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TECHNICAL MEMORANDUM 3

DATE: November 15, 2022

TO: Project Team

FROM: Eileen Chai, EIT; Kayla Fleskes-Lane, PE; John Bosket, PE | DKS Associates

SUBJECT: US 97 at Reed Market Road Operations and Safety Study
Future Baseline (No-Build) Transportation System Conditions

Project #22129-001

This memorandum documents future baseline (No-Build) system conditions for the US 97 at Reed Market Road study area, including documentation of future No-Build traffic operations, walking, biking, and transit conditions. The information provided in this memorandum, in combination with *Technical Memorandum #2: Existing Conditions,* will help provide an understanding of the "No-Build" condition and will be used to identify deficiencies and inform the development of solutions for the Reed Market Road study corridor.

TRAFFIC OPERATIONS

The evaluation includes the same study area as described in *Technical Memorandum #2: Existing Conditions*. Six study intersections (shown in Figure 1) are included in this study to analyze the operational and safety improvements for the study corridor. The following section discusses the process for developing future (Year 2040) traffic volumes and the results of the intersection operations analysis.

FUTURE VOLUME DEVELOPMENT

Future traffic volumes were forecast for Year 2040 at the study intersections using the Bend-Redmond Regional Travel Demand Model (BRM). The BRM transportation network included financially constrained projects listed in the Statewide Transportation Improvement Program, Bend Transportation GO Bond project list, and the Capital Improvement Program (CIP) project list, as noted in *Technical Memorandum #1, Appendix A: Methodology Memorandum.* In addition to the financially constrained projects, the closure of right-on, right-off access on US 97 is assumed, as that planned project[1] has a noticeable impact on the volume of traffic at the interchange. Note that improvements identified in the GO Bond project list along the Reed Market Road corridor (intersection capacity improvement at 3rd Street, the US 97 interchange, and Brookswood

[1] Project included in the Bend Transportation System Plan (C-42) and identified in the US 97 Parkway Plan.

Boulevard/Bond Street) are not included, as these improvements will be tested as part of the build alternatives for this study. Key financially constrained projects in the area included in the modeling are:

- The Chase Road connection
- The Reed Market Road railroad overcrossing (including a removal of access at 9th Street)[2]
- US 97/Murphy Road interchange ramps
- US 97 Frontage Road near Murphy Road (between Badger Road and Ponderosa Street)
- The closure of US 97 right-on, right-off access (e.g., Reed Lane access to the south and Truman Avenue to the north)

Several projects that are included in the City of Bend Transportation System Plan (TSP) project list are not financially constrained (i.e., funding has not been committed for these projects); therefore, these projects are excluded from the 2040 No-Build scenario. This includes the following projects near the study area:

- Ramp metering of US 97 (C-42, Bend TSP Mid-Term project list)
- Powers Road interchange (C-41, Bend TSP Mid-Term project list)

Regarding future transportation projects, there are already projects listed in the Bend TSP/MTP to address the major bottlenecks in the Reed Market Road study corridor. This study intends to refine those concepts and complement them with further operational or safety enhancement projects where feasible. Therefore, no major updates to the TSP/MTP are anticipated and the new state requirements through OAR 660-012-0830 for an enhanced review of select roadway projects would not apply unless this study recommends to advance a new capacity building project that meets the criteria of that rule.

The BRM scenario uses the 2040 land use assumptions developed for the most recent TSP update, with the addition of recent refinements associated with the Stevens Road Tract[3] and Stevens Ranch Tract[4] developments located east of 27th Street between Ferguson Road and Reed Market Road. The scenario was used as the basis to estimate Year 2040 traffic growth at all study intersections, using the base year (2019) scenario and 2040 scenario. Raw link level volumes from the BRM were post-processed using methods consistent with the Oregon Department of Transportation (ODOT) Analysis Procedures Manual (APM). This approach was derived from methodologies outlined in the National Cooperative Highway Research Program (NCHRP) Report 765, *Analytical Travel Forecasting Approaches for Project-Level Planning and Design*.

Figure 1 shows the 2040 traffic volumes under No-Build conditions at the study intersections during the design hour (future equivalent of the 30th highest hour [30th HV] at ODOT intersections and

[2] Depending on the design of a Reed Market Road overcrossing of the railroad, it is possible that access to 9th Street could be maintained. It is not expected that maintaining that access would significantly influence operations at the study intersections.

[3] Stevens Road Tract Concept Plan, June 2022

[4] Stevens Ranch Major Community Master Plan, October 2021

average weekday [AWD] at City of Bend intersections). The volumes shown include seasonal factoring using guidance from the APM. In general, future traffic volumes along Reed Market Road are expected to grow by approximately 20 percent over the next 18 years. On the east side of the interchange, traffic travelling through the 3rd Street/Brosterhous Road intersection is expected to increase by approximately 50 percent on the westbound approach and 15 percent on other approaches over the next 18 years.

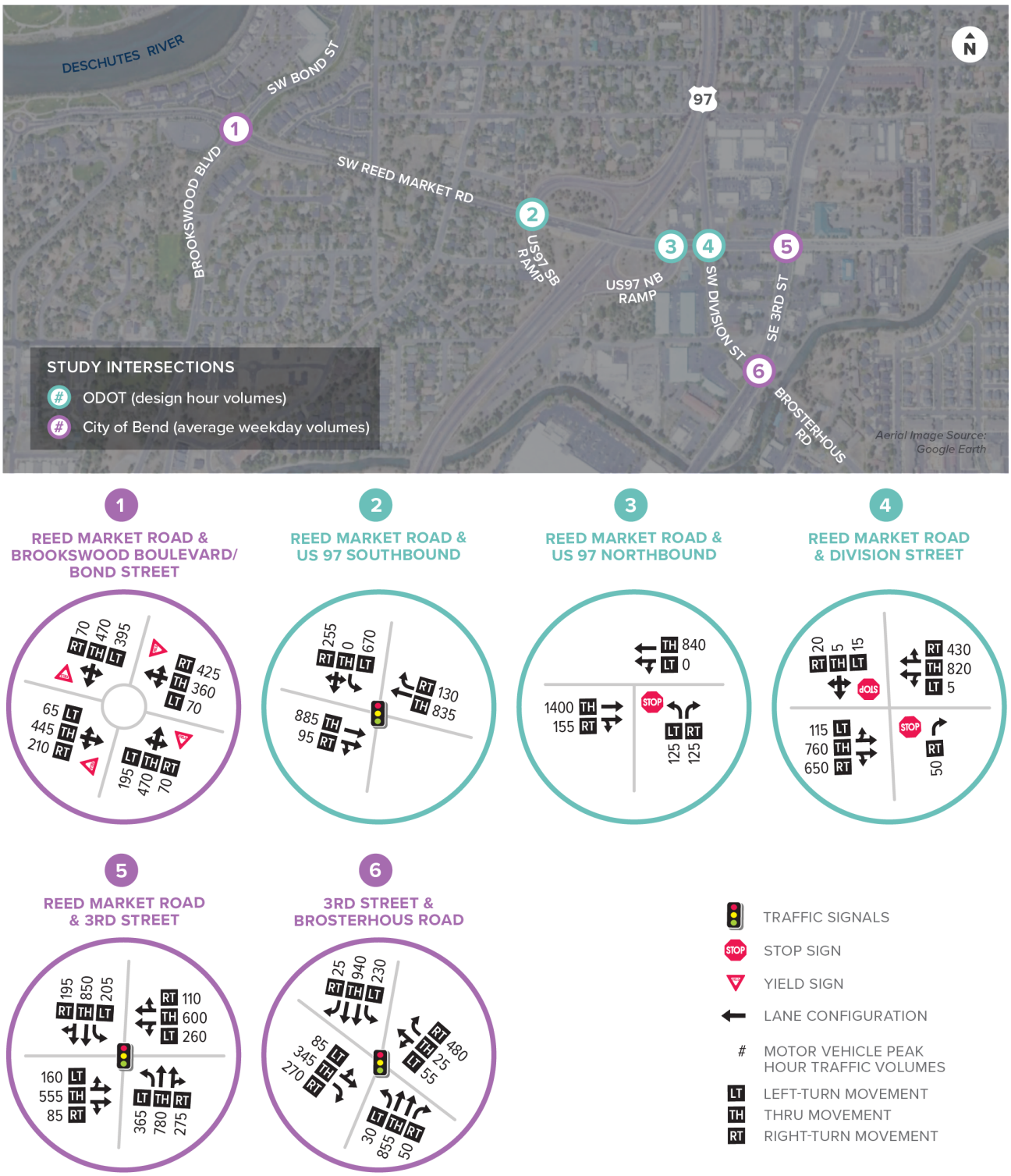


FIGURE 1. FUTURE (YEAR 2040) MOTOR VEHICLE PM PEAK HOUR TRAFFIC VOLUMES

FUTURE MOTOR VEHICLE INTERSECTION OPERATIONS

Intersection operations are reported at the study intersections for the 2040 No-Build scenario using Highway Capacity Manual (6th Edition) methodology. Software reports are included in Appendix A for reference. Table 1 compares each intersection's performance against the adopted mobility target and the results from existing conditions analysis completed for the US 97 Parkway Plan and Bend's TSP, while Figure 2 illustrates the approximate areas impacted by congestion and highlights key findings at major congested intersections:

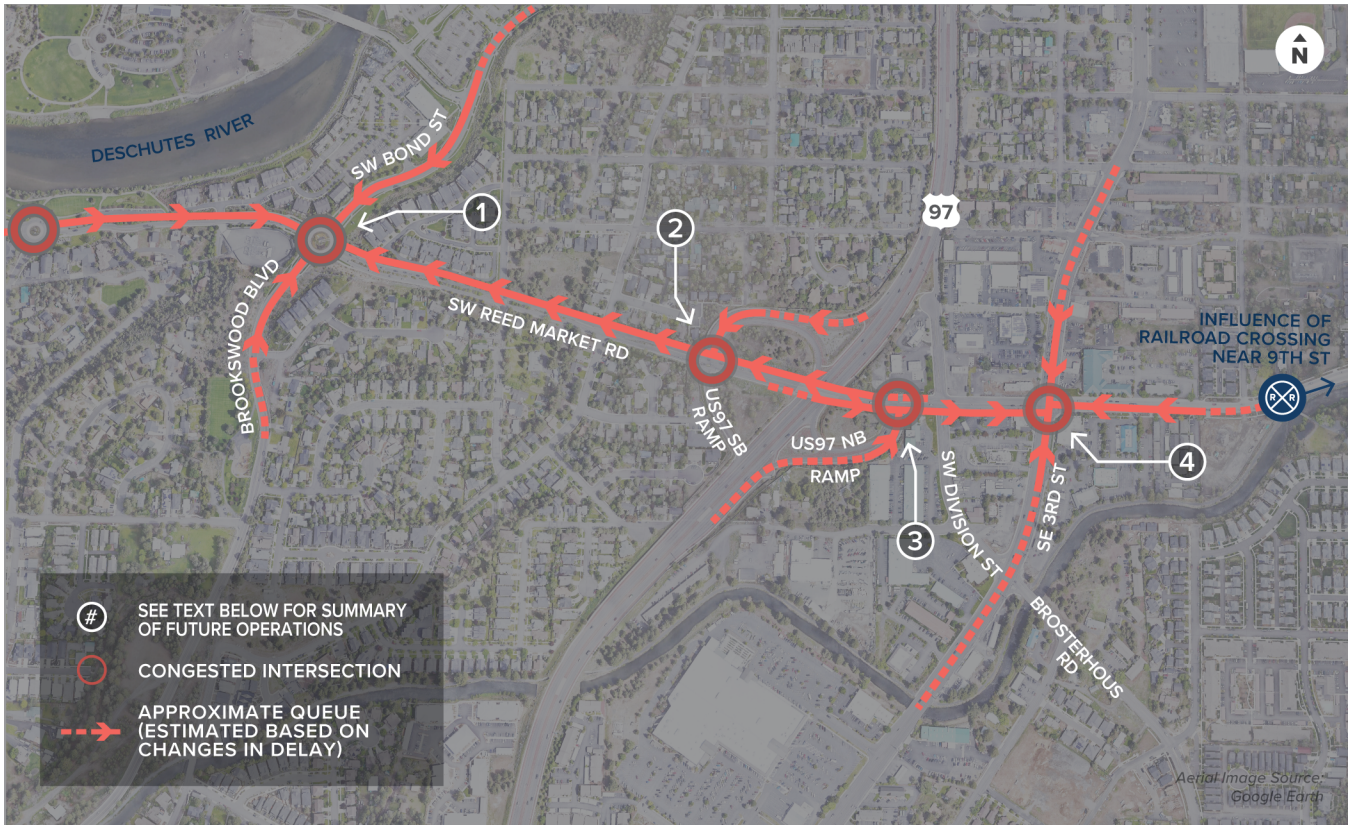


FIGURE 2. FUTURE (YEAR 2040) REED MARKET ROAD CORRIDOR CONGESTION

Notes corresponding with annotations in Figure 2:

1. Reed Market Road/Brookswood Boulevard – All four legs of the roundabout fail in the future, with v/c ratios greater than 1.09, leading to queues spilling back to nearby major intersections, including the US 97 southbound and US 97 northbound ramp terminals.
2. US 97 southbound ramp terminal – This intersection fails to meet mobility targets in the future, and given the queue spillback from the Brookswood Boulevard intersection, it is likely that queues will extend beyond the safe stopping distance on the ramp.
3. US 97 northbound ramp terminal – This intersection continues to fail to meet mobility targets in the future as an unsignalized intersection. It is likely that queues would extend towards the US 97 mainline, well beyond the safe stopping distance on the ramp as drivers struggle to find safe gaps to make a northbound left turn onto Reed Market Road and as queues from the Brookswood Boulevard roundabout and 3rd Street spill back into the intersection.

4. Reed Market Road/3rd Street – This intersection fails to meet mobility targets in the future, with a v/c ratio of 1.26. Northbound queues are expected to spill back beyond the intersection of 3rd Street/Brosterhous Road while eastbound queues are expected to spill back beyond the US 97 northbound ramp terminal.

TABLE 1: FUTURE 2040 DESIGN HOUR NO-BUILD TRAFFIC OPERATIONS AT STUDY INTERSECTIONS

INTERSECTION	JURISDICTION	CONTROL	MOBILITY TARGET	EXISTING [A]			FUTURE (2040)		
				V/C[B]	LOS[C]	DELAY[D] (SEC)	V/C	LOS	DELAY (SEC)
REED MARKET RD & BROOKSWOOD BLVD	City (AWD)	Roundabout	≤ 1.00	**1.14**	F	61	**1.16**	F	>150
REED MARKET RD & US 97 SB	ODOT (30HV)	Signalized	≤ 0.90[E]	**0.95**	C	34	**0.94**	C	26
REED MARKET RD & US 97 NB	ODOT (30HV)	TWSC	≤ 0.85 (ramp) ≤ 0.85 (Reed Market Rd)	NA/**1.53**	NA/F	NA/>100	NA/**2.56**	NA/F	NA/ >150
REED MARKET RD & DIVISION ST	ODOT (30HV)	TWSC	≤ 1.00	0.14/ 0.12	B/C	13/17	0.46/ 0.14	B/C	14/17
REED MARKET RD & 3RD ST	City (AWD)	Signalized	≤ 1.00	**1.05**	F	92	**1.26**	F	>150
3RD ST & BROSTERHOUS RD	City (AWD)	Signalized	≤ 1.00	-	-	-	0.89	C	21

Bold and red indicate a failure to meet the mobility target.

30HV=30th Highest Hour, AWD = Average Weekday, LOS=Level of Service, TWSC=Two-Way Stop-Controlled, V/C=Volume-to-Capacity

[A] Existing conditions are results from the US 97 Parkway Plan using 30HV conditions at all intersections. Future condition results represent 30HV operations for ODOT intersections and average weekday operations for City intersections, consistent with mobility targets.

[B] V/C ratio reported as the overall intersection V/C ratio at signalized intersections, worse case approach V/C at roundabouts, and V/C ratio for Major Street/Minor Street at TWSC intersections.

[C] LOS reported as the worst major street LOS/minor street LOS for TWSC intersections, worst case approach LOS for roundabouts, and overall intersection LOS for signalized intersections.

[D] Control delay reported for worst case major street/minor street for TWSC intersections, worst case approach delay for roundabouts, and overall intersection delay for signalized intersections.

[E] ODOT adopted an alternative mobility target for this intersection as part of the US 97 Parkway Plan, which assumed a 0.90 V/C ratio during 30 HV and ensuring 95th percentile queues do not extend into the portion of the exit ramp needed for deceleration.

As shown in the table, only the Reed Market Road/Division Street and 3rd Street/Brosterhous Road intersections meet mobility targets under future conditions. Additionally, most of the study intersections have higher volume-to-capacity (V/C) ratios and delays compared to the existing conditions (except Reed Market Road/US 97 southbound), indicating operational performance is expected to worsen in the future under No-Build conditions as Bend continues to grow.

At Reed Market Road/US 97 southbound, future operations appear better than the existing conditions operations in Table 1. However, this is due in large part to a change in southbound lane configuration assumptions. Since the completion of the US 97 Parkway Plan existing conditions analysis, the lane configuration at the US 97 southbound ramp terminal was modified to include a southbound left and shared left-through-right turn lane. This results in less delay in the future compared to the existing conditions analysis. It should be noted that the US 97 southbound ramp terminal is expected to operate worse than the recently adopted alternative mobility target of v/c $\leq$ 0.90. The analysis supporting the adoption of the alternative mobility target assumed mitigated conditions at the ramp terminal, which included signal timing modifications (increased cycle length) that were not included in this No-Build analysis, as these improvements will be tested as part of the study alternatives.

Heavy congestion and queue spillback affecting multiple intersections along the study corridor were observed under existing conditions, with many intersections failing to meet the adopted mobility targets. Considering the worsening intersection operations in the future, near-term improvements are needed to improve the current issues and better prepare for the traffic growth. Phasing of the improvements will be critical. For example, queueing from the roundabout at Reed Market Road/Brookswood Boulevard was observed to be spilling back to the US 97 southbound ramp terminal in August 2022. The US 97 southbound ramp terminal will likely continue to operate inefficiently until improvements are made at the roundabout. In addition, given the level of delay and high v/c at 3rd Street/Reed Market Road, it is expected that the northbound queue will extend beyond 3rd Street/Brosterhous Road.

Additionally, the City is implementing several construction projects over the next few years that will influence operations on Reed Market Road. For instance, the Reed Market Road railroad overcrossing project is estimated to be implemented within the next 10 years, which will close Reed Market Road near 9th Street for an extended period of time, affecting east-west travel along the road. Traffic along 3rd Street and west of 3rd Street along Reed Market Road is expected to increase during the closure, especially eastbound left, northbound left, and southbound right movements at the intersection. Future improvements along Reed Market Road should be phased to support long-term mobility needs as well as short-term needs during construction closures.

CONDITIONS FOR PEOPLE WALKING, BICYCLING, AND TAKING TRANSIT

As discussed in *Technical Memorandum #2: Existing Conditions,* walking and bicycling facilities (primarily sidewalks and on-street bike lanes) are consistently provided within the study area, including marked pedestrian crossings primarily existing at the intersections of major streets, and bicycle facilities generally consisting of on-street bike lanes in various forms. However, bike lanes through the study area are generally narrow and unbuffered and contribute to an existing high

stress environment for people biking. Curb-tight sidewalks and narrow bike lanes contribute to a high stress pedestrian environment on Reed Market Road and 3rd Street (Pedestrian Level of Traffic Stress 3). Improvements will be needed within the study area to complete the City's key walking and biking routes, reduce the levels of traffic stress, and address the City's and the project's goals.

The first goal in the City's TSP is to increase system capacity, quality, and connectivity for all users. In particular, policies are included in the TSP to improve safety and usability of facilities for people walking and biking and for micromobility. Policy 40 from the City's TSP mentions all streets should be "complete streets" to allow everyone to travel safely and comfortably along and across the street by all travel modes. The transportation system is intended to increase connectivity, safety and travel time reliability while encouraging walking, biking, and opportunities for using transit and other transportation options. In addition, Policy 59 states the City will consider the environmental impacts of the overall transportation system and act to mitigate negative effects and enhance positive features. The intention of the policy is to reduce greenhouse gases and vehicle miles traveled (VMT) by encouraging bicycling, walking, transit, and electric or other alternately fueled vehicles. The City's TSP focuses on improving multi-modal facilities and adding micromobility options to encourage more people to walk and bike. The increase of congestion and the reductions in parking for new development are likely to further increase the number of people walking and biking. To implement these goals and policies within the study area, improvements will be needed to the active transportation facilities along Reed Market Road and 3rd Street.

Bend's TSP lists several planned projects to improve conditions for people walking and bicycling in the future. Specifically, within the study area, the planned key walking and biking route project (R9-A) on the east leg of the 3rd Street and Brosterhous Road intersection will close a sidewalk gap between 3rd Street and Parrell Road along Brosterhous Road and create a low-stress bikeway on both sides of the street.

Regarding transit conditions, there are two routes currently operating within the study area, including Route 1 (South 3rd Street) and Route 2 (Brookswood Boulevard). The Cascades East Transit (CET) 2040 Transit Master Plan (TMP)[5] identifies several future transit service needs in Bend, including increasing route frequency and service coverage, improving bus on-time arrival and reliability, enhancing services to transit-underserved areas, expanding connections to other transportation modes, and expanding accessibility. This would include the following changes within the study area:

- More frequent service for Route 2, resulting in more buses utilizing Brookswood Boulevard through the study area.
- Combining Routes 1 and 4 to extend transit farther along 3rd Street without requiring a transfer, potentially resulting in more transit trips along 3rd Street.
- Modification of Route 6 to serve downtown and the Oregon State University Cascades Campus by traveling along Reed Market Road between 3rd Street and Brookswood Boulevard.

[5] Cascades East Transit 2040 Transit Master Plan, Cascades East Transit, August 2020.

APPENDIX A: SOFTWARE REPORTS

MOVEMENT SUMMARY

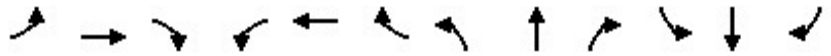
Site: 101 [Reed Market Road/Brookswood Boulevard - 2040NB (Site Folder: General)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Brookswood Boulevard														
1	L2	195	1.0	201	1.0	1.093	134.8	LOS F	60.9	430.2	1.00	5.25	10.77	16.9
2	T1	470	1.0	485	1.0	1.093	134.8	LOS F	60.9	430.2	1.00	5.25	10.77	16.4
3	R2	70	2.0	72	2.0	1.093	134.8	LOS F	60.9	430.2	1.00	5.25	10.77	16.5
Approach		735	1.1	758	1.1	1.093	134.8	LOS F	60.9	430.2	1.00	5.25	10.77	16.6
East: Reed Market Road														
4	L2	70	0.0	74	0.0	1.144	168.6	LOS F	92.8	649.5	1.00	6.61	13.12	14.6
5	T1	360	0.0	379	0.0	1.144	168.6	LOS F	92.8	649.5	1.00	6.61	13.12	14.2
6	R2	425	0.0	447	0.0	1.144	168.6	LOS F	92.8	649.5	1.00	6.61	13.12	14.3
Approach		855	0.0	900	0.0	1.144	168.6	LOS F	92.8	649.5	1.00	6.61	13.12	14.3
North: Bond Street														
7	L2	395	1.0	416	1.0	1.156	176.3	LOS F	108.5	762.5	1.00	6.99	13.15	14.3
8	T1	470	0.0	495	0.0	1.156	176.3	LOS F	108.5	762.5	1.00	6.99	13.15	13.9
9	R2	70	0.0	74	0.0	1.156	176.3	LOS F	108.5	762.5	1.00	6.99	13.15	14.0
Approach		935	0.4	984	0.4	1.156	176.3	LOS F	108.5	762.5	1.00	6.99	13.15	14.1
West: Reed Market Road														
10	L2	65	0.0	68	0.0	1.104	142.9	LOS F	64.3	454.7	1.00	5.51	11.38	16.3
11	T1	445	1.0	468	1.0	1.104	143.0	LOS F	64.3	454.7	1.00	5.51	11.38	15.8
12	R2	210	2.0	221	2.0	1.104	143.0	LOS F	64.3	454.7	1.00	5.51	11.38	15.9
Approach		720	1.2	758	1.2	1.104	143.0	LOS F	64.3	454.7	1.00	5.51	11.38	15.9
All Vehicles		3245	0.6	3400	0.6	1.156	157.6	LOS F	108.5	762.5	1.00	6.17	12.22	15.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	885	95	0	835	130	0	0	0	670	0	255
Future Volume (veh/h)	0	885	95	0	835	130	0	0	0	670	0	255
Initial Q (Qb), veh	0	0	0	0	0	0				0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98				1.00		0.98
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	0	1736	1736	0	1750	1750				1736	1750	1750
Adj Flow Rate, veh/h	0	922	88	0	870	66				447	351	196
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96				0.96	0.96	0.96
Percent Heavy Veh, %	0	1	1	0	0	0				1	0	0
Cap, veh/h	0	1559	149	0	899	743				610	385	215
Arrive On Green	0.00	0.51	0.50	0.00	0.51	0.51				0.37	0.37	0.35
Sat Flow, veh/h	0	3123	290	0	1750	1447				1654	1045	583
Grp Volume(v), veh/h	0	501	509	0	870	66				447	0	547
Grp Sat Flow(s),veh/h/ln	0	1650	1676	0	1750	1447				1654	0	1628
Q Serve(g_s), s	0.0	14.5	14.5	0.0	32.8	1.6				15.9	0.0	21.8
Cycle Q Clear(g_c), s	0.0	14.5	14.5	0.0	32.8	1.6				15.9	0.0	21.8
Prop In Lane	0.00		0.17	0.00		1.00				1.00		0.36
Lane Grp Cap(c), veh/h	0	847	861	0	899	743				610	0	601
V/C Ratio(X)	0.00	0.59	0.59	0.00	0.97	0.09				0.73	0.00	0.91
Avail Cap(c_a), veh/h	0	847	861	0	899	743				655	0	645
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00				1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.00	1.00	1.00				1.00	0.00	1.00
Uniform Delay (d), s/veh	0.0	11.6	11.6	0.0	16.0	8.4				18.6	0.0	20.6
Incr Delay (d2), s/veh	0.0	1.2	1.2	0.0	22.6	0.1				3.9	0.0	16.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	5.0	5.1	0.0	17.0	0.5				6.2	0.0	10.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	12.8	12.8	0.0	38.6	8.5				22.5	0.0	37.1
LnGrp LOS	A	B	B	A	D	A				C	A	D
Approach Vol, veh/h		1010			936						994	
Approach Delay, s/veh		12.8			36.5						30.6	
Approach LOS		B			D						C	

Timer - Assigned Phs	2	4	6
Phs Duration (G+Y+Rc), s	39.0	29.1	39.0
Change Period (Y+Rc), s	5.0	5.0	5.0
Max Green Setting (Gmax), s	34.0	26.0	34.0
Max Q Clear Time (g_c+I1), s	16.5	23.8	34.8
Green Ext Time (p_c), s	7.8	0.4	0.0

Intersection Summary	
HCM 6th Ctrl Delay	26.3
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	42.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1400	155	0	840	125	125
Future Vol, veh/h	1400	155	0	840	125	125
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	240
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	1	1	0	0	0	2
Mvmt Flow	1489	165	0	894	133	133

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	-	-	2020	828
Stage 1	-	-	-	-	1573	-
Stage 2	-	-	-	-	447	-
Critical Hdwy	-	-	-	-	6.8	6.94
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	-	-	3.5	3.32
Pot Cap-1 Maneuver	-	-	0	-	~ 52	314
Stage 1	-	-	0	-	159	-
Stage 2	-	-	0	-	617	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	-	-	~ 52	314
Mov Cap-2 Maneuver	-	-	-	-	~ 52	-
Stage 1	-	-	-	-	159	-
Stage 2	-	-	-	-	617	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	$ 449.6
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBT
Capacity (veh/h)	52	314	-	-	-
HCM Lane V/C Ratio	2.557	0.423	-	-	-
HCM Control Delay (s)	$ 874.6	24.6	-	-	-
HCM Lane LOS	F	C	-	-	-
HCM 95th %tile Q(veh)	13.7	2	-	-	-

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

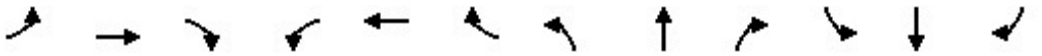
Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	115	760	650	5	820	430	0	0	50	15	5	20
Future Vol, veh/h	115	760	650	5	820	430	0	0	50	15	5	20
Conflicting Peds, #/hr	2	0	2	2	0	2	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	Stop	-	-	None
Storage Length	-	-	-	-	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	3	1	1	0	1	2	0	0	4	33	0	0
Mvmt Flow	119	784	670	5	845	443	0	0	52	15	5	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1290	0	0	1456	0	0	-	-	729	1709	2773	646
Stage 1	-	-	-	-	-	-	-	-	-	1079	1079	-
Stage 2	-	-	-	-	-	-	-	-	-	630	1694	-
Critical Hdwy	4.16	-	-	4.1	-	-	-	-	6.98	8.16	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	7.16	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	7.16	5.5	-
Follow-up Hdwy	2.23	-	-	2.2	-	-	-	-	3.34	3.83	4	3.3
Pot Cap-1 Maneuver	528	-	-	471	-	-	0	0	361	42	19	419
Stage 1	-	-	-	-	-	-	0	0	-	185	297	-
Stage 2	-	-	-	-	-	-	0	0	-	368	150	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	527	-	-	470	-	-	-	-	360	-	0	418
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	-	-	0	-
Stage 1	-	-	-	-	-	-	-	-	-	185	283	-
Stage 2	-	-	-	-	-	-	-	-	-	-	0	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.7	0.2	16.7	
HCM LOS			C	-

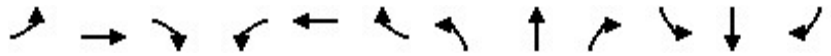
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	360	527	-	-	470	-	-	-
HCM Lane V/C Ratio	0.143	0.225	-	-	0.011	-	-	-
HCM Control Delay (s)	16.7	13.8	5.3	-	12.7	0.3	-	-
HCM Lane LOS	C	B	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0.5	0.9	-	-	0	-	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	160	555	85	260	600	110	365	780	275	205	850	195
Future Volume (veh/h)	160	555	85	260	600	110	365	780	275	205	850	195
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.97	1.00		0.97	1.00		0.98
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	1736	1736	1682	1736	1736	1723	1736	1723	1723	1736	1736	1736
Adj Flow Rate, veh/h	165	572	88	268	619	113	376	804	284	211	876	201
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	5	1	1	2	1	2	2	1	1	1
Cap, veh/h	167	609	98	223	544	103	254	643	227	165	583	134
Arrive On Green	0.25	0.26	0.25	0.25	0.26	0.25	0.15	0.27	0.27	0.10	0.22	0.21
Sat Flow, veh/h	643	2342	376	857	2092	397	1654	2351	830	1654	2652	608
Grp Volume(v), veh/h	438	0	387	530	0	470	376	559	529	211	545	532
Grp Sat Flow(s),veh/h/ln	1704	0	1657	1694	0	1652	1654	1637	1545	1654	1650	1610
Q Serve(g_s), s	38.4	0.0	33.9	39.0	0.0	39.0	23.0	41.0	41.0	15.0	33.0	33.0
Cycle Q Clear(g_c), s	38.4	0.0	33.9	39.0	0.0	39.0	23.0	41.0	41.0	15.0	33.0	33.0
Prop In Lane	0.38		0.23	0.51		0.24	1.00		0.54	1.00		0.38
Lane Grp Cap(c), veh/h	443	0	431	440	0	429	254	447	422	165	363	354
V/C Ratio(X)	0.99	0.00	0.90	1.20	0.00	1.09	1.48	1.25	1.25	1.28	1.50	1.50
Avail Cap(c_a), veh/h	443	0	431	440	0	429	254	447	422	165	363	354
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	0.00	1.00	0.46	0.46	0.46	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.4	0.0	53.7	55.8	0.0	55.6	63.5	54.5	54.8	67.5	58.5	58.7
Incr Delay (d2), s/veh	39.8	0.0	24.3	111.3	0.0	71.6	226.9	121.3	122.5	162.6	239.5	240.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.4	0.0	17.0	30.4	0.0	24.9	25.7	31.9	30.3	13.8	37.9	37.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	95.2	0.0	78.0	167.1	0.0	127.2	290.4	175.8	177.3	230.1	298.0	299.0
LnGrp LOS	F	A	E	F	A	F	F	F	F	F	F	F
Approach Vol, veh/h		825			1000			1464			1288	
Approach Delay, s/veh		87.1			148.3			205.7			287.3	
Approach LOS		F			F			F			F	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	19.0	45.0		43.0	27.0	37.0		43.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	14.0	40.0		38.0	22.0	32.0		38.0				
Max Q Clear Time (g_c+I1), s	17.0	0.0		0.0	25.0	0.0		0.0				
Green Ext Time (p_c), s	0.0	0.0		0.0	0.0	0.0		0.0				

Intersection Summary			
HCM 6th Ctrl Delay		194.8	
HCM 6th LOS		F	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	85	345	270	55	25	480	30	855	50	230	940	25
Future Volume (veh/h)	85	345	270	55	25	480	30	855	50	230	940	25
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	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	1736	1723	1750	1723	1682	1736	1600	1736	1750	1723	1750	1450
Adj Flow Rate, veh/h	88	356	133	57	26	304	31	881	0	237	969	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	2	0	2	5	1	11	1	0	2	0	22
Cap, veh/h	143	375	391	224	81	388	51	1093		286	1571	
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.33	0.00	0.17	0.47	0.00
Sat Flow, veh/h	265	1398	1456	456	303	1445	1524	3299	1483	1641	3325	1229
Grp Volume(v), veh/h	444	0	133	83	0	304	31	881	0	237	969	0
Grp Sat Flow(s),veh/h/ln	1663	0	1456	759	0	1445	1524	1650	1483	1641	1663	1229
Q Serve(g_s), s	11.5	0.0	4.4	0.0	0.0	11.7	1.2	14.6	0.0	8.3	13.0	0.0
Cycle Q Clear(g_c), s	16.0	0.0	4.4	4.4	0.0	11.7	1.2	14.6	0.0	8.3	13.0	0.0
Prop In Lane	0.20		1.00	0.69		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	518	0	391	305	0	388	51	1093		286	1571	
V/C Ratio(X)	0.86	0.00	0.34	0.27	0.00	0.78	0.60	0.81		0.83	0.62	
Avail Cap(c_a), veh/h	873	0	705	552	0	700	127	1157		315	1571	
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	0.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	21.8	0.0	17.6	17.3	0.0	20.3	28.5	18.3	0.0	23.8	11.8	0.0
Incr Delay (d2), s/veh	3.4	0.0	0.4	0.4	0.0	2.6	8.2	4.5	0.0	14.8	0.9	0.0
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(50%),veh/ln	6.1	0.0	1.4	0.9	0.0	3.9	0.5	5.6	0.0	4.2	4.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.2	0.0	18.0	17.7	0.0	22.9	36.8	22.7	0.0	38.6	12.7	0.0
LnGrp LOS	C	A	B	B	A	C	D	C		D	B	
Approach Vol, veh/h		577			387			912			1206	
Approach Delay, s/veh		23.6			21.8			23.2			17.8	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.0	24.3		20.6	6.5	32.8		20.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	11.5	21.0		29.0	5.0	27.5		29.0
Max Q Clear Time (g_c+I1), s	10.3	16.6		13.7	3.2	15.0		6.4
Green Ext Time (p_c), s	0.1	3.3		1.7	0.0	8.6		0.1

Intersection Summary	
HCM 6th Ctrl Delay	21.0
HCM 6th LOS	C

Notes

Unsignalized Delay for [NBR, SBR] is excluded from calculations of the approach delay and intersection delay.