Spack CONSULTING
ENGINEERING TRAFFIC FORWARD

Intersection Study

Burnsville Aging Signals
Burnsville, Minnesota

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

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Executive Summary

Background: Three existing traffic signals in the City of Burnsville are close to the end of their service life; CSAH 5/Burnsville Parkway, CSAH 5/136th Street, and CSAH 11/Burnsville Parkway. The goal of this project is to examine each intersection, determine the most appropriate type of control for today and into the future using objective criterion, and then provide the preliminary design of that preferred alternative.

Results: The principle findings of this traffic study are:

- No significant operational issues were observed at any of the study intersections.
- All three study intersections and all movements at those intersections are operating acceptably.
- A safety review suggests the intersections are reasonably safe today.
- Two or three alternatives were developed for each study intersection.
- Evaluation matrices were developed for the study intersection alternatives, comparing:
  - LOS operations with existing and future volumes
  - Critical indices for overall crashes and severe crashes
  - Impacts to pedestrian and bicycle crossings
  - Right-Of-Way needs
  - Construction costs
  - B - C ratios
- Two open house meetings were held, one on September 7, 2016 and one on February 1, 2017, to discuss the project, its findings, and its recommendations.

Recommendations: The following is recommended based on the evaluations and findings presented in this study:

- CSAH 5/Burnsville Parkway: Signalized intersection with added Flashing Yellow Arrow (FYA) phasing for left turn movements and northbound and southbound exclusive right turn lanes.
- CSAH 5/136th Street: Signalized intersection with added FYA phasing for left turn movements and westbound right turn lane.
- CSAH 11/Burnsville Parkway: Signalized intersection with added FYA phasing for left turn movements and conversion of the eastbound shared through/right turn lane to an exclusive right turn lane. However, a multi-lane roundabout is a viable option and could be implemented if construction costs are reduced, additional funding is provided, or conditions change causing the evaluations to be revised. This option will be reassessed prior to programming a project at this location.

Signal justification reports are provided in the Appendix for each study intersection.

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1. Introduction

a. Purpose of Study

Three existing traffic signals in the City of Burnsville are close to the end of their service life, ranging in age from 27 to 37 years old. Rather than simply remove and replace the signals, Dakota County and the City of Burnsville wanted to take this opportunity to review the intersections, determine the appropriate traffic control and assess the intersection geometry needs.

The three intersections and their signal turn on dates are:

- County State Aid Highway (CSAH) 5/Burnsville Parkway (12/30/1979)
- CSAH 5/136th Street (1/18/1989)
- CSAH 11/Burnsville Parkway (10/10/1986)

b. Study Objectives

The goal of this project is to examine each intersection, determine the most appropriate type of control for today and into the future using objective criterion, and then provide the preliminary design of that preferred alternative.

To accomplish this goal, we have laid out the following study objectives:

i. Document how the study intersections are operating with today's volumes and existing characteristics.
ii. Compare and contrast different traffic control options for each intersection with an evaluation matrix.
iii. Recommend the most appropriate traffic control for each intersection based on the evaluation matrix, along with input from the County, the City, and the public.
iv. Prepare preliminary geometric layouts of the preferred alternative for each intersection.
v. Prepare justification reports or letters for each intersection.

This report documents the process, methodology, results, and recommendations of the study, including the preliminary design of the preferred alternative for each intersection.

2. Background

a. Intersection Locations

The three study intersections are signalized intersections located in the City of Burnsville at:

- CSAH 5/Burnsville Parkway
- CSAH 5/136th Street
- CSAH 11/Burnsville Parkway

These locations are shown in Figure 1 and in the Appendix.

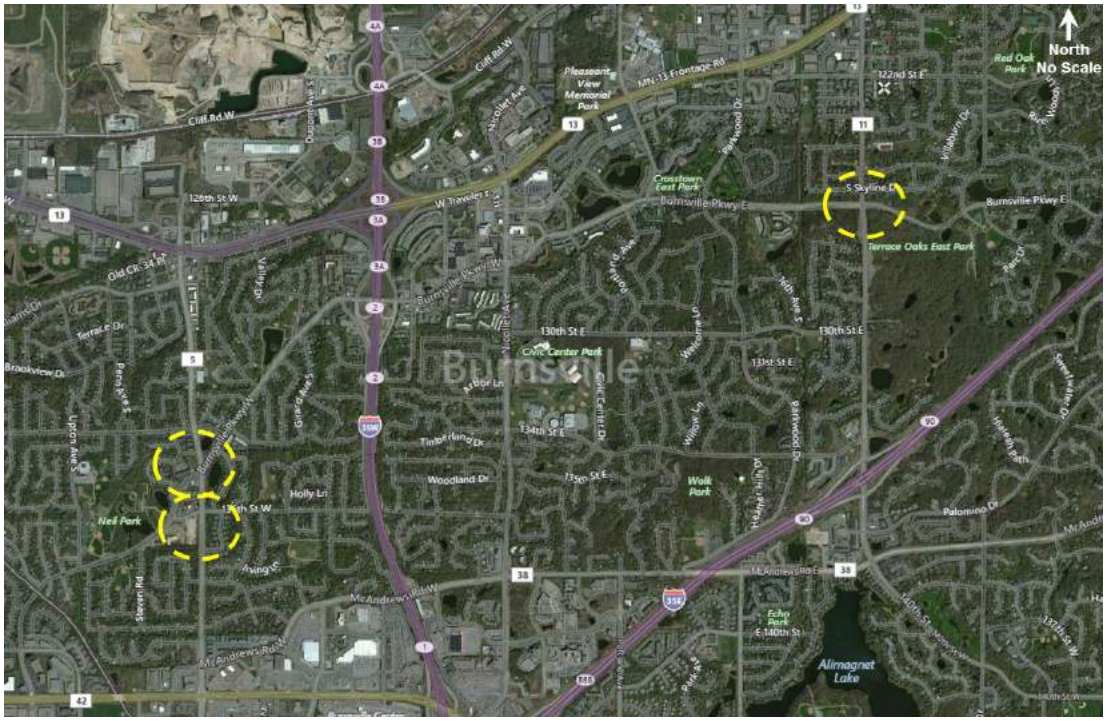


Figure 1 – Location Map

b. Transportation Network Characteristics

Dakota CSAH 5 is a four-lane, divided, north-south road with a 45-mph speed limit in the study area. CSAH 5 is classified as an A Minor Arterial-Expander in the study area. CSAH 5 extends from Trunk Highway (TH) 13 in Burnsville to Interstate 35 in Lakeville. Southeast of I-35, CSAH 5 becomes CSAH 50. CSAH 5 directly serves mostly residential areas with some commercial areas, especially near CSAH 42.

Dakota CSAH 11 is a four-lane, undivided, north-south road with a 40-mph speed limit in the study area. CSAH 11 is classified as an A Minor Arterial-Expander in the study area. CSAH 11 extends from TH 13 in Burnsville to

CSAH 38 in Apple Valley. North of TH 13, CSAH 11 becomes a city street and south of CSAH 38, CSAH 11 becomes a city street. CSAH 11 directly serves mostly residential areas with some commercial areas, especially near TH 13 and I-35E.

Burnsville Parkway also known as Burnsville Municipal State Aid Street (MSAS) 102 is a four-lane, divided, east-west road with a 35-mph speed limit west of CSAH 5 and east of CSAH 11 and a 40-mph speed limit between CSAH 5 and CSAH 11. Burnsville Parkway is classified as a Collector road west of CSAH 5 as well as east of CSAH 11, and classified as an A Minor Arterial-Reliever between CSAH 5 and CSAH 11. Burnsville Parkway extends from CSAH 42 in Burnsville to Slater Road in Burnsville. Burnsville Parkway serves mostly residential areas with some commercial areas especially near I-35W and some industrial areas near CSAH 42.

West 136th Street is Burnsville MSAS 130 east of CSAH 5. West of CSAH 5, the road is classified as a local road. 136th Street is a two-lane, undivided, east-west road with a 30-mph speed limit in the study area. 136th Street is approximately 3/4 of a mile in length and extends from Burnsville Parkway to just west of I-35W serving residential areas.

The CSAH 5/Burnsville Parkway intersection is currently signalized. CSAH 5 runs north-south through the intersection and Burnsville Parkway runs northeast-southwest through the intersection making it a skewed intersection. Exclusive left turn lanes are provided on all approaches and channelized right turns are provided on Burnsville Parkway. The channelizing islands are substandard based on current design guidelines. The existing signal operates under eight phases, providing protected left turn phasing only. Although striped crosswalks are only provided on three of the four crossings due to the geometrics, pedestrian pushbuttons and indications are provided for all crossings.

The CSAH 5/136th Street intersection is currently signalized. CSAH 5 runs north-south through the intersection and 136th Street runs east-west through the intersection. Northbound and southbound exclusive left turn lanes are provided. The eastbound approach flares out at the intersection to provide space for a right turning vehicle. The existing signal operates with six phases, providing protected left turn phasing only for the northbound and southbound left turn movements. Pedestrian crosswalks are striped for three of the four crossings. Pedestrian pushbuttons and indications are provided for all four crossings.

The CSAH 11/Burnsville Parkway intersection is currently under signal control. CSAH 11 runs north-south through the intersection and Burnsville Parkway runs east-west through the intersection. Exclusive left turn lanes are provided on all approaches. Exclusive right turn lanes or other types of

channelization are not provided at this intersection. The existing signal operates with six phases, providing protected left turn phasing only for the northbound and southbound left turn movements. Striped pedestrian crossings, pushbuttons, and indications are provided for all four crossings of the intersection.

Existing traffic control and travel lanes for the study intersections are shown in Figure 2 and in the Appendix.

Sidewalks/trails exists on all sides of each study intersection with the exceptions of the north side of 136th Street west of CSAH 5 and the north side of Burnsville Parkway around CSAH 11.

There are transit stops on southbound CSAH 5 on the south side of both the Burnsville Parkway and 136th Street intersections. Burnsville Parkway has a westbound transit stop west of CSAH 5 and an eastbound transit stop east of CSAH 5. These transit stops are in the right hand through lane, except for the stop on CSAH 5 south of 136th Street which has a bus pull-out on the right side of the road. These transit stops are for express bus routes that provide service from Savage and Burnsville to Downtown Minneapolis and the Mall of America.

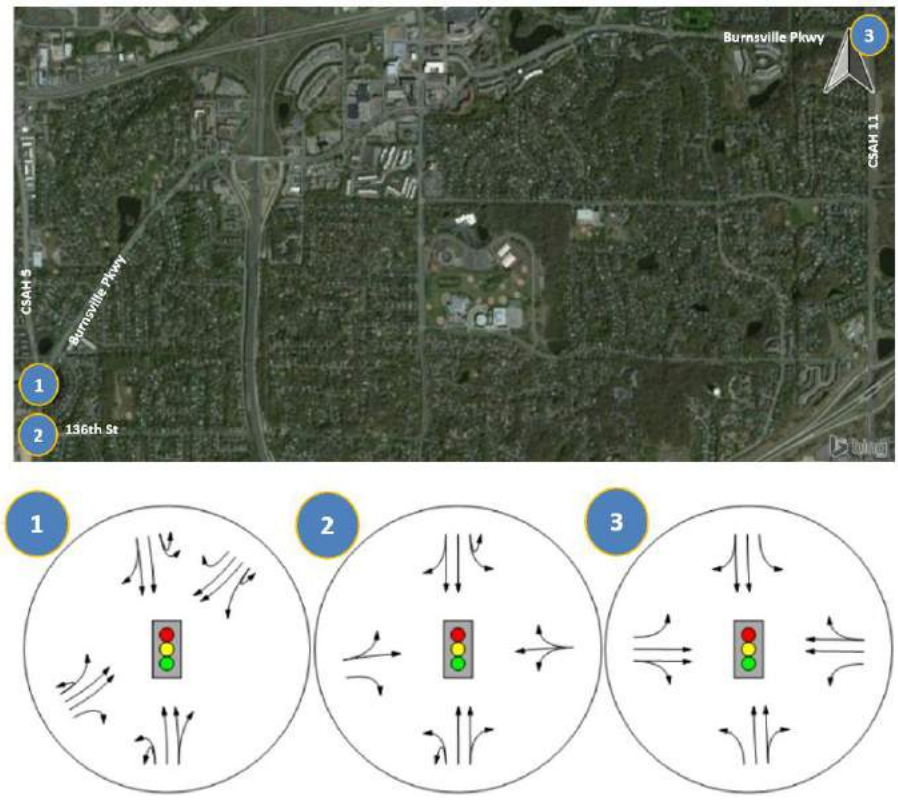


Figure 2 – Existing Lanes & Traffic Control

c. Existing Traffic Volumes

Intersection video was collected at each study intersection under normal weekday conditions in August of 2016 with clear weather. Using these videos, 24-hour turning movement counts were collected at the three study intersections. Based on these counts, the peak hours were found to be from 7:15 to 8:15 a.m. and 4:45 to 5:45 p.m. at all the study intersections. The 2016 turning movement count data for each study intersection is contained in 15-minute intervals in the Appendix. The peak hour volumes are shown in Figure 3 and in the Appendix.

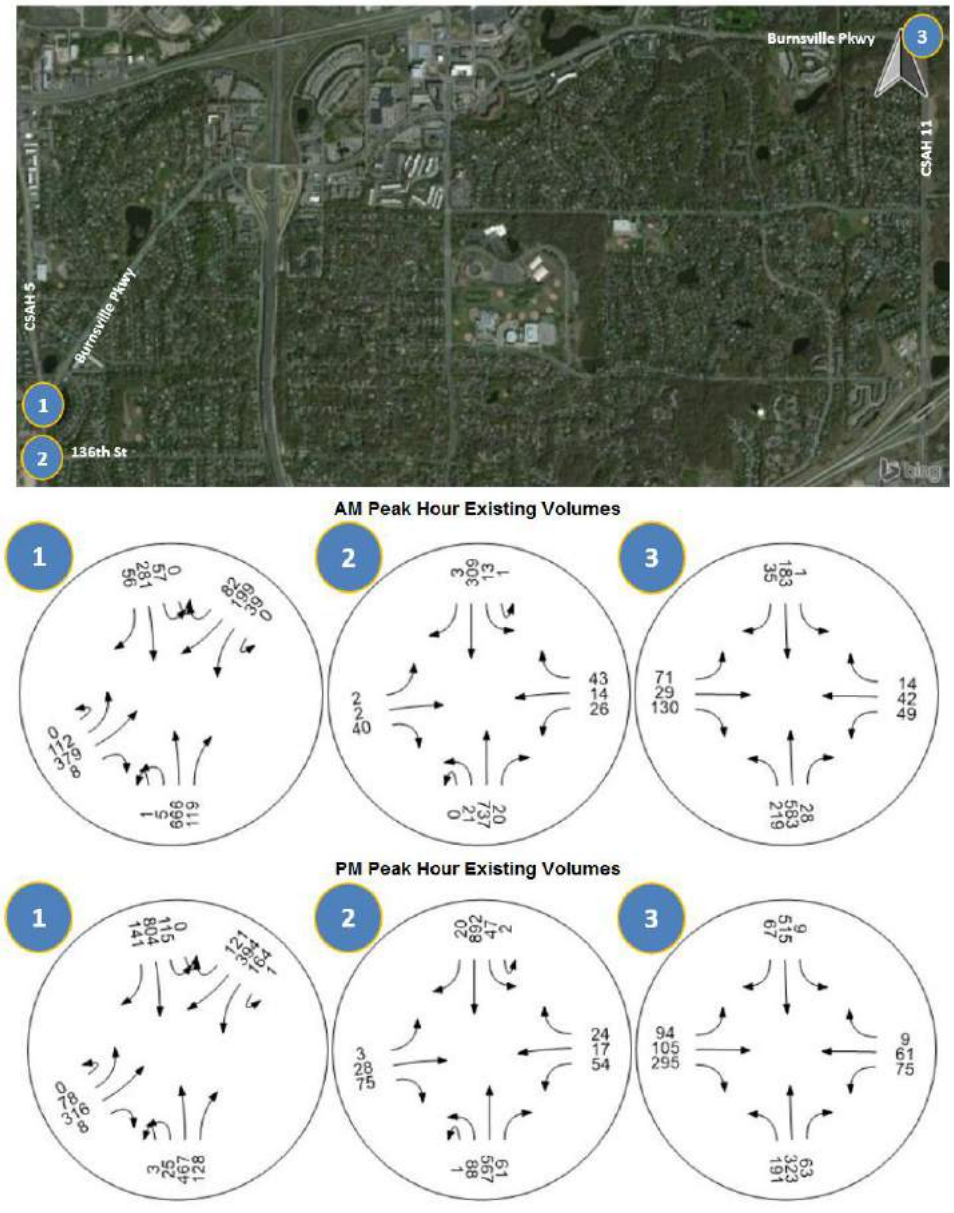


Figure 3 – Existing Volumes

Previously collected daily traffic volumes are also available from the Minnesota Department of Transportation's (MnDOT's) Traffic Mapping. These volumes are annual average daily traffic volumes (AADTs) which provide just the total number of vehicles on a road as opposed to turning movement volumes. The AADT vehicle volumes near the study intersections were collected in 2014 and 2015 and are:

- At CSAH 5/Burnsville Parkway: 15,100 on the north leg, 14,800 on the south leg, 9,700 on the west leg and 12,700 on the east leg.
- At CSAH 5/136th Street: 14,800 on the north and south legs, and 1,750 on the east leg. No data is available on the west leg.
- At CSAH 11/Burnsville Parkway: 10,400 on the north leg, 13,400 on the south leg, 7,600 on the west leg and 3,300 on the east leg.

These daily volumes are in line with the volumes from the turning movement counts.

3. Analysis of Existing Conditions

a. Field Observations

A field review of existing operations was conducted at each of the three study intersections during the a.m. and p.m. peak hours in July of 2016. These reviews observed no significant operational issues at any of the study intersections. All vehicle queues were observed to clear during green phases and no significant queues that stretch beyond turn lane lengths or excessive delays (such as waiting through two or more signal cycles) were noted.

Other important notes included:

- Flashing Yellow Arrow (FYA) to provide protective/permissive left turn operation appears to have potential at each currently protected left turn movement. Observed gaps in the conflicting traffic flow and sufficient sight lines suggest this is a viable option.
- Very few pedestrians and bicyclists were observed to use the study intersections in both the field review and the traffic counts.
- Operations did not appear to have any issues on approaches that do not provide exclusive right turn lanes.
- The CSAH 5/136th Street intersection primarily rests in a green phase for the northbound and southbound traffic. This limits the interaction and potential vehicle platooning that could develop between this and the CSAH 5/Burnsville Parkway intersection.
- Traffic volumes on 136th Street appear low compared to other movements and intersections. If these volumes are low enough compared to the discounted thresholds of the traffic signal warrants, the signal may no longer be justified at this location.
- Although the westbound left turn movement on Burnsville Parkway at the CSAH 11 intersection appears to have a sight distance issue due to a slight grade change to the west, sufficient sight distance is available to safely and efficiently complete this turn.

The full field notes from our intersection observations are provided in the Appendix.

b. Existing Operational Analysis

An intersection capacity analysis was conducted for the existing intersections per the *Highway Capacity Manual, 2010*. Intersections are assigned a “Level of Service” (LOS) letter grade for the peak hour of traffic based on the number of lanes at the intersection, traffic volumes, and traffic control. LOS A represents light traffic flow (free flow conditions) while LOS F represents heavy traffic flow (over capacity conditions). LOS D is considered acceptable at most intersections. Individual movements are also assigned LOS grades. At busy intersections, one or more individual movements may operate at a

lower LOS when the overall intersection is operating acceptably at LOS C or D. This situation often occurs for movements with relatively low volumes and/or a relatively high overall traffic signal cycle length.

Related to LOS is vehicle delay. The analysis software provides an estimate for the overall average delay at the intersection. This volume-weighted average provides the delay associated with the traffic control that could be expected by a driver for any approach and movement to that intersection.

A summary of the LOS and delay results for the existing operations is shown in Table 1. These are based on the existing traffic control and lane configurations as shown in Figure 1. These calculations were completed with the VISTRO™ software package, which uses the methodology detailed in the *Highway Capacity Manual 2010*. Signal timings were provided by Dakota County and the model was calibrated to match observations made in the field. The full LOS calculations are provided in the Appendix. Also, included in the Appendix is a guide explaining the Level of Service grade concept.

Table 1 – Existing Peak Hour Operations

Intersection	AM Peak Hour		PM Peak Hour	
	LOS[1]	Delay[2]	LOS[1]	Delay[2]
CSAH 5/Burnsville Parkway	C (d)	21	C (d)	24
CSAH 5/136th Street	A (c)	10	B (c)	12
CSAH 11/Burnsville Parkway	B (d)	13	B (c)	18

[1] The first letter is the Level of Service for the intersection. The second letter (in parentheses) is the Level of Service for the worst operating movement

[2] Average delay for the entire intersection based upon a volume weighted average of each movements' delay, rounded up and presented in seconds.

As shown in Table 1, all three study intersections and all movements at those intersections are operating acceptably. These computer results match the field observations of the intersection operations during a.m. and p.m. peak hours. All vehicle queues at the intersections cleared during the green phases and no significant existing operational issues were identified.

c. Warrant Analysis

The decision to install a traffic signal should include a review of the traffic signal warrants, which present thresholds that indicate when traffic signal control is beneficial. Traffic control signals should not be installed until one or more of these warrants are met, but the meeting of a warrant does not alone justify its installation. Engineering judgement based on data beyond satisfying the traffic signal warrants is necessary for its justification.

Using the turning movement counts, the volume signal warrants (Warrants 1-3) were reviewed for the study intersections using the methodology from the Minnesota Manual on Uniform Traffic Control Devices (MN-MUTCD).

Although three warrants are examined in this study, MnDOT generally focuses on Warrant 1 only, the Eight Hour Warrant. This warrant accounts for traffic volumes over a longer period, ensuring the installation decision reflects operations over the course of an entire day.

Several factors can impact the results of a warrant analysis, such as whether to use the existing or future lane configuration (the number of lanes impacts the warrant thresholds), whether to include right turning traffic (which generally would be able to find gaps and not need a signal to complete their movement), and whether to use the posted or 85th percentile speed (45 mph or greater applies a reduction factor to the volume warrant thresholds).

For the purposes of this warrant analysis, the following factors were applied:

- Eliminating the right turning movement volumes from the analysis.
- Removing any existing right turn lanes from consideration in the analysis.
- Considering whether actual vehicle speeds are higher than the posted speed limit.

A summary of the warrant results is shown in Table 2.

Table 2 – Volume Warrant Analysis Summary with Existing Volumes

Intersection	Warrant 1 8 Hrs Required	Warrant 2 4 Hrs Required	Warrant 3 1 Hr Required
CSAH 5/Burnsville Parkway	Met (16 Hrs)	Met (15 Hrs)	Met (10 Hrs)
CSAH 5/136th Street	Not Met (3 Hrs)	Not Met (1 Hrs)	Met (1 Hr)
CSAH 11/Burnsville Parkway 45 mph vehicle travel speeds 40 mph posted speed	 Not Met (7 Hrs) Not Met (2 Hrs)	 Met (5 Hrs) Not Met (0 Hrs)	 Met (2 Hrs) Not Met (0 Hrs)

As shown, only the CSAH 5/Burnsville Parkway intersection meets all three volume based warrants. The CSAH 5/136th Street satisfies the Peak Hour Volume Warrant only, falling short on the other warrants. The CSAH 11/Burnsville Parkway intersection satisfies two of the three warrants if actual vehicle speeds are considered, not the posted speed limit. Full results of the warrant analyses are included in the Appendix.

The satisfaction of one or more warrants suggests that traffic signal control may be appropriate at these intersections. In many areas, satisfaction of the traffic signal warrants also indicates the potential for roundabout control of an intersection. However, satisfaction of the warrants by itself does not indicate that traffic signal or roundabout control is justified.

d. Crash History

Crash data at the existing study intersections was collected from MnDOT's Minnesota Crash Mapping Analysis Tool. Data was collected for the ten most recent years available, years 2006 through 2015. These crashes are categorized into five different severity types: fatal (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C) and property damage (PD).

Using previously collected intersection volumes, the crash data was translated into rates, allowing for an 'apples-to-apples' comparison between intersections of different types and volumes. An overall crash rate accounts for all crashes evenly. The severity rate applies different weights to the type of crash (fatal crashes having an impact five times greater than property damage crashes). These rates were determined for each location and present in Table 3. Crash rates are presented in units of crashes per million entering vehicles (MEV).

Table 3 – Existing Conditions Crash Rates

Intersection	Overall Crash Rate per MEV[1]	Severity Rate per MEV[1]
CSAH 5/Burnsville Pkwy	0.39	1.06
CSAH 5/136th St	0.25	3.39
CSAH 11/Burnsville Pkwy	0.76	3.16

[1] MEV = Million Entering Vehicles

The critical index is a metric that compares an intersection's observed rate to the critical rate, which is a statistically-valid rate based on the average crash rates for similar intersections statewide throughout Minnesota (similar in terms of volumes, speeds, and traffic control). If the critical index is below 1.00, it suggests the intersection operates within the expected, normal range of crashes. A rate above 1.0 indicates a potential safety issue that deserves additional scrutiny. Table 4 shows the average crashes per year and the critical index for each intersection.

Table 4 – Existing Conditions Crash Statistics

Intersection	Overall Crashes		Severe Crashes	
	Avg. Per Year	Critical Index	Avg. Per Year	Critical Index
CSAH 5/Burnsville Pkwy	3.70	0.51	0.10	0.45
CSAH 5/136th St	1.50	0.31	0.20	**1.15**
CSAH 11/Burnsville Pkwy	4.80	0.94	0.20	**1.11**

As shown, two study intersections show a critical severity index above 1.0, indicating a potential issue. However, a deeper examination of the crash data reveals only two severe non-fatal crashes at each intersection during the ten-

year study period. This relatively low number of severe crashes is not considered an issue despite the higher than desired critical index.

In addition, the crash data was reviewed for potential trends of characteristics that could indicate an issue (i.e. most crashes occurring at night, in adverse weather, of a certain type like rear end, etc.). This review did not reveal any particular pattern or points of interest. While these intersections should continue to be watched, this safety review suggests the intersections are reasonably safe.

4. Intersection Alternatives

Within the universe of alternatives for traffic control exists options for traditional, non-traditional, access management, and grade separated solutions. Each category contains several possibilities that could be considered for each study intersection. Due to the close spacing of approximately 900 feet, alternatives at the two intersections on CSAH 5 will need to be considered together. The impacts of potential changes at one intersection may have an impact on potential changes at the other.

An initial review of the existing information and characteristics narrowed this universe of alternatives. For instance, grade-separated or other alternatives that involve elevated approaches or lanes (bridges) were deemed too expensive. This initial evaluation identified four potential intersection options for each of the three study intersections. Table 5 shows the potential options for each intersection based on generic MnDOT criterion. Currently, all three intersections are under signal control.

Table 5 – Initial Intersection Options using MnDOT Criterion

Intersection Location	Intersection Control Option						
	Traffic Signal	Round-about	Offset "T"s	Indirect Left Turn	Access Manage-ment*	Side Street Stop	Split Inter-sections
CSAH 5/Burnsville Pkwy	X	X	X	X			
CSAH 5/136th St	X	X			X	X	
CSAH 11/Burnsville Pkwy	X	X		X			X

* Access Management refers to options that limit the intersection movements. Example include extending a center median on the mainline to limit the side street to right in/right out only.

Meeting with the City and County, this list was further reduced, eliminating options due to consideration of the existing volumes, movements, operations, and surrounding area. For instance, with acceptable traffic operations at the intersections today, several non-traditional options were eliminated from consideration. Table 6 shows the resulting alternatives identified for evaluation.

Table 6 – Intersection Alternatives for Study

Intersection	Signal	Roundabout	Limited Access*
CSAH 5/Burnsville Pkwy	X	X	
CSAH 5/136th St	X	X	X
CSAH 11/Burnsville Pkwy	X	X	

* Limit Access refers to eliminating the left turn and through movements from the side street approaches.

These alternatives were carried forward for more detailed analysis and evaluation.

Although the traffic control types were determined, the exact lane configuration could be adjusted to better serve the traffic volumes. Using an iterative process, different intersection geometries were evaluated considering the existing configurations, existing and projected volumes, and surrounding roadway network. This was not a full capacity analysis, but an exercise to determine the concept designs for the full capacity analysis. Table 7 shows the initial lane geometry for evaluation in this study. The appendix contains the concept-level layouts of the proposed alternatives.

Table 7 – Intersection Alternatives Lane Initial Configurations

Intersection	Signal[1]	Roundabout	Limited Access
CSAH 5/Burnsville Pkwy	NB & SB: L,T,T/R or L,T,T,R EB & WB: L,T,T,R	2 lanes with EBR & WBR bypass lanes	N/A
CSAH 5/136th St	NB & SB: L,T,T/R EB & WB: T/L, R	NB & SB: 2 lanes EB & WB: 1 lane	NB & SB: L,T,T/R EB & WB: R
CSAH 11/Burnsville Pkwy	NB & SB & WB: L,T,T/R EB: L,T,R	NB & SB: 2 lanes WB: 1 lane EB: L/T, R	N/A

[1] Modifications to signalized intersections include the addition of Flashing Yellow Arrows.
NB = Northbound Approach, SB = Southbound Approach, EB Approach, WB Approach
L = Left Turn Lane, T = Thru Lane, R = Right Turn Lane

In addition to the geometric changes, new traffic signal systems would use flashing yellow arrows (FYA) to provide for protective/permissive operations on the mainline during non-peak periods.

5. Analysis of Future Conditions

a. Traffic Volume Forecasting

To ensure the preferred alternative for each study intersection accommodated existing and future conditions, two time periods were chosen for review; existing and the year 2036. Existing volumes were obtained through intersection videos in August of 2016.

To project the existing volumes to the year 2036, traffic forecasts from the Dakota County Transportation Plan and the City of Burnsville Comprehensive Plan Update were utilized. These documents, which generally coincide, show the expected growth in traffic from year 2006 or 2007 to year 2030. Using the forecasted volumes for the two sets of years, general growth rates were established on the roadways surrounding the study intersections.

Forecasts were not available for 136th Street, a local road with limited access to other areas/roads. Due to the potential for area development on the west side of CSAH 5, the general growth rate for this portion of 136th Street was assumed to match the general growth rate of CSAH 5. With the area east of CSAH 5 largely built-out with few development opportunities, this assumption would lead to an overly high estimate of traffic volumes. Instead, the general growth rate for this section was assumed at 0.5 percent per year, reflecting a slow but steady increase in traffic.

Customized growth rates for every turning movement were then developed. The overall growth rates used on the existing traffic at the study intersections to model 2036 forecast conditions are shown in Figure 4 and in the Appendix. Figure 3, also in the Appendix, show the existing and projected 2036 turning movement volumes for each study intersection used in the analyses.

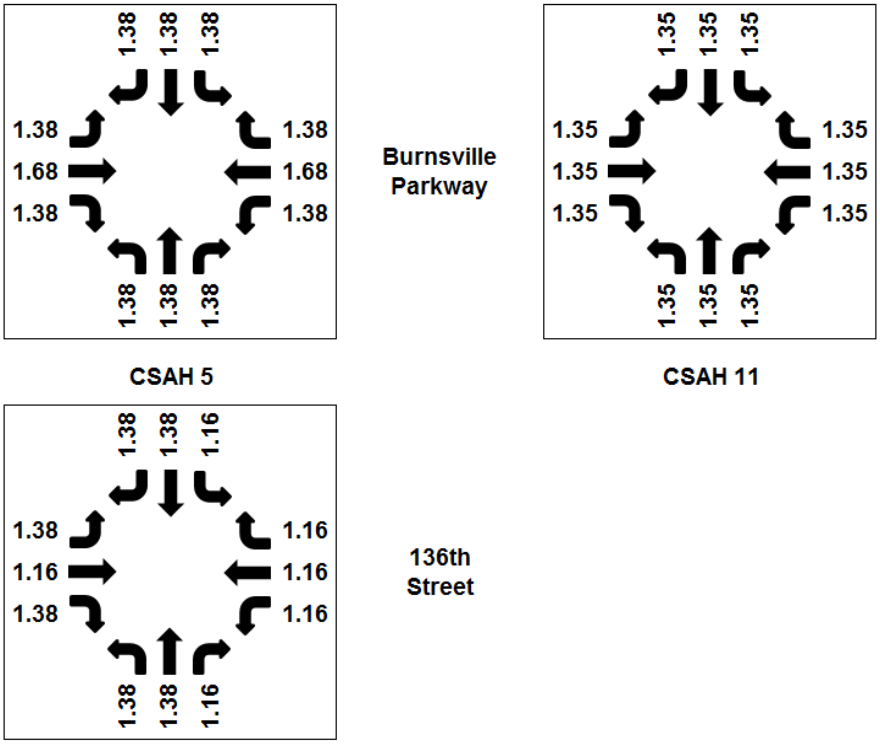


Figure 4 – Growth Rates for 2036 Projections

b. Future Operational Analysis

As before, an intersection capacity analysis was conducted in accordance with the Highway Capacity Manual, using the Vistro software package to assign "Level of Service" letter grades. Signal timings, provided by Dakota County, were adjusted as necessary to reflect the change in geometry and the increase in future volumes. The capacity analysis results for the lane configurations are shown in Table 8. The full calculations for each study scenario, including Level of Service (LOS) grades and queue lengths, are included in the Appendix.

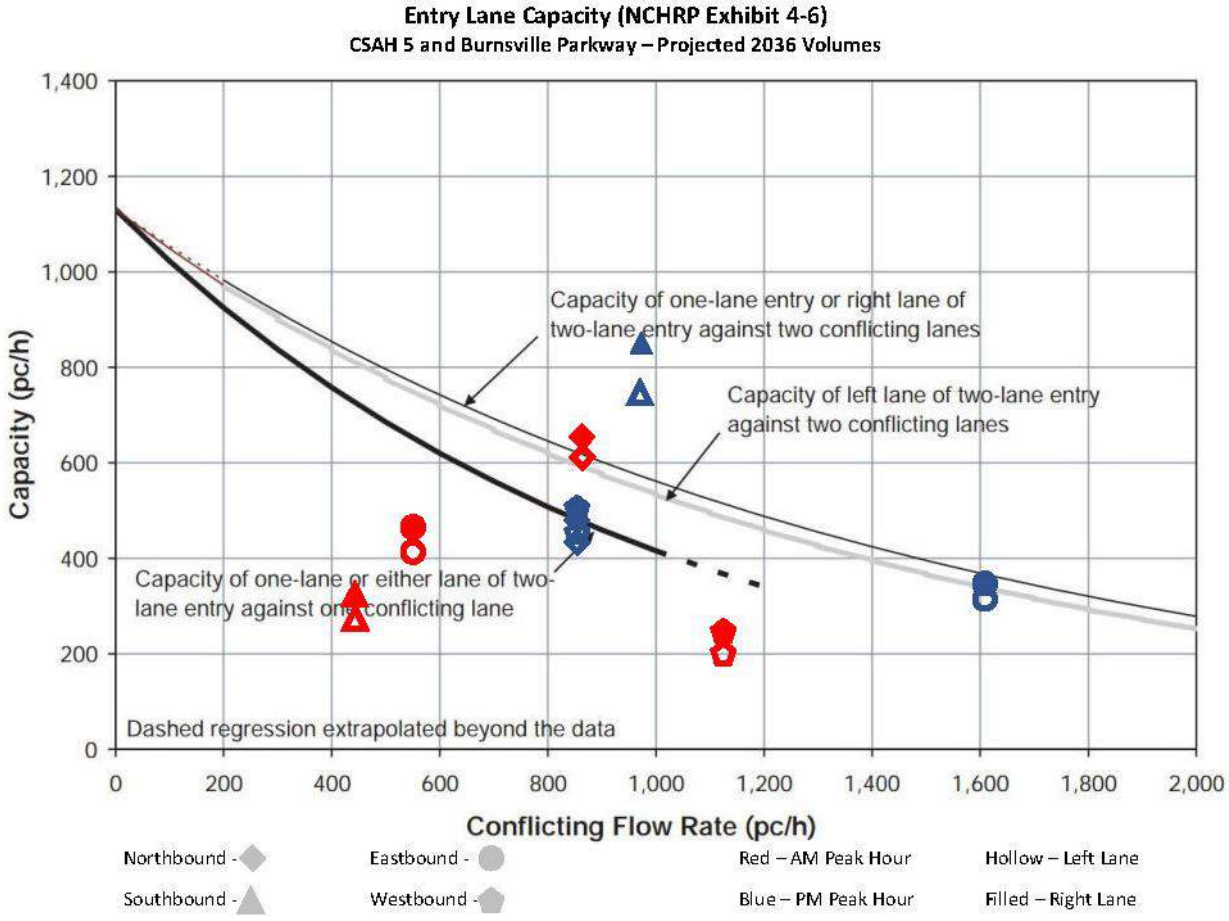
Table 8 – Forecast Peak Hour Operations[1]

Intersection	Signal		Roundabout		Limited Access	
	Existing	2036	Existing	2036	Existing	2036
CSAH 5/Burnsville Parkway	C(B), B(B)[2]	C(C), C(C)[2]	A (B)	**E (F)**	N/A	N/A
CSAH 5/136th Street	A (A)	A (A)	A (A)	A (A)	A (A)	A (A)
CSAH 11/Burnsville Parkway	B (C)	B (C)	A (A)	A (A)	N/A	N/A

[1] The first letter is the Level of Service for the intersection in the a.m. peak hour. The second letter (in parentheses) is the Level of Service for the intersection in the p.m. peak hour. The configurations from Table 5 are used in these analyses.

[2] The first set of letters is for the northbound and southbound approaches with the layout of L,T,T/R and the second set of letters if for the northbound and southbound approaches with the layout of L,T,T,R.

As a check on the roundabout operations at the CSAH 5/Burnsville Parkway intersection, the entry lane volumes were compared against the entry lane capacity from the National Cooperative Highway Research Program (NCHRP) Report 672, *Roundabouts: An Informational Guide, Second Edition*. The diagram below shows this comparison.



As shown, in the morning peak the traffic for the northbound approach is just above the capacity of the roundabout. In the afternoon peak, traffic on the southbound approach is well above the capacity. The concentration of volume on these approaches means more traffic than expected gaps in traffic, leading to the capacity issues identified.

c. *Forecast Crash Analysis*

Changes to the intersection geometry and traffic control will impact the above rates and impact the safety of the intersections. To determine these projected safety impacts, crash modification factors (CRFs), compiled by the Federal Highway Administration, were consulted. CRFs represent the expected impact to crashes based on a vast collection of studies evaluating the before and after of different changes. Multiplying the existing crash and severity rates by the CRF forecasts the expected rates if the change is implemented.

The crash modification factors used in this analysis were:

- FYA: 0.901 for all crashes, 0.926 for severe crashes
- Right Turn Lanes: 0.920 for all crashes
- Multi-lane Roundabout: 1.062 for all crashes, 0.367 for severe crashes
- Signal Removal: 0.760 for all crashes
- 3/4 Access Conversion: 0.560 for all crashes

These CRFs were applied to the rates for the study intersections based on the expected changes, as shown in the concept layouts. For one CSAH 5/Burnsville Parkway alternative, two CRFs were applied reflecting both the FYA and the addition of right turn lanes. For the CSAH 5/136th Street alternative of a limited access intersection both the signal removal and 3/4 access conversion factors were used.

Using the crash modification factors combined with the traffic volume forecasts for the study intersections, the existing and future crashes and critical rates were established for each alternative. Table 9 shows this information.

As shown, the critical indices for overall crashes are at or below 1.00 using existing and forecast volumes. This suggests that the intersections operate within the expected, normal range of overall crashes.

The critical indices for severe crashes are above 1.00 for the signalized options at CSAH 5/136th Street and CSAH 11/Burnsville Parkway. However, as previously mentioned, each of these study intersections experienced two severe crashes over the past ten years. This relatively low amount of severe crashes does not represent a significant issue. In addition, the addition of Flashing Yellow Arrow is expected to reduce the critical index for severe crashes compared to the existing conditions.

Table 9 – Forecast Conditions Crash Statistics[1]

Intersection	Intersection Configuration	Overall Crashes		Severe Crashes	
		Avg. Per Year	Critical Index	Avg. Per Year	Critical Index
CSAH 5/ Burnsville Pkwy	Existing	3.70 (5.55)	0.51 (0.44)	0.10 (0.15)	0.45 (0.47)
	FYA[2]	3.33 (5.00)	0.46 (0.40)	0.09 (0.14)	0.42 (0.44)
	FYA & RTL[3]	3.28 (4.92)	0.45 (0.39)	0.09 (0.14)	0.41 (0.42)
	Multi-Lane RA[4]	3.93 (5.90)	0.54 (0.47)	0.04 (0.06)	0.17 (0.17)
CSAH 5/ 136th St	Existing	1.50 (2.79)	0.31 (0.28)	0.20 (0.37)	**1.15 (1.37)**
	FYA[2]	1.35 (2.51)	0.28 (0.25)	0.19 (0.34)	**1.06 (1.27)**
	Multi-Lane RA[4]	1.59 (2.96)	0.33 (0.30)	0.07 (0.14)	0.42 (0.50)
	Limited Access[5]	0.93 (1.72)	0.19 (0.17)	0.12 (0.23)	0.71 (0.85)
CSAH 11/ Burnsville Pkwy	Existing	4.80 (6.92)	0.94 (0.80)	0.20 (0.29)	**1.11 (1.18)**
	FYA[2]	4.32 (6.24)	0.85 (0.72)	0.19 (0.27)	**1.03 (1.09)**
	Multi-Lane RA[4]	5.10 (7.35)	1.00 (0.85)	0.07 (0.11)	0.41 (0.43)

[1]Data presented as: 2016 volumes (2036 traffic volumes)
[2]Signalized intersection with addition of Flashing Yellow Arrows
[3]Signalized intersection with addition of Flashing Yellow Arrows plus northbound and southbound right turn lanes
[4]Conversion to a multi-lane roundabout
[5]Conversion to an unsignalized limited access intersection

d. Intersection Interaction

Related to, but separate from the capacity analysis, is the relationship between operations at adjacent intersections. In this case, the CSAH 5 intersections with Burnsville Parkway and with 136th Street are approximately 900 feet apart. Operations at one intersection could have impacts on the other intersection. Based on the capacity analyses, the vehicle queues do not stretch back between intersections. Therefore, from a pure capacity point of view, operations at one intersection do not influence the other.

Another type of interaction is the redirection of traffic due to the limited access alternative of the CSAH 5/136th Street intersection. With the elimination of left turn and through movements from 136th Street across or onto CSAH 5, these movements will be forced to other intersections. Many of these movements will redirect to the CSAH 5/Burnsville Parkway. This intersection was examined assuming the additional traffic and found to have sufficient capacity to accommodate this extra traffic. However, some drivers will want to complete a U-turn movement. For this movement, a roundabout at the CSAH 5/Burnsville Parkway intersection would best accommodate both passenger car and truck U-turn movements.

Beyond the study intersections, the elimination of several movements will cause drivers to re-route to other neighborhood roads. The traffic counts show approximately 1,000 vehicles impacted over the course of an average 24-hour day. A portion of these vehicles will redirect to the CSAH 5/Burnsville Parkway intersection, resulting in minimal impact on other area roads. Some, however, will use other surrounding roads resulting in increases in

neighborhood roads by up to a couple hundred vehicles per day in some cases.

Capacity-wise, these roads are able to accommodate this increase in traffic volume. However, the increase would be expected to be noticeable by the residents, particularly if these drivers drive faster in an attempt to “make up” lost time due to the re-route. Therefore, the limited access alternative is expected to have a negative impact on surrounding roads not explicitly studied in this evaluation.

e. Pedestrian and Bicyclist Impacts

With the different intersection control types, pedestrians are handled differently. At the signalized intersections, crosswalk users have a single stage crossing with active control. This means crossing the length of the street, both directions of traffic, at once when presented with the WALK signal, or green light for pedestrians. The benefit is clear communication to both pedestrians and drivers for when crossings should occur. A shortcoming is the potential for pedestrians to wait a long time, particularly if crossing the mainline, before being allowed to cross even in the absence of vehicular traffic.

At a roundabout, pedestrians are presented a two-stage crossing with passive control. Two-stage means crossing one direction of traffic at a time while passive means the pedestrian looks for gaps in traffic on their own, without assistance from a traffic signal. Benefits to this type of crossing include not having to wait for a signal, but instead crossing when a gap is present or when drivers stop to allow the crossing. In addition, crossing one direction of traffic flow at a time means cars approaching only from one way, reducing the complexity of watching for cars from multiple directions. The drawback of roundabout crossings is often having to wait for drivers to stop, which is a mixed experience in the Twin Cities. Many drivers are focused on their movements only and do not observe or stop for pedestrian crossings.

For the limited access intersection, the marked pedestrian crossings are limited to the side street with the mainline crossing removed. Specifically, for the CSAH 5/136th Street intersection, pedestrians would need to detour approximately 900 feet north to the Burnsville Parkway crossing for the next available intersection crossing of CSAH 5.

Bicyclists are able to proceed through an intersection operating as either a car, riding in traffic, or a pedestrian, dismounting and walking in the crosswalk. As a pedestrian, the impacts on bicycle travel would match those described above. As a car, vehicle speeds are higher with a traffic signal compared to a roundabout. In addition, left turn movements can be more difficult for a bicyclist when operating in the driving lanes due to switching

lanes. For any alternative, many drivers are not accustomed to bicyclists operating in the driving lane.

f. Right-of-Way Needs

Based on the concept layouts for each intersection alternative, the amount of right-of-way and temporary easement needs were determined. Right-of-way is the permanent area necessary to accommodate the alternative. Temporary easement is space needed for construction which would return to the property owner after construction is completed.

Both types cost money to acquire and can be difficult and time-consuming process to obtain depending upon the property owner, current use of the area needed, and many other factors. Decreasing these needs is therefore desirable to minimize disruption to area residents and businesses as well as keep the cost of the alternative lower. The estimated right-of-way and easement needs are presented in Table 10 based on the concept drawings.

Table 10 – Estimated Easement and Right-of-Way Needs (sq. ft.)

Intersection	Signal	Roundabout	Limited Access
CSAH 5/Burnsville Pkwy	120 - 8,327[1]	23,556	N/A
CSAH 5/136th St	0	4,722	3,027
CSAH 11/Burnsville Pkwy	0	7,559	N/A

[1] The first number is for the northbound and southbound approaches with the layout of L,T,T/R and the second number is for the northbound and southbound approaches with the layout of L,T,T,R.

g. Construction Costs

Concept construction costs were determined from the concept layouts prepared for each study alternative. Included in the concept cost estimates are the material and construction costs as well as estimates for:

- Removals
- Utilities
- Drainage
- Lighting
- Signing and striping
- Landscaping
- Erosion control/turf establishment
- Permanent Right-of-Way and temporary easements
- Risk and contingency lump sums

The costs for each intersection alternative are shown in Table 11.

Table 11 – Estimated Construction Costs[1]

Intersection	Signal	Roundabout	Limited Access
CSAH 5/Burnsville Pkwy	$350,000 $500,000[2]	$1,050,000	N/A
CSAH 5/136th St	$350,000	$550,000	$250,000
CSAH 11/Burnsville Pkwy	$350,000	$950,000	n/a

[1] Costs are rounded to the nearest $50,000.

[2] The first number is for the northbound and southbound approaches with the layout of L,T,T/R and the second number is for the northbound and southbound approaches with the layout of L,T,T,R.

h. Benefit to Cost Ratios

As described by MnDOT, a benefit-cost analysis is an evaluation method to systematically compare the economic benefits to the drawbacks. The primary objective is to translate the expected advantages of an alternative into monetary terms for comparison against the expected cost. The two benefits for this study include the expected savings based on improved operations and a reduction in crashes. For this study, the total estimated benefits across the 20-year analysis period were compared to the project construction.

This information is then translated into a Benefit-Cost Ratio (B-C ratio) where a result above 1.0 indicates a project that provides overall economic benefit and a result at or below 1.0 indicates a project that cost as much or more than the expected economic benefits.

It should be noted that this calculation does not consider the magnitude of cost to an agency. For instance, an intersection to be constructed into a grade-separated interchange may provide a large benefit in terms of increased capacity and reduced crashes resulting in a very high B-C ratio. However, that agency will still need to provide the millions of dollars necessary to construct the interchange, which may or may not be possible.

The concept construction estimates were presented earlier and represent the project costs portion of the B-C ratio. The next step is the first benefit, vehicle operating cost savings. To calculate this value, additional capacity analyses were completed for each intersection alternative, including a base no-build alternative if no construction or changes occurred. The average vehicle delay was determined for four sets of traffic volumes, both in the year 2016 and year 2036, representing four different periods throughout the day (morning peak, afternoon peak, off-peak, and overnight). Through a series of calculations and using the MnDOT recommended standard values for use in a B-C ratio examination, annual costs were determined for each intersection alternative, including the base. Subtracting the costs of each study alternative from the cost of the base scenario, factoring in present value, and summing for all 20 years provided the total operating and emissions cost benefit for each intersection alternative. To calculate the safety benefits, the crash

differences for each severity crash from the alternatives and the base scenarios were found. The crash rates were iterated for the 20-year period using volume forecasts. Crashes were split amongst severities using Minnesota state averages as well as factors from the National Cooperative Highway Research Program Report 672. Dollar amounts were assigned to each crash severity per MnDOT recommended standards values. Subtracting the costs of the alternatives from the cost of the base scenario at each intersection, factoring in present value, and summing for all 20 years gave a safety cost savings for each alternative.

These three components; project costs, vehicle operating cost savings, and safety cost savings costs (summing the vehicle operating and safety cost savings) were then used to calculate the B-C ratios for each intersection alternative. Table 12 these ratios.

Table 12 – Benefit to Cost Ratios

Intersection	Signal	Roundabout	Limited Access
CSAH 5/Burnsville Pkwy	5.68 - 7.72[1]	8.65	n/a
CSAH 5/136th St	3.37	13.13	32.65
CSAH 11/Burnsville Pkwy	2.58	9.75	n/a

[1] The first number is for the northbound and southbound approaches with the layout of L,T,T/R and the second number if for the northbound and southbound approaches with the layout of L,T,T,R.

As shown in the table, all alternatives have positive B-C ratios meaning an economic benefit is expected under any option. As mentioned earlier, it is important to note the B-C ratio is an economic tool only that does not account for other factors, such as the magnitude of cost to an agency or impact of an alternative on the surrounding residents and businesses.

i. Evaluation Matrices

Using the analysis presented, evaluation matrices were developed to provide a comparison between alternatives for each study intersections. These matrices show the different criteria for each alternative side-by-side. Included in the evaluation matrices are:

- LOS operations with existing and future volumes
- Critical indices for overall crashes and severe crashes
- Impacts to pedestrian and bicycle crossings
- Right-Of-Way needs
- Construction costs
- B - C ratios

The matrix for each intersection is provided below.

Matrix 1 – CSAH 5/Burnsville Parkway Alternative Comparison

	Existing (for comparison only)	Traffic Signal (FYA)	Traffic Signal (FYA & Rt Turn Lanes)	Multi-Lane Roundabout
Operations LOS for Existing Volumes AM Peak (PM Peak)	C (C)	C (B)	B (B)	A (B)
Operations LOS for Future Volumes AM Peak (PM Peak)	C (C)	C (C)	C (C)	**E (F)**
Safety Critical Index (All Crashes)	< 0.85	< 0.85	< 0.85	< 0.85
Safety Critical Index (K/A Crashes)	< 0.85	< 0.85	< 0.85	< 0.85
Bicycle/Pedestrians Crossings	Active Control Single Stage	Active Control Single Stage	Active Control Single Stage	Passive Control Two Stage
Right-of-Way Needs Less Impact is Desired	N/A	**Minor**	**Minor**	**Major**
Construction Costs	N/A	$350,000	$500,000	$1,050,000
Benefit to Cost Ratio Positive Result is Desired	N/A	+	+	+

For the CSAH 5/Burnsville Parkway intersection, the recommendation is a traffic signal control with added FYA as well as northbound and southbound right turn lanes.

The addition of the turn lanes will have some vehicular operational and safety benefits. The desire for right turn lanes was also brought up by the public in meetings (see next section). Only minor impacts to the adjacent pond were assumed with the northbound right turn lane. If major impacts are identified through final design, construction of this turn lane will be reconsidered.

The skew of the intersection did not lend itself to a roundabout, leading to less than ideal design elements, such as higher entry speeds and an inability to fully meet driver expectations. Combined with higher costs and right-of-way needs, the roundabout was dropped from consideration.

Matrix 2 – CSAH 5/136th Street Alternative Comparison

	Existing (for comparison only)	Traffic Signal (FYA & WB Rt Turn Lane)	Multi-Lane Roundabout	Limited Access
Operations LOS for Existing Volumes AM Peak (PM Peak)	A (B)	A (A)	A (A)	A (A)
Operations LOS for Future Volumes AM Peak (PM Peak)	A (B)	A (A)	A (A)	A (A)
Safety Critical Index (All Crashes)	< 0.85	< 0.85	< 0.85	< 0.85
Safety Critical Index (K/A Crashes)	**> 1.0**	**> 1.0**	< 0.85	< 0.85
Bicycle/Pedestrians Crossings	Active Control Single Stage	Active Control Single Stage	Passive Control Two Stage	**Passive Control No CSAH 5 Crossing**
Right-of-Way Needs Less Impact is Desired	N/A	None	**Major**	**Minor**
Construction Costs	N/A	$350,000	$550,000	$250,000
Benefit to Cost Ratio Positive Result is Desired	N/A	+	+	++

For the CSAH 5/136th Street intersection, the recommendation is traffic signal control with added FYA as well as a westbound right turn lane.

The westbound right turn lane will allow turning vehicles to proceed after stopping on a red light. This will, in turn, help maximize green time devoted to CSAH 5 by reducing the number of times the side street needs green time.

A multi-lane roundabout had concerns due to a high imbalance between the north-south and east-west traffic. This alternative also had concerns from the potential for mixing traffic control, which impacts driver expectations.

A limited access intersection would restrict movements along a collector road without providing an acceptable alternative route. In addition, this alternative raised concerns regarding U-turn movements at the CSAH 5/Burnsville Parkway and other adjacent intersections. The removal of a pedestrian crossing of CSAH 5 was also a concern. Finally, public comments from the community were not favorable to this alternative (see next section).

Matrix 3 – CSAH 11/Burnsville Parkway Alternative Comparison

	Existing (for comparison only)	Traffic Signal (FYA & EB Rt Turn Lane)	Multi-Lane Roundabout
Operations LOS for Existing Volumes AM Peak (PM Peak)	B (B)	B (C)	A (A)
Operations LOS for Future Volumes AM Peak (PM Peak)	B (C)	B (C)	A (A)
Safety Critical Index (All Crashes)	0.85 - 1.0	0.85 - 1.0	0.85 - 1.0
Safety Critical Index (K/A Crashes)	> 1.0	> 1.0[2]	< 0.85
Bicycle/Pedestrians Crossings	Active Control Single Stage	Active Control Single Stage	Passive Control Two Stage
Right-of-Way Needs Less Impact is Desired	N/A	None	Major
Construction Costs	N/A	$350,000	$950,000
Benefit to Cost Ratio Positive Result is Desired	N/A	+	+

For the CSAH 11/Burnsville Parkway intersection, the recommendation is a traffic signal with added FYA and adjustment to provide an exclusive eastbound right turn lane.

The primary reason for the selection of the traffic signal alternative is the construction cost. At approximately three times the cost of the signal, and without a substantial safety benefit (two severe crashes in ten years is not considered a concern even if the severe critical index is higher than desired), the roundabout does not have a compelling reason.

However, the roundabout does provide satisfactory operations and would be a good fit for the intersection. Though cost prohibitive now, conditions could change in the future that might bring the cost down, provide appropriate funding, or result in other factors to change the evaluation results. For these reasons, the roundabout remains an acceptable alternative and should be re-evaluated in the future before completing final design and construction of the traffic signal option.

6. Public Input

Public input is viewed as a critical component to this study's process. Although not a 'popularity contest' where each alternative could be voted up or down by the public, understanding and buy-in was sought. This input was a factor considered in the evaluation of the alternatives even if not a direct part of the evaluation matrices. Two open houses were held for the public; the first to provide an opportunity to learn about the project and provide insight into the existing operations and concerns, the second to present the draft results and recommendations for discussion.

The first open house was held at the Burnsville City Council Chambers on Wednesday, September 7, 2016. Existing information about the study intersections was presented along with the opportunity to discuss with the project team and provide comments. Comments were also received around this time through direct communication with the County via phone and email.

Over 50 people attended the open house and 57 comments were received from the meeting as well as submitted to the County before or after the meeting. The general themes of the comments included:

- Concerns regarding roundabouts and their operations
- A need to address 'cut-thru' traffic in the neighborhood.
- A desire for Flashing Yellow Arrow for the left turn phases.
- Concerns regarding pedestrian and bicycle crossings.
- A desire for exclusive right turn lanes.

Specific comments were also obtained for each study intersection included and their study alternatives. The top comment for the CSAH 5/Burnsville Parkway intersection was concerns about roundabout operations. However, equal support was also expressed in favor of a traffic signal and a roundabout.

At the CSAH 5/136th Street intersection, the top comment was concerns about changes due to the limited access alternative. All three alternatives received about equal positive endorsement. Concerns about roundabout operations were outweighed by concerns about the limited access alternative.

The top comment regarding the CSAH 5/Burnsville Parkway intersection was in favor of roundabout operations. At the same time, concerns about roundabout operations were greater than support for the traffic signal alternative.

The meeting materials and comments are provided in the Appendix.

The second public meeting was also held at the Burnsville City Council Chambers on Wednesday, February 1, 2017. Results of the study analyses along with the draft recommendations for each study intersection were presented.

About 35 people attended this meeting. Most comments provided were verbal, expressing relief that the limited access alternative was not being pursued. Four other written comments were received:

- Concerns regarding ‘cut-thru’ traffic in neighborhoods during construction of the preferred alternatives, particularly for the CSAH 5/Burnsville Parkway intersection.
- Support for the signal at the 136th Street intersection.
- Support for a roundabout at the CSAH 11/Burnsville Parkway intersection, if additional funding can be found.
- Concerns regarding the condition of the existing sidewalks, particularly on the east side of CSHA 5, south of the 136th Street intersection.

The meeting materials and comments received for this second public meeting are also provided in the Appendix.

7. Preliminary Layouts

Following receipt of all input, the traffic signal alternative concepts were updated to provide preliminary layouts. These layouts are a more accurate representation of the recommended alternatives and allowed for development of improved cost estimates compared to the concept-level ones. The preliminary layouts are provided in the Appendix. The updated, rounded cost estimates for the preliminary layouts are:

- CSAH 5/Burnsville Parkway Traffic Signal Alternative - $518,000
- CSAH 5/136th Street Traffic Signal Alternative - $ 358,000
- CSAH 11/Burnsville Parkway Traffic Signal Alternative - $348,000

The full preliminary layout cost estimates are provided in the Appendix.

8. Conclusions and Recommendations

The three signalized study intersections were analyzed for different traffic control and geometric alternatives. Through the analysis and evaluation of the different study alternatives for each intersection, the following was found:

- No significant operational issues were observed at any of the study intersections. All vehicle queues were observed to clear during green phases and no significant queues that stretch beyond turn lane lengths or excessive delays were noted.
- All three study intersections and all movements at those intersections are operating acceptably.
- A safety review suggests the intersections are reasonably safe today.
- Alternatives were developed for each study intersection, including:
    - CSAH 5/Burnsville Parkway; traffic signal with FYA, traffic signal with FYA and northbound-southbound exclusive right turn lanes, and multi-lane roundabout.
    - CSAH 5/136th Street; traffic signal with FYA and westbound exclusive right turn lane, multi-lane roundabout, and limited access (eliminating the thru and left turn movement from the 136th Street side streets.
    - CSAH 11/Burnsville Parkway; traffic signal with FYA and exclusive eastbound right turn lane and multi-lane roundabout.

  Updated pedestrian facilities would be included as a part of the reconstruction of any of these intersections.
- Evaluation matrices were developed for the study intersection alternatives, comparing:
    - LOS operations with existing and future volumes
    - Critical indices for overall crashes and severe crashes
    - Impacts to pedestrian and bicycle crossings
    - Right-Of-Way needs
    - Construction costs
    - B - C ratios
- Two open house meetings were held September 7, 2016 and February 1, 2017. These provided residents, businesses, and others the opportunity to learn more about the project, express their concerns or issues regarding each intersection (meeting #1) and present initial findings and the draft preferred alternative for each study intersection alternative (meeting #2).

Based on the evaluations and findings presented in this study, the recommended intersection alternatives are:

- CSAH 5/Burnsville Parkway: Signalized intersection with added FYA phasing for left turn movements and northbound and southbound exclusive right turn lanes.

- CSAH 5/136th Street: Signalized intersection with added FYA phasing for left turn movements and westbound right turn lane.
- CSAH 11/Burnsville Parkway: Signalized intersection with added FYA phasing for left turn movements and conversion of the eastbound shared through/right turn lane to an exclusive right turn lane. However, a multi-lane roundabout is a viable option and could be implemented if construction costs are reduced, additional funding is provided, or conditions change causing the evaluations to be revised.

The updated, rounded cost estimates based on the preliminary layouts are:

- CSAH 5/Burnsville Parkway Traffic Signal Alternative - $518,000
- CSAH 5/136th Street Traffic Signal Alternative - $ 358,000
- CSAH 11/Burnsville Parkway Traffic Signal Alternative - $348,000

Signal justification reports are provided in the Appendix for each study intersection.

9. Appendix

A. Figures 1-4

B. Traffic Counts

C. Intersection Observation Field Notes

D. Existing Capacity Analysis Backup

E. Existing Warrant Analysis

F. Preliminary Concept Drawings for All Alternatives

G. Alternative Capacity Analysis Backup

H. Public Meeting Materials and Comments

I. Preliminary Layouts for Recommendations

J. Preliminary Cost Estimates for Recommendations

K. Signal Justification Reports

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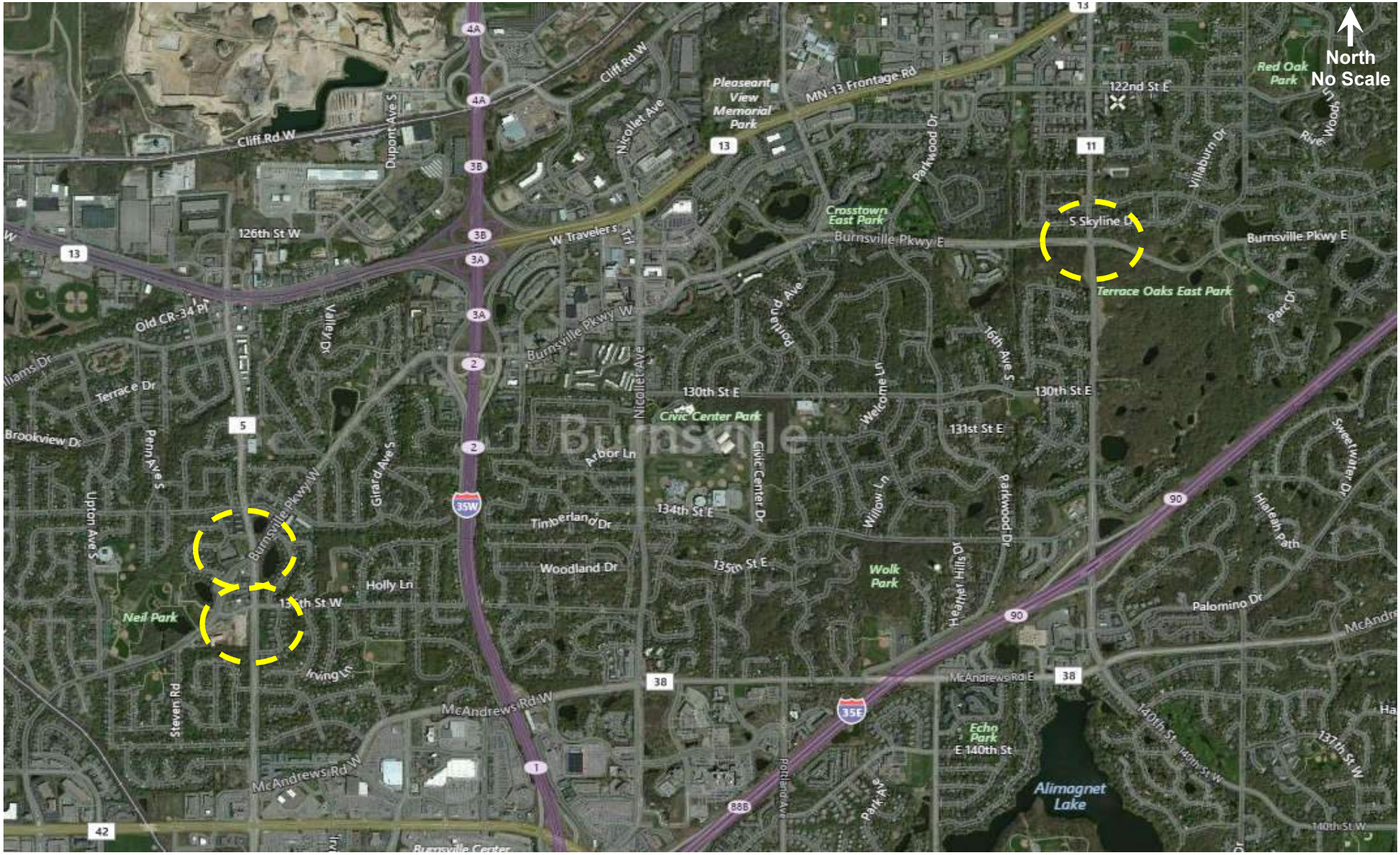
ENGINEERING TRAFFIC FORWARD

Figure 1
Location Maps



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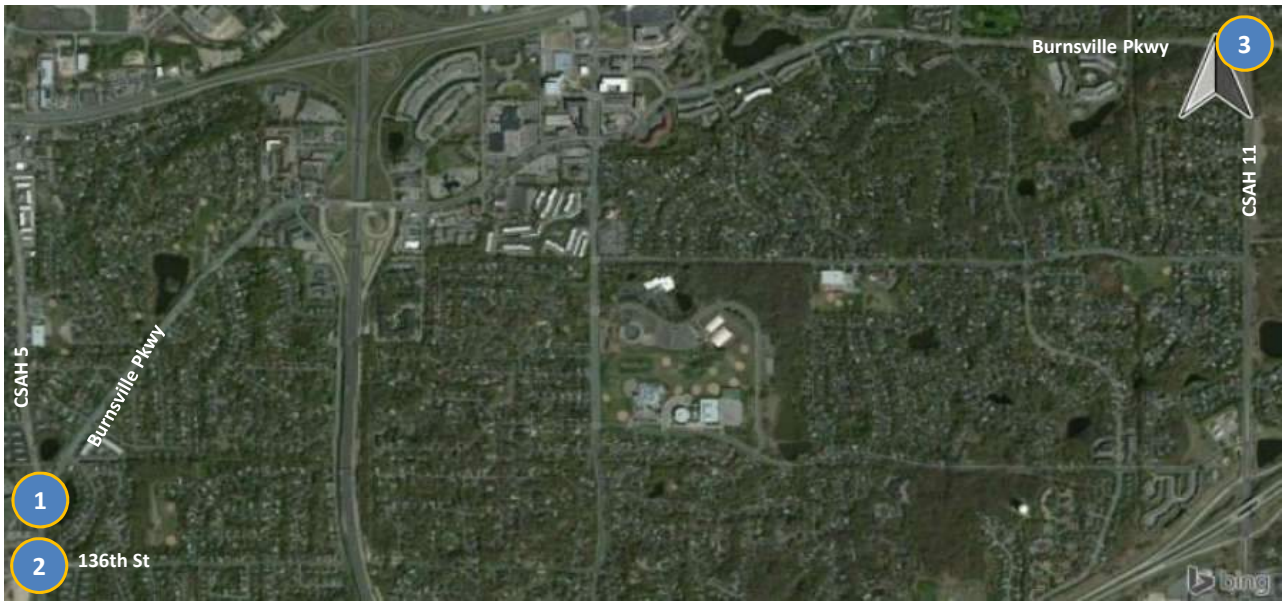
ENGINEERING TRAFFIC FORWARD

Figure 2
Existing Lanes & Traffic Control



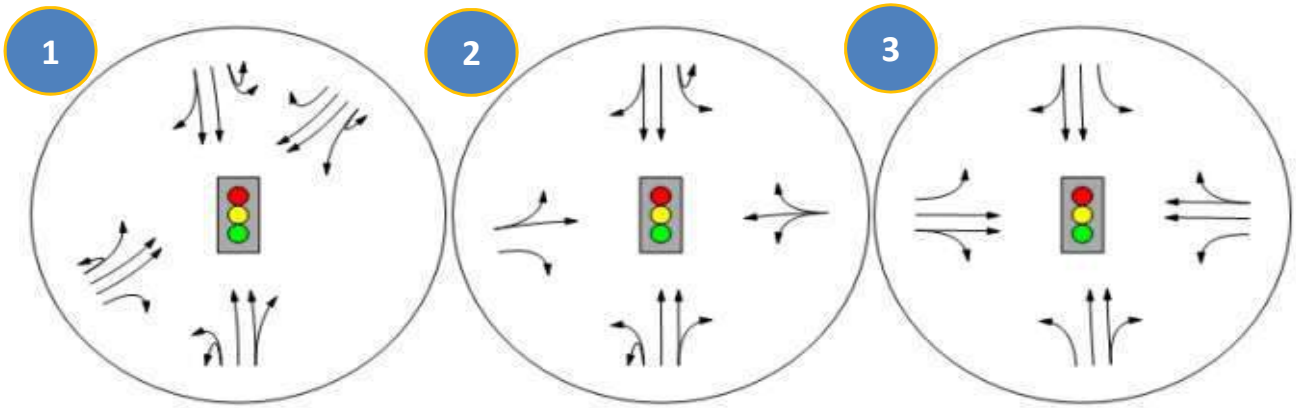


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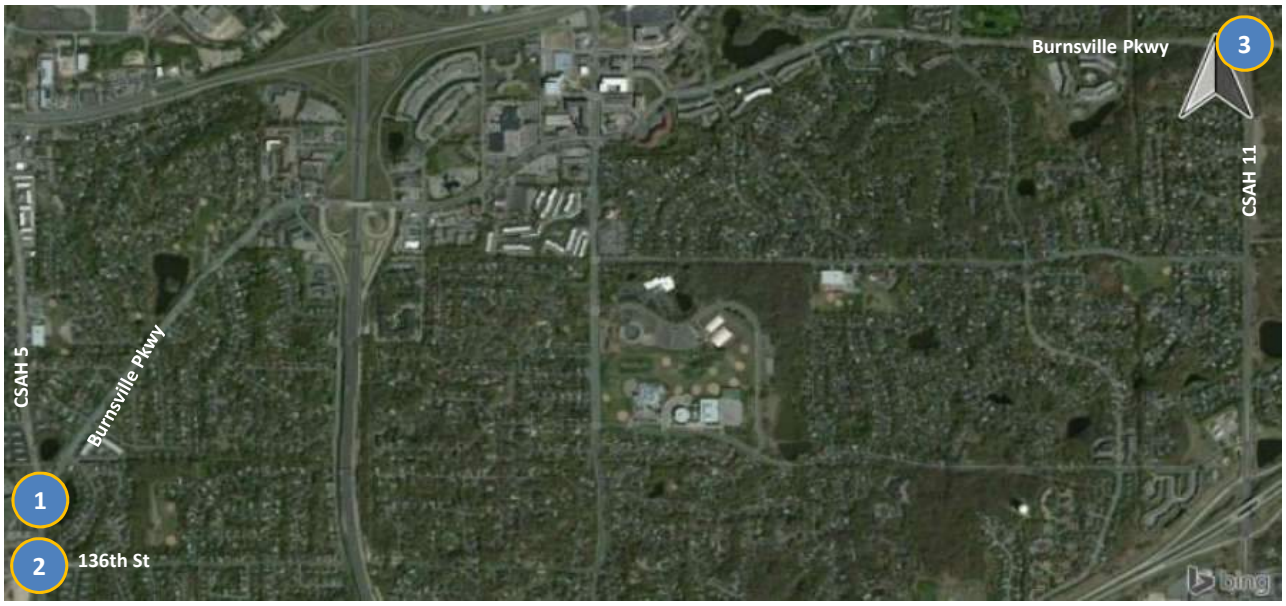
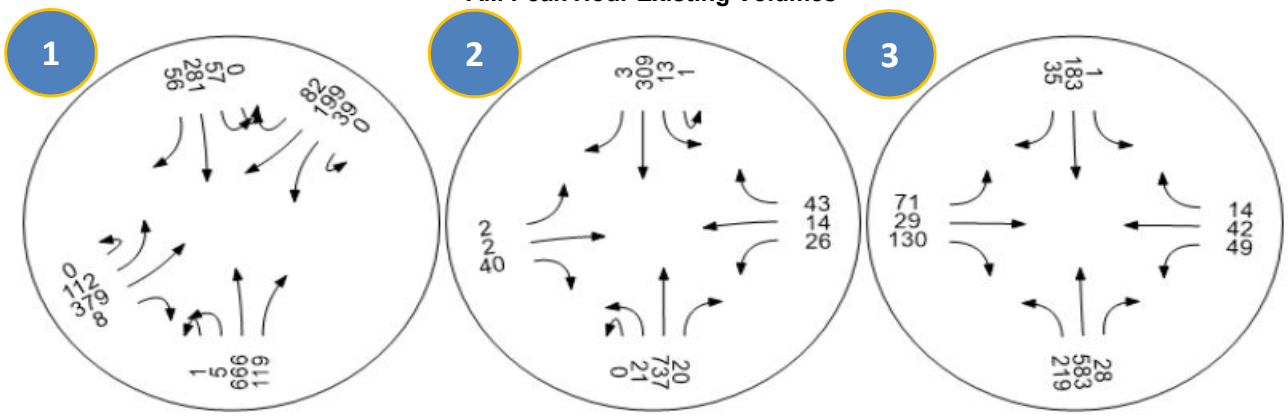
Figure 3
Existing Volumes



AM Peak Hour Existing Volumes



PM Peak Hour Existing Volumes

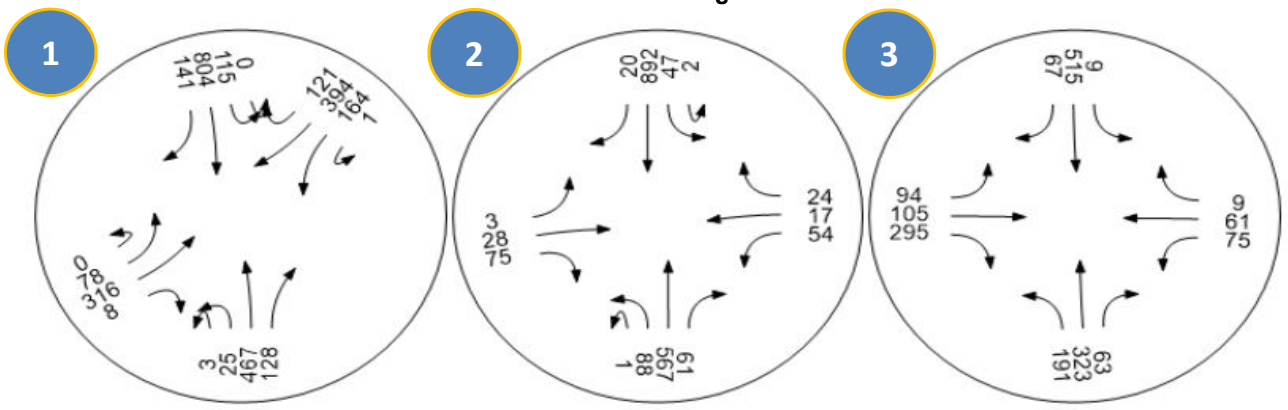


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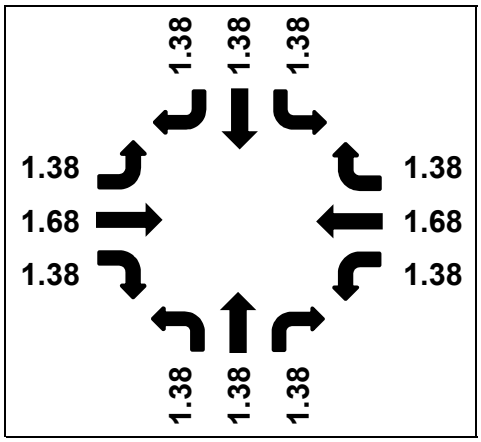
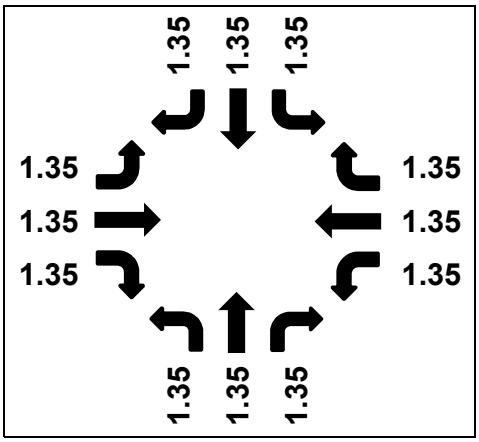
Figure 4
Growth Rates for 2036 Projections

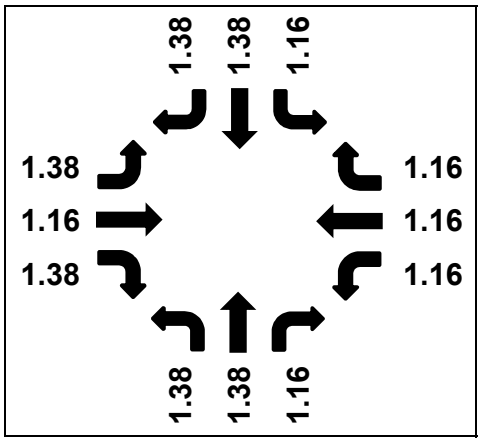


CSAH 5

Burnsville Parkway



CSAH 11



136th Street

Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 1

CSAH 5 & Burnsville Pkwy
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
12:00 AM	0	0	5	2	0	7	0	4	6	0	0	10	0	0	6	4	0	10	0	1	8	0	0	9	36
12:15 AM	0	0	10	3	0	13	0	2	5	3	0	10	0	1	7	2	0	10	0	1	4	0	0	5	38
12:30 AM	0	1	6	1	0	8	0	6	6	3	0	15	0	0	5	2	0	7	0	0	3	1	0	4	34
12:45 AM	0	0	2	1	0	3	0	0	5	1	0	6	0	0	9	2	0	11	0	0	3	0	0	3	23
Total	0	1	23	7	0	31	0	12	22	7	0	41	0	1	27	10	0	38	0	2	18	1	0	21	131
01:00 AM	0	5	4	1	0	10	0	2	2	1	0	5	0	0	6	2	0	8	0	1	3	0	0	4	27
01:15 AM	0	2	7	2	0	11	0	1	1	2	0	4	0	0	4	2	0	6	0	0	2	0	0	2	23
01:30 AM	0	0	2	1	0	3	0	1	3	0	0	4	0	0	1	0	0	1	0	1	1	0	0	2	10
01:45 AM	0	1	5	1	0	7	0	1	3	2	0	6	0	0	5	0	0	5	0	0	2	0	0	2	20
Total	0	8	18	5	0	31	0	5	9	5	0	19	0	0	16	4	0	20	0	2	8	0	0	10	80
02:00 AM	0	2	4	2	0	8	0	1	1	1	0	3	0	0	0	2	0	2	0	0	2	0	0	2	15
02:15 AM	0	1	4	0	0	5	0	2	1	2	0	5	0	0	2	0	0	2	0	0	0	0	0	0	12
02:30 AM	0	0	4	0	0	4	0	1	3	0	0	4	0	0	4	1	0	5	0	0	2	0	0	2	15
02:45 AM	0	0	2	0	0	2	0	0	0	0	0	0	0	0	3	1	0	4	0	0	1	0	0	1	7
Total	0	3	14	2	0	19	0	4	5	3	0	12	0	0	9	4	0	13	0	0	5	0	0	5	49
03:00 AM	0	0	6	1	0	7	0	0	2	1	0	3	0	0	0	0	0	0	0	0	1	0	1	2	12
03:15 AM	0	1	0	0	0	1	0	1	2	2	0	5	0	1	1	5	0	7	0	0	2	0	0	2	15
03:30 AM	0	0	2	0	0	2	0	1	1	0	0	2	0	0	4	4	0	8	0	2	1	0	0	3	15
03:45 AM	0	1	5	0	0	6	0	2	2	0	0	4	0	0	4	2	0	6	0	1	4	0	0	5	21
Total	0	2	13	1	0	16	0	4	7	3	0	14	0	1	9	11	0	21	0	3	8	0	1	12	63
04:00 AM	0	1	3	0	0	4	0	0	2	1	0	3	0	0	2	0	0	2	0	1	6	0	0	7	16
04:15 AM	0	0	8	0	0	8	0	0	3	2	0	5	0	0	9	3	0	12	0	0	9	0	0	9	34
04:30 AM	0	2	3	0	0	5	0	0	7	2	0	9	0	0	10	3	0	13	0	2	6	0	0	8	35
04:45 AM	0	2	8	1	0	11	0	1	5	1	0	7	0	1	11	3	0	15	0	3	8	0	0	11	44
Total	0	5	22	1	0	28	0	1	17	6	0	24	0	1	32	9	0	42	0	6	29	0	0	35	129
05:00 AM	0	3	7	1	0	11	0	4	4	3	0	11	0	0	17	6	0	23	0	2	12	0	0	14	59
05:15 AM	0	3	16	3	0	22	0	1	3	5	0	9	0	0	29	3	0	32	0	5	20	0	0	25	88
05:30 AM	0	6	14	1	1	22	0	2	13	6	0	21	0	0	47	12	0	59	0	9	35	0	0	44	146
05:45 AM	0	4	21	0	0	25	0	5	12	6	0	23	0	0	43	10	0	53	0	7	40	0	0	47	148
Total	0	16	58	5	1	80	0	12	32	20	0	64	0	0	136	31	0	167	0	23	107	0	0	130	441
06:00 AM	0	8	15	3	2	28	0	6	20	8	0	34	0	0	52	16	0	68	0	4	43	0	0	47	177
06:15 AM	0	4	44	3	0	51	0	2	30	12	0	44	0	0	79	18	1	98	0	5	52	1	1	59	252
06:30 AM	0	9	40	5	2	56	1	17	37	13	0	68	0	2	82	20	2	106	0	24	80	0	1	105	335

Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 2

CSAH 5 & Burnsville Pkwy
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
06:45 AM	0	14	54	9	0	77	0	11	39	12	0	62	0	1	140	25	0	166	0	18	87	1	0	106	411
Total	0	35	153	20	4	212	1	36	126	45	0	208	0	3	353	79	3	438	0	51	262	2	2	317	1175
07:00 AM	0	13	41	7	0	61	0	12	25	22	0	59	0	4	140	26	1	171	0	28	80	0	1	109	400
07:15 AM	0	15	60	13	1	89	0	7	43	27	0	77	0	0	198	30	0	228	0	43	119	1	0	163	557
07:30 AM	0	17	62	12	0	91	0	9	49	20	0	78	1	3	180	36	0	220	0	25	90	2	0	117	506
07:45 AM	0	13	85	17	0	115	0	11	62	26	0	99	0	1	165	30	0	196	0	19	97	2	0	118	528
Total	0	58	248	49	1	356	0	39	179	95	0	313	1	8	683	122	1	815	0	115	386	5	1	507	1991
08:00 AM	0	12	74	14	0	100	0	12	45	9	0	66	0	1	123	23	0	147	0	25	73	3	0	101	414
08:15 AM	0	9	70	7	1	87	0	12	30	13	0	55	0	7	95	25	0	127	0	19	57	1	1	78	347
08:30 AM	0	20	50	11	0	81	0	17	35	20	2	74	0	6	84	24	0	114	0	17	63	1	0	81	350
08:45 AM	0	15	73	10	0	98	0	18	42	11	0	71	2	2	71	19	1	95	0	12	59	1	0	72	336
Total	0	56	267	42	1	366	0	59	152	53	2	266	2	16	373	91	1	483	0	73	252	6	1	332	1447
09:00 AM	0	15	73	9	0	97	0	18	38	24	0	80	1	1	63	20	0	85	0	11	54	0	0	65	327
09:15 AM	0	8	53	8	0	69	0	12	31	10	0	53	1	5	67	22	0	95	0	10	59	1	1	71	288
09:30 AM	0	9	70	5	0	84	0	16	29	6	0	51	1	1	66	26	1	95	0	14	41	0	0	55	285
09:45 AM	0	11	82	4	0	97	0	13	33	14	0	60	0	2	62	16	0	80	0	8	50	2	0	60	297
Total	0	43	278	26	0	347	0	59	131	54	0	244	3	9	258	84	1	355	0	43	204	3	1	251	1197
10:00 AM	1	14	84	12	0	111	0	16	42	17	1	76	0	3	62	12	0	77	0	7	40	0	1	48	312
10:15 AM	0	5	64	9	0	78	0	15	21	15	0	51	1	2	77	14	1	95	0	9	50	0	0	59	283
10:30 AM	1	14	54	16	0	85	0	13	36	11	1	61	2	3	51	17	1	74	0	8	43	3	1	55	275
10:45 AM	0	13	61	14	0	88	0	22	33	14	0	69	0	1	78	21	0	100	0	16	35	0	0	51	308
Total	2	46	263	51	0	362	0	66	132	57	2	257	3	9	268	64	2	346	0	40	168	3	2	213	1178
11:00 AM	0	14	65	11	0	90	0	21	44	12	0	77	0	2	55	24	0	81	0	9	50	2	1	62	310
11:15 AM	0	9	69	12	0	90	0	16	41	14	0	71	0	2	71	20	0	93	0	7	40	0	0	47	301
11:30 AM	0	14	87	20	0	121	0	22	43	13	1	79	0	5	78	21	1	105	0	8	33	1	0	42	347
11:45 AM	0	12	83	10	0	105	0	21	48	23	0	92	1	2	68	18	0	89	0	11	45	3	4	63	349
Total	0	49	304	53	0	406	0	80	176	62	1	319	1	11	272	83	1	368	0	35	168	6	5	214	1307
12:00 PM	0	21	101	14	0	136	0	24	39	22	0	85	0	7	83	22	1	113	0	12	46	1	0	59	393
12:15 PM	0	7	73	19	0	99	1	18	38	25	0	82	0	3	80	28	0	111	0	15	44	1	0	60	352
12:30 PM	0	10	85	13	2	110	0	26	40	15	2	83	1	2	84	25	1	113	0	14	44	3	0	61	367
12:45 PM	0	15	103	27	1	146	0	17	43	15	0	75	0	3	79	18	1	101	0	12	45	2	3	62	384
Total	0	53	362	73	3	491	1	85	160	77	2	325	1	15	326	93	3	438	0	53	179	7	3	242	1496

Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 3

CSAH 5 & Burnsville Pkwy
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
01:00 PM	0	14	78	12	0	104	0	26	38	15	0	79	1	1	90	27	0	119	0	17	39	2	0	58	360
01:15 PM	0	26	72	11	0	109	0	22	41	16	0	79	1	2	84	23	0	110	0	20	42	3	0	65	363
01:30 PM	0	14	81	16	0	111	0	23	38	15	0	76	0	4	103	16	2	125	0	13	36	1	1	51	363
01:45 PM	0	16	110	10	0	136	0	20	45	18	0	83	0	5	80	32	0	117	0	10	45	3	0	58	394
Total	0	70	341	49	0	460	0	91	162	64	0	317	2	12	357	98	2	471	0	60	162	9	1	232	1480
02:00 PM	0	18	96	22	1	137	0	26	48	18	0	92	0	2	85	19	2	108	0	15	42	2	1	60	397
02:15 PM	0	10	101	17	0	128	0	23	42	17	0	82	1	7	72	28	0	108	0	12	33	2	0	47	365
02:30 PM	0	17	94	16	0	127	0	27	56	7	0	90	1	6	103	28	0	138	0	10	42	4	0	56	411
02:45 PM	0	13	98	17	1	129	0	32	52	13	0	97	0	3	88	29	0	120	0	9	46	2	1	58	404
Total	0	58	389	72	2	521	0	108	198	55	0	361	2	18	348	104	2	474	0	46	163	10	2	221	1577
03:00 PM	0	15	112	16	0	143	0	28	63	15	1	107	0	1	78	28	4	111	0	13	48	1	1	63	424
03:15 PM	1	19	114	10	2	146	0	22	68	18	0	108	0	2	111	19	1	133	0	16	52	1	3	72	459
03:30 PM	0	20	142	16	2	180	0	27	55	12	1	95	0	3	115	29	1	148	0	18	78	2	0	98	521
03:45 PM	0	21	143	20	0	184	0	26	72	27	0	125	0	6	113	30	0	149	0	21	55	3	0	79	537
Total	1	75	511	62	4	653	0	103	258	72	2	435	0	12	417	106	6	541	0	68	233	7	4	312	1941
04:00 PM	1	15	154	32	2	204	0	40	100	16	0	156	1	7	117	21	3	149	0	22	59	1	2	84	593
04:15 PM	0	35	170	30	0	235	0	32	92	28	0	152	0	8	128	30	2	168	0	14	64	2	1	81	636
04:30 PM	0	29	193	28	0	250	0	33	97	21	0	151	0	2	132	30	0	164	0	18	83	3	0	104	669
04:45 PM	0	19	192	39	0	250	1	39	86	33	0	159	0	7	108	27	1	143	0	16	83	3	1	103	655
Total	1	98	709	129	2	939	1	144	375	98	0	618	1	24	485	108	6	624	0	70	289	9	4	372	2553
05:00 PM	0	24	203	35	2	264	0	53	104	32	1	190	1	4	119	34	1	159	0	23	88	1	0	112	725
05:15 PM	0	39	202	29	2	272	0	36	115	37	2	190	1	11	107	26	5	150	0	19	65	1	0	85	697
05:30 PM	0	33	207	38	0	278	0	36	89	19	0	144	1	3	133	41	0	178	0	20	80	3	0	103	703
05:45 PM	1	23	158	33	1	216	2	43	79	18	0	142	0	4	95	30	5	134	0	15	62	4	5	86	578
Total	1	119	770	135	5	1030	2	168	387	106	3	666	3	22	454	131	11	621	0	77	295	9	5	386	2703
06:00 PM	0	16	164	27	0	207	0	33	79	26	0	138	0	4	115	32	2	153	1	10	54	2	5	72	570
06:15 PM	0	29	125	19	0	173	0	36	60	20	2	118	0	3	103	34	0	140	0	11	52	3	0	66	497
06:30 PM	0	13	115	12	0	140	0	29	47	16	0	92	1	3	104	24	2	134	0	8	40	1	0	49	415
06:45 PM	1	20	78	17	0	116	0	15	40	17	0	72	1	3	99	30	3	136	0	11	47	5	0	63	387
Total	1	78	482	75	0	636	0	113	226	79	2	420	2	13	421	120	7	563	1	40	193	11	5	250	1869
07:00 PM	0	9	101	18	1	129	0	21	51	15	0	87	0	1	81	31	0	113	0	6	45	2	0	53	382
07:15 PM	0	12	93	13	0	118	0	18	40	17	1	76	0	4	91	26	3	124	1	11	45	1	0	58	376
07:30 PM	0	8	76	10	3	97	0	27	50	11	2	90	1	2	68	16	4	91	0	17	20	2	0	39	317

Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 4

CSAH 5 & Burnsville Pkwy
Burnsville, MN

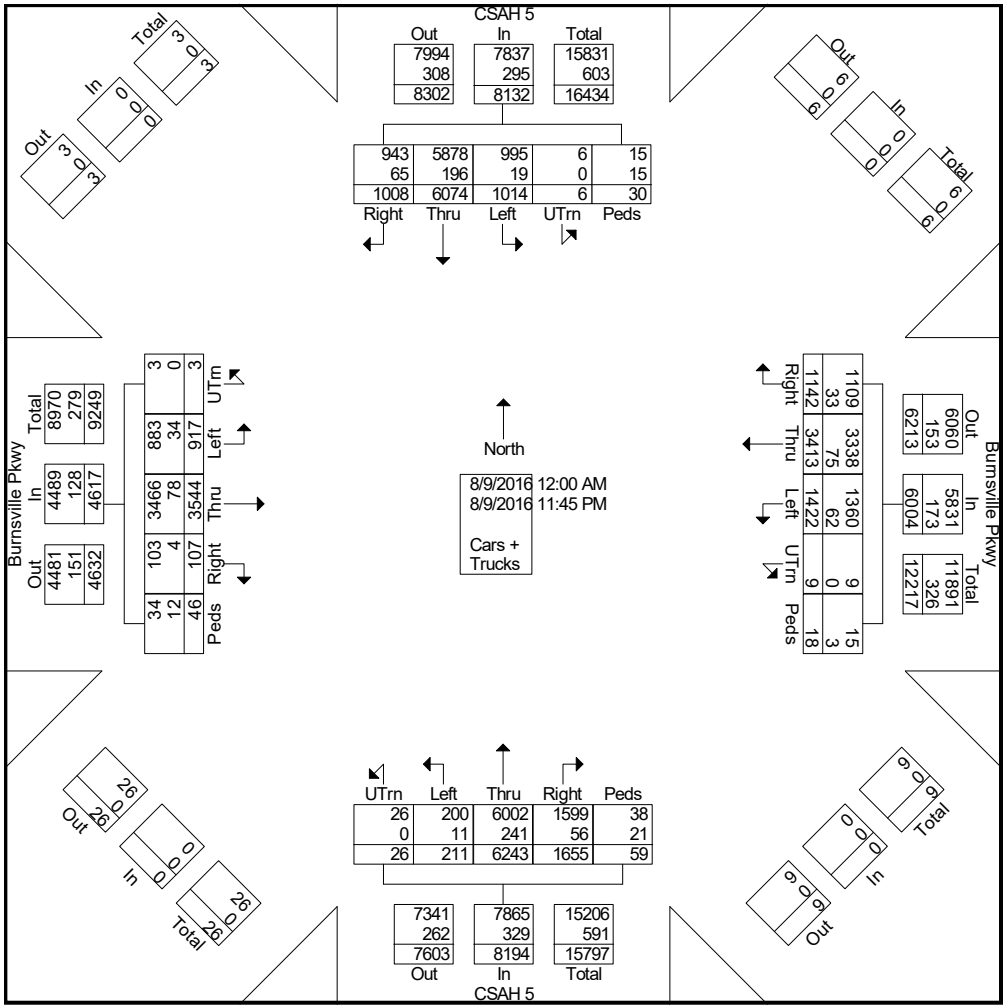
Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
07:45 PM	0	9	71	9	1	90	0	7	49	11	0	67	0	3	82	26	2	113	0	13	22	1	0	36	306
Total	0	38	341	50	5	434	0	73	190	54	3	320	1	10	322	99	9	441	1	47	132	6	0	186	1381
08:00 PM	0	6	55	9	0	70	0	18	38	9	1	66	0	1	83	18	2	104	0	3	26	1	3	33	273
08:15 PM	0	8	42	16	0	66	1	16	39	13	0	69	1	4	60	14	0	79	0	10	33	2	1	46	260
08:30 PM	0	10	67	14	2	93	1	16	33	12	0	62	0	7	82	17	0	106	0	6	33	3	0	42	303
08:45 PM	0	11	40	11	0	62	0	10	38	9	0	57	0	1	55	21	0	77	0	6	32	0	0	38	234
Total	0	35	204	50	2	291	2	60	148	43	1	254	1	13	280	70	2	366	0	25	124	6	4	159	1070
09:00 PM	0	16	43	4	0	63	0	17	47	11	0	75	0	4	63	25	0	92	0	6	33	1	0	40	270
09:15 PM	0	7	37	7	0	51	0	9	32	9	0	50	1	1	67	15	1	85	0	6	21	1	0	28	214
09:30 PM	0	5	47	7	0	59	1	10	42	11	0	64	1	3	53	11	1	69	0	6	16	1	2	25	217
09:45 PM	0	6	32	4	0	42	0	9	22	5	0	36	1	0	38	19	0	58	0	5	15	0	0	20	156
Total	0	34	159	22	0	215	1	45	143	36	0	225	3	8	221	70	2	304	0	23	85	3	2	113	857
10:00 PM	0	5	41	2	0	48	0	10	37	7	0	54	0	0	45	13	0	58	0	2	10	1	0	13	173
10:15 PM	0	5	22	4	0	31	0	7	26	7	0	40	0	1	31	10	0	42	1	1	9	1	1	13	126
10:30 PM	0	9	20	7	0	36	0	9	23	7	0	39	0	2	29	7	0	38	0	1	8	0	0	9	122
10:45 PM	0	4	12	4	0	20	0	9	21	6	0	36	0	0	20	11	0	31	0	2	12	1	0	15	102
Total	0	23	95	17	0	135	0	35	107	27	0	169	0	3	125	41	0	169	1	6	39	3	1	50	523
11:00 PM	0	6	16	2	0	24	0	5	24	7	0	36	0	2	16	8	0	26	0	2	9	0	2	13	99
11:15 PM	0	1	13	4	0	18	0	7	13	8	0	28	0	0	11	7	0	18	0	3	10	0	0	13	77
11:30 PM	0	1	9	3	0	13	1	6	17	5	0	29	0	0	18	3	0	21	0	2	7	1	0	10	73
11:45 PM	0	3	12	3	0	18	0	2	17	1	0	20	0	0	6	5	0	11	0	2	9	0	0	11	60
Total	0	11	50	12	0	73	1	20	71	21	0	113	0	2	51	23	0	76	0	9	35	1	2	47	309
Grand Total	6	1014	6074	1008	30	8132	9	1422	3413	1142	18	6004	26	211	6243	1655	59	8194	3	917	3544	107	46	4617	26947
Apprch %	0.1	12.5	74.7	12.4	0.4		0.1	23.7	56.8	19	0.3		0.3	2.6	76.2	20.2	0.7		0.1	19.9	76.8	2.3	1		
Total %	0	3.8	22.5	3.7	0.1	30.2	0	5.3	12.7	4.2	0.1	22.3	0.1	0.8	23.2	6.1	0.2	30.4	0	3.4	13.2	0.4	0.2	17.1	
Cars +	6	995	5878	943	15	7837	9	1360	3338	1109	15	5831	26	200	6002	1599	38	7865	3	883	3466	103	34	4489	26022
% Cars +	100	98.1	96.8	93.6	50	96.4	100	95.6	97.8	97.1	83.3	97.1	100	94.8	96.1	96.6	64.4	96	100	96.3	97.8	96.3	73.9	97.2	96.6
Trucks	0	19	196	65	15	295	0	62	75	33	3	173	0	11	241	56	21	329	0	34	78	4	12	128	925
% Trucks	0	1.9	3.2	6.4	50	3.6	0	4.4	2.2	2.9	16.7	2.9	0	5.2	3.9	3.4	35.6	4	0	3.7	2.2	3.7	26.1	2.8	3.4

Appendix B - Traffic Counts

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 5

CSAH 5 & Burnsville Pkwy
Burnsville, MN



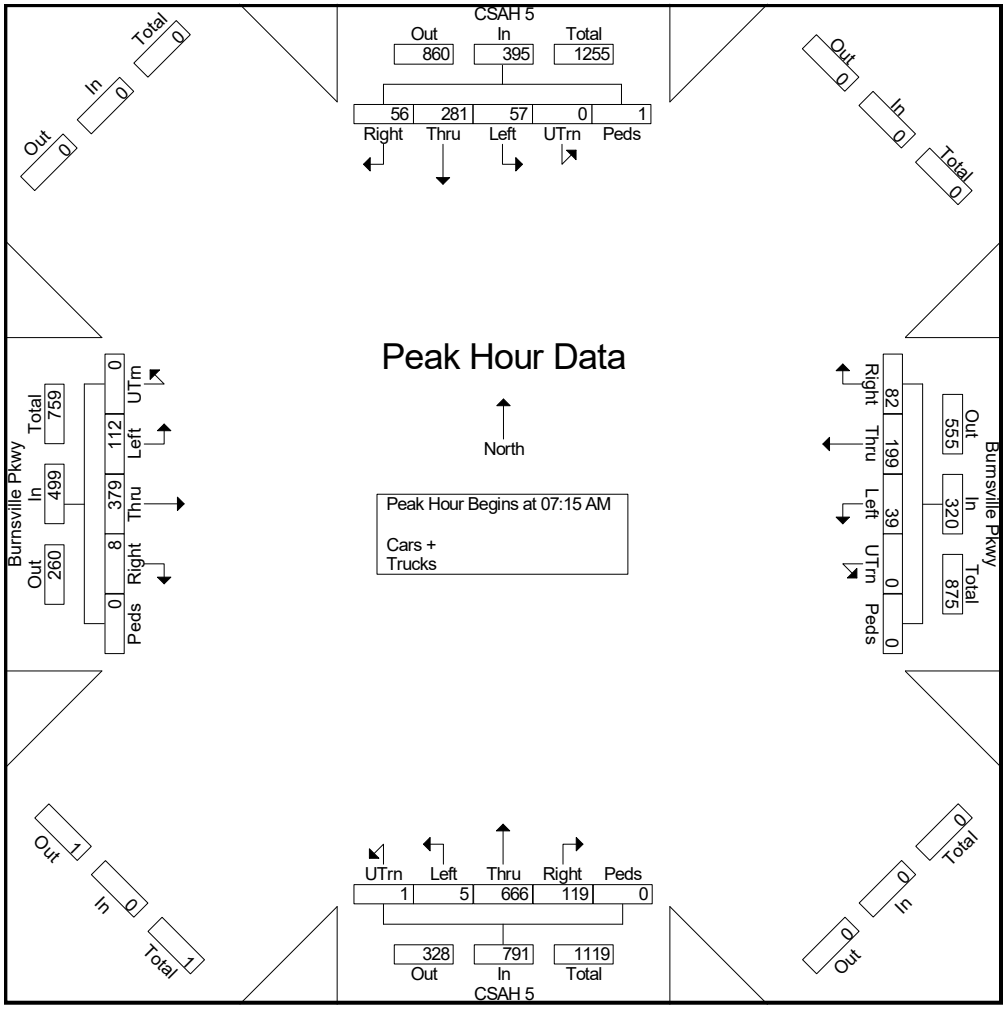
File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 6

CSAH 5 & Burnsville Pkwy
Burnsville, MN

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 AM to 09:45 AM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 07:15 AM																									
07:15 AM	0	15	60	13	1	89	0	7	43	27	0	77	0	0	198	30	0	228	0	43	119	1	0	163	557
07:30 AM	0	17	62	12	0	91	0	9	49	20	0	78	1	3	180	36	0	220	0	25	90	2	0	117	506
07:45 AM	0	13	85	17	0	115	0	11	62	26	0	99	0	1	165	30	0	196	0	19	97	2	0	118	528
08:00 AM	0	12	74	14	0	100	0	12	45	9	0	66	0	1	123	23	0	147	0	25	73	3	0	101	414
Total Volume	0	57	281	56	1	395	0	39	199	82	0	320	1	5	666	119	0	791	0	112	379	8	0	499	2005
% App. Total	0	14.4	71.1	14.2	0.3		0	12.2	62.2	25.6	0		0.1	0.6	84.2	15	0		0	22.4	76	1.6	0		
PHF	.000	.838	.826	.824	.250	.859	.000	.813	.802	.759	.000	.808	.250	.417	.841	.826	.000	.867	.000	.651	.796	.667	.000	.765	.900

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 7

CSAH 5 & Burnsville Pkwy
Burnsville, MN



File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 8

CSAH 5 & Burnsville Pkwy
Burnsville, MN

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 12:00 PM																									
12:00 PM	0	21	101	14	0	136	0	24	39	22	0	85	0	7	83	22	1	113	0	12	46	1	0	59	393
12:15 PM	0	7	73	19	0	99	1	18	38	25	0	82	0	3	80	28	0	111	0	15	44	1	0	60	352
12:30 PM	0	10	85	13	2	110	0	26	40	15	2	83	1	2	84	25	1	113	0	14	44	3	0	61	367
12:45 PM	0	15	103	27	1	146	0	17	43	15	0	75	0	3	79	18	1	101	0	12	45	2	3	62	384
Total Volume	0	53	362	73	3	491	1	85	160	77	2	325	1	15	326	93	3	438	0	53	179	7	3	242	1496
% App. Total	0	10.8	73.7	14.9	0.6		0.3	26.2	49.2	23.7	0.6		0.2	3.4	74.4	21.2	0.7		0	21.9	74	2.9	1.2		
PHF	.000	.631	.879	.676	.375	.841	.250	.817	.930	.770	.250	.956	.250	.536	.970	.830	.750	.969	.000	.883	.973	.583	.250	.976	.952

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
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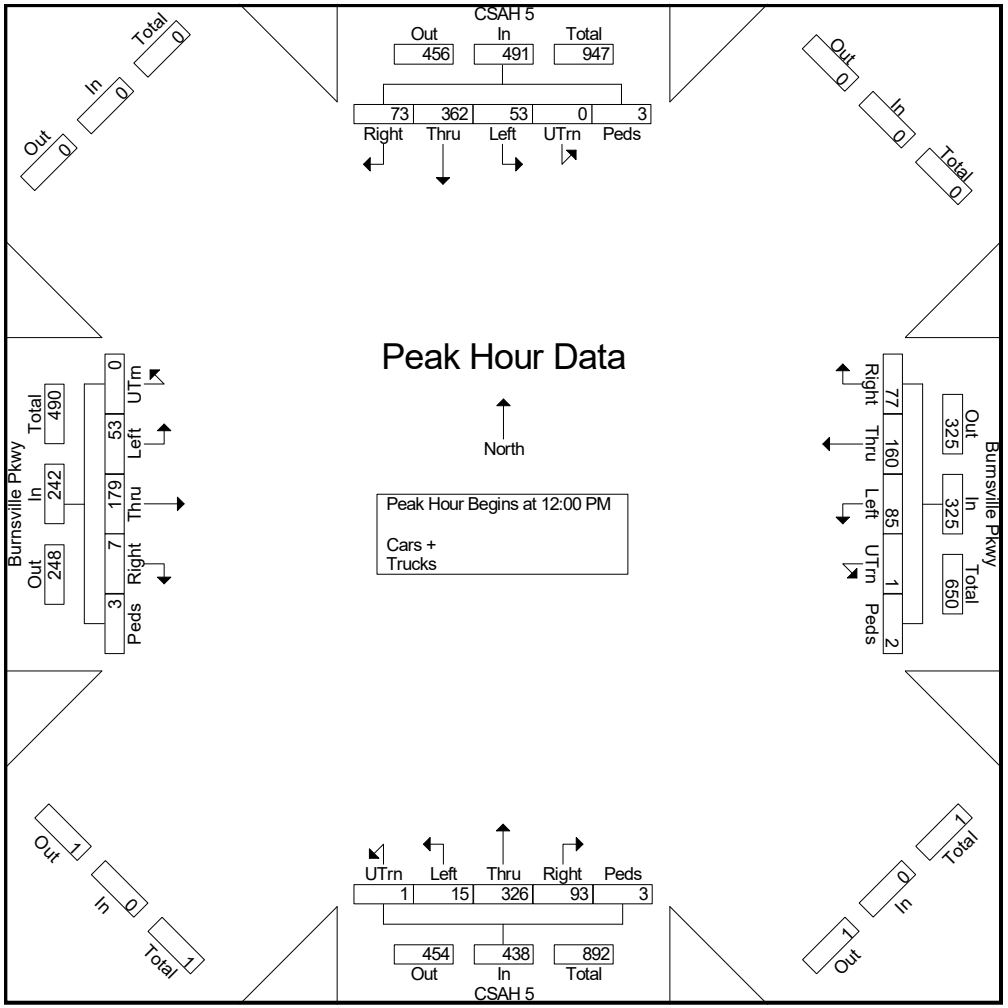
CSAH 5 & Burnsville Pkwy
Burnsville, MN



File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 10

CSAH 5 & Burnsville Pkwy
Burnsville, MN

	CSAH 5 Southbound						Burnsville Pkwy Westbound						CSAH 5 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 11:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 04:45 PM																									
04:45 PM	0	19	192	39	0	250	1	39	86	33	0	159	0	7	108	27	1	143	0	16	83	3	1	103	655
05:00 PM	0	24	203	35	2	264	0	53	104	32	1	190	1	4	119	34	1	159	0	23	88	1	0	112	725
05:15 PM	0	39	202	29	2	272	0	36	115	37	2	190	1	11	107	26	5	150	0	19	65	1	0	85	697
05:30 PM	0	33	207	38	0	278	0	36	89	19	0	144	1	3	133	41	0	178	0	20	80	3	0	103	703
Total Volume	0	115	804	141	4	1064	1	164	394	121	3	683	3	25	467	128	7	630	0	78	316	8	1	403	2780
% App. Total	0	10.8	75.6	13.3	0.4		0.1	24	57.7	17.7	0.4		0.5	4	74.1	20.3	1.1		0	19.4	78.4	2	0.2		
PHF	.000	.737	.971	.904	.500	.957	.250	.774	.857	.818	.375	.899	.750	.568	.878	.780	.350	.885	.000	.848	.898	.667	.250	.900	.959

File Name : CSAH 5 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
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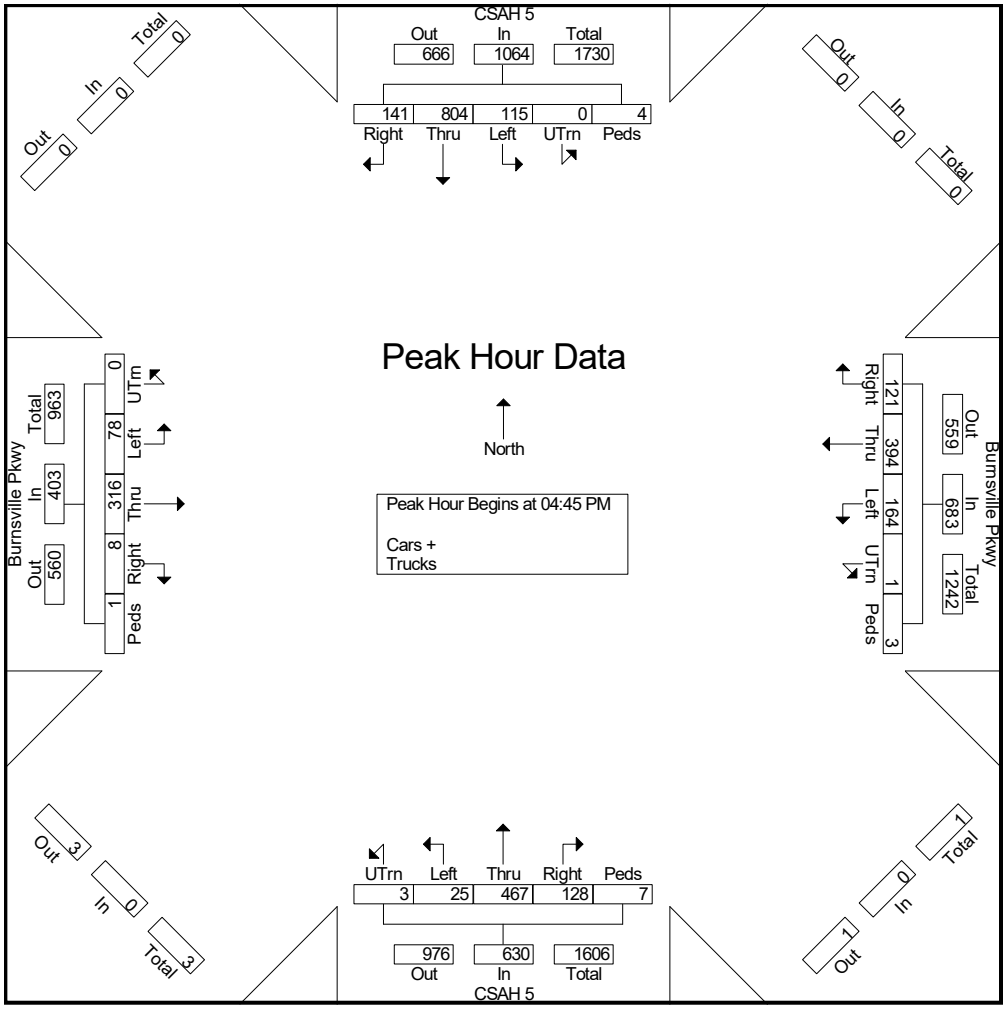
CSAH 5 & Burnsville Pkwy
Burnsville, MN



Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 1

CSAH 5 & 136th St
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
12:00 AM	0	1	9	0	0	10	0	0	0	1	0	1	0	2	10	1	0	13	0	0	0	2	0	2	26
12:15 AM	1	0	11	0	0	12	0	1	3	1	0	5	0	0	9	0	0	9	0	0	0	0	0	0	26
12:30 AM	0	1	9	0	0	10	0	1	0	0	0	1	0	0	5	1	0	6	0	0	0	0	0	0	17
12:45 AM	0	1	2	0	0	3	0	0	0	0	0	0	0	1	11	0	0	12	0	0	2	1	0	3	18
Total	1	3	31	0	0	35	0	2	3	2	0	7	0	3	35	2	0	40	0	0	2	3	0	5	87
01:00 AM	0	1	5	0	0	6	0	2	0	1	0	3	0	0	6	1	0	7	0	0	1	0	0	1	17
01:15 AM	0	0	7	0	0	7	0	0	0	0	0	0	0	1	6	0	0	7	0	0	0	0	0	0	14
01:30 AM	0	1	1	0	0	2	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	4
01:45 AM	0	0	6	0	0	6	0	0	0	0	0	0	0	1	4	0	0	5	0	0	0	1	0	1	12
Total	0	2	19	0	0	21	0	2	0	1	0	3	0	2	18	1	0	21	0	0	1	1	0	2	47
02:00 AM	0	1	6	0	0	7	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	1	1	10
02:15 AM	0	0	4	0	0	4	0	0	0	0	0	0	0	0	8	2	0	10	0	0	0	0	0	0	14
02:30 AM	0	0	5	0	0	5	0	1	0	0	0	1	0	0	3	0	0	3	0	0	0	0	0	0	9
02:45 AM	0	0	3	0	0	3	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5
Total	0	1	18	0	0	19	0	2	0	1	0	3	0	0	13	2	0	15	0	0	0	0	1	1	38
03:00 AM	0	0	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
03:15 AM	0	0	1	0	0	1	0	0	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	8
03:30 AM	0	1	3	0	0	4	0	1	0	2	0	3	0	0	8	0	0	8	0	0	0	0	0	0	15
03:45 AM	0	1	5	0	0	6	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	11
Total	0	2	14	0	0	16	0	1	0	2	0	3	0	0	20	0	0	20	0	0	0	0	0	0	39
04:00 AM	0	1	2	0	0	3	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	6
04:15 AM	0	0	8	0	0	8	0	0	0	1	0	1	0	0	12	1	0	13	0	0	0	0	0	0	22
04:30 AM	0	0	1	0	0	1	0	0	1	1	0	2	0	0	9	0	0	9	0	0	0	2	0	2	14
04:45 AM	0	0	9	0	0	9	0	2	0	0	0	2	0	2	16	1	0	19	0	0	0	3	0	3	33
Total	0	1	20	0	0	21	0	2	1	2	0	5	0	2	40	2	0	44	0	0	0	5	0	5	75
05:00 AM	0	1	9	0	0	10	0	1	0	1	0	2	0	1	22	1	0	24	0	0	0	2	0	2	38
05:15 AM	0	0	18	0	0	18	0	0	0	1	0	1	0	0	34	0	0	34	0	0	0	0	0	0	53
05:30 AM	0	0	20	0	0	20	0	3	0	4	0	7	0	0	48	1	0	49	0	1	1	5	0	7	83
05:45 AM	0	1	22	0	0	23	0	4	1	4	0	9	0	0	45	1	0	46	0	0	0	1	0	1	79
Total	0	2	69	0	0	71	0	8	1	10	0	19	0	1	149	3	0	153	0	1	1	8	0	10	253
06:00 AM	0	0	24	1	0	25	0	5	0	5	0	10	0	1	63	0	0	64	0	0	0	2	0	2	101
06:15 AM	0	1	48	0	1	50	0	5	1	2	0	8	0	0	91	0	0	91	0	0	0	7	0	7	156
06:30 AM	0	2	51	1	0	54	0	7	3	6	0	16	0	4	118	2	0	124	0	0	0	5	0	5	199
06:45 AM	0	1	70	1	0	72	0	13	2	9	0	24	0	1	151	0	1	153	0	0	0	5	0	5	254
Total	0	4	193	3	1	201	0	30	6	22	0	58	0	6	423	2	1	432	0	0	0	19	0	19	710
07:00 AM	0	0	47	1	0	48	0	4	4	9	1	18	0	4	156	1	1	162	0	0	0	9	0	9	237
07:15 AM	0	3	65	2	0	70	0	2	4	10	0	16	0	3	225	8	0	236	0	0	0	17	0	17	339
07:30 AM	0	3	73	1	0	77	0	12	1	14	0	27	0	2	205	2	0	209	0	1	0	8	0	9	322

TRAFFIC DATA INC.

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 2

CSAH 5 & 136th St
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
07:45 AM	1	4	89	0	0	94	0	8	4	12	0	24	0	8	161	5	0	174	0	0	1	5	0	6	298
Total	1	10	274	4	0	289	0	26	13	45	1	85	0	17	747	16	1	781	0	1	1	39	0	41	1196
08:00 AM	0	3	82	0	0	85	0	4	5	7	0	16	0	8	146	5	0	159	0	1	1	10	0	12	272
08:15 AM	0	2	81	1	0	84	0	6	2	3	1	12	0	4	125	5	1	135	0	1	1	11	1	14	245
08:30 AM	0	0	69	1	0	70	0	6	3	3	1	13	0	7	103	1	0	111	0	0	1	7	0	8	202
08:45 AM	0	3	86	1	0	90	0	8	1	7	2	18	0	4	90	5	0	99	0	0	0	5	0	5	212
Total	0	8	318	3	0	329	0	24	11	20	4	59	0	23	464	16	1	504	0	2	3	33	1	39	931
09:00 AM	2	2	84	1	0	89	0	3	5	9	0	17	0	8	89	2	0	99	0	0	1	9	0	10	215
09:15 AM	1	1	73	1	0	76	0	8	1	4	0	13	0	3	85	3	0	91	0	0	2	9	0	11	191
09:30 AM	0	0	81	1	0	82	0	9	1	3	1	14	0	5	85	7	1	98	0	0	0	12	0	12	206
09:45 AM	0	3	89	1	1	94	0	6	2	4	2	14	0	8	73	5	1	87	0	0	6	11	0	17	212
Total	3	6	327	4	1	341	0	26	9	20	3	58	0	24	332	17	2	375	0	0	9	41	0	50	824
10:00 AM	0	1	97	0	2	100	0	9	3	2	0	14	0	9	73	8	1	91	0	0	1	9	0	10	215
10:15 AM	0	1	80	2	1	84	0	9	1	3	0	13	0	8	85	2	0	95	0	0	4	13	0	17	209
10:30 AM	1	6	57	1	0	65	0	10	1	3	0	14	0	8	80	8	0	96	0	0	1	9	0	10	185
10:45 AM	1	4	80	0	0	85	0	6	4	5	0	15	0	6	89	4	1	100	0	0	3	14	0	17	217
Total	2	12	314	3	3	334	0	34	9	13	0	56	0	31	327	22	2	382	0	0	9	45	0	54	826
11:00 AM	0	3	81	0	0	84	0	13	4	3	1	21	1	5	73	9	1	89	0	1	1	10	0	12	206
11:15 AM	1	5	79	3	1	89	0	15	1	0	0	16	0	5	90	7	1	103	0	0	4	12	0	16	224
11:30 AM	0	1	98	3	0	102	0	7	2	2	1	12	1	9	107	7	2	126	0	1	2	12	0	15	255
11:45 AM	2	3	105	5	0	115	0	11	2	4	3	20	0	17	83	9	1	110	0	1	2	20	0	23	268
Total	3	12	363	11	1	390	0	46	9	9	5	69	2	36	353	32	5	428	0	3	9	54	0	66	953
12:00 PM	0	3	115	2	0	120	0	8	7	4	0	19	0	15	103	7	0	125	0	2	2	17	0	21	285
12:15 PM	0	7	90	3	0	100	0	6	4	6	0	16	1	6	100	10	0	117	0	0	0	12	0	12	245
12:30 PM	1	2	105	2	0	110	0	8	6	9	0	23	2	9	99	8	0	118	0	0	3	11	0	14	265
12:45 PM	0	5	118	1	0	124	0	8	4	6	0	18	0	14	94	6	1	115	0	0	2	16	0	18	275
Total	1	17	428	8	0	454	0	30	21	25	0	76	3	44	396	31	1	475	0	2	7	56	0	65	1070
01:00 PM	0	1	96	1	1	99	0	5	2	6	0	13	0	14	119	9	0	142	0	0	4	12	0	16	270
01:15 PM	1	5	90	3	0	99	0	9	2	3	0	14	1	11	111	9	0	132	0	1	0	17	0	18	263
01:30 PM	1	7	103	1	0	112	0	12	2	2	0	16	0	13	109	9	1	132	0	4	0	15	0	19	279
01:45 PM	1	5	113	1	0	120	0	11	4	5	0	20	0	12	112	6	0	130	0	0	2	11	0	13	283
Total	3	18	402	6	1	430	0	37	10	16	0	63	1	50	451	33	1	536	0	5	6	55	0	66	1095
02:00 PM	1	3	117	2	4	127	0	8	2	3	0	13	1	10	108	5	0	124	0	1	1	8	0	10	274
02:15 PM	1	7	118	2	0	128	0	4	6	1	2	13	1	14	111	5	0	131	0	0	4	14	0	18	290
02:30 PM	1	3	110	2	0	116	0	7	3	3	0	13	3	13	124	9	0	149	0	0	2	16	0	18	296
02:45 PM	2	6	126	4	0	138	0	7	1	4	0	12	0	8	101	8	0	117	0	3	3	10	0	16	283
Total	5	19	471	10	4	509	0	26	12	11	2	51	5	45	444	27	0	521	0	4	10	48	0	62	1143

Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 3

CSAH 5 & 136th St
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
03:00 PM	3	1	135	5	0	144	0	12	1	3	1	17	0	10	105	8	0	123	0	2	1	11	1	15	299
03:15 PM	1	6	128	5	0	140	0	11	3	3	0	17	0	12	134	11	1	158	0	1	3	10	4	18	333
03:30 PM	1	6	167	1	0	175	0	7	3	6	1	17	1	12	120	8	0	141	0	1	3	31	1	36	369
03:45 PM	3	12	147	4	0	166	0	6	2	9	0	17	1	20	146	12	1	180	0	3	1	17	0	21	384
Total	8	25	577	15	0	625	0	36	9	21	2	68	2	54	505	39	2	602	0	7	8	69	6	90	1385
04:00 PM	0	9	189	3	0	201	0	7	1	4	1	13	1	15	152	16	0	184	0	0	3	20	0	23	421
04:15 PM	1	7	210	2	0	220	0	15	5	8	0	28	0	14	153	6	1	174	0	0	6	12	0	18	440
04:30 PM	0	7	214	3	0	224	0	8	5	9	4	26	0	23	138	9	0	170	0	2	2	20	0	24	444
04:45 PM	1	8	205	6	4	224	0	9	3	2	0	14	0	20	138	10	0	168	0	2	5	25	0	32	438
Total	2	31	818	14	4	869	0	39	14	23	5	81	1	72	581	41	1	696	0	4	16	77	0	97	1743
05:00 PM	0	9	238	7	0	254	0	15	2	6	2	25	0	24	149	24	3	200	0	0	7	20	0	27	506
05:15 PM	1	16	241	3	0	261	0	14	7	9	0	30	1	20	144	13	1	179	0	0	4	14	0	18	488
05:30 PM	0	14	208	4	2	228	0	16	5	7	0	28	0	24	136	14	4	178	0	1	12	16	2	31	465
05:45 PM	0	8	201	3	1	213	0	18	7	5	2	32	0	17	128	19	2	166	0	2	5	19	0	26	437
Total	1	47	888	17	3	956	0	63	21	27	4	115	1	85	557	70	10	723	0	3	28	69	2	102	1896
06:00 PM	0	7	199	2	4	212	0	7	0	10	0	17	1	14	131	9	0	155	0	0	3	12	0	15	399
06:15 PM	1	13	142	6	4	166	0	10	7	2	0	19	0	13	121	16	1	151	0	3	3	23	0	29	365
06:30 PM	2	7	125	2	0	136	0	5	5	4	2	16	0	17	130	6	1	154	0	0	2	22	0	24	330
06:45 PM	3	6	97	1	0	107	0	8	0	4	0	12	0	12	111	13	0	136	0	3	3	16	0	22	277
Total	6	33	563	11	8	621	0	30	12	20	2	64	1	56	493	44	2	596	0	6	11	73	0	90	1371
07:00 PM	0	6	109	5	0	120	0	12	2	3	0	17	0	12	105	16	0	133	0	1	3	15	0	19	289
07:15 PM	0	7	99	4	0	110	0	8	6	4	0	18	1	12	114	10	0	137	0	2	5	12	0	19	284
07:30 PM	0	2	97	4	0	103	0	6	5	0	0	11	0	9	75	10	0	94	0	0	10	10	0	20	228
07:45 PM	1	10	71	4	0	86	0	3	7	6	0	16	0	14	102	11	2	129	0	1	5	7	1	14	245
Total	1	25	376	17	0	419	0	29	20	13	0	62	1	47	396	47	2	493	0	4	23	44	1	72	1046
08:00 PM	0	4	63	5	0	72	0	16	12	8	0	36	0	7	95	9	0	111	0	2	3	8	0	13	232
08:15 PM	0	6	53	3	0	62	0	4	4	3	0	11	1	10	73	8	0	92	0	2	0	8	1	11	176
08:30 PM	2	6	66	5	0	79	0	4	2	6	2	14	0	12	90	13	1	116	0	4	3	7	0	14	223
08:45 PM	0	3	48	0	0	51	0	3	2	5	0	10	1	4	78	5	0	88	0	2	7	5	1	15	164
Total	2	19	230	13	0	264	0	27	20	22	2	71	2	33	336	35	1	407	0	10	13	28	2	53	795
09:00 PM	1	7	57	2	1	68	0	3	4	2	0	9	1	6	82	6	0	95	0	2	2	6	1	11	183
09:15 PM	0	3	42	0	0	45	0	6	1	3	1	11	1	9	81	9	0	100	0	1	6	9	1	17	173
09:30 PM	0	6	46	1	0	53	0	0	1	6	0	7	0	4	50	6	0	60	0	1	3	5	0	9	129
09:45 PM	0	2	39	1	0	42	0	0	4	2	0	6	0	1	51	11	0	63	0	1	0	4	0	5	116
Total	1	18	184	4	1	208	0	9	10	13	1	33	2	20	264	32	0	318	0	5	11	24	2	42	601
10:00 PM	0	3	46	0	0	49	0	3	1	3	0	7	0	5	52	7	0	64	0	0	1	2	1	4	124
10:15 PM	0	0	31	0	0	31	0	1	0	5	0	6	0	5	33	6	0	44	0	0	0	4	0	4	85
10:30 PM	0	3	28	0	0	31	0	5	0	2	0	7	0	7	37	4	0	48	0	0	1	2	0	3	89

Appendix B - Traffic Counts

TRAFFIC DATA INC.

CSAH 5 & 136th St
Burnsville, MN

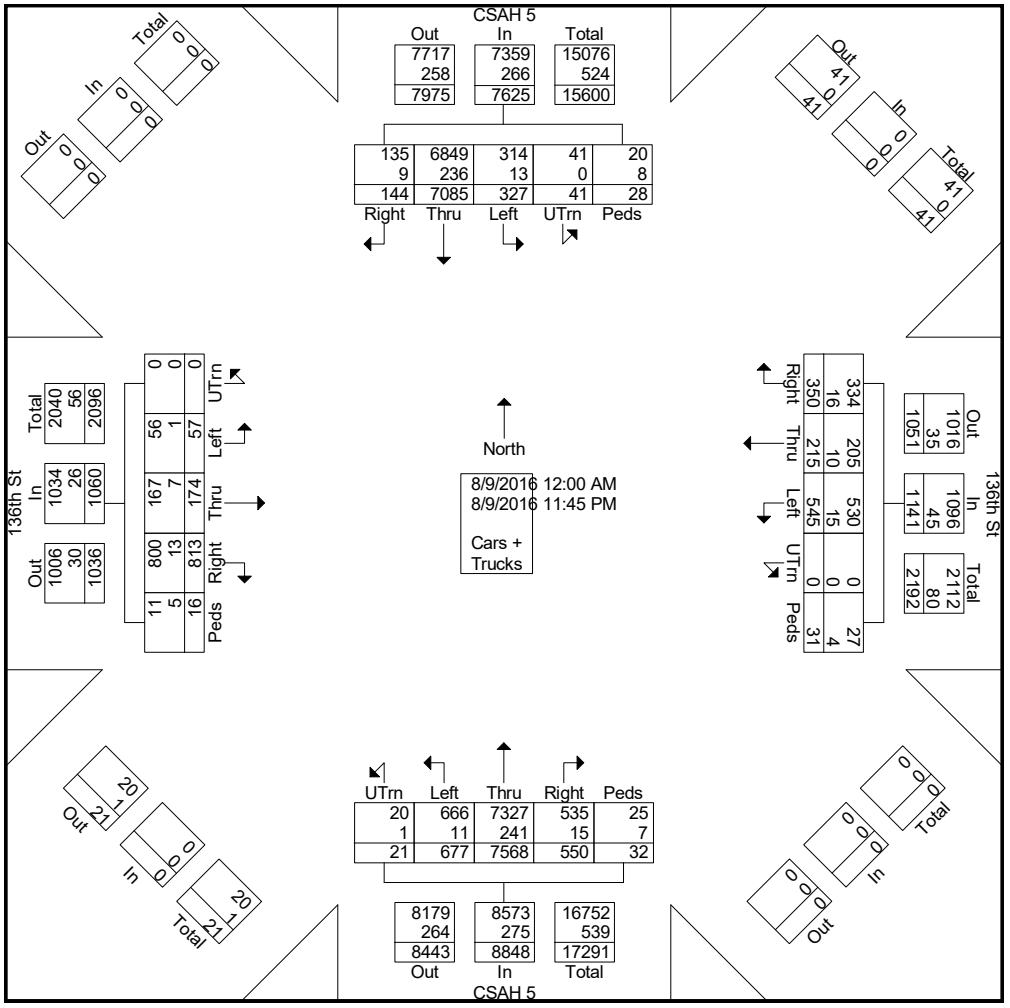
File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 4

Groups Printed- Cars + - Trucks

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
10:45 PM	0	2	20	0	0	22	0	0	0	0	0	0	0	2	30	2	0	34	0	0	1	2	0	3	59
Total	0	8	125	0	0	133	0	9	1	10	0	20	0	19	152	19	0	190	0	0	3	10	1	14	357
11:00 PM	0	1	17	1	0	19	0	3	1	0	0	4	0	1	25	3	0	29	0	0	2	6	0	8	60
11:15 PM	0	1	18	0	0	19	0	2	2	1	0	5	0	1	19	5	0	25	0	0	0	2	0	2	51
11:30 PM	1	0	18	0	1	20	0	0	0	1	0	1	0	2	15	7	0	24	0	0	1	1	0	2	47
11:45 PM	0	2	10	0	0	12	0	2	0	0	0	2	0	3	13	2	0	18	0	0	0	3	0	3	35
Total	1	4	63	1	1	70	0	7	3	2	0	12	0	7	72	17	0	96	0	0	3	12	0	15	193
Grand Total	41	327	7085	144	28	7625	0	545	215	350	31	1141	21	677	7568	550	32	8848	0	57	174	813	16	1060	18674
Apprch %	0.5	4.3	92.9	1.9	0.4		0	47.8	18.8	30.7	2.7		0.2	7.7	85.5	6.2	0.4		0	5.4	16.4	76.7	1.5		
Total %	0.2	1.8	37.9	0.8	0.1	40.8	0	2.9	1.2	1.9	0.2	6.1	0.1	3.6	40.5	2.9	0.2	47.4	0	0.3	0.9	4.4	0.1	5.7	
Cars +	41	314	6849	135	20	7359	0	530	205	334	27	1096	20	666	7327	535	25	8573	0	56	167	800	11	1034	18062
% Cars +	100	96	96.7	93.8	71.4	96.5	0	97.2	95.3	95.4	87.1	96.1	95.2	98.4	96.8	97.3	78.1	96.9	0	98.2	96	98.4	68.8	97.5	96.7
Trucks	0	13	236	9	8	266	0	15	10	16	4	45	1	11	241	15	7	275	0	1	7	13	5	26	612
% Trucks	0	4	3.3	6.2	28.6	3.5	0	2.8	4.7	4.6	12.9	3.9	4.8	1.6	3.2	2.7	21.9	3.1	0	1.8	4	1.6	31.2	2.5	3.3

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 5

CSAH 5 & 136th St
Burnsville, MN



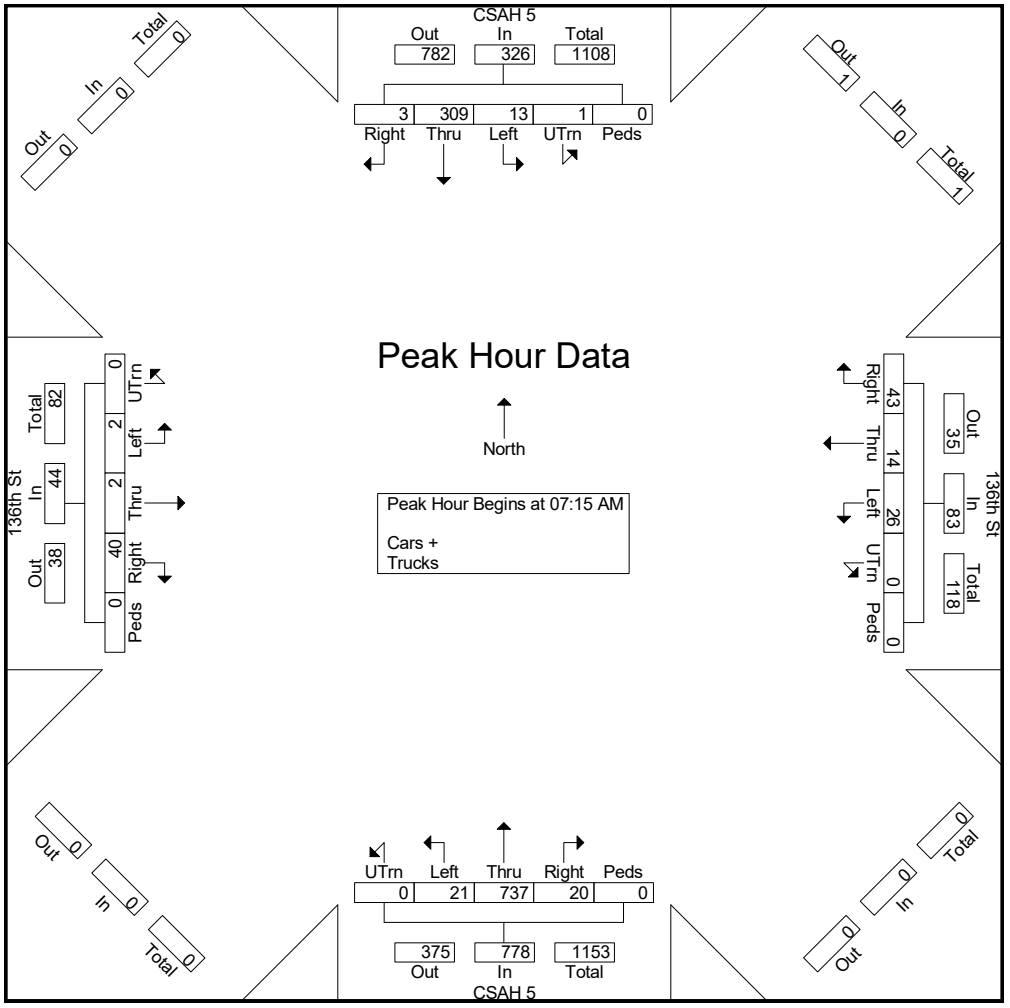
File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 6

CSAH 5 & 136th St
Burnsville, MN

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 AM to 09:45 AM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 07:15 AM																									
07:15 AM	0	3	65	2	0	70	0	2	4	10	0	16	0	3	225	8	0	236	0	0	0	17	0	17	339
07:30 AM	0	3	73	1	0	77	0	12	1	14	0	27	0	2	205	2	0	209	0	1	0	8	0	9	322
07:45 AM	1	4	89	0	0	94	0	8	4	12	0	24	0	8	161	5	0	174	0	0	1	5	0	6	298
08:00 AM	0	3	82	0	0	85	0	4	5	7	0	16	0	8	146	5	0	159	0	1	1	10	0	12	272
Total Volume	1	13	309	3	0	326	0	26	14	43	0	83	0	21	737	20	0	778	0	2	2	40	0	44	1231
% App. Total	0.3	4	94.8	0.9	0		0	31.3	16.9	51.8	0		0	2.7	94.7	2.6	0		0	4.5	4.5	90.9	0		
PHF	.250	.813	.868	.375	.000	.867	.000	.542	.700	.768	.000	.769	.000	.656	.819	.625	.000	.824	.000	.500	.500	.588	.000	.647	.908

CSAH 5 & 136th St
Burnsville, MN

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 7



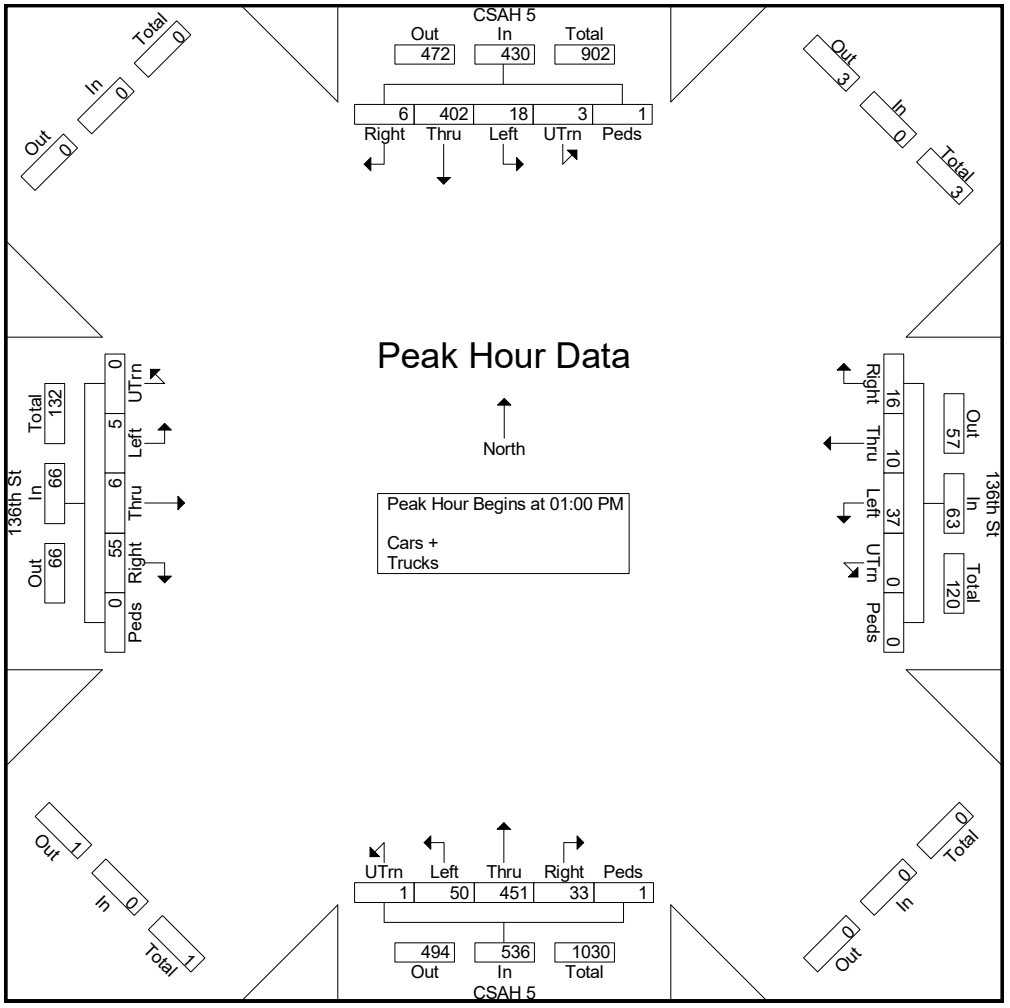
File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 8

CSAH 5 & 136th St
Burnsville, MN

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 01:00 PM																									
01:00 PM	0	1	96	1	1	99	0	5	2	6	0	13	0	14	119	9	0	142	0	0	4	12	0	16	270
01:15 PM	1	5	90	3	0	99	0	9	2	3	0	14	1	11	111	9	0	132	0	1	0	17	0	18	263
01:30 PM	1	7	103	1	0	112	0	12	2	2	0	16	0	13	109	9	1	132	0	4	0	15	0	19	279
01:45 PM	1	5	113	1	0	120	0	11	4	5	0	20	0	12	112	6	0	130	0	0	2	11	0	13	283
Total Volume	3	18	402	6	1	430	0	37	10	16	0	63	1	50	451	33	1	536	0	5	6	55	0	66	1095
% App. Total	0.7	4.2	93.5	1.4	0.2		0	58.7	15.9	25.4	0		0.2	9.3	84.1	6.2	0.2		0	7.6	9.1	83.3	0		
PHF	.750	.643	.889	.500	.250	.896	.000	.771	.625	.667	.000	.788	.250	.893	.947	.917	.250	.944	.000	.313	.375	.809	.000	.868	.967

CSAH 5 & 136th St
Burnsville, MN

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 9



File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 10

CSAH 5 & 136th St
Burnsville, MN

	CSAH 5 Southbound						136th St Westbound						CSAH 5 Northbound						136th St Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 11:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 04:45 PM																									
04:45 PM	1	8	205	6	4	224	0	9	3	2	0	14	0	20	138	10	0	168	0	2	5	25	0	32	438
05:00 PM	0	9	238	7	0	254	0	15	2	6	2	25	0	24	149	24	3	200	0	0	7	20	0	27	506
05:15 PM	1	16	241	3	0	261	0	14	7	9	0	30	1	20	144	13	1	179	0	0	4	14	0	18	488
05:30 PM	0	14	208	4	2	228	0	16	5	7	0	28	0	24	136	14	4	178	0	1	12	16	2	31	465
Total Volume	2	47	892	20	6	967	0	54	17	24	2	97	1	88	567	61	8	725	0	3	28	75	2	108	1897
% App. Total	0.2	4.9	92.2	2.1	0.6		0	55.7	17.5	24.7	2.1		0.1	12.1	78.2	8.4	1.1		0	2.8	25.9	69.4	1.9		
PHF	.500	.734	.925	.714	.375	.926	.000	.844	.607	.667	.250	.808	.250	.917	.951	.635	.500	.906	.000	.375	.583	.750	.250	.844	.937

CSAH 5 & 136th St
Burnsville, MN

File Name : CSAH 5 & 136th St, 8-9-16
Site Code :
Start Date : 8/9/2016
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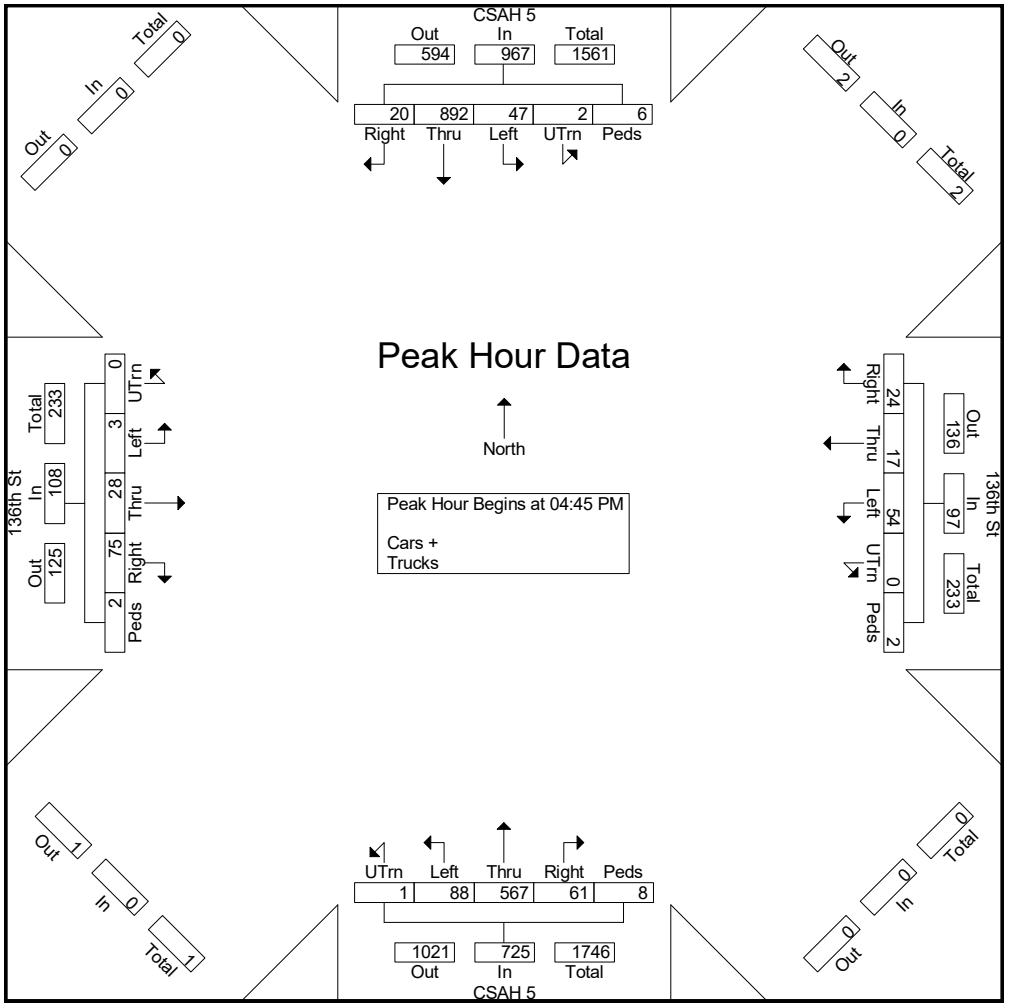

Appendix B - Traffic Counts

TRAFFIC DATA INC.

File Name : CSAH 11 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 1

CSAH 11 & Burnsville Pkwy
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
12:00 AM	0	0	6	3	0	9	0	1	0	1	0	2	0	6	3	0	0	9	0	1	1	7	0	9	29
12:15 AM	0	0	6	0	0	6	0	1	2	0	0	3	0	4	6	0	0	10	0	2	3	3	0	8	27
12:30 AM	0	0	2	3	0	5	0	0	1	0	0	1	0	2	10	1	0	13	1	1	0	4	0	6	25
12:45 AM	0	0	7	1	0	8	0	0	0	0	0	0	0	2	4	0	0	6	0	1	0	5	0	6	20
Total	0	0	21	7	0	28	0	2	3	1	0	6	0	14	23	1	0	38	1	5	4	19	0	29	101
01:00 AM	0	0	6	2	0	8	0	0	0	0	0	0	0	3	7	0	0	10	0	3	1	1	0	5	23
01:15 AM	0	0	0	2	0	2	0	1	1	0	0	2	0	1	2	2	0	5	0	1	0	2	0	3	12
01:30 AM	0	0	4	1	0	5	0	0	0	0	0	0	0	1	2	1	0	4	0	3	2	1	0	6	15
01:45 AM	0	0	2	1	0	3	0	0	1	0	0	1	0	1	3	0	0	4	0	0	0	3	0	3	11
Total	0	0	12	6	0	18	0	1	2	0	0	3	0	6	14	3	0	23	0	7	3	7	0	17	61
02:00 AM	0	0	3	0	0	3	0	0	0	0	0	0	0	2	2	0	0	4	0	1	0	3	1	5	12
02:15 AM	0	0	4	1	0	5	0	0	1	0	0	1	0	3	2	0	0	5	0	0	0	0	0	0	11
02:30 AM	0	0	2	1	0	3	0	0	0	0	0	0	0	2	1	0	0	3	0	0	1	2	0	3	9
02:45 AM	0	0	2	1	0	3	0	0	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0	0	6
Total	0	0	11	3	0	14	0	0	1	0	0	1	0	8	7	0	0	15	0	1	1	5	1	8	38
03:00 AM	0	0	2	0	0	2	0	0	0	0	0	0	0	2	0	0	0	2	0	0	2	2	0	4	8
03:15 AM	0	2	4	0	0	6	0	1	1	0	0	2	0	0	2	0	0	2	0	0	0	2	0	2	12
03:30 AM	0	0	4	0	0	4	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	9
03:45 AM	0	0	2	1	0	3	0	2	0	1	0	3	0	3	4	0	0	7	0	0	0	4	0	4	17
Total	0	2	12	1	0	15	0	3	1	1	0	5	0	5	11	0	0	16	0	0	2	8	0	10	46
04:00 AM	0	1	3	1	0	5	0	0	0	0	0	0	0	3	2	1	0	6	0	1	0	2	0	3	14
04:15 AM	0	0	2	0	0	2	0	0	0	2	0	2	0	4	2	0	0	6	0	3	0	1	0	4	14
04:30 AM	0	0	5	0	1	6	0	0	0	0	0	0	0	3	7	1	0	11	0	1	0	2	0	3	20
04:45 AM	0	0	3	0	0	3	0	0	0	0	0	0	0	4	10	0	0	14	0	3	0	5	0	8	25
Total	0	1	13	1	1	16	0	0	0	2	0	2	0	14	21	2	0	37	0	8	0	10	0	18	73
05:00 AM	0	0	12	0	0	12	0	0	1	0	0	1	0	3	12	1	0	16	0	2	0	9	0	11	40
05:15 AM	0	0	11	0	0	11	0	7	0	0	2	9	0	7	18	1	0	26	0	3	1	9	0	13	59
05:30 AM	0	0	14	2	0	16	0	8	3	2	0	13	0	8	29	0	0	37	0	6	1	12	0	19	85
05:45 AM	0	0	9	6	0	15	0	2	3	0	0	5	0	14	41	3	0	58	0	6	1	19	1	27	105
Total	0	0	46	8	0	54	0	17	7	2	2	28	0	32	100	5	0	137	0	17	3	49	1	70	289
06:00 AM	0	0	23	1	0	24	0	6	5	0	1	12	0	16	40	2	1	59	0	2	4	16	0	22	117
06:15 AM	0	0	32	1	0	33	0	6	6	5	0	17	0	17	62	3	1	83	0	9	0	27	1	37	170
06:30 AM	0	0	27	4	0	31	0	7	7	3	1	18	0	26	70	2	0	98	0	11	3	28	0	42	189

TRAFFIC DATA INC.

File Name : CSAH 11 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
Page No : 2

CSAH 11 & Burnsville Pkwy
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
06:45 AM	0	1	33	6	1	41	0	4	7	0	0	11	0	30	127	4	0	161	0	15	5	43	0	63	276
Total	0	1	115	12	1	129	0	23	25	8	2	58	0	89	299	11	2	401	0	37	12	114	1	164	752
07:00 AM	0	1	38	5	0	44	0	9	9	1	1	20	0	27	132	2	1	162	0	15	3	29	1	48	274
07:15 AM	0	0	47	5	0	52	0	12	9	4	2	27	0	48	154	2	0	204	0	14	2	29	0	45	328
07:30 AM	0	0	50	12	0	62	0	14	12	1	0	27	0	55	160	6	1	222	0	21	11	44	0	76	387
07:45 AM	0	1	51	10	0	62	0	9	14	2	0	25	0	55	155	11	0	221	0	22	5	38	0	65	373
Total	0	2	186	32	0	220	0	44	44	8	3	99	0	185	601	21	2	809	0	72	21	140	1	234	1362
08:00 AM	0	0	35	8	0	43	0	14	7	7	0	28	0	61	114	9	0	184	0	14	11	19	0	44	299
08:15 AM	0	1	39	9	0	49	0	9	15	5	0	29	0	69	123	6	0	198	0	13	11	25	0	49	325
08:30 AM	0	1	43	10	0	54	0	16	19	4	1	40	0	42	87	4	0	133	0	11	9	28	0	48	275
08:45 AM	0	3	43	7	0	53	0	11	18	4	4	37	0	52	79	8	2	141	0	17	6	29	0	52	283
Total	0	5	160	34	0	199	0	50	59	20	5	134	0	224	403	27	2	656	0	55	37	101	0	193	1182
09:00 AM	0	0	45	12	0	57	0	8	12	3	0	23	0	49	64	5	0	118	0	5	9	24	2	40	238
09:15 AM	0	1	48	7	0	56	0	13	10	0	1	24	0	29	60	5	0	94	0	10	9	25	0	44	218
09:30 AM	1	0	47	4	0	52	0	8	12	3	0	23	0	30	47	8	0	85	0	6	11	30	1	48	208
09:45 AM	0	0	60	12	0	72	0	7	17	1	1	26	0	36	63	12	1	112	0	12	8	26	0	46	256
Total	1	1	200	35	0	237	0	36	51	7	2	96	0	144	234	30	1	409	0	33	37	105	3	178	920
10:00 AM	0	1	34	12	0	47	0	12	7	2	0	21	0	24	52	6	0	82	0	15	9	28	0	52	202
10:15 AM	0	0	48	5	0	53	0	10	8	3	1	22	0	22	53	11	2	88	0	14	18	37	0	69	232
10:30 AM	0	0	48	15	0	63	0	19	10	2	0	31	0	23	60	11	0	94	0	7	3	25	0	35	223
10:45 AM	0	1	51	11	0	63	0	7	11	3	0	21	0	23	69	8	2	102	0	11	16	28	0	55	241
Total	0	2	181	43	0	226	0	48	36	10	1	95	0	92	234	36	4	366	0	47	46	118	0	211	898
11:00 AM	0	0	45	5	0	50	0	9	10	0	1	20	0	36	53	10	0	99	0	18	17	29	0	64	233
11:15 AM	0	1	49	13	0	63	0	15	9	1	0	25	0	19	45	14	2	80	0	6	14	32	1	53	221
11:30 AM	0	2	60	9	0	71	0	14	12	0	2	28	0	29	51	6	1	87	1	6	5	31	0	43	229
11:45 AM	0	0	54	5	0	59	0	18	12	0	1	31	0	40	41	11	0	92	0	14	8	27	0	49	231
Total	0	3	208	32	0	243	0	56	43	1	4	104	0	124	190	41	3	358	1	44	44	119	1	209	914
12:00 PM	0	2	60	12	0	74	0	7	7	2	0	16	0	33	69	13	1	116	0	13	16	36	0	65	271
12:15 PM	0	1	51	17	0	69	0	7	13	0	2	22	0	30	67	16	1	114	0	9	12	31	0	52	257
12:30 PM	0	3	57	7	0	67	0	15	15	1	4	35	0	32	41	6	0	79	0	13	11	45	0	69	250
12:45 PM	0	5	58	11	0	74	0	14	10	4	1	29	0	47	67	7	1	122	0	11	12	44	0	67	292
Total	0	11	226	47	0	284	0	43	45	7	7	102	0	142	244	42	3	431	0	46	51	156	0	253	1070

TRAFFIC DATA INC.

File Name : CSAH 11 & Burnsville Pkwy, 8-9-16
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CSAH 11 & Burnsville Pkwy
Burnsville, MN

Groups Printed- Cars + - Trucks

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
01:00 PM	0	1	56	12	0	69	0	13	11	3	1	28	0	39	59	12	0	110	0	12	11	27	0	50	257
01:15 PM	0	0	56	12	0	68	0	9	12	1	2	24	0	31	65	6	2	104	0	12	7	32	0	51	247
01:30 PM	0	2	51	19	0	72	0	9	10	0	1	20	0	27	60	16	0	103	0	15	10	37	0	62	257
01:45 PM	0	1	61	13	1	76	0	10	10	1	0	21	0	25	54	17	0	96	0	15	11	42	0	68	261
Total	0	4	224	56	1	285	0	41	43	5	4	93	0	122	238	51	2	413	0	54	39	138	0	231	1022
02:00 PM	0	1	53	16	0	70	0	9	9	1	1	20	0	26	59	18	0	103	0	14	11	40	5	70	263
02:15 PM	0	1	57	11	0	69	0	12	10	2	2	26	0	39	52	15	4	110	0	10	11	39	0	60	265
02:30 PM	0	1	57	6	0	64	0	9	12	0	2	23	0	38	70	11	5	124	0	10	15	40	1	66	277
02:45 PM	0	2	80	12	0	94	0	14	19	5	2	40	0	37	65	14	6	122	0	16	16	40	1	73	329
Total	0	5	247	45	0	297	0	44	50	8	7	109	0	140	246	58	15	459	0	50	53	159	7	269	1134
03:00 PM	0	2	85	18	0	105	0	9	9	1	0	19	0	44	57	18	0	119	0	15	12	43	0	70	313
03:15 PM	0	3	76	8	0	87	0	10	10	0	0	20	0	49	65	14	0	128	0	21	13	43	0	77	312
03:30 PM	0	1	80	14	0	95	0	13	6	0	3	22	0	37	64	15	3	119	0	9	14	54	0	77	313
03:45 PM	0	1	94	26	0	121	0	8	14	4	0	26	0	52	50	15	1	118	1	18	11	49	0	79	344
Total	0	7	335	66	0	408	0	40	39	5	3	87	0	182	236	62	4	484	1	63	50	189	0	303	1282
04:00 PM	0	0	94	12	0	106	0	10	14	3	0	27	0	59	67	25	0	151	0	17	21	70	0	108	392
04:15 PM	0	1	101	12	0	114	0	12	11	1	0	24	0	61	68	17	0	146	0	22	20	50	5	97	381
04:30 PM	0	3	125	26	0	154	0	17	8	3	1	29	0	39	88	16	3	146	0	16	19	63	0	98	427
04:45 PM	0	5	111	22	0	138	0	12	19	4	0	35	0	50	73	17	0	140	0	26	28	80	0	134	447
Total	0	9	431	72	0	512	0	51	52	11	1	115	0	209	296	75	3	583	0	81	88	263	5	437	1647
05:00 PM	0	1	137	15	0	153	0	14	16	3	0	33	0	47	83	16	0	146	0	17	17	72	2	108	440
05:15 PM	0	1	136	13	0	150	0	27	13	1	0	41	0	54	92	17	1	164	0	27	26	71	0	124	479
05:30 PM	0	2	131	17	0	150	0	22	13	1	0	36	0	40	75	13	1	129	0	24	34	72	0	130	445
05:45 PM	0	2	128	24	0	154	0	11	15	2	0	28	0	55	68	23	3	149	0	30	22	55	1	108	439
Total	0	6	532	69	0	607	0	74	57	7	0	138	0	196	318	69	5	588	0	98	99	270	3	470	1803
06:00 PM	0	1	77	19	0	97	2	11	14	2	0	29	0	42	58	20	0	120	2	7	31	53	0	93	339
06:15 PM	0	4	74	18	0	96	0	13	16	1	1	31	0	52	71	16	2	141	0	15	18	41	1	75	343
06:30 PM	0	2	77	18	0	97	0	18	15	2	2	37	0	38	59	15	2	114	0	16	19	30	0	65	313
06:45 PM	0	1	64	25	0	90	0	12	9	0	0	21	0	22	56	15	0	93	0	15	16	37	0	68	272
Total	0	8	292	80	0	380	2	54	54	5	3	118	0	154	244	66	4	468	2	53	84	161	1	301	1267
07:00 PM	0	3	43	6	0	52	0	13	14	1	0	28	0	32	46	7	2	87	1	12	14	35	0	62	229
07:15 PM	0	1	41	15	0	57	0	5	12	3	8	28	0	29	46	12	7	94	0	14	9	28	0	51	230
07:30 PM	0	2	47	13	0	62	0	9	20	0	1	30	0	27	56	10	2	95	0	13	11	31	0	55	242

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CSAH 11 & Burnsville Pkwy
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Groups Printed- Cars + - Trucks

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
07:45 PM	0	4	35	11	0	50	0	7	10	1	2	20	0	28	61	12	0	101	0	11	8	24	1	44	215
Total	0	10	166	45	0	221	0	34	56	5	11	106	0	116	209	41	11	377	1	50	42	118	1	212	916
08:00 PM	0	1	35	7	0	43	0	10	13	2	5	30	0	31	42	15	2	90	0	9	9	28	0	46	209
08:15 PM	0	1	47	10	0	58	0	6	13	2	1	22	0	21	50	13	0	84	0	16	13	29	1	59	223
08:30 PM	0	2	48	4	0	54	0	8	5	1	1	15	0	18	46	7	3	74	0	7	8	18	0	33	176
08:45 PM	0	0	38	7	0	45	0	5	3	0	2	10	0	19	27	13	0	59	0	11	11	21	0	43	157
Total	0	4	168	28	0	200	0	29	34	5	9	77	0	89	165	48	5	307	0	43	41	96	1	181	765
09:00 PM	0	1	47	4	0	52	0	4	6	2	0	12	0	18	37	9	1	65	0	2	10	20	0	32	161
09:15 PM	0	1	34	7	0	42	0	7	0	1	0	8	0	21	30	11	0	62	0	8	3	21	0	32	144
09:30 PM	0	0	26	5	0	31	0	4	7	1	4	16	0	19	23	5	0	47	0	10	5	21	0	36	130
09:45 PM	0	0	23	8	0	31	0	3	4	0	0	7	0	21	20	5	0	46	0	8	3	12	0	23	107
Total	0	2	130	24	0	156	0	18	17	4	4	43	0	79	110	30	1	220	0	28	21	74	0	123	542
10:00 PM	0	1	29	10	0	40	0	4	1	2	0	7	0	17	17	3	0	37	0	10	7	19	0	36	120
10:15 PM	0	1	16	3	0	20	0	4	6	0	0	10	0	24	25	5	0	54	0	6	5	11	0	22	106
10:30 PM	0	0	17	5	0	22	0	1	2	1	1	5	0	14	22	3	0	39	0	4	4	17	0	25	91
10:45 PM	0	2	14	4	0	20	0	2	3	4	1	10	0	13	19	2	0	34	0	2	2	11	0	15	79
Total	0	4	76	22	0	102	0	11	12	7	2	32	0	68	83	13	0	164	0	22	18	58	0	98	396
11:00 PM	0	2	15	1	0	18	0	2	2	2	0	6	0	16	16	3	0	35	0	5	1	19	0	25	84
11:15 PM	0	0	12	3	0	15	0	1	2	1	0	4	0	8	11	0	0	19	0	4	5	5	0	14	52
11:30 PM	0	1	17	1	0	19	0	1	0	0	0	1	0	12	11	4	0	27	0	5	1	2	0	8	55
11:45 PM	0	0	4	0	0	4	0	0	0	0	0	0	0	8	6	0	0	14	0	3	0	4	1	8	26
Total	0	3	48	5	0	56	0	4	4	3	0	11	0	44	44	7	0	95	0	17	7	30	1	55	217
Grand Total	1	90	4040	773	3	4907	2	723	735	132	70	1662	0	2478	4570	739	67	7854	6	931	803	2507	27	4274	18697
Apprch %	0	1.8	82.3	15.8	0.1		0.1	43.5	44.2	7.9	4.2		0	31.6	58.2	9.4	0.9		0.1	21.8	18.8	58.7	0.6		
Total %	0	0.5	21.6	4.1	0	26.2	0	3.9	3.9	0.7	0.4	8.9	0	13.3	24.4	4	0.4	42	0	5	4.3	13.4	0.1	22.9	
Cars +	1	86	3936	762	0	4785	2	704	721	129	45	1601	0	2440	4451	719	31	7641	6	921	790	2461	18	4196	18223
% Cars +	100	95.6	97.4	98.6	0	97.5	100	97.4	98.1	97.7	64.3	96.3	0	98.5	97.4	97.3	46.3	97.3	100	98.9	98.4	98.2	66.7	98.2	97.5
Trucks	0	4	104	11	3	122	0	19	14	3	25	61	0	38	119	20	36	213	0	10	13	46	9	78	474
% Trucks	0	4.4	2.6	1.4	100	2.5	0	2.6	1.9	2.3	35.7	3.7	0	1.5	2.6	2.7	53.7	2.7	0	1.1	1.6	1.8	33.3	1.8	2.5

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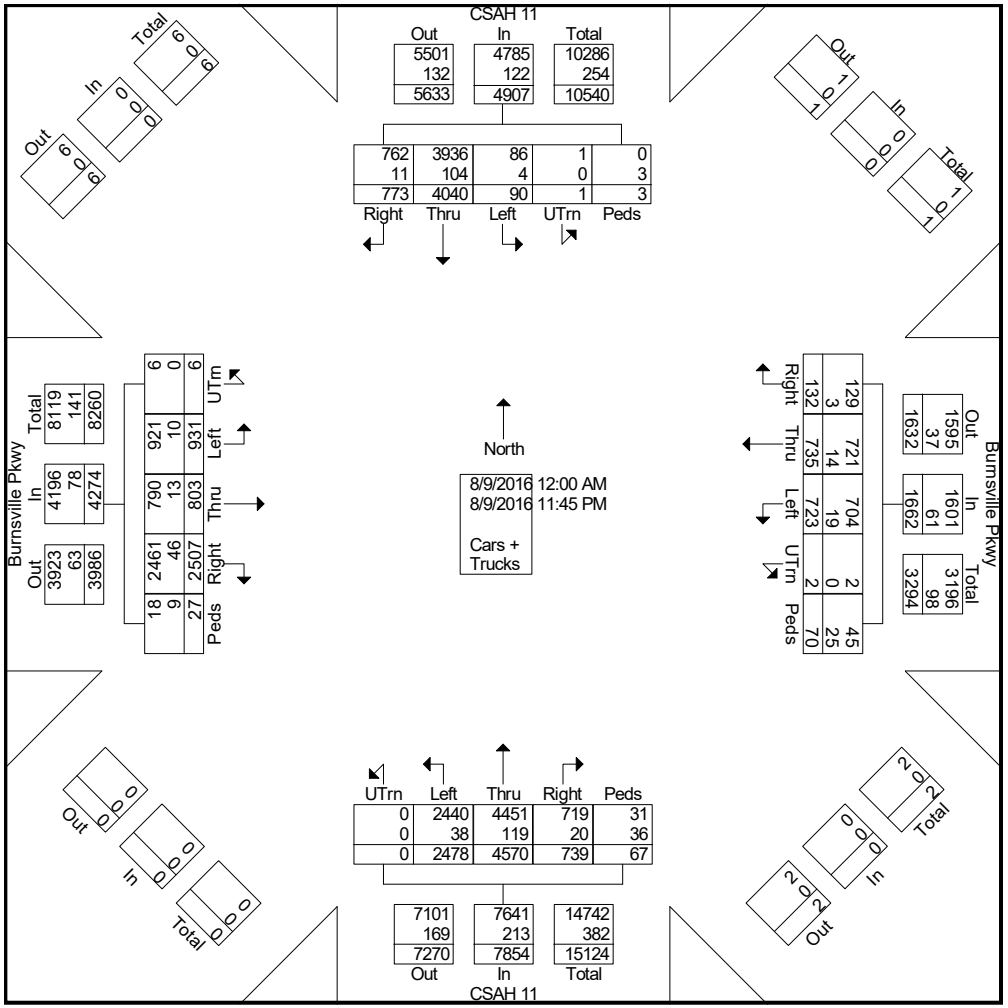

File Name : CSAH 11 & Burnsville Pkwy, 8-9-16
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CSAH 11 & Burnsville Pkwy
Burnsville, MN

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 AM to 09:45 AM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 07:15 AM																									
07:15 AM	0	0	47	5	0	52	0	12	9	4	2	27	0	48	154	2	0	204	0	14	2	29	0	45	328
07:30 AM	0	0	50	12	0	62	0	14	12	1	0	27	0	55	160	6	1	222	0	21	11	44	0	76	387
07:45 AM	0	1	51	10	0	62	0	9	14	2	0	25	0	55	155	11	0	221	0	22	5	38	0	65	373
08:00 AM	0	0	35	8	0	43	0	14	7	7	0	28	0	61	114	9	0	184	0	14	11	19	0	44	299
Total Volume	0	1	183	35	0	219	0	49	42	14	2	107	0	219	583	28	1	831	0	71	29	130	0	230	1387
% App. Total	0	0.5	83.6	16	0		0	45.8	39.3	13.1	1.9		0	26.4	70.2	3.4	0.1		0	30.9	12.6	56.5	0		
PHF	.000	.250	.897	.729	.000	.883	.000	.875	.750	.500	.250	.955	.000	.898	.911	.636	.250	.936	.000	.807	.659	.739	.000	.757	.896

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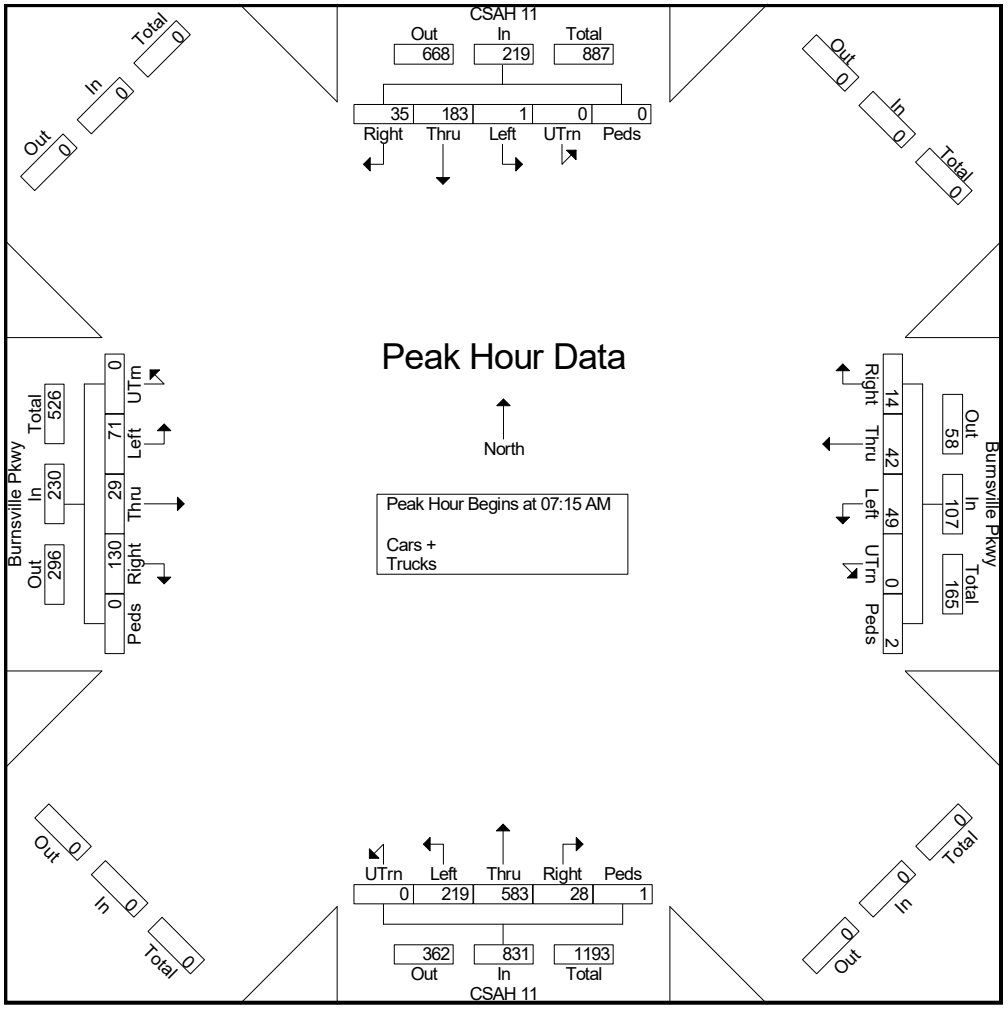
CSAH 11 & Burnsville Pkwy
Burnsville, MN



File Name : CSAH 11 & Burnsville Pkwy, 8-9-16
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CSAH 11 & Burnsville Pkwy
Burnsville, MN

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 12:00 PM																									
12:00 PM	0	2	60	12	0	74	0	7	7	2	0	16	0	33	69	13	1	116	0	13	16	36	0	65	271
12:15 PM	0	1	51	17	0	69	0	7	13	0	2	22	0	30	67	16	1	114	0	9	12	31	0	52	257
12:30 PM	0	3	57	7	0	67	0	15	15	1	4	35	0	32	41	6	0	79	0	13	11	45	0	69	250
12:45 PM	0	5	58	11	0	74	0	14	10	4	1	29	0	47	67	7	1	122	0	11	12	44	0	67	292
Total Volume	0	11	226	47	0	284	0	43	45	7	7	102	0	142	244	42	3	431	0	46	51	156	0	253	1070
% App. Total	0	3.9	79.6	16.5	0		0	42.2	44.1	6.9	6.9		0	32.9	56.6	9.7	0.7		0	18.2	20.2	61.7	0		
PHF	.000	.550	.942	.691	.000	.959	.000	.717	.750	.438	.438	.729	.000	.755	.884	.656	.750	.883	.000	.885	.797	.867	.000	.917	.916

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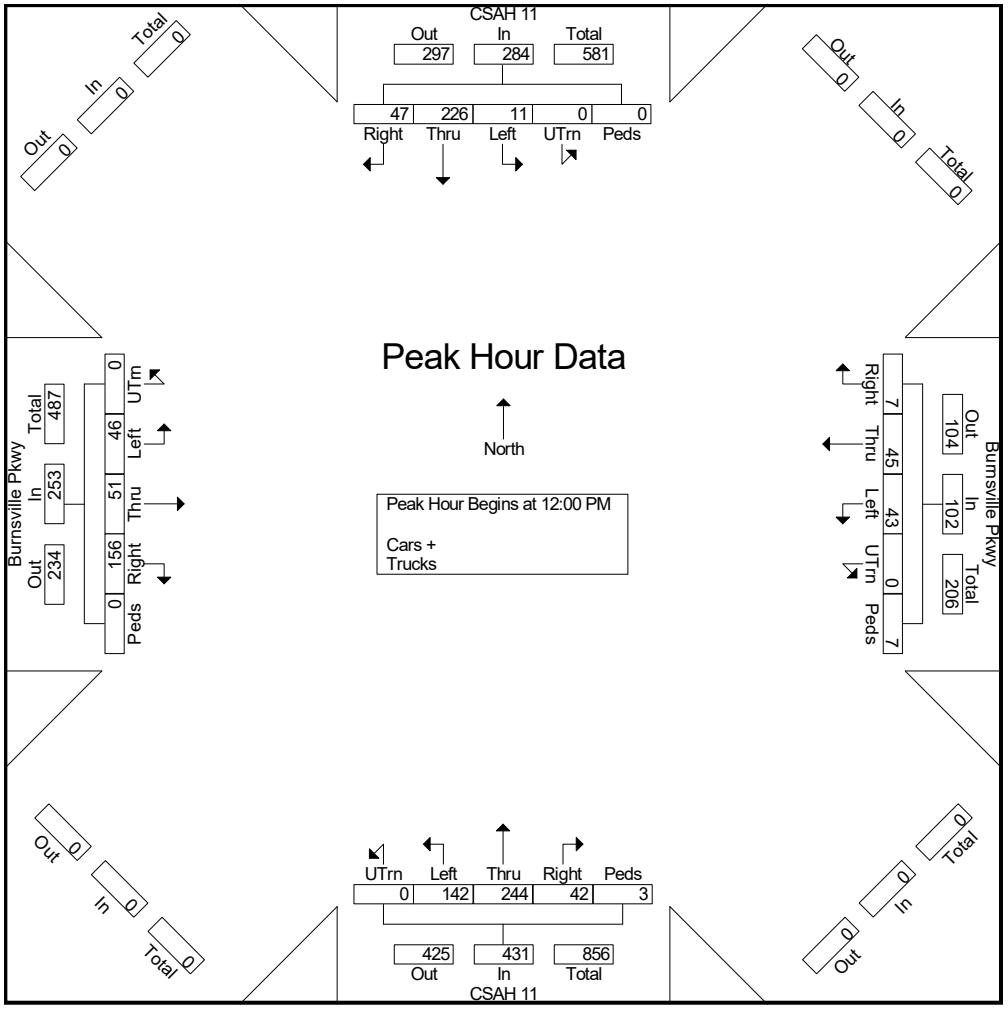
CSAH 11 & Burnsville Pkwy
Burnsville, MN



File Name : CSAH 11 & Burnsville Pkwy, 8-9-16
Site Code :
Start Date : 8/9/2016
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CSAH 11 & Burnsville Pkwy
Burnsville, MN

	CSAH 11 Southbound						Burnsville Pkwy Westbound						CSAH 11 Northbound						Burnsville Pkwy Eastbound						
Start Time	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	UTrn	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 11:45 PM - Peak 1 of 1																									
Peak Hour for Entire Intersection Begins at 04:45 PM																									
04:45 PM	0	5	111	22	0	138	0	12	19	4	0	35	0	50	73	17	0	140	0	26	28	80	0	134	447
05:00 PM	0	1	137	15	0	153	0	14	16	3	0	33	0	47	83	16	0	146	0	17	17	72	2	108	440
05:15 PM	0	1	136	13	0	150	0	27	13	1	0	41	0	54	92	17	1	164	0	27	26	71	0	124	479
05:30 PM	0	2	131	17	0	150	0	22	13	1	0	36	0	40	75	13	1	129	0	24	34	72	0	130	445
Total Volume	0	9	515	67	0	591	0	75	61	9	0	145	0	191	323	63	2	579	0	94	105	295	2	496	1811
% App. Total	0	1.5	87.1	11.3	0		0	51.7	42.1	6.2	0		0	33	55.8	10.9	0.3		0	19	21.2	59.5	0.4		
PHF	.000	.450	.940	.761	.000	.966	.000	.694	.803	.563	.000	.884	.000	.884	.878	.926	.500	.883	.000	.870	.772	.922	.250	.925	.945

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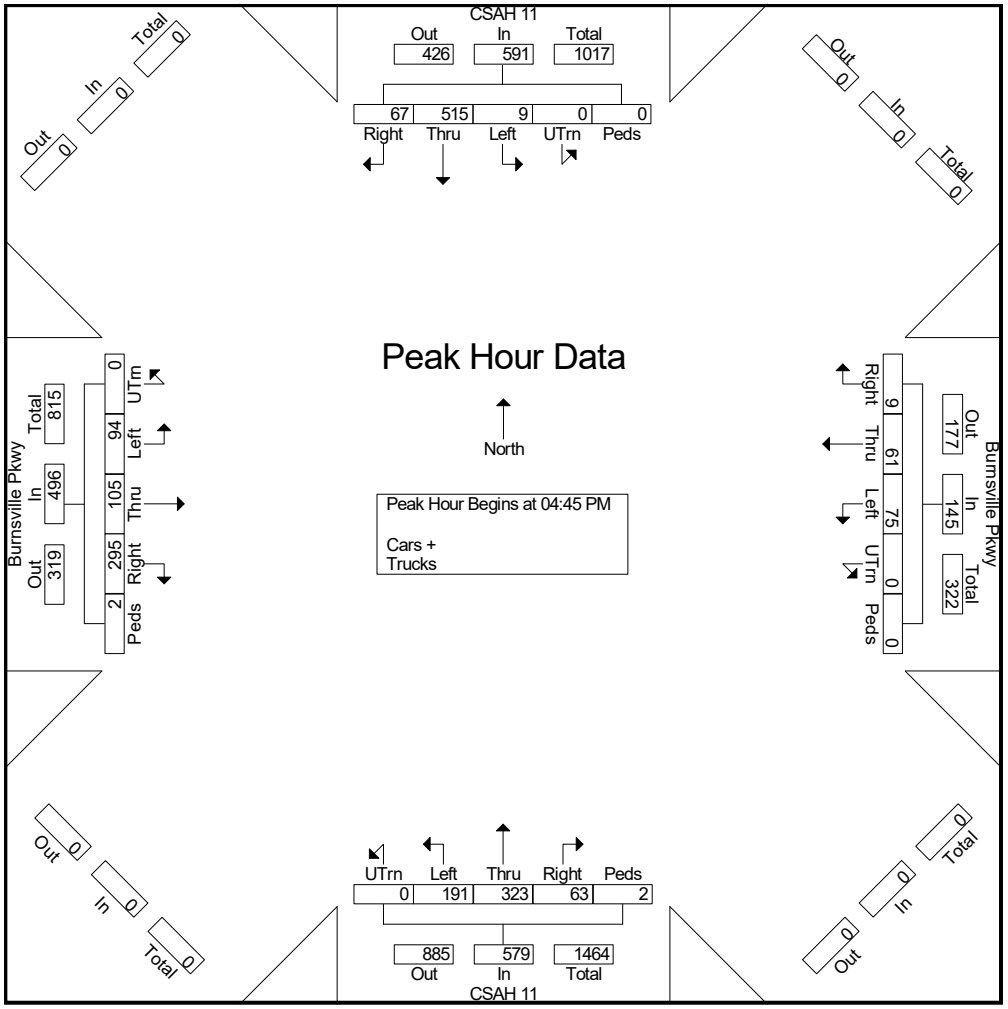
CSAH 11 & Burnsville Pkwy
Burnsville, MN



Appendix C - Field Review Notes

Burnsville Aging Signals Field Review

Conducted 7/20/2016 during AM and PM peak hour

CSAH 5 and Burnsville Parkway

1. AM Peak (7:25 – 7:40 AM)
    a. Barely any pedestrians, only observed one crossing during this time.
    b. Northbound through movement had highest volume and largest queues, consistent with a morning commuter pattern toward the downtowns.
    c. Signal operated well with all queues clearing during their green phase.
    d. Potential to install Flashing Yellow Arrow (FYA) phasing due to the number of gaps in traffic flow. There were plenty of spaces for vehicles to make a permissive left turn movement but were held in queue due to the current protected signal.
    e. Observed queues:
        i. Mainline thru: 3-6 vehicles SB, 7-10 vehicles NB
        ii. Mainline left turn: 2-6 vehicles SB, 1-3 vehicles NB
        iii. Cross Street: 1-3 vehicles WB, 3-7 vehicles EB
        iv. Cross Street left turn: 1-2 vehicles WB, 2-5 vehicles EB
2. PM Peak (5:05 – 5:20 PM)
    a. Noticeably higher traffic overall compared to observed traffic during the AM Peak. Southbound through movement had the highest volume and longest queues, again consistent with commuter patterns.
    b. Signal operated well with all queues clearing during their green phase.
    c. Cross street volume appears to support FYA due to noticeable gaps in east-west traffic flow.
    d. Fewer gaps available in north-south traffic, but FYA may still provide a small benefit if implemented.
    e. Very few pedestrians, again only observed a couple crossings during this time.
    f. Observed queues:
        i. Mainline thru: 8-15 vehicles SB, 5-10 vehicles NB
        ii. Mainline left turn: 2-3 vehicles SB, 1-2 vehicles NB
        iii. Cross Street: 3-8 vehicles WB, 3-8 vehicles EB
        iv. Cross Street left turn: 4-7 vehicles WB, 2-5 vehicles EB
3. General Notes
    a. No operational concerns during the peak periods.
    b. The adjacent signal at CSAH 5/136th Street primarily rests in the north-south green phase, meaning little chance for platooning between intersections.
    c. The lack of northbound and southbound right turn lanes did not appear to impact operations.
    d. The right turn channelizing islands for the eastbound-westbound approaches helped to correctly position vehicles for their turning movement.

Appendix C - Field Review Notes

Burnsville Aging Signals Field Review

Conducted 7/20/2016 during AM and PM peak hour

CSAH 5 and 136th Street

1. AM Peak (7:45 – 8:00 AM)
    a. Only a small number of eastbound-westbound vehicles observed compared to the CSAH 5 traffic.
    b. No pedestrians were observed during this time.
    c. The signal primarily rested in a green phase for northbound-southbound traffic on CSAH 5.
    d. The signal operated well with all queues clearing during their green phase.
    e. The left turn movements on CSAH 5 could benefit from FYA operation due to noticeable gaps in traffic flow. Currently during these times, left turn traffic is held in the queue with the protected only left turn phasing.
    f. Observed queues:
        i. Mainline thru: 1-3 vehicles SB, 4-7 vehicles NB
        ii. Mainline left turn: 1-2 vehicles SB, 1-2 vehicles NB
        iii. Cross Street: 1-3 vehicles WB, 1 vehicles EB
        iv. Cross Street left turn: 1-3 vehicles WB, 1 vehicles EB
2. PM Peak (5:25 – 5:40 PM)
    a. The wide westbound approach on the 136th Street operates as two lanes (one left turn/thru lane and one right turn lane).
    b. The signal primarily rests in a green phase for northbound-southbound traffic on CSAH 5.
    c. Majority of right turning traffic on 136th Street can complete their movement on the red and do not need a green light to proceed.
    d. The signal operated well with all queues clearing during their green phase.
    e. Observed queues:
        i. Mainline thru: 3-5 vehicles SB, 2-7 vehicles NB
        ii. Mainline left turn: 1-3 vehicles SB, 1-2 vehicles NB
        iii. Cross Street: 1-2 vehicles WB, 1-2 vehicles EB
        iv. Cross Street left turn: 1-2 vehicles WB, 2-4 vehicles EB
3. General Notes
    a. No operational concerns during the peak periods.
    b. A small platooning effect noticeable for southbound traffic from the adjacent CSAH 5/Burnsville Parkway intersection. However, since this signal primarily rests in the north-south green phase, there is little operational benefit from this platooning between intersections.
    c. The lack of northbound and southbound right turn lanes did not appear to impact operations.
    d. Due to low volumes on 136th Street, a traffic signal does not appear justified at this location. There appears to be available gaps in the CSAH 5 traffic flow to allow for side-street turning movements across the intersection. Volumes on 136th Street are also low, with few calls for a 136th Street green light.

Appendix C - Field Review Notes

Burnsville Aging Signals Field Review

Conducted 7/20/2016 during AM and PM peak hour

CSAH 11 and Burnsville Parkway

1. AM Peak (7:00 – 7:15 AM)
    a. CSAH 11 could benefit from FYA operation due to plenty of gaps for left turning vehicles. Under the current protected only operation, cars are held in a queue instead of being able to proceed during these gaps.
    b. Only one observed pedestrian crossing during this time.
    c. Generally low volumes (compared to CSAH 5/Burnsville Parkway) with all queues clearing during their green phase.
    d. Observed queues:
        i. Mainline thru: 1-3 vehicles
        ii. Mainline left turn: 2-7 vehicles
        iii. Cross Street: 1-3 vehicles
        iv. Cross Street left turn: 1-4 vehicles
2. PM Peak (4:45 – 5:00 PM)
    a. Higher traffic volume compared to the AM peak period.
    b. All vehicle queues can clear during their green phase.
    c. Volume appears to support FYA operation due to sufficient gaps in the through traffic flow for permissive left turn movements.
    d. Three pedestrian crossings observed during this time.
    e. Observed queues:
        i. Mainline thru: 1-7 vehicles
        ii. Mainline left turn: 3-9 vehicles
        iii. Cross Street: 2-5 vehicles
        iv. Cross Street left turn: 1-4 vehicles
3. General Notes
    a. No operational concerns during the peak periods.
    b. The lack of dedicated right turn lanes did not appear to impact operations.
    c. Sight distance for the westbound left turn movement appears limited by a slight grade change on the west approach to the intersection. However, sufficient sight distance is available to complete the left turn movement safely. Drivers were observed easily completing this movement without appearing to have issues and driving the movement firsthand felt safe and did not raise issues.

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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals.vistro
Report File: C:\...\AM Existing.pdf

Scenario 1: AM Existing
8/18/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	NB Left	0.396	20.4	C
2	CSAH 5 & 136th St	Signalized	HCM 2010	SB Left	0.294	9.2	A
3	CSAH 11 & Burnsville Pkwy	Signalized	HCM 2010	SB Left	0.270	12.2	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	20.4
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.396

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	100.0	350.0	100.0	100.0	100.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	30	0	0	0	14	0	0	0	4	0	0	0	41
Total Hourly Volume [veh/h]	1	5	666	89	0	57	281	42	0	112	379	4	0	39	199	41
Peak Hour Factor	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	0	1	185	25	0	16	78	12	0	31	105	1	0	11	55	11
Total Analysis Volume [veh/h]	1	6	740	99	0	63	312	47	0	124	421	4	0	43	221	46
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0				0			
Bicycle Volume [bicycles/h]	0				1				0				0			

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	5.00	6.00	6.00	5.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00
g_i, Effective Green Time [s]	1	23	23	3	26	26	6	13	13	3	10	10
g / C, Green / Cycle	0.01	0.36	0.36	0.05	0.40	0.40	0.09	0.20	0.20	0.04	0.15	0.15
(v / s)_i Volume / Saturation Flow Rate	0.00	0.23	0.23	0.03	0.10	0.10	0.07	0.10	0.00	0.02	0.06	0.03
s, saturation flow rate [veh/h]	1732	1829	1754	2200	1841	1752	1745	4200	1557	1733	3540	1569
c, Capacity [veh/h]	16	655	628	117	740	704	161	858	318	73	547	242
d1, Uniform Delay [s]	31.56	13.76	13.76	29.10	9.72	9.73	28.51	22.60	20.39	30.23	24.50	23.66
k, delay calibration	0.04	0.39	0.39	0.08	0.39	0.39	0.04	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	6.61	3.98	4.15	2.87	0.62	0.67	2.96	1.58	0.06	2.79	1.74	1.36
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.43	0.65	0.65	0.54	0.25	0.25	0.77	0.49	0.01	0.59	0.40	0.19
d, Delay for Lane Group [s/veh]	38.17	17.74	17.92	31.97	10.34	10.40	31.48	24.18	20.45	33.01	26.24	25.02
Lane Group LOS	D	B	B	C	B	B	C	C	C	C	C	C
Critical Lane Group	No	No	Yes	Yes	No	No	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.13	4.12	3.98	0.94	1.22	1.19	1.88	2.78	0.05	0.66	1.51	0.65
50th-Percentile Queue Length [ft]	3.21	102.90	99.52	23.49	30.43	29.71	46.94	69.43	1.23	16.55	37.86	16.18
95th-Percentile Queue Length [veh]	0.23	7.41	7.17	1.69	2.19	2.14	3.38	5.00	0.09	1.19	2.73	1.17
95th-Percentile Queue Length [ft]	5.78	185.21	179.14	42.29	54.77	53.47	84.49	124.97	2.22	29.79	68.14	29.13

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	38.17	38.17	17.81	17.92	31.97	31.97	10.37	10.40	31.48	31.48	24.18	20.45	33.01	33.01	26.24	25.02
Movement LOS	D	D	B	B	C	C	B	B	C	C	C	C	C	C	C	C
d_A, Approach Delay [s/veh]	17.99				13.60				25.80				27.00			
Approach LOS	B				B				C				C			
d_I, Intersection Delay [s/veh]	20.45															
Intersection LOS	C															
Intersection V/C	0.396															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Signalized	Delay (sec / veh):	9.2
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.294

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	1	0	0	0
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	25.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	5	0	0	0	1	0	0	20	0	0	11
Total Hourly Volume [veh/h]	0	21	737	15	1	13	309	2	2	2	20	26	14	32
Peak Hour Factor	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.9080	0.9080	0.9080	0.9080	0.9080	0.9080
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	6	203	4	0	4	85	1	1	1	6	7	4	9
Total Analysis Volume [veh/h]	0	23	812	17	1	14	340	2	2	2	22	29	15	35
Presence of On-Street Parking	No			No	No			No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0			1		
Bicycle Volume [bicycles/h]	0				0				0			0		

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	1	6	0	0	5	2	0	0	4	0	0	4	0
Auxiliary Signal Groups														
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	15	0	0	5	15	0	0	7	0	0	7	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	35	0	0	35	0
Amber [s]	0.0	3.0	4.5	0.0	0.0	3.0	4.5	0.0	0.0	3.5	0.0	0.0	3.5	0.0
All red [s]	0.0	2.0	1.5	0.0	0.0	2.0	1.5	0.0	0.0	1.5	0.0	0.0	1.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	5.0	0.0	0.0	2.0	5.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	0	10	0	0	0	10	0	0	16	0	0	16	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No	No			No	No			No			No	
Maximum Recall		No	No			No	No			No			No	
Pedestrian Recall		No	Yes			No	Yes			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	C	R	C
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	1	15	15	1	15	15	5	5	5
g / C, Green / Cycle	0.03	0.41	0.41	0.02	0.40	0.40	0.13	0.13	0.13
(v / s)_i Volume / Saturation Flow Rate	0.01	0.23	0.23	0.01	0.09	0.09	0.00	0.01	0.06
s, saturation flow rate [veh/h]	1781	1841	1828	1744	1839	1836	1746	1590	1336
c, Capacity [veh/h]	54	761	756	36	743	741	373	205	307
d1, Uniform Delay [s]	17.45	8.14	8.14	17.58	5.45	5.45	13.92	14.09	14.75
k, delay calibration	0.04	0.23	0.23	0.04	0.23	0.23	0.13	0.13	0.13
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.99	1.31	1.32	2.80	0.33	0.34	0.01	0.28	0.53
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.43	0.55	0.55	0.41	0.23	0.23	0.01	0.11	0.26
d, Delay for Lane Group [s/veh]	19.44	9.45	9.46	20.38	5.78	5.79	13.94	14.36	15.28
Lane Group LOS	B	A	A	C	A	A	B	B	B
Critical Lane Group	No	No	Yes	Yes	No	No	No	No	Yes
50th-Percentile Queue Length [veh]	0.18	1.55	1.55	0.12	0.42	0.42	0.03	0.15	0.54
50th-Percentile Queue Length [ft]	4.39	38.85	38.63	3.09	10.55	10.54	0.63	3.71	13.46
95th-Percentile Queue Length [veh]	0.32	2.80	2.78	0.22	0.76	0.76	0.05	0.27	0.97
95th-Percentile Queue Length [ft]	7.91	69.94	69.54	5.57	18.98	18.97	1.14	6.68	24.23

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	19.44	19.44	9.45	9.46	20.38	20.38	5.78	5.79	13.94	13.94	14.36	15.28	15.28	15.28
Movement LOS	B	B	A	A	C	C	A	A	B	B	B	B	B	B
d_A, Approach Delay [s/veh]	9.72				6.40				14.30			15.28		
Approach LOS	A				A				B			B		
d_I, Intersection Delay [s/veh]	9.24													
Intersection LOS	A													
Intersection V/C	0.294													

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	12.2
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.270

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	1	0	0	1	0	0
Pocket Length [ft]	250.00	100.00	100.00	150.00	100.00	100.00	100.00	100.00	100.00	175.00	100.00	100.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	7	0	0	9	0	0	33	0	0	4
Total Hourly Volume [veh/h]	219	583	21	1	183	26	71	29	97	49	42	10
Peak Hour Factor	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	61	163	6	0	51	7	20	8	27	14	12	3
Total Analysis Volume [veh/h]	244	651	23	1	204	29	79	32	108	55	47	11
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			2		
Bicycle Volume [bicycles/h]	1			0			0			0		

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	5	2	0	1	6	0	0	4	0	0	8	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	5	15	0	5	15	0	0	8	0	0	5	0
Maximum Green [s]	40	65	0	25	50	0	0	35	0	0	35	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
All red [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	2.0	5.0	0.0	2.0	6.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	22	0	0	22	0	0	18	0	0	18	0
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	4.0	0.0	3.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Minimum Recall	No	No		No	No			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	C	L	C	C
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
g_i, Effective Green Time [s]	8	22	22	0	14	14	8	8	8	8	8	8
g / C, Green / Cycle	0.17	0.47	0.47	0.00	0.31	0.31	0.16	0.16	0.16	0.16	0.16	0.16
(v / s)_i Volume / Saturation Flow Rate	0.14	0.18	0.18	0.00	0.06	0.07	0.06	0.02	0.07	0.04	0.02	0.02
s, saturation flow rate [veh/h]	1783	1852	1828	1733	1852	1773	1352	1870	1590	1236	1865	1747
c, Capacity [veh/h]	305	879	868	3	565	541	298	302	257	227	301	282
d1, Uniform Delay [s]	17.36	5.29	5.29	23.41	12.10	12.12	19.88	16.79	17.71	21.74	16.77	16.78
k, delay calibration	0.04	0.23	0.23	0.04	0.39	0.39	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.85	0.59	0.60	24.47	0.66	0.71	0.47	0.15	1.10	0.55	0.14	0.16
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.80	0.39	0.39	0.35	0.21	0.21	0.27	0.11	0.42	0.24	0.10	0.10
d, Delay for Lane Group [s/veh]	19.20	5.88	5.89	47.88	12.75	12.83	20.35	16.95	18.81	22.29	16.91	16.94
Lane Group LOS	B	A	A	D	B	B	C	B	B	C	B	B
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes	No	No	No
50th-Percentile Queue Length [veh]	2.10	1.10	1.09	0.03	0.82	0.81	0.73	0.26	0.96	0.56	0.24	0.24
50th-Percentile Queue Length [ft]	52.49	27.44	27.16	0.73	20.48	20.27	18.36	6.49	23.91	14.01	6.08	6.02
95th-Percentile Queue Length [veh]	3.78	1.98	1.96	0.05	1.47	1.46	1.32	0.47	1.72	1.01	0.44	0.43
95th-Percentile Queue Length [ft]	94.48	49.39	48.89	1.32	36.87	36.48	33.04	11.68	43.03	25.22	10.95	10.83

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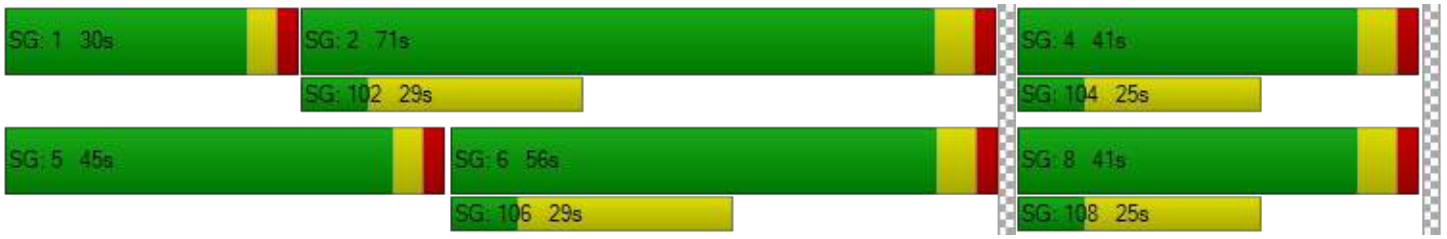
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	19.20	5.89	5.89	47.88	12.79	12.83	20.35	16.95	18.81	22.29	16.92	16.94
Movement LOS	B	A	A	D	B	B	C	B	B	C	B	B
d_A, Approach Delay [s/veh]	9.43			12.94			19.09			19.53		
Approach LOS	A			B			B			B		
d_I, Intersection Delay [s/veh]	12.18											
Intersection LOS	B											
Intersection V/C	0.270											

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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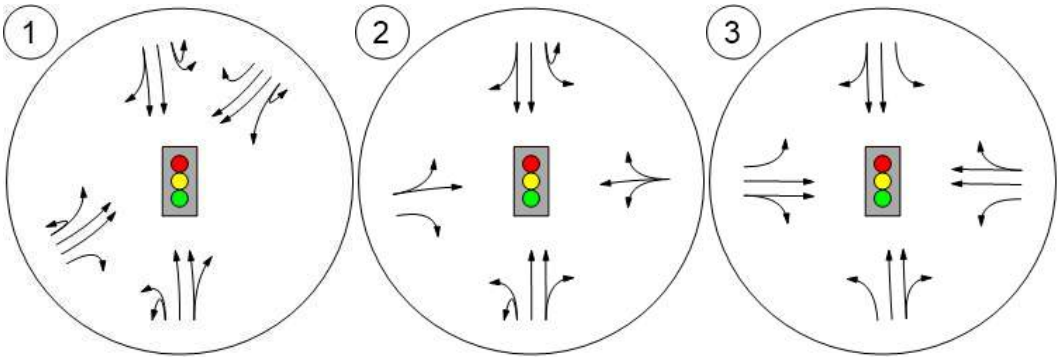
Lane Configuration and Traffic Control



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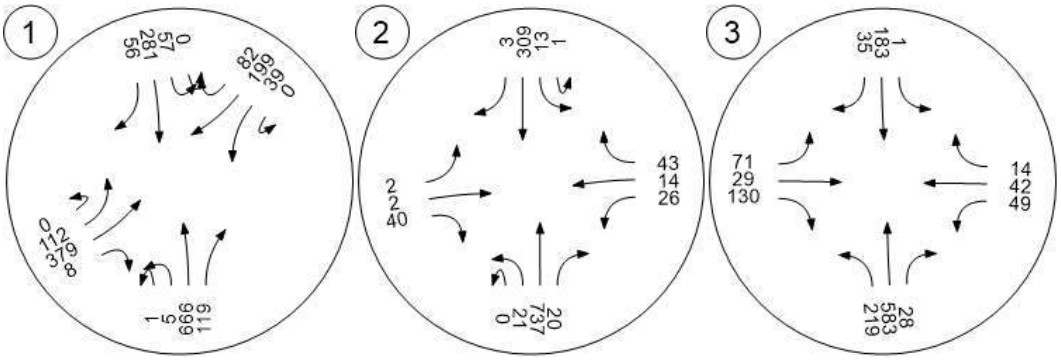
Traffic Volume - Base Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals.vistro
Report File: C:\...\PM Existing.pdf

Scenario 2: PM Existing
8/18/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	NEB Left	0.459	23.4	C
2	CSAH 5 & 136th St	Signalized	HCM 2010	NB Left	0.397	11.3	B
3	CSAH 11 & Burnsville Pkwy	Signalized	HCM 2010	SB Left	0.425	17.5	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	23.4
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.459

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	100.0	350.0	100.0	100.0	100.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	32	0	0	0	35	0	0	0	4	0	0	0	61
Total Hourly Volume [veh/h]	3	25	467	96	0	115	804	106	0	78	316	4	1	164	394	60
Peak Hour Factor	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	1	7	122	25	0	30	210	28	0	20	82	1	0	43	103	16
Total Analysis Volume [veh/h]	3	26	487	100	0	120	838	111	0	81	330	4	1	171	411	63
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	3				2				1				3			
Bicycle Volume [bicycles/h]	4				2				0				0			

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	5.00	6.00	6.00	5.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00
g_i, Effective Green Time [s]	2	24	24	5	27	27	4	11	11	9	15	15
g / C, Green / Cycle	0.03	0.34	0.34	0.08	0.38	0.38	0.06	0.15	0.15	0.12	0.22	0.22
(v / s)_i Volume / Saturation Flow Rate	0.02	0.16	0.17	0.05	0.26	0.26	0.05	0.08	0.00	0.10	0.12	0.04
s, saturation flow rate [veh/h]	1729	1829	1711	2200	1841	1760	1745	4200	1557	1734	3540	1569
c, Capacity [veh/h]	54	619	579	167	706	675	105	640	237	214	763	338
d1, Uniform Delay [s]	33.56	15.16	15.21	31.18	14.15	14.17	32.89	27.70	25.59	30.29	24.73	22.77
k, delay calibration	0.04	0.39	0.39	0.08	0.39	0.39	0.04	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	3.13	2.15	2.36	4.22	4.25	4.50	4.37	2.33	0.10	2.66	2.14	0.95
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.54	0.49	0.49	0.72	0.69	0.69	0.77	0.52	0.02	0.80	0.54	0.19
d, Delay for Lane Group [s/veh]	36.69	17.32	17.57	35.40	18.40	18.67	37.26	30.03	25.69	32.95	26.87	23.73
Lane Group LOS	D	B	B	D	B	B	D	C	C	C	C	C
Critical Lane Group	Yes	No	No	No	No	Yes	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.50	3.11	2.99	2.00	5.00	4.84	1.44	2.64	0.06	2.82	3.04	0.88
50th-Percentile Queue Length [ft]	12.48	77.70	74.64	49.99	124.89	121.08	35.89	65.98	1.53	70.42	76.07	22.12
95th-Percentile Queue Length [veh]	0.90	5.59	5.37	3.60	8.66	8.45	2.58	4.75	0.11	5.07	5.48	1.59
95th-Percentile Queue Length [ft]	22.47	139.86	134.35	89.99	216.53	211.30	64.60	118.76	2.75	126.76	136.93	39.81

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	36.69	36.69	17.41	17.57	35.40	35.40	18.52	18.67	37.26	37.26	30.03	25.69	32.95	32.95	26.87	23.73
Movement LOS	D	D	B	B	D	D	B	B	D	D	C	C	C	C	C	C
d_A, Approach Delay [s/veh]	18.35				20.43				31.40				28.18			
Approach LOS	B				C				C				C			
d_I, Intersection Delay [s/veh]	23.44															
Intersection LOS	C															
Intersection V/C	0.459															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Signalized	Delay (sec / veh):	11.3
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.397

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	1	0	0	0
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	25.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	15	0	0	0	5	0	0	38	0	0	6
Total Hourly Volume [veh/h]	1	88	567	46	2	47	892	15	3	28	37	54	17	18
Peak Hour Factor	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.9370	0.9370	0.9370	0.9370	0.9370	0.9370
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	23	151	12	1	13	238	4	1	7	10	14	5	5
Total Analysis Volume [veh/h]	1	94	605	49	2	50	952	16	3	30	39	58	18	19
Presence of On-Street Parking	No			No	No			No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	6				5				2			1		
Bicycle Volume [bicycles/h]	2				1				0			1		

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	1	6	0	0	5	2	0	0	4	0	0	4	0
Auxiliary Signal Groups														
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	15	0	0	5	15	0	0	7	0	0	7	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	35	0	0	35	0
Amber [s]	0.0	3.0	4.5	0.0	0.0	3.0	4.5	0.0	0.0	3.5	0.0	0.0	3.5	0.0
All red [s]	0.0	2.0	1.5	0.0	0.0	2.0	1.5	0.0	0.0	1.5	0.0	0.0	1.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	5.0	0.0	0.0	2.0	5.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	0	10	0	0	0	10	0	0	16	0	0	16	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No	No			No	No			No			No	
Maximum Recall		No	No			No	No			No			No	
Pedestrian Recall		No	Yes			No	Yes			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	C	R	C
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	3	19	19	2	18	18	7	7	7
g / C, Green / Cycle	0.08	0.43	0.43	0.05	0.41	0.41	0.15	0.15	0.15
(v / s)_i Volume / Saturation Flow Rate	0.05	0.18	0.18	0.03	0.26	0.26	0.02	0.02	0.08
s, saturation flow rate [veh/h]	1780	1841	1786	1743	1839	1827	1816	1571	1202
c, Capacity [veh/h]	141	800	776	95	754	749	362	237	312
d1, Uniform Delay [s]	19.89	8.66	8.67	20.06	7.80	7.81	16.30	16.41	17.53
k, delay calibration	0.04	0.23	0.23	0.04	0.23	0.23	0.13	0.13	0.13
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	2.11	0.73	0.76	1.83	1.97	1.99	0.13	0.39	0.66
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.68	0.41	0.42	0.55	0.64	0.64	0.09	0.16	0.30
d, Delay for Lane Group [s/veh]	22.00	9.39	9.43	21.89	9.78	9.80	16.43	16.80	18.19
Lane Group LOS	C	A	A	C	A	A	B	B	B
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	0.86	1.53	1.50	0.47	2.14	2.14	0.27	0.33	0.86
50th-Percentile Queue Length [ft]	21.53	38.34	37.57	11.80	53.61	53.40	6.68	8.20	21.42
95th-Percentile Queue Length [veh]	1.55	2.76	2.70	0.85	3.86	3.84	0.48	0.59	1.54
95th-Percentile Queue Length [ft]	38.76	69.00	67.62	21.24	96.50	96.11	12.02	14.76	38.55

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	22.00	22.00	9.41	9.43	21.89	21.89	9.79	9.80	16.43	16.43	16.80	18.19	18.19	18.19
Movement LOS	C	C	A	A	C	C	A	A	B	B	B	B	B	B
d_A, Approach Delay [s/veh]	11.01				10.41				16.63			18.19		
Approach LOS	B				B				B			B		
d_I, Intersection Delay [s/veh]	11.25													
Intersection LOS	B													
Intersection V/C	0.397													

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	17.5
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.425

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	1	0	0	1	0	0
Pocket Length [ft]	250.00	100.00	100.00	150.00	100.00	100.00	100.00	100.00	100.00	175.00	100.00	100.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	16	0	0	17	0	0	74	0	0	2
Total Hourly Volume [veh/h]	191	323	47	9	515	50	94	105	221	75	61	7
Peak Hour Factor	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	51	85	12	2	136	13	25	28	58	20	16	2
Total Analysis Volume [veh/h]	202	342	50	10	545	53	99	111	234	79	65	7
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	1			0			2			0		
Bicycle Volume [bicycles/h]	1			0			0			0		

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	5	2	0	1	6	0	0	4	0	0	8	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	5	15	0	5	15	0	0	8	0	0	5	0
Maximum Green [s]	40	65	0	25	50	0	0	35	0	0	35	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
All red [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	2.0	5.0	0.0	2.0	6.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	22	0	0	22	0	0	18	0	0	18	0
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	4.0	0.0	3.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Minimum Recall	No	No		No	No			No			No	
Maximum Recall	No	No		No	No			No			No	
Pedestrian Recall	No	No		No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	C	L	C	C
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
g_i, Effective Green Time [s]	8	23	23	1	16	16	14	14	14	14	14	14
g / C, Green / Cycle	0.14	0.42	0.42	0.01	0.29	0.29	0.26	0.26	0.26	0.26	0.26	0.26
(v / s)_i Volume / Saturation Flow Rate	0.11	0.11	0.11	0.01	0.16	0.16	0.07	0.06	0.15	0.08	0.02	0.02
s, saturation flow rate [veh/h]	1783	1852	1764	1733	1852	1794	1335	1870	1588	1025	1865	1802
c, Capacity [veh/h]	253	782	745	23	543	526	406	479	407	224	478	462
d1, Uniform Delay [s]	21.58	7.61	7.62	27.01	16.46	16.47	18.77	16.22	17.89	24.68	15.56	15.56
k, delay calibration	0.04	0.23	0.23	0.04	0.39	0.39	0.11	0.11	0.11	0.11	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	2.18	0.36	0.39	4.97	3.23	3.37	0.31	0.24	1.29	0.94	0.07	0.07
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.80	0.26	0.26	0.44	0.56	0.56	0.24	0.23	0.58	0.35	0.08	0.08
d, Delay for Lane Group [s/veh]	23.77	7.98	8.01	31.98	19.69	19.84	19.08	16.46	19.18	25.62	15.62	15.64
Lane Group LOS	C	A	A	C	B	B	B	B	B	C	B	B
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes	No	No	No
50th-Percentile Queue Length [veh]	2.25	0.98	0.95	0.15	3.20	3.13	0.98	0.98	2.35	0.98	0.31	0.31
50th-Percentile Queue Length [ft]	56.15	24.62	23.82	3.74	79.90	78.28	24.41	24.52	58.78	24.56	7.84	7.78
95th-Percentile Queue Length [veh]	4.04	1.77	1.72	0.27	5.75	5.64	1.76	1.77	4.23	1.77	0.56	0.56
95th-Percentile Queue Length [ft]	101.07	44.32	42.88	6.73	143.81	140.91	43.93	44.14	105.80	44.21	14.12	14.00

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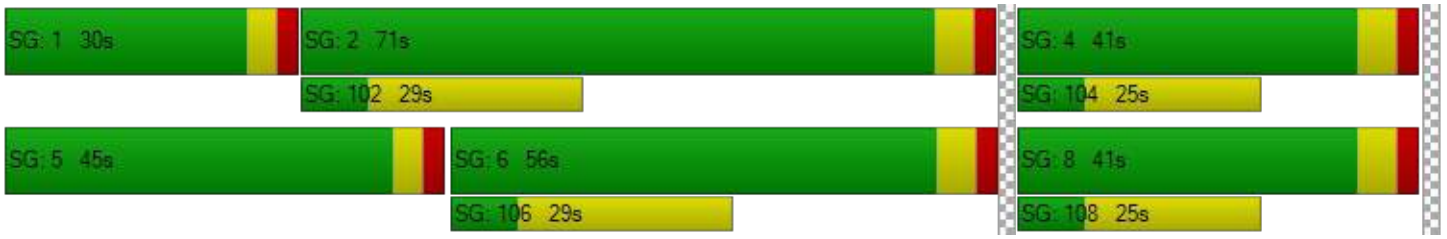
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	23.77	7.99	8.01	31.98	19.76	19.84	19.08	16.46	19.18	25.62	15.63	15.64
Movement LOS	C	A	A	C	B	B	B	B	B	C	B	B
d_A, Approach Delay [s/veh]	13.36			19.97			18.48			20.86		
Approach LOS	B			B			B			C		
d_I, Intersection Delay [s/veh]	17.49											
Intersection LOS	B											
Intersection V/C	0.425											

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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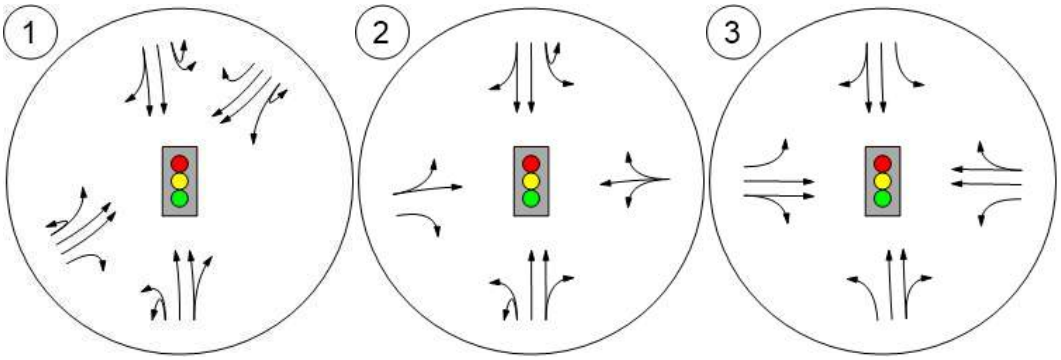
Lane Configuration and Traffic Control



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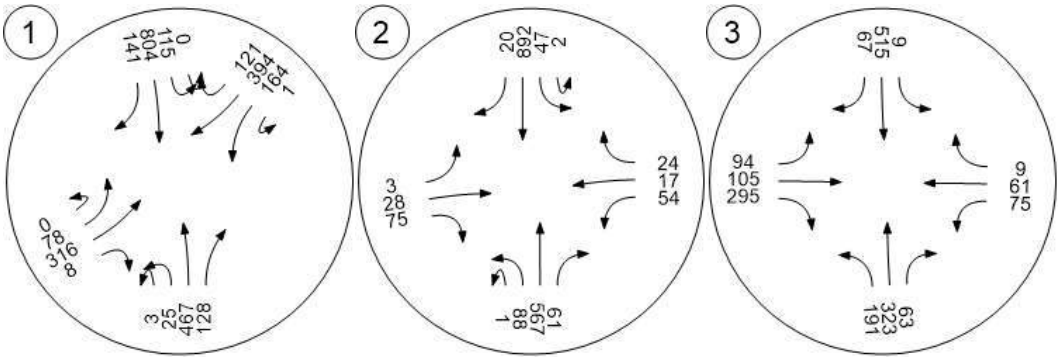
Traffic Volume - Base Volume



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Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	CSAH 5 & Burnsville Parkway
Project/File #	227-16-03
Scenario	Existing

Intersection Information			
Major Street (N/S Road)	CSAH 5	Minor Street (E/W Road)	Burnsville Parkway
Analyzed with	2 or more approach lanes	Analyzed with	2 or more approach lanes
Total Approach Volume	16205 vehicles	Total Approach Volume	10545 vehicles
Total Ped/Bike Volume	89 crossings	Total Ped/Bike Volume	64 crossings
Right turn reduction of	100 percent applied	Right turn reduction of	100 percent applied

Reduction applied to Volume Warrant thresholds due to high speeds on CSAH 5.

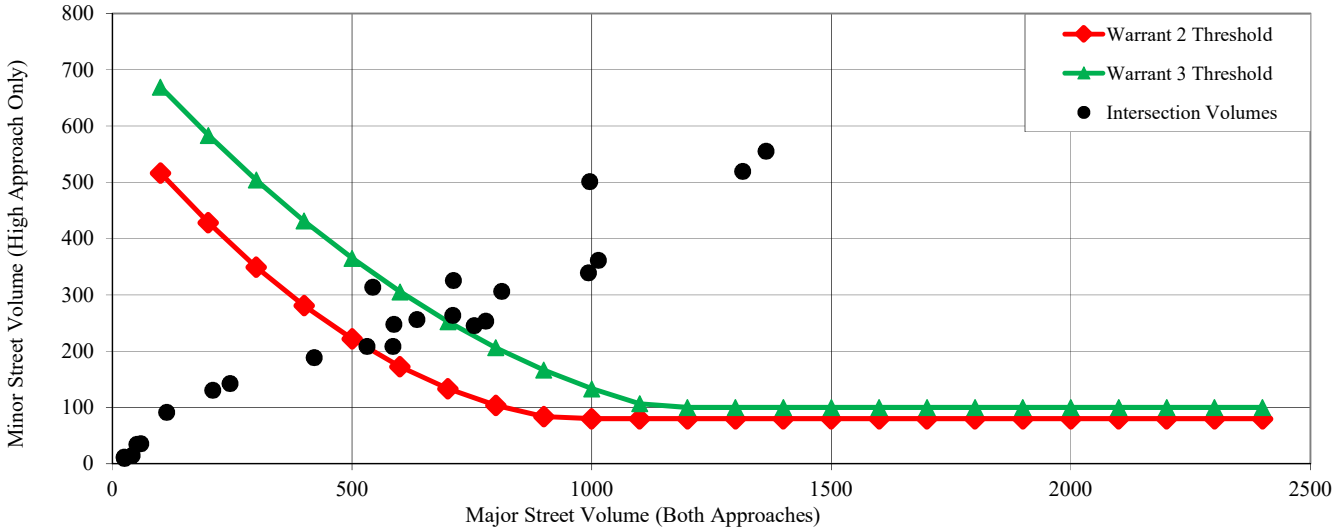
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	**Condition B**	**Condition A+B***
Condition Satisfied?	**Satisfied**	**Satisfied**	**Satisfied**
Required values reached for	16 hours	11 hours	16 (Cond. A) & 15 (Cond. B)
Criteria - Major Street (veh/hr)	420	630	336 (Cond. A) & 504 (Cond. B)
Criteria - Minor Street (veh/hr)	140	70	112 (Cond. A) & 56 (Cond. B)

* Should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	**Satisfied**
Required values reached for	15 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	**Condition B**
Condition Satisfied?	**Not Examined**	**Satisfied**
Required values reached for		10 hours
Criteria - Total Approach Volume (veh in one hour)	800	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

Figure 4C-2 (Warrant 2 - 70% Factor) & Figure 4C-4 (Warrant 3 - 70% Factor)



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Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	CSAH 5 & 136th Street
Project/File #	227-16-03
Scenario	Existing

Intersection Information			
Major Street (N/S Road)	CSAH 5	Minor Street (E/W Road)	136th Street
Analyzed with	2 or more approach lanes	Analyzed with	1 Approach Lane
Total Approach Volume	16351 vehicles	Total Approach Volume	2154 vehicles
Total Ped/Bike Volume	60 crossings	Total Ped/Bike Volume	47 crossings
Right turn reduction of	100 percent applied	Right turn reduction of	100 percent applied

Reduction applied to Volume Warrant thresholds due to high speeds on CSAH 5.

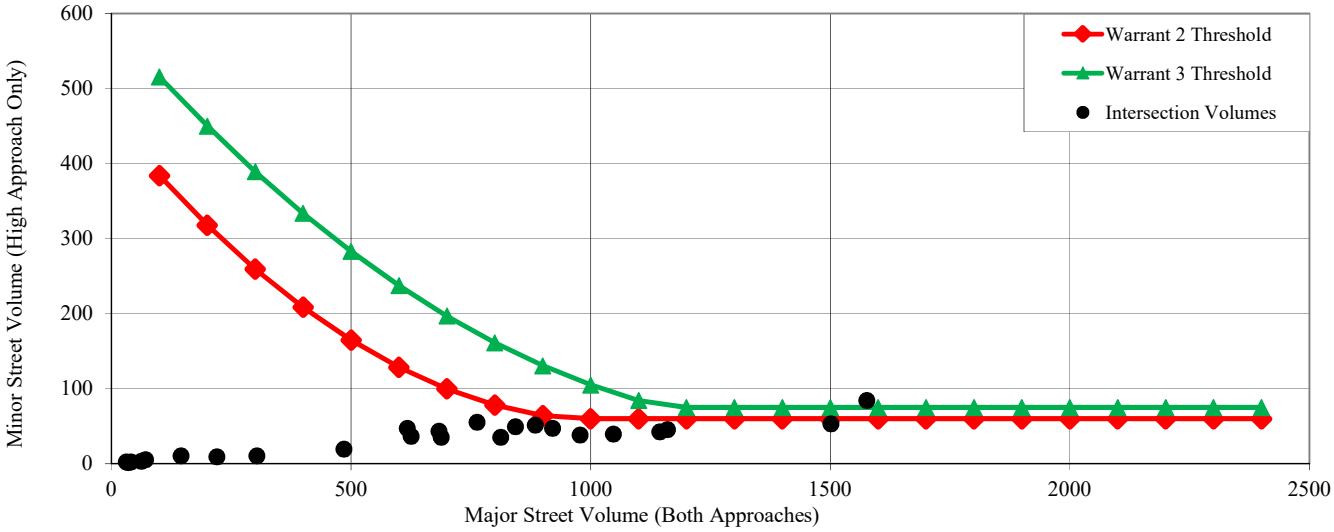
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	**Condition B**	**Condition A+B***
Condition Satisfied?	**Not satisfied**	**Not satisfied**	**Not satisfied**
Required values reached for	0 hours	3 hours	1 (Cond. A) & 10 (Cond. B)
Criteria - Major Street (veh/hr)	420	630	336 (Cond. A) & 504 (Cond. B)
Criteria - Minor Street (veh/hr)	105	53	84 (Cond. A) & 42 (Cond. B)

* Should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	**Not satisfied**
Required values reached for	1 hour
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	**Condition B**
Condition Satisfied?	**Not Examined**	**Satisfied**
Required values reached for		1 hour
Criteria - Total Approach Volume (veh in one hour)	650	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	100	
Criteria - Minor Street High Side Delay (veh-hrs)	4	

Figure 4C-2 (Warrant 2 - 70% Factor) & Figure 4C-4 (Warrant 3 - 70% Factor)



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Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	CSAH 11 & Burnsville Parkway
Project/File #	227-16-03
Scenario	August 2016

Intersection Information			
Major Street (N/S Road)	CSAH 11	Minor Street (E/W Road)	Burnsville Parkway
Analyzed with	2 or more approach lanes	Analyzed with	2 or more approach lanes
Total Approach Volume	12690 vehicles	Total Approach Volume	5831 vehicles
Total Ped/Bike Volume	70 crossings	Total Ped/Bike Volume	97 crossings
Right turn reduction of	100 percent applied	Right turn reduction of	100 percent applied

Reduction applied to Volume Warrant thresholds due to high speeds on CSAH 11.

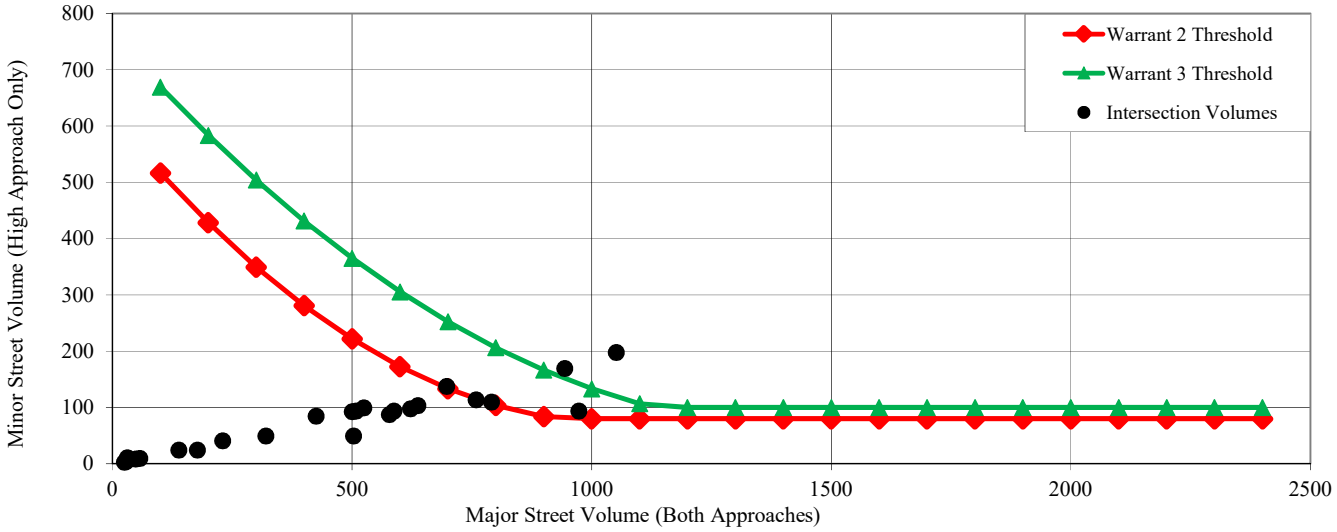
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	**Condition B**	**Condition A+B***
Condition Satisfied?	**Not satisfied**	**Not satisfied**	**Not satisfied**
Required values reached for	2 hours	7 hours	4 (Cond. A) & 12 (Cond. B)
Criteria - Major Street (veh/hr)	420	630	336 (Cond. A) & 504 (Cond. B)
Criteria - Minor Street (veh/hr)	140	70	112 (Cond. A) & 56 (Cond. B)

* Should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	**Satisfied**
Required values reached for	5 hours
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	**Condition B**
Condition Satisfied?	**Not Examined**	**Satisfied**
Required values reached for		2 hours
Criteria - Total Approach Volume (veh in one hour)	800	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

Figure 4C-2 (Warrant 2 - 70% Factor) & Figure 4C-4 (Warrant 3 - 70% Factor)



SPACK ACADEMY

Traffic Signal Warrant Analysis

Warrants 1 - 3 (Volume Warrants)

Project Name	CSAH 11 & Burnsville Parkway
Project/File #	227-16-03
Scenario	August 2016

Intersection Information			
Major Street (N/S Road)	CSAH 11	Minor Street (E/W Road)	Burnsville Parkway
Analyzed with	2 or more approach lanes	Analyzed with	2 or more approach lanes
Total Approach Volume	12690 vehicles	Total Approach Volume	5831 vehicles
Total Ped/Bike Volume	70 crossings	Total Ped/Bike Volume	97 crossings
Right turn reduction of	100 percent applied	Right turn reduction of	100 percent applied

No high speed or isolated community reduction applied to the Volume Warrant thresholds.

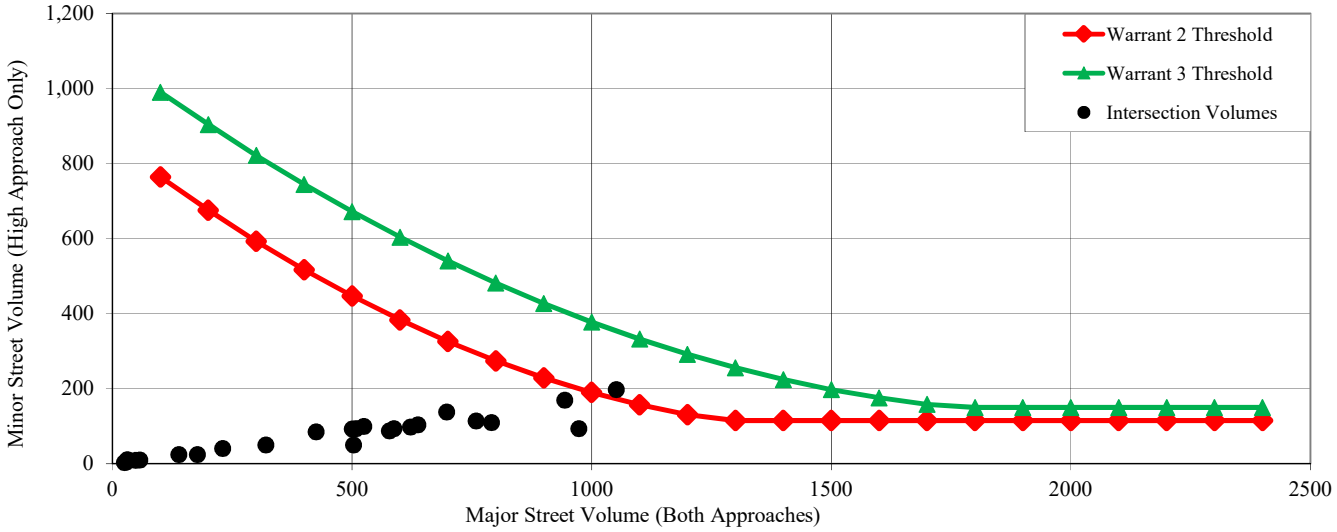
Warrant 1, Eight Hour Vehicular Volume			
	Condition A	**Condition B**	**Condition A+B***
Condition Satisfied?	**Not satisfied**	**Not satisfied**	**Not satisfied**
Required values reached for	0 hours	2 hours	2 (Cond. A) & 5 (Cond. B)
Criteria - Major Street (veh/hr)	600	900	480 (Cond. A) & 720 (Cond. B)
Criteria - Minor Street (veh/hr)	200	100	160 (Cond. A) & 80 (Cond. B)

* Should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Warrant 2, Four Hour Vehicular Volume	
Condition Satisfied?	**Not satisfied**
Required values reached for	1 hour
Criteria	See Figure Below

Warrant 3, Peak Hour Vehicular Volume		
	Condition A	**Condition B**
Condition Satisfied?	**Not Examined**	**Not Satisfied**
Required values reached for		0 hours
Criteria - Total Approach Volume (veh in one hour)	800	See Figure Below
Criteria - Minor Street High Side Volume (veh in one hour)	150	
Criteria - Minor Street High Side Delay (veh-hrs)	5	

Figure 4C-1 (Warrant 2) & Figure 4C-3 (Warrant 3)



CSAH 5 & BURNSVILLE PKWY TRAFFIC SIGNAL

Burnsville Aging Signals

CSAH 5 & BURNSVILLE PKWY TRAFFIC SIGNAL (NB & SB RTL)

Burnsville Aging Signals

SCALE IN FEET
0 25 50 100

CSAH 5

BURNSVILLE PKWY

CSAH 5 & BURNSVILLE PKWY
170' DIAMETER ROUNDABOUT

Burnsville Aging Signals

CSAH 5 & 136TH ST TRAFFIC SIGNAL

Burnsville Aging Signals

SCALE IN FEET
0 25 50 100

CSAH 5

136TH ST

CSAH 5 & 136TH ST
150' DIAMETER ROUNDABOUT

Burnsville Aging Signals

SCALE IN FEET
0 25 50 100

CSAH 5

136TH ST

CSAH 5 & 136TH ST
LIMITED ACCESS

Burnsville Aging Signals

CSAH 11 & BURNSVILLE PKWY TRAFFIC SIGNAL

Burnsville Aging Signals

CSAH 11 & BURNSVILLE PKWY ROUNDABOUT (SPLIT R/W)

Burnsville Aging Signals

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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 1: AM Existing - Signals

Report File: C:\...\AM Existing Signals.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	SWB Left	0.397	21.0	C
2	CSAH 5 & 136th St	Signalized	HCM 2010	WB Left	0.322	8.4	A
3	CSAH 11 & Burnsville Pkwy	Signalized	HCM 2010	EB Right	0.446	14.1	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	21.0
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.397

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	100.0	350.0	100.0	100.0	100.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	26	14	0	0	0	0	0	0	0	1	2	2	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	30	0	0	0	14	0	0	0	4	0	0	0	41
Total Hourly Volume [veh/h]	27	19	666	89	0	57	281	42	0	113	381	6	0	39	199	41
Peak Hour Factor	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	8	5	185	25	0	16	78	12	0	31	106	2	0	11	55	11
Total Analysis Volume [veh/h]	30	21	740	99	0	63	312	47	0	126	423	7	0	43	221	46
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0				0			
Bicycle Volume [bicycles/h]	0				1				0				0			

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	5.00	6.00	6.00	5.00	6.00	6.00	5.00	6.00	6.00	5.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00	3.00	4.00	4.00
g_i, Effective Green Time [s]	3	23	23	3	23	23	6	13	13	3	10	10
g / C, Green / Cycle	0.05	0.36	0.36	0.05	0.36	0.36	0.09	0.21	0.21	0.04	0.15	0.15
(v / s)_i Volume / Saturation Flow Rate	0.03	0.23	0.23	0.03	0.08	0.08	0.07	0.10	0.00	0.02	0.06	0.03
s, saturation flow rate [veh/h]	1772	1829	1754	2200	2200	2200	1745	4200	1557	1733	3540	1569
c, Capacity [veh/h]	84	655	628	117	801	801	164	864	320	73	545	242
d1, Uniform Delay [s]	29.68	13.83	13.83	29.24	11.36	11.33	28.57	22.66	20.47	30.37	24.65	23.81
k, delay calibration	0.04	0.39	0.39	0.08	0.39	0.39	0.04	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	2.66	3.98	4.15	2.84	0.52	0.50	2.83	1.56	0.10	2.74	1.76	1.37
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.61	0.65	0.65	0.54	0.23	0.22	0.77	0.49	0.02	0.59	0.41	0.19
d, Delay for Lane Group [s/veh]	32.35	17.80	17.97	32.08	11.88	11.83	31.40	24.22	20.57	33.10	26.42	25.19
Lane Group LOS	C	B	B	C	B	B	C	C	C	C	C	C
Critical Lane Group	No	No	Yes	Yes	No	No	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.76	4.14	4.00	0.94	1.35	1.31	1.91	2.80	0.09	0.66	1.52	0.65
50th-Percentile Queue Length [ft]	18.95	103.41	99.96	23.58	33.79	32.66	47.72	69.96	2.17	16.60	38.08	16.27
95th-Percentile Queue Length [veh]	1.36	7.45	7.20	1.70	2.43	2.35	3.44	5.04	0.16	1.20	2.74	1.17
95th-Percentile Queue Length [ft]	34.11	186.14	179.93	42.44	60.83	58.78	85.90	125.93	3.91	29.89	68.54	29.29

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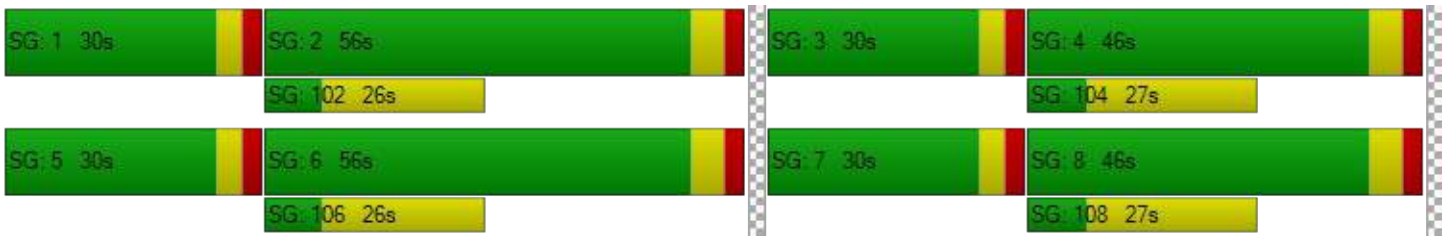
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	32.35	32.35	17.87	17.97	32.08	32.08	11.86	11.83	31.40	31.40	24.22	20.57	33.10	33.10	26.42	25.19
Movement LOS	C	C	B	B	C	C	B	B	C	C	C	C	C	C	C	C
d_A, Approach Delay [s/veh]	18.72				14.87				25.80				27.16			
Approach LOS	B				B				C				C			
d_I, Intersection Delay [s/veh]	20.98															
Intersection LOS	C															
Intersection V/C	0.397															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Signalized	Delay (sec / veh):	8.4
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.322

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	1	0	0	1
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	50.00	100.00	100.00	50.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	5	0	0	0	1	0	0	20	0	0	11
Total Hourly Volume [veh/h]	0	21	737	15	1	13	309	2	2	2	20	26	14	32
Peak Hour Factor	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.9080	0.9080	0.9080	0.9080	0.9080	0.9080
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	6	203	4	0	4	85	1	1	1	6	7	4	9
Total Analysis Volume [veh/h]	0	23	812	17	1	14	340	2	2	2	22	29	15	35
Presence of On-Street Parking	No			No	No			No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0			1		
Bicycle Volume [bicycles/h]	0				0				0			0		

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	1	6	0	0	5	2	0	0	8	0	0	4	0
Auxiliary Signal Groups														
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	15	0	0	5	15	0	0	7	0	0	7	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	35	0	0	35	0
Amber [s]	0.0	3.0	4.5	0.0	0.0	3.0	4.5	0.0	0.0	3.5	0.0	0.0	3.5	0.0
All red [s]	0.0	2.0	1.5	0.0	0.0	2.0	1.5	0.0	0.0	1.5	0.0	0.0	1.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	5.0	0.0	0.0	2.0	5.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	0	10	0	0	0	10	0	0	16	0	0	16	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No	Yes			No	Yes			No			No	
Maximum Recall		No	No			No	No			No			No	
Pedestrian Recall		No	No			No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	C	R	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	21	15	15	21	15	15	4	4	4	4
g / C, Green / Cycle	0.58	0.42	0.42	0.58	0.41	0.41	0.11	0.11	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.02	0.23	0.23	0.02	0.09	0.09	0.00	0.01	0.09	0.02
s, saturation flow rate [veh/h]	1184	1841	1828	845	1839	1836	869	1590	473	1544
c, Capacity [veh/h]	949	778	772	684	759	758	246	175	219	170
d1, Uniform Delay [s]	3.19	7.72	7.72	2.34	5.11	5.11	14.27	14.38	15.09	14.51
k, delay calibration	0.04	0.23	0.23	0.23	0.23	0.23	0.13	0.13	0.13	0.13
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.00	1.22	1.23	0.03	0.32	0.32	0.03	0.39	0.54	0.72
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.02	0.53	0.54	0.02	0.23	0.23	0.02	0.13	0.20	0.21
d, Delay for Lane Group [s/veh]	3.19	8.94	8.95	2.37	5.43	5.43	14.30	14.77	15.63	15.23
Lane Group LOS	A	A	A	A	A	A	B	B	B	B
Critical Lane Group	No	No	Yes	Yes	No	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.01	1.42	1.41	0.01	0.38	0.38	0.03	0.15	0.30	0.25
50th-Percentile Queue Length [ft]	0.35	35.56	35.36	0.24	9.60	9.60	0.65	3.78	7.52	6.17
95th-Percentile Queue Length [veh]	0.03	2.56	2.55	0.02	0.69	0.69	0.05	0.27	0.54	0.44
95th-Percentile Queue Length [ft]	0.64	64.01	63.65	0.44	17.29	17.27	1.17	6.81	13.54	11.10

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	3.19	3.19	8.95	8.95	2.37	2.37	5.43	5.43	14.30	14.30	14.77	15.63	15.63	15.23
Movement LOS	A	A	A	A	A	A	A	A	B	B	B	B	B	B
d_A, Approach Delay [s/veh]	8.79				5.30				14.69			15.45		
Approach LOS	A				A				B			B		
d_I, Intersection Delay [s/veh]	8.36													
Intersection LOS	A													
Intersection V/C	0.322													

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Spack CONSULTING THE TRAFFIC STUDY COMPANY

Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	14.1
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.446

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	1	0	1	1	0	0	1	0	1
Pocket Length [ft]	250.00	100.00	600.00	150.00	100.00	400.00	100.00	100.00	100.00	175.00	100.00	200.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			No		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	7	0	0	9	0	0	33	0	0	4
Total Hourly Volume [veh/h]	219	583	21	1	183	26	71	29	97	49	42	10
Peak Hour Factor	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	61	163	6	0	51	7	20	8	27	14	12	3
Total Analysis Volume [veh/h]	244	651	23	1	204	29	79	32	108	55	47	11
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			0		
Bicycle Volume [bicycles/h]	1			0			0			0		

Appendix F - Alternative Capacity Analysis Backup

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Spack CONSULTING THE TRAFFIC STUDY COMPANY

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	0	1	6	0	7	4	0	3	8	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	0	5	15	0	5	8	0	5	5	0
Maximum Green [s]	40	65	0	25	50	0	20	35	0	20	35	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
All red [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	2.0	5.0	0.0	2.0	6.0	0.0	2.0	3.0	0.0	2.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	22	0	0	22	0	0	18	0	0	18	0
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
Minimum Recall	No	Yes		No	Yes		No	No		No	No	
Maximum Recall	No	No		No	No		No	No		No	No	
Pedestrian Recall	No	No		No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	31	26	26	31	19	19	15	7	7	15	7	7
g / C, Green / Cycle	0.53	0.44	0.44	0.53	0.33	0.33	0.26	0.12	0.12	0.26	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.18	0.35	0.01	0.00	0.11	0.02	0.05	0.02	0.07	0.04	0.03	0.01
s, saturation flow rate [veh/h]	1362	1852	1540	858	1852	1593	1551	1870	1586	1521	1865	1579
c, Capacity [veh/h]	816	821	682	436	621	534	562	232	197	564	210	178
d1, Uniform Delay [s]	4.71	9.80	6.67	8.45	14.38	13.03	16.53	22.60	23.83	16.30	23.38	22.95
k, delay calibration	0.23	0.23	0.23	0.04	0.39	0.39	0.11	0.11	0.11	0.04	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.43	3.74	0.04	0.00	1.11	0.15	0.11	0.27	2.37	0.03	0.53	0.14
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.30	0.79	0.03	0.00	0.33	0.05	0.14	0.14	0.55	0.10	0.22	0.06
d, Delay for Lane Group [s/veh]	5.15	13.54	6.71	8.45	15.49	13.19	16.64	22.87	26.20	16.32	23.91	23.10
Lane Group LOS	A	B	A	A	B	B	B	C	C	B	C	C
Critical Lane Group	No	Yes	No	Yes	No	No	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh]	0.80	4.47	0.10	0.00	1.88	0.24	0.72	0.37	1.37	0.50	0.57	0.13
50th-Percentile Queue Length [ft]	19.90	111.81	2.60	0.11	46.88	5.99	18.05	9.16	34.32	12.52	14.20	3.26
95th-Percentile Queue Length [veh]	1.43	7.94	0.19	0.01	3.38	0.43	1.30	0.66	2.47	0.90	1.02	0.23
95th-Percentile Queue Length [ft]	35.82	198.52	4.68	0.19	84.39	10.78	32.48	16.50	61.78	22.54	25.57	5.87

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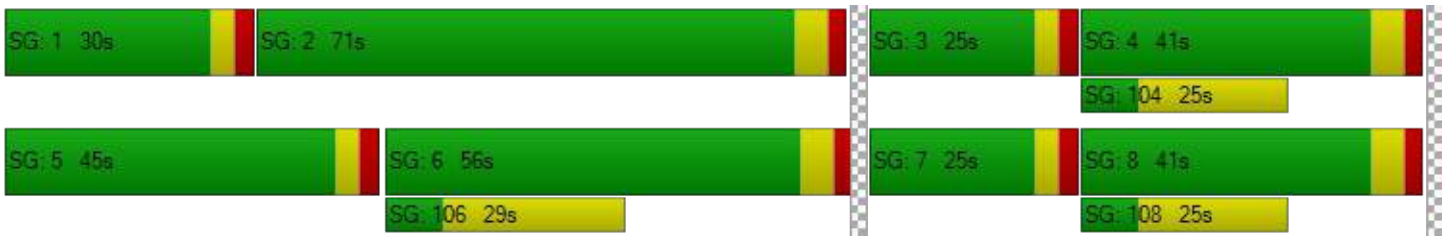
Movement, Approach, & Intersection Results

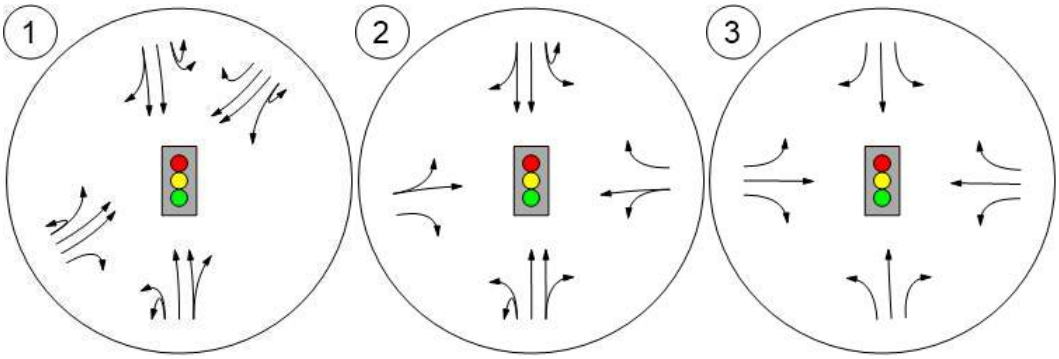
d_M, Delay for Movement [s/veh]	5.15	13.54	6.71	8.45	15.49	13.19	16.64	22.87	26.20	16.32	23.91	23.10
Movement LOS	A	B	A	A	B	B	B	C	C	B	C	C
d_A, Approach Delay [s/veh]	11.14			15.18			22.26			20.14		
Approach LOS	B			B			C			C		
d_I, Intersection Delay [s/veh]	14.10											
Intersection LOS	B											
Intersection V/C	0.446											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Lane Configuration and Traffic Control



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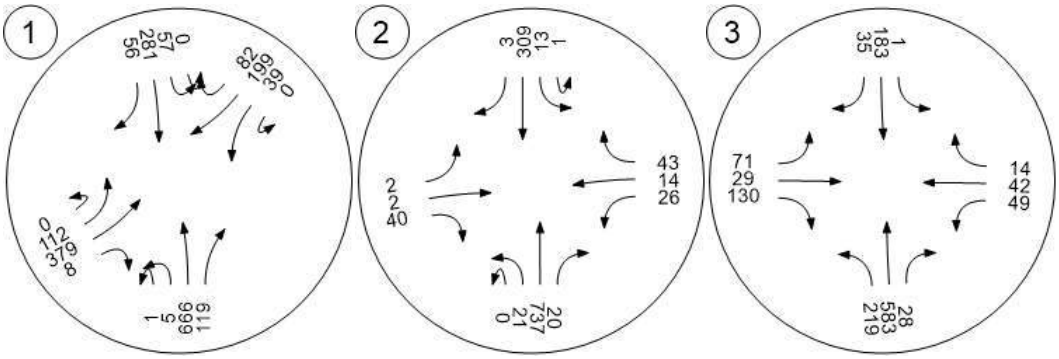
Traffic Volume - Base Volume



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Burnsville Aging Signals

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Scenario 7: AM Existing - Signal with Rights

Report File: C:\...\AM Existing Signal with Rights.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	SWB Thru	0.346	16.9	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	16.9
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.346

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	200.0	350.0	100.0	100.0	200.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	30	0	0	0	14	0	0	0	5	0	0	0	41
Total Hourly Volume [veh/h]	1	5	666	89	0	57	281	42	0	112	379	3	0	39	199	41
Peak Hour Factor	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	0	1	185	25	0	16	78	12	0	31	105	1	0	11	55	11
Total Analysis Volume [veh/h]	1	6	740	99	0	63	312	47	0	124	421	3	0	43	221	46
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0				0			
Bicycle Volume [bicycles/h]	0				1				0				0			

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	31	23	23	31	26	26	21	13	13	21	10	10
g / C, Green / Cycle	0.49	0.36	0.36	0.49	0.40	0.40	0.33	0.21	0.21	0.33	0.16	0.16
(v / s)_i Volume / Saturation Flow Rate	0.01	0.21	0.06	0.03	0.07	0.02	0.09	0.10	0.00	0.04	0.06	0.03
s, saturation flow rate [veh/h]	1118	3482	1562	2200	4400	2200	1384	4200	1557	1156	3540	1569
c, Capacity [veh/h]	676	1244	558	915	1764	882	554	865	321	460	574	254
d1, Uniform Delay [s]	5.83	13.45	11.45	5.88	9.52	9.13	15.87	22.56	20.34	15.27	24.11	23.29
k, delay calibration	0.04	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.00	1.65	0.55	0.11	0.17	0.09	0.73	1.54	0.04	0.03	1.54	1.22
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.01	0.59	0.18	0.07	0.18	0.05	0.22	0.49	0.01	0.09	0.39	0.18
d, Delay for Lane Group [s/veh]	5.83	15.11	11.99	5.99	9.70	9.22	16.60	24.11	20.38	15.30	25.65	24.52
Lane Group LOS	A	B	B	A	A	A	B	C	C	B	C	C
Critical Lane Group	No	Yes	No	Yes	No	No	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.03	3.17	0.76	0.27	0.96	0.29	1.31	2.78	0.04	0.39	1.49	0.64
50th-Percentile Queue Length [ft]	0.68	79.28	18.94	6.85	23.94	7.18	32.63	69.38	0.92	9.70	37.31	15.93
95th-Percentile Queue Length [veh]	0.05	5.71	1.36	0.49	1.72	0.52	2.35	5.00	0.07	0.70	2.69	1.15
95th-Percentile Queue Length [ft]	1.22	142.70	34.10	12.32	43.09	12.92	58.74	124.88	1.66	17.46	67.16	28.68

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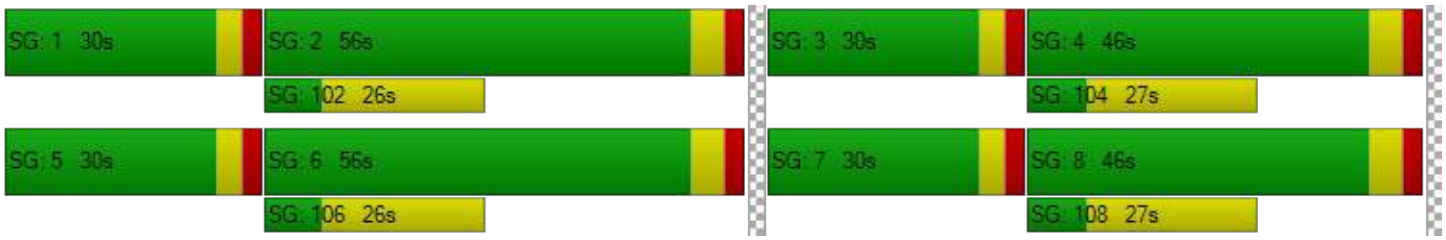
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	5.83	5.83	15.11	11.99	5.99	5.99	9.70	9.22	16.60	16.60	24.11	20.38	15.30	15.30	25.65	24.52
Movement LOS	A	A	B	B	A	A	A	A	B	B	C	C	B	B	C	C
d_A, Approach Delay [s/veh]	14.67				9.09				22.39				24.05			
Approach LOS	B				A				C				C			
d_I, Intersection Delay [s/veh]	16.92															
Intersection LOS	B															
Intersection V/C	0.346															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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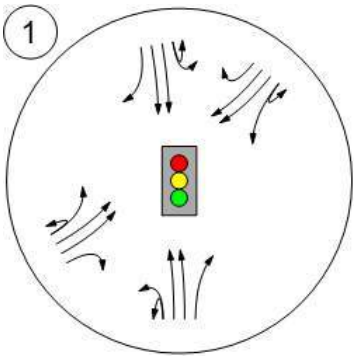
Lane Configuration and Traffic Control



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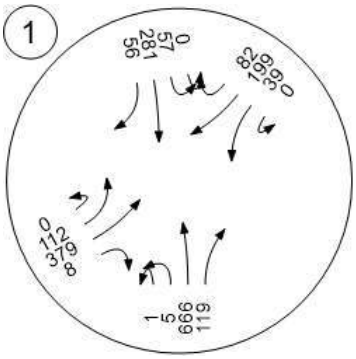
Traffic Volume - Base Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 2: PM Existing - Signals

Report File: C:\...\PM Existing Signals.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	NEB Thru	0.386	18.5	B
2	CSAH 5 & 136th St	Signalized	HCM 2010	WB Left	0.349	9.1	A
3	CSAH 11 & Burnsville Pkwy	Signalized	HCM 2010	EB Right	0.530	21.1	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	18.5
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.386

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	100.0	350.0	100.0	100.0	100.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	32	0	0	0	35	0	0	0	4	0	0	0	61
Total Hourly Volume [veh/h]	3	25	467	96	0	115	804	106	0	78	316	4	1	164	394	60
Peak Hour Factor	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	1	7	122	25	0	30	210	28	0	20	82	1	0	43	103	16
Total Analysis Volume [veh/h]	3	26	487	100	0	120	838	111	0	81	330	4	1	171	411	63
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	3				2				1				3			
Bicycle Volume [bicycles/h]	4				2				0				0			

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	33	23	23	33	25	25	23	11	11	23	14	14
g / C, Green / Cycle	0.48	0.34	0.34	0.48	0.38	0.38	0.34	0.17	0.17	0.34	0.21	0.21
(v / s)_i Volume / Saturation Flow Rate	0.04	0.16	0.17	0.05	0.22	0.21	0.07	0.08	0.00	0.13	0.12	0.04
s, saturation flow rate [veh/h]	755	1829	1711	2200	2200	2200	1192	4200	1557	1325	3540	1569
c, Capacity [veh/h]	432	624	584	977	828	828	467	699	259	538	742	329
d1, Uniform Delay [s]	7.52	14.28	14.33	6.55	13.16	13.01	15.81	25.56	23.61	16.52	23.97	22.07
k, delay calibration	0.04	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.02	2.09	2.30	0.20	2.38	2.16	0.64	1.79	0.09	0.13	2.34	1.02
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.07	0.48	0.49	0.12	0.58	0.56	0.17	0.47	0.02	0.32	0.55	0.19
d, Delay for Lane Group [s/veh]	7.54	16.38	16.62	6.75	15.53	15.17	16.44	27.35	23.70	16.65	26.31	23.09
Lane Group LOS	A	B	B	A	B	B	B	C	C	B	C	C
Critical Lane Group	Yes	No	No	No	Yes	No	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.13	2.91	2.79	0.59	4.37	4.14	0.87	2.42	0.06	1.75	2.92	0.85
50th-Percentile Queue Length [ft]	3.20	72.63	69.80	14.67	109.37	103.53	21.74	60.55	1.41	43.63	73.01	21.23
95th-Percentile Queue Length [veh]	0.23	5.23	5.03	1.06	7.80	7.45	1.57	4.36	0.10	3.14	5.26	1.53
95th-Percentile Queue Length [ft]	5.76	130.73	125.64	26.41	195.12	186.35	39.14	108.99	2.54	78.54	131.41	38.21

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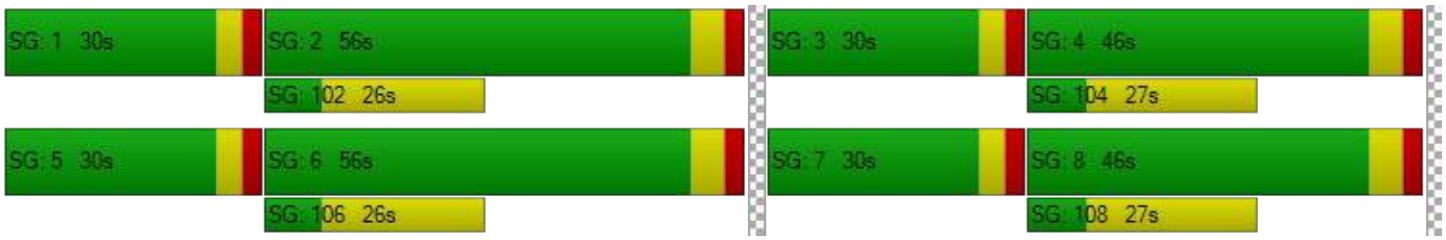
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	7.54	7.54	16.47	16.62	6.75	6.75	15.38	15.17	16.44	16.44	27.35	23.70	16.65	16.65	26.31	23.09
Movement LOS	A	A	B	B	A	A	B	B	B	B	C	C	B	B	C	C
d_A, Approach Delay [s/veh]	16.08				14.39				25.19				23.42			
Approach LOS	B				B				C				C			
d_I, Intersection Delay [s/veh]	18.53															
Intersection LOS	B															
Intersection V/C	0.386															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Signalized	Delay (sec / veh):	9.1
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.349

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	1	0	0	1
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	50.00	100.00	100.00	50.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	15	0	0	0	5	0	0	38	0	0	6
Total Hourly Volume [veh/h]	1	88	567	46	2	47	892	15	3	28	37	54	17	18
Peak Hour Factor	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.9370	0.9370	0.9370	0.9370	0.9370	0.9370
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	23	151	12	1	13	238	4	1	7	10	14	5	5
Total Analysis Volume [veh/h]	1	94	605	49	2	50	952	16	3	30	39	58	18	19
Presence of On-Street Parking	No			No	No			No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	6				5				2			1		
Bicycle Volume [bicycles/h]	2				1				0			1		

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	1	6	0	0	5	2	0	0	8	0	0	4	0
Auxiliary Signal Groups														
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	15	0	0	5	15	0	0	7	0	0	7	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	35	0	0	35	0
Amber [s]	0.0	3.0	4.5	0.0	0.0	3.0	4.5	0.0	0.0	3.5	0.0	0.0	3.5	0.0
All red [s]	0.0	2.0	1.5	0.0	0.0	2.0	1.5	0.0	0.0	1.5	0.0	0.0	1.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	5.0	0.0	0.0	2.0	5.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	0	10	0	0	0	10	0	0	16	0	0	16	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No	Yes			No	Yes			No			No	
Maximum Recall		No	No			No	No			No			No	
Pedestrian Recall		No	No			No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	C	R	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	26	19	19	26	18	18	5	5	5	5
g / C, Green / Cycle	0.62	0.45	0.45	0.62	0.42	0.42	0.12	0.12	0.12	0.12
(v / s)_i Volume / Saturation Flow Rate	0.11	0.18	0.18	0.05	0.26	0.26	0.02	0.02	0.06	0.01
s, saturation flow rate [veh/h]	871	1841	1786	960	1839	1827	1370	1567	1355	1505
c, Capacity [veh/h]	688	823	799	752	776	771	263	196	317	188
d1, Uniform Delay [s]	4.09	8.00	8.01	1.89	7.10	7.10	16.76	16.85	17.41	16.64
k, delay calibration	0.04	0.23	0.23	0.23	0.23	0.23	0.13	0.13	0.13	0.13
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.03	0.68	0.71	0.08	1.77	1.79	0.26	0.59	0.46	0.28
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.14	0.40	0.40	0.07	0.63	0.63	0.13	0.20	0.24	0.10
d, Delay for Lane Group [s/veh]	4.12	8.68	8.72	1.98	8.87	8.89	17.01	17.44	17.87	16.92
Lane Group LOS	A	A	A	A	A	A	B	B	B	B
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.10	1.37	1.34	0.04	1.90	1.89	0.27	0.33	0.65	0.16
50th-Percentile Queue Length [ft]	2.60	34.27	33.58	1.02	47.55	47.36	6.79	8.33	16.17	3.98
95th-Percentile Queue Length [veh]	0.19	2.47	2.42	0.07	3.42	3.41	0.49	0.60	1.16	0.29
95th-Percentile Queue Length [ft]	4.68	61.68	60.45	1.83	85.59	85.25	12.22	14.99	29.10	7.17

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	4.12	4.12	8.70	8.72	1.98	1.98	8.88	8.89	17.01	17.01	17.44	17.87	17.87	16.92
Movement LOS	A	A	A	A	A	A	A	A	B	B	B	B	B	B
d_A, Approach Delay [s/veh]	8.12				8.53				17.25			17.68		
Approach LOS	A				A				B			B		
d_I, Intersection Delay [s/veh]	9.14													
Intersection LOS	A													
Intersection V/C	0.349													

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	21.1
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.530

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	1	0	1	1	0	0	1	0	1
Pocket Length [ft]	250.00	100.00	600.00	150.00	100.00	400.00	100.00	100.00	100.00	175.00	100.00	200.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	16	0	0	17	0	0	74	0	0	2
Total Hourly Volume [veh/h]	191	323	47	9	515	50	94	105	221	75	61	7
Peak Hour Factor	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	51	85	12	2	136	13	25	28	58	20	16	2
Total Analysis Volume [veh/h]	202	342	50	10	545	53	99	111	234	79	65	7
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	1			0			2			0		
Bicycle Volume [bicycles/h]	1			0			0			0		

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	0	1	6	0	7	4	0	3	8	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	0	5	15	0	5	8	0	5	5	0
Maximum Green [s]	40	65	0	25	50	0	25	35	0	25	35	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
All red [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	2.0	5.0	0.0	2.0	6.0	0.0	2.0	3.0	0.0	2.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	22	0	0	22	0	0	18	0	0	18	0
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
Minimum Recall	No	Yes		No	Yes		No	No		No	No	
Maximum Recall	No	No		No	No		No	No		No	No	
Pedestrian Recall	No	No		No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	39	33	33	39	27	27	23	14	14	23	13	13
g / C, Green / Cycle	0.53	0.45	0.45	0.53	0.38	0.38	0.31	0.19	0.19	0.31	0.18	0.18
(v / s)_i Volume / Saturation Flow Rate	0.19	0.18	0.03	0.01	0.29	0.03	0.07	0.06	0.15	0.06	0.03	0.00
s, saturation flow rate [veh/h]	1079	1852	1540	1084	1852	1588	1491	1870	1582	1423	1865	1579
c, Capacity [veh/h]	492	827	688	619	696	597	569	347	294	522	334	283
d1, Uniform Delay [s]	10.36	9.67	8.41	8.57	20.22	14.76	18.56	25.82	28.50	18.42	25.56	24.78
k, delay calibration	0.23	0.23	0.23	0.04	0.39	0.39	0.11	0.11	0.11	0.04	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	1.17	0.71	0.09	0.00	6.87	0.23	0.14	0.53	4.92	0.05	0.28	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.41	0.41	0.07	0.02	0.78	0.09	0.17	0.32	0.80	0.15	0.19	0.02
d, Delay for Lane Group [s/veh]	11.53	10.38	8.50	8.58	27.10	15.00	18.70	26.34	33.42	18.47	25.84	24.81
Lane Group LOS	B	B	A	A	C	B	B	C	C	B	C	C
Critical Lane Group	Yes	No	No	No	Yes	No	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh]	1.02	2.45	0.31	0.06	8.55	0.55	1.14	1.61	4.03	0.91	0.94	0.10
50th-Percentile Queue Length [ft]	25.40	61.24	7.86	1.59	213.66	13.77	28.62	40.23	100.71	22.78	23.48	2.45
95th-Percentile Queue Length [veh]	1.83	4.41	0.57	0.11	13.34	0.99	2.06	2.90	7.25	1.64	1.69	0.18
95th-Percentile Queue Length [ft]	45.71	110.23	14.15	2.86	333.52	24.79	51.51	72.41	181.28	41.01	42.27	4.41

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	11.53	10.38	8.50	8.58	27.10	15.00	18.70	26.34	33.42	18.47	25.84	24.81
Movement LOS	B	B	A	A	C	B	B	C	C	B	C	C
d_A, Approach Delay [s/veh]	10.61			25.74			28.37			21.94		
Approach LOS	B			C			C			C		
d_I, Intersection Delay [s/veh]	21.07											
Intersection LOS	C											
Intersection V/C	0.530											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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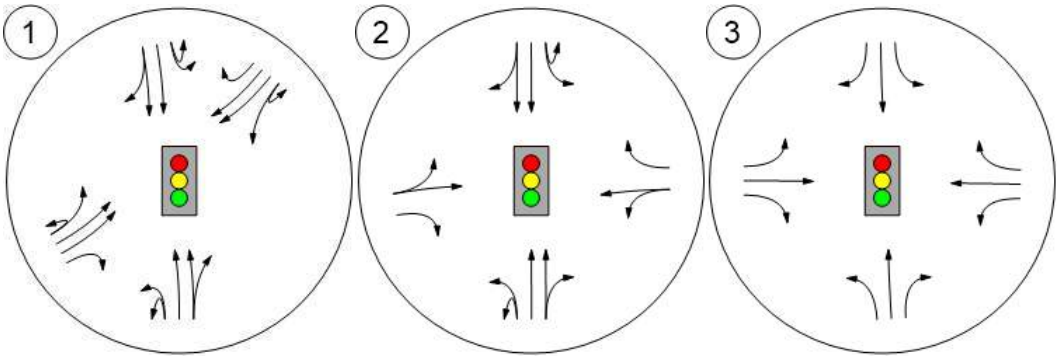
Lane Configuration and Traffic Control



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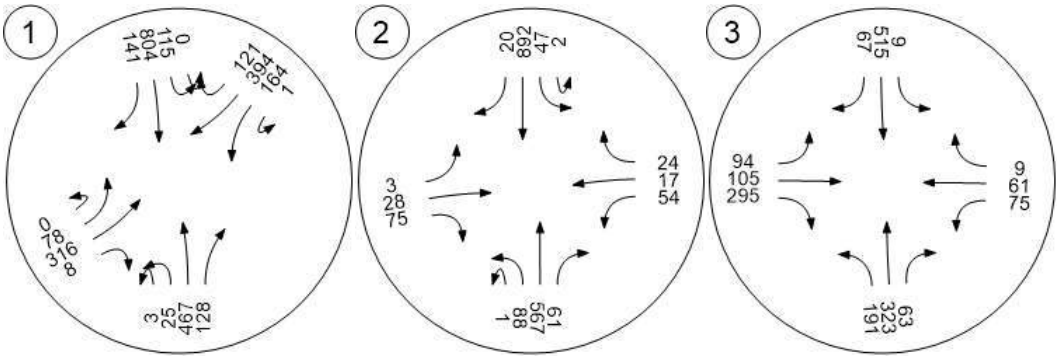
Traffic Volume - Base Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 8: PM Existing - Signal with Rights

Report File: C:\...\PM Existing Signal with Rights.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	NEB Thru	0.357	17.4	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	17.4
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.357

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	200.0	350.0	100.0	100.0	200.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	32	0	0	0	35	0	0	0	18	0	0	0	61
Total Hourly Volume [veh/h]	3	25	467	96	0	115	804	106	0	78	316	0	1	164	394	60
Peak Hour Factor	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	1	7	122	25	0	30	210	28	0	20	82	0	0	43	103	16
Total Analysis Volume [veh/h]	3	26	487	100	0	120	838	111	0	81	330	0	1	171	411	63
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	3				2				1				3			
Bicycle Volume [bicycles/h]	4				2				0				0			

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	33	24	24	33	26	26	23	11	11	23	14	14
g / C, Green / Cycle	0.48	0.34	0.34	0.48	0.38	0.38	0.34	0.17	0.17	0.34	0.21	0.21
(v / s)_i Volume / Saturation Flow Rate	0.04	0.14	0.07	0.05	0.19	0.05	0.07	0.08	0.00	0.13	0.12	0.04
s, saturation flow rate [veh/h]	807	3482	1535	2200	4400	2200	1192	4200	1557	1326	3540	1569
c, Capacity [veh/h]	467	1202	530	1037	1671	835	464	696	258	536	740	328
d1, Uniform Delay [s]	7.08	13.80	12.80	6.50	12.61	10.93	16.00	25.85	0.00	16.73	24.21	22.30
k, delay calibration	0.04	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.02	0.80	0.62	0.18	0.85	0.26	0.64	1.82	0.00	0.13	2.36	1.02
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.06	0.41	0.19	0.12	0.50	0.13	0.17	0.47	0.00	0.32	0.56	0.19
d, Delay for Lane Group [s/veh]	7.10	14.60	13.42	6.68	13.46	11.19	16.65	27.67	0.00	16.86	26.57	23.32
Lane Group LOS	A	B	B	A	B	B	B	C	A	B	C	C
Critical Lane Group	Yes	No	No	No	Yes	No	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.13	2.14	0.86	0.58	3.42	0.81	0.88	2.45	0.00	1.77	2.95	0.86
50th-Percentile Queue Length [ft]	3.19	53.52	21.55	14.57	85.40	20.35	22.03	61.27	0.00	44.26	73.83	21.46
95th-Percentile Queue Length [veh]	0.23	3.85	1.55	1.05	6.15	1.47	1.59	4.41	0.00	3.19	5.32	1.55
95th-Percentile Queue Length [ft]	5.75	96.33	38.79	26.23	153.73	36.63	39.66	110.29	0.00	79.66	132.90	38.63

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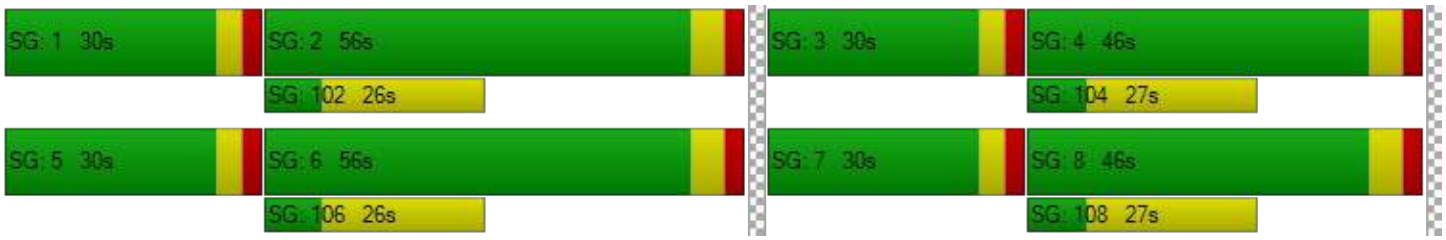
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	7.10	7.10	14.60	13.42	6.68	6.68	13.46	11.19	16.65	16.65	27.67	0.00	16.86	16.86	26.57	23.32
Movement LOS	A	A	B	B	A	A	B	B	B	B	C	A	B	B	C	C
d_A, Approach Delay [s/veh]	14.06				12.46				25.50				23.67			
Approach LOS	B				B				C				C			
d_I, Intersection Delay [s/veh]	17.42															
Intersection LOS	B															
Intersection V/C	0.357															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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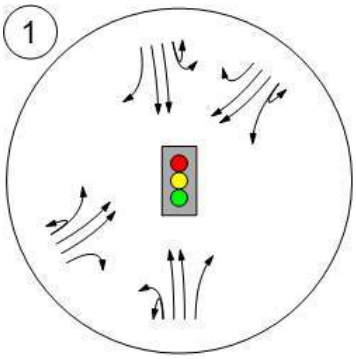
Lane Configuration and Traffic Control



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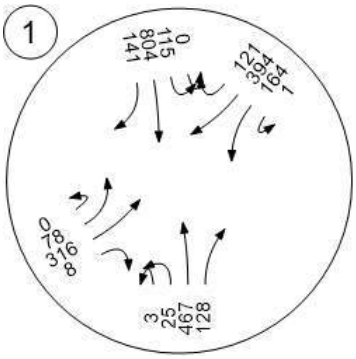
Traffic Volume - Base Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo.vistro

Scenario 3: AM Existing - Roundabouts

Report File: C:\...\AM Existing Roundabouts.pdf

11/9/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Roundabout	HCM	NB U-T		10.1	B
2	CSAH 5 & 136th St	Roundabout	HCM	WB Right		5.1	A
3	CSAH 11 & Burnsville Pkwy	Roundabout	HCM	WB Left		6.0	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	10.1
Analysis Method:	HCM	Level Of Service:	B
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	26	14	0	0	0	0	0	0	0	1	2	2	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	27	19	666	119	0	57	281	56	0	113	381	10	0	39	199	82
Peak Hour Factor	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	8	5	185	33	0	16	78	16	0	31	106	3	0	11	55	23
Total Analysis Volume [veh/h]	30	21	740	132	0	63	312	62	0	126	423	11	0	43	221	91
Pedestrian Volume [ped/h]	0				0				0				0			

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Intersection Settings

Number of Conflicting Circulating Lanes	2				2				2				2			
Circulating Flow Rate [veh/h]	627				323				461				952			
Exiting Flow Rate [veh/h]	497				248				397				900			
Demand Flow Rate [veh/h]	27	19	666	119	0	57	281	56	0	113	381	10	0	39	199	82
Adjusted Demand Flow Rate [veh/h]	30	21	740	132	0	63	312	62	0	126	423	11	0	43	221	91

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.65	4.32	4.65	4.32	4.65	4.32	4.32	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.67	2.53	2.67	2.53	2.67	2.53	2.53	2.67	2.53	2.53
A (intercept)	1348.31	1422.92	1348.31	1422.92	1348.31	1422.92	1422.92	1348.31	1422.92	1422.92
B (coefficient)	0.00092	0.00085	0.00092	0.00085	0.00092	0.00085	0.00085	0.00092	0.00085	0.00085
HV Adjustment Factor	0.96	0.96	0.97	0.96	0.98	0.98	0.96	0.98	0.98	0.97
Entry Flow Rate [veh/h]	451	508	212	241	265	298	0	128	144	0
Capacity of Entry and Bypass Lanes [veh/h]	757	836	1002	1082	882	963	1017	562	635	664
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	730	805	973	1044	861	942	980	548	620	645
X, volume / capacity	0.59	0.61	0.21	0.22	0.30	0.31	0.01	0.23	0.23	0.14

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Movement, Approach, & Intersection Results

Lane LOS	B	B	A	A	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	3.98	4.20	0.80	0.85	1.26	1.32	0.03	0.87	0.86	0.49
95th-Percentile Queue Length [ft]	99.43	105.03	19.91	21.23	31.62	33.03	0.85	21.63	21.56	12.24
Approach Delay [s/veh]	14.52		5.64		7.19			8.61		
Approach LOS	B		A		A			A		
Intersection Delay [s/veh]	10.09									
Intersection LOS	B									

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Roundabout	Delay (sec / veh):	5.1
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Peak Hour Factor	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.9080	0.9080	0.9080	0.9080	0.9080	0.9080
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	6	203	6	0	4	85	1	1	1	11	7	4	12
Total Analysis Volume [veh/h]	0	23	812	22	1	14	340	3	2	2	44	29	15	47
Pedestrian Volume [ped/h]	0				0				0			1		

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Intersection Settings

Number of Conflicting Circulating Lanes	1				1				2			2		
Circulating Flow Rate [veh/h]	20				69				397			864		
Exiting Flow Rate [veh/h]	17				39				381			841		
Demand Flow Rate [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Adjusted Demand Flow Rate [veh/h]	0	23	812	22	1	14	340	3	2	2	44	29	15	47

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00085	0.00085
HV Adjustment Factor	0.97	0.97	0.97	0.97	0.98	0.96
Entry Flow Rate [veh/h]	416	469	174	197	49	95
Capacity of Entry and Bypass Lanes [veh/h]	1393	1393	1332	1332	1013	682
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1350	1350	1289	1289	996	655
X, volume / capacity	0.30	0.34	0.13	0.15	0.05	0.14

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	1.26	1.50	0.45	0.52	0.15	0.48
95th-Percentile Queue Length [ft]	31.57	37.56	11.23	12.91	3.79	12.02
Approach Delay [s/veh]	5.51		3.94		4.04	7.08
Approach LOS	A		A		A	A
Intersection Delay [s/veh]	5.15					
Intersection LOS	A					

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	6.0
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	1	0	0	1	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	600.00	100.00	100.00	400.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Peak Hour Factor	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960	0.8960
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	61	163	8	0	51	10	20	8	36	14	12	4
Total Analysis Volume [veh/h]	244	651	31	1	204	39	79	32	145	55	47	16
Pedestrian Volume [ped/h]	0			0			0			2		

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Intersection Settings

Number of Conflicting Circulating Lanes	1			1			2			2		
Circulating Flow Rate [veh/h]	113			352			267			995		
Exiting Flow Rate [veh/h]	34			296			266			748		
Demand Flow Rate [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Adjusted Demand Flow Rate [veh/h]	244	651	31	1	204	39	79	32	145	55	47	16

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.67	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1348.31	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00092	0.00085	0.00085
HV Adjustment Factor	0.98	0.97	0.97	0.98	0.99	0.98	0.98
Entry Flow Rate [veh/h]	446	504	118	133	113	148	121
Capacity of Entry and Bypass Lanes [veh/h]	1279	1279	1029	1029	1055	1131	610
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1250	1246	1003	1005	1042	1111	597
X, volume / capacity	0.35	0.39	0.11	0.13	0.11	0.13	0.20

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	1.58	1.91	0.39	0.44	0.36	0.45	0.73
95th-Percentile Queue Length [ft]	39.48	47.79	9.66	11.04	8.92	11.22	18.28
Approach Delay [s/veh]	6.46		4.70		4.39		8.51
Approach LOS	A		A		A		A
Intersection Delay [s/veh]	5.99						
Intersection LOS	A						

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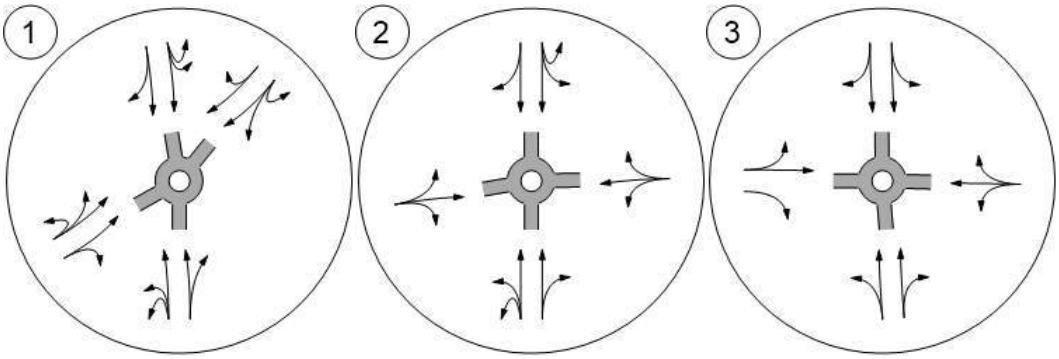
Lane Configuration and Traffic Control



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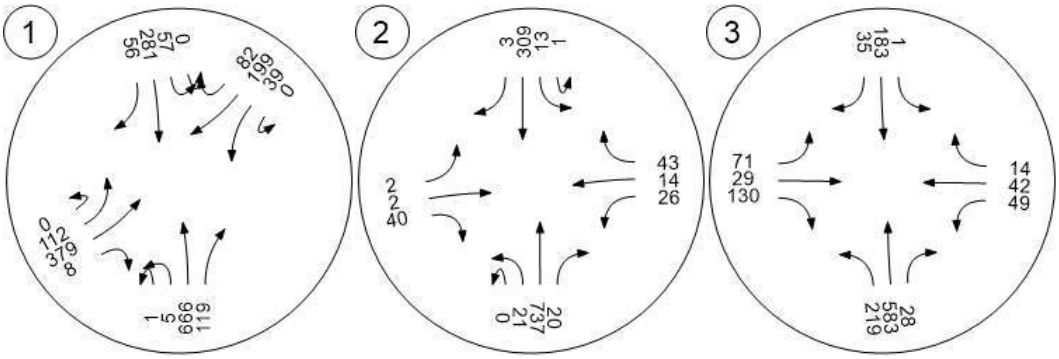
Traffic Volume - Base Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo.vistro
Scenario 4: PM Existing - Roundabouts
Report File: C:\...\PM Existing Roundabouts.pdf
11/9/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Roundabout	HCM	SB Left		15.8	C
2	CSAH 5 & 136th St	Roundabout	HCM	EB Right		7.0	A
3	CSAH 11 & Burnsville Pkwy	Roundabout	HCM	EB Right		7.0	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	15.8
Analysis Method:	HCM	Level Of Service:	C
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	54	17	0	0	0	0	0	0	0	1	2	2	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	57	42	467	128	0	115	804	141	0	79	318	10	1	164	394	121
Peak Hour Factor	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959	0.959
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	15	11	122	33	0	30	210	37	0	21	83	3	0	43	103	32
Total Analysis Volume [veh/h]	59	44	487	133	0	120	838	147	0	82	332	10	1	171	411	126
Pedestrian Volume [ped/h]	3				2				1				3			

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Intersection Settings

Number of Conflicting Circulating Lanes	2				2				2				2			
Circulating Flow Rate [veh/h]	548				705				1226				696			
Exiting Flow Rate [veh/h]	463				466				1102				591			
Demand Flow Rate [veh/h]	57	42	467	128	0	115	804	141	0	79	318	10	1	164	394	121
Adjusted Demand Flow Rate [veh/h]	59	44	487	133	0	120	838	147	0	82	332	10	1	171	411	126

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.65	4.32	4.65	4.32	4.65	4.32	4.32	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.67	2.54	2.67	2.54	2.67	2.54	2.54	2.67	2.54	2.54
A (intercept)	1348.31	1417.32	1348.31	1417.32	1348.31	1417.32	1417.32	1348.31	1417.32	1417.32
B (coefficient)	0.00092	0.00085	0.00092	0.00085	0.00092	0.00085	0.00085	0.00092	0.00085	0.00085
HV Adjustment Factor	0.97	0.96	0.97	0.96	0.98	0.98	0.96	0.97	0.98	0.97
Entry Flow Rate [veh/h]	353	398	536	608	200	225	0	282	317	0
Capacity of Entry and Bypass Lanes [veh/h]	815	892	705	781	437	502	558	711	786	860
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	785	858	684	752	426	491	538	690	767	834
X, volume / capacity	0.43	0.45	0.76	0.78	0.46	0.45	0.02	0.40	0.40	0.15

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Movement, Approach, & Intersection Results

Lane LOS	B	A	C	C	C	C	A	B	A	A
95th-Percentile Queue Length [veh]	2.20	2.33	7.07	7.71	2.34	2.27	0.06	1.91	1.96	0.53
95th-Percentile Queue Length [ft]	55.10	58.34	176.66	192.70	58.45	56.84	1.42	47.68	48.95	13.27
Approach Delay [s/veh]	9.98		23.56		16.23			9.43		
Approach LOS	A		C		C			A		
Intersection Delay [s/veh]	15.81									
Intersection LOS	C									

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Roundabout	Delay (sec / veh):	7.0
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Peak Hour Factor	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.9370	0.9370	0.9370	0.9370	0.9370	0.9370
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	23	151	16	1	13	238	5	1	7	20	14	5	6
Total Analysis Volume [veh/h]	1	94	605	65	2	50	952	21	3	30	80	58	18	26
Pedestrian Volume [ped/h]	6				5				2			1		

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Intersection Settings

Number of Conflicting Circulating Lanes	1				1				2			2		
Circulating Flow Rate [veh/h]	88				175				1098			726		
Exiting Flow Rate [veh/h]	83				114				1044			629		
Demand Flow Rate [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Adjusted Demand Flow Rate [veh/h]	1	94	605	65	2	50	952	21	3	30	80	58	18	26

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00085	0.00085
HV Adjustment Factor	0.97	0.97	0.97	0.97	0.98	0.97
Entry Flow Rate [veh/h]	371	419	498	562	116	106
Capacity of Entry and Bypass Lanes [veh/h]	1308	1308	1209	1209	560	767
Pedestrian Impedance	0.99	0.99	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1262	1260	1164	1164	547	740
X, volume / capacity	0.28	0.32	0.41	0.47	0.21	0.14

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	1.18	1.41	2.07	2.54	0.77	0.48
95th-Percentile Queue Length [ft]	29.58	35.13	51.73	63.62	19.26	11.93
Approach Delay [s/veh]	5.63		7.74		9.32	6.33
Approach LOS	A		A		A	A
Intersection Delay [s/veh]	6.95					
Intersection LOS	A					

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	7.0
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	1	0	0	1	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	600.00	100.00	100.00	400.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Peak Hour Factor	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450	0.9450
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	51	85	17	2	136	18	25	28	78	20	16	2
Total Analysis Volume [veh/h]	202	342	67	10	545	71	99	111	312	79	65	10
Pedestrian Volume [ped/h]	1			0			2			0		

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Intersection Settings

Number of Conflicting Circulating Lanes	1			1			2			2		
Circulating Flow Rate [veh/h]	223			352			651			656		
Exiting Flow Rate [veh/h]	123			271			640			451		
Demand Flow Rate [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Adjusted Demand Flow Rate [veh/h]	202	342	67	10	545	71	99	111	312	79	65	10

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.67	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1348.31	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00092	0.00085	0.00085
HV Adjustment Factor	0.98	0.97	0.97	0.98	0.99	0.98	0.98
Entry Flow Rate [veh/h]	294	333	302	340	213	318	158
Capacity of Entry and Bypass Lanes [veh/h]	1157	1157	1029	1029	741	817	814
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1131	1126	1002	1004	730	802	795
X, volume / capacity	0.25	0.29	0.29	0.33	0.29	0.39	0.19

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	1.01	1.20	1.23	1.46	1.19	1.86	0.71
95th-Percentile Queue Length [ft]	25.29	29.92	30.76	36.41	29.74	46.39	17.86
Approach Delay [s/veh]	5.74		6.79		8.90		6.58
Approach LOS	A		A		A		A
Intersection Delay [s/veh]	7.01						
Intersection LOS	A						

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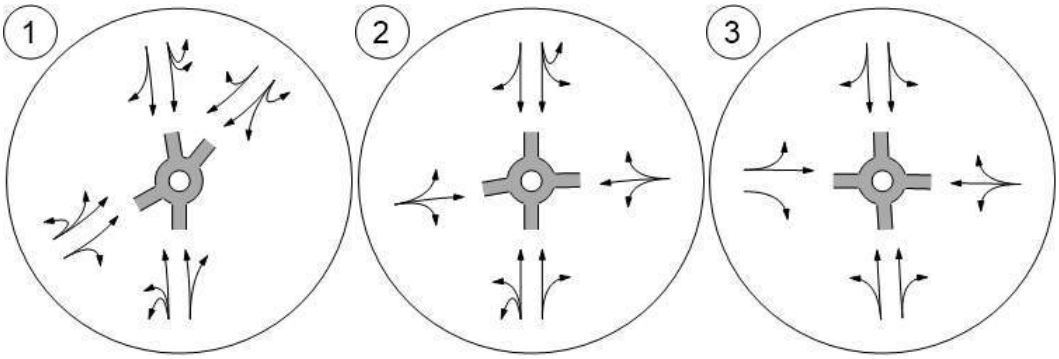
Lane Configuration and Traffic Control



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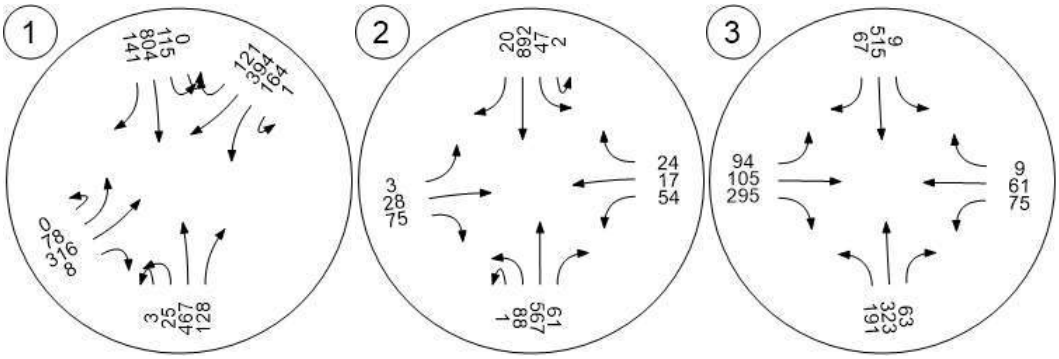
Traffic Volume - Base Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 5: AM Existing - Limited Access

Report File: C:\...\AM Existing Limited Access.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
2	CSAH 5 & 136th St	Two-way stop	HCM 2010	SB U-T	0.007	18.6	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Two-way stop	Delay (sec / veh):	18.6
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.007

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	1	0	26	7	-2	-2	0	-26	-14	20
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	21	737	20	2	13	335	10	0	0	40	0	0	63
Peak Hour Factor	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.908	0.9080	0.9080	0.9080	0.9080	0.9080	0.9080
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	6	203	6	1	4	92	3	0	0	11	0	0	17
Total Analysis Volume [veh/h]	0	23	812	22	2	14	369	11	0	0	44	0	0	69
Pedestrian Volume [ped/h]	0				0				0			1		

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Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

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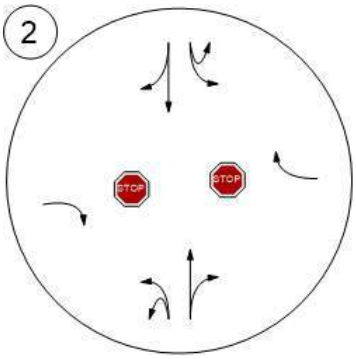
Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.02	0.01	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.19
d_M, Delay for Movement [s/veh]	11.02	8.11	0.00	0.00	18.61	9.71	0.00	0.00	0.00	0.00	10.73	0.00	0.00	17.01
Movement LOS	B	A	A	A	C	A	A	A			B			C
95th-Percentile Queue Length [veh]	0.06	0.06	0.00	0.00	0.08	0.08	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.68
95th-Percentile Queue Length [ft]	1.49	1.49	0.00	0.00	1.94	1.94	0.00	0.00	0.00	0.00	5.24	0.00	0.00	16.98
d_A, Approach Delay [s/veh]	0.22				0.44				10.73			17.01		
Approach LOS	A				A				B			C		
d_I, Intersection Delay [s/veh]	1.47													
Intersection LOS	C													

Lane Configuration and Traffic Control



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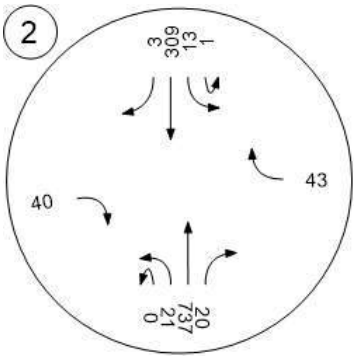
Traffic Volume - Base Volume



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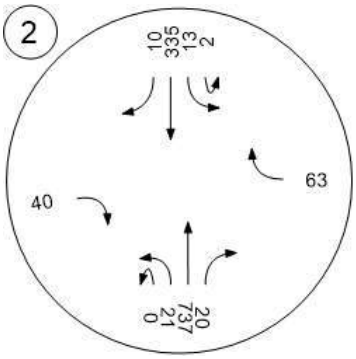
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

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Scenario 6: PM Existing - Limited Access

Report File: C:\...\PM Existing Limited Access.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
2	CSAH 5 & 136th St	Two-way stop	HCM 2010	NB U-T	0.005	24.6	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Two-way stop	Delay (sec / veh):	24.6
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.005

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	14	54	8	-3	-28	0	-54	-17	35
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	88	567	61	2	61	946	28	0	0	75	0	0	59
Peak Hour Factor	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.937	0.9370	0.9370	0.9370	0.9370	0.9370	0.9370
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	23	151	16	1	16	252	7	0	0	20	0	0	16
Total Analysis Volume [veh/h]	1	94	605	65	2	65	1010	30	0	0	80	0	0	63
Pedestrian Volume [ped/h]	6				5				2			1		

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Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

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Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.14	0.01	0.00	0.01	0.07	0.01	0.00	0.00	0.00	0.16	0.00	0.00	0.10
d_M, Delay for Movement [s/veh]	24.60	11.38	0.00	0.00	14.78	9.35	0.00	0.00	0.00	0.00	13.78	0.00	0.00	11.23
Movement LOS	C	B	A	A	B	A	A	A			B			B
95th-Percentile Queue Length [veh]	0.51	0.51	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.33
95th-Percentile Queue Length [ft]	12.82	12.82	0.00	0.00	6.28	6.28	0.00	0.00	0.00	0.00	14.48	0.00	0.00	8.14
d_A, Approach Delay [s/veh]	1.43				0.58				13.78			11.23		
Approach LOS	A				A				B			B		
d_I, Intersection Delay [s/veh]	1.76													
Intersection LOS	C													

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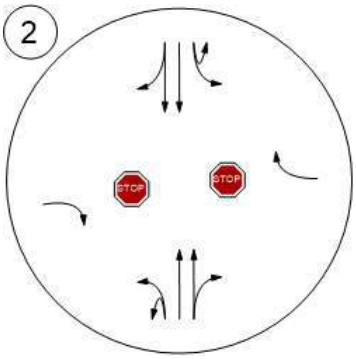
Lane Configuration and Traffic Control



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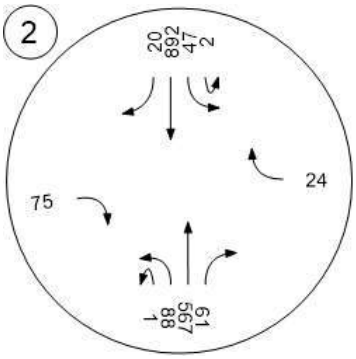
Traffic Volume - Base Volume



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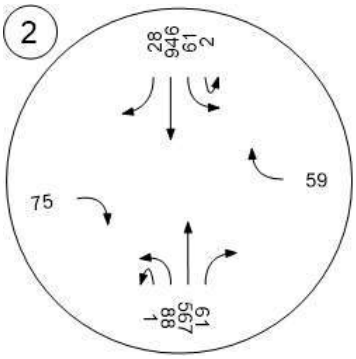
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 9: AM 2036 - Signals

Report File: C:\...\AM 2036 Signals.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	SWB Thru	0.523	25.0	C
2	CSAH 5 & 136th St	Signalized	HCM 2010	WB Left	0.428	8.6	A
3	CSAH 11 & Burnsville Pkwy	Signalized	HCM 2010	EB Right	0.587	16.0	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	25.0
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.523

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	100.0	350.0	100.0	100.0	100.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.68	1.38	1.38	1.38	1.68	1.38
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	28	16	0	0	0	0	0	0	0	1	2	2	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	41	0	0	0	19	0	0	0	6	0	0	0	57
Total Hourly Volume [veh/h]	29	23	919	123	0	79	388	58	0	156	639	7	0	54	334	56
Peak Hour Factor	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	8	6	250	33	0	21	105	16	0	42	174	2	0	15	91	15
Total Analysis Volume [veh/h]	32	25	999	134	0	86	422	63	0	170	695	8	0	59	363	61
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0				0			
Bicycle Volume [bicycles/h]	0				1				0				0			

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	47	37	37	47	38	38	34	25	25	34	19	19
g / C, Green / Cycle	0.51	0.40	0.40	0.51	0.41	0.41	0.36	0.27	0.27	0.36	0.21	0.21
(v / s)_i Volume / Saturation Flow Rate	0.06	0.32	0.32	0.04	0.11	0.11	0.13	0.17	0.01	0.06	0.10	0.04
s, saturation flow rate [veh/h]	1031	1829	1754	2200	2200	2200	1273	4200	1557	935	3540	1569
c, Capacity [veh/h]	585	739	709	683	903	903	489	1127	418	350	740	328
d1, Uniform Delay [s]	7.85	18.15	18.17	7.66	13.64	13.58	21.21	29.76	24.96	20.45	32.35	30.20
k, delay calibration	0.04	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.03	6.59	6.91	0.30	0.59	0.56	1.53	2.00	0.07	0.08	1.83	0.98
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.10	0.78	0.78	0.13	0.27	0.26	0.35	0.62	0.02	0.17	0.49	0.19
d, Delay for Lane Group [s/veh]	7.87	24.74	25.08	7.96	14.23	14.14	22.74	31.75	25.03	20.53	34.17	31.19
Lane Group LOS	A	C	C	A	B	B	C	C	C	C	C	C
Critical Lane Group	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.36	8.47	8.21	0.59	2.56	2.45	2.70	6.86	0.13	0.80	3.63	1.17
50th-Percentile Queue Length [ft]	8.88	211.65	205.20	14.71	63.99	61.35	67.58	171.50	3.35	20.08	90.76	29.25
95th-Percentile Queue Length [veh]	0.64	13.24	12.91	1.06	4.61	4.42	4.87	11.16	0.24	1.45	6.53	2.11
95th-Percentile Queue Length [ft]	15.99	330.94	322.66	26.49	115.18	110.43	121.65	278.89	6.04	36.15	163.37	52.65

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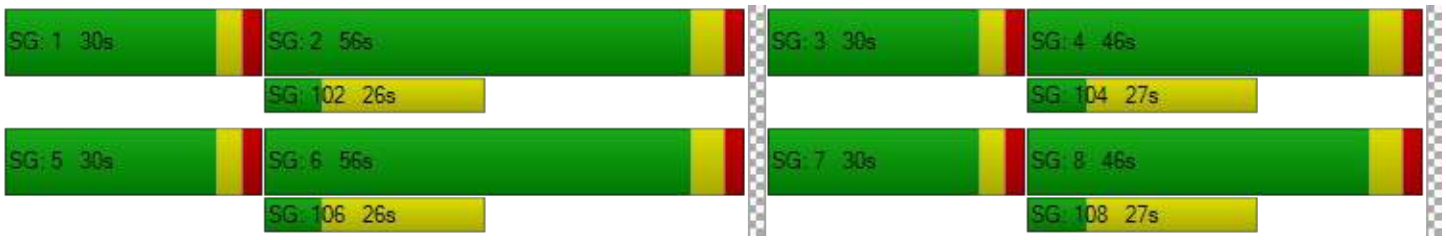
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	7.87	7.87	24.88	25.08	7.96	7.96	14.19	14.14	22.74	22.74	31.75	25.03	20.53	20.53	34.17	31.19
Movement LOS	A	A	C	C	A	A	B	B	C	C	C	C	C	C	C	C
d_A, Approach Delay [s/veh]	24.09				13.25				29.94				32.13			
Approach LOS	C				B				C				C			
d_I, Intersection Delay [s/veh]	24.99															
Intersection LOS	C															
Intersection V/C	0.523															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Signalized	Delay (sec / veh):	8.6
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.428

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	1	0	0	1
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	50.00	100.00	100.00	50.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.38	1.38	1.38	1.16	1.16	1.16	1.38	1.38	1.38	1.16	1.38	1.16	1.16	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	6	0	0	0	1	0	0	23	0	0	13
Total Hourly Volume [veh/h]	0	29	1017	17	1	15	426	3	3	2	32	30	16	37
Peak Hour Factor	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	8	276	5	0	4	116	1	1	1	9	8	4	10
Total Analysis Volume [veh/h]	0	32	1105	18	1	16	463	3	3	2	35	33	17	40
Presence of On-Street Parking	No			No	No			No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0			1		
Bicycle Volume [bicycles/h]	0				0				0			0		

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	1	6	0	0	5	2	0	0	8	0	0	4	0
Auxiliary Signal Groups														
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	15	0	0	5	15	0	0	7	0	0	7	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	35	0	0	35	0
Amber [s]	0.0	3.0	4.5	0.0	0.0	3.0	4.5	0.0	0.0	3.5	0.0	0.0	3.5	0.0
All red [s]	0.0	2.0	1.5	0.0	0.0	2.0	1.5	0.0	0.0	1.5	0.0	0.0	1.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	5.0	0.0	0.0	2.0	5.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	0	10	0	0	0	10	0	0	16	0	0	16	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No	Yes			No	Yes			No			No	
Maximum Recall		No	No			No	No			No			No	
Pedestrian Recall		No	No			No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	C	R	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	27	21	21	27	21	21	5	5	5	5
g / C, Green / Cycle	0.63	0.50	0.50	0.63	0.48	0.48	0.11	0.11	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.03	0.31	0.31	0.03	0.13	0.13	0.01	0.02	0.12	0.03
s, saturation flow rate [veh/h]	1071	1841	1831	672	1839	1835	506	1590	420	1544
c, Capacity [veh/h]	886	914	909	567	884	882	189	176	185	171
d1, Uniform Delay [s]	2.98	7.88	7.88	2.64	4.45	4.45	17.26	17.46	18.14	17.53
k, delay calibration	0.04	0.23	0.23	0.23	0.23	0.23	0.13	0.13	0.13	0.13
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.01	1.45	1.46	0.05	0.34	0.34	0.07	0.66	0.94	0.84
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.04	0.62	0.62	0.03	0.26	0.26	0.03	0.20	0.27	0.23
d, Delay for Lane Group [s/veh]	2.99	9.33	9.34	2.69	4.78	4.78	17.33	18.12	19.08	18.37
Lane Group LOS	A	A	A	A	A	A	B	B	B	B
Critical Lane Group	No	No	Yes	Yes	No	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.03	2.38	2.37	0.01	0.56	0.55	0.04	0.31	0.45	0.36
50th-Percentile Queue Length [ft]	0.71	59.50	59.24	0.33	13.89	13.87	1.06	7.75	11.17	8.95
95th-Percentile Queue Length [veh]	0.05	4.28	4.26	0.02	1.00	1.00	0.08	0.56	0.80	0.64
95th-Percentile Queue Length [ft]	1.29	107.10	106.62	0.59	25.00	24.97	1.91	13.94	20.11	16.12

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	2.99	2.99	9.33	9.34	2.69	2.69	4.78	4.78	17.33	17.33	18.12	19.08	19.08	18.37
Movement LOS	A	A	A	A	A	A	A	A	B	B	B	B	B	B
d_A, Approach Delay [s/veh]	9.16				4.71				18.02			18.76		
Approach LOS	A				A				B			B		
d_I, Intersection Delay [s/veh]	8.63													
Intersection LOS	A													
Intersection V/C	0.428													

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	16.0
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.587

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	1	0	1	1	0	0	1	0	1
Pocket Length [ft]	250.00	100.00	600.00	150.00	100.00	400.00	100.00	100.00	100.00	175.00	100.00	200.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	10	0	0	12	0	0	44	0	0	5
Total Hourly Volume [veh/h]	296	787	28	1	247	35	96	39	132	66	57	14
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	80	214	8	0	67	10	26	11	36	18	15	4
Total Analysis Volume [veh/h]	322	855	30	1	268	38	104	42	143	72	62	15
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0			0			0			2		
Bicycle Volume [bicycles/h]	1			0			0			0		

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	0	1	6	0	7	4	0	3	8	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	0	5	15	0	5	8	0	5	5	0
Maximum Green [s]	40	65	0	25	50	0	25	35	0	25	35	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
All red [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	2.0	5.0	0.0	2.0	6.0	0.0	2.0	3.0	0.0	2.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	22	0	0	22	0	0	18	0	0	18	0
l1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
l2, Clearance Lost Time [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
Minimum Recall	No	Yes		No	Yes		No	No		No	No	
Maximum Recall	No	No		No	No		No	No		No	No	
Pedestrian Recall	No	No		No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	45	40	40	45	32	32	18	9	9	18	8	8
g / C, Green / Cycle	0.60	0.53	0.53	0.60	0.43	0.43	0.24	0.12	0.12	0.24	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.25	0.46	0.02	0.00	0.14	0.02	0.07	0.02	0.09	0.05	0.03	0.01
s, saturation flow rate [veh/h]	1273	1852	1537	704	1852	1593	1546	1870	1586	1510	1865	1579
c, Capacity [veh/h]	802	986	819	347	797	685	473	226	192	479	196	166
d1, Uniform Delay [s]	4.07	8.87	5.15	10.52	14.24	12.48	23.08	29.67	31.87	22.64	31.08	30.34
k, delay calibration	0.23	0.23	0.23	0.04	0.39	0.39	0.11	0.11	0.11	0.04	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.69	5.09	0.04	0.00	0.90	0.12	0.23	0.39	5.67	0.05	0.92	0.23
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.40	0.87	0.04	0.00	0.34	0.06	0.22	0.19	0.75	0.15	0.32	0.09
d, Delay for Lane Group [s/veh]	4.76	13.96	5.19	10.52	15.14	12.60	23.31	30.06	37.55	22.70	32.00	30.57
Lane Group LOS	A	B	A	B	B	B	C	C	D	C	C	C
Critical Lane Group	No	Yes	No	Yes	No	No	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh]	1.03	6.15	0.13	0.01	2.87	0.35	1.41	0.67	2.65	0.96	1.05	0.25
50th-Percentile Queue Length [ft]	25.83	153.73	3.23	0.13	71.75	8.87	35.26	16.69	66.36	24.06	26.13	6.14
95th-Percentile Queue Length [veh]	1.86	10.22	0.23	0.01	5.17	0.64	2.54	1.20	4.78	1.73	1.88	0.44
95th-Percentile Queue Length [ft]	46.50	255.40	5.82	0.23	129.15	15.97	63.47	30.05	119.46	43.30	47.03	11.06

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	4.76	13.96	5.19	10.52	15.14	12.60	23.31	30.06	37.55	22.70	32.00	30.57
Movement LOS	A	B	A	B	B	B	C	C	D	C	C	C
d_A, Approach Delay [s/veh]	11.29			14.81			31.34			27.36		
Approach LOS	B			B			C			C		
d_I, Intersection Delay [s/veh]	16.04											
Intersection LOS	B											
Intersection V/C	0.587											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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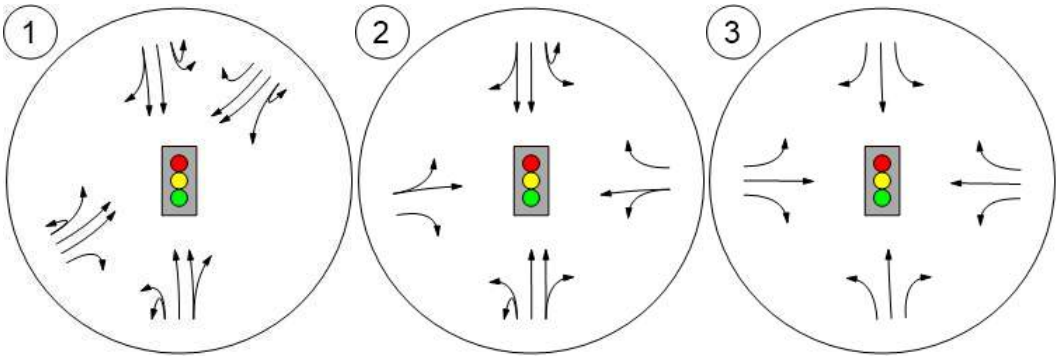
Lane Configuration and Traffic Control



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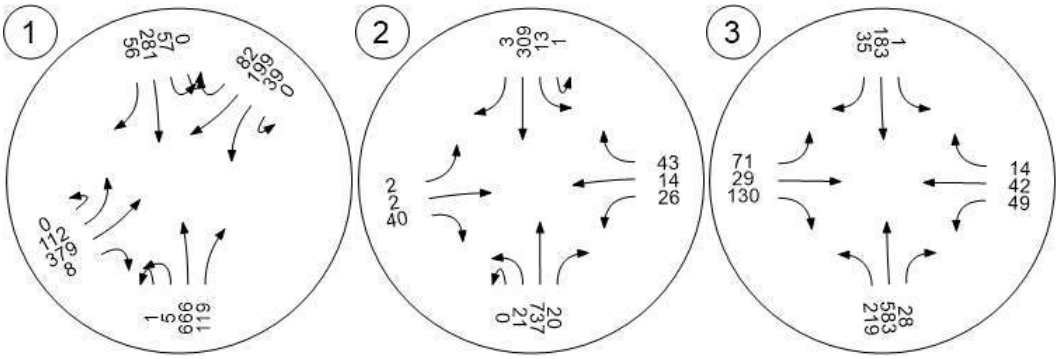
Traffic Volume - Base Volume



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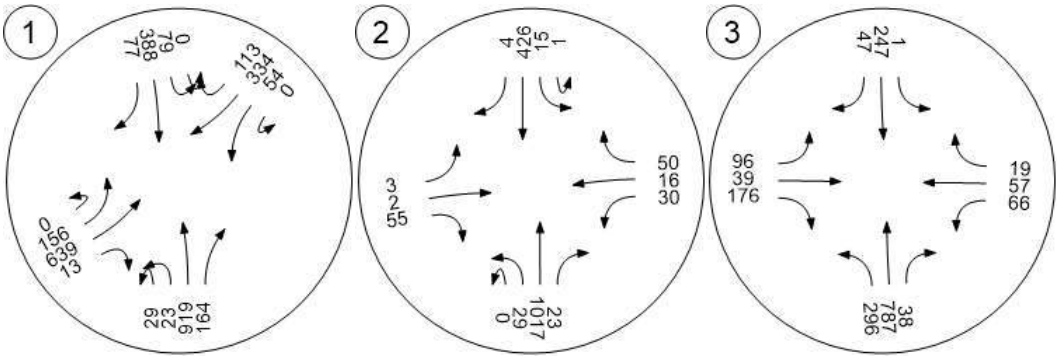
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 19: AM 2036 - Signal with Rights

Report File: C:\...\AM 2036 Signal with Rights.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	SWB Thru	0.493	22.8	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	22.8
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.493

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	200.0	350.0	100.0	100.0	200.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.68	1.38	1.38	1.38	1.68	1.38
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	28	16	0	0	0	0	0	0	0	1	2	2	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	41	0	0	0	19	0	0	0	6	0	0	0	57
Total Hourly Volume [veh/h]	29	23	919	123	0	79	388	58	0	156	639	7	0	54	334	56
Peak Hour Factor	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	8	6	250	33	0	21	105	16	0	42	174	2	0	15	91	15
Total Analysis Volume [veh/h]	32	25	999	134	0	86	422	63	0	170	695	8	0	59	363	61
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	0				0				0				0			
Bicycle Volume [bicycles/h]	0				1				0				0			

Appendix F - Alternative Capacity Analysis Backup

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	47	37	37	47	38	38	34	25	25	34	19	19
g / C, Green / Cycle	0.51	0.40	0.40	0.51	0.41	0.41	0.36	0.27	0.27	0.36	0.21	0.21
(v / s)_i Volume / Saturation Flow Rate	0.05	0.29	0.09	0.04	0.10	0.03	0.13	0.17	0.01	0.06	0.10	0.04
s, saturation flow rate [veh/h]	1077	3482	1562	2200	4400	2200	1273	4200	1557	935	3540	1569
c, Capacity [veh/h]	615	1406	631	766	1805	902	490	1129	418	351	741	328
d1, Uniform Delay [s]	7.79	17.38	13.74	7.67	13.46	12.69	21.19	29.75	24.96	20.44	32.35	30.20
k, delay calibration	0.04	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.04	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.02	2.43	0.60	0.23	0.24	0.12	1.53	1.99	0.07	0.08	1.82	0.98
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.09	0.71	0.21	0.11	0.23	0.07	0.35	0.62	0.02	0.17	0.49	0.19
d, Delay for Lane Group [s/veh]	7.81	19.81	14.35	7.91	13.70	12.81	22.72	31.74	25.02	20.52	34.17	31.18
Lane Group LOS	A	B	B	A	B	B	C	C	C	C	C	C
Critical Lane Group	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.36	6.34	1.42	0.58	2.09	0.60	2.70	6.86	0.13	0.80	3.63	1.17
50th-Percentile Queue Length [ft]	8.89	158.44	35.41	14.56	52.35	15.12	67.54	171.44	3.35	20.08	90.74	29.24
95th-Percentile Queue Length [veh]	0.64	10.47	2.55	1.05	3.77	1.09	4.86	11.15	0.24	1.45	6.53	2.11
95th-Percentile Queue Length [ft]	16.00	261.65	63.74	26.21	94.22	27.21	121.58	278.80	6.03	36.14	163.32	52.63

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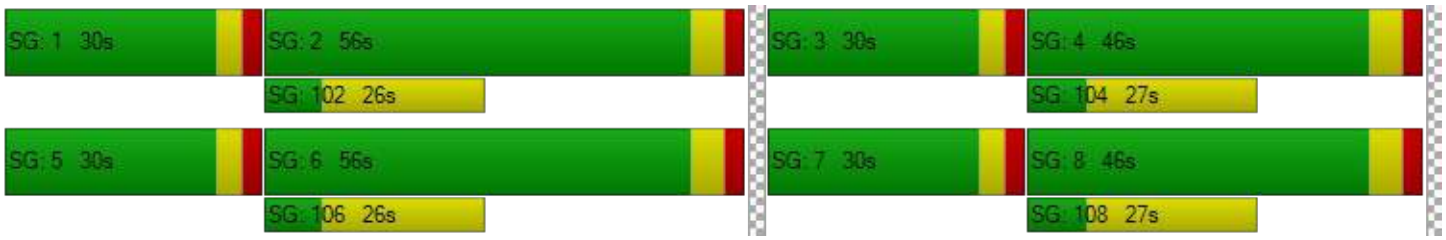
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	7.81	7.81	19.81	14.35	7.91	7.91	13.70	12.81	22.72	22.72	31.74	25.02	20.52	20.52	34.17	31.18
Movement LOS	A	A	B	B	A	A	B	B	C	C	C	C	C	C	C	C
d_A, Approach Delay [s/veh]	18.62				12.73				29.92				32.12			
Approach LOS	B				B				C				C			
d_I, Intersection Delay [s/veh]	22.80															
Intersection LOS	C															
Intersection V/C	0.493															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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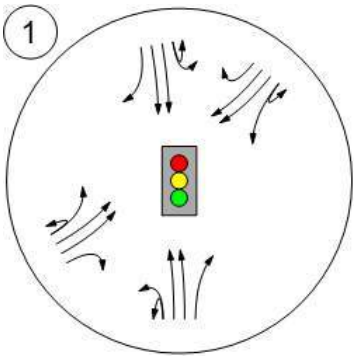
Lane Configuration and Traffic Control



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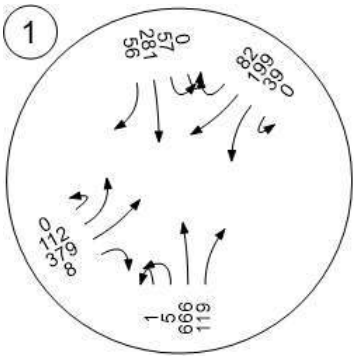
Traffic Volume - Base Volume



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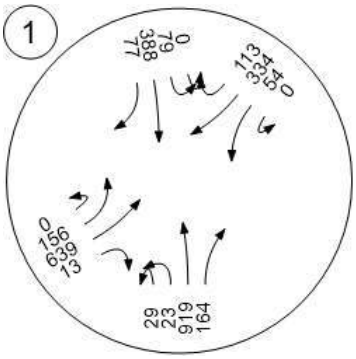
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

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Scenario 10: PM 2036 - Signals

Report File: C:\...\PM 2036 Signals.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	NEB Thru	0.635	31.0	C
2	CSAH 5 & 136th St	Signalized	HCM 2010	WB Left	0.453	9.3	A
3	CSAH 11 & Burnsville Pkwy	Signalized	HCM 2010	EB Right	0.690	32.0	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	31.0
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.635

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	100.0	350.0	100.0	100.0	100.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.68	1.38	1.38	1.38	1.68	1.38
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	54	17	0	0	0	0	0	0	1	2	2	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	44	0	0	0	49	0	0	0	6	0	0	0	84
Total Hourly Volume [veh/h]	58	52	644	133	0	159	1110	146	1	110	533	5	1	226	662	83
Peak Hour Factor	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	15	14	168	35	0	41	289	38	0	29	139	1	0	59	172	22
Total Analysis Volume [veh/h]	60	54	671	139	0	166	1156	152	1	115	555	5	1	235	690	86
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	3				2				1				3			
Bicycle Volume [bicycles/h]	4				2				0				0			

Appendix F - Alternative Capacity Analysis Backup

Generated with PTV VISTRO
Version 4.00-04

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	56	45	45	56	46	46	41	23	23	41	29	29
g / C, Green / Cycle	0.51	0.41	0.41	0.51	0.42	0.42	0.38	0.21	0.21	0.38	0.26	0.26
(v / s)_i Volume / Saturation Flow Rate	0.19	0.23	0.23	0.08	0.36	0.37	0.12	0.13	0.00	0.20	0.19	0.05
s, saturation flow rate [veh/h]	605	1829	1710	2200	1841	1761	992	4200	1557	1181	3540	1569
c, Capacity [veh/h]	278	754	705	906	780	746	340	893	331	443	934	414
d1, Uniform Delay [s]	19.71	18.15	18.19	8.86	20.96	21.16	24.84	39.14	34.08	25.71	36.89	31.42
k, delay calibration	0.26	0.39	0.39	0.39	0.44	0.44	0.39	0.39	0.39	0.30	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	2.29	2.30	2.50	0.35	10.17	11.47	2.14	2.57	0.07	2.74	4.15	0.89
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.41	0.55	0.56	0.18	0.85	0.86	0.34	0.62	0.02	0.53	0.74	0.21
d, Delay for Lane Group [s/veh]	22.00	20.45	20.68	9.21	31.13	32.64	26.98	41.71	34.14	28.44	41.04	32.32
Lane Group LOS	C	C	C	A	C	C	C	D	C	C	D	C
Critical Lane Group	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	1.04	6.02	5.71	1.36	13.04	13.03	2.17	6.98	0.11	4.60	8.70	1.84
50th-Percentile Queue Length [ft]	26.06	150.49	142.72	33.92	325.98	325.86	54.23	174.40	2.76	114.98	217.47	45.89
95th-Percentile Queue Length [veh]	1.88	10.04	9.63	2.44	18.96	18.96	3.90	11.31	0.20	8.12	13.54	3.30
95th-Percentile Queue Length [ft]	46.90	251.08	240.69	61.06	474.03	473.88	97.61	282.69	4.97	202.91	338.39	82.60

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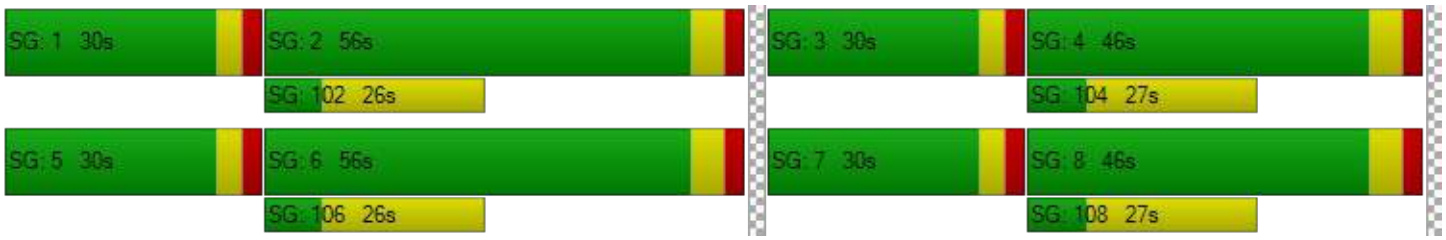
Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	22.00	22.00	20.54	20.68	9.21	9.21	31.77	32.64	26.98	26.98	41.71	34.14	28.44	28.44	41.04	32.32
Movement LOS	C	C	C	C	A	A	C	C	C	C	D	C	C	C	D	C
d_A, Approach Delay [s/veh]	20.74				29.32				39.12				37.36			
Approach LOS	C				C				D				D			
d_I, Intersection Delay [s/veh]	30.99															
Intersection LOS	C															
Intersection V/C	0.635															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Signalized	Delay (sec / veh):	9.3
Analysis Method:	HCM 2010	Level Of Service:	A
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.453

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	1	0	0	1
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	50.00	100.00	100.00	50.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.38	1.38	1.38	1.16	1.38	1.16	1.38	1.38	1.38	1.16	1.38	1.16	1.16	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	18	0	0	0	7	0	0	52	0	0	7
Total Hourly Volume [veh/h]	1	121	782	53	3	55	1231	21	4	32	51	63	20	21
Peak Hour Factor	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	32	204	14	1	14	321	5	1	8	13	16	5	5
Total Analysis Volume [veh/h]	1	126	815	55	3	57	1282	22	4	33	53	66	21	22
Presence of On-Street Parking	No			No	No			No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	6				5				2			1		
Bicycle Volume [bicycles/h]	2				1				0			1		

Appendix F - Alternative Capacity Analysis Backup

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Version 4.00-04

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	1	6	0	0	5	2	0	0	8	0	0	4	0
Auxiliary Signal Groups														
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	-	-	-	-	-
Minimum Green [s]	0	5	15	0	0	5	15	0	0	7	0	0	7	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	35	0	0	35	0
Amber [s]	0.0	3.0	4.5	0.0	0.0	3.0	4.5	0.0	0.0	3.5	0.0	0.0	3.5	0.0
All red [s]	0.0	2.0	1.5	0.0	0.0	2.0	1.5	0.0	0.0	1.5	0.0	0.0	1.5	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	5.0	0.0	0.0	2.0	5.0	0.0	0.0	3.5	0.0	0.0	3.5	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	0	10	0	0	0	10	0	0	16	0	0	16	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0
Minimum Recall		No	Yes			No	Yes			No			No	
Maximum Recall		No	No			No	No			No			No	
Pedestrian Recall		No	No			No	No			No			No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	C	L	C	C	C	R	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	3.00	3.00	3.00	3.00
g_i, Effective Green Time [s]	36	28	28	36	27	27	6	6	6	6
g / C, Green / Cycle	0.68	0.53	0.53	0.68	0.50	0.50	0.12	0.12	0.12	0.12
(v / s)_i Volume / Saturation Flow Rate	0.18	0.24	0.24	0.07	0.36	0.36	0.03	0.03	0.06	0.01
s, saturation flow rate [veh/h]	696	1841	1794	809	1839	1827	1321	1565	1348	1503
c, Capacity [veh/h]	578	968	944	655	923	917	231	185	278	178
d1, Uniform Delay [s]	4.90	7.88	7.89	1.75	6.37	6.38	21.21	21.48	22.19	21.06
k, delay calibration	0.04	0.23	0.23	0.23	0.23	0.23	0.13	0.13	0.13	0.13
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.07	0.71	0.74	0.13	2.15	2.18	0.39	1.01	0.77	0.37
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.22	0.45	0.46	0.09	0.71	0.71	0.16	0.29	0.31	0.12
d, Delay for Lane Group [s/veh]	4.97	8.60	8.63	1.88	8.52	8.56	21.60	22.49	22.95	21.43
Lane Group LOS	A	A	A	A	A	A	C	C	C	C
Critical Lane Group	Yes	No	No	No	No	Yes	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.18	2.19	2.15	0.05	2.72	2.71	0.41	0.61	1.00	0.25
50th-Percentile Queue Length [ft]	4.52	54.70	53.68	1.16	67.97	67.81	10.22	15.25	25.12	6.14
95th-Percentile Queue Length [veh]	0.33	3.94	3.86	0.08	4.89	4.88	0.74	1.10	1.81	0.44
95th-Percentile Queue Length [ft]	8.14	98.45	96.62	2.09	122.34	122.07	18.40	27.44	45.22	11.04

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	4.97	4.97	8.61	8.63	1.88	1.88	8.54	8.56	21.60	21.60	22.49	22.95	22.95	21.43
Movement LOS	A	A	A	A	A	A	A	A	C	C	C	C	C	C
d_A, Approach Delay [s/veh]	8.15				8.25				22.13			22.65		
Approach LOS	A				A				C			C		
d_I, Intersection Delay [s/veh]	9.31													
Intersection LOS	A													
Intersection V/C	0.453													

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	-	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	32.0
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.690

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	1	0	1	1	0	0	1	0	1
Pocket Length [ft]	250.00	100.00	600.00	150.00	100.00	400.00	100.00	100.00	100.00	175.00	100.00	200.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	21	0	0	23	0	0	100	0	0	3
Total Hourly Volume [veh/h]	258	436	64	12	695	67	127	142	298	101	82	9
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	67	114	17	3	181	17	33	37	78	26	21	2
Total Analysis Volume [veh/h]	269	454	67	13	724	70	132	148	310	105	85	9
Presence of On-Street Parking	No		No	No		No	No		No	No		No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	1			0			2			0		
Bicycle Volume [bicycles/h]	1			0			0			0		

Appendix F - Alternative Capacity Analysis Backup

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Version 4.00-04

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Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss	Protecte	Permiss	Permiss
Signal group	5	2	0	1	6	0	7	4	0	3	8	0
Auxiliary Signal Groups												
Lead / Lag	Lead	-	-	Lead	-	-	Lead	-	-	Lead	-	-
Minimum Green [s]	5	15	0	5	15	0	5	8	0	5	5	0
Maximum Green [s]	10	65	0	10	65	0	15	40	0	15	40	0
Amber [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
All red [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	2.0	5.0	0.0	2.0	6.0	0.0	2.0	3.0	0.0	2.0	3.0	0.0
Walk [s]	0	7	0	0	7	0	0	7	0	0	7	0
Pedestrian Clearance [s]	0	22	0	0	22	0	0	18	0	0	18	0
I1, Start-Up Lost Time [s]	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0	3.0	4.0	0.0
Minimum Recall	No	Yes		No	Yes		No	No		No	No	
Maximum Recall	No	No		No	No		No	No		No	No	
Pedestrian Recall	No	No		No	No		No	No		No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	65	58	58	65	51	51	37	25	25	37	24	24
g / C, Green / Cycle	0.57	0.51	0.51	0.57	0.45	0.45	0.32	0.22	0.22	0.32	0.21	0.21
(v / s)_i Volume / Saturation Flow Rate	0.29	0.25	0.04	0.01	0.39	0.04	0.09	0.08	0.20	0.08	0.05	0.01
s, saturation flow rate [veh/h]	928	1852	1540	971	1852	1589	1462	1870	1583	1369	1865	1579
c, Capacity [veh/h]	365	950	790	545	828	710	517	412	349	454	387	327
d1, Uniform Delay [s]	25.83	10.84	9.03	11.28	28.62	18.24	28.29	37.63	43.09	28.05	37.51	36.01
k, delay calibration	0.23	0.23	0.23	0.04	0.42	0.39	0.11	0.11	0.11	0.04	0.11	0.11
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	6.06	0.80	0.10	0.01	10.82	0.22	0.26	0.53	8.10	0.10	0.28	0.03
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.74	0.48	0.08	0.02	0.87	0.10	0.26	0.36	0.89	0.23	0.22	0.03
d, Delay for Lane Group [s/veh]	31.89	11.64	9.13	11.29	39.44	18.45	28.55	38.16	51.19	28.15	37.80	36.04
Lane Group LOS	C	B	A	B	D	B	C	D	D	C	D	D
Critical Lane Group	Yes	No	No	No	Yes	No	No	No	Yes	Yes	No	No
50th-Percentile Queue Length [veh]	2.28	4.44	0.56	0.13	19.31	1.08	2.61	3.49	9.00	2.06	1.99	0.20
50th-Percentile Queue Length [ft]	56.96	110.98	14.03	3.37	482.76	26.98	65.31	87.18	225.10	51.38	49.64	5.04
95th-Percentile Queue Length [veh]	4.10	7.89	1.01	0.24	26.52	1.94	4.70	6.28	13.93	3.70	3.57	0.36
95th-Percentile Queue Length [ft]	102.53	197.36	25.26	6.06	662.93	48.57	117.56	156.92	348.13	92.48	89.36	9.08

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	31.89	11.64	9.13	11.29	39.44	18.45	28.55	38.16	51.19	28.15	37.80	36.04
Movement LOS	C	B	A	B	D	B	C	D	D	C	D	D
d_A, Approach Delay [s/veh]	18.32			37.17			42.86			32.63		
Approach LOS	B			D			D			C		
d_I, Intersection Delay [s/veh]	31.96											
Intersection LOS	C											
Intersection V/C	0.690											

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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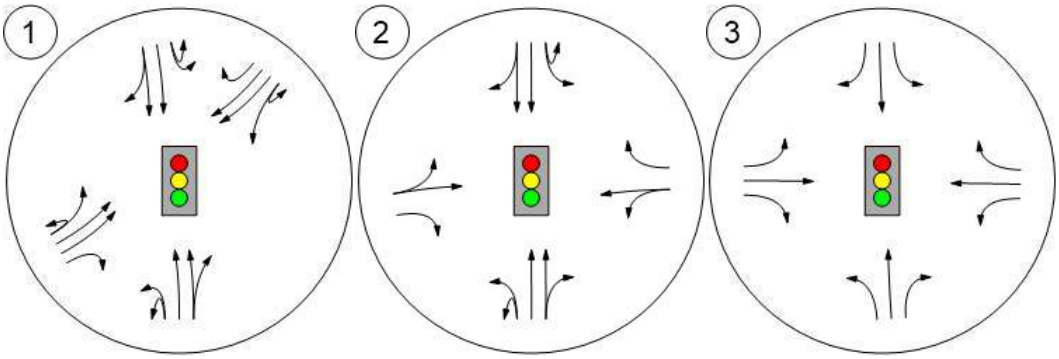
Lane Configuration and Traffic Control



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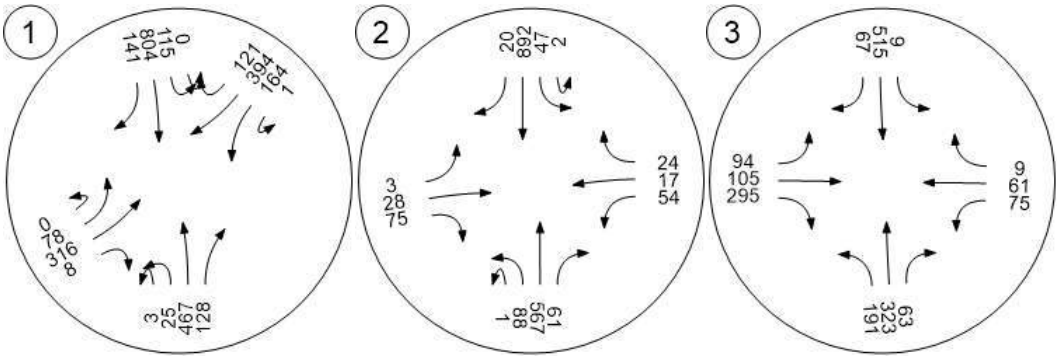
Traffic Volume - Base Volume



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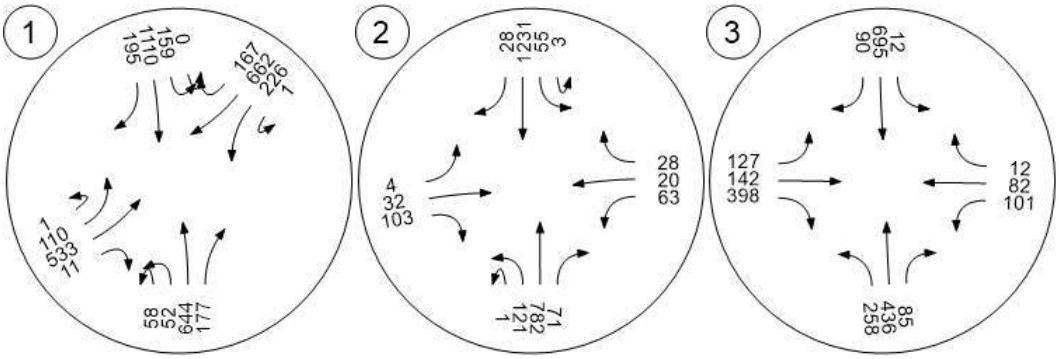
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 20: PM 2036 - Signal with Rights

Report File: C:\...\PM 2036 Signal with Rights.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Signalized	HCM 2010	NEB Thru	0.533	25.4	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Signalized	Delay (sec / veh):	25.4
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.533

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1
Pocket Length [ft]	300.0	100.0	100.0	200.0	350.0	100.0	100.0	200.0	175.0	100.0	100.0	50.00	175.0	100.0	100.0	50.00
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.68	1.38	1.38	1.38	1.68	1.38
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	54	17	0	0	0	0	0	0	1	2	2	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	44	0	0	0	49	0	0	0	6	0	0	0	84
Total Hourly Volume [veh/h]	58	52	644	133	0	159	1110	146	1	110	533	5	1	226	662	83
Peak Hour Factor	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	15	14	168	35	0	41	289	38	0	29	139	1	0	59	172	22
Total Analysis Volume [veh/h]	60	54	671	139	0	166	1156	152	1	115	555	5	1	235	690	86
Presence of On-Street Parking	No			No	No			No	No			No	No			No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	3				2				1				3			
Bicycle Volume [bicycles/h]	4				2				0				0			

Appendix F - Alternative Capacity Analysis Backup

Generated with PTV VISTRO
Version 4.00-04

Spack CONSULTING THE TRAFFIC STUDY COMPANY

Intersection Settings

Located in CBD	No
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Free Running
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi	Permi	Prote	Permi	Permi
Signal group	0	1	6	0	0	5	2	0	0	7	4	0	0	3	8	0
Auxiliary Signal Groups																
Lead / Lag	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-	-	Lead	-	-
Minimum Green [s]	0	5	12	0	0	5	12	0	0	5	10	0	0	5	10	0
Maximum Green [s]	0	25	50	0	0	25	50	0	0	25	40	0	0	25	40	0
Amber [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
All red [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
Split [s]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicle Extension [s]	0.0	2.0	6.0	0.0	0.0	2.5	6.0	0.0	0.0	2.0	6.0	0.0	0.0	2.0	6.0	0.0
Walk [s]	0	0	7	0	0	0	7	0	0	0	7	0	0	0	7	0
Pedestrian Clearance [s]	0	0	19	0	0	0	19	0	0	0	20	0	0	0	20	0
I1, Start-Up Lost Time [s]	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0	0.0	3.0	4.0	0.0
Minimum Recall		No	Yes			No	Yes			No	No			No	No	
Maximum Recall		No	No			No	No			No	No			No	No	
Pedestrian Recall		No	No			No	No			No	No			No	No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Version 4.00-04

Spack CONSULTING THE TRAFFIC STUDY COMPANY

Lane Group Calculations

Lane Group	L	C	R	L	C	R	L	C	R	L	C	R
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00	0.00	4.00	4.00
g_i, Effective Green Time [s]	52	41	41	52	42	42	40	23	23	40	28	28
g / C, Green / Cycle	0.50	0.39	0.39	0.50	0.41	0.41	0.38	0.22	0.22	0.38	0.27	0.27
(v / s)_i Volume / Saturation Flow Rate	0.17	0.19	0.09	0.08	0.26	0.07	0.12	0.13	0.00	0.20	0.19	0.05
s, saturation flow rate [veh/h]	675	3482	1536	2200	4400	2200	991	4200	1557	1176	3540	1569
c, Capacity [veh/h]	351	1368	603	938	1783	891	354	918	340	457	952	422
d1, Uniform Delay [s]	12.64	18.10	16.26	9.18	18.68	15.07	23.00	36.62	31.88	23.79	34.53	29.41
k, delay calibration	0.16	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.27	0.39	0.39
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.78	0.99	0.70	0.32	1.45	0.33	1.93	2.33	0.06	2.21	3.80	0.86
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.33	1.33	1.33	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.33	0.49	0.23	0.18	0.65	0.17	0.33	0.60	0.01	0.52	0.72	0.20
d, Delay for Lane Group [s/veh]	13.41	19.09	16.96	9.50	20.13	15.40	24.93	38.95	31.94	26.01	38.33	30.27
Lane Group LOS	B	B	B	A	C	B	C	D	C	C	D	C
Critical Lane Group	Yes	No	No	No	Yes	No	Yes	No	No	No	Yes	No
50th-Percentile Queue Length [veh]	0.94	4.51	1.75	1.35	7.98	1.77	2.01	6.52	0.10	4.22	8.12	1.72
50th-Percentile Queue Length [ft]	23.49	112.81	43.86	33.81	199.61	44.22	50.25	162.90	2.59	105.50	202.89	42.92
95th-Percentile Queue Length [veh]	1.69	8.00	3.16	2.43	12.62	3.18	3.62	10.70	0.19	7.59	12.79	3.09
95th-Percentile Queue Length [ft]	42.28	199.90	78.94	60.85	315.47	79.60	90.45	267.56	4.65	189.72	319.70	77.26

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Version 4.00-04

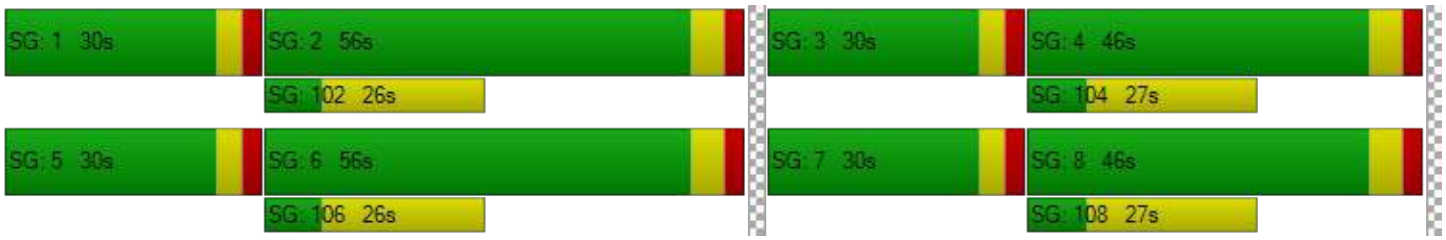
Spack CONSULTING THE TRAFFIC STUDY COMPANY

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	13.41	13.41	19.09	16.96	9.50	9.50	20.13	15.40	24.93	24.93	38.95	31.94	26.01	26.01	38.33	30.27
Movement LOS	B	B	B	B	A	A	C	B	C	C	D	C	C	C	D	C
d_A, Approach Delay [s/veh]	18.07				18.45				36.49				34.77			
Approach LOS	B				B				D				C			
d_I, Intersection Delay [s/veh]	25.39															
Intersection LOS	C															
Intersection V/C	0.533															

Sequence

Ring 1	1	2	3	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	5	6	7	8	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



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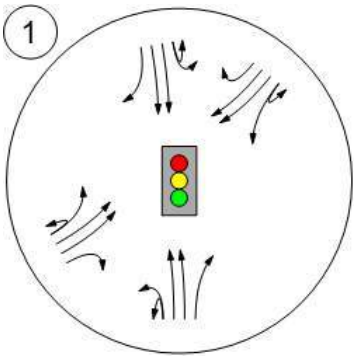
Lane Configuration and Traffic Control



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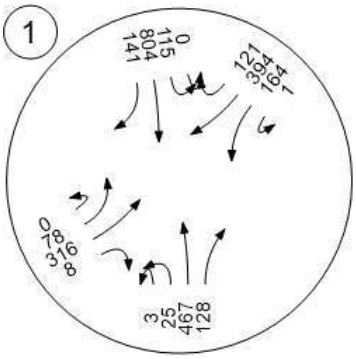
Traffic Volume - Base Volume



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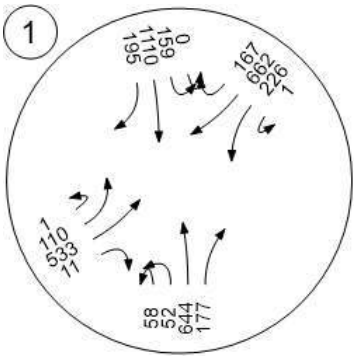
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 11: AM 2036 - Roundabouts

Report File: C:\...\AM 2036 Roundabouts.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Roundabout	HCM	NB U-T		42.8	E
2	CSAH 5 & 136th St	Roundabout	HCM	WB Right		5.7	A
3	CSAH 11 & Burnsville Pkwy	Roundabout	HCM	WB Left		7.9	A

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	42.8
Analysis Method:	HCM	Level Of Service:	E
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	1	5	666	119	0	57	281	56	0	112	379	8	0	39	199	82
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.68	1.38	1.38	1.38	1.68	1.38
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	30	16	0	0	0	0	0	0	0	1	2	2	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	31	23	919	164	0	79	388	77	0	156	639	13	0	54	334	113
Peak Hour Factor	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	8	6	250	45	0	21	105	21	0	42	174	4	0	15	91	31
Total Analysis Volume [veh/h]	34	25	999	178	0	86	422	84	0	170	695	14	0	59	363	123
Pedestrian Volume [ped/h]	0				0				0				0			

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Intersection Settings

Number of Conflicting Circulating Lanes	2				2				2				2			
Circulating Flow Rate [veh/h]	974				493				619				1275			
Exiting Flow Rate [veh/h]	798				397				531				1214			
Demand Flow Rate [veh/h]	31	23	919	164	0	79	388	77	0	156	639	13	0	54	334	113
Adjusted Demand Flow Rate [veh/h]	34	25	999	178	0	86	422	84	0	170	695	14	0	59	363	123

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.65	4.32	4.65	4.32	4.65	4.32	4.32	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.67	2.53	2.67	2.53	2.67	2.53	2.53	2.67	2.53	2.53
A (intercept)	1348.31	1422.92	1348.31	1422.92	1348.31	1422.92	1422.92	1348.31	1422.92	1422.92
B (coefficient)	0.00092	0.00085	0.00092	0.00085	0.00092	0.00085	0.00085	0.00092	0.00085	0.00085
HV Adjustment Factor	0.96	0.96	0.97	0.96	0.98	0.98	0.96	0.98	0.98	0.97
Entry Flow Rate [veh/h]	604	681	287	326	417	469	0	204	229	0
Capacity of Entry and Bypass Lanes [veh/h]	550	623	857	937	763	842	907	417	483	508
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	530	600	832	903	745	824	875	407	472	494
X, volume / capacity	1.10	1.09	0.33	0.35	0.55	0.56	0.02	0.49	0.47	0.25

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Movement, Approach, & Intersection Results

Lane LOS	F	F	A	A	B	B	A	C	C	B
95th-Percentile Queue Length [veh]	18.31	19.52	1.48	1.56	3.35	3.50	0.05	2.60	2.51	0.98
95th-Percentile Queue Length [ft]	457.70	488.05	36.92	39.11	83.68	87.52	1.22	64.90	62.67	24.39
Approach Delay [s/veh]	92.58		7.99		12.71			16.40		
Approach LOS	F		A		B			C		
Intersection Delay [s/veh]	42.83									
Intersection LOS	E									

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Roundabout	Delay (sec / veh):	5.7
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.38	1.38	1.16	1.38	1.38	1.16	1.38	1.38	1.38	1.16	1.38	1.16	1.16	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	29	855	28	1	15	426	4	3	2	55	30	16	50
Peak Hour Factor	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	8	232	8	0	4	116	1	1	1	15	8	4	14
Total Analysis Volume [veh/h]	0	32	929	30	1	16	463	4	3	2	60	33	17	54
Pedestrian Volume [ped/h]	0				0				0			1		

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Intersection Settings

Number of Conflicting Circulating Lanes	1				1				2			2		
Circulating Flow Rate [veh/h]	23				84				530			995		
Exiting Flow Rate [veh/h]	19				50				512			963		
Demand Flow Rate [veh/h]	0	29	855	28	1	15	426	4	3	2	55	30	16	50
Adjusted Demand Flow Rate [veh/h]	0	32	929	30	1	16	463	4	3	2	60	33	17	54

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00085	0.00085
HV Adjustment Factor	0.97	0.97	0.97	0.97	0.98	0.96
Entry Flow Rate [veh/h]	481	542	236	266	67	109
Capacity of Entry and Bypass Lanes [veh/h]	1389	1389	1313	1313	905	610
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1346	1346	1271	1271	890	587
X, volume / capacity	0.35	0.39	0.18	0.20	0.07	0.18

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	1.57	1.89	0.65	0.75	0.24	0.64
95th-Percentile Queue Length [ft]	39.14	47.16	16.28	18.86	5.90	16.01
Approach Delay [s/veh]	6.09		4.46		4.73	8.35
Approach LOS	A		A		A	A
Intersection Delay [s/veh]	5.70					
Intersection LOS	A					

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	7.9
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	1	0	0	1	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	600.00	100.00	100.00	400.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	219	583	28	1	183	35	71	29	130	49	42	14
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	296	787	38	1	247	47	96	39	176	66	57	19
Peak Hour Factor	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200	0.9200
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	80	214	10	0	67	13	26	11	48	18	15	5
Total Analysis Volume [veh/h]	322	855	41	1	268	51	104	42	191	72	62	21
Pedestrian Volume [ped/h]	0			0			0			2		

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Intersection Settings

Number of Conflicting Circulating Lanes	1			1			2			2		
Circulating Flow Rate [veh/h]	149			464			350			1309		
Exiting Flow Rate [veh/h]	44			390			349			982		
Demand Flow Rate [veh/h]	296	787	38	1	247	47	96	39	176	66	57	19
Adjusted Demand Flow Rate [veh/h]	322	855	41	1	268	51	104	42	191	72	62	21

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.67	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1348.31	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00092	0.00085	0.00085
HV Adjustment Factor	0.98	0.97	0.97	0.98	0.99	0.98	0.98
Entry Flow Rate [veh/h]	586	663	155	174	148	0	159
Capacity of Entry and Bypass Lanes [veh/h]	1238	1238	929	929	977	1055	468
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1210	1207	906	907	965	1037	458
X, volume / capacity	0.47	0.54	0.17	0.19	0.15	0.18	0.34

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	A	A	A	B
95th-Percentile Queue Length [veh]	2.61	3.30	0.59	0.68	0.53	0.67	1.48
95th-Percentile Queue Length [ft]	65.23	82.48	14.85	17.12	13.30	16.84	37.03
Approach Delay [s/veh]	8.55		5.71		5.17		13.56
Approach LOS	A		A		A		B
Intersection Delay [s/veh]	7.92						
Intersection LOS	A						

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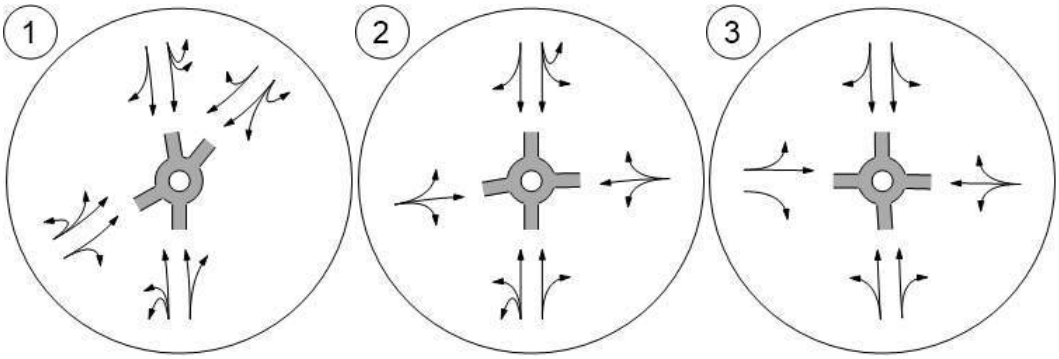
Lane Configuration and Traffic Control



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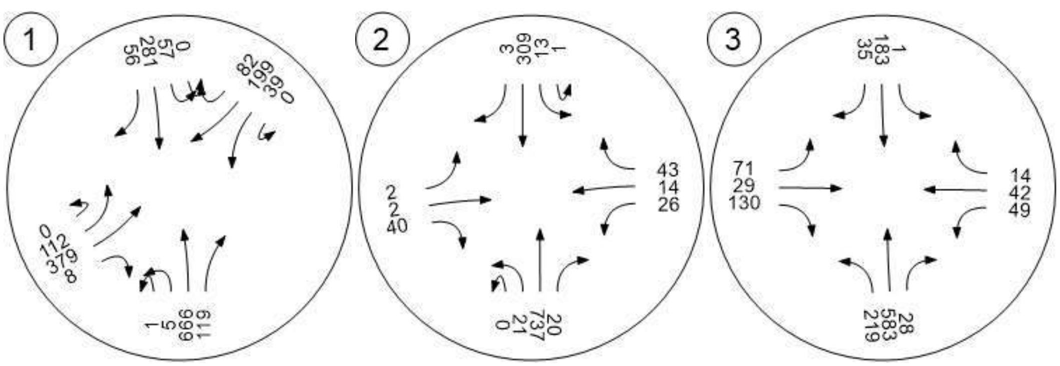
Traffic Volume - Base Volume



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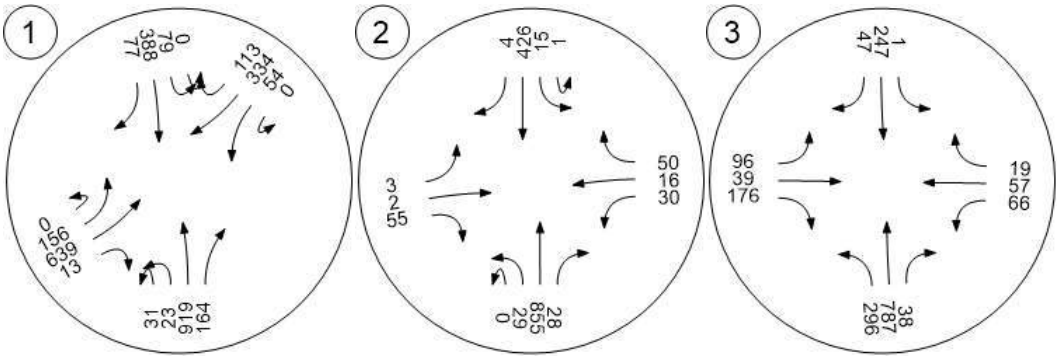
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 12: PM 2036 - Roundabouts

Report File: C:\...\PM 2036 Roundabouts.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	CSAH 5 & Burnsville Pkwy	Roundabout	HCM	SB Left		115.7	F
2	CSAH 5 & 136th St	Roundabout	HCM	EB Right		9.8	A
3	CSAH 11 & Burnsville Pkwy	Roundabout	HCM	EB Right		10.5	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: CSAH 5 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	115.7
Analysis Method:	HCM	Level Of Service:	F
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Approach	Northbound				Southbound				Northeastbound				Southwestbound			
Lane Configuration																
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Speed [mph]	45.00				45.00				35.00				40.00			
Grade [%]	0.00				0.00				0.00				0.00			
Crosswalk	Yes				Yes				Yes				Yes			

Volumes

Name	CSAH 5				CSAH 5				Burnsville Pkwy				Burnsville Pkwy			
Base Volume Input [veh/h]	3	25	467	128	0	115	804	141	0	78	316	8	1	164	394	121
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	0.00	5.20	3.90	3.40	0.00	1.90	3.20	6.40	0.00	3.70	2.20	3.70	0.00	4.40	2.20	2.90
Growth Rate	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.68	1.38	1.38	1.38	1.68	1.38
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	54	17	0	0	0	0	0	0	1	2	2	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	58	52	644	177	0	159	1110	195	1	110	533	11	1	226	662	167
Peak Hour Factor	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	15	14	168	46	0	41	289	51	0	29	139	3	0	59	172	43
Total Analysis Volume [veh/h]	60	54	671	184	0	166	1156	203	1	115	555	11	1	235	690	174
Pedestrian Volume [ped/h]	3				2				1				3			

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Intersection Settings

Number of Conflicting Circulating Lanes	2				2				2				2			
Circulating Flow Rate [veh/h]	858				1069				1668				934			
Exiting Flow Rate [veh/h]	737				763				1498				816			
Demand Flow Rate [veh/h]	58	52	644	177	0	159	1110	195	1	110	533	11	1	226	662	167
Adjusted Demand Flow Rate [veh/h]	60	54	671	184	0	166	1156	203	1	115	555	11	1	235	690	174

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.65	4.32	4.65	4.32	4.65	4.32	4.32	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.67	2.53	2.67	2.53	2.67	2.53	2.53	2.67	2.53	2.53
A (intercept)	1348.31	1422.92	1348.31	1422.92	1348.31	1422.92	1422.92	1348.31	1422.92	1422.92
B (coefficient)	0.00092	0.00085	0.00092	0.00085	0.00092	0.00085	0.00085	0.00092	0.00085	0.00085
HV Adjustment Factor	0.96	0.96	0.97	0.96	0.98	0.98	0.96	0.97	0.98	0.97
Entry Flow Rate [veh/h]	473	534	739	838	324	364	0	448	503	0
Capacity of Entry and Bypass Lanes [veh/h]	613	688	504	575	291	346	400	571	644	712
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	591	662	489	554	284	338	385	556	630	692
X, volume / capacity	0.77	0.78	1.47	1.46	1.11	1.05	0.03	0.78	0.78	0.25

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Movement, Approach, & Intersection Results

Lane LOS	D	D	F	F	F	F	A	D	D	A
95th-Percentile Queue Length [veh]	7.13	7.42	35.96	39.47	13.07	12.71	0.09	7.32	7.44	0.99
95th-Percentile Queue Length [ft]	178.13	185.46	899.06	986.75	326.82	317.87	2.20	182.91	185.93	24.83
Approach Delay [s/veh]	26.49		239.94		110.86			25.16		
Approach LOS	D		F		F			D		
Intersection Delay [s/veh]	115.73									
Intersection LOS	F									

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Roundabout	Delay (sec / veh):	9.8
Analysis Method:	HCM	Level Of Service:	A
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.38	1.38	1.38	1.16	1.38	1.16	1.38	1.38	1.38	1.16	1.38	1.16	1.16	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	121	782	71	3	55	1231	28	4	32	103	63	20	28
Peak Hour Factor	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	32	204	18	1	14	321	7	1	8	27	16	5	7
Total Analysis Volume [veh/h]	1	126	815	74	3	57	1282	29	4	33	107	66	21	29
Pedestrian Volume [ped/h]	6				5				2			1		

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Intersection Settings

Number of Conflicting Circulating Lanes	1				1				2			2		
Circulating Flow Rate [veh/h]	101				219				1455			977		
Exiting Flow Rate [veh/h]	94				150				1393			848		
Demand Flow Rate [veh/h]	1	121	782	71	3	55	1231	28	4	32	103	63	20	28
Adjusted Demand Flow Rate [veh/h]	1	126	815	74	3	57	1282	29	4	33	107	66	21	29

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00085	0.00085
HV Adjustment Factor	0.97	0.97	0.97	0.97	0.98	0.97
Entry Flow Rate [veh/h]	492	556	666	752	148	121
Capacity of Entry and Bypass Lanes [veh/h]	1294	1294	1162	1162	413	620
Pedestrian Impedance	0.99	0.99	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1248	1246	1119	1118	405	598
X, volume / capacity	0.38	0.43	0.58	0.65	0.36	0.19

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Movement, Approach, & Intersection Results

Lane LOS	A	A	B	B	C	A
95th-Percentile Queue Length [veh]	1.83	2.23	3.83	5.05	1.58	0.71
95th-Percentile Queue Length [ft]	45.64	55.71	95.76	126.23	39.57	17.84
Approach Delay [s/veh]	6.93		11.36		15.53	8.44
Approach LOS	A		B		C	A
Intersection Delay [s/veh]	9.76					
Intersection LOS	A					

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Intersection Level Of Service Report
Intersection 3: CSAH 11 & Burnsville Pkwy

Control Type:	Roundabout	Delay (sec / veh):	10.5
Analysis Method:	HCM	Level Of Service:	B
Analysis Period:	15 minutes		

Intersection Setup

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	1	0	0	1	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	600.00	100.00	100.00	400.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	40.00			40.00			40.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	CSAH 11			CSAH 11			Burnsville Pkwy			Burnsville Pkwy		
Base Volume Input [veh/h]	191	323	63	9	515	67	94	105	295	75	61	9
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	1.50	2.60	2.70	4.40	2.60	1.40	1.10	1.60	1.80	2.60	1.90	2.30
Growth Rate	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	258	436	85	12	695	90	127	142	398	101	82	12
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	67	114	22	3	181	23	33	37	104	26	21	3
Total Analysis Volume [veh/h]	269	454	89	13	724	94	132	148	415	105	85	13
Pedestrian Volume [ped/h]	1			0			2			0		

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Intersection Settings

Number of Conflicting Circulating Lanes	1			1			2			2		
Circulating Flow Rate [veh/h]	297			467			864			872		
Exiting Flow Rate [veh/h]	164			360			851			599		
Demand Flow Rate [veh/h]	258	436	85	12	695	90	127	142	398	101	82	12
Adjusted Demand Flow Rate [veh/h]	269	454	89	13	724	94	132	148	415	105	85	13

Lanes

Overwrite Calculated Critical Headway	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Critical Headway [s]	4.55	4.55	4.55	4.55	4.65	4.32	4.32
Overwrite Calculated Follow-Up Time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
User-Defined Follow-Up Time [s]	2.54	2.54	2.54	2.54	2.67	2.54	2.54
A (intercept)	1417.32	1417.32	1417.32	1417.32	1348.31	1417.32	1417.32
B (coefficient)	0.00091	0.00091	0.00091	0.00091	0.00092	0.00085	0.00085
HV Adjustment Factor	0.98	0.97	0.97	0.98	0.99	0.98	0.98
Entry Flow Rate [veh/h]	390	442	401	452	284	423	208
Capacity of Entry and Bypass Lanes [veh/h]	1081	1081	926	926	609	682	677
Pedestrian Impedance	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capacity per Entry Lane [veh/h]	1057	1053	903	904	601	670	662
X, volume / capacity	0.36	0.41	0.43	0.49	0.47	0.62	0.31

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Movement, Approach, & Intersection Results

Lane LOS	A	A	A	B	B	C	A
95th-Percentile Queue Length [veh]	1.66	2.02	2.21	2.72	2.47	4.31	1.30
95th-Percentile Queue Length [ft]	41.57	50.57	55.35	68.11	61.78	107.75	32.45
Approach Delay [s/veh]	7.49		9.69		15.48		9.36
Approach LOS	A		A		C		A
Intersection Delay [s/veh]	10.54						
Intersection LOS	B						

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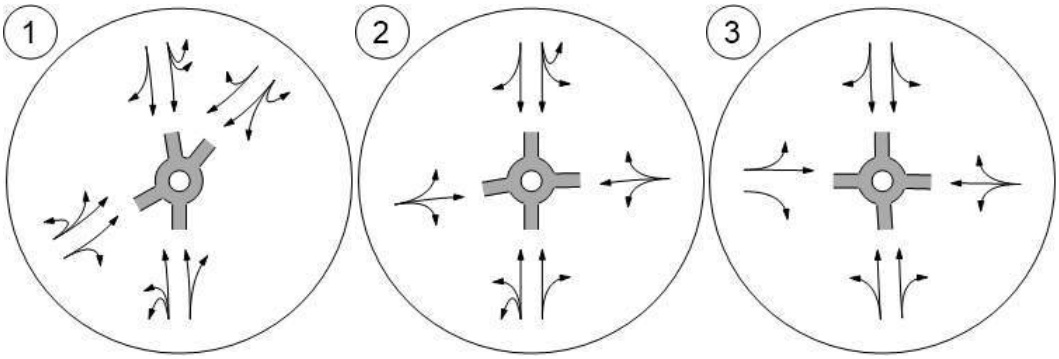
Lane Configuration and Traffic Control



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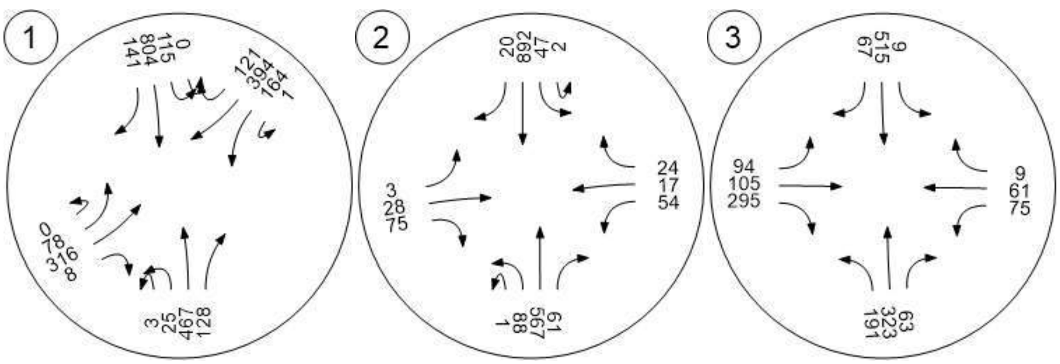
Traffic Volume - Base Volume



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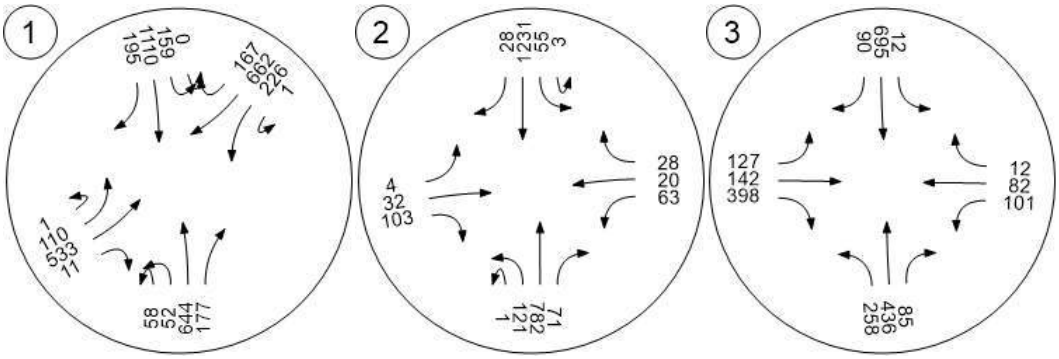
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 13: AM 2036 - Limited Access

Report File: C:\...\AM 2036 Limited Access.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
2	CSAH 5 & 136th St	Two-way stop	HCM 2010	SB U-T	0.004	20.7	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Two-way stop	Delay (sec / veh):	20.7
Analysis Method:	HCM 2010	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.004

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	0	21	737	20	1	13	309	3	2	2	40	26	14	43
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.38	1.38	1.16	1.38	1.38	1.16	1.38	1.38	1.00	1.00	1.38	1.00	1.00	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	1	26	7	-2	-2	0	-26	-14	20
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	0	29	855	28	1	16	452	11	0	0	55	0	0	70
Peak Hour Factor	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.920	0.9080	0.9080	0.9200	0.9080	0.9080	0.9200
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	8	232	8	0	4	123	3	0	0	15	0	0	19
Total Analysis Volume [veh/h]	0	32	929	30	1	17	491	12	0	0	60	0	0	76
Pedestrian Volume [ped/h]	0				0				0			1		

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Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

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Version 4.00-04

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.03	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.15
d_M, Delay for Movement [s/veh]	12.46	8.50	0.00	0.00	20.68	10.32	0.00	0.00	0.00	0.00	10.22	0.00	0.00	13.04
Movement LOS	B	A	A	A	C	B	A	A			B			B
95th-Percentile Queue Length [veh]	0.09	0.09	0.00	0.00	0.09	0.09	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.50
95th-Percentile Queue Length [ft]	2.33	2.33	0.00	0.00	2.21	2.21	0.00	0.00	0.00	0.00	6.51	0.00	0.00	12.62
d_A, Approach Delay [s/veh]	0.27				0.38				10.22			13.04		
Approach LOS	A				A				B			B		
d_I, Intersection Delay [s/veh]	1.26													
Intersection LOS	C													

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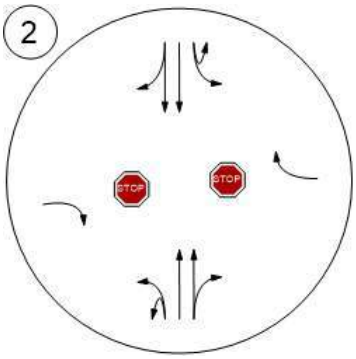
Lane Configuration and Traffic Control



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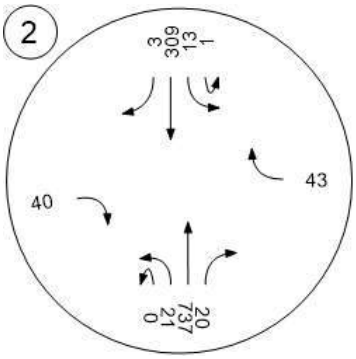
Traffic Volume - Base Volume



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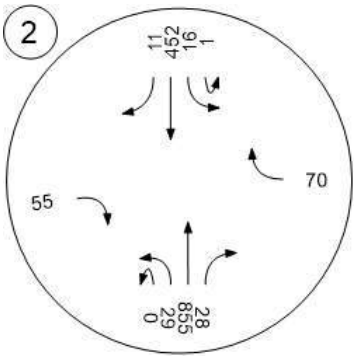
Traffic Volume - Future Total Volume



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Burnsville Aging Signals

Vistro File: C:\...\Burnsville Aging Signals - Modified Geo - with Limited Access Alt.vistro

Scenario 14: PM 2036 - Limited Access

Report File: C:\...\PM 2036 Limited Access.pdf

11/10/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
2	CSAH 5 & 136th St	Two-way stop	HCM 2010	NB U-T	0.010	44.7	E

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 2: CSAH 5 & 136th St

Control Type:	Two-way stop	Delay (sec / veh):	44.7
Analysis Method:	HCM 2010	Level Of Service:	E
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.010

Intersection Setup

Name	CSAH 5				CSAH 5				136th St			136th St		
Approach	Northbound				Southbound				Eastbound			Westbound		
Lane Configuration														
Turning Movement	U-tu	Left	Thru	Right	U-tu	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	200.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	45.00				45.00				30.00			30.00		
Grade [%]	0.00				0.00				0.00			0.00		
Crosswalk	Yes				Yes				Yes			Yes		

Volumes

Name	CSAH 5				CSAH 5				136th St			136th St		
Base Volume Input [veh/h]	1	88	567	61	2	47	892	20	3	28	75	54	17	24
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	4.80	1.60	3.20	2.70	0.00	4.00	3.30	6.20	1.80	4.00	1.60	2.80	4.70	4.60
Growth Rate	1.38	1.38	1.38	1.16	1.38	1.16	1.38	1.38	1.00	1.00	1.38	1.00	1.00	1.16
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	14	54	8	-3	-28	0	-54	-17	35
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	1	121	782	71	3	69	1285	36	0	0	103	0	0	63
Peak Hour Factor	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.960	0.9370	0.9370	0.9600	0.9370	0.9370	0.9600
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	32	204	18	1	18	335	9	0	0	27	0	0	16
Total Analysis Volume [veh/h]	1	126	815	74	3	72	1339	38	0	0	107	0	0	66
Pedestrian Volume [ped/h]	6				5				2			1		

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Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane				
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

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Version 4.00-04

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.01	0.26	0.01	0.00	0.01	0.10	0.01	0.00	0.00	0.00	0.28	0.00	0.00	0.12
d_M, Delay for Movement [s/veh]	44.71	14.99	0.00	0.00	19.18	10.47	0.00	0.00	0.00	0.00	18.15	0.00	0.00	12.53
Movement LOS	E	B	A	A	C	B	A	A			C			B
95th-Percentile Queue Length [veh]	1.06	1.06	0.00	0.00	0.36	0.36	0.00	0.00	0.00	0.00	1.14	0.00	0.00	0.41
95th-Percentile Queue Length [ft]	26.48	26.48	0.00	0.00	9.05	9.05	0.00	0.00	0.00	0.00	28.47	0.00	0.00	10.29
d_A, Approach Delay [s/veh]	1.90				0.56				18.15			12.53		
Approach LOS	A				A				C			B		
d_I, Intersection Delay [s/veh]	2.09													
Intersection LOS	E													

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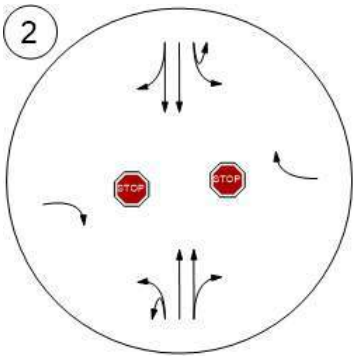
Version 4.00-04

Spack CONSULTING THE TRAFFIC STUDY COMPANY

Lane Configuration and Traffic Control



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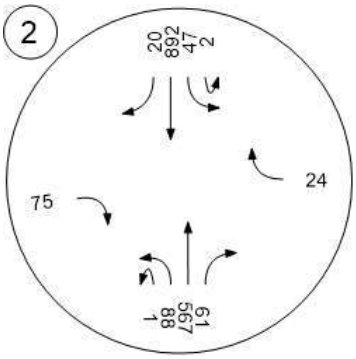
Traffic Volume - Base Volume



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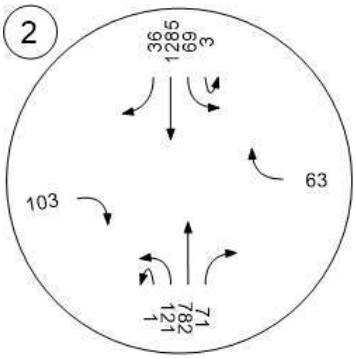
Traffic Volume - Future Total Volume

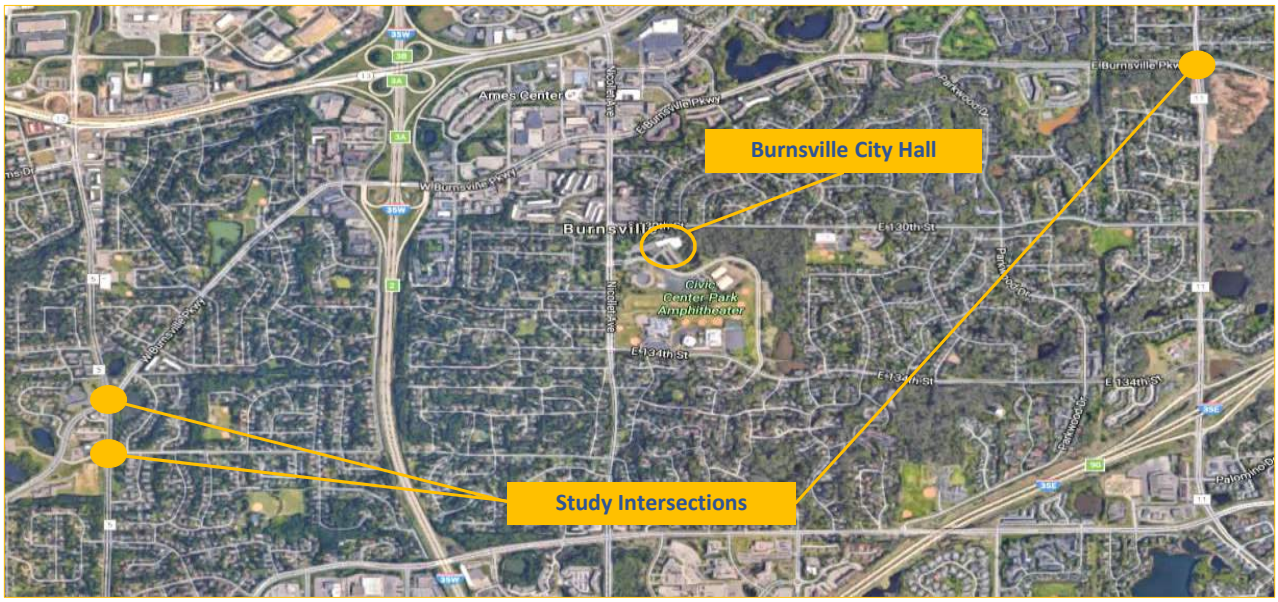


Purpose of Study

Three existing traffic signals are close to the end of their service life. The current age of the signals range from 27 to 37 years old.
Rather than simply remove and replace, Dakota County and the City of Burnsville are taking this opportunity to:

- Review the intersections
- Determine the appropriate traffic control
- Assess the intersection geometry needs

CSAH 5 & Burnsville Parkway (Turn on Date 12/30/1979)
CSAH 5 & 136th Street (Turn on Date 01/18/1989)
CSAH 11 & Burnsville Parkway (Turn on Date 10/10/1986)



Purpose of Meeting

- Meet with the study team
- Learn about existing intersection operations
- Discuss your issues and concerns
- Review potential traffic control options that are being considered

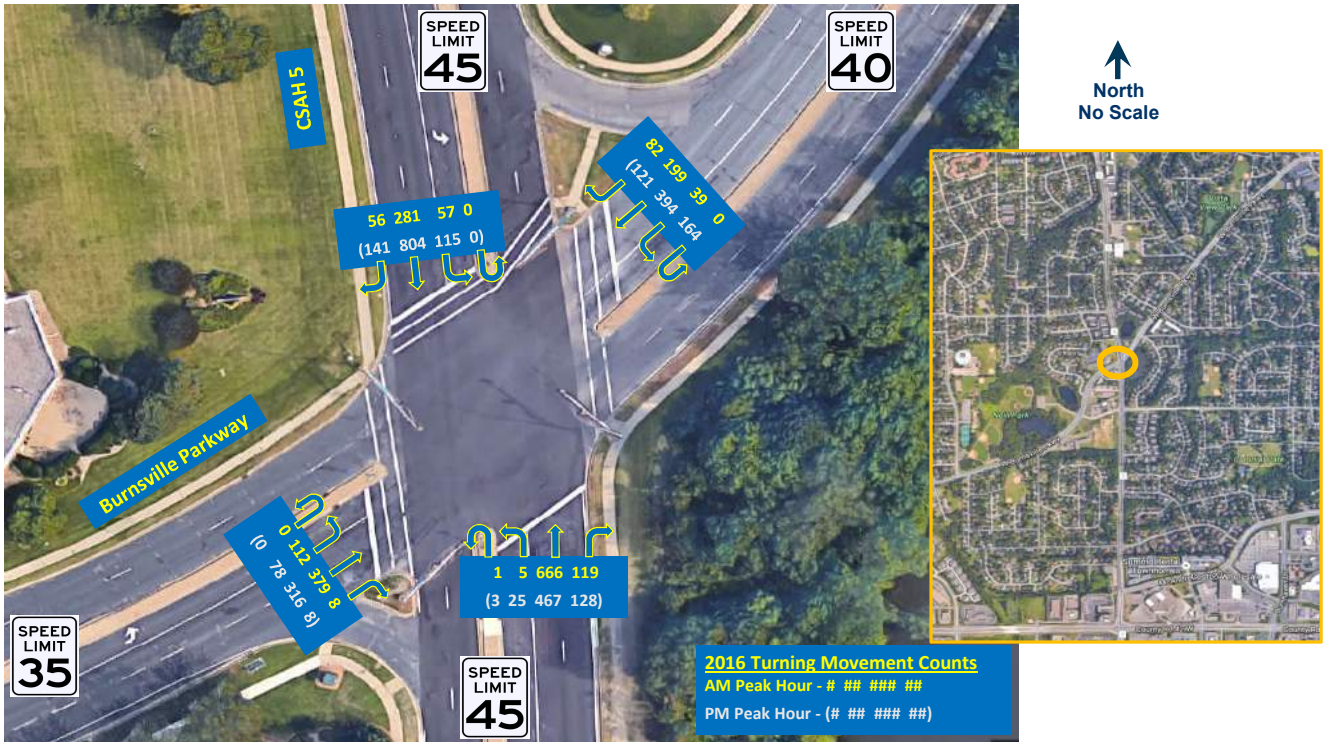
What's next?

- Alternative evaluation and design
- Open House #2 in Mid-October to share draft recommendations
- Preliminary layout and cost estimate development
- Study recommendations presented to City Council and County Board
- Projects placed in Capital Improvement Program

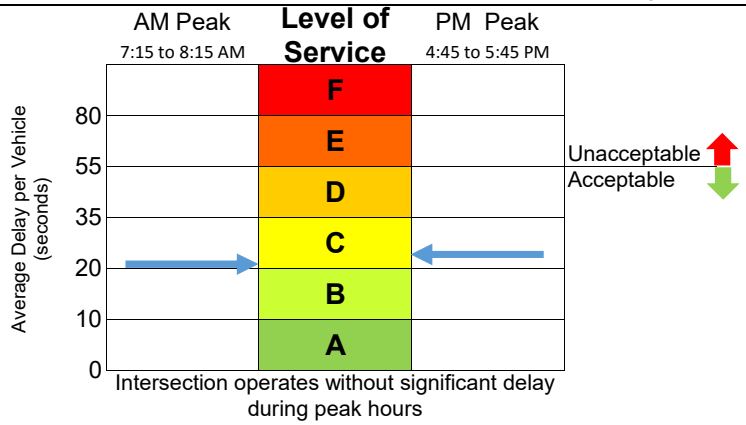
What happens after the study?

- Prepare construction plans to update the study intersections to the preferred design in 2017
- Construction in 2018 (estimated)

CSAH 5 & Burnsville Parkway



Intersection Operations

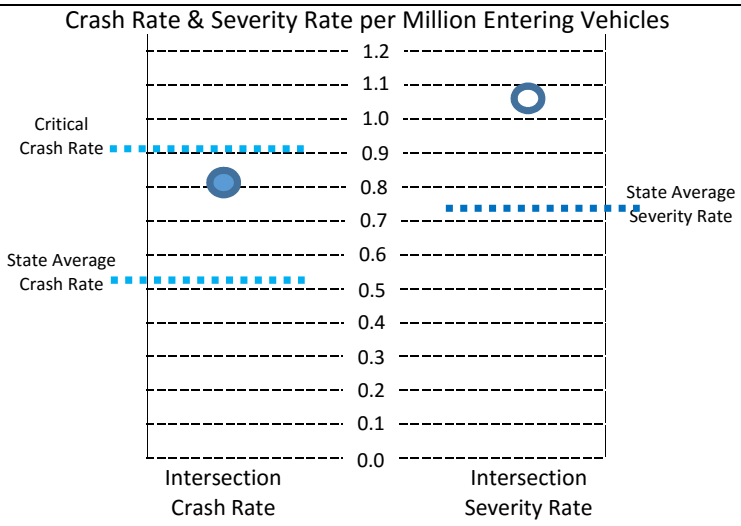


Longest queues are:
Less than 10 vehicles for NB & SB
Less than 6 vehicles for EB & WB

Less than 16 pedestrians or bicycles in each peak hour

Volumes throughout the day justify a signal

Intersection Safety

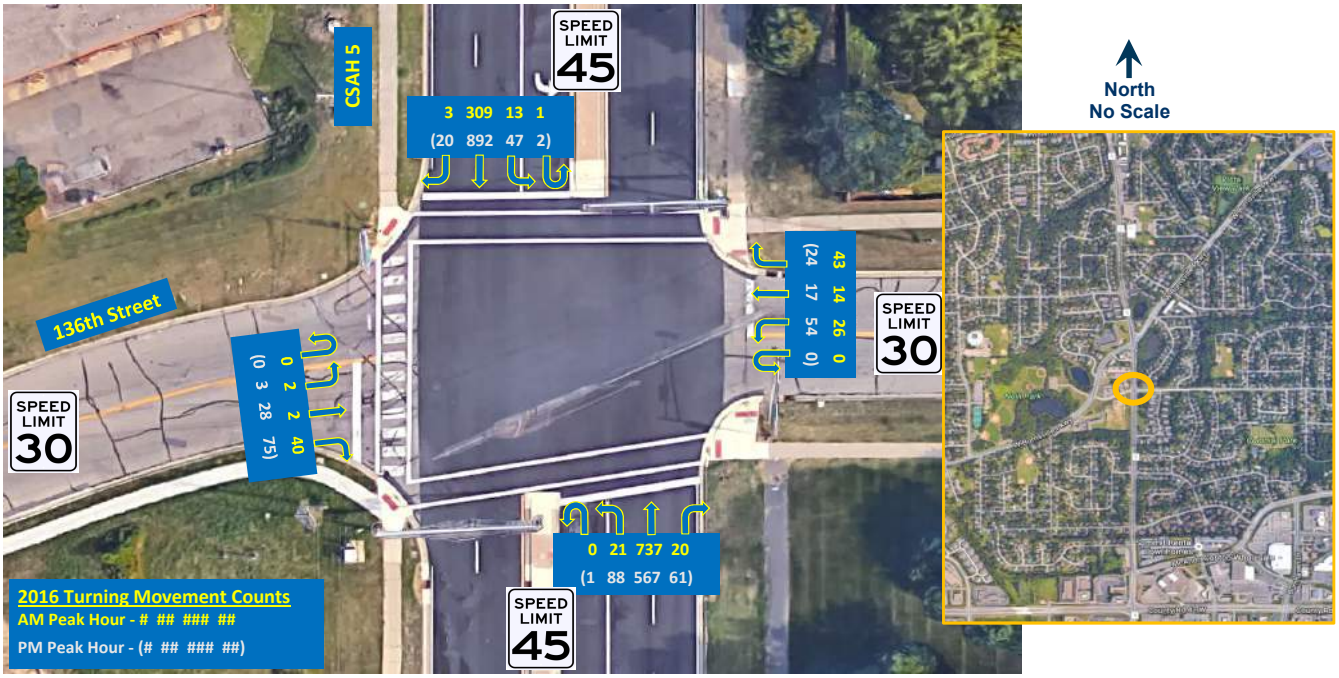


Crashes Per Year at Intersection:
2013 = 7
2014 = 9
2015 = 7
3 Year Total = 23

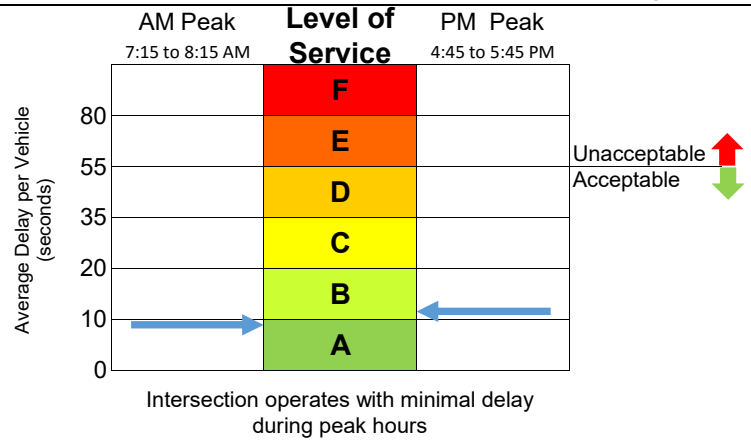
2016 Entering Vehicle Volume:
25,950 vehicles per day

CSAH 5 & 136th Street

Signal is approximately 900 feet south of the Burnsville Parkway intersection



Intersection Operations



Longest queues are:
Less than 5 vehicles for NB & SB
Less than 4 vehicles for EB & WB

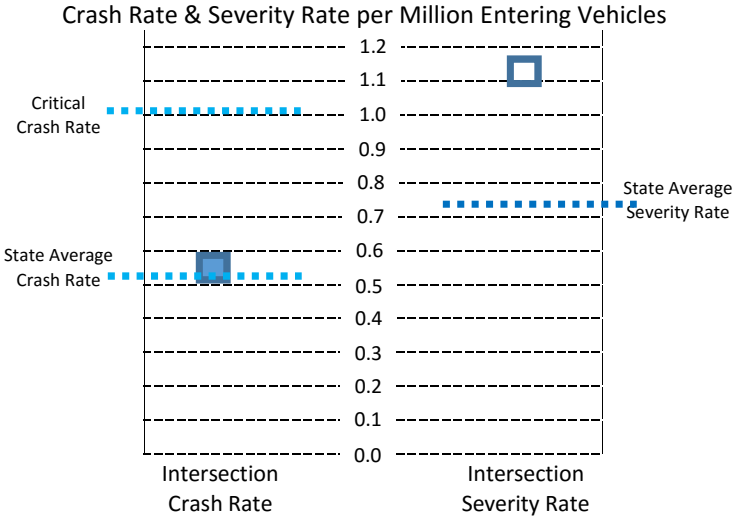
Less than 21 pedestrians or bicycles in each peak hour

Volumes minimally meet peak hour signal warrant

Daily volumes on the east leg have been decreasing

Over 25 locations in Dakota County have a higher need for a signal

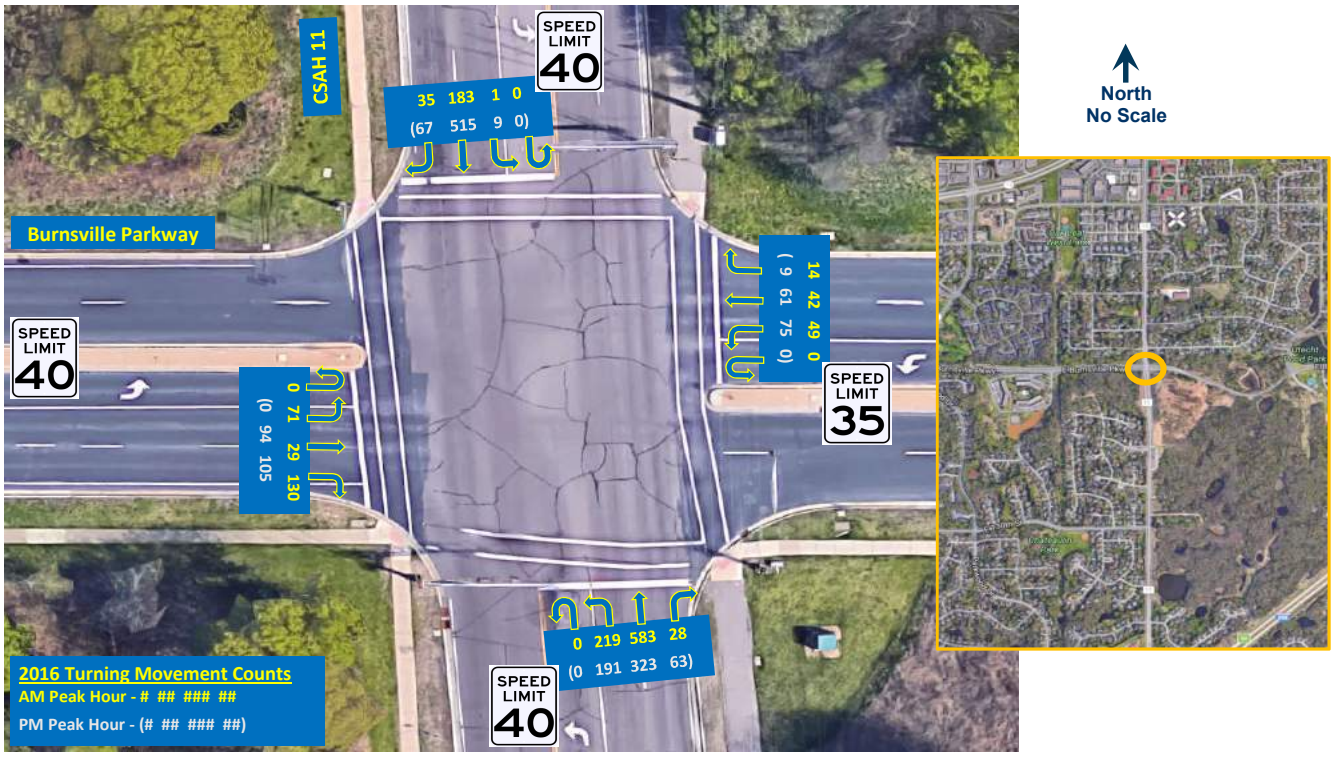
Intersection Safety



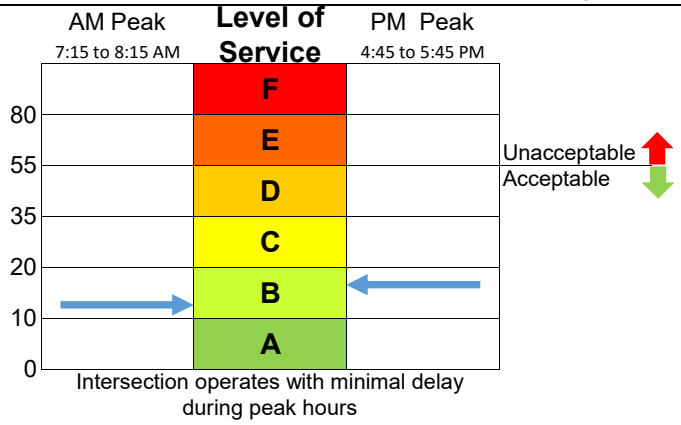
Crashes Per Year at Intersection:
2013 = 4
2014 = 3
2015 = 3
3 Year Total = 10

2016 Entering Vehicle Volume:
16,150 vehicles per day

CSAH 11 & Burnsville Parkway



Intersection Operations

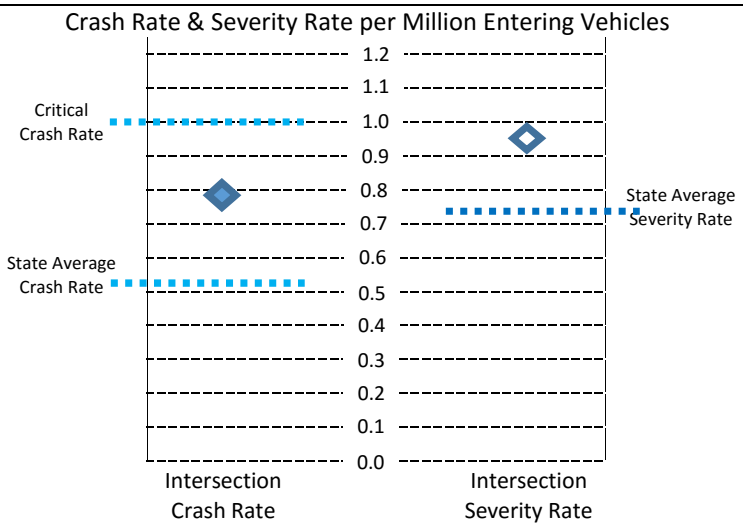


Longest queues are:
Less than 10 vehicles for NB & SB
Less than 6 vehicles for EB & WB

Less than 6 pedestrians or bicycles in each peak hour

Volumes meet peak hour signal warrant

Intersection Safety



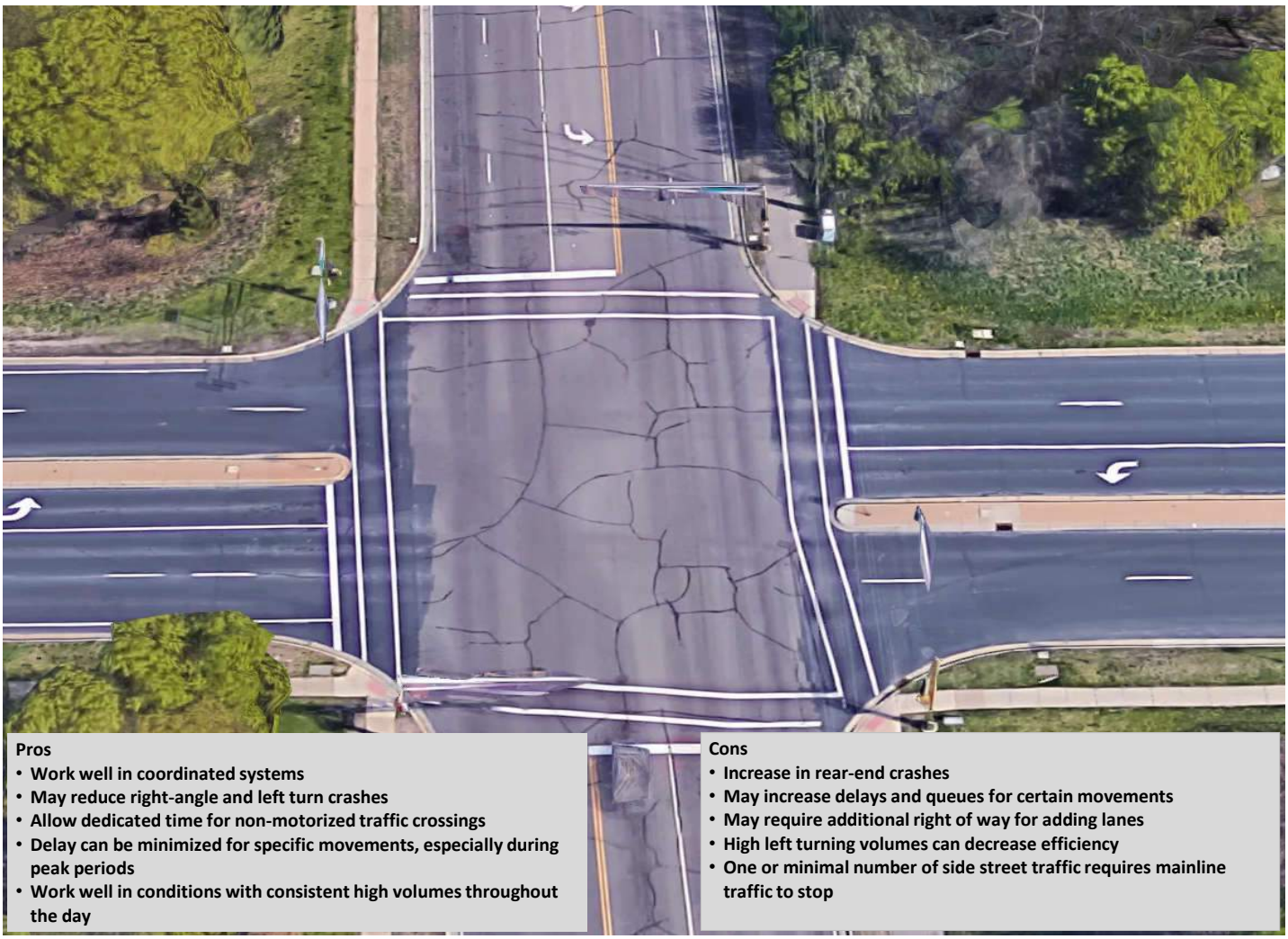
Crashes Per Year at Intersection:
2013 = 6
2014 = 5
2015 = 4
3 Year Total = 15

2016 Entering Vehicle Volume:
17,350 vehicles per day

Intersection Option: Signal

For consideration at:
CSAH 5 & Burnsville Parkway
CSAH 5 & 136th Street
CSAH 11 & Burnsville Parkway

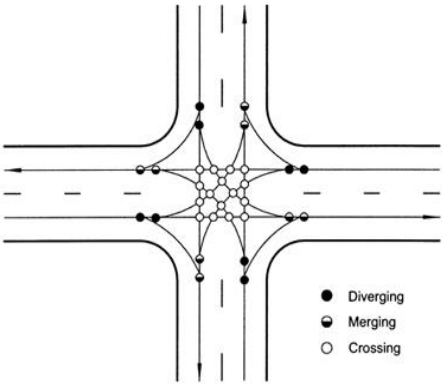
Example: CSAH 11 and Burnsville Parkway in Burnsville, Minnesota



Pros
- Work well in coordinated systems
- May reduce right-angle and left turn crashes
- Allow dedicated time for non-motorized traffic crossings
- Delay can be minimized for specific movements, especially during peak periods
- Work well in conditions with consistent high volumes throughout the day

Cons
- Increase in rear-end crashes
- May increase delays and queues for certain movements
- May require additional right of way for adding lanes
- High left turning volumes can decrease efficiency
- One or minimal number of side street traffic requires mainline traffic to stop

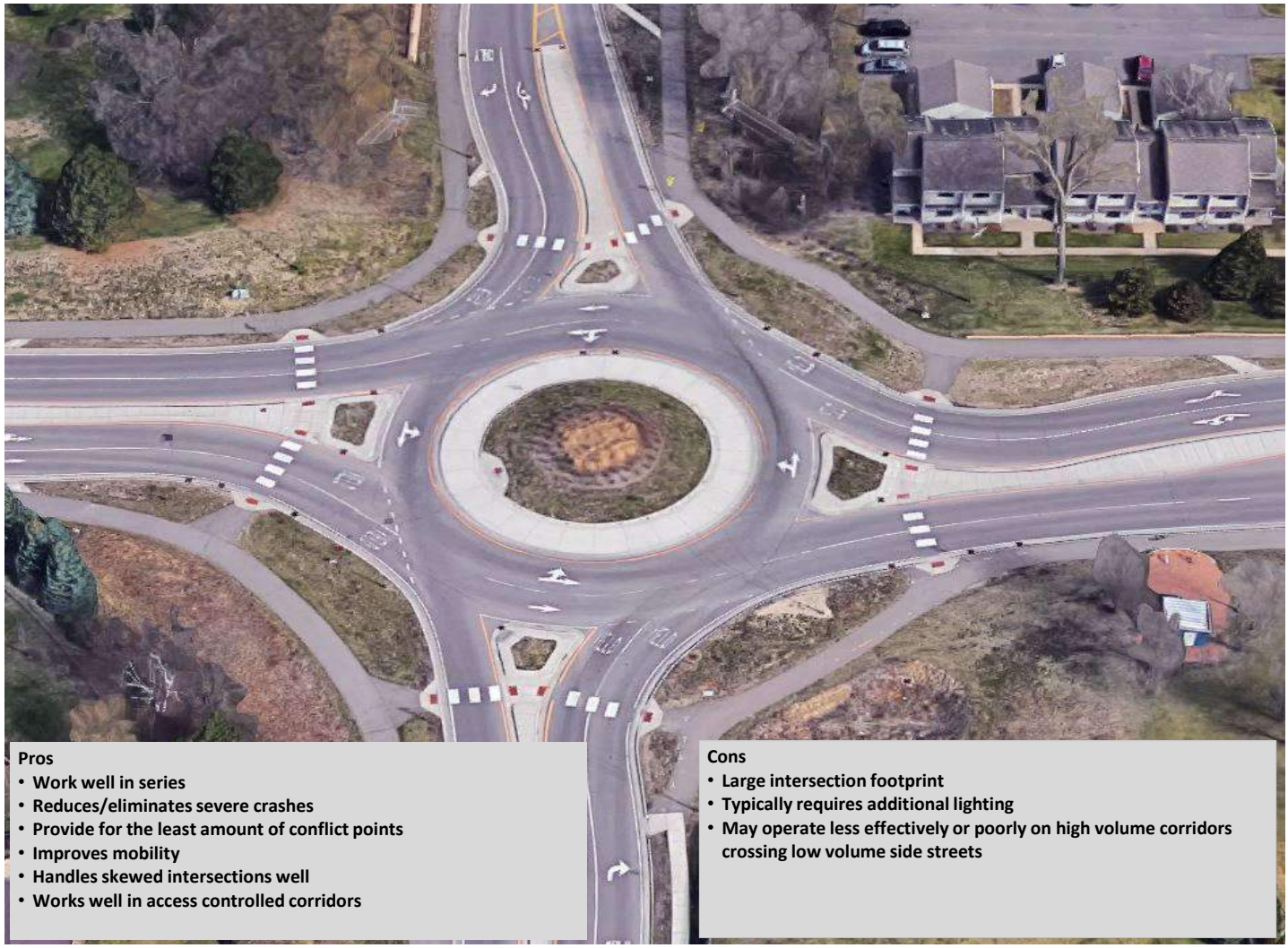
Conflict Points



Intersection Option: Roundabout

For consideration at:
CSAH 5 & Burnsville Parkway
CSAH 5 & 136th Street
CSAH 11 & Burnsville Parkway

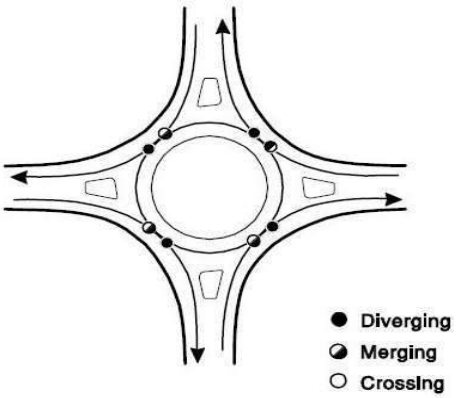
Example: CSAH 16 (McColl Drive) and Lynn Avenue/Glendale Road in Savage, Minnesota



Pros
- Work well in series
- Reduces/eliminates severe crashes
- Provide for the least amount of conflict points
- Improves mobility
- Handles skewed intersections well
- Works well in access controlled corridors

Cons
- Large intersection footprint
- Typically requires additional lighting
- May operate less effectively or poorly on high volume corridors crossing low volume side streets

Conflict Points



Intersection Option: Limited Access

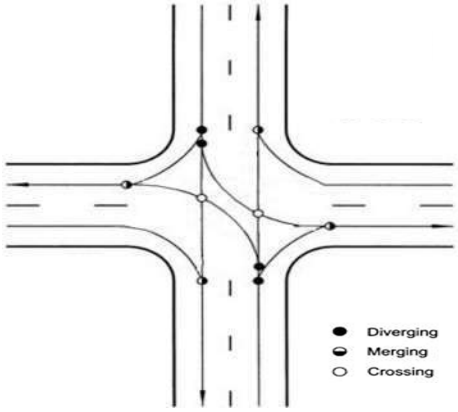
For consideration at:
CSAH 5 & 136th Street

Example: CSAH 42 (140th Street NW) and Shepards Path/Fountain Hills Road in Prior Lake, Minnesota

Pros
- Less conflict points leads to higher safety and lower crash severity
- Discourages cut through traffic in minor approaches
- Less stops for mainline traffic
- Less delay at minor approach

Cons
- Increased travel time for some movements on minor streets
- Potential removal of pedestrian crossing

Conflict Points



This option is under consideration at CSAH 5/136th St because:

- Minimal eastbound through and left turns movements
- Heavy mainline volumes
- Nearby intersections provide acceptable alternate routes
- Would reduce non-residential traffic on the east leg

Comment Sheet

Dakota County and the City of Burnsville are reviewing three intersections to determine if changes to the traffic control or the intersection geometry are necessary and desired. The three intersections are CSAH 5/Burnsville Parkway, CSAH 5/136th Street, CSAH 11/Burnsville Parkway.

We need your input to help guide the study. In space answer the following questions:

Do you have any issues or concerns regarding the study intersections?

Do you have any suggestions or opinions regarding potential improvements?

Please answer these or provide any general comments in the space below (use the reverse side of page for more space if needed).

Leave your comments in the "Comments" box on the table or, if you prefer, you may mail or email your comments to:

Sarah Tracy
Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

1) Please - no roundabout @ CSAH5/Bville Parkway !
2) 2 bus (MVTA) routes use CSAH5/Bville Parkway intersection - sometimes traffic backs up when bus stops to pick up passengers

Name: **Telephone:**

Address: **Email:**

Comment Sheet

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Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

BURNSVILLE PARKWAY & CO 5

NO ROUNDABOUT

GOD AWFUL IDEA

Name: Tom Stephes Telephone: 952-890-6422

Address: 13705 Vincent Ave S Email:

Comment Sheet

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Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

5 + 136th

- I would like the flashing yellow for left turns on [redacted] NB 5 going on to 136th. (if the light is replaced)
- The limited Access option would be [redacted] a decent option

[redacted]

Name: **Telephone:**

Address: **Email:**

Comment Sheet

Dakota County and the City of Burnsville are reviewing three intersections to determine if changes to the traffic control or the intersection geometry are necessary and desired. The three intersections are CSAH 5/Burnsville Parkway, CSAH 5/136th Street, CSAH 11/Burnsville Parkway.

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Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

CSAH 5/ Burnsville Parkway: Works well the way it is for me. The only concern I have is the left turn from Burnsville Parkway to north CSAH 5 is slow to respond to cars / there. Please no roundabout here! They are confusing to a lot of drivers.

CSAH 5 / 126th Street: Works well the way it is for me. Please No roundabout here! They are confusing to a lot of drivers. Either the stoplight or limited access works fine for me.

CSAH 11 / Burnsville Parkway: No opinion. I don't ~~drive~~ drive there much.

Name: Bette Lowry **Telephone:** 952-8946927

Address: 13600 Judicial Rd **Email:** lowrybette@q.com

Comment Sheet

Dakota County and the City of Burnsville are reviewing three intersections to determine if changes to the traffic control or the intersection geometry are necessary and desired. The three intersections are CSAH 5/Burnsville Parkway, CSAH 5/136th Street, CSAH 11/Burnsville Parkway.

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Sarah Tracy
Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

I have talked to the people here about cty 11/Burnsville Parkway, which I have gone there multiple times daily for 24 years. I also have experience with roundabouts in this County & So. Washington County. My thought is that a roundabout at 11/Parkway would be the a bad idea because of traffic volume. Hopefully your studies will show this.

So I prefer improved stop lights & left turn signals & better medians. Thank you!

Nonstop traffic on cty 11 north of Burnsville Parkway, if there is a roundabout, will [redacted] make it even more difficult for people in those neighborhoods to get onto cty 11. They complain about traffic traveling between 35E & 13 being too heavy for them to exit their neighborhoods!

Name: Kris Pichelmann **Telephone:** 612-386-0607

Address: 2800 Acadia Ct. **Email:** Kpichelmann@msn.com

Comment Sheet

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Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

Intersection 5 & Parkway : Roundabout will not work!
Rush hours are very busy!
Still need signals - but need yellow left turn arrow when light is green.

136th & 5 - Limited access ??? many people go straight accross and with this option they are unable. Roundabout may work ???
However ..... older people get very confused - I have seen them go the wrong way. Roundabouts are relatively new to MN.

Have you asked the Police department for their input? They are on the roads a lot -- their comments are important.

Name: Janet Schuenke **Telephone:** 952-840-5763
Address: 13414 Xerxes Ave S **Email:**

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No left turn from 136th St on to CASH 5 will cause some real concern. People to turn ~~right~~ right from 136th on to Cash 5 would send people to Burnsville Parkway to make U turns not a good idea

Name: Edward Gregoire Telephone: 952-457-3981

Address: 13622 Xerxes Email: edwardgregoire@yahoo.com

Comment Sheet

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~~LARRY~~

HWY 5 & 136TH PROBLEM — NO LEFT TURN TO SOUTH ON 5
HAD STUDY 15-20 YRS AGO FOR TRAFFIC THRU
BURNHAVEN WOODS (ON THOMPSON DEVELOPMENT)
STUDY ON SPEEDHUMPS — DID NOT WORK
ADDED STOP SIGNS — IMPROVED

THIS IS THE ONLY ACCESS TO MALL AREA
FOR MUCH OF NEIGBORHOODS EAST OF 5 AND
WEST OF 35.

IF NO LEFT TURN TO SOUTH ON 5
YOU WILL NEED TO PREVENT INCREASED
TRAFFIC THROUGH OUR NEIGHBORHOOD.

THANKS

Larry Hesse

Name: LARRY HESSE **Telephone:** 612-636-8787
Address: 1508 WEST 139TH ST **Email:** lhanlanhesse@gmail.com

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X Limited access is real bad idea for CO5 & 136
Much traffic from homes east of CO5
turns LT to go south on CO5
W/o that traffic goes on neighborhood streets (James etc)
or has to go up to CO5 & parkway
which adds traffic to that intersection

this then dumps more traffic on Meadows across from Costco at a high speed curve

X U-turns on CO5 are the traffic moves that I see that cause the most near-crashes

X lots of loud traffic noise at CO5 & 136 intersection for homes on Knox Drive

X hidden west access to SA causes confusion & U turns on parkway & CSAH 5 intersection

Name: Tim Graf
Telephone: 612 804 1978
Address: 609 Knox Dr
Email: tgraf15@gmail.com

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for 136TH street ~ don't care per se - except please no round about

for the other two - my "vote" is for signal replacement

Name: MIKE DRIESSEN Telephone: 612 396 0555

Address: 12113 24th AVE Email: DRIESSENMT@MSN.COM

Comment Sheet

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Co Rd 11 was 2 lane - 1 north, 1 south. Then, because of volume, it has been 2 lanes each way and traffic has increased. It is difficult to make a left turn during morning and afternoon rush hours now, so to go from 2 lanes each way to one ~~lane~~ lane each way, it is going to harder to get a break in traffic. It would make sense to see how the current changes affect traffic flow before deciding on lights vs round-a-bout. A round-a-bout will not provide any break in traffic from 134th St to 122nd St.

Name: Dave Moen Telephone: 952-846-8451

Address: 12408 Skyline Dr, BV Email: dtmoen@q.com

Sept. 13

Comment Sheet

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on #5

No Round abouts – 48 wheel semis will not [redacted]

No Limit access – You will create more Traffic on 136th 45 on James ave, where we have no sidewalks to walk

Name: Telephone:

Address: Email:

Comment Sheet

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Irving & Burnsville Pkwy

Too much priority given to Irving traffic

- wait 30 sec. before light changed for Irving vehicles because they wish to make a right turn, or they'll soon find a time to make a left.
- consider making it a flashing red/yellow for all non-school hours
- parked cars on Irving accidentally trip the light, so BVPW traffic stops for nothing.

Name: Bob Huebel **Telephone:**

Address: **Email:**

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I am interested in the intersections on County Rd 5. Presently, I have experienced poor signal timing at the intersection with & BV Parkway, especially when going north. The timing is such that only 3 or so cars can get through the intersection, at least at certain times of the day. My concern is that traffic will increase on BV Parkway to such an extent that a roundabout there would not suffice and cause issues over time. It makes more sense to straighten out the approach on BV Pkwy so that the turning angles are closer to 90° each. As for the intersection at 136th Street, cross-traffic from 136th is not heavy, so a roundabout makes more sense. Please don't restrict the residents from turning south to Cty Rd 5 from 136th St. east of 5.

Name: Fay Finn Telephone: 952-890-0995

Address: 13369 Upton Ave S. Email: fay.finn@gmail.com

BV

Comment Sheet

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Walking & Biking - Where & How Do Pedestrians and biker cross CO 5 at Both intersections

How much Traffic will be diverted on Jones ave if left turn Ave. will be closed on CO 5

Name: **Telephone:**

Address: **Email:**

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NO ROUNDABOUTS

LEAVE THEM AS IS JUST UPGRADE THE SIGNAL

OPTIONS LIMITED ON 136TH IS A 2ND POSSIBLE SOLUTION

Name: LOREY WILLIAMS Telephone: 952 891-1405

Address: 13529 MORGAN AVE SO. Email:

Comment Sheet

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AT CR5 + BURNSVILLE PKWY, WOULD RECOMMEND A LGAT W/ ABILITY TO MAKE A LH TURN WHILE A LIGHT IS GREEN IN MY DIRECTION

CR5

LIMITED ACCESS FOR 136TH + ~~[illegible]~~ WOULD BE BEST TO KEEP THE FLOW YOU WOULD GET W/ NEW INTERCHANGE @ CR5 + PKWY

IF A ROUND ABOUT IS PROPOSED @ CR5 + PKWY THEN IT WOULD BE A MUST TO HAVE A LIMITED ACCESS FROM TO 136TH + CR5

IF ALL LIGHTS CONTROLLED INTERSECTION, YIELD ON GREEN OR FLASHING YELLOW FOR ALL LH TURNS

Name: TIM & ANGELA NELD Telephone: 612 867 9898

Address: 2008 HIGHLAND DR Email: tim@ammf.com

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at CR 5 & 136th a Flashing turn signal should be The Min. That is done - a round about could work To help elimelate some Stop lights along 5, but I Think That a Round about at 5 & Parkway Might not work Because of Heavy Traffic but This is only a few Times during The day so it might work - I don't what Traffic Flows are for The area but if it looks like it would work I would not object to any round a bouts at any of The locations

Name: Bob Kump Telephone: 952-882-1273

Address: Email:

Comment Sheet

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REGARDING HWY 5 & 136TH STREET: WE ARE VERY CONCERNED BY & OBJECT TO THE LIMITED ACCESS DESIGN THAT WILL FORCE WESTBOUND TRAFFIC ON 136TH ST TO TURN RIGHT & IF THEY DESIRE TO GO SOUTH, MAKE A U TURN AT 5 & BURNSVILLE PARKWAY. THIS DESIGN WILL PROMPT TRAFFIC FROM KNOB HILL & WELLINGTON CRESCENT ETC TO CUT THROUGH THE RESIDENTIAL AREA ON IRVING OR JAMES TO REACH McANDREWS. THERE IS ALREADY A LOT OF CUT-THROUGH TRAFFIC ON JAMES (WHICH HAS VEHICLE, WALKING & KIDS ON BIKES) THE LIMITED ACCESS INTERSECTION AT 5 & 136TH WILL CAUSE THIS TO MARKEDLY INCREASE. ALSO THE NUMBER OF LEFT TURNS FROM FREMONT & 140TH WILL INCREASE AND POSSIBLY CAUSE INCREASED ACCIDENTS.

Name: PATTY LYNN GALBRAITH Telephone: 952-894-4835
Address: 13612 JAMES AVE SO Email: GALBRAITHPJ@HOTMAIL.COM

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? Scott Co. – Vol. compared to here ?

McCall & Lin – Scott Co. RA
Savage / MN

Name: Bob Heinrich Telephone: 651 - 271 - 7058

Address: 3308 W 134 St Email: robertscartigues@hotmail.com

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No replacement of equipment that is still working NO need for roundabout at 136th and 5 and limited access will only cause more traffic through Burnsville Woods. Neighborhood — James Ave

Don't spend money you don't need to

New traffic lights are not needed and roundabouts are a huge waste of money.

Name: Tom Schwenke Telephone: 952 890-4905

Address: 13600 137th Place Burnsville MN Email: Tschwenke@comcast.net

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CTY 5/136th - Limited Access is TOTALLY unacceptable - it would lead to more traffic encouraged through residential neighborhoods - we already are limited in options to get out - we are on EAST Wellington — Leave it as a traffic light.

Cty 5/Parkway involves even levels of traffic that is mostly transient so whatever supports that best/safest should be the choice - I've seen roundabouts work well but am concerned there is way more traffic than would make it flow OK.

Parkway/11 - a Roundabout would work well.

Name: Ben Lamprecht Telephone: 952 890 8744

Address: 13804 E. Wellington Email: JML313@AOL.COM

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CTY 5/136
We have limited options to get out of our neighborhood - having a traffic light is a MUST - Limited Access is NOT acceptable.

CTY 5/Parkway - I think this should remain a traffic light - am concerned there is way more traffic than would make it flexible

Parkway/11 a Roundabout would work well here

Name: Claudette Lamprecht Telephone: 952-890-8746
Address: 13804 E. Wellington Cres Email:
Burnsville, MN

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CSAH 5/136th ① - leave as is ② Roundabout dont like limited access.

CSAH 5/Burnsville Parkway - Signal Lights + Rt turn/Lanes going North on 5 + South on 5.

CSAH 11/Burnsville Parkway - No Comment

Name: Diane Sanders Telephone: 651-308-4545

Address: 13841 Shirley Dr Email:

Comment Sheet

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1. MY RESPONSES ARE IN RELATION TO THE COUNTY 5 INTERSECTIONS.

2. ROUNDABOUTS AT THESE INTERSECTIONS ARE NOT PRACTICAL BECAUSE OF HIGH TRAFFIC VOLUMES. SINGLE LANE ROUNDABOUTS ARE BUT MULTIPLE LANE ROUNDABOUTS ARE CONFUSING FOR THOSE NOT FAMILIAR WITH THEM. MANY PEOPLE DO NOT MAINTAIN THE LANE INTEGRITY REQUIRED.

3. THE PEOPLE COMING FROM THE EAST ON 136TH NEED TO BE ABLE TO TURN BOTH NORTH AND SOUTH ON COUNTY 5. LEAVE THE LIGHTS

4. ADD RIGHT TURN LANES ON COUNTY 5 BOTH NORTH AND SOUTH APPROACHING BVL. PKWY. THIS WILL ALLOW BETTER FLOW TO THOSE TURNING AND THE THROUGH TRAFFIC ON CO. 5

Name: TOM SANDERS **Telephone:** 651-303-7557
Address: 13841 SHIRLEY DR. **Email:** SANDERSTW@HOTMAIL.COM

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At the intersection of 11 + BV Parkway, we're concerned about pedestrian crossing. On N 11 Turning E on BV Parkway. It's notoriously dangerous. Cars tend to speed coming down the hill on 11. + don't slow down for the turn. We live on E S. Skyline Dr - very close to BVPky - 11 intersection. At rush hours it's very difficult/dangerous to turn left into 11 from S Skyline Dr.

I can see a roundabout at 11 + Pkwy would positively slow the very fast traffic

Name: Steve Boruff **Telephone:** 952-890-9633

Address: 2040 S. Skyline Dr **Email:** sboruff@comcast.net

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Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

1. Please carefully consider pedestrian crossing at intersection of CO RD 11 + Burnsville Parkway.
2. Ability for traffic to turn right + not need to wait in line for light to change
3. Going to South + North on 11 – Are there right turn lanes? at intersections?
4. Ability of drivers in a roundabout to notice + stop for pedestrians – do it safer?
5. On Co Rd 11 near 122 + ~~Hyline~~ MVTA Bus Stop – Will buses block the one lane of traffic as passengers board?

Name: Diane Borutff **Telephone:**
Address: 2040 Skyline Dr S **Email:** dsborutff@comcast.net

Comment Sheet

Dakota County and the City of Burnsville are reviewing three intersections to determine if changes to the traffic control or the intersection geometry are necessary and desired. The three intersections are CSAH 5/Burnsville Parkway, CSAH 5/136th Street, CSAH 11/Burnsville Parkway.

We need your input to help guide the study. In space answer the following questions:

Do you have any issues or concerns regarding the study intersections?

Do you have any suggestions or opinions regarding potential improvements?

Please answer these or provide any general comments in the space below (use the reverse side of page for more space if needed).

Leave your comments in the "Comments" box on the table or, if you prefer, you may mail or email your comments to:

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My comments only pertain to CSAH 11 & BVILLE PKWY because it is the area I am most familiar with. The traffic in this intersection has huge fluctuation in the AM and PM rush hour versus normal hours. There is also high pedestrian levels, particularly in the PM. I much prefer single lane roundabout; provided lighting and accommodation can be made for pedestrians. If a new stoplight is selected, the yellow left turn option is an absolute must, as is some modifications for right turn access. I am confident you will hold neighborhood hearings for the people to express concerns or support for the possible options.

Name: GREG DRAZKOWSKI Telephone: 952 891 2193

Address: 1704 COMMONWEALTH DRIVE Email: drz1954@comcast.net

Comment Sheet

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CSAH 5/ Burnsville Pkwy – rush hours may overload the two ~~lane~~ lane roundabout – left turns vs flow thrus.

Name: Larry Leskinen Telephone: 952 890 0651

Address: 13410 Xerxes Ave S Email: lleskine@aol.com

Comment Sheet

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CSAH 5 + 136th - Best option for change - Round About of Limited Access - Personally Doesn't seem efficient with traffic flows I see currently. - Unless we change signals for flashing yellow for left turns, would help flow I can keep signals

CSAH 5 + Burnsville Parkway - North/South Lights turn quickly causing delays - PM only 6-7 cars get through if everyone is bumper to bumper - if not 4 to 5 cars

Thank you for asking for input.

Name: Chris Clark **Telephone:**

Address: 2605 Highland Dr. **Email:**

Comment Sheet

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YOUR TRAFFIC NUMBERS ARE SCUED SINCE YOU DID YOUR ASSESSMENT DURING THE SUMMER AND NOT DURING THE FALL AND WINTER.

NO TO ROUNDABOUTS

[redacted] I BELEVE THAT THE CAPACITY CAN'T HANDLE IT. I DON'T CARE WHAT YOUR STATISTICS SAY.

THINK ABOUT VISTA VIEW KIDS AND PEDESTRIANS

HAVE A HEARING

NEXT TIME INCLUDE THE PHRASE ROUNDABOUT IN YOUR COMMUNICATION PIECE

Name: JESS MINGO Telephone: 952-882-0818

Address: 13005 FOREST GLEN DRIVE Email: jessmingo@comcast.net

EDUCATE THE PUBLIC ON HOW TO USE ROUNDABOUTS. I'VE SEEN A LOT OF IMPROPER USE.

Comment Sheet

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I think all the stop lights are just fine. The one at 5 + B'ville Pkwy is my favorite. It's easy to get thru no matter which way you go. I go all 4 ways. It turns fast so you don't wait long. I like this stoplight. 5 + 136th St is okay. I use it a lot too. Sometimes if you cross 5, the wait is longer. Also if you turn left from either direction on 5, it can be a longer wait. I don't use the 3rd one on 11 much any more. I used too. I think that one is fine.
Please - no round abouts. I dislike driving them.
Please keep the stop lights.
I've driven B'ville Pkwy for over 35 years. I've seen more traffic but it doesn't seem bad to me.
If you won't put a stop light back at 136th + 5 - I think the limited access would be best.
Round abouts are not pedestrian friendly. They are hard for bikers too.
Please!! No round abouts.

Name: Wendy West **Telephone:** 952-890-1464
Address: 3209 Sunset Ln DR **Email:** Zip567-212 hotmail.com
My suggestion is to just leave them alone. Completely!

Comment Sheet

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We travel through both City 5 intersections daily. We support:

1) Eliminate lights at 5/136th. Replace with Limited access.

2) Roundabout at 5/Bulle Pkwy.

Please do not replace the lights at 5/136. The vast majority of travelers at this intersection are North South. A negligible number of travelers (although vocal) represent WB left turners. Please do not sacrifice for the minority.

Save folks project concern about possible commercial development in the 6.6 acre corner lot at 5/136th. I am personally advocating and fundraising for this land to be converted to greenspace - so traffic concerns may be null concerning potential development!

(continued)

Name: Sarah Keefer **Telephone:** 952-356-6540

Address: 13820 Shirley Drive **Email:** sarahkeefer@hotmail.com

If the lights are replaced @ 5/Pkwy, please add R turn lane for Northbound Cty 5 (to turn R on Burlepkwy). (And SB cty 5)

Also please add those nice "yellow flashing left turn arrows" all around.

* Roundabouts are great - yeah some people don't "get them", but they are safer, and they are better for the environment! (less time spent idling by 1,000s of cars will measurably reduce carbon emissions in Burnsville - and help meet Burnsville's environmental impact improvement objectives!) The island space in a roundabout can (and should) be planted w/ Minnesota native plants, including milkweeds; nectar flowers for Monarch Butterflies and other pollinators! (I can donate seeds; plants!)

In Germany, they have signs in Roundabouts "Signal your turn". Maybe that would make drivers feel better?

** 11/Burle Pkwy - I'm less frequently in this area... but I support a roundabout there too!

Comment Sheet

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PLEASE - NO ROUND-ABOUTS. WORKS NICE IN EUROPE - SMALLER CARS, LITTLE TRUCKS (LORRYS), SHORTER DISTANCES TO TRAVEL - TOO MUCH TRAFFIC ON CO RD 5 (TRAFFIC IS LOWER NOW BECAUSE OF THE ECONOMY - LESS TRAFFIC TO BVILLE CTR.
ROUND-ABOUTS ARE TOUGH FOR SCHOOL BUSSES - 3 SCHOOLS AFFECTED NEILL, VISTA VIEW, ST JOHNS (SAVAGE), MANY 18 WHEELERS USE 5 TO 42. WASTE MANAGEMENT'S FLEET USES CO RD 5. SNOW ON CO RD 5 (SOUTHBOUND) IS A PROBLEM ON THE HILL - NEED TO GET A RUN AT IT!
5 & 136 HAS A LARGE SENIOR BLDG WITH WALKERS TO THE PARKS. 5 & 136 HAS A LIQUOR STORE. LIMITED ACCESS WOULD DETER NORTHBOUND CUSTOMERS, OPTIONS - U-TURNS, CROSSING THRU NEIGHBORHOODS, OR CIRCLING THE BLOCK.
5 & BVILLE PKWY - KEEP LIGHTS. YOUNG KIDS FROM THE APARTMENTS CROSS HERE TO GET TO SA FOR CANDY, POP, MILK, ETC. MOST ARE NOT ACCOMPANIED BY ADULTS. I LIVE ON 140TH ST. IF TRAFFIC IS (OVER)

Name: CONNIE SVATA **Telephone:** 952-890-8550

Address: 2201 W 140 ST **Email:** N/A

DISRUPTED, CARS SHORT-CUT ~~OR AVOID~~ THROUGH OUR NEIGHBORHOOD - HAPPENED WHEN 5 WAS REDONE. THE CARS DO NOT GO BACK TO THE ORIGINAL, BUT STAY ON THE NEW DETOUR AND TRAVEL FAST.

ANOTHER FACET IS THAT BVLLE PKWY #5 IS A CLEAR SHOT TO THE TWO TRAILER PARKS AND A LOT OF TRAFFIC IS GENERATED.

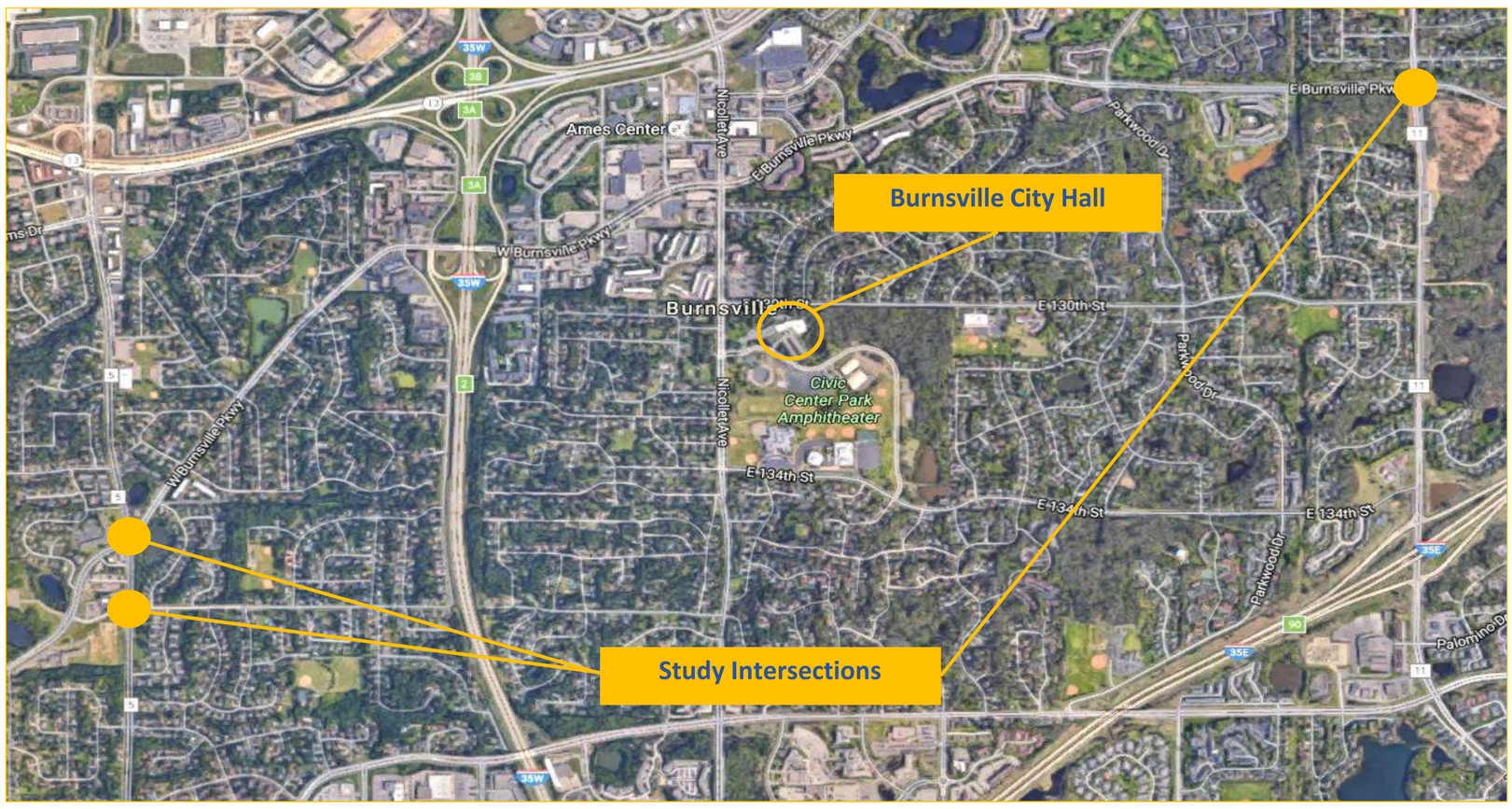
Purpose of Study

Three existing traffic signals are close to the end of their service life. The current age of the signals range from 27 to 37 years old.

Rather than simply remove and replace, Dakota County and the City of Burnsville are taking this opportunity to:

- Review the intersections
- Determine the appropriate traffic control
- Assess the intersection geometry needs

CSAH 5 & Burnsville Parkway (Turn on Date 12/30/1979)
CSAH 5 & 136th Street (Turn on Date 01/18/1989)
CSAH 11 & Burnsville Parkway (Turn on Date 10/10/1986)



Purpose of Meeting

- Discuss the evaluation with the study team
- Learn about the recommended alternatives
- Discuss your issues and concerns

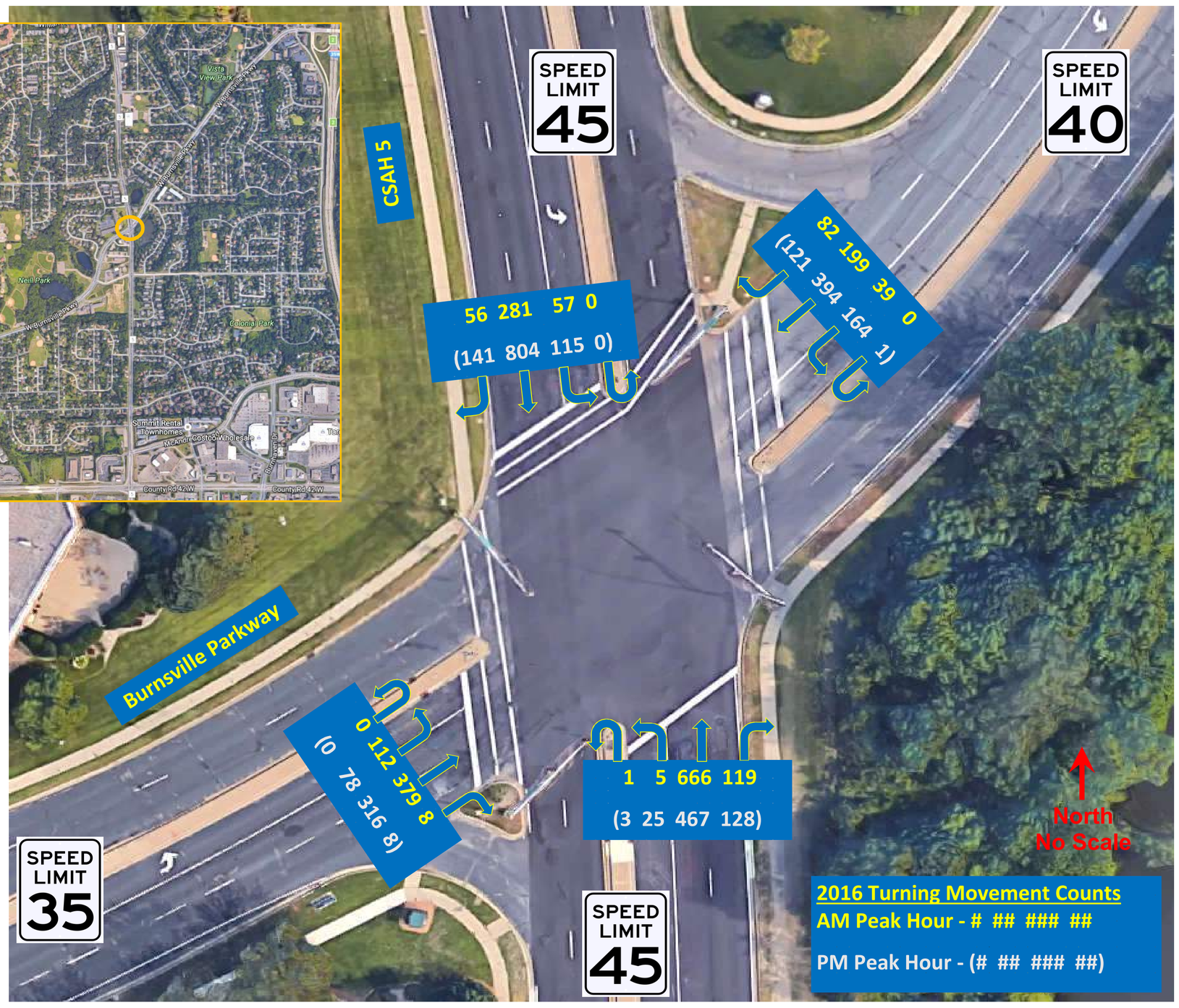
What's next?

- Study recommendations presented to City Council and County Board
- Final reports
- Preliminary layout and cost estimate development
- Projects placed in Capital Improvement Program

What happens after the study?

- Prepare construction plans to update the study intersections to the preferred design in 2017
- Construction on at least one intersection in 2018 (estimated)

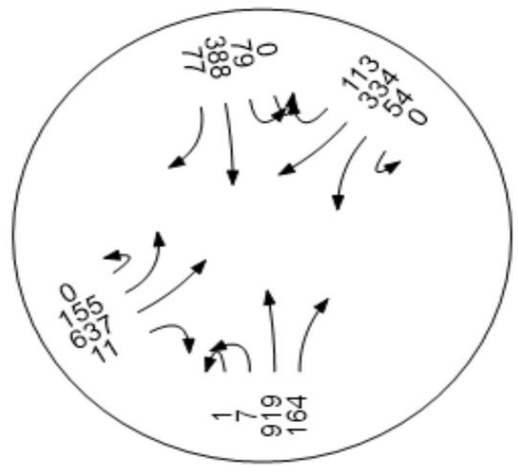
CSAH 5 & Burnsville Parkway Street Alternative Concepts



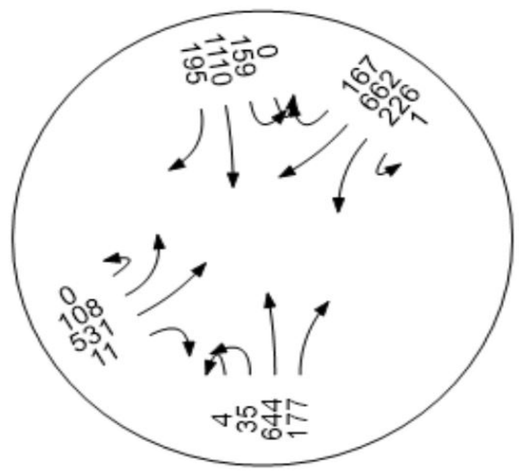
Existing Traffic Signal Turn on Date: December 30, 1979

Projected 2036 Turning Movements

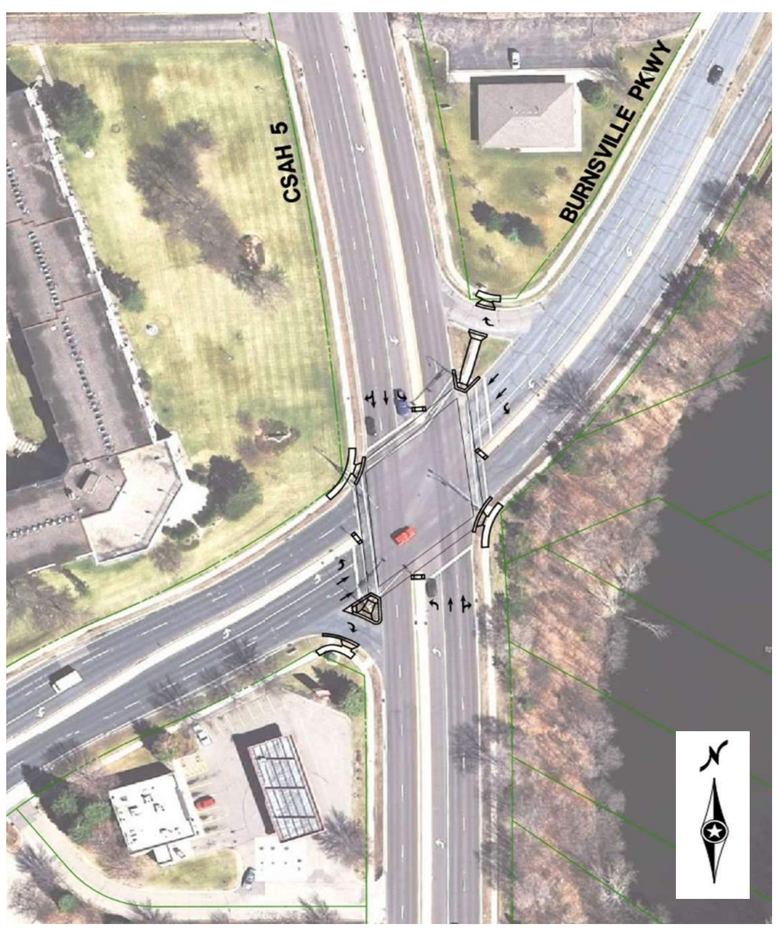
AM Peak Hour



PM Peak Hour



Traffic Signal with FYA



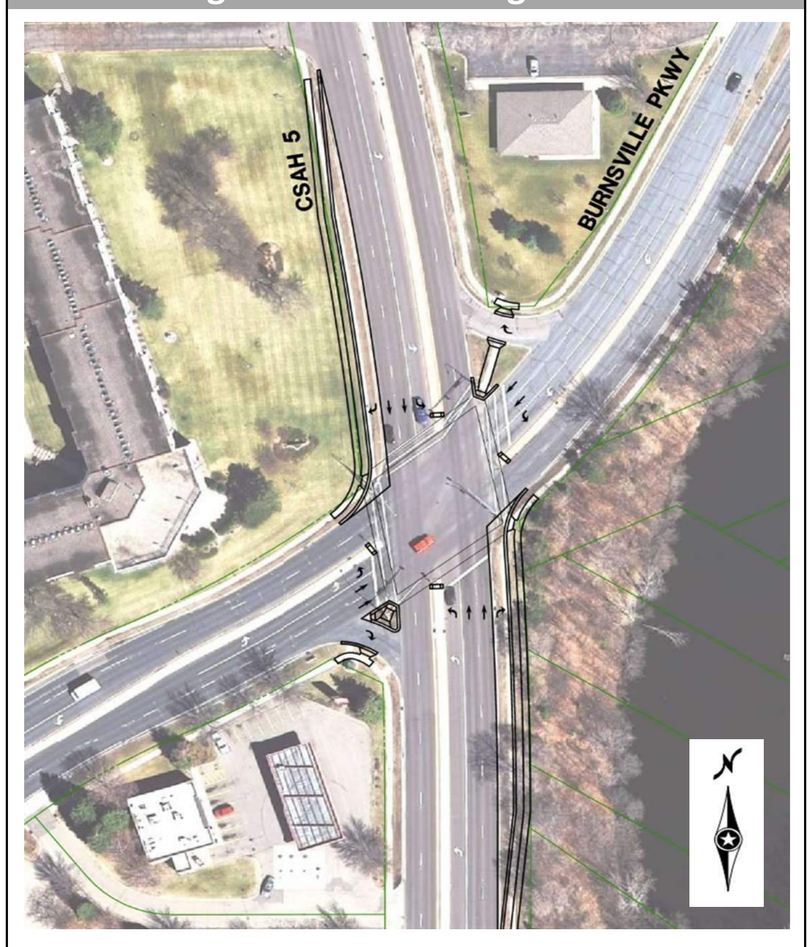
Improvements:
- New Traffic Signal with Flashing Yellow Arrow (FYA)
- Reconfiguration of right turn island
- Updated pedestrian facilities

Cost:
- $350,000

Summary:
- Acceptable operations today and into the future
- Slight improvement of safety compared to existing conditions
- Maintains active, single stage pedestrian crossings
- Minor right-of-way needs
- Positive Benefit-Cost ratio

Public Comments:
- Support expressed for traffic signal
- Support expressed for FYA

RECOMMENDED
Traffic Signal with FYA & Right Turn Lanes



Improvements:
- New Traffic Signal with Flashing Yellow Arrow (FYA)
- Reconfiguration of right turn island
- Updated pedestrian facilities
- Northbound and southbound right turn lanes

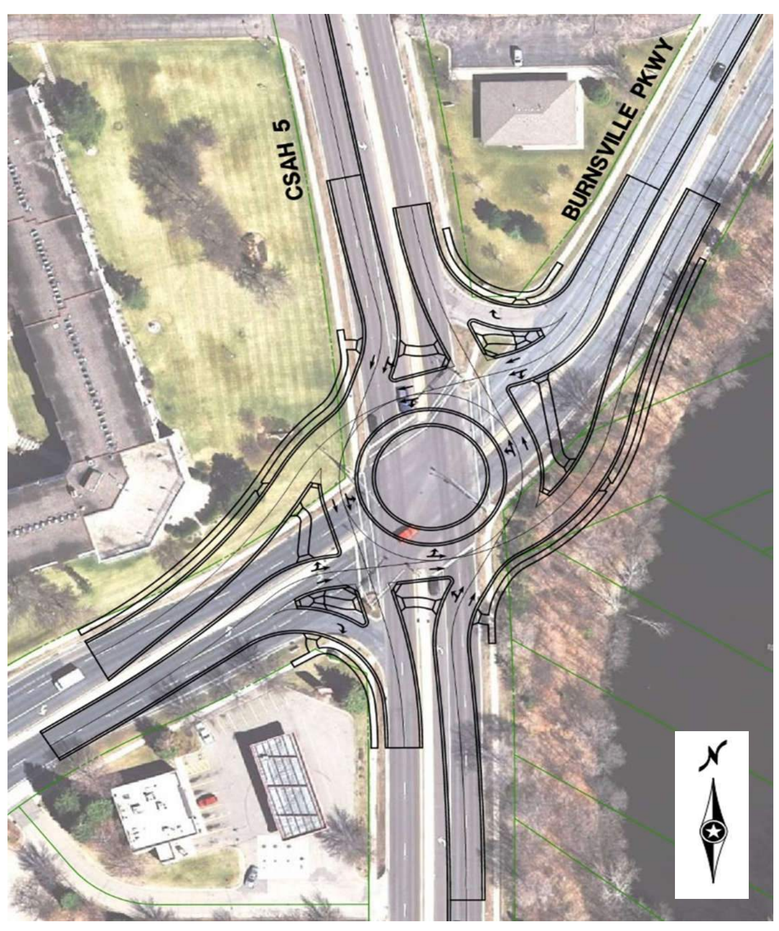
Cost:
- $500,000

Summary:
- Acceptable operations today and into the future
- Slight improvement of safety compared to existing conditions
- Maintains active, single stage pedestrian crossings
- Minor right-of-way needs
- Minor impact to pond (if major impact discovered in final design, northbound right turn lane may be reconsidered)
- Positive Benefit-Cost ratio

Public Comments:
- Support expressed for traffic signal
- Support expressed for FYA

RECOMMENDED

Multi-Lane Roundabout



Improvements:
- Reconstruction to multi-lane roundabout
- Revised pedestrian facilities

Cost:
- $1,050,000

Summary:
- Acceptable operations today, concerns regarding future operations
- Improvement in safety through reduced severe crashes
- Provides passive, two-stage pedestrian crossings
- Major right-of-way needs
- Unable to safely accommodate intersection skew

Public Comments:
- Concerns raised regarding roundabout operations
- Concerns expressed about pedestrian/bicycle crossings

CSAH 5 & Burnsville Parkway Alternatives Comparison

	Existing Conditions (for comparison only)	Traffic Signal[1] (FYA)	RECOMMENDED Traffic Signal[1 2] (FYA & Rt Turn Lanes)	Multi-Lane Roundabout[3]
Operations Level of Service for Existing Volumes AM Peak (PM Peak)	C (C)	C (B)	B (B)	A (B)
Operations Level of Service for Future Volumes AM Peak (PM Peak)	C (C)	C (C)	C (C)	E (F)
Safety Critical Index (All Crashes) Lower Number is Desired	< 0.85	< 0.85	< 0.85	< 0.85
Safety Critical Index (Fatal & Type A Crashes) Lower Number is Desired	< 0.85	< 0.85	< 0.85	< 0.85
Bicycle/Pedestrians Crossings	Active Control Single Stage	Active Control Single Stage	Active Control Single Stage	Passive Control Two Stage
Right-of-Way Needs Less Impact is Desired	N/A	Minor	Minor	Major
Construction Costs	N/A	$350,000	$500,000	$1,050,000
Benefit to Cost Ratio Positive Result is Desired (Indicating a benefit)	N/A	+	+	+
			RECOMMENDED	

Recommendation is for Traffic Signal Control with Flashing Yellow Arrow (FYA) and exclusive northbound and southbound right turn lanes on CSAH 5.

Other Details:

1 Traffic Signal options assume the reconfiguration of the existing right turn island to a slightly better approach angle and yield condition. This is expected to help reduce the risk of crashes related to the right turn movement.

2 Only minor impacts to the adjacent pond are assumed with the addition of the northbound right turn lane. If major impacts are identified through final design, construction of this turn lane could be reconsidered.

3 The intersection skew increased the expected crash rates and expected delays for the roundabout option due to less than ideal design elements, higher entry speeds, and inability to fully meet driver expectations.

Public Comments:

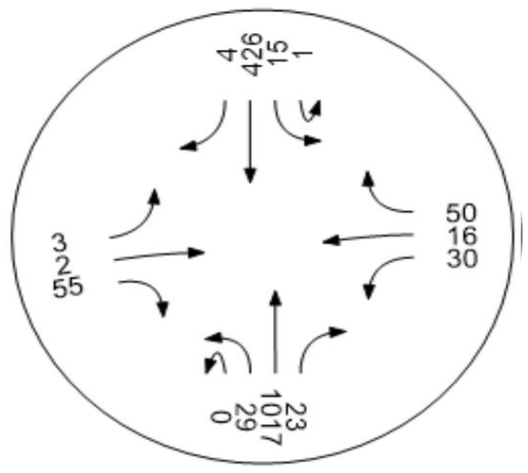
Support expressed for traffic signal.
Support expressed for adding Flashing Yellow Arrow to a traffic signal.
Support expressed for right turn lanes on CSAH 5 (northbound and southbound).
Concerns raised regarding roundabout operations.
Concerns expressed about pedestrian and bicycle crossings.

CSAH 5 & 136th Street Alternative Concepts

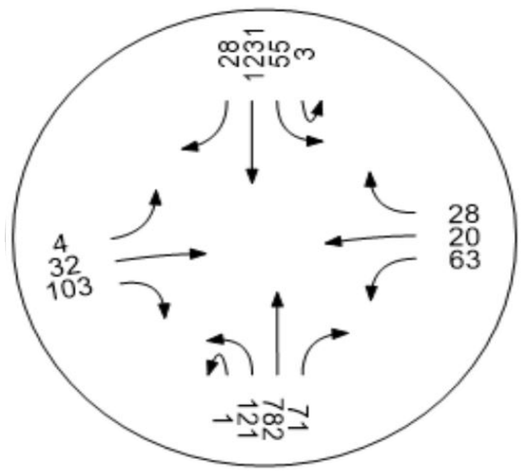
Existing Traffic Signal Turn on Date:
January 18, 1989

Projected 2036 Turning Movements

AM Peak Hour



PM Peak Hour



RECOMMENDED
Traffic Signal with FYA & WB Right Turn Lane

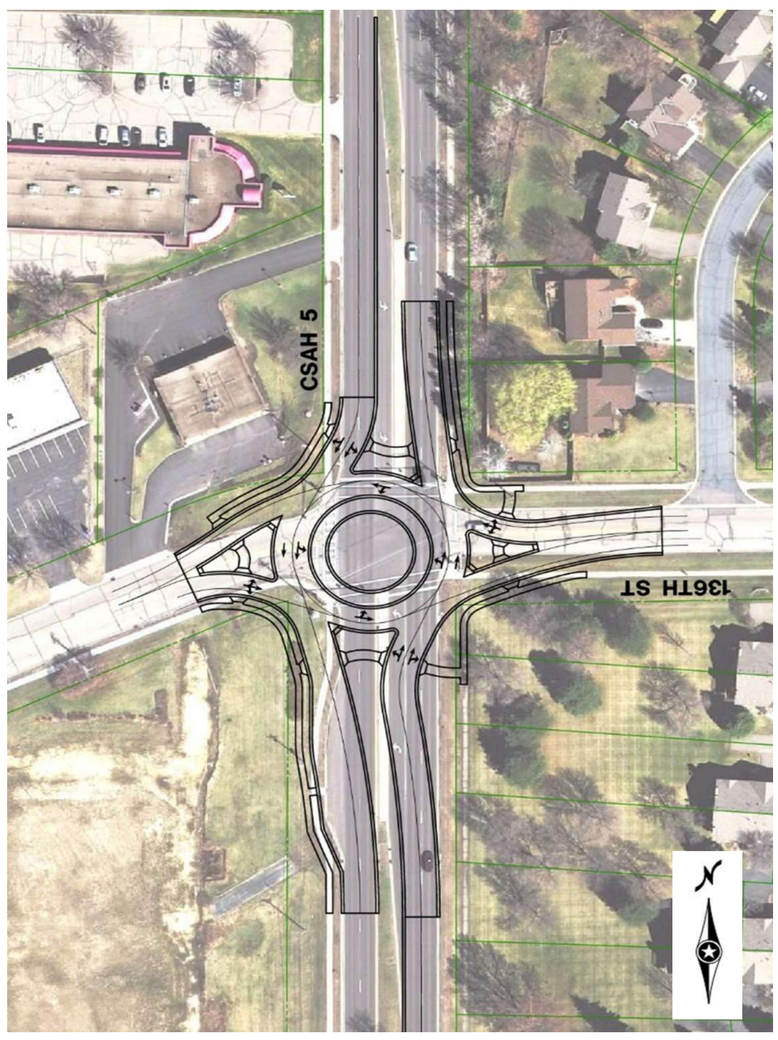
Improvements:
- New Traffic Signal with Flashing Yellow Arrow (FYA)
- Addition of westbound right turn lane
- Updated pedestrian facilities
- Better defined eastbound right turn lane

Cost:
- $350,000

Summary:
- Acceptable operations today and into the future
- Slight improvement of safety compared to existing conditions
- Maintains active, single stage pedestrian crossings
- No right-of-way needs
- Positive Benefit-Cost ratio

Public Comments:
- Support expressed for FYA

Multi-Lane Roundabout



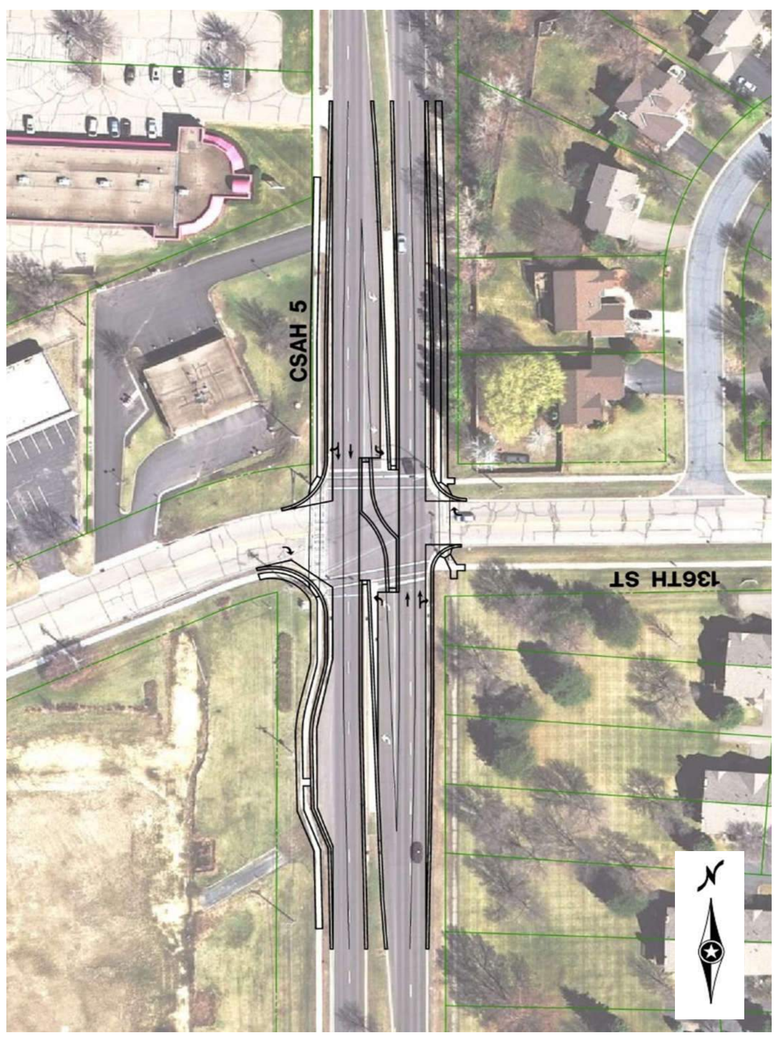
Improvements:
- Reconstruction to multi-lane roundabout
- Revised pedestrian facilities

Cost:
- $550,000

Summary:
- Acceptable operations today and into the future
- Improvement in safety through reduced severe crashes
- Provides passive, two-stage pedestrian crossings
- Major right-of-way needs
- Concern regarding imbalance of north-south traffic versus east-west traffic
- Concern regarding mixing of traffic control options
- Positive Benefit-Cost ratio
- Potential to re-evaluate if conditions change

Public Comments:
- Support and concerns expressed for roundabout operations
- Concerns expressed about pedestrian/bicycle crossings

Limited Access



Improvements:
- Removal of traffic signal
- Reduction in 136th Street movements with revised raised median
- Revised pedestrian facilities (no CSAH 5 crossings)

Cost:
- $250,000

Summary:
- Acceptable operations today and into the future
- Improves overall safety, including reduced severe crashes
- Provides passive pedestrian crossings of 136th Street, no crossings of CSAH 5
- Minor right-of-way needs
- Restricts movements along collector road without acceptable
- Concern regarding U-turn movements at adjacent intersections

Public Comments:
- Concerns raised regarding movement restrictions and potential for cut-thru traffic in other areas
- Concerns expressed about pedestrian and bicycle crossings

RECOMMENDED

CSAH 5 & 136th Street Alternatives Comparison

	Existing Conditions (for comparison only)	RECOMMENDED Traffic Signal (FYA & WB Rt Turn Lane)	Multi-Lane Roundabout[1]	Limited Access[2]
Operations Level of Service for Existing Volumes AM Peak (PM Peak)	A (B)	A (A)	A (A)	A (A)
Operations Level of Service for Future Volumes AM Peak (PM Peak)	A (B)	A (A)	A (A)	A (A)
Safety Critical Index (All Crashes) Lower Number is Desired	< 0.85	< 0.85	< 0.85	< 0.85
Safety Critical Index (Fatal & Type A Crashes) Lower Number is Desired	> 1.0	> 1.0[3]	< 0.85	< 0.85
Bicycle/Pedestrians Crossings	Active Control Single Stage	Active Control Single Stage	Passive Control Two Stage	Passive Control No CSAH 5 Crossing
Right-of-Way Needs Less Impact is Desired	N/A	None	Major	Minor
Construction Costs	N/A	$350,000	$550,000	$250,000
Benefit to Cost Ratio Positive Result is Desired (Indicating a benefit)	N/A	+	+	++
		RECOMMENDED		

Recommendation is for Traffic Signal Control with Flashing Yellow Arrow (FYA) and exclusive westbound right turn lane on 136th Street.

Other Details:

1 The Roundabout option had concerns due to a high imbalance between north-south traffic and east-west traffic as well as the potential for mixing traffic control options (driver expectations) along CSAH 5. If conditions change in the future, the option could be re-examined.

2 The Limited Access option would restrict movements along a collector road without providing acceptable alternatives to other routes. In addition, this option raised concerns about U-turn movements necessary at adjacent intersections as well as the removal of the CSAH 5 pedestrian crossing.

3 There were two Type A (incapacitating) Injury crashes in the past ten years, slightly above the critical rate expected at intersections with similar characteristics. The addition of Flashing Yellow Arrow and turn lane is expected to help reduce the number and severity of crashes compared to the existing conditions, but not as much as the Roundabout or Limited Access options.

Public Comments:

Concerns expressed about pedestrian and bicycle crossings.

Support expressed for adding Flashing Yellow Arrow to a traffic signal.

The roundabout option had both support and concerns expressed about it.

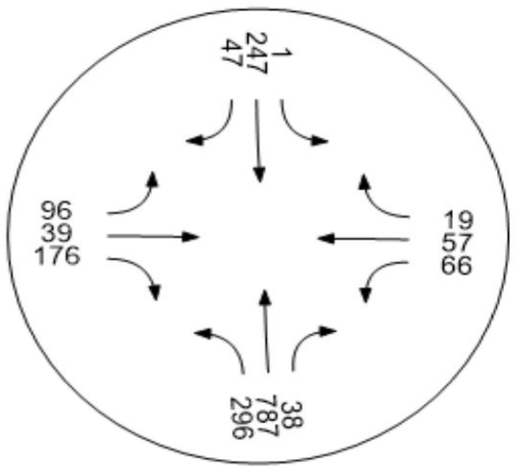
Concerns raised regarding movement restriction with limited access.

Concerns raised regarding neighborhood cut through traffic to be caused by limited access.

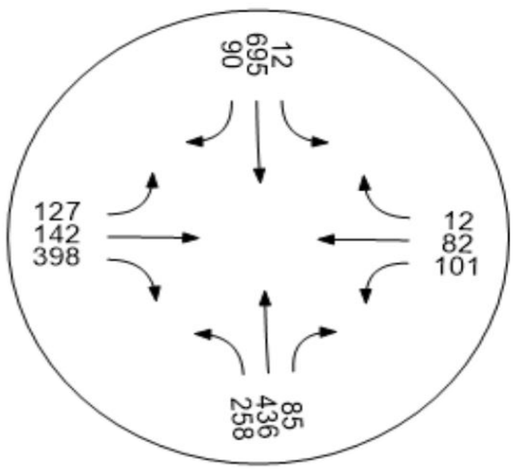
CSAH 11 & Burnsville Parkway Street Alternative Concepts

Existing Traffic Signal Turn on Date:
October 10, 1986

Projected 2036 Turning Movements
AM Peak Hour



PM Peak Hour



RECOMMENDED TODAY DUE TO COST

Traffic Signal with FYA & EB Right Turn Lane

Improvements:

- New Traffic Signal with Flashing Yellow Arrow (FYA)
- Revision of Eastbound outside lane to exclusive right turn lane
- Updated pedestrian facilities
- Maintain current striping on CASH 11

Cost:

$350,000

Summary:

- Acceptable operations today and into the future
- Slight improvement of safety compared to existing conditions
- Maintains active, single stage pedestrian crossings
- No right-of-way needs
- Positive Benefit-Cost ratio

Public Comments:

- Support expressed for FYA

POTENTIAL FUTURE OPTION

Multi-Lane Roundabout

Improvements:

- Reconstruction to multi-lane roundabout
- Revised pedestrian facilities

Cost:

$950,000

Summary:

- Acceptable operations today and into the future
- Improvement in safety through reduced severe crashes
- Provides passive, two-stage pedestrian crossings
- Major right-of-way needs
- Concern regarding imbalance of north-south traffic versus east-west traffic
- Concern regarding mixing of traffic control options
- Positive Benefit-Cost ratio
- Potential to re-evaluate if conditions change

Public Comments:

- Support and concerns expressed for roundabout operations
- Concerns raised regarding impacts to adjacent intersection operations

CSAH 11 & Burnsville Parkway Alternatives Comparison

		RECOMMENDED TODAY DUE TO COST	POTENTIAL FUTURE OPTION
	Existing Conditions (for comparison only)	Traffic Signal (FYA & EB Rt Turn Lane)	Multi-Lane Roundabout[1]
Operations Level of Service for Existing Volumes AM Peak (PM Peak)	B (B)	B (C)	A (A)
Operations Level of Service for Future Volumes AM Peak (PM Peak)	B (C)	B (C)	A (A)
Safety Critical Index (All Crashes) Lower Number is Desired	0.85 - 1.0	0.85 - 1.0	0.85 - 1.0
Safety Critical Index (Fatal & Type A Crashes) Lower Number is Desired	> 1.0	> 1.0[2]	< 0.85
Bicycle/Pedestrians Crossings	Active Control Single Stage	Active Control Single Stage	Passive Control Two Stage
Right-of-Way Needs Less Impact is Desired	N/A	None	Major
Construction Costs	N/A	$350,000	$950,000
Benefit to Cost Ratio Positive Result is Desired (Indicating a benefit)	N/A	+	+
		RECOMMENDED TODAY DUE TO COST	POTENTIAL FUTURE OPTION

Recommendation is for Traffic Signal Control with Flashing Yellow Arrow (FYA) and modified eastbound approach to provide an exclusive right turn lane.

Other Details:

1 The Roundabout option represents an acceptable option and good fit for the intersection. However, the option is cost-prohibitive. If conditions change in the future, the option could be re-evaluated.

2 There were two Type A (incapacitating) Injury crashes in the past ten years, slightly above the critical rate expected at intersections with similar characteristics. The addition of Flashing Yellow Arrow to the operations is expected to help reduce the number and severity of crashes compared to the existing conditions, but not as much as the Roundabout option.

Public Comments:

Support expressed for adding Flashing Yellow Arrow to a traffic signal.

The Roundabout option had both support and concerns expressed about it.

Concerns raised regarding impacts to adjacent intersection operations with the Roundabout option.

Please Sign In

Name	Address	Telephone	Email Address
GINGER JOHNSON	13622 KNOX DR, BVL	952 451 3980	gingerjohnson 55337 @ comcast net
ELRICK GREGOIRE	13622 KNOX DR BVL	952-451-3981	elrickgregoire@yahoo.net
Kari Gill	Dakota County CDA	651-675-4477	Kgill@dakotacda.state.mn.us
Jenni faulkner	13120 Knox Dr, BVL	(952) 895-4407	jenni.tovar@comcast.net
Linda Slipka	13410 Washburn Dr. B'Ville	952 890 9595	KSlipka@msn.com
EARL KALLESTAD	2901 - W 135 ST B'VILLE	952 894 3938	
Cortney McCormick	15705 Fremont Ave S Burnsville	612-309-0234	cortney.mccormick@gmail.com
LARRY WILLIAMS	13529 MORGAN AVE SO BURNSVILLE	952 894-1409	
Randall Eisenbeisz	13517 KNOX DRIVE, Burnsville Burnsville MN	612-716-3826	ref5d428@gmail.com
Kevin Grass	13615 Oakland Dr	6514841636	KDGville@Gmail.com
ED VAN BENTHUYSEN	13421 KNOX DR		
Brian Pankratz	~~4424~~ CBRE	952 922 8485	brian.pankratz@cbre.com
Ben Lamprecht	13804 E. Wellington	952 890 8744	JML313@AOL.COM
Gretchen Freeman	2320 Williams Dr. B'ville	952 210-3588	
Carol Nygaard	2252 Williams Dr B'Ville	952-882-1787	
Paul Conrad	2305 Skyline Drive Bville		
Andrew Bros	1629 Knox Circle Burnsville	952 808 7584	
Heidi Bros	1629 Knox Circle B'Ville	"	
Ben Bros	1629 Knox Circle Burnsville	"	
JESS MINGO	13905 FOREST GLEN DRIVE BURNS		
Pam Watcher	13521 Knox Dr Burnsville MN	952 894-8077	
Doug Swanson	13705 James Ave Burnsville	952-894-7576	

February 1, 2017 Public Meeting
4:00 - 6:00 PM
City of Burnsville City Hall

Please Sign In

Name	Address	Telephone	Email Address
Dennis Vivion	13425 Knox Drive Burnsville	952 894 6111	dennisvivion@gmail.com
LARRY HESSE	1508 W. 137TH ST	612-636-8787	lharlan hesse@gmail.c
Carol Brennan	3105 125th St E Burnsville	952-484-9093	cabrennan63@comcast.net
Irene Mikkelsen	2801 Highland DR B'ville	952-890-5981	
Robert Schreiber	13619 Knox Dr.		
Brian Lofquist	1109 Emerson Ct	952 707 6723	lofquistfamily@msn.com
LeeAnn Lane	13528 Knox Dr. Burnsville MN 337	952 334 4921	leeann.lane@live.com
Rosemary Eisenbeisz	13517 Knox Dr. Burnsville	952-894-7793	reisenbeisz@isd.net
Louisi Grass	13615 Oakland Dr Burnsville	763-350-5959	louisigrass@ledyour.com
Gretchen Johnson	Burnsville		
Stephen Sandberg	Burnsville		
ART KALMES	12949 COUNTY ROAD 11, BURNSVILLE	952-994-4540	ARKALMES@COMCAST.NET

February 1, 2017 Public Meeting
4:00 - 6:00 PM
City of Burnsville City Hall

Comment Sheet

Three existing signals are close to the end of their service life. Dakota County and the City of Burnsville took this opportunity to review the intersections to determine if changes to the traffic control or the intersection geometry are necessary and desired.

This study has now been completed and the study intersections and recommendations are:

- A signal at CSAH 5/Burnsville Parkway
- A signal at CSAH 5/136th Street
- A signal at CSAH 11/Burnsville Parkway due to cost considerations

Please review the study information with the project team and provide your thoughts on these draft recommendations. These study recommendations will be presented to the City Council and County Board before any action is finalized.

Leave your comments with a project team member or on the sign-in table or, if you prefer, you may mail or email your comments to:

Sarah Tracy
Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

35E & Burnsville Parkway – ped audible tones

* Sarah to follow up w/ MnDOT & Gretchen

Name: Gretchen **Telephone:**

Address: **Email:** Gretchen ~~SJ~~ 3 @ earthlink.net SJ

Comment Sheet

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Sarah Tracy
Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

I agree with the recommendations that minimal tweaking is needed. Not enamored with what the county did on County Road 11. My street is one block north of Burnsville Parkway. Turning left on to 11 is now more challenging than it used to be

Name: Paul Conrad **Telephone:**

Address: 2705 Skyline Dr **Email:**

Comment Sheet

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14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

o I live on the short segment of Knox Drive that Connects 136th to the Parkway.

o I support the Current recommendation to keep the lights with adding the flashing yellow. ~~for~~ The alternate plans would encourage a significant increase in traffic flow through our neighborhood.

o Additional concern when construction begins on the CR5 & Bville PKY interchange.
To avoid that intersection, especially North bound on CR5, our street is a convenient by pass to northeast bound Bville PKWY.

Name: Rosemary Eisenbeisz **Telephone:** 952-894-7793

Address: 13517 Knox Drive **Email:** reisenbeisz@isd.net

Comment Sheet

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Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

Much more Automation

PLC Programmable Logic Controllers

Nema 4 enclosures + Heaters

Self enclosed LED Lights w/ Camera to Auto change function of Lights

Automate Hwy 13 west of 35W would have been greatly better and effecient + 1/10 price of over/ under of cty 5 + Hwy 13

Name: **Telephone:**

Address: **Email:**

Comment Sheet

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Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

The side walk on the right hand side from 136th to the next street is in very bad shape. It's black top and is very cracked and uneven.

Name: Ben Bros **Telephone:** 952-808-8584
Address: 1629 Knox Circle **Email:**

Comment Sheet

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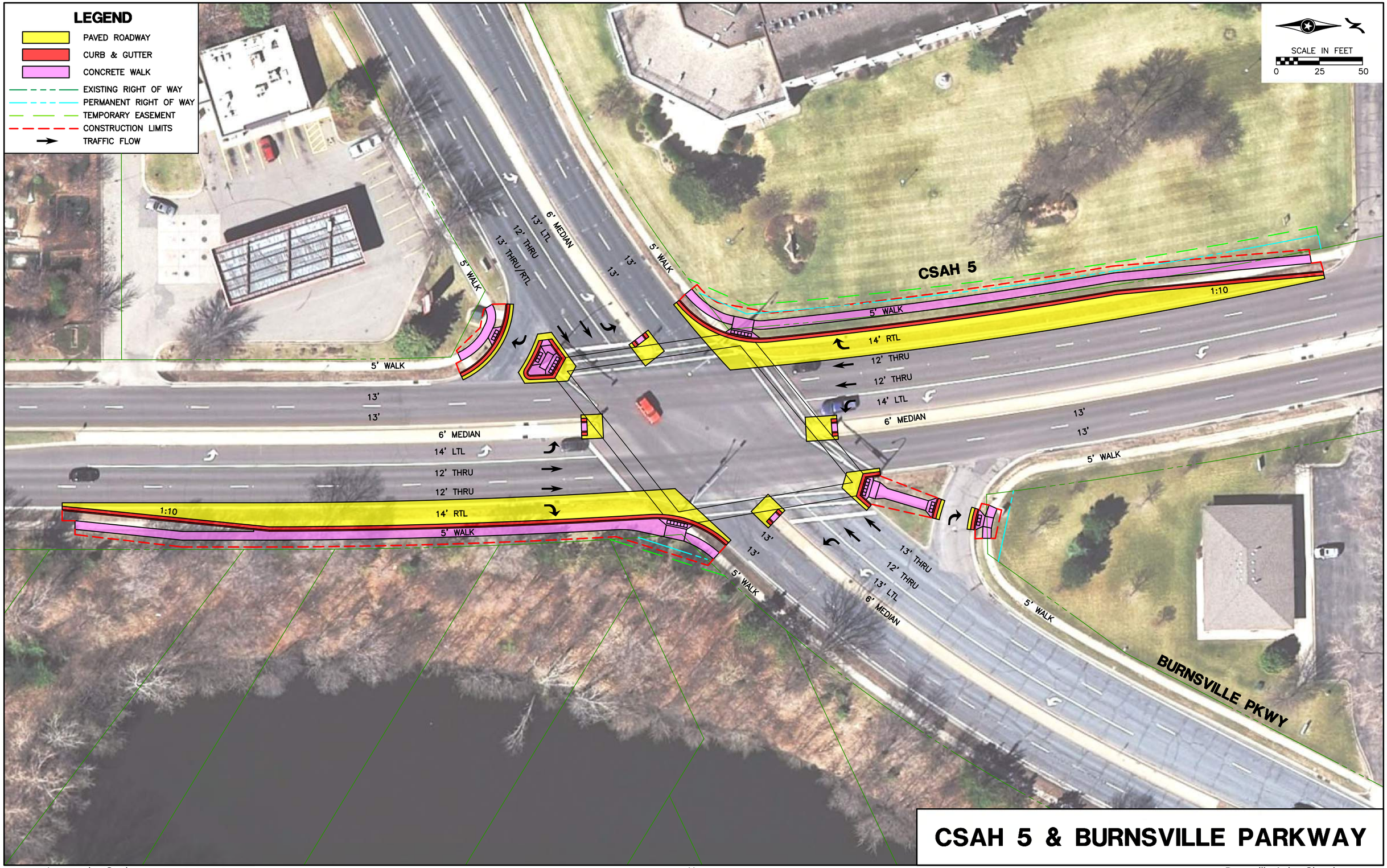
Dakota County Transportation Department
Dakota County Western Service Center
14955 Galaxie Avenue
Apple Valley, Minnesota 55124
Sarah.Tracy@co.dakota.mn.us

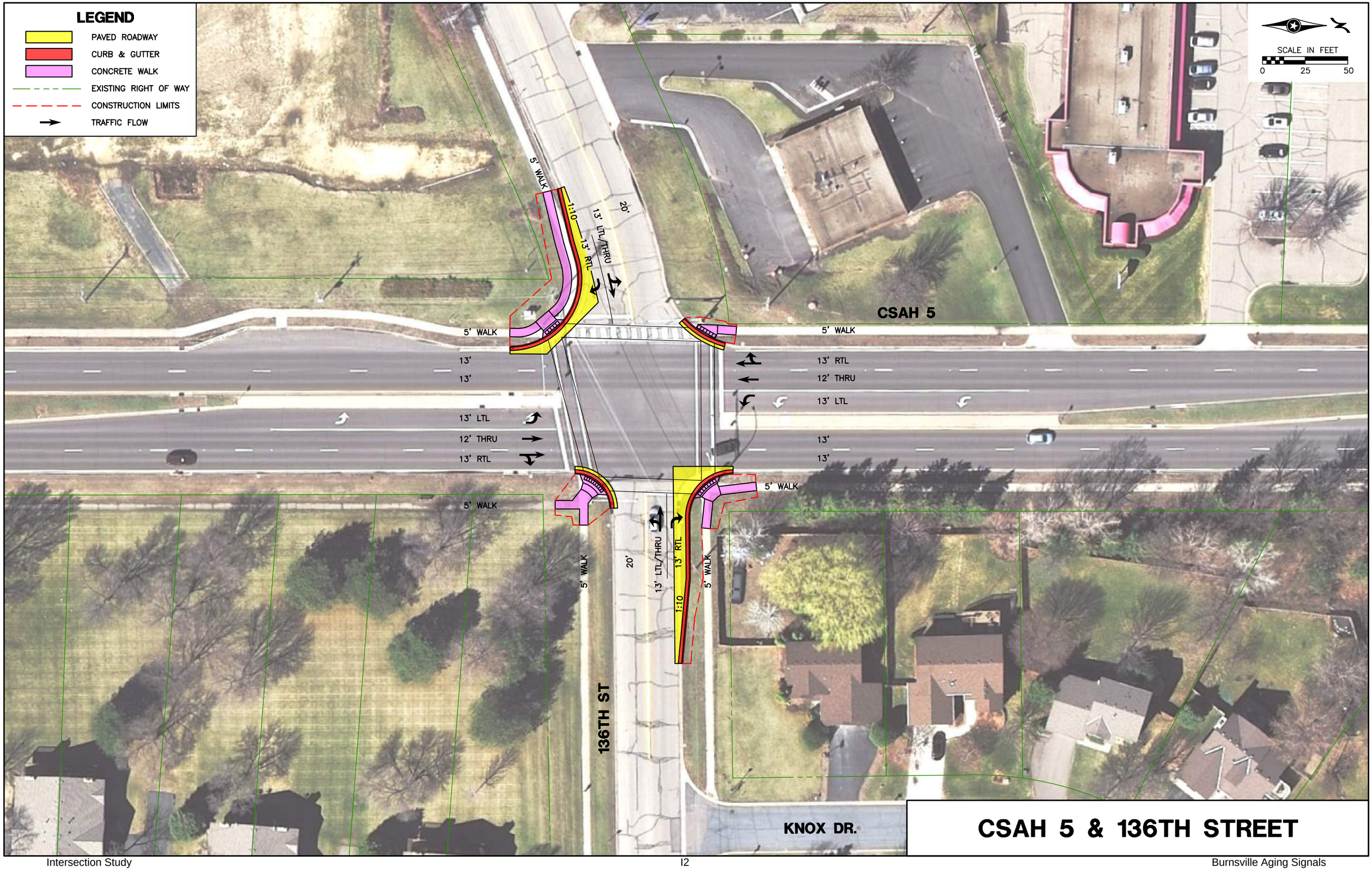
PROPOSED ROUNDABOUT @ CTY RD 11 & BURNSVILLE PARKWAY SEEMS REASONABLE. IT SHOULD BE PURSUED IF WARRENTED BY BENEFIT/COST RATIO AND IF FUNDING CAN BE OBTAINED

Name: ART KALMES **Telephone:**

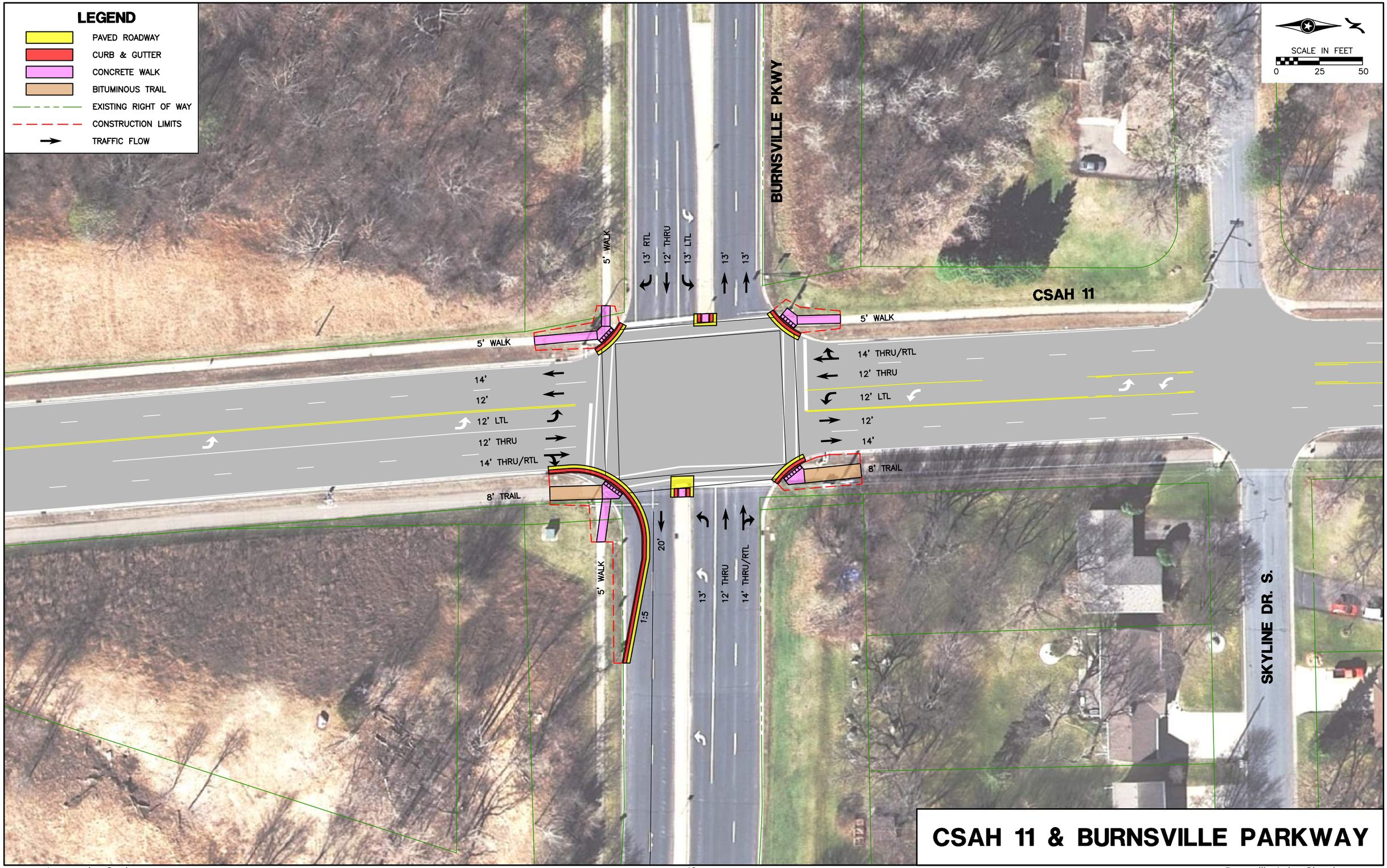
Address: 12949 COUNTY ROAD 11 BURNSVILLE, MN **Email:** ARKALMES@COMCAST.NET



CSAH 5 & BURNSVILLE PARKWAY



CSAH 5 & 136TH STREET



CSAH 11 & BURNSVILLE PARKWAY

Appendix J - Preliminary Cost Estimates for Recommendations

CSAH 5 & BURNSVILLE PARKWAY - PRELIMINARY COST ESTIMATE					
ITEM NO.	ITEM	UNIT	UNIT PRICE	PROJECT TOTAL	
				QUANTITY	AMOUNT
2021.501	MOBILIZATION	LUMP SUM	$29,000.00	1	$29,000.00
2104.501	REMOVE CURB & GUTTER	LIN FT	$3.00	1055	$3,165.00
2104.503	REMOVE CONCRETE WALK	SQ FT	$1.50	4908	$7,362.00
2104.505	REMOVE BITUMINOUS PAVEMENT	SQ YD	$3.00	340	$1,020.00
2104.509	REMOVE MANHOLE OR CATCH BASIN	EACH	$370.00	1	$370.00
2104.513	SAWING BIT PAVEMENT (FULL DEPTH)	LIN FT	$2.40	1242	$2,980.80
2104.523	SALVAGE SIGN TYPE C	EACH	$48.00	1	$48.00
2106.501	EXCAVATION - COMMON	CU YD	$4.00	609	$2,436.00
2106.521	GRANULAR EMBANKMENT (CV)	CU YD	$14.00	494	$6,916.00
2106.523	COMMON EMBANKMENT (CV)	CU YD	$4.00	115	$460.00
2211.503	AGGREGATE BASE (CV) CLASS 5	CU YD	$25.00	330	$8,250.00
2360.503	TYPE SP 12.5 WEARING COURSE MIX	TON	$75.00	388	$29,100.00
2503.541	RC PIPE SEWER DES 3006	LIN FT	$60.00	12	$720.00
2503.602	CONNECT TO EXISTING STORM SEWER	EACH	$750.00	1	$750.00
2506.501	CONST DRAINAGE STRUCTURE	LIN FT	$350.00	4	$1,400.00
2506.516	CASTING ASSEMBLY	EACH	$685.00	1	$685.00
2521.501	4" CONCRETE WALK	SQ FT	$4.00	4110	$16,440.00
2521.501	6" CONCRETE WALK	SQ FT	$7.80	795	$6,201.00
2531.501	CONCRETE CURB & GUTTER DESIGN B424	LIN FT	$19.00	965	$18,335.00
2531.618	TRUNCATED DOMES	SQ FT	$42.00	140	$5,880.00
2563.601	TRAFFIC CONTROL	LUMP SUM	$6,000.00	1	$6,000.00
2564.531	SIGN PANELS TYPE C	SQ FT	$36.00	13	$468.00
2564.537	INSTALL SIGN TYPE C	EACH	$180.00	1	$180.00
2565.511	TRAFFIC CONTROL SIGNAL SYSTEM	SIG SYS	$275,000.00	1	$275,000.00
2573.502	SILT FENCE, TYPE MS	LIN FT	$2.00	350	$700.00
2573.530	STORM DRAIN INLET PROTECTION	EACH	$170.00	8	$1,360.00
2573.533	SEDIMENT CONTROL LOG TYPE COMPOST	LIN FT	$3.00	500	$1,500.00
2574.508	FERTILIZER TYPE 3	POUND	$0.70	70	$49.00
2575.501	SEEDING	ACRE	$250.00	0.2	$50.00
2575.502	SEED MIXTURE	POUND	$3.30	20	$66.00
2575.511	MULCH MATERIAL TYPE 1	TON	$150.00	1	$150.00
2582.501	PAVT MSSG PREF TAPE	SQ FT	$25.00	60	$1,500.00
2582.502	4" SOLID LINE EPOXY	LIN FT	$0.40	400	$160.00
2582.502	8" SOLID LINE EPOXY	LIN FT	$0.80	794	$635.20
				SUBTOTAL	**$429,337.00**
				10% CONTINGENCY	$42,933.70
				CONSTRUCTION TOTAL	**$472,270.70**
	PERMANENT RIGHT-OF-WAY	ACRE	$500,000.00	0.08	$40,000.00
	TEMPORARY EASEMENT	ACRE	$100,000.00	0.05	$5,000.00
				LAND ACQUISITION TOTAL	**$45,000.00**
				PROJECT TOTAL	**$517,270.70**

CSAH 5 & 136TH STREET - PRELIMINARY COST ESTIMATE					
ITEM NO.	ITEM	UNIT	UNIT PRICE	PROJECT TOTAL	
				QUANTITY	AMOUNT
2021.501	MOBILIZATION	LUMP SUM	$22,000.00	1	$22,000.00
2104.501	REMOVE CURB & GUTTER	LIN FT	$3.00	318	$954.00
2104.503	REMOVE CONCRETE WALK	SQ FT	$1.50	1320	$1,980.00
2104.505	REMOVE BITUMINOUS PAVEMENT	SQ YD	$3.00	81	$243.00
2104.509	REMOVE MANHOLE OR CATCH BASIN	EACH	$370.00	2	$740.00
2104.513	SAWING BIT PAVEMENT (FULL DEPTH)	LIN FT	$2.40	371	$890.40
2106.501	EXCAVATION - COMMON	CU YD	$4.00	154	$616.00
2106.521	GRANULAR EMBANKMENT (CV)	CU YD	$14.00	107	$1,498.00
2106.523	COMMON EMBANKMENT (CV)	CU YD	$4.00	47	$188.00
2211.503	AGGREGATE BASE (CV) CLASS 5	CU YD	$25.00	71	$1,775.00
2360.503	TYPE SP 12.5 WEARING COURSE MIX	TON	$75.00	6	$450.00
2503.541	RC PIPE SEWER DES 3006	LIN FT	$60.00	10	$600.00
2503.602	CONNECT TO EXISTING STORM SEWER	EACH	$750.00	1	$750.00
2506.501	CONST DRAINAGE STRUCTURE	LIN FT	$350.00	8	$2,800.00
2506.516	CASTING ASSEMBLY	EACH	$685.00	2	$1,370.00
2506.522	ADJUST FRAME & RING CASTING	EACH	$570.00	2	$1,140.00
2521.501	4" CONCRETE WALK	SQ FT	$4.00	907	$3,628.00
2521.501	6" CONCRETE WALK	SQ FT	$7.80	408	$3,182.40
2531.501	CONCRETE CURB & GUTTER DESIGN B424	LIN FT	$19.00	305	$5,795.00
2531.618	TRUNCATED DOMES	SQ FT	$42.00	97	$4,074.00
2563.601	TRAFFIC CONTROL	LUMP SUM	$2,500.00	1	$2,500.00
2564.531	SIGN PANELS TYPE C	SQ FT	$36.00	13	$468.00
2565.511	TRAFFIC CONTROL SIGNAL SYSTEM	SIG SYS	$265,000.00	1	$265,000.00
2573.530	STORM DRAIN INLET PROTECTION	EACH	$170.00	5	$850.00
2573.533	SEDIMENT CONTROL LOG TYPE COMPOST	LIN FT	$3.00	100	$300.00
2574.508	FERTILIZER TYPE 3	POUND	$0.70	35	$24.50
2575.501	SEEDING	ACRE	$250.00	0.1	$25.00
2575.502	SEED MIXTURE	POUND	$3.30	10	$33.00
2575.511	MULCH MATERIAL TYPE 1	TON	$150.00	1	$150.00
2582.501	PAVT MSSG PREF TAPE	SQ FT	$25.00	30	$750.00
2582.502	4" SOLID LINE EPOXY	LIN FT	$0.40	102	$40.80
2582.502	8" SOLID LINE EPOXY	LIN FT	$0.80	584	$467.20
				SUBTOTAL	**$325,282.30**
				10% CONTINGENCY	$32,528.23
				CONSTRUCTION TOTAL	**$357,810.53**

	PERMANENT RIGHT-OF-WAY	ACRE	$500,000.00		
	TEMPORARY EASEMENT	ACRE	$100,000.00		
				LAND ACQUISITION TOTAL	
				PROJECT TOTAL	**$357,810.53**

CSAH 11 & BURNSVILLE PARKWAY - PRELIMINARY COST ESTIMATE					
ITEM NO.	ITEM	UNIT	UNIT PRICE	PROJECT TOTAL	
				QUANTITY	AMOUNT
2021.501	MOBILIZATION	LUMP SUM	$21,000.00	1	$21,000.00
2104.501	REMOVE CURB & GUTTER	LIN FT	$3.00	226	$678.00
2104.503	REMOVE BITUMINOUS WALK	SQ FT	$1.00	480	$480.00
2104.503	REMOVE CONCRETE WALK	SQ FT	$1.50	775	$1,162.50
2104.505	REMOVE BITUMINOUS PAVEMENT	SQ YD	$3.00	185	$555.00
2104.509	REMOVE MANHOLE OR CATCH BASIN	EACH	$370.00	1	$370.00
2104.513	SAWING BIT PAVEMENT (FULL DEPTH)	LIN FT	$2.40	316	$758.40
2104.523	SALVAGE SIGN TYPE C	EACH	$48.00	1	$48.00
2106.501	EXCAVATION - COMMON	CU YD	$4.00	122	$488.00
2106.521	GRANULAR EMBANKMENT (CV)	CU YD	$14.00	72	$1,008.00
2106.523	COMMON EMBANKMENT (CV)	CU YD	$4.00	50	$200.00
2211.503	AGGREGATE BASE (CV) CLASS 5	CU YD	$25.00	48	$1,200.00
2360.503	TYPE SP 9.5 WEARING COURSE MIX	TON	$75.00	10	$750.00
2360.503	TYPE SP 12.5 WEARING COURSE MIX	TON	$75.00	23	$1,725.00
2503.541	RC PIPE SEWER DES 3006	LIN FT	$60.00	14	$840.00
2503.602	CONNECT TO EXISTING STORM SEWER	EACH	$750.00	1	$750.00
2506.501	CONST DRAINAGE STRUCTURE	LIN FT	$350.00	1	$350.00
2506.516	CASTING ASSEMBLY	EACH	$685.00	1	$685.00
2521.501	4" CONCRETE WALK	SQ FT	$4.00	492	$1,968.00
2521.501	6" CONCRETE WALK	SQ FT	$7.80	350	$2,730.00
2531.501	CONCRETE CURB & GUTTER DESIGN B424	LIN FT	$19.00	234	$4,446.00
2531.618	TRUNCATED DOMES	SQ FT	$42.00	88	$3,696.00
2563.601	TRAFFIC CONTROL	LUMP SUM	$2,500.00	1	$2,500.00
2564.537	INSTALL SIGN TYPE C	EACH	$180.00	1	$180.00
2565.511	TRAFFIC CONTROL SIGNAL SYSTEM	SIG SYS	$265,000.00	1	$265,000.00
2573.530	STORM DRAIN INLET PROTECTION	EACH	$170.00	5	$850.00
2573.533	SEDIMENT CONTROL LOG TYPE COMPOST	LIN FT	$3.00	60	$180.00
2574.508	FERTILIZER TYPE 3	POUND	$0.70	35	$24.50
2575.501	SEEDING	ACRE	$250.00	0.1	$25.00
2575.502	SEED MIXTURE	POUND	$3.30	10	$33.00
2575.511	MULCH MATERIAL TYPE 1	TON	$150.00	1	$150.00
2582.502	4" SOLID LINE EPOXY	LIN FT	$0.40	400	$160.00
2582.502	8" SOLID LINE EPOXY	LIN FT	$0.80	672	$537.60
			SUBTOTAL		**$315,528.00**
			10% CONTINGENCY		$31,552.80
			CONSTRUCTION TOTAL		**$347,080.80**

	PERMANENT RIGHT-OF-WAY	ACRE	$500,000.00		
	TEMPORARY EASEMENT	ACRE	$100,000.00		
			LAND ACQUISITION TOTAL		
			PROJECT TOTAL		**$347,080.80**

Spack CONSULTING
ENGINEERING TRAFFIC FORWARD

Signal Justification Report

County State-Aid Highway (CSAH) 5
at Burnsville Parkway Intersection

in

Burnsville, Dakota County

Program: Pending

Funding: Pending

Letting Date: Pending

Work Identification: S.P. Pending

CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Professional Engineer under the laws of the State of Minnesota.

Bryant J. Ficek, PE, PTOE	42802	April 28, 2017
	Lic. Number	Date

REVIEWED:

City Engineer	Date

APPROVED:

Metro District Traffic Engineer – Program Support	Date

Dakota County Engineer	Date

Signal Justification Report

County State-Aid Highway (CSAH) 5 at Burnsville Parkway Intersection

City of Burnsville
Dakota County, Minnesota

TABLE OF CONTENTS

I. Project Description

This signal justification report is for the intersection of Dakota County State Aid Highway (CSAH) 5 and Burnsville Parkway in Burnsville, Minnesota. This intersection is currently under traffic signal control, but the signal system is reaching the end of its useful life and will need to be replaced. A full review of this intersection and two others examined alternatives to control traffic. This report summarizes those findings and presents the justification to continue with traffic signal control.

Burnsville is a southern suburb of the Twin Cities, located approximately 15 miles south of downtown Minneapolis in Dakota County. Burnsville's population, per the year 2010 census, is 60,306 people. The Metropolitan Council estimates the population will reach 63,500 by year 2020.

CSAH 5 is maintained and operated by Dakota County while Burnsville Parkway is under City of Burnsville jurisdiction. The operation of the current and future intersection will be under a joint powers agreement of both agencies.

The land uses immediately adjacent to the intersection are a mix of residential, in the northwest and southeast quadrants, and business/retail/office, in the northeast and southwest quadrants. These parcels are generally developed.

II. Existing Conditions

Dakota CSAH 5 is a four-lane, divided, north-south road with a 45-mph speed limit in the study area. CSAH 5 is classified as an A Minor Arterial-Expander in the study area. Burnsville Parkway also known as Burnsville Municipal State Aid Street (MSAS) 102 is a four-lane, divided, east-west road with a 35-mph speed limit west of CSAH 5 and a 40-mph speed limit east of CSAH 5. Burnsville Parkway is classified as a Collector road west of CSAH 5 and classified as an A Minor Arterial-Reliever east of CSAH 5.

The CSAH 5/Burnsville Parkway intersection is currently signalized. CSAH 5 runs north-south through the intersection and Burnsville Parkway runs northeast-southwest through the intersection making it a skewed intersection. Exclusive left turn lanes are provided on all approaches and channelized right turns are provided on Burnsville Parkway. The channelizing islands are substandard based on current design guidelines. The existing signal operates under eight phases, providing protected left turn phasing only. Although striped crosswalks are only provided on three of the four crossings, pedestrian pushbuttons and indications are provided for all crossings.

Intersection video was collected under normal weekday conditions in August of 2016 with clear weather. Using these videos, 24-hour turning movement counts were obtained and, based on these counts, the peak hours were found to be from 7:15 to 8:15 a.m. and 4:45 to 5:45 p.m.

A field review of existing operations was conducted during the a.m. and p.m. peak periods in July of 2016. These reviews observed no significant operational issues. All vehicle queues were observed to clear during green phases and no significant queues that stretch beyond turn lane lengths or excessive delays (such as waiting through two or more signal cycles) were noted.

An intersection capacity analysis was conducted for the existing intersections using the Vistro Software Package, which is based upon the methodology of the Highway Capacity Manual. Intersections are assigned a "Level of Service" (LOS) letter grade for the peak hour of traffic based on the number of lanes at the intersection, traffic volumes, and traffic control. LOS A represents light traffic flow (free flow conditions) while LOS F represents heavy traffic flow (over capacity conditions). LOS D is considered acceptable at most intersections. Individual movements are also assigned LOS grades. At busy intersections, one or more individual movements may operate at a lower LOS when the overall intersection is operating acceptably at LOS C or D. This situation often occurs for movements with relatively low volumes and/or a relatively high overall traffic signal cycle length. A summary of the LOS and delay results for the existing operations is shown in Table 1. Signal timings were provided by Dakota County and the model was calibrated to match observations made in the field.

Table 1 – Existing Peak Hour Operations

Intersection	AM Peak Hour		PM Peak Hour	
	LOS[1]	Delay[2]	LOS[1]	Delay[2]
CSAH 5/Burnsville Parkway	C (d)	21	C (d)	24

[1] The first letter is the Level of Service for the intersection. The second letter (in parentheses) is the Level of Service for the worst operating movement

[2] Average delay for the entire intersection based upon a volume weighted average of each movements' delay, rounded up and presented in seconds.

As shown in Table 1, the intersection and all movements are operating acceptably. These computer results match the field observations of the intersection operations during a.m. and p.m. peak hours. All vehicle queues at the intersections cleared during the green phases and no significant existing operational issues were identified.

Crash data at the existing study intersections was collected from the Minnesota Department of Transportation's (MnDOT's) Minnesota Crash Mapping Analysis Tool. Data was collected for the ten most recent years available, years 2006 through 2015. Using previously collected intersection volumes with this crash data, the critical index for the crash rate and severity rate was determined. The critical index is a metric that compares an intersection's observed rate to the critical rate, which is a statistically-valid rate based on the average crash rates for similar intersections statewide throughout Minnesota (similar in terms of volumes, speeds, and traffic control). If the critical index is below 1.00, it suggests the intersection operates within the expected, normal range of crashes. A rate above 1.00 indicates a potential safety issue that deserves additional scrutiny. The Crash Critical Index is 0.51 and the Severity Critical Index is 0.45 for this intersection. Based on this data, the intersection does not have a current crash/safety issue.

III. Intersection Traffic Signal Warrants

Using the turning movement counts, the volume signal warrants (Warrants 1-3) were reviewed using the methodology from the Minnesota Manual on Uniform Traffic Control Devices (Mn-MUTCD). Although three warrants are examined in this study, MnDOT generally focuses on only Warrant 1 only, the Eight Hour Warrant. This warrant accounts for traffic volumes over a longer period, ensuring the installation decision reflects operations over the course of an entire day.

For the purposes of this warrant analysis, the following factors were applied:

- Eliminating the right turning movement volumes from the analysis.
- Removing any existing right turn lanes from consideration in the analysis.
- Considering whether actual vehicle speeds are higher than the posted speed limit.

The CSAH 5/Burnsville Parkway intersection meets all three volume based warrants. The satisfaction of one or more warrants suggests that traffic signal control may be appropriate at these intersections. This also indicates the potential for roundabout control of an intersection. However, satisfaction of the warrants by itself does not indicate that traffic signal or roundabout control is justified.

IV. Intersection Alternatives

Within the universe of alternatives for traffic control exists options for traditional, non-traditional, access management, and grade separated solutions. Each category contains several possibilities that could be considered for the study intersection. An initial review of the existing information and characteristics and generic MnDOT criterion narrowed this universe of alternatives to four: traffic signal, roundabout, offset “T”s, and indirect left turn treatment. Meeting with the City and County further reduced this list due to considerations of the existing volumes, movements, operations, and surrounding area. The alternatives deemed appropriate for this intersection included:

- Traffic signal control with the existing geometry.
- Traffic signal control with the existing geometry and the addition of northbound and southbound right turn lanes.
- Roundabout control assuming two lane approaches, two circulating lanes, and bypass right turn lanes for the eastbound and westbound approaches.

In addition, the traffic signal alternatives would use flashing yellow arrow (FYA) operation to provide protective/permissive left turn phasing during non-peak periods.

V. Future Volumes

To project the existing volumes to the year 2036, traffic forecasts from the Dakota County Transportation Plan and the City of Burnsville Comprehensive Plan Update were utilized. These documents, which generally coincide, show the expected growth in traffic from year 2006 or 2007 to year 2030. Using the forecasted volumes for the two sets of years, general growth rates were established on each of the intersection roadways. Customized growth rates for every turning movement were then developed.

VI. Alternatives Evaluation

Analysis was completed for each alternative of the intersection to evaluate the most appropriate traffic control and geometry for the intersection. The factors considered include operations, safety, pedestrian and bicycle impacts, right-of-way impacts, and estimated construction costs. Each is discussed separately below.

Operations

As before, an intersection capacity analysis was conducted in accordance with the Highway Capacity Manual, using the Vistro software package to assign LOS letter grades. Signal timings, provided by Dakota County, were adjusted as necessary to reflect the change in geometry and the increase in future volumes. The capacity analysis results for the three alternatives are shown in Table 2.

Table 2 – Forecast Peak Hour Operations[1]

Intersection	Signal (existing geometry)		Signal (added NB/SB right turn lanes)		Dual Lane Roundabout	
	Existing	2036	Existing	2036	Existing	2036
CSAH 5/Burnsville Parkway	C (B)	C (C)	B (B)	C (C)	A (B)	**E (F)**

[1] The first letter is the Level of Service for the intersection in the a.m. peak hour. The second letter (in parentheses) is the Level of Service for the intersection in the p.m. peak hour. The configurations from Table 5 are used in these analyses.

As shown, poor operations would be expected in the future under roundabout control. A traffic signal is able to satisfactorily accommodate volume for today and into the future.

Safety

Changes to the intersection geometry and traffic control will impact the rates and safety of the intersections. To determine these projected safety impacts, crash modification factors (CRFs), compiled by the Federal Highway Administration, were consulted. CRFs represent the expected impact to crashes based on a vast collection of studies evaluating the before and after of different changes. Multiplying the existing crash and severity rates by the CRF forecasts the expected rates if the change is implemented.

The crash modification factors used in this analysis were:

- FYA: 0.901 for all crashes, 0.926 for severe crashes.
- Right Turn Lanes: 0.920 for all crashes.
- Multi-lane Roundabout: 1.062 for all crashes, 0.367 for severe crashes.

Using the crash modification factors combined with the traffic volume forecasts for the study intersections, the existing and future crashes and critical rates were established for each alternative. Table 3 shows this information.

Table 3 – Forecast Conditions Crash Statistics[1]

Intersection	Intersection Configuration	Overall Crashes		Severe Crashes	
		Avg. Per Year	Critical Index	Avg. Per Year	Critical Index
CSAH 5/ Burnsville Pkwy	Existing	3.70 (5.55)	0.51 (0.44)	0.10 (0.15)	0.45 (0.47)
	FYA[2]	3.33 (5.00)	0.46 (0.40)	0.09 (0.14)	0.42 (0.44)
	FYA & RTL[3]	3.28 (4.92)	0.45 (0.39)	0.09 (0.14)	0.41 (0.42)
	Multi-Lane RA[4]	3.93 (5.90)	0.54 (0.47)	0.04 (0.06)	0.17 (0.17)

[1]Data presented as: 2016 volumes (2036 traffic volumes)
[2]Signalized intersection with addition of Flashing Yellow Arrows
[3]Signalized intersection with addition of Flashing Yellow Arrows plus northbound and southbound right turn lanes
[4]Conversion to a multi-lane roundabout

As shown, the critical indices are at or below 1.00 using existing and forecast volumes. This suggests that the intersection will operate within the expected, normal range of overall crashes under any alternative.

Pedestrian and Bicycle Impacts

With the different intersection control types, pedestrians are handled differently. At the signalized intersections, crosswalk users have a single stage crossing with active control. This means crossing the length of the street, both directions of traffic, at once when presented with the WALK signal, or green light for pedestrians. The benefit is clear communication to both pedestrians and drivers for when crossings should occur. A shortcoming is the potential for pedestrians to wait a long time, particularly if crossing the mainline, before being allowed to cross even in the absence of vehicular traffic.

At a roundabout, pedestrians are presented a two-stage crossing with passive control. Two-stage means crossing one direction of traffic at a time while passive means the pedestrian looks for gaps in traffic on their own, without assistance from a traffic signal. Benefits to this type of crossing include not having to wait for a signal, but instead crossing when a gap is present or when drivers stop to allow the crossing. In addition, crossing one direction of traffic flow at a time means cars approaching only from one way, reducing the complexity of watching for cars from multiple directions. The drawback of roundabout crossings is often having to wait for drivers to stop, which is a mixed experience in the Twin Cities. Many drivers are focused on their movements only and do not observe or stop for pedestrian crossings.

Bicyclists are able to proceed through an intersection operating as either a car, riding in traffic, or a pedestrian, dismounting and walking in the crosswalk. As a pedestrian, the impacts on bicycle travel would match those described above. As a car, vehicle speeds are higher with a traffic signal compared to a roundabout. In addition, left turn movements can

be more difficult for a bicyclist when operating in the driving lanes due to switching lanes. For any alternative, many drivers are not accustomed to bicyclists operating in the driving lane.

Right-Of-Way Impacts

Right-of-way is the permanent area necessary to accommodate an alternative. Temporary easement is space needed for construction which would return to the property owner after construction is completed. Both types cost money to acquire and can be a difficult and time-consuming process to obtain depending upon the property owner, current use of the area needed, and many other factors. Decreasing these needs is therefore desirable to minimize disruption to area residents and businesses as well as keep the cost of the alternative lower.

Using concept drawings of each alternative, the estimated right-of-way and easement needs were determined. Under traffic signal control, less than 10,000 square feet would be necessary for construction. A dual-lane roundabout, however, would require more than twice that of the signal needs at approximately 23,500 square feet.

Estimated Construction Cost

Concept construction costs were determined from the concept drawings of each intersection alternative. Included in the concept cost estimates are the material and construction costs as well as estimates for:

- Removals
- Utilities
- Drainage
- Lighting
- Signing and striping
- Landscaping
- Erosion control/turf establishment
- Permanent Right-of-Way and temporary easements
- Risk and contingency lump sums

Under traffic signal control with the existing geometry, the estimated construction fee is approximately $350,000. Under traffic signal control with the addition of northbound and southbound right turn lanes, the estimated construction fee increases to about $500,000. The roundabout control alternative construction fee is estimated at $1,050,000, approximately double that of the traffic signal alternative.

VII. Justification

Based upon the information in this report, the intersection of CSAH 5/Burnsville Parkway could operate efficiently today under traffic signal control (as currently exists) or roundabout control. However, the roundabout alternative exhibited operational issues with projected volumes. In addition, the skew of the intersection did not lend itself to a roundabout and would have less than ideal design elements (such as higher entry speeds and an inability to fully meet driver expectations).

Benefits of traffic signal control are:

- Currently operating under traffic signal control.
- Satisfying the traffic signal volume warrants.
- Providing acceptable operations with today and projected volumes.
- Maintaining, or slightly improving upon, the existing safety of the intersection, which is below the standard measure for determining issues using the existing and projected crashes.
- Requiring less right-of-way and easement needs in comparison to the roundabout control alternative.
- Costing less than half the roundabout control option based on concept-level construction cost estimates.

Due to these factors, and through engineering judgment and discussions with City and County staff, traffic signal control is recommended and justified at the intersection of CSAH 5/Burnsville Parkway.

In addition, FYA and northbound/southbound right turn lanes are recommended. Both will have some vehicular operational and safety benefits. The desire for right turn lanes was also brought up by the public in project meetings. Only minor impacts to the adjacent pond were assumed with the northbound right turn lane. If major impacts are identified through final design, construction of this turn lane will be reconsidered.

Spack CONSULTING
ENGINEERING TRAFFIC FORWARD

Signal Justification Report

County State-Aid Highway (CSAH) 5
at 136th Street Intersection

in

Burnsville, Dakota County

Program: Pending

Funding: Pending

Letting Date: Pending

Work Identification: S.P. Pending

CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Professional Engineer under the laws of the State of Minnesota.

Bryant J. Ficek, PE, PTOE	42802	April 28, 2017
	Lic. Number	Date

REVIEWED:

City Engineer	Date

APPROVED:

Metro District Traffic Engineer – Program Support	Date

Dakota County Engineer	Date

Signal Justification Report

County State-Aid Highway (CSAH) 5 at 136th Street Intersection

City of Burnsville
Dakota County, Minnesota

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I. Project Description

This signal justification report is for the intersection of Dakota County State Aid Highway (CSAH) 5 and 136th Street in Burnsville, Minnesota. This intersection is currently under traffic signal control, but the signal system is reaching the end of its useful life and will need to be replaced. A full review of this intersection and two others examined alternatives to control traffic. This report summarizes those findings and presents the justification to continue with traffic signal control.

Burnsville is a southern suburb of the Twin Cities, located approximately 15 miles south of downtown Minneapolis in Dakota County. Burnsville's population, per the year 2010 census, is 60,306 people. The Metropolitan Council estimates the population will reach 63,500 by year 2020.

CSAH 5 is maintained and operated by Dakota County while 136th Street is under City of Burnsville jurisdiction. The operation of the current and future intersection will be under a joint powers agreement of both agencies.

The land uses immediately adjacent to the intersection are residential to the east of CSAH 5, business/retail/office in the northwest quadrant, and mixed use in the southwest quadrant. These parcels are generally developed except for the southwest quadrant.

II. Existing Conditions

Dakota CSAH 5 is a four-lane, divided, north-south road with a 45-mph speed limit in the study area. CSAH 5 is classified as an A Minor Arterial-Expander in the study area. 136th Street is also known as Burnsville MSAS 130 east of CSAH 5. To the west, the road is classified as a local road. 136th Street is a two-lane, undivided, east-west road with a 30-mph speed limit in the study area.

The CSAH 5/136th Street intersection is currently signalized. CSAH 5 runs north-south through the intersection and 136th Street runs east-west. Northbound and southbound exclusive left turn lanes are provided. The eastbound approach flares out at the intersection to provide space for a right turning vehicle. The existing signal operates with six phases, providing protected left turn phasing only for the northbound and southbound left turn movements. Pedestrian crosswalks are striped for three of the four crossings. Pedestrian pushbuttons and indications are provided for all four crossings.

Intersection video was collected under normal weekday conditions in August of 2016 with clear weather. Using these videos, 24-hour turning movement counts were obtained and, based on these counts, the peak hours were found to be from 7:15 to 8:15 a.m. and 4:45 to 5:45 p.m.

A field review of existing operations was conducted during the a.m. and p.m. peak periods in July of 2016. These reviews observed no significant operational issues. All vehicle queues were observed to clear during green phases and no significant queues that stretch beyond turn lane lengths or excessive delays (such as waiting through two or more signal cycles) were noted. The CSAH 5/136th Street intersection primarily rests in a green phase for the northbound and southbound traffic. This limits the interaction and potential vehicle platooning that could develop between this and the CSAH 5/Burnsville Parkway intersection.

An intersection capacity analysis was conducted for the existing intersections using the Vistro Software Package, which is based upon the methodology of the Highway Capacity Manual. Intersections are assigned a "Level of Service" (LOS) letter grade for the peak hour of traffic based on the number of lanes at the intersection, traffic volumes, and traffic control. LOS A represents light traffic flow (free flow conditions) while LOS F represents heavy traffic flow (over capacity conditions). LOS D is considered acceptable at most intersections. Individual movements are also assigned LOS grades. At busy intersections, one or more individual movements may operate at a lower LOS when the overall intersection is operating acceptably at LOS C or D. This situation often occurs for movements with relatively low volumes and/or a relatively high overall traffic signal cycle length. A summary of the LOS and delay results for the existing operations is shown in Table 1. Signal timings were provided by Dakota County and the model was calibrated to match observations made in the field.

Table 1 – Existing Peak Hour Operations

Intersection	AM Peak Hour		PM Peak Hour	
	LOS[1]	Delay[2]	LOS[1]	Delay[2]
CSAH 5/136th Street	A (c)	10	B (c)	12

[1] The first letter is the Level of Service for the intersection. The second letter (in parentheses) is the Level of Service for the worst operating movement

[2] Average delay for the entire intersection based upon a volume weighted average of each movements' delay, rounded up and presented in seconds.

As shown in Table 1, the intersection and all movements are operating acceptably. These computer results match the field observations of the intersection operations during a.m. and p.m. peak hours. All vehicle queues at the intersections cleared during the green phases and no significant existing operational issues were identified.

Crash data at the existing study intersections was collected from the Minnesota Department of Transportation's (MnDOT's) Minnesota Crash Mapping Analysis Tool. Data was collected for the ten most recent years available, years 2006 through 2015. Using previously collected intersection volumes with this crash data, the critical index for the crash rate and severity rate was determined. The critical index is a metric that compares an intersection's observed rate to the critical rate, which is a statistically-valid rate based on the average crash rates for similar intersections statewide throughout Minnesota (similar in terms of volumes, speeds, and traffic control). If the critical index is below 1.00, it suggests the intersection operates within the expected, normal range of crashes. A rate above 1.00 indicates a potential safety issue that deserves additional scrutiny. The Crash Critical Index is 0.31 and the Severity Critical Index is 1.15 for this intersection.

With a Critical Severity Index above 1.00, the CSAH 5/136th Street intersection demonstrates a potential safety issue. However, a deeper examination of the crash data revealed only two severe non-fatal crashes at each intersection during the ten-year study period. This relatively low number of severe crashes is not considered an issue despite the higher than desired critical index. In addition, a review for potential trends did not show any particular patterns or points of interest. While the intersection should continue to be monitored, this review suggests the intersection is reasonably safe.

III. Intersection Traffic Signal Warrants

Using the turning movement counts, the volume signal warrants (Warrants 1-3) were reviewed using the methodology from the Minnesota Manual on Uniform Traffic Control Devices (Mn-MUTCD). Although three warrants are examined in this study, MnDOT generally focuses on only Warrant 1 only, the Eight Hour Warrant. This warrant accounts for traffic volumes over a longer period, ensuring the installation decision reflects operations over the course of an entire day.

For the purposes of this warrant analysis, the following factors were applied:

- Eliminating the right turning movement volumes from the analysis.
- Removing any existing right turn lanes from consideration in the analysis.
- Considering whether actual vehicle speeds are higher than the posted speed limit.

The CSAH 5/136th Street intersection satisfies the Peak Hour Volume Warrant only, falling short of the thresholds on the other volume warrants. The satisfaction of one or more warrants suggests that traffic signal control may be appropriate at these intersections. This also indicates the potential for roundabout control of an intersection. However, satisfaction of the warrants by itself does not indicate that traffic signal or roundabout control is justified.

IV. Intersection Alternatives

Within the universe of alternatives for traffic control exists options for traditional, non-traditional, access management, and grade separated solutions. Each category contains several possibilities that could be considered for the study intersection. An initial review of the existing information and characteristics and generic MnDOT criterion narrowed this universe of alternatives to four: traffic signal, roundabout, offset “T”s, and indirect left turn treatment. Meeting with the City and County further reduced this list due to considerations of the existing volumes, movements, operations, and surrounding area. The alternatives deemed appropriate for this intersection included:

- Traffic signal control with the existing geometry plus a new westbound right turn lane.
- Multi-lane roundabout control assuming two lane approaches on CSAH 5 and one lane approaches on 136th Street.
- Limited access control, eliminating the left turn and thru movements from the 136th Street approaches.

In addition, the traffic signal alternative would use flashing yellow arrow (FYA) operation to provide protective/permissive left turn phasing during non-peak periods.

V. Future Volumes

To project the existing volumes to the year 2036, traffic forecasts from the Dakota County Transportation Plan and the City of Burnsville Comprehensive Plan Update were utilized. These documents, which generally coincide, show the expected growth in traffic from year 2006 or 2007 to year 2030. Using the forecasted volumes for the two sets of years, general growth rates were established on each of the intersection roadways. Customized growth rates for every turning movement were then developed.

VI. Alternatives Evaluation

Analysis was completed for each alternative of the intersection to evaluate the most appropriate traffic control and geometry for the intersection. The factors considered include operations, safety, pedestrian and bicycle impacts, right-of-way impacts, and estimated construction costs. Each is discussed separately below.

Operations

As before, an intersection capacity analysis was conducted in accordance with the Highway Capacity Manual, using the Vistro software package to assign LOS letter grades. Signal timings, provided by Dakota County, were adjusted as necessary to reflect the change in geometry and the increase in future volumes. The capacity analysis results for the three alternatives are shown in Table 2.

Table 2 – Forecast Peak Hour Operations[1]

Intersection	Signal (existing geometry)		Signal (added NB/SB right turn lanes)		Multi-Lane Roundabout	
	Existing	2036	Existing	2036	Existing	2036
CSAH 5/136th Street	A (A)	A (A)	A (A)	A (A)	A (A)	A (A)

[1] The first letter is the Level of Service for the intersection in the a.m. peak hour. The second letter (in parentheses) is the Level of Service for the intersection in the p.m. peak hour. The configurations from Table 5 are used in these analyses.

As shown, all alternatives can satisfactorily accommodate existing and future traffic volumes.

Beyond the computer model results, a multi-lane roundabout had concerns due to a high imbalance between the north-south and east-west traffic. Some studies have demonstrated operational issues (and safety issues) as the mainline drivers learn not to stop or yield due to the lower amount of side street traffic. This alternative also had concerns from the potential for mixing traffic control with the proposed traffic signal at the CSAH 5/Burnsville Parkway intersection, which could impact driver expectations.

The limited access alternative also has concerns beyond the intersection operations. This type of control would restrict movements along a collector road without providing an acceptable alternative route. In addition, this alternative raised concerns regarding U-turn movements at the CSAH 5/Burnsville Parkway and other adjacent intersections.

Safety

Changes to the intersection geometry and traffic control will impact the rates and safety of the intersections. To determine these projected safety impacts, crash modification factors (CRFs), compiled by the Federal Highway Administration, were consulted. CRFs represent the expected impact to crashes based on a vast collection of studies evaluating the before and after of different changes. Multiplying the existing crash and severity rates by the CRF forecasts the expected rates if the change is implemented.

The crash modification factors used in this analysis were:

- FYA: 0.901 for all crashes, 0.926 for severe crashes.
- Multi-lane Roundabout: 1.062 for all crashes, 0.367 for severe crashes.
- Signal Removal: 0.760 for all crashes
- 3/4 Access Conversion: 0.560 for all crashes

Using the crash modification factors combined with the traffic volume forecasts for the study intersections, the existing and future crashes and critical rates were established for each alternative. Table 3 shows this information.

Table 3 – Forecast Conditions Crash Statistics[1]

Intersection	Intersection Configuration	Overall Crashes		Severe Crashes	
		Avg. Per Year	Critical Index	Avg. Per Year	Critical Index
CSAH 5/ 136th Street	Existing	1.50 (2.79)	0.31 (0.28)	0.20 (0.37)	**1.15 (1.37)**
	FYA[2]	1.35 (2.51)	0.28 (0.25)	0.19 (0.34)	**1.06 (1.27)**
	Multi-Lane RA[3]	1.59 (2.96)	0.33 (0.30)	0.07 (0.14)	0.42 (0.50)
	Limited Access[4]	0.93 (1.72)	0.19 (0.17)	0.12 (0.23)	0.71 (0.85)

[1]Data presented as: 2016 volumes (2036 traffic volumes)
[2]Signalized intersection with addition of Flashing Yellow Arrows
[3]Conversion to a multi-lane roundabout
[4]Conversion to an unsignalized limited access intersection

As shown, the critical indices for overall crashes are at or below 1.00 using existing and forecast volumes. The critical indices for severe crashes is above 1.00 under the traffic signal alternative. However, as previously mentioned, the study intersection experienced only two severe crashes over the past ten years. This relatively low amount of severe crashes does not represent a significant issue. In addition, the use of Flashing Yellow Arrow (FYA) is expected to reduce the critical index for severe crashes compared to the existing conditions.

Pedestrian and Bicycle Impacts

With the different intersection control types, pedestrians are handled differently. At the signalized intersections, crosswalk users have a single stage crossing with active control. This means crossing the length of the street, both directions of traffic, at once when presented with the WALK signal, or green light for pedestrians. The benefit is clear communication to both pedestrians and drivers for when crossings should occur. A shortcoming is the potential for pedestrians to wait a long time, particularly if crossing the mainline, before being allowed to cross even in the absence of vehicular traffic.

At a roundabout, pedestrians are presented a two-stage crossing with passive control. Two-stage means crossing one direction of traffic at a time while passive means the pedestrian looks for gaps in traffic on their own, without assistance from a traffic signal. Benefits to this type of crossing include not having to wait for a signal, but instead crossing when a gap is present or when drivers stop to allow the crossing. In addition, crossing one direction of traffic flow at a time means cars approaching only from one way, reducing the complexity of watching for cars from multiple directions. The drawback of roundabout crossings is often having to wait for drivers to stop, which is a mixed experience in the Twin Cities. Many drivers are focused on their movements only and do not observe or stop for pedestrian crossings.

For the limited access alternative, the marked pedestrian crossings are limited to the side street with the mainline crossing removed. Pedestrians would need to detour approximately 900 feet north to the Burnsville Parkway crossing for the next available intersection crossing of CSAH 5.

Bicyclists can proceed through an intersection operating as either a car, riding in traffic, or a pedestrian, dismounting and walking in the crosswalk. As a pedestrian, the impacts on bicycle travel would match those described above. As a car, vehicle speeds are higher with a traffic signal compared to a roundabout. In addition, left turn movements can be more difficult for a bicyclist when operating in the driving lanes due to switching lanes. For any alternative, many drivers are not accustomed to bicyclists operating in the driving lane.

Right-Of-Way Impacts

Right-of-way is the permanent area necessary to accommodate an alternative. Temporary easement is space needed for construction which would return to the property owner after construction is completed. Both types cost money to acquire and can be a difficult and time-consuming process to obtain depending upon the property owner, current use of the area needed, and many other factors. Decreasing these needs is therefore desirable to minimize disruption to area residents and businesses as well as keep the cost of the alternative lower.

Using concept drawings of each alternative, the estimated right-of-way and easement needs were determined. Under the traffic signal alternative, no temporary or permanent land is necessary. The multi-lane roundabout and limited access alternatives would require less than 5,000 square feet for construction.

Estimated Construction Cost

Concept construction costs were determined from the concept drawings of each intersection alternative. Included in the concept cost estimates are the material and construction costs as well as estimates for:

- Removals
- Utilities
- Drainage
- Lighting
- Signing and striping
- Landscaping
- Erosion control/turf establishment
- Permanent Right-of-Way and temporary easements
- Risk and contingency lump sums

Under traffic signal control with the existing geometry, the estimated construction fee is approximately $350,000. The roundabout control alternative construction fee is estimated at $550,000, less than twice that of the traffic signal alternative. The limited access alternative had the lowest estimate at $250,000.

VII. Justification

Based upon the information in this report, the intersection of CSAH 5/136th Street could operate efficiently under traffic signal control (as currently exists), multi-lane roundabout control, or limited access (removing the signal and preventing left turns and thru movements from 136th Street). However, the roundabout alternative had concerns due to a high imbalance between the north-south and east-west traffic. In addition, driver expectations may be impacted given the CSAH 5/Burnsville Parkway intersection is expected to remain under traffic signal control. The limited access alternative would restrict movements along a collector road, raise concerns regarding U-turn movements at adjacent intersections, and remove a pedestrian crosswalk (with the substitute crossing 900 feet away). Impacts may also be felt along other neighborhood roads as traffic seeks other routes.

The benefits of traffic signal control are:

- Currently operating under traffic signal control.
- Satisfying one traffic signal volume warrants.
- Providing acceptable operations with today and projected volumes.
- Maintaining neighborhood vehicle and pedestrian connections.
- Improving the existing safety of the intersection.
- Requiring less right-of-way and easement needs in comparison to other alternatives.
- Costing less than the roundabout control option based on concept-level construction cost estimates.

Due to these factors, and through engineering judgment and discussions with City and County staff, traffic signal control is recommended and justified at the intersection of CSAH 5/136th Street.

In addition, FYA and a westbound right turn lane is recommended. Both will have some vehicular operational and safety benefits.

Spack CONSULTING
ENGINEERING TRAFFIC FORWARD

Signal Justification Report

County State-Aid Highway (CSAH) 11
at Burnsville Parkway Intersection

in

Burnsville, Dakota County

Program: Pending

Funding: Pending

Letting Date: Pending

Work Identification: S.P. Pending

CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Professional Engineer under the laws of the State of Minnesota.

Bryant J. Ficek, PE, PTOE	42802	April 28, 2017
	Lic. Number	Date

REVIEWED:

City Engineer — Date

APPROVED:

Metro District Traffic Engineer – Program Support — Date

Dakota County Engineer — Date

Signal Justification Report

County State-Aid Highway (CSAH) 11 at Burnsville Parkway Intersection

City of Burnsville
Dakota County, Minnesota

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I. Project Description

This signal justification report is for the intersection of Dakota County State Aid Highway (CSAH) 11 and Burnsville Parkway in Burnsville, Minnesota. This intersection is currently under traffic signal control, but the signal system is reaching the end of its useful life and will need to be replaced. A full review of this intersection and two others examined alternatives to control traffic. This report summarizes those findings and presents the justification to continue with traffic signal control.

Burnsville is a southern suburb of the Twin Cities, located approximately 15 miles south of downtown Minneapolis in Dakota County. Burnsville's population, per the year 2010 census, is 60,306 people. The Metropolitan Council estimates the population will reach 63,500 by year 2020.

CSAH 11 is maintained and operated by Dakota County while Burnsville Parkway is under City of Burnsville jurisdiction. The operation of the current and future intersection will be under a joint powers agreement of both agencies.

The land uses immediately adjacent to the intersection are generally residential, with open space in the southeast quadrant. The residential parcels are generally developed.

II. Existing Conditions

Dakota CSAH 11 is a four-lane, undivided, north-south road with a 40-mph speed limit in the study area. CSAH 11 is classified as an A Minor Arterial-Expander. Burnsville Parkway, also known as Burnsville Municipal State Aid Street (MSAS) 102, is a four-lane, divided, east-west road with a 40-mph speed limit west of CSAH 11 and a 35-mph speed limit east of CSAH 11. Burnsville Parkway is classified as an A Minor Arterial-Reliever west of CSAH 11 and classified as a Collector road east of CSAH 11.

The CSAH 11/Burnsville Parkway intersection is currently under signal control. CSAH 11 runs north-south through the intersection and Burnsville Parkway runs east-west through the intersection. Exclusive left turn lanes are provided on all approaches. Exclusive right turn lanes or other types of channelization are not provided at this intersection. The existing signal operates with six phases, providing protected left turn phasing only for the northbound and southbound left turn movements. Striped pedestrian crossings, pushbuttons, and indications are provided for all four crossings of the intersection.

Intersection video was collected under normal weekday conditions in August of 2016 with clear weather. Using these videos, 24-hour turning movement counts were obtained and, based on these counts, the peak hours were found to be from 7:15 to 8:15 a.m. and 4:45 to 5:45 p.m.

A field review of existing operations was conducted during the a.m. and p.m. peak periods in July of 2016. These reviews observed no significant operational issues. All vehicle queues were observed to clear during green phases and no significant queues that stretch beyond turn lane lengths or excessive delays (such as waiting through two or more signal cycles) were noted. Although the westbound left turn movement on Burnsville Parkway at the CSAH 11 intersection appears to have an issue due to a slight grade change to the west, sufficient sight distance is available to safely and efficiently complete this turn.

An intersection capacity analysis was conducted for the existing intersections using the Vistro Software Package, which is based upon the methodology of the Highway Capacity Manual. Intersections are assigned a "Level of Service" (LOS) letter grade for the peak hour of traffic based on the number of lanes at the intersection, traffic volumes, and traffic control. LOS A represents light traffic flow (free flow conditions) while LOS F represents heavy traffic flow (over capacity conditions). LOS D is considered acceptable at most intersections. Individual movements are also assigned LOS grades. At busy intersections, one or more individual movements may operate at a lower LOS when the overall intersection is operating acceptably at LOS C or D. This situation often occurs for movements with relatively low volumes and/or a relatively high overall traffic signal cycle length. A summary of the LOS and delay results for the existing operations is shown in Table 1. Signal timings were provided by Dakota County and the model was calibrated to match observations made in the field.

Table 1 – Existing Peak Hour Operations

Intersection	AM Peak Hour		PM Peak Hour	
	LOS[1]	Delay[2]	LOS[1]	Delay[2]
CSAH 11/Burnsville Parkway	B (d)	13	B (c)	18

[1] The first letter is the Level of Service for the intersection. The second letter (in parentheses) is the Level of Service for the worst operating movement

[2] Average delay for the entire intersection based upon a volume weighted average of each movements' delay, rounded up and presented in seconds.

As shown in Table 1, the intersection and all movements are operating acceptably. These computer results match the field observations of the intersection operations during a.m. and p.m. peak hours. All vehicle queues at the intersections cleared during the green phases and no significant existing operational issues were identified.

Crash data at the existing study intersections was collected from the Minnesota Department of Transportation's (MnDOT's) Minnesota Crash Mapping Analysis Tool. Data was collected for the ten most recent years available, years 2006 through 2015. Using previously collected intersection volumes with this crash data, the critical index for the crash rate and severity rate was determined. The critical index is a metric that compares an intersection's observed rate to the critical rate, which is a statistically-valid rate based on the average crash rates for similar intersections statewide throughout Minnesota (similar in terms of volumes, speeds, and traffic control). If the critical index is below 1.00, it suggests the intersection operates within the expected, normal range of crashes. A rate above 1.00 indicates a potential safety issue that deserves additional scrutiny. The Crash Critical Index is 0.94 and the Severity Critical Index is 1.11 for this intersection.

With a Critical Severity Index above 1.00, the CSAH 11/Burnsville Parkway intersection demonstrates a potential safety issue. However, a deeper examination of the crash data revealed only two severe non-fatal crashes at each intersection during the ten-year study period. This relatively low number of severe crashes is not considered an issue despite the higher than desired critical index. In addition, a review for potential trends did not show any particular patterns or points of interest. While the intersection should continue to be monitored, this review suggests the intersection is reasonably safe.

III. Intersection Traffic Signal Warrants

Using the turning movement counts, the volume signal warrants (Warrants 1-3) were reviewed using the methodology from the Minnesota Manual on Uniform Traffic Control Devices (Mn-MUTCD). Although three warrants are examined in this study, MnDOT generally focuses on only Warrant 1 only, the Eight Hour Warrant. This warrant accounts for traffic volumes over a longer period, ensuring the installation decision reflects operations over the course of an entire day.

For the purposes of this warrant analysis, the following factors were applied:

- Eliminating the right turning movement volumes from the analysis.
- Removing any existing right turn lanes from consideration in the analysis.
- Considering whether actual vehicle speeds are higher than the posted speed limit.

If using the actual vehicle speeds as opposed to the posted speed limit, the high-speed reduction can be applied to the warrant threshold values. Under this scenario, the CSAH 11/Burnsville Parkway intersection meets the Four Hour and Peak Hour Vehicular Volume warrants. The satisfaction of one or more warrants suggests that traffic signal control may be appropriate at these intersections. This also indicates the potential for roundabout control of an intersection. However, satisfaction of the warrants by itself does not indicate that traffic signal or roundabout control is justified.

IV. Intersection Alternatives

Within the universe of alternatives for traffic control exists options for traditional, non-traditional, access management, and grade separated solutions. Each category contains several possibilities that could be considered for the study intersection. An initial review of the existing information and characteristics and generic MnDOT criterion narrowed this universe of alternatives to four: traffic signal, roundabout, offset “T”s, and indirect left turn treatment. Meeting with the City and County further reduced this list due to considerations of the existing volumes, movements, operations, and surrounding area. The alternatives deemed appropriate for this intersection included:

- Traffic signal control with a revised eastbound approach to a left turn lane, thru lane, and right turn lane.
- Roundabout control assuming two lane approaches on CSAH 11 and eastbound Burnsville Parkway and a one lane approach for westbound Burnsville Parkway.

In addition, the traffic signal alternatives would use flashing yellow arrow (FYA) operation to provide protective/permissive left turn phasing during non-peak periods.

V. Future Volumes

To project the existing volumes to the year 2036, traffic forecasts from the Dakota County Transportation Plan and the City of Burnsville Comprehensive Plan Update were utilized. These documents, which generally coincide, show the expected growth in traffic from year 2006 or 2007 to year 2030. Using the forecasted volumes for the two sets of years, general growth rates were established on each of the intersection roadways. Customized growth rates for every turning movement were then developed.

VI. Alternatives Evaluation

Analysis was completed for each alternative of the intersection to evaluate the most appropriate traffic control and geometry for the intersection. The factors considered include operations, safety, pedestrian and bicycle impacts, right-of-way impacts, and estimated construction costs. Each is discussed separately below.

Operations

As before, an intersection capacity analysis was conducted in accordance with the Highway Capacity Manual, using the Vistro software package to assign LOS letter grades. Signal timings, provided by Dakota County, were adjusted as necessary to reflect the change in geometry and the increase in future volumes. The capacity analysis results for the three alternatives are shown in Table 2.

Table 2 – Forecast Peak Hour Operations[1]

Intersection	Signal (revised EB approach)		Multi-Lane Roundabout	
	Existing	2036	Existing	2036
CSAH 11/Burnsville Parkway	B (C)	B (C)	A (A)	A (A)

[1] The first letter is the Level of Service for the intersection in the a.m. peak hour. The second letter (in parentheses) is the Level of Service for the intersection in the p.m. peak hour. The configurations from Table 5 are used in these analyses.

As shown, both alternatives satisfactorily accommodate traffic volumes today and into the future. Under roundabout control, operations would be expected to be better.

Safety

Changes to the intersection geometry and traffic control will impact the rates and safety of the intersections. To determine these projected safety impacts, crash modification factors (CRFs), compiled by the Federal Highway Administration, were consulted. CRFs represent the expected impact to crashes based on a vast collection of studies evaluating the before and after of different changes. Multiplying the existing crash and severity rates by the CRF forecasts the expected rates if the change is implemented.

The crash modification factors used in this analysis were:

- FYA: 0.901 for all crashes, 0.926 for severe crashes.
- Multi-lane Roundabout: 1.062 for all crashes, 0.367 for severe crashes.

Using the crash modification factors combined with the traffic volume forecasts for the study intersections, the existing and future crashes and critical rates were established for each alternative. Table 3 shows this information.

Table 3 – Forecast Conditions Crash Statistics[1]

Intersection	Intersection Configuration	Overall Crashes		Severe Crashes	
		Avg. Per Year	Critical Index	Avg. Per Year	Critical Index
CSAH 11/ Burnsville Pkwy	Existing	4.80 (6.92)	0.94 (0.80)	0.20 (0.29)	**1.11 (1.18)**
	FYA[2]	4.32 (6.24)	0.85 (0.72)	0.19 (0.27)	**1.03 (1.09)**
	Multi-Lane RA[3]	5.10 (7.35)	1.00 (0.85)	0.07 (0.11)	0.41 (0.43)

[1]Data presented as: 2016 volumes (2036 traffic volumes)
[2]Signalized intersection with addition of Flashing Yellow Arrows
[3]Conversion to a multi-lane roundabout

As shown, the critical indices for overall crashes are at or below 1.00 using existing and forecast volumes. The critical indices for severe crashes is above 1.00 under the traffic signal alternative. However, as previously mentioned, the study intersection experienced only two severe crashes over the past ten years. This relatively low amount of severe crashes does not represent a significant issue. In addition, the use of Flashing Yellow Arrow (FYA) is expected to reduce the critical index for severe crashes compared to the existing conditions.

Pedestrian and Bicycle Impacts

With the different intersection control types, pedestrians are handled differently. At the signalized intersections, crosswalk users have a single stage crossing with active control. This means crossing the length of the street, both directions of traffic, at once when presented with the WALK signal, or green light for pedestrians. The benefit is clear communication to both pedestrians and drivers for when crossings should occur. A shortcoming is the potential for pedestrians to wait a long time, particularly if crossing the mainline, before being allowed to cross even in the absence of vehicular traffic.

At a roundabout, pedestrians are presented a two-stage crossing with passive control. Two-stage means crossing one direction of traffic at a time while passive means the pedestrian looks for gaps in traffic on their own, without assistance from a traffic signal. Benefits to this type of crossing include not having to wait for a signal, but instead crossing when a gap is present or when drivers stop to allow the crossing. In addition, crossing one direction of traffic flow at a time means cars approaching only from one way, reducing the complexity of watching for cars from multiple directions. The drawback of roundabout crossings is often having to wait for drivers to stop, which is a mixed experience in the Twin Cities. Many drivers are focused on their movements only and do not observe or stop for pedestrian crossings.

Bicyclists are able to proceed through an intersection operating as either a car, riding in traffic, or a pedestrian, dismounting and walking in the crosswalk. As a pedestrian, the impacts on bicycle travel would match those described above. As a car, vehicle speeds are higher with a traffic signal compared to a roundabout. In addition, left turn movements can

be more difficult for a bicyclist when operating in the driving lanes due to switching lanes. For any alternative, many drivers are not accustomed to bicyclists operating in the driving lane.

Right-Of-Way Impacts

Right-of-way is the permanent area necessary to accommodate an alternative. Temporary easement is space needed for construction which would return to the property owner after construction is completed. Both types cost money to acquire and can be a difficult and time-consuming process to obtain depending upon the property owner, current use of the area needed, and many other factors. Decreasing these needs is therefore desirable to minimize disruption to area residents and businesses as well as keep the cost of the alternative lower.

Using concept drawings of each alternative, the estimated right-of-way and easement needs were determined. Under traffic signal control, no temporary or permanent land is necessary for construction. A multi-lane roundabout, however, would require approximately 7,500 square feet.

Estimated Construction Cost

Concept construction costs were determined from the concept drawings of each intersection alternative. Included in the concept cost estimates are the material and construction costs as well as estimates for:

- Removals
- Utilities
- Drainage
- Lighting
- Signing and striping
- Landscaping
- Erosion control/turf establishment
- Permanent Right-of-Way and temporary easements
- Risk and contingency lump sums

Under traffic signal control with the existing geometry, the estimated construction fee is approximately $350,000. The roundabout control alternative construction fee is estimated at $950,000, almost three times that of the traffic signal alternative.

VII. Justification

Based upon the information in this report, the intersection of CSAH 11/Burnsville Parkway could operate efficiently today under traffic signal control (as currently exists) or roundabout control. The roundabout alternative would be expected to have better operations and safety in comparison to a traffic signal. However, this alternative is cost prohibitive given the substantial estimate compared to that of the traffic signal alternation.

Benefits of traffic signal control are:

- Currently operating under traffic signal control.
- Satisfying the traffic signal volume warrants.
- Providing acceptable operations with today and projected volumes.
- Slightly improving the existing safety of the intersection.
- Requiring less right-of-way and easement needs in comparison to the roundabout control alternative.
- Costing approximately a third of the roundabout control alternative based on concept-level construction cost estimates.

Due to these factors, and through engineering judgment and discussions with City and County staff, traffic signal control is recommended and justified at the intersection of CSAH 11/Burnsville Parkway.

In addition, FYA and revision of the eastbound approach to provide one left turn lane, one thru lane, and one right turn lane are recommended. Both will have some vehicular operational and safety benefits.