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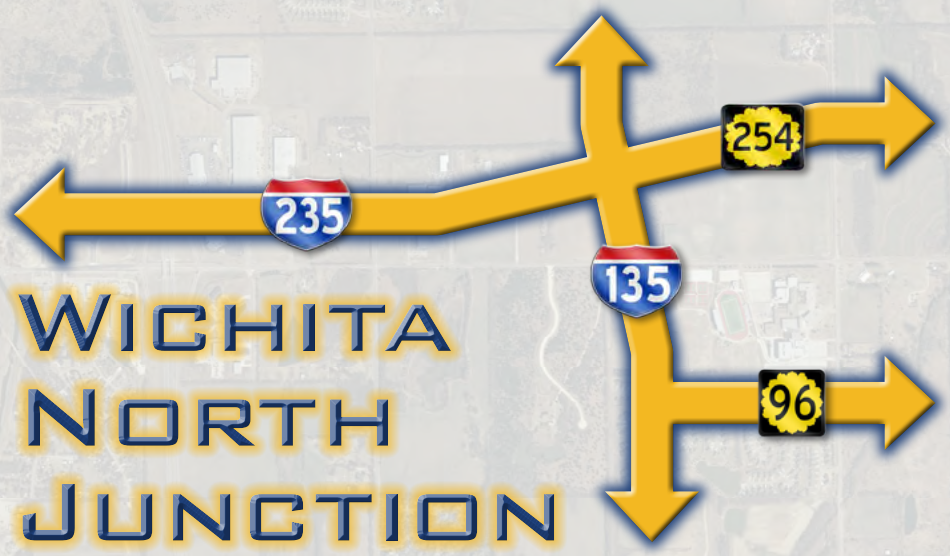

Wichita North Junction Concept Study

Kansas
Department of Transportation

ACKNOWLEDGMENTS

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CHAPTER 1: INTRODUCTION

The interchange of I-135, I-235, and K-254 in northern Wichita is commonly referred to as the North Junction. This system interchange is a major junction of two interstates and two state routes and carries people and goods traveling through the region, state, and across the nation.

The North Junction experiences a high degree of directional congestion during the morning and evening rush hours, raising concerns about delay and safety. The congestion as well as other factors led the Kansas Department of Transportation (KDOT) to pursue options to improve the North Junction. Also, the Wichita Area Metropolitan Planning Organization (WAMPO) has identified improvements to the North Junction as a regional priority.

> Over 80,000 vehicles use the North Junction each day

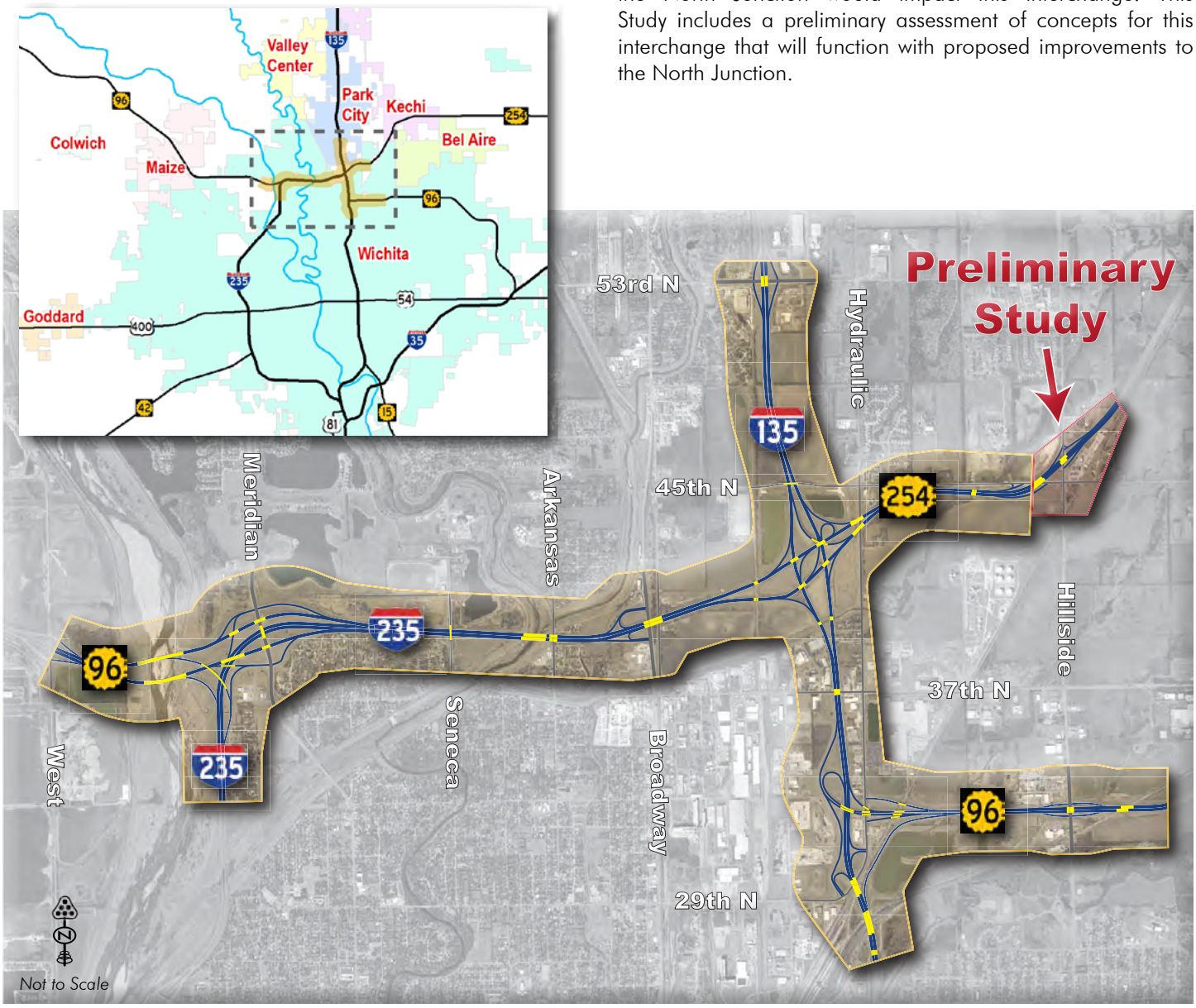
STUDY AREA

The North Junction is located in north central Wichita within Sedgwick County, Kansas. The Study Area includes the North Junction and extends outward along I-135, I-235, and K-254.

The North Junction is in close proximity to the I-135 and K-96 Interchange. These two interchanges tend to function as one complex interchange. I-235 and I-135 and the two interchanges carry eastbound and westbound traffic passing through the Study Area on K-96. There is a high volume of traffic traveling on northbound I-235 to southbound I-135 to eastbound K-96 in the mornings and vise versa in the evenings. Improving safety and mobility at the North Junction requires taking into account the I-135 and K-96 Interchange.

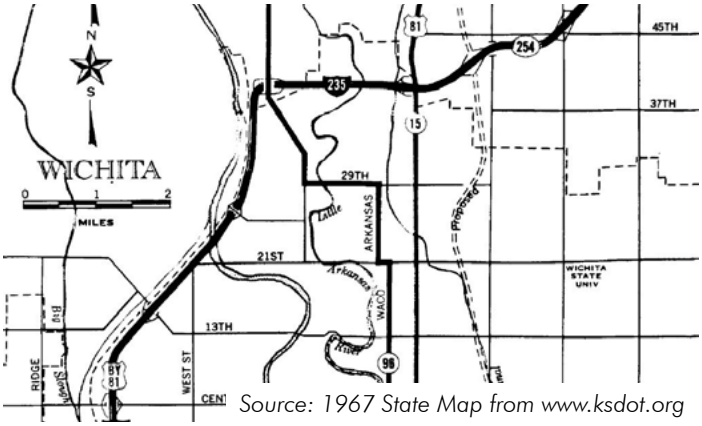
During the development of the 2015 Study, there was an identified need to assess the K-254 and Hillside/45th Street North Interchange since the alignment of K-254 through the North Junction would impact this interchange. This Study includes a preliminary assessment of concepts for this interchange that will function with proposed improvements to the North Junction.

Exhibit 1: Study Area



HISTORY

The North Junction was originally constructed in the late 1960s and early 1970s. The increase in development and traffic over time has driven the state and region to assess needed improvements to meet growing and changing travel demands. KDOT developed a study in 1998, which identified a preferred concept for the North Junction. In 2012, the study was updated based upon changes in traffic that occurred since 1998 and to extend the design year. The 2012 Study identified a preferred concept that was slightly different than the 1998 concept.



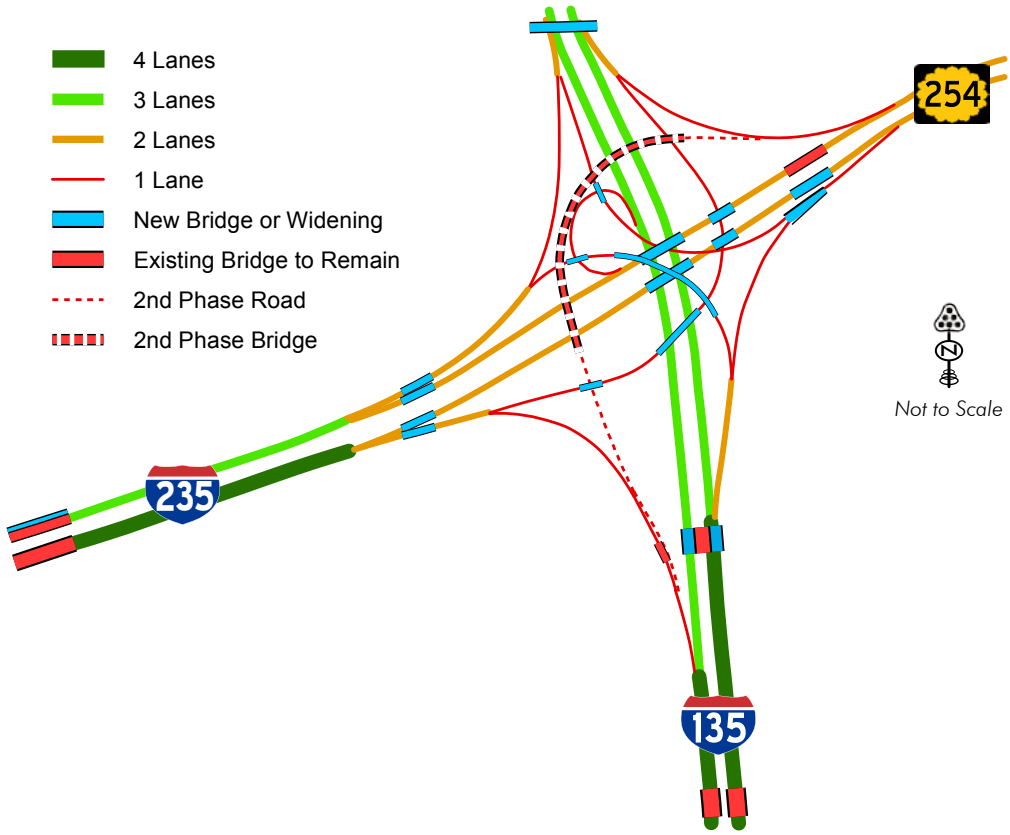
Source: 1967 State Map from www.ksdot.org

1998 Study

The I-135/I-235 Interchange Advance Study Project (1998 Study) performed by Professional Engineering Consultants, P.A. proposed an improved interchange, but funds were not identified for construction. The goals for improvement were to provide three basic travel lanes in both the north and south directions on I-135, reduce or eliminate the number of left-off and left-on ramps, provide lane continuity in the east and west directions, be constructible, reuse portions of the existing interchange, and provide route continuity for K-96.

The 1998 Study presented six concepts to accommodate projected traffic volumes to 2024 and would be viable in terms of constructibility. After the completion of the 1998 Study, a preferred concept was developed by modifying a concept from the 1998 Study. A slightly modified version of Concept A was identified as the preferred concept, which is shown in **Exhibit 2**.

Exhibit 2: Recommended Concept from 1998 Study



2012 Study

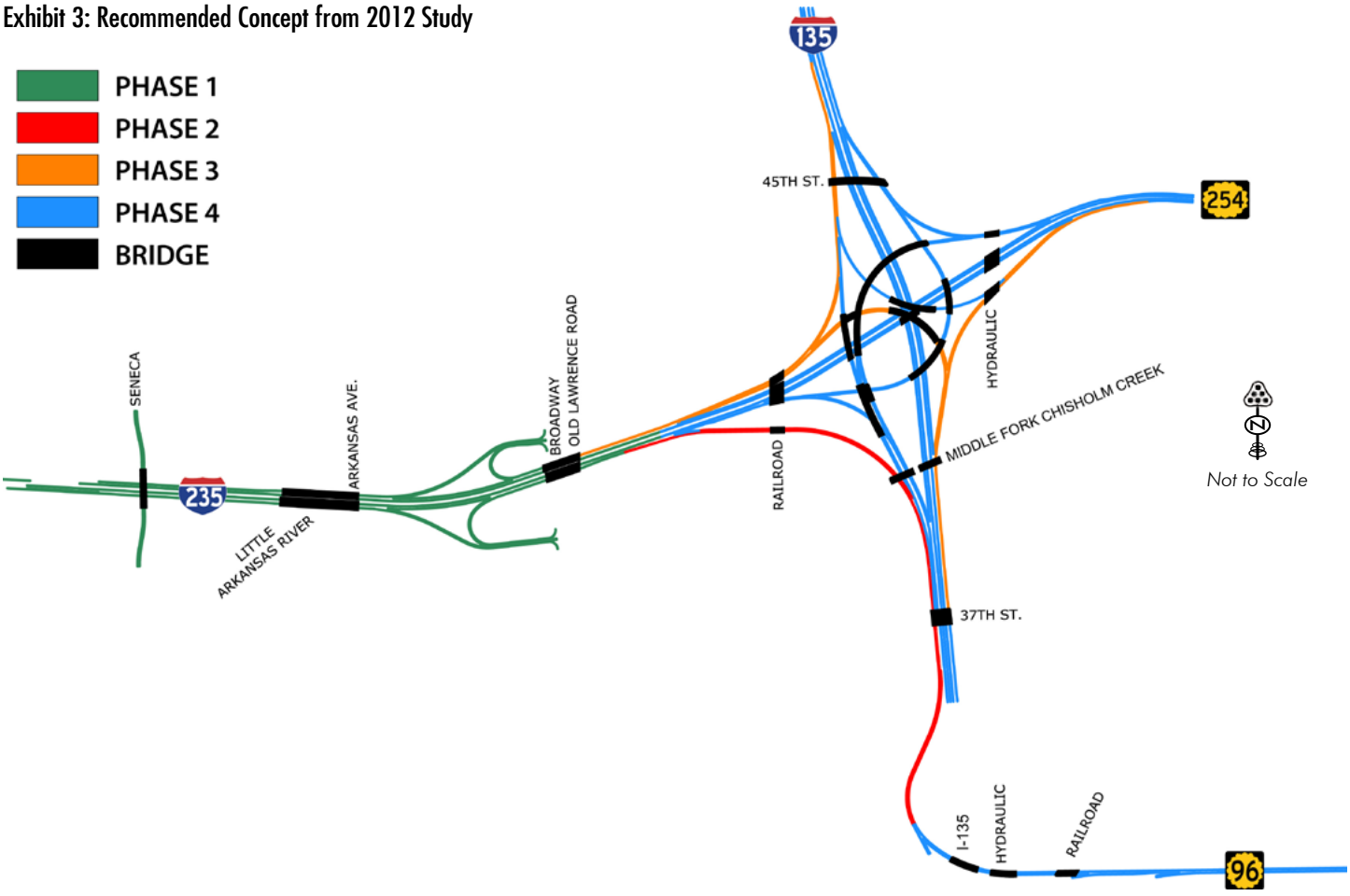
Since 1998, traffic conditions continued to degrade within and around the North Junction. In addition, multiple bridges on I-235 to the west of the interchange were deemed to be in need of replacement. Construction was not anticipated to be complete until near or after the 2024 design year for the 1998 concept. KDOT determined that a re-evaluation of the 1998 interchange concept was needed with an extended design year.

The Wichita North Interchange (I-135/I-235/K-254/K-96) Concept Study (2012 Study) re-evaluated the preferred interchange concept from the 1998 Study. It is important to note that no new concepts were developed as part of the 2012 Study. The 2012 Study made only minor modifications to the 1998 Study's preferred concept to accommodate traffic to a new design year of 2050. The 2012 Study ultimately identified a modified concept to better accommodate future traffic, especially with an improved connection from northbound I-235 to eastbound K-96. It also divided the project into phases that could progressively improve traffic flow and safety. The preferred concept from the 2012 Study is shown in **Exhibit 3**.

In addition to traffic operational improvements, the 2012 Study identified the need to rehabilitate and/or replace other bridge structures within the Study Area to facilitate safe and efficient traveler mobility. KDOT decided to move forward with design for Phase 1 (Green Project). This project is expected to be completed by 2020.

> The 2012 Study did not assess any new concepts

Exhibit 3: Recommended Concept from 2012 Study



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SCOPE OF THE 2015 STUDY

The intent of the 2015 Wichita North Junction Concept Study (2015 Study) is to finalize a preferred concept that 1) meets current design criteria, 2) will function safely and efficiently long into the future, and 3) meets the needs for a Break-in-Access request and environmental clearances. The 2015 Study builds upon previous studies to develop an ultimate preferred concept and phasing plan for improvements to the North Junction. The Study documents the process used in selecting the preferred concept.

The 2015 Study provides additional considerations that previous studies did not, including improvements beyond the originally defined Study Area. It also includes vital engagement with local stakeholders and the public. Details on the engagement process are discussed later in this chapter.

> The 2015 Study assessed new concepts that could reduce the overall cost of the improvements while achieving improved traffic flow and safety

Although the intent of the 2015 Study is to identify a concept for the entire North Junction, there is a focus on mitigating immediate congestion problems. There are existing operational deficiencies on two major movements in the North Junction. The first is from northbound I-235 to southbound I-135 to eastbound K-96 during the morning peak hour. The second is the opposite travel path during the evening peak hour; westbound K-96 to northbound I-135 to southbound I-235.

The Kansas Department of Transportation (KDOT) desired a phasable concept for the North Junction, which would allow the existing operational deficiencies to be mitigated without reconstructing the entire North Junction. The remainder of the concept could then be constructed at a later date with minimal temporary improvements.

> Large projects are often divided into phases. Project phases are individual projects that incrementally build towards an ultimate project. A **temporary improvement** is constructed as part of a project phase that is not used by the ultimate project. It is desirable to minimize these temporary improvements to reduce the cost of the ultimate project.

A priority of the 2015 Study was to coordinate the North Junction concept with the design of the Green Project. In October 2012, it was determined to proceed with design for Phase 1 from the 2012 Study (Green Project) with construction to commence in early 2018. The Green Project is located along I-235 from just east of Broadway to just west of Seneca, as shown in **Exhibit 3**. Design is currently underway on the Green Project. The design of the Green Project will fit within the preferred concept for the North Junction to ensure continuity and minimize throw away improvements.

STUDY DEVELOPMENT PROCESS

The 2015 Study followed a logical process to develop an ultimate preferred concept. This process along with details about the data collection process, design criteria, and other specifics is provided in **Appendix A**.

The study development process focused on assessing options for improvements to the North Junction. A major component of the process was traffic forecasting models. The models were used to assess how well each concept would handle future traffic. **Appendix A** provides details on the traffic forecasting methodology.

The Study development process was led by a Core Team comprised of staff from KDOT, the Federal Highway Administration (FHWA), the City of Wichita, and the design team (PEC and HNTB). The Core Team met four times throughout the process to review information and develop recommendations. The meeting summaries are included in **Appendix B**.

> The 2015 Study included more involvement from local stakeholders than previous studies

The Core Team identified a preferred concept and phasing plan for improvements to the North Junction. The preferred concept, as well as details on the selection process is provided in **Chapter 5**.

The preferred concept was then presented to the public and stakeholders to obtain input, identify concerns, and gauge support.

ENGAGEMENT

There had been limited involvement from local stakeholders and the public in previous planning efforts on the North Junction. The 2015 Study process involved stakeholders in the process of developing an ultimate interchange concept.

Stakeholders

In August and September of 2015, project staff met with stakeholders for the North Junction Project, including:

- Wichita Area Metropolitan Planning Organization
  - Transportation Policy Body
  - Technical Advisory Committee
- Local elected officials
- Bridgeport Area Business Association
- Koch Industries
- Westar
- Unified School District 259
- First Student (district bus provider)

Public

Project staff met individually with property owners that would be relocated due to the Green Project in August 2015. These meetings provided the owners with an opportunity to view the proposed improvements, ask questions of project staff, and gain an understanding of the relocation process.

On September 22, 2015, a public open house was held. A presentation informed attendees about the preferred concept, phasing plan, schedule, and funding. This was followed by breakout sessions where the public could discuss ideas with the project team, have questions answered, and voice concerns and support for the project.

The open house was promoted by a variety of means. KDOT made a press release, an invite and fact sheet were posted on the WAMPO website, WAMPO sent out information to their email distribution list, and postcard invites were sent to over 400 individual properties around the Study Area.

The open house was attended by 61 members of the public. Also, two media outlets attended and ran stories about the open house and proposed improvements. In general, attendees were supportive of the preferred concept. The public is well aware of the operational issues and support the preferred concept to improve traffic flow and safety. Concerns included the following:

- Right-of-way impacts
- Noise
- Lighting

A summary of the input received by the public at the open house is available in **Appendix C**.

CHAPTER 3: TRANSPORTATION INFRASTRUCTURE

The Study Area is comprised of a variety of transportation infrastructure including highways, arterial streets, interchanges, and bridges. Much of this infrastructure was constructed in the 1950s, 1960s, and 1970s. Due to its age and high traffic volumes, much of it is in need of replacement.

Information presented in this chapter was used during concept evaluation to identify a preferred concept that utilizes existing infrastructure that is in good condition to reduce the cost of improvements. However, the preferred concept had to balance the desire to utilize existing infrastructure with the need to facilitate safe and efficient traffic long into the future.

INVENTORY

The following is an inventory of the existing highways, arterial streets, interchanges, and bridges within the Study Area.

Highways

There are four highways within the Study Area with a few segments carrying more than one designation. **Table A** lists the Study Area highways and some general characteristics. **Exhibit 4** shows the configuration of the highways and the number of lanes.

According to the Kansas State Highway Classification System, I-135 and I-235 are class A routes, K-96 is a class B route, and K-254 is a class C route.

The highways within the Study Area are integral to freight movement. The Kansas Freight Advisory Committee considers I-135 and I-235 as primary freight corridors. Also, I-135 north of I-235 and I-235 west of I-135 is an oversize truck route.

All of the highways in the Study Area are included in the Wichita Area Metropolitan Planning Organization's (WAMPO) Multimodal Freight Network. WAMPO's Freight Plan identifies the North Junction as a bottleneck that impedes truck traffic. This shows how vital the North Junction and Study Area highways are to regional and statewide freight mobility.

Arterials

Beyond the highways, local arterials have access to and/or pass over or under the highways in the Study Area. These arterial streets are shown in **Exhibit 4**. Arterial streets that have access to the highways via an interchange are listed in **Table B**.

Interchanges

There are eight interchanges within the Study Area, three of which are system-to-system interchanges. The remaining five provide access between the highways and local arterials. **Table B** lists the interchanges as well as the type of interchange configuration. **Exhibit 4** shows the location and configuration of the interchanges.

The configuration of highways and interchanges within the Study Area is unique. The North Junction, where I-135/I-235/K-254 intersect, is just over a mile north of the partial interchange where K-96 intersects with I-135. The proximity of these two interchanges create challenges. The close proximity of the I-235 and Broadway Interchange to the North Junction also poses challenges.

Bridges

There are 57 state-system bridges in the Study Area. These bridges and details about them are listed in **Table C**, which are sorted by bridge number. The location of these bridges is shown in **Exhibit 4**.

Table A: Highway Inventory

Highway	Segment	Posted Speed	Median Type	Other Designation(s)
I-135	North of I-235	60mph	Grass	81, 15
	I-235 to 37th N	60mph	Grass	81, 15, 96
	37th N to K-96	60mph	Raised Concrete	81, 15, 96
	South of K-96	60mph	Raised Concrete	81, 15
I-235	25th N to K-96	65mph	Grass	None
	K-96 to I-135	65mph	Grass	96
K-254	East of I-135	60mph	Grass	None
K-96	East of I-135	65mph	Grass	None
	West of I-235	60-70mph	Grass	None

Table B: Interchange Inventory

Interchange	Type of Interchange Configuration
I-135/53rd N	Diamond
I-135/I-235/K-254	Three-Leg Directional / Partial Cloverleaf
I-135/K-96	Trumpet
I-135/Hydraulic (including 29th N)	Partial Cloverleaf
I-235/K-96 (including Meridian)	Three-Leg Directional & Complete Diamond
I-235/Broadway	Partial Cloverleaf
K-96/Hydraulic	Partial Diamond
K-96/Hillside	Diamond

CONDITION

Highway Pavement

The highway pavement is in fair to good condition based upon the data from KDOT's pavement condition database and a preliminary assessment by KDOT Pavement Design. **Table D** shows the pavement condition information from the database. Northbound and southbound I-135 south of 53rd Street North have a fair performance level. However, a rehab project was recently completed along this segment of I-135, which is described in the following section. The remainder of the pavement within the Study Area is at level 1 (good). There are no highway sections that have pavement that is at level 3 (poor).

The information from the pavement condition database does not identify all issues with pavement condition. This is due to the large distances at which the database divides the highway sections. Additional areas of concern include sections of patchwork concrete under and between the bridges of I-135/I-235/K-254 on I-135. Ramps to/from K-96 and I-235 are older concrete with quite a few midpanel cracks and there are midpanel cracks on I-235.

Bridge Structures

Of the 57 bridges in the Study Area, three bridges are structurally deficient. Structurally deficient means there are issues with the structural integrity of the bridge. These include the two bridges on I-235 over the Little Arkansas River and the bridge from northbound I-235 to westbound K-96 over both directions of I-235 and eastbound K-96. **Table C** shows the condition of the bridges within the Study Area. **Exhibit 4** shows the location and condition of bridges within the Study Area. The two bridges over the Little Arkansas River will be replaced as part of the Green Project.

In addition to the structurally deficient bridges, there are 18 functionally obsolete bridges. A functionally obsolete bridge is a structure that has older design features and often has narrow shoulders or inadequate clearance.

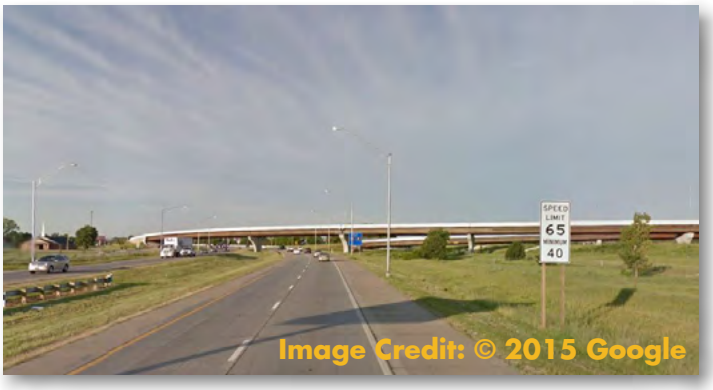
AREA PROJECTS

There are major projects planned, underway, or recently completed that are within the Study Area or in close proximity. These projects have or will modify the transportation infrastructure in the Study Area or will impact traffic within the Study Area.

Projects Underway & Recently Completed

13th Street Flyover

This project included a partial interchange at I-235 and 13th Street North. It included a connection from northbound I-235 to westbound 13th Street North and from eastbound 13th Street North to southbound I-235. This project was completed in the spring of 2015.



High Friction Ramps

High friction surfaces were applied to the westbound K-96 ramp to southbound I-135 and the northbound I-135 ramp to southbound I-235. This project was completed in the summer of 2015.

K-96 Shoulders

The asphalt shoulders on K-96 from the Arkansas River to the I-235/K-96/Meridian Interchange were reconstructed. This included the shoulders on the five bridges along this stretch of K-96. This project was completed in the summer of 2015.

I-135 Rehab

I-135 from 37th Street North to 85th Street North was rehabilitated. This major highway rehabilitation project includes mill and overlay of the driving lanes, bridge repairs, and other work. This project was completed in the fall of 2015.

K-96 over Arkansas River

This project focused on bridge repairs including patching, polymer overlays, strip seals, and rocker plates on the two bridges on K-96 over the Arkansas River. This project is expected to be complete in November 2015.

US-54/400 (Kellogg) and I-235 Interchange

The planning and design for this system-to-system interchange project is underway. The project has been broken into four phases. The first phase of reconstruction will focus on replacing two of the existing loop ramps with flyovers. Phase one will include a two-lane flyover ramp from southbound I-235 to eastbound Kellogg, a one-lane flyover ramp from northbound I-235 to westbound Kellogg, and auxiliary lanes for I-235 from Kellogg to Central Avenue. Construction on the phase one project will start in November 2015.

Subsequent phases of this interchange project will completely reconstruct the interchange. However, the time frame for construction of these subsequent phases is unknown and funding has not been secured.

Future Projects

45th St N and Hillside

As this Study was being developed, the City of Wichita was developing plans to improve the 45th Street North and Hillside intersection. This project will improve traffic operations at the intersection.

Northwest Bypass

The Northwest Bypass is a planned project that will provide a freeway connecting K-96 at Tyler Road to US-54 east of 183rd Street West. Some right-of-way has been acquired for this freeway but funds are not currently available for construction. This major project has the likelihood of changing traffic patterns within the Study Area.

Table C: Bridge Inventory & Condition

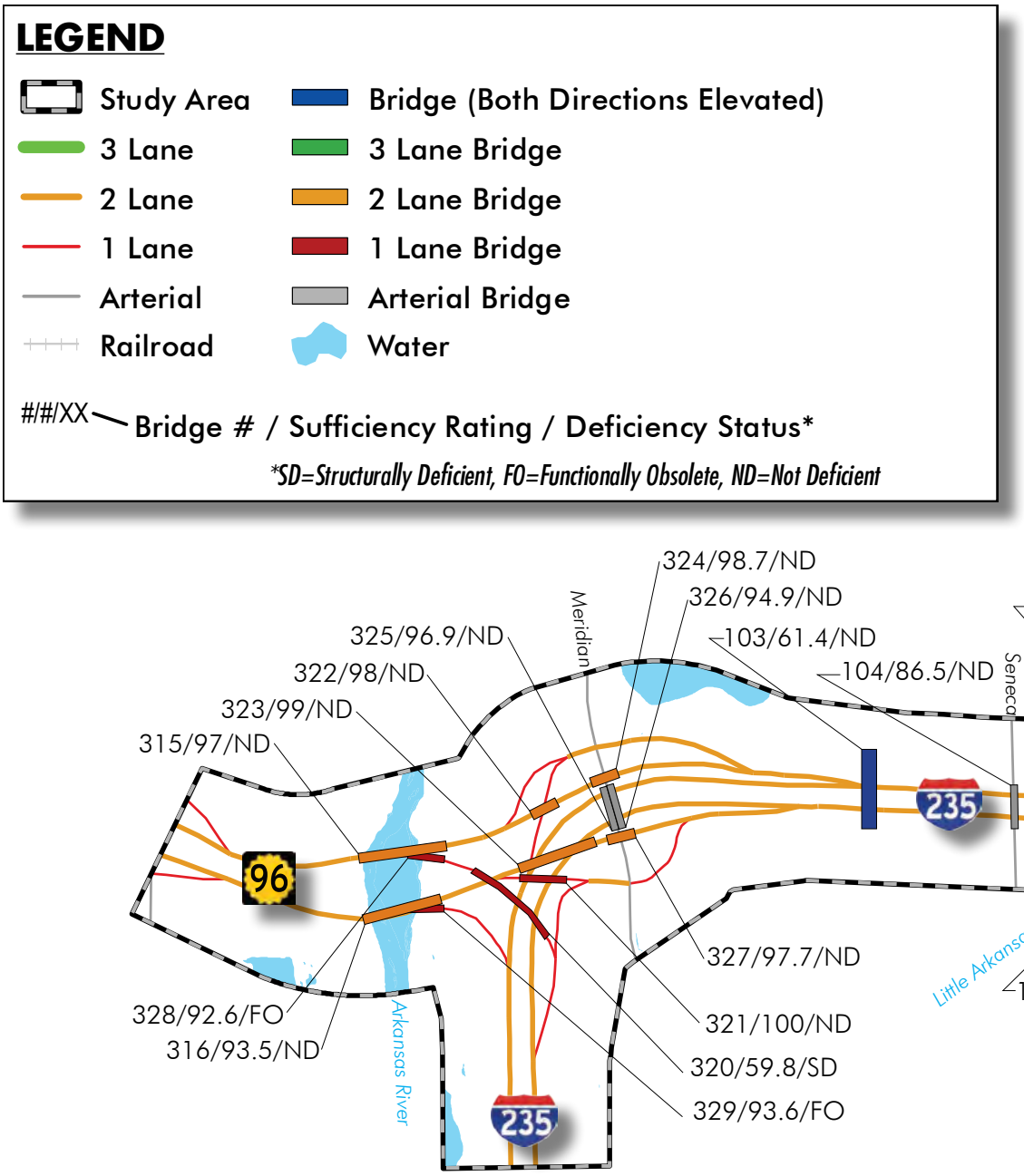
BRIDGE #	ON ROAD	PATH	FEATURE CROSSING	LOCATION	LENGTH (FT)	Sufficiency Rating*	Deficiency Status**
023	I135 NB/SB	OVER	NEW YORK/HYRDAULIC	0.85 MI N 21ST ST	32	68.8	FO
024	I135 SB	OVER	MOPAC RR,CHISHOLM CR DRG	1.00 MI N 21ST ST N	509	93.9	ND
025	I135 NB	OVER	MOPAC RR,CHISHOLM CR DRG	1.01 MI N 21ST ST N	515	93.9	ND
026	I135 SB	OVER	OKT RR, HYDRAULIC	1.18 MI N 21ST ST N	478	90.8	ND
027	I135 NB	OVER	OKT RR, HYDRAULIC	1.19 MI N 21ST ST N	479	93.9	ND
028	I135 SB	OVER	37TH ST N	JCT 37TH ST N/I135 SB	150	98	ND
029	I135 NB	OVER	37TH ST N	JCT 37TH ST N/I135 NB	150	98	ND
030	I135 SB	OVER	WICHITA FL CONTR CANAL	0.35 MI N 37TH ST N	44	68	ND
031	I135 NB	OVER	WICHITA FL CONTR CANAL	0.36 MI N 37TH ST N	46	95.1	ND
032	I235 NB	OVER	I135 SB	AT N INTERCHANGE	148	88.8	FO
033	K254 EB	OVER	I135 NB	AT N INTERCHANGE	141	79.9	FO
034	I235 SB	OVER	I-135 SB	AT N INTERCHANGE	122	87.1	FO
035	K254 WB	OVER	I135 NB	AT N INTERCHANGE	239	65.9	FO
036	45TH ST N	OVER	I135 NB/SB	0.42 MI N OF N INTERCHANGE	322	95	ND
037	I135 SB	OVER	53RD ST N	JCT 53RD ST N/I135 SB	217	95	ND
038	I135 NB	OVER	53RD ST N	JCT 53RD ST N/I135 NB	217	95.3	ND
103	I235 NB/SB,K96 EB,40TH ST N	OVER	LITTLE ARK RIVER DRG	0.55 MI E MERIDIAN	25	61.4	ND
104	SENECA	OVER	I235 NB/SB	0.92 MI E MERIDIAN	221	86.5	ND
105	I235 SB	OVER	LITTLE ARKANSAS RIVER	E OF JCT I235/ARKANSAS	694	40	SD
106	I235 NB	OVER	LITTLE ARKANSAS RIVER	E OF JCT I235/ARKANSAS	694	41	SD
107	I235 SB	OVER	ARKANSAS	JCT ARKANSAS/I235	133	74.3	FO
109	I235 SB	OVER	BROADWAY,ATSF RR	JCT BROADWAY/I235 SB	439	61.8	FO
110	I235 NB	OVER	BROADWAY,ATSF RR	JCT BROADWAY/I235 NB	431	91.9	ND
111	I235 SB	OVER	ATSF RR	0.54 MI E BROADWAY	146	71.1	ND
112	I235 NB	OVER	ATSF RR	0.53 MI E BROADWAY	135	88.4	ND
133	K96 EB/WB	OVER	STREAM	1.06 MI E OF JCT I135/K96	31	85	ND
194	K254 WB	OVER	HYDRAULIC	E OF N INTERCHANGE	259	89.4	ND
195	K254 EB	OVER	HYDRAULIC	E OF N INTERCHANGE	315	93.9	ND
196	K254 WB	OVER	MIDDLE FORK CHISHOLM CR	0.61 MI E HYDRAULIC	123	96.6	ND
197	K254 EB	OVER	MIDDLE FORK CHISHOLM CR	0.60 MI E HYDRAULIC	123	96.6	ND
315	K96 WB	OVER	ARKANSAS RIVER	0.56 MI E WEST ST	1,096	97	ND
316	K96 EB	OVER	ARKANSAS RIVER	0.57 MI E WEST ST	1,106	93.5	ND
320	I235 NB RP TO K96 WB	OVER	I235 NB/SB,K96 EB	0.81 MI E WEST ST	909	59.8	SD
321	K96 EB RP TO MERIDIAN	OVER	I235 NB/SB	0.89 MI E WEST ST	350	100	ND
322	K96 WB	OVER	MERIDIAN RP TO I235 SB	0.93 MI E WEST ST	208	98	ND
323	K96 EB	OVER	I235 NB/SB, MERIDIAN RP TO I235 SB	0.94 MI E WEST ST	552	99	ND
324	K96 WB	OVER	MERIDIAN	1.08 MI E WEST ST	250	98.7	ND
325	MERIDIAN SB	OVER	I235 NB/SB	3.16 MI NE ZOO	287	96.9	ND
326	MERIDIAN NB	OVER	I235 NB/SB	3.15 MI NE ZOO	287	94.9	ND
327	K96 EB	OVER	MERIDIAN	1.12 MI E WEST ST	250	97.7	ND
328	I235 NB RP TO K96 WB	OVER	ARKANSAS RIVER	0.61 MI E WEST ST	515	92.6	FO
329	K96 EB RP TO I235 SB	OVER	ARKANSAS RIVER	0.65 MI E WEST ST	131	93.6	FO
330	I135 SB RP TO I254 EB	OVER	K254 WB & I135 NB	AT N INTERCHANGE	428	94	FO
355	I235 NB	OVER	ARKANSAS	JCT ARKANSAS/I235	133	95.9	ND
388	K96 EB	OVER	I135 NB/SB	JCT I135/K96	323	95	FO
389	K96 WB	OVER	I135 NB/SB	JCT I135/K-96	323	94	FO
390	K96 WB RP TO I135 NB	OVER	HYDRAULIC	E OF JCT I135/K96	302	93	FO
391	K96 WB	OVER	HYDRAULIC	E OF JCT I135/K96	283	93	FO
392	K96 EB	OVER	HYDRAULIC	E OF JCT I135/K96	283	95	FO
393	K96 EB RP FROM HYDRAULIC	OVER	OKT RR	E OF JCT I135/K96	223	96	FO
394	K96 EB	OVER	OKT RR	E OF JCT I135/K96	223	96	FO
395	K96 WB	OVER	OKT RR	E OF JCT I135/K96	223	100	ND
396	K96 WB RP TO HYDRAULIC	OVER	OKT RR	E OF JCT I135/K96	223	96	FO
397	K96 EB	OVER	HILLSIDE	JCT K96/HILLSIDE	198	100	ND
398	K96 WB	OVER	HILLSIDE	JCT K96/HILLSIDE	198	100	ND
399	K96 EB	OVER	UP RR	E OF JCT K-96/HILLSIDE	532	98	ND
400	K96 WB	OVER	UP RR	E OF JCT K-96/HILLSIDE	532	100	ND

*sufficiency rating from SI&A reports. **FO=Functionally Obsolete, SD=Structurally Deficient, ND=Not Deficient

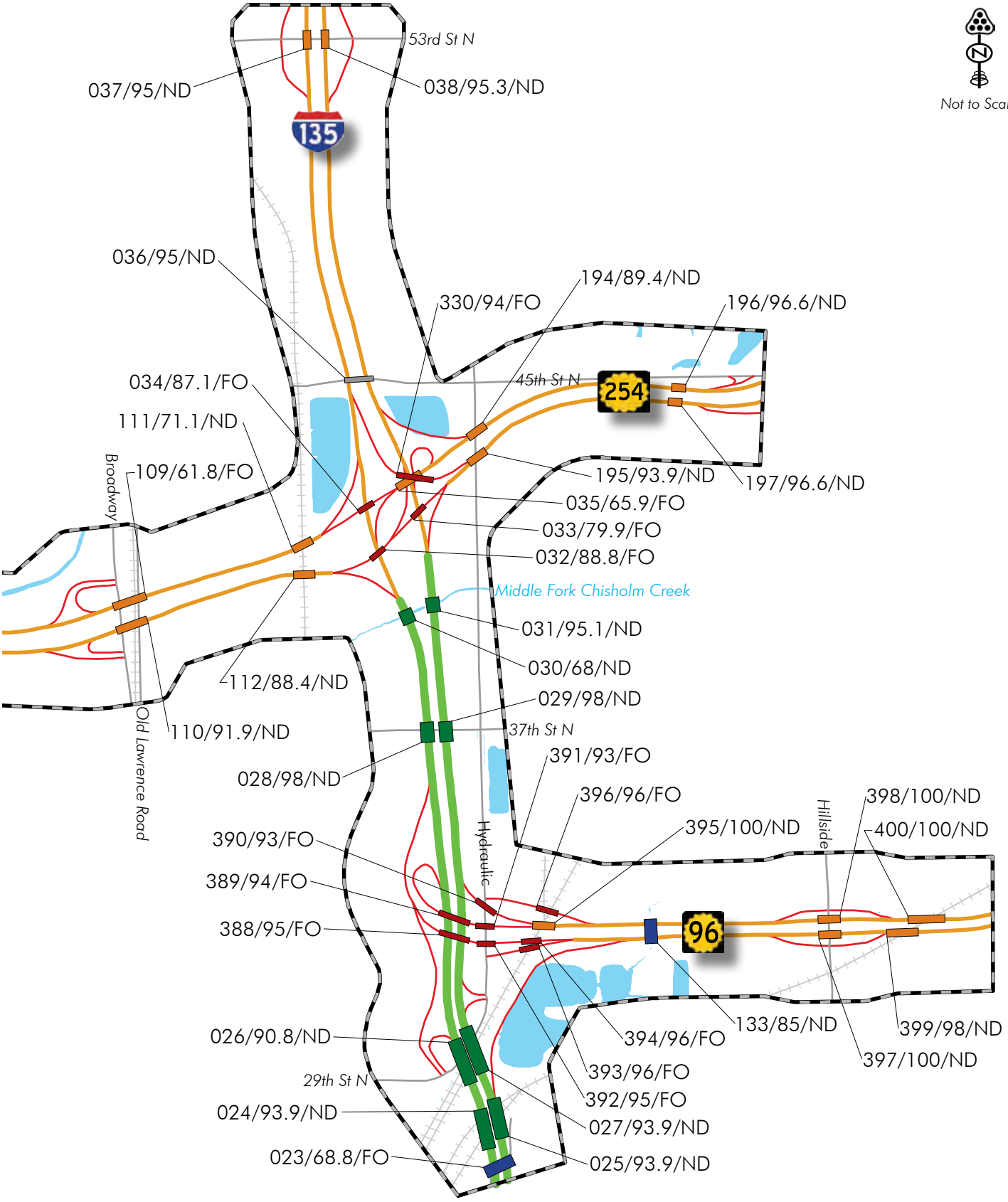
Table D: Pavement Condition

ID	MPBEG	SECLGT	MPEND	DSDATE	PL	DS	IRIDATE	IRIR	FDATE	RUTVAL	COUNTY	TCR1	TCR2	TCR3	FCR1	FCR2	FCR3	FCR4	BCR
0871135010112	10	1.474	11.474	7/31/14	1	111	4/8/14	79	4/8/14	0.124	87	16	0	0	0	0	0	0	0
0871135010114	10	1.474	11.474	7/31/14	1	111	4/8/14	86	4/8/14	0.108	87	0	6	0	0	0	0	0	0
0871135011122	11.474	0.526	12	7/31/14	1	111	4/8/14	100	4/8/14	0.143	87	18	0	0	0	0	0	0	0
0871135011124	11.474	0.526	12	7/31/14	1	211	4/8/14	122	4/8/14	0.101	87	20	0	0	1	0	0	0	0
0871135012132	12	1	13	7/31/14	2	221	4/8/14	125	4/8/14	0.252	87	45	0	0	1	0	0	0	0
0871135012134	12	1	13	7/31/14	1	121	4/8/14	88	4/8/14	0.163	87	55	0	0	1	0	0	0	0
0871135013142	13	1.224	14.224	7/31/14	2	231	4/8/14	128	4/8/14	0.207	87	0	60	0	0	0	0	0	0
0871135013144	13	1.224	14.224	7/31/14	2	221	4/8/14	105	4/8/14	0.207	87	65	0	0	1	0	0	0	0
0871235011122	11	1	12	7/31/14	1	111	4/8/14	37	4/8/14	0.083	87	0	0	0	0	0	0	0	0
0871235011124	11	1	12	7/31/14	1	111	4/8/14	40	4/8/14	0.06	87	0	0	0	0	0	0	0	0
0871235012132	12	1.237	13.237	7/31/14	1	111	4/8/14	41	4/8/14	0.06	87	0	0	0	0	0	0	0	0
0871235012134	12	1.237	13.237	7/31/14	1	111	4/8/14	40	4/8/14	0.061	87	0	0	0	0	0	0	0	0
0871235013142	13.237	0.856	14.093	7/31/14	1	111	4/8/14	37	4/8/14	0.056	87	0	0	0	0	0	0	0	0
0871235013144	13.237	0.856	14.093	7/31/14	1	111	4/8/14	40	4/8/14	0.04	87	0	0	0	0	0	0	0	0
0871235014152	14.093	1.492	15.585	7/31/14	1	111	4/8/14	40	4/8/14	0.057	87	0	0	0	0	0	0	0	0
0871235014154	14.093	1.492	15.585	7/31/14	1	111	4/8/14	40	4/8/14	0.058	87	0	0	0	0	0	0	0	0
0871235015162	15.585	0.931	16.516	7/31/14	1	121	4/8/14	66	4/8/14	0.057	87	46	0	0	4	0	0	0	0
0871235015164	15.585	0.931	16.516	7/31/14	1	121	4/8/14	72	4/8/14	0.072	87	44	0	0	2	0	0	0	0
0873096020211	20	1.085	21.085	7/31/14	1	111	4/9/14	44	4/9/14	0.066	87	0	0	0	0	0	0	0	0
0873096020213	20	1.085	21.085	7/31/14	1	121	4/9/14	43	4/9/14	0.055	87	0	0	2	0	0	0	0	0
0873096025271	25.663	1.337	27	7/31/14	1	111	4/8/14	63	4/8/14	0.074	87	0	0	0	0	0	0	0	0
0873096025273	25.663	1.337	27	7/31/14	1	111	4/8/14	71	4/8/14	0.074	87	0	0	2	0	0	0	0	0
0873254000011	0	1.183	1.183	7/31/14	1	111	4/8/14	50	4/8/14	0.069	87	19	0	0	1	0	0	0	0
0873254000013	0	1.183	1.183	7/31/14	1	121	4/8/14	59	4/8/14	0.077	87	31	0	0	6	0	0	0	1
#1-#3=County; #4=RTTY 1-I,2-U,3-K; #5-#7=RTNO; #8=CODE; #9-#10=Milepost begin; #11-#12=Milepost end, #12= 0-undivided, 1-WB, 2-NB, 3-EB, 4-SB	County milepost at start of segment	Length of segment in miles	County milepost at end of segment	Date the Distress State and PL were computed	Performance Level with 1=Good, 2=Fair, 3=Poor	Distress State (1st digit is roughness level, 2nd digit is a transverse cracking level, 3rd digit is rutting level)	Date the longitudinal profile was taken for the survey	Right wheelpath international roughness index in inches per mil	Date the distress data was taken for the survey	Average rut depth for both wheelpaths in inches	the three digit county number	Code 1 (low severity) transverse cracks as number of full width cracks per 100 feet with one implied decimal	Code 2 (medium severity) transverse cracks as number of full width cracks per 100 feet with one implied decimal	Code 3 (high severity) transverse cracks as number of full width cracks per 100 feet with one implied decimal	Code 1 (low severity) pattern cracks as number of wheelpath feet per 100 feet	Code 2 (medium severity) pattern cracks as number of wheelpath feet per 100 feet	Code 3 (high severity) pattern cracks as number of wheelpath feet per 100 feet	FCR4 - code 4 (typically shoved pavement with cracking) pattern cracks as number of wheelpath feet per 100 feet	Severity level of block cracking where at least 50% of the surveyed area exhibits block cracking. 1 is large blocks without secondary cracking, 2 is smaller blocks without secondary cracking, 3 is large without , and 4 is large with

Exhibit 4: Existing Infrastructure Configuration & Bridge Conditions



Bridge Conditions: From Structure Inventory and Appraisal Sheets obtained August 2014.


N
Not to Scale
53rd St N
037/95/ND
038/95.3/ND
135
036/95/ND
330/94/FO
194/89.4/ND
196/96.6/ND
034/87.1/FO
45th St N
254
111/71.1/ND
109/61.8/FO
Broadway
195/93.9/ND
197/96.6/ND
035/65.9/FO
033/79.9/FO
032/88.8/FO
Middle Fork Chisholm Creek
031/95.1/ND
030/68/ND
112/88.4/ND
029/98/ND
110/91.9/ND
Old Lawrence Road
37th St N
028/98/ND
391/93/FO
396/96/FO
398/100/ND
395/100/ND
400/100/ND
Hillside
390/93/FO
Hydraulic
389/94/FO
388/95/FO
96
026/90.8/ND
394/96/FO
133/85/ND
399/98/ND
393/96/FO
397/100/ND
29th St N
392/95/FO
024/93.9/ND
027/93.9/ND
023/68.8/FO
025/93.9/ND

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Identifying a preferred concept for the North Junction that will function safely and efficiently into the future requires analyzing existing operations and safety. The analysis of existing traffic operations show that there are areas of congestion. Future conditions without improvement show degradation in operations. The crash analysis in this chapter also indicates that there are opportunities to improve safety.

HISTORIC & EXISTING TRAFFIC VOLUMES

Over the past 20 years, traffic using the North Junction has increased by almost 50% and truck traffic has increased by more than 30%. With increased traffic, congestion and travel delay has become more widespread and intense. This is especially true during the morning and evening rush hours for specific traffic movements. Without improvement, congestion at the North Junction is expected to increase.

> Daily traffic on K-96 east of I-135 has increased by 80% (25,740 vehicles) over the past 20 years

Daily Volumes

KDOT's Traffic Flow Maps over the past two decades include traffic and truck volumes at 12 locations within or just outside the Study Area. Over the past 20 years, annual average daily traffic (AADT) in the Study Area grew by 54.2% and daily truck volumes grew by 39.3%. The greatest increases were during the 1990s and early 2000s. **Chart A** shows the total AADT and daily truck volumes over the past 20 years for all count locations (all counts added together).

The AADT and daily truck volumes using the North Junction have also increased substantially. Over the past 20 years, the AADT of the North Junction grew by 48.7% and daily truck volumes grew by 32.7%. AADT grew substantially from 1994-2004 and has stayed fairly consistent since 2004. Truck traffic increased fairly steadily since 1994 with slight declines from 1996-1998 and 2008-2011. **Chart B** shows the AADT and daily truck traffic using the North Junction over the past 20 years.

The AADT and truck volumes on individual highway segments are shown in **Chart C** and **Chart D**, respectively.

Chart A: Total Study Area Traffic Volumes

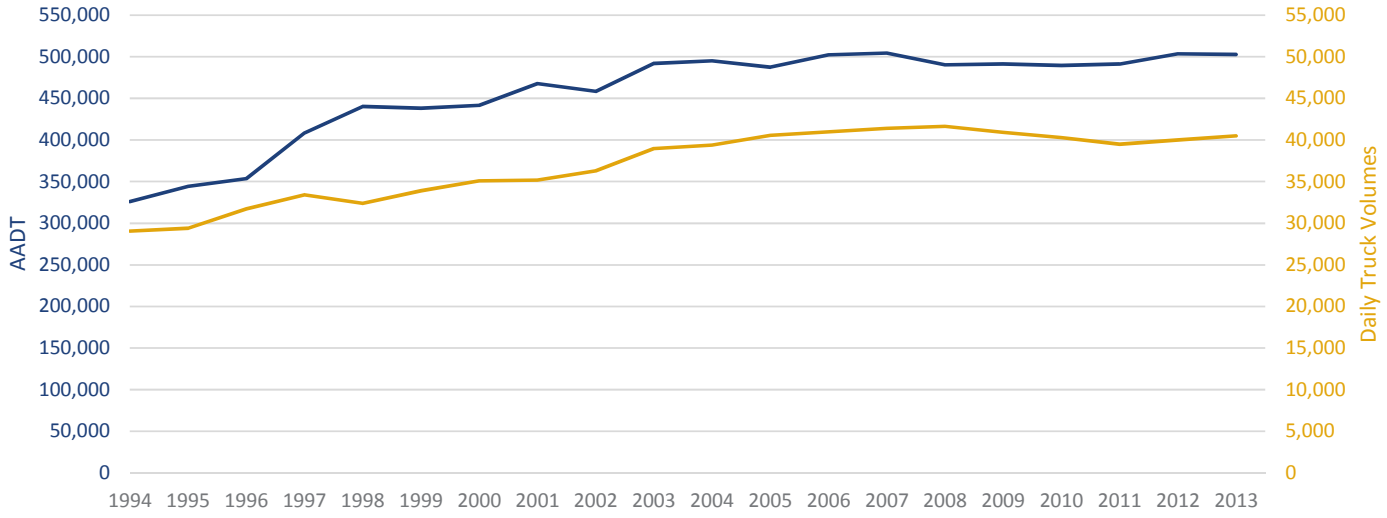


Chart B: North Junction Traffic Volumes

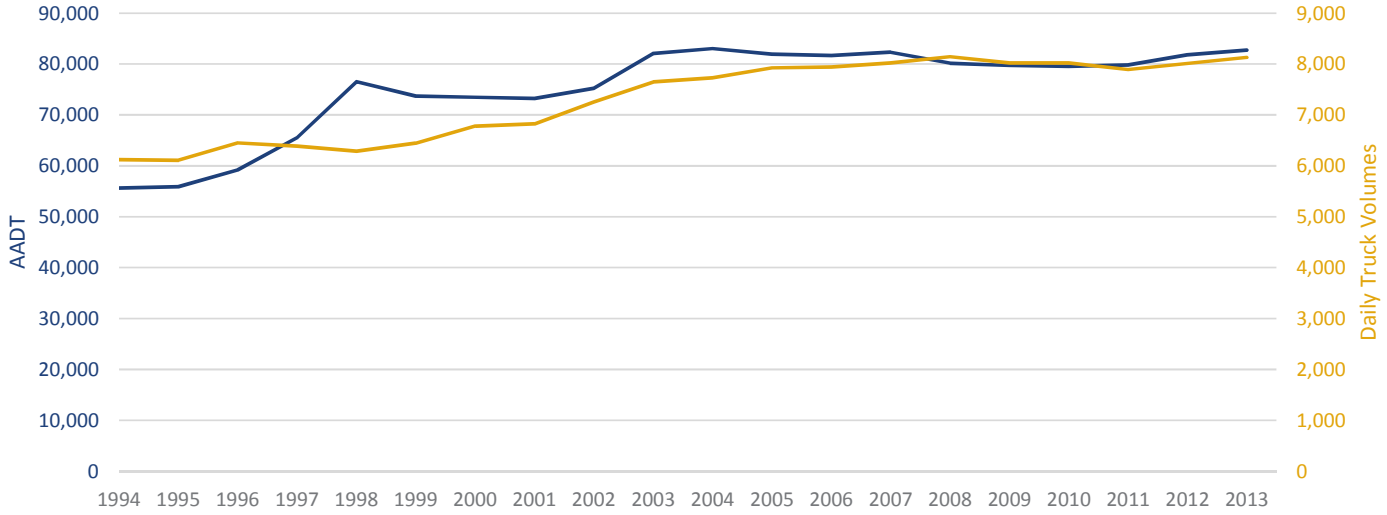


Chart C: AADT for Highway Segments

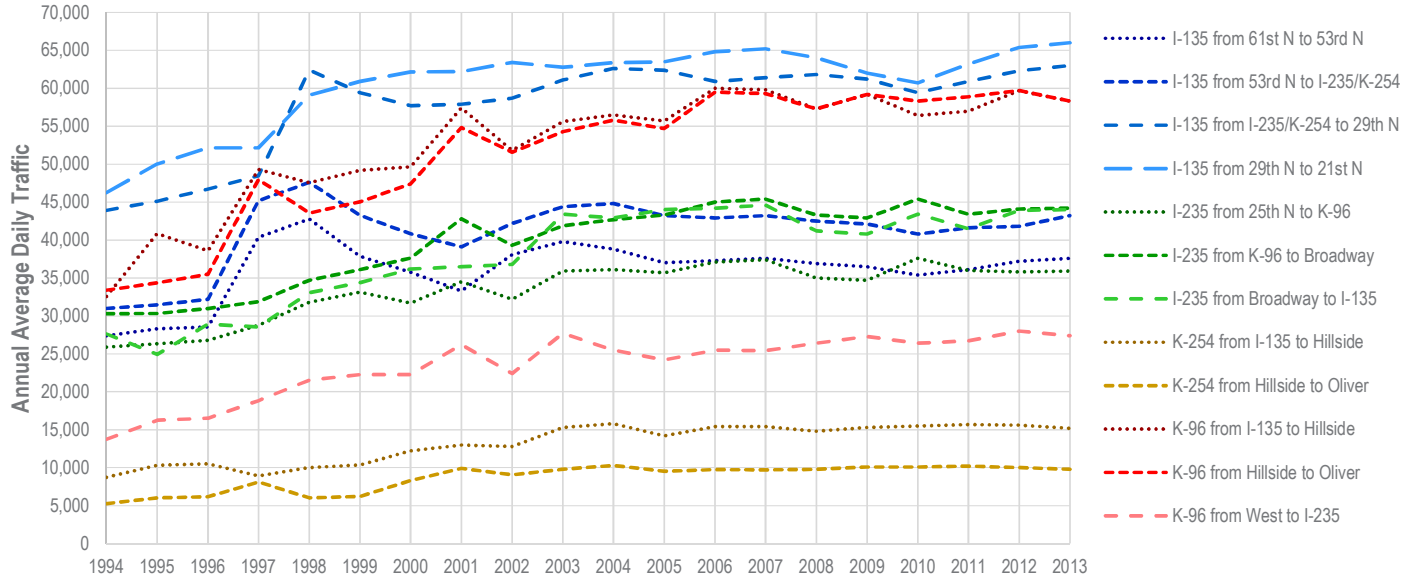
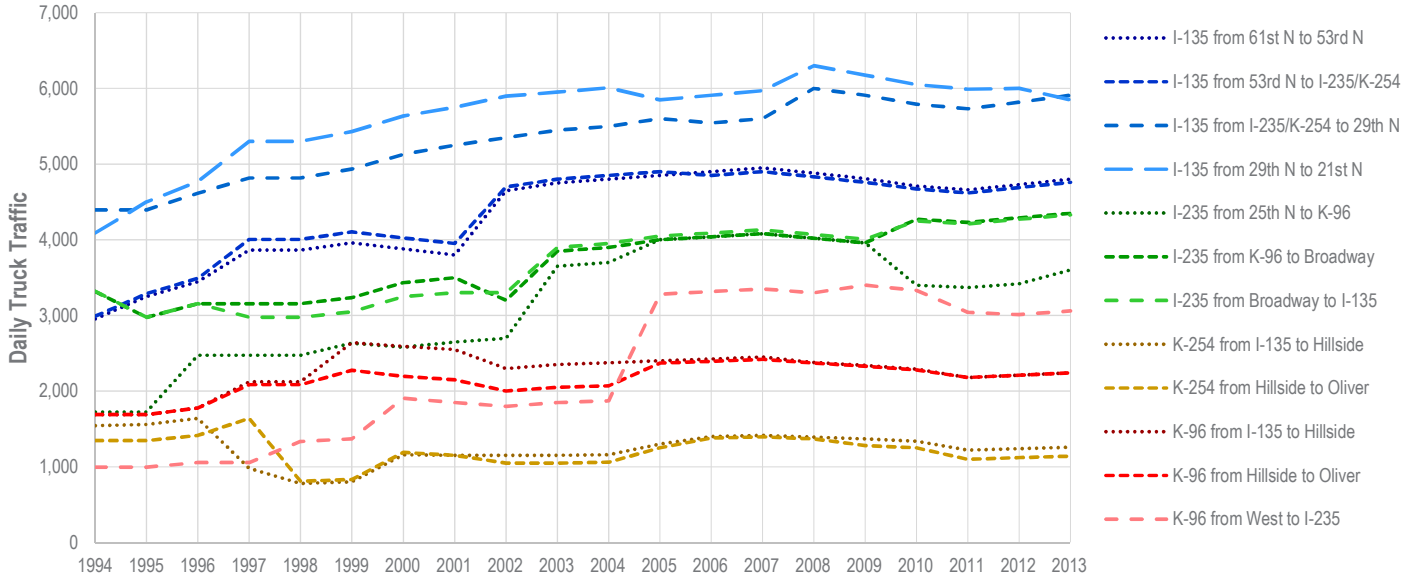


Chart D: Daily Truck Volumes for Highway Segments



Peak Hour Volumes

The peak hour represents four consecutive 15-minute periods with the highest traffic volumes. There is a peak hour in the morning and one in the evening. The data indicates that the peak hours in the Study Area are 7:15 to 8:15 AM and 4:30 to 5:30 PM. The existing conditions operational analysis (as well as Future No-Build and Build conditions), were modeled using these two peak hour periods. **Table E** shows the 2010 AADT and the peak hour traffic on all legs of the North Junction.

Table E: Peak Hour Traffic (2010)

Highway Segment	2-Way AADT	AM Peak 2-Way Traffic	AM Peak % of AADT	PM Peak 2-Way Traffic	PM Peak % of AADT
I-235 West of N Junction	43,400	4,263	9.8%	4,981	11.5%
I-135 North of N Junction	40,800	4,068	10.0%	4,522	11.1%
I-135 South of N Junction	59,400	6,511	11.0%	5,785	9.7%
K-254 East of N Junction	15,500	1,670	10.8%	2,026	13.1%

Source: KDOT Traffic Counts 2010

Exhibit 5 shows the 2010 peak hour volumes based on traffic counts and turning movement counts collected for this Study.

EXISTING TRAFFIC OPERATIONS

Level-of-Service

Level-of-Service (LOS) is a letter grade representing the traffic conditions along a segment of road. LOS A represents free-flow conditions while LOS F is extremely congested. It is desirable to minimize those segments operating at LOS E and F. **Exhibit 6** and **Exhibit 7** show the existing AM and PM peak hour LOS as defined by the Highway Capacity Manual (HCM). They include average speed and densities for the highway segments that are at or below LOS D.

The following summarizes the LOS:

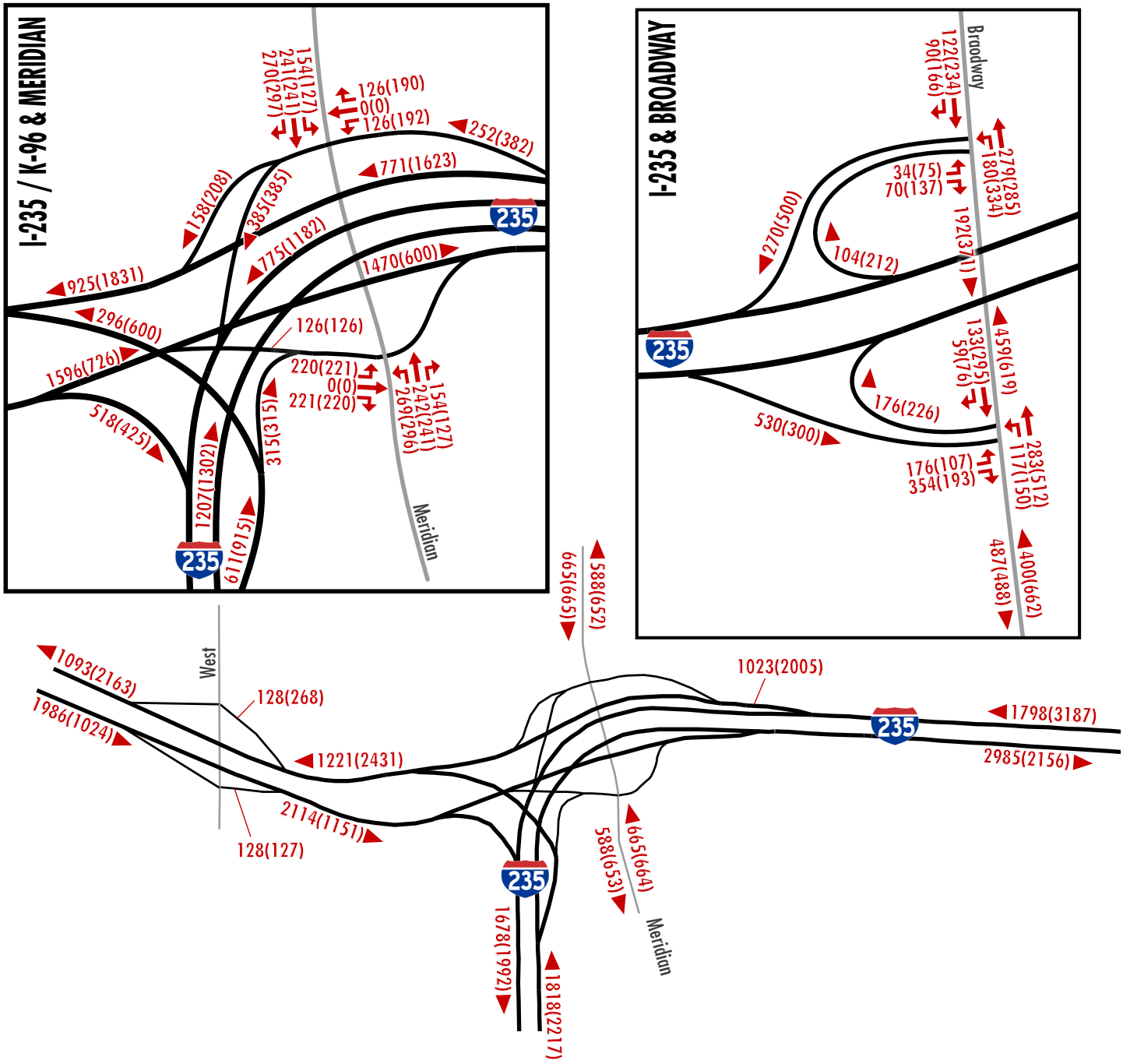
- LOS in the AM peak hour is primarily in the range of A through C with a few isolated segments at D through F. The poorest LOS segments include:
  - Northbound I-235 west of Broadway to the ramp to southbound I-135 (LOS E and F)
  - LOS D on either end of the aforementioned segment
- LOS in the PM peak hour is primarily in the range of A through C with a few isolated segments at D through F. The poorest LOS segments include:
  - Northbound I-135 leading to the loop ramp to southbound I-135 (LOS D through F)
  - Southbound I-235 where the northbound I-135 loop ramp merges in with westbound K-254 (LOS E)

It can be noted that the peak hour congestion is highly directional and centered around the North Junction. Many vehicles traveling from northbound I-235 to southbound I-135 in the AM peak hour are ultimately traveling eastbound on K-96. In the PM peak hour, many vehicles traveling northbound I-135 to southbound I-235 come from westbound K-96.

Travel Time

Travel time runs were conducted for the Study Area. Information was collected for both directions during AM and PM peak hours in order to calibrate the existing VISSIM traffic model. The results of the travel time runs are shown in **Table F** and **Table G**. The travel time tables list the beginning and end points that were used as well as the time it took and average running speed to travel these segments during the peak hours. The travel time runs reinforce the VISSIM traffic modeling results in **Exhibit 6** and **Exhibit 7**.

Exhibit 5: 2010 Peak Hour Traffic Volumes



###(###) = AM Peak Hour Volumes (PM Peak Hour Volumes)

► ⮥ → ⮧ = Travel Direction

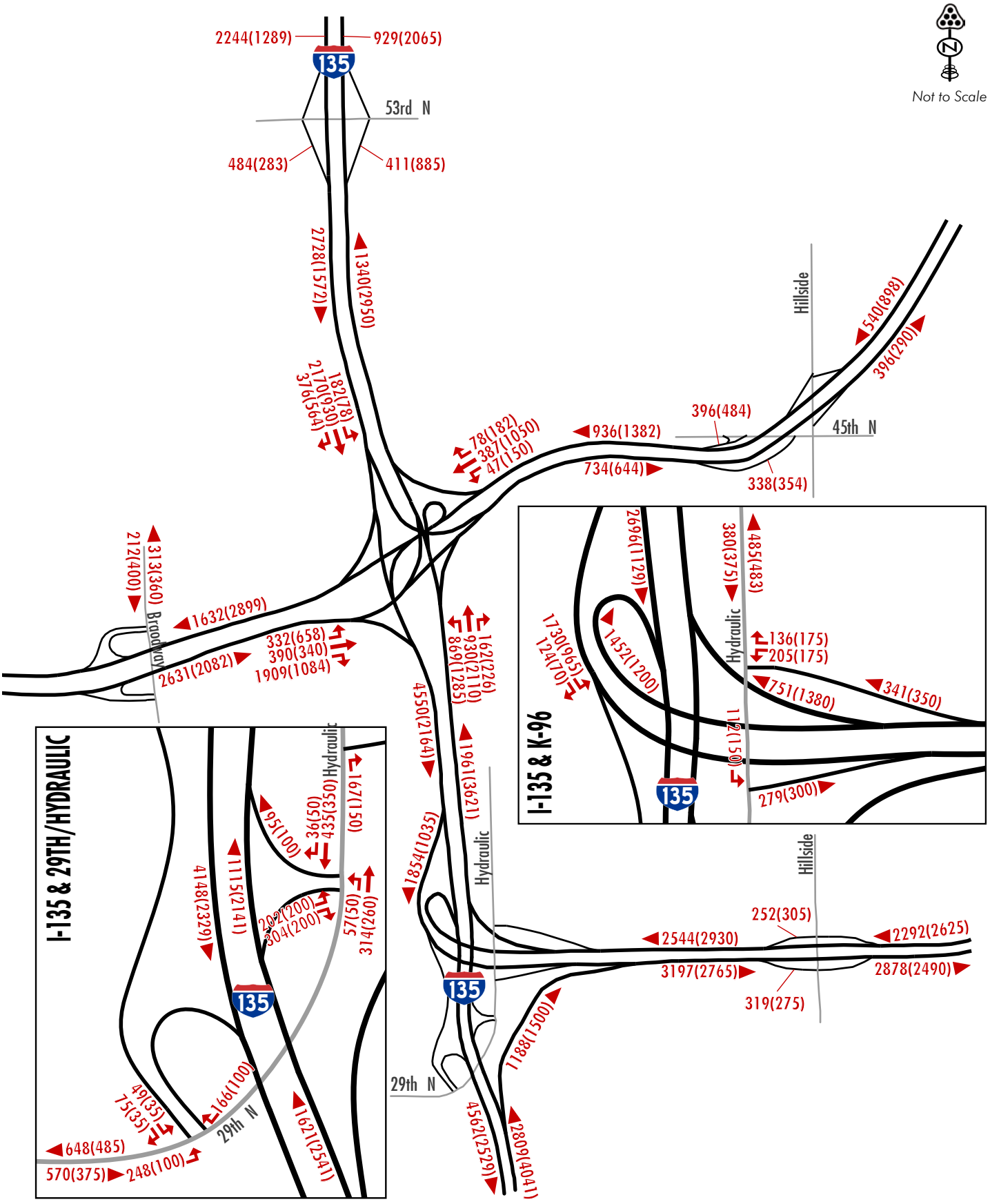

Not to Scale
2244(1289)
929(2065)
135
53rd N
484(283)
411(885)
2728(1572)
1340(2650)
182(78)
217(930)
376(564)
78(182)
387(1050)
47(150)
936(1382)
396(484)
45th N
734(644)
338(354)
Hillside
540(898)
396(290)
212(400)
313(360)
Broadway
1632(2899)
2631(2082)
332(658)
390(340)
1909(1084)
162(226)
930(2110)
869(1285)
455(2164)
1961(3621)
1854(1035)
Hydraulic
I-135 & K-96
2696(1129)
1730(965)
124(70)
1452(1200)
380(375)
485(483)
136(175)
205(175)
751(1380)
341(350)
112(150)
279(300)
I-135 & 29TH/HYDRAULIC
95(100)
36(50)
435(350)
167(150)
4148(2329)
1115(2141)
207(200)
304(200)
57(50)
314(260)
49(35)
75(35)
166(100)
29th N
648(485)
570(375)
248(100)
1621(2541)
252(305)
2544(2930)
2292(2625)
3197(2765)
2878(2490)
319(275)
1188(1500)
456(2529)
2809(4041)

Exhibit 6: 2010 AM Peak Hour Level-of-Service

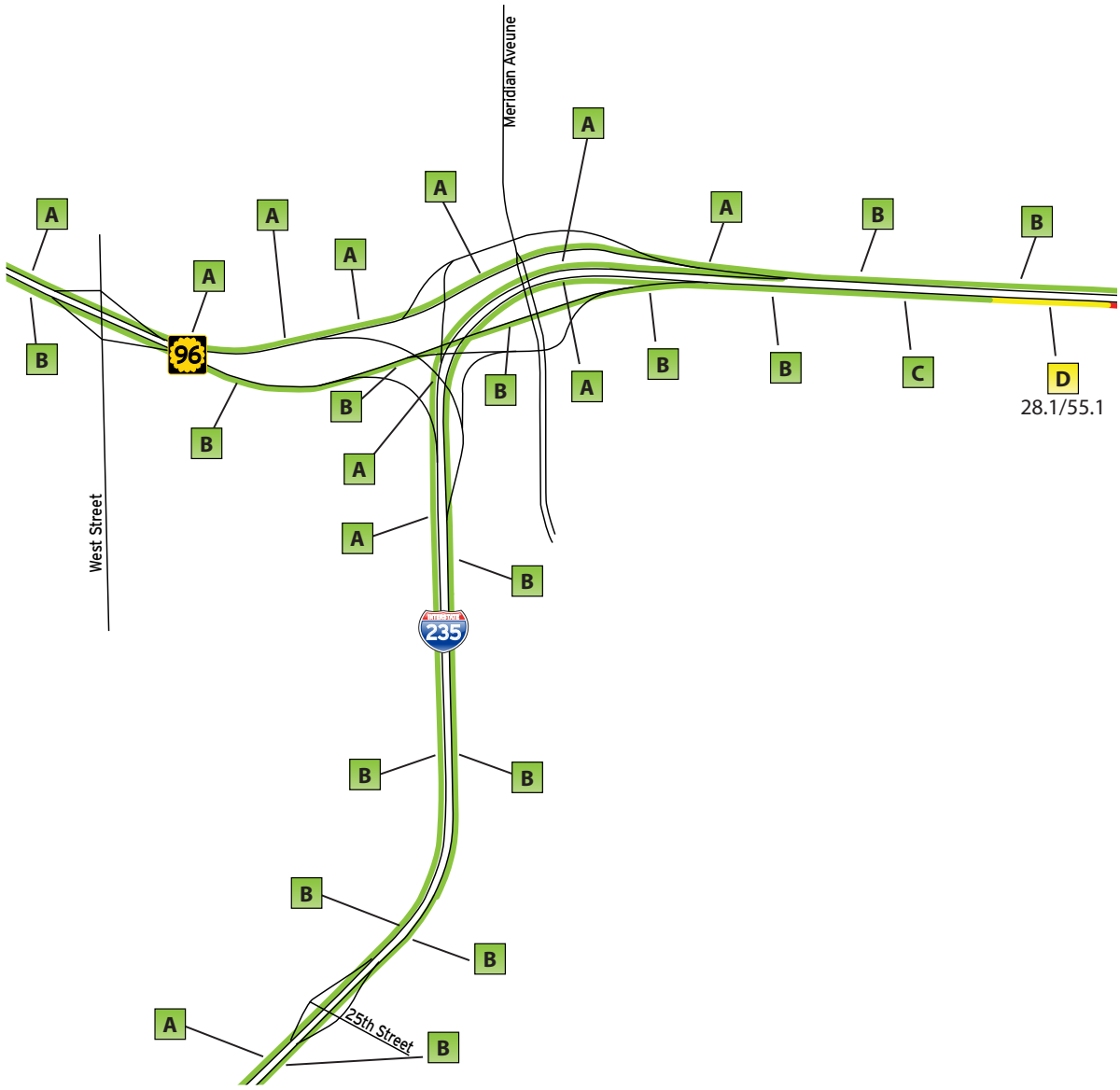
Freeway Level of Service Thresholds

	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
	A	≤ 11	≤ 10	≤ 10
Free Flow	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed




Not to Scale
53rd Street
45th Street
29th Street
Broadway Street
Hillside Street
Hydraulic Street
Hillside Street
135
235
96
254
96
135
68.3/20.6
60.7/27.3
50.9/29.4
43.9/40.3
42.8/38.3
58.1/32.3
41.3/38.8
29.7/51.4
30.5/53.3
26.4/59.1

Exhibit 7: 2010 PM Peak Hour Level-of-Service

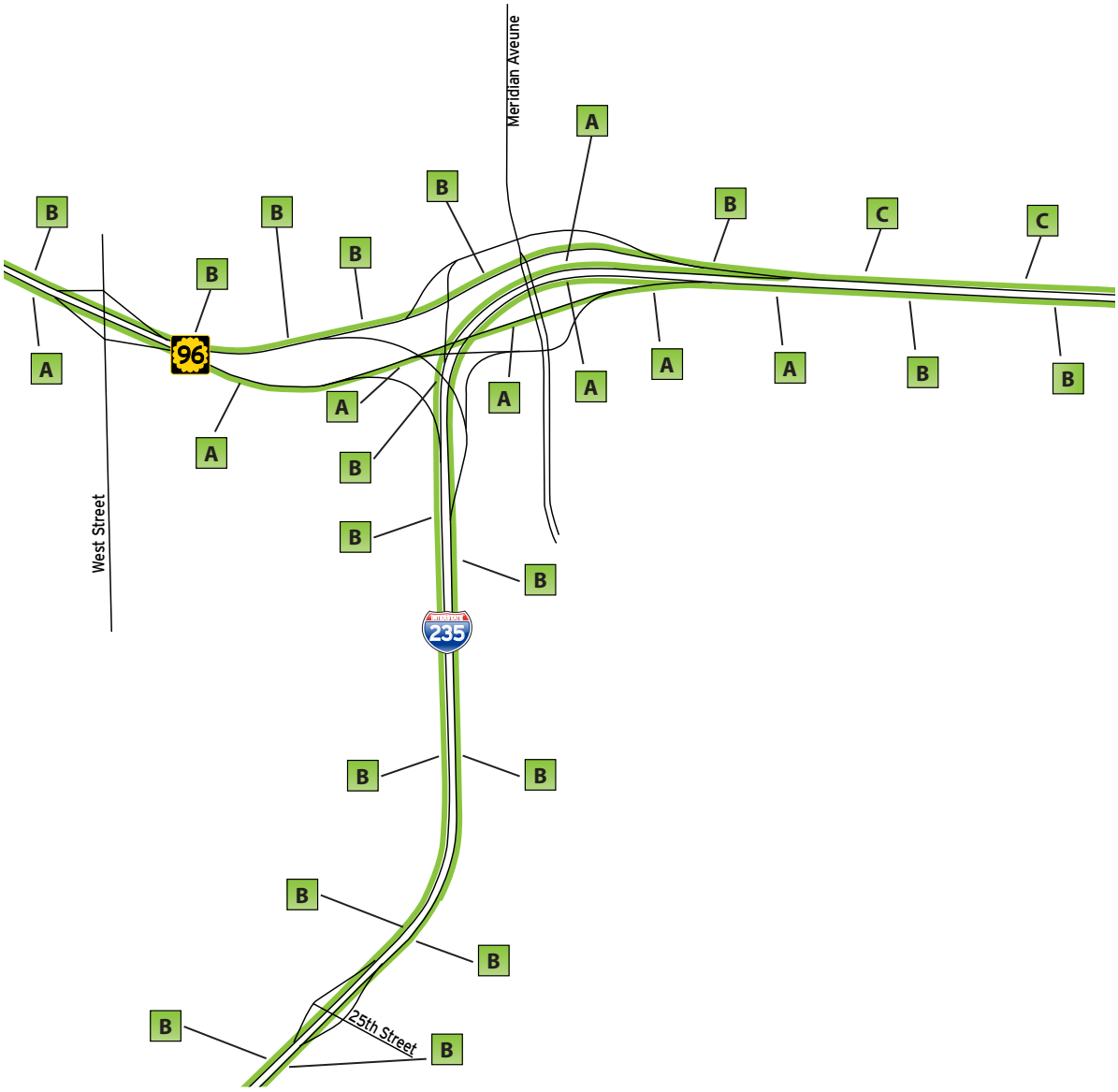
Freeway Level of Service Thresholds

	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
Free Flow	A	≤ 11	≤ 10	≤ 10
	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed




N
Not to Scale
53rd Street
45th Street
29th Street
Broadway Street
Hydraulic Street
Hillside Street
Hillside Street
135
235
96
254
96
135
F
43.1/24.4
F*
72.1/35.7
F
64.4/31.6
F
58.2/36.0
E
36.6/46.9
B
13.7/62.2

Table F: AM Peak Hour Travel Times

Location			Field Avg. Travel Time (s)	Distance (ft)	Avg. Speed (mph)
From (Data Point)	To (Data Point)	Via Route			
West St. (ent. Gore)	Meridian Ave.	EB K-96	53.5	4900	62.4
Meridian Ave.	Broadway St.	EB K-96 / NB I-235	144.5	10000	47.2
Broadway St.	37th St.	NB I-235 / SB I-135	144.7	6600	31.1
37th St.	Hydraulic (exit gore)	SB I-135 / EB K-96	44.0	2850	44.2
Hydraulic (exit gore)	Hillside (exit gore)	EB K-96	79.0	5500	47.5
Hillside (ent. Gore)	37th St.	WB K-96 / NB I-135	79.5	7550	64.8
37th St.	Broadway St.	NB I-135 / SB I-235	126.5	10150	54.7
Broadway St.	Meridian Ave.	SB I-235	107.5	10050	63.7
Meridian Ave.	25th St. (exit gore)	SB I-235	101.0	9800	66.2
25th St. (ent. Gore)	Meridian Ave.	NB I-235	96.0	9600	68.2
Meridian Ave.	Broadway St.	NB I-235	129.5	10030	52.8
Broadway St.	Hillside/45th (exit gore)	NB I-235 / EB K-254	103.0	10000	66.2
Hillside/45th (ent. Gore)	37th St.	WB K-254 / SB I-135	98.0	10600	73.7
Hydraulic (ent. Gore)	37th St.	NB I-135	39.0	3600	62.9
Broadway St.	Meridian Ave.	SB I-235 / WB K-96	107.5	10150	64.4
Meridian Ave.	West St. (exit gore)	WB K-96	50.5	4750	64.1
Broadway St.	53rd St.	NB I-235 / NB I-135	118.0	11350	65.6
53rd St. (ent. gore)	Broadway St.	SB I-135 / SB I-235	109.0	10350	64.7
37th St.	Hillside/45th (exit gore)	NB I-135 / EB K-254	86.0	8300	65.8
Hillside/45th (ent. gore)	Broadway St.	WB K-254 / SB I-235	113.0	10000	60.3

Table G: PM Peak Hour Travel Times

Location			Field Avg. Travel Time (s)	Distance (ft)	Avg. Speed (mph)
From (Data Point)	To (Data Point)	Via Route			
West St. (ent. Gore)	Meridian Ave.	EB K-96	49.8	4900	67.1
Meridian Ave.	Broadway St.	EB K-96 / NB I-235	100.4	10000	67.9
Broadway St.	37th St.	NB I-235 / SB I-135	71.9	6600	62.6
37th St.	Hydraulic (exit gore)	SB I-135 / EB K-96	33.5	2850	58
Hydraulic (exit gore)	Hillside (exit gore)	EB K-96	92.8	8350	61.4
Hillside (ent. Gore)	37th St.	WB K-96 / NB I-135	110.3	7550	46.7
37th St.	Broadway St.	NB I-135 / SB I-235	204.5	10150	33.8
Broadway St.	Meridian Ave.	SB I-235	101.3	10050	67.7
Meridian Ave.	25th St. (exit gore)	SB I-235	100.5	9800	66.5
25th St. (ent. Gore)	Meridian Ave.	NB I-235	98.5	9600	66.5
Meridian Ave.	Broadway St.	NB I-235	100.0	10030	68.4
Broadway St.	Hillside/45th (exit gore)	NB I-235 / EB K-254	104.0	10000	65.6
Hillside/45th (ent. Gore)	37th St.	WB K-254 / SB I-135	103.0	10600	70.2
Hydraulic (ent. Gore)	37th St.	NB I-135	54.5	3600	45
Broadway St.	Meridian Ave.	SB I-235 / WB K-96	104.2	10150	66.4
Meridian Ave.	West St. (exit gore)	WB K-96	47.4	4750	68.3
Broadway St.	53rd St.	NB I-235 / NB I-135	118.0	11350	65.6
53rd St. (ent. gore)	Broadway St.	SB I-135 / SB I-235	107.0	10350	66
37th St.	Hillside/45th (exit gore)	NB I-135 / EB K-254	105.0	8300	53.9
Hillside/45th (ent. gore)	Broadway St.	WB K-254 / SB I-235	196.5	10000	34.7

2050 NO-BUILD TRAFFIC & OPERATIONS

Future No-Build conditions assume leaving the area "as is" except for planned or committed projects. This essentially answers the question, "How will this Study Area function in the future with no changes to the existing roadway configuration?" The following section helps answer this question by providing an understanding of regional population and employment forecasts, future traffic demand, operations, safety, and planned or committed transportation enhancements.

Regional Growth

Regional growth patterns can determine where traffic patterns will change. Wichita is experiencing greater growth and suburban sprawl to the east and west of the City, which explains the higher forecasted growth rates of traffic seen on K-96 and K-254. If these growth patterns were to change dramatically, future traffic patterns could be altered.

Regional Influences

Regional influences are those factors which could change or modify the traffic demands on the Study Area in the future. These regional influences can have a direct impact on future population and economic forecast data. The primary regional influencer in this case is the proposed Northwest Wichita Bypass. KDOT has not committed to building this project, so the Study's traffic forecast methodology was considered with and without a Northwest Bypass. Ultimately, the decision was made to analyze future traffic under conditions that would lead to the maximum traffic on Study Area routes. This scenario was based on planned (short- and long-term) transportation improvements within the Wichita Area and includes the Northwest Bypass and other planned transportation projects.

Roadway

When analyzing future No-Build conditions, committed projects in the area were taken into consideration. It was assumed that there would be no major roadway improvements within the Study Area beyond normal maintenance. Consequently, the current roadway is assumed to have the same configuration in the year 2050 for the No-Build condition.

Traffic

Appendix A outlines the approach used to develop the Future No-Build traffic forecast. The VISSIM models were used to forecast the No-Build volumes and to evaluate anticipated traffic operations. 2050 No-Build traffic volumes are shown in **Table H** and **Exhibit 8**. 2050 No-Build AM and PM peak hour LOS is shown in **Exhibit 9** and **Exhibit 10**, respectively. They also include average speed and densities for the highway segments that are at or below LOS D.

Table H: Peak Hour Traffic (2050 No-Build)

Location	Total Two-Way Traffic Demand (AADT)	Peak Two-Way Traffic Demand (AM/PM)
I-235 West of N Junction	83,000	7,219 / 8,317
I-135 North of N Junction	82,600	6,697 / 7,291
I-135 South of N Junction	109,000	10,930 / 9,235
K-254 East of N Junction	45,500	3,586 / 3,512

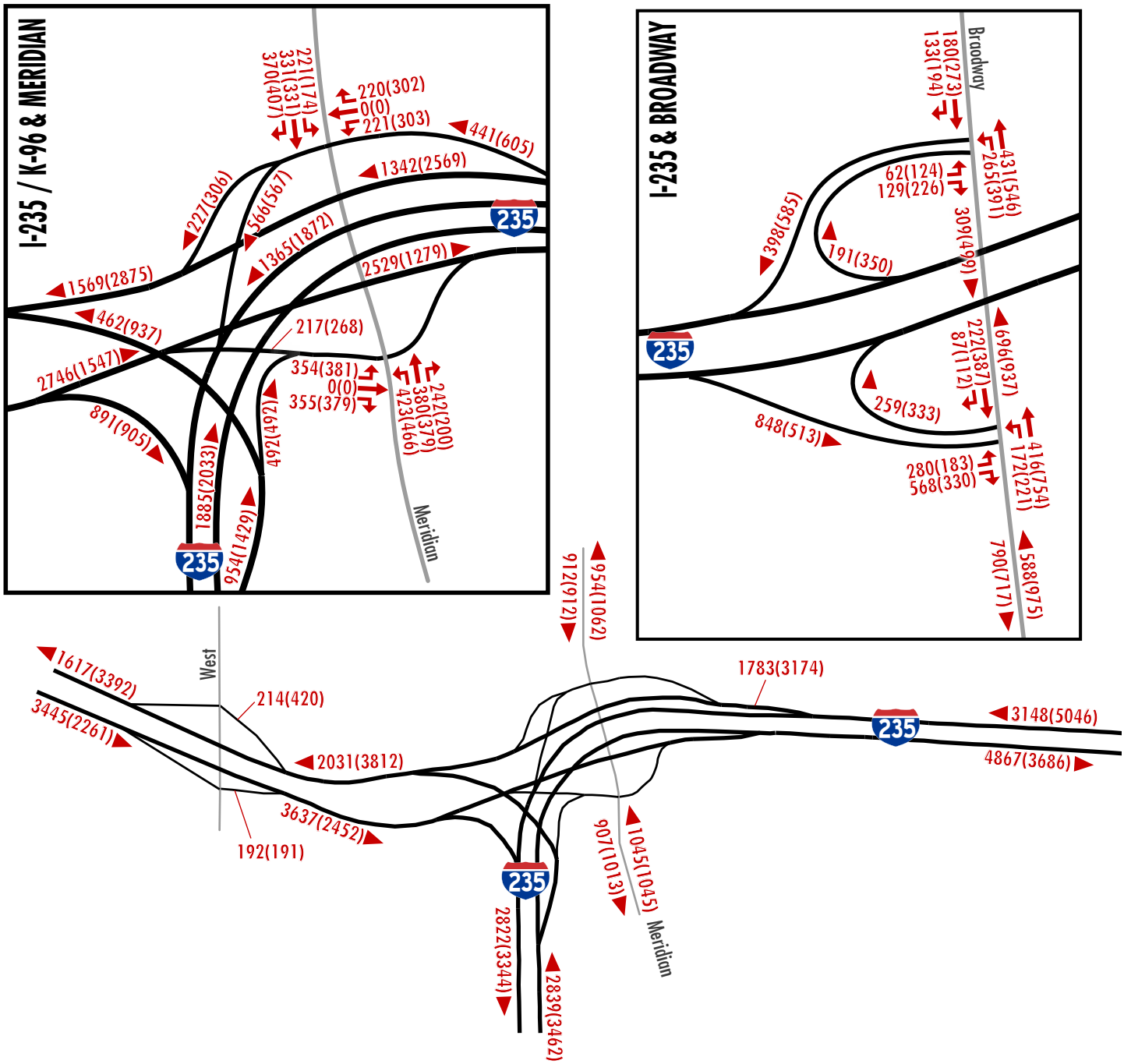
Source: KDOT Projections 2050

The following summarizes the future No-Build traffic analysis:

- 160,000 AADT through the North Junction representing a 78% growth over existing volumes
- LOS is primarily in the range of D through F in the AM peak hour in the eastbound direction leading into the North Junction
- LOS is primarily in the range of D through F in the PM peak hour in the westbound and northbound directions leading into the North Junction
- Network capacity issues (same as existing conditions) include:
  - Northbound I-235 to southbound I-135 ramp movement in the AM peak hour
  - Northbound I-135 to southbound I-235 ramp movement in the PM peak hour

This analysis demonstrates the need for improvements. Traffic volumes are expected to grow leading to more widespread and intense congestion.

Exhibit 8: 2050 No-Build Traffic Volumes



###(###) = AM Peak Hour Volumes (PM Peak Hour Volumes)

► ⬏ → ⬎ = Travel Direction

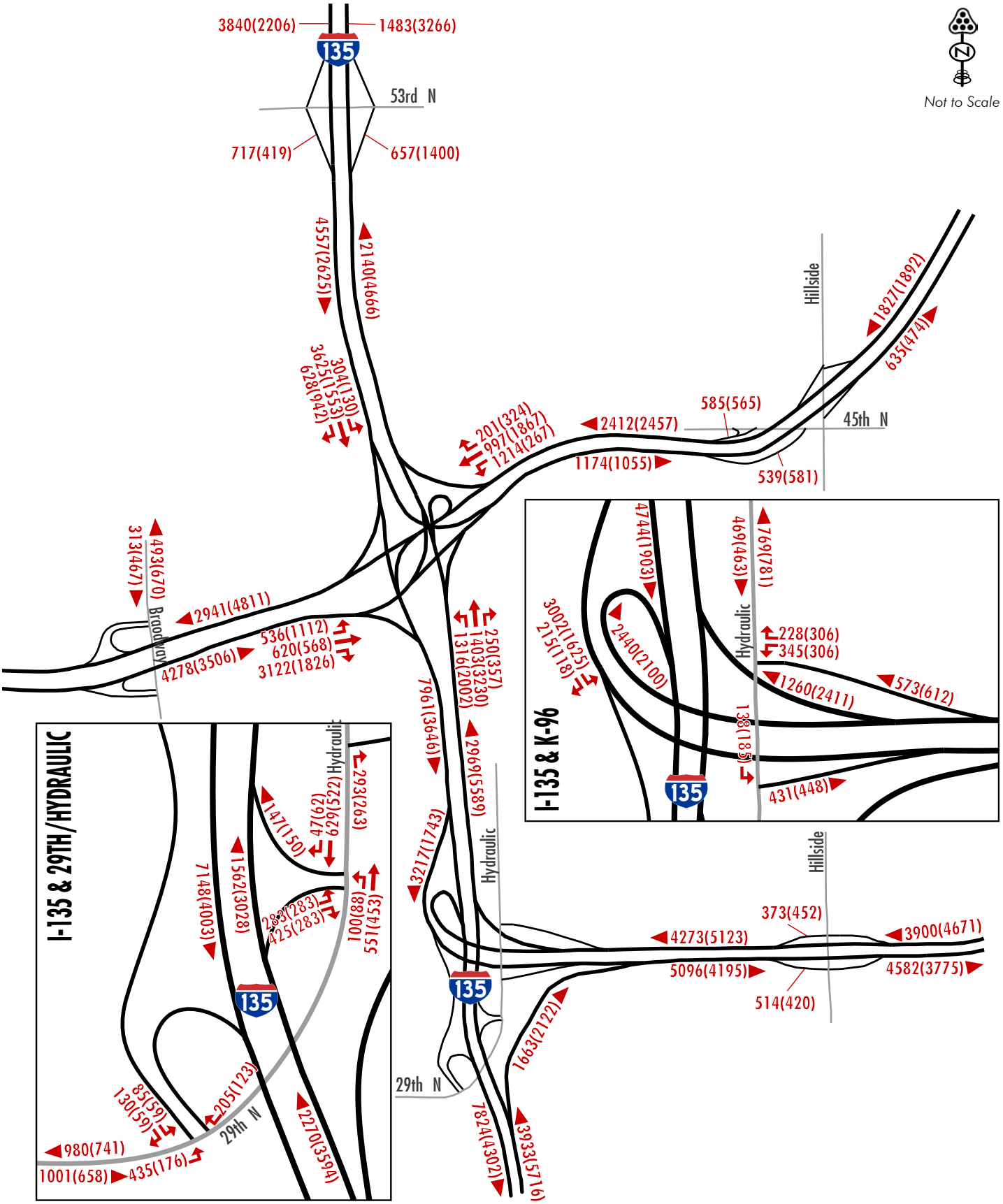

Not to Scale
3840(2206)
1483(3266)
135
53rd N
717(419)
657(1400)
4557(2925)
2140(4666)
304(1130)
362(1553)
628(942)
201(324)
997(1867)
1214(267)
2412(2457)
585(565)
45th N
1174(1055)
539(581)
Hillside
1827(1892)
635(474)
493(670)
313(467)
Broadway
2941(4811)
4278(3506)
536(1112)
620(568)
3122(1826)
250(357)
1403(3230)
1316(2002)
2969(5589)
7961(3646)
3217(1743)
Hydraulic
I-135 & K-96
4744(1903)
2440(2100)
3002(1625)
215(118)
4694(4631)
7697(7811)
228(306)
345(306)
1260(2411)
573(612)
138(185)
431(448)
I-135 & 29TH/HYDRAULIC
293(263)
629(522)
47(62)
147(150)
1562(3028)
7148(4003)
283(283)
425(283)
88(100)
455(453)
85(59)
130(59)
205(123)
980(741)
1001(658)
435(176)
29th N
2270(3594)
373(452)
4273(5123)
3900(4671)
5096(4195)
4582(3775)
514(420)
1663(2122)
7824(4302)
3933(5716)

Exhibit 9: 2050 No-Build AM Peak Hour Level-of-Service

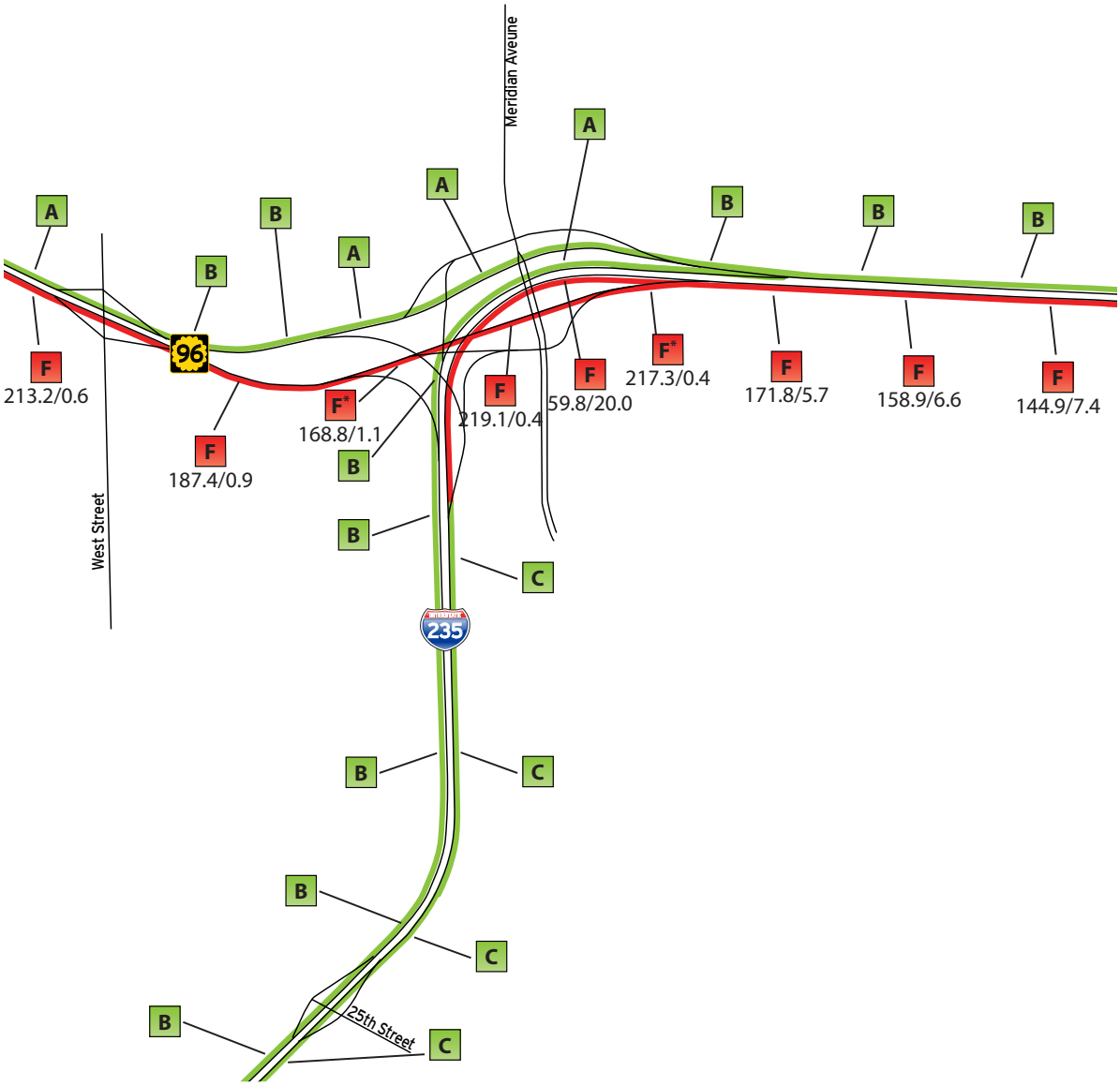
Freeway Level of Service Thresholds

	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
Free Flow	A	≤ 11	≤ 10	≤ 10
	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed



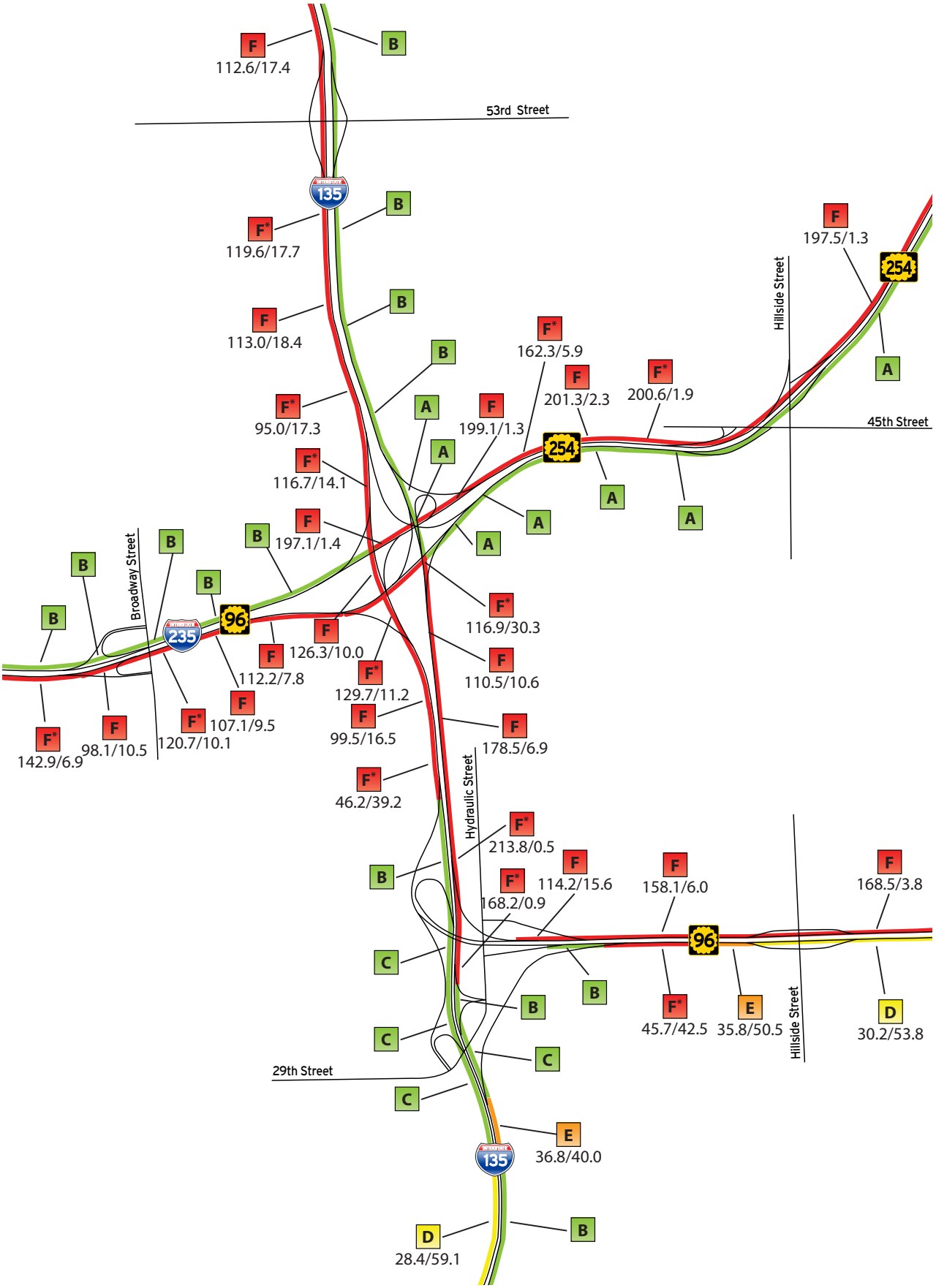

N
Not to Scale
53rd Street
45th Street
29th Street
Broadway Street
Hillside Street
Hydraulic Street
Hillside Street
135
235
96
254
96
135
F 112.6/17.4
F* 119.6/17.7
F 113.0/18.4
F* 95.0/17.3
F* 116.7/14.1
F 197.1/1.4
F 126.3/10.0
F 112.2/7.8
F* 107.1/9.5
120.7/10.1
F 98.1/10.5
F* 142.9/6.9
F* 129.7/11.2
F 99.5/16.5
F* 46.2/39.2
F* 116.9/30.3
F 110.5/10.6
F 178.5/6.9
F* 213.8/0.5
F* 168.2/0.9
F 114.2/15.6
F 158.1/6.0
F* 45.7/42.5
E 35.8/50.5
F 168.5/3.8
D 30.2/53.8
E 36.8/40.0
D 28.4/59.1
F* 162.3/5.9
F 201.3/2.3
F* 200.6/1.9
F 199.1/1.3
F 197.5/1.3
A
B
C
D
E

Exhibit 10: 2050 No-Build PM Peak Hour Level-of-Service

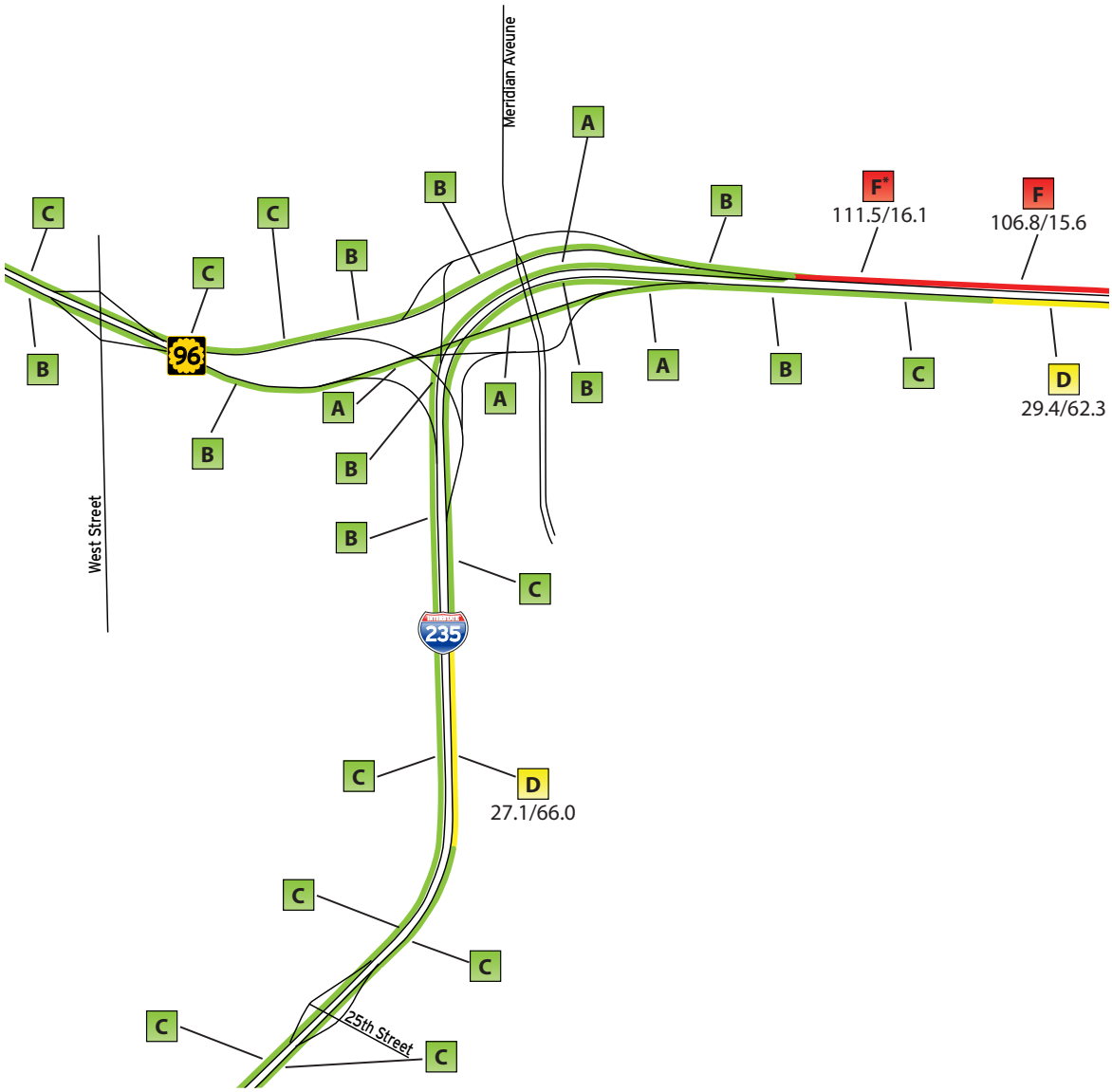
Freeway Level of Service Thresholds

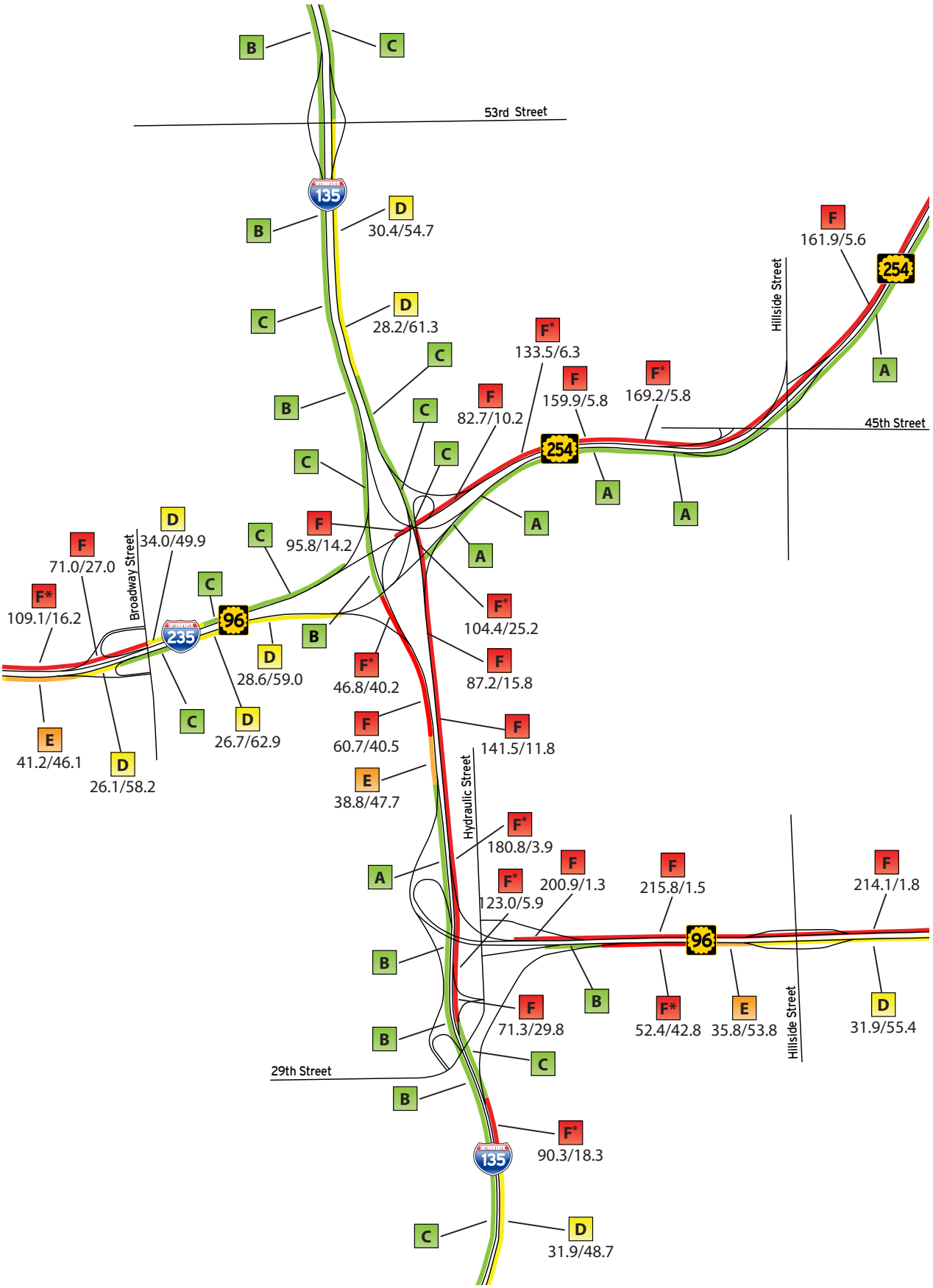
	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
	A	≤ 11	≤ 10	≤ 10
Free Flow	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed




N
Not to Scale
53rd Street
135
254
96
235
Broadway Street
Hillside Street
45th Street
Hydraulic Street
29th Street
B
C
D 30.4/54.7
D 28.2/61.3
F* 133.5/6.3
F 159.9/5.8
F* 169.2/5.8
F 161.9/5.6
A
F 82.7/10.2
F 95.8/14.2
D 34.0/49.9
F 71.0/27.0
F* 109.1/16.2
E 41.2/46.1
D 26.1/58.2
D 26.7/62.9
D 28.6/59.0
F* 46.8/40.2
F 60.7/40.5
E 38.8/47.7
F* 104.4/25.2
F 87.2/15.8
F 141.5/11.8
F* 180.8/3.9
F* 123.0/5.9
F 200.9/1.3
F 215.8/1.5
F 214.1/1.8
F 71.3/29.8
F* 52.4/42.8
E 35.8/53.8
D 31.9/55.4
F* 90.3/18.3
D 31.9/48.7

SAFETY ANALYSIS

One of the goals for the North Junction is to provide safe travel long into the future. As KDOT strives to reduce crashes and crash severity, it is important to identify safety concerns and develop a future concept that will facilitate the safe movement of people and goods.

A safety analysis was completed to identify safety concerns in the Study Area. The analysis looks at the number, severity, rates, time of day, types, and locations of crashes. The analysis shows a tendency for rear-end crashes in the Study Area, which are often attributable to congestion. More detailed crash data and analysis is provided in **Appendix D**.

Number & Severity

Crash data from 2009 through 2013 was obtained for the Study Area. Over the five-year period, there were 1,040 total crashes on the Study Area highways. This equates to about four crashes per week. **Table I** shows the total number of crashes on individual segments of the Study Area highways. It also shows the number of fatal, injury, and property damage only (PDO) crashes on each segment. **Chart E** presents the crash severity for the entire Study Area.

Chart E: Crash Severity for Entire Study Area

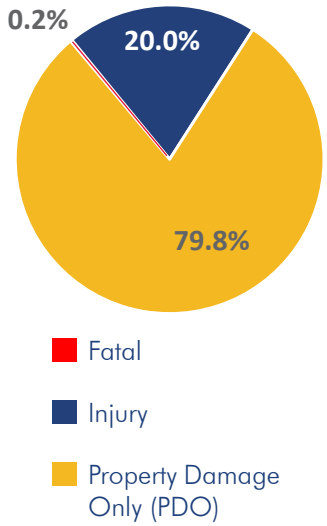


Table I: Crashes & Severity per Highway Segment

	Highway Segment (Direction)	Total Crashes	Fatal Crashes		Injury Crashes		PDO Crashes	
		#	#	%	#	%	#	%
I-135	**53rd St N to I-235 (Total)**	**125**	**0**	**0.0%**	**22**	**17.6%**	**103**	**82.4%**
	53rd St N to I-235 (NB)	*60*	0	0.0%	11	18.3%	49	81.7%
	53rd St N to I-235 (SB)	*65*	0	0.0%	11	16.9%	54	83.1%
	I-235 to K-96 (Total)	**345**	**0**	**0.0%**	**84**	**24.3%**	**261**	**75.7%**
	I-235 to K-96 (NB)	*214*	*0*	*0.0%*	*48*	*22.4%*	*166*	*77.6%*
	I-235 to K-96 (SB)	*128*	*0*	*0.0%*	*35*	*27.3%*	*93*	*72.7%*
	I-235 to K-96 (Unknown)	*3*	*0*	*0.0%*	*1*	*33.3%*	*2*	*66.7%*
	K-96 to 29th St N (Total)	**80**	**0**	**0.0%**	**14**	**17.5%**	**66**	**82.5%**
	K-96 to 29th St N (NB)	*53*	*0*	*0.0%*	*8*	*15.1%*	*45*	*84.9%*
	K-96 to 29th St N (SB)	*27*	*0*	*0.0%*	*6*	*22.2%*	*21*	*77.8%*
I-235	**Meridian to Arkansas (Total)**	**74**	**0**	**0.0%**	**16**	**21.6%**	**58**	**78.4%**
	Meridian to Arkansas (NB)	*35*	*0*	*0.0%*	*5*	*14.3%*	*30*	*85.7%*
	Meridian to Arkansas (SB)	*39*	*0*	*0.0%*	*11*	*28.2%*	*28*	*71.8%*
	Arkansas to I-135 (Total)	**134**	**1**	**0.7%**	**17**	**12.7%**	**116**	**86.6%**
	Arkansas to I-135 (NB)	*79*	*0*	*0.0%*	*10*	*12.7%*	*69*	*87.3%*
	Arkansas to I-135 (SB)	*54*	*1*	*1.9%*	*7*	*13.0%*	*46*	*85.2%*
	Arkansas to I-135 (Unknown)	*1*	*0*	*0.0%*	*0*	*0.0%*	*1*	*100.0%*
K-254	**I-135 to 45th St N (Total)**	**50**	**1**	**2.0%**	**14**	**28.0%**	**35**	**70.0%**
	I-135 to 45th St N (WB)	*22*	*0*	*0.0%*	*5*	*22.7%*	*17*	*77.3%*
	I-135 to 45th St N (EB)	*25*	*1*	*4.0%*	*7*	*28.0%*	*17*	*68.0%*
	I-135 to 45th St N (Unknown)	*3*	*0*	*0.0%*	*2*	*66.7%*	*1*	*33.3%*
K-96	**I-135 to Hillside (Total)**	**232**	**0**	**0.0%**	**41**	**17.7%**	**191**	**82.3%**
	I-135 to Hillside (WB)	*111*	*0*	*0.0%*	*19*	*17.1%*	*92*	*82.9%*
	I-135 to Hillside (EB)	*118*	*0*	*0.0%*	*22*	*18.6%*	*96*	*81.4%*
	I-135 to Hillside (Unknown)	*3*	*0*	*0.0%*	*0*	*0.0%*	*3*	*100.0%*
	TOTAL	**1040**	**2**	**0.2%**	**208**	**20.0%**	**830**	**79.8%**

Crash Rates

As shown in **Table J**, the total crash rates for I-135, K-254, and K-96 are higher than the statewide average for similar type facilities. The crash rate on I-235 is slightly lower than that statewide average. The fatal crash rates are lower than the statewide average on I-135, I-235, and K-96. However, the fatal crash rate on K-254 is higher than the statewide average.

Table J: Crash Rate Comparison

Road Segment	Specific Rates		Statewide Average Rates	
	Total Crashes per MVM	Fatal Crashes per HMVM	Total Crashes per MVM	Fatal Crashes per HMVM
I-135	1.921	0.000	1.134	0.676
I-235*	1.128	0.500	1.134	0.676
K-254	1.498	2.996	1.134	0.676
K-96	1.319	0.000	1.134	0.676

**I-235 segment is from South Meridian to I-135 at North Junction*
MVM - Million Vehicle Miles Traveled
HMVM - Hundred Million Vehicle Miles Traveled

Time of Day

Crashes tend to occur during certain times during the day. **Chart F** shows the hourly distribution of crashes for the entire Study Area over the five-year time frame. The hours with the highest number of crashes were 5-6 PM (25%) and 7-8 AM (13%). 40% of crashes occurred from 3-6 PM and 21% occurred from 7-10 AM. These spikes correspond with the peak travel times.

Crash Types

The majority of crashes involved crashes with another motor vehicle (66%). Fixed object crashes made up 21% of the crashes. The remaining 12% were other crash types, which include animal, overturned, parked motor vehicle, non-collision, and other. **Chart G** shows the main crash types for all crashes on the Study Area highways. It also shows the specific crash types for the crashes involving other motor vehicles.

The majority of crashes involving other motor vehicles were rear end crashes (82%). Sideswipe crashes with vehicles moving in the same direction made up 13% of crashes with other motor vehicles. The remaining 5% were other types, which include side impact, sideswipe opposite direction, head on, backed into, and other.

Chart F: Hourly Distribution of Crashes

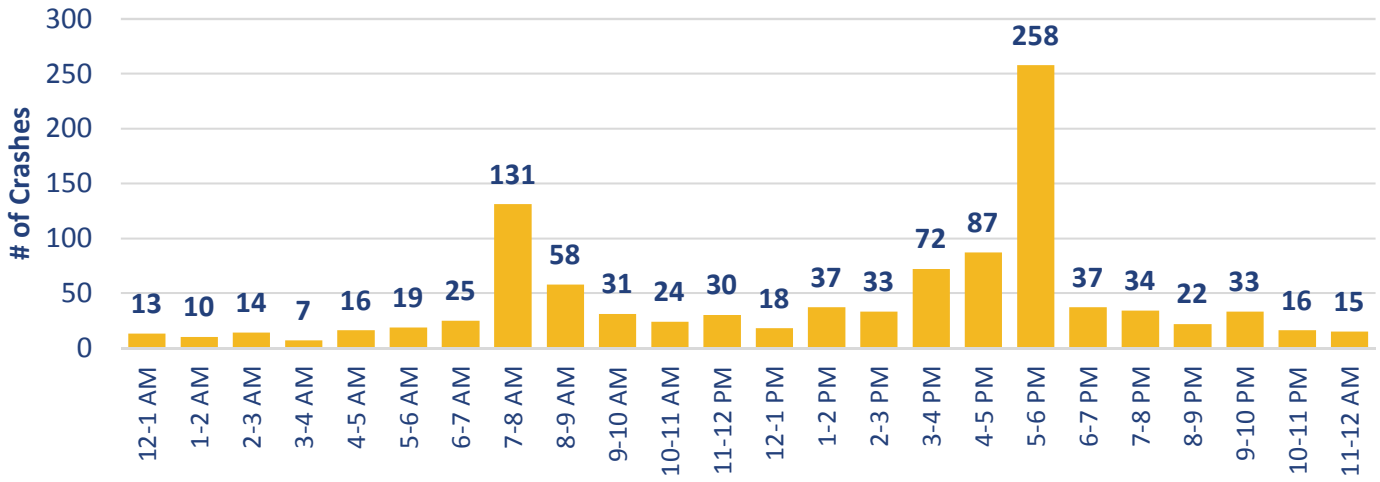
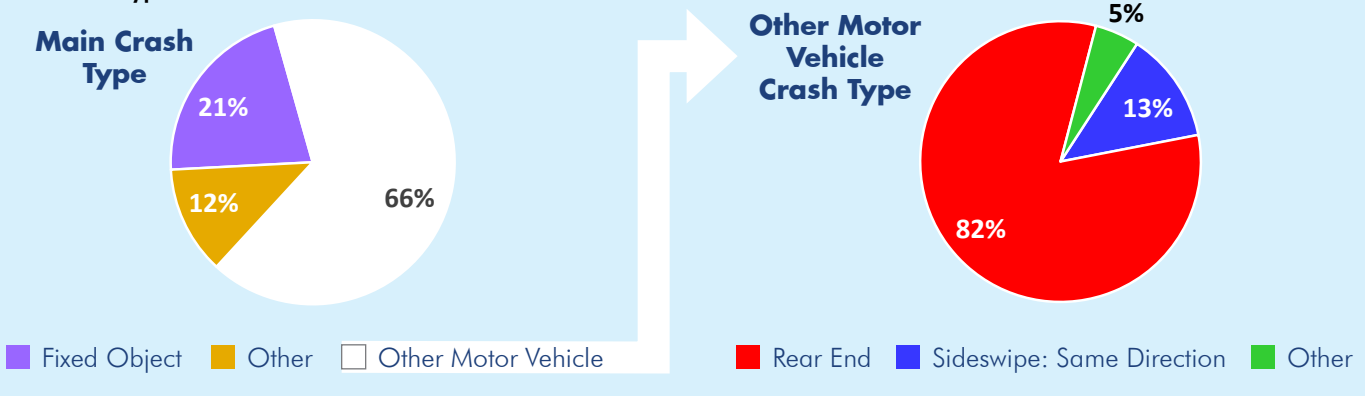


Chart G: Crash Types



Locations

There are high concentrations of crashes along I-135 from I-235/K-254 to south of K-96, K-96 near I-135, and I-235 west of Broadway. **Exhibit 11** shows the crash densities along the Study Area highways. The high crash concentrations are consistent throughout the five-year period of analysis and match the areas of greatest congestion. Higher concentrations of crashes were observed near ramp merge and diverge areas and tight mainline radii corners. Maps showing the crash locations for individual segments of the Study Area highways are provided in **Appendix D**.

Future No-Build Safety

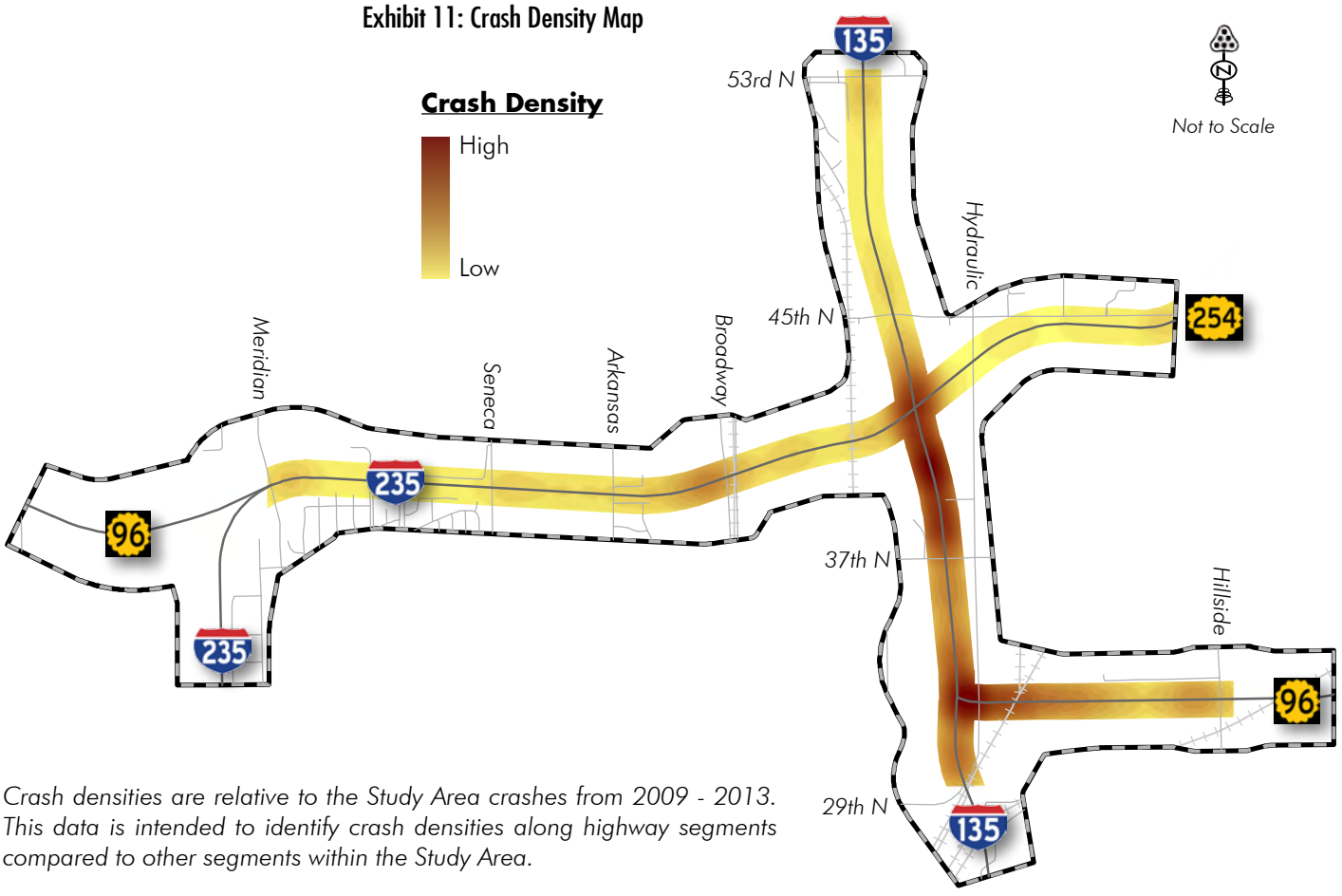
The Interactive Highway Safety Design Model (IHSDM) version 10.1.0 was used to predict the future crash rates under a No-Build scenario. The IHSDM relies on traffic volumes as well as geometric data for horizontal alignment, lane widths, number of lanes, ramp connections, shoulder widths, etc. For a comparison between existing and future No-Build conditions, an existing model was developed using available geometric data.

Traffic volumes for the existing and future No-Build scenarios discussed previously were utilized in the safety analysis. The traffic volumes within the corridor are expected to increase more than 75% in 2050. With this traffic increase and no infrastructure improvements, the number of crashes is expected to increase by more than 90% in the No-Build scenario.

Potential mitigation measures for the types of crashes occurring in the Study Area would focus on:

- Improving general capacity to minimize queuing
- Geometric changes to allow for consistent speeds
- Eliminating/minimizing conflict points with improved weaving, merging and diverge locations

Exhibit 11: Crash Density Map



Crash densities are relative to the Study Area crashes from 2009 - 2013. This data is intended to identify crash densities along highway segments compared to other segments within the Study Area.

The 2015 Study identifies an ultimate preferred concept to address the identified needs and achieve project goals. The preferred concept reconstructs and reconfigures the existing North Junction to redistribute access, eliminate or lengthen weaving areas, and add roadway capacity.

A logical process of concept development, evaluation, and refinement was used to develop the preferred concept for improving the North Junction. This chapter highlights the major concepts considered during the process and identifies the preferred concept.

An analysis of traffic operations and safety was completed to assess how well the preferred concept meets the goals for the project. The preferred concept is expected to operate acceptably long into the future and improve safety compared to the No-Build scenario.

PURPOSE & NEED FOR PROJECT

As discussed in **Chapter 3**, much of the transportation infrastructure within the Study Area is in poor condition. **Chapter 4** identifies existing traffic operational deficiencies and shows that traffic operations will continue to degrade through 2050 without significant improvement.

The purpose of the North Junction Project is to rehabilitate and/or replace infrastructure within the Study Area to facilitate safe and efficient traveler mobility long into the future. The preferred concept will:

- Reduce congestion and improve traveler mobility to meet existing and future travel demands
- Enhance traffic safety by upgrading the interchange to meet current design standards and to address high crash locations within the Study Area
- Improve the condition of the existing infrastructure by rehabilitating or replacing aging bridge and roadway infrastructure that is in poor condition to decrease maintenance costs

Current traffic demand is causing congestion on existing roadways. Future traffic demands are projected to increase at the North Junction, which will increase congestion and travel delay.

The crash analysis shows a high percentage of rear-end and fixed-object crashes. Rear-end crashes are often attributable to congestion. Fixed-object crashes can be attributable to a variety of circumstances or conditions including substandard roadway geometry. Areas with high crash density coincide with the areas of congestion, which are within the merging and diverging areas. Improving capacity to minimize queuing, changing geometry to allow for consistent speeds, and eliminating/minimizing conflict points with improved merging and diverging locations will improve the safety of the North Junction. Updating the geometry to current design standards will also improve the safety of the North Junction.

The pavement in the Study Area is generally in good condition. However, there are areas of patchwork concrete and midpanel cracks that present long-term maintenance concerns. The bridges are generally in good condition. Of the 57 bridges, 18 are functionally obsolete; having older design features such as narrow shoulders or inadequate clearance. The North Junction Project provides the opportunity to reduce long-term maintenance costs by repairing or replacing aging infrastructure that carries a high volume of traffic.

PROJECT GOALS

The Core Team developed the goals for the North Junction project. They are as follows:

- Address existing congestion
  - Northbound I-235 to southbound I-135 and eastbound K-96
  - Northbound I-135 to southbound I-235
- Address future congestion
- Address known safety issues
- Replace deteriorating infrastructure
- Utilize existing infrastructure that is in good condition
- Encourage economic development
- Develop a phased approach
- Maintain all existing traffic movements during and after implementation

Major Considerations

Key considerations for the North Junction were also identified by the Core Team and are as follows:

- Consider the cost for improvements
- Consider future improvements to the interchange
- Coordinate with adjacent projects
- Consider driver expectancy
- Encourage trucks to use the North Junction rather than US-50 Highway through Newton
- Consider major utilities
- Consider political influences
- Consider non-traditional solutions

CONCEPT DEVELOPMENT PROCESS

The Core Team was responsible for reviewing concept options, reviewing traffic analyses of each concept, and ultimately recommending a preferred concept.

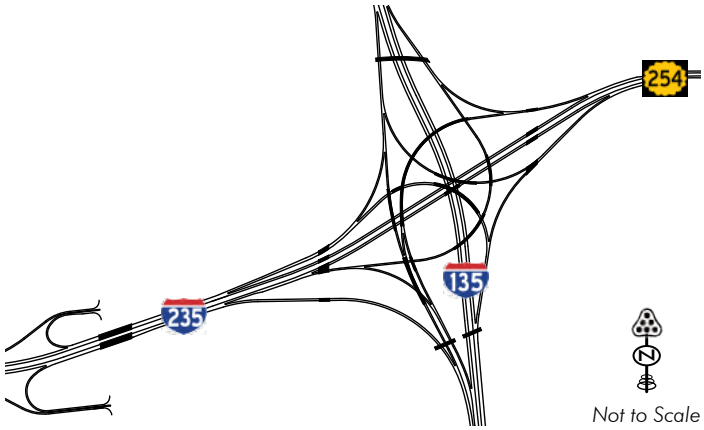
The Core Team met four times during the concept development process to review information, provide feedback, and recommend a preferred concept.

Step 1 - 2012 Concept

The concept recommended from the 2012 Study (**Exhibit 12**) served as a starting point for developing a preferred concept. An analysis of the 2012 Concept identified three issues.

- Current criteria identifies a maximum number of destinations per exit based on the number of lanes and configuration of the exit. The 2012 Concept exceeded this maximum at the southbound I-135 exit point to southbound I-235, eastbound K-254, eastbound K-96, and Hydraulic/29th Street North.
- One of the considerations for the North Junction is project cost. The 2012 Concept provided several costly flyover bridges. Options could be provided to reduce the cost while still meeting operational goals.
- It was difficult to break the 2012 Concept into phases. Due to the desire to have a preferred concept that could be completed in phases, to meet current design criteria, and to potentially reduce the cost of the improvements, KDOT determined that new concepts should be developed and analyzed.

Exhibit 12: 2012 Concept



Project phases are individual projects that incrementally build towards an ultimate project. Often, large projects are too costly to build as a single project. Breaking a large project into multiple smaller projects increase opportunities for funding in incremental stages over a longer period of time.

Step 2 - Four New Concepts

The design team developed four new concepts to address the issues with the 2012 Concept as well as achieve the goals set forth for the project.

Concept 1 (**Exhibit 13**) was a slight modification of the 2012 Concept. The main change was to shorten some bridges to reduce the cost while still utilizing flyovers for all of the ramps. This Concept still provided three expensive single-lane flyover ramps and a complex fork in the flyover from westbound K-254 to southbound I-135 and eastbound K-96.

Concept 2 (**Exhibit 14**) included a loop ramp from westbound K-254 to eastbound K-96 via a Collector-Distributor (C-D) road rather than having a forked flyover bridge provided in Concept 1.

> A Collector-Distributor (C-D) road runs parallel but separate from a mainline freeway. It connects a freeway mainline to a ramp to another freeway. C-D roads improve traffic flow on freeways by reducing weaving issues where traffic enters and/or exits freeways.

Concept 3 (**Exhibit 15**) included two loop ramps; one from westbound K-254 to eastbound K-96 and one from southbound I-135 to eastbound K-254. The consecutive loop ramps is typically an undesirable configuration; however, the weaving area would be separated from the mainline I-135 traffic. This reduced the number of bridges while maintaining an acceptable LOS.

Concept 4 (**Exhibit 16**) was vastly different than the other three concepts; using turbine-style ramps instead of flyovers or loop ramps. This option reduced the hight of bridges and reduced the cost for improvements while maintaining an acceptable LOS. However, there would be challenges with breaking Concept 4 into phases.

> A turbine-style ramp provides directional connections similar to flyovers. However, they reduce the height and length of many of the bridges; therefore, reducing the cost.

Core Team selected Concept 3 and Concept 4 for further development and analysis. There were a variety of reasons these options were selected. The main justification for selecting these two concepts was to reduce the cost by removing expensive flyovers while still maintaining an acceptable LOS.

Exhibit 13: Concept 1

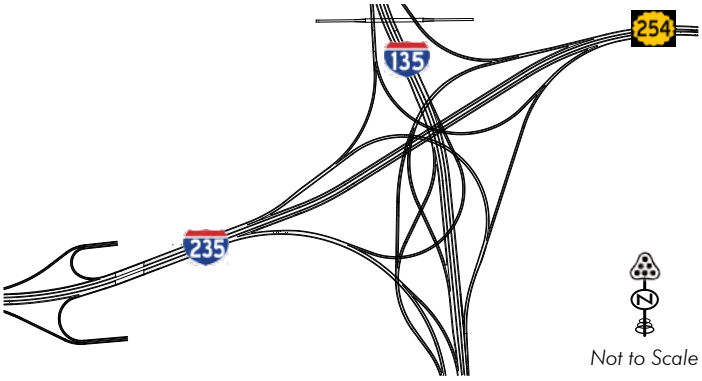


Exhibit 14: Concept 2

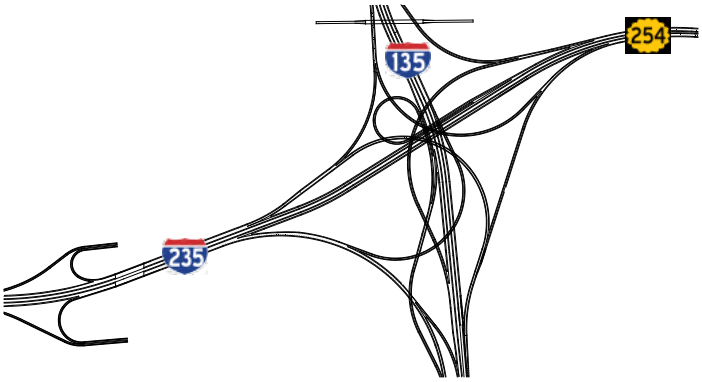


Exhibit 15: Concept 3

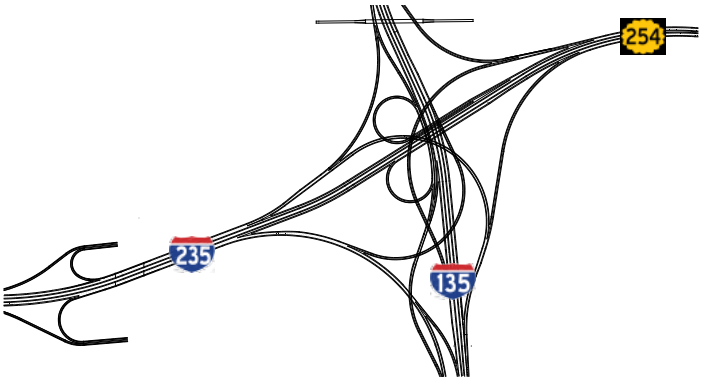
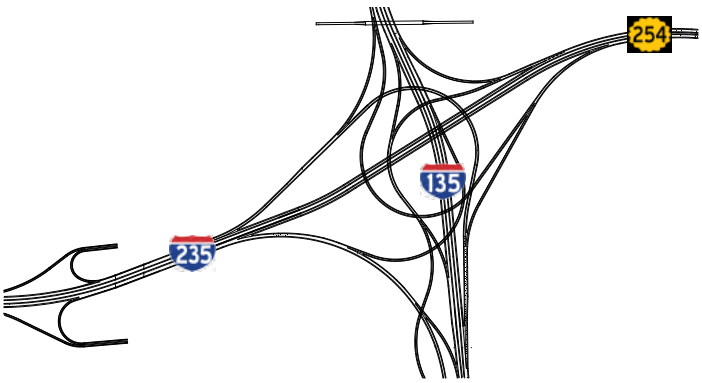


Exhibit 16: Concept 4



Step 3 - Refined Concepts

Concept 3 and 4 each had desirable elements. Concept 5 was created by taking the most desirable elements of Concept 3 and 4; providing a more economical ultimate project.

Concept 5 (**Exhibit 17**) used common elements of Concept 3 and 4, including the alignments of the mainline highways and the turbine-style ramp from northbound I-235 to northbound I-135. Concept 5 included the northbound I-135 ramp to southbound I-235 from Concept 3, the southbound I-135 to eastbound K-254 loop ramp from Concept 3, and the westbound K-254 and southbound I-135 ramp to eastbound K-96 from Concept 4.

Although Concept 5 improved on previous concepts, it had some undesirable configurations for a interim phase. It had three consecutive exits on northbound I-235 (to eastbound K-96, to southbound I-135, and to northbound I-135). It also had a short weave distance (1200 feet) between the merge point where southbound I-135 exit merges with the C-D road from northbound I-235 to eastbound K-96 and the exit from the C-D road to Hydraulic (or not providing for the westbound K-254 to eastbound K-96 movement).

Concept 6 (**Exhibit 18**) was developed to address the undesirable configurations in Concept 5. Concept 6 added a 4th level flyover from westbound K-254 to southbound I-135 to facilitate easier movement from southbound I-135 to eastbound K-96 in interim phase. This flyover provided desirable traffic movement with the interim configuration. However, the flyover added considerable expense to the project.

Concept 7 (**Exhibit 19**) was developed to achieve the desirable traffic movement in Concept 6 in a more economical way. Concept 7 used Concept 5 as a base and modified the configuration. It moved the access from southbound I-135 to eastbound K-96 north of the interchange. It also moved the location of braided ramps over 37th Street North.

Braided ramps are where one ramp bridges over another ramp to obtain a desirable configuration and eliminate major weaving movements on the mainline highways.

The location of the braided ramps for Concept 7 increased the cost of both the interim phase and the ultimate project. However, Concept 7 provided an acceptable connection from southbound I-135 to eastbound K-96 after the interim improvements without constructing the entire project. This enabled the project to be broken into phases while achieving acceptable traffic movements after the interim improvements and prior to the completion of the ultimate project.

Concept 8 (**Exhibit 20**) focused on providing an option that would significantly reduce the cost of the ultimate project. However, the entire project would have to be constructed as one project so it could not be divided into phases. Concept 8 is similar to Concept 7, but it optimized the position of the braided ramps previously discussed.

Exhibit 17: Concept 5

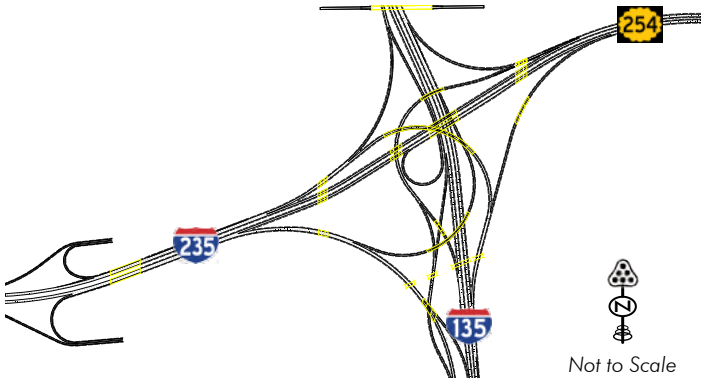


Exhibit 18: Concept 6

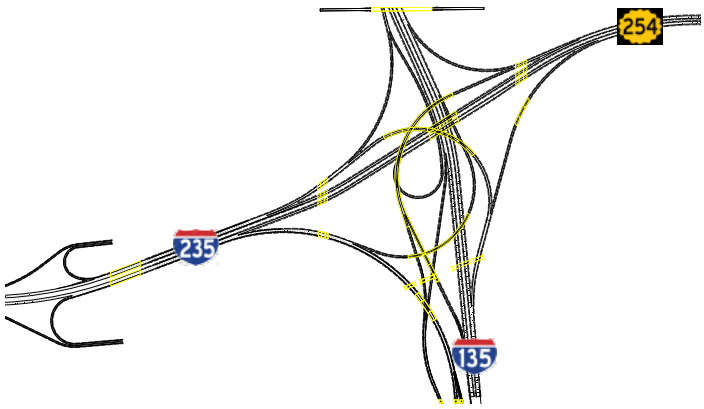


Exhibit 19: Concept 7

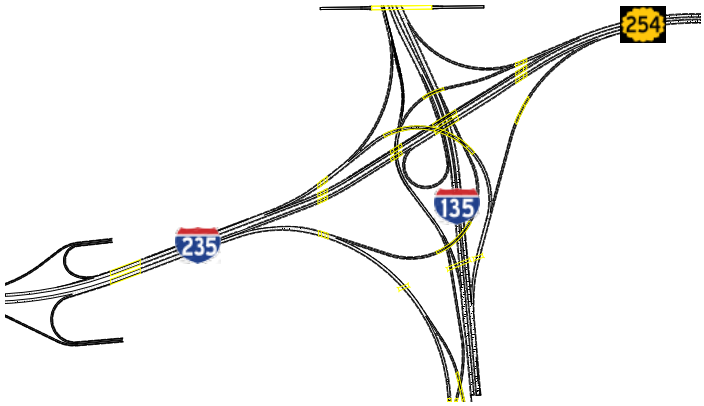
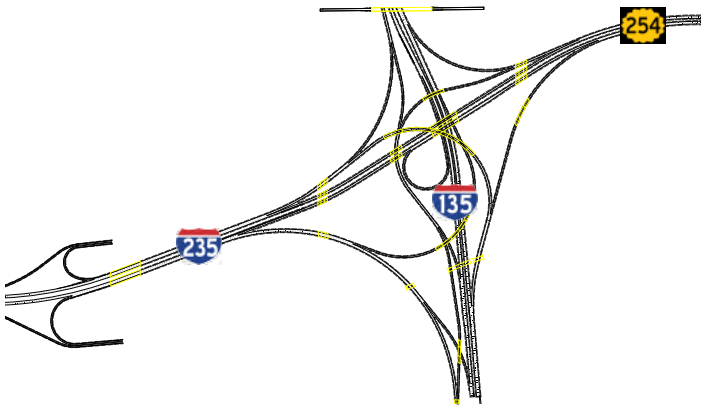


Exhibit 20: Concept 8



PREFERRED CONCEPT

After assessing the eight new concepts, Concept 7 was selected by the Core Team as the ultimate preferred concept. It achieved the purpose and need for the project and met the goals for the project. It addressed the existing operational deficiencies and provided for safe and efficient traffic flow through 2050. The ultimate configuration of the preferred concept maintained access to all the local interchanges and was the best option for constructibility while addressing the purpose and need of the project. **Exhibit 21** shows the entire ultimate preferred concept.

A planning level cost estimate for the full build-out of the preferred concept is $251 to $281 million in 2015 dollars. The estimate for the entire preferred concept, as well as individual phases shown in **Table K**. This estimate is preliminary in nature and only includes construction costs. The estimate will be refined as final design is completed. Dividing the project in different ways will impact the cost for temporary improvements that are included in individual phases but not part of the ultimate preferred concept.

Table K: Preferred Concept Construction Cost Estimate

Project	Construction Cost Estimate Range (Millions)	
	Low	High
Green Project	$71	$71
Gold Project	$65	$80
Purple Project	$110	$124
Orange Project	$5	$6
Entire Project	**$251**	**$281**

Estimates in 2015 Dollars

The preferred concept is identified as a regional priority of the Wichita Area Metropolitan Planning Organization (WAMPO). The entire project is in WAMPO's fiscally constrained long-range transportation plan (MOVE2040).

PREFERRED CONCEPT PHASING PLAN

The preferred concept provides the ability for the project to be phased into multiple stand-alone projects. The ability to break the interchange into multiple projects was seen as an important factor when selecting the preferred concept so that KDOT can utilize this flexibility to adjust to unknown future funding. The first two phases of the preferred concept would address critical bridge condition issues and relieve the heavy congestion on I-135 and I-235, which is an immediate need. Then, as traffic congestion becomes problematic for the other movements, the ultimate configuration could be built with minimal rework of the initial project improvements.

Project phases are individual projects that incrementally build towards an ultimate project. Often, large projects are perceived too costly to build as a single project. Breaking a large project into multiple smaller projects increase opportunities for funding in incremental stages over a longer period of time.

Green Project (Phase 1)

Phase 1, or the Green Project, is a bridge replacement project on I-235 from Meridian Avenue to west of I-135. This project will not alleviate the existing peak hour congestion at the North Junction. The Green Project includes the following elements, as illustrated in **Exhibit 22**:

- Replaces the two I-235 bridges over the BNSF railroad, Old Lawrence Road, and Broadway Street
- Replaces the four I-235 bridges over the Arkansas River and the Little Arkansas River with two new bridges
- New connector road from Seneca Street to Meridian Avenue running along the north side of I-235 where it will tie into Meridian Avenue at 42nd Street North (Seneca Street bridge over I-235 will not be replaced)
- Improved geometry at the Broadway Interchange
- Continuous auxiliary lanes along I-235 in both directions to work with future phases of the North Junction Project

Funding has not been committed to construct the Green Project. However, funding has been identified for final design, right-of-way acquisition, and utility relocation. It is anticipated that construction will begin in 2018 and be completed by 2020. This project is currently in the WAMPO 2015 Transportation Improvement Program (TIP).

Gold Project (Phase 2)

Phase 2, or the Gold Project, is intended to alleviate the existing AM and PM peak hour congestion at the North Junction. It includes the following elements, as illustrated in **Exhibit 23**:

- New connection from northbound I-235 to eastbound K-96 via a C-D road
- Continuous auxiliary lane on eastbound K-96 to Hillside Avenue
- Directional flyover from northbound I-135 to southbound I-235
- New ramp from northbound I-135 to eastbound K-254
- New ramp from southbound I-135 to southbound I-235

The Gold Project is funded for field check design only, equating to approximately 50% of design. Funding has not been identified for final design, right-of-way acquisition, utility relocation, or construction.

Purple Project (Phase 3)

Phase 3, or the Purple Project, reconstructs the remaining major movements of the North Junction and is intended to alleviate future congestion. It includes the following elements, as illustrated in **Exhibit 24**:

- Reconstructs mainline I-135, provides three continuous lanes in both directions, and moves the southbound lanes to the east to parallel the northbound lanes
- Reconstructs mainline I-235/K254 and moves the northbound/eastbound lanes to the north to parallel the southbound/westbound lanes
- New ramp from westbound K-254 to northbound I-135
- New ramp from westbound K-254 to southbound I-135 and the southbound C-D road west of I-135
- New ramp from southbound I-135 to the southbound C-D road west of I-135
- New loop ramp from southbound I-135 to eastbound K-96
- New ramp from northbound I-235 to northbound I-135
- New 45th Street North bridge over I-135

The Purple Project is funded for field check design only, equating to approximately 50% of design. Funding has not been identified for final design, right-of-way acquisition, utility relocation, or construction.

Orange Project (Phase 4)

Phase 4, or the Orange Project, replaces the loop ramp from westbound K-96 to southbound I-135 with a new loop ramp with improved geometry, as illustrated in **Exhibit 25**. The new single-lane loop ramp is able to be expanded into a two-lane loop ramp when/if traffic volumes necessitate the additional capacity. The geometry and location of this loop ramp is important to enable setting the location of the southbound C-D road west of I-135. This loop ramp does not preclude a future directional flyover if it is desired. This improvement is expected far into the future and reassessment is likely to occur prior to final design and construction. Other improvements on K-96 east of I-135 and on I-135 south of K-96 will likely be needed if a two-lane loop ramp is warranted.

The Orange Project is funded for field check design only, equating to approximately 50% of design. Funding has not been identified for final design, right-of-way acquisition, utility relocation, or construction.

OPTIONS FOR K-254 & HILLSIDE/45TH STREET NORTH

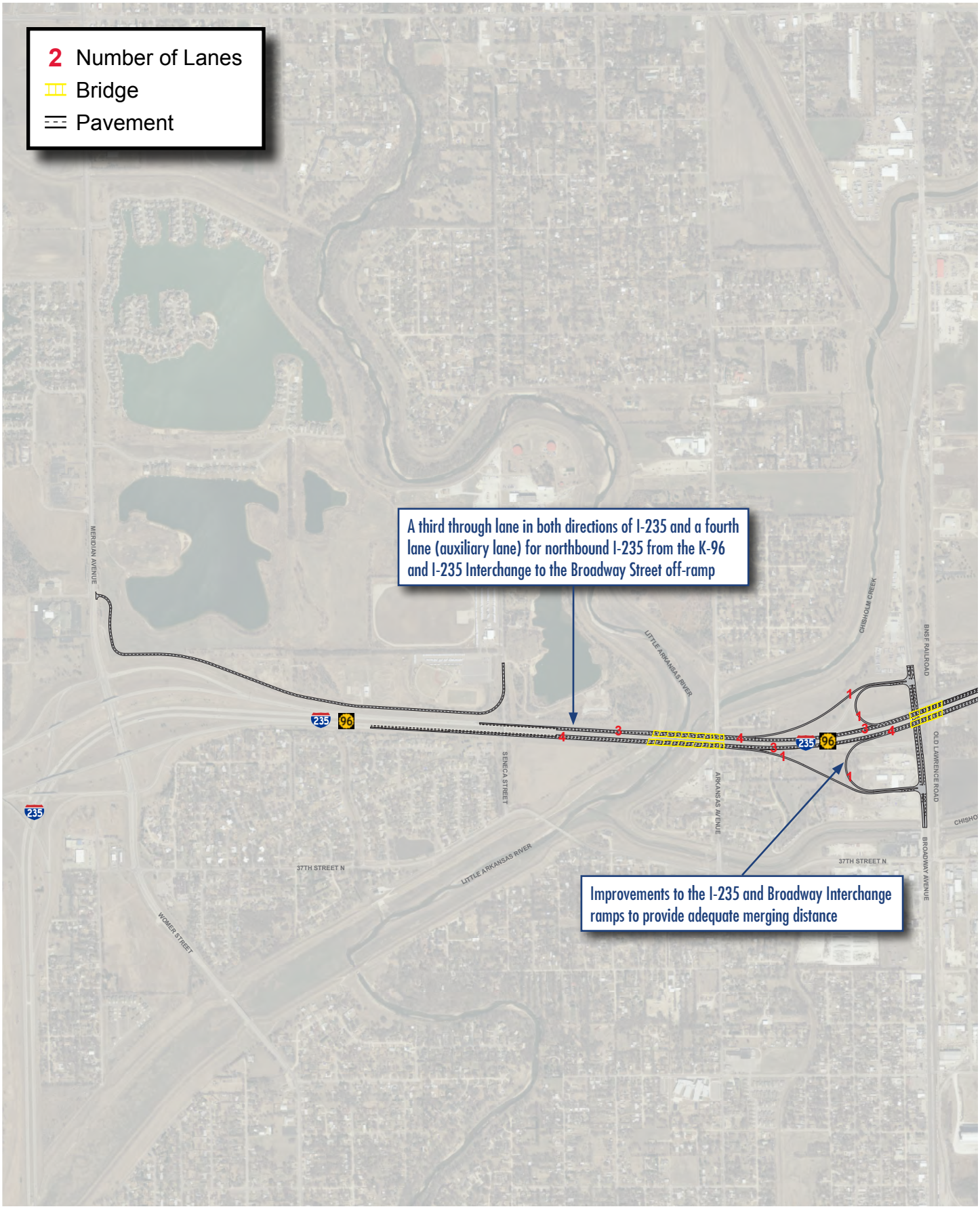
The K-254 alignment through the North Junction is set by the preferred concept. As shown, the preferred concept ties into existing K-254 at Chisholm Creek between I-135 and Hillside. The preferred concept is set to have a design speed of 65+ along the I-235 and K-254 corridor. The curve east of Chisholm Creek on K-254 is currently below the 65+ design speed. Ultimately, it is desirable to have a consistent speed along the I-235 and K-254 corridor through the North Junction.

In order to achieve the consistency, improvements would need to be made east of Chisholm Creek on K-254. This would require modifications to the existing configuration at the K-254 and Hillside/45th Street North Interchange.

Several options were developed for K-254 east of Chisholm Creek including the Hillside/45th Street North Interchange that allow for design speed consistency and tie into the eastern extent on K-254 of the preferred concept. The Core Team reviewed the options and identified concepts that would be acceptable. Further study and concept development will be needed for this project. The options are illustrated in **Appendix E**.

This project would likely be constructed independently from the North Junction projects. However, it could be included if so desired.

Exhibit 21: Ultimate Preferred Concept



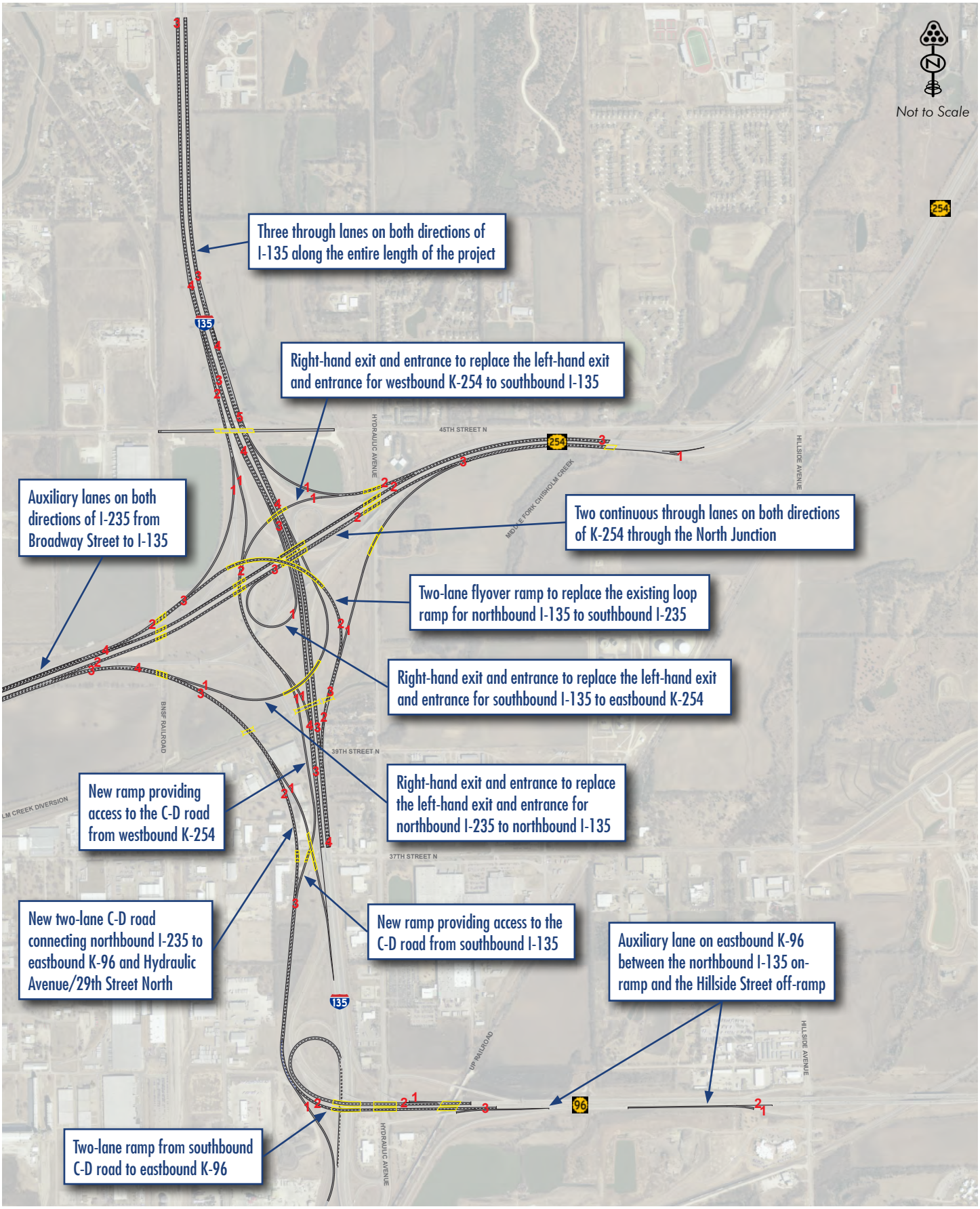

Not to Scale
Three through lanes on both directions of I-135 along the entire length of the project
Right-hand exit and entrance to replace the left-hand exit and entrance for westbound K-254 to southbound I-135
Auxiliary lanes on both directions of I-235 from Broadway Street to I-135
Two continuous through lanes on both directions of K-254 through the North Junction
Two-lane flyover ramp to replace the existing loop ramp for northbound I-135 to southbound I-235
Right-hand exit and entrance to replace the left-hand exit and entrance for southbound I-135 to eastbound K-254
Right-hand exit and entrance to replace the left-hand exit and entrance for northbound I-235 to northbound I-135
New ramp providing access to the C-D road from westbound K-254
New two-lane C-D road connecting northbound I-235 to eastbound K-96 and Hydraulic Avenue/29th Street North
New ramp providing access to the C-D road from southbound I-135
Auxiliary lane on eastbound K-96 between the northbound I-135 on-ramp and the Hillside Street off-ramp
Two-lane ramp from southbound C-D road to eastbound K-96
45TH STREET N
39TH STREET N
37TH STREET N
HYDRAULIC AVENUE
HILLSIDE AVENUE
BNSF RAILROAD
UP RAILROAD
MIDDLE FORK CHISHOLM CREEK
254
135
96

Exhibit 22: Green Project (Phase 1)

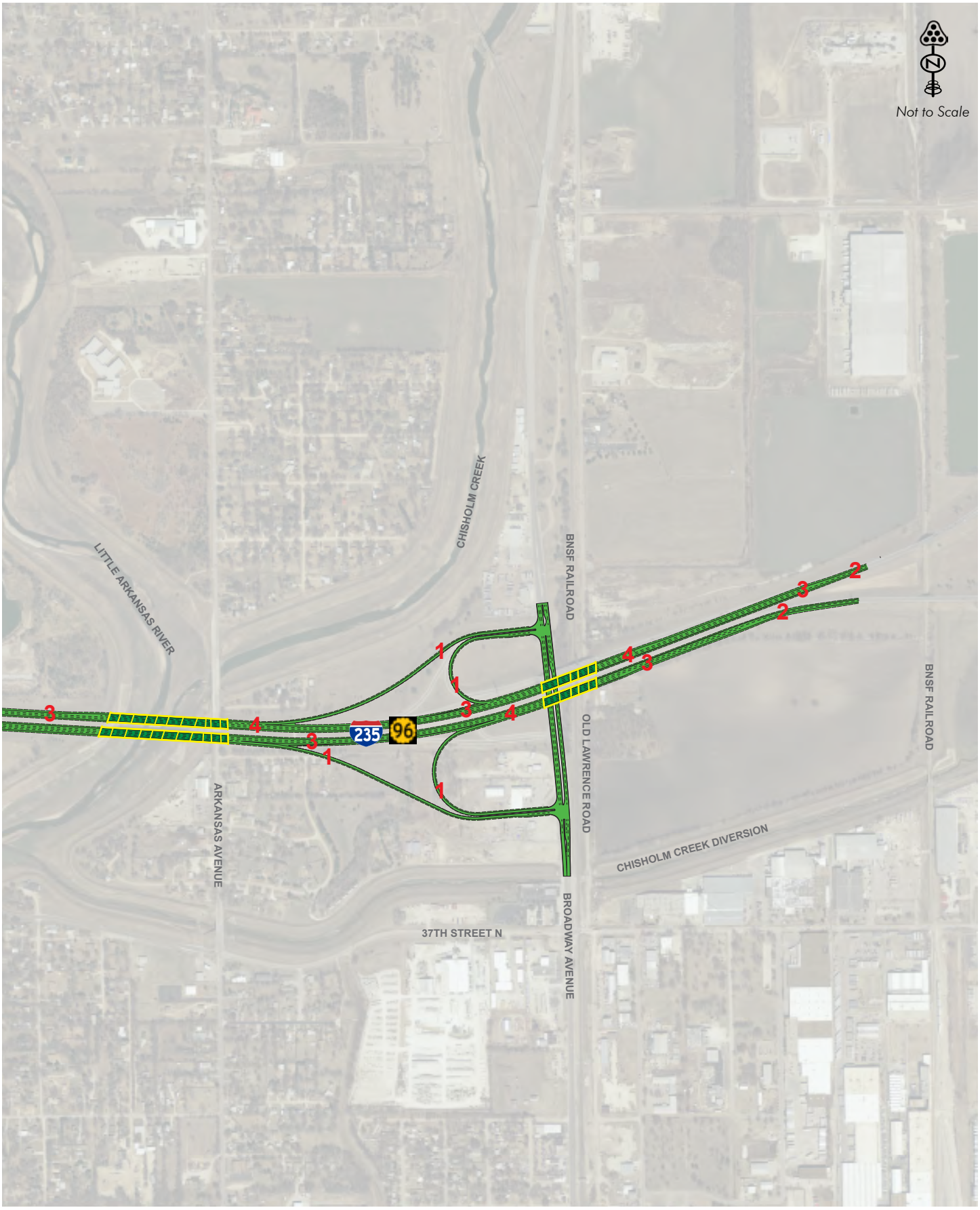

N
Not to Scale
CHISHOLM CREEK
BNSF RAILROAD
LITTLE ARKANSAS RIVER
235
96
ARKANSAS AVENUE
OLD LAWRENCE ROAD
BNSF RAILROAD
CHISHOLM CREEK DIVERSION
37TH STREET N
BROADWAY AVENUE

Exhibit 23: Gold Project (Phase 2)

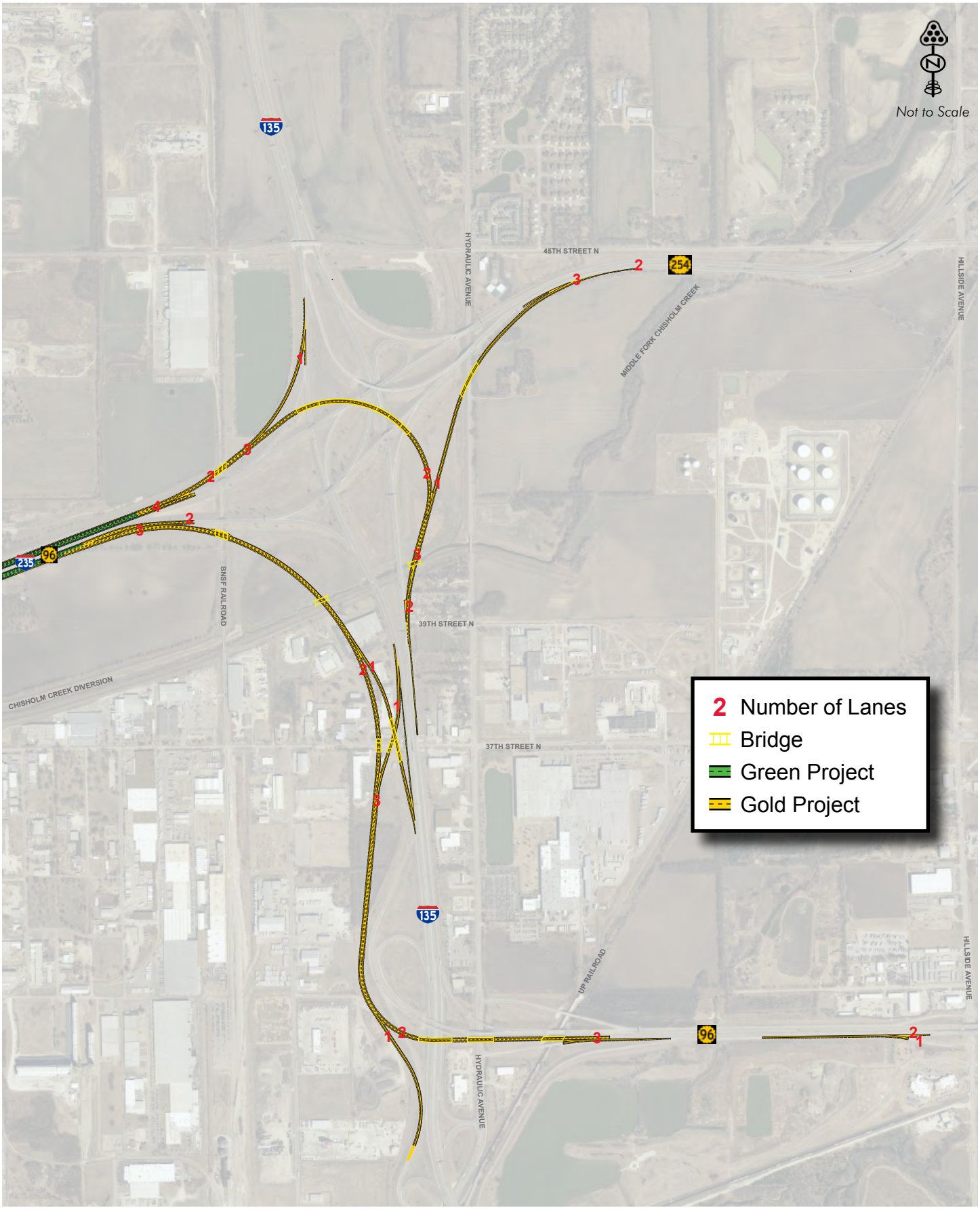


Exhibit 24: Purple Project (Phase 3)

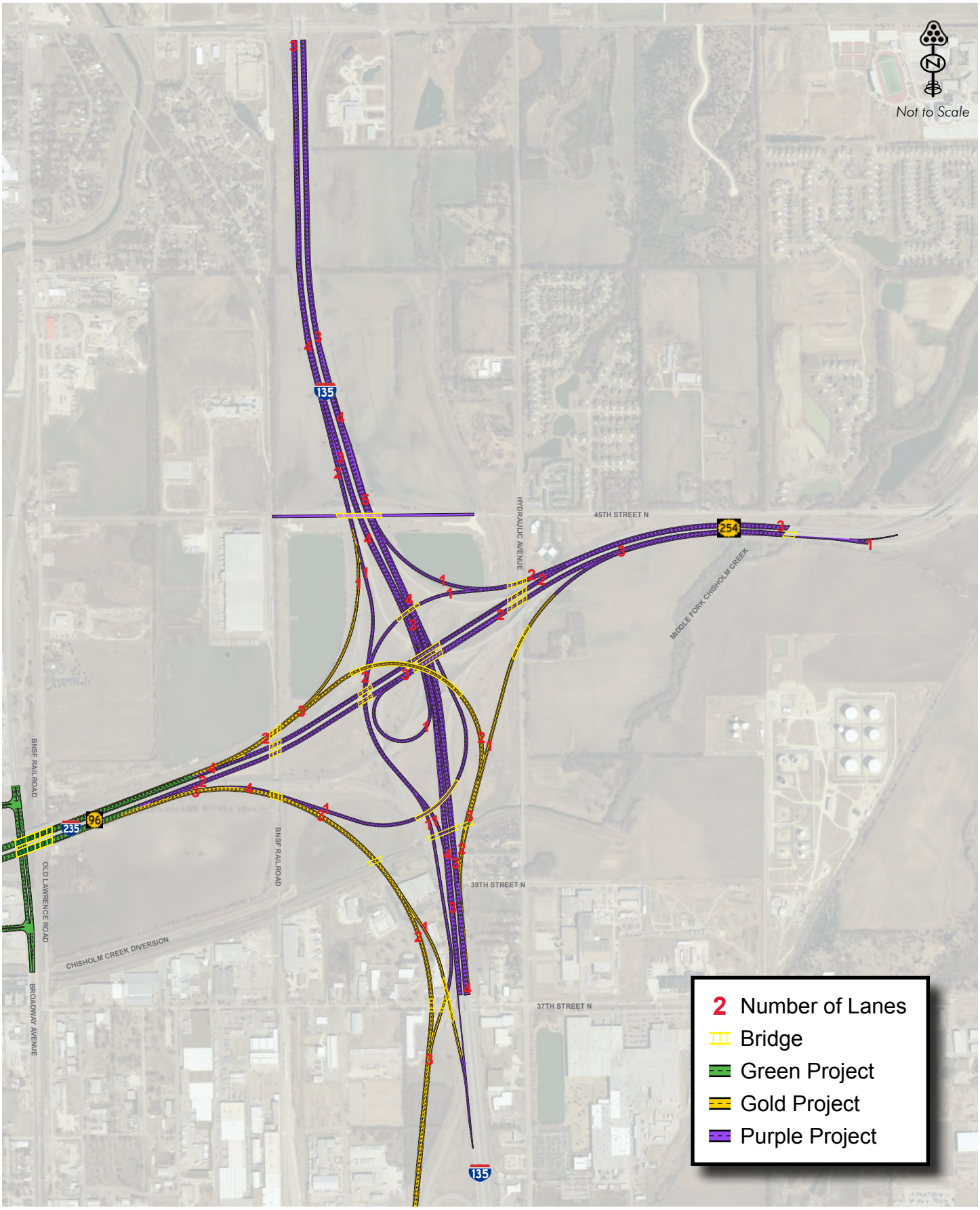
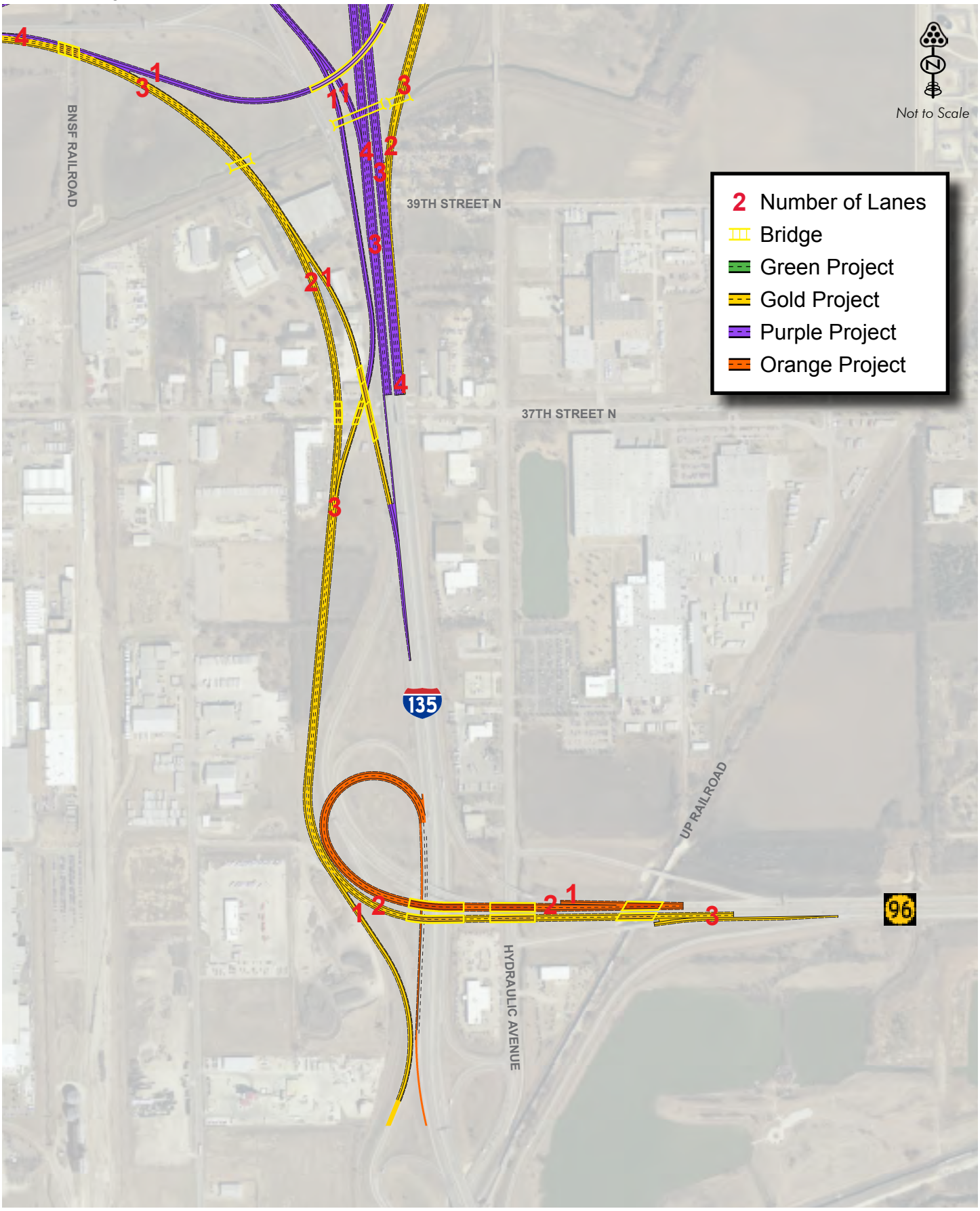


Exhibit 25: Orange Project (Phase 4)



PREFERRED CONCEPT TRAFFIC ANALYSIS

Full Build-Out Traffic Analysis

Exhibit 26 and **Exhibit 27** show the traffic operations of the preferred concept at full build-out (Green, Gold, Purple, and Orange Projects completed) in 2050 for the AM peak hour and PM peak hour, respectively. As illustrated, the only segment that is expected to operate at LOS E or worse is southbound I-135 at the Hydraulic Avenue on-ramp in the AM peak hour. Even though the amount of traffic entering at this ramp is modest, it is enough traffic to cause the downstream freeway mainline to operate over capacity. This causes the merge to operate at LOS F, but is not anticipated to cause upstream queuing. This segment is outside of the proposed project improvements because it is likely to require additional expansion south on I-135. Therefore, this issue will not be addressed with this project but rather would be addressed with a separate future project on I-135 to the south.

The preferred concept provides significant improvement on the percent of freeway miles operating at LOS E and F in 2050 compared with the No-Build scenario, as shown in **Table L**.

Table L: Freeway Miles at LOS E & F in 2050

Scenario	AM Peak Hour	PM Peak Hour
2050 No-Build	47.7%	27.9%
2050 Preferred Concept	0.4%	0.0%

Source: VISSIM Model

Interim Traffic Analysis

A separate traffic analysis was completed for every five years through 2035. This was performed to gain an understanding of when the Purple Project and Orange Project will be needed. The Green Project and Gold Project represent the interim improvements; as it was assumed that they would be completed in the next decade.

The analysis shows that the Green and Gold Projects have individual utility. After these projects are complete, the traffic model shows vast improvement in LOS compared to the existing (2010) and 2050 No-Build scenarios. Significant improvements in operation are experienced on I-235, K-254, and I-135 in all directions. During the AM peak hour, the traffic causing the problematic weaving movements on southbound I-135 between the I-235 and K-96 has been improved by moving traffic to the C-D road. The northbound I-135 to southbound I-235 loop ramp has been replaced by a two-lane flyover ramp with auxiliary lanes along I-135 and I-235 to reduce the number of merge and diverge movements while lengthening the weaving segments. Thus, in the PM peak hour, the congestion on northbound I-135 is improved along with southbound traffic on I-235 and westbound traffic on K-254 and K-96.

> Individual utility means that an individual phase of a larger project will provide desirable benefits as a stand-alone project.

However, by 2035, traffic operations begin to degrade during the AM and PM peak hours, as shown in **Exhibit 28** and **Exhibit 29**, respectively. The volumes become too large for the interim configuration, and the Purple Project would need to be built to achieve acceptable traffic operations.

There are two locations that become problematic by 2035. Westbound K-254 to southbound I-135 experiences LOS D in 2030 in the AM peak hour. By 2035, the movement degrades to LOS F. Similarly, northbound I-235 to northbound I-135 experiences LOS B in 2030 and LOS E in 2035. Additionally, as traffic continues to grow in the interchange other congestion issues are expected along mainline I-135. Therefore, by the time traffic volumes reach those predicted for year 2035, the full build-out of the preferred concept will need to be constructed in order to accommodate traffic.

PREFERRED CONCEPT SAFETY ANALYSIS

An Interactive Highway Safety Design Model (IHSDM) analysis was performed to compare the safety of the 2050 No-Build scenario to the 2050 Build scenario (preferred concept at full build-out). The analysis assumed the same traffic demand for both the No-Build and the Build scenarios. Comparatively, the preferred concept offers a 17% reduction in the number of crashes for the following reasons:

- Larger radii for curves – higher ramp speeds creates a smaller speed differential between ramps and mainlines
- Longer ramps at Broadway allow more time for accel/decel from I-235
- Fewer and better-spaced conflict points on I-235/K-254 (consolidated entrances and exits)
- Reduced weaving/conflict points on southbound I-135 for traffic heading to eastbound K-96 (this traffic is now on the C-D road)
- Auxiliary lanes will allow traffic to stay in the current lane longer than the existing merging lanes and therefore, give vehicles more time to find gaps in the freeway traffic to shift lanes

There is no substantive anticipated change in crash severity. Overall, the preferred concept is anticipated to operate safer than the No-Build scenario.

Exhibit 26: 2050 Preferred Concept AM Peak Hour Level-of-Service

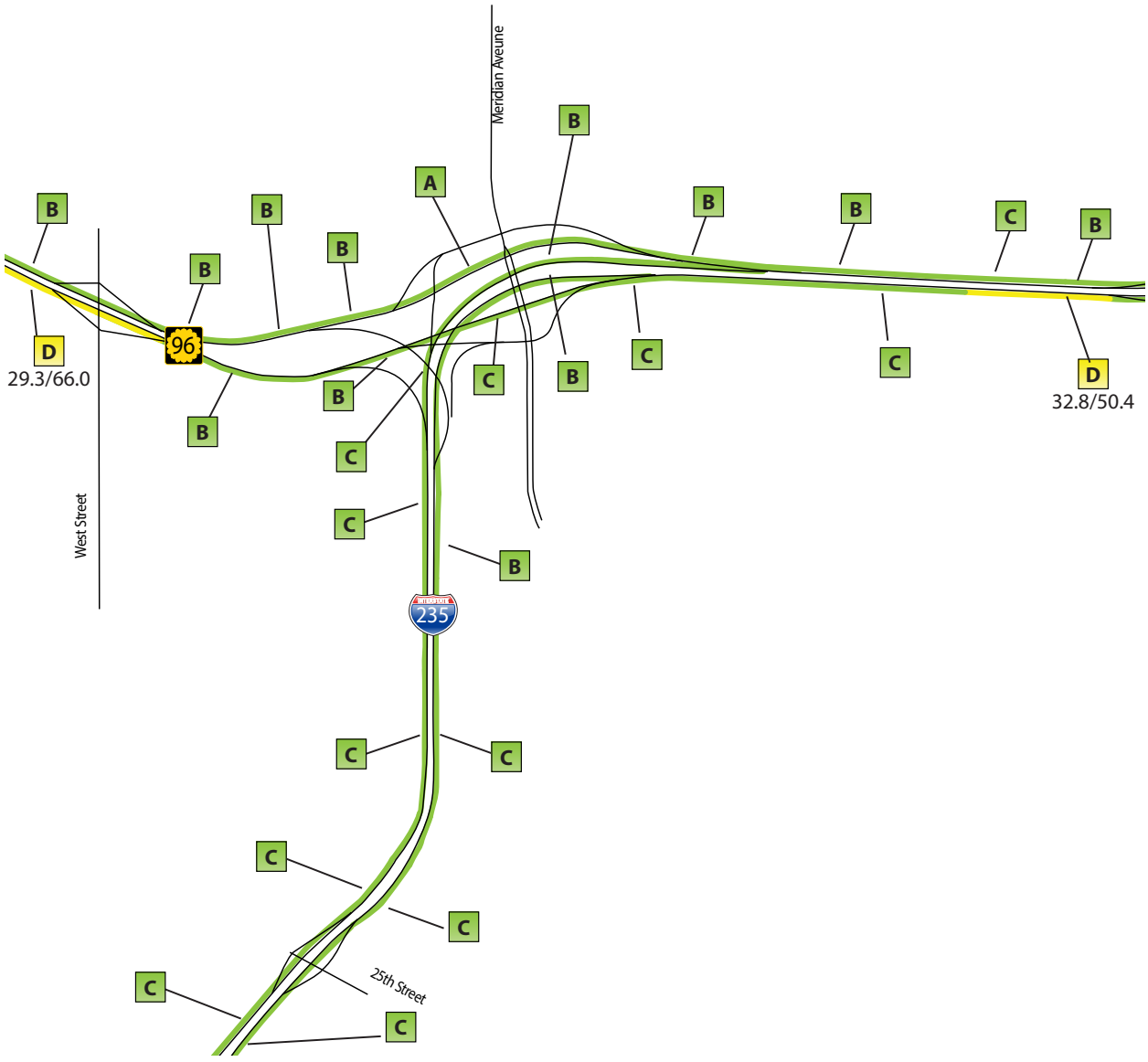
Freeway Level of Service Thresholds

	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
	A	≤ 11	≤ 10	≤ 10
Free Flow	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed



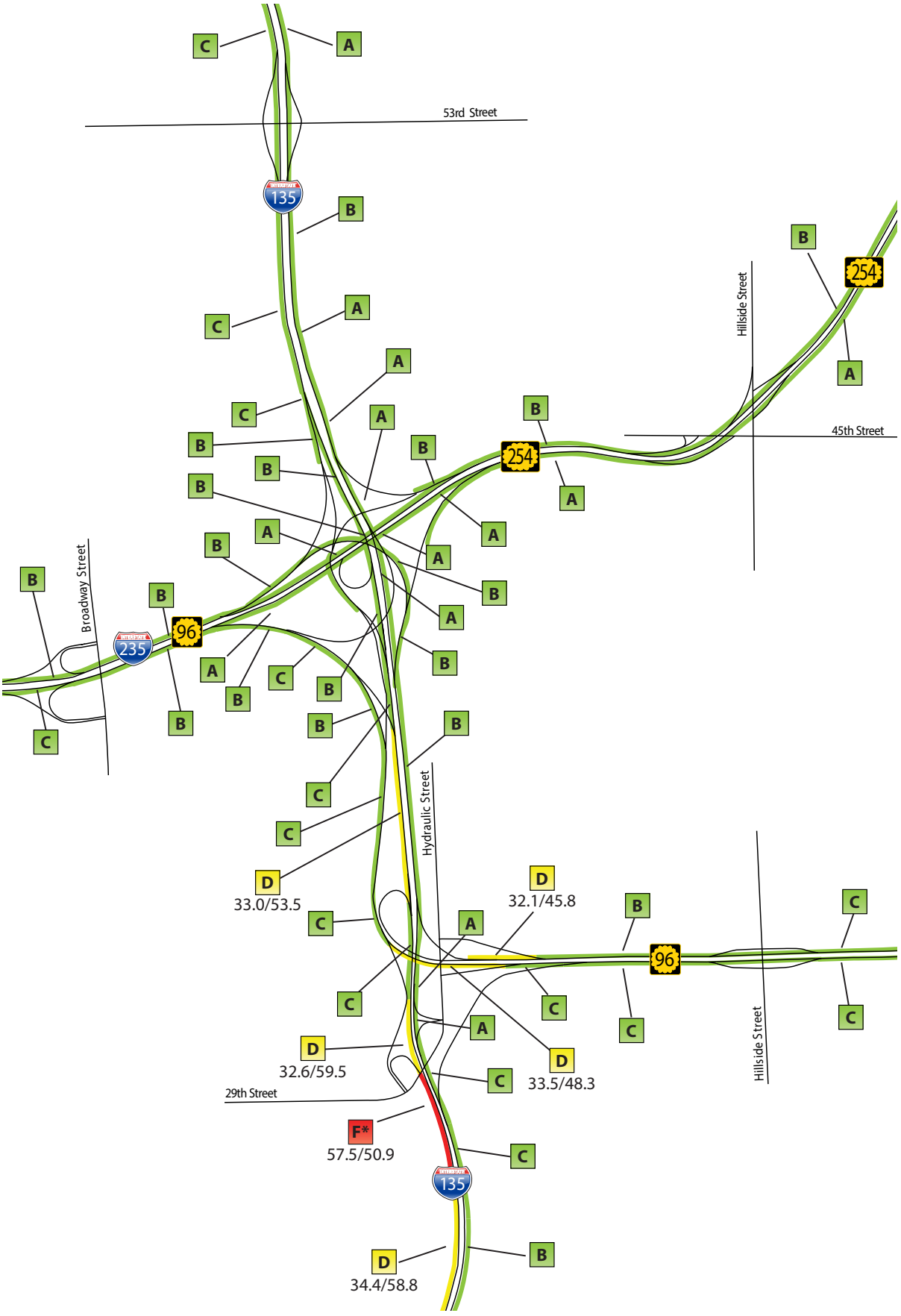

53rd Street
135
254
Hillside Street
45th Street
Broadway Street
235
96
Hydraulic Street
33.0/53.5
32.1/45.8
32.6/59.5
33.5/48.3
29th Street
57.5/50.9
34.4/58.8
Not to Scale

Exhibit 27: 2050 Preferred Concept PM Peak Hour Level-of-Service

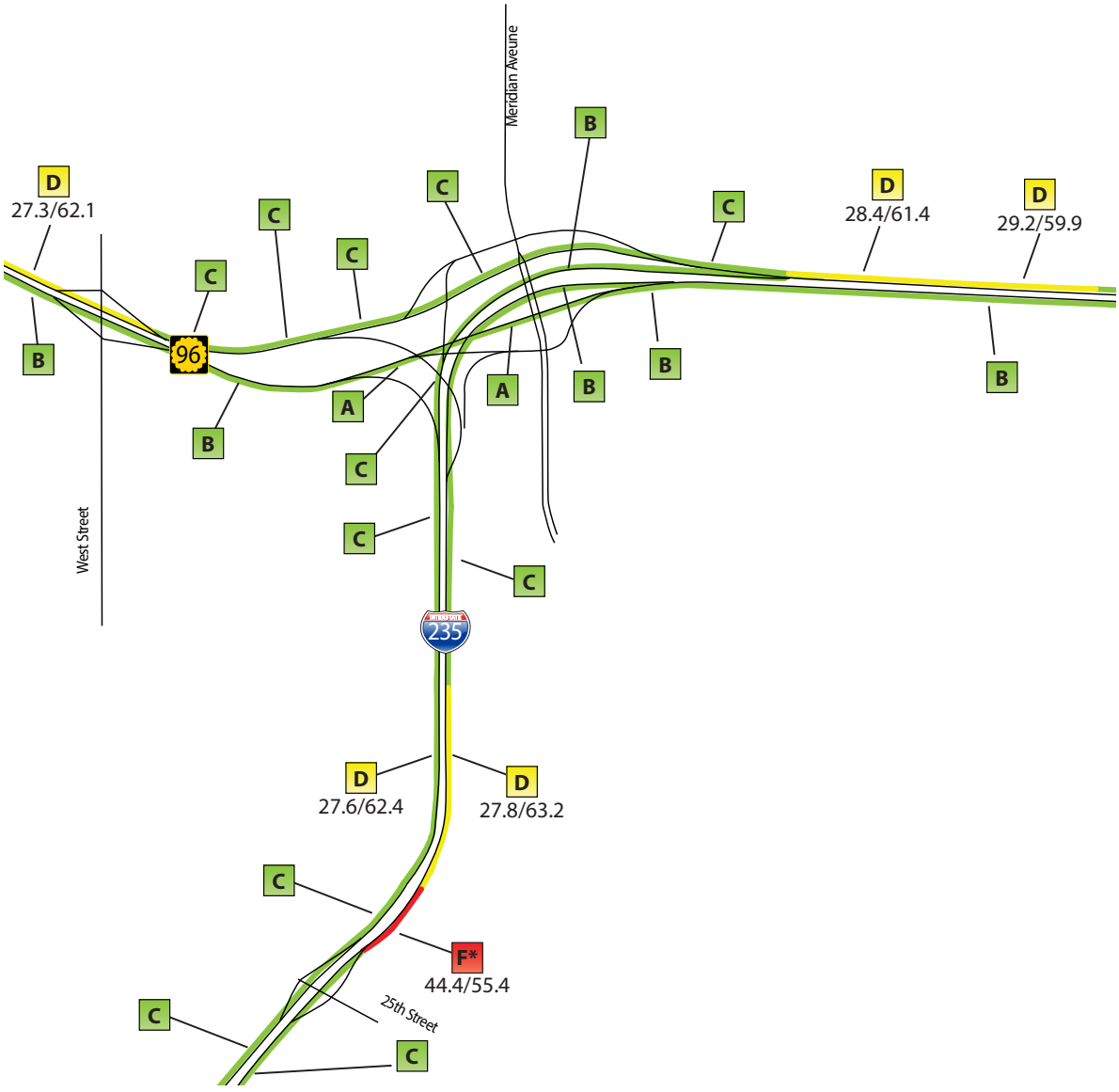
Freeway Level of Service Thresholds

	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
	A	≤ 11	≤ 10	≤ 10
Free Flow	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed



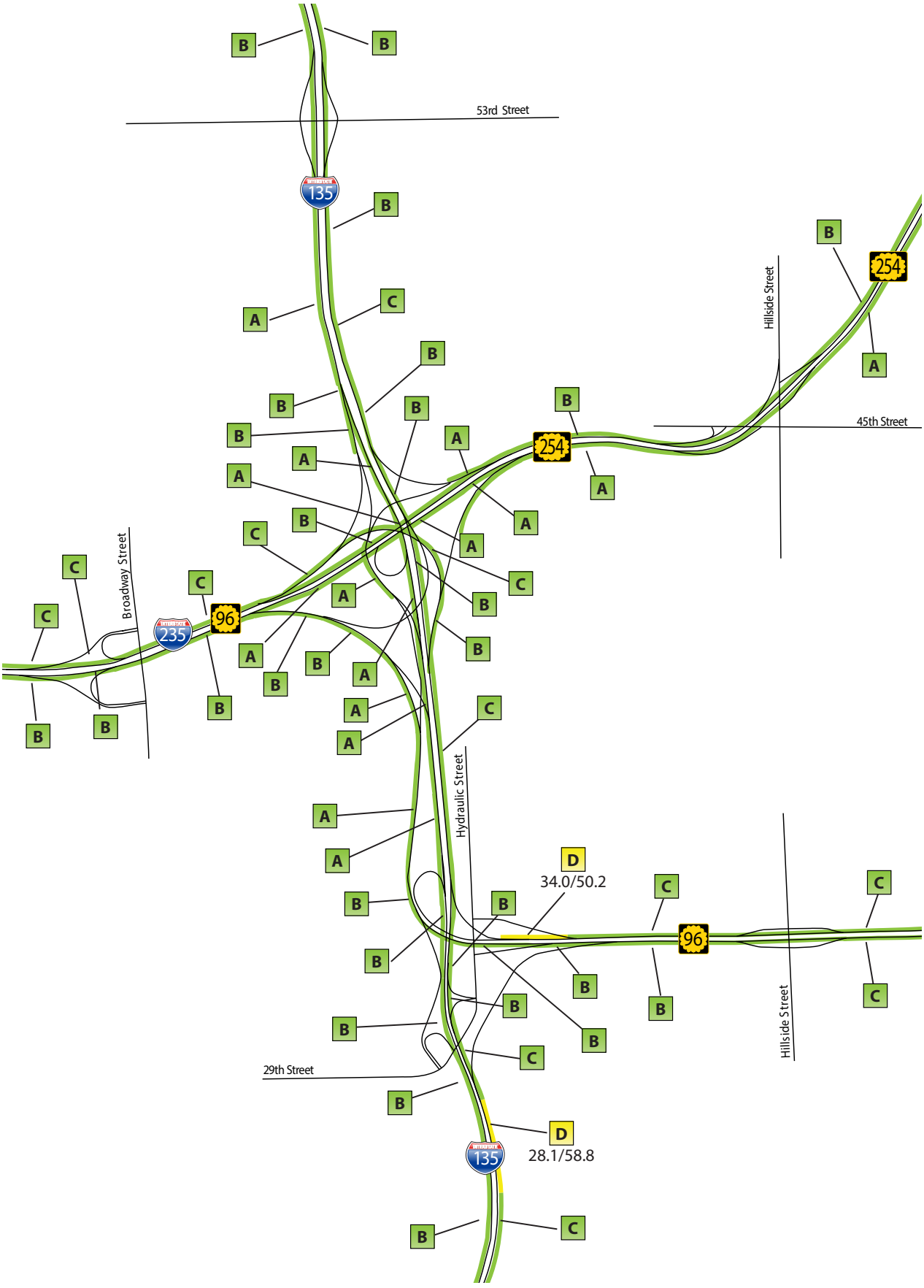

N
Not to Scale
53rd Street
135
254
Hillside Street
45th Street
Broadway Street
235
96
Hydraulic Street
D
34.0/50.2
29th Street
D
28.1/58.8

Exhibit 28: 2035 Preferred Concept AM Peak Hour Level-of-Service

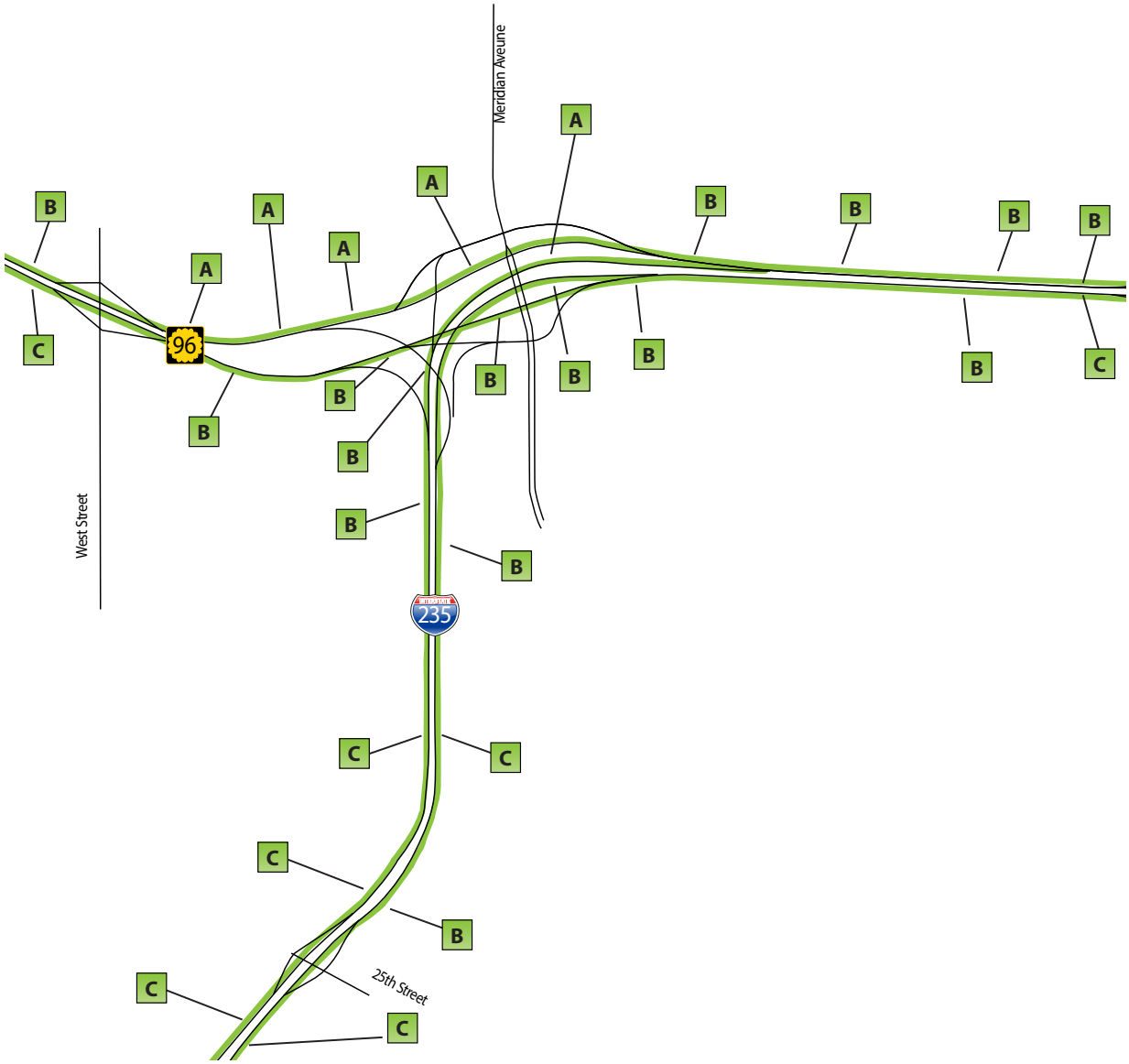
Freeway Level of Service Thresholds

	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
	A	≤ 11	≤ 10	≤ 10
Free Flow	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed



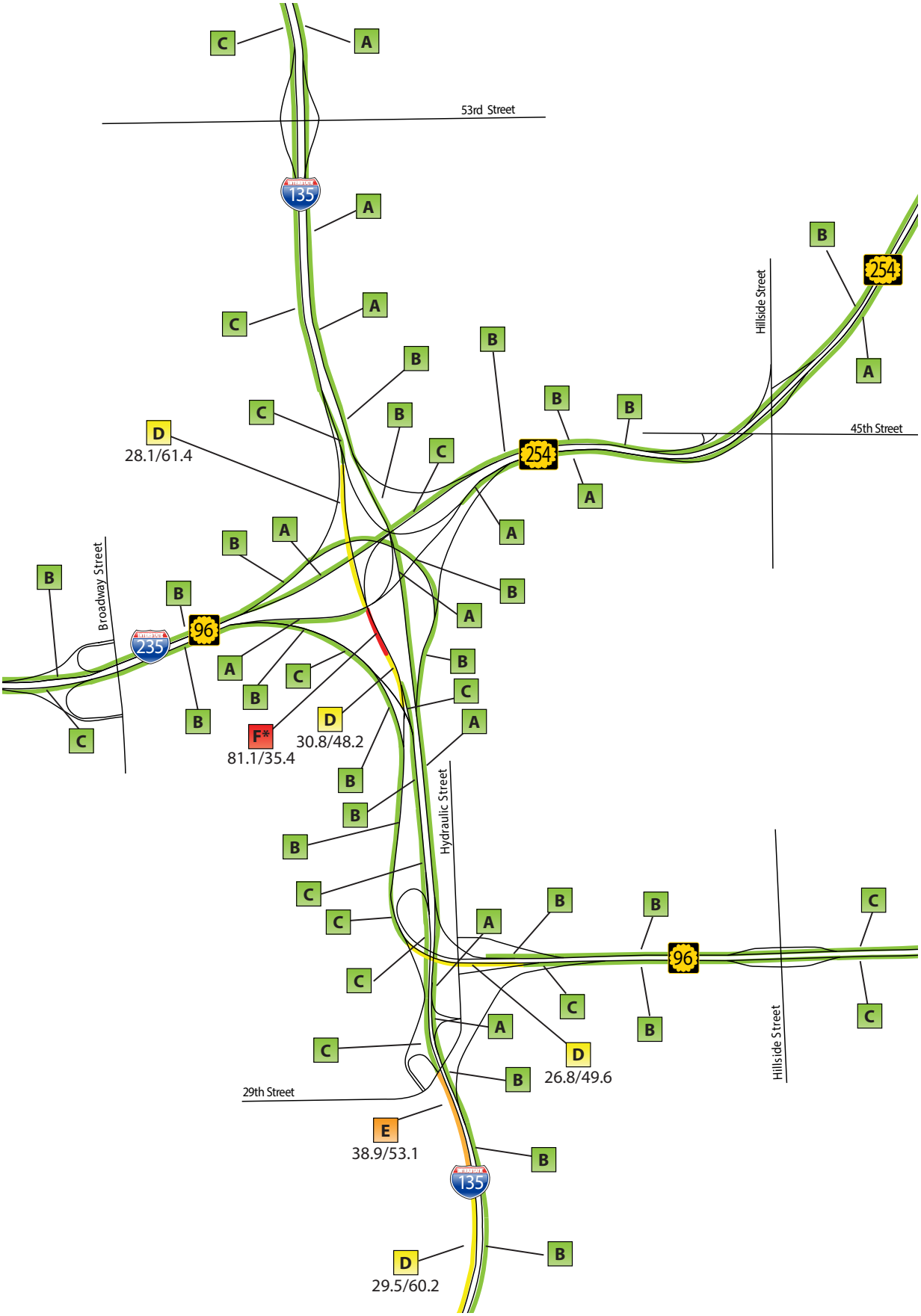

N
Not to Scale
53rd Street
135
254
Hillside Street
45th Street
28.1/61.4
Broadway Street
235
96
F*
81.1/35.4
30.8/48.2
Hydraulic Street
26.8/49.6
29th Street
E
38.9/53.1
29.5/60.2

Exhibit 29: 2035 Preferred Concept PM Peak Hour Level-of-Service

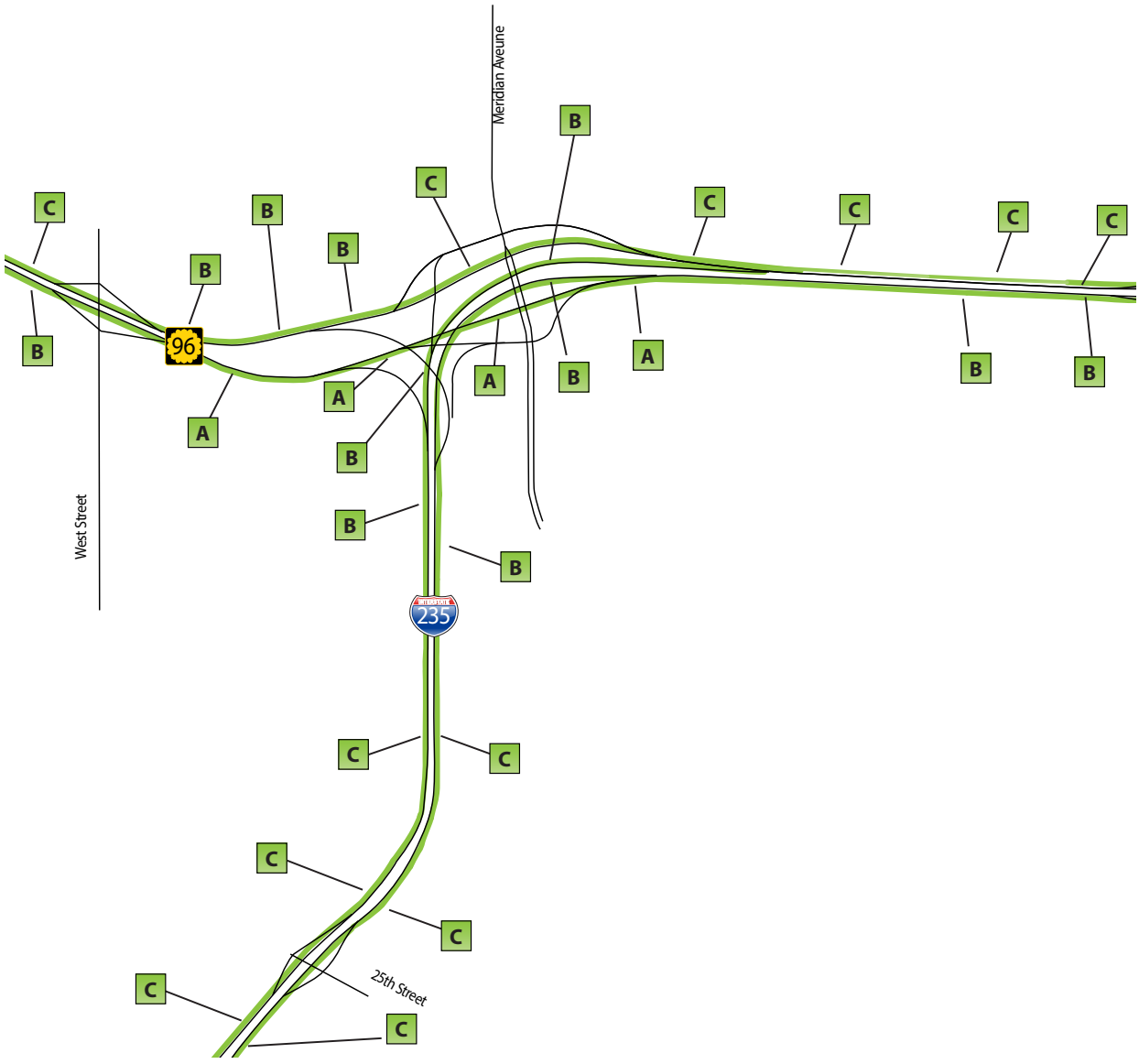
Freeway Level of Service Thresholds

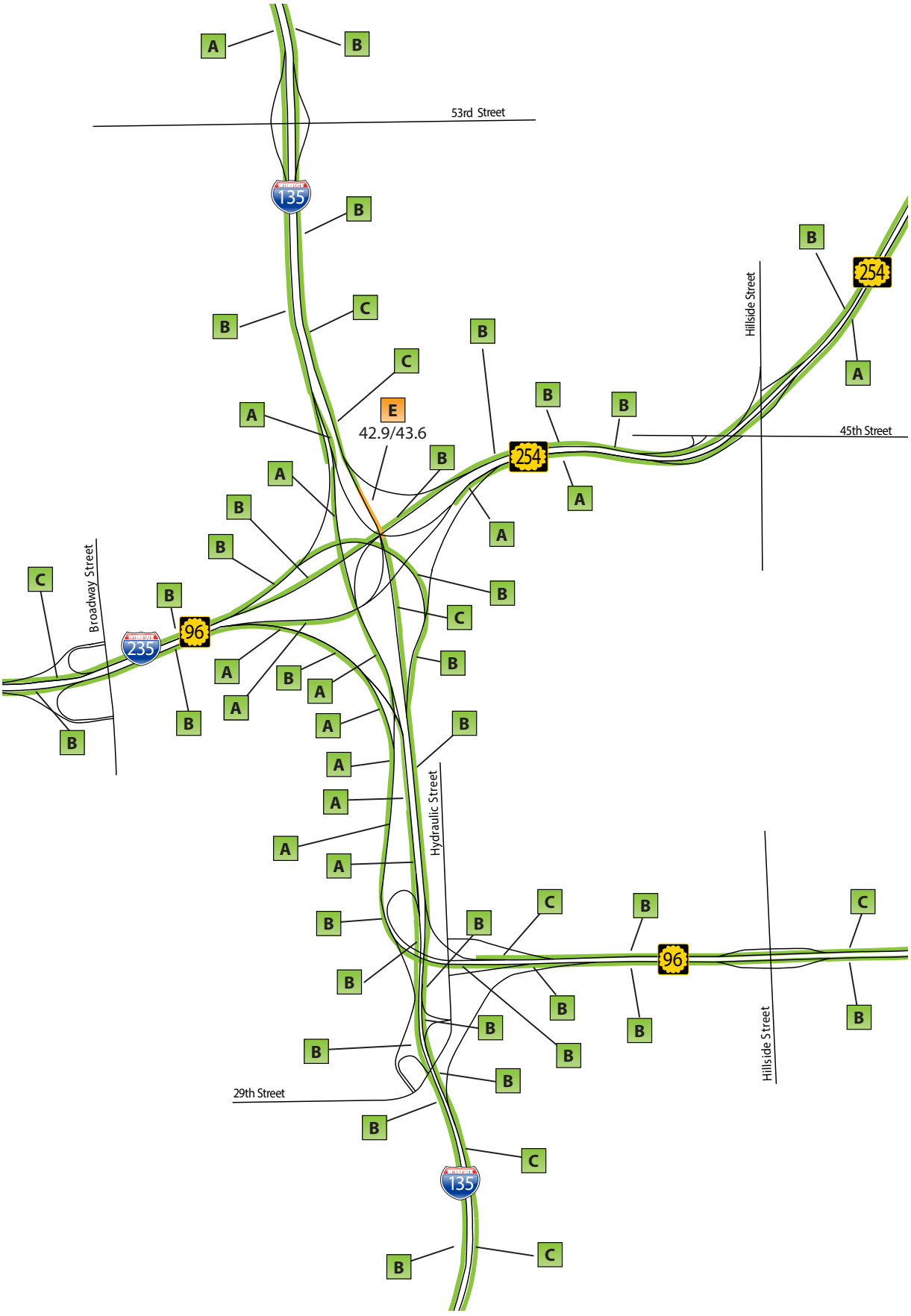
	LOS	Freeways Mainline Max Density (pc/mi/ln)	Freeways Merge/Diverge Max Density (pc/mi/ln)	Freeways Weave Max Density (pc/mi/ln)
	A	≤ 11	≤ 10	≤ 10
Free Flow	B	> 11 - 18	> 10 - 20	> 11 - 20
Minor Delays	C	> 18 - 26	> 20 - 28	> 20 - 28
Delays	D	> 26 - 35	> 28 - 35	> 28 - 35
Major Delays (Density/Speed)	E	> 35 - 45	> 35	> 35 - 43
Failure (Density/Speed)	F	> 45	Demand Exceeds Capacity	> 43

Source: Highway Capacity Manual 2010

LOS

Density / Average Speed




53rd Street
135
254
Hillside Street
45th Street
42.9/43.6
Broadway Street
235
96
Hydraulic Street
29th Street
N
Not to Scale

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Impacts to elements of the environment were considered during the selection of the preferred concept. Social conditions were considered, including impacts to properties, Environmental Justice populations, the economy, parks, historic resources, utilities, concept transportation modes, and travel patterns including impacts during construction.

Impacts to the natural environment were also considered, including impacts to water features, wetlands, flood zones, species, and air quality.

Data is presented in this chapter to identify potential adverse environmental and social impacts for the preferred concept. It also provides the foundation for identifying regulations and requirements that will influence the project. The data was used during the concept selection process and to identify mitigation options to avoid or minimize potential negative impacts of the North Junction Project.

ENVIRONMENTAL CONSIDERATIONS

The environmental conditions within and surrounding the Study Area will influence the design, project schedule, and permitting requirements for improvements to the North Junction.

Water

Water features are prevalent throughout the Study Area. The Arkansas River, Little Arkansas River, and Chisholm Creek flow through the Study Area from north to south. There are also ponds and lakes within and surrounding the Study Area. The water features are shown in **Exhibit 30**. The water features shown on the map are from 2011 LIDAR data.

The Arkansas River is designated by the Kansas Department of Health and Environment (KDHE) as a Special Aquatic Life Use Waters (SALU). SALUs are identified in the Kansas Administrative Regulations, K.A.R. 28-16-28d (b)(2)(A). SALUs are defined as "either classified surface waters other than classified stream segments that contain combinations of habitat types and indigenous biota not found commonly in the state or classified surface waters other than classified stream segments that contain representative populations of threatened or endangered species." Coordination with the KDHE may be needed as the project moves forward.

Wetlands

Wetlands are also prevalent throughout the Study Area. The wetlands shown in **Exhibit 30** are from the National Wetlands Inventory (NWI) database and have not been delineated for this Study. The location of wetlands is being shown to identify areas likely to contain wetlands.

Wetlands are regulated by the US Army Corp of Engineers (USACE). As such, coordination with the USACE will be needed as the project moves forward. The wetlands identified may or may not qualify as USACE jurisdictional wetlands. If jurisdictional wetlands might be impacted by improvements, appropriate mitigation measures will be developed that are consistent with current regulatory practices.

Flood Zones

Flood zones cross through the Study Area, generally following similar routes as the water and wetland features. The flood zones, shown in **Exhibit 30**, were identified from data from the digital 2015 preliminary Flood Insurance Rate Maps (DFIRMs) obtained from the Kansas Division of Water Resources. Although not approved at this time, it is assumed that these will be the identified flood zones when the preferred concept is constructed.

Floodplains serve many purposes including habitat, nutrient retention and removal, and erosion control. Actions are to be avoided, to the extent practical, which result in the location of improvements in floodplains and/or impact floodplain values.

The Federal Emergency Management Agency (FEMA) imposes requirements for construction in the floodplain and floodway. For cases involving construction in the floodplain where a regulatory floodway is defined, no hydrologic or hydraulic analysis is required for construction and placement of fill in the floodway fringe. However, construction proposed within the floodway requires a detailed analysis demonstrating the impacts of proposed construction.

Endangered & Threatened Species

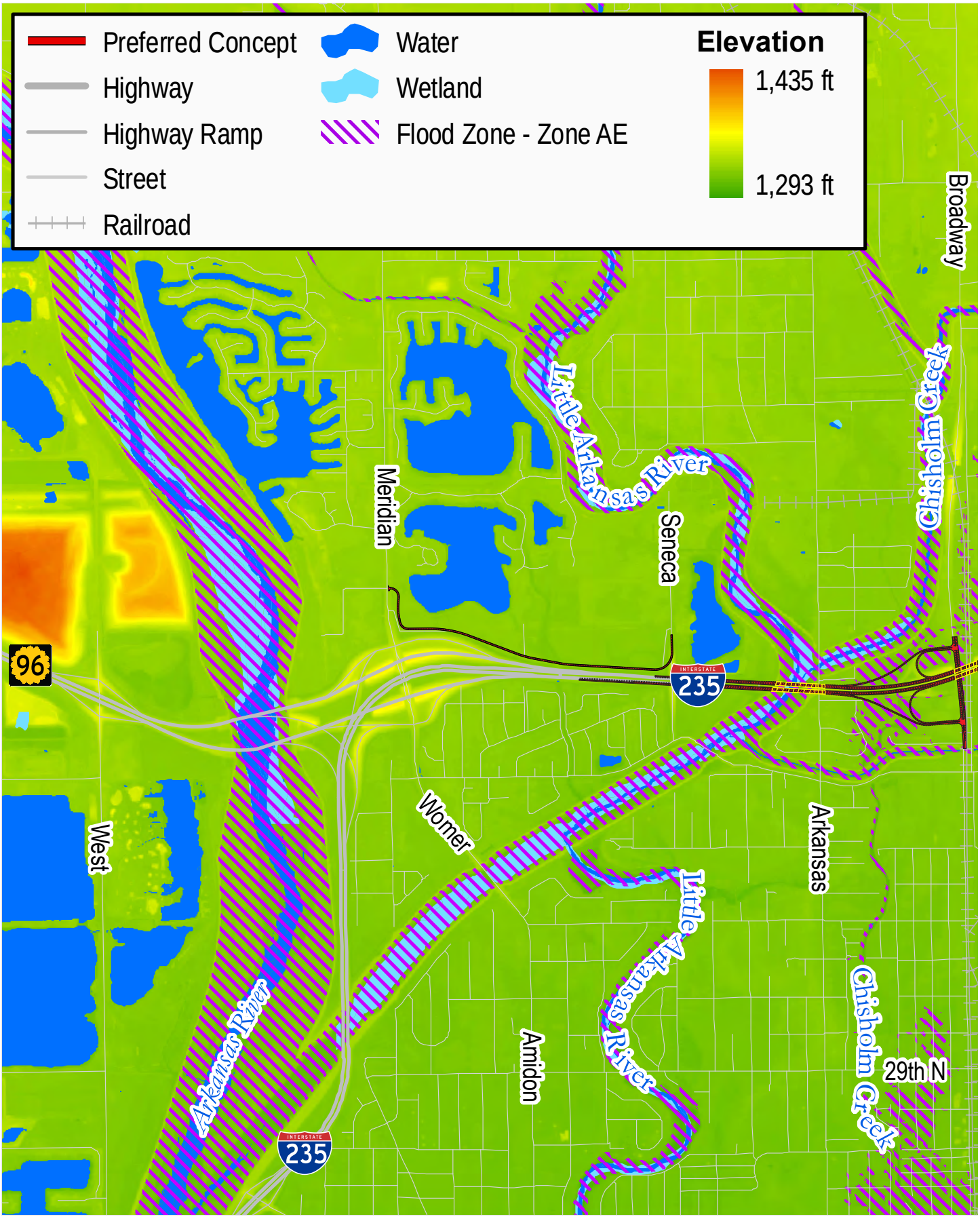
An important consideration are the habitats of threatened and endangered species. According to the Kansas Department of Wildlife, Parks and Tourism (KDWPT), there are seven threatened or endangered species that have Designated Critical Habitat (DCH) and two species that have Known Historic Ranges (KHR) in Sedgwick County.

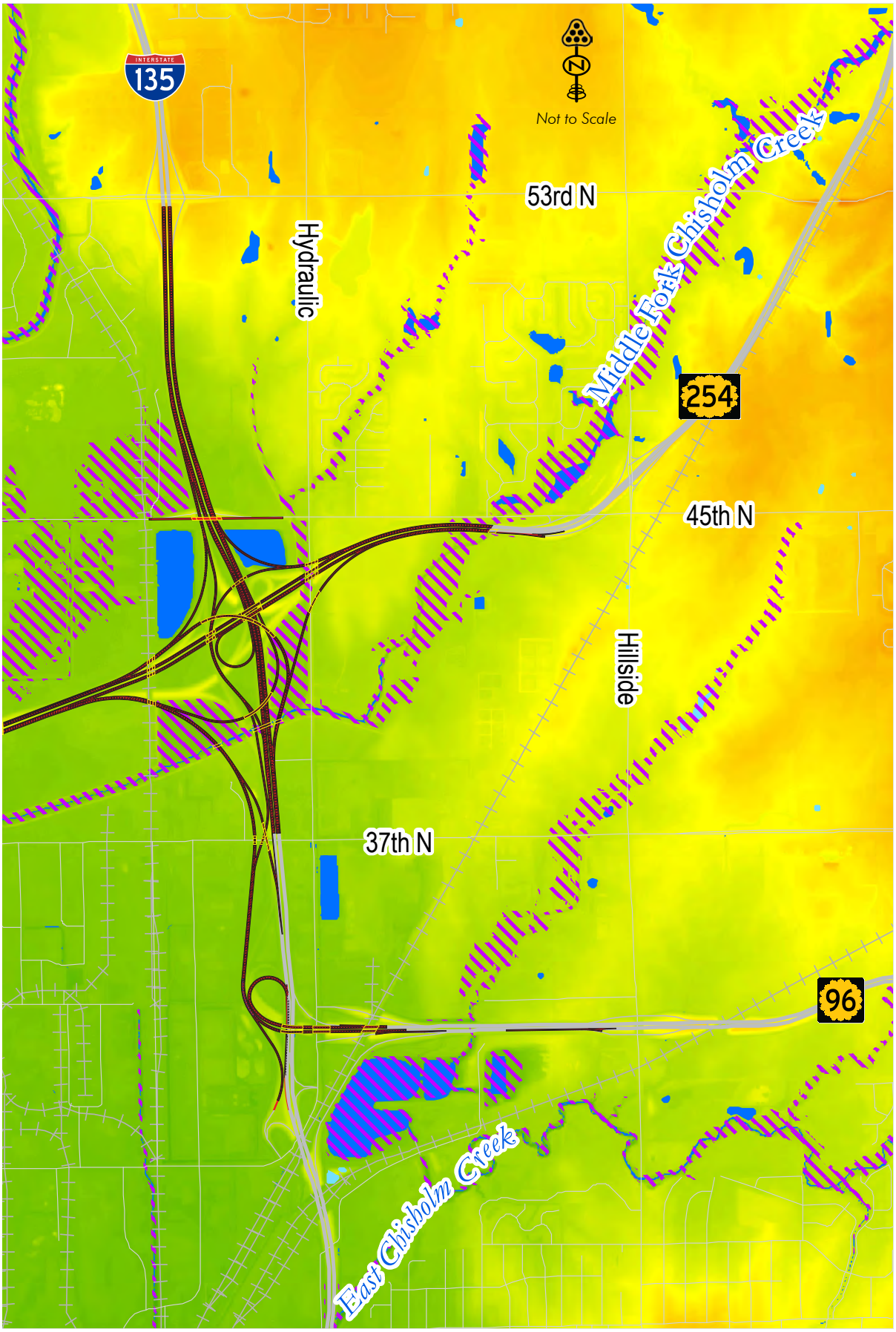
Air Quality

The Study Area is within the Wichita Metropolitan Statistical Area (MSA), which is monitored for six criteria air pollutants. The MSA is currently in attainment, meaning the area does not violate federal standards for air pollution. However, the region is close to violating these standard for ground-level ozone. If the area violates this standard, it would likely bring the region into non-attainment. This designation would have an impact on transportation improvements that can be made using federal funds.

With the goal of the project to facilitate efficient traffic flow and enhance the safety of the interchange, the project will reduce recurring and non-recurring delay. Although it would require air quality modeling to make a firm conclusion, it is assumed that the outcomes of the North Junction Project will reduce on-road mobile source emissions.

Exhibit 30: Water, Wetlands, Flood Zones, & Terrain




INTERSTATE
135
N
Not to Scale
53rd N
Hydraulic
Middle Fork Chisholm Creek
254
45th N
Hillside
37th N
96
East Chisholm Creek

SOCIAL CONSIDERATIONS

The social conditions within and surrounding the Study Area have a large influence on the design of the North Junction Project. The configuration must balance the need to meet travel demand long into the future and the desire to minimize adverse impacts to property and traveling public.

Area Development Pattern

The land use and development pattern surrounding the North Junction provides a baseline understanding of what types of development are in the area. The land uses vary from open space to residential to industrial. The surrounding land uses have an impact on traffic volumes and flow on Study Area highways and interchanges. Each development generates and attracts trips, which likely utilize the highway system, especially for longer trips.

The landscape of the area south of I-235 between I-135 and Broadway is dominated by the railroad tracks. This area contains industrial, commercial, and transportation-type uses including Johnson Controls, Groendyke Transport, Universal Companies Inc., and Waste Connections. These businesses desire access to the freeway network, efficient traffic flow on the freeways, and geometry that is conducive to large truck traffic.

The area south of I-235 and west of Broadway is primarily residential with small areas of industrial, commercial, and institutional uses. The City landfill is located west of the Arkansas River north of K-96. North of I-235 and west of I-135 includes various water features and contains a mix of uses with some developable land still available. The area east of I-135 and north of K-254 is primarily agricultural land with some residential development. The area east of I-135 between K-254 and K-96 has some agricultural land to the north near K-254 and industrial and commercial to the south near K-96. Koch Industries and Coleman Company, Inc. are some of the major employers in this area. The area east of I-135 and south of K-96 includes park land with mainly residential uses south of 27th Street North. Wichita State University is located in this area at 21st Street North and Hillside. **Exhibit 31** shows the existing land uses within and surrounding the Study Area.

Jobs & Economic Growth

The North Junction is a key junction in getting people to jobs, shopping, and entertainment as well as getting goods to market. The safe and efficient flow of traffic is vital to the economic health of the Study Area, the region, and the state. Congestion at the North Junction delays not only personal vehicle traffic, but commercial transport as well.

Major traffic generators in close proximity to the Study Area, including Koch Industries, Johnson Controls, Waste Connections, and Wichita State University, benefit from being in close proximity to the highways and interchanges. Regional destinations not in close proximity to the North Junction also benefit from the mobility provided by the highways and interchanges. Many people use the Study Area highways when traveling to New Market Square, Bradley Fair, Old Town, Towne West, or Wichita Dwight D. Eisenhower National Airport just to name a few.

The highway network also facilitates the transport of people and goods traveling to and from locations beyond the region. Intrastate and interstate commerce as well as the economic growth of Kansas and the United States influence traffic on the highway network.

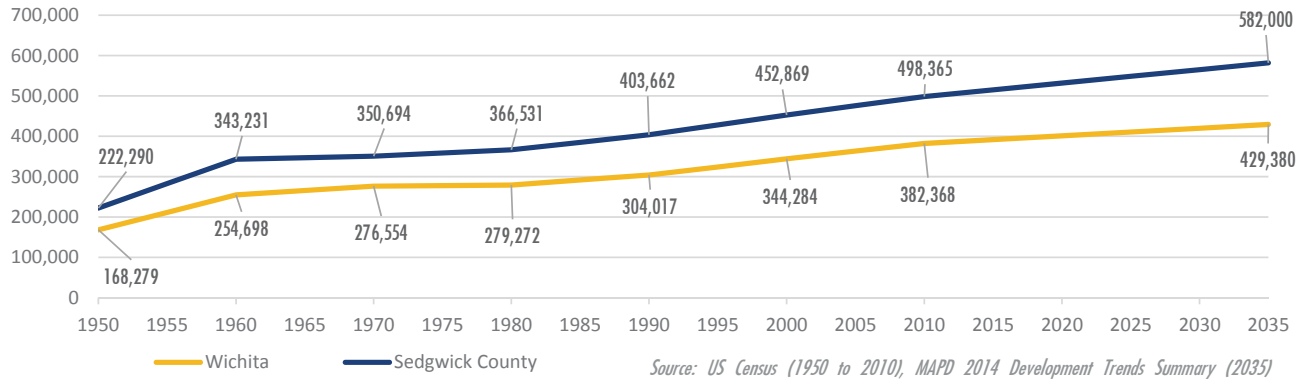
The proposed concept was developed to support existing business activity and opportunities for economic growth.

Population

Traffic is projected to increase due to a variety of circumstances, including an anticipated increase in regional population. Sedgwick County has historically experienced steady growth. Wichita and the surrounding communities are growing and projected to continue grow. **Chart H** shows the historic and projected population of Wichita and Sedgwick County as a whole.

There is a small portion of the regional population residing in the general vicinity of the Study Area. **Exhibit 32** shows the population density within and surrounding the Study Area using block level 2010 Census data. The population residing within and near the Study Area is not necessarily indicative of traffic through the North Junction since it is a system interchange that serves the a much larger area. However, right-of-way needed for the preferred concept could impact residences.

Chart H: Population



Source: US Census (1950 to 2010), MAPD 2014 Development Trends Summary (2035)

An important consideration for this major transportation investment is Executive Order 12898 requiring that federal actions address Environmental Justice (EJ) in minority and low-income populations. WAMPO has developed a Title VI Program for the region that identifies EJ census tracts based upon their socioeconomic composition. **Exhibit 33** shows the Study Area overlaid on the EJ Map. The next section discusses impacts to EJ areas due to right-of-way needs for the North Junction Project.

Impacted Properties

Properties will be impacted by the preferred concept. Each of the concept concepts considered had similar impacts to properties. These impacts were considered during the selection of the preferred concept, but since there was minimal difference between them, it was not a major factor.

Areas being impacted the most are along the west side of I-135 where the southbound C-D road is located. Other options to accommodate this major movement were assessed but did not accommodate future traffic flow on the heavy AM peak hour movement from northbound I-235 to eastbound K-96.

Other properties surrounding the preferred concept will be impacted. Since this concept is preliminary, much is unknown about the exact impact to properties. The right-of-way impacts, including impacts to EJ areas, will be taken into account during the final design of the North Junction Project. Mitigation strategies will be considered during final design.

Parks

Any improvements to the North Junction will require Federal Highway Administration (FHWA) approval. FHWA and other Department of Transportation (USDOT) agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless there is no feasible and prudent concept to the use of land and the action includes all possible planning to minimize harm to the property resulting from use.

There are multiple parks in close proximity to the Study Area as identified in **Table M** and illustrated in **Exhibit 34**. The data used in creating the map was obtained from the Sedgwick County GIS website on November 18, 2014.

The three most likely impacted parks are the Bridgeport Soccer Field (3), K-96 Lake Park (4), and Primrose Park (7). As stated earlier, the exact right-of-way needed for the North Junction Project is unknown at this point. As design proceeds, impacts to parks will be reviewed and mitigation strategies will be assessed.

Historic Resources

A review was completed of the National Register of Historic Places database, which was retrieved on November 18, 2014. There were no listed properties within the Study Area. The closest listed properties were in the vicinity of the 25th Street North and Broadway intersection and the 21st Street North and Hillside intersection.

Utility Infrastructure

Private and public utilities will be impacted by the preferred concept. However, to achieve the goals for the North Junction Project, these impacts are unavoidable. Each concept considered would have similar impacts to private utilities.

As the North Junction Project moves forward with design, coordination will be required with each of the utilities. The major impacts for the North Junction Project are the gas lines that pass under the existing highways as well as the proposed improvements. Coordination will occur on the modification of utility infrastructure which could include gas, electric power, potable water, sanitary sewer, and communications.

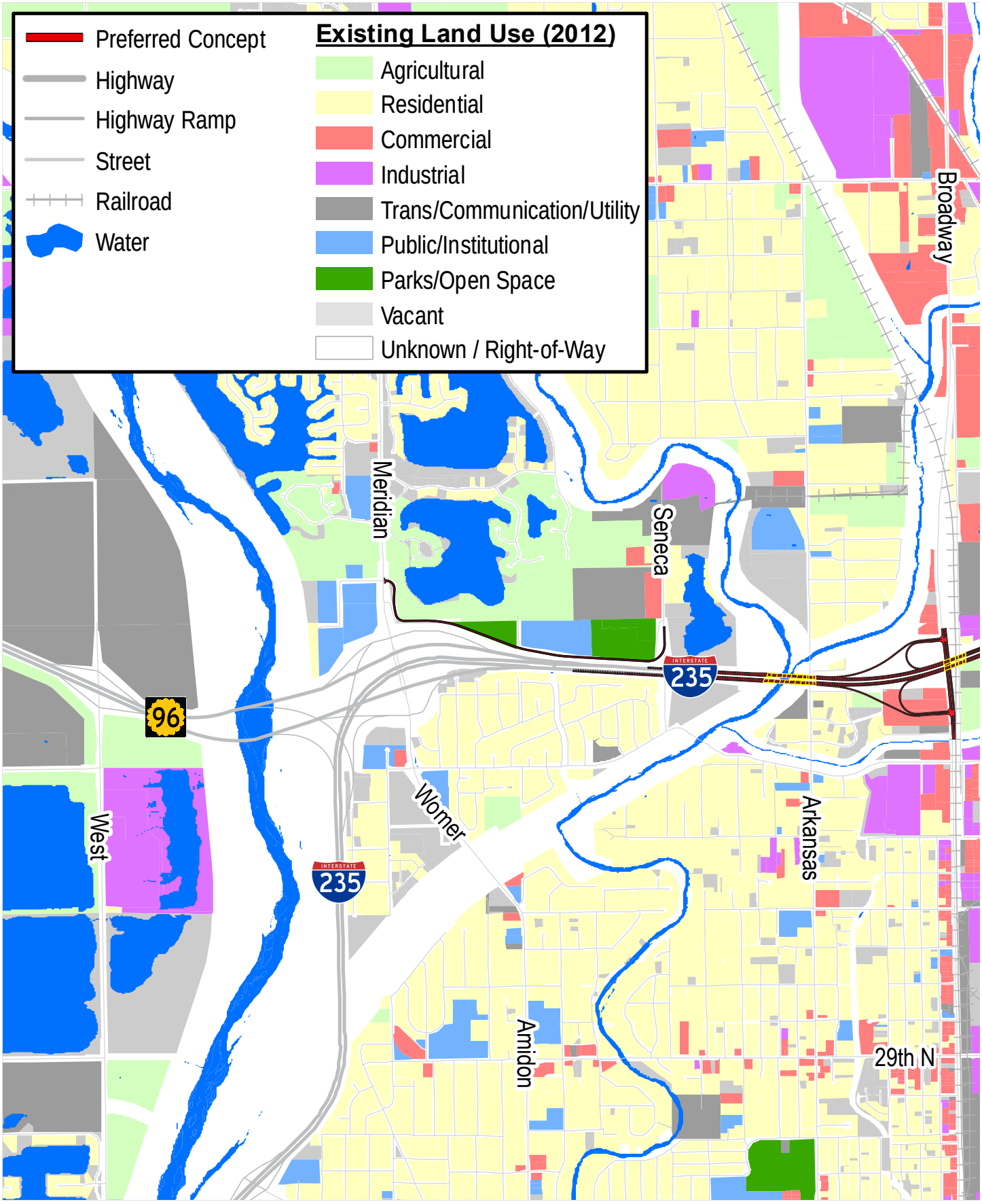
Intelligent Transportation Systems Infrastructure

KDOT currently has Intelligent Transportation Systems (ITS) infrastructure in the Study Area. There are dynamic message boards, cameras, and associated elements. The location of the boards and cameras are provided below:

- Boards
  - I-235 between the northbound and southbound lanes just west of the Seneca bridge (west-facing)
  - I-135 east of the freeway between 23rd Street North and Looman (south-facing)
  - Boards at 61st St N on I-135 for both travel directions
- Cameras
  - On Broadway south of I-235 looking at I-235
  - Middle of North Junction between travel directions of I-235/K-254 and I-135
  - East of I-135 just north of 37th Street North and west of Hydraulic
  - Middle of loop from westbound K-96 to southbound I-135
  - Between I-135, K-96, Hydraulic, and ramp from Hydraulic to northbound I-135
  - East of I-135 at southern most railroad track
  - East of I-135 at 21st Street North east of ramp terminals
  - K-96 east of Hillside but west of ramp termini
  - North of K-96 exit from southbound I-235, east of Meridian and south of ramp from aforementioned ramp to Meridian

KDOT has plans to expand the ITS infrastructure in the Study Area. These improvements will be coordinated with improvements to the North Junction. During construction of the North Junction, KDOT will utilize ITS signs to communicate construction activities to the traveling public to the extent practicable.

Exhibit 31: Land Use Pattern



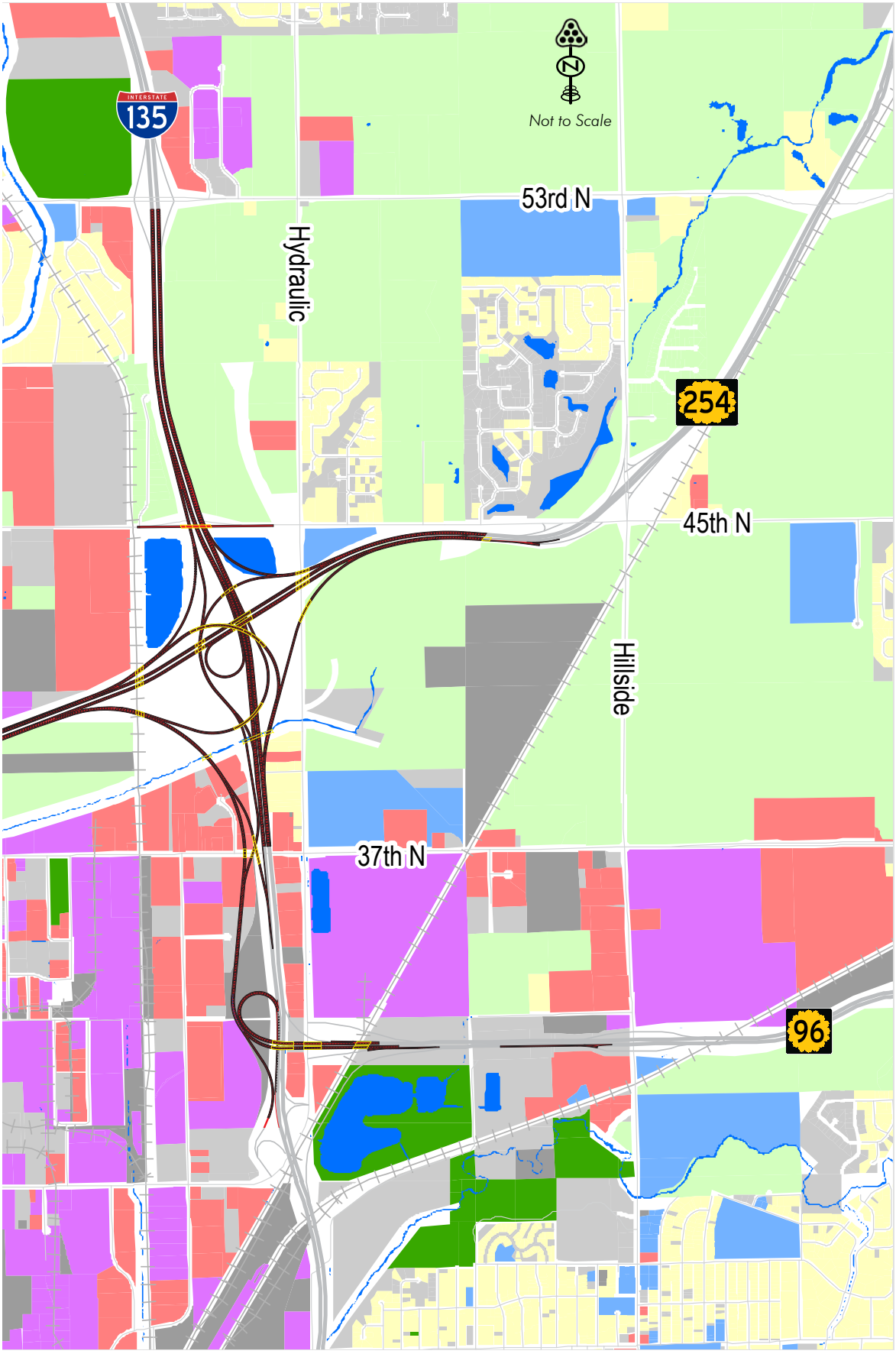
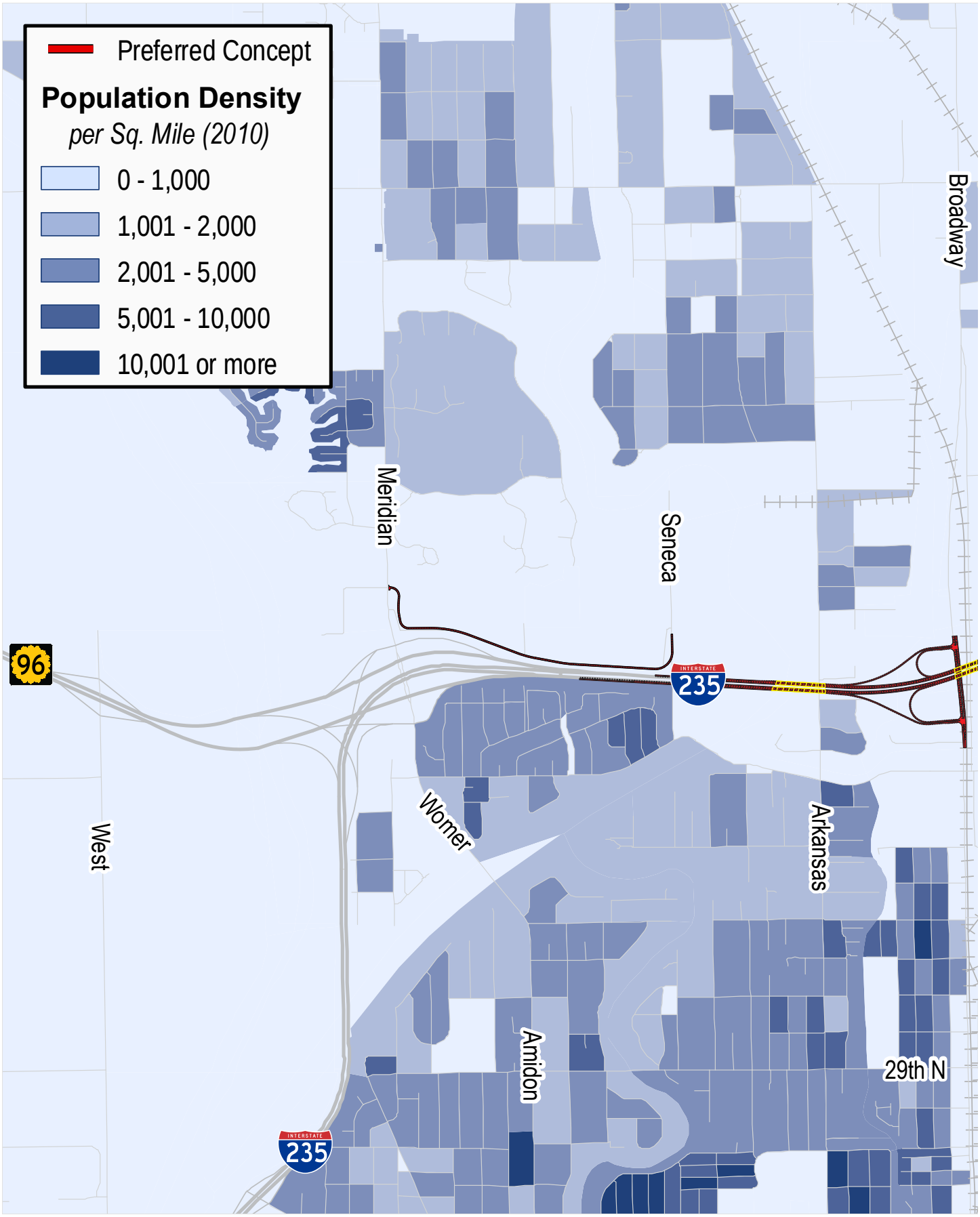

Not to Scale
N
INTERSTATE
135
53rd N
Hydraulic
254
45th N
Hillside
37th N
96

Exhibit 32: Population Density



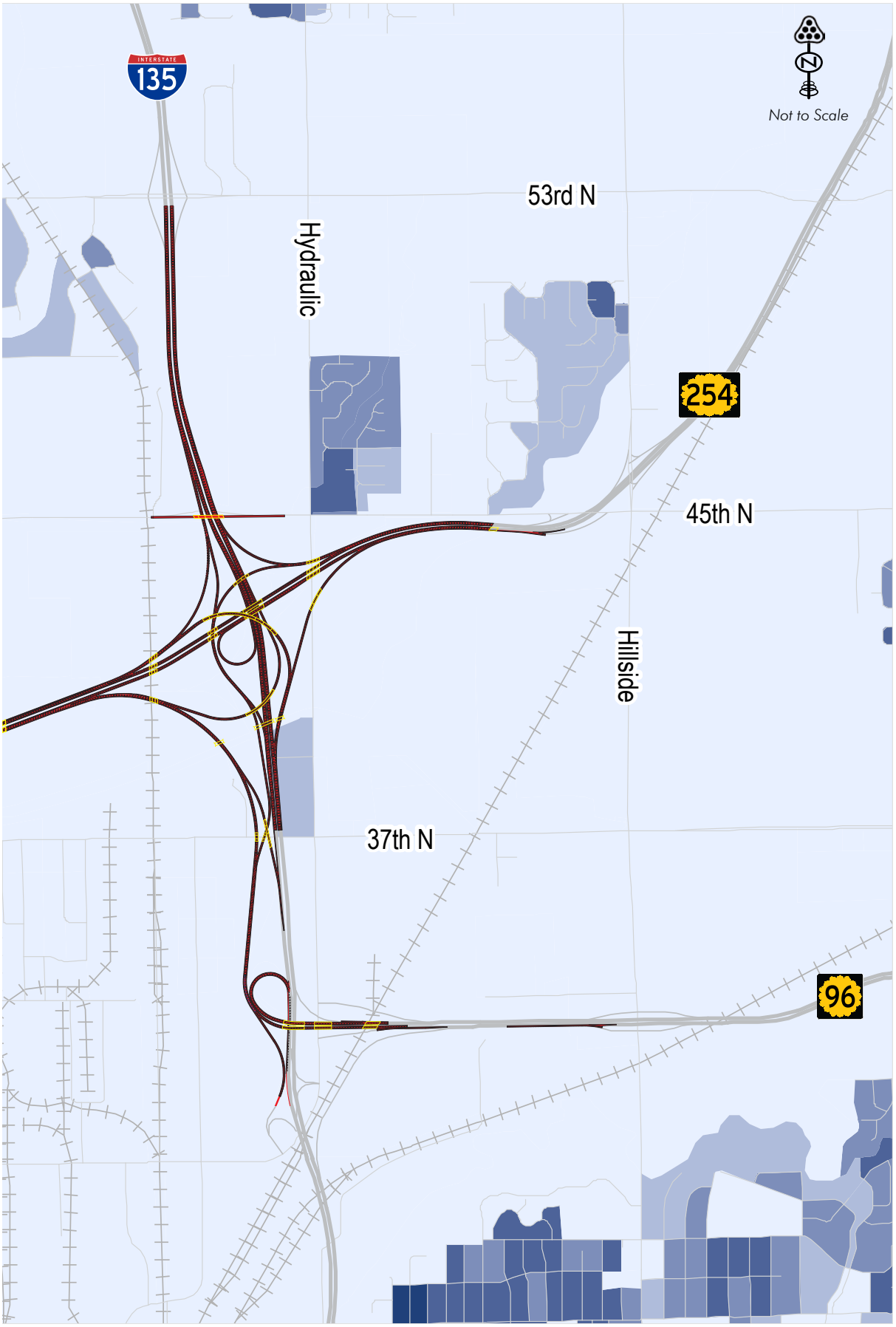
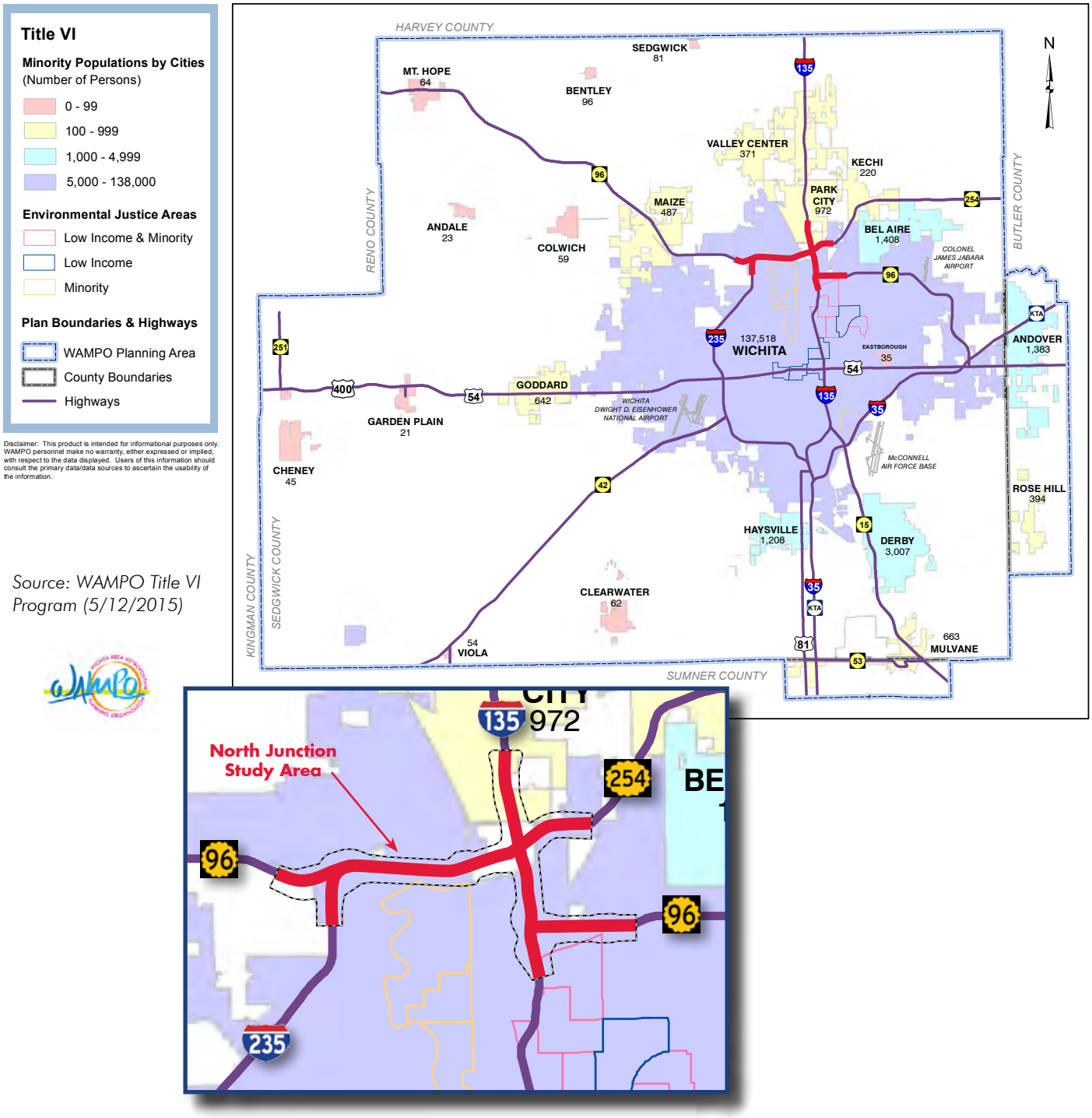

INTERSTATE
135
Not to Scale
53rd N
Hydraulic
254
45th N
Hillside
37th N
96

Exhibit 33: Environmental Justice Areas

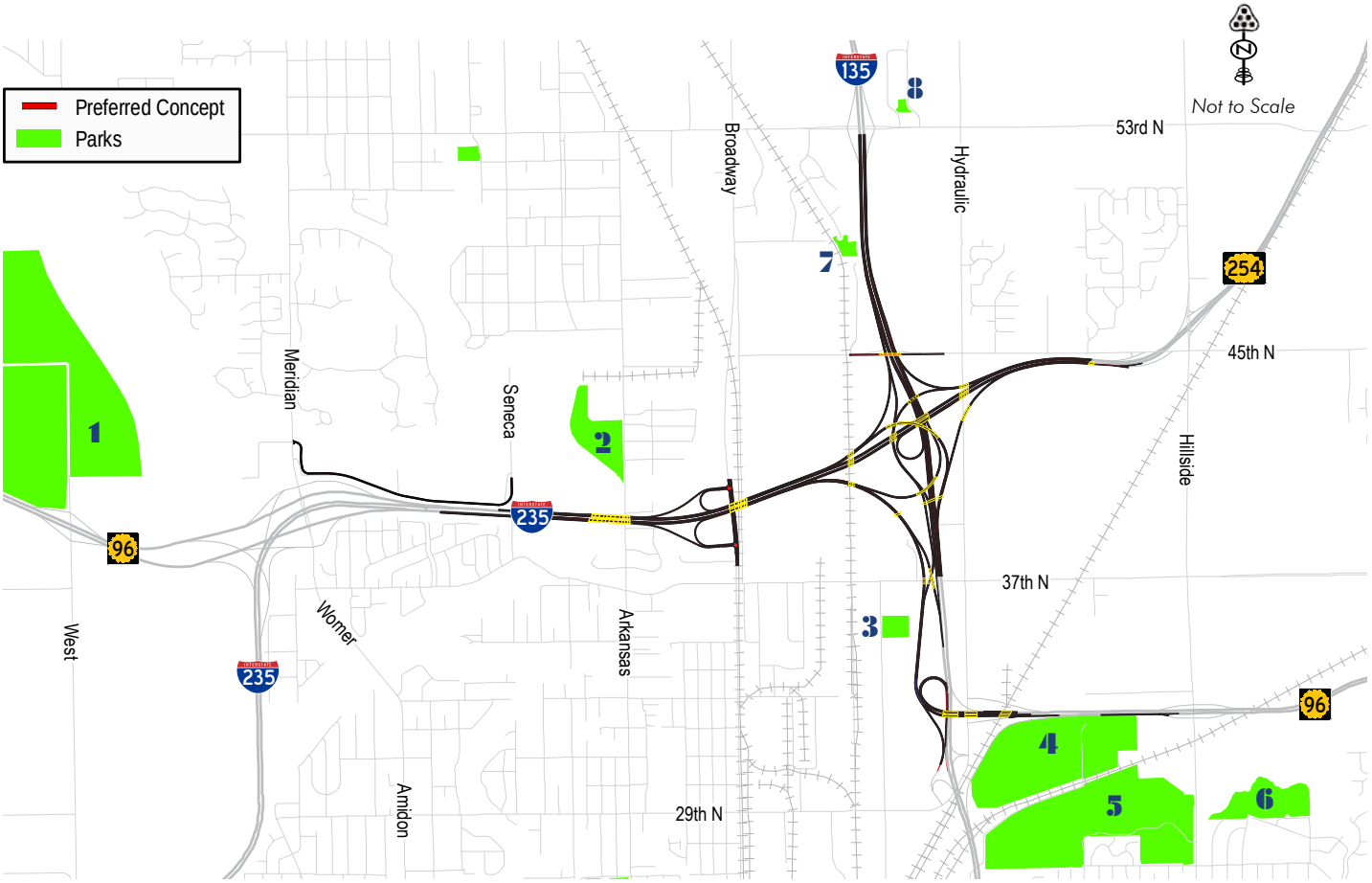


Source: WAMPO Title VI Program (5/12/2015)

Table M: Parks

Map ID	Name	City	Acres
1	Brooks Tracts	Wichita	729.8
2	Hellers Park	Wichita	30.6
3	Bridgeport Soccer Field	Wichita	7.5
4	K-96 Lake Park	Wichita	128.9
5	Dr. Glen Dey Park (Grove Park)	Wichita	174.7
6	Chisholm Greenway	Wichita	33.5
7	Primrose Park	Park City	4.0
8	Osage Trail Park	Park City	1.6

Exhibit 34: Parks



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STUDY INITIATION

There were two major factors that prompted the 2015 Study. The first was the needed coordination with the Green Project that is currently being designed. KDOT would also like to initiate the design of the North Junction so improvements can be implemented when funding becomes available. In order to have plans ready for the North Junction and have those plans fit with the Green Project, a final detailed concept for the North Junction was needed.

Additional planning and discovery was needed to develop a preferred ultimate concept for the North Junction. In 2014, KDOT commissioned PEC and HNTB to complete the 2015 Study. The design team was responsible for developing realistic concepts and providing recommendations.

DATA COLLECTION

Much of the traffic data collected for the 2012 Study was still valid and was used for the 2015 Study. Traffic counts, travel time data, field observations, and videos from the 2012 Study were used for the 2015 Study. This data was used to identify existing traffic operations as well as project future traffic operations, as discussed in the Traffic Forecasting section later in this appendix.

A 5-year crash history from 2009 to 2013 was obtained from KDOT and analyzed as part of the 2015 Study. This data was analyzed and presented in **Chapter 4**. More detailed information crash data is presented in **Appendix D**. The data was used to identify opportunities to enhance safety with improvements to the North Junction.

Various other data were collected as part of the 2015 Study, including existing land uses, floodplain locations, and socioeconomic data. Existing land use data was collected from Sedgwick County. Socioeconomic data was collected from the US Census Bureau. This data aided in identifying potential impacts of each concept, including the preferred concept.

DESIGN CRITERIA

There have been a number of changes to design criteria since the previous concept was last evaluated from a roadway and bridge geometrics perspective. The 2015 Study evaluated the 2012 concept and developed concept concepts based on current criteria.

On July 9, 2015, KDOT representatives and the design team met to determine the design criteria to be used for the North Junction project. **Exhibit 35** shows the agreed upon design criteria. These design criteria identified desirable and minimum/maximum targets that were to be used to develop concepts.

Once the Core Team selected a preferred concept, the design team met with KDOT staff to discuss the design in greater detail. The focus was on reevaluating the design criteria that was set early in the process and comparing it with the design characteristics of the preferred concept. The intent was to identify where the desired design criteria could be achieved, where the minimum/maximum criteria would be used, and where the minimum/maximum criteria were not achievable due to a variety of circumstances.

TRAFFIC FORECASTING

VISSIM (version 5.4) microscopic traffic simulation models were built to analyze the operations of the Study Area road network. The models were an update to those used for the 2012 Study.

VISSIM is a traffic simulation software used to analyze traffic operations

Two VISSIM models were developed; one for the AM peak hour and one for the PM peak hour. The peak hour represents the four highest consecutive 15-minute periods in the morning and in the afternoon. The existing conditions (as well as Future No-Build and Build conditions) were modeled using these two peak hours The existing data indicated that the peak hours in the Study Area were 7:15 to 8:15 for the AM and 4:30 to 5:30 for the PM.

When calibrating the VISSIM models, the PM model was extended beyond the peak hour by 30 minutes in order to accurately replicate field conditions. The congestion experienced within the study area needs approximately 30 minutes after the peak hour to dissipate and flow freely. This was experienced in travel time runs as well as the VISSIM modeling.

Existing traffic volumes combined with field observations and travel time runs in both the peak and off-peak directions during the AM and PM peak hours were the primary inputs into the VISSIM model. Calibration of the model was performed by utilizing observations to better understand vehicle queues and congestion. AirSage origin and destination data collected from cellular phones was also used to understand traffic movements through the interchange. The distribution of traffic was modified in two locations for the 2015 Study based upon the AirSage data; northbound I-235 at the ramp to southbound I-135 and southbound I-135 at the ramp from northbound I-235.

The limits of the traffic analysis are described below, and shown in **Exhibit 36**.

- East: K-96 and Hillside Interchange, K-254 and Hillside/45th N Interchange
- West: K-96 and West Interchange
- North: I-135 and 53rd N Interchange
- South: I-135 and Hydraulic/29th N Interchange, I-235 and 25th N Interchange
- Local Limits: Supporting ramp and local roadway network including Meridian, Hydraulic /29th N, and Broadway around the interchange ramp terminals

The limits of the traffic analysis study area are larger than the limits of the project study area in order to gain a comprehensive understanding of the area that influences the traffic operations and safety in the project study area.

The VISSIM models were used to extract Highway Capacity Manual (HCM) equivalent information related to the freeway mainline, merge, diverge, and weave conditions as well as intersection operations at the interchange ramp terminals.

Level-of-Service (LOS) results were determined using the VISSIM model and HCM 2010 methodology. LOS is a qualitative measure describing operational conditions (how well a roadway operates) in terms of average delay per motorist with regard to intersections and in terms of average passenger cars per mile per lane on the freeway. LOS is described with letter designations A (free-flow) through F (severely congested). The HCM provides a description of the qualitative and quantitative meaning of each letter. For this Study, LOS D or better was assumed to be the desirable LOS for this area.

After the existing AM and PM models were developed, future No-Build models were developed. The future No-Build models assume no changes to the existing infrastructure while increasing traffic demand to 2050. The Wichita Area Metropolitan Planning Organization's (WAMPO) travel demand model was used as the primary basis for determining future traffic growth. The WAMPO model includes inputs about population and job growth to project future traffic. Based upon the results, traffic is projected to increase.

The traffic was forecast to the design year 2050 using 2011 traffic volumes that were grown between 0.5% and 1.5% per year. Two locations are projected for larger growth – vehicles entering the Study Area on eastbound K-96 were grown by 3.0% per year while vehicles entering the Study Area on westbound K-254 were grown by nearly 6.0% per year. These growth rates were determined based on data from the WAMPO model.

The traffic models were used to evaluate different future improvement concepts (Build scenarios) to determine their impact on future traffic operations. Each option was compared to the No-Build scenario as well as the other concepts. This information was a major consideration during the selection of the preferred concept. One of the major goals for the project was to efficiently handle traffic long into the future.

Exhibit 35: Design Criteria

Design Feature	Mainline			
	I-235	I-135	K-254	K-96
Access Control	Full	Full	Full	Full
Design Speed (mph)	75 (Des); 70 (Min)	75 (Des); 70 (Min)	75 (Des); 70 (Min)	75 (Des); 70 (Min)
Design Vehicle	WB-67	WB-67	WB-67	WB-67
Typical Section				
-Lane Width (ft)	12'	12'	12'	12'
-Shoulders (ft)				
-Outside (Rt.)*	12'	12'	12'	12'
-Inside/Median (Lt.)*	10'; 12' w/ CSB	10'; 12' w/ CSB	10'; 12' w/ CSB	10'; 12' w/ CSB
Vertical Alignment				
-Minimum Long. Slope ##	0.30%	0.30%	0.30%	0.30%
-Maximum Long. Slope	3%	3%	3%	3%
-SSD at Crest Curves (ft)	820' (Des); 730' (Min)	820' (Des); 730' (Min)	820' (Des); 730' (Min)	820' (Des); 730' (Min)
-K Values				
-Sag Vertical	206 (Des); 181 (Min)	206 (Des); 181 (Min)	206 (Des); 181 (Min)	206 (Des); 181 (Min)
-Crest Vertical	312 (Des); 247 (Min)	312 (Des); 247 (Min)	312 (Des); 247 (Min)	312 (Des); 247 (Min)
Horizontal Curvature				
-Maximum Superelevation**	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)
-Minimum Radius (ft)	75 - 3620' (Des); 2210' (Min) 70 - 3150' (Des); 1810' (Min)	75 - 3620' (Des); 2210' (Min) 70 - 3150' (Des); 1810' (Min)	75 - 3620' (Des); 2210' (Min) 70 - 3150' (Des); 1810' (Min)	75 - 3620' (Des); 2210' (Min) 70 - 3150' (Des); 1810' (Min)
-Stopping Sight Distance (ft)	820' (Des); 730' (Min)	820' (Des); 730' (Min)	820' (Des); 730' (Min)	820' (Des); 730' (Min)
Vertical Clearance				
-Over interstate highways & local roads with interstate interchanges	16'-4"	16'-4"	16'-4"	16'-4"
-Over local roads (no interchange)	15'-4"	15'-4"	15'-4"	15'-4"
-Over RR	23'-6"	23'-6"	23'-6"	23'-6"
Clear Zone (ft)* **	34'	34'	34'	34'

[1] AASHTO, A Policy on Geometric Design of Highways and Streets, 2011 6th Editiion "The Green Book"
[2] AASHTO, Roadside Design Guide, 2011 4th Editiion
[3] KDOT Design Manual Volume I (Part A & B) November, 2011 Editiion; Revised May, 2014

A number of future Build scenarios were developed and evaluated in VISSIM to arrive at the preferred concept. Traffic analysis of future Build scenarios showed congestion at the model area limits because 2050 future traffic was unable to operate efficiently on some unimproved portions of the network. To be confident that the proposed interchange would operate acceptably if and when nearby roadway improvements would allow the full traffic demand into the interchange, several nearby roadway improvements that would be separate from the interchange project were assumed in the future Build traffic analysis. These included:

- Widening K-96 from four to six lanes east of I-135
- Widening I-135 from six to eight lanes south of K-96
- Widening I-135 from four to six lanes north of I-235 / K-254
- Extending the acceleration distance for the northbound I-235 to westbound K-96 ramp

Design Feature	Ramps						C-D Roads
	At Gores		System Ramps	Service Ramp		Loop Ramps	
	Entrance	Exit		Ramp Proper	Sideroad Terminal		
Access Control	Full	Full	Full	Full	Full	Full	Full
Design Speed (mph)	50	55 †	55 (Des); 50 (Min)	50	30	30	65 (Des); 55 (Min)
Design Vehicle	WB-67		WB-67	WB-67	WB-67+P (Truck off-tracking allowed)	WB-67	WB-67
Typical Section							
-Lane Width (ft)	Single Lane: 16', Multiple Lane: 12' each		Single Lane: 16', Multi Lane: 12' each	Single Lane: 16', Multiple Lane: 12' each		16'	12'
-Shoulders (ft)							
-Outside (Rt.)*	8'	8'	10'; 12' W/ CSB	8'	8'	8'	10'; 12' w/ CSB
-Inside/Median (Lt.)*	Single lane: 2', 4' w/ CSB Multiple Lanes: 4', 6' w/ CSB		8'; 10' w/ CSB	Single lane: 2', 4' w/ CSB Multiple Lanes: 4', 6' w/ CSB		4'	8'; 10' w/ CSB
Vertical Alignment							
-Minimum Long. Slope ##	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
-Maximum Long. Slope	5%		5%	5% (Des); 6% (Max)		5% (Des); 6% (Max)	5%
-SSD at Crest Curves (ft)	425'	495'	495' (Des); 425' (Min)	425'	200'	200'	645' (Des); 495' (Min)
-K Values							
-Sag Vertical	96	115	96	96	37	37	157
-Crest Vertical	84	114	114 (Des); 84 (Min)	84	19	19	193 (Des); 114 (Min)
Horizontal Curvature							
-Maximum Superelevation**	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)	6% (Des); 8% (Max)
-Minimum Radius (ft)	1560' (Des); 758' (Min)	1920' (Des); 960' (Min)	55 - 1920' (Des); 960' (Min) 50 - 1560' (Des); 758' (Min)	1560' (Des); 758' (Min)	506' (Des); 214' (Min)	506' (Des); 214' (Min)	65 - 2710' (Des); 1480' (Min) 55 - 1920' (Des); 960' (Min)
-Stopping Sight Distance (ft)	425'	495'	495' (Des); 425' (Min)	425'	(use ISD)	200'	645' (Des); 495' (Min)
Vertical Clearance							
-Over interstate highways & local roads with interstate interchanges	16'-4"	16'-4"	16'-4"	16'-4"	16'-4"	16'-4"	16'-4"
-Over local roads (no interchange)	15'-4"	15'-4"	15'-4"	15'-4"	15'-4"	15'-4"	15'-4"
-Over RR	23'-6"	23'-6"	23'-6"	23'-6"	23'-6"	23'-6"	23'-6"
Clear Zone (ft)*	22'	24'	22'	22'	16'	16'	34'

* Rt. & Lt. Is referenced looking in the direction of traffic

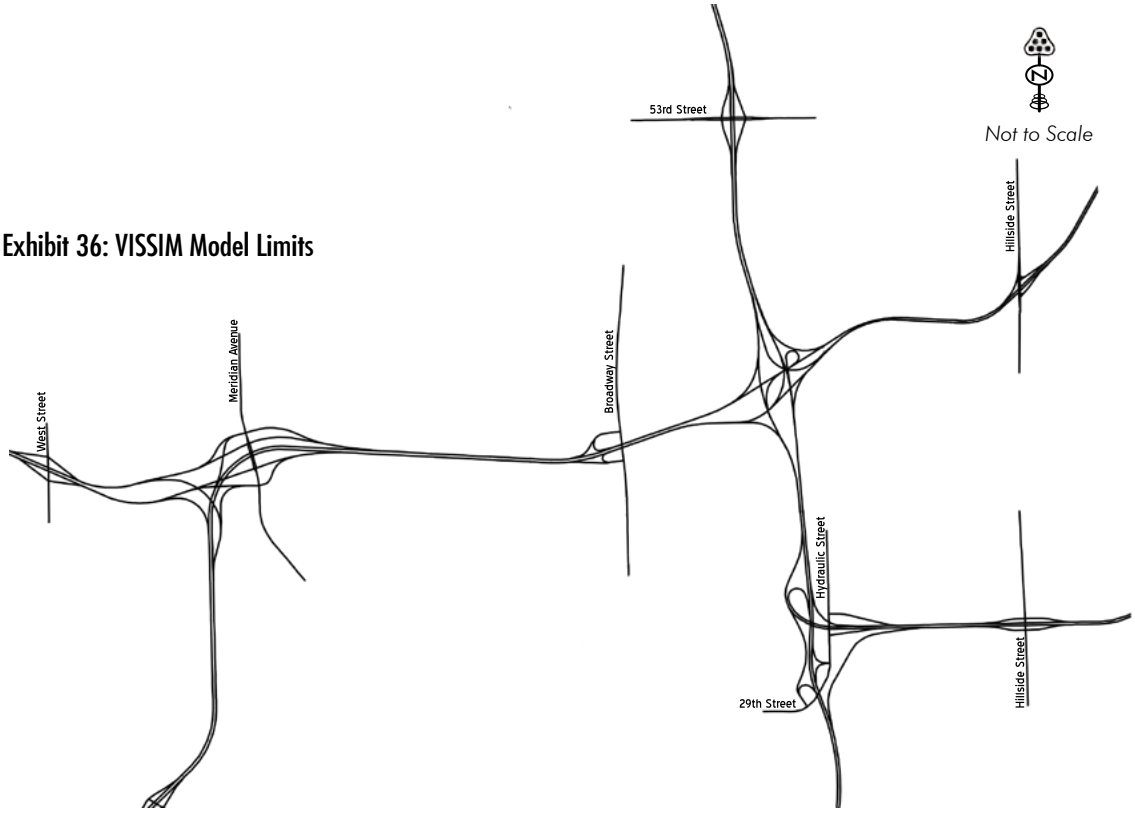
** Use emax = 8% table in 2011 Green Book

*** Values for 6:1 or flatter fill slopes.

0.5% min when cross-slope is flatter than 1.6%

† Design speed at decision lane exits should equal design speed of adjacent through roadway (70 mph min on ML); 50 mph min for non-decision lane exits from CD roads

Exhibit 36: VISSIM Model Limits



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MEMO

PEC SCIENCE APPLIED
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

TO: Project File
ATTENTION: Jim Richardson, PE
FROM: Colin Costley, PE
REFERENCE: Meeting Notes – Core Team Mtg #1

DATE: August 29, 2014
PROJECT NO.: PEC Project No. 32-14537-000-0011
PROJECT: I-235 / I-135 / K-254 Interchange
KDOT Proj. 235-87 KA-3232-01
COPIES TO: Meeting Attendees

Please advise immediately of any misconceptions or omissions you believe to be contained herein.

MEETING DOCUMENTATION

The first Core Team meeting for the I-235 / I-135 / K-254 Interchange in Wichita was held in the 4th floor conference room of the Eisenhower State Office Building on Friday, August 29, 2014 at 10:00 am. The parties involved included staff from the KDOT, the City of Wichita, FHWA, PEC and HNTB. A list of individual attendees is attached.

Following introductions, Dave Hubbard provided both a review of the project history as well as an overview of the current study and its purpose.

DISCUSSION ITEMS –

- The purpose of the Core Team is to engage knowledgeable staff with varying perspectives to ensure the design addresses as many needs as possible and to maintain an informed group of people that can serve as advocates for the project.
- Project Goal Discussion – What should be accomplished with the proposed improvements?
  - Address existing and future traffic congestion
  - Address known safety issues
  - Replace deteriorating infrastructure / Utilize existing infrastructure that is in good condition
    - Pavement is generally in good condition. Only a few locations noted as poor.
    - KDOT is open to utilizing existing infrastructure as long as it does not compromise the design of the proposed improvements.
  - Encourage economic development – Anticipated area(s) for long-term growth?
  - Phased construction / traffic impacts during construction - Do all existing traffic movements need to be maintained during phased implementation?
    - COW is open to the idea of road closures to facilitate construction of the project. People in Wichita will adjust (Example: Maintain NB I-235 to SB I-135, but not the connection to EB K-96)
  - Project budget
  - Implementing non-traditional solutions
    - Buses on shoulders, wider shoulders if space allows – Discuss in Break-in-Access
- The project design should consider future improvements to the interchange, adjacent project coordination, and driver expectancy. It should also try to encourage trucks to travel through this interchange rather than on US-50 HWY through Newton.
- Other design considerations include major utilities (transmission lines, pipelines, etc.) and political influences.
- Take a high-level look at improvements to the interchange at 45th St. N. & Hillside to ensure the design of the current project can be coordinated with any future improvements to this location.
  - City of Wichita currently has a project under design to signalize the intersection of 45th St. N. & Hillside. Timing issues to be able to coordinate any conflicts

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- Existing and Future congestion / mobility issues
  - Existing
    - NB I-235 to SB I-135 and SB I-135 to EB K-96 are single lane ramps and breakdown in the AM peak.
    - NB I-135 to SB I-235 as well as WB-K-254 breakdown in the PM peak
  - Future (2050): No Build Option
    - WB K-254 to SB I-135 backs up
    - K-96 Interchange: 2050 Traffic model indicates all ramp movements exceed acceptable traffic volumes (2000+)
- Phase I Priorities
  - NB I-135 to SB I-235
  - NB I-235 to EB K-96
  - Widening WB K-254 to 2-lanes thru the interchange (Possible to include with the "Green Project"?)
- Design Criteria
  - Maximum of 6% superelevation on ramps. Design for 50 mph
  - Constant shoulder width across bridges
  - Be conscious of horizontal sight distance on ramps
  - Design Speeds:
    - Mainlines – 75-80 mph
    - Ramps – 50 mph
    - C-D Roads – 60-65 mph if long, 50-55 mph if short
- Meeting with KDOT Design Staff - Week of Sept. 15th.
  - Review design criteria
  - Review traffic data from Airsage and revised traffic projections (if necessary)
- Next Core Team meeting - Late October – Present evaluation of the current concept

Signed:

Colin K. Costley, P.E.

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ATTENDANCE RECORD

DATE: 8-29-14 TIME: 10:00 AM

PROJECT NUMBER: 235-87 KA-3232-01 Sedgwick

LOCATION: 4th East Tower, ESOB

MEETING ARRANGED BY: Road Design

PURPOSE: Core Team Meeting

Kansas Department of Transportation

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MEMO

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

TO: Project File
DATE: November 04, 2014
ATTENTION: Jim Richardson, PE
PROJECT NO.: PEC Project No. 32-14537-000-0011
FROM: Mitch Coffman, AICP
PROJECT: I-235 / I-135 / K-254 Interchange
REFERENCE: Meeting Notes – Core Team Mtg #2
KDOT Proj.: 235-87 KA-3232-01
Attachments: #1-11/4/2014 Meeting Agenda & #2-11/4/2014 Sign In Sheet
COPIES TO: Meeting Attendees

Please advise immediately of any misconceptions or omissions you believe to be contained herein.

MEETING DOCUMENTATION

The second Core Team meeting for the I-235 / I-135 / K-254 Interchange in Wichita was held in the 4th floor conference room of the Eisenhower State Office Building on Tuesday, November 4th, 2014 at 1:00 pm. The parties involved included staff from the KDOT, the City of Wichita, FHWA, PEC and HNTB. The agenda and a list of individual attendees are attached.

Following introductions, Dave Hubbard provided a brief discussion regarding the progression that has been made towards evaluating the current concept since the first Core Team meeting and also described the intentions and goals of this second meeting. A recap of the first Core Team meeting then followed to reiterate the goals and priorities for the project.

Project Design Criteria

- Discussion
  - Meeting with the KDOT in mid-September to establish project design criteria
  - The highlights of the design criteria are as follows:
    - Mainlines: 75mph desirable, 70mph minimum
    - C-D Roads: 65mph desirable, 55mph minimum
    - System Ramps: 55mph desirable, 50mph minimum
    - Superelevation Rates: 6% desirable, 8% maximum (preferred maximum is 7.2%)
  - Current concept has been modified to reflect the current criteria
  - The modifications have increased the footprint of the improvements which increase ROW needed on the east and west sides of I-135 between K-96 and I-235
- Decisions and action items
  - There was agreement upon the design criteria for the project

Existing Conditions Report

- Discussion
  - Most of the pavement / bridges within the project limits are in good condition.
  - There are three structurally deficient bridges, two of which are being replaced with the “Green” project.
  - The other structurally deficient bridge is over I-235 and EB K-96 from NB I-235 to WB K-96.
  - There are 18 functionally obsolete bridges, most likely due to width and clearance issues.
  - There are small sections of pavement that are in poor condition that do not show up on the data from the KDOT conditions report.
  - Roadway improvements included with the I-135 rehabilitation project currently under construction are anticipated to last 5-8 years
  - Benny Tarverdi noted that some of the pavements that are considered to be in good condition are overlays on old pavement (1965). He recommended that pavements / bridges ultimately be replaced with the project.

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- The current concept is not designed to use existing infrastructure where improvements, new alignments, or new bridges are proposed
- The current concept has not been analyzed to determine what, if any, infrastructure could be utilized long term

- Decisions and action items
  - Moving forward, the project team will evaluate the opportunity to utilize existing infrastructure that is in good condition

Improvements to the Study Extents

- Discussion
  - 45th St. N. & Hillside Interchange
    - Current K-254 alignment at this location will be a restriction geometrically once proposed improvements are completed (does not meet 70 mph design criteria)
    - Two (2) options were discussed
      - *Option #1 – Matches into the current North Interchange concept but would require the relocation of the KDOT Wichita Metro Office*
      - *Option #2 – Re-align K-254 south of its current location through the North Interchange. This option has major impacts to the current concept and would also require a large portion of the proposed interchange to be constructed in the first phase of the project.*
    - Both options would require substantial R/W acquisition and potential environmental concerns/impacts
    - There is likely little commercial development potential in the NW quadrant and the Koch properties south of 45th St. N.
    - PEC offered to meet with Koch Industries representatives to discuss concepts and impacts
  - NB I-235 to WB K-96 near West Street
    - Improvements to the North Interchange allow traffic to flow to this location more quickly, resulting in LOS degradation
    - It was recommended to extend the acceleration lane along WB K-96 beyond the ramp gore area for the exit to West St. It was decided that this improvement could be made with a separate project in the future.
  - I-135 / K-96 Interchange
    - There are operational issues with the current concept, namely WB K-96 to SB I-135
    - Two (2) options for improving this interchange were presented
    - Traffic was only modeled using Option A because it would be cheaper to construct and does operate well in the model through 2050
    - Option A: 2-Lane Loop (Expandable 1-Lane Loop)
      - *Lower construction cost*
      - *Fewer impacts to R/W*
    - Option B: Directional Interchange
      - *Higher design speeds / better traffic operation*
      - *Provides the option for future expansion*
  - Option A could be constructed as an interim solution, Option B would be considered a “Beyond 2050” solution
  - Option B is not excluded as a result of construction of Option A
  - KDOT requested more investigation into Option A before making a decision which includes the movement of two (2) WB-67’s side-by-side through the loop
- Decisions and action items
  - There was general consensus on the need to develop a general concept for the K-254 and 45th Street North/Hillside interchange area that will work with the North Interchange improvements and allow system continuity. It was also agreed upon that this study should include developing a concept to upgrade the interchange at 45th St. N./Hillside and K-254 to meet current design criteria.
  - The consultants, KDOT, and City of Wichita will meet with Koch Industries to discuss concepts with an emphasis on 45th Street North/Hillside and K-254

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- Any improvement for the NB I-235 to WB K-96 movement can be completed as a separate project. However, this improvement will be included in the traffic modeling for the North Interchange Study.
- The consultants will investigate Option A and its ability to accommodate WB-67 trucks side-by-side on the loop ramp

Evaluation of the Current Concept

- Discussion
  - Signing
    - The current concept was evaluated using the 2009 MUTCD
    - There are several locations where deceleration lanes need to be extended or the spacing needs increased between successive decision points to accommodate sign spacing requirements
      - *SB I-135 C-D Road Exit (NW Quadrant) – Significant Challenge*
        - *The number of destinations for this exit (4) exceeds MUTCD recommendations as well as KDOT preference (exit to SB I-235, EB K-254, EB K-96, and Hydraulic/29th St.)*
        - *There is Insufficient spacing to provide arrow per lane signing between the successive exits*
        - *Preferred alternative would be to separate this exit into two (2) successive exits from SB I-135, each to serve fewer destinations to meet MUTCD*
  - Traffic Operations
    - With the approval of the KDOT, traffic distributions were modified in a few locations for both AM and PM traffic models based on data obtained from AirSage. Changes were made to the distributions only, traffic volumes were not modified.
    - It was noted that the current concept works from a traffic operations standpoint, however there are many locations which operate at LOS A or B. This indicates that portions of the current concept may be "overbuilt" and provide more improvements than are necessary.
- Decisions and action items
  - It is appropriate to fix the signing issues identified by modifying the concept rather than pursuing a signing exemption

Potential Concept Modifications

- Discussion
  - There is an opportunity to utilize the existing alignments for NB and/or SB I-135. Glen Scott noted there is the potential for using an alternate funding source to reconstruct the existing I-135 pavement separate from the North Interchange project. This action would require significant modifications to the current concept.
    - It is possible that the reconstruction of I-135 (NB, SB, or both) could be completed prior to the initial phase of reconstruction of the North Interchange
  - There are several flyover ramps that have LOS A and B, which present an opportunity for cost saving by modifying the concept.
    - The consultant presented multiple alternatives to illustrate reductions in "Excess Capacity" by replacing low traffic volume fly-overs with loop ramps (i.e. SB I-135 to EB K-254, WB K-254 to SB I-135, etc.)
  - There was general consensus to move forward with investigating new alternatives, with the main intent to fix the signing issues and identify potential cost savings by 'right-sizing' the improvements
- Decisions and action items
  - It was decided to investigate new alternatives to address issues with the current concept as noted above and also look at potential cost saving modifications. It is believed that any modifications to the current concept would not significantly impact the "Green Project".

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Next Steps

- The consultant will develop a supplemental agreement to move forward with Task 5 and 6
- It was noted that this evaluation should move quickly so as to not have significant impacts to the overall project schedule.

Signed:

Mitchel Coffman, AICP

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Meeting Agenda

Attachment 1

Date: November 4, 2014

Project: Wichita North Junction
KDOT Project No.: 235-87 KA-3232-01

Meeting Subject: Core Team Meeting #2 - Current Concept Evaluation

1. Meeting Purpose
2. Recap of Core Team Mtg #1
3. Additional Study
   - Design Criteria and Modified Geometrics
   - Summary of Existing Conditions
   - Improvements at the Study Extents
   - The Modified Current Concept
4. Evaluation of the Modified Current Concept
5. Potential Concept Modifications
6. Next Steps
7. Review of Action Items

Attachment 2

ATTENDANCE RECORD

DATE: 11-4-2014 TIME: 1:00 PM

PROJECT NUMBER: 235-87 KA-3232-01 Sedgwick

LOCATION: 4th East Tower

MEETING ARRANGED BY: KDOT Road

PURPOSE: Core Team Meeting # 2

Kansas
Department of Transportation

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Attachment 2

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MEMO

PEC SCIENCE APPLIED
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

TO: Project File
ATTENTION: Jim Richardson, PE
FROM: Mitch Coffman, AICP
REFERENCE: Meeting Notes – Core Team Meeting #3
Attachments: #1-02/20/2015 Meeting Agenda & #2-02/20/2015 Sign In Sheet

DATE: March 6, 2015
PROJECT NO.: PEC Project No. 32-14537-000-0011
PROJECT: I-235 / I-135 / K-254 Interchange
KDOT Proj.: 235-87 KA-3232-01
COPIES TO: Meeting Attendees

Please advise immediately of any misconceptions or omissions you believe to be contained herein.

MEETING DOCUMENTATION

The third Core Team meeting for the I-235 / I-135 / K-254 Interchange in Wichita was held in the 4th floor conference room of the Eisenhower State Office Building on Friday, February 20th, 2015 at 10:00 am. Participating parties included staff from KDOT, the City of Wichita, FHWA, PEC and HNTB. The agenda and attendance record are attached.

Following introductions, Dave Hubbard provided a brief introduction summarizing the design team's progress from the previous Core Team meeting. Mitch Coffman stated that the purpose of the meeting was to '*select two options for the North Interchange (I-135/I-235/K-254) that include a single option for each of the other two areas; K-254 and the I-135 & K-96 Interchange*.' The two overall concepts selected will be carried forward to Task 6, which will include more detailed evaluation including from an engineering and traffic perspective. This will provide quantitative information related to operational performance, phasing, costs, etc. He then provided a summary of the decisions made at the previous Core Team meeting.

Presentation, Discussion, & Selection of Options

- **K-254 alignment including interchange at Hillside/45th N**
  - Four options were presented for discussion
    - Option #1
      - Ties into existing K-254 alignment just west of Chisholm Creek.
      - Includes a traditional diamond interchange at Hillside.
      - Breaks the connection of 45th Street North.
    - Option #2
      - Crossing of Chisholm Creek moved to the southwest.
      - Split diamond interchange with EB off-ramp to 45th Street North, WB on-ramp from 45th Street North, use existing EB on-ramp from Hillside, and use existing WB off-ramp to Hillside.
      - Use existing K-254 bridges over hillside.
    - Option #3
      - Crossing of Chisholm Creek moved to the southwest.
      - Crossing of 45th Street North moved to the west.
      - Crossing of Hillside moved to the North.
      - Folded diamond interchange at Hillside.
    - Option #4
      - Alignment of K-254 moved to the north, tying into existing K-254 just east of Hydraulic.
      - Traditional diamond interchange at Hillside and located approximately one half mile north of 45th Street North.

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- Each option presented could be designed to function with any of the four Route Interchange options presented.
- Right-of-way impacts / concerns
  - Option #1
    - Major impacts to KDOT metro office at northeast corner of 45th Street North and Hillside
    - 45th Street North split would impact platted property between existing K-254 and the floodway and the undeveloped property southeast of railroad tracks east of Hillside and south of 45th Street North.
  - Option #2
    - Undeveloped property south of existing K-254 between Hydraulic and Hillside.
  - Option #3
    - Undeveloped property south of existing K-254 from North Interchange to just west of existing K-254 crossing of 45th Street North.
    - Minor impacts to KDOT metro office.
    - Residential property north of K-254 and east of Hillside.
    - Platted property between existing K-254 and the floodway.
  - Option #4
    - Residential neighborhood north of 45th Street North and west of Hillside, which was viewed as a major detriment to this option due to the neighborhood impacts and anticipated high cost for right-of-way.
    - Undeveloped property and residential property north of existing K-254 east of Hillside.
- Floodway impacts / concerns
  - Option #1
    - There was very little concern due to anticipated minor impacts because new bridges over Chisholm Creek would be located in the same place.
  - Option #2
    - There was concern about the new floodway crossings (new location) and the associated regulations.
  - Option #3
    - There was concern about the new floodway crossings (new location) and the associated regulations.
  - Option #4
    - There was major concern about the new floodway crossings (new location) and the associated regulations as well as the additional crossings for the K-254 ramps.
- Constructability, safety, and operations impacts / concerns
  - Option #1
    - Core Team members liked the traditional diamond interchange.
    - There was concern about the proximity of the southern ramp terminals to the railroad tracks.
    - There was some concern about breaking the connection of 45th Street North, but it was not a major issue due to the assumed low volume of traffic using 45th Street North west of Hillside.
    - This option removed one at-grade railroad crossing (45th Street North).
    - Assumed to be the simplest from a construction phasing standpoint.
  - Option #2
    - Core Team members did not prefer the split interchange as a long-term solution.
    - The City of Wichita project at the 45th Street North and Hillside intersection would not be impacted.
    - Core Team members liked the idea of straightening K-254 through the Route Interchange.

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- Option #3
  - Core Team members liked the folded diamond interchange.
  - Core Team members liked that the ramp terminals would be further from the 45th Street North and Hillside intersection.
  - The folded diamond provides more space between the WB K-254 off-ramp and the Route Interchange, although level-of-service is not an issue on K-254 east of the Route Interchange.
  - Core Team members liked the idea of straightening K-254 through the Route Interchange.
- Option #4
  - Core Team members liked the traditional diamond interchange.
  - This option moves ramp terminals far north of intersection which is desirable for traffic operations and safety.

- General Discussion
  - Core Team members discussed the possible grade separations for the railroad with Hillside and 45th Street North or taking Hillside and 45th Street North over the railroad tracks and K-254. No consensus was reached about the future grade separation with the railroad tracks. Also, there were vertical layout issues with raising Hillside and 45th Street North.
  - There was discussion about the K-254 and Hillside Interchange becoming part of the Route Interchange project. Core Team members preferred an option that allowed it to be completely separate project from the Route Interchange.
- Decisions and action items
  - Core Team members concurred that Option #1 and Option #3 should be carried forward for further review and detailed analysis.
  - Core Team members concurred that an alternative similar to Option #2 should be reviewed as an interim solution for Option #3. This would allow the K-254 and Hillside Interchange to be constructed independently of the Route Interchange.
  - Core Team members concurred to eliminate Option #4 from further review and analysis.

- **I-135 & K-96 Interchange**
  - Two options were presented for discussion
    - Option #1
      - Provides a 40mph expandable loop ramp from WB K-96 to SB I-135.
    - Option #2
      - Provides a 35mph expandable loop ramp from WB K-96 to SB I-135.
  - Each option presented could be designed to function with any of the four Route Interchange options presented.
  - Each option presented would work with the existing loop ramp and does not preclude a future flyover from WB K-96 to SB I-135.
  - Each option would require additional I-135 improvements if expanded to a two-lane loop.
  - The main concern about this interchange is to set the bounds for the SB to EB C/D road, which is expected to be included in the first phase of the Route Interchange improvements.
  - Each option would accommodate side-by-side WB-67 trucks in the 16 foot wide lanes, and could be accommodated in 14 foot wide lanes without any lane departure.
  - Right-of-way impacts / concerns
    - Option #1
      - Greater degree of right-of-way needed.
    - Option #2
      - Lesser degree of right-of-way needed.

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- For Option #2, Core Team members expressed concern about the compounding ratios for the curves for the loop ramp. They prefer the ratios to be 2:1 or less.
- Core Team members expressed concern about sight distance coming over the hill on WB K-96, similar to the issue at K-96 and US-54/400. However, the crest of the hill is at the railroad bridge, allowing much more sight distance.
- Decisions and action items
  - Core Team members concurred that Option #1 should be carried forward for further review and detailed analysis.
  - Core Team members concurred that 35mph is an acceptable design speed for the loop ramp from WB K-96 to SB I-135.
  - Core Team members directed the design team to improve the compounding ratio of the loop ramp, with 2:1 as the preferred.

- **Route Interchange**
  - Four options were presented for discussion
    - Option #1
      - Flyover for WB K-254 to SB I-135, K-96, and Hydraulic/29th Street North.
      - Flyover for NB I-135 to SB I-235.
      - Flyover for EB I-135 to NB I-135.
      - Flyover for SB I-135 to EB K-254.
    - Option #2
      - Same flyovers as Option #1 except a loop ramp from WB K-254 to K-96 and Hydraulic/29th Street North would replace the flyover.
      - Loop ramp would be on C/D road separated from mainline K-254/I-235.
    - Option #3
      - Same as Option #2 with a loop ramp from SB I-135 to EB K-254 replacing the flyover.
      - Both loop ramps would be on a C/D road from I-135 exit to C/D road to K-96 and Hydraulic/29th Street North.
    - Option #4
      - Turbine-style interchange.
  - Each option presented could be designed to function with any of the four K-254 options presented and either of the two I-135 and K-96 Interchange options presented.
  - Each option presented operated at acceptable levels-of-service in 2050.
  - Proximity of the Broadway Interchange
    - There was concern expressed about the proximity of the Broadway Interchange to the North Interchange. The NB I-235 segment between the entrance ramp from Broadway to the exit for I-135 and K-96 is the most operationally sensitive area and is viewed as the weakest link in the North Interchange. The previous concept was modified since the November 2014 Core Team meeting. Previously, this area operated at LOS D (closer to LOS E than LOS C. With the new design, the area operated at LOS D (closer to LOS C than LOS E). All options for the North Interchange incorporate the new design.
    - The City of Wichita would not support permanently closing the Broadway Interchange.
    - If the Broadway Interchange remains open, the Core Team suggested looking at options to reduce the impact in the AM peak hour traffic entering from Broadway to NB I-235. Core Team members suggested looking at peak hour ramp metering, peak hour ramp closures, or charging to use the ramp during peak hours.
  - Option #1
    - This option is likely the most expensive.
    - This option had the highest level-of-service due to the flyovers.
    - Core Team members expressed concern about the high anticipated cost for achieving a high level-of-service.

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- Option #2
  - Core Team members liked the cost saving of a loop ramp for a low volume movement while still maintaining acceptable levels-of-service in 2050.
  - Core Team members did not want the design to preclude a future flyover for SB I-135 to EB K-254.
- Option #3
  - Core Team members liked the cost saving of two loop ramps for two low volume movements while still maintaining acceptable levels-of-service in 2050.
  - Core Team members did not want the design to preclude future flyovers for SB I-135 to EB K-254 and WB K-254 to K-96 and Hydraulic/29th Street North.
  - Core Team members expressed concern about consecutive loop ramps. It was stated that the loop ramps would be on a separated C/D road and would operate at LOS B in 2050 based on a high-level HCM analysis.
  - The design team stated that Option #3 could be modified to include only one loop ramp rather than two; with the preference being a loop ramp from SB I-135 to EB K-254.
- Option #4
  - Core Team members liked this option due to cost savings because of the reduction in levels of the Route Interchange while still providing directional connections rather than loop ramps.
  - Core Team members discussed the potential need for a flyover for NB I-135 to WB I-235 to allow construction of the ramp in the first phase.
- Core Team members expressed concern about the project size, cost, and phasing potential for each of the options.
- Decisions and action items
  - Core Team members concurred to leave the Broadway Interchange open.
  - Core Team members concurred to incorporate the new design for the NB I-235 segment between the Broadway entrance ramp and the exit to I-135 and K-96.
  - Core Team members concurred that Option #3 and Option #4 should be carried forward for further review and detailed analysis.
  - Core Team members desired to make sure Option #3 is set up as to not preclude future flyovers to replace any of the loop ramps.

Wrap Up & Next Steps

- Consultant team will move forward with more detailed analysis of the selected concepts.
- Next Core Team meeting is anticipated mid-April 2015.

Signed:

Mitchel Coffman, AICP

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Attachment #1

Agenda

Date: February 20, 2015
Project: Wichita North Interchange
KDOT Project No.: 235-87 KA-3232-01
Meeting Subject: Core Team Meeting #3 – New Concept Evaluation

1. **Meeting Purpose** *(5 minutes)*
   The purpose of the meeting is to select two options for the North Interchange (I-135/I-235/K-254) that include a single option for each of the other two areas; K-254 and the I-135 & K-96 Interchange.

2. **Recap of Core Team Meeting #2** *(5 minutes)*

3. **Presentation, Discussion, & Selection of Options**
   - K-254 Alignment including the K-254 & Hillside/45th N Interchange *(25 minutes)*
     - Attachments 1-4
   - I-135 & K-96 Interchange *(15 minutes)*
     - Attachments 5-6
   - North Interchange *(50 minutes)*
     - Attachments 7-10
   - I-235 & Broadway Interchange *(10 minutes)*

4. **Wrap Up & Next Steps** *(10 minutes)*

Attachments:
1) K-254 Option 1
2) K-254 Option 2
3) K-254 Option 3
4) K-254 Option 4
5) I-135 & K-96 Interchange Option 1
6) I-135 & K-96 Interchange Option 2
7) North Interchange Option 1
8) North Interchange Option 2
9) North Interchange Option 3
10) North Interchange Option 4

ATTENDANCE RECORD

Attachment #2

DATE: Feb 20, 2015 TIME: 10:00 AM

PROJECT NUMBER: 235-87 KA-3232-01 Sedgwick

LOCATION: 4th Floor East Tower

MEETING ARRANGED BY: KDOT Road

PURPOSE: Core Team Meeting #3

Kansas Department of Transportation

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Attachment #2

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MEMO

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TO: Project File
DATE: May 19, 2015
ATTENTION: Kelly Farlow, PE
PROJECT NO.: PEC Project No. 32-14537-000-0011
FROM: Michelle Winkelmann, PE
PROJECT: I-235 / I-135 / K-254 Interchange
REFERENCE: Meeting Notes – Core Team Meeting #4
KDOT Proj.: 235-87 KA-3232-01
Attachments: #1-05/07/2015 Meeting Agenda, #2-05/07/2015 Sign In Sheet, & #3-Matrix (Handout)
COPIES TO: Meeting Attendees

Please advise immediately of any misconceptions or omissions you believe to be contained herein.

MEETING DOCUMENTATION

The fourth Core Team meeting for the I-235 / I-135 / K-254 Interchange in Wichita was held in the 4th floor conference room of the Eisenhower State Office Building on Thursday, May 7th, 2015 at 9:30 am. Participating parties included staff from KDOT, the City of Wichita, FHWA, PEC and HNTB. The agenda and attendance record are attached.

Following introductions, Dave Hubbard provided a brief introduction summarizing the design team's progress from the previous Core Team meeting. He also stated that the purpose of the meeting was to select one option for the North Interchange. Michelle Winkelmann presented the agenda and facilitated the meeting.

Recap of Core Team Meeting #3

- **K-254 alignment including the interchange at Hillside/45th Street North**
  - The design team recommended that K-254 remain on the existing westbound alignment which is favorable to phased construction of the North Interchange.
  - Option #4 which would offset K-254 to the north of the existing alignment was not selected for further review at Core Team Meeting #3.
  - Option #3 which offset K-254 south of the existing alignment was not recommended due to limited construction phasing options.
  - Option #2 a split diamond interchange with Hillside/45th Street was modified from what was previously presented at Core Team #3 to utilize the existing K-254 alignment. This modified version was recommended as a viable option.
  - Option #1 a traditional diamond interchange with Hillside maintained the existing alignment of K-254 and remained a viable option.
  - Key takeaways:
    - If K-254 remains on existing alignment the K-254 and Hillside/45th Street North Interchange can be designed and constructed as an independent project. Meeting attendees concluded that K-254 should remain on alignment.
    - Both Option #1 and Option #2 can achieve favorable geometry utilizing the existing K-254 alignment providing more than one viable option for the future K-254 and Hillside/45th Street North Interchange.
- **K-96 and I-135 Interchange**
  - Two options for a two lane loop ramp from K-96 to southbound I-235 were presented at Core Team #3. The Core Team requested refinement of these options to provide for a desired 35mph deign speed utilizing a compounding curve ratio of 2:1. The design team presented an alternative that met the desired criteria.
  - Further refinement is expected in the next phases of design development. The design team recommended facilitating a separate meeting to discuss specific design criteria and geometry.
  - Improvements south of the K-96 and I-135 interchange would be needed to accommodate a two-lane loop ramp.
  - Key takeaways:

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- A 1-lane expandable loop ramp designed for 35mph with a 2:1 compounding curve ratio expandable to 2 lanes is recommended. The presented design would accommodate side-by-side WB-67 trucks.
- There was consensus among meeting attendees to proceed into the next phases of design development with the loop ramp as presented.

- **Route Interchange**
  - Two options were selected for further review and refinement at Core Team Meeting #3.
    - Option A is a semi-directional interchange. At Core Team Meeting #3, the group expressed concern about having loop ramps in succession and desired the consultant team to look at a 1-loop option for the SB I-135 to EB K-254 movement. It was also recommended that the design would not preclude a future flyover to replace the loop ramps.
    - Option B is a turbine-style interchange. At Core Team Meeting #3, the group expressed concern about the NB I-135 to SB I-235 turbine-style ramp and requested further review to identify any need for a flyover rather than a turbine-style ramp.

North Interchange Modification Process

- **Evaluation of Options A & B**
  - Options A & B were selected by the Core Team at the previous meeting for future analysis.
  - These options were reviewed, modified based upon direction from the Core Team, and evaluated.
- **Issue Identification**
  - Specific issues were identified with Option A & B regarding management of traffic, constructability, construction phasing, and required interim improvements.
- **Development of Modified Options**
  - Michelle provided a high-level overview of the process used to develop a recommended concept for the North Interchange.
  - The development of a recommended option followed the following process:
    - Individual elements (alignments, ramp types, etc.) of each Option A & Option B were evaluated. The most valuable elements of each option were then combined to develop a new, hybrid option called Option C1.
    - Option C1 was then refined to address issues that were identified during the analysis process.
    - Options C2, C3 and C4 were developed through the refinement process.
- **Creation of Hybrid Option C1**
  - Common elements carried forward from Option A and Option B
    - I-135 alignment to follow the existing northbound alignment of I-135
    - I-235/K-254 alignment to follow the existing westbound alignment of I-235/K-254
    - The outer movements (Northbound to Eastbound, Westbound to Northbound, Southbound to Westbound, and Eastbound to Southbound) were modified slightly for the development of Option C1.
    - Eastbound I-235 to NB I-135 ramp
  - Elements developed from Option A
    - Northbound I-135 to Westbound I-235 flyover ramp was carried forward from Option A. The turbine-style ramp from Option B did not did not achieve the cost-reduction benefits desired to accommodate an independent construction phase. The flyover option allows for an independent construction phase for this movement.
    - The Southbound I-135 to Eastbound K-254 loop ramp was carried forward from Option A. This design could accommodate a flyover to replace the loop ramp in the future if so desired. Several conflict points were identified with the Option B turbine-style ramp which would require a number of complex and lengthy bridges; therefore not achieving the cost reduction benefits desired.

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- Elements developed from Option B
  - The Westbound K-254 to Southbound I-135/K-96 and Southbound I-135 to K-96 ramps were carried forward from Option B. The Westbound K-254 to K-96 loop ramp in Option A would create consecutive loop ramps which was not desired. The turbine-style ramp in Option B would reduce the need for a future fourth level flyover achieving the cost-savings benefits of a turbine-style ramp.

North Interchange Options & Selection

- **Phased Construction**
  - The consultant team was tasked with accommodating phased construction for the North Junction Interchange. The first construction phase shall accommodate the two heaviest traffic movements, Northbound I-135 to Westbound I-235 / K-96 and Eastbound I-235 to Southbound I-135 / K-96. The following movements were recommended to be addressed in the Phase 1 construction.
    - Northbound I-135 to Westbound I-235 / K-96
    - Northbound I-135 to Eastbound K-254
    - Southbound I-135 to Westbound I-235 / K-96
    - Eastbound I-235 to Southbound I-135 / K-96
    - Southbound I-135 to Eastbound K-96
    - 45th Street North bridge over I-135
- **Option C1 Refinement**
  - The ultimate Option C1 accommodated the desired outcome, but created unfavorable elements for phased construction.
  - The consultant team presented two alternatives developed for phasing Option C1 and highlighted issues and interim (throw away) elements that would be constructed in Phase 1 and eradicated in the subsequent construction phases.
  - Phase 1 (1)
    - Issues
      - Additional access point on I-235 creates 3 consecutive exits
        - Eastbound I-235 to K/96 via C/D road
        - Eastbound I-235 to Southbound I-135
        - Eastbound I-235 to Northbound I-135
      - Undesirable ramp gore spacing between the exit ramp from I-135 to Southbound C/D road and the Southbound C/D road exit ramp to Hydraulic.
  - Phase 1 (2)
    - To address Phase 1 (1) issues Phase 1(2) implemented the following design changes:
      - Eradicated the existing ramp from Eastbound I-235 to Southbound I-135. This movement was provided via a new connection from the C/D road to existing I-135
      - Moved the ramp from Southbound I-135 to Southbound C/D road north
    - Issues
      - Denies Westbound K-254 access to K-96
- **Option C2**
  - Option C2 eliminated the K-254 left entrance to I-135 by adding a 4th level flyover to accommodate the Westbound K-254 to Southbound I-135 / K-96 movement.
    - Issues
      - Adding a 4th lever flyover significantly increased the cost of both a Phase 1 construction and the ultimate construction.

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- **Option C3**
  - Option C3 was developed to provide a more cost effective solution from that of Option C2.
  - Option C3was similar to Option C1, but optimized the space between the 3 Southbound access points
    - Westbound K-254 to Southbound I-135 (Existing condition)
    - Southbound I-135 to K-96 via proposed braided connection
    - Eastbound I-235 to Southbound I-135 via braided connection
  - Option C3 Phase 1 provides immediate improvements for the highest priority movements (Northbound I-135 to Westbound I-235 and Eastbound I-235 to Southbound I-135 / K-96) but requiring additional improvements in approximately 2035.
- **Option C4**
  - Option C4 was developed as an alternative single construction project to achieve overall cost reduction.
  - Option C4 positions the Southbound braid in the optimum location to reduce cost while achieving desired operations.
  - Constructing the interchange in a single phase could reduce the construction cost for the ultimate project by approximately $12 million. Constructing the interchange as a single project achieves the desired operations through the design year of 2050 but would require a larger upfront investment.
- **Utility, Floodplain, and Right-of-Way Impacts**
  - Utility, floodplain, and right-of-way impacts are similar in both Option C3 and Option C4; therefore is not be a deciding factor between options.
  - Multiple gas transmission lines cross the study area.
  - Common property and utility owners will be impacted by both the Green Project (Proj. No. 235-87 ka-31101-01) and the North Interchange project. The consultant team recommended that KDOT consider integrating utility relocations and right-of-way acquisitions for those common parcels and/or utilities that will be impacted by both projects.
- **Discussion & Recommendation of Core Team**
  - The consultant team recommended that Option C3 be selected to proceed forward with field check design. The recommendation included a caveat that if funding is available to construct the entire interchange as a single project, that the design could transition to Option C4 with minor design effort to achieve cost reduction in the total cost of the North Interchange project.
  - The Core Team concurred with the recommendation to move forward with Option C3.
  - Concern was expressed about the capacity of the corridors, specifically I-135 south of the K-96 and I-135 interchange and east along K-96. The consultant team identified these as concerns and improvements will be needed along both corridors by 2050.
  - The Core Team desired that environmental clearances for the Green Project include common parcels that are impacted by both the Green Project and the North Interchange Project.

Next Step

- Consultant team to schedule a meeting in June 2015 to discuss specific design criteria for the North Interchange Project.

Signed:

Michelle Winkelmann, PE

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Attachment 2

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PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Attendance

Wichita North Interchange
PEC Project No: 14537
KDOT Project No: 235-87 ka-2388-01

May 7, 2015
9:30 AM
Eisenhower State Office Bldg. 4th Floor

Name	Title/ Organization	Address
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Attachment 2

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MEMO

Please note that Attachments 1 and 2 are not included to ensure the privacy of individuals attending the open house as well as comments received.

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

TO: Kansas Department of Transportation
Eisenhower State Office Building 11th Floor
Topeka, KS 66603

ATTENTION: Kelly Farlow, PE

FROM: Michelle Winkelmann, PE

REFERENCE: Open House Summary

ATTACHMENTS: #1 Open House Sign-In Sheets, #2 Open House Comment Forms

DATE: September 24, 2015

PROJECT NO.: 235-87 KA-3110-01 & KA-3232-01

PROJECT: I-235 Bridge Replacements and Highway Improvements & Wichita North Junction

COPIES TO: File

Please advise immediately of any misconceptions or omissions you believe to be contained herein.

MEETING DOCUMENTATION

The proposed I-235 bridge replacements and highway improvements in conjunction with the recommended interchange concept for the Wichita North Junction (I-235 / I-135 / K-254 / K-96) were presented and discussed at a public officials briefing on September 22, 2015 at 3:00 PM at the KDOT Wichita Metro Hillside Office. Following the briefing, a public open house was held from 5:00 PM to 7:00 PM at Earhart Environmental Elementary School (4401 N. Arkansas Wichita, KS 67204). Below is a brief summary of the issues heard and discussed at the briefing and the open house.

Public Officials Briefing

1) In addition to project staff from KDOT, PEC, and HNTB, the following were in attendance:
    a. Dave Unruh, Sedgwick County Commissioner, District 1
    b. Richard Ranzau, Sedgwick County Commissioner, District 4
    c. Janet Miller, City of Wichita Councilmember, District 6
    d. Gary Janzen, City of Wichita Engineer
2) Presentation
    a. Dave Hubbard provided a brief introduction to the project
    b. Glen Scott presented the preferred concept, focusing on major elements of each phase, funding, and schedule
3) Questions & Comments
    a. There was a question about the scheduling of other projects, specifically the bridge replacement projects on I-235 southwest of the Green Project
        i. The Green Project is anticipated to begin construction after the other bridge replacement projects
    b. There was support of the Green and Gold project
    c. Mr. Ranzau stated the Purple project would not be needed and he was concerned about removing the flyover from southbound I-135 to eastbound K-254 and replacing with a loop ramp

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Public Open House

The open house sign-in sheets are included as Attachment 1. The comment forms received at open house are included as Attachment 2.

4) Presentation
   a. Dave Hubbard provided a brief introduction to the project
   b. Glen Scott presented the preferred concept, focusing on major elements of each phase, funding, and schedule
5) Questions & Comments
   a. Right-of-Way
      i. There were general questions and concerns about property impacts from the Green Project
      ii. There were questions and concerns about the property impacts from the Gold Project along the west side of I-135 between I-235 and K-96
      iii. There was a request to minimize impacts by moving the C-D road further to the east to avoid His Helping Hands property
   b. Noise
      i. There was concern about extra highway noise because of removal of trees
      ii. There was an inquiry about a sign to prohibit jake brakes
   c. Lighting
      i. There was some concern about light from existing billboard near Station 437+00
   d. Concern was expressed about local street closures during the construction of the Green Project. Early communication about the access restrictions and construction impacts is desired.
   e. It was stated that Old Lawrence Road is in poor condition and should not be used as a detour route
   f. Concern was expressed about drainage structure on north side of I-235 near Stations 455+00 and 470+00 that outlets water into ditch that goes onto their property
   g. One member of the public expressed the need for sidewalk along Meridian/Seneca connection for Word of Life students walking
   h. A traffic signal is desired at Meridian Avenue and the new road connecting to Seneca Street
   i. In general, there was agreement with the concept and phasing plan

Signed: _____

Michelle Winkelmann, P.E.

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APPENDIX D: CRASH SUMMARY

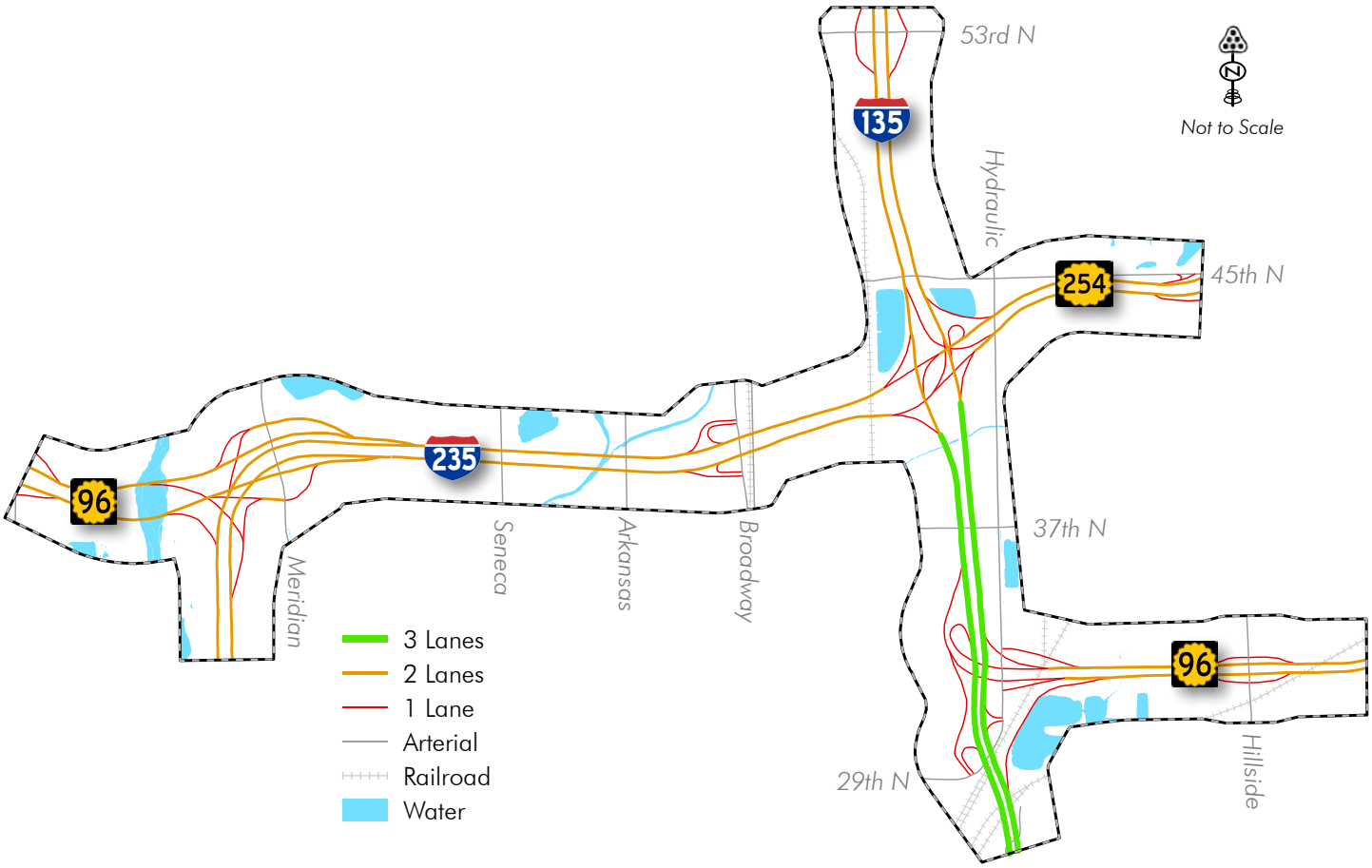
One of the goals for the North Junction is to provide safe travel long into the future. As KDOT strives to reduce crashes and crash severity, it is important to identify safety concerns and develop a future concept that will facilitate the safe movement of people and goods.

A 5-year crash history (2009-2013) was collected from KDOT for the North Junction Study Area. A safety analysis was completed to identify safety concerns in the Study Area. The analysis looks at the number, severity, rates, time of day, types, and locations of crashes. The analysis shows a tendency for rear-end crashes in the Study Area, which are often attributable to congestion. A summary of the crash analysis is presented in **Chapter 4**. This appendix provides greater detail on crash data.

For the purposes of this crash summary, the Study Area roads have been broken into seven segments. The seven segments are as follows:

- I-135 from 53rd Street North to I-235
- I-135 from I-235 to K-96
- I-135 from K-96 to 29th Street North
- I-235 from Meridian to Arkansas
- I-235 from Arkansas to I-135
- K-254 from I-135 to 45th Street North
- K-96 from I-135 to Hillside

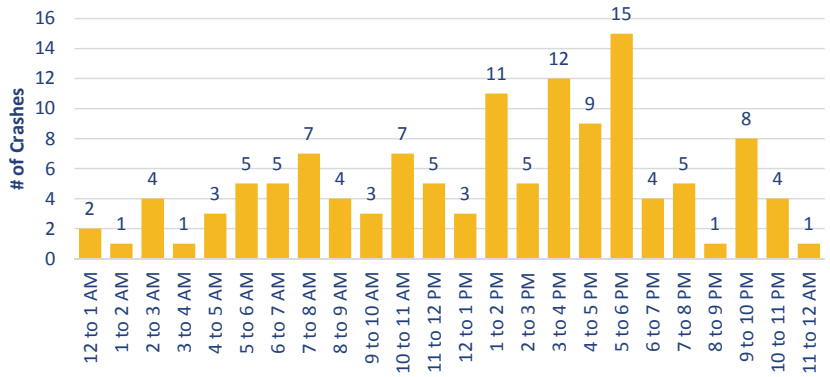
This appendix provides a one page summary of each of the seven segment as well as a one page summary for both directions of travel for each. The summaries provide the number of total crashes, the hourly distribution of crashes, crash types, and maps of the crashes. The maps show all crashes, however, some do not show due to crashes occurring in the same location.

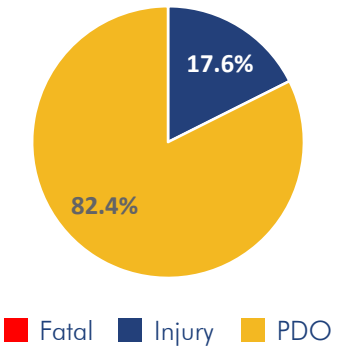


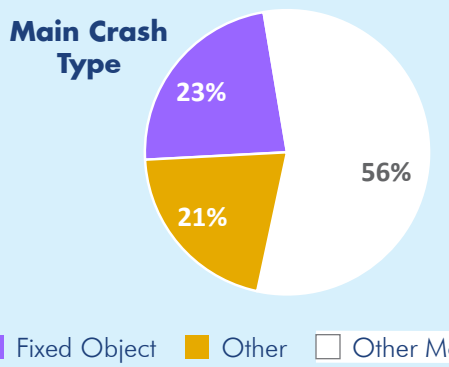
Road: I-135
Segment: 53rd Street North to I-235
Direction: Both (Northbound & Southbound)

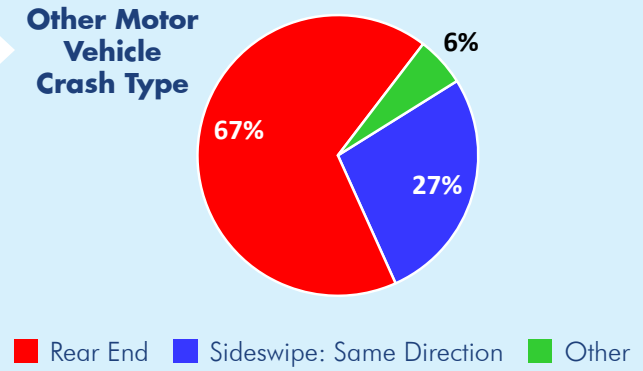
5 Year Crash Summary
2009-2013

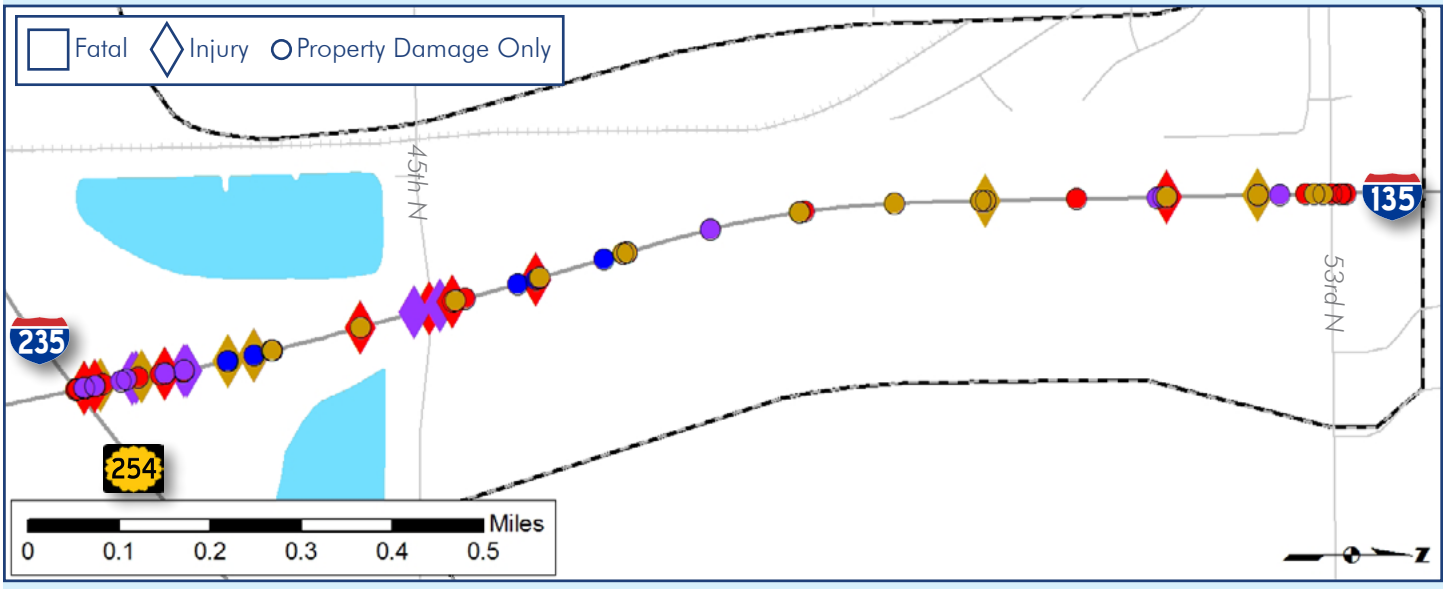
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**125**	**7**	**5.6%**	**14**	**11.2%**	**15**	**12.0%**	**36**	**28.8%**
Northbound	60	5	8.3%	9	15.0%	7	11.7%	19	31.7%
Southbound	65	2	3.1%	5	7.7%	8	12.3%	17	26.2%







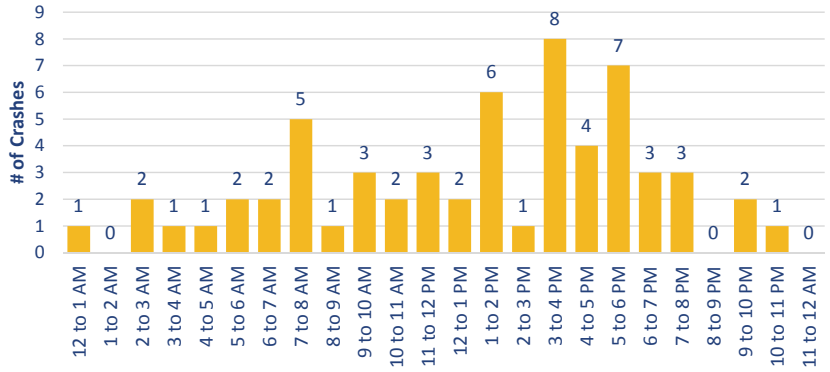


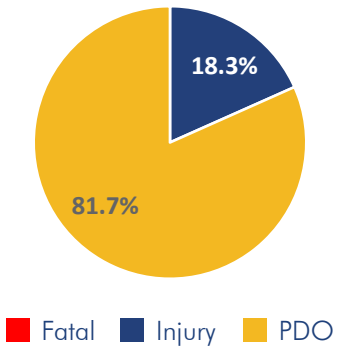


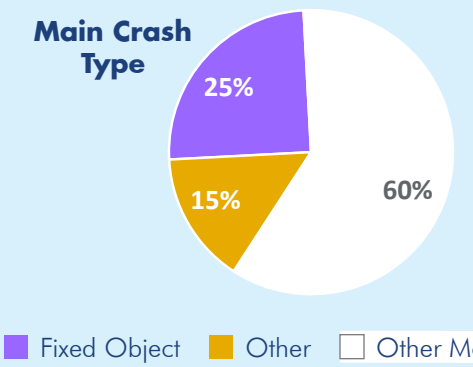
Road: I-135
Segment: 53rd Street North to I-235
Direction: Northbound

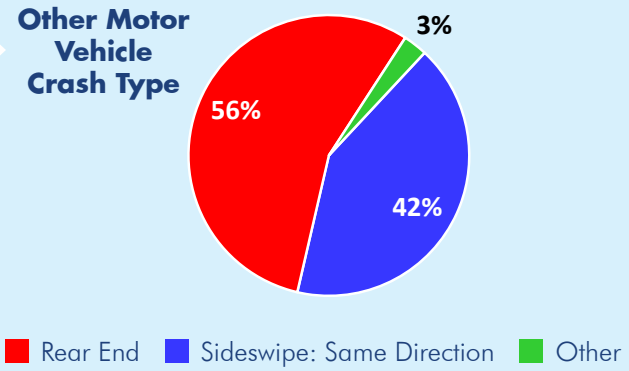
5 Year Crash Summary
2009-2013

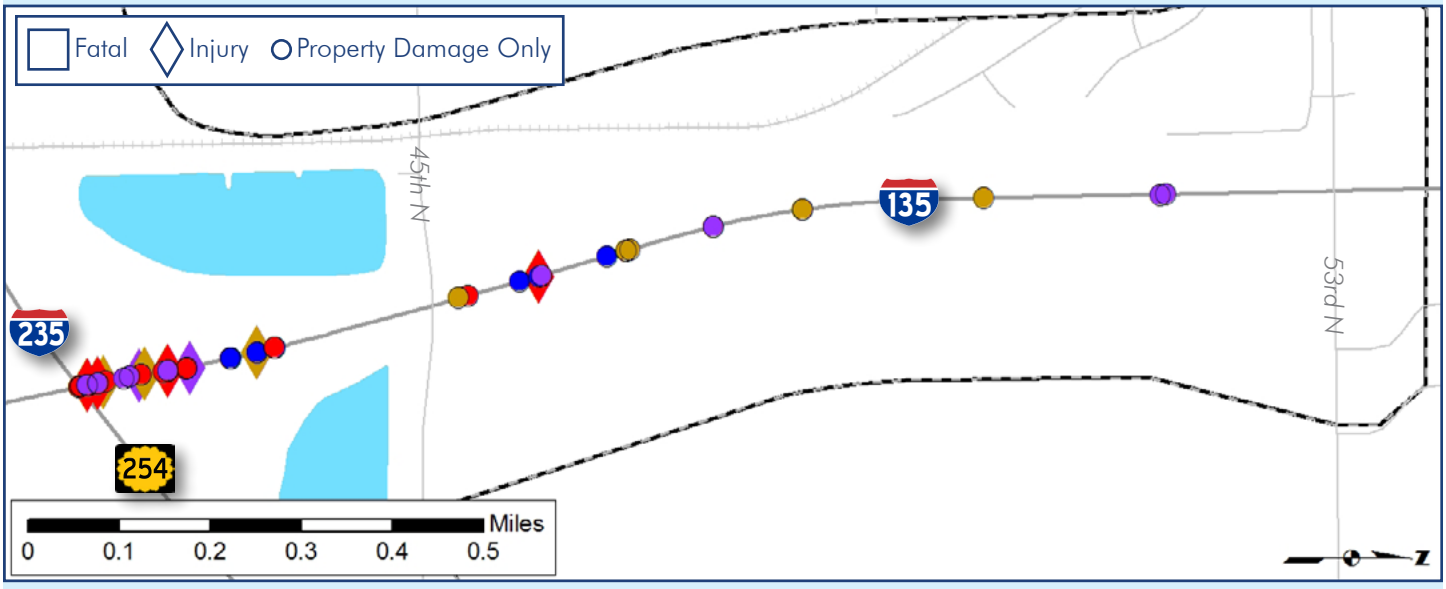
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Northbound	60	5	8.3%	9	15.0%	7	11.7%	19	31.7%







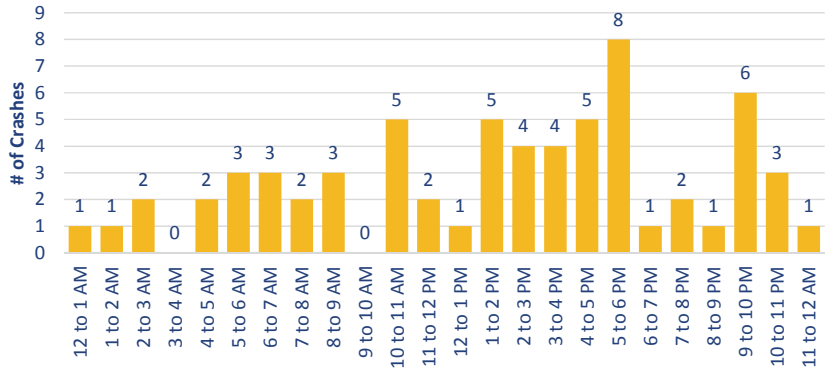


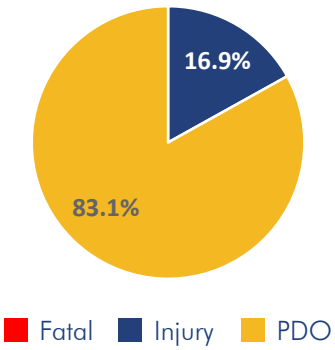


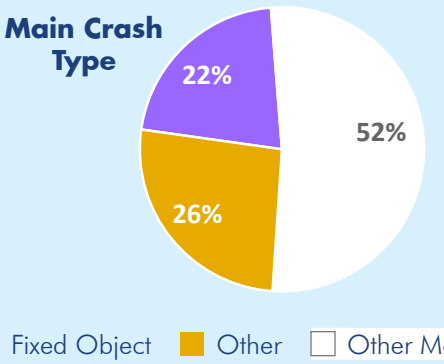
Road: I-135
Segment: 53rd Street North to I-235
Direction: Southbound

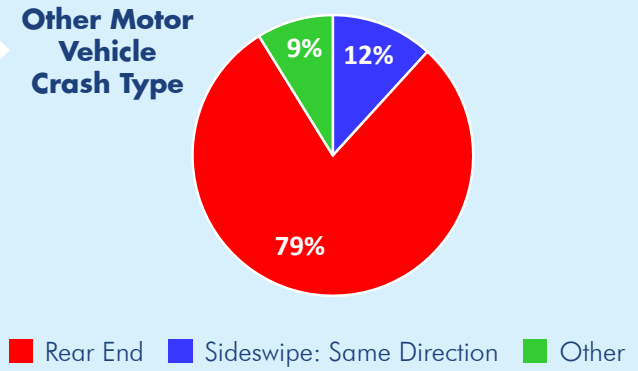
5 Year Crash Summary
2009-2013

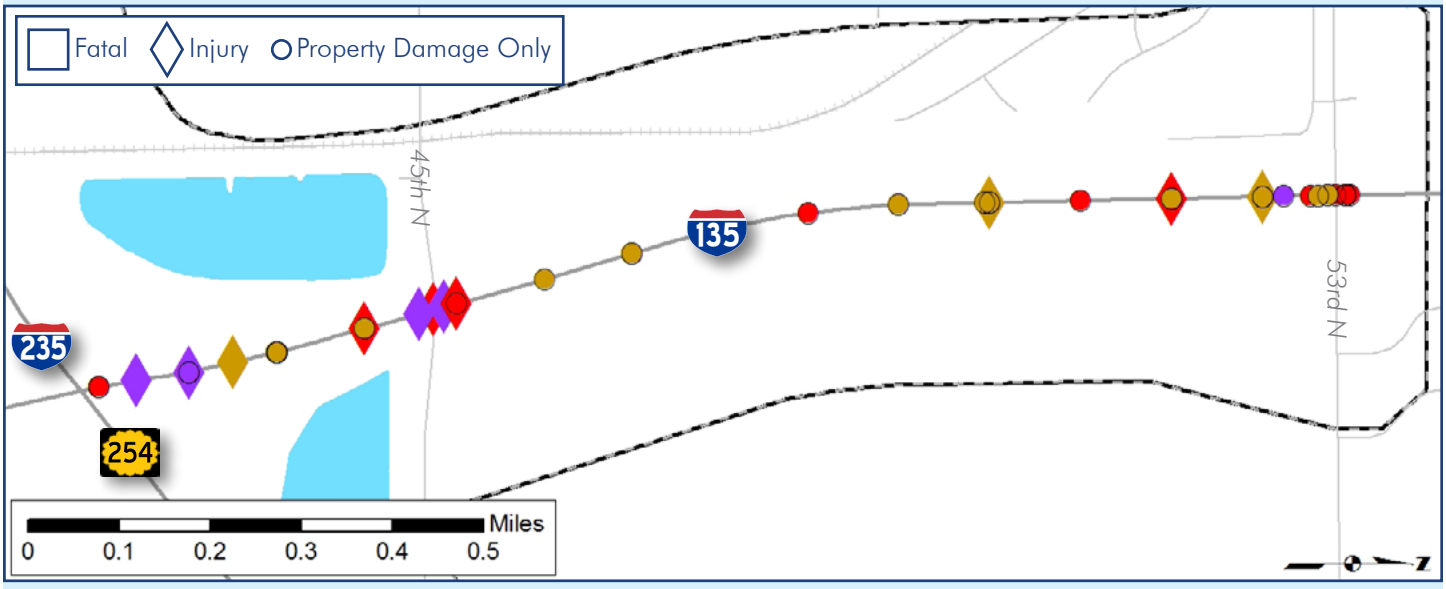
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Southbound	65	2	3.1%	5	7.7%	8	12.3%	17	26.2%











Road: I-135

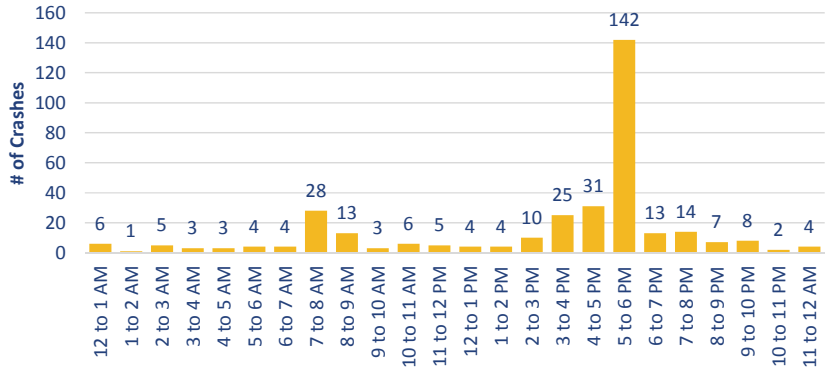
Segment: I-235 to K-96

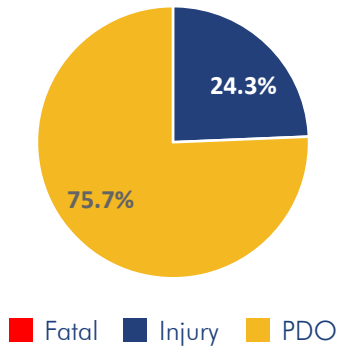
Direction: Both (Northbound & Southbound)

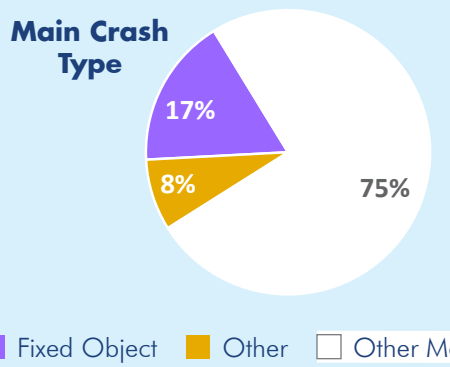
5 Year Crash Summary

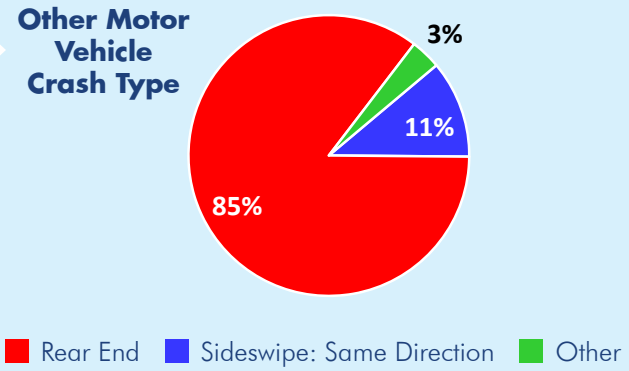
2009-2013

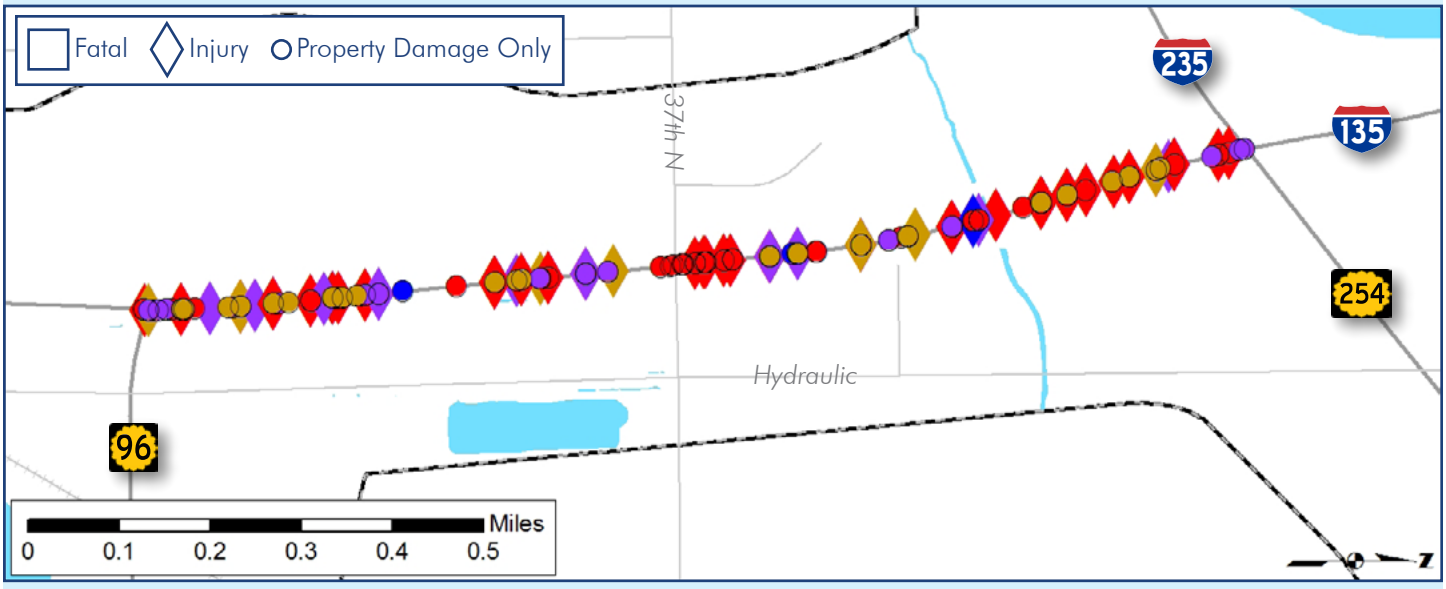
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**345**	**28**	**8.1%**	**44**	**12.8%**	**142**	**41.2%**	**198**	**57.4%**
Northbound	214	18	8.4%	29	13.6%	87	40.7%	125	58.4%
Southbound	128	10	7.8%	15	11.7%	55	43.0%	71	55.5%
Unknown	3	0	0.0%	0	0.0%	0	0.0%	2	66.7%







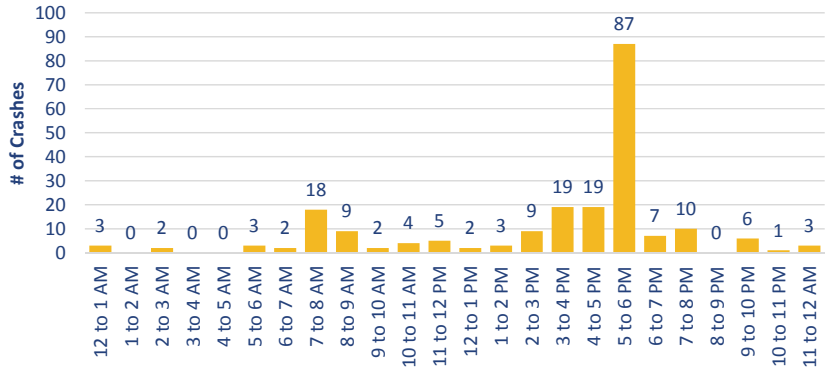


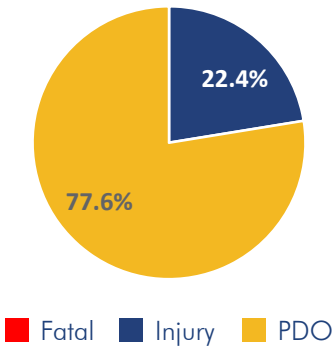


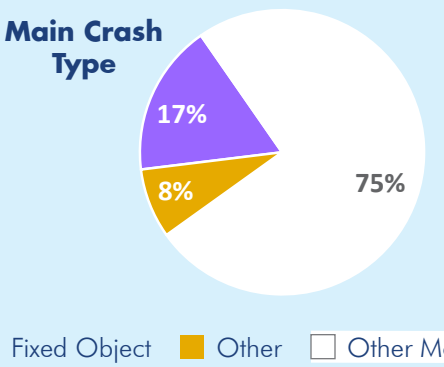
Road: I-135
Segment: I-235 to K-96
Direction: Northbound

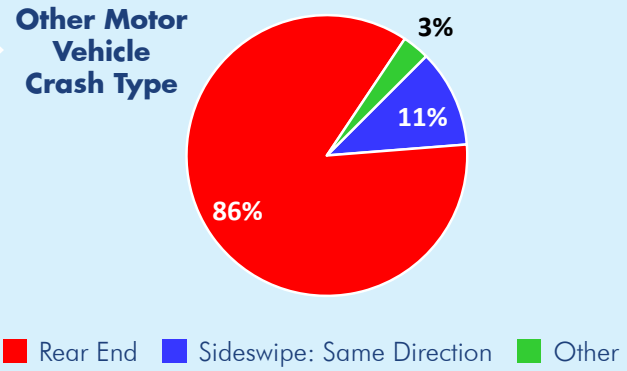
5 Year Crash Summary
2009-2013

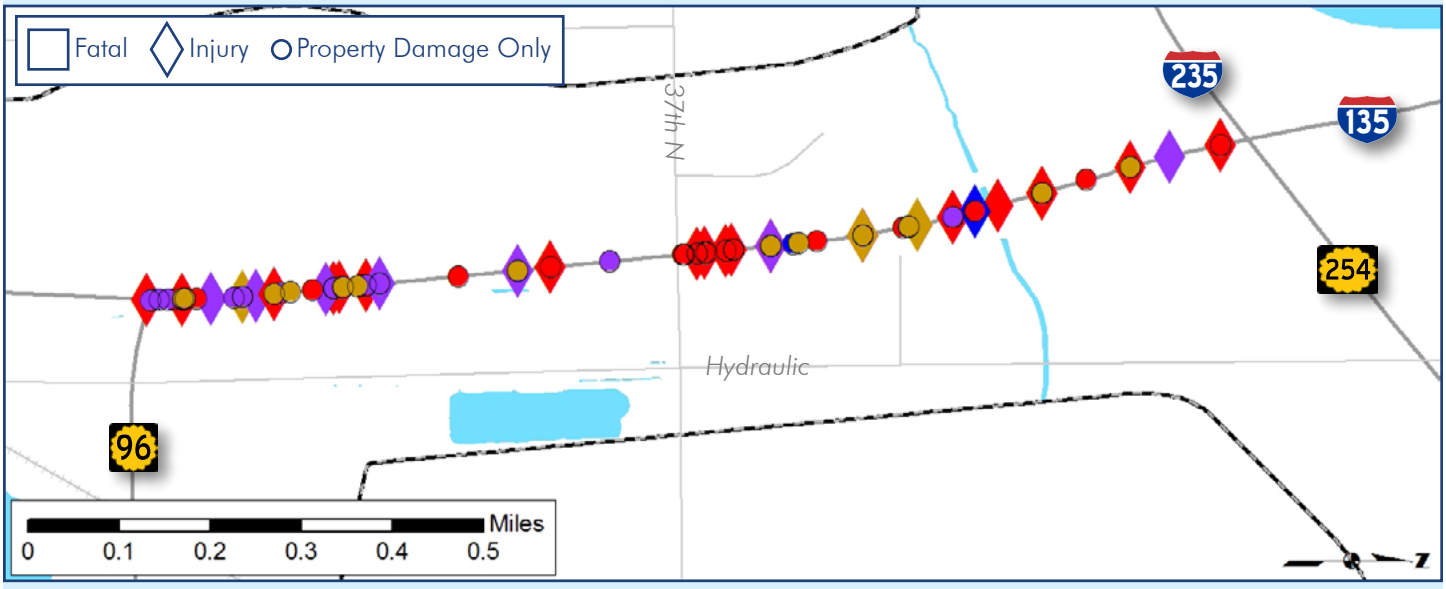
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Northbound	214	18	8.4%	29	13.6%	87	40.7%	125	58.4%







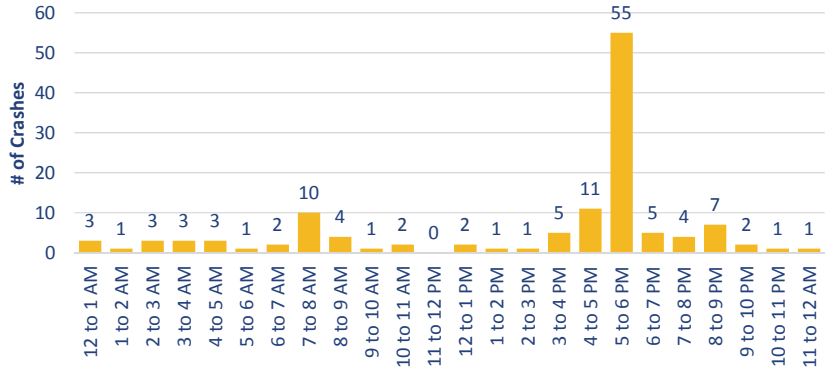


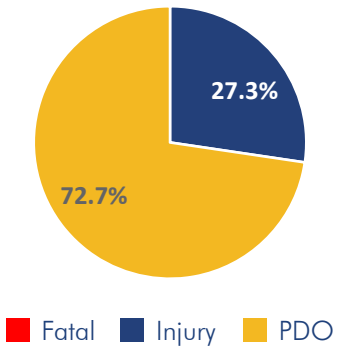


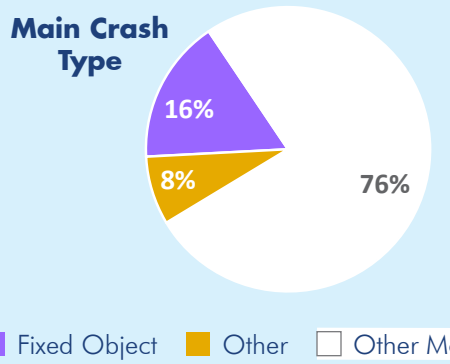
Road: I-135
Segment: I-235 to K-96
Direction: Southbound

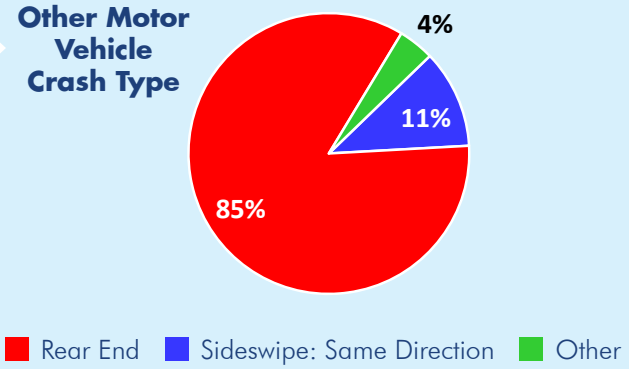
5 Year Crash Summary
2009-2013

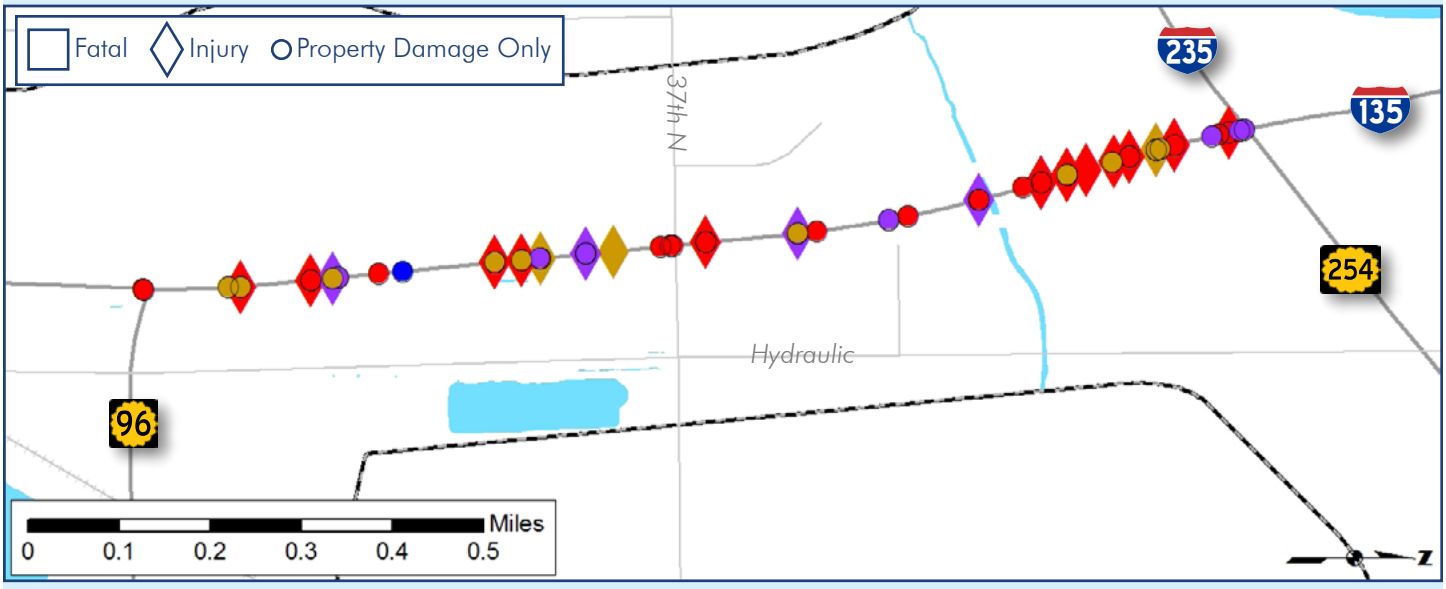
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Southbound	128	10	7.8%	15	11.7%	55	43.0%	71	55.5%







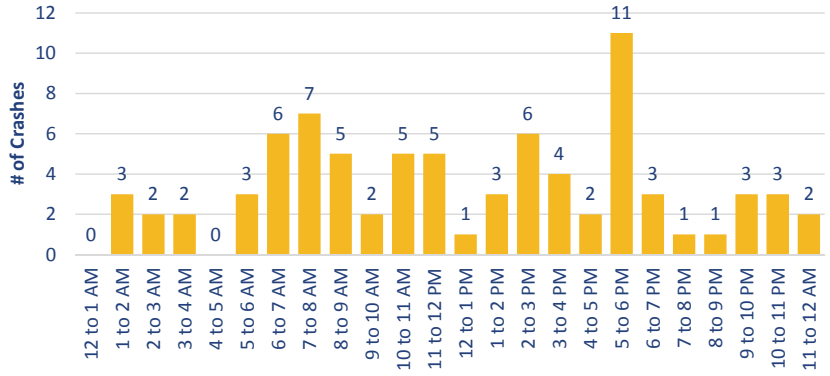


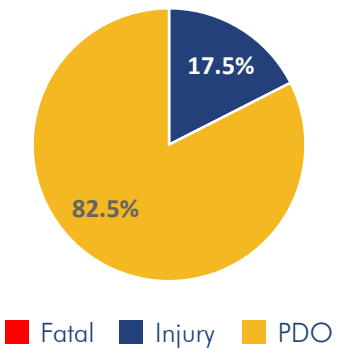


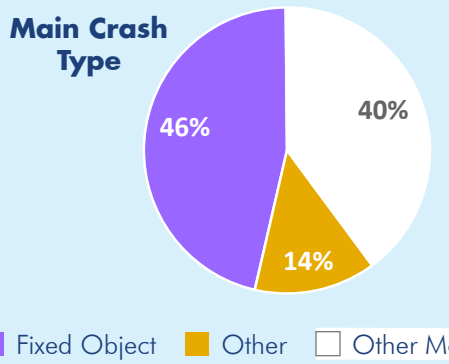
Road: I-135
Segment: K-96 to 29th Street North
Direction: Both (Northbound & Southbound)

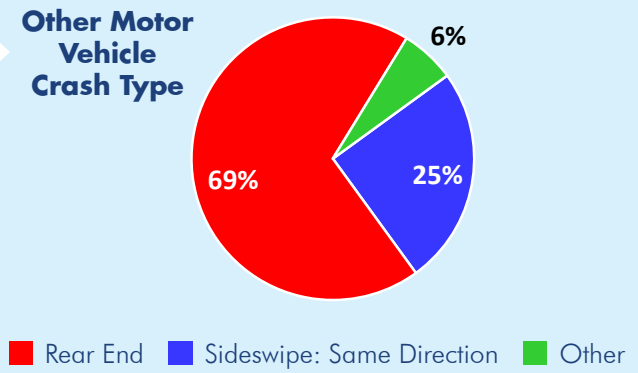
5 Year Crash Summary
2009-2013

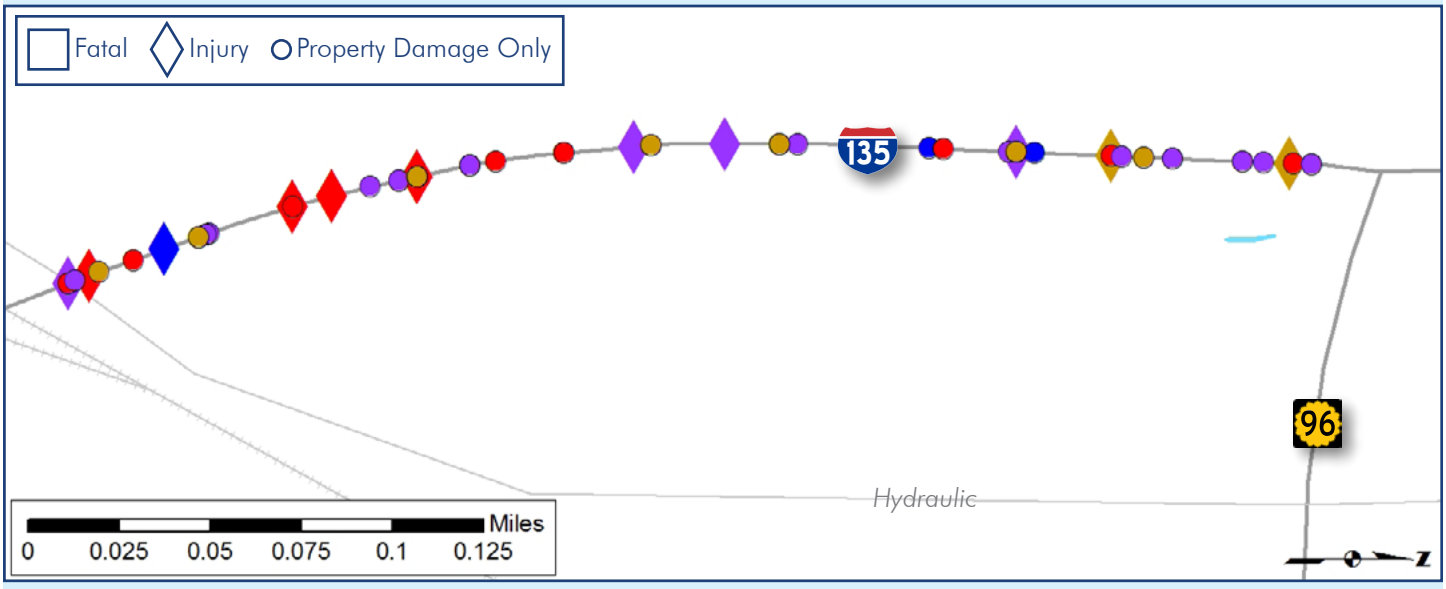
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**80**	**7**	**8.8%**	**14**	**17.5%**	**11**	**13.8%**	**17**	**21.3%**
Northbound	53	5	9.4%	10	18.9%	6	11.3%	9	17.0%
Southbound	27	2	7.4%	4	14.8%	5	18.5%	8	29.6%







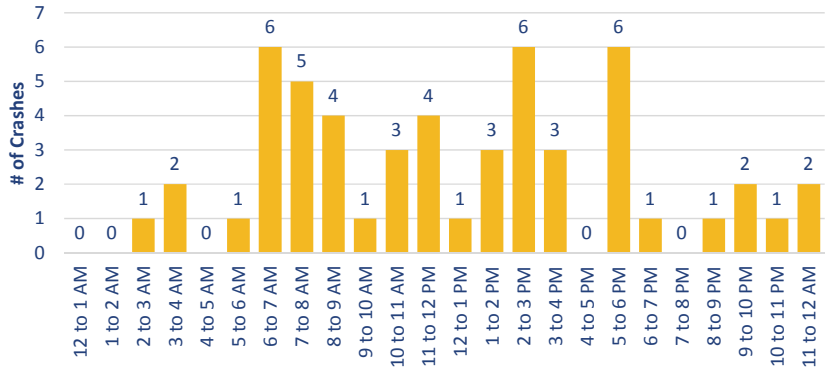


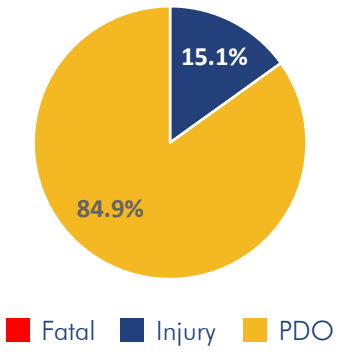


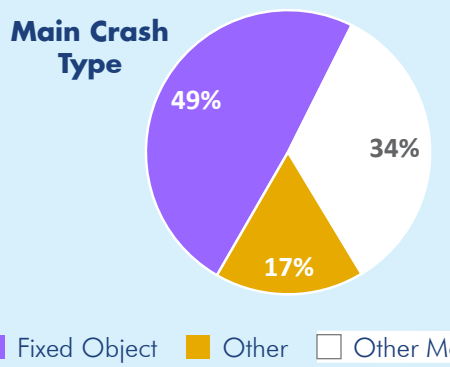
Road: I-135
Segment: K-96 to 29th Street North
Direction: Northbound

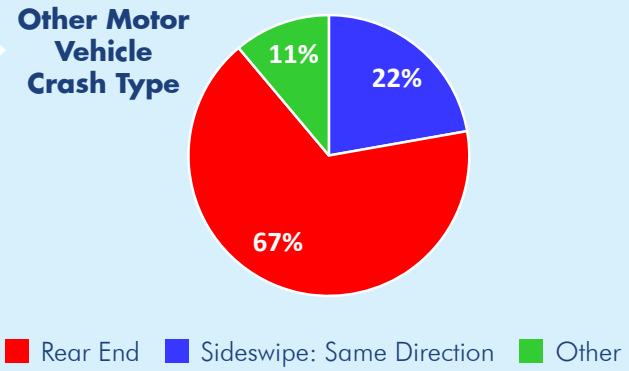
5 Year Crash Summary
2009-2013

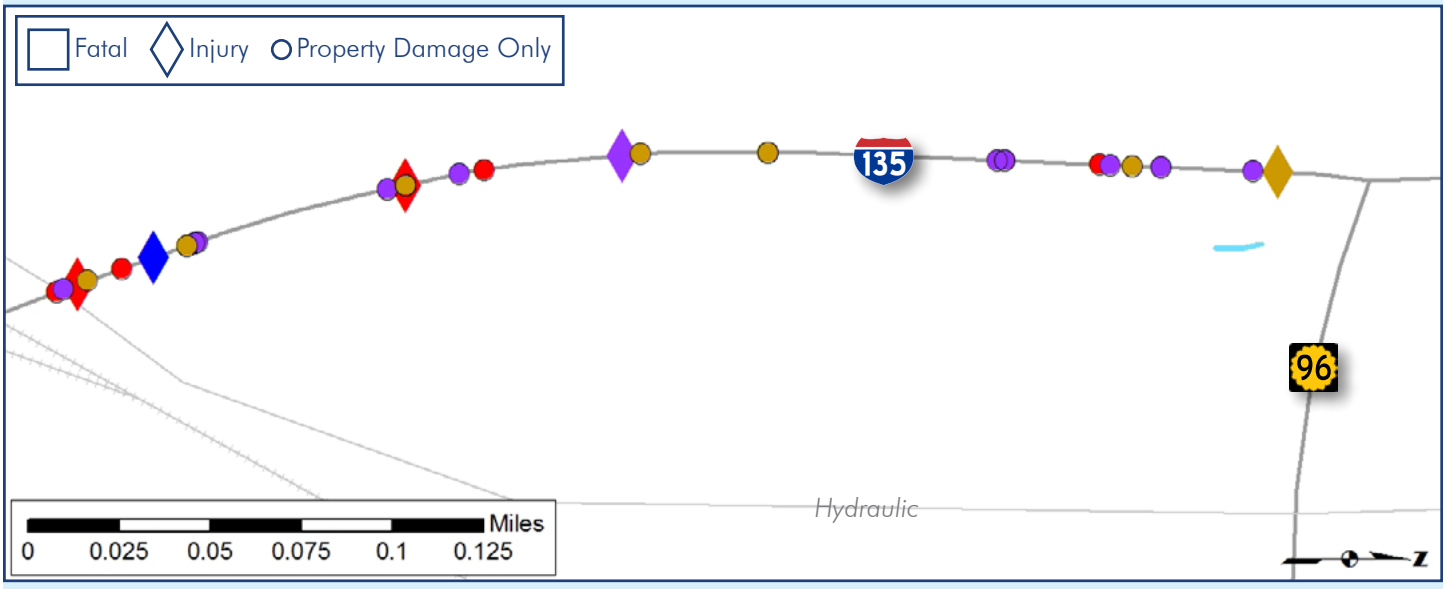
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Northbound	53	5	9.4%	10	18.9%	6	11.3%	9	17.0%







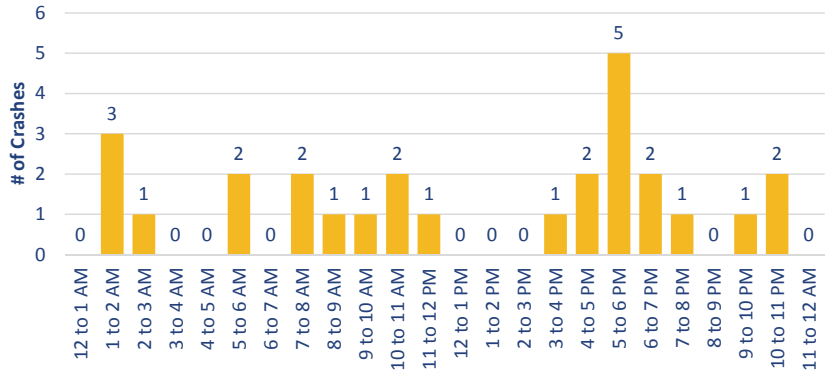


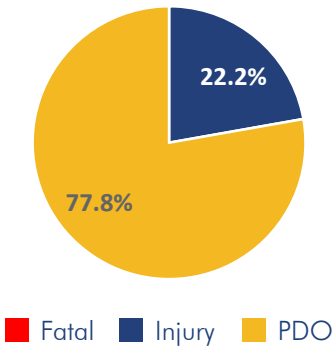


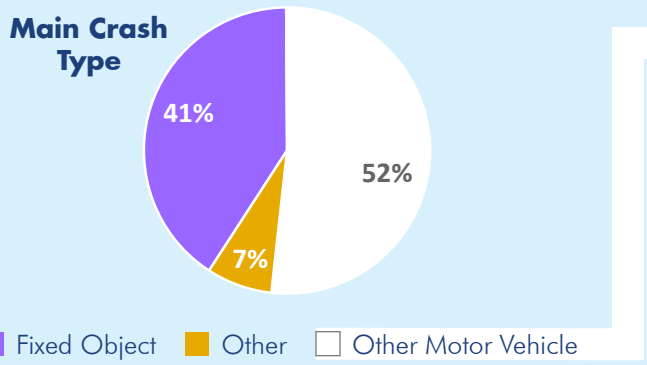
Road: I-135
Segment: K-96 to 29th Street North
Direction: Southbound

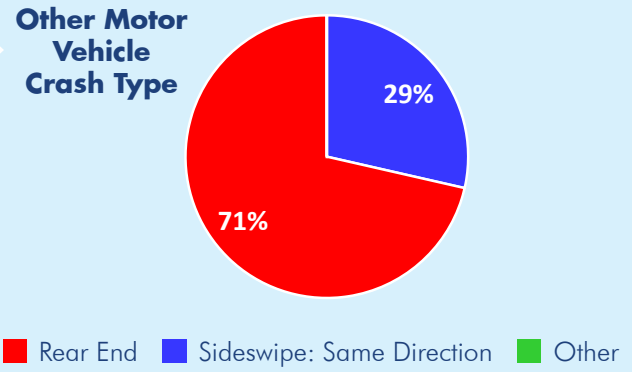
5 Year Crash Summary
2009-2013

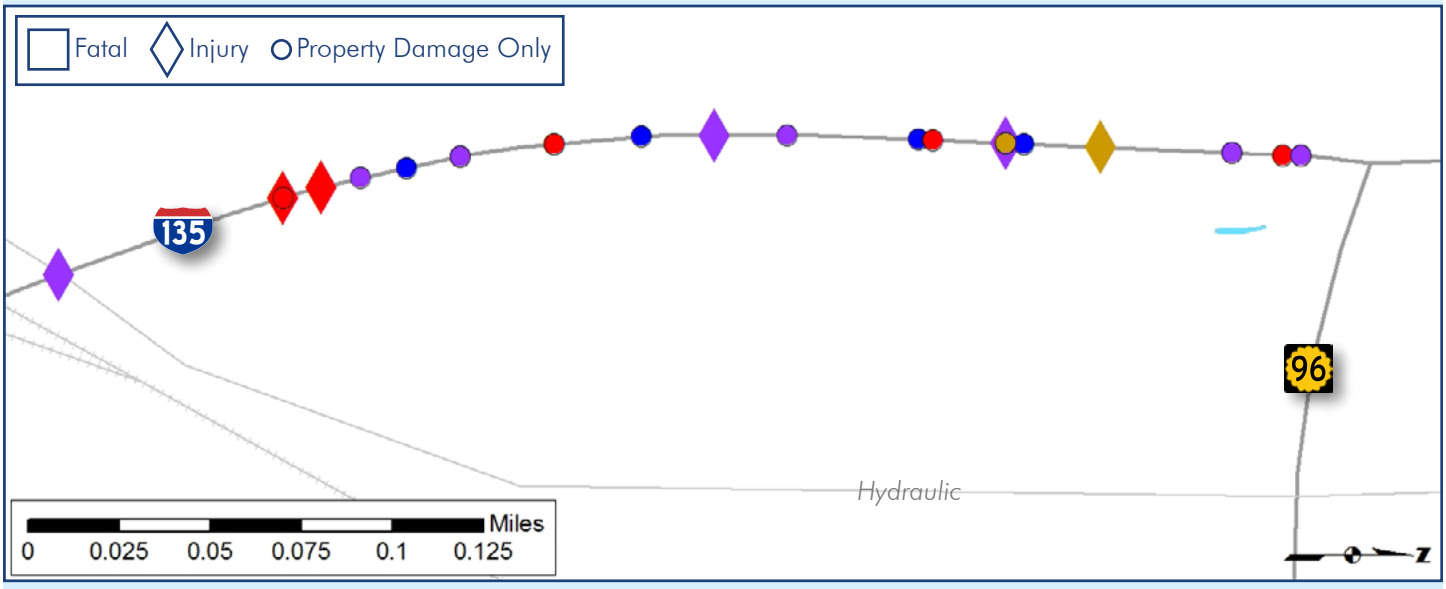
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Southbound	27	2	7.4%	4	14.8%	5	18.5%	8	29.6%











Road: I-235

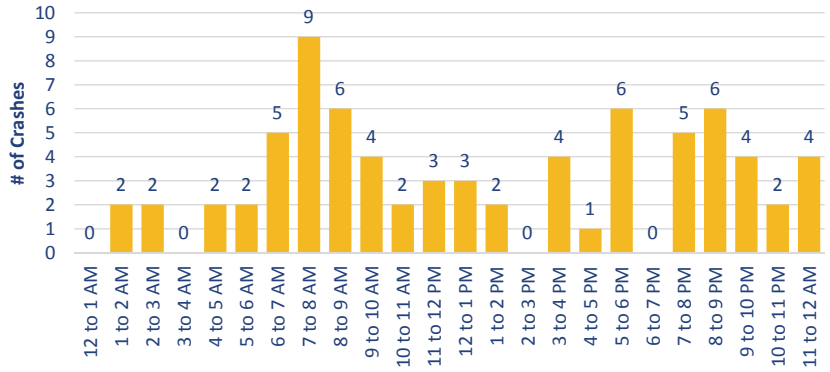
Segment: Meridian to Arkansas

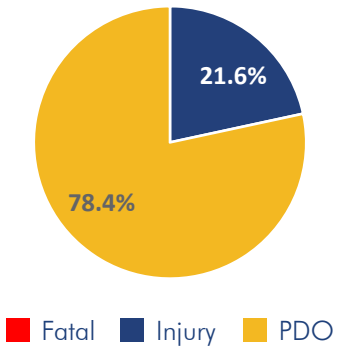
Direction: Both (Northbound & Southbound)

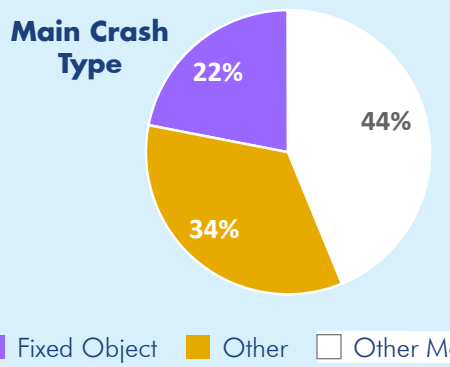
5 Year Crash Summary

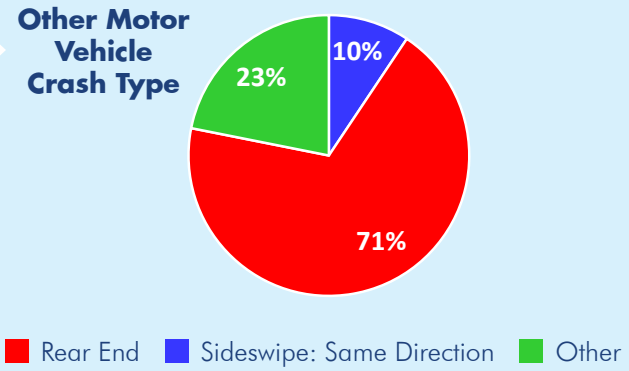
2009-2013

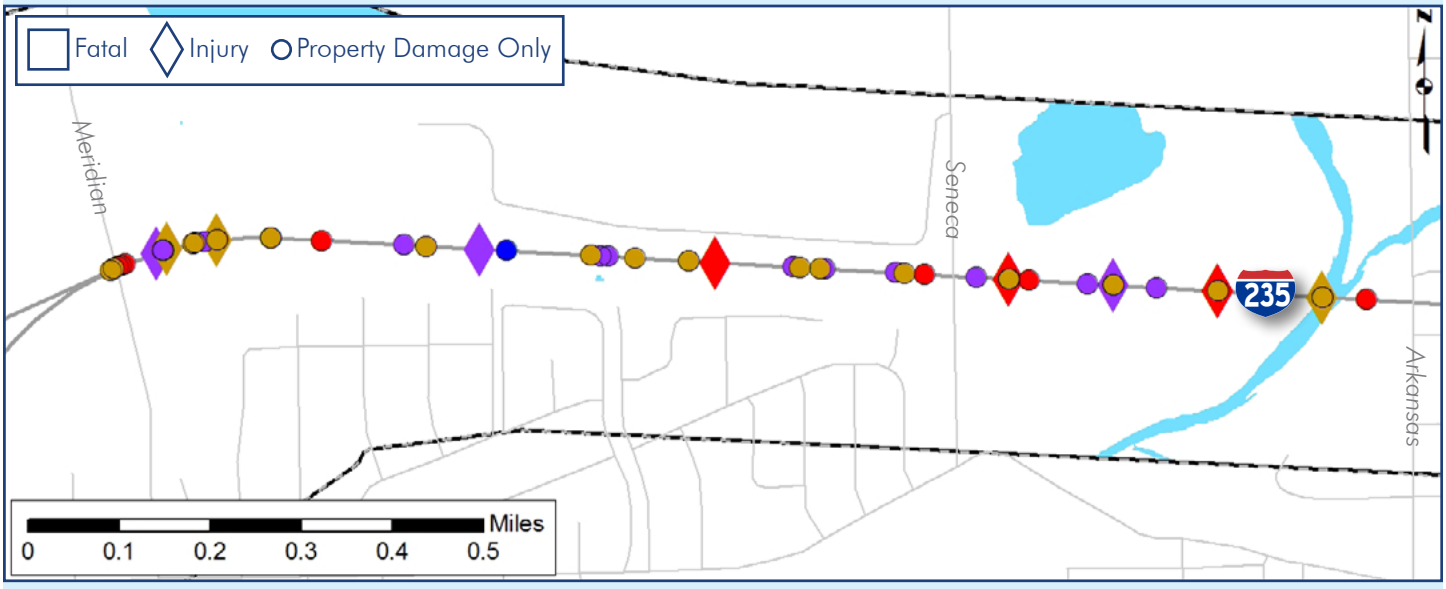
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**74**	**9**	**12.2%**	**19**	**25.7%**	**6**	**8.1%**	**11**	**14.9%**
Northbound	35	3	8.6%	7	20.0%	2	5.7%	5	14.3%
Southbound	39	6	15.4%	12	30.8%	4	10.3%	6	15.4%







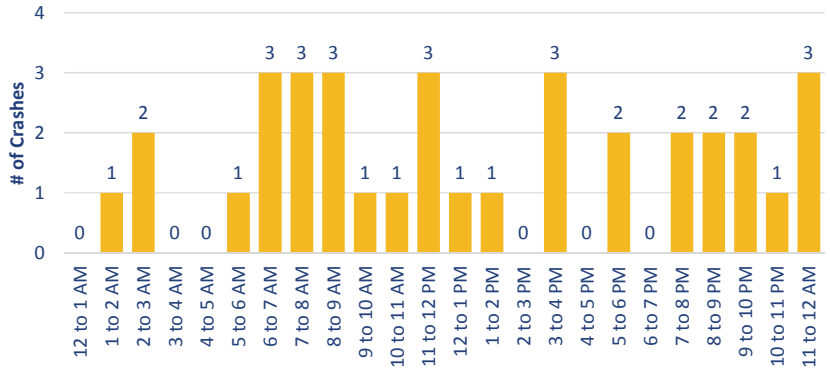


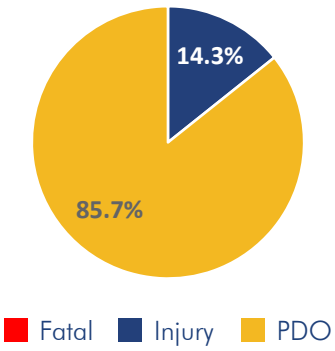


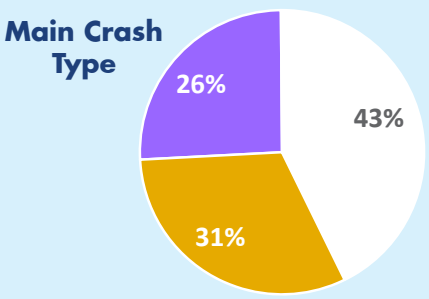
Road: I-235
Segment: Meridian to Arkansas
Direction: Northbound

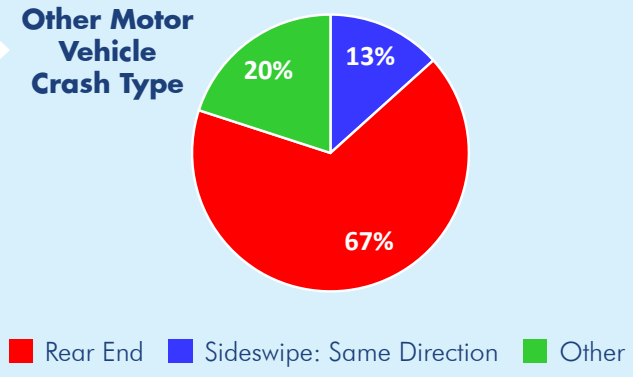
5 Year Crash Summary
2009-2013

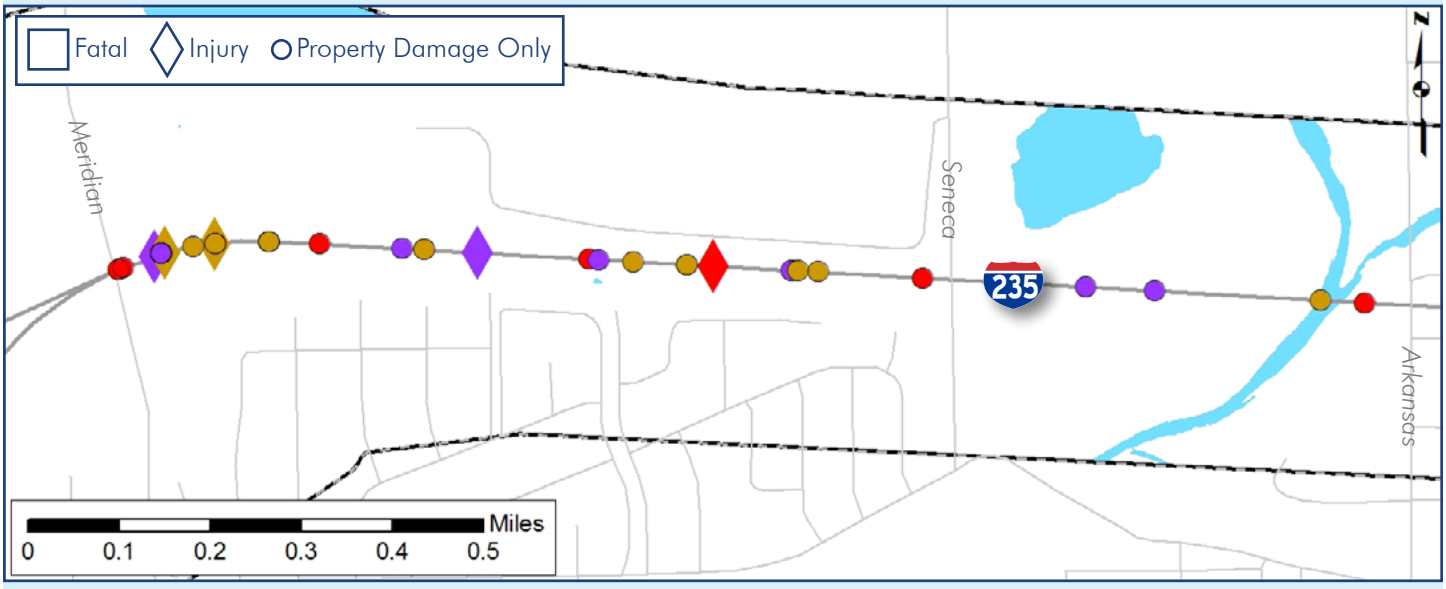
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Northbound	35	3	8.6%	7	20.0%	2	5.7%	5	14.3%







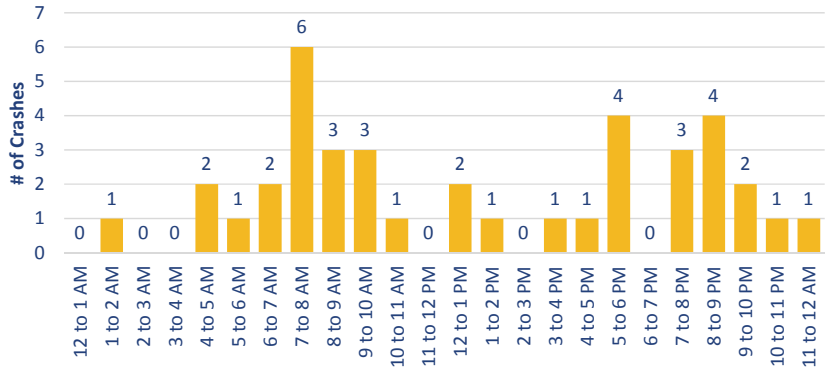


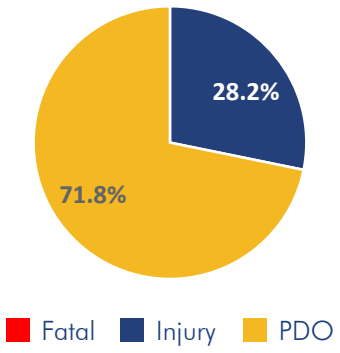


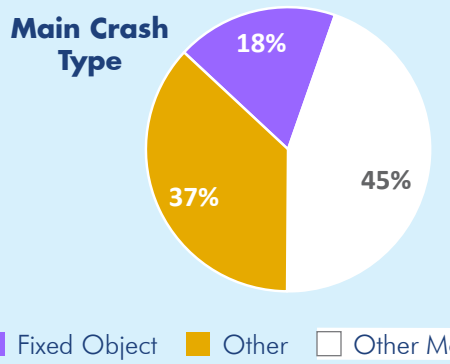
Road: I-235
Segment: Meridian to Arkansas
Direction: Southbound

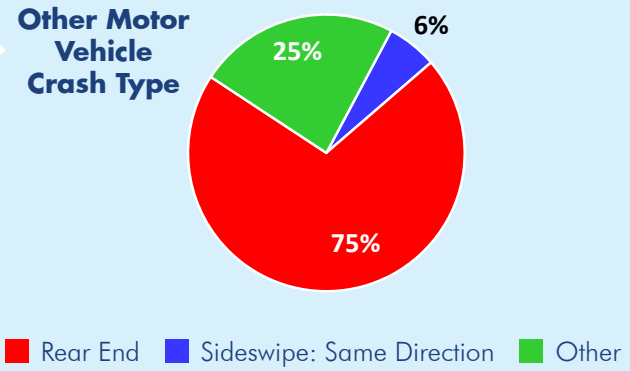
5 Year Crash Summary
2009-2013

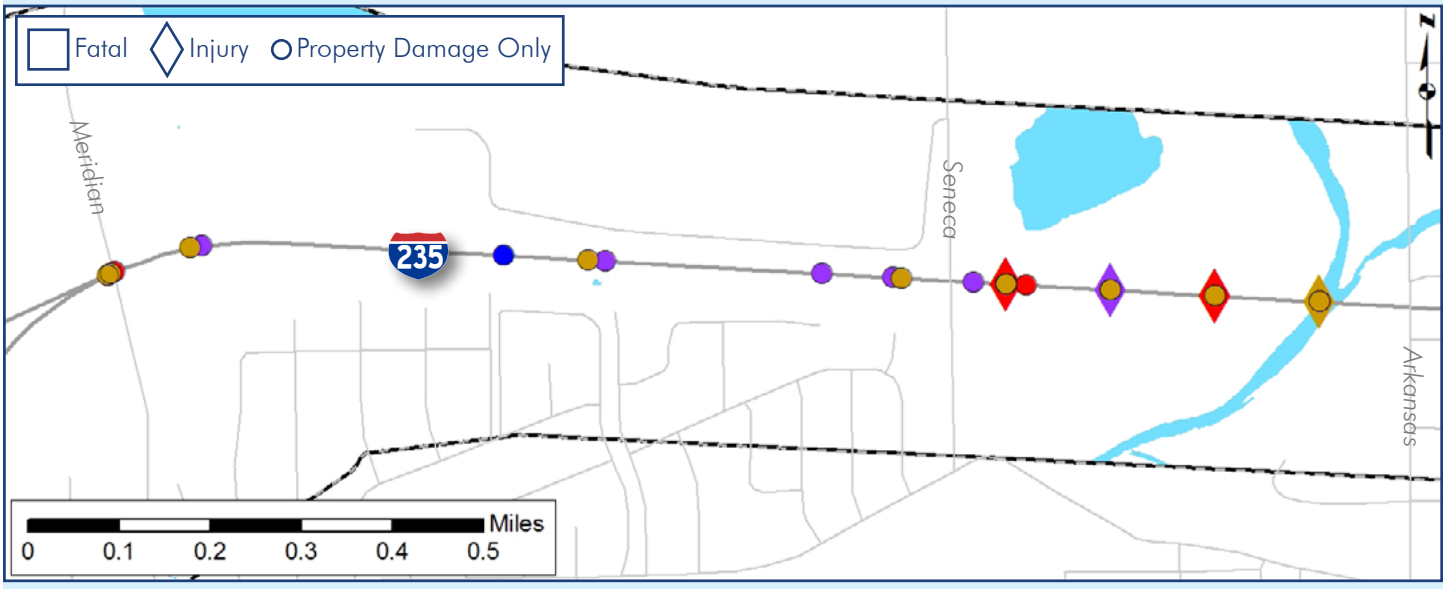
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Southbound	39	6	15.4%	12	30.8%	4	10.3%	6	15.4%







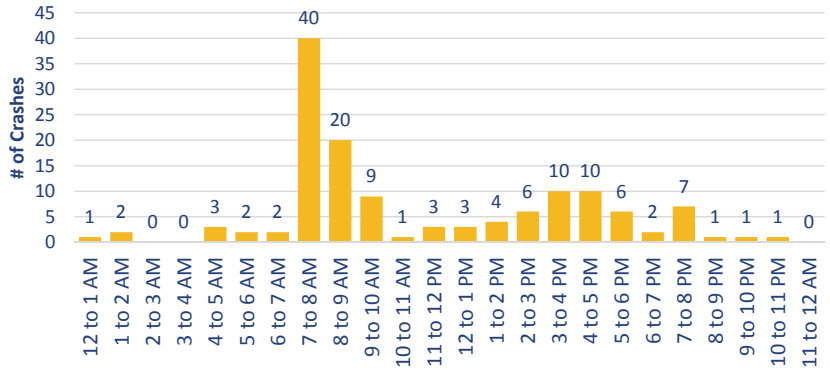


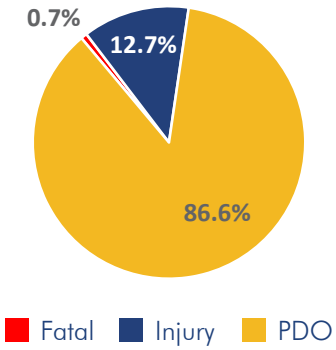


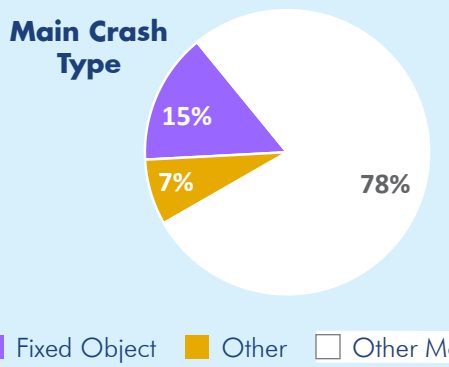
Road: I-235
Segment: Arkansas to I-135
Direction: Both (Northbound & Southbound)

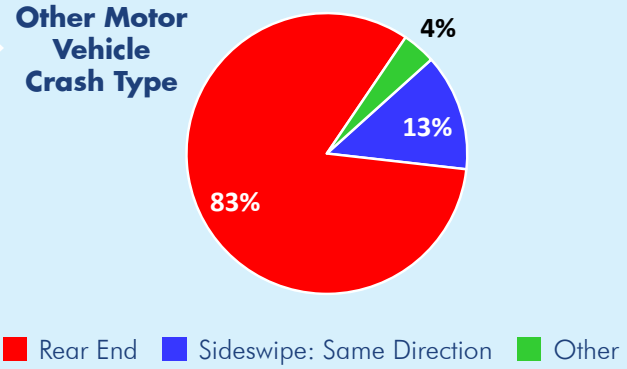
5 Year Crash Summary
2009-2013

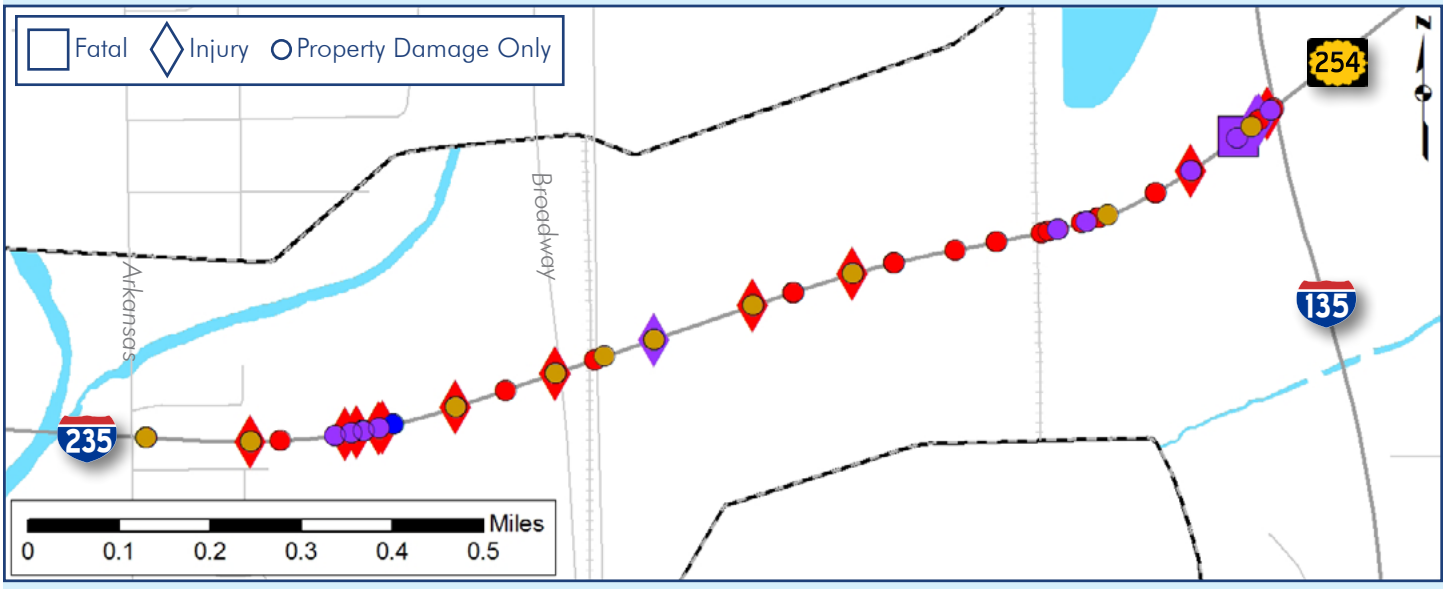
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**134**	**40**	**29.9%**	**69**	**51.5%**	**6**	**4.5%**	**26**	**19.4%**
Northbound	79	31	39.2%	51	64.6%	3	3.8%	13	16.5%
Southbound	54	9	16.7%	18	33.3%	3	5.6%	12	22.2%
Unknown	1	0	0.0%	0	0.0%	0	0.0%	1	100.0%







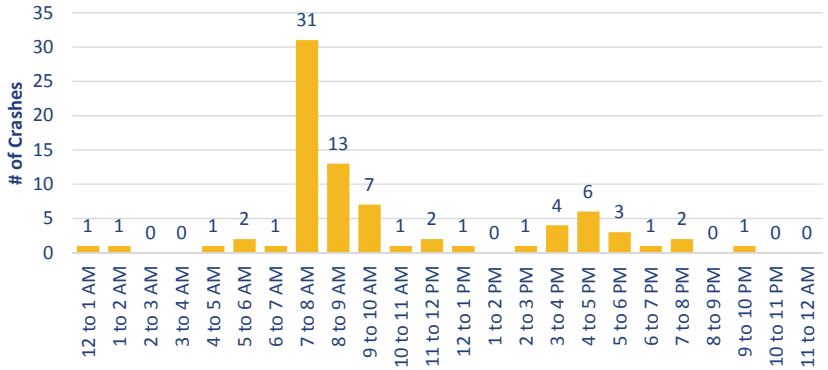


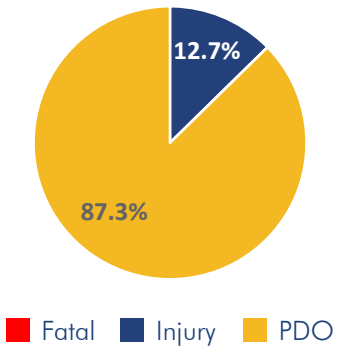


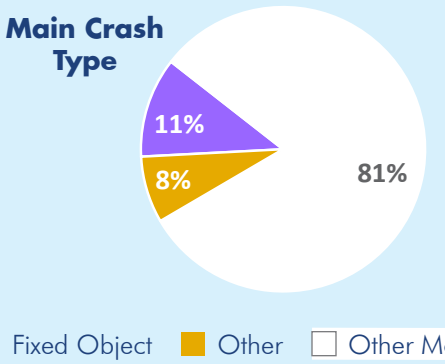
Road: I-235
Segment: Arkansas to I-135
Direction: Northbound

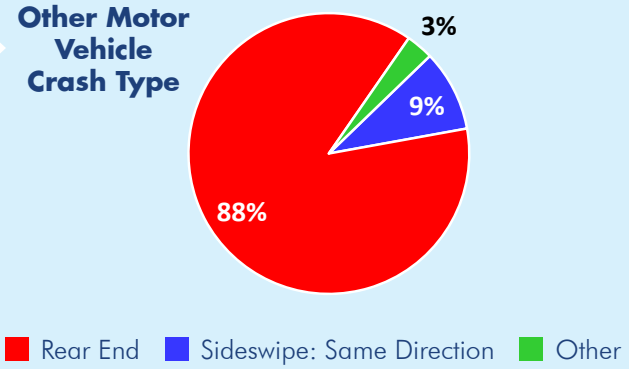
5 Year Crash Summary
2009-2013

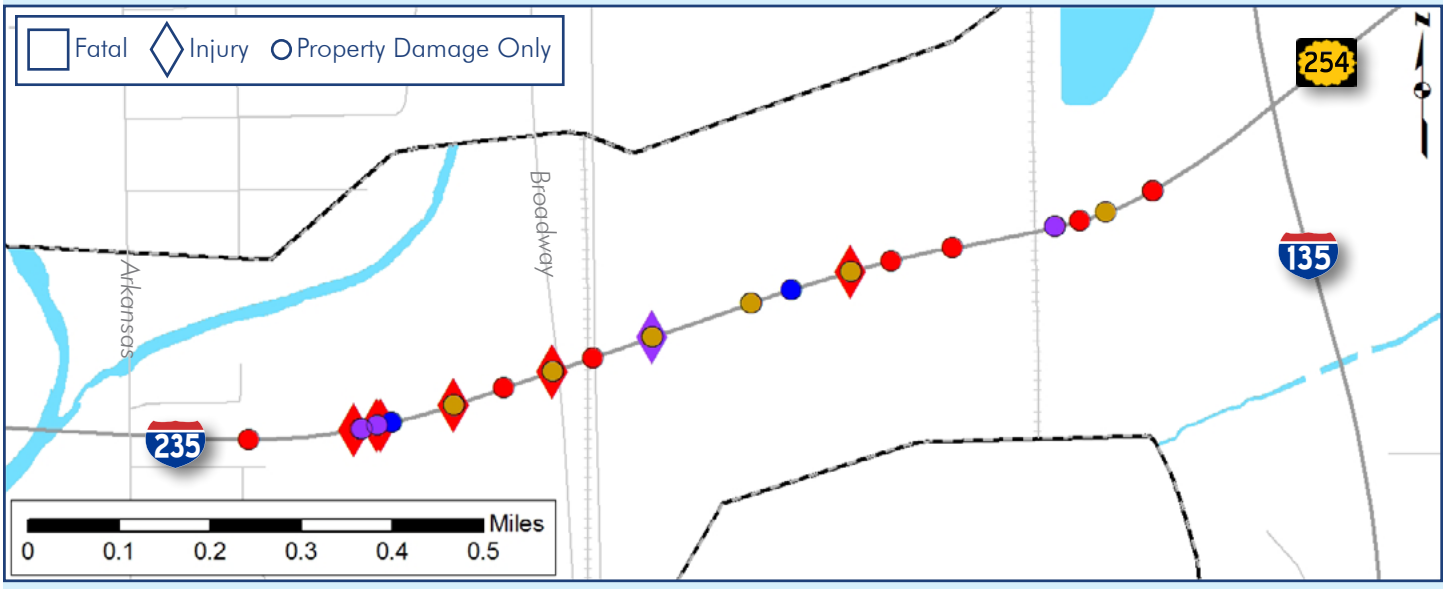
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Northbound	79	31	39.2%	51	64.6%	3	3.8%	13	16.5%







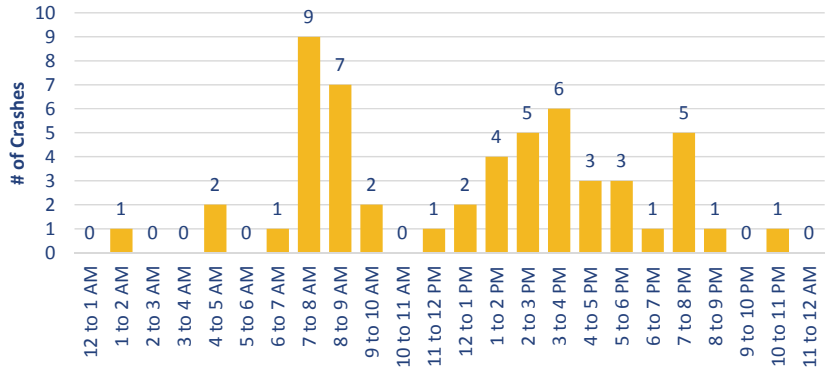


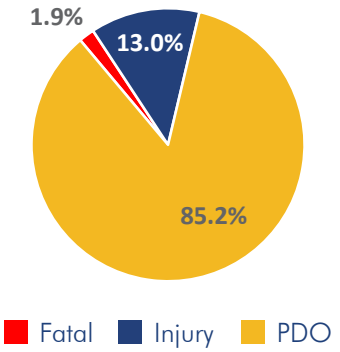


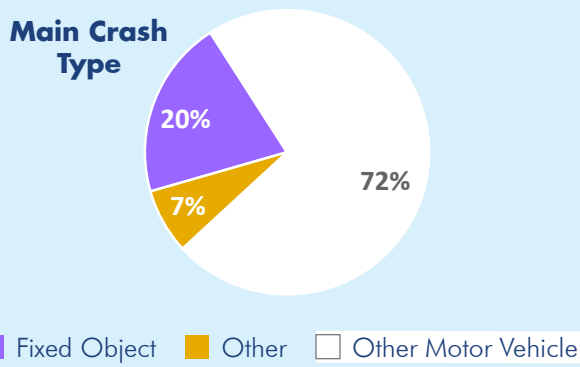
Road: I-235
Segment: Arkansas to I-135
Direction: Southbound

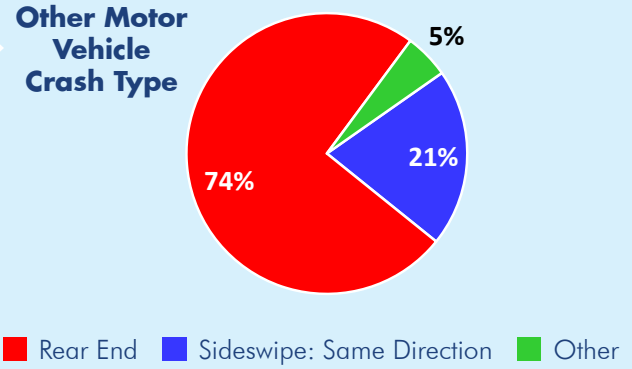
5 Year Crash Summary
2009-2013

Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Southbound	54	9	16.7%	18	33.3%	3	5.6%	12	22.2%









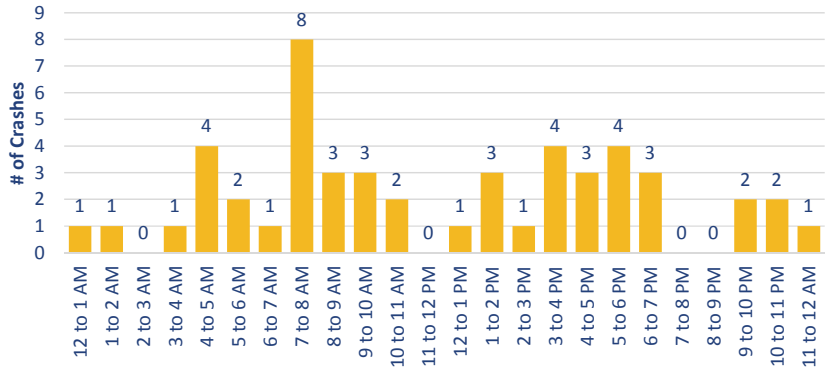
Road: K-254

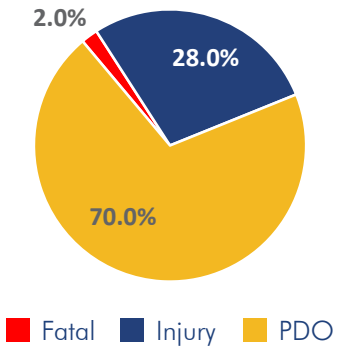
Segment: I-135 to 45th Street North

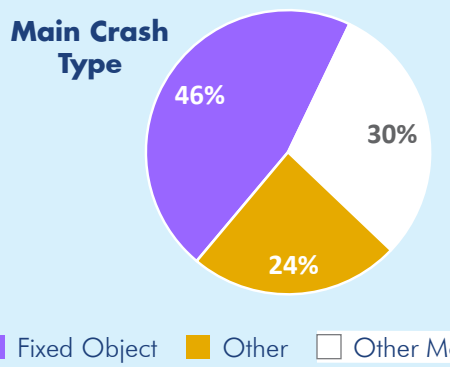
Direction: Both (Eastbound & Westbound)

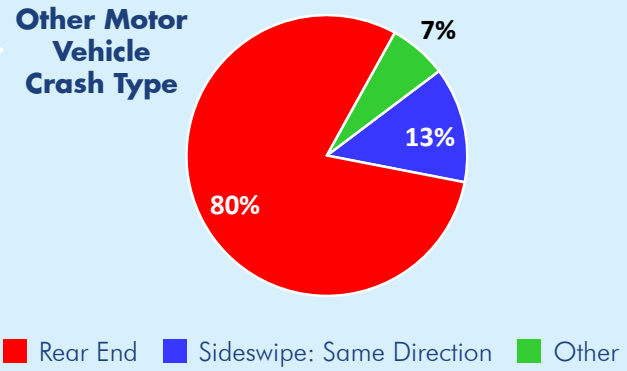
5 Year Crash Summary
2009-2013

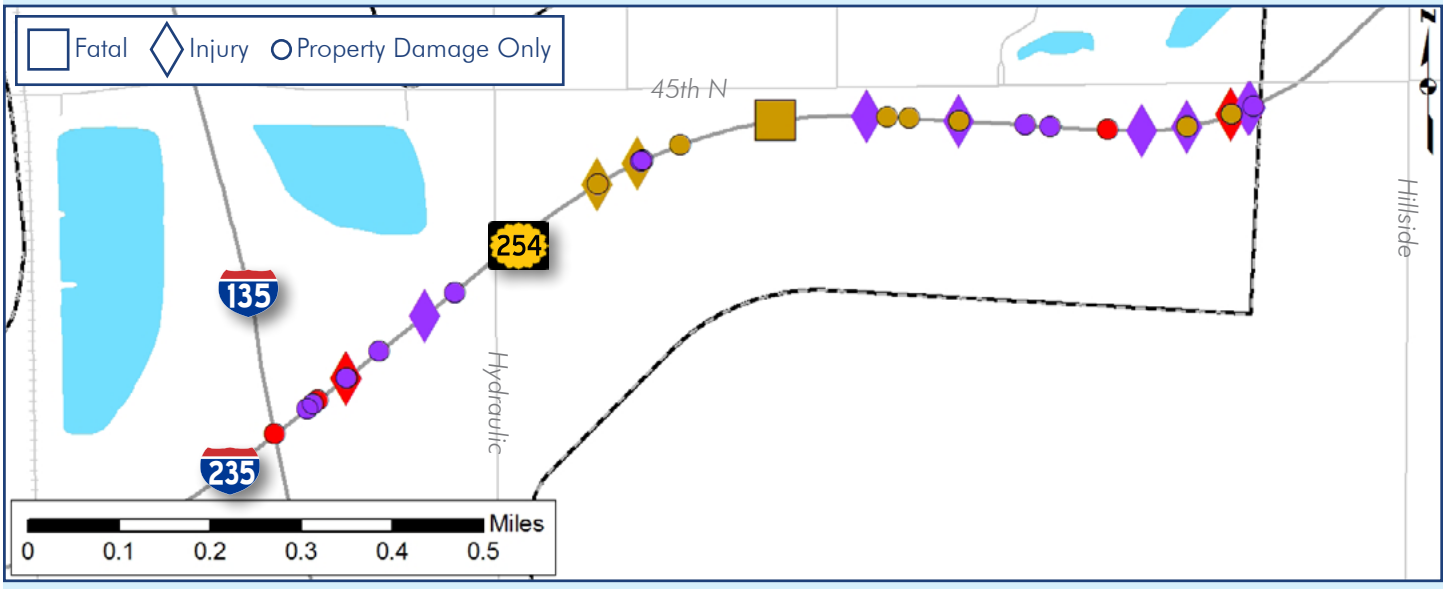
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**50**	**8**	**16.0%**	**14**	**28.0%**	**4**	**8.0%**	**11**	**22.0%**
Westbound	22	5	22.7%	6	27.3%	0	0.0%	2	9.1%
Eastbound	25	3	12.0%	7	28.0%	3	12.0%	8	32.0%
Unknown	3	0	0.0%	1	33.3%	1	33.3%	1	33.3%







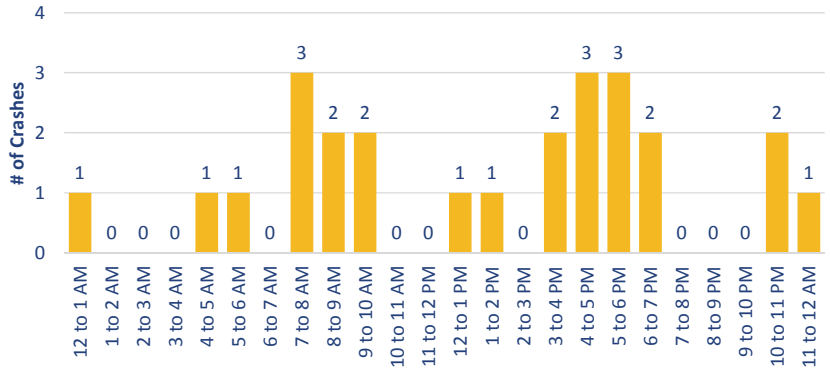


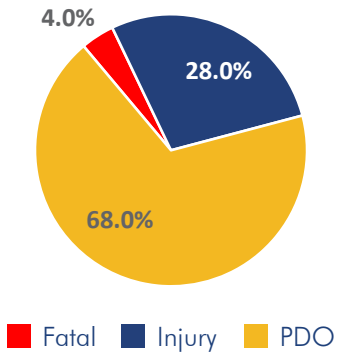


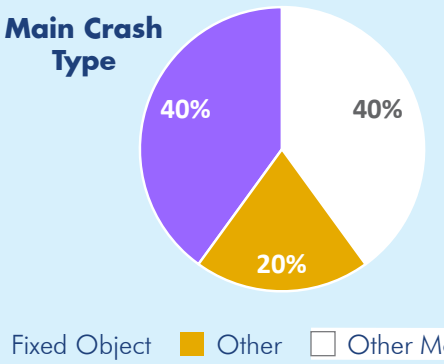
Road: K-254
Segment: I-135 to 45th Street North
Direction: Eastbound

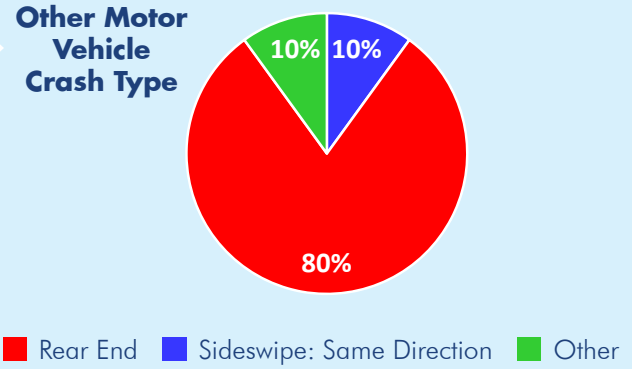
5 Year Crash Summary
2009-2013

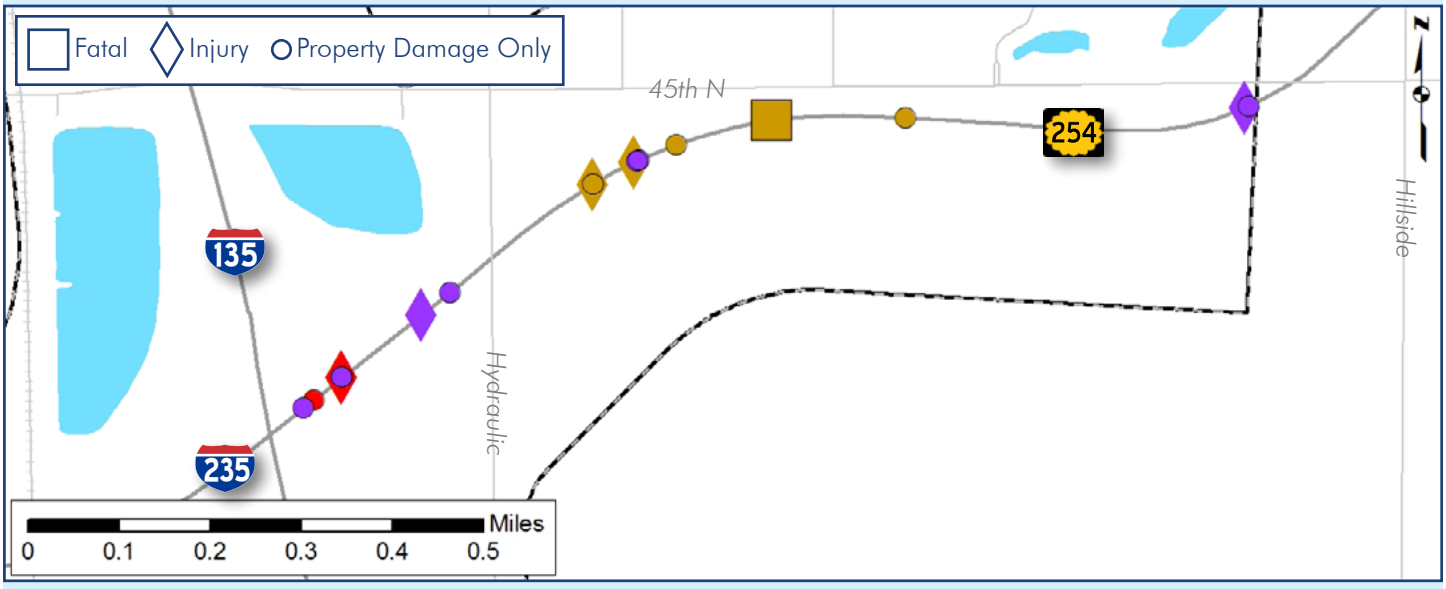
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Eastbound	25	3	12.0%	7	28.0%	3	12.0%	8	32.0%







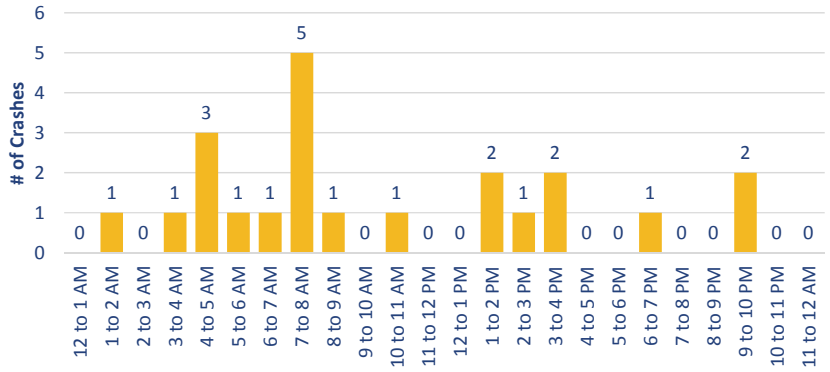


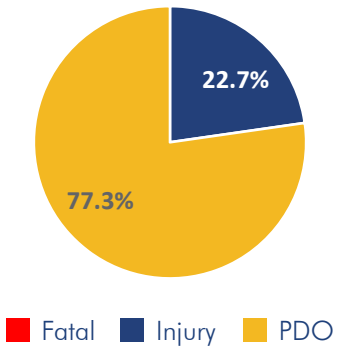


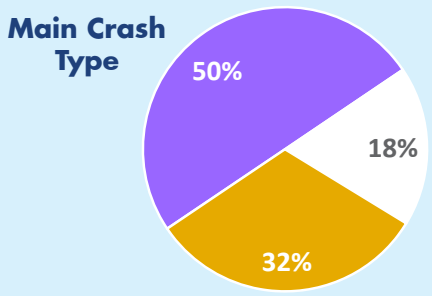
Road: K-254
Segment: I-135 to 45th Street North
Direction: Westbound

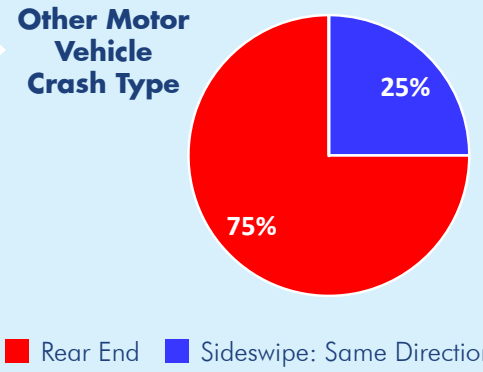
5 Year Crash Summary
2009-2013

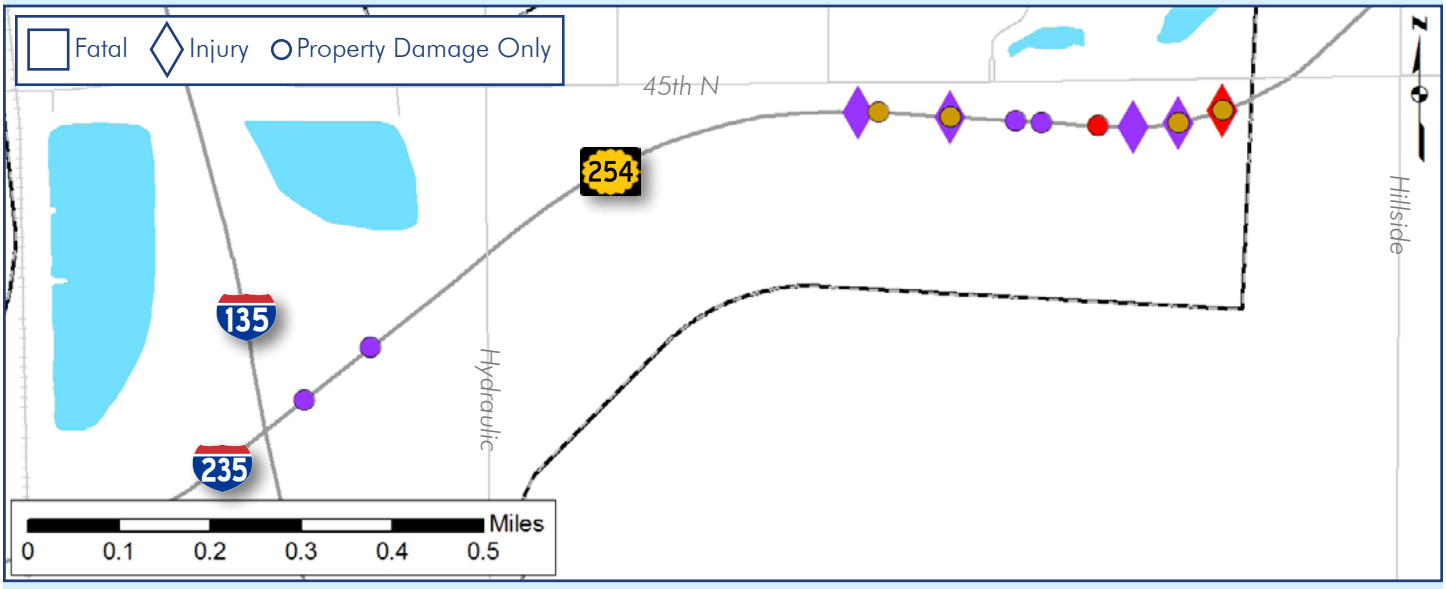
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Westbound	22	5	22.7%	6	27.3%	0	0.0%	2	9.1%











Road: K-96

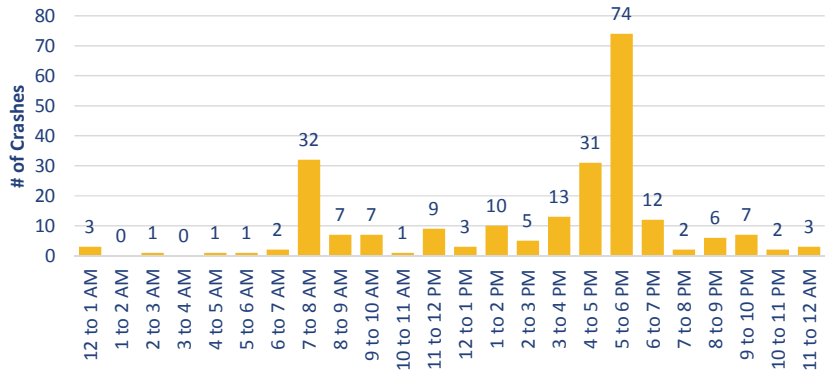
Segment: I-135 to Hillside

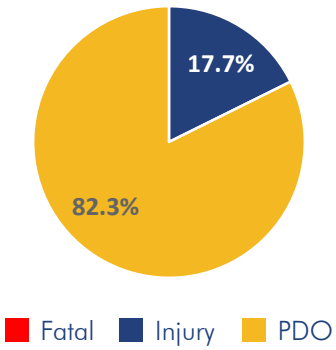
Direction: Both (Eastbound & Westbound)

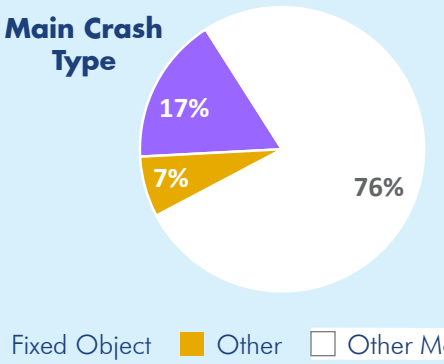
5 Year Crash Summary

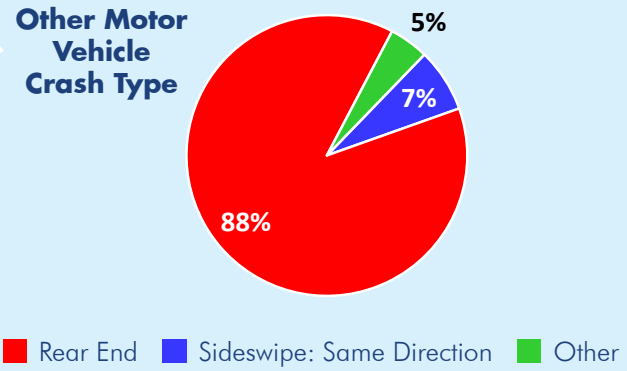
2009-2013

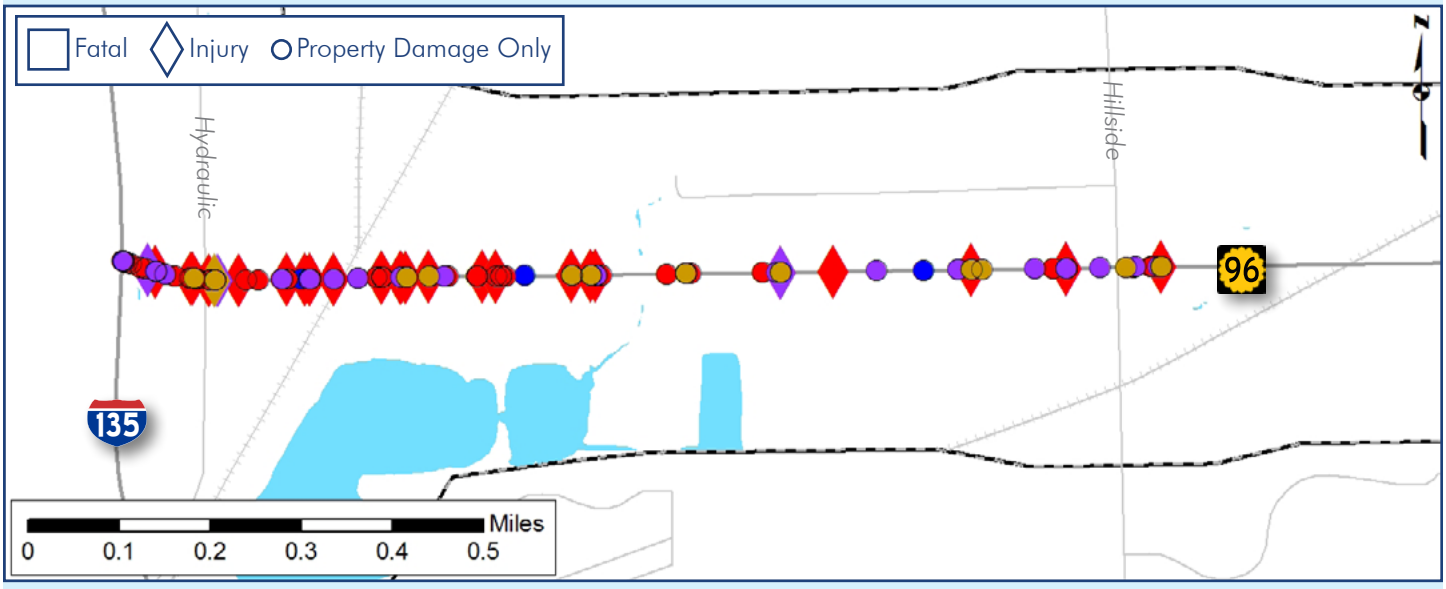
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Total	**232**	**32**	**13.8%**	**46**	**19.8%**	**74**	**31.9%**	**118**	**50.9%**
Westbound	111	20	18.0%	31	27.9%	31	27.9%	50	45.0%
Eastbound	118	12	10.2%	15	12.7%	42	35.6%	66	55.9%
Unknown	3	0	0.0%	0	0.0%	1	33.3%	2	66.7%







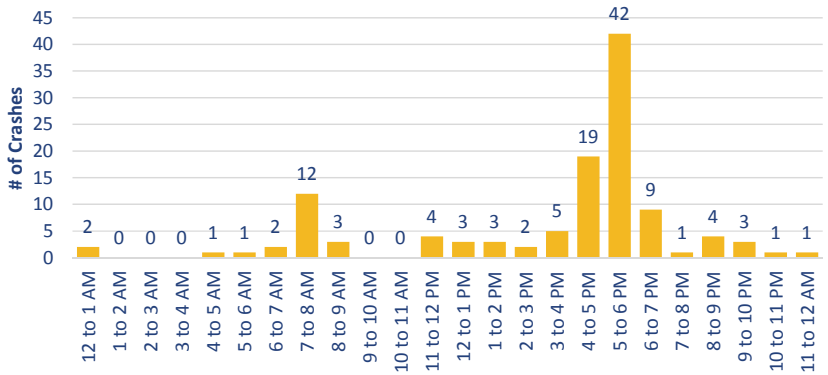


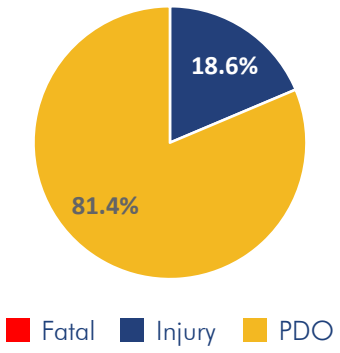


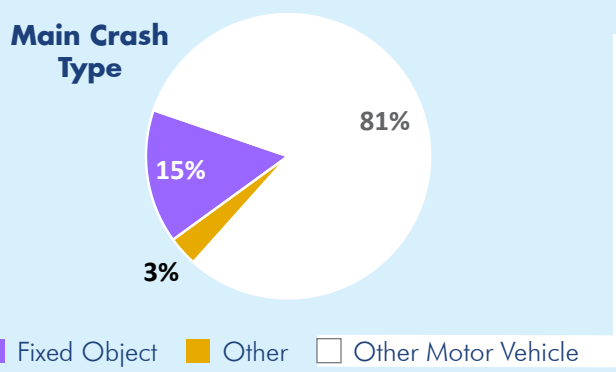
Road: K-96
Segment: I-135 to Hillside
Direction: Eastbound

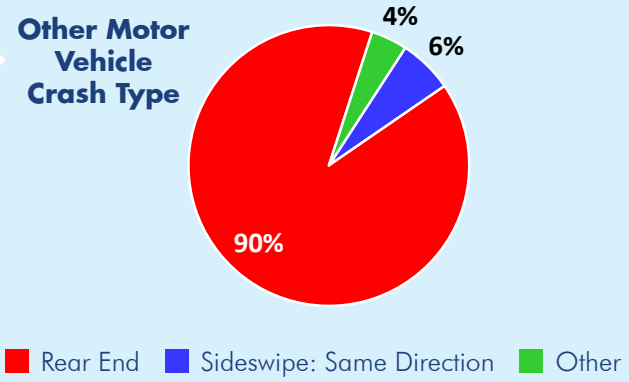
5 Year Crash Summary
2009-2013

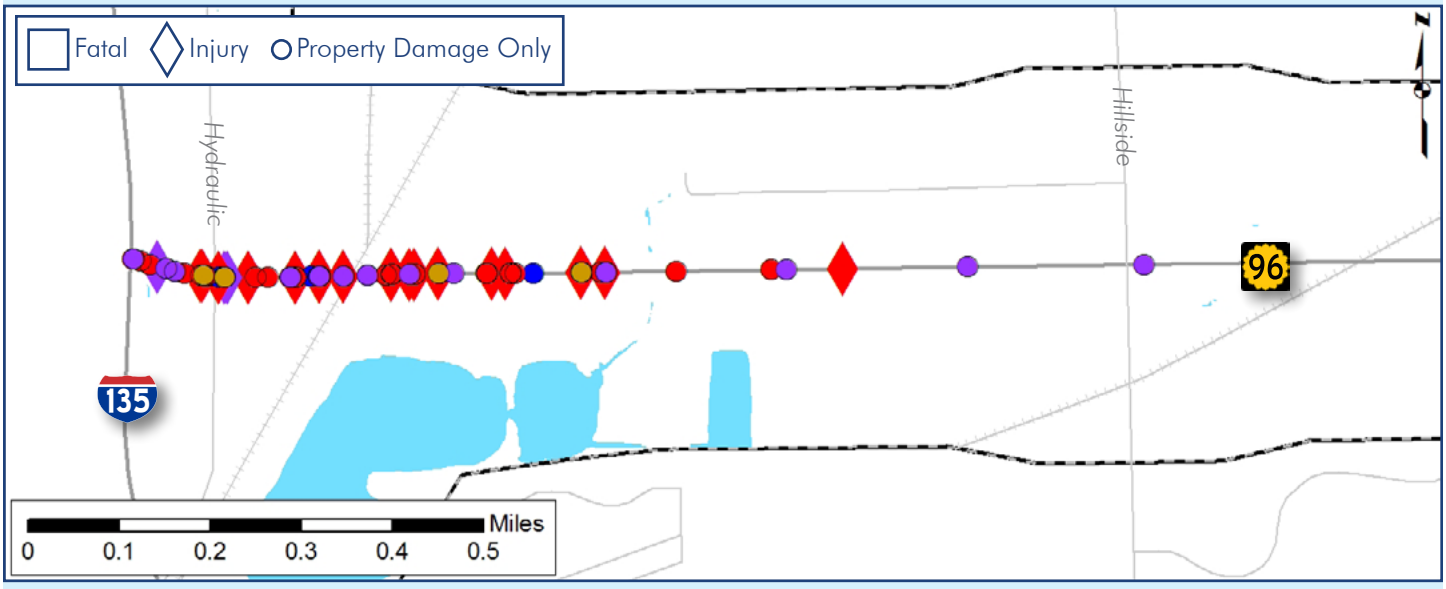
Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Eastbound	118	12	10.2%	15	12.7%	42	35.6%	66	55.9%







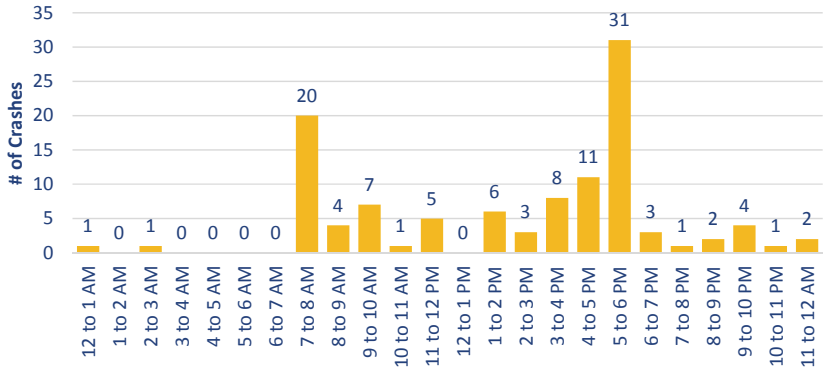


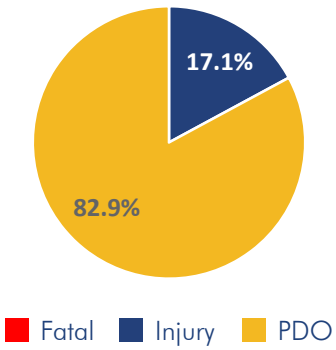


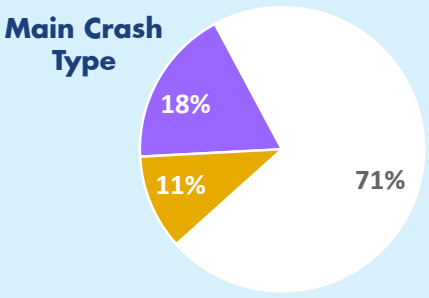
Road: K-96
Segment: I-135 to Hillside
Direction: Westbound

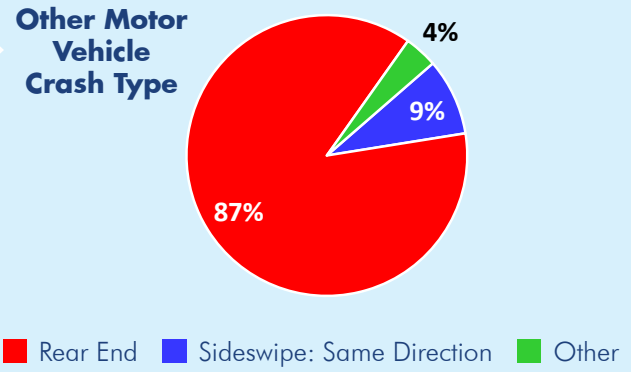
5 Year Crash Summary
2009-2013

Direction	TOTAL CRASHES	AM PEAK HR CRASHES (7-8AM)		AM PEAK PERIOD CRASHES (7-10AM)		PM PEAK HR CRASHES (5-6PM)		PM PEAK PERIOD CRASHES (3-6PM)	
	#	#	% of total	#	% of total	#	% of total	#	% of total
Westbound	111	20	18.0%	31	27.9%	31	27.9%	50	45.0%









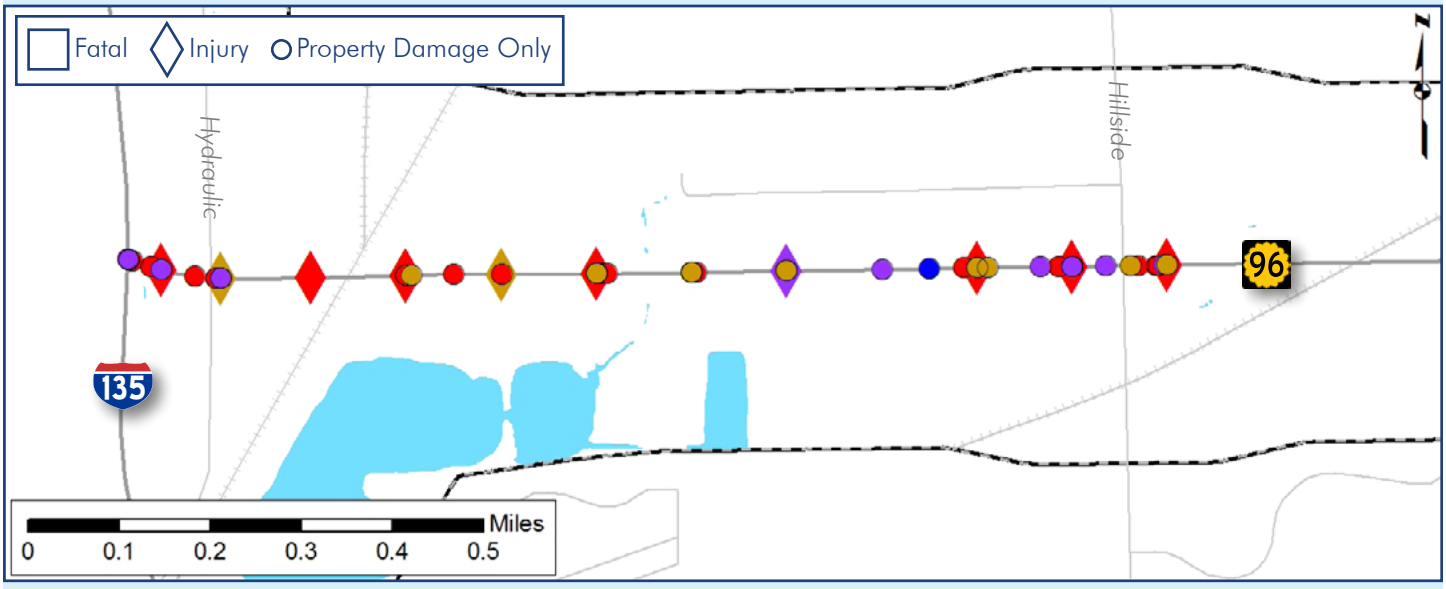


Exhibit 37: K-254 Option A

Exhibit 38: K-254 Option B

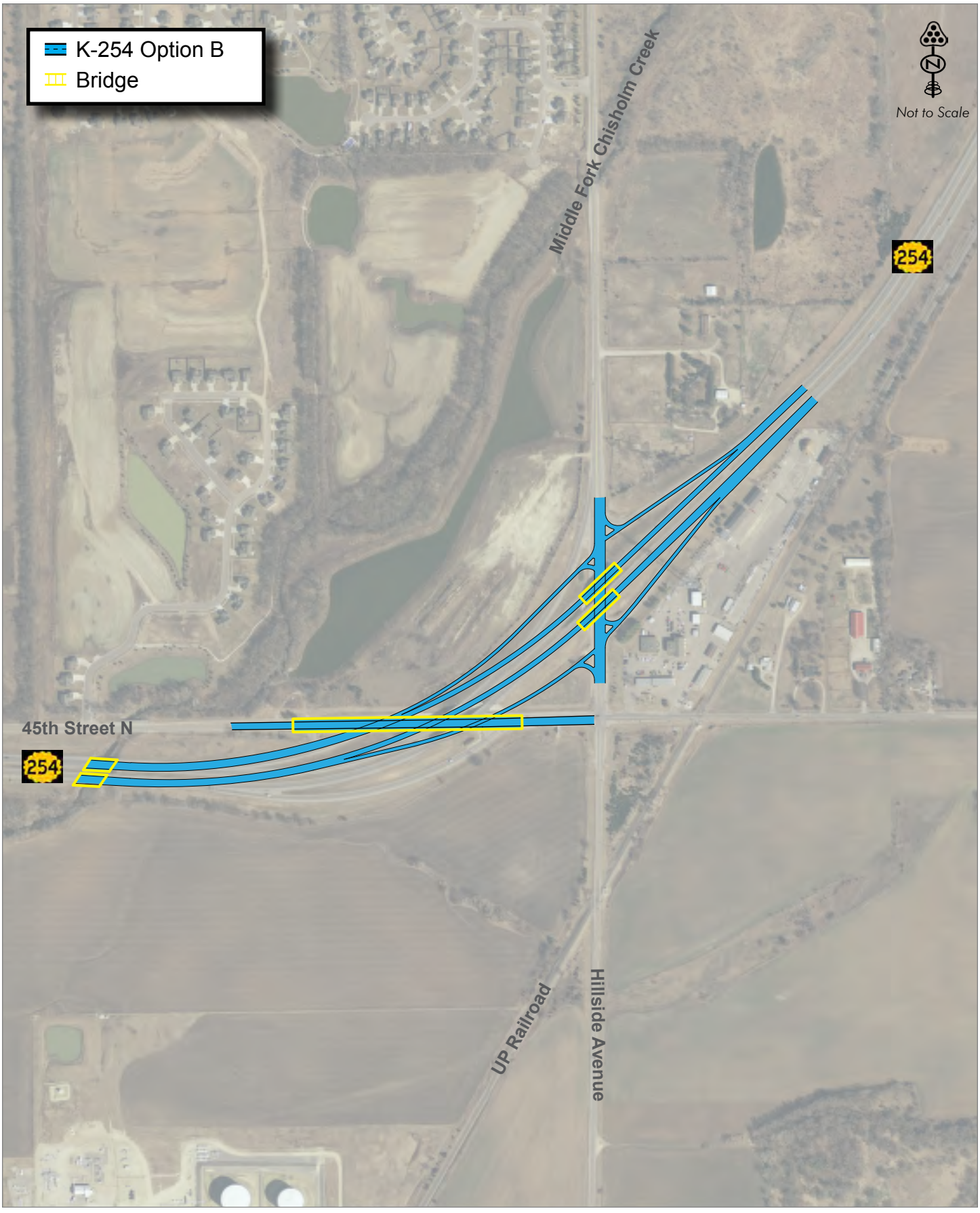


Exhibit 39: K-254 Option C