

ACCESS JUSTIFICATION REPORT

I-40 AND DOUGLAS BOULEVARD INTERCHANGE Oklahoma County, Oklahoma

J/P 28992(04)

Prepared for:



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Oklahoma City, OK 73105**

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Prepared by:
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Submitted by:
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Comments:

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EXECUTIVE SUMMARY

A bridge replacement and interchange reconstruction project are proposed at I-40 and Douglas Boulevard in Oklahoma City, Oklahoma in Oklahoma County. The purpose of the project is to correct the functionally obsolete Douglas Boulevard bridge and to configure an interchange that will accommodate future traffic volumes in a safe and efficient manner within right-of-way constraints.

The existing Douglas Boulevard bridge over I-40 (NBI 15573) is a 6 span bridge described as 41'-55'-60'-60'-50'-41' Continuous Slab Spans with 2-3' sidewalks. The ODOT Bridge Inspection Report sufficiency rating is 77.0 and the report identifies the bridge as functionally obsolete. The bridge inspection report identifies the horizontal underclearance on the right side as 1' too narrow and requires corrective action. In addition to the bridge being functionally obsolete, the Douglas Boulevard bridge is at risk of becoming structurally deficient and should be replaced. The existing Douglas Boulevard bridge has a clear roadway width of 80 ft. The vertical clearance for I-40 is posted as 16'-4" (eastbound) and 17'-1" (westbound).

I-40 underneath Douglas Boulevard is a four-lane divided urban interstate with a 40-ft. wide grass median, 12-ft. wide driving lanes, 3-ft. wide inside shoulders, and 10-ft. wide outside shoulders. Douglas Boulevard is a four-lane curbed urban principal arterial. The existing I-40 and Douglas Boulevard interchange is a full cloverleaf interchange with collector-distributor roads also underneath the Douglas Boulevard bridge adjacent to I-40 and extending approximately 0.25 miles east and west of the Douglas Boulevard bridge.

The need for the Douglas Boulevard bridge replacement and the interchange reconstruction cannot be adequately satisfied by reasonable transportation system management such as the addition of HOV facilities, mass transit, or ramp metering. The replacement of the existing Douglas Boulevard bridge over I-40 requires the interchange to be reconstructed due to longer bridge spans to accommodate I-40 traffic lanes and shoulders, new abutment locations that will be in conflict with the existing collector-distributor roads, and profile grade changes to I-40 and to ramps that are necessary to accommodate increased structural depths and meet minimum vertical clearance requirements for the new bridge.

In the preliminary design phase, multiple interchange designs were studied, and three interchange alternatives were identified for further consideration: Single Point Urban Interchange (SPUI), Tight Urban Diamond Interchange (TUDI) with Ramp Flyover, and Cloverleaf Interchange with Collector-Distributor Roads. After the completion of the preliminary design and public involvement phases of the project, ODOT selected the Single Point Urban Interchange as the Preferred Alternative. The SPUI Alternative improves safety by eliminating weaving, accommodates large volumes of traffic, provides ease of mobility for both cars and large trucks due to long gradual turns, and stays within right-of-way constraints.

The proposed project includes constructing a SPUI in place of the existing cloverleaf interchange. I-40 will be reconstructed for a design speed of 60 mph. The vertical alignment will be lowered near the Douglas Boulevard Interchange to provide a minimum clearance of 16'-9". I-40 will be

widened to six lanes with 10' inside and outside shoulders and a 33' paved median with a concrete longitudinal median barrier. Douglas Boulevard will transition within project extents from four to six through lanes with additional turn lanes. The design speed on Douglas Boulevard will be 45 mph. The SPUI bridge will consist of two spans with an overall nominal length of approximately 190' and an overall bridge deck width of approximately 240'. The SPUI configuration will provide all ramp movements. On I-40, the design includes parallel entrance and exit ramps to the proposed Douglas Boulevard SPUI. General project extents for I-40 run from a transition beginning just west of Industrial Boulevard extending east to approximately 2,800' east of Douglas Boulevard. Douglas Boulevard project extents run from 1,400' south of I-40 extending north to the south edge of S.E. 29th Street. Also included with the proposed SPUI project is the removal of the Engle Road bridge which is no longer in service and removal of the on and off ramps to Industrial Boulevard on the east side of the Industrial Boulevard interchange. The existing ramp configuration between Industrial Boulevard and Douglas Boulevard contains inadequate merge and diverge spacing between the interchanges. The removal of the eastern ramps at the Industrial Boulevard interchange reduces access to and from I-40; however, traffic that once utilized the Industrial Boulevard interchange eastern ramps can utilize either the Douglas Boulevard interchange (approximately 0.5 miles east) or the Town Center Drive interchange (approximately 1 mile west).

A traffic study was performed on the existing cloverleaf configuration and on the proposed SPUI for the design years 2017 and 2045. The 2017 freeway facilities traffic analyses comparison results display several modest improvements to the I-40 freeway and the I-40 ramp merge and diverge locations with the future SPUI configuration in comparison to the existing cloverleaf interchange configuration with I-40 widening. The 2045 freeway facilities comparison results display improvements in level-of-service at the weaving segment between Industrial Boulevard and Douglas Boulevard. The total signalized delay in 2045 is an average 40% greater with the future SPUI configuration in comparison to the existing cloverleaf configuration, which may be attributed to the addition of four signals and the additional traffic from the removed Industrial Boulevard ramps displaced onto Douglas Boulevard.

A collision analysis was performed to assess the crash history from 01/01/2011 to 12/31/2015 for I-40, Douglas Boulevard, and the surrounding facilities. Throughout the study period there have been 640 collisions along I-40 between Town Center Drive and Anderson Road. The overall collision rate for this section is 135.11 collisions per 100 million vehicle miles, compared to the statewide rate of 66.82 for similar facilities. There have been 103 collisions related to the I-40 and Douglas Boulevard Interchange. Most of the collisions occur on ramp or collector-distributor road merge locations.

Utilizing the Interactive Highway Safety Design Model (IHSDM) Predictive Method, a safety analysis has been performed on the existing cloverleaf interchange and the future SPUI. The expected crash totals and crash rates from 2020 to 2045, a total of 25 years, were analyzed. Along I-40 the proposed future conditions reduce the annual crashes by 18.7%. The eastbound ramps combined reduce the annual crashes by 50.0%, and the westbound ramps combined reduce the annual crashes by 19.6%.

1 OPERATIONAL ANALYSIS

“An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraphs 625.2(a), 655.603(d) and 771.111(f)). The crossroads and local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).”

1.1 PROPOSED INTERCHANGE IMPROVEMENTS AT I-40 AND DOUGLAS BOULEVARD

The existing I-40 and Douglas Boulevard Interchange is located in Oklahoma City, Oklahoma in Oklahoma County. The project location map and study area are shown in Exhibit 1. The interchange currently services Oklahoma City (population 579,999), Midwest City (population 54,371), Tinker Air Force Base (TAFB), Saint Anthony Healthplex, a car dealership, assorted restaurants, and retail. Adjacent interchanges along I-40 are shown in Exhibit 1 and include Town Center Drive 1.5 miles west, Industrial Boulevard 0.5 miles west, and Anderson Road 3.2 miles east.

The I-40 study area extends from Town Center Drive east to Anderson Road, including each interchange and intersections in the near vicinity of any interchanges. Within the study area, I-40 is a four-lane divided urban interstate with asphalt pavement in good condition. Town Center Drive, located 1.5 miles west of Douglas Boulevard, is a six-lane curbed local roadway. The I-40 and Town Center Drive interchange is a full tight-diamond interchange utilizing taper ramps on the I-40 westbound exit and the eastbound entrance ramps. Industrial Boulevard, located 0.5 miles west of Douglas Boulevard, is a four-lane curbed local roadway. The I-40 and Industrial Boulevard Interchange is a full tight-diamond interchange utilizing taper ramps on the I-40 exit and entrance ramps. Douglas Boulevard is a four-lane curbed urban principal arterial. The I-40 and Douglas Boulevard Interchange is a full cloverleaf interchange with collector-distributor roads. Anderson Road, located 3.2 miles east of Douglas Boulevard, is a three-lane curbed urban major collector. The I-40 and Anderson Road Interchange is a full diamond interchange utilizing taper ramps on the I-40 exit and entrance ramps.

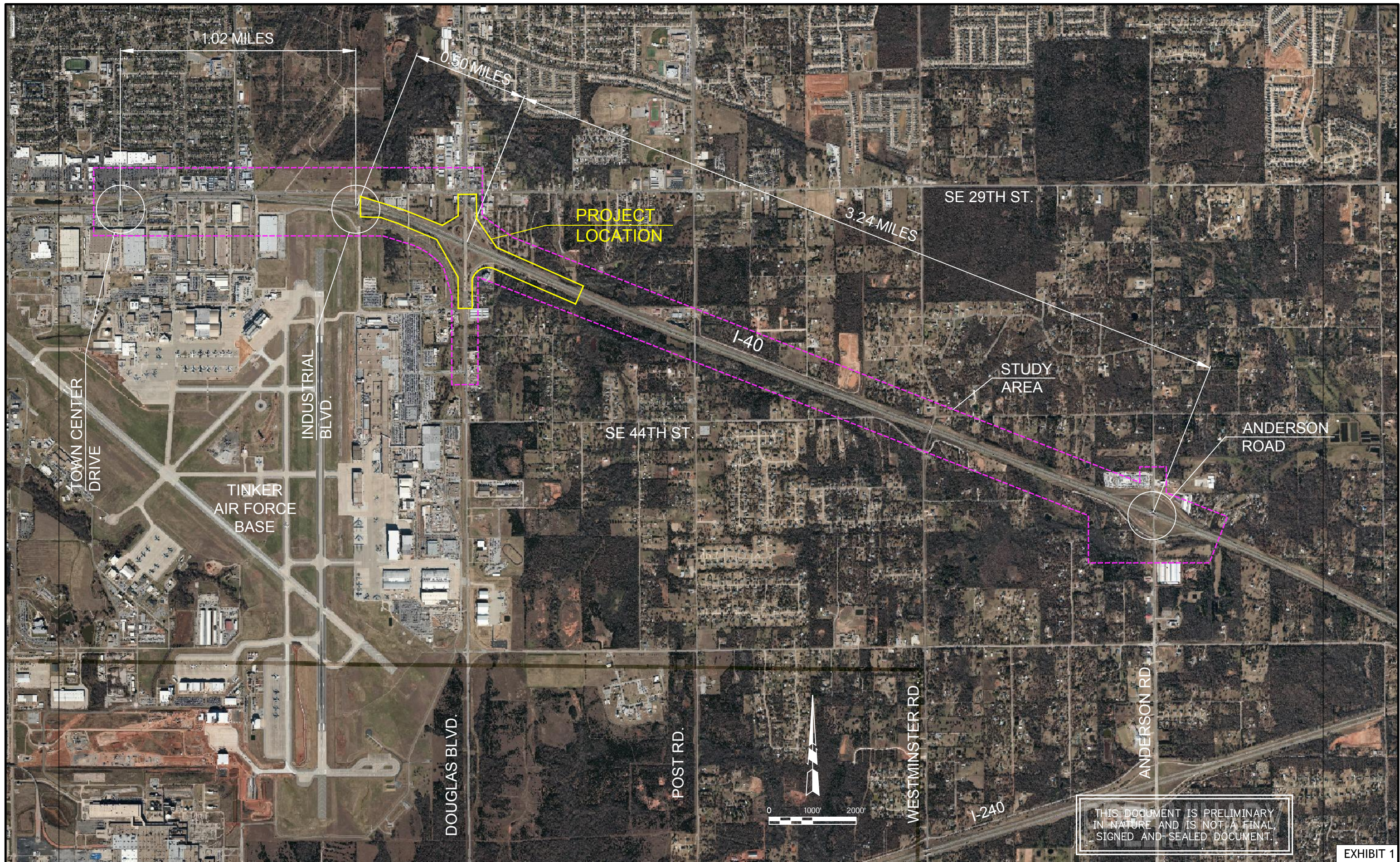


EXHIBIT 1

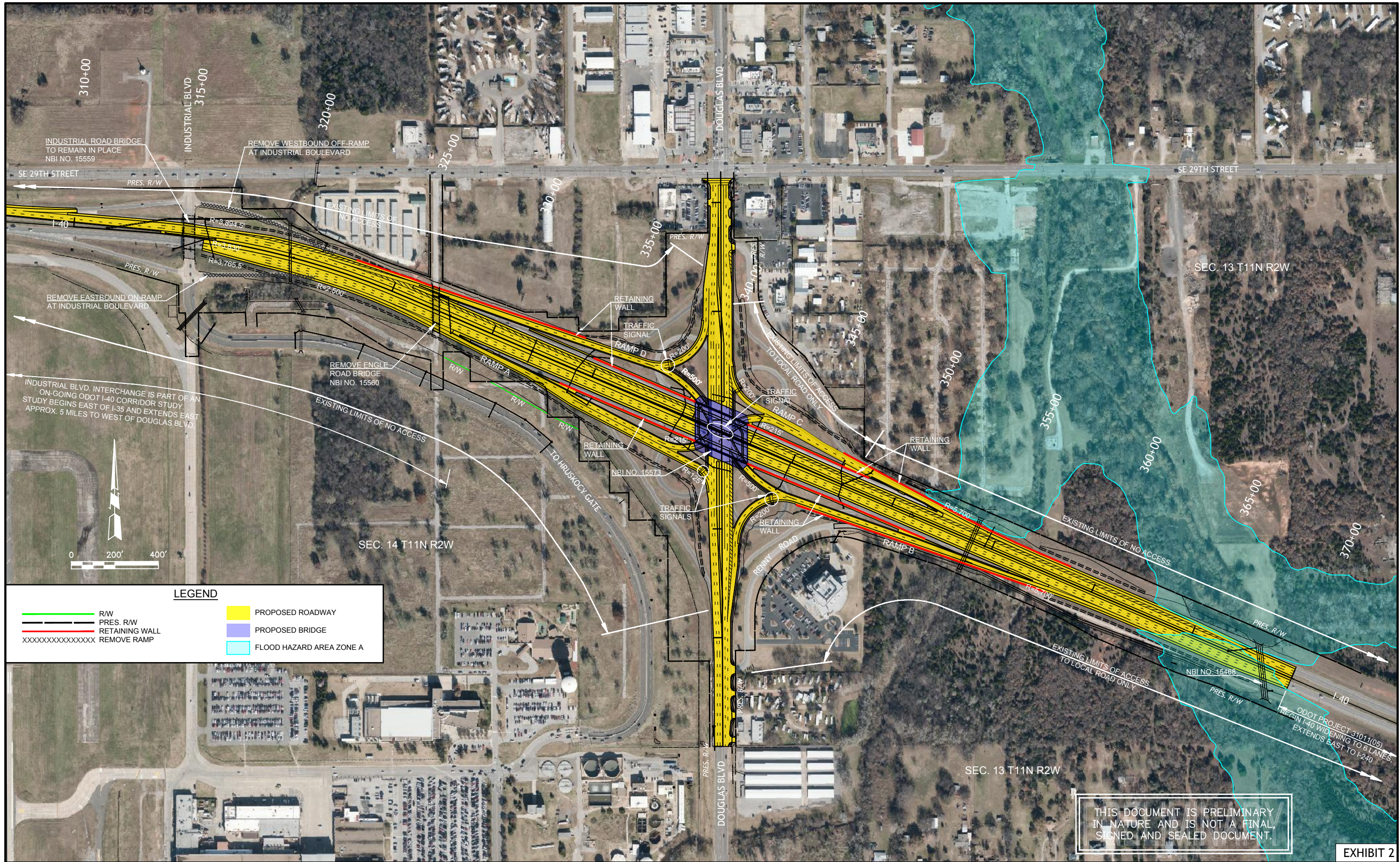
A bridge replacement and interchange reconstruction is proposed on I-40 at Douglas Boulevard. Exhibit 2 displays the proposed improvements at the I-40 and Douglas Boulevard Interchange. Exhibit 3 displays the ultimate design at the I-40 and Douglas Interchange after the Industrial Boulevard Bridge replacement and I-40 widening to six lanes at the western project extents is completed. All the interchange improvements meet all design criteria and guidelines as presented in Exhibit 4 and in accordance with the current editions of *AASHTO's A Policy on Geometric Design of Highways and Streets* and *AASHTO's A Policy on Design Standards—Interstate System*. Conceptual Plans are located in Appendix A.

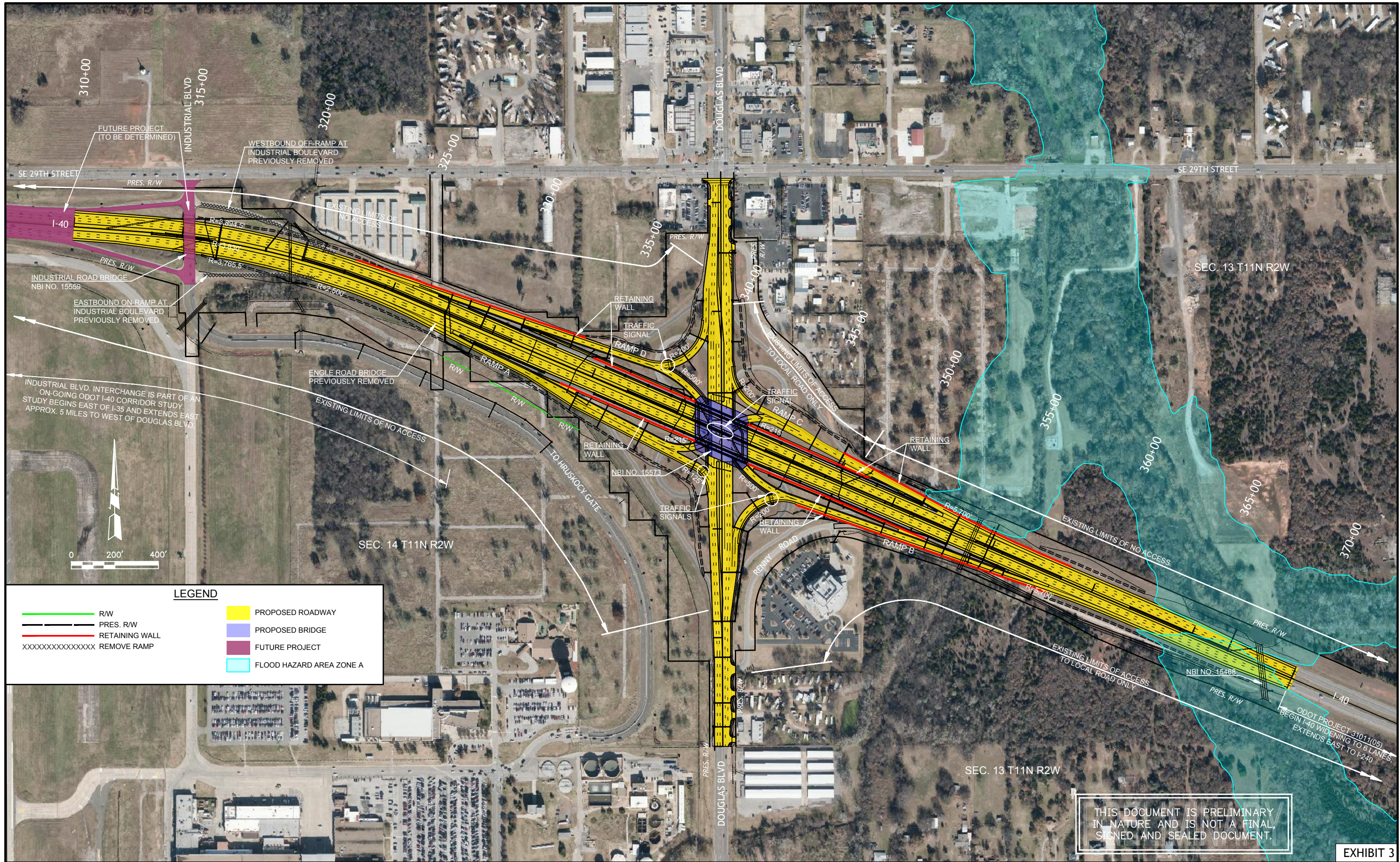
I-40 will be reconstructed for a design speed of 60 mph. The vertical alignment will be lowered near the Douglas Boulevard Interchange to provide a minimum clearance of 16'-9". I-40 will be widened to six lanes with outside shoulders. A Single Point Urban Interchange (SPUI) will be constructed in place of a cloverleaf interchange.

Douglas Boulevard will transition within project extents from four to six through lanes with additional turn lanes. The design speed on Douglas Boulevard will be 45 mph. A parallel sided bridge will be utilized to accommodate the SPUI intersection. Vertical abutments will be placed at the 30' clear zone, and one pier placed on the centerline of I-40. The bridge will consist of two spans with an overall nominal length of approximately 190' and an overall bridge deck width of approximately 240'. F-shaped parapets will follow the outside edges of the bridge deck. Sidewalks will be accommodated across the bridge, with the sidewalks on the roadway portion only constructed on the east side.

The SPUI configuration will provide all ramp movements. On I-40, the design includes parallel entrance and exit ramps to the proposed Douglas Boulevard SPUI. The proposed eastbound exit ramp is 400' long interim (with an 800' ultimate design) with a 300' taper. The proposed westbound exit ramp is 778' long with a 300' taper. The proposed eastbound entrance ramp is 507' long with a 300' taper. The proposed westbound entrance ramp is 805' long interim (with a 1,280' ultimate design) with a 300' taper. The Industrial Boulevard Bridge, on the western limits of I-40, restricts a full build of the western ramp limits. After the completion of a bridge replacement on Industrial Boulevard, the ramps will be constructed to the ultimate design lengths. There are no changes to the "Existing Limits of No Access," which provide 450' or more beyond the ramp terminals on Douglas Boulevard. The access points and driveways on Douglas Boulevard will be spaced and designed to accommodate large trucks and equipment where needed.

Additional improvements include removing the Engle Road Bridge over I-40 and removing the eastern ramps at the I-40 and Industrial Boulevard Interchange. The Engle Road Bridge is no longer in service and will be removed to accommodate the proposed Douglas Boulevard SPUI. The removal of the eastern ramps on the Industrial Boulevard Interchange reduces the access to and from I-40. The existing ramp configuration between the Industrial Boulevard and Douglas Boulevard Interchanges contains inadequate merge and diverge spacing between the interchanges. Due to the close proximity of the two interchanges, traffic that once utilized the eastern ramps on the Industrial Boulevard Interchange can utilize the Douglas Boulevard





LEGEND

	R/W		PROPOSED ROADWAY
	PRES. R/W		PROPOSED BRIDGE
	RETAINING WALL		FUTURE PROJECT
	REMOVE RAMP		FLOOD HAZARD AREA ZONE A

THIS DOCUMENT IS PRELIMINARY
IN NATURE AND IS NOT A FINAL,
SIGNED AND SEALED DOCUMENT.

EXHIBIT 3

Design Feature	I-40		Douglas Blvd.		Ramps	
<u>Functional Classification</u>	Interstate Highway		Urban Principal Arterial		Diamond	
<u>Design Speed (mph)</u>	60		45		50	
<u>ADT</u>						
Existing (2017)	58,500		28,100		9,600	
Future (2045)	84,600		48,000		16,400	
% Trucks (AADT)	15%		5%		4%	
	ODOT/ AASHTO	PROJECT SPECIFIC	ODOT/ AASHTO	PROJECT SPECIFIC	ODOT/ AASHTO	PROJECT SPECIFIC
<u>Stopping Sight Distance (K factor)</u>						
Crest	151	200	61	167	84	105
Sag	136	139	79	80	96	98
<u>Grades</u>						
Desirable Maximum-Level Terrain	3.00%	3.00%	6.00%	4.50%	5.00%	4.68%
Desirable Minimum-Level Terrain (Des/Min)	0.5/0.0%	0.50%	0.5/0.4%	0.40%	0.5/0.0%	0.97%
<u>Horizontal Curves</u>						
Min Radius	1,330'	3,830'	643'	N/A	833'	2,500'
Min Radius w/o Super	11,100'	N/A	6,480'	N/A	7,870'	N/A
<u>Pavement Cross-Slope</u>						
Mainline	2%	2%	2%	2%	2%	2%
Shoulders	4%	4%	2%	2%	2%	2%
<u>Maximum Superelevation Rate</u>	E _{MAX} = 6%	E _{MAX} = 6%	LOW SPEED URBAN	LOW SPEED URBAN	E _{MAX} = 6%	E _{MAX} = 6%
<u>Superelevation (E_s)</u>	3.8%	3.8%	NC	NC	3.8%	3.8%
<u>Lane Widths</u>	12'	12'	12'	12'	15'	15'
<u>Shoulder Widths</u>	10'	10'	2'	2'	8'	8'
<u>Horizontal Clearance (Clear Zone)</u>						
Desirable Minimum W/ 6:1	30'-32'	30'	20'-22'	20'	20'-22'	20'
Desirable Minimum W/ 4:1 to 5:1	36'-44'	N/A	24'-28'	N/A	24'-28'	N/A
<u>Approach Taper Rate (Intersection)</u>	V:1	N/A	V:1	45:1	V:1	N/A
<u>Bay Taper Length (Intersection)</u>	15:1	N/A	10:1	10:1	10:1	10:1
<u>Departure Taper Rate (Intersection)</u>	V:1	N/A	V:1	45:1	V:1	N/A
<u>Intersection Sight Distances</u>	N/A	N/A	430'	430'	N/A	N/A
<u>Decision Sight Distance</u>						
Desirable Avoidance Maneuver A	610'	627'	395'	675'	465'	750'
Desirable Avoidance Maneuver C	990'		675'		750'	
<u>Horizontal Sight Offset</u>	11'	21.5'	N/A	N/A	4'	15'
<u>Acceleration Length</u>						
V=50 mph to V=60 mph	180'	507'	N/A	N/A	180'	507'
<u>Deceleration Length</u>						
V=60 mph to V=50 mph	240'	400'	N/A	N/A	240'	400'

EXHIBIT 4: DESIGN CRITERIA FOR I-40 AND DOUGLAS BOULEVARD INTERCHANGE

Interchange (approximately 0.5 miles east) or the Town Center Drive Interchange (approximately 1-mile west). Advance warning of the I-40 access changes will be reflected in the proposed signage for the interchange as shown on Exhibit 5.

General project extents for I-40 run from a transition beginning just west of Industrial Boulevard extending east to approximately 2,800' east of Douglas Boulevard. The existing lane configuration consists of two lanes in each direction near Douglas Boulevard. The proposed improvements will add an additional lane in each direction that lines up with other future lane widening projects along I-40. Douglas Boulevard project extents run from 1,400' south of I-40 extending north to the south edge of S.E. 29th Street. The lane configuration will widen to six driving lanes with additional turn lanes near the interchange. The improvements are within compliance of the coordination of lane balance and with basic number of lanes, see Exhibit 6.

1.2 TRAFFIC STUDY

Triad Design Group hired Traffic Engineering Consultants, Inc. (TEC) to conduct a traffic study for the I-40 and Douglas Boulevard project. TEC worked closely with the Oklahoma Department of Transportation (ODOT) in collecting the necessary traffic counts and developing the 2017 and 2045 traffic data for both the existing cloverleaf configuration and the proposed SPUI. ODOT approved the 2017 raw traffic data on October 19, 2017. To meet the FHWA/ODOT agreement that traffic data used for operational analysis should not be more than two years old, ODOT has verified that August 2018 ramp counts can be assumed to be consistent with the 2017 ramp counts. TEC also conducted an operational analysis for intersections within the study area for 2017 and 2045 traffic conditions for both the existing configuration and the proposed interchange improvements. The *Operational Analysis* Report, including the intersection operational analyses and freeway capacity analyses, is located in Appendix B.

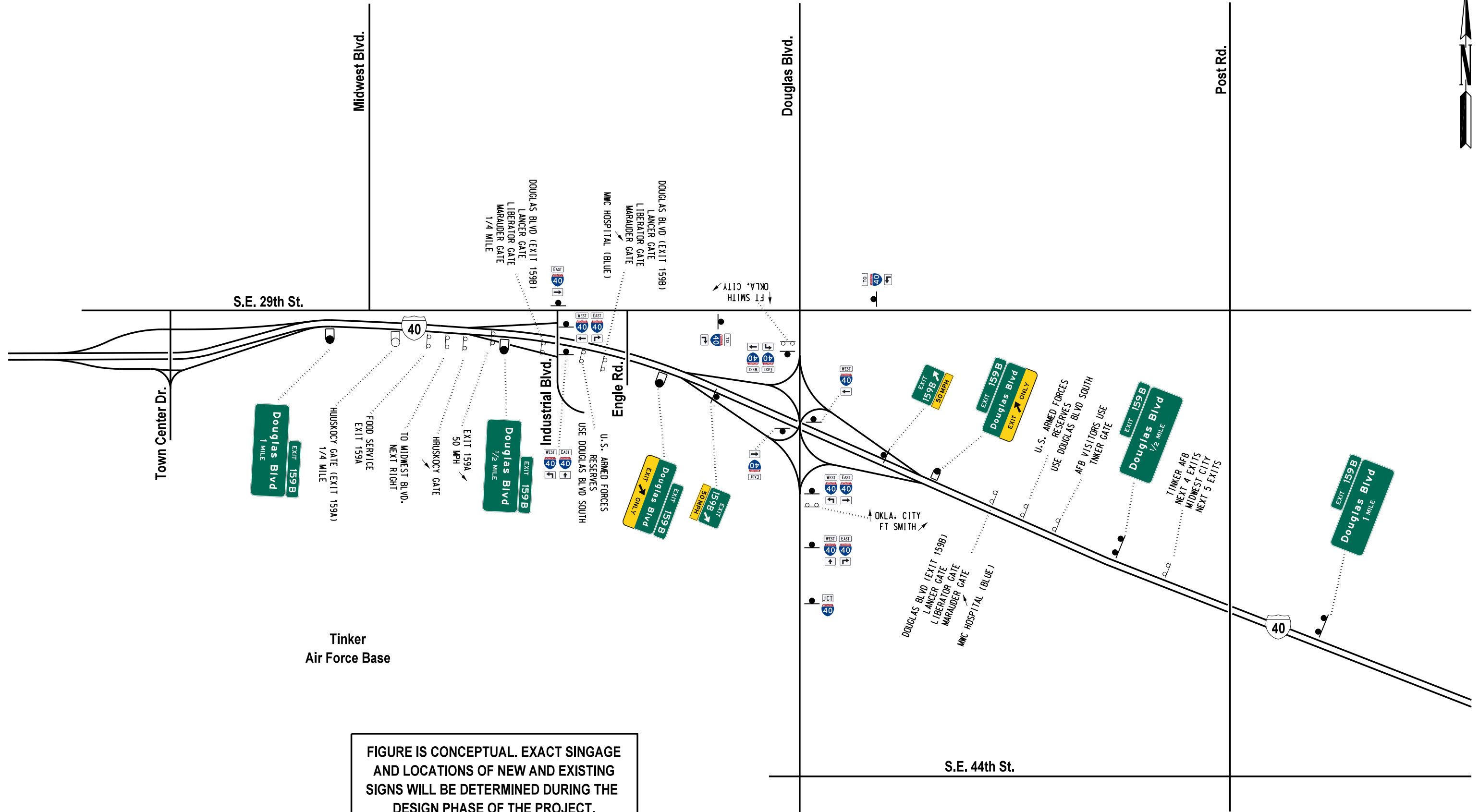
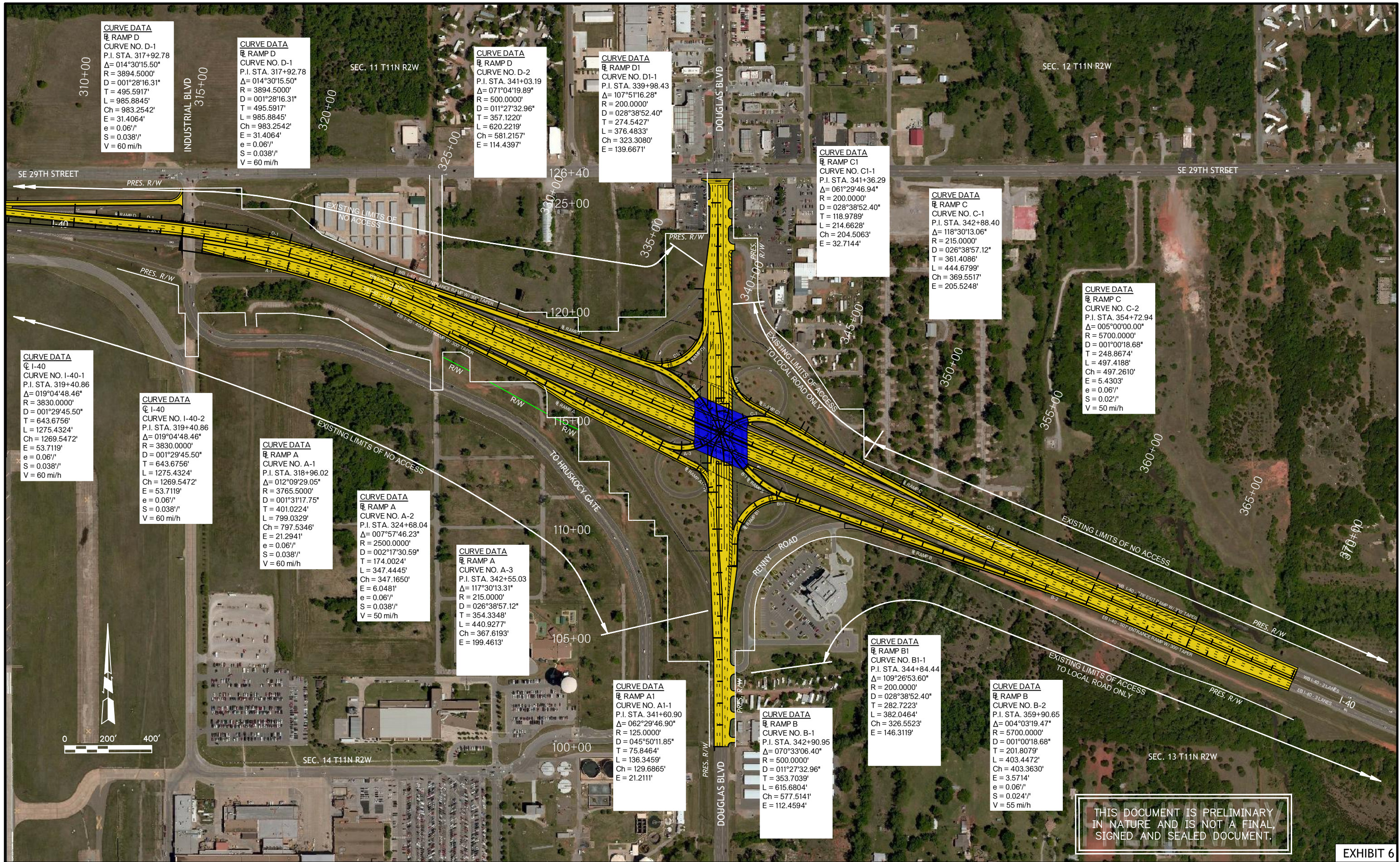


FIGURE IS CONCEPTUAL. EXACT SINGAGE AND LOCATIONS OF NEW AND EXISTING SIGNS WILL BE DETERMINED DURING THE DESIGN PHASE OF THE PROJECT.



EXHIBIT 5. Proposed Signage I-40 & Douglas Blvd.



CURVE DATA
 RAMP D
 CURVE NO. D-1
 P.I. STA. 317+92.78
 $\Delta = 014^{\circ}30'15.50''$
 $R = 3894.5000'$
 $D = 001^{\circ}28'16.31''$
 $T = 495.5917'$
 $L = 985.8845'$
 $Ch = 983.2542'$
 $E = 31.4064'$
 $e = 0.06''$
 $S = 0.038''$
 $V = 60 \text{ mi/h}$

CURVE DATA
 RAMP D
 CURVE NO. D-1
 P.I. STA. 317+92.78
 $\Delta = 014^{\circ}30'15.50''$
 $R = 3894.5000'$
 $D = 001^{\circ}28'16.31''$
 $T = 495.5917'$
 $L = 985.8845'$
 $Ch = 983.2542'$
 $E = 31.4064'$
 $e = 0.06''$
 $S = 0.038''$
 $V = 60 \text{ mi/h}$

CURVE DATA
 RAMP D
 CURVE NO. D-2
 P.I. STA. 341+03.19
 $\Delta = 071^{\circ}04'19.89''$
 $R = 500.0000'$
 $D = 011^{\circ}27'32.96''$
 $T = 357.1220'$
 $L = 620.2219'$
 $Ch = 581.2157'$
 $E = 114.4397'$

CURVE DATA
 RAMP D1
 CURVE NO. D1-1
 P.I. STA. 339+98.43
 $\Delta = 107^{\circ}51'16.28''$
 $R = 200.0000'$
 $D = 028^{\circ}38'52.40''$
 $T = 274.5427'$
 $L = 376.4833'$
 $Ch = 323.3080'$
 $E = 139.6671'$

CURVE DATA
 RAMP C1
 CURVE NO. C1-1
 P.I. STA. 341+36.29
 $\Delta = 061^{\circ}29'46.94''$
 $R = 200.0000'$
 $D = 028^{\circ}38'52.40''$
 $T = 118.9789'$
 $L = 214.6628'$
 $Ch = 204.5063'$
 $E = 32.7144'$

CURVE DATA
 RAMP C
 CURVE NO. C-1
 P.I. STA. 342+88.40
 $\Delta = 118^{\circ}30'13.06''$
 $R = 215.0000'$
 $D = 026^{\circ}38'57.12''$
 $T = 361.4086'$
 $L = 444.6799'$
 $Ch = 369.5517'$
 $E = 205.5248'$

CURVE DATA
 RAMP C
 CURVE NO. C-2
 P.I. STA. 354+72.94
 $\Delta = 005^{\circ}00'00.00''$
 $R = 5700.0000'$
 $D = 001^{\circ}00'18.68''$
 $T = 248.8674'$
 $L = 497.4188'$
 $Ch = 497.2610'$
 $E = 5.4303'$
 $e = 0.06''$
 $S = 0.02''$
 $V = 50 \text{ mi/h}$

CURVE DATA
 I-40
 CURVE NO. I-40-1
 P.I. STA. 319+40.86
 $\Delta = 019^{\circ}04'48.46''$
 $R = 3830.0000'$
 $D = 001^{\circ}29'45.50''$
 $T = 643.6756'$
 $L = 1275.4324'$
 $Ch = 1269.5472'$
 $E = 53.7119'$
 $e = 0.06''$
 $S = 0.038''$
 $V = 60 \text{ mi/h}$

CURVE DATA
 I-40
 CURVE NO. I-40-2
 P.I. STA. 319+40.86
 $\Delta = 019^{\circ}04'48.46''$
 $R = 3830.0000'$
 $D = 001^{\circ}29'45.50''$
 $T = 643.6756'$
 $L = 1275.4324'$
 $Ch = 1269.5472'$
 $E = 53.7119'$
 $e = 0.06''$
 $S = 0.038''$
 $V = 60 \text{ mi/h}$

CURVE DATA
 RAMP A
 CURVE NO. A-1
 P.I. STA. 318+96.02
 $\Delta = 012^{\circ}09'29.05''$
 $R = 3765.5000'$
 $D = 001^{\circ}31'17.75''$
 $T = 401.0224'$
 $L = 799.0329'$
 $Ch = 797.5346'$
 $E = 21.2941'$
 $e = 0.06''$
 $S = 0.038''$
 $V = 60 \text{ mi/h}$

CURVE DATA
 RAMP A
 CURVE NO. A-2
 P.I. STA. 324+68.04
 $\Delta = 007^{\circ}57'46.23''$
 $R = 2500.0000'$
 $D = 002^{\circ}17'30.59''$
 $T = 174.0024'$
 $L = 347.4445'$
 $Ch = 347.1650'$
 $E = 6.0481'$
 $e = 0.06''$
 $S = 0.038''$
 $V = 50 \text{ mi/h}$

CURVE DATA
 RAMP A
 CURVE NO. A-3
 P.I. STA. 342+55.03
 $\Delta = 117^{\circ}30'13.31''$
 $R = 215.0000'$
 $D = 026^{\circ}38'57.12''$
 $T = 354.3348'$
 $L = 440.9277'$
 $Ch = 367.6193'$
 $E = 199.4613'$

CURVE DATA
 RAMP A1
 CURVE NO. A1-1
 P.I. STA. 341+60.90
 $\Delta = 062^{\circ}29'46.90''$
 $R = 125.0000'$
 $D = 045^{\circ}50'11.85''$
 $T = 75.8464'$
 $L = 136.3459'$
 $Ch = 129.6865'$
 $E = 21.2111'$

CURVE DATA
 RAMP B
 CURVE NO. B-1
 P.I. STA. 342+90.95
 $\Delta = 070^{\circ}33'06.40''$
 $R = 500.0000'$
 $D = 011^{\circ}27'32.96''$
 $T = 353.7039'$
 $L = 615.6804'$
 $Ch = 577.5141'$
 $E = 112.4594'$

CURVE DATA
 RAMP B1
 CURVE NO. B1-1
 P.I. STA. 344+84.44
 $\Delta = 109^{\circ}26'53.60''$
 $R = 200.0000'$
 $D = 028^{\circ}38'52.40''$
 $T = 282.7223'$
 $L = 382.0464'$
 $Ch = 326.5523'$
 $E = 146.3119'$

CURVE DATA
 RAMP B
 CURVE NO. B-2
 P.I. STA. 359+90.65
 $\Delta = 004^{\circ}03'19.47''$
 $R = 5700.0000'$
 $D = 001^{\circ}00'18.68''$
 $T = 201.8079'$
 $L = 403.4472'$
 $Ch = 403.3630'$
 $E = 3.5714'$
 $e = 0.06''$
 $S = 0.024''$
 $V = 55 \text{ mi/h}$

THIS DOCUMENT IS PRELIMINARY
 IN NATURE AND IS NOT A FINAL,
 SIGNED AND SEALED DOCUMENT.

1.3 OPERATIONAL ANALYSIS – EXISTING CONFIGURATION (CLOVERLEAF INTERCHANGE)

To determine the effects a transportation network modification may have, capacity analysis of the existing transportation network must be conducted and compared to a capacity analysis of the future transportation network. The study area is shown in Exhibit 1. Capacity analyses were conducted for the 2017 and 2045 Design Traffic Data with the Douglas Boulevard cloverleaf interchange to determine the level-of-service for I-40, Town Center Drive, Industrial Boulevard, Douglas Boulevard, and Anderson Road. The design traffic data with the Douglas Boulevard cloverleaf interchange utilized for the capacity analysis is shown in Exhibits 7 and 9. The overall capacity analysis results for the existing transportation network conditions with I-40 widening for 2017 and 2045 traffic volumes are shown in Exhibits 8 and 10. Widening I-40 from four lanes to six lanes allows the existing transportation network to be compared to the proposed interchange improvements solely in regard to the change in access. Printouts for all capacity analyses are located in Appendix B.

The latest edition of the *Highway Capacity Manual* was used for all freeway, ramp merge/diverge, and street traffic capacity analyses. The intersections were analyzed using *Synchro 10.0* and evaluated with the methodology of the latest edition of the *Highway Capacity Manual*.

Analyses of the existing transportation network with I-40 widening for 2017 traffic data, as shown in Exhibit 8, indicate the intersections operating at a level-of-service E or better, with the I-40 freeway and the I-40 ramp merge and diverge locations operating at a level-of-service C or better in 2017. Analyses of the existing transportation network with I-40 widening for 2045 traffic data, as shown in Exhibit 10, indicate the intersections operating at a level-of-service F or better, with the I-40 freeway and the I-40 ramp merge and diverge locations operating at a level-of-service F in 2045.

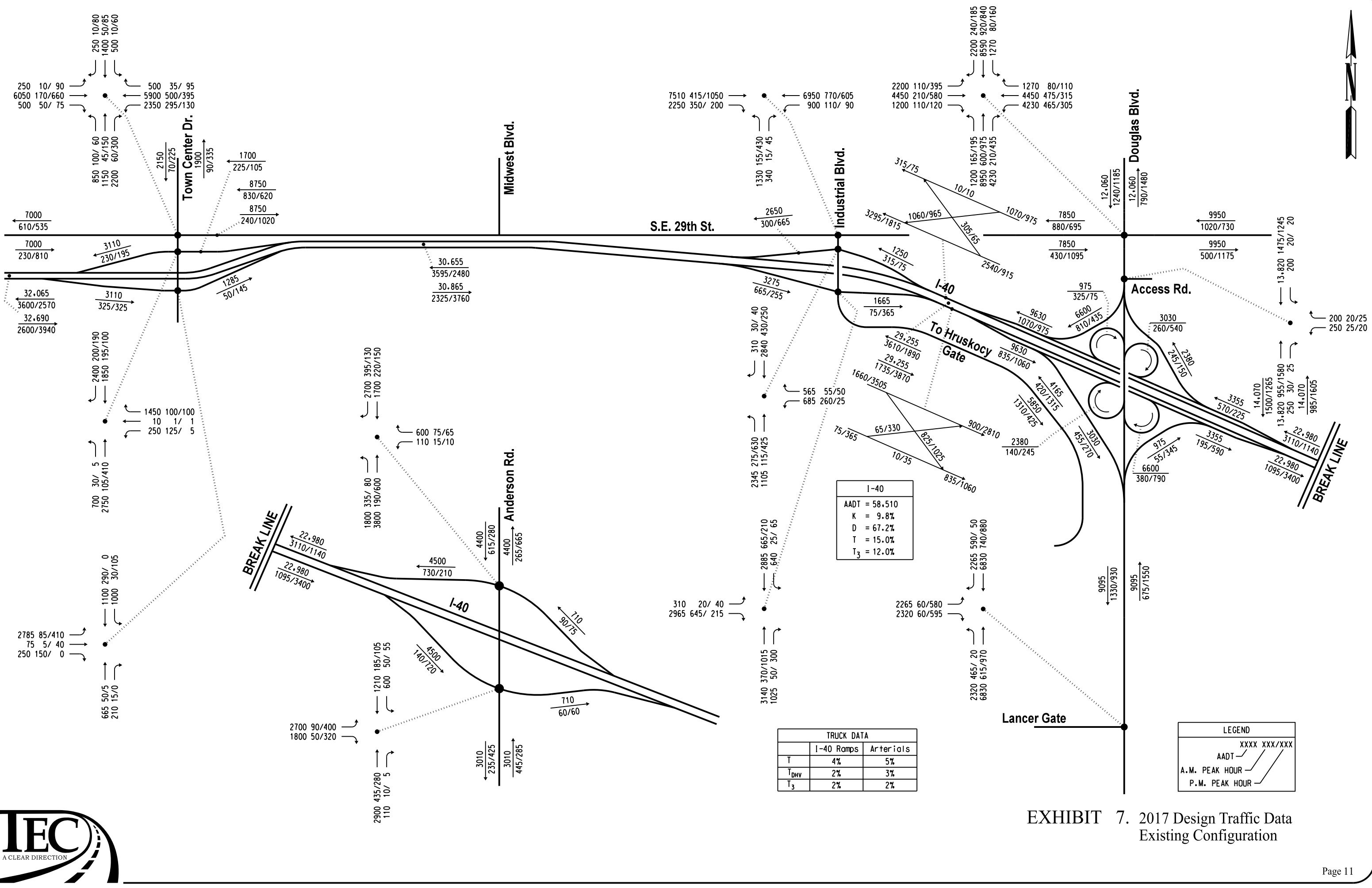
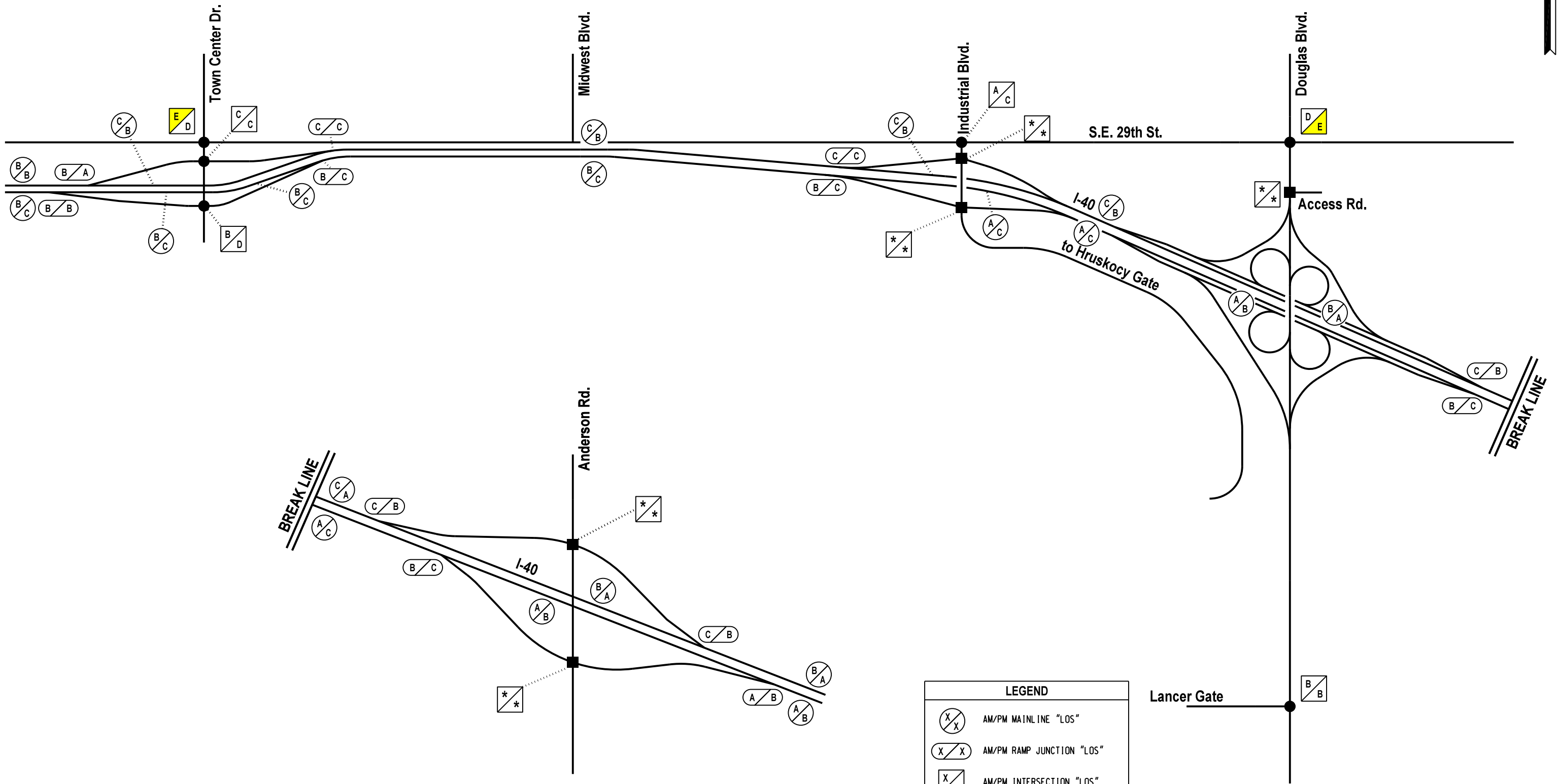


EXHIBIT 7. 2017 Design Traffic Data Existing Configuration



04/03/18 G:\OP\Projects\17-228\B2-05 I-40 & Douglas. Task 10\CAD\EXHIBIT 8 2017 EXIST.dgn



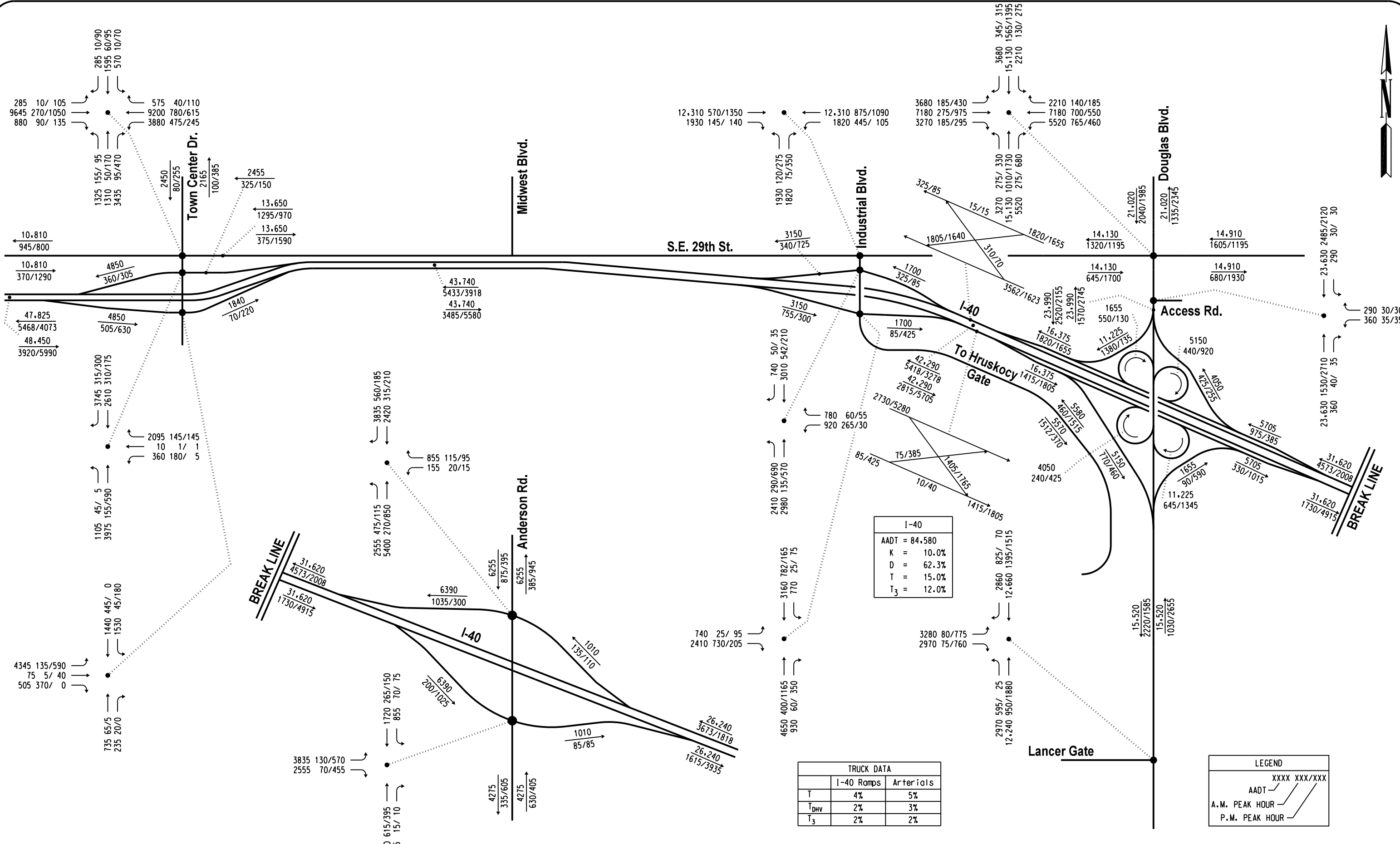
LEGEND	
	AM/PM MAINLINE "LOS"
	AM/PM RAMP JUNCTION "LOS"
	AM/PM INTERSECTION "LOS"
	SIGNALIZED INTERSECTION
	UN-SIGNALIZED INTERSECTION
	"LOS" NOT AVAILABLE FOR UNSIGNALIZED INTERSECTION

Lancer Gate

EXHIBIT 8. 2017 Levels - of - Service Existing Configuration with 6-Lanes on I-40



1/30/2008 G:\OP\Projects\1-228\B2-B5 I-40 & Douglas Task 10\CAD\TRM STUDY PAGES\EXHIBIT 9.dgn



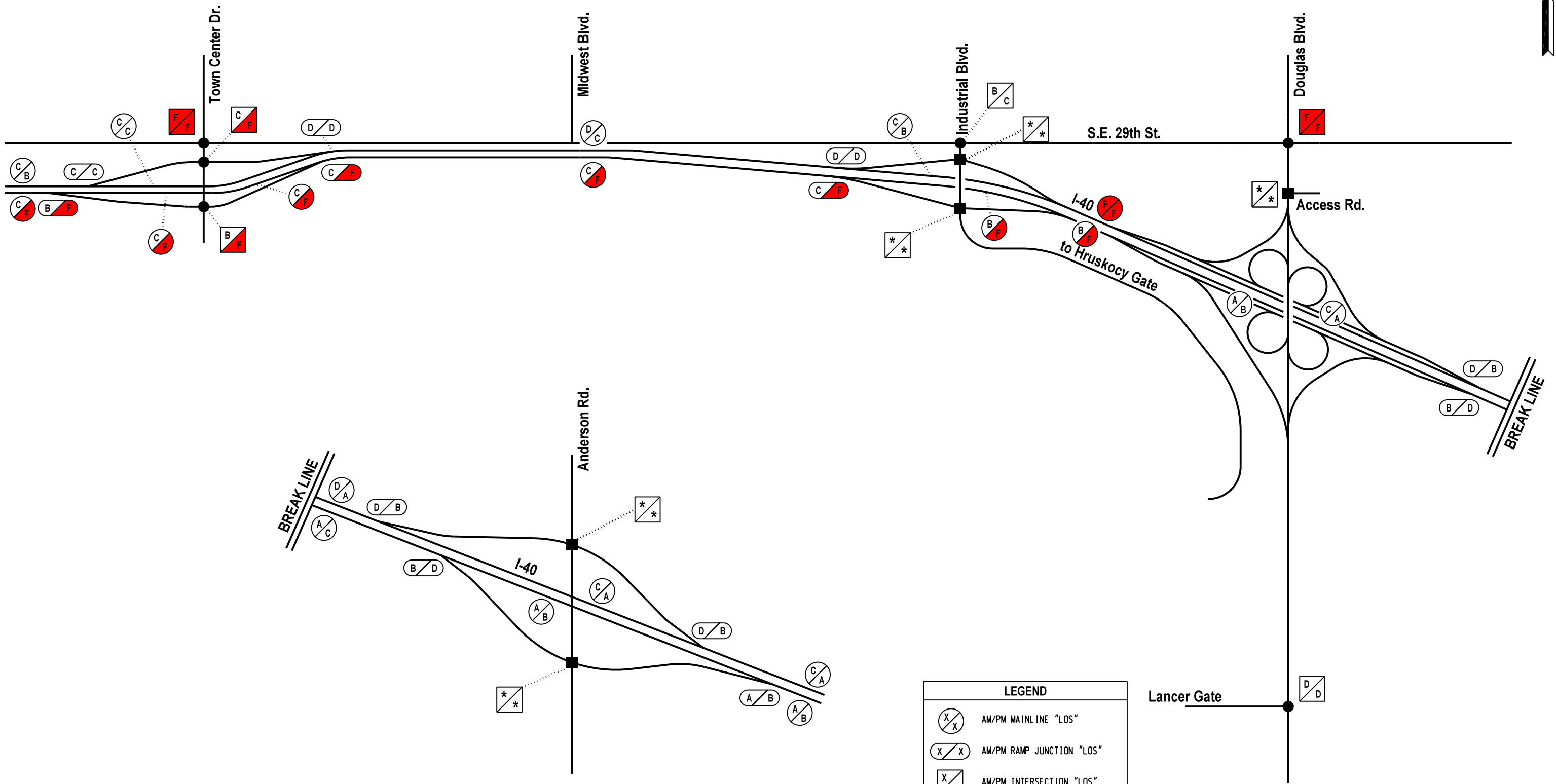
I-40	
AADT	= 84,580
K	= 10.0%
D	= 62.3%
T	= 15.0%
T ₃	= 12.0%

TRUCK DATA		
	I-40 Ramps	Arterials
T	4%	5%
T _{DHV}	2%	3%
T ₃	2%	2%

LEGEND	
XXXX XXX/XXX	AADT
—	A.M. PEAK HOUR
—	P.M. PEAK HOUR

EXHIBIT 9. 2045 Design Traffic Data Existing Configuration





LEGEND	
	AM/PM MAINLINE "LOS"
	AM/PM RAMP JUNCTION "LOS"
	AM/PM INTERSECTION "LOS"
	SIGNALIZED INTERSECTION
	UN-SIGNALIZED INTERSECTION
	"LOS" NOT AVAILABLE FOR UNSIGNALIZED INTERSECTION

EXHIBIT 10. 2045 Levels - of - Service Existing Configuration with 6-lanes on I-40



1.4 OPERATIONAL ANALYSIS – FUTURE CONFIGURATION (SPUI)

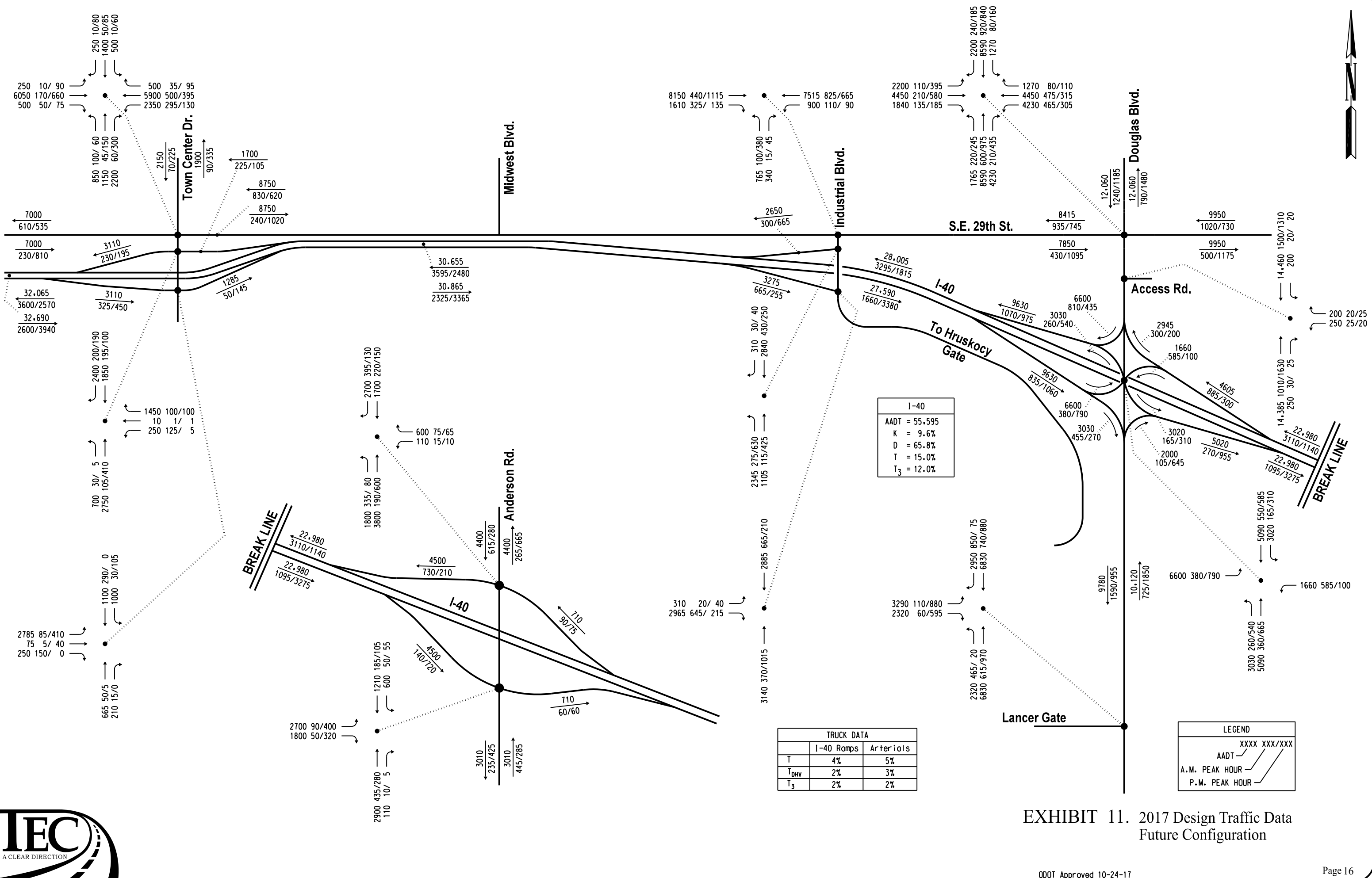
Capacity analyses were conducted for the 2017 and 2045 Design Traffic Data with the Douglas Boulevard SPUI to determine the level-of-service for I-40, Town Center Drive, Industrial Boulevard, Douglas Boulevard, and Anderson Road. The design traffic data with the Douglas Boulevard SPUI utilized for the capacity analysis is shown in Exhibits 11 and 13. The overall capacity analysis results for future transportation network conditions for 2017 and 2045 traffic volumes are shown in Exhibits 12 and 14. Printouts for all capacity analyses are located in Appendix B.

Analyses of the future transportation network for 2017 traffic data, as shown in Exhibit 12, indicate the intersections operating at a level-of-service E or better, with the I-40 freeway and the I-40 ramp merge and diverge locations operating at a level-of-service C or better in 2017. Analyses of the future transportation network for 2045 traffic data, as shown in Exhibit 14, indicate the intersections operating at a level-of-service F or better, with the I-40 freeway and the I-40 ramp merge and diverge locations operating at a level-of-service F or better in 2045.

An intersection delay comparison between the existing cloverleaf interchange configuration with I-40 widening and the future SPUI configuration is located in Exhibit 15 for the design year 2017 and Exhibit 16 for the design year 2045. A freeway segment comparison between the existing cloverleaf interchange configuration with I-40 widening and the future SPUI configuration is located in Exhibit 17 for the design year 2017 and Exhibit 18 for the design year 2045. A freeway segment comparison between the existing cloverleaf interchange configuration without I-40 widening and the future SPUI configuration for the design years 2017 and 2045 is located in Appendix C.

Overall, the intersection delay comparison results, displayed in Exhibits 15 and 16, reveal two generalities. First, the future SPUI configuration generates improvement to the intersection delay along Industrial Boulevard for both signalized and unsignalized intersections. Second, the total signalized delay is an average 40% greater with the future SPUI configuration. The increase may be attributed to the addition of four signals and the additional traffic from the removed Industrial Boulevard ramps displaced onto Douglas Boulevard.

The 2017 freeway facilities comparison results, summarized in Exhibit 17, display several modest improvements to the I-40 freeway and the I-40 ramp merge and diverge locations with the future SPUI configuration in comparison to the existing cloverleaf interchange configuration with I-40 widening. The 2045 freeway facilities comparison results, summarized in Exhibit 18, display improvements in level-of-service at the weaving segment between Industrial Boulevard and Douglas Boulevard.



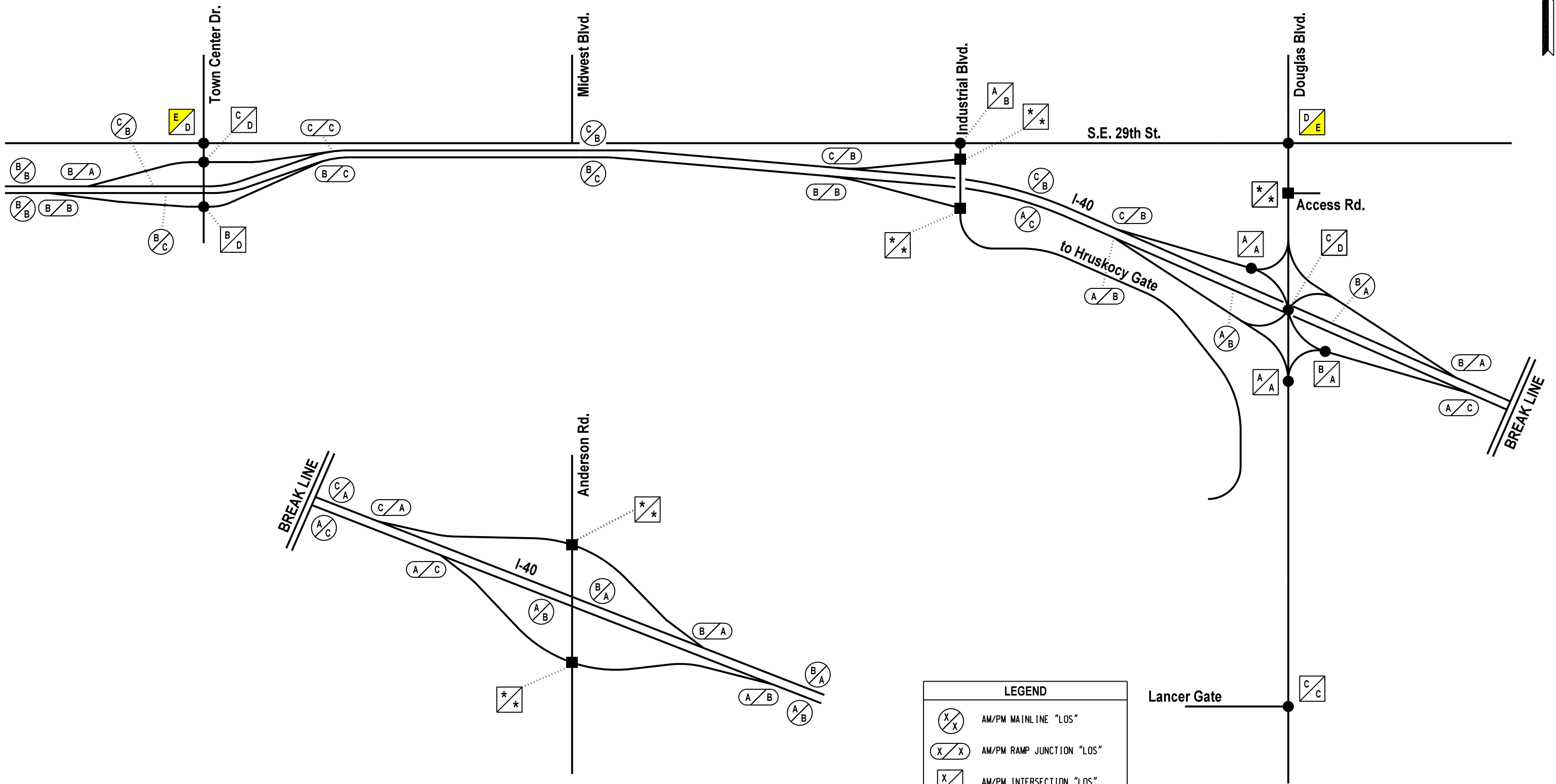
I-40	
AADT	= 55,595
K	= 9.6%
D	= 65.8%
T	= 15.0%
T ₃	= 12.0%

TRUCK DATA		
	I-40 Ramps	Arterials
T	4%	5%
T _{DHV}	2%	3%
T ₃	2%	2%

LEGEND	
XXXX XXX/XXX	AADT
—	A.M. PEAK HOUR
—	P.M. PEAK HOUR

EXHIBIT 11. 2017 Design Traffic Data Future Configuration





LEGEND	
	AM/PM MAINLINE "LOS"
	AM/PM RAMP JUNCTION "LOS"
	AM/PM INTERSECTION "LOS"
	SIGNALIZED INTERSECTION
	UN-SIGNALIZED INTERSECTION
	"LOS" NOT AVAILABLE FOR UNSIGNALIZED INTERSECTION

EXHIBIT 12. 2017 Levels - of - Service Future Configuration



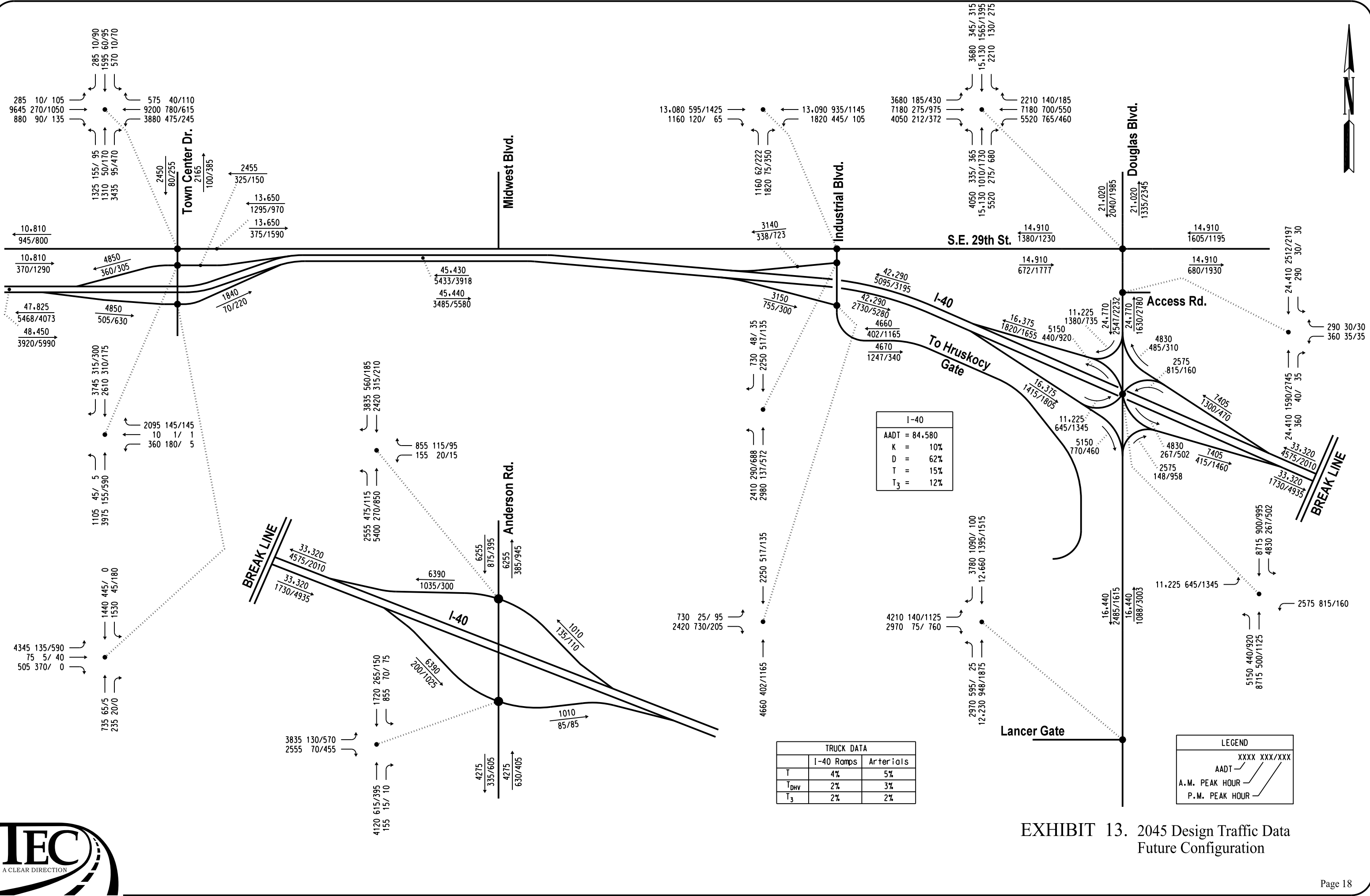


EXHIBIT 13. 2045 Design Traffic Data Future Configuration



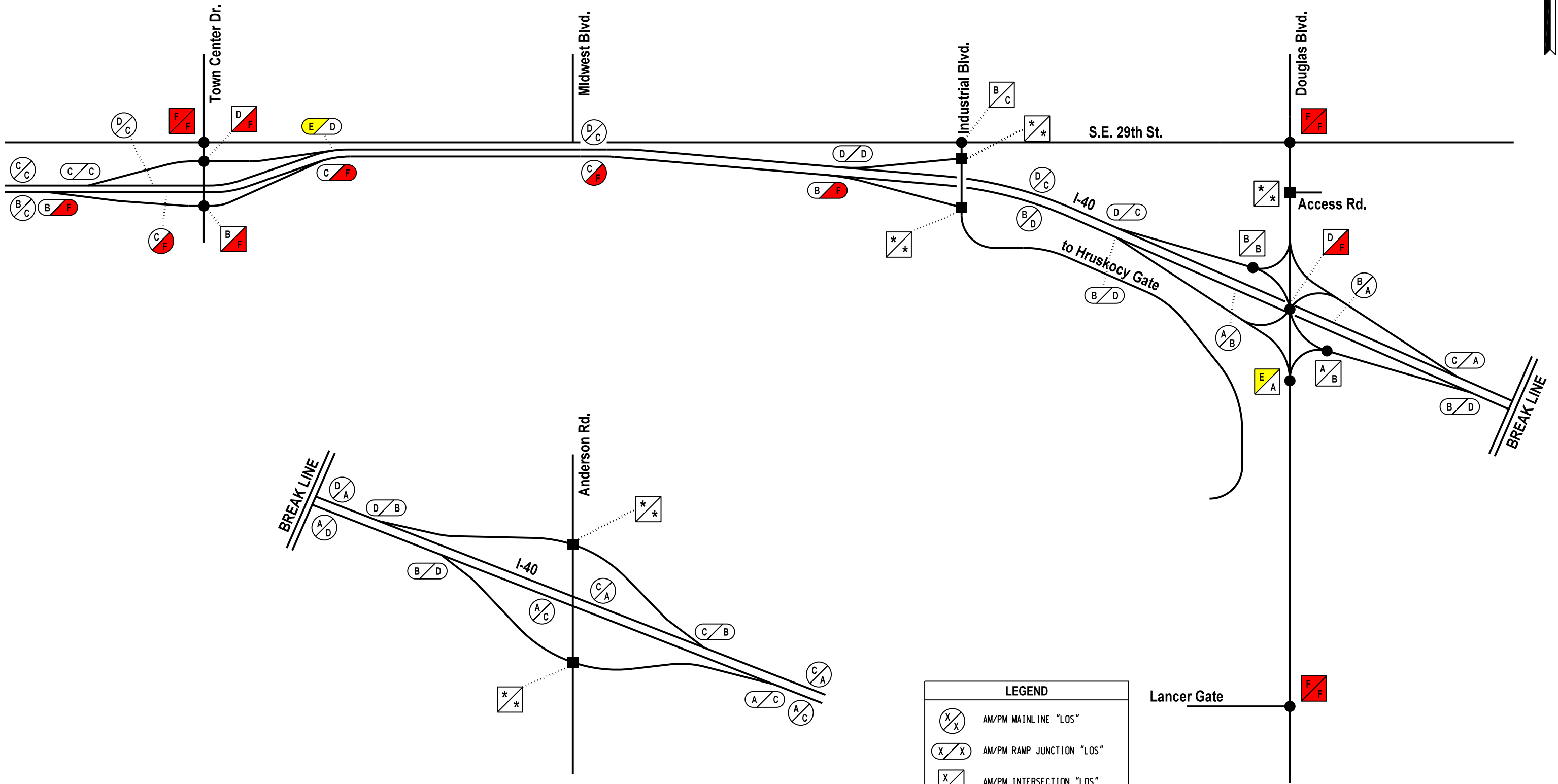


EXHIBIT 14. 2045 Levels - of - Service Future Configuration



Intersection Delay: 2017 AM Peak									
Intersections	Existing Geometry				Future Geometry				
	Delay (sec/veh)	LOS	Delay (veh-hr)	Delay (sec/veh)	LOS	Delay (veh-hr)	Delay (sec/veh)	LOS	Delay (veh-hr)
Signalized Intersections									
Town Center Dr. & S. E. 29th St.	64	E	23.6	62	E	22.9			
Town Center Dr. & I-40 WB Ramps	21	C	4.4	27	C	5.7			
Town Center Dr. & I-40 EB Ramps	15	B	2.5	15	B	2.5			
Industrial Blvd. & S.E. 29th St.	7	A	3.6	6	A	2.9			
Douglas Blvd. & S.E. 29th St.	44	D	44.6	45	D	46.9			
Douglas Blvd. & SPUJ Intersection	Does Not Exist								
Douglas Blvd. SBR to I-40 WB Ramp									
Douglas Blvd. NBR to I-40 EB Ramp									
Douglas Blvd. & I-40 Off Ramp EBR									
Douglas Blvd. & Lancer Gate									
Total Signalized Delay (veh-hr)	19	B	13.1	34	C	27.0			135
Unsignalized Intersections									
(Critical Approach (sec/veh) & Overall Intersection (veh-hr))									
Industrial Blvd. & I-40 WB Ramps	ERROR	F	ERROR	7	A	0.8			
Industrial Blvd. & I-40 EB Ramps	ERROR	F	ERROR	ERROR	F	ERROR			
Douglas Blvd. & Access Rd.	39	E	0.6	17	C	0.4			
Anderson Rd. & I-40 WB Ramps	17	C	1.5	17	C	1.5			
Anderson Rd. & I-40 EB Ramps	20	C	0.9	20	C	0.9			
Total Unsignalized Delay (veh-hr)					3 *				4 *
Intersection Delay: 2017 PM Peak									
Intersections	Existing Geometry				Future Geometry				
	Delay (sec/veh)	LOS	Delay (veh-hr)	Delay (sec/veh)	LOS	Delay (veh-hr)	Delay (sec/veh)	LOS	Delay (veh-hr)
Signalized Intersections									
Town Center Dr. & S. E. 29th St.	42	D	25.2	41	D	25.1			
Town Center Dr. & I-40 WB Ramps	35	C	7.8	36	D	8.1			
Town Center Dr. & I-40 EB Ramps	50	D	7.7	50	D	7.7			
Industrial Blvd. & S.E. 29th St.	22	C	14.6	19	B	12.8			
Douglas Blvd. & S.E. 29th St.	64	E	82.4	68	E	89.6			
Douglas Blvd. & SPUJ Intersection	Does Not Exist								
Douglas Blvd. SBR to I-40 WB Ramp									
Douglas Blvd. NBR to I-40 EB Ramp									
Douglas Blvd. & I-40 Off Ramp EBR									
Douglas Blvd. & Lancer Gate									
Total Signalized Delay (veh-hr)	16	B	13.5	20	C	19.3			204
Unsignalized Intersections									
(Critical Approach (sec/veh) & Overall Intersection (veh-hr))									
Industrial Blvd. & I-40 WB Ramps	ERROR	F	ERROR	7	A	2.1			
Industrial Blvd. & I-40 EB Ramps	14	B	1.4	13	B	0.9			
Douglas Blvd. & Access Rd.	193	F	2.7	15	C	0.4			
Anderson Rd. & I-40 WB Ramps	16	C	0.5	16	C	0.5			
Anderson Rd. & I-40 EB Ramps	203	F	40.7	203	F	40.7			
Total Unsignalized Delay (veh-hr)					45 *				45

*Delays for some intersections not able to be calculated. Total delay likely to be higher.

EXHIBIT 15: INTERSECTION DELAY - 2017

Intersection Delay: 2045 AM Peak									
Intersections	Existing Geometry				Future Geometry				
	Delay (sec/veh)	LOS	Delay (veh-hr)	Delay (sec/veh)	LOS	Delay (veh-hr)	Delay (sec/veh)	LOS	Delay (veh-hr)
Signalized Intersections									
Town Center Dr. & S. E. 29th St.	108	F	61.1	95	F	54.0			
Town Center Dr. & I-40 WB Ramps	28	C	8.9	52	D	16.8			
Town Center Dr. & I-40 EB Ramps	17	B	5.0	17	B	5.0			
Industrial Blvd. & S.E. 29th St.	16	B	10.0	12	B	7.6			
Douglas Blvd. & S.E. 29th St.	140	F	226.7	149	F	244.9			
Douglas Blvd. & SPUJ Intersection				45	D	44.6			
Douglas Blvd. SBR to I-40 WB Ramp			Does Not Exist	13	B	6.7			
Douglas Blvd. NBR to I-40 EB Ramp				3	A	0.4			
Douglas Blvd. & I-40 Off Ramp EBR				67	E	66.0			
Douglas Blvd. & Lancer Gate	51	D	55.8	85	F	100.3			
Total Signalized Delay (veh-hr)					367				
Unsignalized Intersections									
(Critical Approach (sec/veh) & Overall Intersection (veh-hr))									
Industrial Blvd. & I-40 WB Ramps	ERROR	F	ERROR	7	A	0.9			
Industrial Blvd. & I-40 EB Ramps	ERROR	F	ERROR	ERROR	F	ERROR			
Douglas Blvd. & Access Rd.	ERROR	F	ERROR	47	E	1.6			
Anderson Rd. & I-40 WB Ramps	97	F	6.6	97	F	6.6			
Anderson Rd. & I-40 EB Ramps	83	F	4.8	83	F	4.8			
Total Unsignalized Delay (veh-hr)					11 *				
Signalized Intersections									
(Critical Approach (sec/veh) & Overall Intersection (veh-hr))									
Industrial Blvd. & I-40 WB Ramps	ERROR	F	ERROR	6	A	2.1			
Industrial Blvd. & I-40 EB Ramps	25	D	2.6	14	B	1.2			
Douglas Blvd. & Access Rd.	ERROR	F	ERROR	ERROR	F	ERROR			
Anderson Rd. & I-40 WB Ramps	31	D	1.2	31	D	1.2			
Anderson Rd. & I-40 EB Ramps	ERROR	F	ERROR	ERROR	F	ERROR			
Total Unsignalized Delay (veh-hr)					4 *				
Total Signalized Delay (veh-hr)					874				
Unsignalized Intersections									
(Critical Approach (sec/veh) & Overall Intersection (veh-hr))									
Town Center Dr. & S. E. 29th St.	151	F	136.0	139	F	125.5			
Town Center Dr. & I-40 WB Ramps	81	F	27.4	100	F	34.0			
Town Center Dr. & I-40 EB Ramps	137	F	31.1	137	F	31.1			
Industrial Blvd. & S.E. 29th St.	22	C	20.6	21	C	19.1			
Douglas Blvd. & S.E. 29th St.	276	F	584.6	289	F	620.1			
Douglas Blvd. & SPUJ Intersection				121	F	170.1			
Douglas Blvd. SBR to I-40 WB Ramp			Does Not Exist	13	B	6.0			
Douglas Blvd. NBR to I-40 EB Ramp				10	B	4.2			
Douglas Blvd. & I-40 Off Ramp EBR				7	A	8.3			
Douglas Blvd. & Lancer Gate	53	D	74.1	80	F	120.2			
Total Signalized Delay (veh-hr)					874				

EXHIBIT 16: INTERSECTION DELAY - 2045

*Delays for some intersections not able to be calculated. Total delay likely to be higher.

Freeway Facilities: 2017 AM Peak - Westbound			
Existing Configuration - Extra L40 Lane		Future Configuration	
Segment	Type	LOS	Segment
Study Limit to Anderson Off	Basic	B	Study Limit to Anderson Off
Anderson Off	Diverge	C	Anderson Off
Anderson Off to Anderson On	Basic	B	Anderson Off to Anderson On
Anderson On	Merge	C	Anderson On
Anderson On to Douglas Off	Basic	C	Anderson On to Douglas Off
Douglas Off	Diverge	C	Douglas Off
Douglas Off to Douglas On	Basic	B	Douglas Off to Douglas On
Douglas On to Industrial Off	Weaving	C	Douglas On
Industrial Off to Industrial On	Basic	C	Douglas On to Industrial On
Industrial On	Merge	C	Industrial On
Industrial On to Town Center Off	Basic	C	Industrial On to Town Center Off
Town Center Off	Diverge	C	Town Center Off
Town Center Off to Town Center On	Basic	C	Town Center Off to Town Center On
Town Center On	Merge	B	Town Center On
Town Center On to Study Limit	Basic	B	Town Center On to Study Limit

Freeway Facilities: 2017 PM Peak - Westbound			
Existing Configuration - Extra L40 Lane		Future Configuration	
Segment	Type	LOS	Segment
Study Limit to Anderson Off	Basic	A	Study Limit to Anderson Off
Anderson Off	Diverge	B	Anderson Off
Anderson Off to Anderson On	Basic	A	Anderson Off to Anderson On
Anderson On	Merge	B	Anderson On
Anderson On to Douglas Off	Basic	A	Anderson On to Douglas Off
Douglas Off	Diverge	B	Douglas Off
Douglas Off to Douglas On	Basic	A	Douglas Off to Douglas On
Douglas On to Industrial Off	Weaving	B	Douglas On
Industrial Off to Industrial On	Basic	B	Douglas On to Industrial On
Industrial On	Merge	C	Industrial On
Industrial On to Town Center Off	Basic	B	Industrial On to Town Center Off
Town Center Off	Diverge	C	Town Center Off
Town Center Off to Town Center On	Basic	B	Town Center Off to Town Center On
Town Center On	Merge	A	Town Center On
Town Center On to Study Limit	Basic	B	Town Center On to Study Limit

Freeway Facilities: 2017 AM Peak - Eastbound			
Existing Configuration - Extra L40 Lane		Future Configuration	
Segment	Type	LOS	Segment
Study Limit to Town Center Off	Basic	B	Study Limit to Town Center Off
Town Center Off	Diverge	B	Town Center Off
Town Center Off to Lane Drop	Basic	B	Town Center Off to Town Center On
Lane Drop to Town Center On	Basic	B	
Town Center On	Merge	B	Town Center On
Town Center On to Industrial Off	Basic	B	Town Center On to Industrial Off
Industrial Off	Diverge	B	Industrial Off
Industrial Off to Industrial On	Basic	A	Industrial Off to Douglas Off
Industrial On to Douglas Off	Weave	A	Douglas Off
Douglas Off to Douglas On	Basic	A	Douglas Off to Douglas On
Douglas On	Merge	B	Douglas On
Douglas On to Anderson Off	Basic	A	Douglas On to Anderson Off
Anderson Off	Diverge	B	Anderson Off
Anderson Off to Anderson On	Basic	A	Anderson Off to Anderson On
Anderson On	Merge	A	Anderson On
Anderson On to Study Limit	Basic	A	Anderson On to Study Limit

Freeway Facilities: 2017 PM Peak - Eastbound			
Existing Configuration - Extra L40 Lane		Future Configuration	
Segment	Type	LOS	Segment
Study Limit to Town Center Off	Basic	C	Study Limit to Town Center Off
Town Center Off	Diverge	B	Town Center Off
Town Center Off to Lane Drop	Basic	C	Town Center Off to Town Center On
Lane Drop to Town Center On	Basic	C	
Town Center On	Merge	C	Town Center On
Town Center On to Industrial Off	Basic	C	Town Center On to Industrial Off
Industrial Off	Diverge	C	Industrial Off
Industrial Off to Industrial On	Basic	C	Industrial Off to Douglas Off
Industrial On to Douglas Off	Weave	C	Douglas Off
Douglas Off to Douglas On	Basic	B	Douglas Off to Douglas On
Douglas On	Merge	C	Douglas On
Douglas On to Anderson Off	Basic	C	Douglas On to Anderson Off
Anderson Off	Diverge	C	Anderson Off
Anderson Off to Anderson On	Basic	B	Anderson Off to Anderson On
Anderson On	Merge	B	Anderson On
Anderson On to Study Limit	Basic	B	Anderson On to Study Limit

EXHIBIT 17: FREEWAY FACILITIES - 2017

Freeway Facilities: 2045 AM Peak - Westbound			
Existing Configuration - Extra 1-40 Lane		Future Configuration	
Segment	Type	LOS	Type
Study Limit to Anderson Off	Basic	C	Study Limit to Anderson Off
Anderson Off	Diverge	D	Anderson Off
Anderson Off to Anderson On	Basic	C	Anderson Off to Anderson On
Anderson On	Merge	D	Anderson On
Anderson On to Douglas Off	Basic	D	Anderson On to Douglas Off
Douglas Off	Diverge	D	Douglas Off
Douglas Off to Douglas On	Basic	C	Douglas Off to Douglas On
Douglas On to Industrial Off	Weaving	F	Douglas On
Industrial Off to Industrial On	Basic	C	Douglas On to Industrial On
Industrial On	Merge	D	Industrial On
Industrial On to Town Center Off	Basic	D	Industrial On to Town Center Off
Town Center Off	Diverge	D	Town Center Off
Town Center Off to Town Center On	Basic	C	Town Center Off to Town Center On
Town Center On	Merge	C	Town Center On
Town Center On to Study Limit	Basic	C	Town Center On to Study Limit

Freeway Facilities: 2045 PM Peak - Westbound			
Existing Configuration - Extra 1-40 Lane		Future Configuration	
Segment	Type	LOS	Type
Study Limit to Anderson Off	Basic	A	Study Limit to Anderson Off
Anderson Off	Diverge	B	Anderson Off
Anderson Off to Anderson On	Basic	A	Anderson Off to Anderson On
Anderson On	Merge	B	Anderson On
Anderson On to Douglas Off	Basic	A	Anderson On to Douglas Off
Douglas Off	Diverge	B	Douglas Off
Douglas Off to Douglas On	Basic	A	Douglas Off to Douglas On
Douglas On to Industrial Off	Weaving	F	Douglas On
Industrial Off to Industrial On	Basic	B	Douglas On to Industrial On
Industrial On	Merge	D	Industrial On
Industrial On to Town Center Off	Basic	C	Industrial On to Town Center Off
Town Center Off	Diverge	D	Town Center Off
Town Center Off to Town Center On	Basic	C	Town Center Off to Town Center On
Town Center On	Merge	C	Town Center On
Town Center On to Study Limit	Basic	B	Town Center On to Study Limit

Freeway Facilities: 2045 AM Peak - Eastbound			
Existing Configuration - Extra 1-40 Lane		Future Configuration	
Segment	Type	LOS	Type
Study Limit to Town Center Off	Basic	C	Study Limit to Town Center Off
Town Center Off	Diverge	B	Town Center Off
Town Center Off to Lane Drop	Basic	C	Town Center Off to Town Center On
Lane Drop to Town Center On	Basic	C	
Town Center On	Merge	C	Town Center On
Town Center On to Industrial Off	Basic	C	Town Center On to Industrial Off
Industrial Off	Diverge	C	Industrial Off
Industrial Off to Industrial On	Basic	B	Industrial Off to Douglas Off
Industrial On to Douglas Off	Weave	B	Douglas Off
Douglas Off to Douglas On	Basic	A	Douglas Off to Douglas On
Douglas On	Merge	B	Douglas On
Douglas On to Anderson Off	Basic	A	Douglas On to Anderson Off
Anderson Off	Diverge	B	Anderson Off
Anderson Off to Anderson On	Basic	A	Anderson Off to Anderson On
Anderson On	Merge	A	Anderson On
Anderson On to Study Limit	Basic	A	Anderson On to Study Limit

Freeway Facilities: 2045 PM Peak - Eastbound			
Existing Configuration - Extra 1-40 Lane		Future Configuration	
Segment	Type	LOS	Type
Study Limit to Town Center Off	Basic	F	Study Limit to Town Center Off
Town Center Off	Diverge	F	Town Center Off
Town Center Off to Lane Drop	Basic	F	Town Center Off to Town Center On
Lane Drop to Town Center On	Basic	F	
Town Center On	Merge	F	Town Center On
Town Center On to Industrial Off	Basic	F	Town Center On to Industrial Off
Industrial Off	Diverge	F	Industrial Off
Industrial Off to Industrial On	Basic	F	Industrial Off to Douglas Off
Industrial On to Douglas Off	Weave	F	Douglas Off
Douglas Off to Douglas On	Basic	B	Douglas Off to Douglas On
Douglas On	Merge	D	Douglas On
Douglas On to Anderson Off	Basic	C	Douglas On to Anderson Off
Anderson Off	Diverge	D	Anderson Off
Anderson Off to Anderson On	Basic	B	Anderson Off to Anderson On
Anderson On	Merge	B	Anderson On
Anderson On to Study Limit	Basic	B	Anderson On to Study Limit

EXHIBIT 18: FREEWAY FACILITIES - 2045

1.5 DOUGLAS BOULEVARD AND S.E. 29TH STREET INTERSECTION ANALYSIS

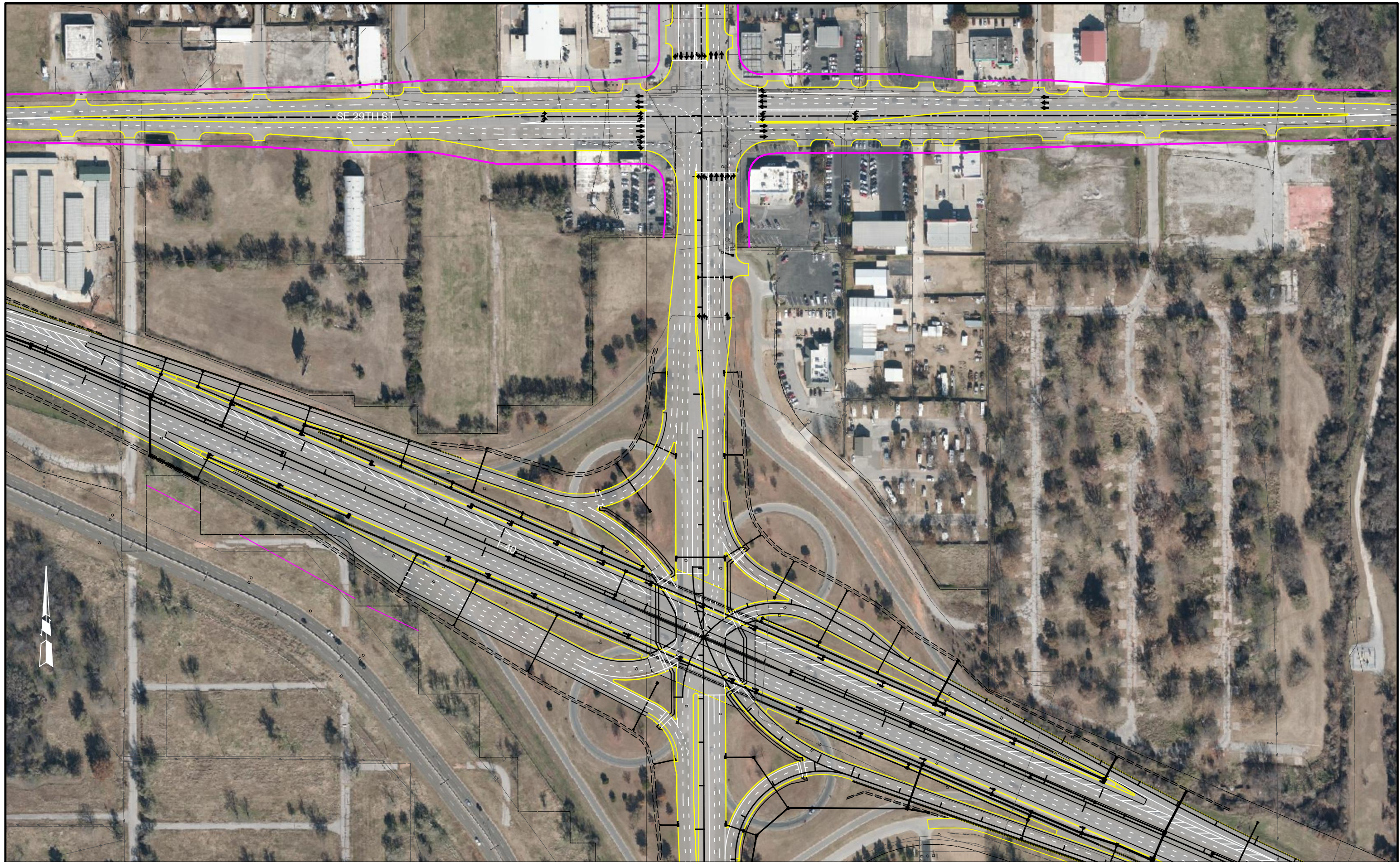
The team worked closely with ODOT to develop VISSIM models of existing conditions for the study corridor. Over the course of development of the VISSIM models it was determined that S.E. 29th Street was a significant bottleneck within the study area. Two variations of the model were studied, one with the S.E. 29th Street intersection and one without the S.E. 29th Street intersection. Ultimately, the team determined it would be best to include the S.E. 29th Street intersection in the model. Through this study process, the existing VISSIM models with the S.E. 29th Street intersection were calibrated to a level sufficient to meet ODOT's approval.

Again, working closely with ODOT, the team created VISSIM models of the build conditions, which includes construction of three lanes along I-40 in each direction and a SPUI at the Douglas Boulevard Interchange. The models were then submitted to ODOT. The approved calibrations made in the Existing Configuration models were carried through the SPUI models. ODOT used the models to create various scenarios within the build condition models with different combinations of signal timing and network improvements along Douglas Boulevard. Through this process ODOT determined that the closely spaced intersection of S.E. 29th Street and I-40 interchange along Douglas Boulevard had a significant impact on traffic operations on the I-40 and Douglas Boulevard Interchange. The ultimate determination was that additional study should be completed on the intersection and that the study should be included in the current study process due to the proximity to the interchange.

Through collaboration with ODOT, three distinct intersection designs were developed for the Douglas Boulevard and S.E. 29th Street intersection: an Improved Conventional Intersection (see Exhibit 19), a Displaced Left-Turn Intersection (see Exhibit 20), and a Quadrant Intersection (see Exhibit 21). The corresponding traffic data for the Conventional Intersection and the Displaced Left-Turn Intersection is shown in Exhibit 22; the traffic data for the Quadrant Intersection is shown in Exhibit 23. These exhibits are also available in Appendix D.

Synchro models of the three intersection types were developed to determine if one solution performed better than the others. All three models were ultimately approved by ODOT. Through the Synchro study process, one solution did not show a more significant increase in performance than the others. To gain a better understanding of how each solution performed, VISSIM models of each of the intersection alternatives were created. The ultimate goal of this portion of the study is to determine the S.E. 29th Street alternative that creates the least impact on the I-40 and Douglas Boulevard Intersection. While the team felt it important to develop a long-term plan that works well in conjunction with the SPUI at the I-40 and Douglas Boulevard Interchange, actual work at the S.E. 29th Street intersection is expected to be conducted by a different project than the I-40 and Douglas Boulevard interchange improvement.

The VISSIM delay and level-of-service comparison between the Improved Conventional Intersection, Displaced Left-Turn Lane Intersection, and Quadrant Intersection is located in Exhibit 24 for the 2045 AM Peak and Exhibit 25 for the 2045 PM Peak.



IMPROVED CONVENTIONAL INTERSECTION

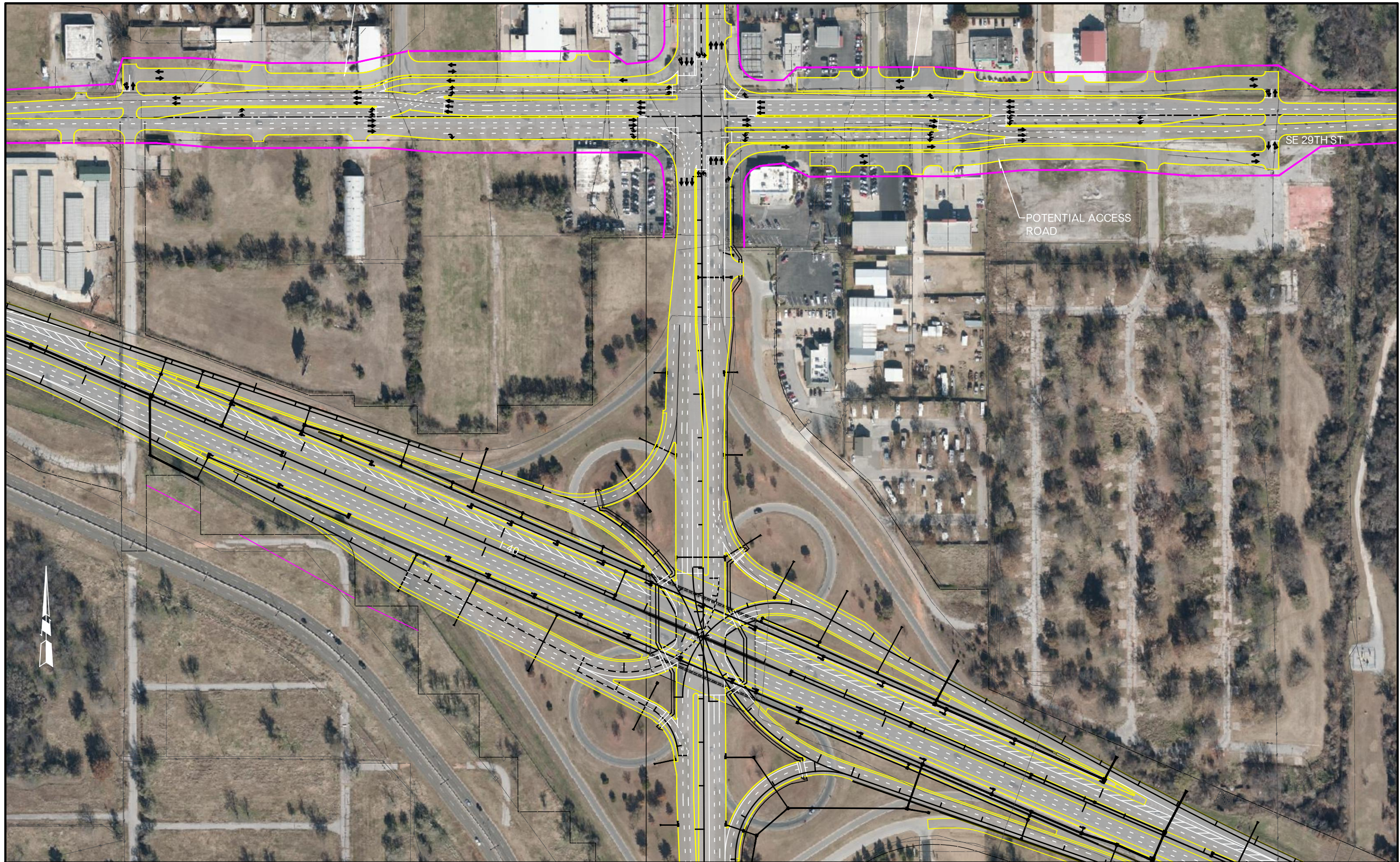
SCALE: 200



I-40 & DOUGLAS INTERCHANGE
DOUGLAS BLVD & SE 29TH ST INTERSECTION

EXHIBIT 19

Page 25



SE 29TH ST

POTENTIAL ACCESS ROAD

SCALE: 200

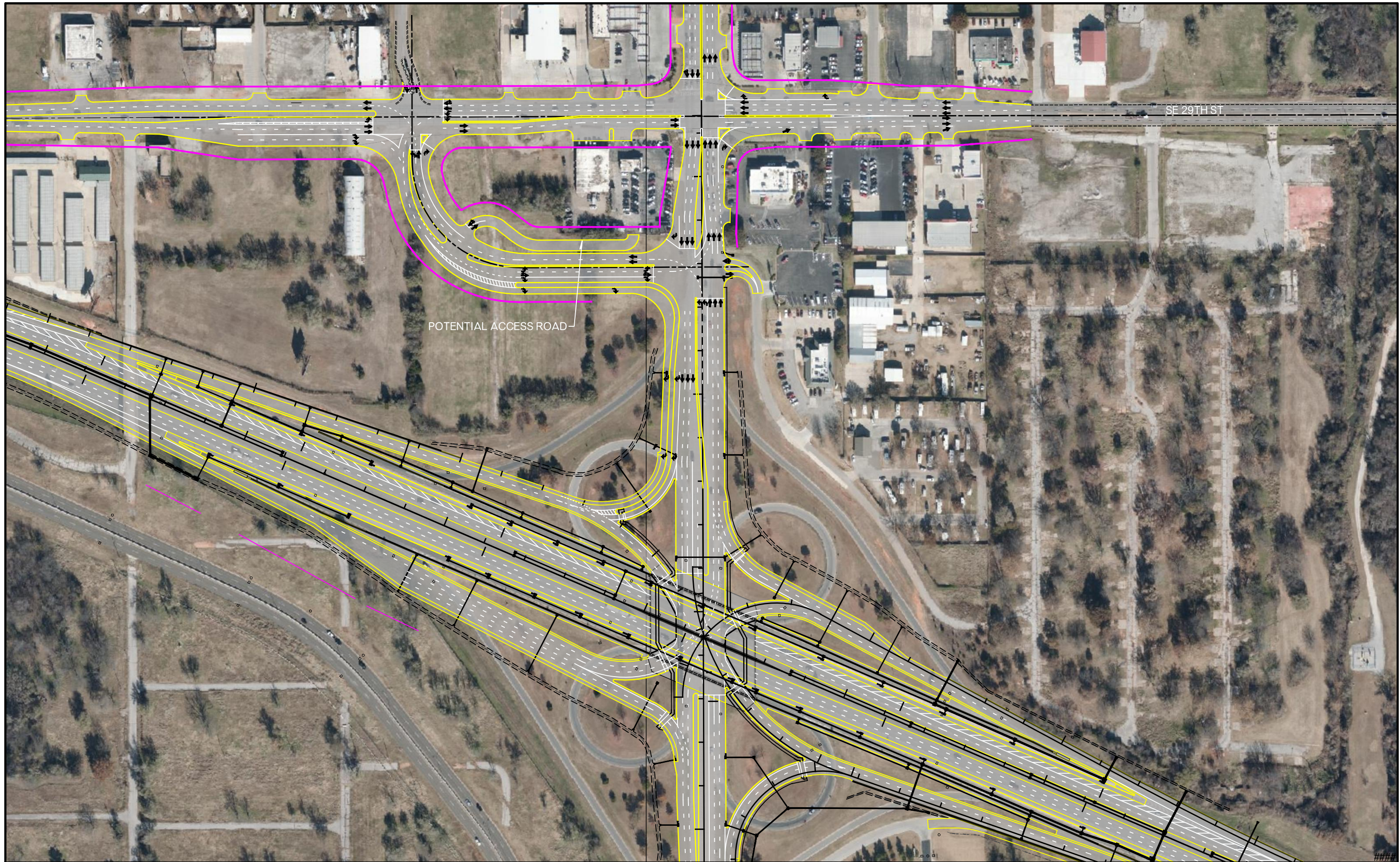


I-40 & DOUGLAS INTERCHANGE
DOUGLAS BLVD & SE 29TH ST INTERSECTION

EXHIBIT 20

Page 26

DISPLACED LEFT-TURN INTERSECTION



QUADRANT INTERSECTION

SCALE: 200



I-40 & DOUGLAS INTERCHANGE
DOUGLAS BLVD & SE 29TH ST INTERSECTION

EXHIBIT 21

Page 27

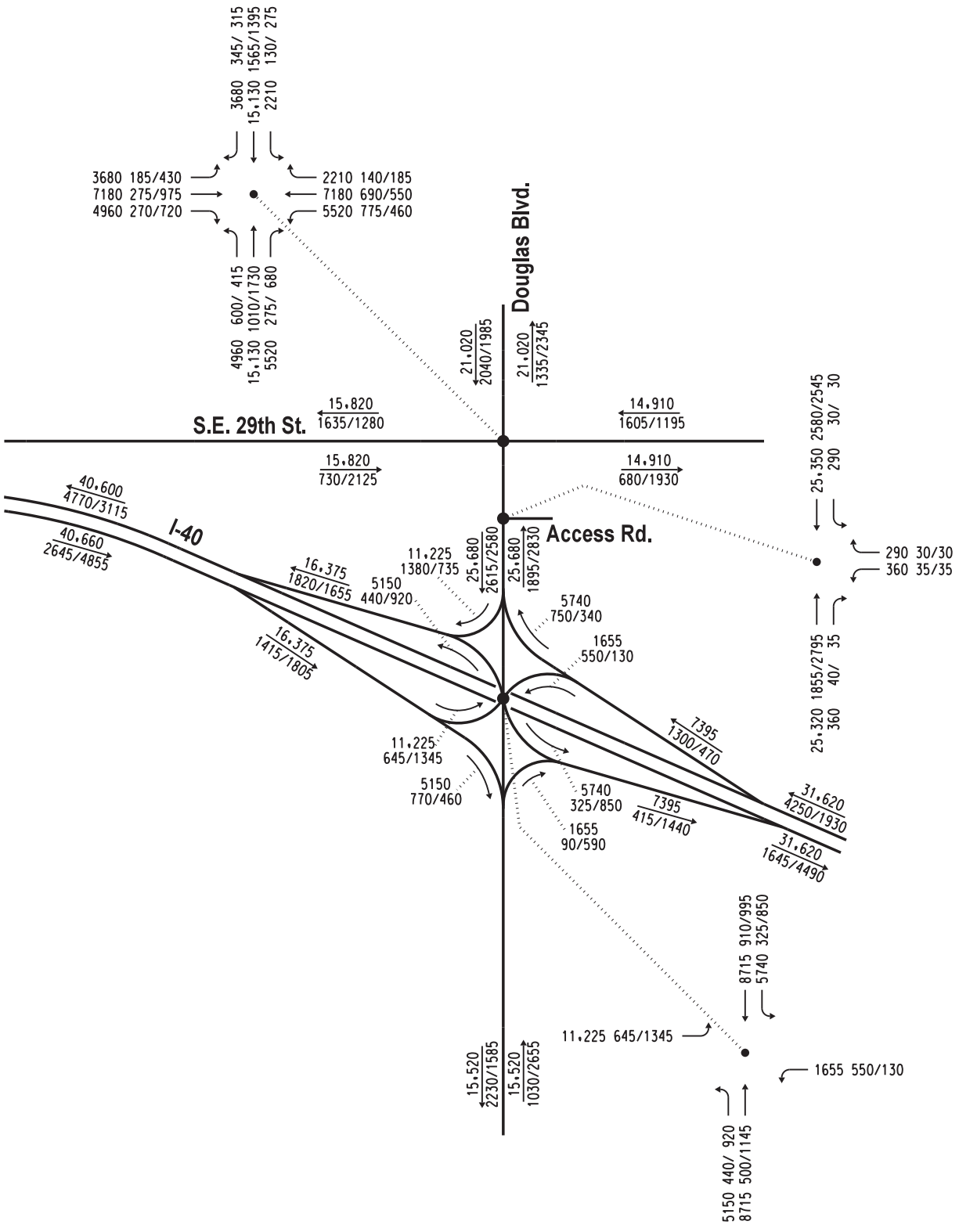


FIGURE 22. 2045 Design Traffic Data SPUI w/ STD Intersection and Displaced Left-Turn at SE 29th St.



LEGEND	
XXXX XXX/XXX	AADT
/	A.M. PEAK HOUR
\	P.M. PEAK HOUR

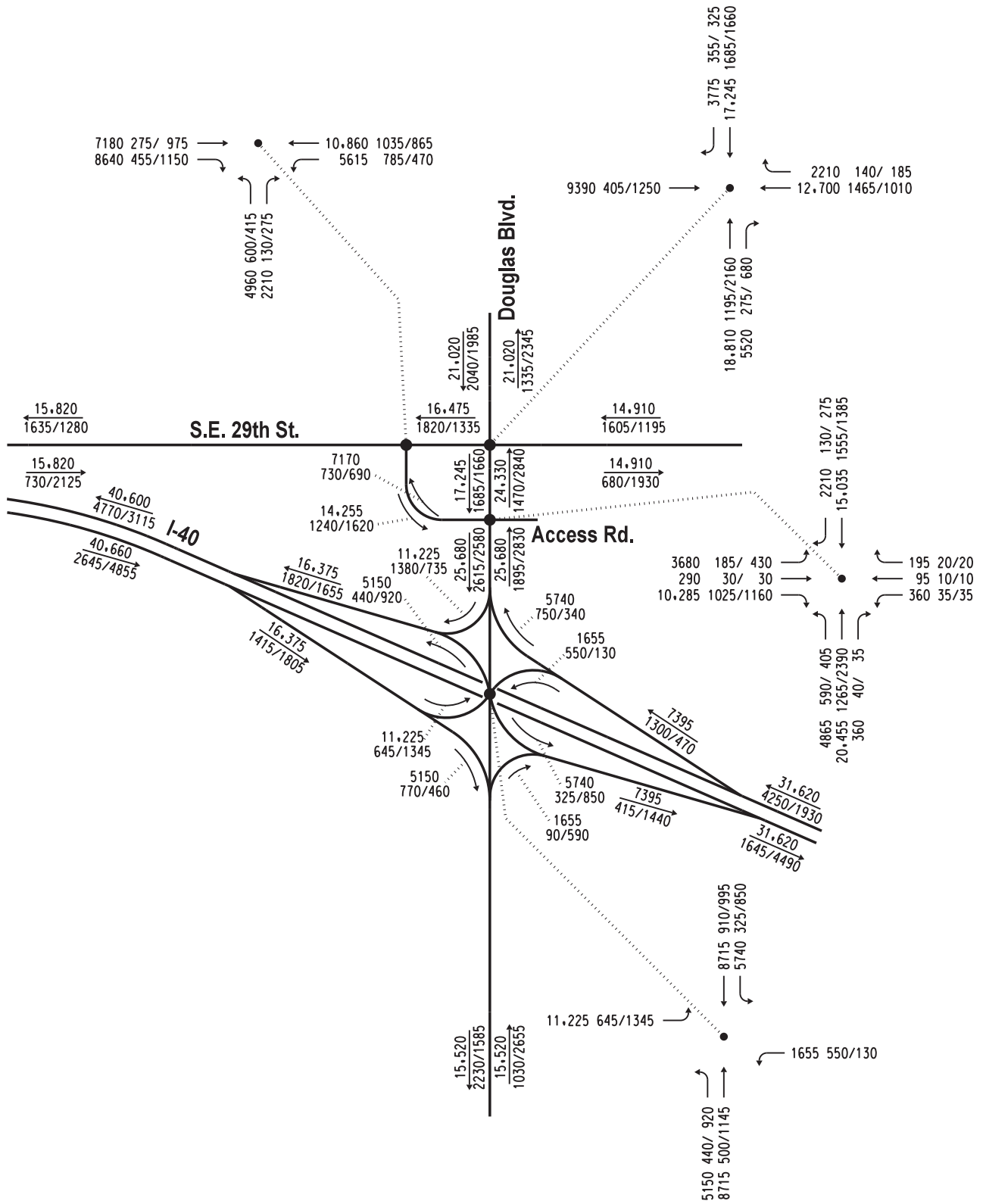


FIGURE 23. 2045 Design Traffic Data
 SPUI w/ Quadrant Jug Handle
 at SE 29th St.



Location	VISSIM Delay and Level for Service: 2045 AM Peak																						
	Improved Conventional Intersection						Displaced Left-Turn Lane Intersection						Quadrant Intersection										
	Delay (sec)		Levels of Service		Delay (sec)		Levels of Service		Delay (sec)		Levels of Service		Delay (sec)		Levels of Service								
	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45							
I-40 EB & Town Center/Eaker Gate	6.9	8.3	8.2	7.1	A	A	A	A	6.9	8.5	8.2	7.1	A	A	A	A	7.5	8.1	7.3	7.4	A	A	A
I-40 WB/29th & Town Center	28.0	28.3	28.9	28.1	C	C	C	C	28.0	28.9	28.9	27.8	C	C	C	C	26.7	27.7	28.8	28.9	C	C	C
I-40 EB & Industrial	2.6	2.9	2.9	3.0	A	A	A	A	2.6	2.9	2.7	2.8	A	A	A	A	2.5	3.0	2.9	2.5	A	A	A
I-40 WB & Industrial	4.7	4.8	5.0	4.3	A	A	A	A	5.0	5.1	4.6	4.2	A	A	A	A	4.5	4.2	6.1	4.9	A	A	A
29th & Industrial	10.1	11.2	11.4	10.4	B	B	B	B	10.4	11.8	9.9	24.7	B	B	A	A	9.6	10.6	22.6	31.9	A	B	C
Douglas & Lancer Gate	28.0	31.8	32.1	33.0	C	C	C	C	30.5	37.4	43.0	44.4	C	D	D	D	26.2	29.3	34.3	31.0	C	C	C
I-40 & Douglas	58.2	70.6	71.0	71.1	E	E	E	E	36.7	44.7	49.0	53.5	D	D	D	D	38.9	40.1	40.6	54.6	D	D	D
29th & Douglas	51.6	57.6	59.5	62.5	D	E	E	E	32.5	32.7	32.2	32.7	C	C	C	C	47.9	55.4	54.6	71.3	D	E	D
I-40 EB & Anderson	2.4	2.5	2.6	2.5	A	A	A	A	2.5	2.5	2.6	2.5	A	A	A	A	2.7	2.5	3.1	2.3	A	A	A
I-40 WB & Anderson	7.5	6.9	6.5	8.6	A	A	A	A	7.3	6.4	6.6	6.6	A	A	A	A	5.9	7.2	8.0	6.6	A	A	A
SPUI NBL	43.6	47.5	47.5	45.8	D	D	D	D	38.6	37.7	39.8	38.5	D	D	D	D	40.7	43.5	38.4	42.2	D	D	D
SPUI NBT	32.4	33.9	34.6	29.8	C	C	C	C	32.5	31.9	32.9	31.7	C	C	C	C	32.3	33.2	30.1	29.7	C	C	C
SPUI NBR	14.3	14.6	18.3	12.8	B	B	B	B	16.1	15.6	15.9	14.7	B	B	B	B	12.6	12.7	13.3	11.9	B	B	B
SPUI SBL	54.9	55.8	53.3	56.8	D	E	D	E	31.9	33.5	34.4	36.3	C	C	C	C	50.2	49.9	47.8	50.2	D	D	D
SPUI SBT	53.3	53.3	51.9	53.6	D	D	D	D	26.8	27.8	28.6	27.3	C	C	C	C	30.8	31.1	50.8	140.7	C	C	D
SPUI SBR (from Douglas)	25.4	24.9	24.1	23.4	C	C	C	C	21.7	22.0	20.7	22.6	C	C	C	C	28.2	27.7	26.8	30.9	C	C	C
SPUI Jughandle to SBR Freeflow	Does Not Exist																						
SPUI WBL	155.2	227.4	238.2	249.5	F	F	F	F	84.5	127.7	152.0	180.2	F	F	F	F	52.9	55.6	52.0	59.1	D	E	D
SPUI WBR	88.3	144.0	155.1	170.3	F	F	F	F	36.0	63.4	79.2	98.3	D	E	E	F	67.1	72.1	97.3	83.2	E	E	F
SPUI EBL	57.5	58.9	61.0	58.5	E	E	E	E	37.9	38.0	38.4	37.8	D	D	D	D	42.9	43.2	43.7	118.6	D	D	F
SPUI EBR	41.3	44.3	45.4	46.0	D	D	D	D	33.1	34.0	35.0	34.9	C	C	C	C	39.6	40.0	60.1	152.2	D	D	F
29th & Douglas NBL	63.0	67.3	68.8	70.1	E	E	E	E	49.3	48.5	50.9	64.3	D	D	D	D	59.5	56.1	62.4	62.2	E	E	E
29th & Douglas NBT	27.7	28.3	26.5	27.7	C	C	C	C	15.9	15.5	14.7	15.3	B	B	B	B	21.6	19.0	18.8	20.0	C	B	B
29th & Douglas NBR	9.7	10.0	9.1	9.4	A	B	A	A	14.8	13.9	12.6	12.5	B	B	B	B	8.6	7.7	7.3	7.6	A	A	A
29th & Douglas SBL	64.9	66.6	70.8	67.5	E	E	E	E	55.0	53.7	58.3	57.8	D	D	D	D	41.2	44.6	43.5	123.1	D	D	D
29th & Douglas SBT	42.1	43.9	39.6	40.3	D	D	D	D	25.7	26.4	25.8	26.9	C	C	C	C	33.3	33.4	34.5	117.4	C	C	C
29th & Douglas SBR	18.3	17.0	16.9	15.4	B	B	B	B	35.6	34.2	35.2	33.8	D	C	D	C	22.9	22.9	21.1	95.0	C	C	F
29th & Douglas WBL (to Douglas)	101.5	120.5	135.9	130.0	F	F	F	F	54.8	59.7	56.6	52.4	D	E	E	D	147.8	151.6	157.6	224.3	F	F	F
29th & Douglas WBL to I-40 WB freeflow	Does Not Exist																						
29th & Douglas WBT	75.6	97.6	112.6	111.3	E	F	F	F	43.8	43.3	42.1	51.7	D	D	D	D	28.5	29.1	29.1	32.7	C	C	C
29th & Douglas WBR	17.0	32.6	47.0	50.1	B	C	D	D	7.1	7.0	7.0	8.1	A	A	A	A	7.6	8.4	8.4	9.0	A	A	A
29th & Douglas EBL	63.9	61.2	64.0	64.0	E	E	E	E	41.7	41.2	38.5	38.0	D	D	D	D	210.6	298.4	338.5	367.4	F	F	F
29th & Douglas EBT	84.2	89.3	84.6	90.9	F	F	F	F	37.5	35.3	39.0	36.7	D	D	D	D	65.5	61.6	60.5	72.1	E	E	E
29th & Douglas EBR	17.1	17.5	17.0	16.7	B	B	B	B	17.7	17.1	18.7	18.6	B	B	B	B	186.1	264.5	304.6	365.8	F	F	F

EXHIBIT 24: VISSIM DELAY AND LEVEL-OF-SERVICE – 2045 AM PEAK

Location	VISSIM Delay and Level fo Service: 2045 PM Peak																				
	Improved Conventional Intersection						Displaced Left-Turn Lane Intersection						Quadrant Intersection								
	Delay (sec)		Levels of Service		Delay (sec)		Levels of Service		Delay (sec)		Levels of Service		Delay (sec)		Levels of Service						
	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45	7:00	7:15	7:30	7:45	
I-40 EB & Town Center/Eaker Gate	161.8	200.1	209.1	207.3	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
I-40 WB/29th & Town Center	60.1	71.8	83.8	84.6	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
I-40 EB & Industrial	5.7	5.0	5.3	4.7	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
I-40 WB & Industrial	9.8	10.2	9.5	9.8	A	B	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
29th & Industrial	35.1	38.6	37.9	38.1	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Douglas & Lancer Gate	38.8	41.7	39.4	39.3	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
I-40 & Douglas	41.2	39.0	40.0	41.3	D	D	D	D	D	D	C	C	D	D	D	D	D	D	D	D	D
29th & Douglas	41.0	41.2	41.0	42.5	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
I-40 EB & Anderson	64.5	78.4	74.7	77.0	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
I-40 WB & Anderson	1.5	1.4	1.4	1.3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
SPUI NBL	49.5	48.0	49.7	52.7	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
SPUI NBT	49.2	41.9	44.0	45.9	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
SPUI NBR	19.5	18.5	21.1	18.8	B	B	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
SPUI SBL	46.6	58.9	56.1	64.0	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
SPUI SBT	36.7	33.7	33.8	37.5	D	C	C	D	C	C	D	D	D	D	D	D	D	D	D	D	D
SPUI SBR (from Douglas)	25.0	20.7	23.7	23.0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
SPUI Jughandle to SBR Freeflow	Does Not Exist																				
SPUI WBL	44.7	42.7	47.1	37.6	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
SPUI WBR	49.1	47.9	45.0	46.5	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
SPUI EBL	55.2	55.0	56.0	53.7	E	E	E	D	E	D	D	D	D	D	D	D	D	D	D	D	D
SPUI EBR	34.9	38.5	34.5	34.0	C	D	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
29th & Douglas NBL	41.4	47.3	46.2	43.8	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
29th & Douglas NBT	38.1	40.1	39.0	39.2	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
29th & Douglas NBR	6.9	6.3	6.7	6.7	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
29th & Douglas SBL	67.0	67.7	65.2	70.0	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
29th & Douglas SBT	41.9	38.3	40.2	41.8	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
29th & Douglas SBR	8.7	8.5	8.9	8.3	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
29th & Douglas WBL (to Douglas)	71.7	65.8	64.6	69.5	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
29th & Douglas WBL to I-40 WB freeflow	Does Not Exist																				
29th & Douglas WBT	50.9	49.9	52.0	53.0	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
29th & Douglas WBR	11.9	10.4	9.4	10.5	B	B	A	B	A	B	A	A	A	A	A	A	A	A	A	A	A
29th & Douglas EBL	49.4	57.1	50.1	53.8	D	E	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
29th & Douglas EBT	60.4	62.4	58.7	65.8	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
29th & Douglas EBR	10.9	12.6	12.5	14.0	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B

EXHIBIT 25: VISSIM DELAY AND LEVEL-OF-SERVICE – 2045 AM PEAK

A VISSIM network performance between the three intersections for design year 2045 in both the AM and PM Peak is located in Exhibit 26.

VISSIM Network Performance: 2045 AM Peak			
Network Performance	Conventional	DLT	Quadrant
Vehicle Arrived	16771	17203	16890
Vehicles in Network	1740	1230	1521
Latent Demand	49	88	65
Delay through Network (veh-hr)	535	301	376
Latent Delay (veh-hr)	11	40	13
VISSIM Network Performance: 2045 PM Peak			
Network Performance	Conventional	DLT	Quadrant
Vehicle Arrived	18454	18451	18450
Vehicles in Network	1465	1461	1547
Latent Demand	2317	2315	2323
Delay through Network (veh-hr)	592	572	617
Latent Delay (veh-hr)	1128	1121	1120

EXHIBIT 26: VISSIM NETWORK PERFORMANCE

Overall, the intersection delay and level-of-service comparison results, displayed in Exhibits 24 and 25, reveal the Displaced Left-Turn Lane Intersection operates the most efficient amongst the three intersection designs. The VISSIM network performance comparison results, summarized in Exhibit 26, display several components. The vehicle arrived category is ideal to be high and the remaining categories are ideal to be low. In the 2045 AM Peak, the Displaced Left-Turn Lane Intersection is the most efficient. In the 2045 PM Peak there is minimal difference amongst the three designs.

1.6 COLLISION ANALYSIS

A collision analysis was performed to assess the crash history from 01/01/2011 to 12/31/2015 for I-40, Douglas Boulevard, and the surrounding facilities. The collision analysis reports are located in Appendix E and are summarized in the following text.

I-40 (Between Town Center Drive and Anderson Road)

Throughout the study period there have been 640 collisions along I-40 between Town Center Drive and Anderson Road. Four collisions resulted in a fatality, 169 resulted in injuries, and 467 resulted in property damage. The most common types of collisions in this study group is rear-end and fixed object collisions. Three of the fatalities occurred from rear-end collisions and the remaining from a fixed object collision. The overall collision rate for this section is 135.11 collisions per 100 million vehicle miles, compared to the statewide rate of 66.82 for similar facilities.

I-40 and Town Center Drive Interchange

There have been 20 collisions related to the I-40 and Town Center Drive Interchange, mostly angle turning collisions. Roughly 55% of the collisions at the interchange are at the ramp terminals along Town Center Drive. Zero collisions resulted in a fatality, three resulted in injury, and 17 resulted in property damage.

I-40 and Industrial Boulevard Interchange

There have been 14 collisions related to the I-40 and Industrial Boulevard Interchange, mostly right angle and angle turning collisions. Roughly 86% of the collisions at the interchange are at the ramp terminals along Industrial Boulevard. Zero collisions resulted in a fatality, three resulted in injury, and 11 resulted in property damage.

I-40 and Douglas Boulevard Interchange

There have been 103 collisions related to the I-40 and Douglas Boulevard Interchange, and about 70% of these were rear-end collisions. Most of the collisions occur on ramp or collector-distributor road merge locations. Zero collisions resulted in a fatality, 27 resulted in injury, and 76 resulted in property damage.

I-40 and Anderson Road Interchange

There have been 29 collisions related to the I-40 and Anderson Road Interchange, the most common of which are fixed object, rear-end, and angle turning collisions. Roughly 45% of the collisions at the interchange are at the ramp terminals along Anderson Road. Zero collisions resulted in a fatality, ten resulted in injury, and 19 resulted in property damage.

Douglas Boulevard (Between S.E. 29th Street and S.E. 44th Street)

Over the course of the study period along Douglas Boulevard between S.E. 29th Street and S.E. 44th Street, there have been 70 collisions. One collision resulted in a fatality, 26 resulted in injuries, and 43 resulted in property damage. The fatality was a rear-end collision which occurred near the drive for the Lancer Gate to Tinker Air Force Base. The most common types of collisions are rear-end and angle turning collisions.

The collision analysis report conducted over the course of the study period along Douglas Boulevard between S.E. 29th Street and S.E. 44th Street has some apparent inaccuracies. Although each collision listed is labeled as being along Douglas Blvd. (3300), on the study map there are a number of collisions being shown on Douglas Ave. (1375), which is 9.3 miles farther to the west. After exporting the collision data and going through each listed collision, 11 collisions can reasonably be determined to have been mislabeled based on the names of the intersecting streets and the latitude and longitude of the collisions; however, there is one collision that cannot be determined whether it was mislabeled or not. Additionally, there is no way to determine if these are the only inaccurate collisions or if there are additional errors; perhaps Douglas Boulevard collisions were mislabeled as Douglas Avenue and were not returned in the data search. Therefore, a second analysis was performed in which the 11 collisions that can be reasonably determined to have been mislabeled were removed from the data set in an effort to gain a more accurate analysis.

When the collision data was re-examined and the 11 collisions which can be reasonably be determined to have been mislabeled were removed from the collision data, there have been 59 collisions over the course of the study period along Douglas Boulevard between S.E. 29th Street and S.E. 44th Street. One collision resulted in a fatality, 24 resulted in injuries, and 34 resulted in property damage. The fatality is the same rear-end collision mentioned before at the drive for the Lancer Gate to Tinker Air Force Base. Even though six of the rear-end collisions and two of the angle turning collisions were removed from the data set, the most common types of collisions are still rear-end and angle turning collisions.

1.7 SAFETY ANALYSIS

A safety analysis has been performed using the American Association of State & Highway Transportation Officials Highway Safety Manual (HSM) Predictive Method. Expected crash totals were estimated using the Interactive Highway Safety Design Model (IHSDM) to evaluate safety implications for replacing the cloverleaf interchange with a SPUI and removing two Industrial Boulevard ramps.

The expected crash totals and crash rates from 2020 to 2045, a total of 25 years, for the existing conditions are summarized in Exhibit 27. The IHSDM Predictive Method results are further summarized in Appendix F.

I-40 was evaluated for the entire project length, a total of 1.47 miles. An additional analysis along I-40 was completed to evaluate the effectiveness of increasing the number of basic lanes from two to three with no changes to the ramp configuration. The ramps were evaluated for their entire length.

Existing Conditions	Expected No. Crashes for Evaluation Period	Expected Crash Rate (crashes/mi/yr)	Expected No. Crashes/Year (crashes/million veh-mi)
I-40	571	14.84	0.67
I-40 (with additional lane widening)	514	13.36	0.60
Industrial Blvd. EB Exit	7	1.23	1.05
Industrial Blvd. EB Entrance	4	0.79	1.29
Douglas Blvd. EB Collector-Distributor	27	2.23	0.73
Douglas Blvd. EB Exit (Diamond)	17	2.24	1.46
Douglas Blvd. EB Entrance (Loop)	37	9.87	8.18
Douglas Blvd. EB Exit (Loop)	80	23.23	6.95
Douglas Blvd. EB Entrance (Diamond)	8	1.48	2.99
Douglas Blvd. WB Collector-Distributor	25	2.02	0.69
Douglas Blvd. WB Exit (Diamond)	15	2.27	1.88
Douglas Blvd. WB Entrance (Loop)	44	11.75	7.66
Douglas Blvd. WB Exit (Loop)	21	6.04	12.25
Douglas Blvd. WB Entrance (Diamond)	33	5.99	1.79
Industrial Blvd. WB Exit	4	0.81	1.48
Industrial Blvd. WB Entrance	6	1.13	1.06

EXHIBIT 27: EXISTING CONDITIONS EXPECTED CRASH TOTALS

The expected crash totals and crash rates from 2020 to 2045, a total of 25 years, for the future conditions of removed eastern ramps on Industrial Boulevard and a SPUI at Douglas Boulevard are summarized in Exhibit 28. The IHSDM Predictive Method results are further summarized in Appendix F.

Future Conditions	Expected No. Crashes for Evaluation Period	Expected Crash Rate (crashes/mi/yr)	Expected No. Crashes/Year (crashes/million veh-mi)
I-40	464	12.07	0.56
Industrial Blvd. EB Exit	7	1.23	1.05
Douglas Blvd. EB Exit	52	3.68	0.75
Douglas Blvd. EB Entrance	31	2.27	0.98
Douglas Blvd. WB Exit	35	2.78	1.24
Douglas Blvd. WB Entrance	78	4.70	0.96
Industrial Blvd. WB Entrance	6	1.13	1.06

EXHIBIT 28: FUTURE CONDITIONS EXPECTED CRASH TOTALS

Along I-40 the proposed future conditions reduce the overall crashes by 18.7%. The eastbound ramps combined reduce the overall crashes by 50.0%, and the westbound ramps combined reduce the overall crashes by 19.6%. The crash reduction is shown in Exhibit 29.

	I-40	I-40 (widening)	EB Ramps	WB Ramps	Total
Expected # Crushes, Existing	571	514	180	148	899
Expected # Crushes, Future	464	464	90	119	673
Total Crash Reduction from Existing	107	50	90	29	226
Crash Reduction Factor (CRF)	18.7%	9.7%	50.0%	19.6%	25.1%

EXHIBIT 29: SUMMARY OF CRASH REDUCTION

The safety analysis utilizing the IHSDM Predictive Method displays improvement with the future configuration of removed eastern ramps on Industrial Boulevard and a SPUI at Douglas Boulevard.

2 ACCESS CONNECTIONS AND DESIGN

“The proposed access connects to a public road only and will provide for all traffic movements. Less than “full interchanges” may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial-interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectation leading to wrong-way movements on ramps, etc. The report should describe whether future provision of a full interchange is precluded by the proposed design.”

Currently Douglas Boulevard is a 4-lane, section line, public road that connects with S.E. 29th Street to the north of I-40 and S.E. 44th Street to the south of I-40. S.E. 44th Street connects to S. Post Road to the east and has no through street to the west. S.E. 29th Street connects with S. Post Road to the east, Midwest Boulevard to the west, and other local streets, see Exhibit 1.

The proposed single point urban interchange at I-40 and Douglas Boulevard will provide a full interchange connecting Douglas Boulevard to I-40, as shown in Exhibit 2. Conceptual Plans are located in Appendix A. The design of the interchange meets or exceeds all design criteria as specified in AASHTO’s *A Policy on Geometric Design of Highways and Streets* and in AASHTO’s *A Policy on Design Standards—Interstate System*. Exhibit 4 displays the design criteria for the I-40 and Douglas Boulevard Interchange project.

The eastern ramps on the Industrial Boulevard Interchange will be removed, reducing the full interchange to half of the traffic movements to and from I-40. The existing ramp configuration between the Industrial Boulevard and Douglas Boulevard Interchanges contains inadequate merge and diverge spacing between the interchanges. Due to the close proximity of the two interchanges, traffic that once utilized the eastern ramps on the Industrial Boulevard Interchange can utilize the Douglas Boulevard Interchange (approximately 0.5 miles east) or the Town Center Drive Interchange (approximately 1-mile west). Advance warning of the I-40 access changes will be reflected in the proposed signage for the interchange as shown on Exhibit 5.

The existing interchange spacing exceeds the design guidelines maximum of one interchange per mile, and the proposed interchange likewise does not adhere to design guidelines for interchange spacing. However, the eastern ramps on the Industrial Boulevard Interchange are being removed to improve the inadequate interchange spacing. The proposed interchange meet design guidelines for lane balance and route continuity. Eastbound I-40 will expand from two basic lanes to three approaching Douglas Boulevard with single lane entrance and exit ramps at Douglas Boulevard and will continue eastward with three basic lanes. Westbound I-40 will be constructed for three basic lanes; however, striping will taper traffic down to two lanes after the single lane exit ramp at Douglas Boulevard and a single lane entrance will merge with the two basic lanes continuing westward, see Exhibit 30. Approximately 1.5 miles of I-40 between Douglas Boulevard and Town Center Drive will be striped as two basic lanes until the completion of the Industrial Boulevard Bridge replacement and I-40 widening to six lanes at the western project extents. At the completion of the western project, the basic number of lanes requirement will be met, see Exhibit 31.

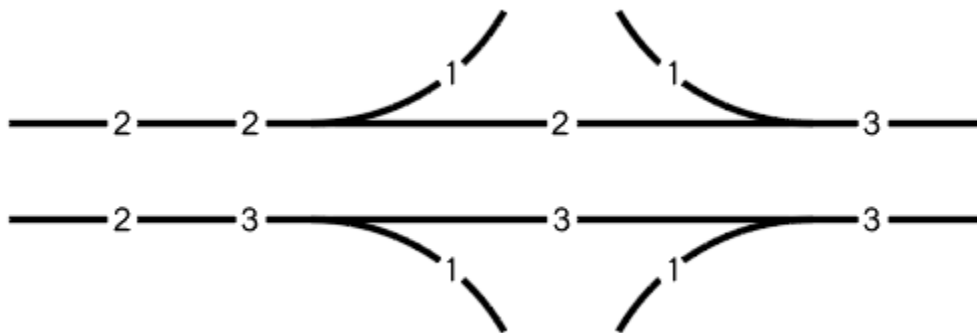


EXHIBIT 30: PROPOSED BASIC NUMBER OF LANES AND LANE BALANCE

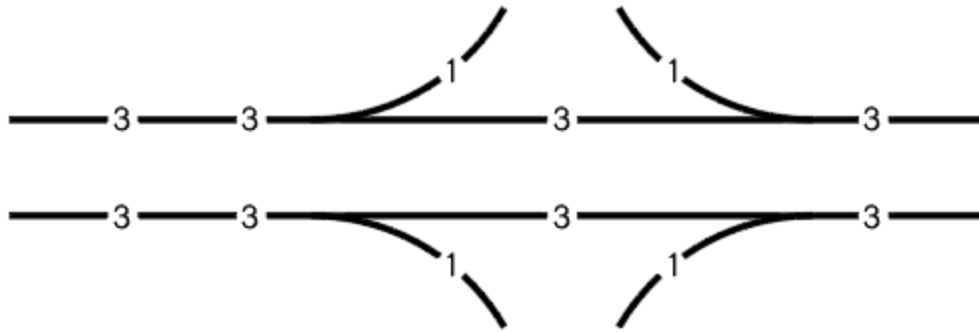


EXHIBIT 31: ULTIMATE BASIC NUMBER OF LANES AND LANE BALANCE

The proposed interchange meets design guidelines for design speed, acceleration and deceleration lane requirements, lane widths, shoulder widths, cross slopes, horizontal curvature, superelevation, cross slope break over requirements, horizontal and vertical stopping sight distance requirements, decision sight distance requirements, intersection sight distance requirements, horizontal clearance, vertical clearance, and clear zone requirements as shown on Exhibit 4.

ODOT Project No. 31011(05) is scheduled to let with the I-40 and Douglas Boulevard project; the project ties to the east end of the I-40 and Douglas Boulevard project and extends east four miles to the I-240 Interchange. Some of the improvements include widening I-40 to a six-lane freeway as well as ramp improvements and new bridges at the Anderson Road Interchange. The new bridge structures will allow for widening of Anderson Road to four lanes in the future and for ramp intersection improvements such as signalization and dual left-turns lanes on the eastbound exit ramp when improvements are warranted.

Additional I-40 corridor studies are being conducted by ODOT to determine I-40 lane and interchange configurations, from east of I-35, extending east approximately five miles, to west of Douglas Boulevard. This study includes the interchanges at Town Center Drive and Industrial Boulevard.

Design Exceptions are not anticipated at this time; however, during the design phase of the project, if the design criteria are not met, a Design Exception will be prepared. The estimated cost of construction for the proposed interchange is \$42,900,000.

The NEPA Document was submitted to ODOT on April 2nd, 2020. ODOT submitted the document to FHWA on April 2nd, 2020. It is currently waiting on FHWA approval.