APPENDIX A: TRAFFIC STUDY UPDATE

Memo

Date:	Friday, January 17, 2025
Project:	20th Street S Interchange
To:	City of Brookings
From:	HDR
Subject:	20th Street S & 22nd Avenue Intersection Traffic Operations Update

Introduction

This memo updates the 20th Street South Corridor Year of Need Analysis within the I-29 20th Street South Interchange Justification Report (IJR) completed in September 2020. Recommendations for intersection turn lane configurations, geometrics, and traffic control are provided for Year 2050 (Planning Horizon) Build condition traffic volumes.

The analysis updates traffic forecasts for Year 2050 to include revised growth rates and trip generation based on current development trends. Existing condition traffic patterns, which provide the foundation for traffic forecasting, were also updated using intersection turning movement counts collected in spring/summer 2024 following opening of the I-29 Exit 130 (20th Street S) interchange.

Data Collection

Peak period intersection turning movement counts were collected on typical weekdays in the months of April, May, and June 2024 at the following intersections:

- 20th Street S & 22nd Avenue (April 2024 when SDSU was still in session)
- 20th Street S & I-29 southbound ramp terminal (May 2024)
- 20th Street S & I-29 northbound ramp terminal (May 2024)
- 20th Street S & 34th Avenue (May 2024)
- 20th Street S & Ace Avenue (June 2024)

Twenty-four hours of counts were processed for the two 20th Street S and I-29 ramp terminal intersections to establish daily volumes.

Seasonal factors and growth factors for study area streets were provided by the South Dakota Department of Transportation (SDDOT).

Existing Volumes

Peak hours were well-defined within the traffic counts and generally reflect:

- AM peak hour: 7:15 – 8: 15 a.m.
- PM Peak hour: 4:30 – 5:30 p.m.

Peak hour volumes specific to each respective intersection were used to develop the existing condition volume set shown in **Figure 1**. These volumes may vary +/- 15 minutes from the corridor peak hour. Volumes were smoothed and balanced across intersections where feasible. Existing 20th Street S volumes do not balance between Ace Avenue and 22nd Avenue due to uncounted, high-volume mid-segment driveways. Heavy vehicle percentages are based on the 2024 intersection turning movement counts.

Traffic Forecasts

The development of traffic forecasts used the following process:

1. **Develop 'Existing' condition volumes**
    a. Based on spring/summer 2024 intersection turning movement counts
2. **Determine traffic growth factor between years 2024 to 2050**
    a. Based on review of SDDOT-derived growth factors
    b. Reflects general traffic growth passing through the study area
3. **Develop Year 2050 'Background' traffic volumes**
    a. 'Background' traffic volumes = Existing traffic x growth factor identified in Step 2
    b. Adjusted intersection volumes using NCHRP 765 'Iterative Procedure – Directional Method' to create the 'Background' traffic volume set
4. **Develop 'Development' generated traffic volumes**
    a. Met with City of Brookings to discuss potential development along the 20th Street S and 22nd Avenue corridors within the study area
    b. City of Brookings provided available site plans and traffic impact studies
    c. For development west of I-29:
        i. Estimated trip generation using ITE Trip Generation Manual, 11th Edition, trip generation rates
    d. For development east of I-29:
        i. Refined trip generation estimates documented in the I-29 20th Street S IJR's Traffic Forecasting Process Summary memo
    e. Assigned trip generation volumes to the study area street network based on location of development, access points, existing traffic patterns, and proximity to I-29 and the Brookings core areas to create the 'Development' traffic volume set
5. **Develop Year 2050 AM, PM, and Daily traffic volumes**
    a. Combine volumes developed in Steps 3 and 4
    b. Adjusted volumes to align with target 'K' factors
    c. Balanced and smoothed volumes to create the Year 2050 traffic volume set

Year 2050 AM, PM, and Daily traffic volumes are provided in **Figure 2**.

EXISTING (2024) TRAFFIC VOLUMES

FIGURE 1

2050 PLANNING HORIZON TRAFFIC VOLUMES

FIGURE 2

BROOKINGS, SD | 20TH STREET S & 22ND AVENUE INTERSECTION TRAFFIC OPERATIONS UPDATE

Development Trip Generation

Trip generation estimates for developable/redevelopable areas west of I-29 are shown in **Table 1**, correlating to areas identified in **Figure 3**. A 10 percent reduction was applied for internal capture to account for trips that begin and end within a development area.

The identified development in this area west of I-29 is expected to generate upwards of 14,000 trips per day. However, it should be noted that pass-by trips (traffic that is already on the corridor that would access the development as part of their typical route) account for nearly half of this development's generated trips. These types of trips do not increase traffic on the arterial street network.

Table 1: Trip Generation for Development West of I-29

Area	#	Land Use	Total Daily Trips	AM				PM			
				In	Out	Pass-By	Total	In	Out	Pass-By	Total
NW	1	C-Store / Gas Station	3,240	68	68	205	341	57	57	173	287
NW	2	Strip Retail Plaza	1,868	33	22	38	93	78	78	104	260
SW	3	C-Store / Gas Station	3,703	78	78	234	390	66	66	196	328
SW	4	Coffee Shop w/DT & Inside Seating	768	6	6	112	124	3	3	50	56
SW	5	Strip Retail Plaza	881	14	9	14	37	32	32	41	105
SE	6	Strip Retail Plaza	2,580	47	32	54	133	112	112	148	372
SE	7	Office	854	105	14	0	119	19	94	0	113
		Totals:	*13,894*	*351*	*229*	*657*	*1,237*	*367*	*442*	*712*	*1,521*

Trips account for 10% reduction for internal capture

Trip generation estimates for developable areas east of I-29 are shown in **Table 2** and correlate to areas identified in **Figure 3**. Since future development is less defined in this area, a 15% internal capture reduction was applied to the mixed-use development area and pass-by trips were not estimated.

Table 2: Trip Generation for Development East of I-29

Area	#	Land Use	Total Daily Trips	AM				PM			
				In	Out	Pass-By	Total	In	Out	Pass-By	Total
E	48	Office Park	3,320	410	40	0	450	80	410	0	490
E	60	Mixed Use (Office, Retail, Apartments, SF Homes)	8,270	640	430	0	1,070	220	490	0	710
		Totals:	*11,590*	*1,050*	*470*	*0*	*1,520*	*300*	*900*	*0*	*1,200*

Mixed-use development trips account for 15% reduction for internal capture

It should be noted that not all generated trips will access the study area street network. In many instances, these developments will include access points to other surrounding streets with connectivity outside of this study area.

0 500 Feet

TRIP GENERATION DEVELOPMENT AREAS

FIGURE 3

Traffic Operations Analysis

Methodology

The traffic operations analysis follows methodology in the Highway Capacity Manual, 7th Edition (HCM7). A Level of Service (LOS) goal of 'C' was used to identify recommended intersection lane configuration and/or traffic control modifications beyond what is currently installed.

The traffic operations analysis was conducted using Synchro/SimTraffic version 12. Analysis measures were reported from Synchro's HCM7 module and SimTraffic. HCM7 methodology recommends right turn on red (RTOR) be zero unless field measured. SimTraffic simulation was used to provide an alternate analysis where RTOR was estimated and incorporated into the operational results.

Analyzed Lane Configurations and Traffic Control

Analyzed lane configurations and traffic control are shown in **Figure 4**. The recommended 2050 Build condition intersection lane configurations and traffic control reflect the following modifications to the existing conditions:

20TH STREET S & 22ND AVENUE INTERSECTION

- Add southbound through lane
  - SB approach: LT, T, T, RT
- Add northbound through lane
  - NB approach: LT, T, T/RT
- Add eastbound right turn lane
  - EB approach: LT, T, RT

I-29 NORTHBOUND AND SOUTHBOUND RAMP TERMINAL INTERSECTIONS

- Signalize both intersections

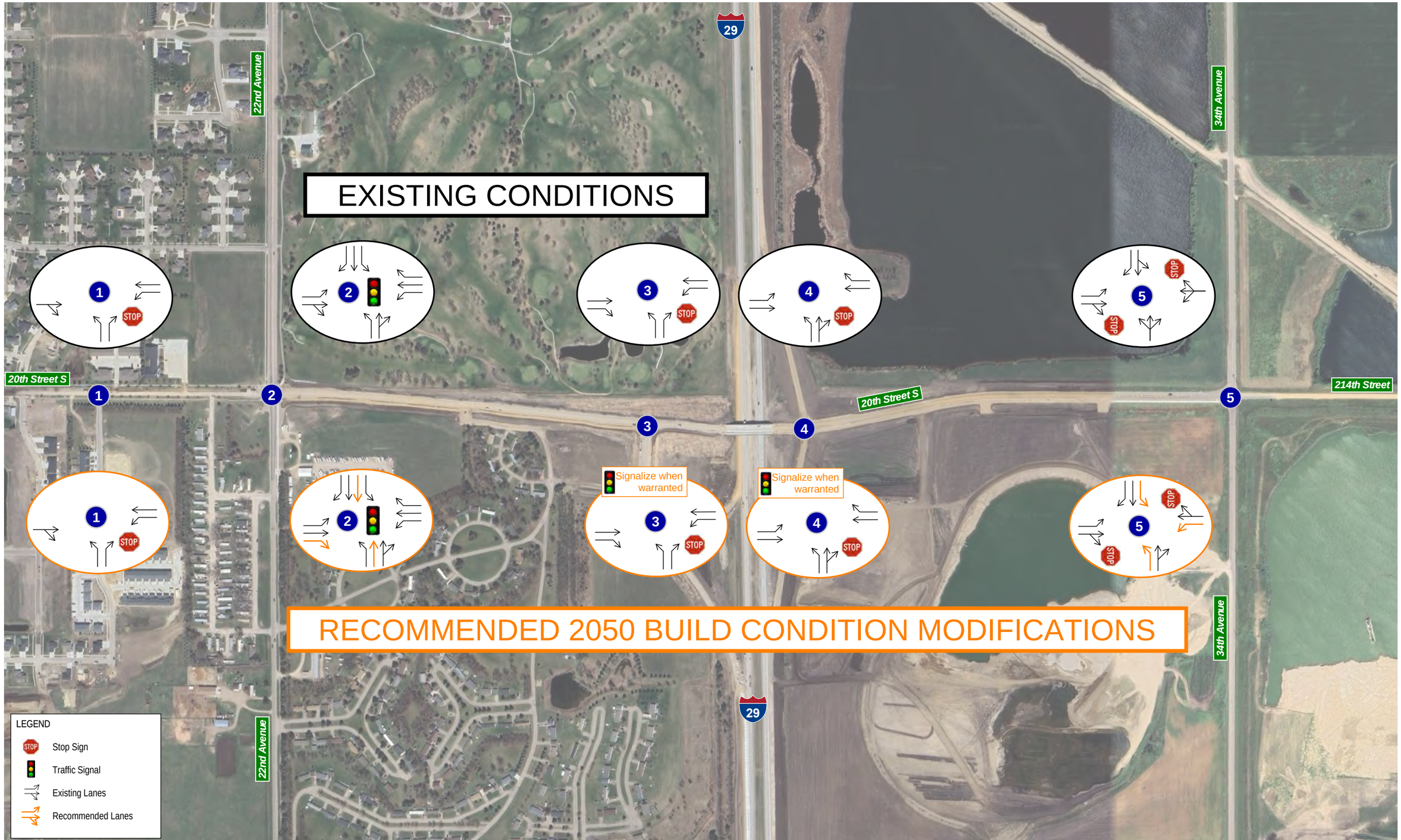
20TH STREET S & 34TH AVENUE

- Add westbound left turn lane
  - WB approach: LT, T/RT
- Add southbound and northbound left turn lanes
  - SB approach: LT, T, RT
  - NB approach: LT, T/RT

Traffic Analysis Output Reports

Traffic analysis output reports are provided in the Appendix as follows:

- **Appendix A:** Existing and 2050 Build condition intersection operations analysis reports for results presented in Table 3 and **Table 4**
- **Appendix B:** I-29 ramp terminal intersection year of need analysis reports
- **Appendix C:** 20th Street S & 22nd Avenue year of need analysis reports
- **Appendix D:** 20th Street S & 34th Avenue year of need analysis reports



LANE CONFIGURATIONS AND TRAFFIC CONTROL

FIGURE 4

Intersection Operations Analysis

A summary of intersection operations for the Existing and 2050 Build conditions is provided in **Table 3** and **Table 4** for HCM7 and SimTraffic output, respectively.

Table 3: Intersection Operations (HCM7)

20th Street S Intersection	**Existing (2024)**			**2050 Build Condition**		
	Intersection Control	**AM** *LOS / Delay*	**PM** *LOS / Delay*	Intersection Control	**AM** *LOS / Delay*	**PM** *LOS / Delay*
Ace Ave	TWSC	A / 0.8 *(B / 11.2)*	A / 0.9 *(B / 11.2)*	TWSC	A / 1.3 *(C / 17.0)*	A / 1.4 *(C / 17.4)*
22nd Ave	Signal	B / 16.7	B / 17.6	Signal	C / 31.9	C / 28.8
I-29 SB RTI	TWSC	A / 1.5 *(B / 11.2)*	A / 2.9 *(B / 12.2)*	Signal	A / 6.4	A / 9.5
I-29 NB RTI	TWSC	A / 6.7 *(B / 13.5)*	A / 6.3 *(B / 12.2)*	Signal	B / 10.4	B / 15.5
34th Ave	TWSC	A / 5.8 *(A / 9.6)*	A / 2.7 *(A / 9.3)*	TWSC	E / 44.5 *(F / 100.6)*	B / 13.8 *(D / 31.1)*

RTOR assumed zero

Overall intersection delay in terms of seconds of delay/vehicle; Worst-case stop-control approach also shown *(LOS / Delay)*

Table 4: Intersection Operations (SimTraffic)

20th Street S Intersection	**Existing (2024)**			**2050 Build Condition**		
	Intersection Control	**AM** *LOS / Delay*	**PM** *LOS / Delay*	Intersection Control	**AM** *LOS / Delay*	**PM** *LOS / Delay*
Ace Ave	TWSC	A / 1.0 *(A / 5.3)*	A / 0.8 *(A / 5.5)*	TWSC	A / 3.1 *(B / 14.3)*	A / 2.0 *(C / 14.1)*
22nd Ave	Signal	B / 12.3	B / 12.2	Signal	C / 28.5	C / 27.9
I-29 SB RTI	TWSC	A / 1.6 *(A / 6.2)*	A / 2.3 *(A / 7.2)*	Signal	A / 8.9	B / 11.3
I-29 NB RTI	TWSC	A / 2.9 *(A / 6.0)*	A / 2.8 *(A / 5.8)*	Signal	B / 13.1	B / 15.1
34th Ave	TWSC	A / 0.8 *(A / 4.9)*	A / 1.4 *(A / 4.5)*	TWSC	A / 8.8 *(C / 14.7)*	A / 6.6 *(D / 13.0)*

RTOR incorporated through SimTraffic simulation

Overall intersection delay in terms of seconds of delay/vehicle; Worst-case stop-control approach also shown *(LOS / Delay)*

Key findings from the intersection operations analysis include:

20TH STREET S & 22ND AVENUE INTERSECTION

- Permitted U-turn movements with right turn on red (RTOR)
    - Permitted U-turn movements within the 20th Street S & 22nd Avenue intersection may limit opportunities for RTOR and right turn overlap signal phasing
        - Example includes the potential need for a southbound to northbound U-turn, where an upstream right-in right-out at the gas station access (northwest quadrant) may lead to downstream U-turn movements
    - As U-turn demand grows, intersection operations will shift from the SimTraffic measures (RTOR permitted) to the HCM7 measures (RTOR assumed 0)
    - If a westbound right turn overlap (with a left turn phase) is not provided due to conflicting U-turn movements, overall intersection operations are expected to degrade to LOS D
    - Include U Turn Yield to Right Turn sign (MUTCD R10-16) to help manage conflict for these movements
- Westbound through movement 95th percentile queue exceeds 725 feet in the Year 2050 PM peak hour
    - Reflects a rolling queue between 22nd avenue and I-29 Exit 130 southbound ramp terminal intersection due to high commuter traffic flow traveling back to residential areas west of 22nd Avenue
        - Several different sources of traffic (e.g., development traffic adjacent to 20th Street S and 34th Avenue, interchange traffic from I-29) contribute to the continuous westbound flow arriving at the intersection
    - Traffic signal coordination with future I-29 Exit 130 interchange traffic signals (when warranted) provides some benefit, but a portion of the continuous flow of westbound through traffic will still be required to stop at 22nd Avenue
    - A second westbound through lane would provide a benefit to westbound, and overall intersection, queue lengths and delay. Additional lanes on 20th Street S should be explored through future planning studies.

20TH STREET S & I-29 NORTHBOUND AND SOUTHBOUND RAMP TERMINAL INTERSECTIONS

- Signalizing the existing ramp terminal intersections address 2050 operational needs

20TH STREET S & 34TH AVENUE INTERSECTION

- Elevated delay for eastbound left turn movement in AM peak hour (HCM7 analysis only)
    - High-volume commute route movement
- Key contributors to this condition include the following, which collectively lead to fewer gaps in 34th Avenue traffic and higher levels of eastbound/westbound delay:
    - Development along 34th Avenue, which increases northbound/southbound traffic traveling through the intersection
    - Development east of I-29, north of 20th Street S, which increases eastbound left turn traffic demand
    - Paving 214th Street east to Aurora, which draws additional traffic to the corridor originating from/destined to areas east of 34th Avenue

I-29 Ramp Terminal Intersections: Traffic Signal Year of Need

Traffic signal year of need analyses were conducted for the two I-29 Exit 130 interchange ramp terminal intersections using the following methods:

- **Traffic signal warrants**: planning-level review of traffic signal warrants to identify when traffic volumes may exceed traffic signal volume-warrant thresholds
- **Stop-controlled approach LOS D:** traffic operations analysis to identify when traffic volumes may result in stop-controlled approach LOS D

As development will be the primary generator of new traffic on 20th Street S and the interchange approaches, the pace and density of future development will play a key role in planning-level timelines. For this analysis, straight-line growth between 2024 and 2050 was assumed.

Traffic Signal Warrants (MUTCD Warrant 1 and 2)

A planning-level review of traffic signal warrants was conducted using guidance provided in the Manual on Uniform Traffic Control Devices (MUTCD). Warrant 1 (8-hour) and Warrant 2 (4-hour) were reviewed by applying peak hour growth factors (between Years 2024 and 2050) to 15-minute count intervals within the 24-hour traffic count spreadsheets. Growth factors were determined for each intersection movement.

Both ramp terminal intersections were analyzed using a single through lane in each direction on 20th Street S. For the off-ramp approach, only the northbound left turn movement traffic volumes were analyzed. It is anticipated that northbound right turn volumes will be able to enter 20th Street S with minimal delay well into the future.

Findings from the planning-level warrant analysis include:

20TH STREET S & I-29 SOUTHBOUND RAMP TERMINAL

- 4-hour warrant met between 2045 and 2050

20TH STREET S & I-29 NORTHBOUND RAMP TERMINAL

- 4-hour warrant met between 2040 and 2045

Stop-Controlled Approach LOS D

A traffic operations analysis was also conducted to identify the approximate volumes and associated timeframe for when the off-ramp approach would reach LOS D. The analysis also identified when the northbound off-ramp left turn movement reaches LOS D. Level of Service measures were obtained from HCM7 output in Synchro.

Findings from the planning-level LOS D analysis include:

20TH STREET S & I-29 SOUTHBOUND RAMP TERMINAL

- AM Peak Hour
  - Off-ramp approach LOS D between 2045 and 2050
  - Off-ramp left turn LOS D movement between 2040 and 2045
- PM Peak Hour
  - Off-ramp approach LOS D between 2035 and 2040
  - Off-ramp left turn LOS D movement between 2035 and 2040

20TH STREET S & I-29 NORTHBOUND RAMP TERMINAL

- AM Peak Hour
  - Off-ramp approach LOS D between 2035 and 2040
  - Off-ramp left turn LOS D movement between 2030 and 2035
- PM Peak Hour
  - Off-ramp approach LOS D between 2035 and 2040
  - Off-ramp left turn LOS D movement between 2035 and 2040

20th Street S & 22nd Avenue Intersection: Intersection Build-Out Year of Need

The 20th Street S & 22nd Avenue intersection existing configuration was analyzed to determine when full built-out may be required. Similar to the ramp terminal intersections, straight-line growth between 2024 and 2050 was assumed. The following summarizes the approximate timeframes for when the intersection transitions from LOS C to LOS D:

- AM peak hour: 2040 (LOS C) – 2045 (LOS D)
- PM peak hour: 2045 (LOS C) – 2050 (LOS D)

Overall, there appears to be capacity within the existing intersection configuration to accommodate several years of traffic growth. Generally, the high volume conflicting movements generating these LOS C to LOS D transitions include eastbound through and left turn movements, southbound left turn and right turn movements, and westbound through and right turn movements.

20th Street S & 22nd Avenue Intersection 95th Percentile Queues

Table 5 summarizes Year 2050 Build condition 95th percentile queues for the 20th Street S & 22nd Avenue intersection obtained from SimTraffic output for use in future intersection design geometrics.

As previously discussed, the westbound queue is expected to reflect a rolling queue extending upstream of the intersection upwards of 725 feet (95th percentile) in the PM peak hour. However, the average queue is measured at 333 feet, which reflects that this queue is well managed for most of the PM peak hour though there may be a short period with the longer condition.

Table 5: 20th Street S & 22nd Avenue 95% Queues (2050 Build Condition, SimTraffic)

Intersection Movement	AM (ft)	PM (ft)
Eastbound Left Turn	**207**	154
Eastbound Through	**307**	153
Eastbound Right Turn	**110**	40
Westbound Left Turn	141	**248**
Westbound Through	318	**725**
Westbound Right Turn	180	**329**
Northbound Left Turn	61	**80**
Northbound Through/Right Turn	**134**	110
Southbound Left Turn	**221**	206
Southbound Through	**258**	231
Southbound Right Turn	36	**174**

Longest queue between the two peak hours noted in **Bold Text**

20th Street S & 34th Avenue Intersection Build-Out Year of Need

An incremental build-out of the intersection was evaluated, first starting with SDDOT unsignalized intersection turn lane warrants[1] for the northbound and southbound left turn volumes. Using straight-line growth between 2024 and 2050 volumes, it was found that turn lanes were warranted in the following timeframes:

- Southbound left turn lane warranted between 2045 and 2050
- Northbound left turn lane warranted by 2030

The northbound left turn lane warrant is highly dependent on development south of 20th Street S and thus the year of need likely correlates with, and is due to, that future development's density and timeline. When a northbound left turn lane is constructed, the north leg should also be widened to include a southbound left turn lane for lane balance through the intersection.

The next step of the incremental build-out analysis analyzed overall intersection LOS. The eastbound left turn movement in the AM peak hour drives the poor LOS shown in **Table 3**. The operational year of need for overall intersection and eastbound approach LOS transitions in the AM peak hour are as follows:

- Overall intersection (AM peak hour): 2045 (LOS C) – 2050 (LOS E)
- Eastbound approach (AM peak hour): 2045 (LOS D) – 2050 (LOS F)

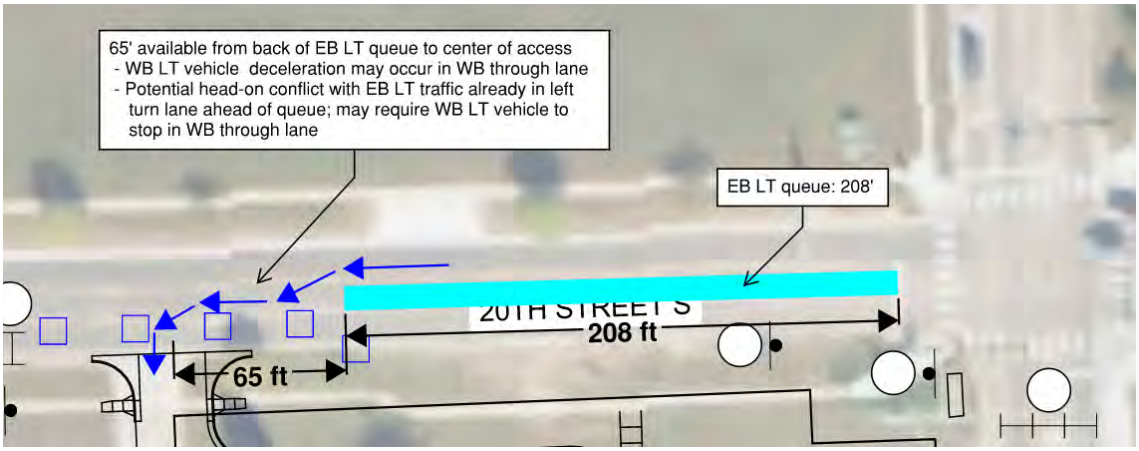
Traffic data was not collected at the 20th Street S & 34th Avenue for a full planning-level traffic signal warrant analysis, but it is anticipated volumes may approach warrant thresholds around the same time as the aforementioned intersection and approach LOS transition timeframes.

[1] SDDOT Road Design Manual, Chapter 15 Traffic, https://dotfiles.sd.gov/rd/rdmch15.pdf

Development Notes

Anecdotal notes associated with development traffic include:

- Right-in right-out access points immediately upstream of a signalized intersection may necessitate U-turn accommodations at that signalized intersection. This may adversely impact overall intersection operations by limiting opportunities for right turn overlap signal phasing and RTOR.
- Over time, traffic will gravitate towards routes and development access points with least delay, shortest travel time, easy turns (right turns in lieu of left turns), etc. Internal connectivity within and between developments is encouraged. Areas of note surrounding the 20th Street S & 22nd Avenue intersection include:
    - **Southeast quadrant:** northbound left turn traffic turning from (out of) the development to westbound 20th Street S may experience lengthy delays waiting for gaps in traffic, particularly during the PM peak hour.
    - **All quadrants:** 20th Street S & 22nd Avenue intersection queues are expected to grow considerably with future development.
        - Several planned developments expect high traffic volumes on adjacent arterial streets, as their proposed uses rely on pass-by type trips for a large portion of their customer traffic.
        - Development full access points should be monitored. When queues on the arterial streets extend through a development full access location and operations and safety are adversely impacted, the development access should be converted to RIRO or closed.
- Access points close to the 20th Street S & 22nd Avenue should be monitored for head-on conflict risk within center left turn lanes. As intersection queues grow, left turn queues may extend back to, or through, upstream access points. This leads to situations where opposing left turn traffic is unable to complete the lane change and then decelerate within the left turn lane without conflict of an opposing left turn vehicle.
    - See **Figure 5** for potential conflict overlap on 20th Street S, west of 22nd Avenue. See **Appendix E** for a sketch of potential turn lane dimensions at this location.



20th Street S & 22nd Avenue intersection, west leg. Site plan sheet modified for this figure.

Figure 5: Example of Potential Left Turn Conflict Overlap

Recommendations

The following recommendations for 20th Street S intersections are based on findings from this analysis. Recommended modifications to the existing intersections are noted in **Bold Orange** in the associated tables and **Figure 4**.

20th Street S & 22nd Avenue Intersection

Recommended lane configuration, intersection traffic control, and planning-level timelines for intersection build-out (recommended lane additions) for the 20th Street S & 22nd Avenue intersection are provided in **Table 6**.

Table 6: Recommended 2050 Build Condition Intersection (20th Street S & 22nd Avenue)

Approach	Lane Configuration	Intersection Control	Traffic Signal Year of Need	Intersection Build-Out Year of Need
EB	LT, T, **RT**	Traffic Signal (existing)	**Approximate year of warrant:** n/a	**Approximate year of LOS D:** 2040-2045 (AM) 2045-2050 (PM)
WB	LT, T, RT			
NB	LT, **T**, T/RT			
SB	LT, T, **T**, RT			

Modifications noted in **Bold Orange**

Where there may be conflict between U-turn and right turn traffic, it is recommended a U Turn Yield to Right Turn sign (MUTCD R10-16) be installed. This recommendation is applicable at other potential U-turn / right turn conflicts within the study area.

I-29 Exit 130 Interchange Ramp Terminal Intersections

Recommended lane configuration, intersection traffic control, and planning-level timelines for intersection build-out (traffic signals) for the southbound and northbound I-29 Exit 130 interchange ramp terminal intersections are provided in **Table 7** and **Table 8**, respectively.

Table 7: Recommended 2050 Build Condition Intersection (I-29 Exit 130 Interchange Southbound Ramp Terminal Intersection)

Approach	Lane Configuration	Intersection Control	Traffic Signal Year of Need	TWSC LOS Year of Need
EB	T, RT	TWSC (existing) **Traffic Signal (when warranted)**	**Approximate year of warrant:** 2045–2050	**Approximate year of off-ramp approach LOS D:** 2045–2050 (AM) 2035–2040 (PM) **Approximate year of NB LT LOS D:** 2040–2045 (AM) 2035–2040 (PM)
WB	LT, T			
NB	LT, RT stop-controlled approach			

Modifications noted in **Bold Orange**

Table 8: Recommended 2050 Build Condition Intersection (I-29 Exit 130 Interchange Northbound Ramp Terminal Intersection)

Approach	Lane Configuration	Intersection Control	Traffic Signal Year of Need	TWSC LOS Year of Need
EB	LT, T	TWSC (existing) **Traffic Signal (when warranted)**	**Approximate year of warrant:** 2040–2045	**Approximate year of off-ramp approach LOS D:** 2035–2040 (AM) 2035–2040 (PM) **Approximate year of NB LT LOS D:** 2030–2035 (AM) 2035–2040 (PM)
WB	T, RT			
NB	LT, T/RT stop-controlled approach			

Modifications noted in **Bold Orange**

20th Street S & 34th Avenue Intersection

Recommended lane configuration, intersection traffic control, and planning-level timelines for intersection build-out (recommended lane additions) for the 20th Street S & 34th Avenue intersection are provided in **Table 9**.

Timelines of needs at this intersection are highly dependent on development along 34th Avenue and paving of 214th Street east of 34th Avenue to Aurora. These conditions are likely more applicable to gauge timeline than the estimated year of need, which was based on straight-line growth assumptions. Therefore, the intersection should be analyzed in conjunction with any large future development along 34th Avenue (to review development-generated turn lane warrants) and/or paving of 214th Street east to Aurora to determine what improvements may be needed upon opening.

While not analyzed, a roundabout should be considered as an option if the intersection is fully reconstructed. Additional analysis should be conducted using updated traffic counts to gauge feasibility at that time.

Table 9: Recommended 2050 Build Condition Intersection (20th Street S & 34th Avenue)

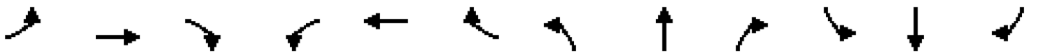
Approach	2050 Build Condition Lane Configuration	Intersection Control	Traffic Signal Year of Need	Intersection Build-Out Year of Need
EB	LT, T/RT	TWSC (existing) *Consider traffic signal or roundabout when intersection control needs to be modified.*	**Approximate year of warrant:** n/a	**Warranted turn lanes:** NB: by 2030 (PM) SB: 2045-2050 (PM) **Approximate year of LOS D:** 2045-2050 (AM)
WB	**LT**, T/RT			
NB	**LT**, T/RT			
SB	**LT**, T, RT			

Modifications noted in **Bold Orange**

Appendix A: Existing and 2050 Build Condition Intersection Operations Reports

HCM 7th Signalized Intersection Summary
3: 22nd Ave & 20th St S

11/21/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	210	15	5	100	110	20	155	20	100	45	60
Future Volume (veh/h)	210	210	15	5	100	110	20	155	20	100	45	60
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	233	233	17	6	111	122	22	172	22	111	50	67
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	595	645	47	444	489	525	341	230	29	299	367	498
Arrive On Green	0.13	0.40	0.40	0.00	0.28	0.28	0.02	0.15	0.15	0.07	0.21	0.21
Sat Flow, veh/h	1674	1619	118	1674	1758	1490	1674	1527	195	1674	1758	1490
Grp Volume(v), veh/h	233	0	250	6	111	122	22	0	194	111	50	67
Grp Sat Flow(s),veh/h/ln	1674	0	1737	1674	1758	1490	1674	0	1723	1674	1758	1490
Q Serve(g_s), s	5.2	0.0	5.8	0.1	2.8	3.3	0.6	0.0	6.2	3.1	1.3	1.8
Cycle Q Clear(g_c), s	5.2	0.0	5.8	0.1	2.8	3.3	0.6	0.0	6.2	3.1	1.3	1.8
Prop In Lane	1.00		0.07	1.00		1.00	1.00		0.11	1.00		1.00
Lane Grp Cap(c), veh/h	595	0	692	444	489	525	341	0	259	299	367	498
V/C Ratio(X)	0.39	0.00	0.36	0.01	0.23	0.23	0.06	0.00	0.75	0.37	0.14	0.13
Avail Cap(c_a), veh/h	734	0	692	581	489	525	460	0	448	378	518	625
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.9	0.0	12.2	14.9	16.1	13.2	20.4	0.0	23.5	18.4	18.6	13.4
Incr Delay (d2), s/veh	0.2	0.0	1.5	0.0	1.1	1.0	0.0	0.0	4.3	0.3	0.2	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	2.9	0.0	3.9	0.1	2.1	2.0	0.4	0.0	4.7	2.0	0.9	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	11.0	0.0	13.7	14.9	17.1	14.2	20.4	0.0	27.8	18.6	18.8	13.5
LnGrp LOS	B		B	B	B	B	C		C	B	B	B
Approach Vol, veh/h		483			239			216			228	
Approach Delay, s/veh		12.4			15.6			27.0			17.2	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	4.8	29.5	5.4	18.1	11.7	22.6	8.8	14.7
Change Period (Y+Rc), s	4.5	6.5	4.5	6.0	4.5	6.5	4.5	6.0
Max Green Setting (Gmax), s	5.0	23.0	5.0	17.0	12.0	16.0	7.0	15.0
Max Q Clear Time (g_c+I1), s	2.1	7.8	2.6	3.8	7.2	5.3	5.1	8.2
Green Ext Time (p_c), s	0.0	1.2	0.0	0.3	0.1	0.7	0.0	0.5

Intersection Summary	
HCM 7th Control Delay, s/veh	16.7
HCM 7th LOS	B

Notes

User approved changes to right turn type.

Intersection	
Int Delay, s/veh	0.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	365	5	5	165	15	25
Future Vol, veh/h	365	5	5	165	15	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	150	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	406	6	6	183	17	28

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	411	0	603	408
Stage 1	-	-	-	-	408	-
Stage 2	-	-	-	-	194	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1142	-	461	641
Stage 1	-	-	-	-	669	-
Stage 2	-	-	-	-	836	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1142	-	458	641
Mov Cap-2 Maneuver	-	-	-	-	541	-
Stage 1	-	-	-	-	669	-
Stage 2	-	-	-	-	832	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.24	11.24
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	541	641	-	-	1142	-
HCM Lane V/C Ratio	0.031	0.043	-	-	0.005	-
HCM Control Delay (s/veh)	11.9	10.9	-	-	8.2	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	220	110	5	150	65	5
Future Vol, veh/h	220	110	5	150	65	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	185	250	-	0	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	244	122	6	167	72	6

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	367	0	422	244
Stage 1	-	-	-	-	244	-
Stage 2	-	-	-	-	178	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1186	-	586	792
Stage 1	-	-	-	-	794	-
Stage 2	-	-	-	-	851	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1186	-	584	792
Mov Cap-2 Maneuver	-	-	-	-	639	-
Stage 1	-	-	-	-	794	-
Stage 2	-	-	-	-	847	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.26	11.22
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	639	792	-	-	1186	-
HCM Lane V/C Ratio	0.113	0.007	-	-	0.005	-
HCM Control Delay (s/veh)	11.3	9.6	-	-	8	-
HCM Lane LOS	B	A	-	-	A	-
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	125	100	0	0	35	10	120	0	5	0	0	0
Future Vol, veh/h	125	100	0	0	35	10	120	0	5	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	185	-	-	-	-	200	0	-	200	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	139	111	0	0	39	11	133	0	6	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	50	0	-	-	-	0	428	439	111
Stage 1	-	-	-	-	-	-	389	389	-
Stage 2	-	-	-	-	-	-	39	50	-
Critical Hdwy	4.13	-	-	-	-	-	6.43	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.53	-
Follow-up Hdwy	2.227	-	-	-	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1550	-	0	0	-	-	582	510	939
Stage 1	-	-	0	0	-	-	683	607	-
Stage 2	-	-	0	0	-	-	981	851	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	1550	-	-	-	-	-	530	0	939
Mov Cap-2 Maneuver	-	-	-	-	-	-	548	0	-
Stage 1	-	-	-	-	-	-	622	0	-
Stage 2	-	-	-	-	-	-	981	0	-

Approach	EB	WB	NB
HCM Control Delay, s/v	4.19	0	13.47
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	548	939	1550	-	-	-
HCM Lane V/C Ratio	0.243	0.006	0.09	-	-	-
HCM Control Delay (s/veh)	13.7	8.9	7.6	-	-	-
HCM Lane LOS	B	A	A	-	-	-
HCM 95th %tile Q(veh)	0.9	0	0.3	-	-	-

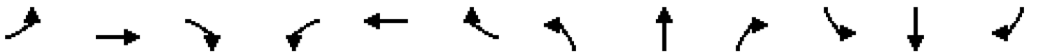
Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	90	5	5	1	5	5	10	35	5	5	10	25
Future Vol, veh/h	90	5	5	1	5	5	10	35	5	5	10	25
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	100	6	6	1	6	6	11	39	6	6	11	28

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	86	89	11	89	114	42	39	0	0	44	0	0
Stage 1	22	22	-	64	64	-	-	-	-	-	-	-
Stage 2	64	67	-	25	50	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	897	799	1067	894	774	1026	1565	-	-	1557	-	-
Stage 1	994	875	-	944	840	-	-	-	-	-	-	-
Stage 2	944	837	-	990	851	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	877	791	1067	874	766	1026	1565	-	-	1557	-	-
Mov Cap-2 Maneuver	877	791	-	874	766	-	-	-	-	-	-	-
Stage 1	990	872	-	938	834	-	-	-	-	-	-	-
Stage 2	926	831	-	975	848	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	9.57	9.15	1.46	0.91
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1565	-	-	877	908	874	877	1557	-	-
HCM Lane V/C Ratio	0.007	-	-	0.114	0.012	0.001	0.013	0.004	-	-
HCM Control Delay (s/veh)	7.3	-	-	9.6	9	9.1	9.2	7.3	-	-
HCM Lane LOS	A	-	-	A	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0	0	0	0	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	120	15	25	215	130	25	100	5	105	165	230
Future Volume (veh/h)	125	120	15	25	215	130	25	100	5	105	165	230
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	139	133	17	28	239	144	28	111	6	117	183	256
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	491	617	79	577	608	632	250	227	12	347	346	408
Arrive On Green	0.08	0.40	0.40	0.02	0.35	0.35	0.02	0.14	0.14	0.08	0.20	0.20
Sat Flow, veh/h	1674	1527	195	1674	1758	1490	1674	1652	89	1674	1758	1490
Grp Volume(v), veh/h	139	0	150	28	239	144	28	0	117	117	183	256
Grp Sat Flow(s),veh/h/ln	1674	0	1723	1674	1758	1490	1674	0	1742	1674	1758	1490
Q Serve(g_s), s	3.0	0.0	3.4	0.6	6.1	3.7	0.9	0.0	3.7	3.4	5.5	9.0
Cycle Q Clear(g_c), s	3.0	0.0	3.4	0.6	6.1	3.7	0.9	0.0	3.7	3.4	5.5	9.0
Prop In Lane	1.00		0.11	1.00		1.00	1.00		0.05	1.00		1.00
Lane Grp Cap(c), veh/h	491	0	696	577	608	632	250	0	239	347	346	408
V/C Ratio(X)	0.28	0.00	0.22	0.05	0.39	0.23	0.11	0.00	0.49	0.34	0.53	0.63
Avail Cap(c_a), veh/h	588	0	696	687	608	632	360	0	440	441	444	490
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	10.7	0.0	11.6	12.2	14.7	10.9	21.6	0.0	23.7	19.0	21.4	18.9
Incr Delay (d2), s/veh	0.1	0.0	0.7	0.0	1.9	0.8	0.1	0.0	1.6	0.2	1.3	1.8
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.7	0.0	2.2	0.4	4.4	2.1	0.6	0.0	2.7	2.2	3.9	5.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	10.8	0.0	12.3	12.2	16.6	11.7	21.6	0.0	25.3	19.2	22.6	20.8
LnGrp LOS	B		B	B	B	B	C		C	B	C	C
Approach Vol, veh/h		289			411			145			556	
Approach Delay, s/veh		11.6			14.6			24.6			21.1	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.6	30.5	5.6	17.7	9.1	27.1	9.2	14.2
Change Period (Y+Rc), s	4.5	6.5	4.5	6.0	4.5	6.5	4.5	6.0
Max Green Setting (Gmax), s	5.0	24.0	5.0	15.0	8.0	20.0	8.0	15.0
Max Q Clear Time (g_c+I1), s	2.6	5.4	2.9	11.0	5.0	8.1	5.4	5.7
Green Ext Time (p_c), s	0.0	0.7	0.0	0.7	0.0	1.4	0.0	0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	17.6
HCM 7th LOS	B

Notes

User approved changes to right turn type.

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	260	15	40	405	10	20
Future Vol, veh/h	260	15	40	405	10	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	150	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	289	17	44	450	11	22

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	306	0	836	297
Stage 1	-	-	-	-	297	-
Stage 2	-	-	-	-	539	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1250	-	336	740
Stage 1	-	-	-	-	751	-
Stage 2	-	-	-	-	583	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1250	-	324	740
Mov Cap-2 Maneuver	-	-	-	-	435	-
Stage 1	-	-	-	-	751	-
Stage 2	-	-	-	-	562	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.72	11.17
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	435	740	-	-	1250	-
HCM Lane V/C Ratio	0.026	0.03	-	-	0.036	-
HCM Control Delay (s/veh)	13.5	10	-	-	8	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	110	120	10	235	135	5
Future Vol, veh/h	110	120	10	235	135	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	185	250	-	0	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	122	133	11	261	150	6

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	256	0	406	122
Stage 1	-	-	-	-	122	-
Stage 2	-	-	-	-	283	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1304	-	599	926
Stage 1	-	-	-	-	901	-
Stage 2	-	-	-	-	762	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1304	-	594	926
Mov Cap-2 Maneuver	-	-	-	-	639	-
Stage 1	-	-	-	-	901	-
Stage 2	-	-	-	-	756	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.32	12.23
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	639	926	-	-	1304	-
HCM Lane V/C Ratio	0.235	0.006	-	-	0.009	-
HCM Control Delay (s/veh)	12.4	8.9	-	-	7.8	-
HCM Lane LOS	B	A	-	-	A	-
HCM 95th %tile Q(veh)	0.9	0	-	-	0	-

Intersection	
Int Delay, s/veh	6.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	75	40	0	0	100	15	145	0	5	0	0	0
Future Vol, veh/h	75	40	0	0	100	15	145	0	5	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	185	-	-	-	-	200	0	-	200	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	83	44	0	0	111	17	161	0	6	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	128	0	-	-	-	0	322	339	44
Stage 1	-	-	-	-	-	-	211	211	-
Stage 2	-	-	-	-	-	-	111	128	-
Critical Hdwy	4.13	-	-	-	-	-	6.43	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.53	-
Follow-up Hdwy	2.227	-	-	-	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1452	-	0	0	-	-	669	581	1023
Stage 1	-	-	0	0	-	-	822	726	-
Stage 2	-	-	0	0	-	-	911	788	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	1452	-	-	-	-	-	631	0	1023
Mov Cap-2 Maneuver	-	-	-	-	-	-	652	0	-
Stage 1	-	-	-	-	-	-	775	0	-
Stage 2	-	-	-	-	-	-	911	0	-

Approach	EB	WB	NB
HCM Control Delay, s/v	4.98	0	12.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	652	1023	1452	-	-	-
HCM Lane V/C Ratio	0.247	0.005	0.057	-	-	-
HCM Control Delay (s/veh)	12.3	8.5	7.6	-	-	-
HCM Lane LOS	B	A	A	-	-	-
HCM 95th %tile Q(veh)	1	0	0.2	-	-	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	10	10	1	5	5	5	10	1	5	40	105
Future Vol, veh/h	25	10	10	1	5	5	5	10	1	5	40	105
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	28	11	11	1	6	6	6	11	1	6	44	117

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	81	79	44	84	195	12	161	0	0	12	0	0
Stage 1	56	56	-	23	23	-	-	-	-	-	-	-
Stage 2	25	23	-	61	172	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	905	809	1023	900	699	1066	1412	-	-	1600	-	-
Stage 1	954	847	-	993	874	-	-	-	-	-	-	-
Stage 2	990	874	-	948	754	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	886	803	1023	872	693	1066	1412	-	-	1600	-	-
Mov Cap-2 Maneuver	886	803	-	872	693	-	-	-	-	-	-	-
Stage 1	951	844	-	989	871	-	-	-	-	-	-	-
Stage 2	975	870	-	922	752	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	9.15	9.32	2.36	0.24
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1412	-	-	886	900	872	840	1600	-	-
HCM Lane V/C Ratio	0.004	-	-	0.031	0.025	0.001	0.013	0.003	-	-
HCM Control Delay (s/veh)	7.6	-	-	9.2	9.1	9.1	9.3	7.3	-	-
HCM Lane LOS	A	-	-	A	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	0	0	-	-

3: 22nd Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	10.2	8.6	20.5	12.9	12.3

7: SB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.4	0.1
Total Del/Veh (s)	1.0	0.9	6.2	1.6

8: NB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.4	0.1
Total Del/Veh (s)	1.7	0.4	6.0	2.9

11: 34th Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.2	0.7	2.8	0.8
Total Del/Veh (s)	4.9	4.3	0.4	0.2	2.9

14: Ace Ave & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.3	0.0	1.6	0.3
Total Del/Veh (s)	1.0	0.2	5.3	1.0

16: Chaparral Dr & 20th St S Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.9	0.5	1.4

19: 22nd Ave & Canasta Ln Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.2
Total Del/Veh (s)	0.6	0.1	0.5

22: 22nd Ave & Starbucks RIRO Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.0	1.6	1.1

23: Starbucks/Circle K Full & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.5	1.5	4.7	1.0

25: Kwik Star Full & 20th St S Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.3	0.1	0.2

29: 22nd Ave & Circle K RIRO Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.1	0.2	0.9

30: 22nd Ave & N Dev. Access Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.0	0.2	0.0
Total Del/Veh (s)	0.1	0.3	0.2

33: East Dev. Access & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	4.2	0.2
Total Del/Veh (s)	0.6	0.5	4.6	0.8

Total Network Performance

Denied Del/Veh (s)	0.4
Total Del/Veh (s)	16.3

3: 22nd Ave & 20th St S Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	11.7	9.3	3.8	9.3	15.1	3.2	17.1	21.9	13.3	18.8	15.4	2.0

3: 22nd Ave & 20th St S Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	12.3

7: SB Ramps & 20th St S Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	3.4	0.1
Total Del/Veh (s)	0.9	1.1	3.2	0.8	6.4	3.2	1.6

8: NB Ramps & 20th St S Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	4.0	0.1
Total Del/Veh (s)	2.5	0.8	0.4	0.2	6.1	2.8	2.9

11: 34th Ave & 20th St S Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0		0.2	0.1	3.2	0.1	0.1	3.7	0.3	3.7
Total Del/Veh (s)	4.9	6.4	1.9		6.9	1.9	0.6	0.5	0.0	0.8	0.4	0.1

11: 34th Ave & 20th St S Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	2.9

14: Ace Ave & 20th St S Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.3	0.5	0.0	0.0	4.3	0.1	0.3
Total Del/Veh (s)	1.0	0.7	3.7	0.1	7.2	4.2	1.0

16: Chaparral Dr & 20th St S Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.9	0.5	1.4

19: 22nd Ave & Canasta Ln Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.2	0.0	0.2
Total Del/Veh (s)	0.6	0.1	0.5

22: 22nd Ave & Starbucks RIRO Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.0	1.6	1.1

23: Starbucks/Circle K Full & 20th St S Performance by movement

Movement	EBT	WBL	WBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.1	0.0
Total Del/Veh (s)	0.5	4.1	1.4	4.7	1.0

25: Kwik Star Full & 20th St S Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.3	0.1	0.2

29: 22nd Ave & Circle K RIRO Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.1	0.2	0.9

30: 22nd Ave & N Dev. Access Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.2	0.0
Total Del/Veh (s)	0.1	0.3	0.2

33: East Dev. Access & 20th St S Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.0	0.0	0.0	4.2	0.2
Total Del/Veh (s)	0.6	0.7	0.5	4.6	0.8

Total Network Performance

Denied Del/Veh (s)	0.4
Total Del/Veh (s)	16.3

Intersection: 3: 22nd Ave & 20th St S

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	T	R
Maximum Queue (ft)	148	136	21	98	70	81	139	112	68	54
Average Queue (ft)	64	55	2	37	31	16	80	46	20	15
95th Queue (ft)	116	111	13	78	58	54	131	88	49	37
Link Distance (ft)		261		1007			134		200	200
Upstream Blk Time (%)						0	1			
Queuing Penalty (veh)						0	2			
Storage Bay Dist (ft)	150		250		275	185		190		
Storage Blk Time (%)	0	0				0	1			
Queuing Penalty (veh)	1	0				0	0			

Intersection: 7: SB Ramps & 20th St S

Movement	EB	WB	NB	NB
Directions Served	R	L	L	R
Maximum Queue (ft)	4	21	66	21
Average Queue (ft)	0	1	26	3
95th Queue (ft)	3	12	51	15
Link Distance (ft)			1036	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185	250		150
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: NB Ramps & 20th St S

Movement	EB	WB	NB	NB
Directions Served	L	R	L	TR
Maximum Queue (ft)	44	2	83	30
Average Queue (ft)	7	0	37	5
95th Queue (ft)	30	2	63	22
Link Distance (ft)			1072	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185	200		200
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 11: 34th Ave & 20th St S

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	L	L
Maximum Queue (ft)	70	23	8	31	8	14
Average Queue (ft)	32	7	0	10	0	0
95th Queue (ft)	56	22	5	32	5	6
Link Distance (ft)		769		1839		
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200		150		200	200
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 14: Ace Ave & 20th St S

Movement	WB	NB	NB
Directions Served	L	L	R
Maximum Queue (ft)	25	35	51
Average Queue (ft)	2	13	18
95th Queue (ft)	14	38	46
Link Distance (ft)			856
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	150	150	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 16: Chaparral Dr & 20th St S

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: 22nd Ave & Canasta Ln

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 22: 22nd Ave & Starbucks RIRO

Movement	NB
Directions Served	T
Maximum Queue (ft)	40
Average Queue (ft)	2
95th Queue (ft)	18
Link Distance (ft)	112
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 23: Starbucks/Circle K Full & 20th St S

Movement	WB	NB
Directions Served	L	TR
Maximum Queue (ft)	21	48
Average Queue (ft)	2	18
95th Queue (ft)	13	45
Link Distance (ft)		239
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	50	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 25: Kwik Star Full & 20th St S

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 29: 22nd Ave & Circle K RIRO

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 30: 22nd Ave & N Dev. Access

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 33: East Dev. Access & 20th St S

Movement	NB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	6
95th Queue (ft)	25
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	75
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 3

3: 22nd Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	9.7	10.5	22.7	12.0	12.2

7: SB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.3	0.1
Total Del/Veh (s)	0.8	1.0	7.2	2.3

8: NB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.4	0.1
Total Del/Veh (s)	1.6	0.5	5.8	2.8

11: 34th Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.2	1.3	2.7	1.9
Total Del/Veh (s)	4.1	4.5	0.5	0.5	1.4

14: Ace Ave & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.2	0.0	1.5	0.1
Total Del/Veh (s)	0.8	0.4	5.5	0.8

16: Chaparral Dr & 20th St S Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.6	0.7	1.1

19: 22nd Ave & Canasta Ln Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.2	0.0	0.1
Total Del/Veh (s)	0.4	0.2	0.3

22: 22nd Ave & Starbucks RIRO Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.7	2.0	1.5

23: Starbucks/Circle K Full & 20th St S Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.3	1.5	1.1

25: Kwik Star Full & 20th St S Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.3	0.3	0.3

29: 22nd Ave & Circle K RIRO Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.1	0.6	0.8

30: 22nd Ave & N Dev. Access Performance by approach

Approach	NB	SB	All
Denied Del/Veh (s)	0.0	0.2	0.1
Total Del/Veh (s)	0.1	0.7	0.4

33: East Dev. Access & 20th St S Performance by approach

Approach	EB	WB	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.3	0.3	0.3

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	16.2

3: 22nd Ave & 20th St S Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	10.9	9.0	4.9	10.3	15.1	3.0	18.9	24.1	13.3	17.6	18.8	4.2

3: 22nd Ave & 20th St S Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	12.2

7: SB Ramps & 20th St S Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	3.6	0.1
Total Del/Veh (s)	0.7	0.9	3.4	0.9	7.4	3.1	2.3

8: NB Ramps & 20th St S Performance by movement

Movement	EBL	EBT	WBT	WBR	NBL	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	4.0	0.1
Total Del/Veh (s)	2.3	0.4	0.5	0.3	6.0	2.6	2.8

11: 34th Ave & 20th St S Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0		0.1	0.1	3.4	0.1	0.1	3.0	0.4	3.5
Total Del/Veh (s)	4.1	6.3	1.7		7.7	1.7	0.8	0.3	0.0	0.7	0.7	0.4

11: 34th Ave & 20th St S Performance by movement

Movement	All
Denied Del/Veh (s)	1.9
Total Del/Veh (s)	1.4

14: Ace Ave & 20th St S Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	4.3	0.1	0.1
Total Del/Veh (s)	0.8	0.6	2.6	0.2	10.3	3.1	0.8

16: Chaparral Dr & 20th St S Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.6	0.7	1.1

19: 22nd Ave & Canasta Ln Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.2	0.0	0.1
Total Del/Veh (s)	0.4	0.2	0.3

22: 22nd Ave & Starbucks RIRO Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.7	2.0	1.5

23: Starbucks/Circle K Full & 20th St S Performance by movement

Movement	EBT	EBR	WBL	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	0.4	0.0	3.6	1.4	1.1

25: Kwik Star Full & 20th St S Performance by movement

Movement	EBT	EBR	WBL	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	0.3	0.1	2.4	0.2	0.3

29: 22nd Ave & Circle K RIRO Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	1.1	0.6	0.8

30: 22nd Ave & N Dev. Access Performance by movement

Movement	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.2	0.1
Total Del/Veh (s)	0.1	0.7	0.4

33: East Dev. Access & 20th St S Performance by movement

Movement	EBT	WBT	All
Denied Del/Veh (s)	0.0	0.0	0.0
Total Del/Veh (s)	0.3	0.3	0.3

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	16.2

Intersection: 3: 22nd Ave & 20th St S

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	TR	L	T	R
Maximum Queue (ft)	103	108	46	157	73	69	130	105	148	90
Average Queue (ft)	41	34	12	71	30	19	61	48	66	43
95th Queue (ft)	79	79	35	128	61	52	107	88	120	77
Link Distance (ft)		261		1007			134		200	200
Upstream Blk Time (%)							0		0	
Queuing Penalty (veh)							0		0	
Storage Bay Dist (ft)	150		250		275	185		190		
Storage Blk Time (%)		0					0		0	
Queuing Penalty (veh)		0					0		0	

Intersection: 7: SB Ramps & 20th St S

Movement	EB	WB	NB	NB
Directions Served	R	L	L	R
Maximum Queue (ft)	6	27	83	22
Average Queue (ft)	0	3	38	4
95th Queue (ft)	5	16	65	16
Link Distance (ft)			1036	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	185	250		150
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8: NB Ramps & 20th St S

Movement	EB	NB	NB
Directions Served	L	L	TR
Maximum Queue (ft)	45	82	30
Average Queue (ft)	8	38	5
95th Queue (ft)	30	64	23
Link Distance (ft)		1072	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	185		200
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 11: 34th Ave & 20th St S

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	L	TR	L	TR	L	L	R
Maximum Queue (ft)	45	28	6	31	16	2	2
Average Queue (ft)	15	10	0	9	1	0	0
95th Queue (ft)	38	27	4	31	7	2	2
Link Distance (ft)		769		1839			
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	200		150		200	200	200
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 14: Ace Ave & 20th St S

Movement	EB	WB	NB	NB
Directions Served	TR	L	L	R
Maximum Queue (ft)	2	35	39	51
Average Queue (ft)	0	8	10	15
95th Queue (ft)	2	31	35	43
Link Distance (ft)	1489			856
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		150	150	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Chaparral Dr & 20th St S

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: 22nd Ave & Canasta Ln

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 22: 22nd Ave & Starbucks RIRO

Movement	NB
Directions Served	T
Maximum Queue (ft)	19
Average Queue (ft)	1
95th Queue (ft)	9
Link Distance (ft)	112
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 23: Starbucks/Circle K Full & 20th St S

Movement	WB
Directions Served	L
Maximum Queue (ft)	26
Average Queue (ft)	4
95th Queue (ft)	19
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	50
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

Intersection: 25: Kwik Star Full & 20th St S

Movement	WB
Directions Served	L
Maximum Queue (ft)	29
Average Queue (ft)	2
95th Queue (ft)	15
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	75
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 29: 22nd Ave & Circle K RIRO

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 30: 22nd Ave & N Dev. Access

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

HCM 7th Signalized Intersection Summary
3: 22nd Ave & 20th St S

11/21/2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	335	520	35	55	315	255	40	220	110	315	105	110
Future Volume (veh/h)	335	520	35	55	315	255	40	220	110	315	105	110
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	372	578	39	61	350	283	44	244	122	350	117	122
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	420	836	766	265	462	624	318	313	151	383	871	621
Arrive On Green	0.16	0.48	0.48	0.35	0.35	0.35	0.04	0.14	0.14	0.16	0.26	0.26
Sat Flow, veh/h	1674	1758	1490	800	1758	1490	1674	2182	1056	1674	3340	1490
Grp Volume(v), veh/h	372	578	39	61	350	283	44	185	181	350	117	122
Grp Sat Flow(s),veh/h/ln	1674	1758	1490	800	1758	1490	1674	1670	1568	1674	1670	1490
Q Serve(g_s), s	12.5	20.6	1.0	4.8	14.1	10.4	1.8	8.5	9.0	12.5	2.1	4.2
Cycle Q Clear(g_c), s	12.5	20.6	1.0	8.4	14.1	10.4	1.8	8.5	9.0	12.5	2.1	4.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.67	1.00		1.00
Lane Grp Cap(c), veh/h	420	836	766	265	462	624	318	239	225	383	871	621
V/C Ratio(X)	0.89	0.69	0.05	0.23	0.76	0.45	0.14	0.77	0.81	0.91	0.13	0.20
Avail Cap(c_a), veh/h	420	836	766	265	462	624	430	282	265	383	871	621
HCM Platoon Ratio	1.00	1.00	1.00	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.8	16.4	9.7	23.3	23.8	14.6	27.5	33.0	33.2	25.1	22.7	14.8
Incr Delay (d2), s/veh	19.7	4.7	0.1	2.0	11.0	2.4	0.2	10.6	14.4	25.7	0.1	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	10.9	13.2	0.6	1.8	10.5	6.0	1.3	7.2	7.5	12.6	1.5	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.5	21.1	9.8	25.3	34.8	16.9	27.7	43.6	47.6	50.9	22.7	15.0
LnGrp LOS	D	C	A	C	C	B	C	D	D	D	C	B
Approach Vol, veh/h		989			694			410			589	
Approach Delay, s/veh		27.2			26.7			43.7			37.8	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	45.0	7.6	27.4	17.0	28.0	17.0	18.0
Change Period (Y+Rc), s	7.0	4.5	6.5	4.5	7.0	4.5	6.5
Max Green Setting (Gmax), s	36.0	8.5	17.5	12.5	19.0	12.5	13.5
Max Q Clear Time (g_c+I1), s	22.6	3.8	6.2	14.5	16.1	14.5	11.0
Green Ext Time (p_c), s	3.2	0.0	0.8	0.0	1.0	0.0	0.5

Intersection Summary	
HCM 7th Control Delay, s/veh	31.9
HCM 7th LOS	C

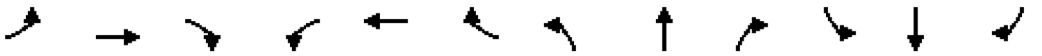
Notes

User approved changes to right turn type.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	715	205	45	470	155	65
Future Volume (veh/h)	715	205	45	470	155	65
Initial Q (Qb), veh	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	794	228	50	522	172	72
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3
Cap, veh/h	1268	1266	485	1268	216	192
Arrive On Green	1.00	1.00	1.00	1.00	0.13	0.13
Sat Flow, veh/h	1758	1490	547	1758	1674	1490
Grp Volume(v), veh/h	794	228	50	522	172	72
Grp Sat Flow(s),veh/h/ln	1758	1490	547	1758	1674	1490
Q Serve(g_s), s	0.0	0.0	0.0	0.0	8.0	3.5
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	8.0	3.5
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1268	1266	485	1268	216	192
V/C Ratio(X)	0.63	0.18	0.10	0.41	0.80	0.38
Avail Cap(c_a), veh/h	1268	1266	485	1268	339	302
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.87	0.87	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	33.8	31.9
Incr Delay (d2), s/veh	2.3	0.3	0.4	0.9	6.9	1.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	1.5	0.2	0.1	0.5	6.4	2.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	2.3	0.3	0.4	0.9	40.8	33.1
LnGrp LOS	A	A	A	A	D	C
Approach Vol, veh/h	1022			572	244	
Approach Delay, s/veh	1.9			0.8	38.5	
Approach LOS	A			A	D	

Timer - Assigned Phs	2			6	8
Phs Duration (G+Y+Rc), s	63.7			63.7	16.3
Change Period (Y+Rc), s	6.0			6.0	6.0
Max Green Setting (Gmax), s	51.8			51.8	16.2
Max Q Clear Time (g_c+I1), s	2.0			2.0	10.0
Green Ext Time (p_c), s	8.0			4.4	0.4

Intersection Summary	
HCM 7th Control Delay, s/veh	6.4
HCM 7th LOS	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	240	540	0	0	280	70	235	0	100	0	0	0
Future Volume (veh/h)	240	540	0	0	280	70	235	0	100	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1758	1758	0	0	1758	1758	1758	1758	1758			
Adj Flow Rate, veh/h	267	600	0	0	311	78	261	0	111			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	673	1166	0	0	1166	988	313	0	278			
Arrive On Green	1.00	1.00	0.00	0.00	0.66	0.66	0.19	0.00	0.19			
Sat Flow, veh/h	987	1758	0	0	1758	1490	1674	0	1490			
Grp Volume(v), veh/h	267	600	0	0	311	78	261	0	111			
Grp Sat Flow(s),veh/h/ln	987	1758	0	0	1758	1490	1674	0	1490			
Q Serve(g_s), s	4.0	0.0	0.0	0.0	5.8	1.5	12.0	0.0	5.2			
Cycle Q Clear(g_c), s	9.8	0.0	0.0	0.0	5.8	1.5	12.0	0.0	5.2			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	673	1166	0	0	1166	988	313	0	278			
V/C Ratio(X)	0.40	0.51	0.00	0.00	0.27	0.08	0.83	0.00	0.40			
Avail Cap(c_a), veh/h	673	1166	0	0	1166	988	481	0	428			
HCM Platoon Ratio	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.74	0.74	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	0.5	0.0	0.0	0.0	5.5	4.8	31.3	0.0	28.6			
Incr Delay (d2), s/veh	1.3	1.2	0.0	0.0	0.6	0.2	7.5	0.0	0.9			
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(95%),veh/ln	0.4	0.7	0.0	0.0	3.3	0.7	8.8	0.0	3.3			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	1.8	1.2	0.0	0.0	6.1	4.9	38.8	0.0	29.5			
LnGrp LOS	A	A			A	A	D		C			
Approach Vol, veh/h		867			389			372				
Approach Delay, s/veh		1.4			5.8			36.0				
Approach LOS		A			A			D				
Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		59.1				59.1		20.9				
Change Period (Y+Rc), s		6.0				6.0		6.0				
Max Green Setting (Gmax), s		45.0				45.0		23.0				
Max Q Clear Time (g_c+I1), s		11.8				7.8		14.0				
Green Ext Time (p_c), s		6.0				2.2		0.9				
Intersection Summary												
HCM 7th Control Delay, s/veh			10.4									
HCM 7th LOS			B									

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	710	50	20	355	35	50
Future Vol, veh/h	710	50	20	355	35	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	150	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	789	56	22	394	39	56

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	844	0	1256	817
Stage 1	-	-	-	-	817	-
Stage 2	-	-	-	-	439	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	788	-	188	375
Stage 1	-	-	-	-	433	-
Stage 2	-	-	-	-	648	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	788	-	183	375
Mov Cap-2 Maneuver	-	-	-	-	313	-
Stage 1	-	-	-	-	433	-
Stage 2	-	-	-	-	630	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.52	17.02
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	313	375	-	-	788	-
HCM Lane V/C Ratio	0.124	0.148	-	-	0.028	-
HCM Control Delay (s/veh)	18.1	16.3	-	-	9.7	-
HCM Lane LOS	C	C	-	-	A	-
HCM 95th %tile Q(veh)	0.4	0.5	-	-	0.1	-

Intersection	
Int Delay, s/veh	44.5

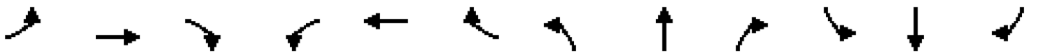
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	250	65	140	55	95	55	130	90	40	40	60	135
Future Vol, veh/h	250	65	140	55	95	55	130	90	40	40	60	135
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	278	72	156	61	106	61	144	100	44	44	67	150

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	597	589	67	603	717	122	217	0	0	144	0	0
Stage 1	156	156	-	411	411	-	-	-	-	-	-	-
Stage 2	442	433	-	192	306	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	413	419	994	410	354	926	1347	-	-	1432	-	-
Stage 1	844	767	-	616	593	-	-	-	-	-	-	-
Stage 2	593	580	-	808	660	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 229	363	994	246	306	926	1347	-	-	1432	-	-
Mov Cap-2 Maneuver	~ 229	363	-	246	306	-	-	-	-	-	-	-
Stage 1	818	743	-	550	529	-	-	-	-	-	-	-
Stage 2	396	518	-	596	640	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	100.62	21.11	4	1.29
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1347	-	-	229	641	246	406	1432	-	-
HCM Lane V/C Ratio	0.107	-	-	1.21	0.356	0.248	0.41	0.031	-	-
HCM Control Delay (s/veh)	8	-	-	171.9	13.7	24.4	19.9	7.6	-	-
HCM Lane LOS	A	-	-	F	B	C	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	13.7	1.6	1	2	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	225	285	55	100	515	360	65	175	50	285	260	365
Future Volume (veh/h)	225	285	55	100	515	360	65	175	50	285	260	365
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	250	317	61	111	572	400	72	194	56	317	289	406
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	333	927	861	454	641	758	252	268	75	363	658	452
Arrive On Green	0.11	0.53	0.53	0.73	0.73	0.73	0.05	0.10	0.10	0.14	0.20	0.20
Sat Flow, veh/h	1674	1758	1490	997	1758	1490	1674	2574	723	1674	3340	1490
Grp Volume(v), veh/h	250	317	61	111	572	400	72	124	126	317	289	406
Grp Sat Flow(s),veh/h/ln	1674	1758	1490	997	1758	1490	1674	1670	1628	1674	1670	1490
Q Serve(g_s), s	7.1	8.3	1.4	3.1	20.2	9.7	3.0	5.7	6.0	11.5	6.1	15.8
Cycle Q Clear(g_c), s	7.1	8.3	1.4	3.1	20.2	9.7	3.0	5.7	6.0	11.5	6.1	15.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.44	1.00		1.00
Lane Grp Cap(c), veh/h	333	927	861	454	641	758	252	174	169	363	658	452
V/C Ratio(X)	0.75	0.34	0.07	0.24	0.89	0.53	0.29	0.71	0.74	0.87	0.44	0.90
Avail Cap(c_a), veh/h	333	927	861	454	641	758	345	219	214	363	658	452
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.9	10.9	7.4	7.3	9.6	5.1	29.9	34.7	34.8	27.7	28.2	26.7
Incr Delay (d2), s/veh	9.2	1.0	0.2	1.3	17.1	2.6	0.6	7.8	10.2	20.2	0.5	20.5
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	5.8	5.6	0.8	1.3	10.2	3.7	2.2	4.7	5.0	11.5	4.3	14.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	26.1	11.9	7.6	8.6	26.7	7.8	30.5	42.5	45.0	47.9	28.7	47.1
LnGrp LOS	C	B	A	A	C	A	C	D	D	D	C	D
Approach Vol, veh/h		628			1083			322			1012	
Approach Delay, s/veh		17.1			17.9			40.8			42.1	
Approach LOS		B			B			D			D	

Timer - Assigned Phs	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	49.2	8.6	22.3	13.0	36.2	16.0	14.8
Change Period (Y+Rc), s	7.0	4.5	6.5	4.5	7.0	4.5	6.5
Max Green Setting (Gmax), s	40.0	8.5	13.5	8.5	27.0	11.5	10.5
Max Q Clear Time (g_c+I1), s	10.3	5.0	17.8	9.1	22.2	13.5	8.0
Green Ext Time (p_c), s	2.1	0.0	0.0	0.0	2.5	0.0	0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	28.2
HCM 7th LOS	C

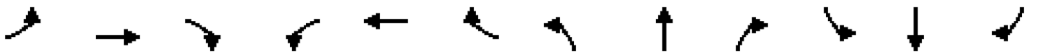
Notes

User approved changes to right turn type.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	380	240	60	705	245	40
Future Volume (veh/h)	380	240	60	705	245	40
Initial Q (Qb), veh	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	422	267	67	783	272	44
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3
Cap, veh/h	1163	1266	585	1163	315	280
Arrive On Green	1.00	1.00	0.88	0.88	0.19	0.19
Sat Flow, veh/h	1758	1490	748	1758	1674	1490
Grp Volume(v), veh/h	422	267	67	783	272	44
Grp Sat Flow(s),veh/h/ln	1758	1490	748	1758	1674	1490
Q Serve(g_s), s	0.0	0.0	1.0	10.5	12.6	2.0
Cycle Q Clear(g_c), s	0.0	0.0	1.0	10.5	12.6	2.0
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1163	1266	585	1163	315	280
V/C Ratio(X)	0.36	0.21	0.11	0.67	0.86	0.16
Avail Cap(c_a), veh/h	1163	1266	585	1163	419	372
HCM Platoon Ratio	2.00	2.00	1.33	1.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.76	0.76	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	1.7	2.3	31.5	27.2
Incr Delay (d2), s/veh	0.9	0.4	0.3	2.4	13.3	0.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	0.5	0.2	0.3	4.0	10.1	1.3
Unsig. Movement Delay, s/veh						
LnGrp Delay(d), s/veh	0.9	0.4	2.0	4.6	44.8	27.4
LnGrp LOS	A	A	A	A	D	C
Approach Vol, veh/h	689			850	316	
Approach Delay, s/veh	0.7			4.4	42.4	
Approach LOS	A			A	D	

Timer - Assigned Phs	2			6	8
Phs Duration (G+Y+Rc), s	58.9			58.9	21.1
Change Period (Y+Rc), s	6.0			6.0	6.0
Max Green Setting (Gmax), s	48.0			48.0	20.0
Max Q Clear Time (g_c+I1), s	2.0			12.5	14.6
Green Ext Time (p_c), s	3.8			7.2	0.5

Intersection Summary	
HCM 7th Control Delay, s/veh	9.5
HCM 7th LOS	A



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	235	0	0	495	95	270	0	50	0	0	0
Future Volume (veh/h)	185	235	0	0	495	95	270	0	50	0	0	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0			
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Work Zone On Approach		No			No			No				
Adj Sat Flow, veh/h/ln	1758	1758	0	0	1758	1758	1758	1758	1758			
Adj Flow Rate, veh/h	206	261	0	0	550	106	300	0	56			
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90			
Percent Heavy Veh, %	3	3	0	0	3	3	3	3	3			
Cap, veh/h	461	1132	0	0	1132	959	345	0	307			
Arrive On Green	0.86	0.86	0.00	0.00	0.64	0.64	0.21	0.00	0.21			
Sat Flow, veh/h	771	1758	0	0	1758	1490	1674	0	1490			
Grp Volume(v), veh/h	206	261	0	0	550	106	300	0	56			
Grp Sat Flow(s),veh/h/ln	771	1758	0	0	1758	1490	1674	0	1490			
Q Serve(g_s), s	11.9	2.1	0.0	0.0	13.0	2.2	13.9	0.0	2.5			
Cycle Q Clear(g_c), s	24.9	2.1	0.0	0.0	13.0	2.2	13.9	0.0	2.5			
Prop In Lane	1.00		0.00	0.00		1.00	1.00		1.00			
Lane Grp Cap(c), veh/h	461	1132	0	0	1132	959	345	0	307			
V/C Ratio(X)	0.45	0.23	0.00	0.00	0.49	0.11	0.87	0.00	0.18			
Avail Cap(c_a), veh/h	461	1132	0	0	1132	959	460	0	410			
HCM Platoon Ratio	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Upstream Filter(I)	0.94	0.94	0.00	0.00	1.00	1.00	1.00	0.00	1.00			
Uniform Delay (d), s/veh	7.5	2.2	0.0	0.0	7.4	5.5	30.7	0.0	26.2			
Incr Delay (d2), s/veh	2.9	0.4	0.0	0.0	1.5	0.2	12.9	0.0	0.3			
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
%ile BackOfQ(95%),veh/ln	2.9	1.2	0.0	0.0	7.7	1.1	10.5	0.0	1.5			
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	10.4	2.6	0.0	0.0	8.9	5.7	43.6	0.0	26.5			
LnGrp LOS	B	A			A	A	D		C			
Approach Vol, veh/h		467			656			356				
Approach Delay, s/veh		6.1			8.4			40.9				
Approach LOS		A			A			D				

Timer - Assigned Phs		2				6		8				
Phs Duration (G+Y+Rc), s		57.5				57.5		22.5				
Change Period (Y+Rc), s		6.0				6.0		6.0				
Max Green Setting (Gmax), s		46.0				46.0		22.0				
Max Q Clear Time (g_c+I1), s		26.9				15.0		15.9				
Green Ext Time (p_c), s		2.8				4.2		0.6				

Intersection Summary												
HCM 7th Control Delay, s/veh			15.5									
HCM 7th LOS			B									

Intersection	
Int Delay, s/veh	1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	490	45	65	780	35	45
Future Vol, veh/h	490	45	65	780	35	45
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	150	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	544	50	72	867	39	50

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	594	0	1581	569
Stage 1	-	-	-	-	569	-
Stage 2	-	-	-	-	1011	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	977	-	119	519
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	350	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	977	-	110	519
Mov Cap-2 Maneuver	-	-	-	-	233	-
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	324	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.69	17.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	233	519	-	-	977	-
HCM Lane V/C Ratio	0.167	0.096	-	-	0.074	-
HCM Control Delay (s/veh)	23.5	12.7	-	-	9	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.6	0.3	-	-	0.2	-

Intersection	
Int Delay, s/veh	13.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	125	95	105	35	60	35	165	50	45	50	90	255
Future Vol, veh/h	125	95	105	35	60	35	165	50	45	50	90	255
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	139	106	117	39	67	39	183	56	50	56	100	283

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	667	683	100	711	942	81	383	0	0	106	0	0
Stage 1	211	211	-	447	447	-	-	-	-	-	-	-
Stage 2	456	472	-	264	494	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	371	370	953	347	262	977	1170	-	-	1479	-	-
Stage 1	789	726	-	589	572	-	-	-	-	-	-	-
Stage 2	583	557	-	739	545	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	211	300	953	171	213	977	1170	-	-	1479	-	-
Mov Cap-2 Maneuver	211	300	-	171	213	-	-	-	-	-	-	-
Stage 1	759	698	-	496	482	-	-	-	-	-	-	-
Stage 2	406	470	-	530	524	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	31.11	25.79	5.49	0.95
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1170	-	-	211	469	171	299	1479	-	-
HCM Lane V/C Ratio	0.157	-	-	0.658	0.474	0.227	0.353	0.038	-	-
HCM Control Delay (s/veh)	8.6	-	-	49.9	19.4	32	23.5	7.5	-	-
HCM Lane LOS	A	-	-	E	C	D	C	A	-	-
HCM 95th %tile Q(veh)	0.6	-	-	4	2.5	0.8	1.5	0.1	-	-

3: 22nd Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.2	0.0
Total Del/Veh (s)	24.0	29.8	30.9	32.8	28.5

7: SB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	1.3	0.2
Total Del/Veh (s)	6.9	5.3	25.5	8.9

8: NB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	1.5	0.3
Total Del/Veh (s)	9.5	6.1	28.3	13.1

11: 34th Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.8	1.7	2.7	1.1
Total Del/Veh (s)	14.7	12.0	2.5	1.2	8.8

14: Ace Ave & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.7	0.0	1.8	0.6
Total Del/Veh (s)	2.9	0.8	14.3	3.1

16: Chaparral Dr & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	2.4	0.1
Total Del/Veh (s)	4.4	2.8	50.6	6.2

19: 22nd Ave & Canasta Ln Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.9	0.8	0.4	0.0	0.4
Total Del/Veh (s)	5.5	4.6	1.4	0.5	1.5

22: 22nd Ave & Starbucks RIRO Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	2.5	1.3	1.5	1.4

23: Starbucks/Circle K Full & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	24.0	233.7	18.5
Total Del/Veh (s)	5.3	3.9	122.1	195.5	24.7

25: Kwik Star Full & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.1	0.0	7.9	0.9
Total Del/Veh (s)	2.8	3.6	29.0	5.8

29: 22nd Ave & Circle K RIRO Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	21.9	1.3	3.0	2.5

30: 22nd Ave & N Dev. Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.0	4.2	0.0	0.2	0.2
Total Del/Veh (s)	8.4	18.2	0.5	1.0	1.1

33: East Dev. Access & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.3	1.5	0.2
Total Del/Veh (s)	5.0	2.6	12.3	9.5	5.0

Total Network Performance

Denied Del/Veh (s)	8.6
Total Del/Veh (s)	48.1

Intersection: 3: 22nd Ave & 20th St S

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	T
Maximum Queue (ft)	175	274	186	223	413	263	89	130	131	200	248	47
Average Queue (ft)	150	201	22	54	182	72	23	75	87	152	112	11
95th Queue (ft)	207	307	110	141	318	180	61	122	134	221	258	36
Link Distance (ft)		250			1006			122	122		201	201
Upstream Blk Time (%)		6					0	1	3	6	9	
Queuing Penalty (veh)		55					0	2	6	0	23	
Storage Bay Dist (ft)	150		200	250		275	185			190		
Storage Blk Time (%)	11	14	0		4	0	0	1		10	9	
Queuing Penalty (veh)	60	51	0		14	0	0	1		5	28	

Intersection: 3: 22nd Ave & 20th St S

Movement	SB
Directions Served	R
Maximum Queue (ft)	83
Average Queue (ft)	27
95th Queue (ft)	61
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	195
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: SB Ramps & 20th St S

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	R	L	T	L	R
Maximum Queue (ft)	231	130	68	133	170	113
Average Queue (ft)	103	20	27	46	87	28
95th Queue (ft)	191	78	60	105	148	71
Link Distance (ft)	872			848	1036	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		185	250			150
Storage Blk Time (%)	1	0			1	0
Queuing Penalty (veh)	1	0			0	0

Intersection: 8: NB Ramps & 20th St S

Movement	EB	EB	WB	WB	NB	NB
Directions Served	L	T	T	R	L	TR
Maximum Queue (ft)	153	171	154	60	240	139
Average Queue (ft)	64	61	62	19	130	45
95th Queue (ft)	117	128	123	47	208	96
Link Distance (ft)		848	1461		1072	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	185			200		200
Storage Blk Time (%)	0	0	0		2	0
Queuing Penalty (veh)	1	0	0		2	0

Intersection: 11: 34th Ave & 20th St S

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	R
Maximum Queue (ft)	168	160	83	113	62	7	38	25
Average Queue (ft)	83	48	32	51	21	0	6	4
95th Queue (ft)	151	116	62	88	53	5	26	19
Link Distance (ft)		769		1839		1513		
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		150		200		200	200
Storage Blk Time (%)	1			0				
Queuing Penalty (veh)	1			0				

Intersection: 14: Ace Ave & 20th St S

Movement	EB	WB	NB	NB
Directions Served	TR	L	L	R
Maximum Queue (ft)	31	47	60	74
Average Queue (ft)	1	12	26	31
95th Queue (ft)	16	40	55	58
Link Distance (ft)	1489			856
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		150	150	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Chaparral Dr & 20th St S

Movement	EB	WB	NB	NB
Directions Served	TR	L	L	R
Maximum Queue (ft)	25	79	122	68
Average Queue (ft)	2	30	50	26
95th Queue (ft)	13	65	111	58
Link Distance (ft)	1006			371
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		200	150	
Storage Blk Time (%)			2	
Queuing Penalty (veh)			1	

Intersection: 19: 22nd Ave & Canasta Ln

Movement	EB	EB	WB	WB	NB	NB	SB
Directions Served	L	TR	L	TR	L	TR	L
Maximum Queue (ft)	31	26	26	44	29	2	42
Average Queue (ft)	10	8	4	14	2	0	6
95th Queue (ft)	30	25	18	39	15	2	26
Link Distance (ft)		370		505		1681	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150		150		150		75
Storage Blk Time (%)							0
Queuing Penalty (veh)							0

Intersection: 22: 22nd Ave & Starbucks RIRO

Movement	EB	NB	NB	SB	SB
Directions Served	R	T	T	T	TR
Maximum Queue (ft)	32	32	63	12	9
Average Queue (ft)	10	2	5	0	0
95th Queue (ft)	33	19	32	12	9
Link Distance (ft)	112	112	112	122	122
Upstream Blk Time (%)		0	0	0	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 23: Starbucks/Circle K Full & 20th St S

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	79	240	36	26	104	210	125	261
Average Queue (ft)	18	58	10	1	19	79	97	142
95th Queue (ft)	54	194	34	11	72	210	154	321
Link Distance (ft)		242		250		239		233
Upstream Blk Time (%)		1				11		42
Queuing Penalty (veh)		8				0		0
Storage Bay Dist (ft)	75		50		100		100	
Storage Blk Time (%)	0	6	0	0		21	59	1
Queuing Penalty (veh)	1	3	1	0		3	21	1

Intersection: 25: Kwik Star Full & 20th St S

Movement	EB	WB	WB	NB	NB
Directions Served	TR	L	T	L	R
Maximum Queue (ft)	159	89	63	98	150
Average Queue (ft)	16	37	3	32	58
95th Queue (ft)	90	72	32	82	128
Link Distance (ft)	241		242		178
Upstream Blk Time (%)	0				4
Queuing Penalty (veh)	1				0
Storage Bay Dist (ft)		75		100	
Storage Blk Time (%)		1		1	6
Queuing Penalty (veh)		5		1	2

Intersection: 29: 22nd Ave & Circle K RIRO

Movement	EB	SB
Directions Served	R	T
Maximum Queue (ft)	75	174
Average Queue (ft)	26	25
95th Queue (ft)	64	115
Link Distance (ft)	183	467
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 30: 22nd Ave & N Dev. Access

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	L	TR	T	TR
Maximum Queue (ft)	49	56	56	39	2	6	25
Average Queue (ft)	15	16	16	8	0	0	1
95th Queue (ft)	42	44	46	31	2	6	23
Link Distance (ft)		408			467	1684	1684
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150		150	150			
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 33: East Dev. Access & 20th St S

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	56	22	60	7	62	55	54	62
Average Queue (ft)	21	2	21	0	26	23	19	28
95th Queue (ft)	50	11	52	5	55	52	47	54
Link Distance (ft)		1461		769		290		302
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		150		75		75	
Storage Blk Time (%)					0	0	0	0
Queuing Penalty (veh)					0	0	0	0

Network Summary

Network wide Queuing Penalty: 297

3: 22nd Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	16.7	35.3	31.4	26.0	27.9

7: SB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.8	0.1
Total Del/Veh (s)	6.4	9.1	27.5	11.3

8: NB Ramps & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	0.9	0.2
Total Del/Veh (s)	11.9	7.9	33.0	15.1

11: 34th Ave & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.6	2.1	2.7	1.5
Total Del/Veh (s)	12.0	13.0	3.4	1.9	6.6

14: Ace Ave & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.5	0.0	2.0	0.3
Total Del/Veh (s)	1.9	0.8	14.1	2.0

16: Chaparral Dr & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	1.8	0.2
Total Del/Veh (s)	3.4	4.5	92.5	14.0

19: 22nd Ave & Canasta Ln Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.1	1.0	0.4	0.0	0.4
Total Del/Veh (s)	6.7	5.5	1.2	0.6	1.7

22: 22nd Ave & Starbucks RIRO Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	4.2	0.9	2.0	1.6

23: Starbucks/Circle K Full & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.0	3.5	0.3
Total Del/Veh (s)	1.7	3.4	30.8	51.9	6.6

25: Kwik Star Full & 20th St S Performance by approach

Approach	EB	WB	NB	All
Denied Del/Veh (s)	0.0	0.0	1.5	0.1
Total Del/Veh (s)	1.1	1.7	15.0	2.5

29: 22nd Ave & Circle K RIRO Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0
Total Del/Veh (s)	10.9	1.1	2.2	2.0

30: 22nd Ave & N Dev. Access Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	1.9	4.0	0.0	0.3	0.3
Total Del/Veh (s)	15.2	30.8	0.8	1.6	2.8

33: East Dev. Access & 20th St S Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.0	2.4	1.6	0.5
Total Del/Veh (s)	2.3	1.6	8.7	8.8	3.5

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	42.7

Intersection: 3: 22nd Ave & 20th St S

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	TR	L	T	T
Maximum Queue (ft)	165	205	57	275	749	300	102	126	121	199	232	181
Average Queue (ft)	94	78	11	98	333	144	39	58	61	136	139	25
95th Queue (ft)	154	153	40	248	725	329	80	104	110	206	231	97
Link Distance (ft)		250			1007			122	122		201	201
Upstream Blk Time (%)		0			0		0	1	1	1	4	0
Queuing Penalty (veh)		1			4		0	1	1	0	19	1
Storage Bay Dist (ft)	150		200	250		275	185			190		
Storage Blk Time (%)	3	0		0	15	0	0	1		3	5	0
Queuing Penalty (veh)	9	1		0	71	1	0	0		3	13	1

Intersection: 3: 22nd Ave & 20th St S

Movement	SB
Directions Served	R
Maximum Queue (ft)	184
Average Queue (ft)	108
95th Queue (ft)	174
Link Distance (ft)	
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	195
Storage Blk Time (%)	0
Queuing Penalty (veh)	0

Intersection: 7: SB Ramps & 20th St S

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	R	L	T	L	R
Maximum Queue (ft)	177	99	96	250	247	137
Average Queue (ft)	85	24	31	117	126	23
95th Queue (ft)	150	69	73	212	206	80
Link Distance (ft)	871			848	1036	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		185	250			150
Storage Blk Time (%)	0	0		0	5	0
Queuing Penalty (veh)	0	0		0	2	0

Intersection: 8: NB Ramps & 20th St S

Movement	EB	EB	WB	WB	NB	NB
Directions Served	L	T	T	R	L	TR
Maximum Queue (ft)	161	84	208	92	293	141
Average Queue (ft)	71	25	100	23	148	29
95th Queue (ft)	130	66	181	63	247	89
Link Distance (ft)		848	1461		1072	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	185			200		200
Storage Blk Time (%)	0		0		3	0
Queuing Penalty (veh)	0		0		2	0

Intersection: 11: 34th Ave & 20th St S

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	R
Maximum Queue (ft)	114	106	61	92	79	9	36	44
Average Queue (ft)	47	46	24	43	35	0	6	10
95th Queue (ft)	89	83	53	77	69	5	25	33
Link Distance (ft)		769		1839		1513		
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	200		150		200		200	200
Storage Blk Time (%)				0				
Queuing Penalty (veh)				0				

Intersection: 14: Ace Ave & 20th St S

Movement	EB	WB	NB	NB
Directions Served	TR	L	L	R
Maximum Queue (ft)	16	55	71	60
Average Queue (ft)	1	21	28	27
95th Queue (ft)	7	51	59	53
Link Distance (ft)	1489			856
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		150	150	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 16: Chaparral Dr & 20th St S

Movement	EB	WB	WB	NB	NB
Directions Served	TR	L	T	L	R
Maximum Queue (ft)	26	96	117	294	212
Average Queue (ft)	2	31	15	152	59
95th Queue (ft)	15	68	133	327	200
Link Distance (ft)	1007		871	370	370
Upstream Blk Time (%)				4	3
Queuing Penalty (veh)				0	0
Storage Bay Dist (ft)		200			
Storage Blk Time (%)			1		
Queuing Penalty (veh)			1		

Intersection: 19: 22nd Ave & Canasta Ln

Movement	EB	EB	WB	WB	NB	NB	SB
Directions Served	L	TR	L	TR	L	TR	L
Maximum Queue (ft)	47	52	34	62	35	6	44
Average Queue (ft)	17	15	10	27	5	0	8
95th Queue (ft)	39	38	32	51	23	5	31
Link Distance (ft)		370		505		1681	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150		150		150		75
Storage Blk Time (%)							0
Queuing Penalty (veh)							0

Intersection: 22: 22nd Ave & Starbucks RIRO

Movement	EB	NB	NB
Directions Served	R	T	T
Maximum Queue (ft)	39	26	32
Average Queue (ft)	11	1	1
95th Queue (ft)	36	16	17
Link Distance (ft)	112	112	112
Upstream Blk Time (%)		0	0
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 23: Starbucks/Circle K Full & 20th St S

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	58	30	36	38	68	68	105	126
Average Queue (ft)	17	1	7	3	18	20	50	39
95th Queue (ft)	46	16	29	20	51	51	102	110
Link Distance (ft)		242		250		239		233
Upstream Blk Time (%)								2
Queuing Penalty (veh)								0
Storage Bay Dist (ft)	75		50		100		100	
Storage Blk Time (%)	0	0	0	0	0	0	7	0
Queuing Penalty (veh)	1	0	1	0	0	0	4	0

Intersection: 25: Kwik Star Full & 20th St S

Movement	EB	WB	NB	NB
Directions Served	TR	L	L	R
Maximum Queue (ft)	19	59	86	79
Average Queue (ft)	1	23	32	34
95th Queue (ft)	9	51	70	61
Link Distance (ft)	241			178
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		75	100	
Storage Blk Time (%)		0	1	0
Queuing Penalty (veh)		1	1	0

Intersection: 29: 22nd Ave & Circle K RIRO

Movement	EB	SB	SB
Directions Served	R	T	TR
Maximum Queue (ft)	76	146	48
Average Queue (ft)	33	19	3
95th Queue (ft)	63	97	32
Link Distance (ft)	183	467	467
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 30: 22nd Ave & N Dev. Access

Movement	EB	EB	WB	NB	SB	SB
Directions Served	L	TR	L	L	T	TR
Maximum Queue (ft)	87	80	77	64	5	23
Average Queue (ft)	38	36	25	26	0	1
95th Queue (ft)	71	65	61	56	3	12
Link Distance (ft)		408			1684	1684
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150		150	150		
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 33: East Dev. Access & 20th St S

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	L	TR	L	TR	L	TR
Maximum Queue (ft)	42	30	2	71	72	66	77
Average Queue (ft)	10	3	0	34	30	27	36
95th Queue (ft)	35	17	2	62	57	56	62
Link Distance (ft)			769		290		302
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150	150		75		75	
Storage Blk Time (%)				1	0	0	0
Queuing Penalty (veh)				0	0	0	0

Network Summary

Network wide Queuing Penalty: 140

Intersection: 33: East Dev. Access & 20th St S

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0

Appendix B: I-29 Ramp Terminal Intersection Year of Need Analysis Reports

Intersection	
Int Delay, s/veh	10.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	196	371	0	0	186	47	191	0	63	0	0	0
Future Vol, veh/h	196	371	0	0	186	47	191	0	63	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	185	-	-	-	-	200	0	-	200	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	218	412	0	0	207	52	212	0	70	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	259	0	-	-	-	0	1054	1107	412
Stage 1	-	-	-	-	-	-	848	848	-
Stage 2	-	-	-	-	-	-	207	259	-
Critical Hdwy	4.13	-	-	-	-	-	6.43	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.53	-
Follow-up Hdwy	2.227	-	-	-	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1300	-	0	0	-	-	249	209	638
Stage 1	-	-	0	0	-	-	418	376	-
Stage 2	-	-	0	0	-	-	826	692	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	1300	-	-	-	-	-	~ 207	0	638
Mov Cap-2 Maneuver	-	-	-	-	-	-	284	0	-
Stage 1	-	-	-	-	-	-	348	0	-
Stage 2	-	-	-	-	-	-	826	0	-

Approach	EB	WB	NB
HCM Control Delay, s/v	2.88	0	38.34
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	284	638	1300	-	-	-
HCM Lane V/C Ratio	0.746	0.11	0.168	-	-	-
HCM Control Delay (s/veh)	47.2	11.3	8.3	-	-	-
HCM Lane LOS	E	B	A	-	-	-
HCM 95th %tile Q(veh)	5.5	0.4	0.6	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	174	286	0	0	139	35	169	0	45	0	0	0
Future Vol, veh/h	174	286	0	0	139	35	169	0	45	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	185	-	-	-	-	200	0	-	200	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	193	318	0	0	154	39	188	0	50	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	193	0	-	-	-	0	859	898	318
Stage 1	-	-	-	-	-	-	704	704	-
Stage 2	-	-	-	-	-	-	154	193	-
Critical Hdwy	4.13	-	-	-	-	-	6.43	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.53	-
Follow-up Hdwy	2.227	-	-	-	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1374	-	0	0	-	-	326	278	720
Stage 1	-	-	0	0	-	-	488	438	-
Stage 2	-	-	0	0	-	-	871	739	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	1374	-	-	-	-	-	280	0	720
Mov Cap-2 Maneuver	-	-	-	-	-	-	350	0	-
Stage 1	-	-	-	-	-	-	420	0	-
Stage 2	-	-	-	-	-	-	871	0	-

Approach	EB	WB	NB
HCM Control Delay, s/v	3.04	0	23.19
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	350	720	1374	-	-	-
HCM Lane V/C Ratio	0.537	0.069	0.141	-	-	-
HCM Control Delay (s/veh)	26.6	10.4	8	-	-	-
HCM Lane LOS	D	B	A	-	-	-
HCM 95th %tile Q(veh)	3	0.2	0.5	-	-	-

Year of Need (NB LT LOS D)
Existing configuration; 2035 traffic volumes

Intersection	
Int Delay, s/veh	4.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	715	205	45	470	155	65
Future Vol, veh/h	715	205	45	470	155	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	185	250	-	0	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	794	228	50	522	172	72

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1022	0	1417	794
Stage 1	-	-	-	-	794	-
Stage 2	-	-	-	-	622	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	675	-	~ 150	386
Stage 1	-	-	-	-	443	-
Stage 2	-	-	-	-	533	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	675	-	~ 139	386
Mov Cap-2 Maneuver	-	-	-	-	276	-
Stage 1	-	-	-	-	443	-
Stage 2	-	-	-	-	494	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.94	31.17
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	276	386	-	-	675	-
HCM Lane V/C Ratio	0.623	0.187	-	-	0.074	-
HCM Control Delay (s/veh)	37.3	16.5	-	-	10.8	-
HCM Lane LOS	E	C	-	-	B	-
HCM 95th %tile Q(veh)	3.8	0.7	-	-	0.2	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	3.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	620	187	37	408	138	53
Future Vol, veh/h	620	187	37	408	138	53
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	185	250	-	0	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	689	208	41	453	153	59

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	897	0	1224	689
Stage 1	-	-	-	-	689	-
Stage 2	-	-	-	-	536	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	753	-	197	444
Stage 1	-	-	-	-	497	-
Stage 2	-	-	-	-	585	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	753	-	186	444
Mov Cap-2 Maneuver	-	-	-	-	323	-
Stage 1	-	-	-	-	497	-
Stage 2	-	-	-	-	553	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.84	22.61
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	323	444	-	-	753	-
HCM Lane V/C Ratio	0.474	0.133	-	-	0.055	-
HCM Control Delay (s/veh)	25.8	14.3	-	-	10.1	-
HCM Lane LOS	D	B	-	-	B	-
HCM 95th %tile Q(veh)	2.4	0.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	9.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	143	160	0	0	343	64	222	0	33	0	0	0
Future Vol, veh/h	143	160	0	0	343	64	222	0	33	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	185	-	-	-	-	200	0	-	200	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	159	178	0	0	381	71	247	0	37	0	0	0

Major/Minor	Major1			Major2			Minor1		
Conflicting Flow All	452	0	-	-	-	0	877	948	178
Stage 1	-	-	-	-	-	-	496	496	-
Stage 2	-	-	-	-	-	-	381	452	-
Critical Hdwy	4.13	-	-	-	-	-	6.43	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	5.43	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	5.43	5.53	-
Follow-up Hdwy	2.227	-	-	-	-	-	3.527	4.027	3.327
Pot Cap-1 Maneuver	1103	-	0	0	-	-	318	260	863
Stage 1	-	-	0	0	-	-	610	544	-
Stage 2	-	-	0	0	-	-	688	569	-
Platoon blocked, %		-			-	-			
Mov Cap-1 Maneuver	1103	-	-	-	-	-	272	0	863
Mov Cap-2 Maneuver	-	-	-	-	-	-	364	0	-
Stage 1	-	-	-	-	-	-	522	0	-
Stage 2	-	-	-	-	-	-	688	0	-

Approach	EB	WB	NB
HCM Control Delay, s/v	4.16	0	30.21
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	WBT	WBR
Capacity (veh/h)	364	863	1103	-	-	-
HCM Lane V/C Ratio	0.677	0.043	0.144	-	-	-
HCM Control Delay (s/veh)	33.3	9.4	8.8	-	-	-
HCM Lane LOS	D	A	A	-	-	-
HCM 95th %tile Q(veh)	4.8	0.1	0.5	-	-	-

Year of Need (approach LOS D)
Year of Need (NB LT LOS D)
Existing configuration; 2040 traffic volumes

Intersection	
Int Delay, s/veh	4.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	276	194	41	524	203	27
Future Vol, veh/h	276	194	41	524	203	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	185	250	-	0	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	307	216	46	582	226	30

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	522	0	980	307
Stage 1	-	-	-	-	307	-
Stage 2	-	-	-	-	673	-
Critical Hdwy	-	-	4.13	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.227	-	3.527	3.327
Pot Cap-1 Maneuver	-	-	1039	-	276	731
Stage 1	-	-	-	-	744	-
Stage 2	-	-	-	-	505	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1039	-	264	731
Mov Cap-2 Maneuver	-	-	-	-	378	-
Stage 1	-	-	-	-	744	-
Stage 2	-	-	-	-	483	-

Approach	EB	WB	NB
HCM Control Delay, s/v	0	0.63	25.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	378	731	-	-	1039	-
HCM Lane V/C Ratio	0.597	0.041	-	-	0.044	-
HCM Control Delay (s/veh)	27.7	10.1	-	-	8.6	-
HCM Lane LOS	D	B	-	-	A	-
HCM 95th %tile Q(veh)	3.7	0.1	-	-	0.1	-

Year of Need (approach LOS D)
Year of Need (NB LT LOS D)
Existing configuration; 2040 traffic volumes

Traffic Signal Warrant Analysis Workbook

Year 2045 Volumes

10/14/2024

STUDY AND ANALYSIS INFORMATION

Municipality:	SDDOT	**Analysis Date:**	10/14/2024
County:		**Conducted By:**	HDR
PennDOT Engineering District:		**Agency/Company Name:**	HDR

Analysis Information

Data Collection Date:	5/14/2024
Day of the Week:	Tuesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Major Street Information

Major Street Name and Route Number:	20th Street S
Major Street Approach #1 Direction:	E-Bound
Major Street Approach #2 Direction:	W-Bound

Number of Lanes for Moving Traffic on Each Major Street Approach:	1	**LANE(S)**
Speed Limit or 85th Percentile Speed on the Major Street:	35	**MPH**

Minor Street Information

Minor Street Name and Route Number:	I-29 NB RTI
Minor Street Approach #1 Direction:	N-Bound
Minor Street Approach #2 Direction:	S-Bound

Number of Lanes for Moving Traffic on Each Minor Street Approach:	1	**LANE(S)**

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Applicable?	Warrant Met?
Warrant 1, Eight-Hour Vehicular Volume	Yes	No
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes
Warrant 3, Peak Hour	Yes	No
Warrant 4, Pedestrian Volume	No	N/A
Warrant 5, School Crossing	No	N/A
Warrant 6, Coordinated Signal System	No	N/A
Warrant 7, Crash Experience	No	N/A
Warrant 8, Roadway Network	No	N/A
Warrant 9, Intersection Near a Grade Crossing	No	N/A
Warrant PA-1, ADT Volume Warrant	No	N/A
Warrant PA-2, Midblock and Trail Crossings	No	N/A

MUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	No

Combination of Conditions A and B Necessary?*: No

**Only applicable for Warrant 1 if after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems. See Section 4C.02 of the 2009 MUTCD for application.*

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or More	1	600	480	420	336	150	120	105	84
2 or More	2 or More	600	480	420	336	200	160	140	112
1	2 or More	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or More	1	900	720	630	504	75	60	53	42
2 or More	2 or More	900	720	630	504	100	80	70	56
1	2 or More	750	600	525	420	100	80	70	56

Condition A Evaluation

Number of Unique Hours Met: 6 **Condition A Satisfied?** No

Condition B Evaluation

Number of Unique Hours Met: 4 **Condition B Satisfied?** No

Combination of Condition A and Condition B Evaluation

Number of Unique Hours Met for Condition A: N/A

Number of Unique Hours Met for Condition B: N/A

Combination of Condition A and Condition B Satisfied? N/A

MUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Total Number of Unique Hours Met On Figure 4C-1
4

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	No

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 AM	19.582	21.324	
12:15 AM	28.331	17.77	
12:30 AM	21.682	19.547	
12:45 AM	17.847	17.77	
1:00 AM	22.396	14.216	
1:15 AM	24.845	10.662	
1:30 AM	31.494	7.108	
1:45 AM	37.064	7.108	
2:00 AM	32.515	7.108	
2:15 AM	47.913	8.885	
2:30 AM	41.264	7.108	
2:45 AM	31.145	7.108	
3:00 AM	35.694	8.885	
3:15 AM	6.284	5.331	
3:30 AM	27.966	7.108	
3:45 AM	38.085	12.439	
4:00 AM	54.992	15.993	
4:15 AM	82.874	24.878	
4:30 AM	94.712	33.763	
4:45 AM	196.648	46.202	
5:00 AM	271.351	51.533	
5:15 AM	312.625	71.08	
5:30 AM	371.72	90.627	
5:45 AM	370.848	111.951	
6:00 AM	443.814	147.491	
6:15 AM	471.606	143.937	
6:30 AM	657.601	163.484	
6:45 AM	887.141	177.7	Met
7:00 AM	1084.231	193.693	Met
7:15 AM	1144.57	209.686	Met
7:30 AM	1007.115	188.362	Met
7:45 AM	802.158	175.923	Met
8:00 AM	568.31	140.383	
8:15 AM	530.389	113.728	
8:30 AM	464.367	95.958	
8:45 AM	446.794	88.85	
9:00 AM	450.674	87.073	
9:15 AM	449.569	92.404	
9:30 AM	465.894	95.958	
9:45 AM	472.821	87.073	
10:00 AM	453.449	94.181	
10:15 AM	437.127	104.843	
10:30 AM	493.408	122.613	
10:45 AM	514.951	120.836	
11:00 AM	526.233	119.059	
11:15 AM	580.007	115.938	

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
11:30 AM	553.647	109.347	
11:45 AM	546.144	106.478	

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 PM	601.928	104.966	
12:15 PM	584.275	121.896	
12:30 PM	576.266	121.896	
12:45 PM	551.19	133.747	
1:00 PM	528.385	126.975	
1:15 PM	519.841	110.045	
1:30 PM	512.09	115.124	
1:45 PM	527.081	135.44	
2:00 PM	515.962	150.677	
2:15 PM	539.358	160.835	
2:30 PM	579.267	170.993	
2:45 PM	580.133	157.449	
3:00 PM	577.035	152.37	
3:15 PM	631.549	164.221	
3:30 PM	683.73	172.686	
3:45 PM	911.885	187.923	Met
4:00 PM	939.636	226.862	Met
4:15 PM	1002.135	264.108	Met
4:30 PM	1041.965	301.354	Met
4:45 PM	807.148	308.126	Met
5:00 PM	769.709	291.196	Met
5:15 PM	582.689	242.099	Met
5:30 PM	467.857	203.16	
5:45 PM	428.142	172.686	
6:00 PM	397.107	154.063	
6:15 PM	418.251	137.133	
6:30 PM	382.195	115.124	
6:45 PM	370.8	108.352	
7:00 PM	340.816	84.65	
7:15 PM	300.82	82.957	
7:30 PM	260.029	77.878	
7:45 PM	220.296	79.571	
8:00 PM	184.332	88.036	
8:15 PM	138.404	91.422	
8:30 PM	134.212	89.729	
8:45 PM	153.802	76.185	
9:00 PM	138.202	74.492	
9:15 PM	145.006	59.255	
9:30 PM	128.146	54.176	
9:45 PM	78.296	47.404	
10:00 PM	57.84	32.167	
10:15 PM	33.352	27.088	
10:30 PM	20.973	18.623	
10:45 PM	29.357	18.623	
11:00 PM	27.341	20.316	

Traffic Signal Warrant Analysis Workbook

Year 2050 Volumes

10/14/2024

STUDY AND ANALYSIS INFORMATION

Municipality:	SDDOT	**Analysis Date:**	10/14/2024
County:		**Conducted By:**	HDR
PennDOT Engineering District:		**Agency/Company Name:**	HDR

Analysis Information

Data Collection Date:	5/7/2022
Day of the Week:	Tuesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

Major Street Information

Major Street Name and Route Number:	20th Street S
Major Street Approach #1 Direction:	E-Bound
Major Street Approach #2 Direction:	W-Bound

Number of Lanes for Moving Traffic on Each Major Street Approach:	1	**LANE(S)**
Speed Limit or 85th Percentile Speed on the Major Street:	35	**MPH**

Minor Street Information

Minor Street Name and Route Number:	I-29 SB Off-Ramp
Minor Street Approach #1 Direction:	N-Bound
Minor Street Approach #2 Direction:	S-Bound

Number of Lanes for Moving Traffic on Each Minor Street Approach:	1	**LANE(S)**

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Applicable?	Warrant Met?
Warrant 1, Eight-Hour Vehicular Volume	**Yes**	**No**
Warrant 2, Four-Hour Vehicular Volume	**Yes**	**Yes**
Warrant 3, Peak Hour	**Yes**	**No**
Warrant 4, Pedestrian Volume	**No**	**N/A**
Warrant 5, School Crossing	**No**	**N/A**
Warrant 6, Coordinated Signal System	**No**	**N/A**
Warrant 7, Crash Experience	**No**	**N/A**
Warrant 8, Roadway Network	**No**	**N/A**
Warrant 9, Intersection Near a Grade Crossing	**No**	**N/A**
Warrant PA-1, ADT Volume Warrant	**No**	**N/A**
Warrant PA-2, Midblock and Trail Crossings	**No**	**N/A**

MUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	No

Combination of Conditions A and B Necessary?*: No

**Only applicable for Warrant 1 if after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems. See Section 4C.02 of the 2009 MUTCD for application.*

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or More	1	600	480	420	336	150	120	105	84
2 or More	2 or More	600	480	420	336	200	160	140	112
1	2 or More	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or More	1	900	720	630	504	75	60	53	42
2 or More	2 or More	900	720	630	504	100	80	70	56
1	2 or More	750	600	525	420	100	80	70	56

Condition A Evaluation

Number of Unique Hours Met: 3 **Condition A Satisfied?** No

Condition B Evaluation

Number of Unique Hours Met: 6 **Condition B Satisfied?** No

Combination of Condition A and Condition B Evaluation

Number of Unique Hours Met for Condition A: N/A

Number of Unique Hours Met for Condition B: N/A

Combination of Condition A and Condition B Satisfied? N/A

MUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Total Number of Unique Hours Met On Figure 4C-1
4

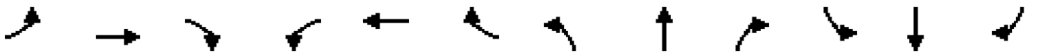
Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	No

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 AM	0.163888889	11.89	
12:15 AM	3.963222222	9.512	
12:30 AM	4.046555556	7.134	
12:45 AM	7.845888889	2.378	
1:00 AM	11.64522222	2.378	
1:15 AM	25.68455556	2.378	
1:30 AM	25.76788889	4.756	
1:45 AM	49.13922222	2.378	
2:00 AM	59.46255556	2.378	
2:15 AM	49.30588889	4.756	
2:30 AM	53.10522222	2.378	
2:45 AM	26.18455556	4.756	
3:00 AM	16.02788889	4.756	
3:15 AM	8.679222222	4.756	
3:30 AM	5.046555556	4.756	
3:45 AM	29.32588889	2.378	
4:00 AM	43.36522222	4.756	
4:15 AM	105.7965556	7.134	
4:30 AM	185.8998889	9.512	
4:45 AM	345.2832222	9.512	
5:00 AM	469.1545556	11.89	
5:15 AM	540.9178889	19.024	
5:30 AM	647.1172222	26.158	
5:45 AM	671.3125556	33.292	
6:00 AM	935.9038889	52.316	
6:15 AM	1190.087222	59.45	
6:30 AM	1411.902556	83.23	Met
6:45 AM	1700.773889	118.9	Met
7:00 AM	1815.565222	145.058	Met
7:15 AM	1862.476556	156.948	Met
7:30 AM	1630.587889	145.058	Met
7:45 AM	1268.303222	114.144	Met
8:00 AM	863.9825556	83.23	
8:15 AM	571.4778889	78.474	
8:30 AM	522.1772222	78.474	
8:45 AM	511.1125556	85.608	
9:00 AM	568.0958889	80.852	
9:15 AM	546.7072222	80.852	
9:30 AM	537.5425556	76.096	
9:45 AM	544.1498889	64.206	
10:00 AM	530.1932222	68.962	
10:15 AM	555.5485556	66.584	
10:30 AM	599.3998889	78.474	
10:45 AM	600.3912222	87.986	
11:00 AM	564.2225556	90.364	
11:15 AM	538.5061667	79.226	

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
11:30 AM	539.8929444	70.556	
11:45 AM	543.8028889	73.776	

Hourly Vehicular Volume			
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Hour Met?
12:00 PM	589.476	72.24	
12:15 PM	665.956	75.852	
12:30 PM	651.064	68.628	
12:45 PM	649.128	68.628	
1:00 PM	644.862	65.016	
1:15 PM	622.316	68.628	
1:30 PM	618.14	65.016	
1:45 PM	627.202	66.822	
2:00 PM	675.91	66.822	
2:15 PM	688.04	65.016	
2:30 PM	739.258	86.688	
2:45 PM	793.382	84.882	
3:00 PM	797.564	102.942	
3:15 PM	891.24	115.584	
3:30 PM	1024.052	124.614	Met
3:45 PM	1188.616	162.54	Met
4:00 PM	1330.374	173.376	Met
4:15 PM	1376.99	222.138	Met
4:30 PM	1373.718	245.616	Met
4:45 PM	1211.604	223.944	Met
5:00 PM	1112.59	213.108	Met
5:15 PM	974.978	162.54	Met
5:30 PM	801.814	119.196	
5:45 PM	752.684	102.942	
6:00 PM	630.462	86.688	
6:15 PM	558.194	81.27	
6:30 PM	494.788	75.852	
6:45 PM	436.034	74.046	
7:00 PM	360.932	74.046	
7:15 PM	321.102	55.986	
7:30 PM	317.306	61.404	
7:45 PM	284.896	55.986	
8:00 PM	293.058	61.404	
8:15 PM	259.764	66.822	
8:30 PM	234.242	52.374	
8:45 PM	245.434	43.344	
9:00 PM	214.972	23.478	
9:15 PM	230.11	21.672	
9:30 PM	210.89	16.254	
9:45 PM	175.892	18.06	
10:00 PM	164.496	19.866	
10:15 PM	146.084	12.642	
10:30 PM	124.59	18.06	
10:45 PM	130.242	12.642	
11:00 PM	137.572	7.224	

Appendix C: 20th Street S & 22nd Avenue Year of Need Analysis Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	284	404	27	36	232	199	32	195	75	229	82	91
Future Volume (veh/h)	284	404	27	36	232	199	32	195	75	229	82	91
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	316	449	30	40	258	221	36	217	83	254	91	101
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	447	617	41	259	462	392	369	248	95	337	546	672
Arrive On Green	0.14	0.38	0.38	0.03	0.26	0.26	0.02	0.21	0.21	0.13	0.31	0.31
Sat Flow, veh/h	1674	1629	109	1674	1758	1490	1674	1211	463	1674	1758	1490
Grp Volume(v), veh/h	316	0	479	40	258	221	36	0	300	254	91	101
Grp Sat Flow(s),veh/h/ln	1674	0	1738	1674	1758	1490	1674	0	1674	1674	1758	1490
Q Serve(g_s), s	10.9	0.0	19.3	1.4	10.4	10.5	1.4	0.0	14.2	9.4	3.1	3.3
Cycle Q Clear(g_c), s	10.9	0.0	19.3	1.4	10.4	10.5	1.4	0.0	14.2	9.4	3.1	3.3
Prop In Lane	1.00		0.06	1.00		1.00	1.00		0.28	1.00		1.00
Lane Grp Cap(c), veh/h	447	0	658	259	462	392	369	0	343	337	546	672
V/C Ratio(X)	0.71	0.00	0.73	0.15	0.56	0.56	0.10	0.00	0.87	0.75	0.17	0.15
Avail Cap(c_a), veh/h	447	0	658	281	462	392	394	0	410	337	589	709
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.9	0.0	21.8	21.9	26.0	26.1	24.9	0.0	31.5	21.8	20.5	13.2
Incr Delay (d2), s/veh	4.3	0.0	6.9	0.1	4.8	5.8	0.0	0.0	16.3	8.3	0.1	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	7.8	0.0	13.4	1.0	8.3	7.5	1.0	0.0	11.4	7.6	2.2	1.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	22.2	0.0	28.7	22.0	30.8	31.9	24.9	0.0	47.8	30.2	20.6	13.3
LnGrp LOS	C		C	C	C	C	C		D	C	C	B
Approach Vol, veh/h		795			519			336			446	
Approach Delay, s/veh		26.1			30.6			45.3			24.4	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.5	37.5	6.4	31.4	16.0	28.0	15.0	22.8
Change Period (Y+Rc), s	4.5	6.5	4.5	6.0	4.5	6.5	4.5	6.0
Max Green Setting (Gmax), s	3.1	29.9	3.1	27.4	11.5	21.5	10.5	20.0
Max Q Clear Time (g_c+I1), s	3.4	21.3	3.4	5.3	12.9	12.5	11.4	16.2
Green Ext Time (p_c), s	0.0	1.9	0.0	0.7	0.0	1.5	0.0	0.6

Intersection Summary	
HCM 7th Control Delay, s/veh	30.0
HCM 7th LOS	C

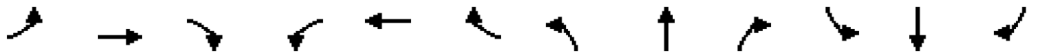
Notes

User approved changes to right turn type.

Year of Need - maintains LOS C
Existing configuration; 2040 traffic volumes

HCM 7th Signalized Intersection Summary
3: 22nd Ave & 20th St S

10/15/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	307	464	31	45	274	227	36	208	93	270	93	100
Future Volume (veh/h)	307	464	31	45	274	227	36	208	93	270	93	100
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	341	516	34	50	304	252	40	231	103	300	103	111
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	402	592	39	197	452	383	387	257	114	325	567	686
Arrive On Green	0.14	0.36	0.36	0.03	0.26	0.26	0.03	0.22	0.22	0.13	0.32	0.32
Sat Flow, veh/h	1674	1631	107	1674	1758	1490	1674	1152	514	1674	1758	1490
Grp Volume(v), veh/h	341	0	550	50	304	252	40	0	334	300	103	111
Grp Sat Flow(s),veh/h/ln	1674	0	1739	1674	1758	1490	1674	0	1665	1674	1758	1490
Q Serve(g_s), s	11.5	0.0	24.7	1.8	13.0	12.7	1.5	0.0	16.3	10.5	3.5	3.6
Cycle Q Clear(g_c), s	11.5	0.0	24.7	1.8	13.0	12.7	1.5	0.0	16.3	10.5	3.5	3.6
Prop In Lane	1.00		0.06	1.00		1.00	1.00		0.31	1.00		1.00
Lane Grp Cap(c), veh/h	402	0	631	197	452	383	387	0	371	325	567	686
V/C Ratio(X)	0.85	0.00	0.87	0.25	0.67	0.66	0.10	0.00	0.90	0.92	0.18	0.16
Avail Cap(c_a), veh/h	402	0	631	206	452	383	406	0	398	325	576	693
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.0	0.0	24.8	23.4	27.9	27.8	24.2	0.0	31.6	23.6	20.4	13.2
Incr Delay (d2), s/veh	14.7	0.0	15.3	0.2	7.8	8.6	0.0	0.0	21.9	30.3	0.2	0.1
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	10.1	0.0	17.8	1.3	10.3	8.9	1.1	0.0	13.3	11.2	2.5	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	35.7	0.0	40.1	23.7	35.7	36.3	24.2	0.0	53.5	53.8	20.5	13.3
LnGrp LOS	D		D	C	D	D	C		D	D	C	B
Approach Vol, veh/h		891			606			374			514	
Approach Delay, s/veh		38.4			35.0			50.4			38.4	
Approach LOS		D			C			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.1	36.9	6.6	33.0	16.0	28.0	15.0	24.6
Change Period (Y+Rc), s	4.5	6.5	4.5	6.0	4.5	6.5	4.5	6.0
Max Green Setting (Gmax), s	3.1	29.9	3.1	27.4	11.5	21.5	10.5	20.0
Max Q Clear Time (g_c+I1), s	3.8	26.7	3.5	5.6	13.5	15.0	12.5	18.3
Green Ext Time (p_c), s	0.0	1.1	0.0	0.8	0.0	1.5	0.0	0.3

Intersection Summary	
HCM 7th Control Delay, s/veh	39.4
HCM 7th LOS	D

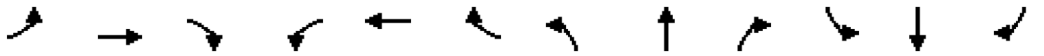
Notes

User approved changes to right turn type.

Year of Need - LOS D
Existing configuration; 2045 traffic volumes

HCM 7th Signalized Intersection Summary
3: 22nd Ave & 20th St S

10/15/2024



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	202	257	47	86	457	316	57	161	41	246	242	339
Future Volume (veh/h)	202	257	47	86	457	316	57	161	41	246	242	339
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	224	286	52	96	508	351	63	179	46	273	269	377
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	276	514	93	394	567	480	262	207	53	365	447	510
Arrive On Green	0.09	0.35	0.35	0.06	0.32	0.32	0.04	0.15	0.15	0.14	0.25	0.25
Sat Flow, veh/h	1674	1447	263	1674	1758	1490	1674	1349	347	1674	1758	1490
Grp Volume(v), veh/h	224	0	338	96	508	351	63	0	225	273	269	377
Grp Sat Flow(s),veh/h/ln	1674	0	1711	1674	1758	1490	1674	0	1695	1674	1758	1490
Q Serve(g_s), s	6.5	0.0	11.7	2.8	20.2	15.4	2.3	0.0	9.5	9.7	9.9	16.4
Cycle Q Clear(g_c), s	6.5	0.0	11.7	2.8	20.2	15.4	2.3	0.0	9.5	9.7	9.9	16.4
Prop In Lane	1.00		0.15	1.00		1.00	1.00		0.20	1.00		1.00
Lane Grp Cap(c), veh/h	276	0	607	394	567	480	262	0	261	365	447	510
V/C Ratio(X)	0.81	0.00	0.56	0.24	0.90	0.73	0.24	0.00	0.86	0.75	0.60	0.74
Avail Cap(c_a), veh/h	276	0	607	431	567	480	293	0	261	365	447	510
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.7	0.0	19.1	15.7	23.7	22.1	24.7	0.0	30.3	21.2	24.1	21.3
Incr Delay (d2), s/veh	15.5	0.0	3.7	0.1	19.4	9.4	0.2	0.0	24.5	7.4	2.3	5.6
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	6.3	0.0	8.5	1.8	16.1	10.2	1.6	0.0	9.3	7.6	7.4	10.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.2	0.0	22.7	15.8	43.1	31.5	24.9	0.0	54.8	28.6	26.4	26.9
LnGrp LOS	C		C	B	D	C	C		D	C	C	C
Approach Vol, veh/h		562			955			288			919	
Approach Delay, s/veh		27.3			36.1			48.3			27.2	
Approach LOS		C			D			D			C	

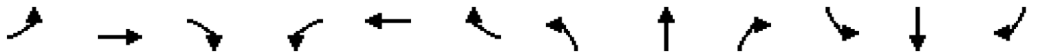
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.6	32.6	7.6	24.7	11.0	30.2	15.0	17.3
Change Period (Y+Rc), s	4.5	6.5	4.5	6.0	4.5	6.5	4.5	6.0
Max Green Setting (Gmax), s	5.7	24.5	4.5	17.3	6.5	23.7	10.5	11.3
Max Q Clear Time (g_c+I1), s	4.8	13.7	4.3	18.4	8.5	22.2	11.7	11.5
Green Ext Time (p_c), s	0.0	1.4	0.0	0.0	0.0	0.7	0.0	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	32.6
HCM 7th LOS	C

Notes

User approved changes to right turn type.

Year of Need - maintains LOS C
Existing configuration; 2045 traffic volumes



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	220	290	55	100	515	360	65	175	50	280	260	365
Future Volume (veh/h)	220	290	55	100	515	360	65	175	50	280	260	365
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758	1758
Adj Flow Rate, veh/h	244	322	61	111	572	400	72	194	56	311	289	406
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	247	527	100	384	622	527	238	214	62	312	405	455
Arrive On Green	0.07	0.37	0.37	0.06	0.35	0.35	0.05	0.16	0.16	0.12	0.23	0.23
Sat Flow, veh/h	1674	1437	272	1674	1758	1490	1674	1311	379	1674	1758	1490
Grp Volume(v), veh/h	244	0	383	111	572	400	72	0	250	311	289	406
Grp Sat Flow(s),veh/h/ln	1674	0	1709	1674	1758	1490	1674	0	1690	1674	1758	1490
Q Serve(g_s), s	5.5	0.0	13.4	3.1	22.9	17.4	2.6	0.0	10.7	8.5	11.1	17.0
Cycle Q Clear(g_c), s	5.5	0.0	13.4	3.1	22.9	17.4	2.6	0.0	10.7	8.5	11.1	17.0
Prop In Lane	1.00		0.16	1.00		1.00	1.00		0.22	1.00		1.00
Lane Grp Cap(c), veh/h	247	0	627	384	622	527	238	0	276	312	405	455
V/C Ratio(X)	0.99	0.00	0.61	0.29	0.92	0.76	0.30	0.00	0.91	1.00	0.71	0.89
Avail Cap(c_a), veh/h	247	0	627	395	622	527	282	0	276	312	405	455
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.8	0.0	19.0	14.6	22.8	21.0	24.2	0.0	30.2	25.3	26.0	24.4
Incr Delay (d2), s/veh	53.2	0.0	4.4	0.2	21.0	9.9	0.3	0.0	31.0	50.3	5.8	19.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	10.1	0.0	9.5	1.9	17.9	11.3	1.8	0.0	10.6	9.7	8.7	13.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	75.0	0.0	23.4	14.8	43.8	30.8	24.4	0.0	61.2	75.6	31.8	43.8
LnGrp LOS	E		C	B	D	C	C		E	E	C	D
Approach Vol, veh/h		627			1083			322			1006	
Approach Delay, s/veh		43.5			36.0			53.0			50.2	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.0	33.5	8.0	23.0	10.0	32.5	13.0	18.0
Change Period (Y+Rc), s	4.5	6.5	4.5	6.0	4.5	6.5	4.5	6.0
Max Green Setting (Gmax), s	5.0	26.5	5.5	15.0	5.5	26.0	8.5	12.0
Max Q Clear Time (g_c+I1), s	5.1	15.4	4.6	19.0	7.5	24.9	10.5	12.7
Green Ext Time (p_c), s	0.0	1.7	0.0	0.0	0.0	0.6	0.0	0.0

Intersection Summary	
HCM 7th Control Delay, s/veh	44.0
HCM 7th LOS	D

Notes

User approved changes to right turn type.

Year of Need - LOS D
Existing configuration; 2050 traffic volumes

Appendix D: 20th Street S & 34th Avenue Year of Need Analysis Reports

Intersection	
Int Delay, s/veh	44.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	250	65	140	55	95	55	130	90	40	40	60	135
Future Vol, veh/h	250	65	140	55	95	55	130	90	40	40	60	135
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	278	72	156	61	106	61	144	100	44	44	67	150

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	597	589	67	603	717	122	217	0	0	144	0	0
Stage 1	156	156	-	411	411	-	-	-	-	-	-	-
Stage 2	442	433	-	192	306	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	413	419	994	410	354	926	1347	-	-	1432	-	-
Stage 1	844	767	-	616	593	-	-	-	-	-	-	-
Stage 2	593	580	-	808	660	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 229	363	994	246	306	926	1347	-	-	1432	-	-
Mov Cap-2 Maneuver	~ 229	363	-	246	306	-	-	-	-	-	-	-
Stage 1	818	743	-	550	529	-	-	-	-	-	-	-
Stage 2	396	518	-	596	640	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	100.62	21.11	4	1.29
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1347	-	-	229	641	246	406	1432	-	-
HCM Lane V/C Ratio	0.107	-	-	1.21	0.356	0.248	0.41	0.031	-	-
HCM Control Delay (s/veh)	8	-	-	171.9	13.7	24.4	19.9	7.6	-	-
HCM Lane LOS	A	-	-	F	B	C	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	13.7	1.6	1	2	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	44.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	250	65	140	55	95	55	130	90	40	40	60	135
Future Vol, veh/h	250	65	140	55	95	55	130	90	40	40	60	135
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	278	72	156	61	106	61	144	100	44	44	67	150

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	597	589	67	603	717	122	217	0	0	144	0	0
Stage 1	156	156	-	411	411	-	-	-	-	-	-	-
Stage 2	442	433	-	192	306	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	413	419	994	410	354	926	1347	-	-	1432	-	-
Stage 1	844	767	-	616	593	-	-	-	-	-	-	-
Stage 2	593	580	-	808	660	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 229	363	994	246	306	926	1347	-	-	1432	-	-
Mov Cap-2 Maneuver	~ 229	363	-	246	306	-	-	-	-	-	-	-
Stage 1	818	743	-	550	529	-	-	-	-	-	-	-
Stage 2	396	518	-	596	640	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	100.62	21.11	4	1.29
HCM LOS	F	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1347	-	-	229	641	246	406	1432	-	-
HCM Lane V/C Ratio	0.107	-	-	1.21	0.356	0.248	0.41	0.031	-	-
HCM Control Delay (s/veh)	8	-	-	171.9	13.7	24.4	19.9	7.6	-	-
HCM Lane LOS	A	-	-	F	B	C	C	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	13.7	1.6	1	2	0.1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Year of Need - Overall intersection LOS E, EB Approach LOS F
Build-out configuration; 2045 traffic volumes

Intersection	
Int Delay, s/veh	16.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	219	53	114	45	78	45	107	79	33	33	50	114
Future Vol, veh/h	219	53	114	45	78	45	107	79	33	33	50	114
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	-	150	-	-	200	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	243	59	127	50	87	50	119	88	37	37	56	127

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	498	491	56	502	599	106	182	0	0	124	0	0
Stage 1	129	129	-	344	344	-	-	-	-	-	-	-
Stage 2	369	362	-	158	256	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	481	477	1008	478	414	945	1387	-	-	1456	-	-
Stage 1	872	788	-	669	635	-	-	-	-	-	-	-
Stage 2	649	623	-	842	694	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	319	425	1008	326	369	945	1387	-	-	1456	-	-
Mov Cap-2 Maneuver	319	425	-	326	369	-	-	-	-	-	-	-
Stage 1	850	768	-	612	581	-	-	-	-	-	-	-
Stage 2	478	570	-	662	677	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	30.68	16.27	3.83	1.26
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1387	-	-	319	702	326	475	1456	-	-
HCM Lane V/C Ratio	0.086	-	-	0.763	0.264	0.153	0.288	0.025	-	-
HCM Control Delay (s/veh)	7.8	-	-	45	12	18	15.6	7.5	-	-
HCM Lane LOS	A	-	-	E	B	C	C	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	5.9	1.1	0.5	1.2	0.1	-	-

Year of Need - Acceptable Operations
Build-out configuration; 2045 traffic volumes

Appendix E: 20th Street S & 22nd Avenue West Leg – Potential Turn Lane Dimensions

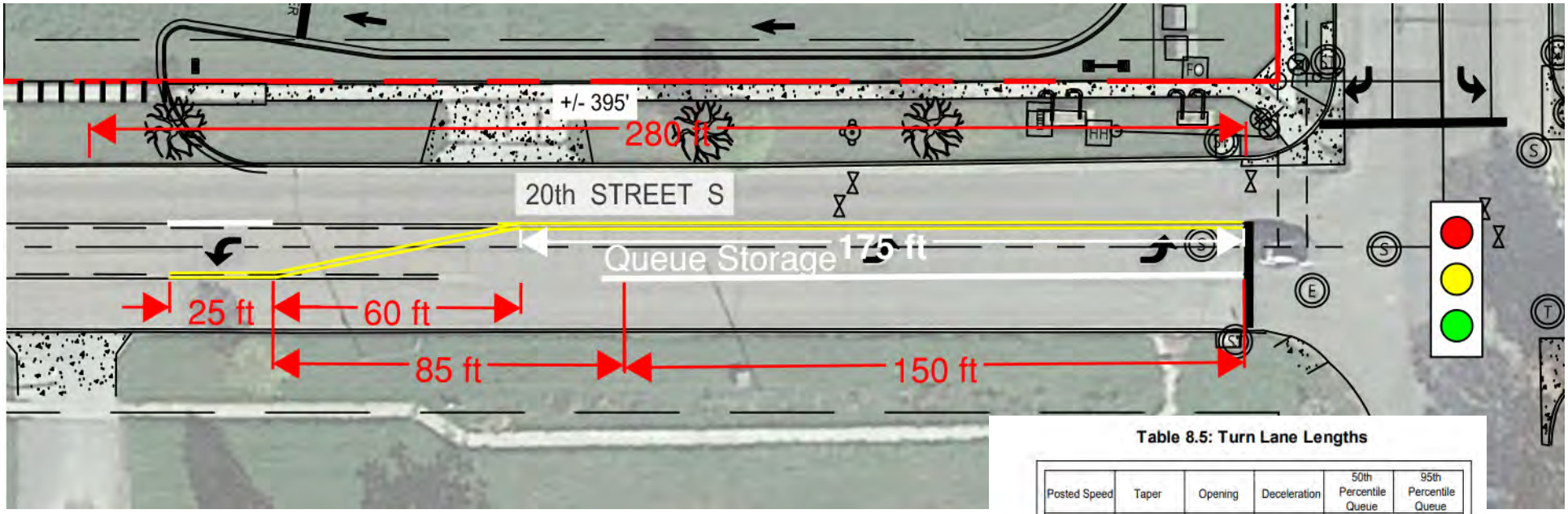


Table 8.5: Turn Lane Lengths

Posted Speed	Taper	Opening	Deceleration	50th Percentile Queue	95th Percentile Queue
30 mph	60'	60'	75'	Values determined by software analysis	
35 mph	60'	85'	75'		
40 mph	90'	120'	100'		
45 mph	120'	150'	125'		

Method I

Opening | Deceleration | 50th Percentile Queue

Taper

Or

Method II

Opening

Taper | 95th Percentile Queue

Use the larger of the two design methods for each turn lane