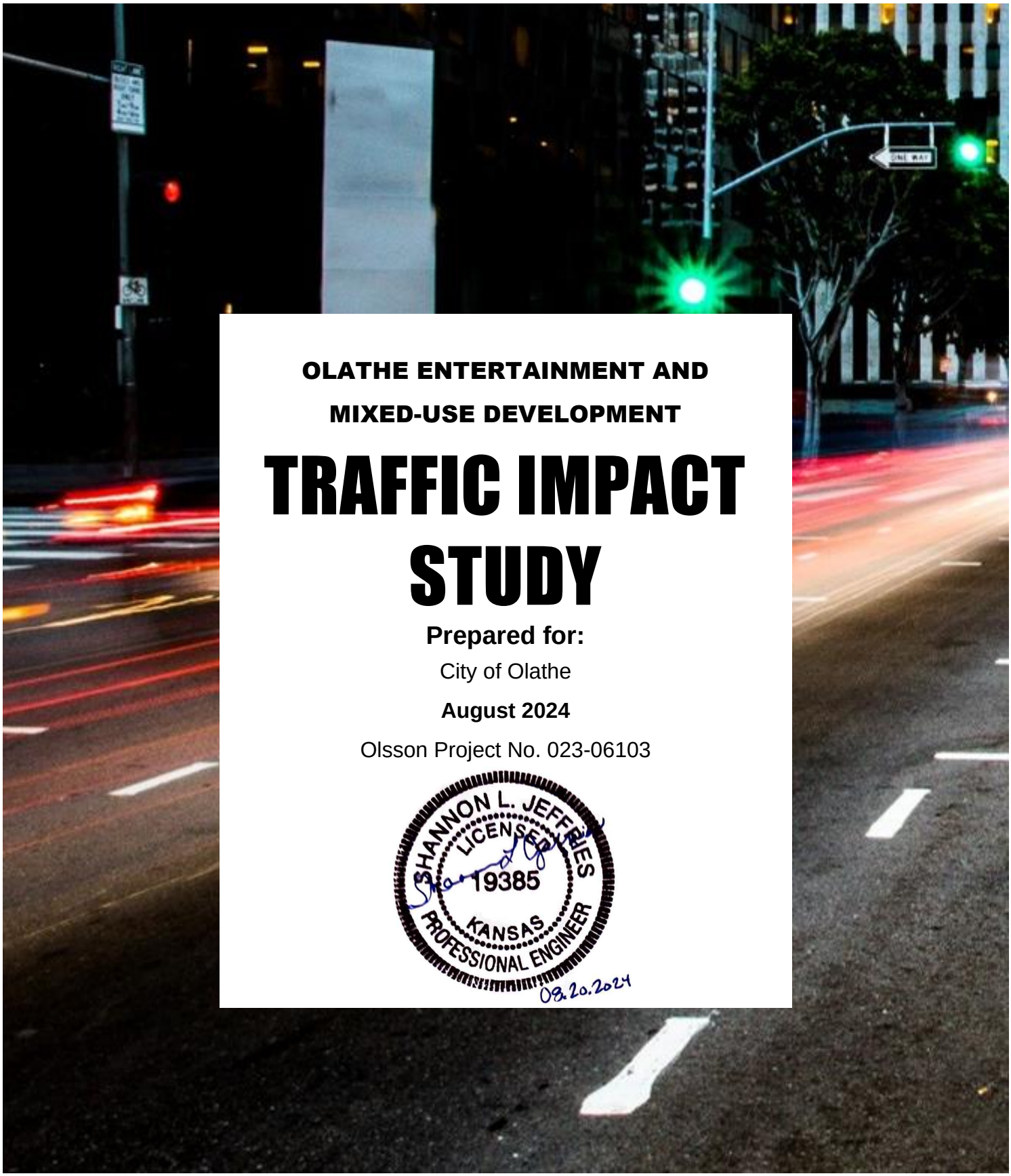

OLATHE ENTERTAINMENT AND MIXED-USE DEVELOPMENT

TRAFFIC IMPACT STUDY

Prepared for:

City of Olathe

August 2024

Olsson Project No. 023-06103

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EXECUTIVE SUMMARY

This report studies the traffic impacts of the Olathe Entertainment and Mixed-Use Development located in the southwest quadrant of 119th Street and Renner Boulevard in Olathe, Kansas. This report presents the potential impacts of the proposed development on the existing roadway network and, as appropriate, recommends improvements considering City of Olathe guidelines.

The proposed development is a mixed-use development consisting of restaurant, retail, hotel, theme park, and arena land uses. The traffic impact study was considered under the following scenarios for the weekday PM and weekend (Saturday) peak hours:

- Existing Conditions
- Existing Plus Development Conditions
- Future Year 2044 Plus Development Conditions

Analysis for the purposes of this study considered overlapping full capacity event ingress for an arena as well as full capacity theme park egress, in addition to planned retail/restaurant/hotel development trips. This is expected to present a conservative analysis of expected operations as full capacity, overlapping events are not expected to be a typical occurrence. Under non-event conditions, the study area network would be expected to operate acceptably with recommended improvements.

To support the proposed development, the following improvements are recommended.

- 119th Street at Barney Boulevard
    - Install dual westbound left-turn lanes with 250 feet of storage plus taper.
    - Install a three-lane section for the northbound approach.
    - Modify the existing traffic signal.
    - Install eastbound right-turn lane with 150 feet of storage plus taper.
- 119th Street at Renner Boulevard
    - Modify existing traffic signal to install a southbound right-turn overlap phase.
- Renner Boulevard at Kansas City Road
    - Modify southbound approach to consist of a shared through/left-turn lane and a dedicated right-turn lane.
    - Modify the existing traffic signal.
- 119th Street at I-35 Interchange
    - Monitor traffic operations as development progresses and during event operations to optimize traffic signal timing plans.

- 119th Street at Driveway A
    - Install eastbound right-turn lane with 150 feet of storage plus taper.
- Prepare an arena traffic management plan that detours arena bound traffic from I-35 Southbound to Kansas City Road and Renner Boulevard to bypass the intersection of 119th Street and Renner Boulevard.

The future year analysis considered planned development as well as background traffic growth. If future year volumes materialize, additional improvements may be needed to support operations.

A detailed summary of existing plus development and future year recommendations is presented in **Section 6.**

1. INTRODUCTION

This report studies the traffic impacts of the Olathe Entertainment and Mixed-Use Development generally located in the southwest quadrant of 119th Street and Renner Boulevard in Olathe, Kansas. The approximate location of the proposed development is shown on the Vicinity Map in **Figure 1.**

This report presents the potential impacts of the proposed development on the existing roadway network and, as appropriate, recommends additional turn lanes, storage bay modifications, and intersection control methods per The City of Olathe's *Access Management Plan.* The study intersections include the following:

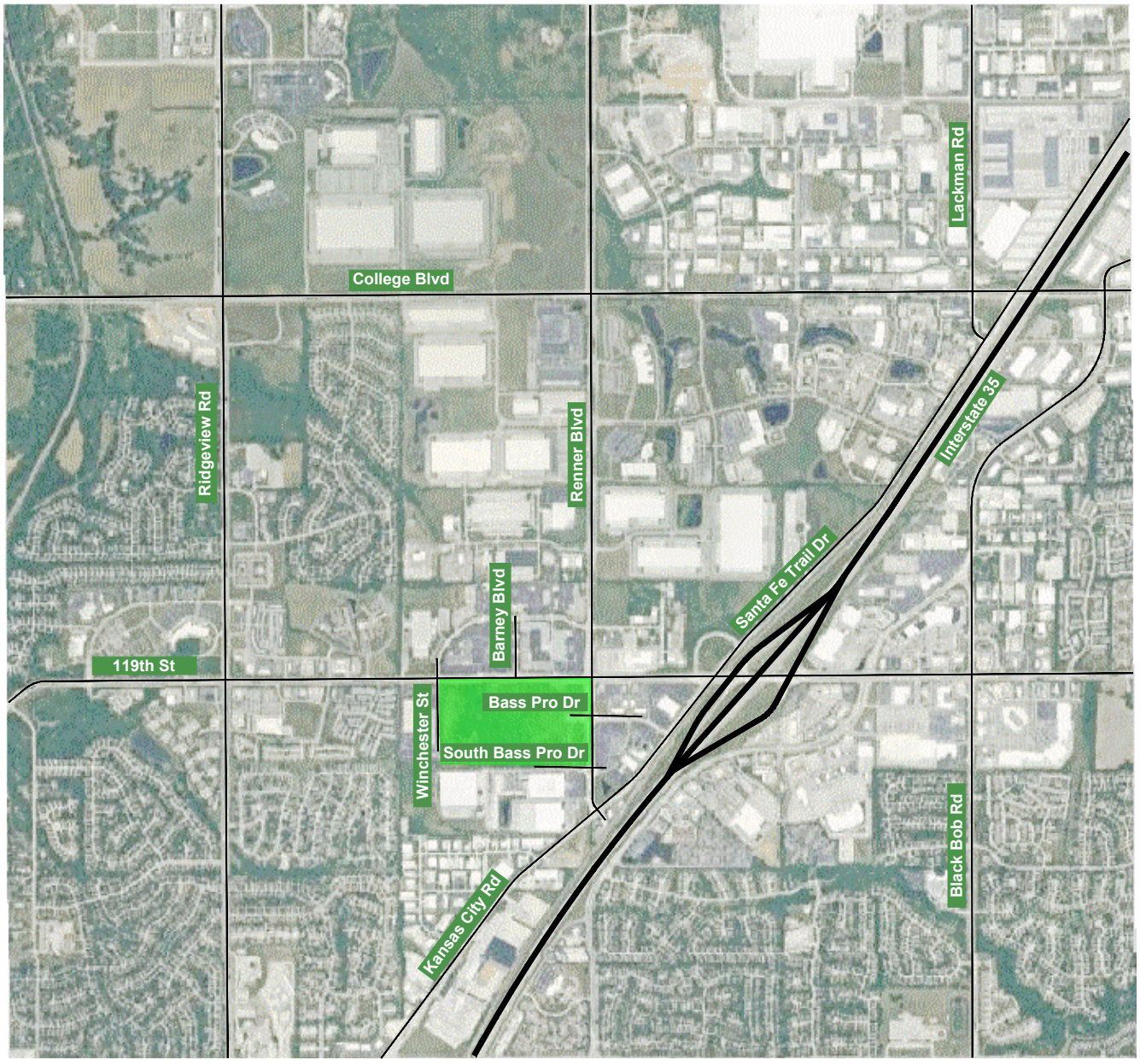
- 119th Street and Ridgeview Road
- 119th Street and Winchester Street
- 119th Street and Barney Boulevard
- 119th Street and Renner Boulevard
- 119th Street and I-35 Southbound Ramp
- 119th Street and I-35 Northbound Ramp
- Renner Boulevard and College Boulevard
- Renner Boulevard and Bass Pro Drive
- Renner Boulevard and South Bass Pro Drive
- Renner Boulevard and Kansas City Road
- Proposed Site Driveways

The following scenarios were analyzed considering weekday PM and weekend (Saturday) peak hour periods:

- Existing Conditions
- Existing Plus Development Conditions
- Future Year 2044 Plus Development Conditions

FIGURE 1

Olathe, KS
Vicinity Map



LEGEND

Development

2. DATA COLLECTION

The data collection effort included acquiring peak period turning movement counts, existing intersection signal timings, and crash data.

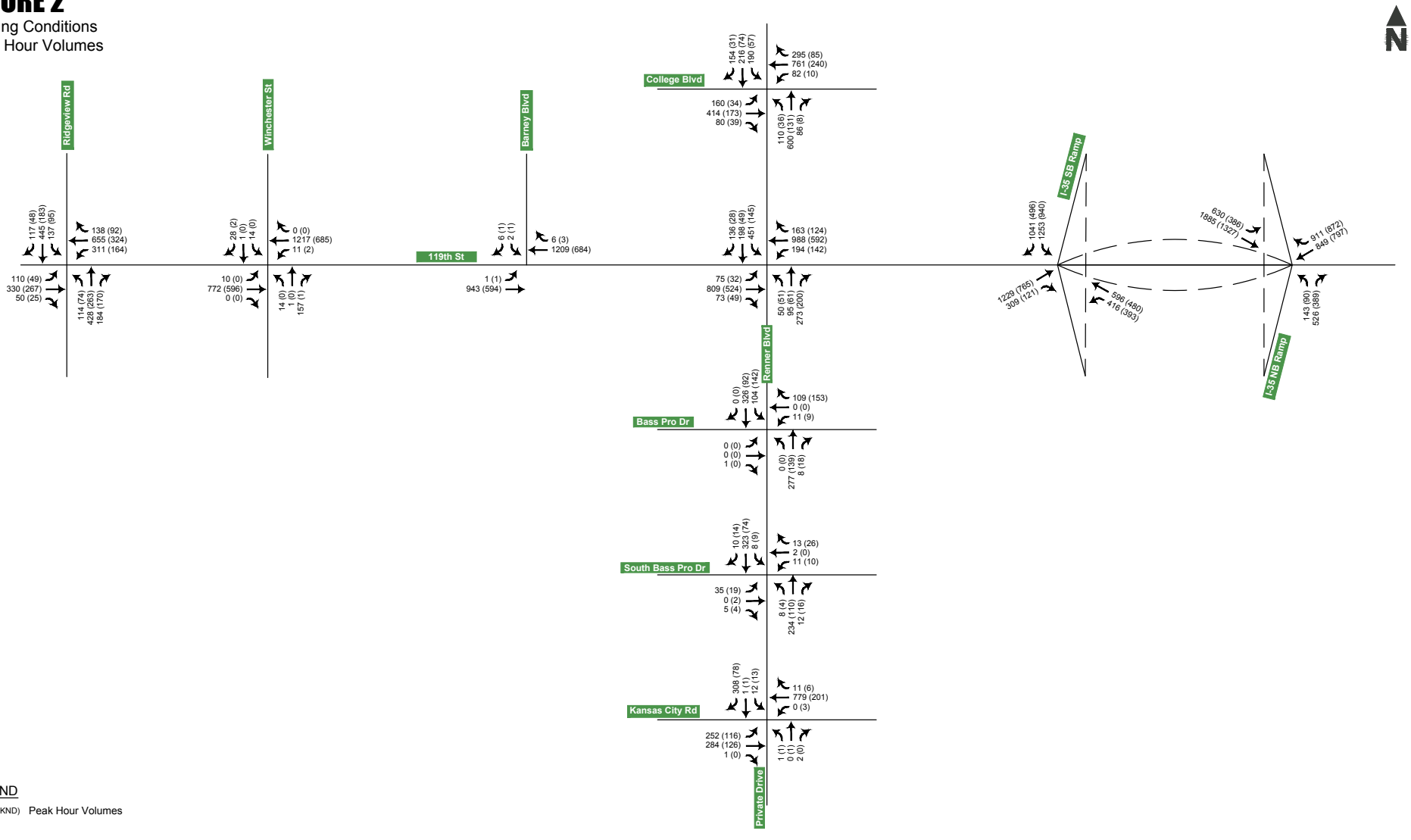
Based on coordination with City of Olathe staff, the PM peak hour and weekend peak hour were to be considered for analysis. Turning movement traffic counts were collected at the study intersections on Tuesday, July 9th, 2024, for the typical weekday PM peak period (4:00-6:00 PM). Counts were also taken on Saturday, July 13th, 2024, from 9:00-11:00 AM and 4:00-6:00 PM to determine the weekend peak hour. With approval from City staff, the selected peak hours for analysis were 4:30-5:30 PM for the weekday PM peak and 4:00-5:00 PM for the weekend peak. Existing peak hour traffic count data is illustrated in **Figure 2**. Traffic count data is provided in **Appendix A.**

Existing signal timings for the intersections of 119th Street with Ridgeview Road, Winchester Street, Barney Boulevard, Renner Boulevard and the Interstate 35 interchange, as well as the intersection of Renner Boulevard and Kansas City Road were provided by the City of Olathe. Existing signal timing information for the intersection of College Boulevard and Renner Boulevard was obtained from the Mid-America Regional Council's (MARC) Central Traffic Control System (TranSuite). These signal timings were used for peak hour period analysis. Signal timing data is provided in **Appendix A.**

Available crash data for the study area from January 2021 to July 2024 was obtained from the Kansas Department of Transportation (KDOT) Official Open Records request. Crash data was reviewed for the intersections of 119th Street with the I-35 interchange and the segment of 119th Street from Renner Boulevard to the I-35 Northbound Ramps. Crash data summary statistics collected for this study are provided in **Appendix A**.

FIGURE 2

Existing Conditions
Peak Hour Volumes



LEGEND

PM (WKND) Peak Hour Volumes

3. EXISTING CONDITIONS

Existing traffic conditions were evaluated to identify any existing deficiencies and to provide a baseline for comparison purposes.

3.1 Network Characteristics

Within the study area there are ten roadways that were considered during analysis: 119th Street, Ridgeview Road, Winchester Street, Barney Boulevard, Renner Boulevard, College Boulevard, Bass Pro Drive, South Bass Pro Drive, Kansas City Road, and I-35.

Functional classification for the study roadways were acquired referencing Olathe's *Major Street Map*. Current network characteristics were determined and are summarized in **Table 1**.

All study intersections are signalized except for the intersections of Renner Boulevard with Bass Pro Drive and South Bass Pro Drive which are roundabouts.

Table 1. Existing Network Summary.

Roadway	Functional Classification	Typical Section	Median Type	Posted Speed
119th Street	Arterial	Four-Lane/ Six-Lane*	Raised	45 mph
Ridgeview Road	Arterial	Four-Lane	Raised	40/45 mph
Winchester Street	Collector	Two-Lane	Undivided	30 mph
Barney Boulevard	Collector	Four-Lane	Raised	40 mph
Renner Boulevard	Arterial	Four-Lane	Raised	45 mph
College Boulevard	Arterial	Four-Lane	Raised	45 mph
Bass Pro Drive	Local	Two-Lane	Raised	30 mph**
South Bass Pro Drive	Local	Two-Lane	Raised	30 mph**
Kansas City Road	Arterial	Four-Lane	Raised	45 mph
I-35	Interstate	Six-Lane	Barrier	65 mph

**119th Street is six-lanes east of Barney Boulevard*

***No posted speed limit, assumed 30 mph*

3.2 Existing Warrant Analysis

Existing lane configuration and traffic control for the study network are illustrated in **Figure 3**.

Turn Lane Warrants: Olathe's *Access Management Plan* was utilized to determine whether auxiliary turn lanes are warranted at the study intersections and site drives. Left-turn lanes are required at all intersections and median breaks along arterial and collector roadways. Right-turn lanes are required at all intersections along arterial roadways and at intersections along collector roadways with at least 100 vehicles making a right-turn movement in any hour. Existing warrant evaluations at the study intersections are outlined below.

Left-Turn Lanes

All study intersections have left-turn lanes for all approaches.

Right-Turn Lanes

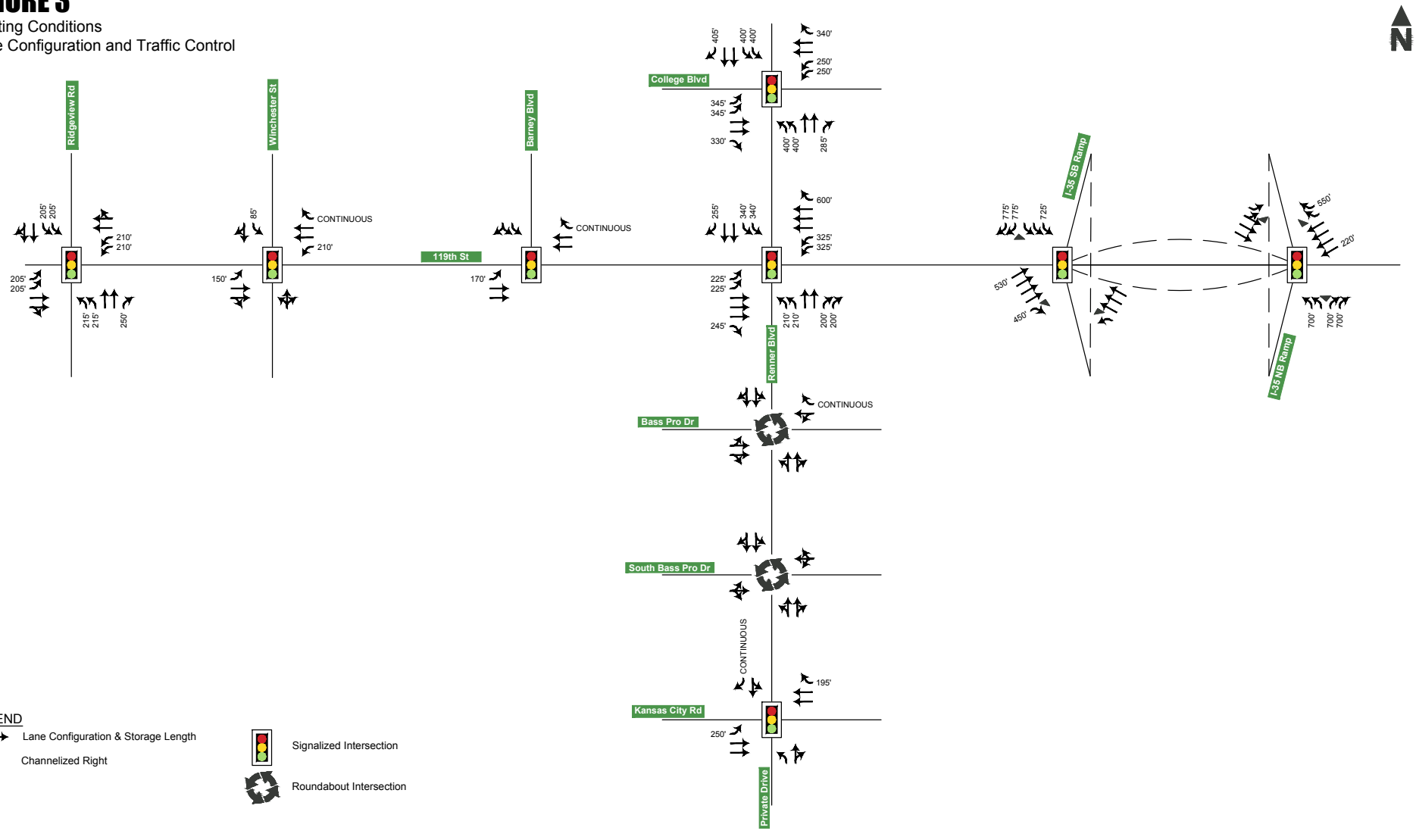
The following right-turn lanes are warranted under existing conditions:

- 119th Street at Ridgeview Road
    - Eastbound, westbound, and southbound right-turn lanes are warranted but not present. Per City guidelines, minimum storage length shall be 250 feet plus taper.
- 119th Street at Winchester Street
    - Eastbound right-turn lane is warranted but not present. Per City guidelines, minimum storage length shall be 150 feet plus taper.

As turn lanes are warranted under existing conditions but currently not in place, operations will be evaluated without the turn lanes.

FIGURE 3

Existing Conditions
Lane Configuration and Traffic Control



3.3 Existing Crash Data

Available crash data from 2021-2024 was obtained from KDOT for 119th Street near the I-35 interchange. The crash summary statistics were used to develop an intersection crash rate for the intersections of 119th Street with I-35 Southbound and Northbound Ramps, as well as segment crash rate for the segment of 119th Street between the Renner Boulevard and the I-35 interchange. The interchange was constructed as a diverging diamond interchange and operational starting in October 2021, thus crash data before that point was not incorporated in this study due to the influence of construction activity. The data available for 2024 did not represent a full year of data but was utilized for the purposes of this study. The total analysis period was 2.75 years, as opposed to the standard 3 years. The reviewed crash information is provided in **Appendix A**.

Intersection Crash Rate

The crash data was used to determine the average crash rate at the study intersections of 119th Street with I-35 Southbound and Northbound Ramps. A total of 51 crashes were noted at the I-35 Southbound Ramp and 32 crashes at the I-35 Northbound Ramp within the 2.75-year period. The crash total was compared to the average daily entering volume at the intersection. Crash rates are reported in number of crashes per million entering vehicles (MEV).

The equation used to calculate intersection crash rate is:

$$Intersection\ Crash\ Rate\ \left(\frac{Crashes}{MEV}\right) = \frac{2.75\ Year\ Crash\ Total}{\left(\frac{Total\ Entering\ Vehicles\ per\ Day}{1{,}000{,}000}\right) \times 365 \times 2.75}$$

KDOT staff also provided their methodology and standard values for calculation of intersection critical crash rate, as summarized below:

$$Critical\ Crash\ Rate\ (Rc) = Ra + K\sqrt{\frac{Ra}{M} + \frac{1}{2M}}$$

Where: R_c = Critical Crash Rate
R_a = Average Crash Rate (0.4)
K = coefficient = 1.96
M = 365 x number of years x ADT x (1/1,000,000)

Table 2 summarizes number of crashes, calculated crash rate, and critical crash rate for the two study intersections.

Table 2. Intersection Crash Rate Summary.

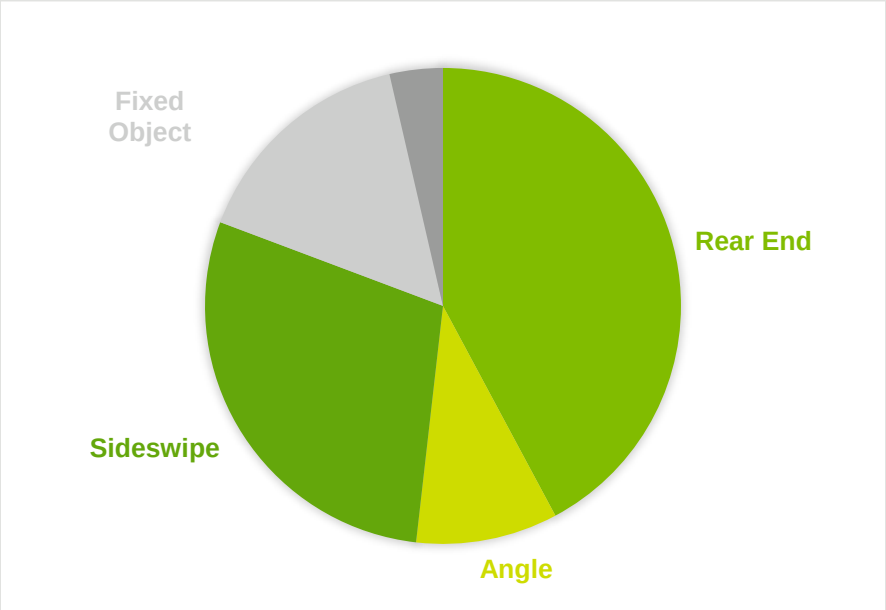
Intersection	Number of Reported Crashes	Calculated Crash Rate 2021-2024 (Crashes/MEV)	Critical Crash Rate
119th Street and I-35 Southbound Ramps	51	0.976	0.554
119th Street and I-35 Northbound Ramps	32	0.967	0.596

The calculated intersection crash rate for each intersection was compared to the critical crash rate. When comparing the calculated rate to the critical crash rate, both intersections are above the critical crash rate. Specific crash trends for both study intersections are shown in **Table 3** and **Exhibit 1**.

Table 3. Intersection Crash Type Summary.

Crash Type	Total Observed	I-35 Southbound Ramps	I-35 Northbound Ramps
Rear End	35	16	19
Angle	8	7	1
Sideswipe	24	17	7
Fixed Object	13	8	5
Other	3	3	-
Total	**83**	**51**	**32**

Exhibit 1: Intersection Crash Type Summary.



Crash types reported at study intersections were reviewed to determine a potential cause for the collisions and to determine if the crashes are correctable by traffic measures. Reviewing reported crash type at both study intersections, the most reported crash type was rear end (35 reported crashes). Several of these crashes were noted to be associated with inattentive driving. The second highest crash type was sideswipe (24 reported crashes) followed by crashes with a fixed object (13 reported crashes). Detailed information was not available to determine if a notable pattern (directionally by crash type) is occurring that is correctable.

As noted above, detailed crash data to determine patterns in crash type were not available. However, both rear end and sideswipe crashes may be occurring as drivers become familiar with navigating the new interchange control (diverging diamond interchange). Reviewing available data for 2024, there has been a slight decrease in crash occurrence rates. This may indicate that drivers are becoming more accustomed to the interchange control. Specific mitigation measures are not recommended at this time.

Segment Crash Rate

A total of 24 crashes were noted along 119th Street between Renner Boulevard and the I-35 interchange within the 2.75-year analysis period from October 2021 to 2024. The crash total was compared to the average daily entering volume of the segment. The calculated crash rate is reported in the number of crashes per million vehicle miles traveled (MVMT) for the study segment. The equation used to calculate the segment crash rate is:

$$Segment\ Crash\ Rate\ \left(\frac{Crashes}{MVMT}\right) = \frac{2.75\ Year\ Crash\ Total}{\left(\frac{Total\ Entering\ Vehicles\ per\ Day}{1{,}000{,}000}\right) \times 365 \times 2.75 \times Length}$$

Table 4 summarizes the number of crashes, calculated crash rate, and critical crash rate for the segment. The critical crash rate equation is presented above; for segment calculations the equation includes reference of the length of the segment.

Table 4. Segment Crash Rate Summary.

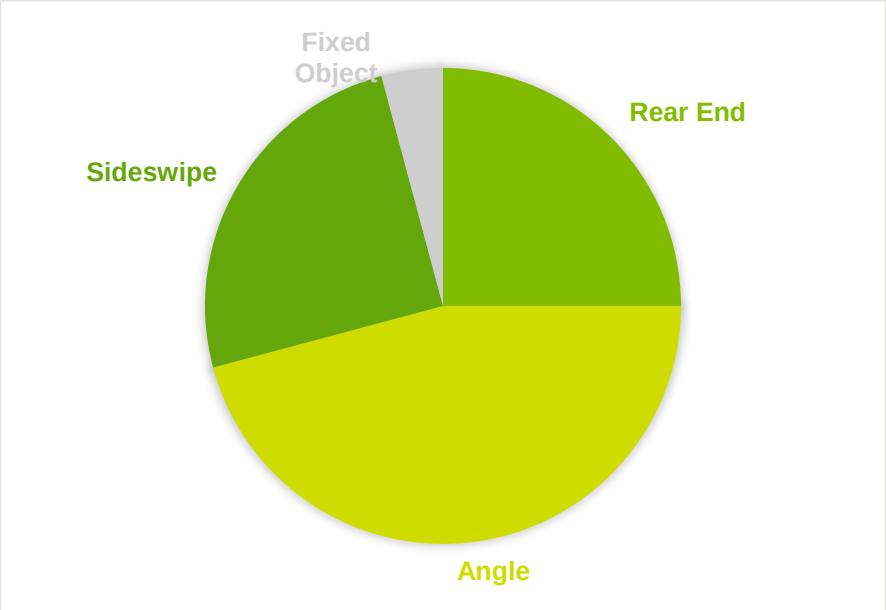
Segment	Number of Reported Crashes	Calculated Crash Rate 2021-2024 (Crashes/MVMT)	Critical Crash Rate
119th Street between Renner Boulevard and I-35 Northbound Ramps	24	2.036	1.245

The calculated segment crash rate is above the critical crash rate for similar road segments. The crash rate calculations are provided in **Appendix A**. Specific crash trends for the roadway segment is shown in **Table 5** and **Exhibit 2.**

Table 5. Segment Crash Type Summary.

Crash Type	Total Observed (2021-2024)
Rear End	6
Angle	11
Sideswipe	6
Fixed Object	1
Total	**24**

Exhibit 2: Segment Crash Type Summary.



Crash types along the roadway segment were reviewed to determine a potential cause for the collisions to determine if crashes are correctable by traffic measures. A total of 24 crashes were reported for this roadway segment, with the highest crash type being angle crashes followed by rear end and sideswipe. Detailed information was not available to determine if a notable pattern (directionally by crash type) is occurring that is correctable. It is anticipated that these crash types may be attributed to queuing associated with signals located along the corridor and congestion, although this could not be confirmed with the data provided. Specific mitigation measures are not recommended at this time.

3.4 Existing Capacity Analysis

Capacity analysis was performed for the study intersections using the existing lane configurations and traffic control. Analysis was conducted using Synchro, Version 11, based on the *Highway Capacity Manual* (HCM) delay methodologies. Roundabout analysis was conducted using SIDRA Intersection, Version 9. For simplicity, the amount of control delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. The amount of delay is assigned a letter grade A through F, LOS A representing little or no delay and LOS F representing very high delay. **Table 6** shows the delays associated with each LOS grade for signalized and unsignalized intersections, respectively. Queuing analysis was conducted referencing the 95th percentile queue length. This represents the queue length that has a 5 percent probability of being exceeded during the peak hour period.

Table 6. Intersection Level of Service Criteria.

Level of Service	Average Control Delay (seconds)	
	Signalized	Unsignalized
A	< 10	< 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50
Highway Capacity Manual (6th Edition)		

Analysis was conducted referencing the existing peak hour factors as obtained from data collection. Heavy vehicle percentages were based on existing conditions.

The signalized intersections are operating at an overall LOS D or better during both peak hour periods. Individual signalized movements are operating at a LOS D or better during both peak hour periods with the exceptions of the movements summarized below. For the intersections below, optimizing cycle length, phasing, and/or splits would be expected to result in movement and/or intersection LOS improvement to D or better. Some movements that serve low traffic volumes under existing conditions may be operating at a lower LOS as higher volume movements are prioritized.

During the PM peak hour period specifically, through lane queuing that may exceed the length of adjacent turn bays may be occurring. This is associated with the high volume of through traffic being serviced along the corridor. Longer queues that may be experienced are expected to be limited to the peak hour periods.

119th Street and Ridgeview Road

- The eastbound left-turn, northbound left-turn, northbound through movement and all southbound movements are operating at a LOS and the eastbound through movement is operating at a LOS F during the weekday PM peak hour period.

119th Street and Winchester Street

- The westbound left-turn, northbound movements and southbound movements are operating at a LOS E during the weekday PM peak hour.

119th Street and Barney Boulevard

- The eastbound left-turn movement operates at a LOS E during both peak hour periods. Southbound movements operate at a LOS E during the weekday PM peak hour.

119th Street and Renner Boulevard

- The eastbound left-turn, northbound left-turn, northbound through, southbound left-turn and southbound right turn movements operate at a LOS E during the weekday PM peak hour. During the weekend peak hour, the eastbound left-turn operates at a LOS E.

Renner Boulevard and College Boulevard

- The southbound left-turn movement operates at a LOS E during the weekday PM peak hour.

Kansas City Road and Renner Boulevard

- The southbound right-turn movement operates at a LOS E during both peak hour periods.

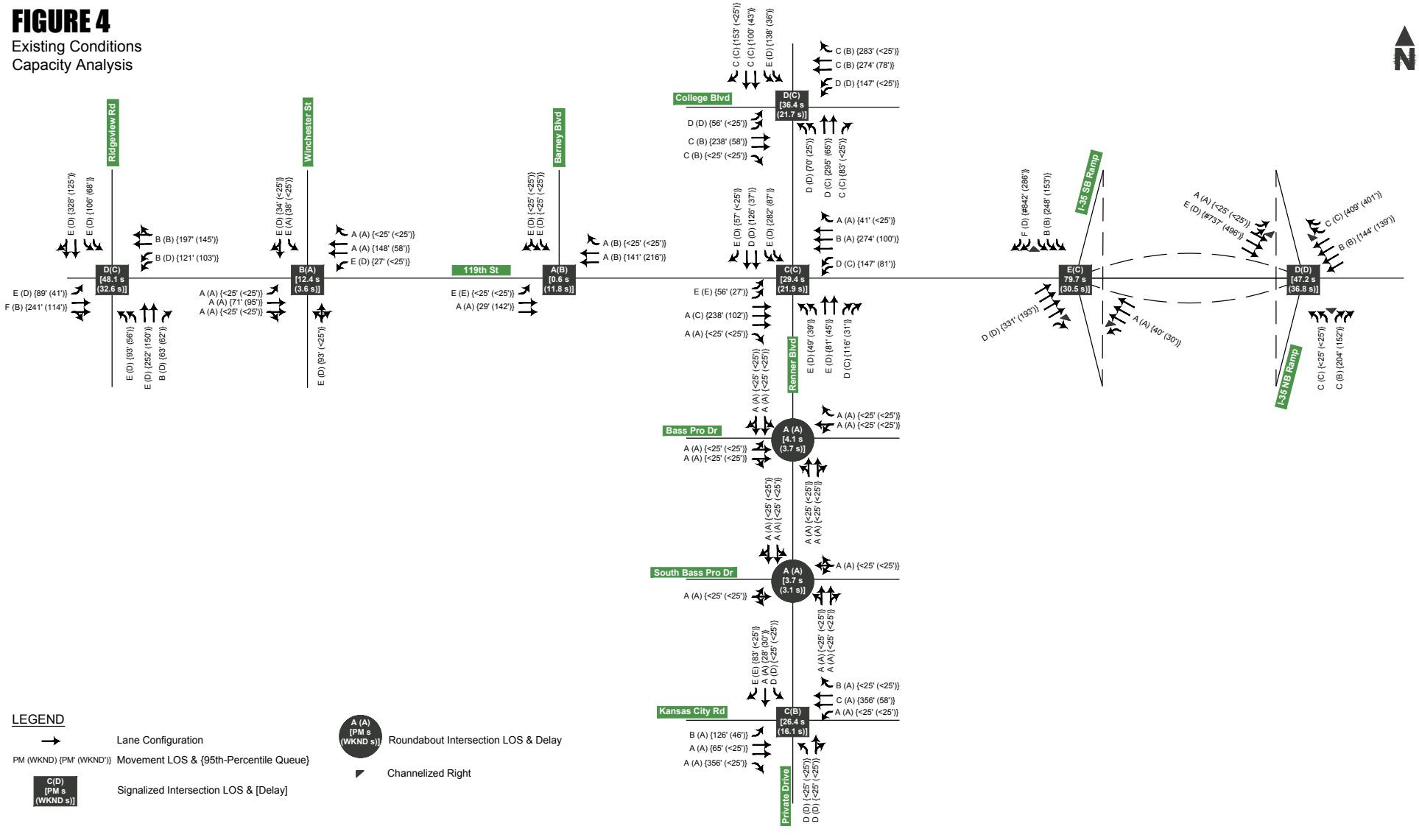
119th Street at I-35 Northbound and Southbound Ramps

- During the weekday PM peak hour, the I-35 Southbound Ramp right-turn operates at a LOS F with an extended 95th-percentile length. During the weekday PM peak hour the I-35 Eastbound movement operates at a LOS E with an extended 95th-percentile queue length. Several movements operate with longer 95th-percentile queue lengths during both peak hour periods.

The roundabout intersections have an overall and individual movement operations of LOS A during both peak hour periods. The Existing capacity analysis summary is illustrated in **Figure 4**. Detailed results are provided in **Appendix B.**

FIGURE 4

Existing Conditions
Capacity Analysis



4. EXISTING PLUS DEVELOPMENT CONDITIONS

The proposed development will consist of a 4,800-person capacity theme park, a 5,500-person capacity arena, 128,000 square feet of restaurant/retail, and a 150 key hotel. The proposed site plan is shown in **Figure 5**. Currently, the site area is open and undeveloped in the location of the proposed development.

4.1 Trip Generation and Distribution

To determine the impact of potential site traffic on the roadway network, expected trips associated with the proposed site were generated and applied to the study network. The Institute of Transportation Engineers (ITE) provides methods for estimating traffic volumes of common land uses in the *Trip Generation Manual (11th Edition)*. For analysis purposes and to best capture estimated development trip generation, the following land uses and densities were assumed for the proposed development:

- Hotel (LUC 310) – 150 keys
- Shopping Plaza (40-150k) w/Supermarket (LUC 821) – 114,000 square feet
- High-Turnover (Sit-Down) Restaurant (LUC 932) – 7,000 square feet
- Fast-Food Restaurant with Drive-Through Window (LUC 934) – 7,000 square feet
- Theme Park – 4,800 maximum capacity
- Arena – 5,500 maximum capacity

Since the site contains multiple land uses, internal trip capture was considered for the PM and weekend peak hours. Internal capture represents the portion of trips generated within a site that begin and end within the development; the trips stay within the site and do not access the external road network. Internal capture reduction rates were determined from the ITE *Trip Generation Manual.* Due to the limited weekend data for internal capture rates, PM peak hour internal capture data was assumed for the weekend peak hour. Based on the analysis, the internal capture percentage was determined to be 25.5% for the weekday PM and weekend peak hour periods.

Pass-by characteristics were also considered for the proposed development referencing the ITE *Trip Generation Handbook (3rd Edition)*. Pass-by trips are made by traffic that is already on the roadway and passing the site, versus making a specific trip to the development (primary trips). Pass-by volumes were considered for the site access points along 119th Street and Renner Boulevard and were only considered for the retail and restaurant land uses. The land uses and their respective pass-by by rates are summarized in **Table 7**.

Table 7. Pass-By Rate Summary

Land Use	Weekday PM Peak Hour	Weekend Peak Hour
Shopping Plaza (40-150k) w/Supermarket (LUC 821)	40%	31%
High-Turnover (Sit-Down) Restaurant (LUC 932)	43%	43%
Fast-Food Restaurant with Drive-Through Window (LUC 934)	50%	55%

For the theme park land use, the following data and assumptions were utilized to develop the estimated PM and weekend peak hour trip generation:

- Maximum theme park capacity of 4,800 people.
- This theme park is open from mid-March to the end of October. Normal operating hours are 10:30 AM to 5:00 PM. The theme park is open from Friday through Sunday when school is in session, and open seven days a week when school is out of session.
- Based on Google Maps probe data for similar types of theme parks, guests typically stay two to five hours during their visit.
- This study considers the weekday PM peak hour period. Thus, weekday PM and weekend peak hour analysis is assumed to only include outbound theme park traffic. Inbound traffic is assumed to occur outside of the traffic peaks.
- Estimated persons per car is assumed to be 2.75. This is based on data collected for theme park and stadium venues that indicate ranges from 2.5 to 3.0 persons per vehicle for similar events.

For the arena land use, the following data and assumptions were utilized to develop the estimated PM and weekend peak hour trip generation:

- Maximum arena capacity of 5,500 people.
- The principal use for the venue is anticipated to be minor league professional sports that typically have evening games during the week and on weekends.
- Based on research for similar sports arenas, games typically start at 7:00 PM for weekday and weekend games, last approximately two hours, and have a pre-event ingress peak of 6:00 to 7:00 PM and post-event egress peak of 9:00 to 10:00 PM.
- Although the pre-event peak ingress is expected to be after the PM peak hour (4:00 for weekday, 4:30 for weekend), the pre-event peak is assumed to align with the PM peak hours for a conservative analysis.
- PM and weekend peak hour analysis is assumed to only include inbound traffic. Outbound traffic is assumed to be outside of traffic peaks.

- Estimated persons per car is assumed to be 2.75. This is based on data collected for stadium venues that indicate ranges from 2.5 to 3.0 persons per vehicle for similar events.
- Research regarding pre-event arrivals indicates that approximately 60% of traffic arrives in the hour before an event in downtown environments and 90% of traffic arrives in the hour before an event for suburban locations with fewer surrounding amenities. Although the proposed development plans a significant number of amenities in addition to the arena, 85% pre-event arrivals was assumed as a conservative measure.

Trip generation characteristics expected for the site are shown in **Table 8**. Detailed ITE trip generation information is provided in **Appendix C**.

Table 8. Trip Generation.

Land Use	ITE Code	Average Weekday	PM Peak Hour			Weekend Peak Hour		
			Total	Enter	Exit	Total	Enter	Exit
310	Hotel	1,199	89	45	44	108	60	48
821	Shopping Plaza (40-150k) w/ Supermarket	10,772	1,029	494	535	1,056	538	518
932	High-Turnover (Sit-Down) Restaurant	750	63	38	25	78	40	38
934	Fast-Food Restaurant with Drive-Through Window	3,272	231	120	111	387	197	190
-	Theme Park	1,746	873	0	873	873	0	873
-	Arena	2,000	1,700	1,700	0	1,700	1,700	0
Gross Trips		19,739	3,985	2,397	1,588	4,202	2,535	1,667
Internal Capture		*-3,400*	*-416*	*-208*	*-208*	*-416*	*-208*	*-208*
Pass-By		*-4,177*	*-390*	*-195*	*-195*	*-418*	*-209*	*-209*
New Trips		12,162	3,179	1,994	1,185	3,368	2,118	1,250
Driveway Volumes		16,339	3,569	2,189	1,380	3,786	2,327	1,459

Trips were distributed through the study network based on the existing gravity, anticipated land use, and review of the surrounding area. The theme park and arena land-uses are anticipated to be a regional attraction and thus trips are expected to be primarily distributed from I-35. The commercial land uses are expected to attract local trip assignments. Directional trip distribution percentages expected for the site are illustrated in **Table 9**.

Table 9. Trip Distribution.

Land Uses	Direction	Trip Distribution
Arena and Theme Park (Total 100%)	To/From the north on I-35	40%
	To/From the South of I-35	15%
	To/From the east on 119th Street	15%
	To/From the north on Renner Boulevard	15%
	To/From the west on 119th Street	5%
	To/From the south on Kansas City Road	10%
Commercial (Total 100%)	To/From the north on I-35	15%
	To/From the South of I-35	10%
	To/From the east on 119th Street	10%
	To/From the north on Renner Boulevard	25%
	To/From the west on 119th Street	20%
	To/From the south on Kansas City Road	20%

Trip generation and distribution was provided to agency staff for review. The expected trip distribution volumes for the proposed development are shown in **Figure 6**. The resulting existing plus development volumes are illustrated in **Figure 7**.

The proposed development consists of a mix of retail/restaurant and hotel uses, which would be expected to generate traffic consistently on a year-round basis. The arena is expected to be used as an event space, with events held periodically on a year-round basis. For the purposes of this study, a full capacity event was considered. The theme park will be open seasonally, with limited to no trip generation for approximately 6 months of the year. For the purposes of this study, full capacity theme park trips were considered. Additionally, for the purposes of this study ingress for an arena event was considered to occur at the same time as egress for the theme park; dependent upon closing time of the theme park and start time of an event this may be a very limited occurrence. The trip generation presented in this study is expected to represent a worst-case scenario for operations.

FIGURE 5

Olathe, Kansas
Site Plan

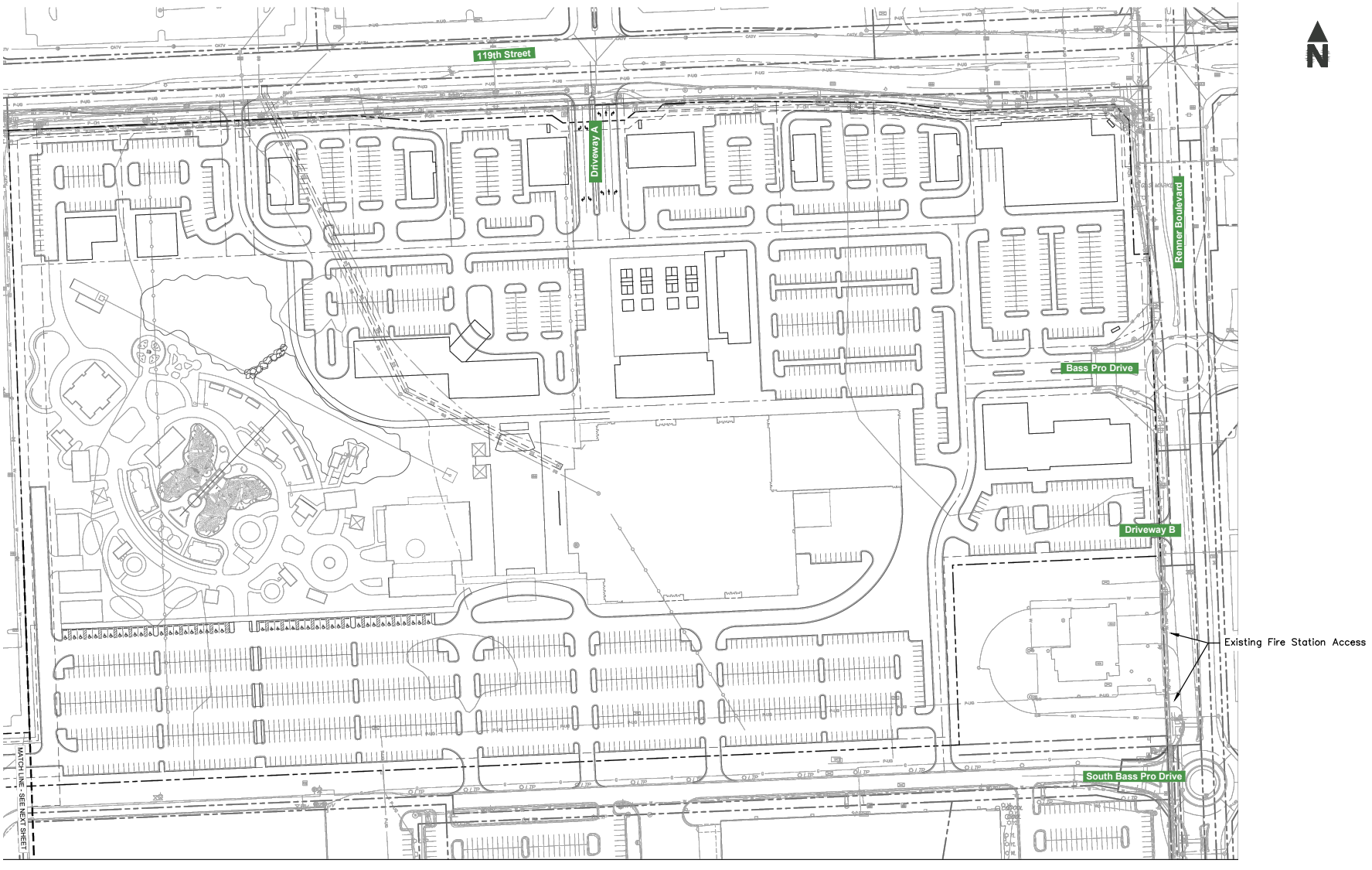
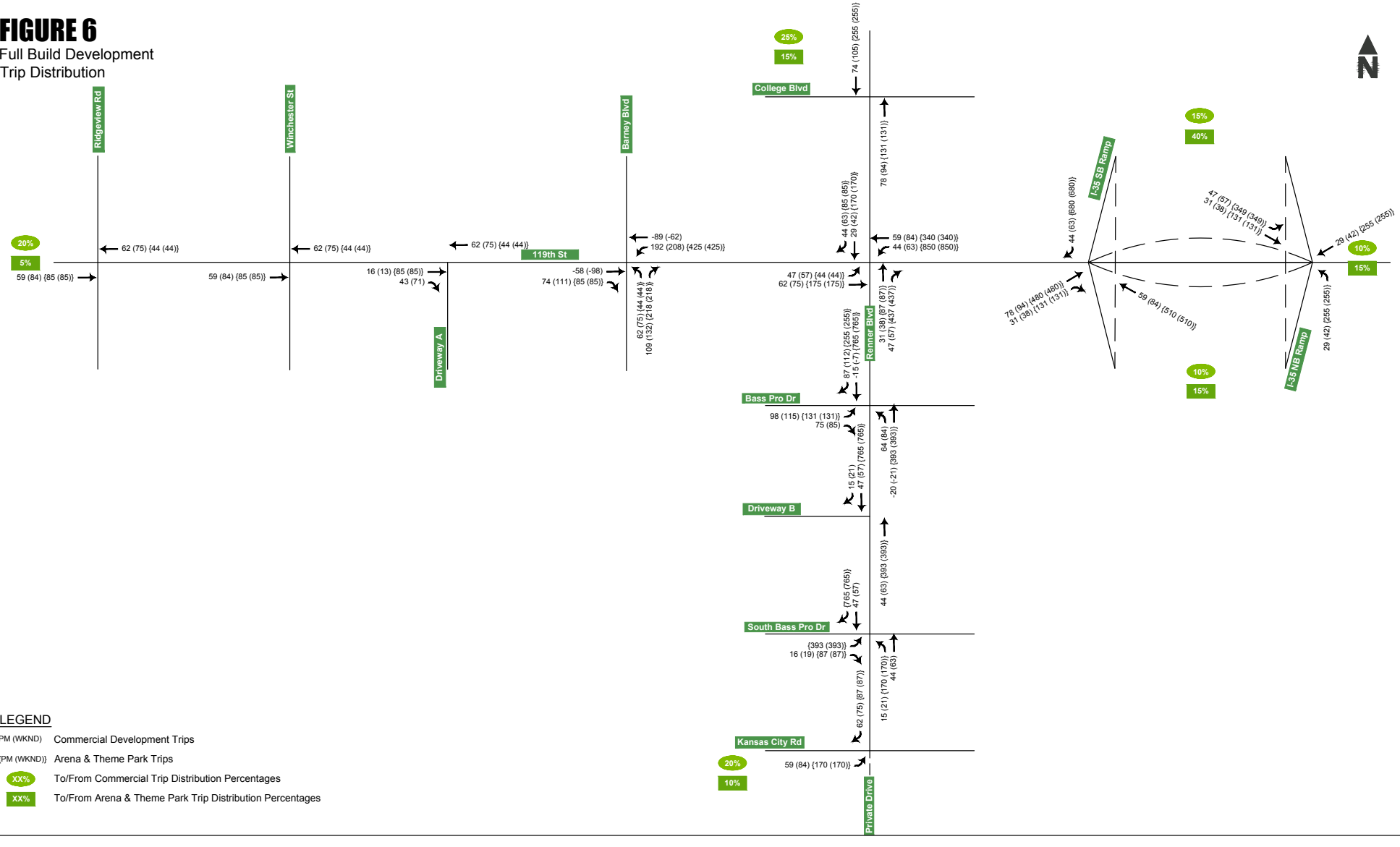


FIGURE 6

Full Build Development
Trip Distribution

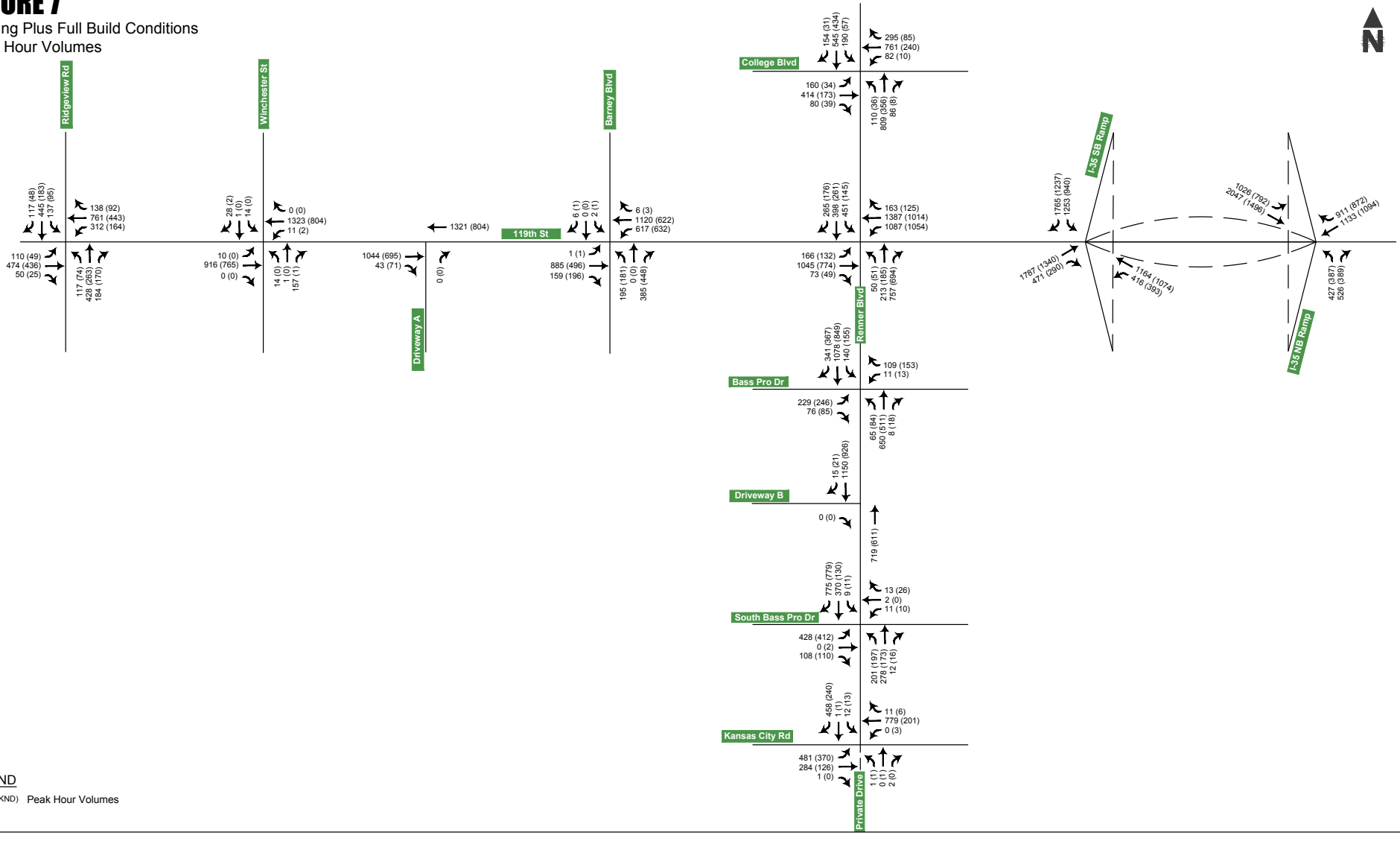


LEGEND

PM (WKND)	Commercial Development Trips
{PM (WKND)}	Arena & Theme Park Trips
XX%	To/From Commercial Trip Distribution Percentages
XX%	To/From Arena & Theme Park Trip Distribution Percentages

FIGURE 7

Existing Plus Full Build Conditions
Peak Hour Volumes



LEGEND

PM (WKND) Peak Hour Volumes

4.2 Access Characteristics

As shown on the site plan presented in **Figure 5**, the proposed development is located in the southwest quadrant of 119th Street and Renner Boulevard.

Access to the site is proposed via full access drives aligning with Barney Boulevard, Bass Pro Drive, and South Bass Pro Drive. In addition, access is proposed via two right-in/right-out drives, Driveway A and Driveway B. Barney Boulevard will extend south of 119th Street, providing access along the north side of the site. Driveway A will be located along 119th Street, approximately 647 feet west of Barney Boulevard and 442 feet east of Winchester Street. The west leg of the Renner Boulevard and Bass Pro Drive intersection will be extended and will provide access on the east side of the site. Driveway B will be located along Renner Boulevard, approximately 288 feet south of Bass Pro Drive and 450 feet north of South Bass Pro Drive. All driveway spacings were measured from center-to-center of the intersections.

Full access is proposed to be provided via existing signalized or roundabout intersections. Alignment of full access at existing intersections is a preferred condition.

According to Olathe's *Access Management Plan*, proposed drives should be outside the influence area of adjacent intersections. For intersections along 119th Street and Renner Boulevard, the influence area is 500 feet.

Driveway A (proposed as a right-in/right-out) is within the downstream influence area for the intersection of 119th Street and Winchester Street by approximately 60 feet. The driveway spacing is expected to be acceptable and provides for adequate upstream influence area from the intersection of 119th Street and Barney Boulevard.

Driveway B is proposed to be located approximately 288 feet south of Bass Pro Drive and 174 feet north of an existing fire station access driveway. Driveway B is located along the southern most point of the site's property line along Renner Boulevard and adjacent to the existing fire station. The fire station access is for emergency vehicle access only, thus is expected to have minimal usage. Primary vehicle access to the fire station is located approximately 130 feet south of the emergency vehicle access. The proposed location of Driveway B is the optimal location considering alignment along the property line and distance from the Bass Pro Drive intersection.

Olathe's *Access Management Plan* provides throat length criteria for full access driveways and right-in/right-out access drives. Throat distance at driveways along arterial roadways should be 250 feet prior to the first internal curb cut or parking isle. Throat distance at right-in/right-out driveways along arterial roadways should be 100 feet prior to the first internal curb cut or parking aisle. Based on the site plan, adequate throat distance is provided for all proposed access drives. Reviewing capacity analysis, vehicular queuing would not be expected to exceed recommended minimum throat lengths.

4.3 Site Circulation and Connectivity

Site circulation and connectivity was reviewed for the site. The site access points of Driveway A, Barney Boulevard, and Bass Pro Drive are expected to be the main access routes for the retail, restaurant, and hotel land uses. The majority of theme park and arena traffic is expected to utilize Barney Boulevard, Bass Pro Drive, Driveway B, and the South Bass Pro Drive access points, as these have the most direct access to the parking areas adjacent to these land uses. However, all site access points will be connected to promote on-site circulation.

As mentioned in **Section 4.1**, the peak arrival period for arena events is anticipated to be from 6:00 PM to 7:00 PM. To support operations of the network, events with ingress occurring during the PM peak hour period should consider implementation of an arena traffic management plan. To support the expected volume of event traffic arriving via I-35 southbound, it is recommended to route inbound arena traffic from the I-35 Southbound Ramp via the 119th Street access to Kansas City Road, continuing along Kansas City Road to Renner Boulevard. This route is shown on a figure provided in **Appendix C**. For the purposes of this report, revised trip distribution considering an event management plan in place was not reviewed. Analysis considers a worst-case scenario with no event traffic management.

Reviewing the site plan, an additional access point is located adjacent to the southwest parking lot and provides access to North Winchester Street to the south of the proposed development. Due to its location, this driveway is not anticipated to be utilized for retail/restaurant/hotel uses but could be utilized as an access route for arena visitors parking in the southwest lot. This study considered entering arena traffic overlapping with exiting theme park traffic, thus entering arena traffic was considered via 119th Street and Renner Boulevard to streamline arena entry. Access south to Winchester Street could be provided during event egress. Typical arena events are expected to end outside of the peak hour, thus, this site access point was not considered in the analysis.

If an event at the arena is scheduled to overlap with operating hours of the theme park, a site parking management plan should be developed to support entering event traffic and exiting theme park traffic and to alleviate vehicle congestion in parking areas.

4.4 Existing Plus Development Warrant Analysis

Turn lanes were warranted under existing conditions at the intersections of 119th Street with Ridgeview Road and Winchester Street. As these turn lanes are not in place under existing conditions, capacity analysis will be reviewed to determine the impact of the proposed development on operations of the intersection.

Left-Turn Lanes

In addition to lanes warranted under existing conditions, the following left-turn lanes are warranted under Existing Plus Development conditions:

- 119th Street at Barney Boulevard
    - A westbound left turn lane is warranted. Per City guidelines, minimum storage length shall be 250 feet plus taper.
    - Reviewing expected traffic volumes, dual left turn lanes with a storage length of 400 feet plus taper are recommended to be constructed.

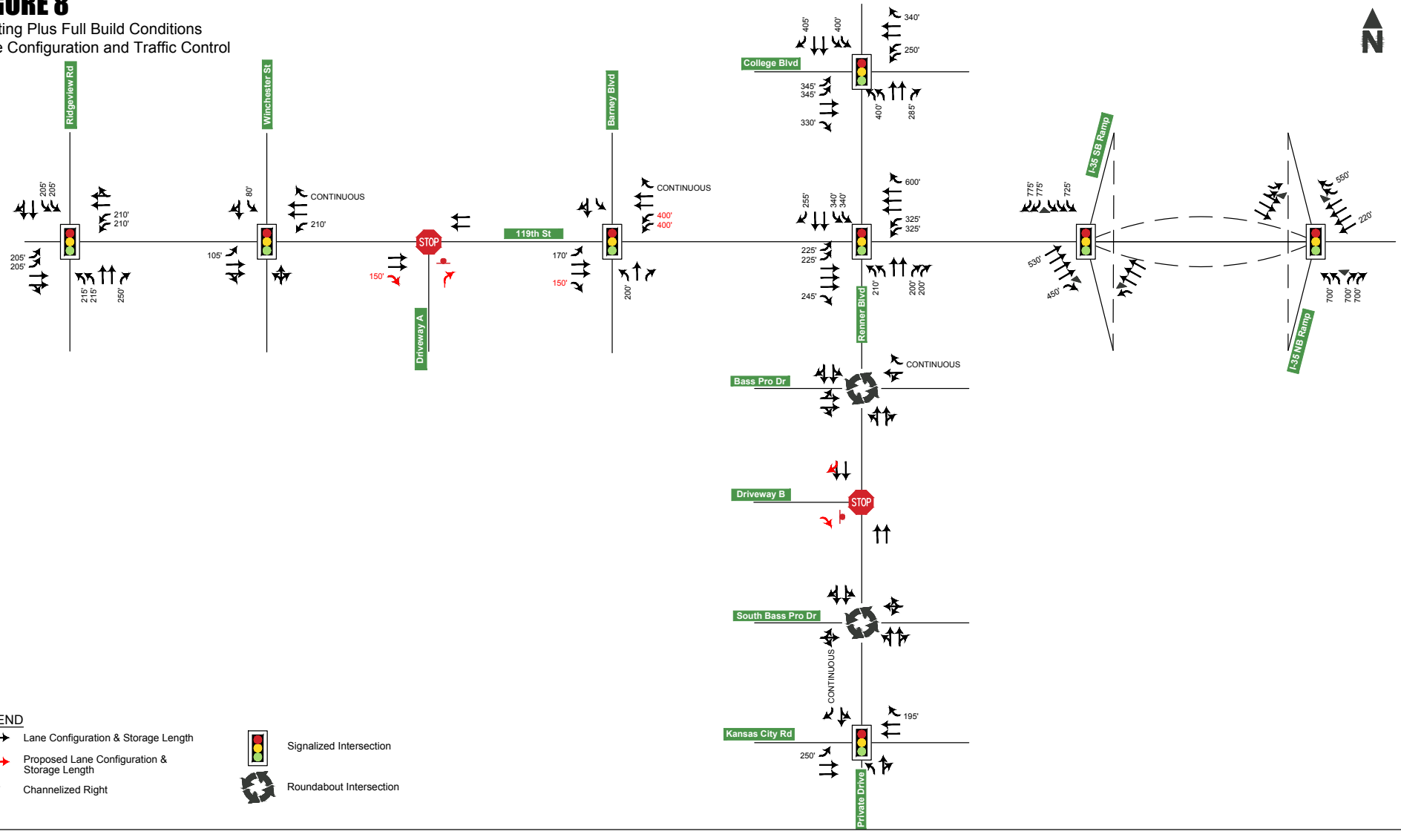
Right-Turn Lanes

In addition to lanes warranted under existing conditions, the following right-turn lanes are warranted under Existing Plus Development conditions:

- 119th Street at Barney Boulevard
    - An eastbound right-turn lane is warranted. Per City guidelines, minimum storage length shall be 150 feet plus taper.
    - This lane is recommended to be constructed per City guidelines.
- 119th Street at Driveway A
    - An eastbound right-turn lane is warranted. Per City guidelines, minimum storage length shall be 150 feet plus taper.
    - This lane is recommended to be constructed per City guidelines.

FIGURE 8

Existing Plus Full Build Conditions
Lane Configuration and Traffic Control



4.5 Existing Plus Development Capacity Analysis

Capacity analysis was performed for Existing Plus Development conditions using the methodologies described in **Section 3.3**. The peak hour factors observed under existing conditions were used for existing plus development conditions at existing study intersections.

The site is not expected to consist of a high volume of truck traffic. A significant impact to adjacent roadway truck percentages is not expected with the proposed development. At the intersection of Renner Boulevard and South Bass Pro Drive, existing traffic data showed high heavy vehicle percentages to/from the western roundabout leg. For analysis purposes, a default heavy vehicle percentage of 2% was applied to this and all study intersections with the expectation that development traffic will significantly decrease the percentage of heavy vehicles in the study area.

As presented in **Section 4.4**, turn lanes are warranted or recommended based on proposed development traffic. Turn bay length was determined based on City of Olathe guidelines and review of capacity analysis results. The following improvements were considered when conducting capacity analysis:

- 119th Street at Barney Boulevard
    - Eastbound right-turn lane with minimum storage length of 150 feet plus taper.
    - Westbound dual left-turn lanes with minimum storage length of 400 feet plus taper.
    - Northbound approach consisting of a dedicated left-turn, through lane, and right-turn lane.
    - Signal modification.
- 119th Street at Driveway A
    - Eastbound right-turn lane with minimum storage length of 150 feet plus taper.
- Kansas City Road and Renner Boulevard
    - Modify the southbound lane arrangement to a shared through/left-turn lane and a dedicated right-turn lane.
    - Signal modification.
- Optimization of signal timings (cycle length, phasing, and/or splits) at signalized intersections.

The signalized intersections are expected to operate at an overall LOS D or better during both peak hour periods. Individual signalized movements are expected to operate at a LOS D or better with acceptable 95th-percentile queue lengths during both peak hour periods with the exceptions of the movements summarized below.

119th Street and Barney Boulevard

- The 95th percentile queue length associated with the eastbound through movement is expected to extend beyond adjacent turn bays during the PM peak hour period.
- This scenario considers ingress for a full capacity arena event overlapping with theme park egress traffic. The extended queuing associated with this movement can be attributed to accommodating the westbound left turn movement entering the site. Reduced queue lengths would be expected under non-event conditions.

119th Street and Renner Boulevard

- The 95th percentile queue length associated with the westbound left-turn movement is expected to exceed available storage during both peak hour periods.
- This scenario considers ingress for a full capacity arena event overlapping with theme park egress traffic and traffic associated with the adjacent development. Event traffic represents an estimated 1,700 ingress trips (arena) and 873 egress trips (theme park) during the weekday and weekend peak hours. This is expected to represent a worst-case scenario with full capacity ingress/egress at the theme park and arena occurring at the same time.
- The arena is not expected to host daily full capacity events, and the theme park will be open seasonally. To mitigate congestion at the intersection of 119th Street and Renner Boulevard during event ingress, a traffic management plan is recommended to be developed. See **Section 4.3** for potential event management routing.

College Boulevard and Renner Boulevard

- The 95th percentile queue length associated with the westbound and northbound through movements is expected to extend beyond adjacent turn bays during the PM peak hour period.
- This scenario considers ingress for a full capacity arena event overlapping with theme park egress traffic. The extended queuing associated with these movements can be attributed heavier vehicular loading associated with event traffic. Reduced queue lengths would be expected under non-event conditions.

Kansas City Road and Renner Boulevard

- The 95th percentile queue length associated with the westbound through movement is expected to extend past the adjacent turn bay.
- This scenario considers ingress for a full capacity arena event overlapping with theme park egress traffic. The extended queuing associated with this movement can be attributed to accommodating the eastbound left turn movement entering the site. Reduced queue lengths would be expected under non-event conditions.

119th Street at I-35 Northbound and Southbound Ramps

- During the weekday PM peak hour, the I-35 Southbound Ramp right-turn operates at a LOS E with a queue length similar to existing conditions.
- To mitigate congestion at the intersection of 119th Street and Renner Boulevard during event ingress, a traffic management plan is recommended to be developed. See **Section 4.3** for potential event management routing.

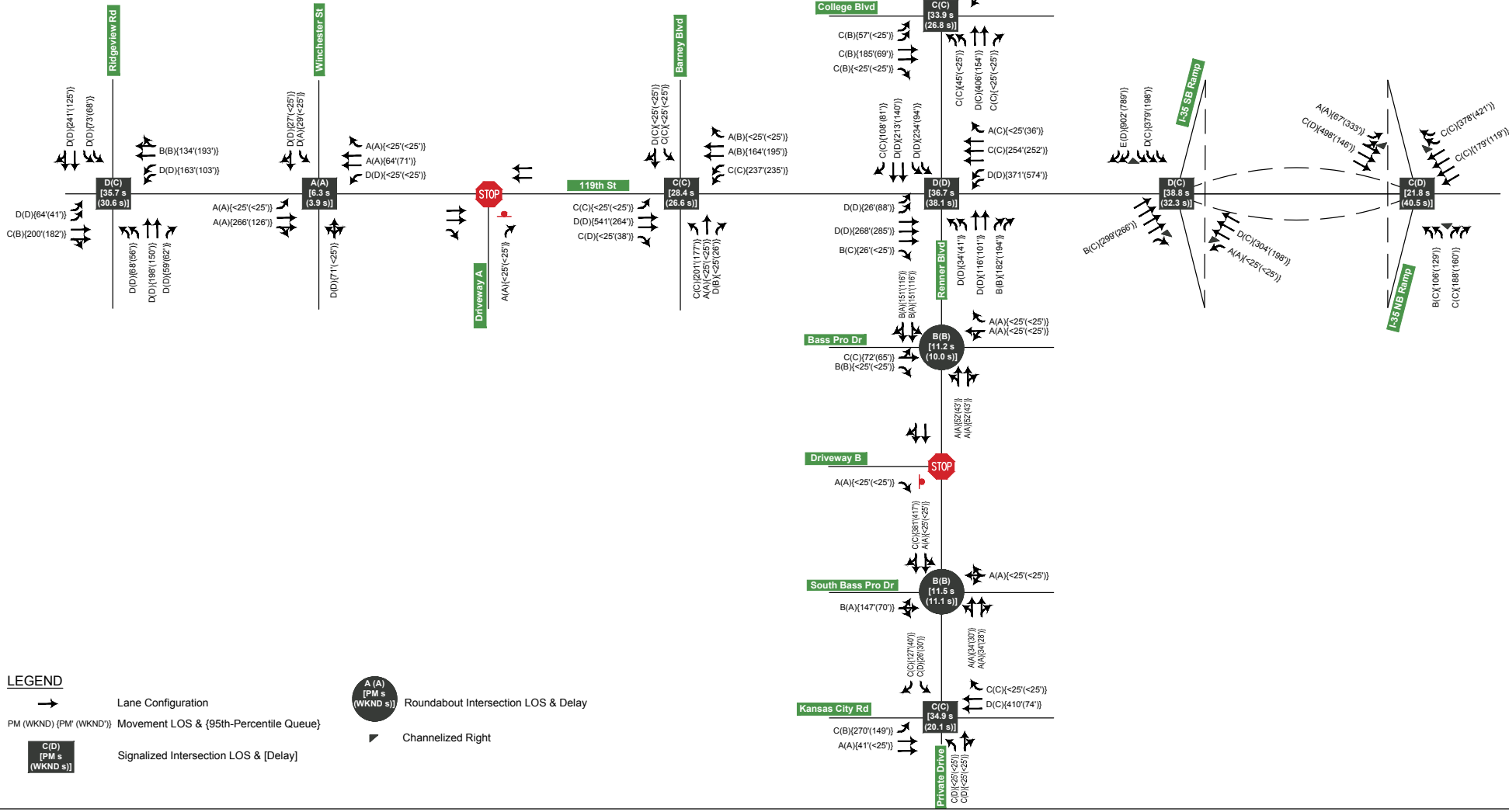
The roundabout intersections have an overall LOS B and individual movement operations of LOS C or better during peak hour periods. Longer queuing is expected at Renner Boulevard and South Bass Pro Drive associated with event traffic. Under non-event conditions, decreased queuing would be expected. Internal site parking management is recommended to support efficient entry and exit of traffic to the site.

The Existing Plus Development capacity analysis summary is illustrated in **Figure 9**. Detailed results are provided in **Appendix C.**

As discussed previously, this study presents network analysis considering traffic ingress for a full capacity event at the arena and full capacity egress of the theme park both occurring during the weekday PM or weekend peak hour period, in addition to trips associated with the adjacent development. This is expected to represent a very conservative analysis scenario with over 2,500 additional event trips considered on the network. During non-event conditions (which would be expected to represent typical operations), the network is expected to operate at acceptable levels of service.

FIGURE 9

Existing Plus Full Build Conditions
Capacity Analysis



5. FUTURE YEAR 2044 PLUS DEVELOPMENT CONDITIONS

This scenario considers operations of the future roadway network considering background traffic growth with the addition of proposed development volumes. The future year considers 20 years of background traffic growth, applied to all movements within the study network. A 2% growth rate was used for the study area. Future Year 2044 Plus Development volumes are illustrated in Error! Reference source not found..

5.1 Future Year 2044 Plus Development Warrant Analysis

Turn lanes were warranted under existing conditions at the intersections of 119th Street with Ridgeview Road and Winchester Street. For the Future Year 2024 Plus Development conditions, these turn lanes were assumed to be installed.

This scenario assumes that recommendations made for the Existing Plus Development scenario have been made. No other turn lane warrants were met for this scenario.

5.2 Future Year 2044 Plus Development Capacity Analysis

Capacity analysis was performed for Future Year 2044 Plus Development conditions using the methodologies presented in **Section 3.3**. The peak hour factors observed under existing conditions were used for Future Year 2044 Plus Development conditions. Truck percentages from the Existing Plus Development conditions were retained.

The signalized intersections are expected to operate at an overall LOS D or better during both peak hour periods with the exceptions noted below. Individual signalized movements are expected to operate at a LOS D or better with acceptable 95th-percentile queue lengths during both peak hour periods with the exceptions of the movements summarized below.

This scenario considers analysis of the network with background traffic growth as well as an overlapping event scenario (as discussed in **Section 4.0**). The corridor should be monitored with future year improvements based on actual conditions.

<u>119th Street and Winchester Street</u>

- Capacity analysis indicates westbound through movement 95th percentile queues to be over 1,000 feet during the weekday PM peak. However, delays show operations at a LOS A for the same movement. Future signal timing operations to optimize mainline operations while keeping side-street delays within acceptable levels.

119th Street and Barney Boulevard

- Weekday PM peak hour capacity analysis indicates that the eastbound through movement is expected to be over capacity with a V/C ratio of 1.03 and movement delay of 48.2 seconds, with a LOS F. 95th percentile queues are indicated to extend over 800 feet.
    - Although the eastbound through movement is shown to be near or just over capacity, the weekend PM peak conditions represent a worst-case scenario with full capacity ingress/egress at the theme park and arena. The arena is not expected to host daily full capacity events, and the theme park will be open seasonally. The corridor should be monitored to determine if additional through lane capacity is needed in the future.
- The westbound left turn movement is expected to operate at LOS E with long queuing of northbound movements during the weekend peak hour period. Expected operations are attributed to the consideration of event traffic. Future year improvements to support typical operations are not expected to be needed.

119th Street and Renner Boulevard

- The 95th percentile queue length associated with several movements is expected to exceed turn lane storage or extend past the adjacent turn lane. During the PM peak hour period, the northbound left turn movement is expected to operate at LOS E, the southbound left turn movement is expected to operate at LOS F, with an overall intersection LOS of E. During the weekend peak hour period, the westbound left turn movement is expected to operate at LOS F with an overall intersection LOS of E.
- As discussed in the previous section, this scenario considers ingress for a full capacity arena event overlapping with theme park egress traffic and traffic associated with the adjacent development. If future year volumes develop and full capacity events are occurring, a traffic management plan, as previously recommended, should be implemented.

Renner Boulevard and College Boulevard

- Northbound and westbound through movements are expected to have a demand of over 1,000 weekday PM peak hour vehicles and are anticipated to operate at a LOS F with no future mitigation. To mitigate these delays, an additional westbound and northbound through lane were considered in addition to right-turn overlap phases for all approaches. With these improvements, movement and intersection LOS would be expected to improve to D or better for the weekday PM peak hour.

- The intersection should be monitored to determine if additional through lane capacity is needed in the future. This study considered a 2% growth rate (applied to all movements) as well as overlapping event conditions. Typical future year operations may not require additional through lane capacity.

Kansas City Road and Renner Boulevard

- The eastbound left-turn movement is expected to operate at a LOS F during the weekday PM peak hour with no future mitigation. Providing dual eastbound left turn lanes would be expected to improve the movement LOS.
- The 95th percentile queue length associated with the westbound through movement is expected to extend past the adjacent turn bay.
    - This scenario considers ingress for a full capacity arena event overlapping with theme park egress traffic. The operations associated with this movement can be attributed to accommodating the eastbound left turn movement entering the site. Improved operations would be expected under non-event conditions.

119th Street at I-35 Northbound and Southbound Ramps

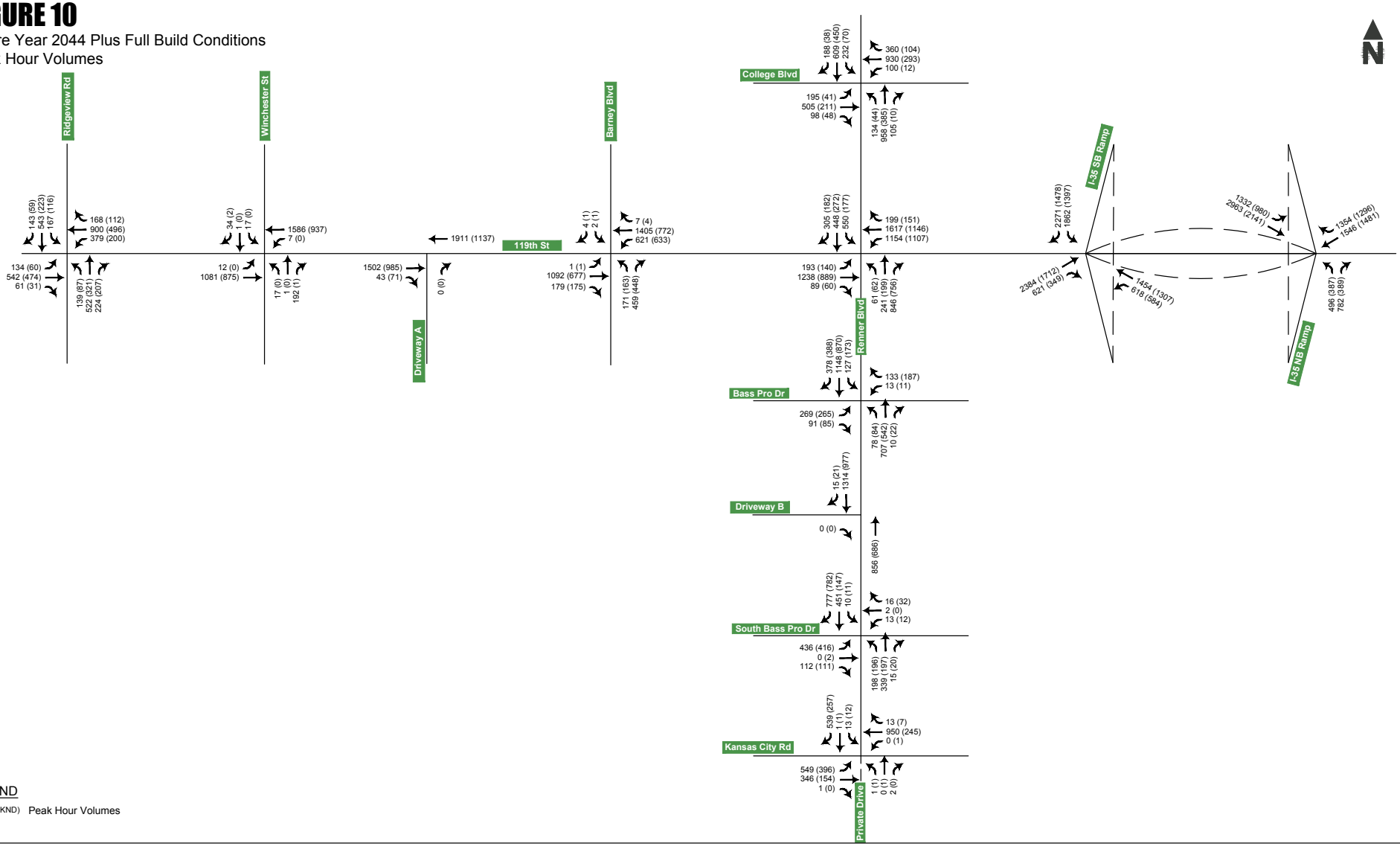
- During the weekday PM peak hour, the I-35 Southbound Ramp right-turn movement is expected to operate at LOS F. At the I-35 Northbound Ramp, the westbound right turn movement is expected to operate at LOS F during the weekday PM peak hour and LOS E during the weekend peak hour period. Long 95th-perentile queue lengths are expected. Due to site constraints for roadway geometry improvements, it is recommended future traffic signal operations be monitored and adjusted to reflect actual traffic demands.

The roundabout intersections are expected to operate at an overall LOS B with individual movement operations of LOS D or better during both peak hour periods. Longer queuing is expected as future year volumes (background traffic growth) and event traffic is accommodated. Under non-event conditions, decreased queuing would be expected.

The Future Year 2044 Plus Development capacity analysis summary is illustrated in **Figure 12**. Detailed results are provided in **Appendix D.**

FIGURE 10

Future Year 2044 Plus Full Build Conditions
Peak Hour Volumes



LEGEND

PM (WKND) Peak Hour Volumes

FIGURE 11

Future Year 2044 Plus Full Build Conditions
Lane Configuration and Traffic Control

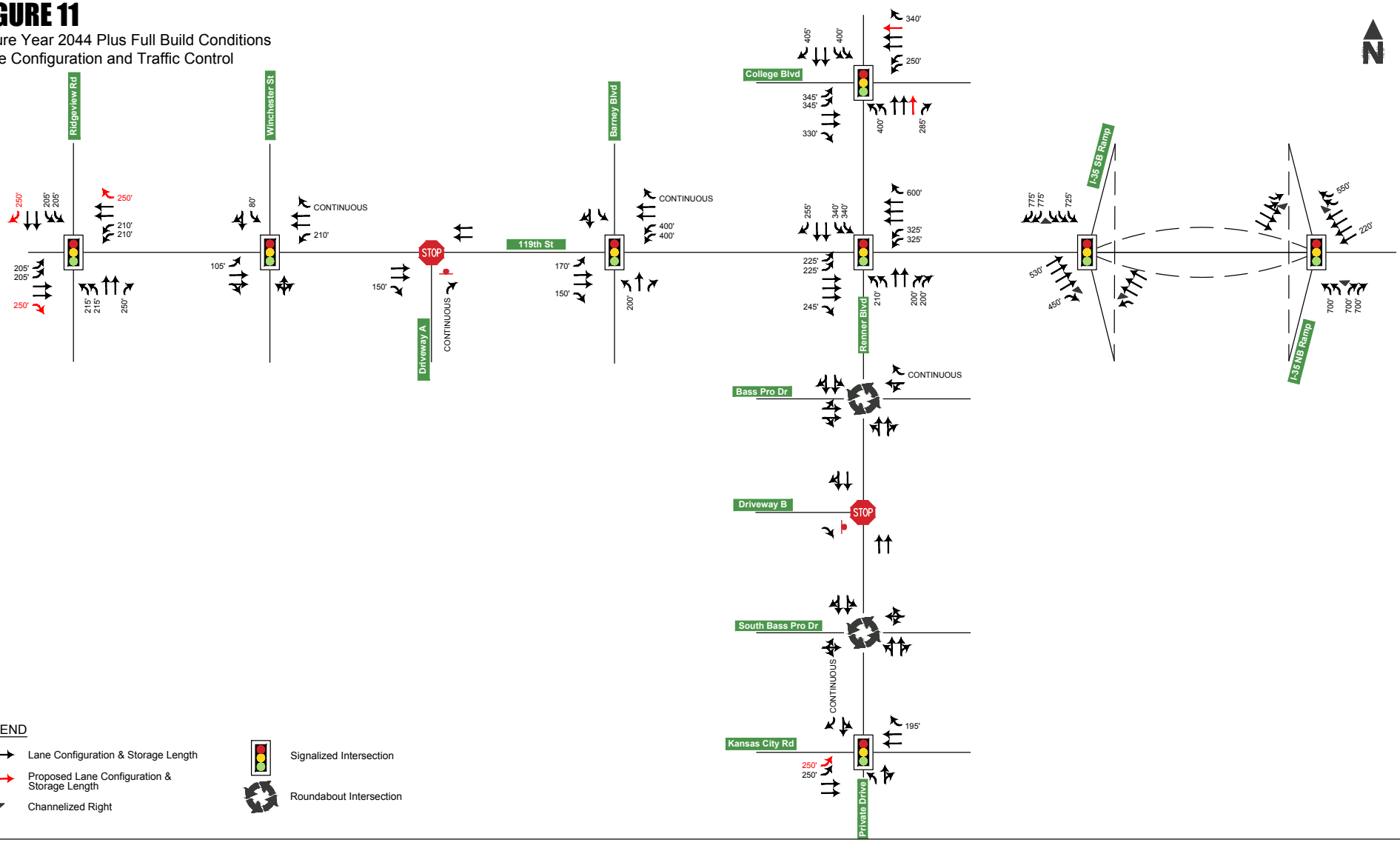
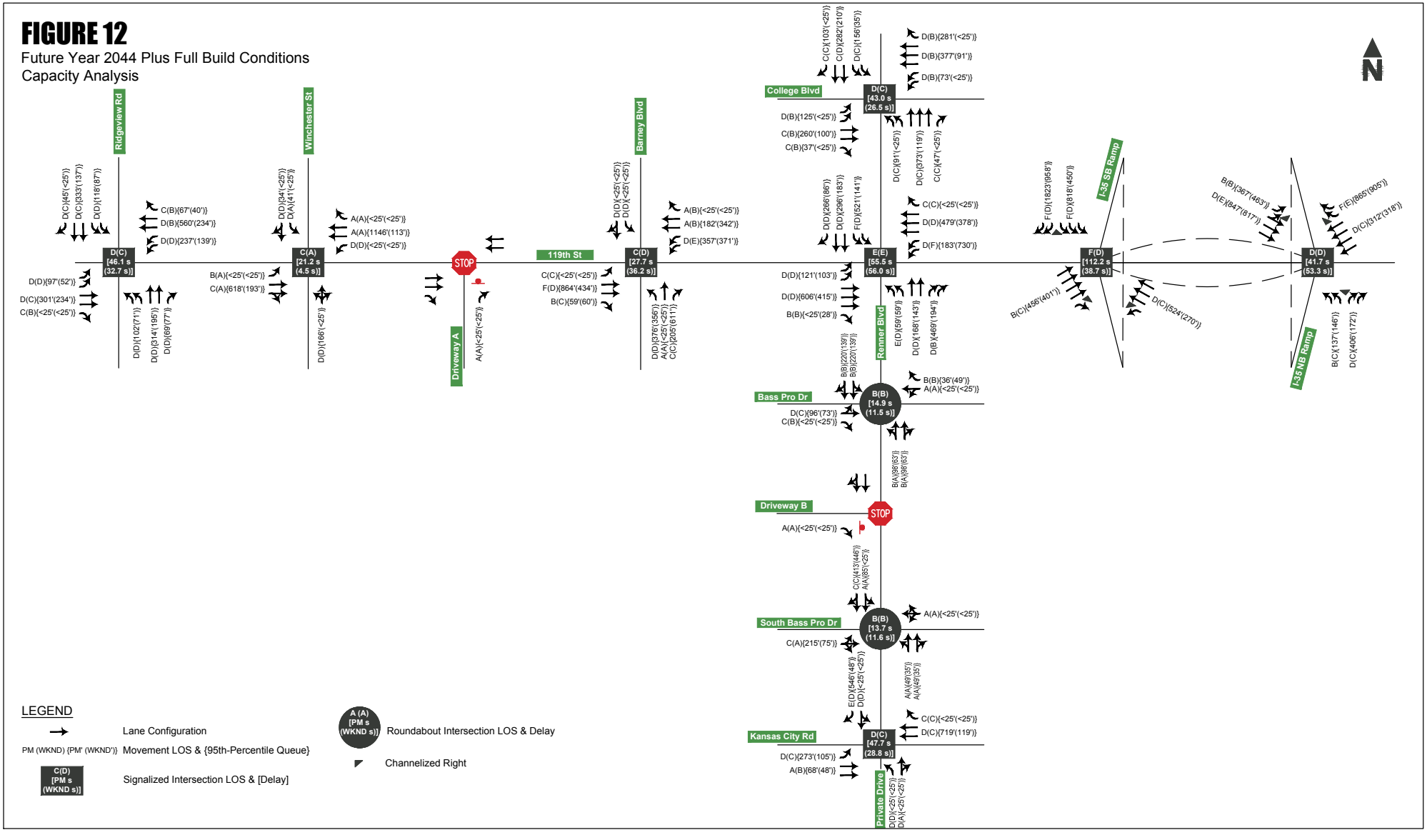


FIGURE 12

Future Year 2044 Plus Full Build Conditions
Capacity Analysis



6. SUMMARY

This report summarizes analysis conducted for the Olathe Entertainment and Mixed-Use Development development located in the southwest quadrant of 119th Street and Renner Boulevard, in Olathe, Kansas.

6.1 Conclusions

The general findings for this traffic impact study include the following:

- This study considered operations of the network with the planned development (retail/restaurant/hotel) in place as well as full capacity events at the theme park and arena. Full capacity events are not expected to be a daily occurrence for the arena. The theme park will be open seasonally, with limited to no trip generation for approximately 6 months of the year. Additionally, for the purposes of this study ingress for an arena event was considered to occur at the same time as egress for the theme park; dependent upon closing time of the theme park and start time of an event this may be a very limited occurrence. The trip generation presented in this study is expected to represent a worst-case scenario for operations.
- If concurrent full capacity events occur at the arena and theme park, degradation of operations of the road network would be expected to occur. Mitigation to address operations are provided below. Under typical operations (lower capacity events and/or operations of the commercial aspects of the development only), acceptable operations of the network would be expected with the recommended improvements.
- Proposed full access locations align with existing full access (signal or roundabout controlled) intersections. Alignment of access at existing intersections is a preferred condition. The proposed spacing of Driveways A and B do not meet minimum recommended guidance. Reviewing the proposed locations, Driveway A is expected to be acceptable, providing increased spacing from the intersection of 119th Street and Barney Boulevard. Driveway B is located along the south property line of the proposed project. Both driveways are proposed to be limited to right-in/right-out only which is a preferred condition.

6.2 Recommendations

Proposed drives and recommended improvements should be constructed following agency guidelines. Sight distance should be provided at new intersections.

6.2.1 Existing Conditions

No recommended improvements.

6.2.2 Existing Plus Development Conditions

The following improvements are recommended to support existing plus development conditions. The identified geometric improvements would be expected to support acceptable operations of the network under typical (non-event) conditions.

- 119th Street at Barney Boulevard
  - Eastbound right-turn lane with minimum storage length of 150 feet plus taper.
  - Westbound dual left-turn lanes with minimum storage length of 400 feet plus taper.
  - Northbound approach consisting of a dedicated left-turn, through lane, and right-turn lane.
  - Signal modification.
- 119th Street at Driveway A
  - Eastbound right-turn lane with minimum storage length of 150 feet plus taper.
- Kansas City Road and Renner Boulevard
  - Modify the southbound lane arrangement to a shared through/left-turn lane and a dedicated right-turn lane.
  - Signal modification.
- Optimization of signal timings (cycle length, phasing, and/or splits) at signalized intersections.

To support event operations, a traffic management plan is recommended for the arena. It is recommended to route inbound arena traffic from the I-35 Southbound Ramp via the 119th Street access to Kansas City Road, continuing along Kansas City Road to Renner Boulevard. This route is shown on a figure provided in **Appendix C**. For the purposes of this report, revised trip distribution considering an event management plan in place was not reviewed. Analysis considers a worst-case scenario with no event traffic management. If event traffic management is in place, improved operations from those presented in this report would be expected.

If an arena event ingress is expected to occur overlapping with theme park traffic egress, internal parking management is recommended to ensure efficient flow into and out of the site.

6.2.3 Future Year 2044 Plus Development Conditions

The future year scenario considers analysis of the network with background traffic growth as well as an overlapping event scenario. The corridor should be monitored with future year improvements based on actual conditions. Improvements to provide additional capacity may not be needed in the future dependent upon how future year volumes materialize and considering typical (non-event) conditions.

- Optimization of signal timings (cycle length, phasing, and/or splits) at signalized intersections.
- Renner Boulevard and College Boulevard
    - Provide an additional westbound and northbound through lane.
    - Right-turn overlap phases for all approaches.
- Kansas City Road and Renner Boulevard
    - Provide dual eastbound left turn lanes.