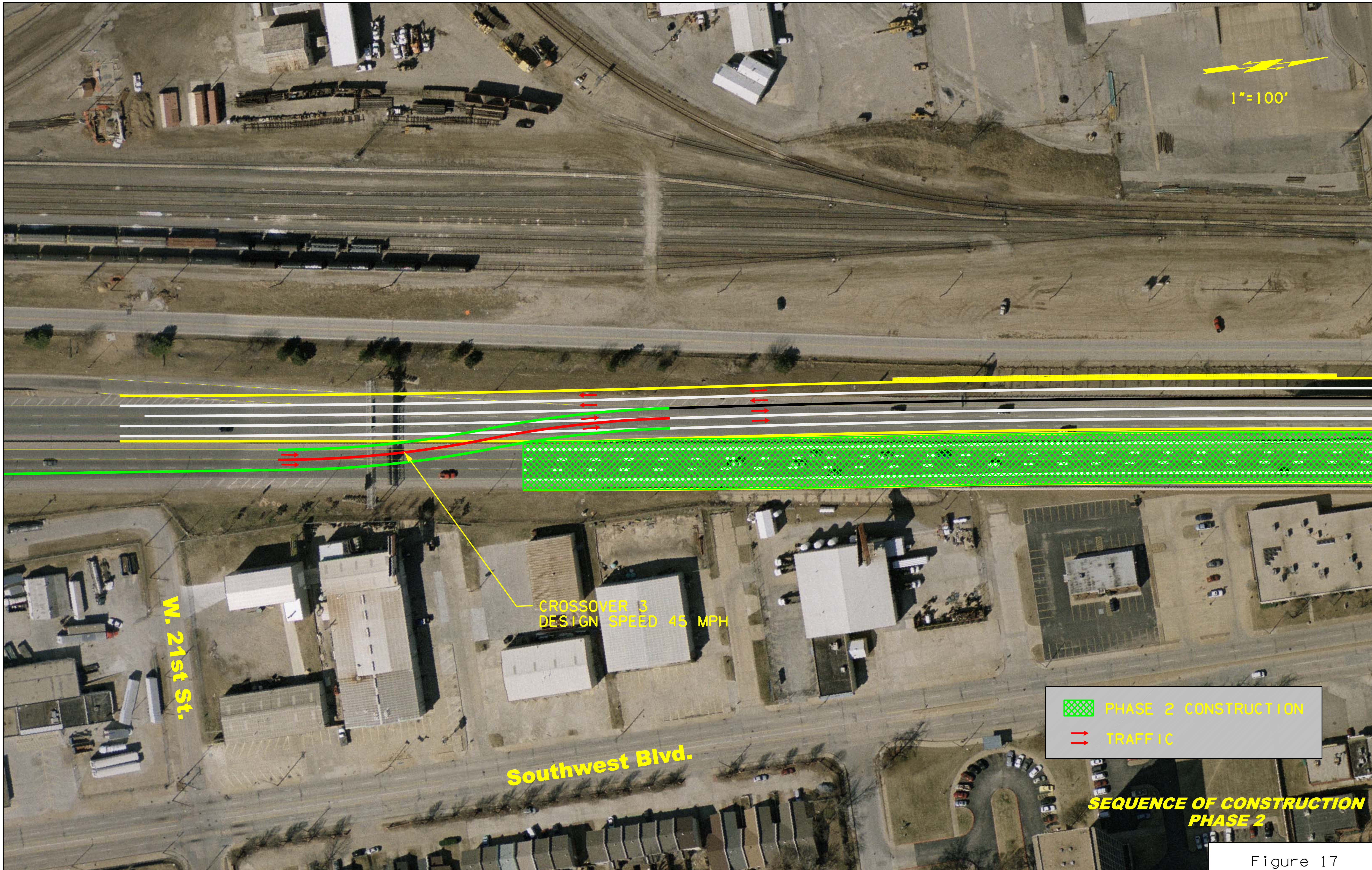

1"=100'
3rd St.
S. Nogales Ave.
I-244 SOUTHBOUND
CROSSOVER 2
DESIGN SPEED 45 MPH
I-244 NORTHBOUND
N. Lawton Ave.
3rd St.
W. 1st St.
TRAFFIC
SEQUENCE OF CONSTRUCTION
PHASE I

Figure 15


CROSSOVER 3
1"=500'
W. 17 St.
W. Archer St.
CROSSOVER 4
3rd St.
I-244
I-444
W. 1st St.
ARKANSAS RIVER
PHASE 2 CONSTRUCTION
RAMP CLOSURES
SEQUENCE OF CONSTRUCTION
PHASE 2
Figure 16



1"=100'
CROSSOVER 3
DESIGN SPEED 45 MPH
W. 21st St.
Southwest Blvd.
PHASE 2 CONSTRUCTION
TRAFFIC
SEQUENCE OF CONSTRUCTION
PHASE 2

Figure 17

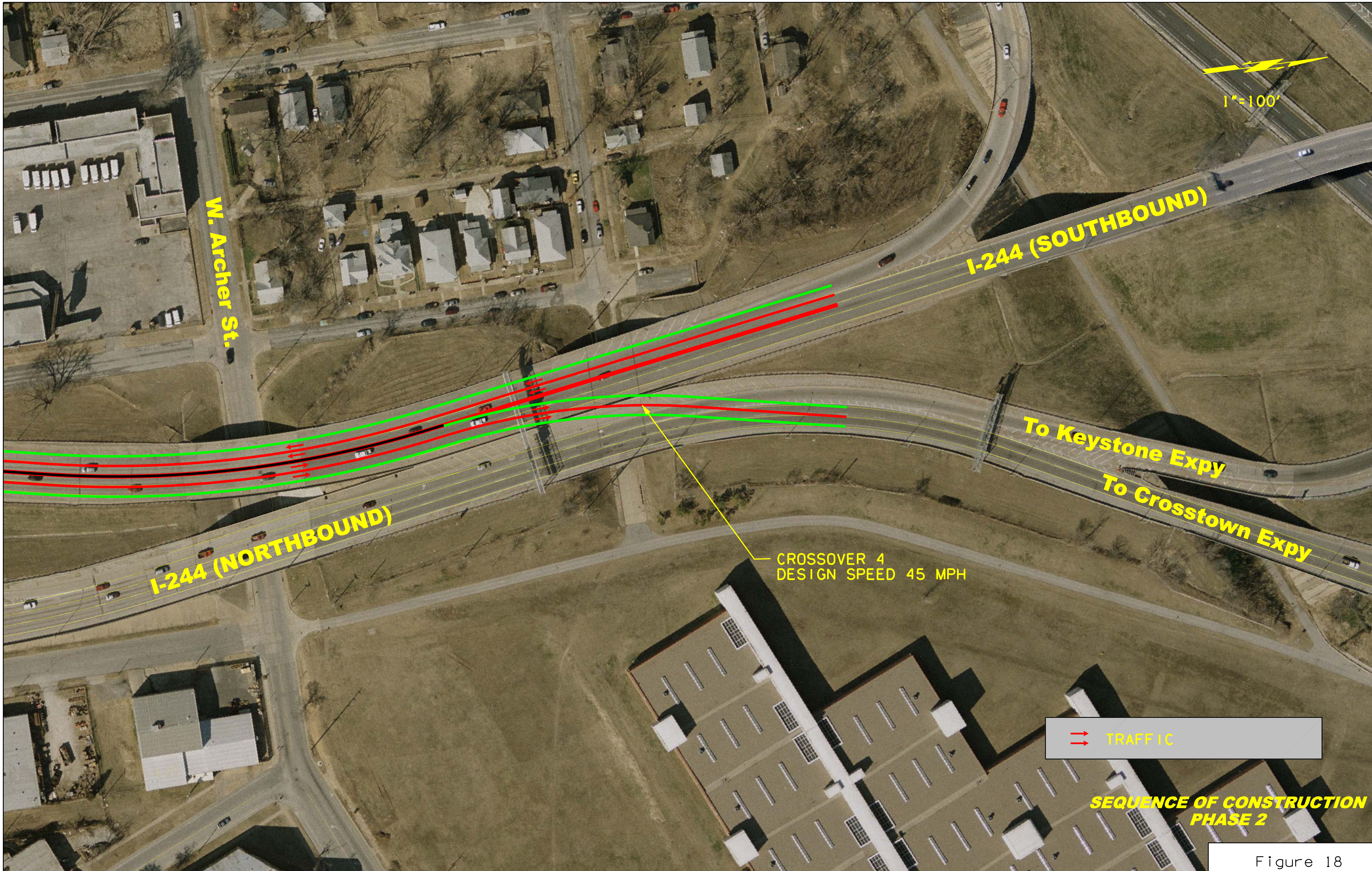

1"=100'
W. Archer St.
I-244 (SOUTHBOUND)
I-244 (NORTHBOUND)
To Keystone Expy
To Crosstown Expy
CROSSOVER 4
DESIGN SPEED 45 MPH
TRAFFIC
SEQUENCE OF CONSTRUCTION
PHASE 2

Figure 18