Memorandum

SRF No. 11556

To: Steve Lillehaug, PE, PTOE
Public Works Director/City Engineer
City of Shakopee

From: Matt Pacyna, PE, Principal
Brent Clark, EIT, Engineer

Date: July 25, 2018

Subject: Canterbury Commons Areawide Transportation Assessment

Introduction

SRF has completed an areawide transportation study for the proposed Canterbury Commons development in the City of Shakopee. Multiple studies have been conducted in the area since 2014 with respect to the future vision for Canterbury Road (CR 83), as well as various development proposals within or adjacent to Canterbury Park. The latest development proposal, referred to as Canterbury Commons, has not been fully accounted for as part of these previous study efforts. Therefore, the purpose of the areawide transportation assessment is to understand how the proposed development impacts the transportation system in conjunction with other planned developments/ infrastructure, as well as to prioritize the various improvements to help with funding and implementation. The following information provides the assumptions, analysis, and study recommendations offered for consideration.

Previous Area Studies

The following studies have been conducted since 2014 that have reviewed various intersections and/or roadway segments within the study area.

1) *Review of Eagle Creek Boulevard Traffic Study from CR 17 to CR 83* (February 2014)
2) *CSAH 83 Corridor Readiness Study* (February 2016)
3) *Traffic Analysis Canterbury Commons* (March 2017)
4) *Eagle Creek Boulevard at Vierling Drive Intersection Improvements Traffic Study* (August 2017)

These studies evaluated various areas, timeframes, development scenarios, and improvement alternatives. However, none of these studies took a comprehensive review of the study area to understand how the overall transportation system is expected to function as area improvements and/or development occurs. Thus, information from each of these studies were leveraged to aide in the development of the *Canterbury Commons Areawide Transportation Assessment*.

Existing Conditions

Existing conditions were reviewed to establish a baseline condition to compare and determine any future impacts. The evaluation of existing conditions includes various data collection efforts, field observations, a safety assessment, and an intersection capacity analysis, which are summarized in the following sections.

Study Intersections

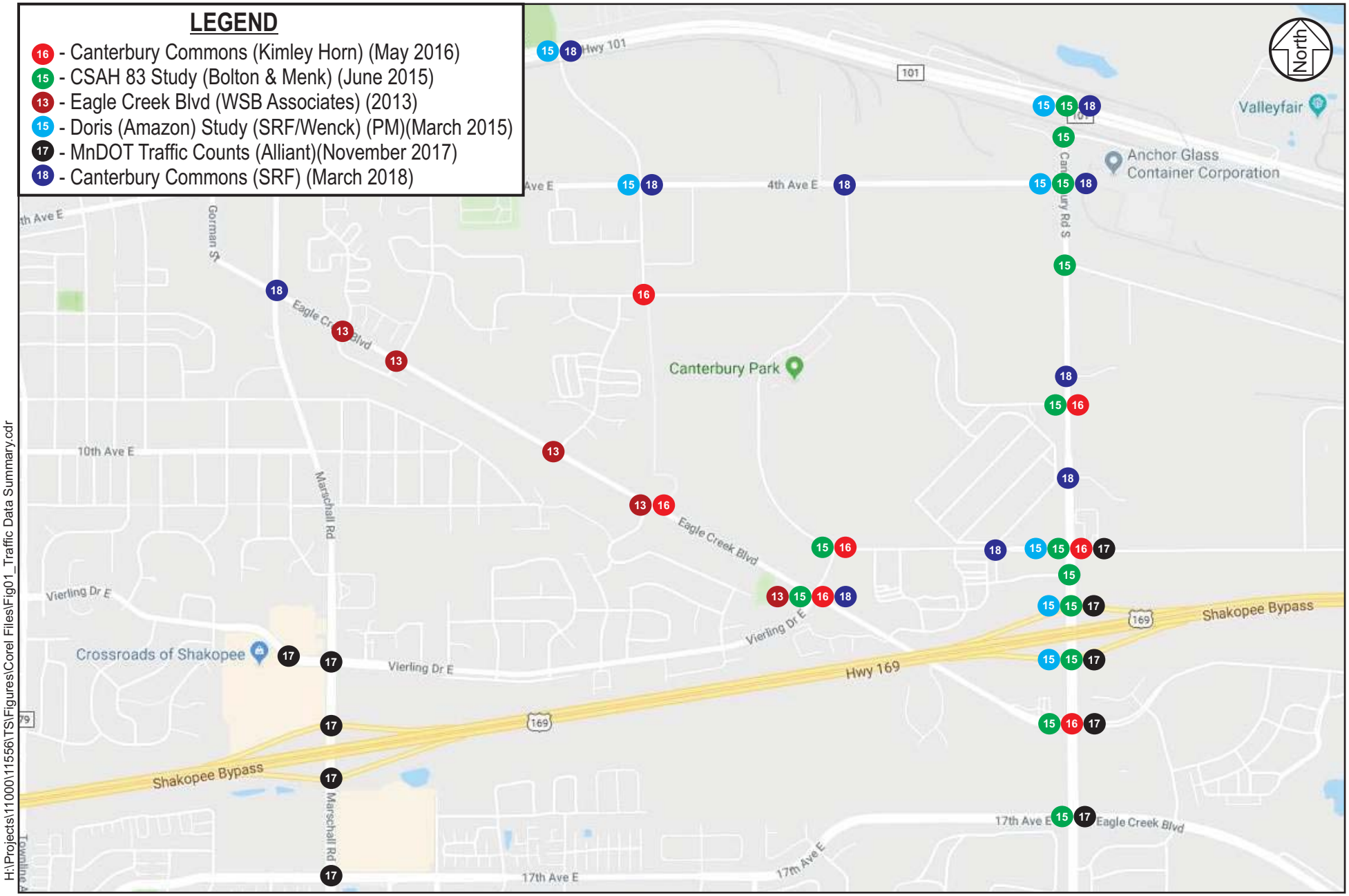
The following study intersections represent the primary focus areas of the transportation assessment. These intersections were identified through discussion with City staff as they relate to potential development impacts, as well as future area infrastructure needs.

- *Marschall Rd/Eagle Creek Blvd*
- *Marschall Rd/Vierling Dr*
- *Shenandoah Dr/County Road 101*
- *Shenandoah Dr/4th Ave*
- *Shenandoah Dr/Eastway Ave/Barenscheer Blvd*
- *4th Ave/North Canterbury Access*
- *Vierling Dr/12th Ave*
- *Vierling Dr/Eagle Creek Blvd*
- *12th Ave/Disc Dr/Secretariat Dr*
- *County Road 83/County Road 101*
- *County Road 83/Valley Industrial Blvd (N)*
- *County Road 83/4th Ave*
- *County Road 83/Valley Industrial Blvd (S)/Barenscheer Blvd*
- *County Road 83/Canterbury Distribution Center (N)*
- *County Road 83/Shenandoah Dr/East Canterbury Access*
- *County Road 83/Canterbury Distribution Center (S)*
- *County Road 83/12th Ave*
- *County Road 83/Disc Dr/Secretariat Dr*
- *County Road 83/Mn Highway 169 North Ramp*
- *County Road 83/Mn Highway 169 South Ramp*
- *County Road 83/Eagle Creek Blvd*
- *County Road 83/County Road 16*

Other internal intersections and access locations were included as part of the future operations analysis as needed to help identify area infrastructure and traffic control needs. These included locations along Eagle Creek Boulevard, Shenandoah Drive, Vierling Drive, and Barenscheer Boulevard.

Data Collection

Intersection turning movement counts were provided by the City, County, and MnDOT, in addition to previous studies completed within the area since 2013. This included data during the weekday a.m. and p.m. peak hours during various months of the year to help identify how area traffic volumes and travel patterns change. This data was supplemented with new intersection turning movement counts collected by SRF in March 2018 at several locations to ensure data within the study area is current. A summary of the traffic data collected within the study area since 2013 is included in Figure 1. Note the data collected previously (prior to 2017) was modified to reflect current conditions based on the most recent (2017 and 2018) counts collected. Detailed peak hour volumes are included in Appendix B.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig01_Traffic Data Summary.cdr

SRF Consulting Group, Inc.

Traffic Data Summary

Canterbury Commons Areawide Transportation Assessment

City of Shakopee

Figure 1

01811556
July 2018

Roadway Characteristics

Area roadway characteristics were reviewed for the primary facilities within the study area. This review included identification of the functional classification, general roadway configuration, approximate roadway width, and the posted speed limit. The existing roadway characteristics are summarized in Table 1.

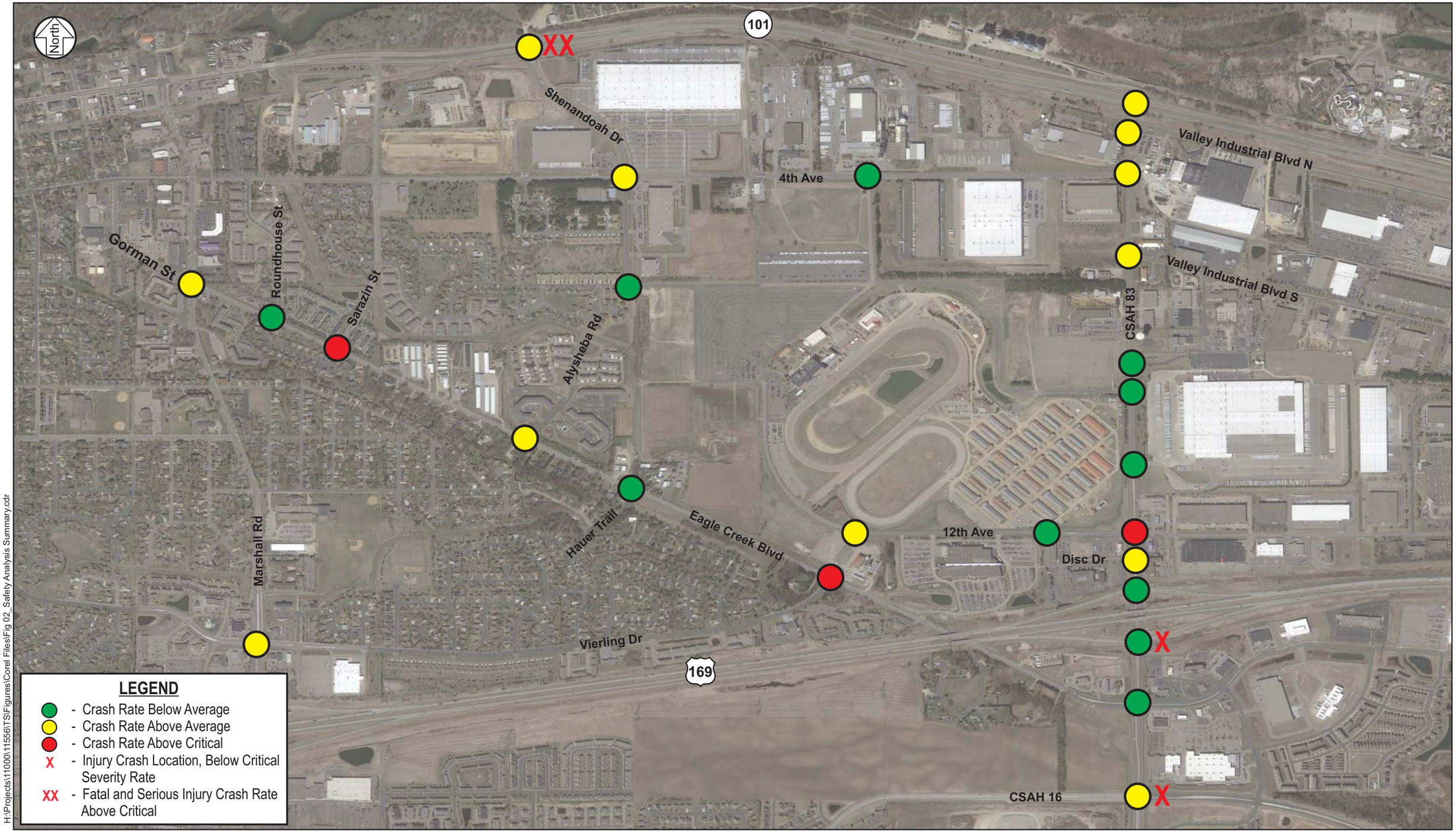
Table 1. Existing Roadway Characteristics

Roadway	Functional Classification	General Configuration	Approx. Roadway Width (feet)	Posted Speed Limit (mph)
Canterbury Rd (CR 83)	Minor Arterial	Variable 4-lane	50 to 120 feet	45 to 55 mph
CR 101	Minor Arterial	4-lane divided	130 feet	55 mph
4th Ave	Major Collector	3-lane	42 to 48 feet	30 to 40 mph
Valley Industrial Blvd	Local Road	2-lane undivided	30 feet	30 mph
12th Ave	Local Road	4-lane undivided	50 feet	40 mph
Eagle Creek Blvd	Minor Arterial	4-lane undivided	50 feet	50 mph
Vierling Dr	Major Collector	4-lane undivided	50 feet	30 mph
Shenandoah Dr	Local Road	4-lane undivided	50 feet	30 mph

Safety Assessment

Several of the previous area studies identified safety issues at various intersections within the study area. However, a preliminary safety assessment was conducted as part of this study utilizing more recently available data to understand current crash trends and identify intersections with higher occurrences of crashes relative to locations with similar characteristics. This safety assessment focused on the most recent three-years of reported crashes using *MnDOTs Crash Mapping Analysis Tool* (MnCMAT) data from January 1, 2013 thru December 31, 2015, which represents the most recent three-year period available.

A detailed crash and severity rate analysis was completed to identify the crash and severity rates for each study intersection, which was then compared to statewide average rates for intersections with similar characteristics (i.e. traffic controls and volumes). This data was also compared to the critical crash and severity rates, which is a statistical measure that helps determine the significance above the average expected crash/severity rates for intersections with similar characteristics. Based on this approach, there were three (3) study intersections (CR 83/12th Avenue; Eagle Creek Boulevard/ Vierling Drive; Eagle Creek Boulevard/Sarazin Street) that have crash rates above the critical crash rate. There was also one (1) location (CR 101/Shenandoah Drive) that has a severity rate above the critical severity rate. A summary of the safety assessment is shown in Figure 2, while detailed crash and severity rates are included in Appendix D.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig 02_Safety Analysis Summary.cdr

SRF Consulting Group, Inc.

Safety Analysis Summary (2013-2015)

Canterbury Commmons Areawide Transportation Assessment
Shakopee, MN

01811556
July 2018

Figure 2

Intersection Capacity Analysis

An intersection capacity analysis was conducted to determine how traffic is currently operating at the study intersections during typical weekday a.m. and p.m. peak hour conditions. Note that additional intersection capacity analysis sensitivity tests were conducted with respect to area event operations. The sensitivity test results are discussed later in this document.

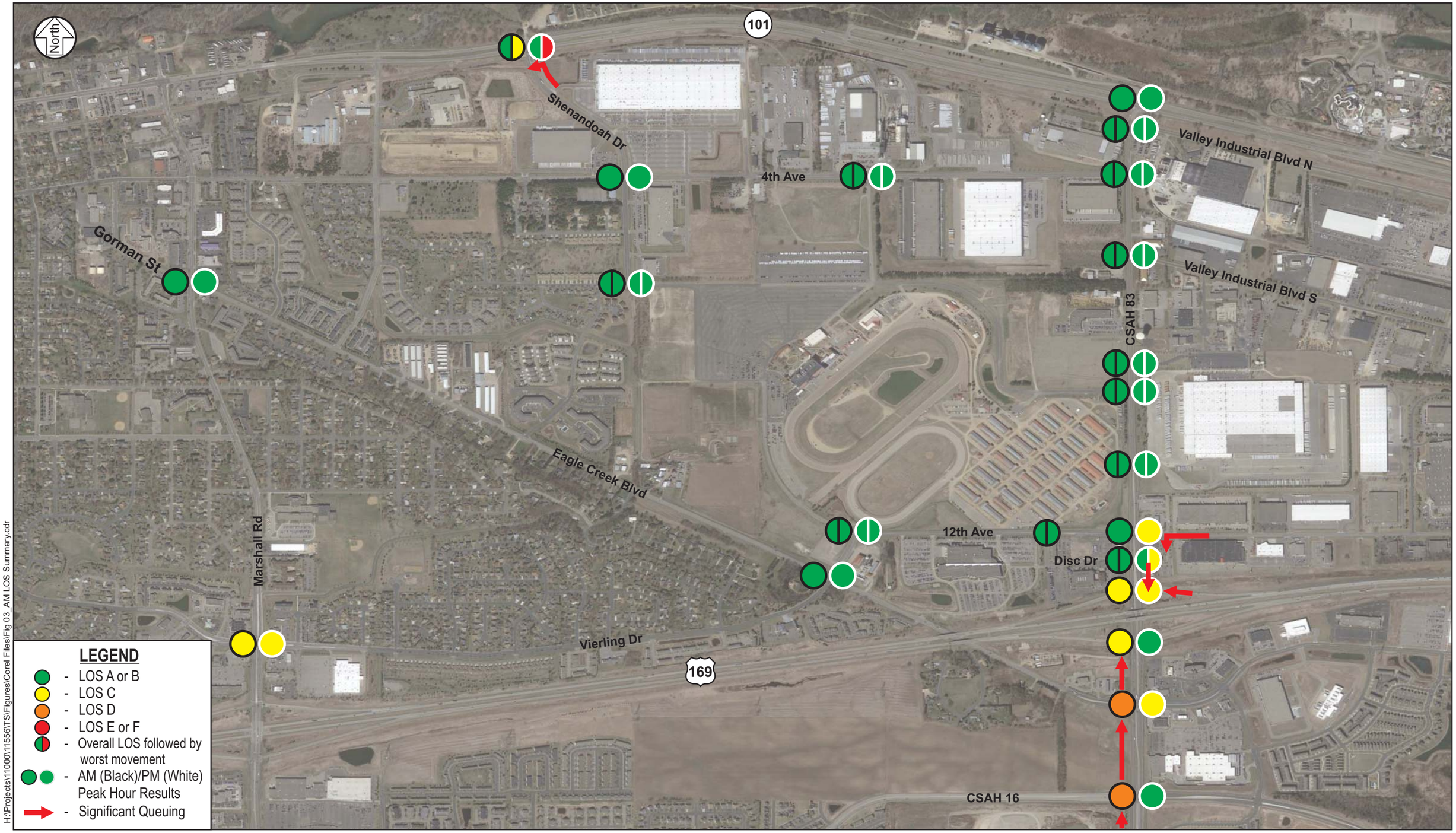
All intersections were analyzed using Synchro/SimTraffic. Capacity analysis results identify a Level of Service (LOS) which indicates how well an intersection is operating. Intersections are ranked from LOS A through LOS F. The LOS results are based on average delay per vehicle results from SimTraffic, which correspond to the delay threshold values shown in Table 2. LOS A indicates the best traffic operation and LOS F indicates an intersection where demand exceeds capacity. Overall intersection LOS A through D is generally considered acceptable by drivers in the Twin Cities Metropolitan Area.

Table 2. Level of Service Criteria for Signalized and Unsignalized Intersections

LOS Designation	Signalized Intersection Average Delay/Vehicle (seconds)	Unsignalized Intersection Average Delay/Vehicle (seconds)
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

For side-street stop controlled intersections, special emphasis is given to providing an estimate for the level of service of the side-street approach. Traffic operations at an unsignalized intersection with side-street stop control can be described in two ways. First, consideration is given to the overall intersection level of service. This takes into account the total number of vehicles entering the intersection and the capability of the intersection to support these volumes. Second, it is important to consider the delay on the minor approach. Since the mainline does not have to stop, the majority of delay is attributed to the side-street approaches. It is typical of intersections with higher mainline traffic volumes to experience high levels of delay (poor levels of service) on the side-street approaches, but an acceptable overall intersection level of service during peak hour conditions.

Results of the existing operations analysis, illustrated in Figure 3, indicate that all study intersections currently operate at an acceptable overall LOS D or better during the weekday a.m. and p.m. peak periods. However, several locations currently experience significant queueing within the study area, including northbound CR 83 (from CR 16 to US 169) during the a.m. peak hour; westbound and southbound directions from the CR 83/US 169 North Ramp intersection during the p.m. peak hour; westbound 12th Avenue (at CR 83) during the p.m. peak hour; and northbound Shenandoah Drive (at CR 101) during the p.m. peak hour. Detailed capacity analysis results are included in Appendix E.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig 03_AM LOS Summary.cdr

SRF Consulting Group, Inc.

01811556
July 2018

Existing Operations Summary

Canterbury Commmons Areawide Transportation Assessment
Shakopee, MN

Figure 3

Existing Issues Summary and Potential Improvements

The following existing capacity and/or safety issues were identified as part of the existing conditions analysis. Potential improvements are noted, but are addressed as part of the future intersection capacity analysis given the desire to identify the long-term needs within the area.

1) Canterbury Road (CR 83) and 12th Avenue Intersection
   a. Significant westbound queues during the p.m. peak hour
   b. High crash rate relative to intersections with similar characteristics
   c. Capacity and safety improvements expected as part of the CR 83 reconstruction

2) Northbound CR 83
   a. Significant northbound queues during the a.m. peak hour (unbalanced lane utilization)
   b. Construct an advance turn-lane through CR 16 to improve lane utilization

3) CR 101 and Shenandoah Drive
   a. Significant northbound left-turn delays during the p.m. peak hour
   b. High crash severity rate relative to intersections with similar characteristics
   c. Construct a traffic signal to improve delays and reduce challenging maneuvers

4) Eagle Creek Boulevard and Vierling Drive Intersection
   a. High crash rate relative to intersections with similar characteristics
   b. Construct a roundabout to better delineate right-of-way

5) Eagle Creek Boulevard and Sarazin Street Intersection
   a. High crash rate relative to intersections with similar characteristics
   b. Restripe roadway from a 4-lane to a 3-lane facility and consider a speed limit reduction

Traffic Forecasts

Traffic forecasts were developed for the study area to help determine short- and long-term transportation infrastructure needs within the study area. The forecasts were developed using a combination of general area historical growth trends, trip generation estimates based on proposed development, and data within the *Scott County Regional Travel Demand Model*. The following sections outline the proposed development within the study area, as well as the overall traffic forecast development process and assumptions.

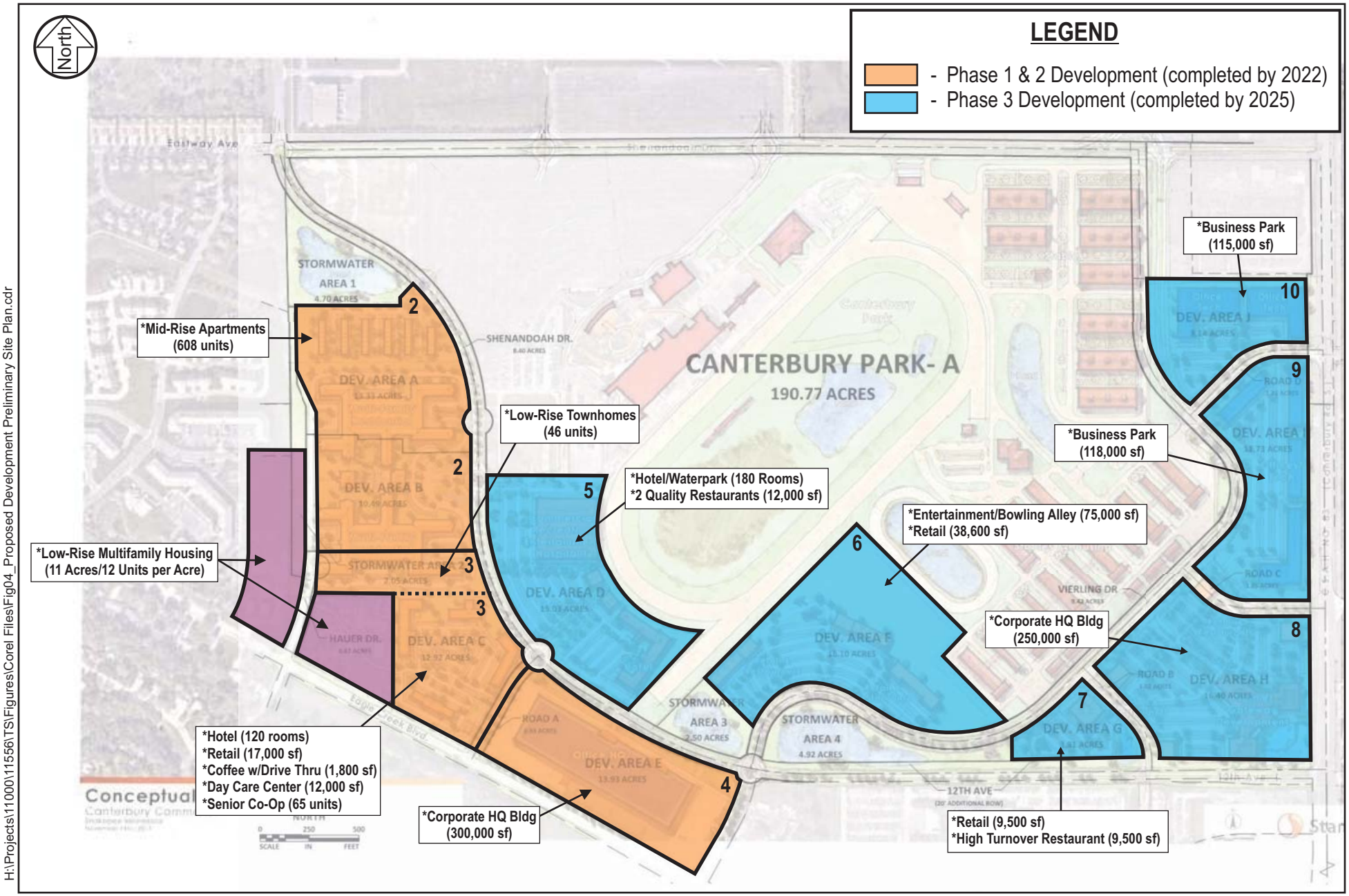
Proposed Development

The Canterbury Commons development includes the area generally bounded by CR 83 to the east, 12th Avenue/Vierling Drive/Eagle Creek Boulevard to the south, existing development to the west, and Barenscheer Boulevard to the north. This area is generally vacant today, with the exception of Canterbury Park and the MN Work Force Center, although there have been seasonal uses such as Sever's Fall Festival. A preliminary site plan for the proposed development is illustrated in Figure 4, which was used as the basis for this transportation assessment. However, note that the internal roadway configuration and access locations may change based on the findings of this study.

The proposed develop is expected to be constructed over the next five to ten years, depending on market conditions. For purposes of this study, the proposed development was assumed to be fully developed by year 2025, including the internal roadway network. A summary of the proposed land uses within the study area includes the following uses and approximate sizes:

- Office/Commercial/Business Park – 800,000 Square Feet
- Retail – 50,000 Square Feet
- Entertainment – 75,000 Square Feet
- Hotel/Waterpark – 300 Rooms
- Residential – 720 Dwelling Units (Apartment/Townhouse/Senior Living)

To account for traffic impacts associated with the proposed development, trip generation estimates for the proposed land uses were developed for the a.m. and p.m. peak hours and a daily basis. These estimates, shown in Table 3, were developed using the *ITE Trip Generation Manual, 10th Edition*. The specific ITE land use codes used, as well as the assumed project phasing, were developed in conjunction with project staff during the study process. Note that a 20 percent multi-use reduction, based on the methodology described in the *ITE Trip Generation Manual, 10th Edition*, was applied to account for trips made within the proposed development between two or more land uses (commonly referred to as internal capture). No pass-by reductions were included to provide a conservative trip generation estimate, particularly given the type of land uses planned (i.e. more office/destination type uses) within the proposed development.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig04_Proposed Development Preliminary Site Plan.cdr

SRF Consulting Group, Inc.

Proposed Development Preliminary Site Plan

Canterbury Commons Areawide Transportation Assessment
City of Shakopee

Figure 4

01811556
July 2018

Table 3. Proposed Development Trip Generation Estimate

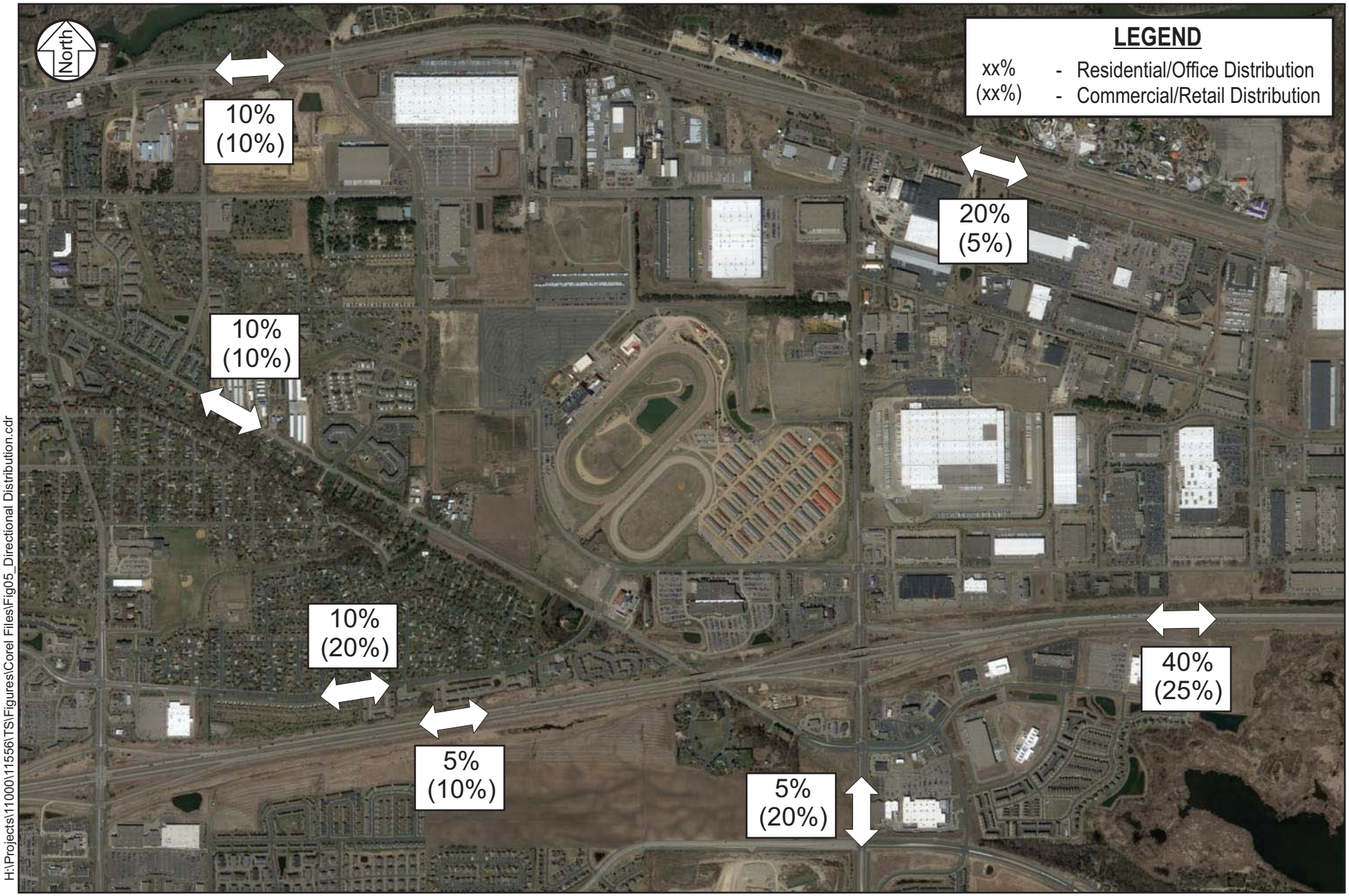
Section - Land Use Type *(ITE Code)*	Size	A.M. Peak Hour Trips		P.M. Peak Hour Trips		Weekday Daily Trips
		In	Out	In	Out	
Phase 1 & Phase 2 Development						
2 - Apartment *(221)*	608 DU	57	162	163	104	3,308
3 - Townhomes *(220)*	46 DU	5	16	16	10	337
3 - Hotel *(310)*	120 rooms	33	23	37	35	1,003
3 - Retail *(820)*	17,000 sf	10	6	31	34	642
3 - Coffee w/Drive Thru *(937)*	1,800 sf	82	78	39	39	1,477
3 - Senior Adult Housing *(252)*	65 DU	5	8	9	8	241
3 - Day Care Center *(565)*	12,000 sf	70	62	63	71	571
4 - Corporate HQ Office *(714)*	300,000 sf	407	31	42	378	2,385
Phase 1 & 2 Development Subtotal		669	387	400	678	9,963
Multi-Use Reduction (20%) [3]		*(-134)*	*(-77)*	*(-80)*	*(-136)*	*(-1,993)*
Phase 1 & 2 Development Total		**535**	**310**	**320**	**542**	**7,970**
Phase 3 Development						
5 – Hotel/Waterpark *(310)* [1]	180 DU	50	35	55	53	1,505
5 – Quality Restaurant *(931)* [2]	12,000 sf	0	0	61	39	1,006
6 – Retail *(820)*	38,600 sf	22	14	71	76	1,457
6 – Entertainment/Bowling Alley *(437)* [2]	75,000 sf	0	0	57	30	956
7 – High Turnover Restaurant *(932)*	9,500 sf	52	42	58	35	1,066
7 – Retail *(820)*	9,500 sf	6	3	17	19	359
8 – Corporate HQ Office *(714)*	250,000 sf	339	26	35	315	1,988
9 – Business Park *(770)*	118,000 sf	140	25	39	110	1,468
10 – Business Park *(770)*	*115,000 sf*	137	24	38	107	1,431
Phase 3 Development Subtotal		747	169	429	785	11,234
Multi-Use Reduction (20%) [3]		(-149)	(-34)	(-86)	(-157)	(-2,247)
Phase 3 Development Total		**598**	**135**	**343**	**628**	**8,987**
Total Trips		**1,133**	**445**	**663**	**1,170**	**16,957**

(1) The hotel land use, ITE Code 310, accounts for recreational uses such as a waterpark. Trip generation results are consistent with previous waterpark hotel traffic counts in the region.

(2) Quality restaurant and Entertainment/Bowling Alley are assumed to be closed during the AM Peak Hour.

(3) A 20-percent multi-use trip reduction was applied to all proposed land use trip generation estimates based on a combination of the internal capture rate methodology in the ITE Trip Generation Handbook and the NCHRP Report 684 methodology.

Accounting for the multi-use reduction, the proposed development is expected to generate approximately 1,578 a.m. peak hour, 1,833 p.m. peak hour and 16,957 daily trips once fully constructed. The proposed development trips were distributed throughout the area based on the directional distribution shown in Figure 5, which was developed based on a combination of previous area studies, existing travel patterns, and data from the regional travel demand model.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig05_Directional Distribution.cdr

SRF Consulting Group, Inc.

Directional Distribution

Canterbury Commons Areawide Transportation Assessment
City of Shakopee

01811556
July 2018

Figure 5

Adjacent Land Use

In addition to the proposed development, there are multiple known adjacent developments planned. These include parcels in the northwest and northeast quadrants of the Eagle Creek Boulevard and Hauer Trail intersection, as well as truck travel pattern changes expected at Amazon. In particular, a total of approximately 130 residential units were assumed for the two developments noted near Eagle Creek Boulevard and Hauer Trail. A trip generation estimate using the *ITE Trip Generation Manual, 10th Edition* and the directional distribution previously identified was utilized to develop trips associated with these adjacent land uses. Note that the adjacent land use changes were assumed to be constructed by year 2025.

Scott County Regional Travel Demand Model

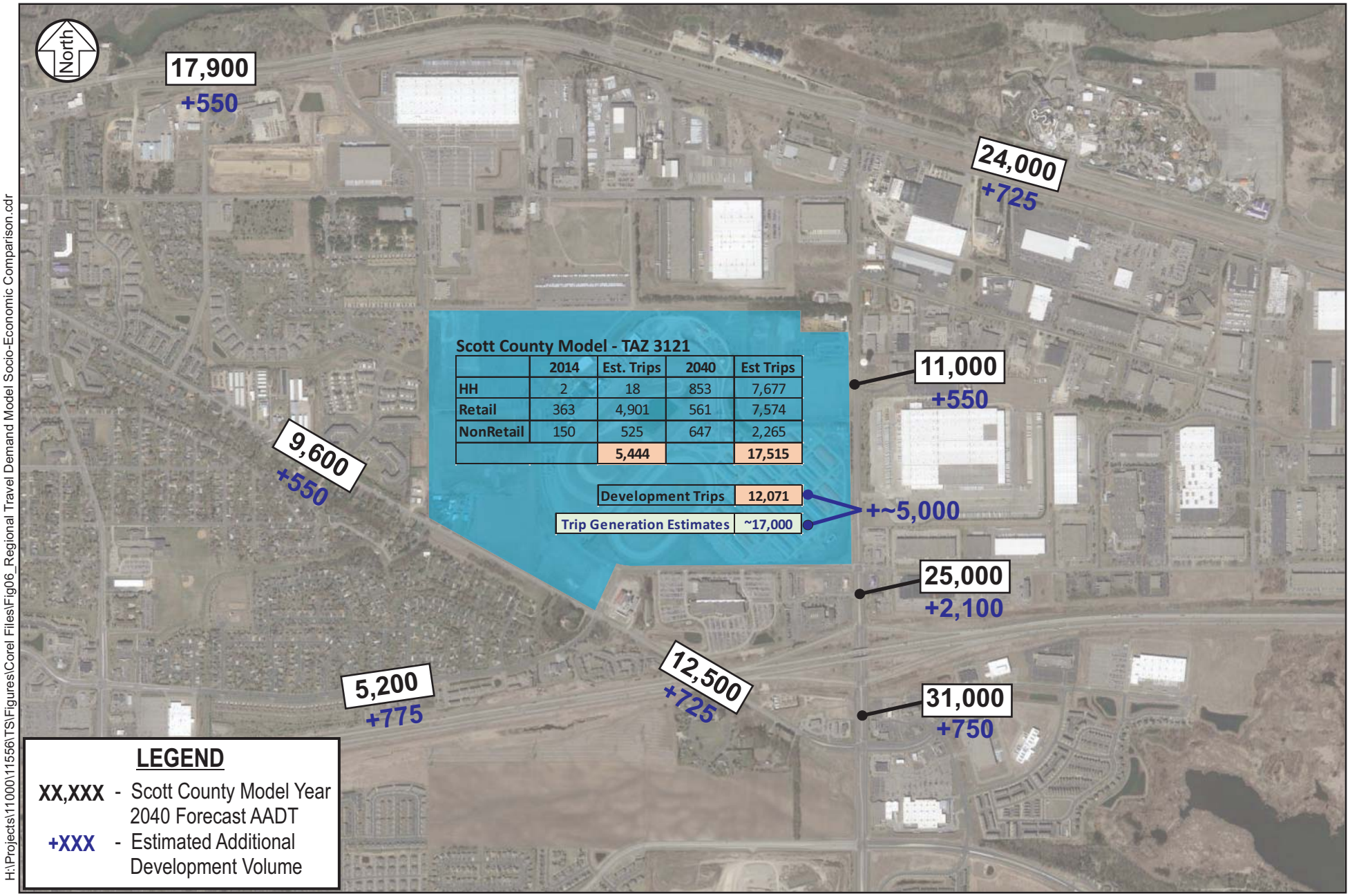
The *Scott County Regional Travel Demand Model* was reviewed to understand how the proposed development land use compares to previous socio-economic (i.e. employment and households) assumptions within the area, as well as to identify general background growth within the study area. The following information provides an overview of the model review process.

First, a review of the employment and household data within the regional model's traffic analysis zone (TAZ) 3121 was completed. This TAZ encompasses the entire proposed development area, as illustrated in Figure 6. The regional model assumes the base (i.e. year 2014) level of trip generation within TAZ 3121 to be approximately 5,500 daily trips, with a future year 2040 project trip generation of approximately 17,500 daily trips. Thus, the expected growth within the proposed development area was estimated to be approximately 12,000 daily trips in the regional model. However, comparing the trip generation identified earlier in this assessment, the proposed development is expected to generate approximately 17,000 daily trips, which equates to approximately 5,000 more daily trips than previously assumed within the regional model.

Second, the socio-economic data from TAZ 3121 was removed from the regional model to understand the general background growth expected on area roadways on an annual basis. This approach identified that area roadway volumes are expected to range from one-half (0.5) percent to two (2) percent annually. Therefore, for purposes of this assessment, a two (2) percent annual background growth rate was applied to the existing peak hour to develop year 2025 no build traffic volumes. To develop year 2040 no build traffic volumes, a one-half (0.5) percent annual background growth rate was applied to the year 2025 no build traffic volumes.

Traffic Forecast Summary

Based on the traffic forecast approach described within this assessment, peak hour and daily traffic volumes were developed for both year 2025 and year 2040 no build and build conditions. The no build conditions include general background growth and known adjacent developments. The build conditions include the traffic volumes generated under no build conditions, as well as trips generated by the proposed development. A summary of the year 2025 and year 2040 no build and build peak hour traffic forecasts, as well as 2040 build daily traffic volumes is provided in Appendix B. Note that the year 2025 conditions were reviewed to help determine the approximate infrastructure need timeline to help identify project priority and aide in funding. Further discussion regarding area infrastructure phasing is provided later in this assessment.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig06_Regional Travel Demand Model Socio-Economic Comparison.cdr

SRF Consulting Group, Inc.

Regional Travel Demand Model Socio-Economic Comparison

Canterbury Commons Areawide Transportation Assessment
City of Shakopee

Figure 6

01811556
July 2018

Canterbury Road (CR 83) Reconstruction

Canterbury Road (CR 83) is planned to be reconstructed in year 2021. The preliminary CR 83 layout was developed as part of the *CSAH 83 Corridor Readiness Study* (February 2016). However, based on review of the CR 83 layout, in addition to the traffic forecasts and other key aspects/desires associated with the proposed development, several modifications were incorporated into a revised CR 83 layout. The main goals of the CR 83 layout modifications are to provide capacity benefits/relief to the CR 83/12th Avenue intersection, improve business access/circulation within the proposed development, and provide a new primary access to Canterbury Park (via Barenscheer Boulevard) to better balance area traffic volumes. A comparison between the previous CR 83 layout and the currently proposed CR 83 layout is provided in Figures 7A and 7B. The following sections provide an overview of the future intersection capacity analysis, which incorporates the CR 83 reconstruction project.

CR 101/Shenandoah Drive Signal Warrant Analysis

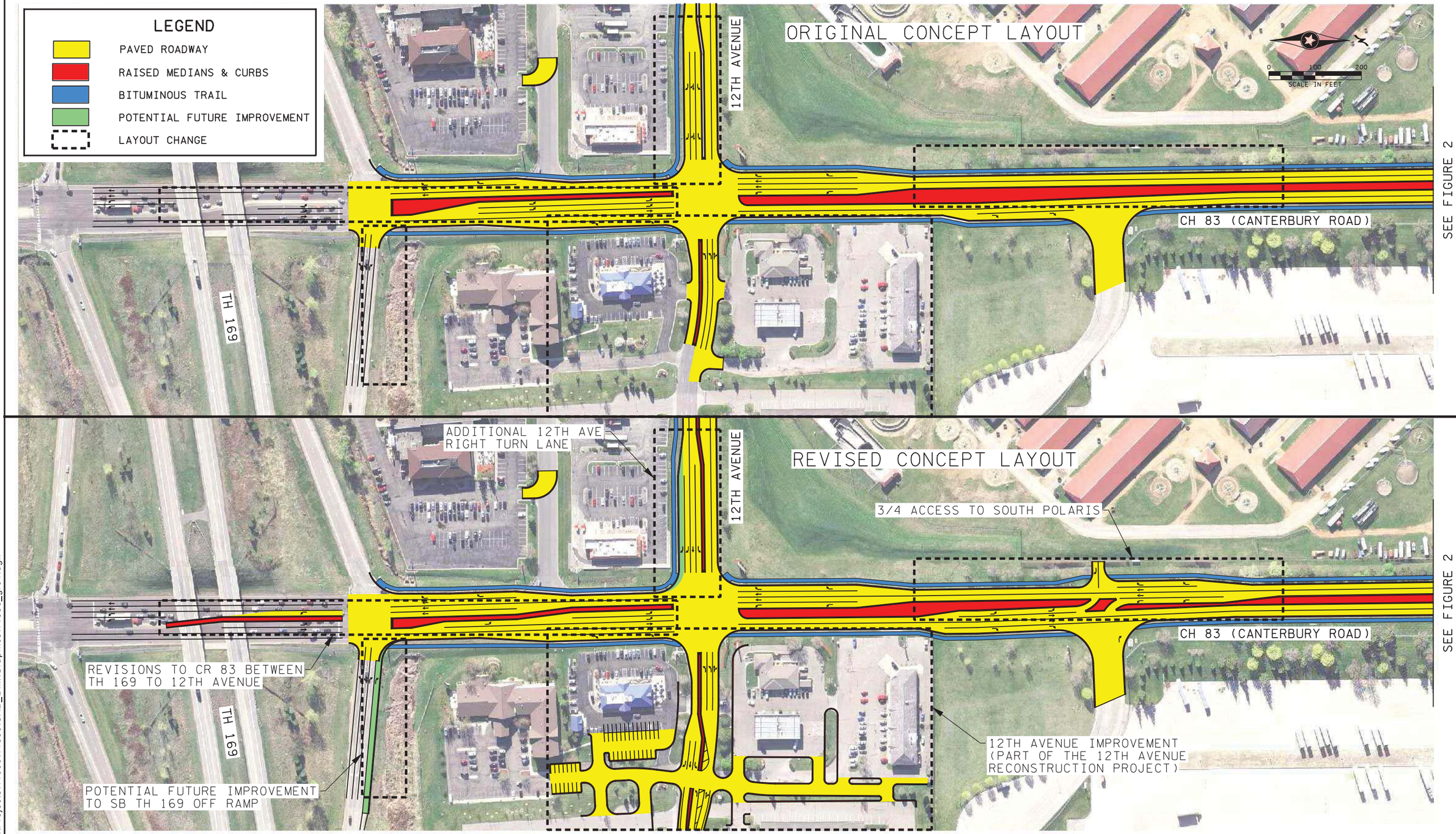
As mentioned under existing conditions, based on current traffic operations and safety conditions a traffic signal was identified for further consideration at the CR 101/Shenandoah Drive intersection. To determine if a signal is warranted, a cursory warrant analysis was performed using the a.m. and p.m. peak hour volumes and estimated non-peak hour volumes based on typical patterns. Results of the cursory warrant analysis indicate that the Peak Hour Warrant (3B) is met for existing as well as year 2025 no build and build conditions. While no other warrants are met based on existing and year 2025 no build volumes, under year 2025 build conditions in addition to the Peak Hour Warrant (3B), the Eight-Hour Vehicular Volume Condition B Interruption of Continuous Traffic Warrant (1B) and Four-Hour Vehicular Volume Warrant (2) are expected to be met.

The volume warrant analyses were based on estimated traffic volumes, since non-peak period data was not available. The adjacent land uses may have employee shift changes as well as truck traffic that peaks during non-peak hour conditions, which was not accounted for in the cursory warrant analysis. Observations conducted during peak hour and non-peak conditions, indicate that truck traffic is more prevalent at this location than other roadways given the area businesses and activity.

The Intersection Near a Grade Crossing Warrant (9) was also reviewed for this intersection. The CR 101/Shenandoah Drive intersection is located approximately 60 feet from a train crossing. Based on the proximity to the train crossing and the existing traffic volumes, this warrant is currently met. It is also important to consider that trucks longer than 60 feet (which were observed) would queue into the railroad tracks. A train preemption system would likely provide safety benefits by providing a clearance time for queued vehicles/trucks.

Future Intersection Capacity Analysis

Several future intersection capacity analysis conditions were reviewed to better understand the short- and long-term infrastructure needs within the study area, as well as to assist with overall project funding and phasing. The improvements identified are intended to provide safe and efficient operations during the typical weekday a.m. and p.m. peak hour conditions. Additional sensitivity and event conditions were also reviewed but are described later in this assessment. A summary of the year 2025 and year 2040 no build and build condition assumptions are provided in Table 4.



H:\Projects\11000\11556\CAD_BIM\Graphics\11556_gr01.dgn

SRF

CH 83 (CANTERBURY ROAD) LAYOUT

Layout Updates
Shakopee, MN

Job #
7/5/2018

Figure 7A

LEGEND

- PAVED ROADWAY
- RAISED MEDIANS & CURBS
- BITUMINOUS TRAIL
- POTENTIAL FUTURE IMPROVEMENT
- LAYOUT CHANGE

ORIGINAL CONCEPT LAYOUT

CH 83 (CANTERBURY ROAD)

BARENSCHEER BLVD

VALLEY INDUSTRIAL BLVD S

SEE FIGURE 1

CONTRACT SAP 070-683-013
CONSTRUCTION TO BEGIN IN 2018

0 100 200
SCALE IN FEET

REVISED CONCEPT LAYOUT

REVISIONS TO NORTH POLARIS ENTRANCE

REVISIONS TO VALLEY INDUSTRIAL BOULEVARD/ BARENSCHEER BLVD

CH 83 (CANTERBURY ROAD)

BARENSCHEER BLVD

VALLEY INDUSTRIAL BLVD S

SEE FIGURE 1

CONTRACT SAP 070-683-013
CONSTRUCTION TO BEGIN IN 2018

H:\Projects\11000\11556\CAD_BIM\Graphics\11556_gr02.dgn

SRF

CH 83 (CANTERBURY ROAD) LAYOUT

Layout Updates
Shakopee, MN

Job #
7/5/2018

Figure 7B

Table 4. Future Capacity Analysis Condition Assumptions

Assumptions	Condition					
	2025 No Build	2025 No Build (Improved)	2025 Build	2040 No Build	2040 No Build (Improved)	2040 Build
Adjacent Development (Hauer Trail Developments)	X	X	X	X	X	X
Background Growth (2% to 2025; 0.5% 2025 to 2040)	X	X	X	X	X	X
Existing Improvements (See Page 8)		X	X		X	X
Revised CR 83 Layout		X	X		X	X
Proposed Development (Phases 1, 2, and 3)			X			X

The following sections provide an overview of the future intersection capacity analysis conditions and infrastructure needs. Capacity analysis results are summarized in Table 5 for each condition, including existing and improvement conditions; detailed results are shown in Appendix E.

Year 2025 No Build Conditions

The existing issues identified are expected to continue and degrade operations and safety if no improvements are implemented as area volumes continue to grow, regardless of the proposed development. Multiple intersections are expected to operate at LOS E or worse during the a.m. peak hour, Shenandoah Drive access to CR 101 will continue to be challenging, and the significant queuing issues noted will increase. The improvements identified to address the existing issues include:

1) Canterbury Road (CR 83) and 12th Avenue Intersection
   a. Capacity and safety improvements expected as part of the CR 83 reconstruction
2) Northbound CR 83
   a. Construct an advance turn-lane through CR 16 to improve lane utilization
3) CR 101 and Shenandoah Drive
   a. As previously noted, under year 2025 no build conditions the Peak Hour Warrant (3B) and the Intersection Near a Grade Crossing Warrant (9) is met. No other signal warrants are expected to be met.
   b. A traffic signal is recommended to address the operational issues on the Shenandoah Drive approach, including significant approach delays of approximately three (3) minutes and queues of approximately 475 feet.
4) Eagle Creek Boulevard and Vierling Drive Intersection
   a. Construct a roundabout to better delineate right-of-way
5) Eagle Creek Boulevard and Sarazin Street Intersection
   a. Restripe roadway from a 4-lane to a 3-lane facility and consider a speed limit reduction

To illustrate how these potential existing improvements, as well as the planned CR 83 improvements (i.e. revised CR 83 layout) are expected to operate under year 2025 no build conditions, an additional intersection capacity analysis was conducted. Results of this analysis, referred to as the year 2025 no build (improved) condition, indicates that all intersection are expected to operate at an overall LOS D or better during the a.m. and p.m. peak hours with the identified existing improvements and the planned CR 83 improvements. Side-street delays and area queuing will be minimized. These results are summarized in Table 5, while detailed results are included in Appendix E.

Year 2025 Build Conditions

To understand potential impacts associated with the proposed development, a year 2025 build condition was evaluated. This condition assumes the existing improvements, as well as the revised CR 83 layout have been constructed/implemented. Once again, results of this capacity analysis are summarized in Table 5, while detailed results are included in Appendix E.

Results of the year 2025 build condition capacity analysis indicate the majority of intersections are expected to operate at an acceptable overall LOS D or better during the peak hours with the assumed improvements. However, there are two locations where potential issues are expected. This includes the Eagle Creek Bouelvard/Marschall Road intersection, where southbound left-turn queues are expected to extend approximately 300 to 500 feet during the peak periods, as well as the CR 83/ US 169 North Ramp intersection, where westbound queues are expected to extend approximately 600 to 1,500 feet during the peak periods.

To address the issue areas noted under year 2025 build conditions, the following improvements were identified.

6) Eagle Creek Boulevard and Marschall Road Intersection
    a. Implement left-turn phasing (i.e. Flashing Yellow Arrows) in all directions and restripe the east and west approaches to provide dedicated left-turn lanes. *Note that Scott County plans to implement left-turn phasing in the north and south directions in 2018.*

7) Canterbury Road (CR 83) and US 169 North Ramp Intersection
    a. Construct a second westbound right-turn lane on the off-ramp to provide dual westbound right-turn lanes. *The need for this improvement is based on the assumptions within this study. However, it is recommended that this turn lane only be constructed if/when needed. Note that the revised CR 83 layout includes this right-turn lane as a potential future improvement.*

To illustrate how these potential improvements, as well as the existing and planned CR 83 improvements (i.e. improvements 1a through 7a) are expected to operate under year 2025 build conditions, an additional intersection capacity analysis was conducted. Results of this analysis, referred to as the year 2025 build (improved) condition, indicates that all intersection are expected to operate at an overall LOS D or better during the a.m. and p.m. peak hours. Side-street delays and area queuing will be minimized and/or within reasonable levels. These results are summarized in Table 5, while detailed results are included in Appendix E.

Year 2040 No Build Conditions

The year 2040 no build conditions (which does not include any of the existing improvements or the revised CR 83 layout) was reviewed to help determine the long-term area needs, regardless of the proposed development. Similar to the year 2025 no build conditions, multiple intersections are expected to operate at LOS E or worse during the a.m. peak hour, Shenandoah Drive access to CR 101 will continue to be challenging, and the significant existing queuing issues noted will increase.

The improvements identified to address the existing issues (see improvements 1a through 5a noted under year 2025 no build conditions) are expected to provide sufficient capacity to accommodate the year 2040 no build conditions. However, the southbound left-turn queues from the Eagle Creek Boulevard/Marschall Road intersection are expected to extend approximately 700 feet during the p.m. peak hour. Therefore, improvement 6a (i.e. southbound/northbound left-turn phasing) is necessary to minimize the southbound queuing at the Eagle Creek Boulevard/Marschall Road intersection, regardless of the proposed development.

The year 2040 no build (improved) condition operations, which includes improvements 1a through 6a, are shown in the intersection capacity analysis summary (shown in Table 5). Detailed analysis results are included in Appendix E.

Year 2040 Build Conditions

To understand potential impacts associated with the proposed development, a year 2040 build condition was evaluated. This condition assumes the existing improvements, the revised CR 83 layout, and the northbound/southbound left-turn phasing at Eagle Creek Boulevard/Marschall Road have been constructed/implemented (see improvements 1a through 6a). Once again, results of this capacity analysis are summarized in Table 5, while detailed results are included in Appendix E.

Results of the year 2040 build condition capacity analysis indicate the majority of intersections are expected to operate at an acceptable overall LOS D or better during the peak hours with the assumed improvements. However, there are a few locations where potential issues are expected. This primarily includes locations along CR 83 at 4th Avenue, 12th Avenue, and the US 169 North Ramp. The overall LOS E operations at the 12th Avenue and US 169 North Ramp intersections are a result of the westbound off-ramp operations and the need to provide sufficient green time, which has a ripple effect back to 12th Avenue. This also impacts the 12th Avenue/Disc Drive intersection.

Therefore, to address the issue areas noted under year 2040 build conditions, the following improvements were identified.

7) Canterbury Road (CR 83) and US 169 North Ramp Intersection (*also noted under year 2025 build*)
    a. Construct a second westbound right-turn lane on the off-ramp to provide dual westbound right-turn lanes. *The need for this improvement is based on the assumptions within this study. However, it is recommended that this turn lane only be constructed if/when needed. However, by year 2040 conditions, this additional turn lane is expected to be needed.*

8) Canterbury Road (CR 83) and 4th Avenue
    a. Construct a traffic signal to improve delays and reduce challenging maneuvers

To illustrate how these potential improvements, as well as the existing and planned CR 83 improvements (i.e. improvements 1a through 8a) are expected to operate under year 2040 build conditions, an additional intersection capacity analysis was conducted. Results of this analysis, referred to as the year 2040 build (improved) condition, indicates that all intersection are expected to operate at an overall LOS D or better during the a.m. and p.m. peak hours. Side-street delays and area queuing will be minimized and within reasonable levels.

These results are summarized in Table 5, while detailed results are included in Appendix E. Note that internal intersections along the Vierling Drive extension through the east side of the proposed development up to Barenscher Boulevard were included as part of the capacity analysis but are not shown in Table 5. Further discussion regarding these internal intersections is provided later in this document.

Table 5. Intersection Capacity Analysis Summary

Intersection	Condition																	
	A.M. Peak Hour									P.M. Peak Hour								
	Existing	2025 No Build	2025 No Build (Improved)	2025 Build	2025 Build (Improved)	2040 No Build	2040 No Build (Improved)	2040 Build	2040 Build (Improved)	Existing	2025 No Build	2025 No Build (Improved)	2025 Build	2025 Build (Improved)	2040 No Build	2040 No Build (Improved)	2040 Build	2040 Build (Improved)
County Road 83/County Road 101	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C
County Road 83/Valley Industrial Blvd (N) (1)	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/B	A/B	A/C	A/C	A/B	A/C	A/D	A/C
County Road 83/4th Ave (1)	A/A	A/A	A/A	A/B	A/B	A/A	A/A	A/B	A	A/B	A/B	A/C	A/C	A/D	A/B	A/C	B/E	B
County Road 83/Valley Industrial Blvd (S)/Barenscheer Blvd (1)	A/A	A/B	B	B	B	A/B	B	B	B	A/A	A/A	B	B	B	A/B	B	B	B
County Road 83/Canterbury Distribution Center (N) (1)	A/B	A/C	A/C	A/D	A/D	A/C	A/C	A/D	A/D	A/A	A/A	A/A	A/C	A/C	A/A	A/B	A/C	A/C
County Road 83/Shenandoah Dr/East Canterbury Access (1)	A/A	A/A	-	-	-	A/B	-	-	-	A/A	A/A	-	-	-	A/A	-	-	-
County Road 83/Canterbury Distribution Center (S) (1)	A/B	A/B	A/A	A/A	A/A	A/B	A/A	A/B	A/A	A/A	A/B	A/A	A/B	A/A	A/B	A/A	A/A	A/A
County Road 83/12th Ave	B	B	B	C	C	B	C	C	C	C	C	C	D	D	D	C	E	D
County Road 83/Secretariat Dr (1)	A/A	A/A	-	-	-	A/A	-	-		A/C	A/C	-	-	-	A/D	-	-	-
County Road 83/TH 169 North Ramp	C	C	C	C	C	C	C	D	C	C	C	C	E	C	C	C	E	D
County Road 83/TH 169 South Ramp	B	B	B	B	B	B	B	C	C	B	B	B	B	B	B	B	B	B
County Road 83/Eagle Creek Blvd	D	E	C	C	C	E	C	C	C	C	C	C	C	C	C	C	C	C
County Road 83/County Road 16	D	F	C	D	C	F	D	D	D	C	C	C	C	C	C	C	C	C
Shenandoah Dr/County Road 101 (1)	A/C	A/C	B	B	B	A/D	B	B	B	A/E	C/F	B	B	B	E/F	B	B	B
Shenandoah Dr/4th Ave (2)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Shenandoah Dr/Eastway Ave/Barenscheer Blvd (1)	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A
Shenandoah Dr/Canterbury Access (3)	-	-	A	A	A	-	A	A	A	-	-	A	A	A	-	A	A	A
Shenandoah Dr/Residential/Business Access (3)	-	-	A	A	A	-	A	A	A	-	-	A	A	A	-	A	A	A
Shenandoah Dr/Business Access (1)	-	-	A/A	A/A	A/A	-	A/A	A/A	A/A	-	-	A/A	A/A	A/A	-	A/A	A/A	A/A
Shenandoah Dr/Vierling Dr/12th Ave (1)	A/A	A/A	A	A	A	A/A	A	A	A	A/A	A/A	A	B	B	A/A	A	B	C
Eagle Creek Blvd/Marschall Rd	B	B	B	C	C	B	B	C	C	B	C	C	C	C	D	C	C	C
Eagle Creek Blvd/Roundhouse St (1)	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/B	A/B	A/A	A/A	A/B	A/B
Eagle Creek Blvd/Sarazin St (1)	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A
Eagle Creek Blvd/Alysheba Rd (1)	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/B	A/B	A/A	A/A	A/C	A/B
Eagle Creek Blvd/Hauer Tr (1)	A/A	A/A	A/A	A/B	A/B	A/A	A/A	A/C	A/B	A/A	A/A	A/C	A/C	A/C	A/A	A/C	A/C	A/C
Eagle Creek Blvd/Business Access (1)	-	-	-	A/B	A/B	-	-	A/B	A/B	-	-	-	A/D	A/D	-	-	A/F	A/F
Eagle Creek Blvd/Vierling Dr (2)	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B
Vierling Dr/Marschall Rd	C	C	C	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D
Vierling Dr/Tasha Blvd	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	B
12th Ave/Disc Dr (1)	A/A	A/A	A/A	A/B	A/B	A/A	A/A	A/A	A/B	A/A	A/A	A/A	A/C	A/C	A/A	A/A	A/E	A/C
4th Ave/North Canterbury Access (1)	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/A	A/B	A/A	A/A	A/A

(1) Indicates an unsignalized intersection with side-street stop control where the overall LOS is shown followed by the worst approach LOS.; (2) Indicates an unsignalized intersection with all-way stop control; (3) Indicates an unsignalized intersection with roundabout control.

Other Area Roadway Considerations

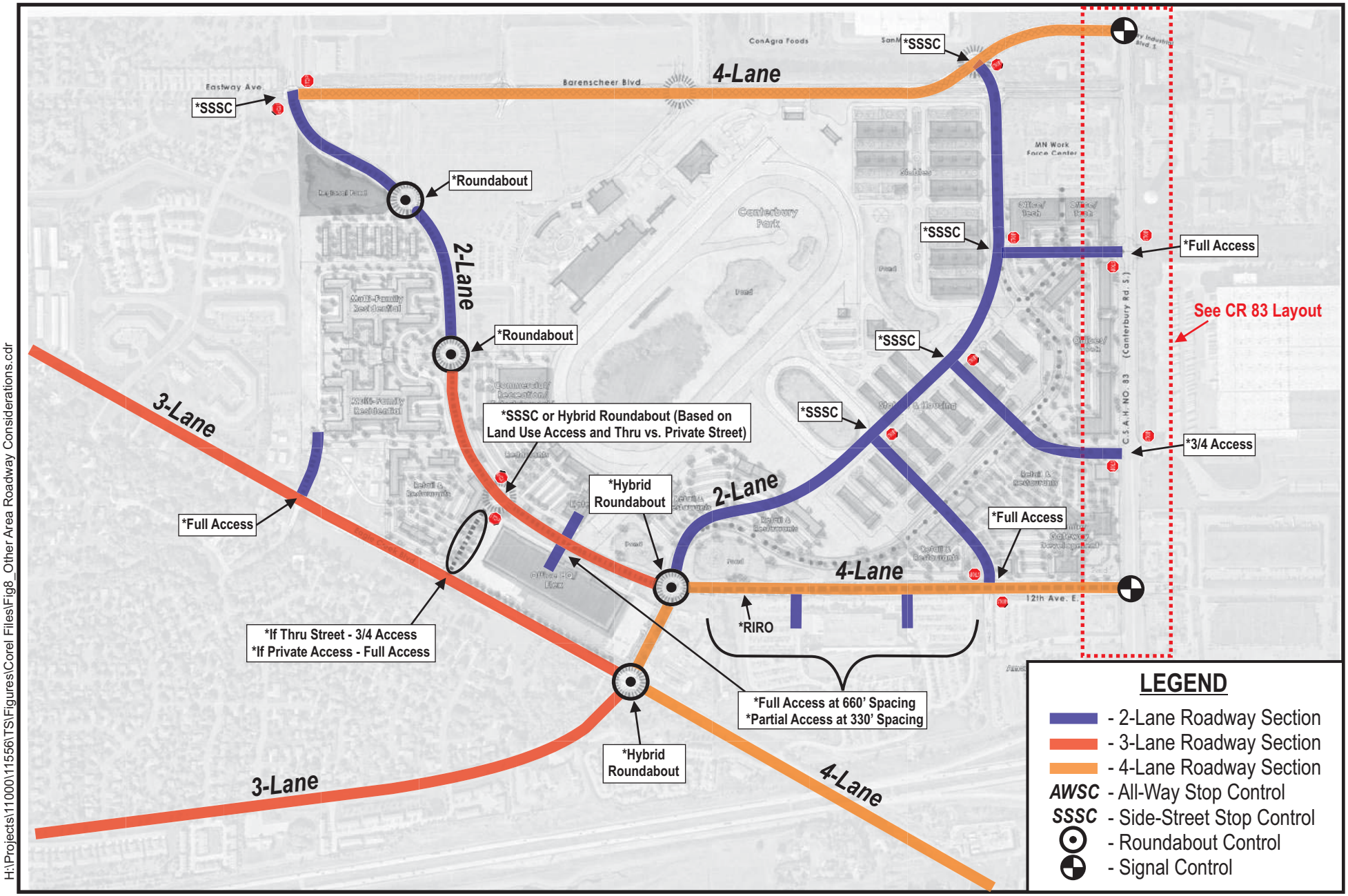
In addition to the improvements identified as part of the existing conditions analysis and future intersection capacity analysis, a number of other area roadway considerations were identified based on review of area traffic volumes, roadway/intersection capacity, coordination with area stakeholders, potential development opportunities, and various event considerations. The result of these efforts, which included several iterations and sensitivity tests, was the preliminary area roadway considerations noted within Figure 8. The following information provides an overview of the various considerations/improvements needed to support both existing and future development within the area or provide improved operations and safety.

9) Shenandoah Drive (Barenscheer Boulevard to Vierling Drive/12th Avenue)
   a. This roadway is planned as primarily a two-lane facility with either a center two-way left-turn lane or a raised median, depending on the location to provide flexibility as development occurs. Roundabouts are planned at the two primary driveways to Canterbury Park. Preliminary conceptual layouts of the roundabouts can be found in Appendix C. The purpose of this roadway is to provide a pedestrian friendly environment, while also serving as a secondary access to Canterbury Park. Any future full-access should be spaced at least 660 feet from the next full-access location; partial access may be considered between the full-access locations if there is no detriment to the public roadway system.
   b. With the extension of Shenandoah Drive, Shendandoah Drive/Barenscheer Boulevard/Eastway Avenue will be reconfigured to a four-legged intersection. Various traffic controls were tested at this intersection including side-street stop control, all-way stop control, and a hybrid roundabout. The intersection is expected to operate at an overall LOS A for each traffic control tested under all scenarios. However, based on future traffic volumes and right-of-way impacts, the hybrid roundabout is not warranted. Therefore, based on discussions with the project team, side-street stop control is recommended at this intersection.

10) 12th Avenue (Vierling Drive/Shenandoah Drive to CR 83)
   a. This roadway is generally a 4-lane undivided facility west of Disc Drive, with a short two-lane section east of Disc Drive. This roadway segment is planned to be a four-lane facility for the entire length from Vierling Drive to CR 83 for consistency. As the facility is reconstructed, access modifications should be designed to provide full-access at least 660 feet from the next full-access location; partial access may be considered between the full-access locations if there is no detriment to the public roadway system. A center left-turn lane or dedicated left-turn lanes with a raised median should also be considered within this segment.

11) Barenscheer Boulevard (Shenandoah Drive to CR 83)
   a. This roadway is planned to be the new primary access to/from Canterbury Park. The roadway is planned to be a four-lane undivided roadway to allow for reversible lanes during events. The facility would expand to a six-lane facility near CR 83 to allow for better lane delineation to reduce driver confusion to/from CR 83.

12) Vierling Drive (Eagle Creek Boulevard to Miller Street)
   a. This roadway is currently a four-lane undivided facility that carries approximately 4,000 to 8,000 vehicles per day. This roadway should be considered for conversion to a three-lane facility, which would provide a slower, more pedestrian/bicyclist friendly facility, while still being able to accommodate existing and future traffic volumes.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig8_Other Area Roadway Considerations.cdr

SRF Consulting Group, Inc.

Other Area Roadway Considerations

Canterbury Commons Areawide Transportation Assessment
City of Shakopee

Figure 8

01811556
July 2018

13) Vierling Drive Extension (between 12th Avenue and Barenscheer Boulevard)/Internal Roadways
    a. This connection and other roadways within this general area are subject to future development plans. Preliminary review of these facilities indicate two lane facilities and side-street stop controls should be sufficient to accommodate future development within this area. Further analysis may be needed to determine the specific needs of area traffic controls and turn lanes.

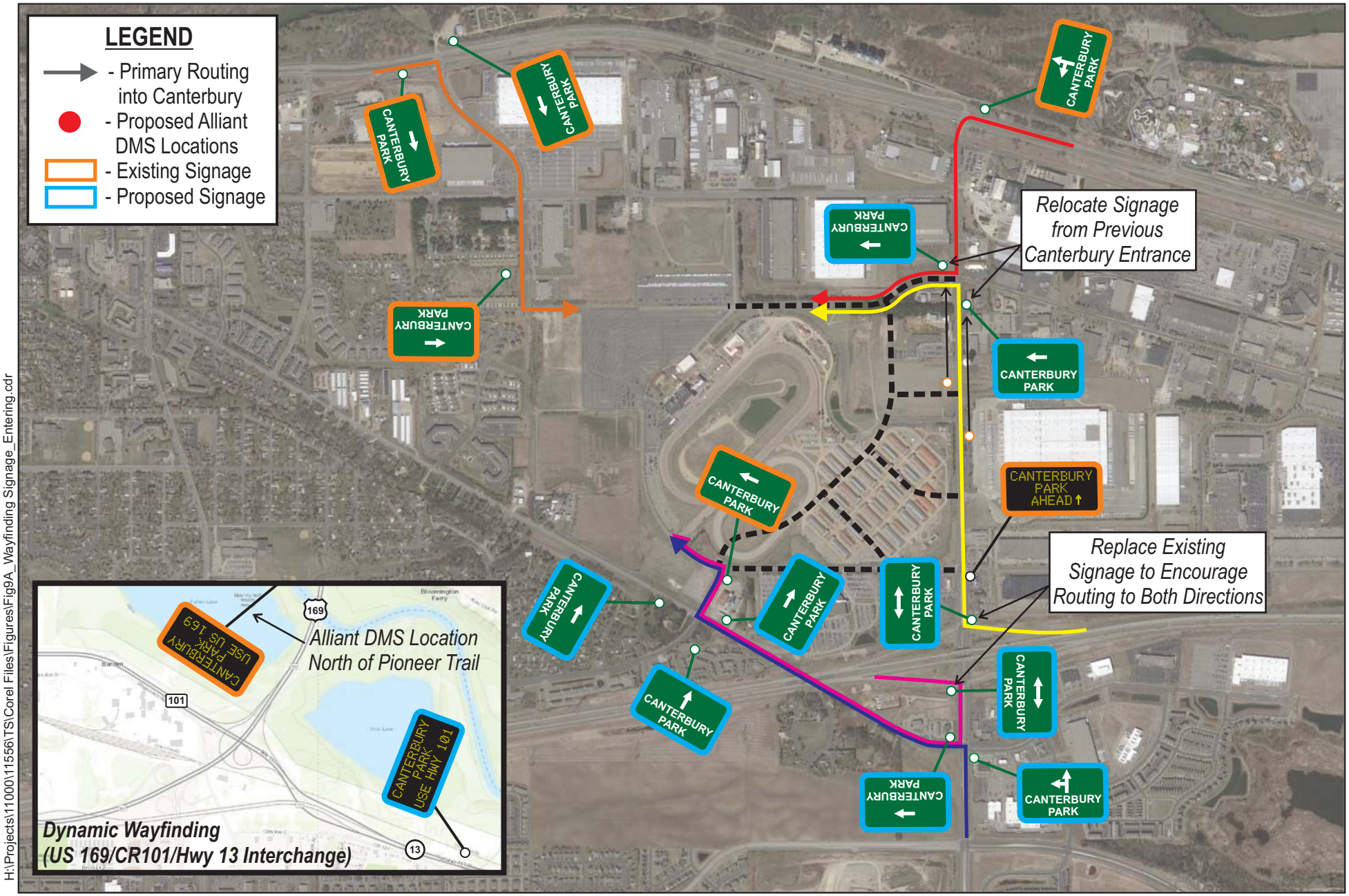
14) Shenandoah Drive/Vierling Drive/12th Avenue Intersection
    a. This intersection is planned as a hybrid roundabout, providing the transition from the four-lane 12th Avenue to the two-lane Shenandoah Drive. The north approach (i.e. potential future extension of Vierling Drive) may not be constructed until future development occurs. The west approach splitter island may also be designed to easily modify if event traffic warrants consideration. However, caution should be used given that the need for this extra capacity may be limited to one or two years until Barenscheer Boulevard is constructed. A preliminary conceptual layout of the planned hybrid roundabout can be found in Appendix C.

Event Management and Wayfinding

In addition to the typical weekday peak period conditions, event traffic to/from Canterbury Park has and is expected to continue to impact area operations. The peak activity at Canterbury Park occurs on Thursday evenings (generally between 5:30 p.m. and 10 p.m.), as well as select larger events that occur at various times of the year. During a typical Thursday evening event, peak entering traffic occurs between 6:00 p.m. and 7:00 p.m., when nearly 1,400 vehicles enter Canterbury Park. Peak exiting traffic occurs between 9:45 p.m. and 10:45 p.m., when nearly 1,100 vehicles exit Canterbury Park. In general, there is limited (non-Canterbury) traffic during these periods. It should be noted that the peak traffic during larger events (such as the July 4 fireworks) experience peak hour traffic volumes in the 1,700 to 1,900 range.

To better understand how the planned roadway network is expected to operate under future event conditions, multiple sensitivity tests were conducted. Results of these tests indicate that since area (non-event) traffic volumes are generally lower during Thursday evening events (given the start/end times), attendance arrivals/departures occur over a longer period, and there are multiple access locations to access Canterbury Park, no significant traffic issues are expected as a result of the future roadway network. In fact, the new primary access at Barenscheer Boulevard is expected to provide similar or improved ingress/egress as compared to current conditions, as well as better balance of event traffic volumes between US 169 and County Road 101. This in turn reduces impacts to the current CR 83 and 12th Avenue intersection, which is the critical intersection today.

Note that traffic control officers may still be needed during peak events to assist motorists with access, circulation, and parking. Furthermore, detailed wayfinding plans were developed for both entering and exiting event conditions to balance traffic volumes between various roadways within the area. These wayfinding plans leverage a combination of static and dynamic message signs, as well coincide with existing signing improvements, some of which were implemented in 2017. The preliminary wayfinding signage and routing plans for entering and exiting conditions are illustrated in Figures 9A and 9B, respectively.



H:\Projects\11000\11556\TS\Corel Files\Figures\Fig9A_Wayfinding Signage_Entering.cdr

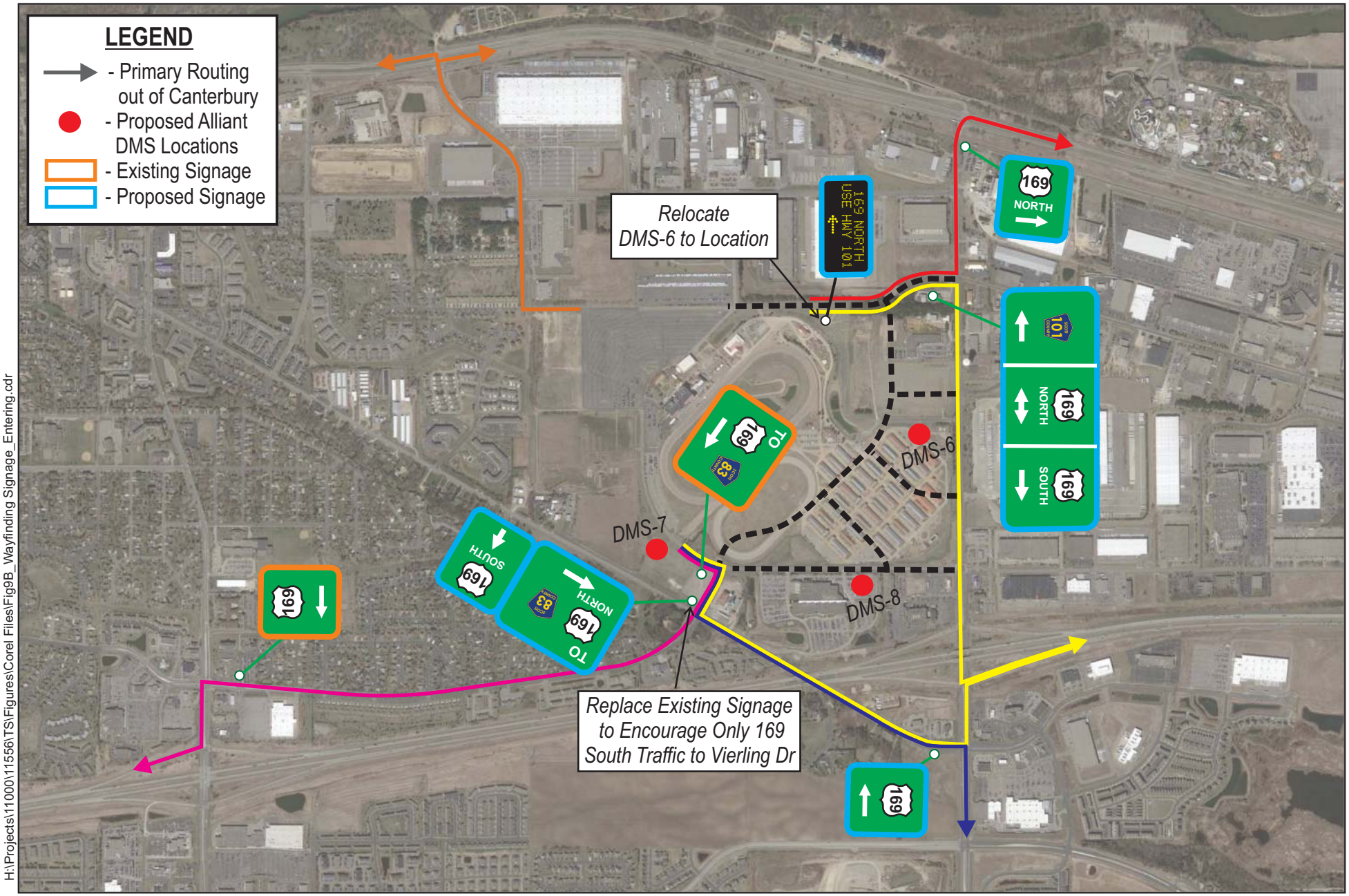
SRF Consulting Group, Inc.

Preliminary Wayfinding Signage/Routing (Entering)

Canterbury Commons Areawide Transportation Assessment
City of Shakopee

Figure 9A

01811556
July 2018



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig9B_Wayfinding Signage_Entering.cdr

SRF Consulting Group, Inc.

Preliminary Wayfinding Signage/Routing (Exiting)

Canterbury Commons Areawide Transportation Assessment
City of Shakopee

01811556
July 2018

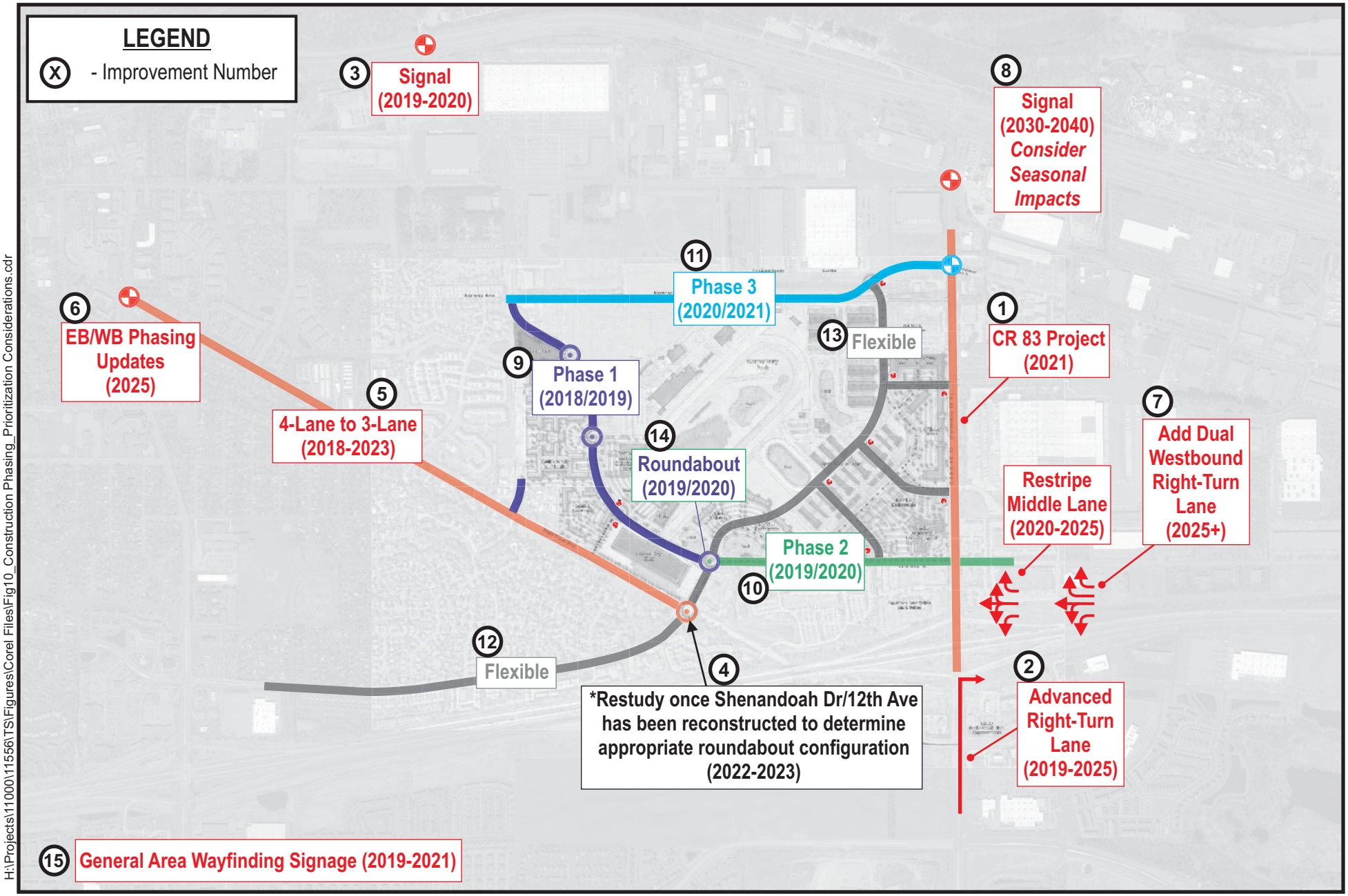
Figure 9B

Project Phasing and Prioritization

The improvements identified within this assessment were reviewed and prioritized based on a combination of discussions with City, County, and development staff. Based on these discussions, as well as the existing and future intersection capacity analysis, safety, and maintenance need, the various improvement projects were prioritized. This included identifying potential construction phasing considerations and general timeframes when the various improvements are expected to be needed. A summary of the construction phasing and prioritization considerations are illustrated in Figure 10. Note that several of the improvements are listed as "flexible", which represents an improvement that can be implemented as funding, need, and/or market conditions warrant.

Improvement Summary

Based on the improvements identified within this assessment, a summary of the various improvements, preliminary project costs, and approximate need timeframe was identified. The improvements, outlined in Table 6, correspond to the bullet numbering within this assessment. Table 6 has been broken down into two sections, Canterbury Commons Projects and Existing/Future Background Projects. Canterbury Commons Projects are classified as improvements that are triggered partially and/or in whole by the Canterbury Commons Development. Existing/Future Background Projects are projects that are not triggered by the Canterbury Commons Development, but rather are existing and/or future issues due to general background growth. Preliminary costs include design engineering, construction administration, and contingency; specific costs for each improvement are included in Appendix A.



H:\Projects\11000\11556\TS\Figures\Corel Files\Fig10_Construction Phasing_Prioritization Considerations.cdr

SRF Consulting Group, Inc.

Construction Phasing/Prioritization Considerations

Canterbury Commons Traffic Study
City of Shakopee

Figure 10

01811556
July 2018

Table 6. Improvement Summary

Location (Improvement) *# Corresponds to Figure 10*	Preliminary Cost	Need/Construction Timeframe
Canterbury Commons Projects		
1) County Road 83 Reconstruction (Changes Only)	$900,000 (1)	2021
4) Eagle Creek Blvd/Vierling Dr (Roundabout)	$1,400,000 (2)	2022 - 2023
7) CR 83/US 169 North Ramp (Turn Lane)	$230,000	2025+
9) Shenandoah Dr (Reconstruct) with Hauer Trail	$8,400,000	2018 - 2019
10) 12th Ave (Reconstruct) (3)	$6,850,000	2019 - 2020
11) Barenscheer Blvd (Reconstruct)	$7,200,000	2020 - 2021
13) Vierling Drive Extension/Internal Roads	$7,000,000	Flexible
14) Shenandoah/Vierling/12th (Roundabout)	$350,000	2019 - 2020
15) General Area Wayfinding Signage	$100,000	2019 - 2021
Subtotal	***$32,430,000***	
Existing/Future Background Projects		
County Road 83 Reconstruction (Revised Layout - All)	*$8,860,000* (4)	2021
2) Northbound CR 83 (Advance Right-Turn Lane)	$1,475,000	2019 - 2025
3) County Road 101/Shenandoah Dr (Signal)	$400,000	2019 - 2020
5) Eagle Creek Blvd (4-Lane to 3-Lane)	$75,000	2018 - 2023
6) Eagle Creek Blvd/Marschall Rd (Signal Phasing)	$75,000	2018 - 2025
8) Canterbury Rd (CR 83)/4th Ave (Signal)	$350,000	2030 - 2040
12) Vierling Drive (4-Lane to 3-Lane)	$50,000	Flexible
Subtotal	***$2,425,000***	

(1) Project cost is $980,000 if CR 83/US 169 North Ramp Turn Lane (#7) is included in CR 83 Project (Additional costs in #7 are if the turn lane is constructed as a separate project)

(2) Includes roadway reconstruction

(3) Includes area east of CR 83

(4) Estimate provided by Scott County.