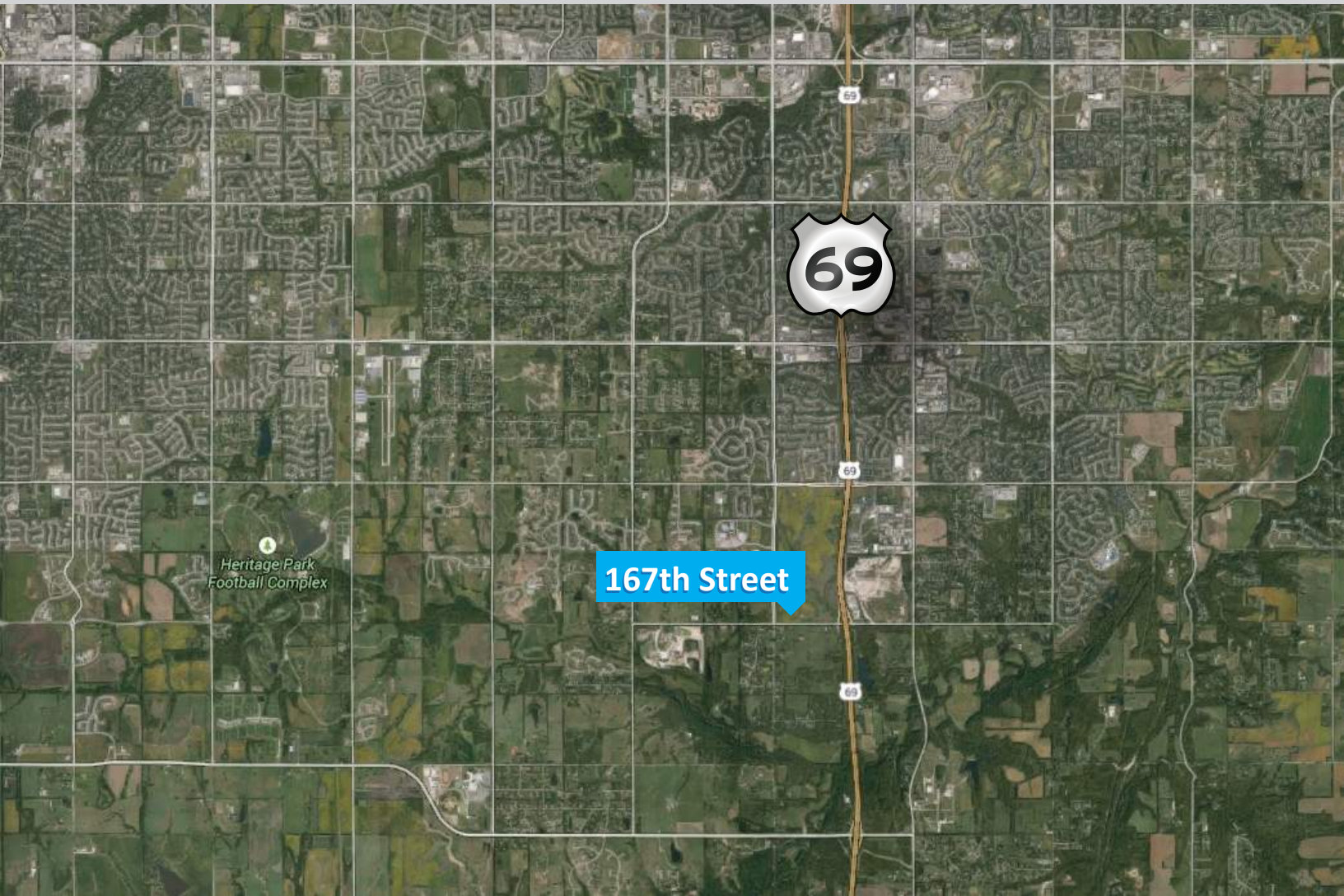
167th Street and US-69 Break-In-Access Request

Kansas Department of Transportation

OVERLAND PARK KANSAS
ABOVE AND BEYOND. BY DESIGN.

Prepared by HNTB



US-69 and 167th Street
Modification in Access Request

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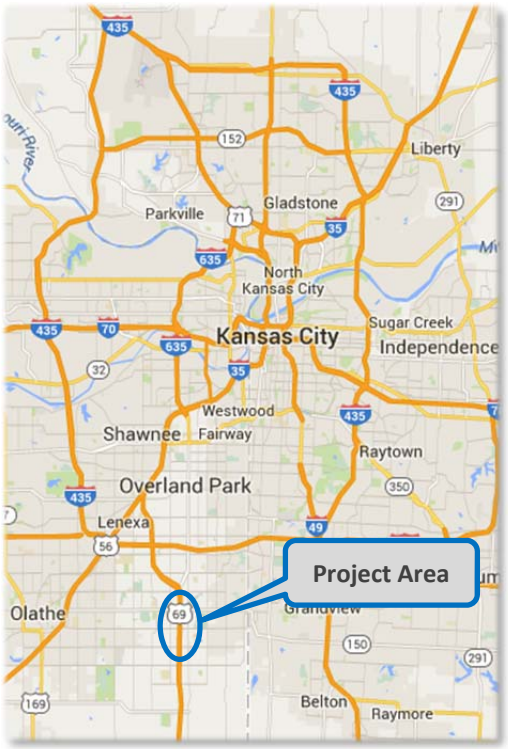
1.0 Project Summary

The 167th Street corridor and associated interchange with US-69 were identified for improvement by the City of Overland Park due to significant anticipated future growth south along US-69. 167th Street is currently an unimproved, two-lane, former county road with no sidewalks, bicycle or pedestrian accommodations, and in many locations no shoulders are present adjacent to the roadway. The current interchange does not provide access to 167th Street from northbound US-69 or access to southbound US-69 from 167th Street. Improvements to this corridor and interchange are necessary to serve existing and future traffic safely, support economic development and efficiently provide for all modes of travel well into the future. The following summarizes the need for improvements and the recommended improvements. Section 2.0 follows the Federal Highway Administration (FHWA) and Kansas Department of Transportation guidelines for an access modification.

Figure 1 – Project Location Map



1.1 Study Area

Figures 1 and 2 illustrate the project location and study area. Generally speaking the study area extends along 167th Street from Antioch Road to Metcalf Avenue and along US-69 from the 151st Street interchange to the 179th Street interchange. Existing (2014) and design year (2040) US-69 traffic operations were analyzed within this study area for the two screened alternatives, the modified diamond interchange and the diverging diamond interchange (DDI). A more detailed discussion on this can be found in Section 2.3.1.

1.2 Previous Studies

In 1998, HNTB conducted a Major Investment Study in coordination with the Mid-America Regional Council (MARC), KDOT and other transportation agencies within the Kansas City area for the I-35 and US-69 corridors in Johnson and Wyandotte Counties. The purpose of the study was to determine the best improvement to meet the area's needs and future travel demands. At the location of US-69 and 167th Street, the study recommended a full diamond interchange be built at this location in the future in order to accommodate anticipated land use and future traffic demand.

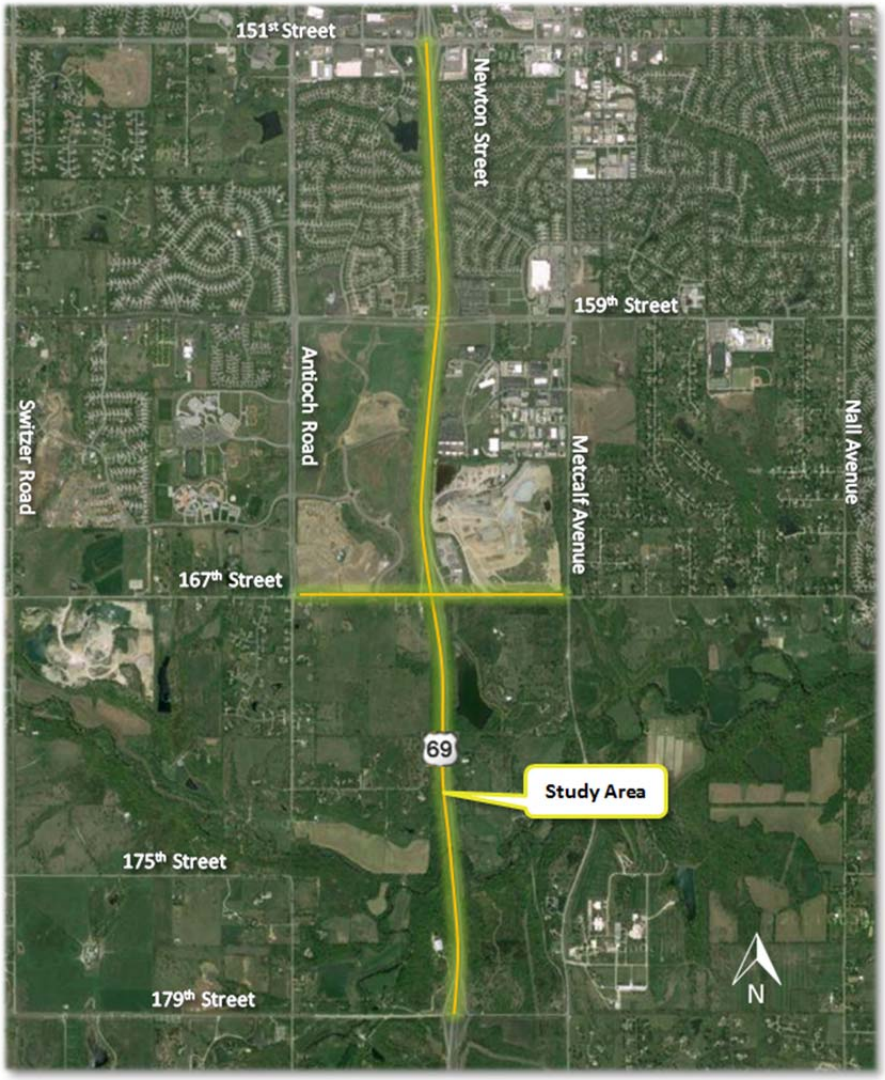
In 2005, as part of the break-in-access request for the US-69 and 159th Street interchange, HNTB evaluated impacts to the existing 167th Street interchange for the existing and future no-build condition of 159th Street. This request concluded that improvements to 167th Street, Antioch Road and Metcalf

Avenue as well as a full access interchange at US-69 and 167th Street would be required to provide adequate design year operations at the proposed US-69 and 159th Street interchange.

In 2006, The City conducted a preliminary engineering study for the 167th Street corridor. The study proposed that 167th Street between Metcalf Avenue and Antioch Road should be upgraded to a standard four-lane divided thoroughfare. In addition to roadway improvements, recommendations included reconstructing the US-69 bridges over 167th Street to accommodate the expansion, acquiring additional right-of-way, and making significant drainage improvements.

In 2015, The City completed the Overland Park South Streets Transportation Plan. This plan identified the need to improve transportation systems in South Overland Park from 159th Street south to the Johnson County line. Similar to previous studies, this study recognized the need to improve 167th Street to four lanes between Metcalf and Antioch with a full access US-69 interchange.

Figure 2 - US-69 and 167th Street Study Area



1.3 Public Involvement

The public involvement for this phase of the study included holding a stakeholder open house meeting to provide an overview of the study process and introduce the future interchange concept. The stakeholder meeting highlighted the following topics:

- Why the interchange is being modified/what are the existing and future problems that need to be addressed
- What improvements are recommended coming out of this study
- What impacts to surrounding properties result from the recommended improvements

The stakeholder meeting was held April 27, 2015 with property owners adjacent to the project area in the concept study. There was no significant opposition to the project and preferred alternative (Modified Diamond Interchange) presented. Additional public meetings will occur during design prior to initiating right-of-way acquisitions and prior to beginning construction.

1.4 Purpose and Need

The purpose of the improvements is to improve roadway geometric and safety conditions along 167th Street between Metcalf Avenue and Antioch Road, expand the capacity of the facility to accommodate the demands of future traffic, and upgrade the existing interchange to a full access interchange south of 167th Street. More specifically, the proposed project is expected to:

1. **Improve 167th Street and provide a full access interchange** based on existing conditions and to meet future travel demands.
2. **Improve traffic safety** by improving existing roadway, drainage, and bridge deficiencies.
3. **Improve pedestrian and bicycle accommodations** along 167th Street as well as connectivity to future trails along US-69.

1.4.1 Improve 167th Street and Provide a Full Access Interchange

Existing Conditions

Through the preliminary engineering study performed in 2006, it was determined that 167th Street between Metcalf Avenue and Antioch Road should be upgraded to a standard four-lane, divided arterial street. The traffic analysis performed with this study determined that this is the appropriate facility type for 167th Street through the Study Limits. The text below briefly describes the traffic evaluation performed for the existing conditions and future no-build conditions which leads to this conclusion.

Existing traffic operations were analyzed. The following provides background information related to existing 167th Street and the existing US-69 interchange.

- 167th Street is an unimproved, two-lane, former county road

- 167th Street existing posted speed is 35 mph
- 2,100 ADT along 167th Street west of interchange (2010, OP Count)
- 2,300 ADT along 167th Street east of interchange (2010, OP Count)
- 5,800 ADT west of interchange at Antioch Road (2013, OP Count)
- 7,800 ADT east of interchange at Metcalf Avenue (2012, OP Count)
- 167th Street is not designated as a truck route
- Existing land use is majority vacant or agricultural. Future land use is residential and industrial/business park.
- Existing crash rates along 167th Street are relatively low. Existing crash rates are high along US-69 and 151st Street.

Based on the existing local and regional land use, existing traffic demand was collected as shown in the Appendix A-1. The existing traffic demand along with the existing lane geometrics and existing signal timings at adjacent interchanges were used to evaluate the existing traffic operations as a baseline.

The existing intersection level of service and delay can be found in Section 2.1. The US-69 and 167th Street interchange and individual ramp intersection movements operate at an acceptable level of service during the morning and afternoon peak hours. Locations of high delay along 167th Street affects a relatively small number of vehicles either at the stop control at the ramp terminal or left turns onto Metcalf Avenue. The majority of the vehicles along 167th Street experience acceptable level of service. LOS D is the threshold goal for the City of Overland Park and KDOT for both intersections and freeways.

Future No-Build Conditions

Future No-Build conditions investigate growth in land use and traffic demand but with no improvements to the study interchange. However, improvements are expected to have occurred on Antioch Road and Metcalf Avenue adjacent to the study limits. Expected improvements include upgrading both streets to four lanes with turn lanes and signalization at 167th Street. The design year for the interchange is 2040. Based on historical growth trends and Overland Park's travel demand model, a 2040 traffic forecast was developed. Future traffic is shown in the Appendix A-5. The future traffic demand was used to analyze the existing facility and traffic operational results were developed using a VISSIM operational model. The existing level of service and delay can be found in Section 2.1.

Poor level of service E and F is a result of the design year traffic demand with the existing, unimproved configuration and capacity. The lack of US-69 ramps south of 167th Street as well as the capacity of 167th Street has a significant impact on the future operating conditions of 159th Street, Metcalf Avenue and Antioch Road. Appendix A-6 and A-7 show the intersection and freeway LOS problems which include southbound US-69 and all intersections along the 167th Street corridor. The Preferred Alternative addresses these problems.

US-69 and 167th St. Interchange Traffic

Existing (2014) = 7,850 ADT
Future No-Build (2040) = 33,620 ADT
Future Build (2040) = 40,030 ADT

1.4.2 Improve traffic safety by improving existing roadway, drainage and bridge deficiencies.

A safety analysis was performed on the existing US-69 mainline system (2008 through 2014) and arterial streets (2009 through 2013) to identify vehicle crash patterns, locations where there is a high density of crashes within the study area, and other safety statistics such as the most prevalent crash types and severity of crashes. This information was used to assess safety in the study area and help develop mitigation measures. Crash data for these periods was collected from KDOT for the study area. Supplemental crash data was also supplied by the City of Overland Park. A summary of the safety data is provided below.

- Between 2009 and 2013, there were 40 crashes on 167th Street and the approaches from Antioch Road and Metcalf Avenue.
- There has been one fatal, 11 injury, and 28 property damage only crashes along 167th Street.
- 40% of incidents were angle crashes and 20% were animal related along 167th Street.
- No intersections along 167th Street are listed on the Overland Park "Top 25 Accident Locations" lists for 2010 to 2013.
- Between 2008 and 2014, there were 289 crashes on US-69 mainline.
- There have been 3 fatal, 59 injury, and 227 property damage only crashes along US-69.
- 48% of incidents were rear end collisions, 14% animal related, and 14% fixed object crashes along US-69.
- The US-69 accident rate over this period is 0.830 MVMT compared to the statewide average accident rate of 1.134 MVMT of similar roadway type.
- The US-69 fatal accident rate over this period is 0.868 HMVMT compared to the statewide average fatal accident rate of 0.676 HMVMT of similar roadway type.

The US-69 mainline overall is a safer facility than the average four lane freeway in Kansas. However, fatal crashes are higher than the statewide average and many of the crashes are rear end collisions, which is likely due to congestion.

When considering improvements to 167th Street, it is recommended to not allow closely spaced intersections, particularly near the interchange with US-69, in order to maintain a safe corridor with good level of service. KDOT's Access Management Policy recommends for this type of thoroughfare (Class C) that public roads shall have signalized intersection spacing of no less than 3/8 mile and up to 3/4 mile from the interchange terminals. Unsignalized intersection spacing should be at least 365 feet from the interchange terminals. However, access points that do not meet this policy may be approved by KDOT if traffic analysis demonstrates adequate traffic operation. Access points should be kept to a minimum and new direct access should not be permitted when the property owner has other reasonable access.

167th Street is currently an unimproved, two-lane, former county road. The horizontal and vertical geometrics and roadside grading in many locations do not meet current design criteria. From a drainage perspective, the current FEMA hydraulic models show overtopping of 167th Street and the existing ramp from US-69 southbound to 167th Street in the 100-year storm. Significant drainage improvements will be required with the project to correct the overtopping of 167th Street and the interchange ramps.

The existing US-69 bridge over 167th Street provides substandard vertical clearances based on current design guidelines and does not provide adequate horizontal space for the standard four-lane divided thoroughfare and proposed bicycle and pedestrian paths. The existing US-69 bridges must be replaced to accommodate the future facility type and to meet current design criteria.

1.4.3 Improve pedestrian and bicycle accommodations along 167th Street as well as connectivity to future trails along US-69.

There are several ongoing studies in the Study Area with regard to provisions for accommodating bicycle and pedestrian traffic. The City of Overland Park Safe Bicycle Use Outreach Project developed a plan for a safe and accessible network of bicycle facilities throughout Overland Park. The project recommends buffered on-street bike lanes along 167th Street from Pflumm Road to Nall Avenue and a shared use path along US-69, outside KDOT right-of-way, north of 167th Street. The MARC Greater Kansas City Regional Bikeway Plan also recognizes the need for bicycle connectivity throughout this study area and includes this area in the MetroGreen plan utilizing the greenway space of the Blue River watershed.

The current City of Overland Park Comprehensive Plan recommends a future multi-purpose trail along the north side of 167th Street connecting the study area to 159th Street to the north, 179th Street and the Arboretum to the south, and Heritage Park and local schools to the west. For the purposes of this study, bicycle and pedestrian facilities have been shown consistent with the current City of Overland Park Comprehensive Plan. The on-street bike lanes recommended by the Safe Bicycle Use Outreach Project are not shown in this study as the City is still in the process of developing an implementation plan for this program. However, major elements, such as the US-69 bridges over 167th Street and the anticipated right-of-way footprint, have been developed to accommodate future on-street bike lanes should they be desired as this moves forward into design and construction. The traffic analysis performed with this study does not include on-street bike lanes, but the impact of these facilities is negligible to the overall performance of the facility.

1.5 Preferred Alternative

A preferred alternative was developed to address the purpose and need of the project. It was essential that the impacts of existing and future traffic growth at this location be considered so that the appropriate interchange, bridge configuration and associated geometric improvements could be incorporated to provide the most feasible, cost-effective solution.

The **Modified Diamond Interchange** was selected as the preferred alternative. This alternative was selected based on improved LOS, safety, maintenance of traffic, and project phasing flexibility. This alternative also provided the City with the greatest flexibility in implementing its Safe Bicycle Use Outreach program. Section 2.0 describes in detail the process by which this alternative was selected and addresses the eight requirements for a modification in access.

Figure 3 - Modified Diamond Preferred Alternative

Source: HNTB

2.0 Access Modification

The following section addresses the requirements for a break-in-access identified in the Federal Register dated August 27, 2009 and in the Kansas Department of Transportation's Standard Operating Manual effective December 1, 2005 regarding access breaks. Eight requirements are addressed in the following section. These requirements are:

2.1 Improving Existing Facilities
2.2 Transportation System Management and Alternatives Analysis
2.3 Operational Analysis
2.4 Access Connections and Design
2.5 Consistency with Transportation Plans
2.6 Consistency with Future Access Plans
2.7 Coordination with Future Development
2.8 Status of NEPA

At the beginning of each of the eight sections, the Federal guideline's intent is described in italics. It is directly quoted from federal guidelines for break-in-access requirements.

2.1 Improving Existing Facilities

FHWA Policy Point One: ***Current design does not meet existing and future purpose and need.***

> *The need being addressed by the request cannot be adequately satisfied by existing interchanges to the Interstate, and/or local roads and streets in the corridor can neither provide the desired access, nor can they be reasonably improved (such as access control along surface streets, improving traffic control, modifying ramp terminals and intersections, adding turn bays or lengthening storage) to satisfactorily accommodate the design-year traffic demands (23 CFR 625.2(a)).*

The existing interchange system (US-69 interchange and 167th Street from Antioch Road to Metcalf Avenue) does provide the capacity needed to meet existing traffic demand but does not provide access to 167th Street from northbound US-69 and to southbound US-69 from 167th Street. In the future, the existing interchange cannot provide the capacity needed to meet future traffic demand based on Overland Park's Future Land Use Plan which includes new office and retail development along US-69 and Metcalf Ave., and new residential development outside of the US-69 corridor. The methodology used to evaluate traffic operations and arrive at these conclusions is summarized below.

Methodology

VISSIM (version 6.0) was used to analyze the intersection traffic delay and queues on the arterial street network. The *Highway Capacity Manual* (HCM) 2010 methodology was used for this analysis. Level of service analyses were performed at the study area intersections for the weekday AM and PM peak hours. Intersection level of service (LOS) is a quantitative and qualitative measure describing operational conditions (how well the intersection operates), in terms of average delay per motorist. LOS is described with letter designations A (best) through F (worst). The *Highway Capacity Manual* provides a description of the qualitative and quantitative meaning of each letter. For this study, LOS D was assumed to be the minimum desirable LOS for this type of area. Table 1 shows the intersection delay thresholds for signalized and unsignalized intersections.

Table 1 - Intersection Level of Service (LOS) Thresholds

	Level of Service (LOS)	**Signalized Intersection** Avg. Delay (sec/veh)	**Unsignalized Intersection** Avg. Delay (sec/veh)
Desirable	A	≤ 10 Seconds	≤ 10 Seconds
	B	< 20 Seconds	< 15 Seconds
	C	< 35 Seconds	< 25 Seconds
	D	< 55 Seconds	< 35 Seconds
Undesirable	E	< 80 Seconds	< 50 Seconds
	F	> 80 Seconds	> 50 Seconds

Source: Highway Capacity Manual, 2010

Freeway operations are also measured on the LOS scale. A, B, C and D levels of service are generally considered acceptable in urban areas. When the LOS for a section of roadway decreases from level D to levels E or F, traffic flow can be impeded (see Table 2). Level of service A describes nearly free flow operation of vehicles, virtually unaffected by the presence of other traffic. In contrast, LOS E describes operation at capacity. Traffic flow at this level is very unstable. Any flow interruption or disruption produces extensive queuing. There is little freedom to maneuver within the traffic stream. KDOT considers LOS D or better the desirable levels of service for the design year peak hour traffic conditions.

Table 2 - Freeway Level of Service (LOS) Thresholds

	Level of Service (LOS)	**Freeways - Mainline** Max Density (pc/mi/ln)	**Freeways - Merge/Diverge** Max Density (pc/mi/ln)
Desirable	A	≤ 11	≤ 10
	B	> 11 – 18	> 10 – 20
	C	> 18 – 26	> 20 – 28
	D	> 26 – 35	> 28 – 35
Undesirable	E	> 35 – 45	> 35
	F	> 45	Demand Exceeds Capacity

Source: Highway Capacity Manual, 2010

The table below shows the existing AM and PM peak hour level of service and average motorist delay based on the methodology described above. The intersections at 151st, 167th and 179th Streets show the overall intersection average level of service and delay along with the individual movement level of service and delay. The intersections along 159th, 167th and 179th Streets shows the intersection delay and level of service for the worst movement along with the individual movement level of service and delay. The Highway Capacity Manual standard is to use average intersection delay for signalized intersections and the worst movement intersection delay for stop controlled intersections. Level of service E and F are highlighted.

Table 3 - Existing (2014) Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
US-69 SB Ramp/151st St.	Signal	**B (16.3)**	**C (20.1)**
WB Left		C (27.3)	D (37.7)
WB Thru		B (11.8)	B (11.6)
SB Left		C (20.8)	C (26.2)
SB Right		A (7.2)	B (14.3)
EB Right		A (7.9)	A (9.7)
EB Thru		B (18.7)	C (24.9)
US-69 NB Ramp/151st St.	Signal	**B (16)**	**B (14.6)**
WB Right		D (39.3)	B (18)
WB Thru		C (23.4)	B (17.7)
NB Left		D (45.3)	D (39.8)
NB Right		A (1.8)	A (1.2)
EB Left		C (33.9)	C (34.3)
EB Thru		A (5.7)	A (5)
167th St./Metcalf Ave.	2-Way Stop	**D (37.2)**	**D (44.5)**
WB Right		C (15.3)	A (8.8)
WB Thru		C (22.6)	C (21.4)
WB Left		D (26.1)	C (21.1)
EB Left		E (35.2)	E (44.5)
EB Thru		E (37.2)	E (43.8)
EB Right		C (24.6)	D (30.8)
NB Thru		A (1.6)	A (2.1)
NB Right		A (1.1)	A (1.7)
NB Left		A (3.9)	A (7.5)
SB Left		A (8.2)	A (2.4)
SB Right		A (1.4)	A (0.9)
SB Thru		A (1.9)	A (1.4)
167th St./Antioch Rd.	4-Way Stop	**B (16.2)**	**B (13.7)**
NB Right		A (6.5)	A (7.2)
NB Thru		B (13.7)	B (11.3)
NB Left		A (8.4)	B (10.2)
EB Thru		B (12)	A (9)
EB Right		B (13.9)	A (7)
EB Left		A (10)	A (8.4)
SB Left		B (11.4)	A (7.1)
SB Thru		B (12.7)	B (11.5)
SB Right		A (6)	A (5.7)
WB Left		A (8.9)	A (8)
WB Thru		C (16.2)	B (13.7)
WB Right		B (10.1)	A (8)

Table 3 - Continued
Existing (2014) Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
167th St./Lowell Ave.	1-Way Stop	**A (3.1)**	**A (0.7)**
EB Thru		A (0.7)	A (0.2)
EB Left		A (3.1)	A (0)
WB Thru		A (0.3)	A (0.4)
WB Right		A (0.7)	A (0.7)
SB Left		A (0)	A (0)
SB Right		A (0)	A (0)
167th St./KDOT Facility Dr.	1-Way Stop	**A (9.1)**	**A (6.9)**
WB Thru		A (0.5)	A (0.4)
WB Right		A (0.9)	A (0.9)
EB Thru		A (0.5)	A (0.2)
EB Left		A (3.3)	A (2.2)
SB Right		A (5.5)	A (5)
SB Left		A (9.1)	A (6.9)
US-69 SB Ramp/167th St.	1-Way Stop	**A (9.5)**	**B (10.2)**
SB Left		B (11)	B (10.2)
SB Right		A (9.5)	A (9.5)
WB Thru		A (0.4)	A (0.5)
EB Thru		A (0.4)	A (0.4)
US-69 NB Ramp/167th St.	1-Way Stop	**A (3.5)**	**A (2.1)**
WB Right		A (0.7)	A (0.6)
WB Thru		A (0.6)	A (0.4)
EB Thru		A (0.5)	A (0.4)
EB Left		A (3.5)	A (2.1)
US-69 SB Ramp/179th St.	1-Way Stop	**B (14)**	**C (18.6)**
EB Right		A (0.6)	A (0.7)
EB Thru		A (1.3)	A (1)
WB Left		A (5)	A (5)
WB Thru		A (0.8)	A (1.1)
SB Right		B (12.8)	C (18.6)
SB Left		B (14)	C (17.8)
US-69 NB Ramp/179th St.	1-Way Stop	**B (12.1)**	**B (10.1)**
NB Right		A (8)	A (8.1)
NB Left		B (12.1)	B (10.1)
WB Right		A (1.1)	A (0.9)
WB Thru		A (2.1)	A (1.2)
EB Left		A (7.3)	A (2.2)
EB Thru		A (5.1)	A (1.1)

Source: VISSIM Model using HCM 2010 methodology. LOS E and F conditions are highlighted.

The City of Overland Park and KDOT prefer an intersection level of service A-D. The 167th Street and US-69 interchange and other intersections within the study limits currently operate at an acceptable level of service during the morning peak hour. Some individual PM peak hour turning movements are operating at LOS E at the 167th Street and Metcalf Avenue intersection.

The existing crash analysis for 167th street included the intersections of Metcalf & 167th and Antioch & 167th. Crash data was collected from January 2009 to December 2013 for the side streets. In total over the five years, there were 40 crashes on 167th street and the approaches from Antioch and Metcalf. One was a fatal crash, 11 were injury crashes, and 28 were PDO crashes. 16 were angle crashes, making up about 40% of the crashes. Another eight crashes were related to animals.

With existing conditions, the interchange is not considered to have severe crash problems. Crash rates in the US-69 / 167th Street study area (0.830 MVMT) are lower than the statewide averages (1.134 MVMT) compared to other 4-lane urban highways in Kansas. However, the fatal crash rate (0.868 HMVMT) is higher than the statewide average (0.676 HMVMT). Over six years from July 2008 to May 2014, the northbound mainline had 180 crashes while southbound had 109 for a total of 289 crashes or a crash every 7 and a half days on average. There were three fatalities over the six year period in the years 2010, 2011, and 2012. There were 59 injury crashes, and the remaining 227 crashes were property damage only. The majority of the freeway crashes were rear end collisions.

The Future No-Build analysis evaluated anticipated traffic operations using design year (2040) traffic demand through an unimproved facility. Improvements at 159th Street of a full interchange were assumed to be in place since it is currently under construction and planned to open in 2015. For the design year, adjacent land use changes from vacant/agricultural to residential/business park increasing the traffic demand for the study area. Poor levels of service are expected for most of the study area movements. Future No-Build conditions warrant improvements to the existing intersections at Antioch Road, Metcalf Avenue and the interchange at US-69 to provide an acceptable level of service and improve safety.

The poor level of service shown at the study intersections in Table 3 is a result of queue backups from the study interchange. The table below shows the Future No-Build AM and PM peak hour level of service and average motorist delay. The freeway mainline Future No-Build LOS is shown in Appendix A-6 and A-7.

Table 4 - Future (2040) No-Build Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)

US-69 SB Ramp/151st St.	Signal	**C (27.1)**	**C (25)**
WB Left		F (>120)	E (66.2)
WB Thru		B (11.9)	B (10.2)
SB Left		F (>120)	F (81.1)
SB Right		F (>120)	E (56.8)
EB Right		D (50.5)	D (36.5)
EB Thru		C (25.3)	C (25.4)
US-69 NB Ramp/151st St.	Signal	**D (44.7)**	**C (21.5)**
WB Right		F (113.9)	C (24.3)
WB Thru		C (32.4)	C (28.8)
NB Left		D (40.8)	D (37.3)
NB Right		B (11.4)	A (6.5)
EB Left		D (44.4)	D (47.3)
EB Thru		A (8.4)	A (8.1)
US-69 SB Ramp/159th St.	Signal	**F (110.6)**	**F (>120)**
SB Left		F (>120)	F (>120)
SB Right		F (>120)	F (>120)
WB Left		F (>120)	F (>120)
WB Thru		B (11.5)	B (10.1)
EB Thru		F (>120)	F (>120)
EB Right		F (>120)	F (>120)
US-69 NB Ramp/159th St.	Signal	**C (26.7)**	**F (>120)**
NB Left		D (51.4)	D (41.9)
NB Right		D (38.7)	C (24)
EB Left		D (52.1)	D (51.7)
EB Thru		A (8.7)	B (12.7)
WB Thru		D (40.2)	F (>120)
WB Right		C (27.5)	F (>120)
167th St./Metcalf Ave.	Signal	**F (>120)**	**F (>120)**
WB Right		F (>120)	F (>120)
WB Thru		F (>120)	F (>120)
WB Left		F (>120)	F (>120)
EB Left		F (>120)	F (>120)
EB Thru		F (>120)	F (>120)
EB Right		F (>120)	F (>120)
NB Thru		F (115.3)	D (50.6)
NB Right		F (111.4)	D (41.2)
NB Left		F (>120)	F (111.2)
SB Left		F (101.5)	F (116.1)
SB Right		F (>120)	F (113.2)
SB Thru		F (92.2)	F (115.3)

Table 4 - Continued
Future (2040) No-Build Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
167th St./Antioch Rd.	Signal	**F (>120)**	**F (>120)**
NB Right		F (>120)	F (88.6)
NB Thru		F (>120)	D (40.2)
NB Left		F (112.4)	E (58.5)
EB Thru		F (>120)	F (>120)
EB Right		F (>120)	F (>120)
EB Left		F (>120)	F (>120)
SB Left		F (>120)	F (>120)
SB Thru		F (>120)	F (>120)
SB Right		F (>120)	F (>120)
WB Left		F (>120)	F (110.9)
WB Thru		F (>120)	F (83.9)
WB Right		F (>120)	E (76.1)
US-69 SB Ramp/167th St.	1-Way Stop	**F (>120)**	**F (>120)**
SB Left		F (>120)	F (>120)
SB Right		F (>120)	F (>120)
WB Thru		F (99.3)	A (4.2)
EB Thru		F (>120)	F (>120)
US-69 NB Ramp/167th St.	1-Way Stop	**F (>120)**	**F (89.7)**
WB Right		F (63.8)	A (6.2)
WB Thru		F (86.9)	A (8.1)
EB Thru		F (>120)	E (40.3)
EB Left		F (82.2)	F (89.7)
167th St./Lowell Ave.	1-Way Stop	**F (>120)**	**F (>120)**
EB Thru		F (>120)	F (>120)
EB Left		F (>120)	F (>120)
EB Right		F (>120)	F (>120)
WB Thru		F (>120)	C (20.5)
WB Right		F (>120)	C (17.4)
WB Left		F (>120)	D (28.2)
SB Left		F (119.6)	F (>120)
SB Right		F (70.9)	F (>120)
SB Thru		F (77.4)	F (>120)
NB Right		D (34.1)	D (27.2)
NB Left		E (39)	D (31.2)
NB Thru		C (22.4)	D (27)

Table 4 - Continued
Future (2040) No-Build Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
167th St./KDOT Facility Dr.	1-Way Stop	**F (>120)**	**F (113.1)**
WB Thru		F (81.5)	A (5.6)
WB Right		F (82.4)	C (16.9)
WB Left		F (78.6)	A (6.7)
EB Thru		F (>120)	E (49)
EB Left		F (>120)	F (113.1)
EB Right		F (>120)	E (40.3)
SB Right		F (53.8)	D (29)
SB Left		F (114.3)	F (83.9)
SB Thru		F (64.9)	D (27)
NB Left		C (23)	C (17.2)
NB Right		F (110.3)	E (35.5)
NB Thru		E (38)	D (27.6)
US-69 SB Ramp/179th St.	Signal	**B (13.8)**	**C (27.4)**
EB Right		B (14.6)	B (11.3)
EB Thru		B (15.7)	B (17.2)
WB Left		D (38.3)	C (27.4)
WB Thru		A (7.9)	A (9.6)
SB Right		B (10.5)	A (7.9)
SB Left		C (24.1)	C (20.7)
US-69 NB Ramp/179th St.	Signal	**B (19.5)**	**C (32.9)**
NB Right		D (45.2)	B (12.3)
NB Left		D (41.4)	C (24.5)
WB Right		A (7.6)	A (6.3)
WB Thru		C (20.1)	B (15.1)
EB Left		D (41.2)	C (32.9)
EB Thru		A (7.1)	A (6.1)

Source: VISSIM Model using HCM 2010 methodology. LOS E and F conditions are highlighted.

Due to the poor level of service at the study intersections along 167th Street, the Future No-Build condition also creates poor level of service along 159th Street at Antioch Road, Metcalf Road and US-69 as well as along US-69 between 159th Street and 167th Street. These results demonstrate that the existing facility cannot satisfactorily accommodate the design-year traffic demands.

2.2 Transportation System Management and Alternatives Analysis

FHWA Policy Point Two: ***Current need is not met by alternative transportation solutions. Alternative solutions are presented.***

> *The need being addressed by the request cannot be adequately satisfied by reasonable transportation system management (such as ramp metering, mass transit, and HOV facilities), geometric design, and alternative improvements to the Interstate without the proposed change(s) in access (23 CFR 625.2(a)).*

Two objectives of the improvements at this interchange are to accommodate future travel demands and improve safety. Alternative transportation system management solutions such as mass transit, HOV, improved signal timing, and minor geometric enhancements were considered early in the study process. After evaluating the anticipated future needs of this interchange, alternative transportation solutions by themselves cannot adequately address the purpose and need for the following reasons:

- Alternative transportation solutions do not address the lack of access to and from the south side of 167th Street.
- Currently no transit routes exist south of 151st Street, nor are there any plans for expansion to 167th Street, making options for improved transit travel to the area limited in the future.
- Addressing the general capacity and safety issues at the existing interchange will require more substantial improvements than can be accomplished through minor geometric enhancements such as adding turn lanes, improving intersection controls, etc.

Since the needs at this interchange cannot be adequately met by alternative transportation solutions, an Interchange Selection Study (ISS) was performed to determine a preferred alternative for this interchange. The preliminary analysis occurred in two phases. Phase 1 considered a variety of interchange types with the intent to narrow potential solutions through a qualitative evaluation process. The following potential interchange configurations were considered as part of this first phase:

- **Folded Diamond Interchange**
- **Modified Diamond Interchange**
- **Diverging Diamond Interchange (DDI)**
- **Modified Diamond with Roundabout Interchange**
- **Oval Roundabout Interchange**
- **Single Point Urban Interchange**

The Oval Roundabout and Single Point interchanges were dismissed early in the evaluation process simply due to their higher construction cost. The remaining four configurations were carried forward as potential cost-effective options and were analyzed qualitatively at a high level. Through this qualitative evaluation, the Modified Diamond with Roundabout interchange was dismissed due to potential new ADA regulations requiring the signalization of multilane roundabouts. If these potential regulations

move forward, the addition of signals on the roundabouts would likely reduce the performance of the interchange below desired levels in the design year. The Folded Diamond interchange was dismissed due to significant right-of-way impacts. The remaining two alternatives, the Modified Diamond and the Diverging Diamond were selected to move forward into Phase 2 of the Interchange Selection Study.

Phase 2 of the Interchange Selection Study then analyzed a Modified Diamond interchange and a Diverging Diamond interchange, shown below in Figures 4 and 5, in more detail. These two alternatives were evaluated based on the following factors:

- **Acceptable Level of Service**
- **Construction Cost**
- **Phasing Flexibility**
- **Right-of-Way Impacts**
- **Utility Impacts**
- **Maintenance of Traffic**
- **Safety**
- **Multi-modal Connectivity**

The Modified Diamond differentiated itself from the Diverging Diamond relative to several of the evaluation factors as discussed below:

- **Acceptable Level of Service** – Both interchange alternatives provide an acceptable level of service and address the purpose and need.

- **Safety** – The Modified Diamond is a more familiar interchange type.

- **Maintenance of Traffic** – The Modified Diamond is easier to construct and maintain 167th Street traffic and connectivity to the existing interchange ramps during construction due to the less complex configuration of the ramp terminals.

- **Phasing Flexibility** – There is the potential that 167th Street is improved prior to constructing the new south ramps and completing the full interchange. In that scenario, where no south ramps exist, the Diverging Diamond would require drivers to maneuver the crossovers at the ramp terminals with no potential to access a ramp to southbound US-69. The Modified Diamond does not present that complication under a phased scenario as the interchange would essentially function as it does today.

For these reasons, the Modified Diamond was selected as the Preferred Alternative.

Figure 4
Alternative 1 - Modified Diamond Interchange

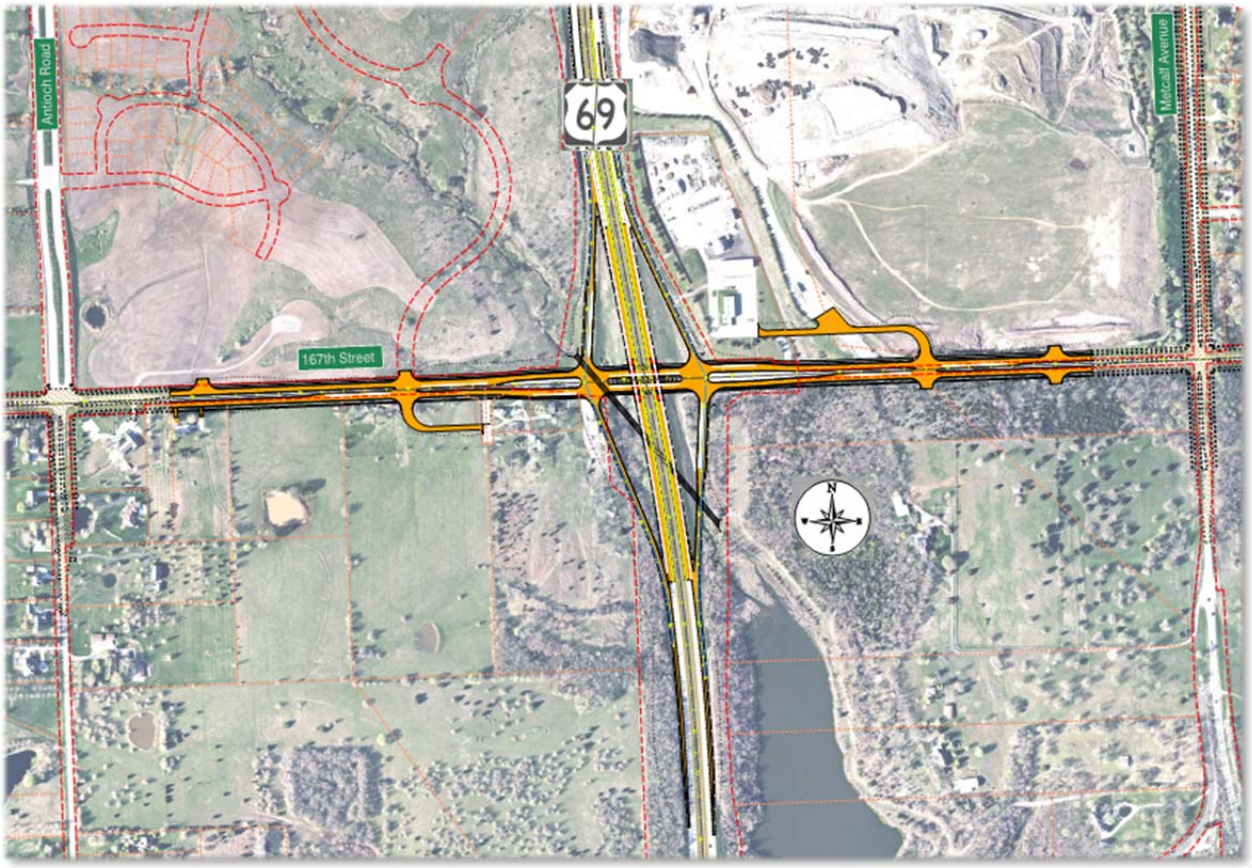
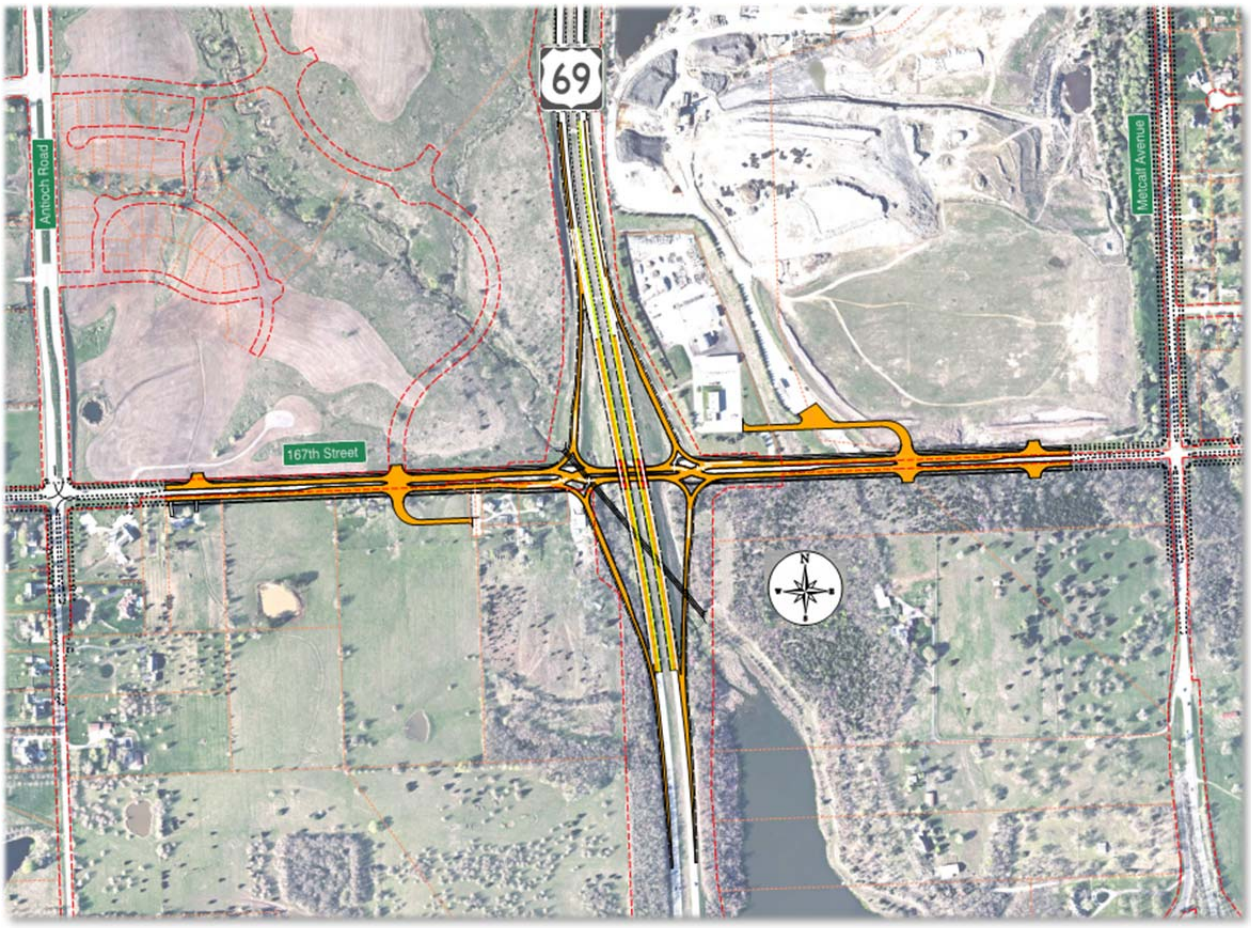


Figure 5
Alternative 2 - Diverging Diamond Interchange



2.3 Operational Analysis

FHWA Policy Point Three: *Operational and safety analysis of the proposed alternatives*

An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis shall, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (23 CFR 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, shall be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street

network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access must include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroad, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request must also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d)).

2.3.1 US-69 and 167th Street Interchange

Traffic analysis for the 2040 Build condition for the Diverging Diamond and Modified Diamond concepts was performed. These improvements are shown in Figures 4 and 5 above and do not include any improvements to US-69 or the intersections at Antioch Road and Metcalf Avenue with 167th Street. The table below compares the level of service and delay results for the Diverging Diamond and Modified Diamond interchange with no additional improvements to the study area.

Table 5 - Future (2040) Build Intersection Level of Service (LOS)

Intersection	Intersection Control	Diverging Diamond		Modified Diamond	
		AM LOS (Delay)	PM LOS (Delay)	AM LOS (Delay)	PM LOS (Delay)
US-69 SB Ramp/151st St.	Signal	**C (22.6)**	**D (43.1)**	**C (23.2)**	**C (22.5)**
WB Left		D (45.5)	D (52.6)	D (45.8)	E (57.1)
WB Thru		B (12.5)	B (10.6)	B (13.6)	B (11.8)
SB Left		C (31.6)	C (34.8)	C (31.9)	C (34)
SB Right		A (6.8)	A (8.5)	A (6.9)	A (8.6)
EB Right		B (11)	F (82.7)	B (11.4)	B (16.9)
EB Thru		C (27.4)	F (83)	C (28.4)	C (25.9)
US-69 NB Ramp/151st St.	Signal	**D (39.3)**	**C (27.2)**	**D (38.4)**	**C (28)**
WB Right		F (86)	D (39.9)	E (79)	C (28.2)
WB Thru		D (47.1)	D (40.6)	D (48.8)	D (38.6)
NB Left		D (47)	D (38.7)	D (47.8)	D (45.9)
NB Right		B (13.7)	A (6.1)	B (15.4)	B (11.2)
EB Left		D (48.9)	D (51.5)	D (53.7)	E (59.6)
EB Thru		A (9.8)	A (8.7)	A (9.2)	A (9)
US-69 SB Ramp/159th St.	Signal	**C (29.9)**	**C (24.5)**	**C (29.1)**	**C (24.5)**
SB Left		D (46)	C (33.2)	D (45.4)	C (33.4)
SB Right		B (12)	B (12.1)	B (11.7)	B (12.7)
WB Left		E (59.3)	D (36.7)	E (62.4)	D (39.4)
WB Thru		B (11.9)	A (8.6)	B (11)	B (11.3)
EB Thru		C (34.7)	C (30.8)	C (32.8)	C (30.5)
EB Right		C (31.8)	C (24.2)	C (31.6)	C (24.3)

Table 5 - Continued
Future (2040) Build Intersection Level of Service (LOS)

Intersection	Intersection Control	Diverging Diamond		Modified Diamond	
		AM LOS (Delay)	PM LOS (Delay)	AM LOS (Delay)	PM LOS (Delay)
US-69 NB Ramp/159th St.	Signal	**C (22.5)**	**C (27.8)**	**C (21.6)**	**C (26.9)**
NB Left		D (52.2)	D (38.2)	D (48.7)	D (36.1)
NB Right		B (15.9)	B (17.6)	C (31)	B (16.7)
EB Left		E (58.2)	D (47.7)	D (54.6)	D (48.7)
EB Thru		B (10.2)	B (12)	A (6.7)	B (11.8)
WB Thru		C (27.7)	D (35.6)	C (28.8)	C (35)
WB Right		C (24.6)	C (33.8)	C (25.8)	C (30.7)
167th St./Metcalf Ave.	Signal	**E (75)**	**F (91.8)**	**E (76.4)**	**F (90.4)**
WB Right		E (59.6)	F (91.6)	E (56.3)	E (68.8)
WB Thru		E (67.3)	E (77.1)	E (64.5)	E (75.9)
WB Left		E (78.7)	F (108.1)	E (79.4)	F (104.6)
EB Left		F (81.1)	F (116.2)	F (88.5)	F (114.3)
EB Thru		D (38.8)	D (54.9)	D (45.3)	E (59.8)
EB Right		C (33.3)	D (48.2)	D (36.1)	D (50.2)
NB Thru		F (>120)	E (65.5)	F (115.4)	E (64.3)
NB Right		F (>120)	E (68.1)	F (113.6)	E (57.5)
NB Left		F (>120)	F (>120)	F (>120)	F (>120)
SB Left		E (64.7)	F (92.2)	E (67.4)	F (91.3)
SB Right		C (28.3)	F (88.4)	C (27.5)	F (91.4)
SB Thru		C (32.5)	F (88.1)	C (32.3)	F (88.3)
167th St./Antioch Rd.	Signal	**F (>120)**	**F (85.8)**	**F (>120)**	**F (86.4)**
NB Right		F (>120)	B (14)	F (>120)	B (15.4)
NB Thru		F (>120)	D (41.6)	F (>120)	D (41.8)
NB Left		F (>120)	F (83.6)	F (>120)	E (67.2)
EB Thru		D (49)	D (42.6)	D (48.4)	D (41.6)
EB Right		D (45.3)	D (49.8)	D (50.3)	D (40.2)
EB Left		F (>120)	E (61.7)	F (>120)	E (62.6)
SB Left		F (>120)	F (95.4)	F (>120)	F (102.9)
SB Thru		D (45.8)	F (>120)	D (50.7)	F (>120)
SB Right		C (27.2)	F (>120)	D (35.4)	F (>120)
WB Left		E (72.5)	F (81.8)	E (73.7)	F (89.3)
WB Thru		E (61.1)	E (65.6)	E (62.9)	E (68.8)
WB Right		E (72.9)	D (53.4)	E (74.4)	E (59.6)

Table 5 - Continued
Future (2040) Build Intersection Level of Service (LOS)

Intersection	Intersection Control	Diverging Diamond		Modified Diamond	
		AM LOS (Delay)	PM LOS (Delay)	AM LOS (Delay)	PM LOS (Delay)
167th St./Lowell Ave.	1-Way Stop	**C (18.9)**	**C (21.6)**	**C (20.1)**	**D (34.4)**
EB Thru		A (0.6)	A (0.7)	A (0.9)	B (12.7)
EB Left		A (5.1)	A (9.2)	A (7.4)	B (13.1)
EB Right		A (0.7)	A (0.4)	A (0.5)	A (6.1)
WB Thru		A (0.5)	A (0.7)	A (0.6)	A (0.7)
WB Right		A (1.1)	A (0.7)	A (0.9)	A (0.9)
WB Left		A (7.9)	B (12)	A (8.6)	B (10.1)
SB Left		B (11)	B (10.3)	B (10.6)	C (16.8)
SB Right		A (7.3)	A (7)	A (5.7)	A (8.2)
SB Thru		C (15.6)	C (18)	B (13.9)	C (22.8)
NB Right		A (7.6)	B (14.8)	A (8.1)	B (12.5)
NB Left		C (15.9)	B (12.6)	B (13.3)	C (21)
NB Thru		C (18.9)	C (21.6)	C (20.1)	D (34.4)
167th St./KDOT Facility Dr.	1-Way Stop	**C (21.8)**	**C (19.5)**	**C (22)**	**C (20.8)**
WB Thru		A (0.6)	A (1)	A (0.5)	A (1)
WB Right		A (0.1)	A (0)	A (3.4)	A (0.4)
WB Left		A (6)	A (0)	A (6)	A (1.1)
EB Thru		A (0.9)	A (0.8)	A (0.6)	A (0.4)
EB Left		A (8.5)	B (11.3)	A (7.7)	A (7.8)
EB Right		A (1)	A (1.3)	A (0.9)	A (1.4)
SB Right		A (7.5)	A (10)	A (7)	B (10.1)
SB Left		B (14)	C (15.1)	C (15.9)	B (12.5)
SB Thru		C (17.6)	C (19)	B (15)	B (14.6)
NB Left		A (8)	A (7.8)	A (7.3)	A (7.1)
NB Right		A (7.5)	A (7.5)	A (7.7)	A (5.4)
NB Thru		C (21.8)	C (19.5)	C (22)	C (20.8)
US-69 SB Ramp/167th St.	Signal	**B (17)**	**B (16.9)**	**C (27.8)**	**D (38)**
SB Left		C (20.9)	C (21.7)	D (40.1)	E (60.8)
SB Right		C (20.7)	B (19.4)	B (19.6)	C (27.8)
WB Thru		B (16)	B (17.3)	B (13.5)	B (10.4)
EB Thru		B (17.8)	B (19.5)	D (35.5)	E (58.1)
US-69 NB Ramp/167th St.	Signal	**B (10.1)**	**B (13.6)**	**B (17.4)**	**C (29.3)**
WB Right		A (3.9)	A (5.4)	B (18.3)	C (27.8)
WB Thru		B (14.1)	B (17.3)	C (21)	D (36.3)
EB Thru		B (11.4)	B (15.9)	A (5.3)	A (4.8)
EB Left		A (5.5)	A (7)	C (34.7)	D (49.9)

Table 5 - Continued
Future (2040) Build Intersection Level of Service (LOS)

Intersection	Intersection Control	Diverging Diamond		Modified Diamond	
		AM LOS (Delay)	PM LOS (Delay)	AM LOS (Delay)	PM LOS (Delay)
US-69 SB Ramp/179th St.	Signal	**B (13.5)**	**B (13.5)**	**B (13)**	**B (13.4)**
EB Right		B (14)	B (11)	B (12.6)	B (11.4)
EB Thru		B (15.3)	B (17.2)	B (14.7)	B (17.2)
WB Left		C (31.5)	C (29.5)	C (31.8)	C (28.2)
WB Thru		A (9.8)	A (9.5)	B (10.4)	A (9.5)
SB Right		B (10.5)	A (8.2)	B (10.8)	A (8.1)
SB Left		C (21.3)	B (19.7)	C (22.1)	B (19.3)
US-69 NB Ramp/179th St.	Signal	**B (12.3)**	**B (12.5)**	**B (12.4)**	**B (12.3)**
NB Right		C (20.3)	A (10)	C (21)	A (9.4)
NB Left		D (39.6)	C (27.8)	D (41.9)	C (25.7)
WB Right		A (6.6)	A (5.9)	A (6.5)	A (5.9)
WB Thru		B (12.2)	B (12.8)	B (12.1)	B (12.9)
EB Left		C (31.2)	C (25.7)	C (32.4)	C (25.1)
EB Thru		A (4.9)	A (4.7)	A (4.6)	A (5)

Source: HNTB VISSIM Model using HCM 2010 methodology. LOS E and F conditions are highlighted.

As shown in the table above, both interchange alternatives experience unacceptable level of service at the Antioch Road and Metcalf Avenue intersections with 167th Street as well as numerous movements along 151st, 159th and 167th Street. The level of service and delay problems are a result of the unimproved Antioch and Metcalf intersections with 167th Street which results in long delays for turning vehicles at the intersections. However, the levels of service at the ramp terminals for the entire intersection are acceptable for both the DDI and Modified Diamond alternatives with only two unacceptable movements at the southbound ramp terminal for the Modified Diamond. Given that both interchange alternatives operate acceptably, the Modified Diamond interchange was selected as the preferred alternative due to its safety benefits, maintenance of traffic, and phasing flexibility.

To further improve the level of service, the study team then evaluated the Modified Diamond preferred alternative with additional enhancements. These enhancements include adding an additional through lane on US-69 through the study area and improvements to the Antioch Road and Metcalf Avenue intersections with 167th Street. Metcalf is assumed to be a six-lane facility with turn lanes and Antioch is assumed to be a four-lane facility with turn lanes. The results in the table below represent 2040 levels of service with these additional enhancements.

Table 6 - Future (2040) Modified Diamond with Additional Enhancements Preferred Build Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
US-69 SB Ramp/151st St.	Signal	**C (22)**	**C (25.9)**
WB Left		D (46.9)	E (60.5)
WB Thru		B (12.3)	B (15.1)
SB Left		C (32.2)	D (36.2)
SB Right		A (6.8)	B (10.1)
EB Right		B (11.4)	C (21.4)
EB Thru		C (27.1)	C (34.8)
US-69 NB Ramp/151st St.	Signal	**D (41.4)**	**C (22.6)**
WB Right		E (69.2)	B (17.7)
WB Thru		D (52.4)	C (28.3)
NB Left		D (39.9)	D (40.5)
NB Right		B (10.2)	A (5.4)
EB Left		D (43.5)	C (33.7)
EB Thru		B (13.5)	A (7.5)
US-69 SB Ramp/159th St.	Signal	**D (37.1)**	**C (27.5)**
SB Left		D (53)	D (35.1)
SB Right		A (9.7)	B (13.4)
WB Left		E (57.1)	D (41.6)
WB Thru		B (17.6)	B (11.8)
EB Thru		D (47.3)	D (39.5)
EB Right		D (44.9)	C (32.4)
US-69 NB Ramp/159th St.	Signal	**C (34.8)**	**C (27.8)**
NB Left		E (61.9)	D (36.8)
NB Right		E (75.5)	B (19)
EB Left		E (55.3)	D (49.6)
EB Thru		B (11.5)	B (13.5)
WB Thru		D (44)	D (35.8)
WB Right		D (39.5)	C (32.7)
167th St./Metcalf Ave.	Signal	**D (53.1)**	**D (52.2)**
WB Right		B (19.5)	C (29)
WB Thru		D (53.2)	F (98.1)
WB Left		E (62.5)	F (107.6)
EB Left		D (53.8)	E (73.7)
EB Thru		D (42.9)	E (59.7)
EB Right		A (8.8)	C (30.4)
NB Thru		E (71)	E (64)
NB Right		D (46.5)	A (7.9)
NB Left		F (99)	F (108.1)
SB Left		E (62.9)	D (42.5)
SB Right		A (9.8)	C (29.7)
SB Thru		C (23.9)	D (40.3)

Table 6 - Future (2040) Modified Diamond with Additional Enhancements Preferred Build Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
167th St./Antioch Road	Signal	**D (48.3)**	**D (46.7)**
NB Right		C (29.3)	B (11.5)
NB Thru		E (68.6)	D (35.3)
NB Left		E (73.6)	E (60.1)
EB Thru		D (42.6)	D (41.8)
EB Right		B (13.1)	C (22.8)
EB Left		E (55.2)	D (54.6)
SB Left		D (54.3)	D (54.2)
SB Thru		C (23)	E (62.4)
SB Right		A (4.5)	C (22.7)
WB Left		E (57.8)	E (63.4)
WB Thru		D (47.5)	D (50.3)
WB Right		B (19.7)	B (10.8)
167th St./Lowell Ave.	1-Way Stop	**C (19.5)**	**D (29.2)**
EB Thru		A (0.8)	A (4.4)
EB Left		A (6.6)	A (9.8)
EB Right		A (1.1)	A (2.4)
WB Thru		A (0.7)	A (1)
WB Right		A (0.7)	A (1.1)
WB Left		A (6.7)	A (9.1)
SB Left		B (14.1)	C (19.5)
SB Right		A (9.7)	B (10.8)
SB Thru		C (19.5)	D (29.2)
NB Right		A (8.8)	A (9.7)
NB Left		B (14.4)	B (14.8)
NB Thru		C (19.2)	D (28.2)
167th St./KDOT Facility Dr.	1-Way Stop	**C (17.8)**	**C (19.1)**
WB Thru		A (0.9)	A (1)
WB Right		A (1)	A (0.8)
WB Left		A (4.2)	A (1.6)
EB Thru		A (0.8)	A (0.6)
EB Left		A (5)	A (6.8)
EB Right		A (1)	A (1.1)
SB Right		A (8.7)	B (12.4)
SB Left		C (16.8)	C (15.6)
SB Thru		C (17.8)	C (17.5)
NB Left		A (7.2)	A (7.4)
NB Right		A (7.2)	A (5.6)
NB Thru		C (17.3)	C (19.1)

Table 6 - Future (2040) Modified Diamond with Additional Enhancements Preferred Build Intersection Level of Service (LOS)

Intersection	Intersection Control	AM LOS (Delay)	PM LOS (Delay)
US-69 SB Ramp/167th St.	Signal	**B (14.1)**	**C (29.1)**
SB Left		B (19.9)	D (40.4)
SB Right		B (10.8)	C (23.1)
WB Thru		A (9)	A (9.1)
EB Thru		B (17.5)	D (50.2)
US-69 NB Ramp/167th St.	Signal	**C (25.7)**	**C (22.8)**
WB Right		B (17.5)	C (23.5)
WB Thru		D (43.9)	C (30.7)
EB Thru		A (5.7)	A (2.8)
EB Left		C (33.6)	D (35.2)
US-69 SB Ramp/179th St.	Signal	**B (13.7)**	**B (13.2)**
EB Right		B (13)	B (13)
EB Thru		B (15.6)	B (20)
WB Left		C (32.1)	C (31.1)
WB Thru		B (10.6)	B (12.4)
SB Right		B (10.8)	A (9.2)
SB Left		C (21.5)	B (19.6)
US-69 NB Ramp/179th St.	Signal	**B (14.4)**	**A (8.8)**
NB Right		B (15.3)	A (9.6)
NB Left		C (30.7)	C (26.5)
WB Right		A (7.3)	A (5.9)
WB Thru		B (15.9)	B (13.1)
EB Left		D (37.5)	C (26.5)
EB Thru		A (7)	A (4.8)

Source: HNTB VISSIM Model using HCM 2010 methodology. LOS E and F conditions are highlighted.

As shown in the table above, the Modified Diamond interchange with additional enhancements greatly improves levels of service. The level of service and delay problems at 159th Street and 167th Street are a result of individual movements with very high turn volumes which results in long delays for turning vehicles at the intersections. However, the overall intersection level of service remains acceptable and these delays exist regardless of the interchange type selected.

Vehicle queues were also analyzed as it is important to design the roadway so that vehicle queues do not back up into adjacent signalized intersections or through the off-ramps onto the mainline as this can cause additional delay and safety concerns. Travel time results and vehicle queue results are graphically shown in the Appendix. Queue results indicate that vehicle queues do not back up into adjacent signalized intersections or onto the freeway mainline.

2.3.2 US 69 Mainline

US-69 operations were analyzed for 2040 conditions by increasing existing traffic based on historical US-69 growth rates. Table 7 shows the results of the VISSIM analysis considering the scenarios of the Future No-Build compared with the Future Build that includes the modified diamond interchange at 167th Street, six-lanes on US-69, and signalized intersections at Antioch Road and Metcalf Avenue with 167th Street.

Table 7 - US-69 Mainline Level of Service - 2040

US-69 Segment	2040 No-Build			2040 Build		
AM Peak Hour	Peak Density	Peak Speed	LOS	Peak Density	Peak Speed	LOS
Southbound						
North of 151st Off Ramp	204.53	1.66	F	21.36	57.26	C
Between 151st Off and On Ramps	213.66	1.66	F	20.66	57.76	C
Between 159th Off and On ramps	216.81	1.56	F	15.98	65.75	B
Between 159th On and 167th Off	227.01	1.52	F	12.91	66.12	B
Between 167th Ramps	---	---	---	12.66	66.64	B
167th On Ramp	---	---	---	11.82	65.39	B
Between 167th and 179th	18.44	61.65	C	14.11	65.52	B
North of 179th Off ramp	16.35	64.33	B	11.76	65.51	B
Between 179th Off and On Ramps	12.06	66.45	B	9.87	67.04	A
South of 179th On ramp	13.50	63.11	B	9.79	65.58	A
Northbound						
South of 179th Off ramp	85.17	19.14	F	28.27	60.60	D
Between 179th Off and On Ramps	106.24	14.86	F	31.58	59.08	D
North of 179th On ramp	64.16	34.84	F	34.24	50.26	D
Between 167th and 179th	35.68	57.87	E	37.48	56.75	E
167th Off Ramp	---	---	---	30.22	60.33	D
Between 167th Ramps	---	---	---	32.95	60.64	D
167th On Ramp	25.05	63.74	C	23.83	59.92	C
Between 167th On and 159th Off	27.04	59.32	D	28.74	60.13	D
South of 159th Off Ramp	27.66	58.15	D	23.10	61.17	C
Between 159th Off and On ramps	37.35	56.73	E	33.61	61.86	D
Between 159th On ramp and 151st Off ramp	33.07	54.84	D	33.24	56.50	D
Between 151st Off and On Ramps	38.76	54.64	E	33.91	55.41	D
North of 151st On Ramp	36.42	56.03	E	31.46	56.22	D

Table 7 - Continued
US-69 Mainline Level of Service – 2040

US-69 Segment	2040 No-Build			2040 Build		
PM Peak Hour	Peak Density	Peak Speed	LOS	Peak Density	Peak Speed	LOS
Southbound						
North of 151st Off Ramp	184.65	3.14	F	34.19	54.86	D
Between 151st Off and On Ramps	185.87	3.22	F	34.71	56.14	D
Between 159th Off and On ramps	190.69	4.14	F	29.59	63.14	D
Between 159th On and 167th Off	117.70	43.28	F	26.13	61.15	D
Between 167th Ramps	---	---	---	29.20	63.18	D
167th On Ramp	---	---	---	29.84	55.48	D
Between 167th and 179th	30.96	59.37	D	34.34	57.55	D
North of 179th Off ramp	22.56	58.94	C	23.84	61.63	C
Between 179th Off and On Ramps	22.41	64.98	C	23.09	64.48	C
South of 179th On ramp	25.69	59.99	C	21.55	64.14	C
Northbound						
South of 179th Off ramp	25.27	63.32	C	16.67	65.94	B
Between 179th Off and On Ramps	26.09	61.45	D	16.12	64.56	B
North of 179th On ramp	35.24	48.91	E	15.63	62.84	B
Between 167th and 179th	31.71	60.64	D	20.62	65.04	C
167th Off Ramp	---	---	---	16.77	64.83	B
Between 167th Ramps	---	---	---	18.89	65.19	C
167th On Ramp	24.19	62.17	C	16.20	63.49	B
Between 167th On and 159th Off	24.65	61.72	C	18.12	64.82	C
South of 159th Off Ramp	176.00	27.98	F	15.57	64.87	B
Between 159th Off and On ramps	30.93	61.62	D	21.14	64.80	C
Between 159th On ramp and 151st Off ramp	28.17	56.52	D	20.90	60.85	C
Between 151st Off and On Ramps	35.40	56.11	E	24.19	57.72	C
North of 151st On Ramp	33.04	57.03	D	25.28	57.52	C

Source: HNTB VISSIM Model

As shown in the table above, there are numerous locations expected to operate at LOS E or F for the No-Build scenario. For the 2040 Build scenario only one location is expected to operate at LOS E in 2040 – NB US-69 between 167th Street and 179th Street during the AM peak hour. The Kansas Department of Transportation has agreed that several factors, including differences in actual versus projected traffic and the LOS E being close to the LOS D range, make this single level of service E acceptable for the 2040 design year despite the typical LOS threshold being LOS D.

Safety within the study area is expected to improve in the future with the proposed improvements discussed above.

Conceptual Signing Plan

A conceptual signing plan depicting the type and location of the signs proposed to support the preferred alternative is shown in the Appendix C.

2.3.3 Conclusion

An operational and safety analysis concluded that the proposed change in access does not have an adverse impact on the safety and operation of the highway facility in the 2040 design year. The Modified Diamond interchange provides a desirable overall level of service D or better for all intersections in the study area. One segment of US-69 is expected to operate at an undesirable level of service in the design year. Traffic and safety is expected to improve throughout the study area as a result of the proposed improvements compared to the No-Build condition.

2.4 Access Connections and Design

FHWA Policy Point Four: ***Proposed access connects to a public road only and will provide for all traffic movements***

> *The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access for managed lanes (e.g., transit, HOVs, HOT lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)).*

The proposed US-69 and 167th Street interchange provides full access between US-69 and 167th Street. Plan plates of the interchange study area and Preferred Alternative are shown in the Appendix.

The preferred alternative maintains access to the adjacent properties along 167th Street. The local access configurations shown in the plan plates have been discussed with KDOT Road Design Staff and the operational analysis indicates acceptable traffic operations.

The preferred alternative meets or exceeds current AASHTO Green Book guidance, and KDOT, and City of Overland Park design standards. The preliminary design criteria established for the proposed improvements are shown in the Table below. The design criteria will be revisited in the design phase to address any changes in design standards.

Table 8 - US-69 and 167th Street Design Criteria

Design Feature	US-69		Ramps						167th Street
			Regular Ramps						
			At Gores		Intermediate		Departing/ Approaching Side Rd.		
	Desirable	Minimum	Entrance	Exit	Desirable	Minimum	Desirable	Minimum	
Design Speed (mph)	75	70	50	55	45	40	35	30	50
Design Vehicle	WB-67		WB-67		WB-67		WB-67		WB-50 (Ck WB-67)
Typical Section									
-Lane Width (ft)	12		16 (1 lane), 12 each (2 or more lanes)						Varies (see Typical Sections)
-Pavement Cross Slope	1.60% NC		1.60% NC		1.60% NC		1.60% NC		2.10%
-Shoulders/Curbs (ft)	Shoulders		Shoulders						Curbs
-Outside (Rt.)[1]	10		8		8		8		OP Type B
-Median (Lt.)[1]	6		2		2		2		OP Type E
-Percent Grade									
-Minimum Desirable	0.50% (0.30% min.)		0.50% (0.30% min.)		0.50% (0.30% min.)		0.50% (0.30% min.)		1%
-Maximum Desirable	3%		5%		5%		3%		6%
-Min. Stopping Sight Dist. (ft)	820	730	425	495	360	305	250	200	425
-Min. K Values									
-Sag Vertical	206	181	96	115	79	64	49	37	96, Comfort OK
-Crest Vertical	312	247	84	114	61	44	29	19	84
-Horizontal Curvature[2]									
-Des. Minimum Radius (ft)	3620	3150	1560	1920	1250	965	715	510	1200
-Des. Max. Superelevation[3]	6% (7.2% max.)		8.0%		8.0%		8.0%		N/A
Vertical Clearance									
-Over highways & local roads w/ I/C	16'-4"		16'-4"		16'-4"		16'-4"		16'-4"
-Over local roads	15'-4"		15'-4"		15'-4"		15'-4"		15'-4"
Miscellaneous									
-Curb Return Radii (ft)	N/A		N/A		N/A		60 (sho.)/ 75 (c&g)		30 (sidestreets)/ 50 (thoroughfare)
-Clear Zone (ft)	34		24 (22 min.)	24	24	16	16	16	2 (from back of curb)

167th Street DDI Criteria[4]	Design Speed (mph)	Crossing Angle	Tangent Length (Before Crossover)	Tangent Length (After Crossover)	Curve Radii (at Crossover)
	30 (25 Posted)	40°-50°	15'-20'	10'-15'	150'-300'

Design Criteria based on 2011 AASHTO Green Book and 2014 KDOT Road Manual

1. Rt. & Lt. Is referenced looking in the direction of traffic.
2. Desired maximum superelevation is 6.0%
3. Use e_{max} = 8% AASHTO table
4. Design criteria for Diverging Diamond Interchange is based on MoDOT's Engineering Policy Guide section 234.6.

2.5 Consistency with Transportation Plans

FHWA Policy Point Five: *Consistent with local and regional land use and transportation plans*

The proposal considers and is consistent with local and regional land use and transportation plans. Prior to receiving final approval, all requests for new or revised access must be included in

an adopted Metropolitan Transportation Plan, in the adopted Statewide or Metropolitan Transportation Improvement Program (STIP or TIP), and the Congestion Management Process within transportation management areas, as appropriate, and as specified in 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

The US-69 and 167th Street Preferred Alternative is consistent with other local and regional land use and transportation plans. Plans include:

1. MARC Transportation Improvement Program 2014 - 2018 is an important document for budgeting the funds needed to make transportation improvements possible in the Kansas City metropolitan area. It represents an agency's intent to construct or implement a specific project and the anticipated flow of federal funds and matching state or local contributions. The improvement of Metcalf Avenue and US-69 north of 167th Street is included in the MARC TIP as follows:

   TIP Number 350214
   Project Name: Metcalf Avenue, 159th Street to 167th Street
   Project Category: Reconstruction (Added Capacity)

   Project Description: Reconstruct unimproved 2-lane roadway to 4-lane thoroughfare with curb and gutter, sidewalks, raised median, turn lanes, storm sewers and street lighting.

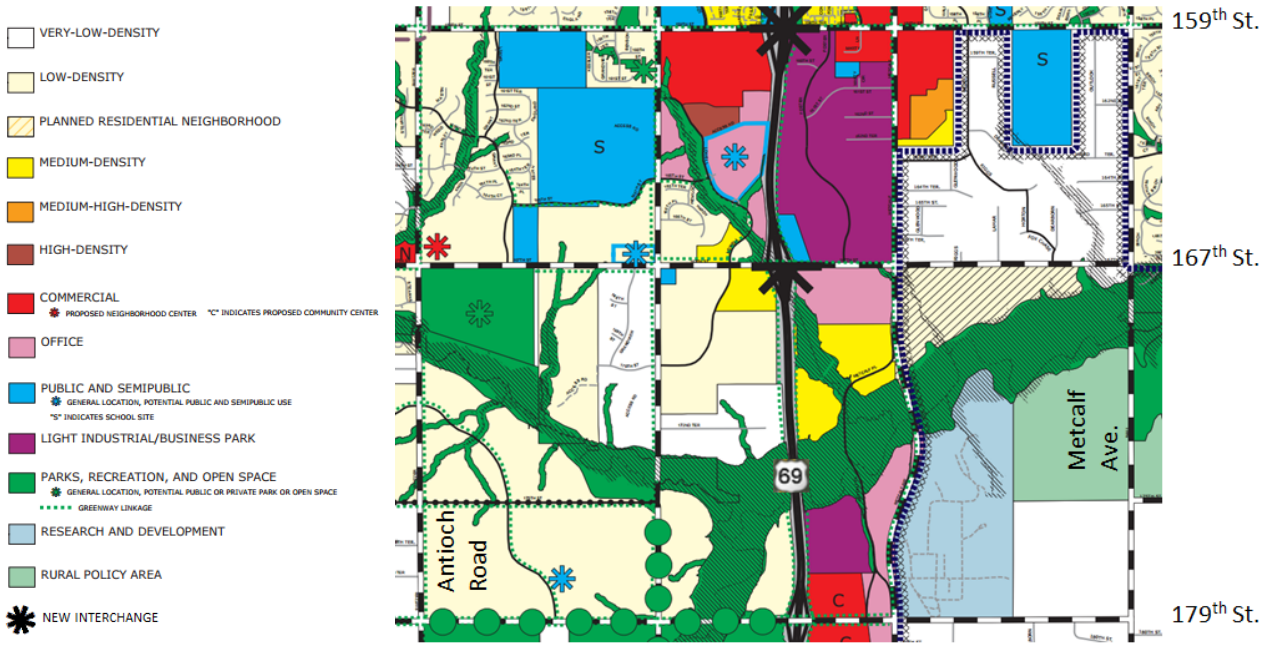
   TIP Number 350224 (Combined with 350219)
   Project Name: US-69 from 167th Street to 151st Street
   Project Category: Widening & Resurfacing (Added Capacity)

   Project Description: Construct auxiliary lanes on US-69 (NB and SB) from 167th Street north to 151st Street.

2. Overland Park Master Plan

   The City of Overland Park has identified the area around US-69 and 167th Street as a light to medium growth area, but overall the US-69 and 167th Street corridors will experience high levels of growth over the next 30 years. Areas immediately adjacent to the proposed interchange are designated as light industrial/business park, medium density housing and parks and recreation land use.

Figure 6 - Overland Park Future Development Plan



3. I-35/US-69 Major Investment Study

The I-35/US-69 MIS was sponsored by KDOT in coordination with MARC and several cities in Johnson County. The purpose of the study, with a design year of 2020, was to identify needed future improvements for the I-35 and US-69 highway corridors. The MIS southern study terminus along US-69 was 179th.

4. Overland Park South Streets Study

The Overland Park South Streets Study was initiated in the Spring of 2014 in order to analyze all of the thoroughfare roadways from 159th Street to 215th Street in the Overland Park area. One of the main goals of the study was to right size the roadways given lower density development and the abundance of parks and floodplain areas. There was also a desire to increase the investment in bicycle and pedestrian accommodations in the study area.

5. 167th Street Preliminary Engineering Study

The 2003 City of Overland Park Preliminary Engineering Study (PES) analyzed the proposed configurations of Pflumm Road from 159th Street to 175th Street, 167th Street from Pflumm Road to Metcalf Avenue, and Quivira, Switzer, and Antioch Roads between 159th Street and 167th Street. The portion that is pertinent to the current study, 167th Street between Antioch Road and Metcalf Avenue,

was proposed to be a four-lane arterial roadway. This is in conformance with what this current study recommends.

Taken collectively, these plans and studies highlight coordination between the City of Overland Park, KDOT and the regional planning agency, MARC.

2.6 Consistency with Future Access Plans

FHWA Policy Point Six: *The Concept Study considered regional impacts*

> *In corridors where the potential exists for future multiple interchange additions, a comprehensive corridor or network study must accompany all requests for new or revised access with recommendations that address all of the proposed and desired access changes within the context of a longer-range system or network plan (23 U.S.C. 109(d), 23 CFR 625.2(a), 655.603(d), and 771.111).*

There are no plans for any new access along US-69 between 151st Street and 199th Street. However, the I-35/US-69 Major Investment Study (MIS) identified that US-69 would need to be a six lane facility south to 179th Street and that 167th Street should be constructed as a full diamond interchange. The study had also identified the need for a full access 159th Street interchange which is set to open in 2015.

2.7 Coordination with Future Development

FHWA Policy Point Seven: *The Proposed Concept is to serve regional transportation needs.*

> *When a new or revised access point is due to a new, expanded, or substantial change in current or planned future development or land use, requests must demonstrate appropriate coordination has occurred between the development and any proposed transportation system improvements (23 CFR 625.2(a) and 655.603(d)). The request must describe the commitments agreed upon to assure adequate collection and dispersion of the traffic resulting from the development with the adjoining local street network and Interstate access point (23 CFR 625.2(a) and 655.603(d)).*

The preferred alternative provides adequate collection and dispersion of the traffic resulting from the development at 159th Street as well as the improvements to Metcalf Avenue and US-69. The preferred alternative also completes a full access interchange alleviating congestion on Metcalf Avenue and 159th Street. During initial evaluation of the Preferred Concept, it was determined that additional capacity was needed on US-69 through the project area. The I-35/US-69 MIS had also expected US-69 to eventually be improved to a six-lane facility to 179th Street by 2020. The current recommendation is to improve US-69 to a six-lane facility past 179th Street by 2040. The Preferred Concept has an acceptable level of service and improves the interchange to full direct access.

2.8 Status of NEPA

FHWA Policy Point Eight: ***The Preferred Concept will be evaluated using NEPA guidelines.***

> *The proposal can be expected to be included as an alternative in the required environmental evaluation, review and processing. The proposal should include supporting information and current status of the environmental processing (23 CFR 771.111).*

During this study, a preliminary assessment of environmental impacts was performed. This evaluation included a desktop survey and one field visit. Through this investigation, it is anticipated that environmental impacts will be limited to Corp-Jurisdictional streams and wetlands only.

At this time, funding has not been identified for design or construction of these improvements. When identified, initial activities will include preparing the appropriate environmental documentation in accordance with NEPA. It is anticipated that a Categorical Exclusion will be sufficient to satisfy NEPA requirements.

2.9 Conclusion

The current partial interchange cannot satisfactorily meet the future purpose and need for the following reasons:

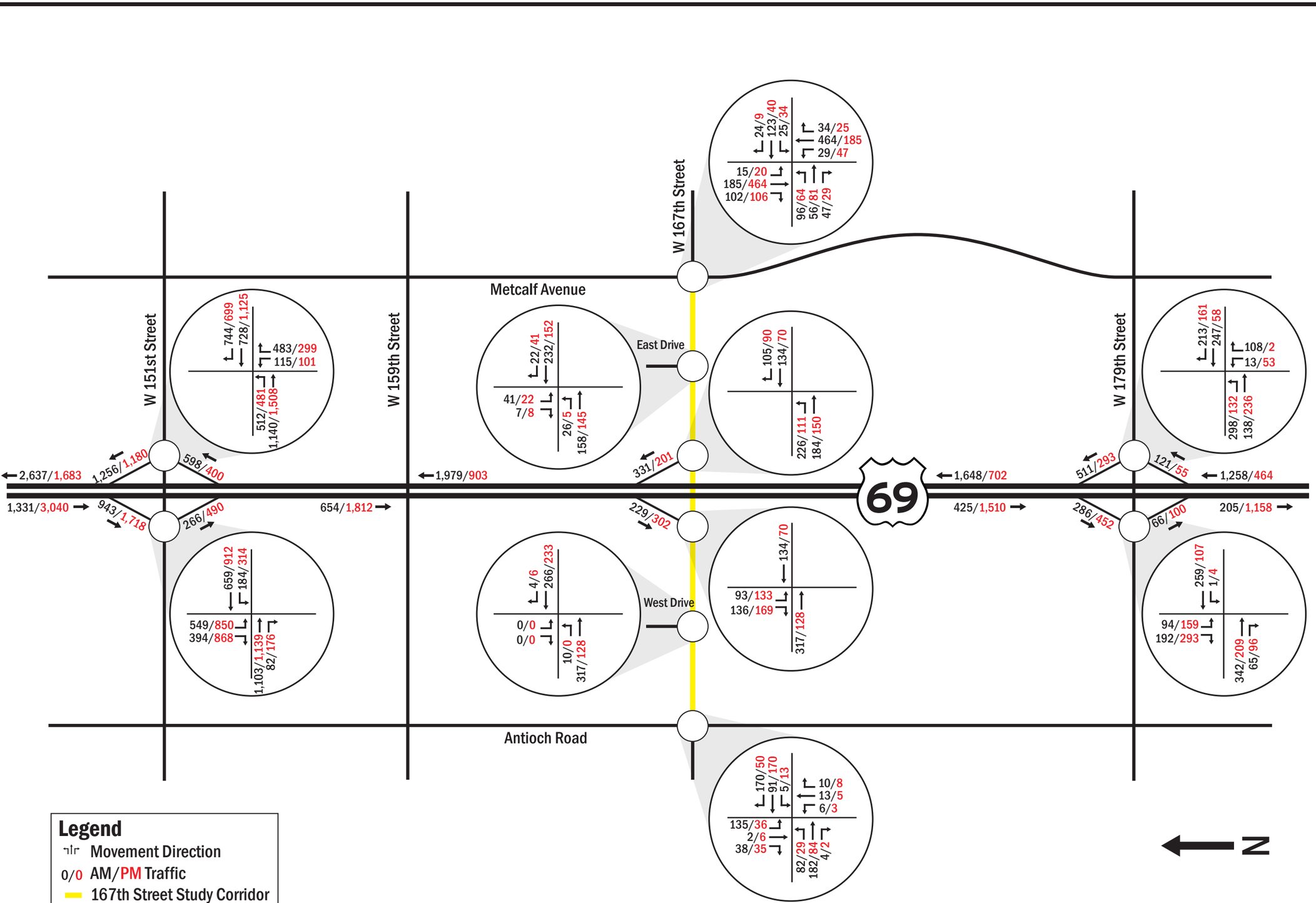
- It cannot adequately accommodate the design-year traffic demands due to the development trends south along US-69.
- Lack of access to 167th Street from northbound US-69 or access to southbound US-69 from 167th Street.
- The existing interchange has roadway geometric deficiencies, bridge deficiencies, flooding issues, and safety concerns. The general capacity and safety issues at the existing interchange will require more substantial improvements than can be accomplished through minor geometric enhancements such as adding turn lanes, improving intersection controls, etc. or other alternative transportation solutions.

The proposed improvements to the US-69 and 167th Street interchange are expected to mitigate the existing and future issues presented in this request and meet the future purpose and need. Therefore, the City of Overland Park requests approval from KDOT for a modification in access to the US-69 and 167th Street interchange consistent with the Preferred Concept developed through this study.

This request documents that the modified access point at US-69 and 167th Street satisfies the requirements outlined in the Federal Register.

Appendix A

Traffic Analysis



Legend

- ⌐|⌐ Movement Direction
- 0/0 AM/PM Traffic
- 167th Street Study Corridor

EXHIBIT

1

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Existing (2014) AM/PM Peak Hour Traffic

HNTB

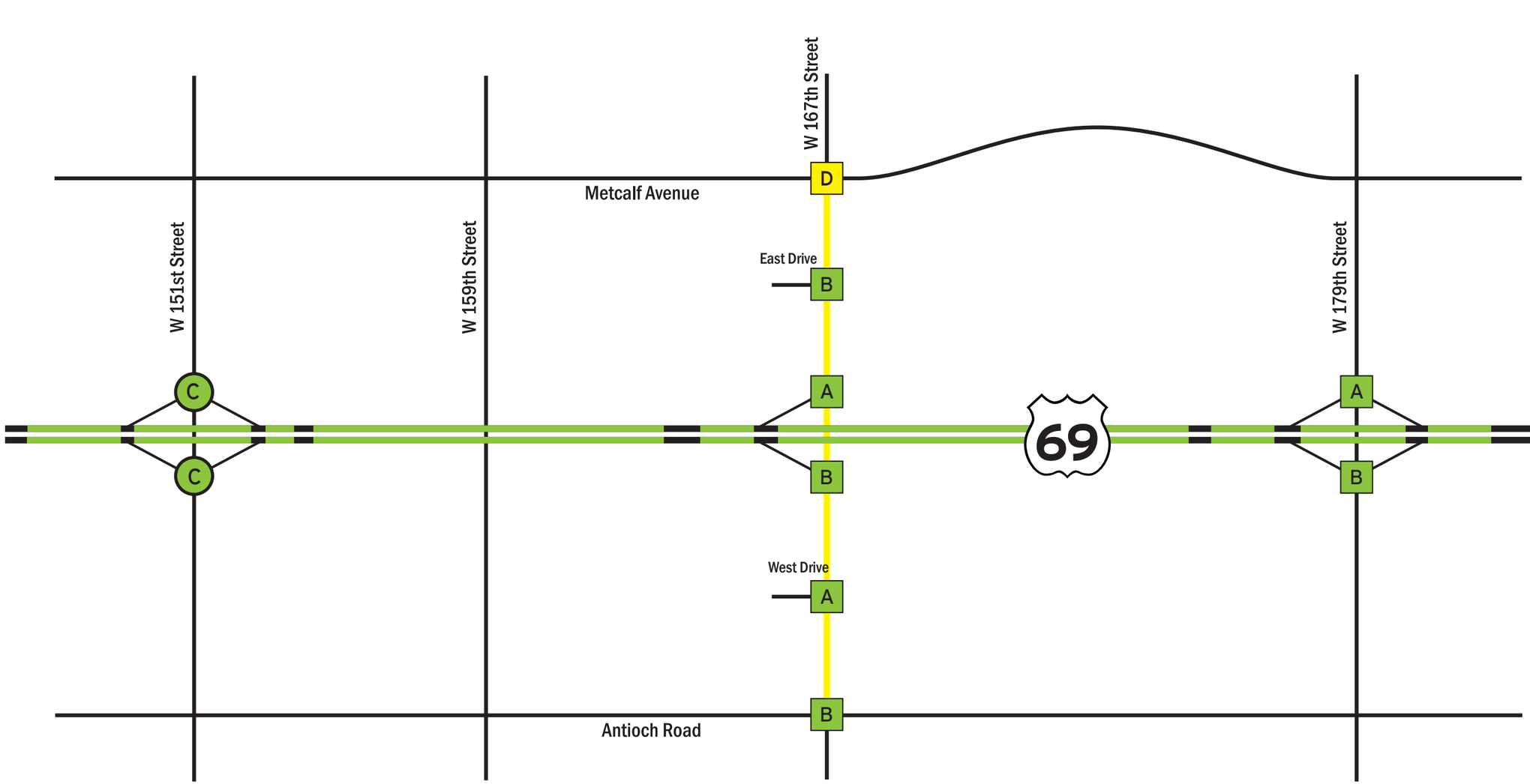
EXHIBIT

2

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Existing (2014) AM Peak Level of Service



Legend
167th Street Study Corridor

	Freeway (Density, pc/mi/ln)	Intersection Signalized (Delay, Sec)	Unsignalized (Delay, Sec)
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

N

HNTB

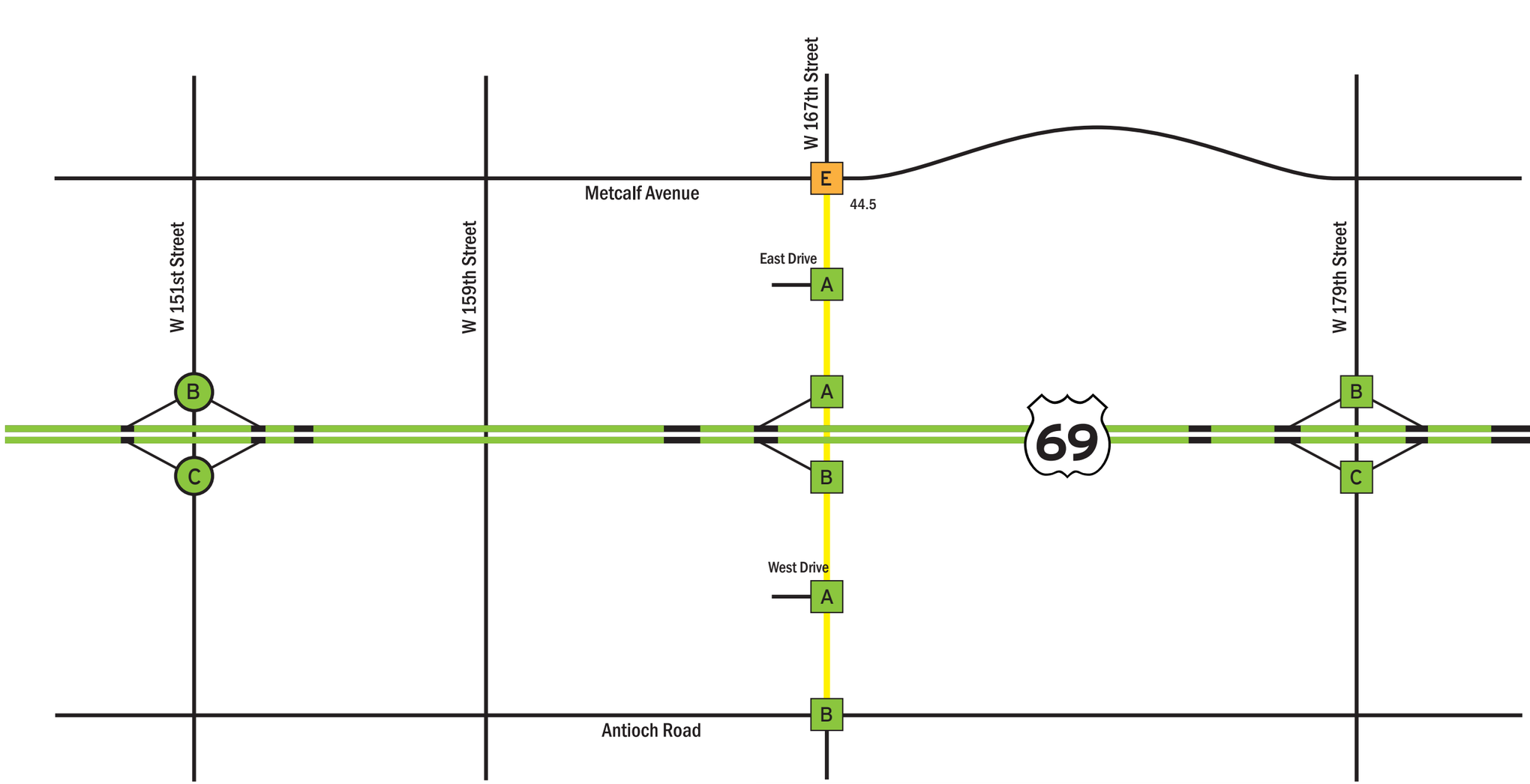
EXHIBIT

3

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Existing (2014) PM Peak Level of Service



Legend
167th Street Study Corridor

	Freeway (Density, pc/mi/ln)	Intersection Signalized	(Delay, Sec) Unsignalized
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

N

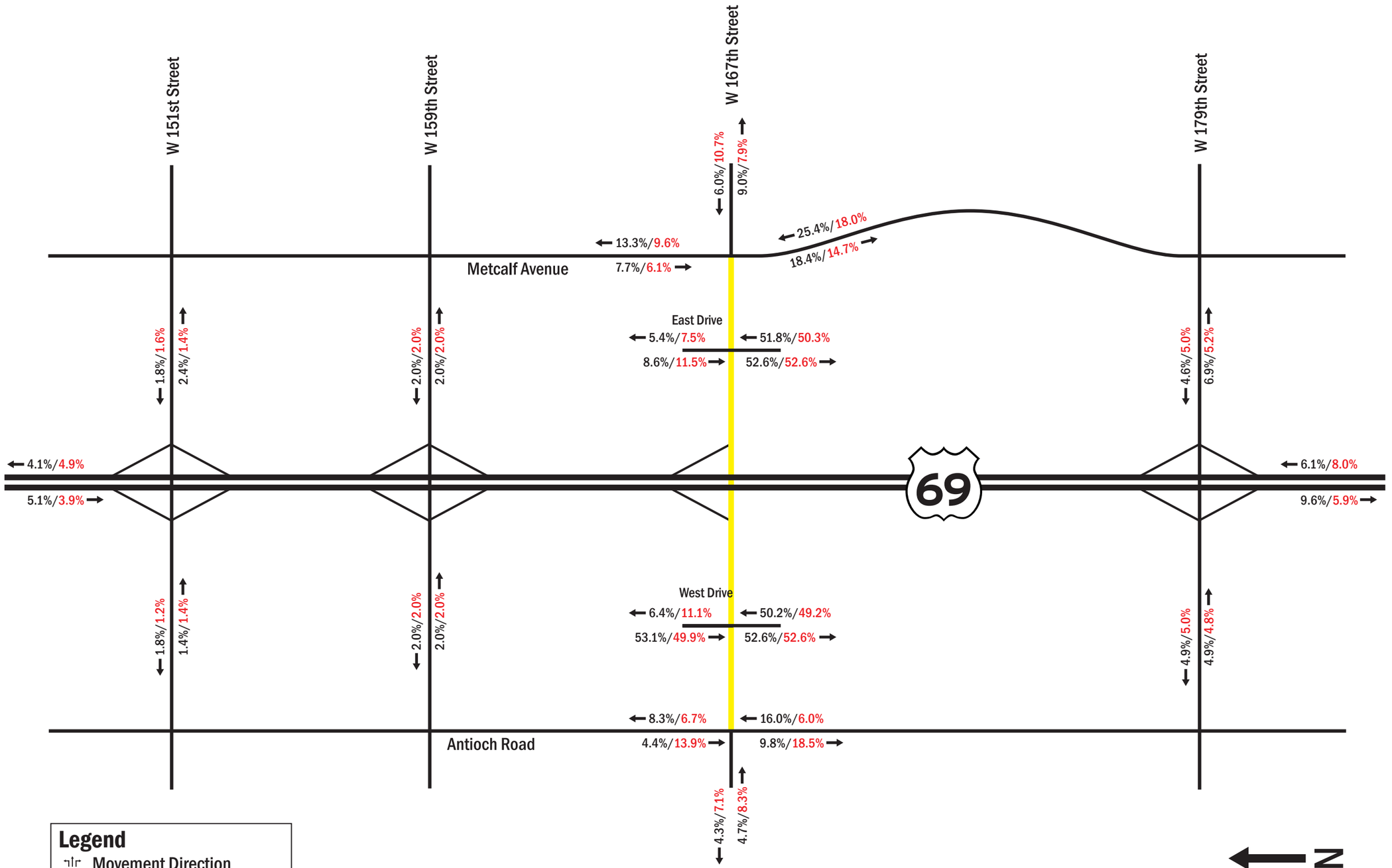
HNTB

EXHIBIT 4

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

AM/PM Annual Growth Rates



HNTB

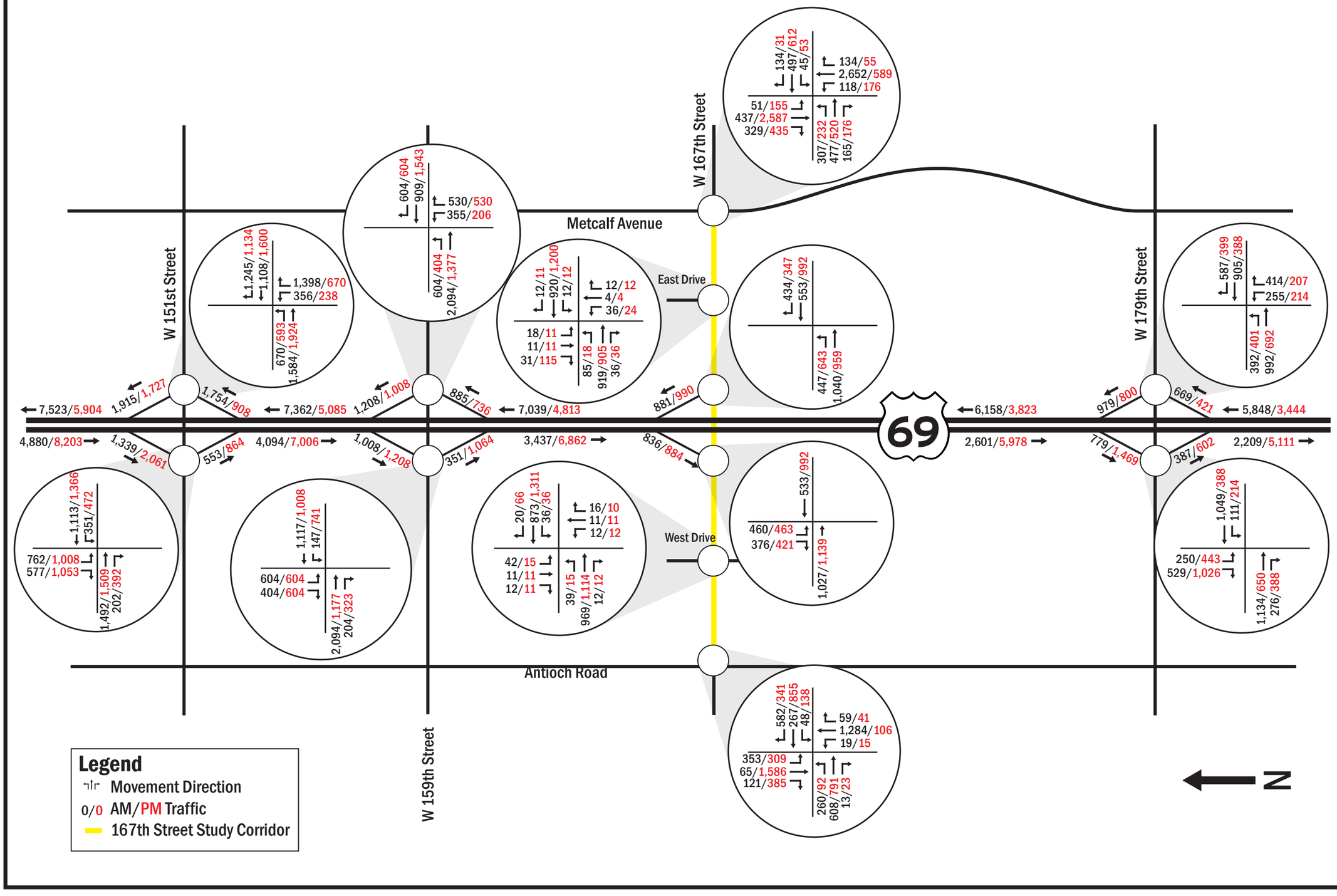
EXHIBIT

5

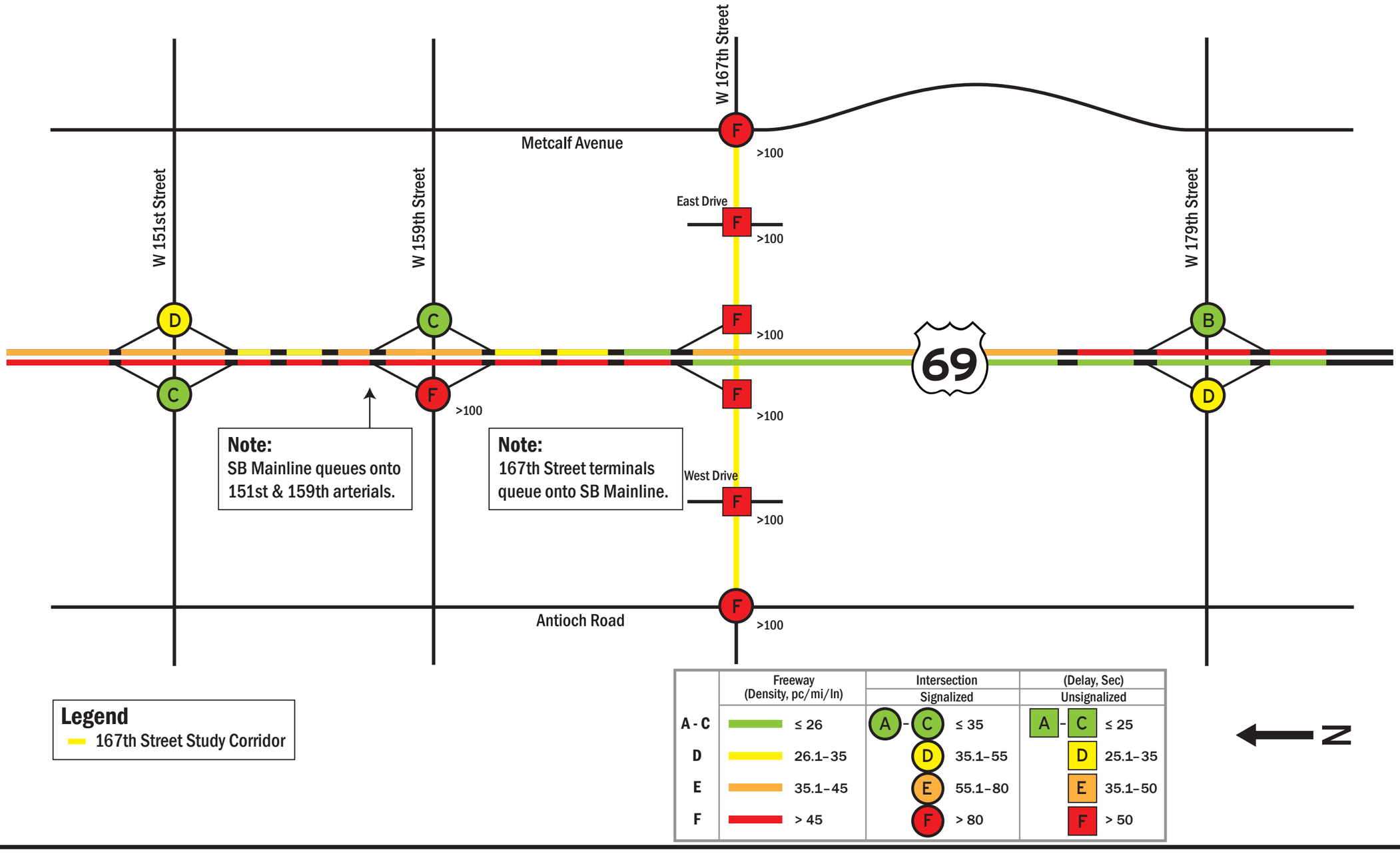
TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) No-Build AM/PM Peak Hour Traffic



HNTB



EXHIBIT

6

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) No-Build AM Peak Level of Service

HNTB

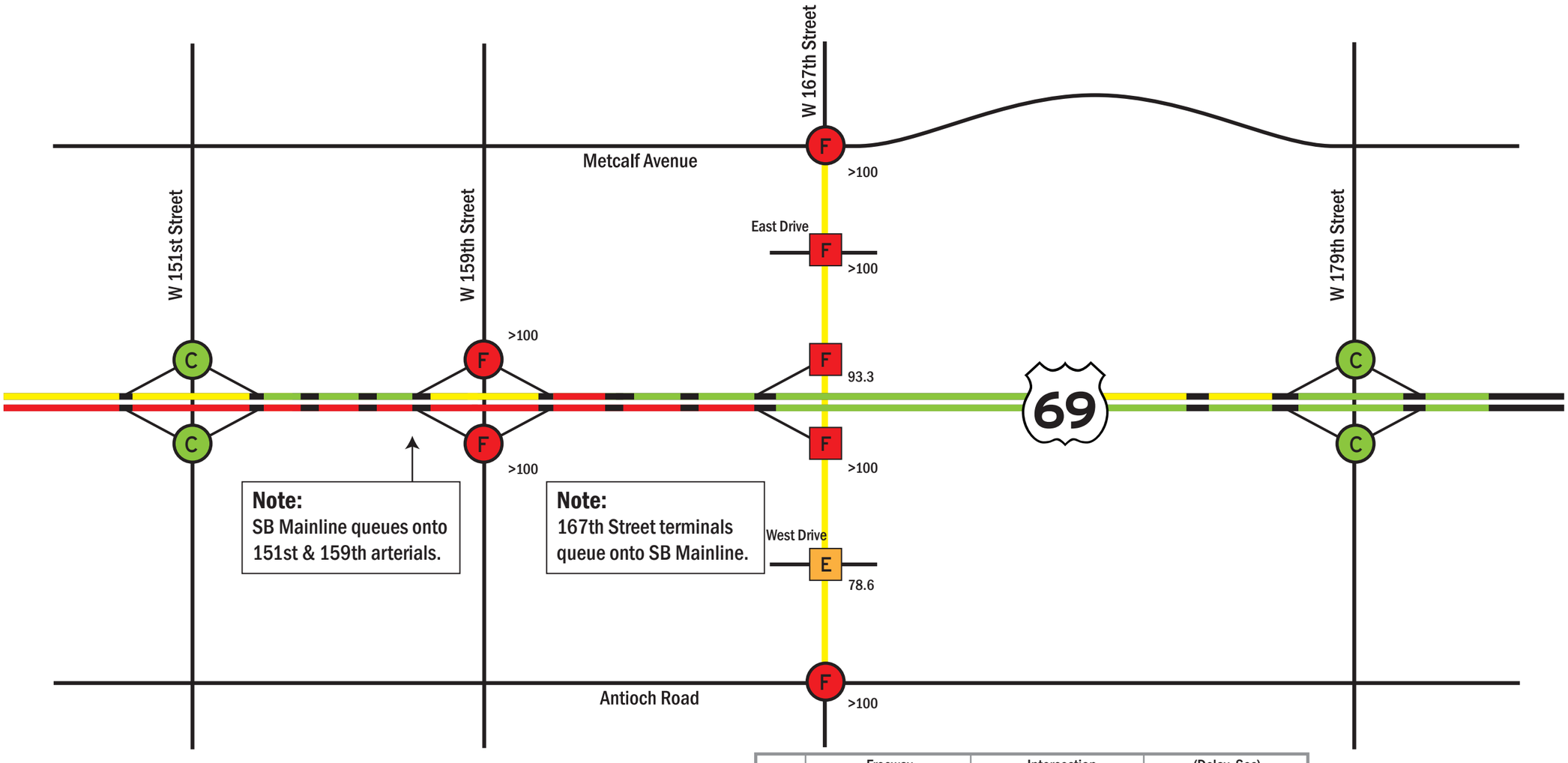
EXHIBIT

7

TRAFFIC STUDY
167TH St.
Interchange

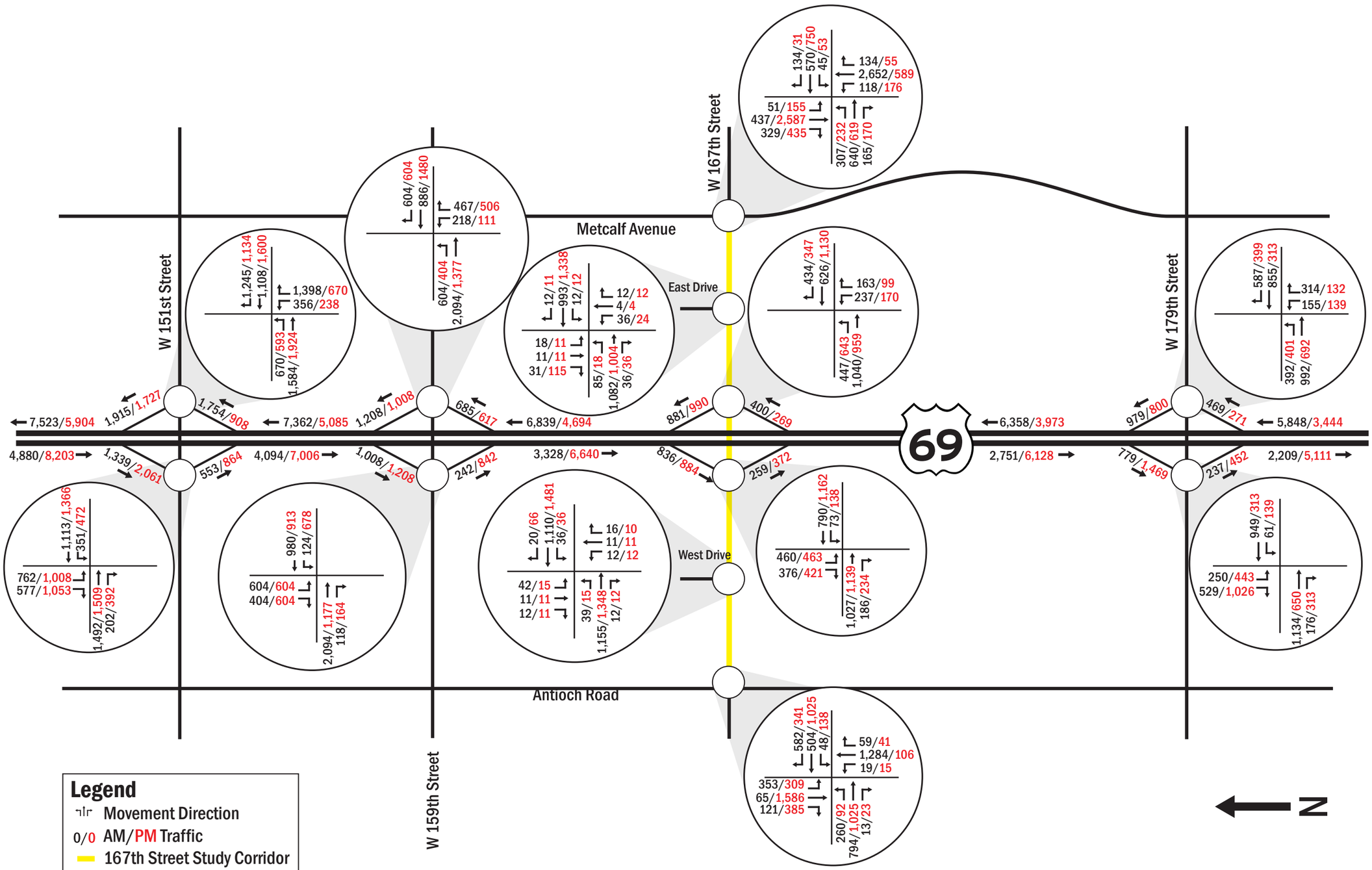
Overland Park, KS

Future (2040) No-Build PM Peak Level of Service



	Freeway (Density, pc/mi/ln)	Intersection Signalized	(Delay, Sec) Unsignalized
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

HNTB



EXHIBIT

8

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) Build AM/PM Peak Hour Traffic

HNTB

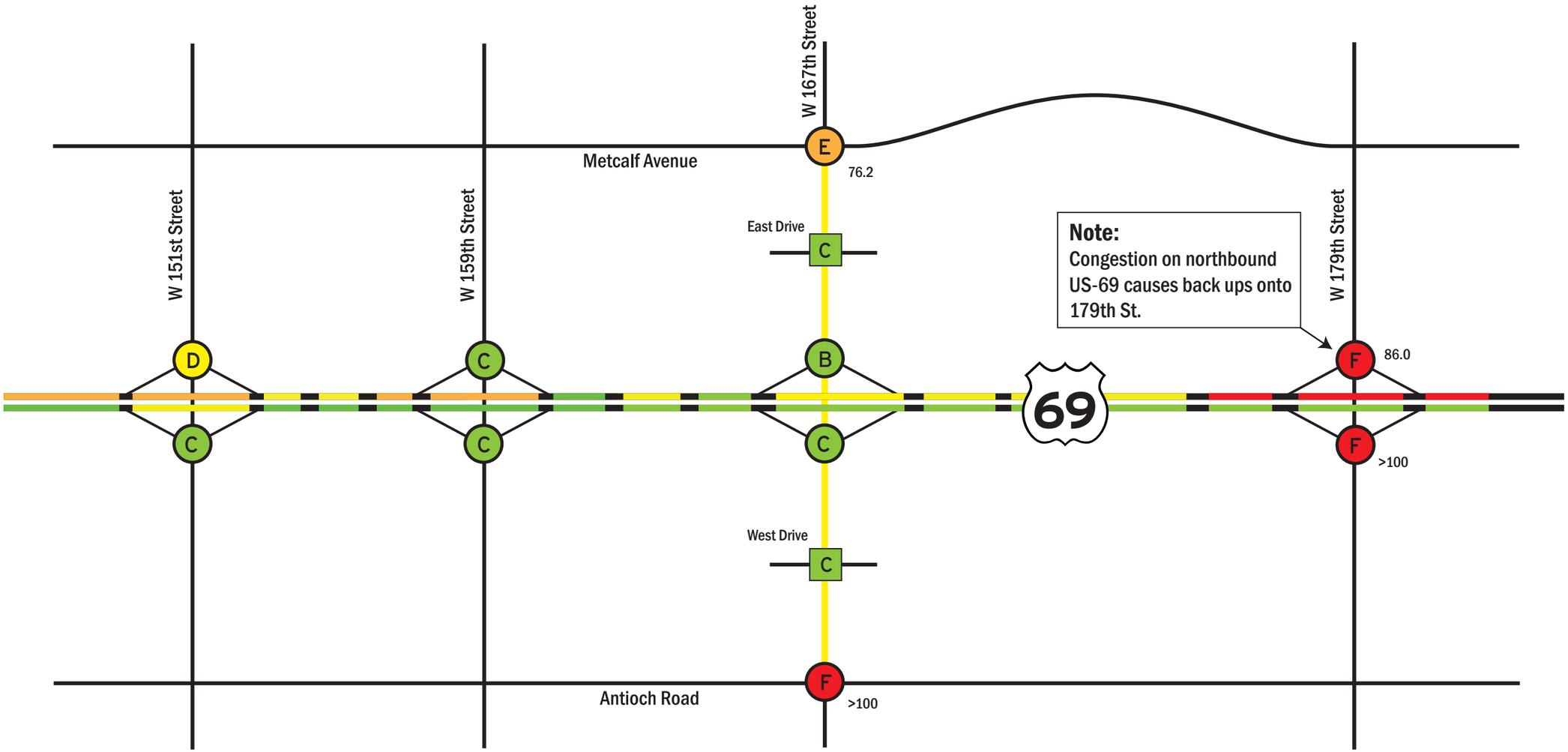
EXHIBIT

9

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) Modified Diamond AM Peak Level of Service



Legend
- 167th Street Study Corridor

	Freeway (Density, pc/mi/ln)	Intersection Signalized (Delay, Sec)	Unsignalized (Delay, Sec)
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

N

HNTB

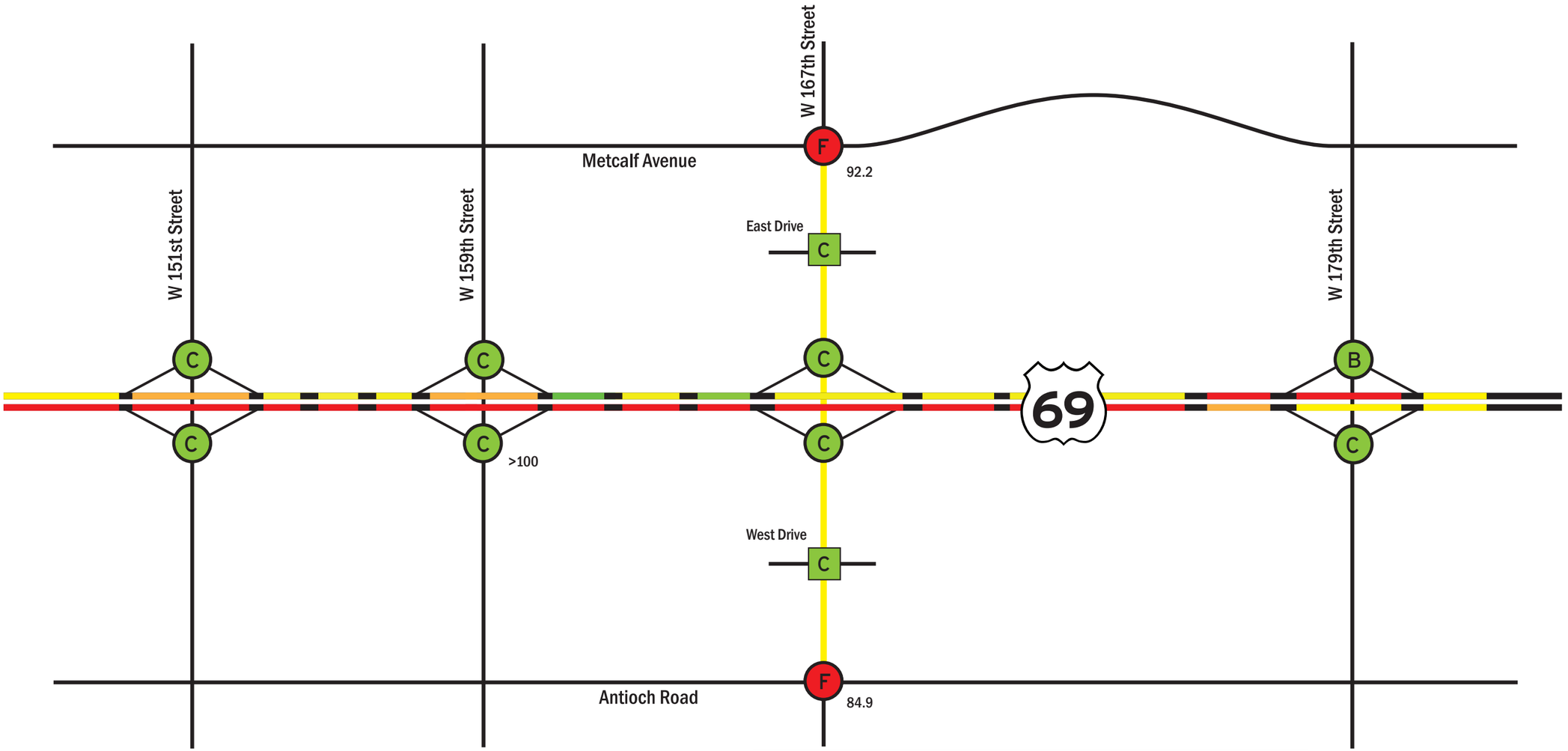
EXHIBIT

10

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) Modified Diamond PM Peak Level of Service



Legend
167th Street Study Corridor

	Freeway (Density, pc/mi/ln)	Intersection Signalized	(Delay, Sec) Unsignalized
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

N

HNTB

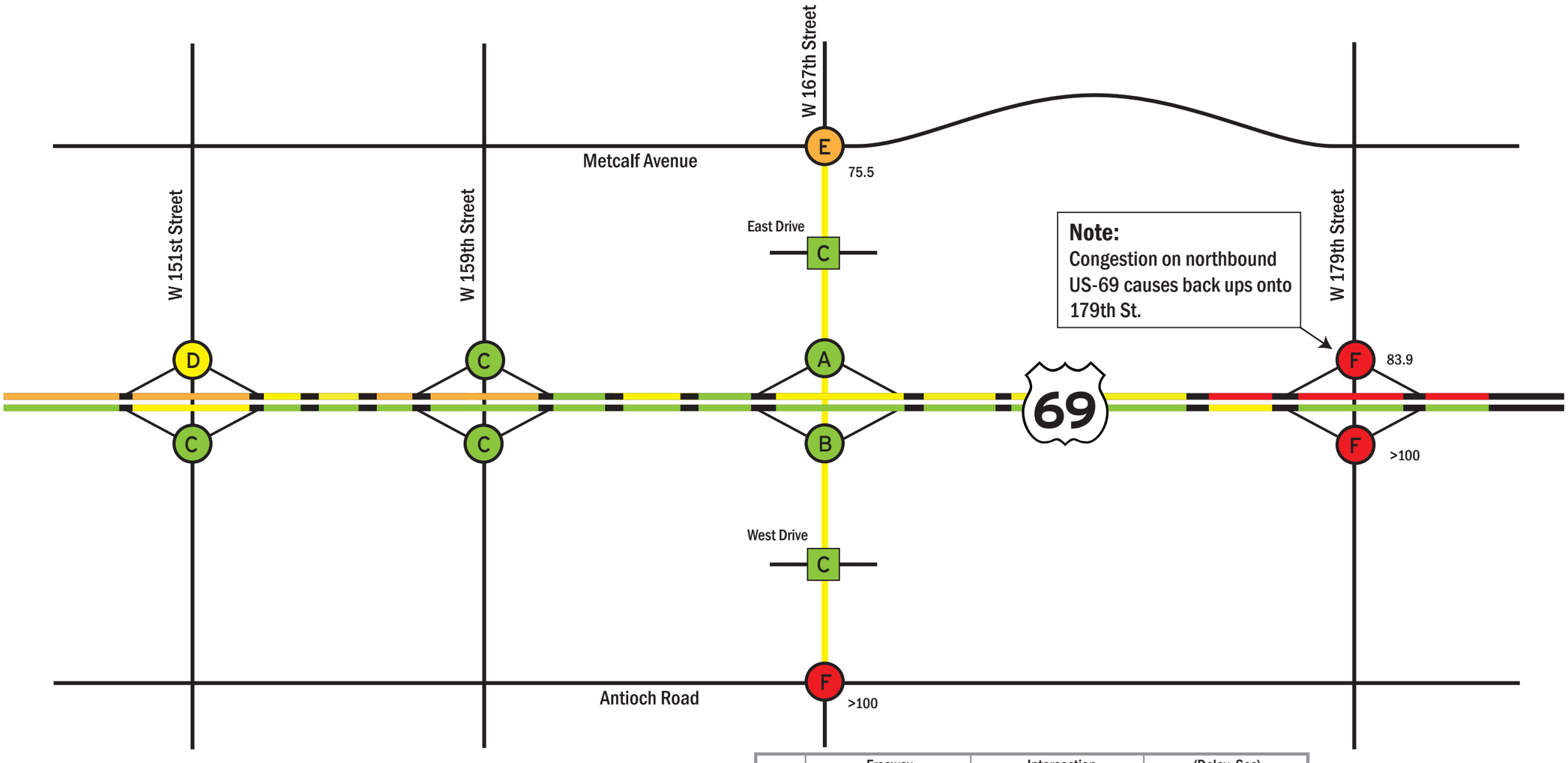
EXHIBIT

11

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) DDI AM Peak Level of Service

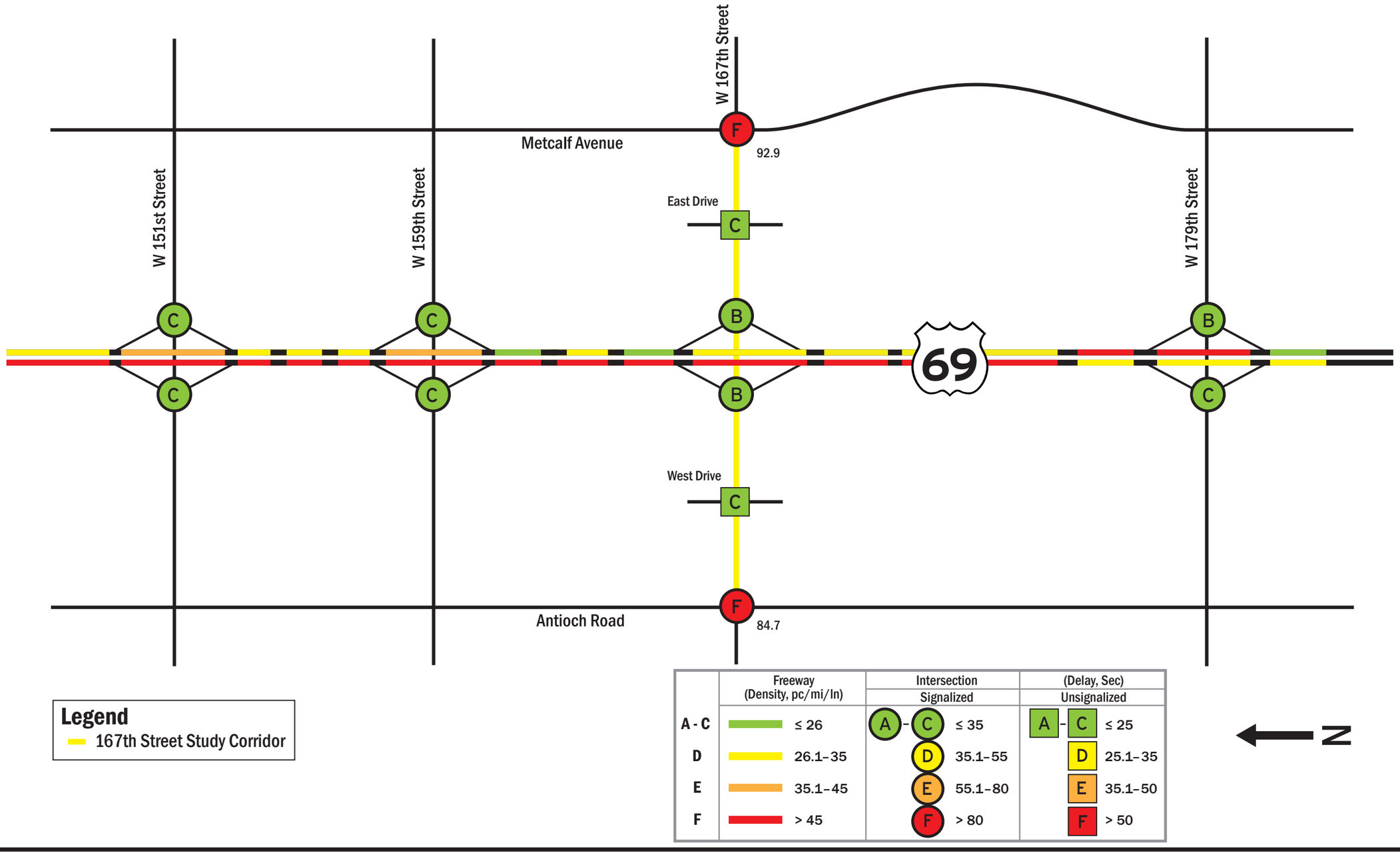


Legend
167th Street Study Corridor

	Freeway (Density, pc/mi/ln)	Intersection Signalized	(Delay, Sec) Unsignalized
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

N

HNTB



Legend
- 167th Street Study Corridor

	Freeway (Density, pc/mi/ln)	Intersection Signalized	(Delay, Sec) Unsignalized
A - C	≤ 26	A - C ≤ 35	A - C ≤ 25
D	26.1–35	D 35.1–55	D 25.1–35
E	35.1–45	E 55.1–80	E 35.1–50
F	> 45	F > 80	F > 50

N

EXHIBIT 12

TRAFFIC STUDY
167TH St.
Interchange

Overland Park, KS

Future (2040) DDI PM Peak Level of Service

HNTB

Appendix B

Vehicle Queues

Existing (2014) Queue Lengths

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
US-69 SB Ramp/151st St.	Signal				
WB Left		196.3	19.1	239.1	35.2
WB Thru		216.0	23.4	253.8	39.9
SB Left		161.5	34.3	281.4	67.1
SB Right		178.8	18.8	316.6	75.0
EB Right		72.1	0.8	168.4	4.7
EB Thru		154.8	26.2	208.8	41.3
US-69 NB Ramp/151st St.	Signal				
WB Right		658.3	198.4	470.9	83.3
WB Thru		642.8	188.5	455.3	79.2
NB Left		141.0	29.0	130.0	23.1
NB Right		91.3	7.9	80.3	6.1
EB Left		216.7	33.5	259.2	35.9
EB Thru		274.8	25.5	307.4	25.6
167th St./Metcalf Ave.	4-Way Stop				
WB Right		136.1	19.1	86.0	6.0
WB Thru		125.5	20.4	75.9	8.6
WB Left		124.2	19.8	74.7	8.2
EB Left		176.7	39.3	196.5	50.1
EB Thru		179.2	40.9	198.9	51.9
EB Right		188.3	41.4	208.0	52.3
NB Thru		34.0	0.4	17.3	0.3
NB Right		34.0	0.4	17.3	0.3
NB Left		74.5	1.3	82.2	2.6
SB Left		64.9	1.4	45.7	0.4
SB Right		14.2	0.5	7.9	0.1
SB Thru		14.2	0.5	7.9	0.1
167th St./Antioch Road	4-Way Stop				
NB Right		0.0	0.0	0.0	0.0
NB Thru		0.0	0.0	0.0	0.0
NB Left		0.0	0.0	0.0	0.0
EB Thru		10.9	0.1	0.0	0.0
EB Right		10.9	0.1	0.0	0.0
EB Left		10.9	0.1	0.0	0.0
SB Left		9.4	0.2	0.0	0.0
SB Thru		9.4	0.2	0.0	0.0
SB Right		9.4	0.2	0.0	0.0
WB Left		29.0	0.5	12.6	0.1
WB Thru		29.0	0.5	12.6	0.1
WB Right		29.0	0.5	12.6	0.1

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./Lowell Ave.	2-Way Stop				
EB Thru		9.5	0.1	0.0	0.0
EB Left		33.8	0.3	0.0	0.0
WB Thru		0.0	0.0	0.0	0.0
WB Right		0.0	0.0	0.0	0.0
SB Left		0.0	0.0	0.0	0.0
SB Right		0.0	0.0	0.0	0.0
167th St./KDOT Facility Dr.	2-Way Stop				
WB Thru		0.0	0.0	0.0	0.0
WB Right		0.0	0.0	0.0	0.0
EB Thru		4.6	0.0	0.0	0.0
EB Left		27.7	0.3	7.8	0.0
SB Right		72.9	2.9	69.5	2.0
SB Left		43.4	1.8	40.3	1.1
US-69 SB Ramp/167th St.	2-Way Stop				
SB Left		109.2	6.4	118.6	7.3
SB Right		109.7	6.2	123.5	7.6
WB Thru		0.0	0.0	0.0	0.0
EB Thru		0.0	0.0	0.0	0.0
US-69 NB Ramp/167th St.	2-Way Stop				
WB Right		0.0	0.0	0.0	0.0
WB Thru		0.0	0.0	0.0	0.0
EB Thru		2.4	0.0	0.0	0.0
EB Left		53.2	1.3	25.6	0.2
US-69 SB Ramp/179th St.	2-Way Stop				
EB Right		0.0	0.0	0.0	0.0
EB Thru		0.0	0.0	0.0	0.0
WB Left		7.1	0.0	14.3	0.1
WB Thru		2.7	0.0	8.7	0.0
SB Right		174.7	17.7	264.4	37.5
SB Left		167.7	13.7	257.4	32.1
US-69 NB Ramp/179th St.	2-Way Stop				
NB Right		86.4	5.9	28.7	0.1
NB Left		62.3	1.1	62.7	3.0
WB Right		0.0	0.0	0.0	0.0
WB Thru		0.0	0.0	0.0	0.0
EB Left		150.6	8.9	47.6	0.5
EB Thru		107.2	3.9	13.2	0.0

Future (2040) No-Build Queue Lengths

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
US-69 SB Ramp/151st St.	Signal				
WB Left		312.5	74.3	361.5	99.7
WB Thru		307.3	58.3	356.3	80.4
SB Left		291.5	195.7	283.3	68.5
SB Right		316.8	160.5	188.8	17.1
EB Right		602.3	94.6	1044.0	261.1
EB Thru		537.0	83.2	998.1	250.8
US-69 NB Ramp/151st St.	Signal				
WB Right		1162.1	562.9	552.9	137.8
WB Thru		1159.8	462.9	552.9	138.5
NB Left		764.5	69.1	312.7	45.6
NB Right		646.7	86.5	241.1	14.9
EB Left		369.6	647.1	334.3	93.6
EB Thru		399.9	643.4	364.1	49.3
US-69 SB Ramp/159th St.	Signal				
SB Left		359.5	396.9	199.3	50.0
SB Right		370.7	397.0	210.5	55.3
WB Left		435.3	1635.6	439.0	416.5
WB Thru		435.4	1635.7	439.0	416.6
EB Thru		1673.9	1488.6	1673.9	1649.6
EB Right		1673.9	637.7	1673.9	1649.2
US-69 NB Ramp/159th St.	Signal				
NB Left		285.3	86.7	273.3	75.2
NB Right		289.6	89.5	281.7	78.2
EB Left		446.6	279.5	327.9	76.7
EB Thru		453.8	276.4	335.1	75.3
WB Thru		696.7	894.8	1673.9	1648.5
WB Right		697.5	882.6	1673.9	1649.3

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./Metcalf Ave.	Signal				
WB Right		1383.1	882.6	1500.1	1062.0
WB Thru		1372.9	1304.9	1493.4	1053.1
WB Left		1372.9	1304.9	1493.4	1053.1
EB Left		1384.9	1334.6	1102.6	741.0
EB Thru		1384.9	1427.5	1102.6	741.0
EB Right		1414.6	1426.2	1132.3	769.1
NB Thru		1673.9	1443.4	441.8	171.6
NB Right		1673.9	1444.8	450.3	154.2
NB Left		1673.9	1443.9	436.2	167.4
SB Left		683.2	377.7	1672.0	1432.5
SB Right		701.9	1236.0	1672.1	1431.7
SB Thru		690.0	1231.2	1672.0	1432.9
167th St./Antioch Road	Signal				
NB Right		1673.8	1236.3	140.1	34.8
NB Thru		1673.8	1530.7	138.6	39.1
NB Left		49.6	1530.8	64.6	7.8
EB Thru		1672.0	1531.3	1668.4	1573.6
EB Right		1672.1	1621.6	1669.4	1573.3
EB Left		1672.1	1620.3	1668.4	1573.5
SB Left		1672.0	1621.0	1673.9	1560.9
SB Thru		1672.0	1215.2	1673.9	1560.0
SB Right		1672.0	1324.5	1673.9	1560.9
WB Left		1394.4	1259.0	1151.4	567.3
WB Thru		1393.9	1258.5	1150.8	566.4
WB Right		1396.9	1261.6	1153.5	568.9
167th St./Lowell Ave.	2-Way Stop				
EB Thru		1348.8	1084.7	1342.7	1027.6
EB Left		1403.5	1006.1	1397.4	1081.5
EB Right		1348.8	1022.6	1342.7	1027.6
WB Thru		1132.5	1022.6	437.6	131.8
WB Right		1132.5	1070.6	437.6	131.8
WB Left		1180.6	1067.2	476.1	144.3
SB Left		112.2	34.1	103.3	51.4
SB Right		125.5	29.6	116.6	58.3
SB Thru		113.6	24.7	104.8	51.1
NB Right		74.7	5.6	65.0	3.6
NB Left		52.2	585.7	42.5	2.4
NB Thru		53.8	605.8	44.1	2.4

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./KDOT Facility Dr.	2-Way Stop				
WB Thru		1198.8	605.8	187.2	37.2
WB Right		1198.8	973.2	187.2	37.2
WB Left		1232.2	1025.4	173.2	34.9
EB Thru		1040.7	1014.1	228.3	80.6
EB Left		1093.0	969.7	251.0	91.5
EB Right		1040.7	918.3	228.3	80.6
SB Right		136.5	26.5	132.4	37.4
SB Left		107.0	18.3	102.9	25.2
SB Thru		107.4	17.7	103.2	25.0
NB Left		68.7	6.2	63.5	4.6
NB Right		70.7	1651.3	65.4	3.2
NB Thru		70.5	1651.6	65.4	3.0
US-69 SB Ramp/167th St.	2-Way Stop				
SB Left		1673.9	1651.1	1673.8	1649.6
SB Right		1673.8	1651.6	1673.9	1649.5
WB Thru		569.5	789.6	66.8	21.4
EB Thru		1053.9	710.4	1051.3	759.6
US-69 NB Ramp/167th St.	2-Way Stop				
WB Right		891.4	422.8	166.7	34.0
WB Thru		891.4	499.6	166.7	34.0
EB Thru		561.2	472.4	557.4	374.1
EB Left		640.5	441.0	636.7	448.5
US-69 SB Ramp/179th St.	Signal				
EB Right		267.8	44.7	202.6	38.8
EB Thru		267.8	44.7	174.9	29.5
WB Left		273.3	32.7	106.2	21.8
WB Thru		273.3	32.7	106.2	21.8
SB Right		126.0	55.8	142.4	27.6
SB Left		112.8	55.8	127.8	20.3
US-69 NB Ramp/179th St.	Signal				
NB Right		228.6	52.0	175.8	37.1
NB Left		228.6	52.0	144.7	25.7
WB Right		260.3	39.1	73.3	5.5
WB Thru		256.6	51.5	80.9	13.3
EB Left		223.5	54.5	159.2	40.4
EB Thru		219.1	49.1	150.1	33.7

Future (2040) Diverging Diamond Queue Lengths

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
US-69 SB Ramp/151st St.	Signal				
WB Left		293.2	70.0	345.2	96.3
WB Thru		288.0	55.7	340.0	78.3
SB Left		281.2	71.3	266.5	68.1
SB Right		186.7	18.8	172.0	17.4
EB Right		235.3	7.5	484.5	191.1
EB Thru		285.1	65.2	475.1	227.5
US-69 NB Ramp/151st St.	Signal				
WB Right		928.1	486.8	673.2	263.7
WB Thru		928.3	484.9	673.3	264.0
NB Left		762.2	112.7	422.6	49.4
NB Right		691.1	73.3	351.0	18.5
EB Left		392.2	109.4	405.5	129.8
EB Thru		420.2	69.0	436.2	98.8
US-69 SB Ramp/159th St.	Signal				
SB Left		352.8	91.3	181.6	44.0
SB Right		364.0	98.1	192.8	49.5
WB Left		318.9	47.5	342.9	88.0
WB Thru		319.0	47.0	343.0	87.6
EB Thru		994.0	247.5	436.1	99.1
EB Right		996.5	247.0	439.0	94.7
US-69 NB Ramp/159th St.	Signal				
NB Left		196.2	39.7	258.2	50.4
NB Right		204.3	37.0	266.0	52.9
EB Left		434.7	139.1	336.6	77.0
EB Thru		441.9	140.6	343.8	77.2
WB Thru		608.9	122.0	950.5	234.1
WB Right		611.2	122.6	953.0	234.0

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./Metcalf Ave.	Signal				
WB Right		432.3	172.3	566.1	219.7
WB Thru		404.8	150.4	538.6	197.9
WB Left		404.8	150.4	538.6	197.9
EB Left		484.7	181.0	450.6	179.1
EB Thru		484.7	181.0	450.6	179.1
EB Right		528.9	215.8	494.7	216.3
NB Thru		1673.8	1433.8	742.2	549.6
NB Right		1673.8	1433.4	761.8	566.4
NB Left		1673.8	1433.8	742.2	549.6
SB Left		354.1	87.1	1667.3	1299.4
SB Right		376.3	100.1	1667.3	1299.4
SB Thru		354.1	87.1	1667.3	1299.4
167th St./Antioch Road	Signal				
NB Right		1673.8	1358.0	150.3	28.5
NB Thru		1673.9	1358.0	119.4	30.3
NB Left		1673.9	1358.0	119.4	30.3
EB Thru		924.9	412.0	683.3	182.3
EB Right		954.3	428.3	720.1	210.6
EB Left		924.9	412.0	683.3	182.3
SB Left		1276.8	1037.2	1673.9	1461.2
SB Thru		1276.8	1037.2	1673.9	1461.2
SB Right		1311.8	1073.0	1673.9	1460.7
WB Left		747.1	296.7	693.8	259.9
WB Thru		747.1	296.7	693.8	259.9
WB Right		783.3	326.6	729.9	288.9
167th St./Lowell Ave.	2-Way Stop				
EB Thru		0.0	0.0	0.0	0.0
EB Left		51.2	0.9	41.1	0.7
EB Right		0.0	0.0	0.0	0.0
WB Thru		3.0	0.0	0.0	0.0
WB Right		3.0	0.0	0.0	0.0
WB Left		52.5	1.5	51.3	2.3
SB Left		84.5	4.8	74.0	2.7
SB Right		86.1	4.0	74.5	2.4
SB Thru		85.2	4.2	74.8	2.6
NB Right		51.3	2.0	53.2	1.8
NB Left		51.5	2.2	53.4	1.9
NB Thru		51.8	2.2	53.8	2.1

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./KDOT Facility Dr.	2-Way Stop				
WB Thru		3.1	0.0	4.2	0.0
WB Right		3.1	0.0	0.0	0.0
WB Left		37.6	0.3	0.0	0.0
EB Thru		0.0	0.0	0.0	0.0
EB Left		73.7	2.4	30.3	0.6
EB Right		0.0	0.0	0.0	0.0
SB Right		62.7	2.8	91.5	9.8
SB Left		63.0	3.1	91.2	8.9
SB Thru		63.7	3.0	91.9	8.5
NB Left		81.7	3.3	71.1	2.4
NB Right		62.0	2.2	55.6	1.7
NB Thru		64.1	2.4	57.8	1.9
US-69 SB Ramp/167th St.	Signal				
SB Left		299.5	55.9	229.2	38.3
SB Right		364.6	45.6	262.0	33.7
WB Thru		267.9	33.9	469.6	67.1
EB Thru		342.3	53.7	478.7	74.4
US-69 NB Ramp/167th St.	Signal				
WB Right		121.2	2.8	320.5	19.4
WB Thru		253.7	22.5	453.2	48.1
EB Thru		335.7	32.4	371.3	47.2
EB Left		182.4	5.4	254.5	11.9
US-69 SB Ramp/179th St.	Signal				
EB Right		255.0	47.7	196.8	33.4
EB Thru		227.3	38.2	169.2	27.4
WB Left		204.7	22.2	89.6	17.0
WB Thru		204.7	22.2	89.6	17.0
SB Right		145.1	32.8	134.5	33.1
SB Left		130.6	23.6	119.6	23.4
US-69 NB Ramp/179th St.	Signal				
NB Right		165.6	28.4	128.9	22.5
NB Left		134.4	20.8	97.8	17.1
WB Right		119.9	15.1	75.8	5.4
WB Thru		125.0	21.1	83.4	9.8
EB Left		216.4	40.4	155.2	29.6
EB Thru		207.4	32.9	146.2	24.3

Future (2040) Preferred Modified Diamond Queue Lengths

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
US-69 SB Ramp/151st St.	Signal				
WB Left		317.7	72.9	375.6	127.1
WB Thru		312.6	56.7	370.4	111.9
SB Left		290.6	74.0	383.3	110.5
SB Right		196.3	22.3	288.8	50.9
EB Right		238.2	8.2	486.6	45.1
EB Thru		304.1	62.6	491.6	110.1
US-69 NB Ramp/151st St.	Signal				
WB Right		851.7	407.8	498.1	108.3
WB Thru		853.2	407.6	497.9	112.0
NB Left		192.5	51.5	126.9	32.9
NB Right		205.3	50.2	134.8	18.9
EB Left		419.7	110.6	380.0	73.5
EB Thru		467.3	96.4	410.7	47.1
US-69 SB Ramp/159th St.	Signal				
SB Left		363.6	101.2	243.5	63.7
SB Right		370.6	104.1	254.7	70.7
WB Left		360.5	61.3	352.2	99.3
WB Thru		360.6	61.7	352.3	98.5
EB Thru		1331.6	474.4	468.2	132.9
EB Right		1336.3	475.5	473.2	128.3
US-69 NB Ramp/159th St.	Signal				
NB Left		425.9	204.6	227.0	58.2
NB Right		432.9	211.1	237.5	61.7
EB Left		457.0	153.9	371.2	87.3
EB Thru		463.6	150.1	378.4	86.2
WB Thru		787.7	227.8	936.6	226.3
WB Right		788.3	227.3	938.9	226.1

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./Metcalf Ave.	Signal				
WB Right		302.2	106.0	580.1	260.6
WB Thru		280.2	92.7	563.5	247.1
WB Left		280.2	92.7	563.5	247.1
EB Left		327.9	97.5	461.0	134.8
EB Thru		327.9	97.5	461.0	134.8
EB Right		364.2	126.4	499.2	166.6
NB Thru		1329.9	760.0	300.0	144.1
NB Right		1353.2	782.3	320.0	138.4
NB Left		1329.9	760.0	300.0	144.1
SB Left		154.3	38.5	1063.5	318.2
SB Right		154.3	38.5	1083.8	333.7
SB Thru		154.3	38.5	1063.5	318.2
167th St./Antioch Road	Signal				
NB Right		863.5	386.6	124.8	11.3
NB Thru		836.0	365.6	104.1	22.6
NB Left		836.0	365.6	104.1	22.6
EB Thru		302.2	103.2	356.9	122.0
EB Right		340.9	133.0	395.6	154.6
EB Left		302.2	103.2	356.9	122.0
SB Left		189.5	60.6	1274.4	540.2
SB Thru		189.5	60.6	1274.4	540.2
SB Right		235.2	63.1	1309.6	583.3
WB Left		268.4	80.5	669.6	181.4
WB Thru		268.4	80.5	669.6	181.4
WB Right		302.3	95.7	700.1	197.5
167th St./Lowell Ave.	2-Way Stop				
EB Thru		3.7	0.0	110.0	9.2
EB Left		55.7	1.2	165.8	16.1
EB Right		3.7	0.0	110.0	9.2
WB Thru		0.0	0.0	0.0	0.0
WB Right		0.0	0.0	0.0	0.0
WB Left		48.4	1.5	45.6	2.2
SB Left		90.8	6.0	77.5	3.8
SB Right		92.1	5.2	80.5	3.6
SB Thru		91.4	5.3	79.9	4.0
NB Right		52.0	2.1	52.0	1.9
NB Left		52.1	2.3	52.1	2.2
NB Thru		52.8	2.4	52.3	2.6

Intersection	Intersection Control	AM Queue		PM Queue	
		Maximum (feet)	Average (feet)	Maximum (feet)	Average (feet)
167th St./KDOT Facility Dr.	2-Way Stop				
WB Thru		0.0	0.0	0.0	0.0
WB Right		0.0	0.0	0.0	0.0
WB Left		32.4	0.2	0.0	0.0
EB Thru		7.2	0.1	0.0	0.0
EB Left		65.5	1.8	45.3	1.0
EB Right		7.2	0.1	0.0	0.0
SB Right		66.1	3.8	94.8	10.4
SB Left		66.8	4.0	94.8	9.3
SB Thru		68.5	3.8	95.5	9.4
NB Left		80.9	2.9	71.2	2.1
NB Right		61.1	1.9	27.5	0.1
NB Thru		63.2	2.1	67.3	2.0
US-69 SB Ramp/167th St.	Signal				
SB Left		184.6	31.4	308.0	79.7
SB Right		212.9	43.4	341.4	101.2
WB Thru		218.2	24.7	401.0	60.1
EB Thru		387.7	46.0	735.6	253.6
US-69 NB Ramp/167th St.	Signal				
WB Right		294.4	58.6	643.8	135.2
WB Thru		513.9	94.0	599.6	115.4
EB Thru		430.9	87.8	524.2	162.4
EB Left		430.9	87.8	524.2	162.4
US-69 SB Ramp/179th St.	Signal				
EB Right		264.7	51.4	209.5	41.9
EB Thru		237.1	40.9	182.0	33.2
WB Left		223.5	28.3	92.4	19.1
WB Thru		223.5	28.3	92.4	19.1
SB Right		130.2	32.1	175.9	44.7
SB Left		114.4	22.4	155.6	31.5
US-69 NB Ramp/179th St.	Signal				
NB Right		202.6	47.6	132.8	22.0
NB Left		171.4	32.6	101.7	16.0
WB Right		145.3	22.7	72.7	5.2
WB Thru		150.3	30.0	75.6	9.9
EB Left		219.4	50.7	161.5	31.0
EB Thru		210.3	42.8	152.5	26.4

Appendix C

Plan Plates

Ex. R/W
Const. Limits
Prop. R/W
Const. Limits
Ex. R/W
69
Const. Limits
Ex. R/W
Approximately 1500'
167th St
EXIT 1 MILE
159th St
EXIT 1 MILE
167th St
EXIT ONLY
EXIT
Temp. Const. Esmt.
167TH STREET
Const. Limits
Ex. R/W

Interchange Improvements

N

200' 0 200'

167th Street & US 69 Interchange Study

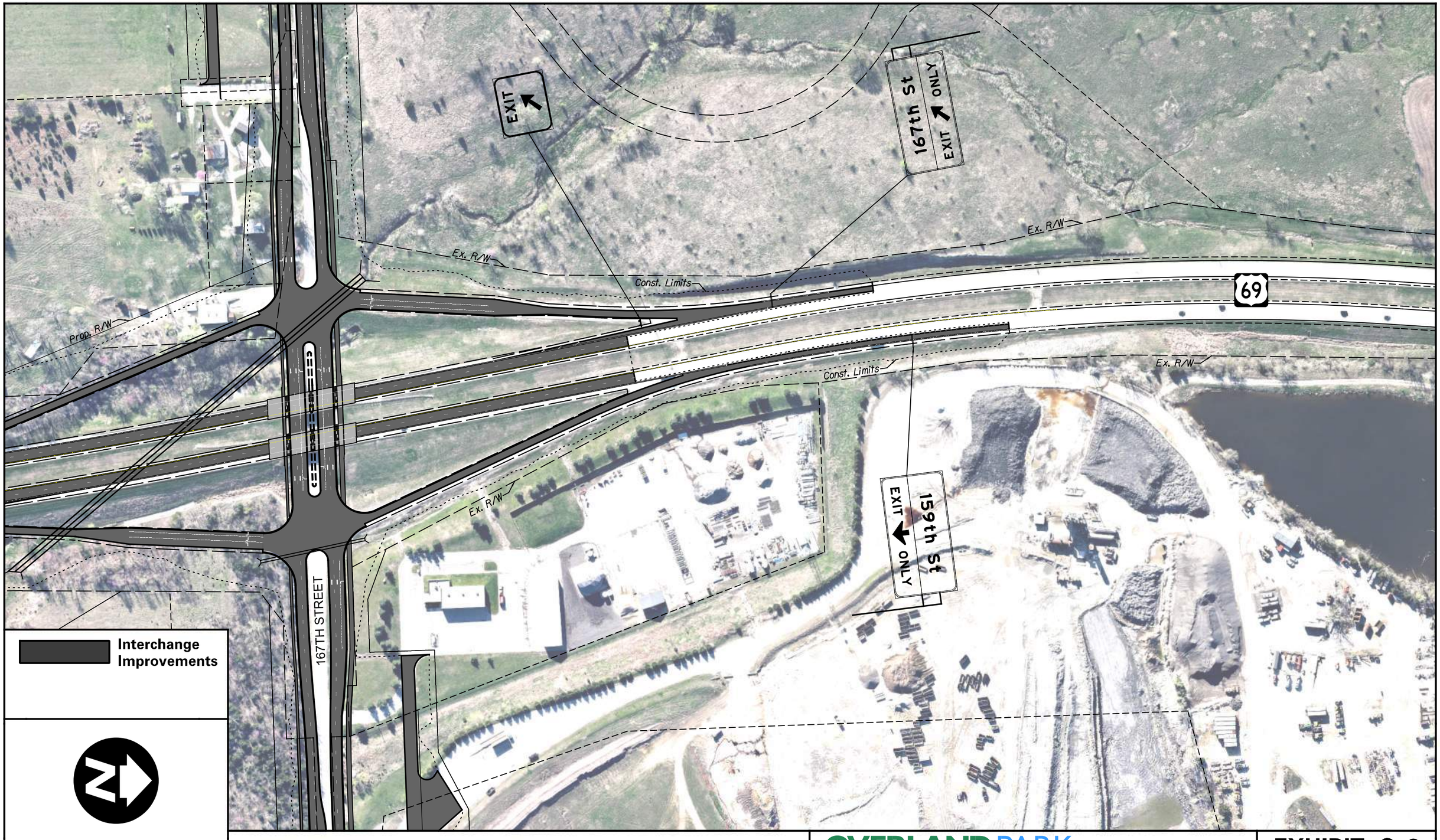
2040 Build

OVERLAND PARK KANSAS

ABOVE AND BEYOND. BY DESIGN.

HNTB

EXHIBIT C–1



167th Street & US 69 Interchange Study

2040 Build

OVERLAND PARK KANSAS

ABOVE AND BEYOND. BY DESIGN.

HNTB

EXHIBIT C–2

167th Street & US 69 Interchange Study

2040 Build

OVERLAND PARK KANSAS

ABOVE AND BEYOND. BY DESIGN.

HNTB

EXHIBIT C–3

69

MM 4

SOUTH 69

NORTH 69

Mount On Signal Arm

Temp. Const. Esmt.

Prop. R/W

Ex. R/W

Const. Limits

167TH STREET

Interchange Improvements

N

200′ 0 200′

167th Street & US 69 Interchange Study

2040 Build

OVERLAND PARK KANSAS

ABOVE AND BEYOND. BY DESIGN.

HNTB

EXHIBIT C–4

167th Street & US 69 Interchange Study

2040 Build

OVERLAND PARK KANSAS

ABOVE AND BEYOND. BY DESIGN.

HNTB

EXHIBIT C–5