Chambers Node Reconsidered

Operational and Pedestrian Safety Analysis

Chambers at Broadway: Looking North

May 27, 2005

Chambers at 7th: Looking East

Prepared for:
City of Eugene
Eugene, OR

Garfield at 13th: Looking North

Chambers at 7th: Looking North

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INTRODUCTION

The Operational and Pedestrian Safety Analysis for the Chambers Node Reconsidered project analyzes both traffic and pedestrian aspects of the transportation system within the Chambers Node study area. The analysis addresses three primary elements: traffic operations, pedestrians and safety. The results of these analyses are then used to recommend improvements.

A peak hour traffic operations analysis is performed for the following scenarios:

1. Base (2004)

2. Future (2024) No Build

3. Future (2024) Mitigation

Level-of-service (LOS) and volume-to-capacity (v/c) ratio are the performance measures used to assess traffic operations. When intersections exceed performance thresholds established by the City of Eugene and the Oregon Department of Transportation (ODOT) mitigation measures are then considered. The mitigation measures are designed to enhance pedestrian movements, improve traffic flow and ultimately maintain the integrity of the neighborhood.

Pedestrian enhancements are a major focus of this study. Specifically, the study investigates means to improve pedestrian crossings at the seven study area intersections. In addition, a sidewalk inventory is performed at the seven study intersection to identify missing sidewalk segments and any obstructions that restrict the sidewalk width. Transit it also a major generator of pedestrians. Therefore, transit stops in the immediate vicinity are surveyed to determine if any treatments can be implemented to improve the pedestrian experience at these stops.

The safety analysis reviews the collision history involving pedestrians, bicyclists and traffic at the seven study area intersections during a five year period extending from 1998 through 2002. Collisions are summarized and potential solutions recommended where definitive patterns are observed and correctable by traffic control measures.

Before delving into the analysis, it is important to mention that improvements for traffic can have a secondary benefit for pedestrians as well as the neighborhood as a whole. A number of traffic improvements are targeted at the signalized intersections in the study area. Improving traffic operations at these signals will make it less rewarding for motorists to cut through the neighborhood to avoid delays and congestion. The intention is to keep unnecessary traffic out of the neighborhood, but rather on roadways that are designed to carry higher volumes of traffic at higher speeds. As a result, the neighborhood streets will feel more like neighborhood streets (low traffic volumes and

speeds). They will be much more conducive to walking, biking and many other activities that are not as compatible with high volume high speed streets.

STUDY AREA

The study area is located in west Eugene and includes seven intersections. These intersections are listed below and highlighted with a red circle in Figure 1.

- West 7th Avenue/Highway 99 and Garfield Street
- West 7th Avenue/Highway 99 and Chambers Street
- West 7th Avenue/Highway 99 and Polk Street
- West 11th Avenue/Highway 126 at Garfield Street/Highway 126
- West 11th Avenue at Chambers Street
- West 13th Avenue at Garfield Street
- West 13th Avenue at Chambers Street

Figure 1. Study Area

With the exception of 13th at Garfield, all intersections are signalized. 13th at Garfield is controlled by stop signs on the eastbound and northbound approaches. The southbound approach is uncontrolled and thus traffic flows freely through the intersection

TRAFFIC OPERATIONS ANALYSIS

Performance Measures

Each intersection was analyzed in terms of LOS (delay), v/c-ratio and number of stops. Highway Capacity Manual (HCM) procedures available in SYNCHRO were used for the signalized intersections. HCM procedures available in the Highway Capacity Software were used for the unsignalized intersection.

The City of Eugene and ODOT have established performance measures that are used to determine if mitigation measures are necessary. The ODOT's criteria is based on the intersection's v/c-ratio (Oregon Highway Plan, Table 6) while the City's is based on LOS. ODOT's criteria requires first identifying the highway category of the roadway. Study area roadways that would fall under ODOT's criteria are shown in Table 1 along with their Highway Category designation. All other roadway sections would fall only under the City of Eugene criteria.

Table 1. Study Area Roadways Under ODOT Performance Criteria

Roadway	Section	ODOT Highway Category (MPO)
7th/Hwy. 99	Garfield – Polk	Statewide NHS Freight Route
11th/Bus. 126/ORE 126	West leg at Garfield	Regional Highway Segment
Garfield/Bus. 126/ORE 126	7th – 11th	Regional Highway Segment

Based on Table 1, mitigation measures would need to be studied at intersections along these roadways that exceed a v/c-ratio of 0.80. The City of Eugene's LOS criteria requires investigating mitigation measures when signals operate above a LOS D and unsignalized intersections above LOS E. A summary of the criteria that triggers the need to investigate mitigation measures is provided in Table 2. Table 3 provides the HCM relationship between LOS and delay.

Table 2. Performance Criteria – Need for Mitigation

Intersection	Criteria Triggering Need for Mitigation	
	ODOT ***v/c-ratio***	**City of Eugene** ***LOS***
7th at Garfield	0.80	D
7th at Chambers	0.80	D
7th at Polk	0.80	D
11th at Garfield	not applicable	D
11th at Chambers	not applicable	D
13th at Garfield[1]	not applicable	E
13th at Chambers	not applicable	D

1. Unsignalized intersection

Table 3. LOS Criteria

LOS	Intersection Control Delay (seconds/vehicle)	
	Signalized	**Unsignalized**
A	≤ 10	< 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Once the need for mitigation is determined, strategies are investigated to bring the intersections performance into compliance. The ODOT compliance criteria, however, differs from the criteria in Table 2. Based on the ODOT Highway Design Manual (Table 10-1), 7th/Highway 99 would have to be mitigated to a 0.75 v/c-ratio. The City of Eugene criteria is LOS D for signalized intersections and LOS E for unsignalized intersections. A summary of the minimum performance standards after mitigation are shown in Table 4.

Table 4. Performance Criteria – Minimum After Mitigation

Intersection	Criteria To Mitigate To	
	ODOT *v/c-ratio*	City of Eugene *LOS*
7th at Garfield	0.75	D
7th at Chambers	0.75	D
7th at Polk	0.75	D
11th at Garfield	not applicable	D
11th at Chambers	not applicable	D
13th at Garfield[1]	not applicable	E
13th at Chambers	not applicable	D

1. Unsignalized intersection

Base Scenario

The Base scenario reflects 2004 conditions in the study area. Data used for the Base analysis are presented in the following sections followed by the analysis results.

Lane Geometry

Lane configurations at the study area intersections are shown in Figure 2 with details shown in Appendix A. Speeds were 30 mph on all approaches to the study area intersections. Each roadway is briefly described below. All references to the functional classification of the roadways are based on the 2004 Regional Transportation Plan.

West 7th Avenue/Highway 99 is a 4-lane major arterial. It forms a 1-way couplet with West 6th Avenue. West 7th Avenue services traffic traveling in the eastbound direction.

West 11th Avenue is a minor arterial that varies in the number of lanes through the study area. From Polk Street to a point 100 feet west of Fillmore Street, West 11th is 1-way westbound with two lanes. From 100 feet west of Fillmore to Garfield, it remains a 1-way westbound street, but with three lanes. West of Garfield, 11th carries 2-way traffic with a 5-lane cross section. Eastbound traffic is forced to make either a right or left turn at Garfield.

West 13th Avenue is a 2-lane minor arterial. It is primarily 1-way eastbound through the study area. It becomes a 2-way local street west of Garfield.

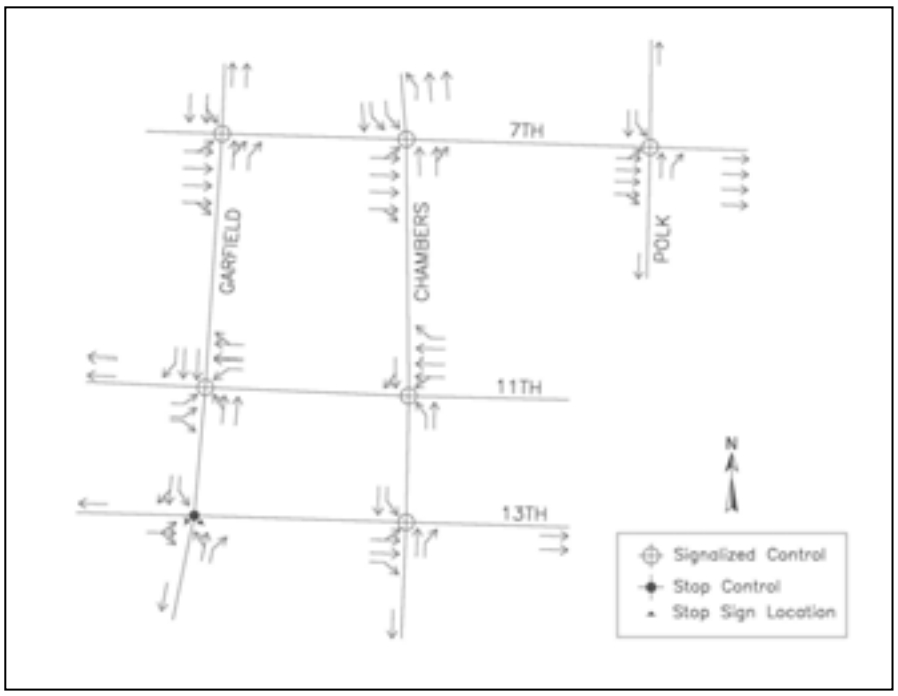


Figure 2. Existing Intersection Lane Configurations and Control

Garfield Street is classified as a major arterial north of 11th Avenue and a minor arterial south of 11th Avenue. The number of lanes along Garfield varies through the study area. North of 11th Avenue it is a 4-lane facility carrying 2-way traffic. Traveling southbound from 11th Avenue, Garfield has two lanes with the inside lane becoming an exclusive left-turn lane at 13th Avenue. Traveling southbound from 11th Avenue to 13th Avenue, Garfield widens from one lane northbound to two lanes. South of 13th Avenue, Garfield is a 2-lane, 2-way major collector.

Chambers Street is classified as a major arterial north of 7th Avenue and a minor arterial to the south. Throughout the study area it is a 3-lane facility with the center lane serving as a 2-way left turn lane. Bike lanes are provided on both sides of the street.

Polk Street is classified as a major collector. It is a 2-lane facility carrying 2-way traffic.

Volumes

Base scenario volumes were collected in 2004. The PM-Peak hour volumes for the study area intersections are shown in Figure 3 and Table 5.

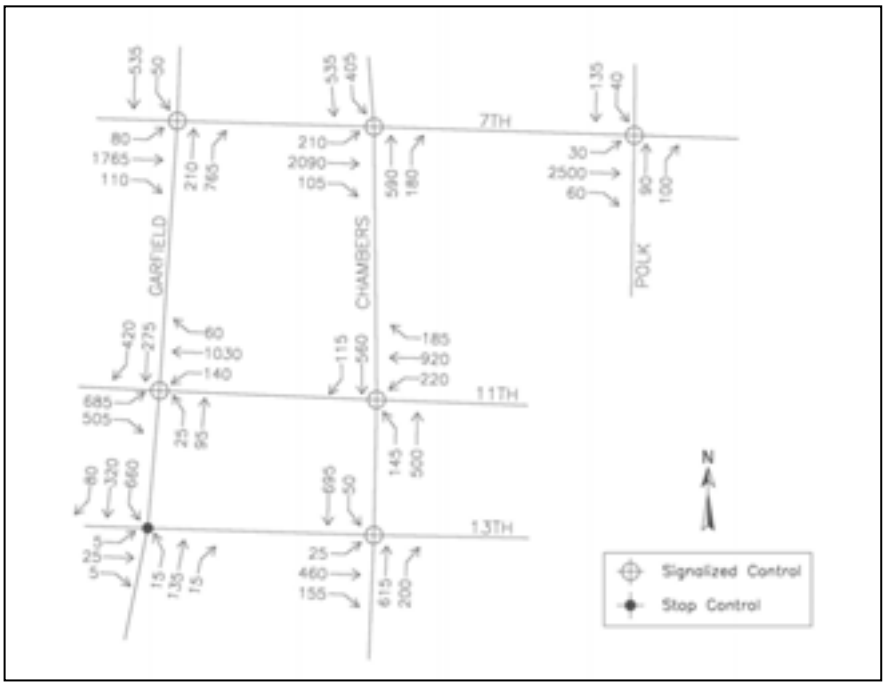


Figure 3. Base (2004) Scenario PM-Peak Hour Volumes

Table 5. Base (2004) PM-Peak Hour Pedestrian and Bicycle Volumes

Intersection	Pedestrians					Bicyclists				
	Leg Being Crossed				Total	Leg Being Crossed				Total
	N	E	S	W		N	E	S	W	
7th at Garfield	2	1	2	0	5	1	1	3	2	7
7th at Chambers	2	3	3	1	9	0	5	6	8	19
7th at Polk	3	1	9	5	18	8	0	8	2	18
11th at Garfield	3	0	4	2	9	4	2	4	5	15
11th at Chambers	4	3	4	6	17	7	3	6	7	23
13th at Garfield[1]	Data Unavailable					Data Unavailable				
13th at Chambers	5	2	4	3	14	6	9	2	7	24
Total				**72**	**Total**					**106**

Note: N = north, E = east, S = south, W = west

Lane utilization data was collected and reduced for the following intersections and movements:

- Garfield at 11th
    - Eastbound lefts
    - Northbound through
    - Westbound through
- Chambers at 11th
    - Westbound through

Lane utilization data provides information about the unequal distribution of volume across multiple lanes within a lane group. For example, an eastbound dual left turn lane exists at a signal. Downstream of the left turn movement is a shopping mall on the east side of the roadway. The shopping mall attracts a substantial number of trips. In this case, motorists choose to be in the right most lane of the dual left turn to make it easier to access the mall. This choice results in the right most lane of the dual left turn lanes carrying a greater percentage of traffic than the left most lane. This unequal distribution of traffic across al lane group has an impact on traffic operations, capacity and signal timing. The resulting lane utilization factors (refer to Appendix A) are then used to provide a more accurate analysis of field conditions.

Intersection Control

Six of the seven study intersections are signalized while the remaining one is unsignalized. A summary of the control for these intersections is provided in Table 6. The signal timing plans provided by the City of Eugene were entered into SYNCHRO and provided in Appendix A.

Table 6. Base (2004) PM-Peak Hour Intersection Control

Intersection	Control	Type of Operation	Cycle Length	Left Turn Phasing	Overlap Phases	Pedestrian Signal Heads	Pedestrian Push Buttons	Marked Crosswalks
7th at Garfield	Signalized	Actuated Coordinated	72	All Permissive	None	Yes	Yes	Yes
7th at Chambers	Signalized	Actuated Coordinated	72	SB: permissive followed by lagging protected	None	Yes	Yes	Yes
7th at Polk	Signalized	Actuated Coordinated	72	All Permissive	None	Yes	Yes	Yes
11th at Garfield	Signalized	Actuated Uncoordinated	97	All Permissive	SB right turn overlap with EB movements	Yes	Yes	Yes
11th at Chambers	Signalized	Semi-Actuated Uncoordinated	65	NB: Protected/ Permissive	None	Yes	NB+SB only	Yes
13th at Garfield[1]	Unsignalized -SB flows free -EB+NB stop	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	No
13th at Chambers	Signalized	Pre-timed Uncoordinated	60	All Permissive	None	Yes	No	Yes

Analysis Results

Performance results for the Base scenario are shown in Table 7. Details on the analysis results are provided in Appendix A.

Table 7. Base (2004) Performance Results

Intersection	Delay (sec/veh)	LOS	v/c Ratio	Stops (stops/hr)
7th at Garfield	20.0	B	0.78	2714
7th at Chambers	27.5	C	0.90	3156
7th at Polk	7.7	A	0.59	966
11th at Garfield	42.3	D	0.90	2181
11th at Chambers	55.8	E	1.06	2913
13th at Garfield[1]	219.3	F	0.64	199
13th at Chambers	14.3	B	0.64	1371

1. Unsignalized intersection, delay reported for worst performing movement - Eastbound

Four of the seven study intersections do not satisfy the delay and/or v/c-ratio criteria:

- 7th at Chambers
- 11th at Garfield
- 11th at Chambers
- 13th at Garfield

7th at Chambers operates at a 0.90 v/c-ratio which exceeds the 0.85 criteria. The northbound and eastbound through movements are the primary movements that result in the intersections exceeding the v/c-ratio criteria.

11th at Garfield operates at a LOS D which satisfies the City's criteria. Critical movements at this intersection are: eastbound right and westbound through.

11th at Chambers exceeds both the delay and v/c-ratio criteria. It operates at a LOS E and a v/c-ratio of 1.06. The movement contributing to this performance is the southbound through. It operates at LOS F and a v/c-ratio of 1.25.

13th at Garfield is an unsignalized intersection. The southbound movements flow freely while northbound and eastbound movements must stop. For unsignalized intersections,

the worst operating movement is used to report intersection performance. The eastbound through and left movements are the worst performing movements at LOS F which exceeds the LOS E delay criteria. These two movements have a total of approximately 30 vehicles/hour during the PM-peak hour. Therefore, the volume is extremely low. These vehicles, which most are likely to originate in the residential area west of the intersection, however, can take an alternate route along Arthur to West 11th to travel in the eastbound direction. The land use along this route is mix-use commercial, industrial and residential.

The number of stops at an intersection can be compared between alternatives to provide an indirect measure of safety performance. Reducing the number of stops reduces the potential for rear-end collisions. The number of stops per hour is reported in Table 7 and will be used to compare other scenarios.

Queue lengths and the available storage for each movement are shown in Table 8. The available storage equals either the upstream distance to the next signal or the length of the storage bay for a turning movement. Queue lengths represent the 95th percentile queue. In other words, the queue length is expected to be less than this measurement 95 percent of the time. None of the reported queue lengths exceed the available storage.

Table 8. Base (2004) Queue Lengths

Intersection	Storage (feet)	Queue Length (feet)	Intersection	Storage (feet)	Queue Length (feet)
7th at Garfield			**11th at Chambers[2]**		
EB Thru	350	262	WB LT	1000+	112
NB Thru	1500	407	WB Thru	1000+	451
NB RT	1500	293	WB RT	120	34
SB Thru[1]	350	149	NB LT	750	63
7th at Chambers			NB Thru	750	243
EB Thru	1100	438	SB Thru	1150	572
NB Thru	400	316	**13th at Garfield**		
SB LT	300	82	EB Thru	350	91
SB Thru	300	292	NB Thru	1000+	60
7th at Polk			NB RT	200	3
EB Thru	1500	135	**13th at Chambers**		
NB Thru	400	62	EB Thru	1300	118
NB RT	250	68	EB RT	250	35
SB LT	150	33	NB Thru	1000+	253
SB Thru	300	86	NB RT	250	41
11th at Garfield			SB LT	750	26
EB LT	1000+	321	SB Thru	750	311
EB RT	310	143			
W B LT	1250	106			
WB Thru	1250	537			
NB Thru	800	82			
SB Thru	1500	126			
SB RT	1500	244			

1. Unequal lane distribution results in the queue occupying the entire right lane between 6th and 7th.
2. 11th at Chambers was modeled as two westbound through lanes with an exclusive right turn bay and exclusive left turn bay. This approach best reflected through vehicles avoiding the third through lane due to left turn queues.

Future No Build

The Future No Build scenario reflects anticipated 2024 conditions in the study area. The data and analysis results for this scenario are presented in the following sections.

Lane Geometry

For the 2024 Future No Build scenario, the lane geometry remained the same as 2004. Therefore, Figure 2 is used here as the reference for 2024 lane geometry.

Currently, there is a safety improvement project on Garfield extending from 6th Avenue to 7th Avenue that is underway. A number of preliminary geometric changes have been proposed for this section (refer to Appendix B). At the time of this study, a set of improvements had not been selected for implementation. The analysis of the Future No Build Scenario does not include any of these proposed improvements in the analysis.

Volumes

Future No Build volumes (refer to Figure 4) were estimated by applying a growth rate to the 2004 Base volumes. To arrive at a growth rate, 2002 and 2025 PM-peak hour turning movement volumes were provided by Lane Council of Governments. These volumes were used to estimate an annual growth rate for each movement. The growth rates were then applied to the 2004 Base volumes to arrive at 2024 No Build volumes.

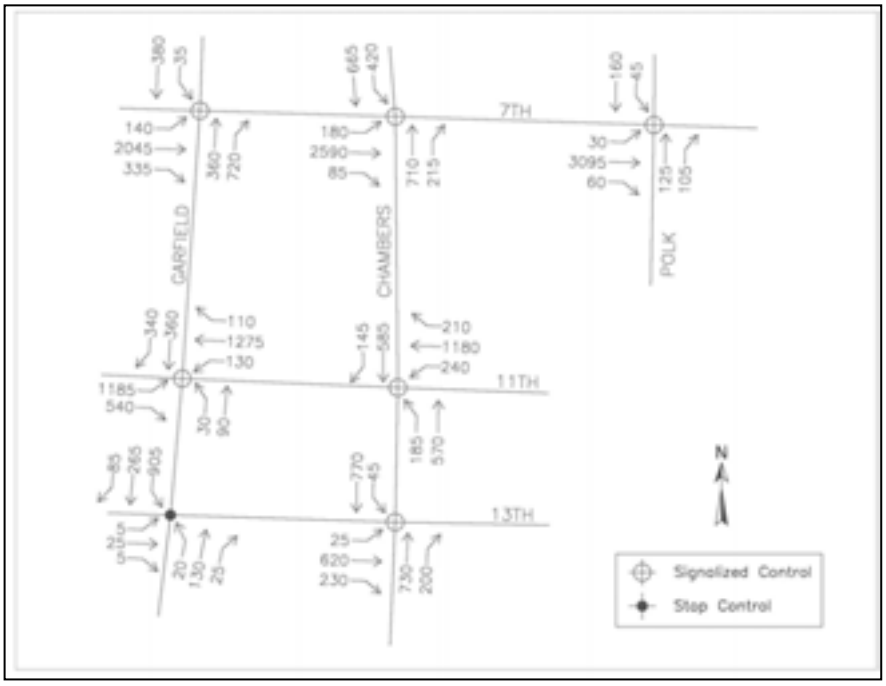


Figure 4. Future (2024) No Build PM-Peak Hour Volumes

Intersection Control

Signal timings were optimized for the Future No Build scenario. Results from the optimization are provided in Appendix B with primary changes listed below:

- Cycle length on 7th Avenue increased from 72 seconds to 100 seconds
- Garfield and Chambers along 11th were coordinated
- Cycle length for 11th at Garfield increased from 97 seconds to 100 seconds
- Cycle length for 11th at Chambers increased from 65 seconds to 100 seconds
- Cycle length for 13th at Chambers increased from 60 seconds to 100 seconds

Analysis Results

Analysis results for the Future No Build scenario are provided in Table 9. Additional details from the analysis are provided in Appendix B.

Table 9. Future (2024) No Build Performance Results

Intersection	Delay (sec/veh)		LOS		v/c-ratio		Stops (stops/hr)	
	2004	2024 No Build	2004	2024 No Build	2004	2024 No Build	2004	2024 No Build
7th at Garfield	20.0	23.0	B	C	0.78	0.89	2714	2745
7th at Chambers	27.5	46.5	C	D	0.90	1.01	3156	4722
7th at Polk	7.7	5.7	A	A	0.59	0.69	966	713
11th at Garfield	42.3	105.4	D	F	0.90	1.15	2181	4613
11th at Chambers	55.8	86.8	E	F	1.06	1.15	2913	3454
13th at Garfield[1]	219.3	Not available	F	F	0.64	2.07	199	209
13th at Chambers	14.3	17.4	B	B	0.64	0.70	1371	1527
Total							13500	17983

1. Unsignalized intersection, delay reported for worst performing movement - Eastbound

The LOS increases for three intersections between 2004 and 2024: 7th at Garfield, 7th at Chambers and Garfield at 11th. The v/c-ratios increased at every intersection. Five of the seven study intersections exceeded the delay and/or v/c-ratio criteria:

- 7th at Garfield
- 7th at Chambers
- 11th at Garfield
- 11th at Chambers
- 13th at Garfield

7th at Garfield operates at a 0.89 v/c-ratio which exceeds the 0.80 criteria. The eastbound through and northbound through are the movements that cause the intersection to exceed the v/c-ratio criteria.

7th at Chambers operates at a demand v/c-ratio of 1.01. All movements at this intersection operate above a 0.80 v/c-ratio. These movements include the northbound though, eastbound through, southbound left and southbound through.

11th at Garfield operates at a demand v/c-ratio of 1.15 which exceeds the 0.80 criteria. The critical movements contributing to this performance include: eastbound left, eastbound right and westbound through.

11th at Chambers exceeds the delay threshold. It operates at a LOS F and a demand v/c-ratio of 1.15. The movements contributing to this performance are: westbound through, northbound left and southbound through.

13th at Garfield continues to exhibit poor performance on the eastbound approach. The eastbound demand v/c-ratio exceeds 2.0. In reality, this v/c-ratio will not be observed in the field. Instead of enduring the associated delays, eastbound left and through vehicles will take an alternate path (e.g., 11th via Arthur) to their destination and avoid this intersection. The eastbound left and through volume remains low at 30 vph.

The number of stops per hour increased by approximately 33 percent between 2004 and 2024. This entire increase in stops was primarily attributed to the increase in stops at two signals: 7th at Chambers and 11th at Garfield.

Queue lengths are reported in Table 10 for the Future No Build scenario. In a number of instances, the queue length is reported as being metered by an upstream signal. If an upstream intersection is operating at a v/c-ratio equal to or greater than 1.0, it will limit the number of vehicles that arrive at the downstream intersection where queues are being reported. This situation is referred to as metering and is labeled as such in Table

10. The "Metered" queues are not expected to exceed the storage capacity. Movements where the queues exceed storage capacity are highlighted with a bold box. These movements include:

- 7th at Garfield
    - Eastbound through
- 7th at Chambers
    - Northbound through
    - Southbound through

Table 10. Future (2024) No Build Queue Lengths

Intersection	Storage (feet)	Queue Length (feet)	
		Base (2004)	Future No Build (2024)
7th at Garfield			
EB Thru	350	262	504
NB Thru	1500	407	Metered
NB RT	1500	293	Metered
SB Thru[1]	350	149	141
7th at Chambers			
EB Thru	1100	438	674
NB Thru	400	316	501
SB LT	300	82	208
SB Thru	300	292	666
7th at Polk			
EB Thru	1500	135	Metered
NB Thru	400	62	125
NB RT	250	68	105
SB LT	150	33	58
SB Thru	300	86	156
11th at Garfield			
EB LT	1000+	321	796
EB RT	310	143	212
WB LT	1250	106	Metered
WB Thru	1250	537	Metered
NB Thru	800	82	85
SB Thru	1500	126	Metered
SB RT	1500	244	Metered
11th at Chambers			
WB LT	1000+	112	184
WB Thru	1000+	451	936
W B RT	120	34	79
NB LT	750	63	Metered
NB Thru	750	243	529
SB Thru	1150	572	Metered
13th at Garfield			
EB Thru	350	91	298
NB Thru	1000+	60	134
NB RT	200	3	8
13th at Chambers			
EB Thru	1300	118	282
EB RT	250	35	95
NB Thru	1000+	253	432
NB RT	250	41	73
SB LT	750	26	Metered
SB Thru	750	311	Metered

1. Current unequal lane distribution in 2004 will likely result in the queue occupying the entire right lane between 6th and 7th in 2024.

PEDESTRIAN ANALYSIS

The pedestrian analysis involved a thorough review of pedestrian facilities in the immediate vicinity of the seven study area intersections. At each intersection, the pedestrian signal control was reviewed, crosswalks inventoried and sidewalks evaluated for width and obstructions that would impede the movement of people.

Pedestrian Signal Control

Pedestrian signal heads were present at all signals. Pedestrians also were allowed to cross every leg of each signalized and unsignalized intersection. Pedestrian push-buttons were available at each signal with two exceptions. At 11th and Chambers, pedestrian push-buttons were only installed for northbound and southbound pedestrians. The eastbound and westbound pedestrian phases are active each cycle, thus push-buttons are not needed. For similar reasons, pedestrian push-buttons are not provided at 13th and Chambers since this signal operates on a fixed timing plan. This type of timing plan automatically activates the pedestrian signal for each phase which eliminates the need for push-buttons.

During a field visit to 7th at Garfield, an issue regarding pedestrian safety was mentioned for northbound pedestrians crossing the east leg. The dual right movement can result in the vehicle in the inside lane obstructing the driver's view in the outside lane. Thus, the visibility of pedestrians in the crosswalk is reduced. One potential solution is to provide an early WALK signal for the pedestrians that allows them to get further into the intersection before the right turns receive a green signal.

The WALK signal for a pedestrian crossing can begin when all conflicting through movements and protected turning movements across the crossing have ended. The signal operations at 11th and Garfield operate slightly different. Pedestrians crossing the east leg only receive the WALK signal when the northbound and southbound throughs receive a green signal. An opportunity exists to reduce the delay for these pedestrians. All eastbound movements are forced to turn either left or right. Therefore, neither movement conflicts with the pedestrians. A WALK signal could be displayed when the eastbound movements initially receive a green.

Crosswalks

Crosswalks are marked at all six signalized intersections. During a field study, however, it was noted that crosswalks are not marked at the unsignalized intersection of 13th and Garfield. Since the southbound throughs and lefts flow freely, marking the crosswalk on the north leg has the potential to create an unsafe situation for pedestrians. In locations where two lanes flow freely in the same direction, a situation could result where a vehicle in one lane stops for a pedestrian in the crosswalk. The

pedestrian begins to cross in front of the stopped vehicle. A vehicle in the adjacent lane approaches and does not see the pedestrians since the motorist's visibility is obstructed by the stopped vehicle. This scenario can result in a collision between a vehicle and pedestrian. Therefore, marking a crosswalk on the legs with free flow movements should be avoided. Marking crosswalks on the west leg of the intersection does not create the situation described above.

(a) West + North Leg

(b) South Leg

(c) East Leg

Figure 5. Pedestrian Crossings at 13th and Garfield

Sidewalks

Sidewalks were inventoried in the vicinity of the seven study area intersections. Missing linkages in the sidewalk system and any obstructions that would restrict the sidewalk width were documented.

The ODOT Highway Design Manual (2003, Chapter 11) identifies the following requirements for sidewalk widths:

- Standard and curb-side sidewalk width – 6 feet
- Minimum sidewalk width – 5 feet
- Minimum passage width – 3 feet (very constrained areas, such as around obstacles that cannot be moved)

All sidewalk widths were at least five feet wide where planting strips existed between the roadway and sidewalk. All curb-side sidewalks were at least six feet wide. Signal and utility poles were the primary obstacles that either encroached or were completely within the sidewalk width. None of these physical obstacles reduced the passage width below three feet (refer to Appendix C for more details on obstacles and available passage distances). The only roadway segment without sidewalks was 7th west of Garfield. Both sides of 7th had a missing sidewalk segment.

Vegetation reduced the clear width of the sidewalk at 11th and Garfield to approximately two feet (refer to Figure 6). The sidewalk is located on the west side of Garfield south of 11th.

Figure 6. Vegetation Encroaching on Sidewalk

Vegetation from overhanging limbs also encroached on the vertical clear space above the sidewalk. This scenario was observed at 13th and Garfield on the south side of 13th west of the intersection. The overhanging limbs are shown in Figure 7. The limbs are roughly six feet above the sidewalk.

Figure 7. Vegetation Restricting Vertical Clear Distance

Transit

Only one bus stop was located in the vicinity of the seven study area intersections. The stop was located on the north side of 11th west of Chambers (refer to Figure 8). The American with Disabilities Act requires a 8.5 foot landing for passengers entering and exiting a bus (ODOT Highway Design Manual, 2003, Chapter 11). The sidewalk at the transit stop is nine feet wide, which satisfies the ADA requirement. Additional transit data is provided in Appendix D.

Figure 8. Transit Stop

SAFETY ANALYSIS

The traffic safety analysis is based on DMV reported collision data for the study area from 1998 through 2002 that the City of Eugene provided to the consultant team. Additional details regarding collision statistics can be found in Appendix E. An annual average of 55 collisions per year was observed at the seven study area intersections between 1998 and 2002. This corresponds to an annual intersection average of 7.8 collisions per intersection. Figure 9 depicts the annual collision frequency within the study area. While the number of collisions declined over the time period of 1998 through 2000, it increased again in 2001 before dropping back to the 1999 level in 2002.

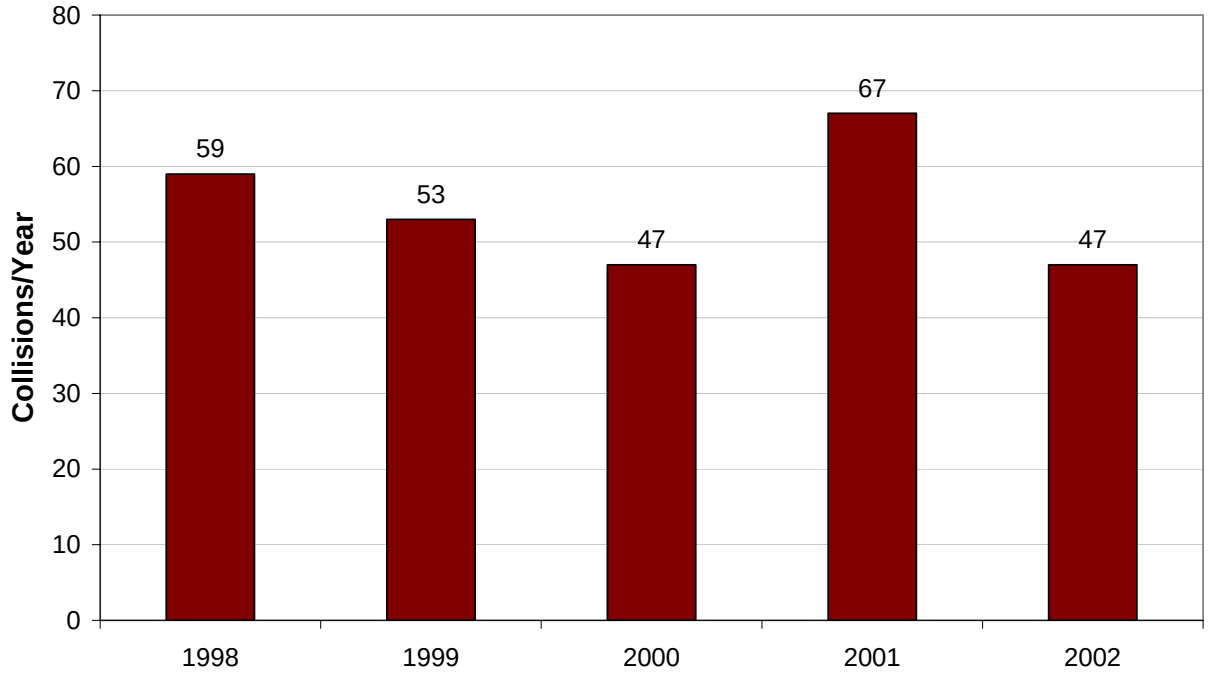


Figure 9. Annual Collision Frequency

When taking into account the traffic volumes at the seven study intersections, the 5-year average collision rate computes to a value between 0.30 and 1.10, with two intersections (7th at Garfield and 11th at Chambers) slightly above the commonly accepted standard of 1.0 collisions per million entering vehicles. Figure 10 below depicts the 5-year collision summary and collision rate for each study intersection.

Collision severity for all seven study intersections is reported in Figure 11 from 1998 to 2002. During this period, no fatalities were reported. Eighty-six injury collisions were report while the remaining 187 collisions were property damage only.

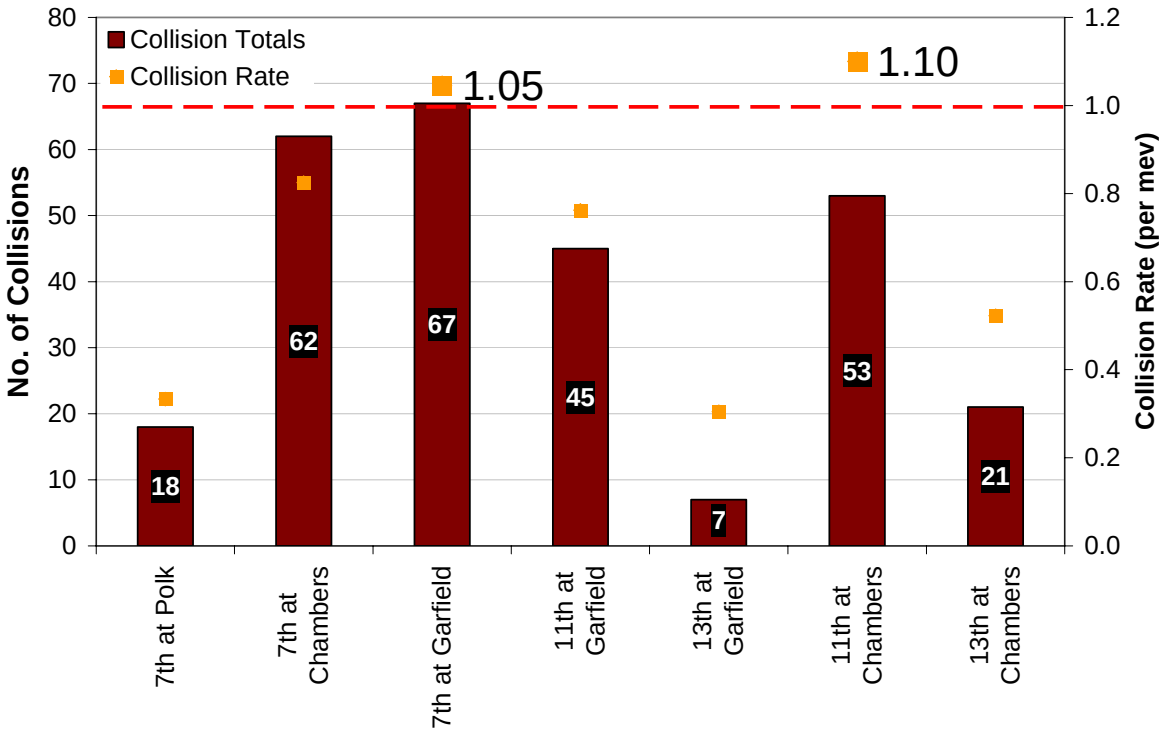


Figure 10. Intersection Collisions and Collision Rates (1998 – 2002)

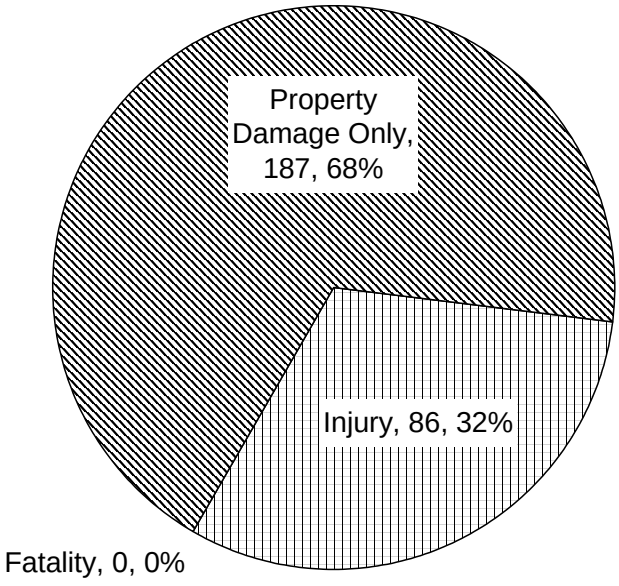


Figure 11. Collision Severity (1998-2002)

A collision classification from 1998 to 2002 reveals that 261 of the 273 reported collisions involved vehicles. Two of the 273 collisions involved pedestrians and 10 involved bicyclists. Figure 12 classifies collisions by mode during this 5-year period.

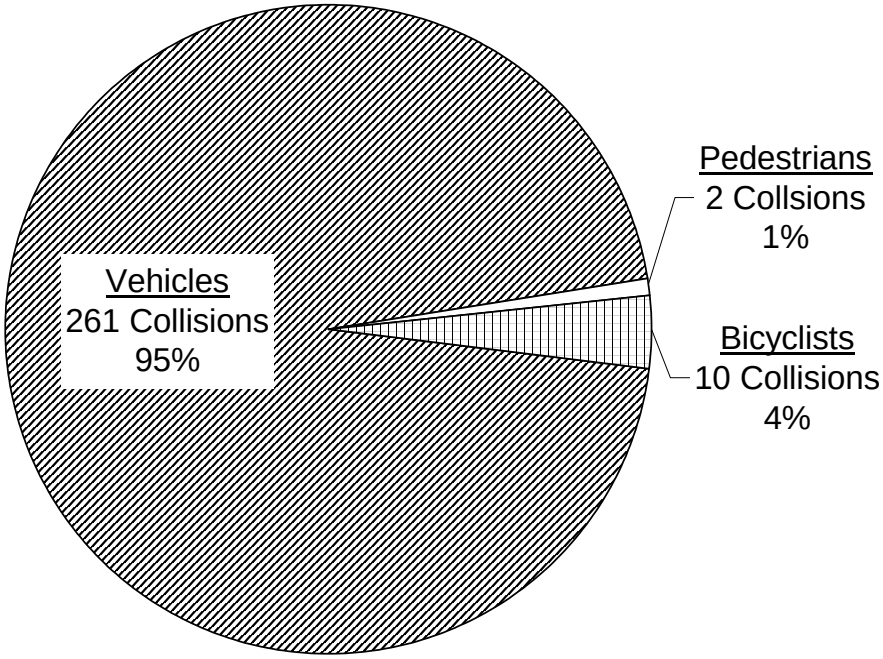


Figure 12. Collisions by Mode of Travel (1998-2002)

Evaluating the past collision history for collision types reveals that rear-end collisions are the predominant collision type at the study intersections. The main reason for rear-end collisions is traffic congestion. The only exception to this finding is the intersection of 13th and Garfield, which also exhibits a significantly lower peak flow than all other studied intersections. Furthermore, the analysis shows that side-swipe collisions are very common at the intersection of 7th and Garfield. Many of those collisions appear to have occurred at the eastbound exit of the actual intersection and thus are most likely the result of weaving maneuvers for downstream intersection lane utilization. At the intersection of 7th and Chambers, right angle collisions show a significant frequency which could be the result of red light running associated with the intersection operating at a high degree of saturation. Figure 13 below depicts the number of collisions by collision type for each of the study intersections.

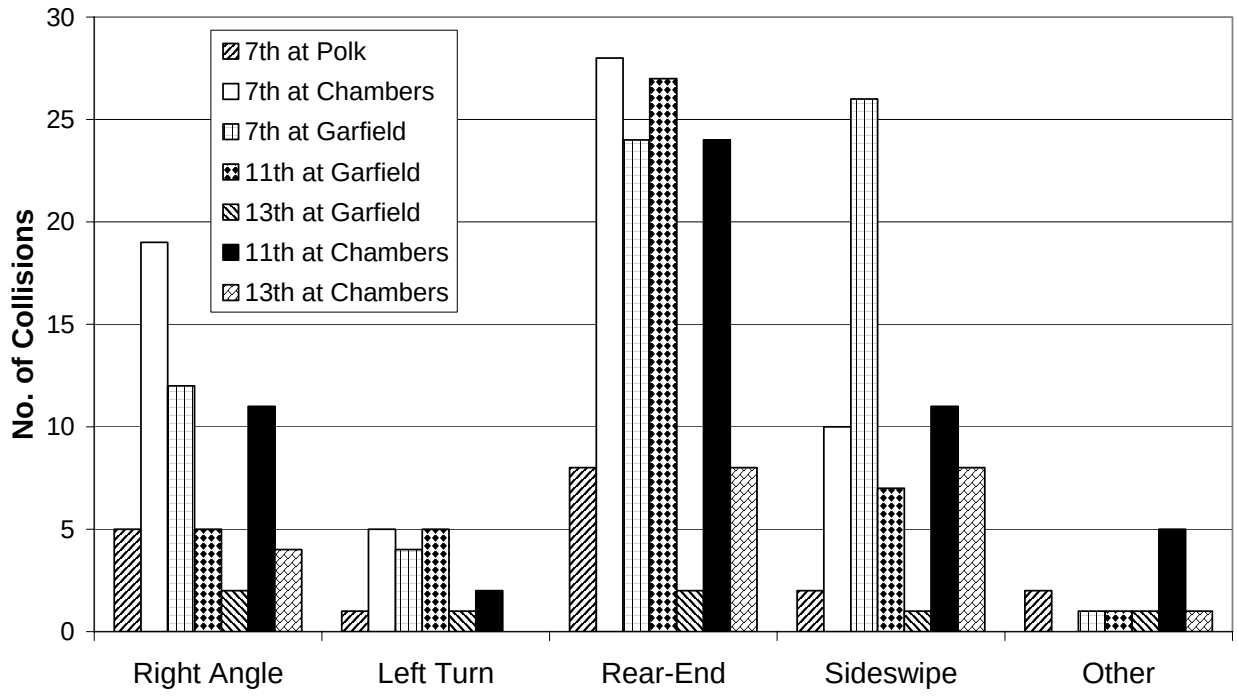


Figure 13. 5-Year Collision Type Summary

RECOMMENDATIONS

A summary of the operational and safety issues is shown in Table 11. A section is dedicated to traffic and pedestrian mitigation measures. All mitigation analysis results related to traffic operations are located in Appendix F.

Policy vs. Context Sensitive Driven Design

Prior to discussing the results, it is important to present the approach used to develop the recommendations presented in the following sections. An initial set of recommendations were developed for each intersection that warranted improvements. This initial set is referred to as the Policy Driven Solution since it strives to satisfy traffic operations standards outlined in policy documents (e.g., Oregon Highway Plan). Realizing that the resulting Policy Driven Solutions are not compatible with the desires of the neighborhood, a second analysis is performed that considers the desires of the neighborhood and the environment they want to maintain. This second set is referred to as the Context Sensitive Solution. It is also the solution that is recommended for implementation at each intersection. Some additional background on the differences between a Policy and Context Sensitive Driven design are presented prior to presenting the recommendations.

Policy Driven Design

Recommendations to improve mobility within an area such as Chambers need to consider the multi-modal nature of the transportation system. Today, however, the Policy driven analysis requirements and resulting design recommendations do not consider the context of the area being studied. Instead, they primarily focus on vehicular traffic. The result is less traffic congestion (commonly through the addition of more lanes), but typically at the expense of a pedestrian friendly environment (refer to Figure 14). Improving traffic operations also makes it less rewarding for motorists to cut through the neighborhood to avoid delays and congestion.

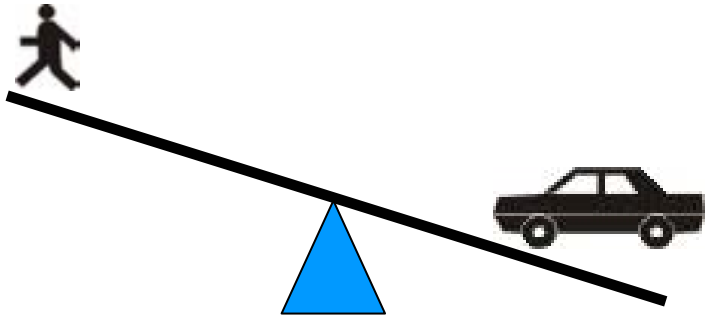


Figure 14. Policy Driven Design – Weighted Toward Vehicular Traffic

Context Sensitive Driven Design

A Context Sensitive analysis and design are aimed at providing a greater balance between the needs of pedestrians and vehicular traffic (refer to Figure 15). The result leads to a more pedestrian friendly set of recommendations than the Policy driven approach. Consequently, the trade-offs are usually a greater degree of traffic congestion and an increased potential for neighborhood cut through traffic. Disincentives on the local street network may be required to make it less rewarding to cut through the neighborhood.

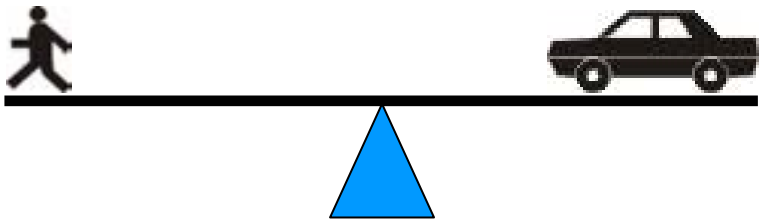


Figure 15. Context Sensitive Driven Design – Balanced Between Pedestrians and Vehicular Traffic

Table 11. Summary of Operational and Safety Issues

Intersection[1]	OPERATIONAL ISSUES						SAFETY ISSUES
	Delay > LOS D		v/c-Ratio > 0.85		Queue Lengths > Storage		
	2004	2024	2004	2024	2004	2024	
7th at Garfield				X			- Right angle
EB Thru						X	- Side-swipe-NB, EB
7th at Chambers			X	X			- Right angle
EB Thru							
NB Thru						X	
SB LT							
SB Thru						X	
11th at Garfield		X	X	X			
EB LT							
EB RT							
WB Thru							
11th at Chambers	X	X	X	X			- Right angle
WB Thru							- Side-swipe-WB
NB LT							
SB Thru							
13th at Garfield	X	X		X			
EB Thru							

1. Movements contributing to the operational issues at the intersection are listed in the first column.

Traffic

7th at Garfield

The eastbound through and northbound through are the primary movements contributing to the operational issues at this intersection in 2024. By operating at a v/c-ratio of 0.89, the intersection as a whole exceeds the 0.80 v/c-ratio criteria.

One method to reduce the v/c-ratio at an intersection, and the potential for cut-through traffic, is to increase geometric capacity. Increasing the geometric capacity (e.g., adding turn lanes) for a given movement can simultaneously result in a reduction in green time while still reducing the v/c-ratio. Expanding the northbound approach to an exclusive through lane and two exclusive right turn lanes was analyzed as a potential Policy mitigation strategy (refer to Figure 16). This strategy reduced the intersection v/c-ratio to 0.79 (refer to Appendix F). It also allowed the green time for the eastbound through to be increased by five seconds which reduced its v/c-ratio to 0.83. The five seconds came from the northbound and southbound phases. Even with the 5-second reduction in green time, the v/c-ratios for these movements were reduced due to the increased capacity added by the change in lane configurations. This strategy, however, did not reduce the eastbound queue to a point where it would not extend into the West 7th Place intersection on occasion.

Realizing the importance of pedestrian mobility within the Chambers study area, a more pedestrian friendly approach was considered for the south and east legs of the intersection. It is shown in Figure 16 and was originally conceived in Proposal 1 of the Safety Improvement Project illustrated in Appendix B. The design would physically remove the issues that restrict the visibility of pedestrians for motorists in the northbound dual right turn lanes. It would also reduce the pedestrian crossing distance on the south leg.

Right-angle and side-swipe collisions were also frequent at 7th and Garfield. Twelve right angle collisions occurred at this intersection during the five year review period. Providing an all red clearance interval is a proven strategy to reduce right angle collisions. Therefore, a ½-second all red clearance interval following the amber for each phase is recommended.

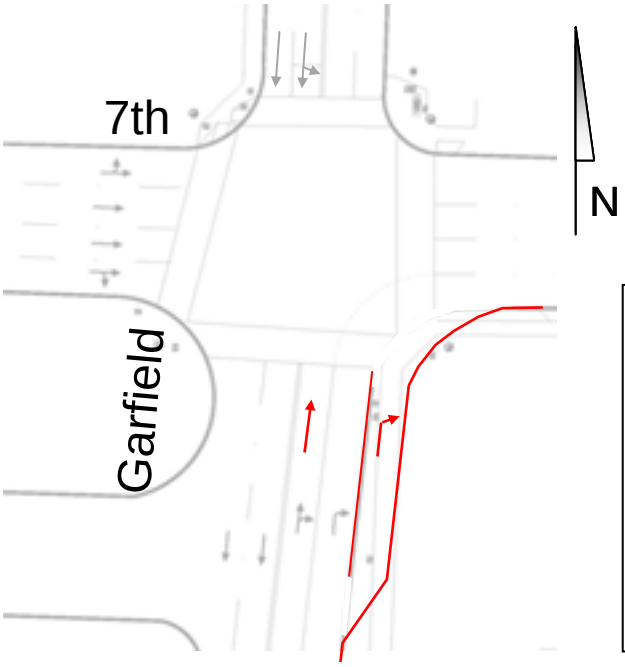
Side-swipe overtaking collisions were also prevalent on the eastbound and northbound approaches. The eastbound collisions are possibly due to weaving from traffic entering from West 7th Place which is approximately 350 east of Garfield on 7th. West 7th Place is a three lane facility where it enters West 7th Avenue at an angle. A potential solution is to guide the three lanes of traffic entering from West 7th Place by using dashed lines as they transition onto West 7th Avenue. The dashed lines are intended to keep the motorists in their lane during this transition.

The northbound side-swipe collisions are likely due to the right turn trap lane. Once northbound through motorists realize they are in the right turn trap lane, they attempt to change lanes. This maneuver when done with a sense of urgency in close proximity to the intersection can result in side-swipe collisions. A potential solution is to extend and to modify the solid white lane line delineating the right turn lane further to the south. To further increase awareness of the trap lane the four inch solid white line could be replaced with lane drop markings ("elephant tracks") that are eight inches wide and three feet long with a nine foot gap. Right turn lane markings and signing already exist on the approach.

As summarized in Table 12, the proposed mitigation measures achieve the delay and v/c-ratio criteria. In addition, the number of stops at the intersection are reduced which has the potential to reduce rear-end collisions.

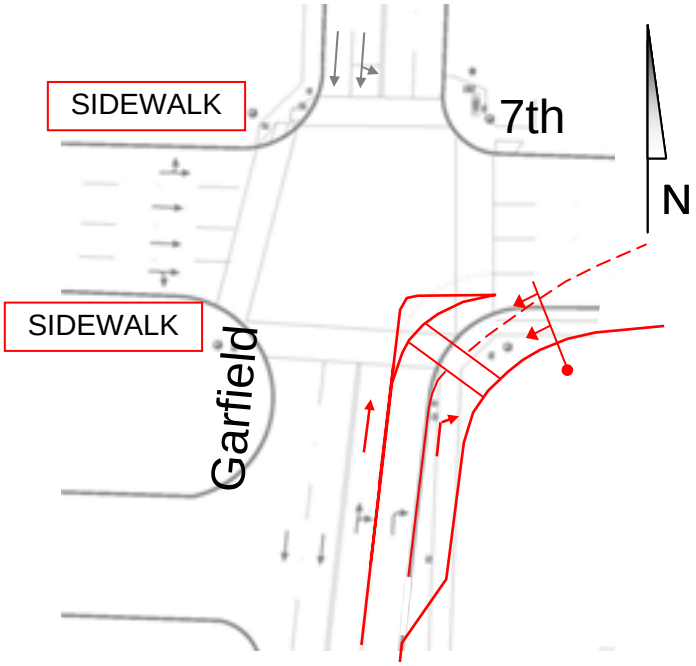
Table 12. 7th at Garfield Performance Summary with Mitigation

Measures of Effectiveness	2004	2024 No Build	2024 Context Sensitive
Delay (sec/veh)	20.0	23.0	18.8
LOS	B	C	B
v/c-ratio	0.78	0.89	0.79
Stops (stops/hr)	2714	2745	2589



- Optimize timings
- Add ½ second all red
  (12 right angle collisions)
- Restripe EB markings from 7th Pl. onto 7th Ave.
  (16 sideswipe collisions)
- Extend NB right turn solid lane line
  (7 sideswipe collisions)

(a) Policy Driven Solution



- Optimize timings
- Add ½ second all red
  (12 right angle collisions)
- Restripe EB markings from 7th Pl. onto 7th Ave.
  (16 sideswipe collisions)
- Extend NB right turn solid lane line
  (7 sideswipe collisions)

(b) Context Sensitive Solution – Recommended

Figure 16. Lane Configurations – 7th at Garfield

7th at Chambers

This intersection operates at a LOS D and a v/c-ratio of 1.01 in 2024. All movements operate above a 0.90 v/ c-ratio.

The Policy strategy (refer to Figure 17) requires a rather substantial increase in right-of-way at the intersection in order to approach a v/c-ratio of 0.80. Even with the following geometric improvements (in order of preference), the intersection remained above the v/c-ratio criteria of 0.80:

- Southbound through lane
- Northbound right turn bay
- Eastbound right turn bay
- Eastbound left turn bay

The Context Sensitive solution which does not involve any widening of 7th, reduces the intersection v/c-ratio to 0.90. These mitigation measures also result in the southbound queue not exceeding the storage area. The northbound queue is also reduced. However, since this movement is at capacity, the queue may still extend into West 8th Avenue.

Adding an additional southbound through lane on Chambers would likely be the most challenging improvement. Currently, northbound Chambers flares to two northbound lanes (though, through and right) at West 7th. Adding the southbound through lane would balance the lanes at this intersection. However, continuing the lane further south would require at a minimum restriping Chambers between 7th and 8th. A concrete and painted median exist on the south leg (refer to Figure 18) that could be removed to provide a second through lane. The additional through lane could be terminated (1) at 8th as either a left turn or right turn trap lane or (2) prior to 8th by merging the two lanes to one.

7th at Chambers had the highest number of right-angle collisions of the seven study area intersections with 19. Providing a ½-second all red clearance interval following the amber for each phase is recommended.

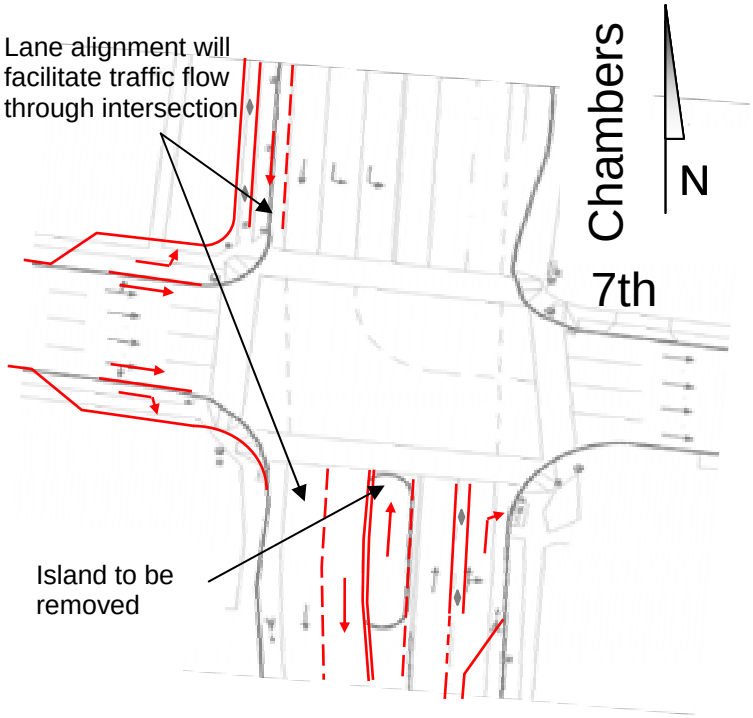
Figure 18. 7th at Chambers – South Leg Looking South

Table 13 summarizes the improvements resulting from the mitigation measures.

Intersection operations satisfy both the LOS and v/c-ratio criteria. The number of stops at the intersection are also reduced which reduces the potential for rear-end collisions.

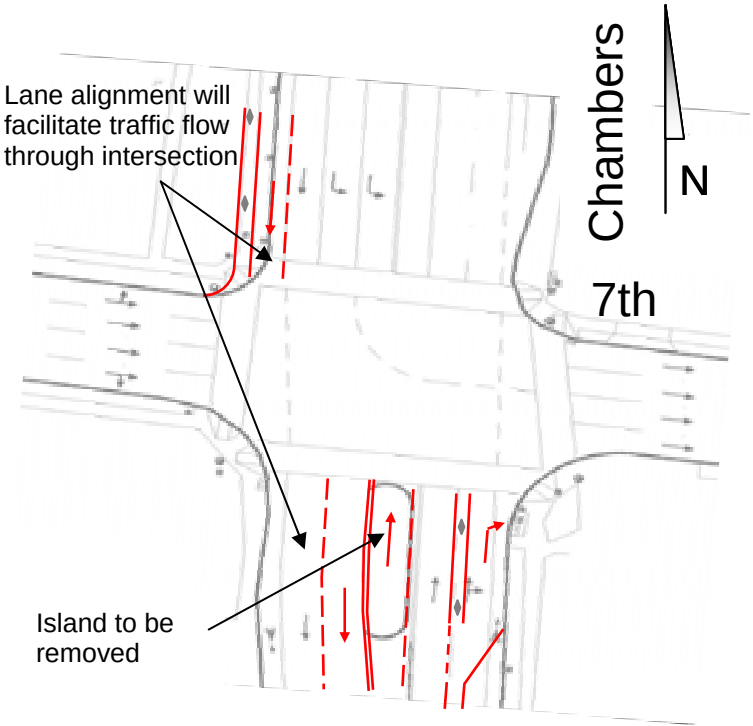
Table 13. 7th at Chambers Performance Summary with Mitigation

Measures of Effectiveness	2004	2024 No Build	2024 Context Sensitive
Delay (sec/veh)	27.5	46.5	28.1
LOS	C	D	C
v/c-ratio	0.90	1.01	0.90
Stops (stops/hr)	3156	4722	3275



- Optimize timings
- Add ½ second all red *(19 right angle collisions)*

(a) Policy Driven Solution



- Optimize timings
- Add ½ second all red *(19 right angle collisions)*

(b) Context Sensitive Solution – Recommended

Figure 17. Lane Configurations – 7th at Chambers

11th at Garfield

11th at Garfield currently operates LOS D and a v/c-ratio of 0.94, which already exceeds the v/c-ratio criteria. The intersection operates at LOS F and a demand v/c-ratio of 1.15 in 2024. The primary movements contributing to this performance are the eastbound lefts and westbound throughs.

A number of strategies were considered to improve intersection operations. These strategies included:

- Adding eastbound through lanes and converting 11th between Garfield and Chambers to 2-way
- Rerouting portions of the eastbound lefts and rights at Garfield to eastbound lefts and rights at Chambers
- Increasing the cycle length
- Rearranging the phasing
- Adding a westbound right turn bay

None of these strategies resulted in the intersection operating below capacity. Additional discussions with the City of Eugene regarding this intersection are recommended. Since the potential strategies above did not produce meaningful benefits, improvements are not recommended at this time.

11th at Chambers

11th at Chambers operates at LOS E in 2004 and Los F in 2024. The v/c-ratio increases from 1.06 in 2004 to 1.15 in 2024. The main movements responsible for this operation are the westbound through, southbound through and northbound left.

Adding a westbound left turn bay (refer to Figure 19) improved the intersection to LOS D and a v/c-ratio to 0.96. Even though the intersection as a whole satisfies the City's LOS criteria, SB motorists will experience roughly 1 minute of delay on average. The queues will also back up and block motorists who live on 10th and 9th from getting onto and off of Chambers. Therefore, the context sensitive solution also recommends converting the center 2-way left turn lane to a southbound through lane to improve mobility within the vicinity of 11th and Chambers and improve access to businesses. This improvement also requires removing northbound left turns from the intersection. Combined, these improvements reduce southbound delay to less than 10 seconds per vehicle and queues are consistently shorter than the distance to 10th.

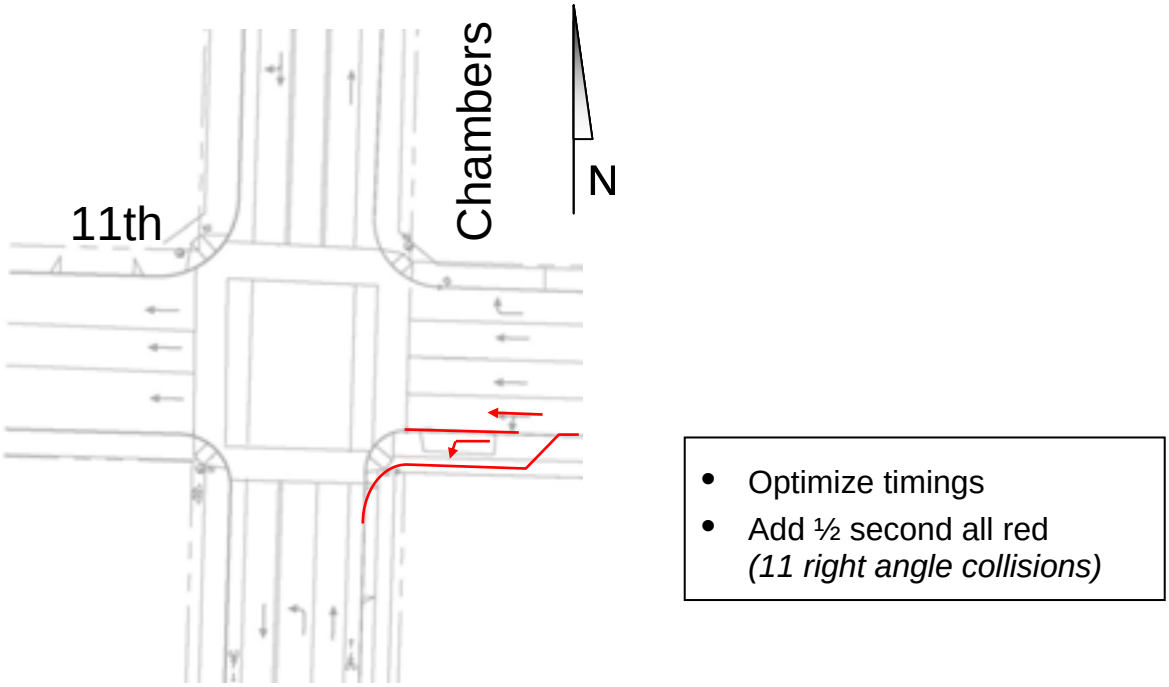
Eleven right angle collisions were reported at this intersection during the 5-year review period. An all-red clearance of a ½-second is recommended after the amber of each phase to address this collision type.

The other reported collision pattern was eight westbound sideswipe collisions. There were three sideswipes in 1998 and 1999. This collision pattern tapered off to one in 2000 and one in 2002. A field investigation did not reveal any potential reason for these collisions. Due to the reduction in this collision pattern, mitigation measures are not recommended at this time.

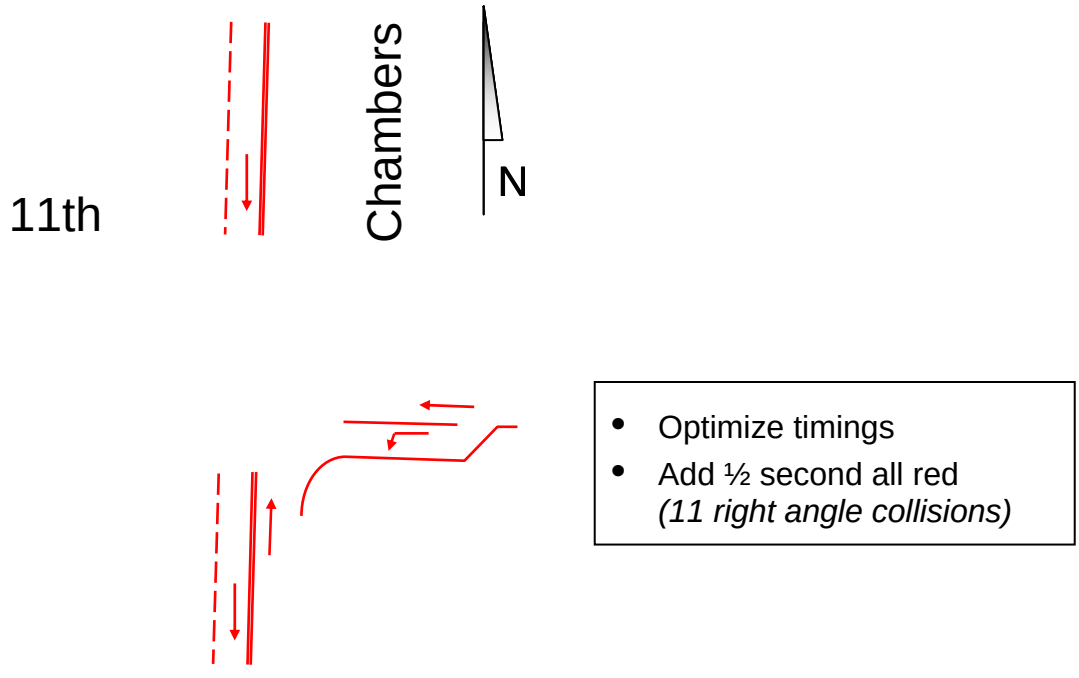
Table 14 summarizes the improved performance resulting from the mitigation measures. The mitigation measures satisfy the LOS and v/c-ratio criteria and reduce the number of stops.

Table 14. 11th at Chambers Performance Summary with Mitigation

Measures of Effectiveness	2004	2024 No Build	2024 Context Sensitive
Delay (sec/veh)	55.8	86.8	21.8
LOS	E	F	C
v/c-ratio	1.06	1.15	0.81
Stops (stops/hr)	2913	3454	1985



(a) Policy Driven Solution



(b) Context Sensitive Solution – Recommended

Figure 19. Lane Configurations – 11th at Chambers

13th at Garfield

The eastbound through and left turn movements cause 13th at Garfield to operate at LOS F and above capacity in 2004 and 2024. The total volume for the eastbound lefts and throughs is below 30 vph in PM-peak hour. Given the relatively low volume and alternate route along Arthur to West 11th for these movements, no traffic improvements are recommended at this time.

11th – Garfield to Chambers

The Draft Chambers Nodal Development Plan (June, 1999) included a recommendation to convert West 11th Avenue from one-way to two-way traffic between Chambers and Garfield. The recommended conversion was part of a strategy to revitalize the commercial area by improving pedestrian conditions along the street by introducing on-street parking within parking bays, street tree plantings, pedestrian islands at intersections, and curb extensions where possible to reduce the length of crosswalks. Because the plan was abandoned before it went to public hearing, the recommendation was never brought forward.

The pedestrian crossing improvement at Garfield and West 11th suggested above would be negated and, frankly, would be made unnecessary by a two-way conversion of 11th. The two-way conversion proposal should be reintroduced at some point to stimulate further discussion and allow continued analysis of the impacts of that improvement.

The traffic analysis, which typically focuses on capacity and level of service aspects of the roadway network, did not indicate any perceptible benefits to the conversion of West 11th between Garfield and Chambers to two-way operation. However, while benefits may be difficult to quantify from a level of service standpoint, there are advantages to reducing turning movements, simplifying circuitous routing and providing additional circulation for traffic particularly when adjacent land uses are commercial or mixed use in nature. For instance, eastbound traffic destined for Chambers Street south of 13th Avenue must currently turn right from West 11th to Garfield, weave one lane over to turn left at West 13th Avenue, weave one lane over to turn right at Chambers Street. The three block conversion of West 11th to two-way operation would replace this movement with a single right turn and no subsequent weaving maneuvers or additional turns.

Pedestrians

7th at Garfield

During a field visit, an issue regarding pedestrian safety was mentioned for northbound pedestrians crossing the east leg of the intersection. The dual right movement can result in the vehicle in the inside lane obstructing the driver's view in the outside lane. Thus, the visibility of pedestrians in the crosswalk is reduced. One solution is to provide an early WALK signal for the pedestrians that allows them to get further into the intersection before the right turns receive a green signal. An early green of five seconds would allow the pedestrians adequate time to establish themselves in the crosswalk prior to the right turns receiving a green signal.

If the above strategy does not produce the desired safety improvement for pedestrians, a more substantial improvement would be implementing Proposal 1 of the Safety Improvement Project illustrated in Appendix B. The design would remove the issues that restrict the visibility of pedestrians for the dual right.

Sidewalks should be added to the north and south side of 7th west of Garfield. These sidewalk sections would complete the linkage between the existing sidewalks to the east and further to west at 7th Place.

11th at Garfield

The firmware used at 11th and Garfield to control the signal timing should be investigated to determine if it can provide a pedestrian overlap phase on the east leg. The pedestrians on this leg currently only receive a WALK signal when the northbound and southbound traffic movements receive a green signal. If possible with the controller firmware, these pedestrians could receive a substantially longer WALK signal by allowing them to cross when the eastbound movements receive a green signal. This operation would reduce pedestrian delay on this leg of the intersection.

Vegetation reduces the clear width of the sidewalk to roughly two feet on the west side of Garfield south of 11th. This vegetation should be cut back to provide the full 5-foot sidewalk width.

13th at Garfield

Sidewalk bulbs are recommended to shorten the pedestrian crossing distances. These bulbs are recommended in the northwest and southwest corners (refer to Figure 20). A bulb is not recommended for the southeast corners since the resulting turning radius would be too short for a bus to make a northbound right turn.

In addition, to enhance the awareness of pedestrians, a crosswalk should be painted on the west leg. Painting crosswalks on the other legs that service free flow movements could potentially reduce the safety for pedestrians.

Currently, limbs overhang into the space above the sidewalk on the south side of 13th west of Garfield. Although these limbs are not a major hindrance to pedestrians using the sidewalk, they should be trimmed and maintained to provide at least seven feet of clear distance.

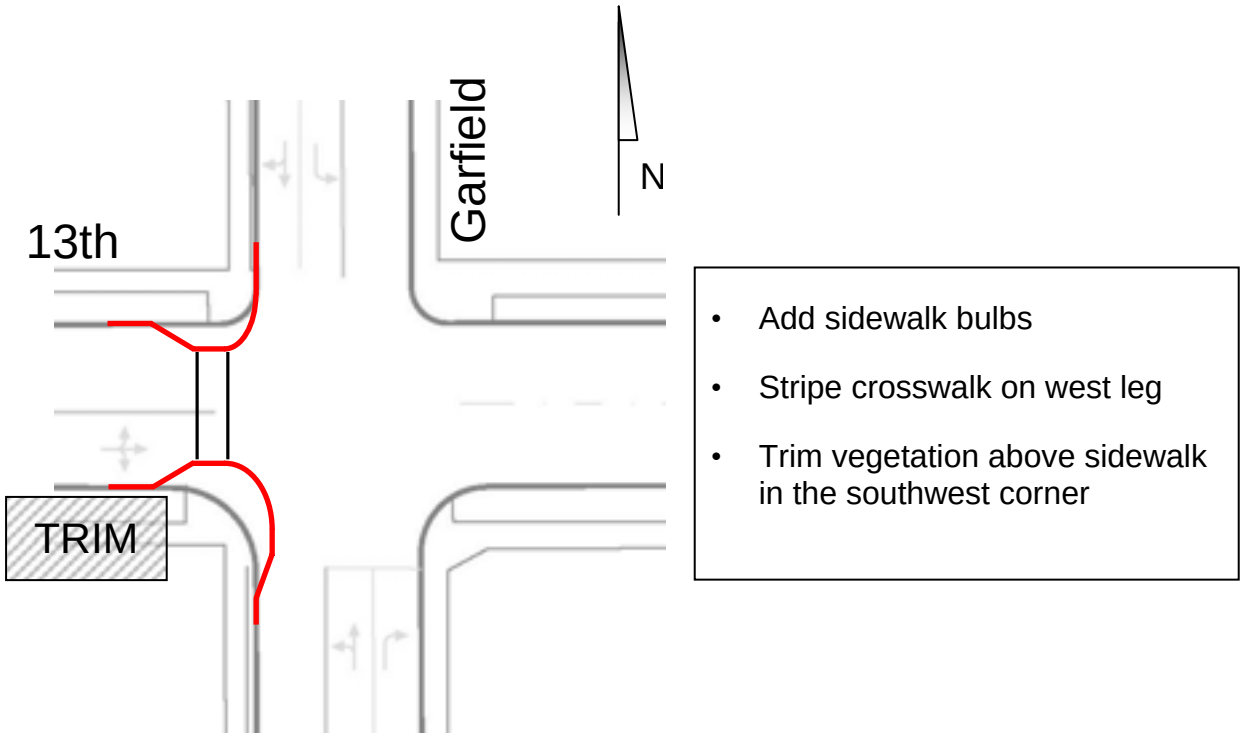


Figure 20. Context Sensitive Design – 13th at Garfield

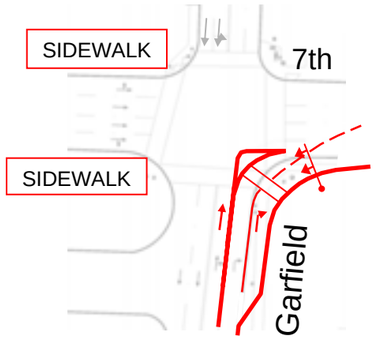
Summary

Recommendations to improve operations and pedestrian safety are summarized in Table 15 and illustrated in Figure 21. It is important to mention that many of the recommendations that reduce traffic congestion and delays also have the benefit of reducing the potential for neighborhood cut-through traffic. Any recommendations aimed at improving operations, and especially safety, should be reviewed after implementation to monitor their success in achieving the desired performance and safety.

Table 15. Operations and Pedestrian Safety Recommendations

Intersection	Traffic	Pedestrians
7th at Garfield	1. Expand northbound approach from a shared through and right and exclusive right to an exclusive through lane and dual right turn lanes with island 2. Optimize signal timings 3. Add ½-second all red clearance for each phase 4. Add markings to guide eastbound traffic from West 7th Place onto West 7th Avenue 5. Extend and modify ("elephant tracks") northbound solid white lane line to the south	1. Shorten pedestrian crossing distance by adding an island to channelize dual northbound right turn 2. Control northbound right turn with a signal 3. Add sidewalks on north and south sides of 7th west of Garfield
7th at Chambers	1. Add northbound right turn bay 2. Add southbound through lane 3. Optimize signal timing 4. Add ½-second all red clearance for each phase	
7th at Polk	1. Intersection operates satisfactorily – optimize timings	
11th at Garfield	1. Although intersection operates below LOS and v/c-ratio criteria, all analyzed strategies did not improve operations. Other than optimizing timings, no other traffic improvements are recommended at this time.	1. Provide pedestrian overlap phase for pedestrians crossing east leg 2. Remove vegetation overgrowing on sidewalk on the west side of Garfield south of 11th
11th at Chambers	1. Add westbound left turn bay 2. Add southbound through lane carried through intersection 3. Remove northbound left turn movement 4. Optimize timings 5. Add ½-second all red clearance for each phase	
13th at Garfield[1]		1. Add sidewalk bulbs in northwest and southwest corners 2. Stripe crosswalk on west leg 3. Cut back limbs overgrowing above sidewalk on the south side of 13th west of Garfield
13th at Chambers	1. Intersection operates satisfactorily – optimize timings	
11th: Garfield to Chambers	1. Further investigate converting 11th to 2-way between Garfield and Chambers	

1. Unsignalized intersection.



LEGEND

- Study Area Boundary
- Sidewalk Improvement
- Study Intersection
- Intersection-Traffic Improvement
- Intersection-Pedestrian Improvement
- Median Island – Pedestrian/Bike Refuge

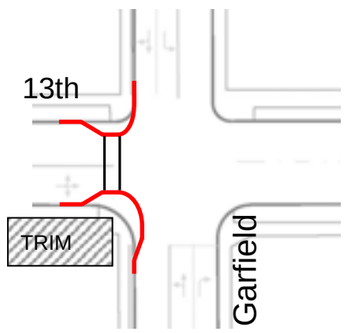
N

7th at Garfield

- Add ½ second all red *(12 right angle collisions)*
- Restripe EB markings from 7th Pl. onto 7th Ave. *(16 sideswipe collisions)*
- Extend NB right turn solid lane line *(7 sideswipe collisions)*

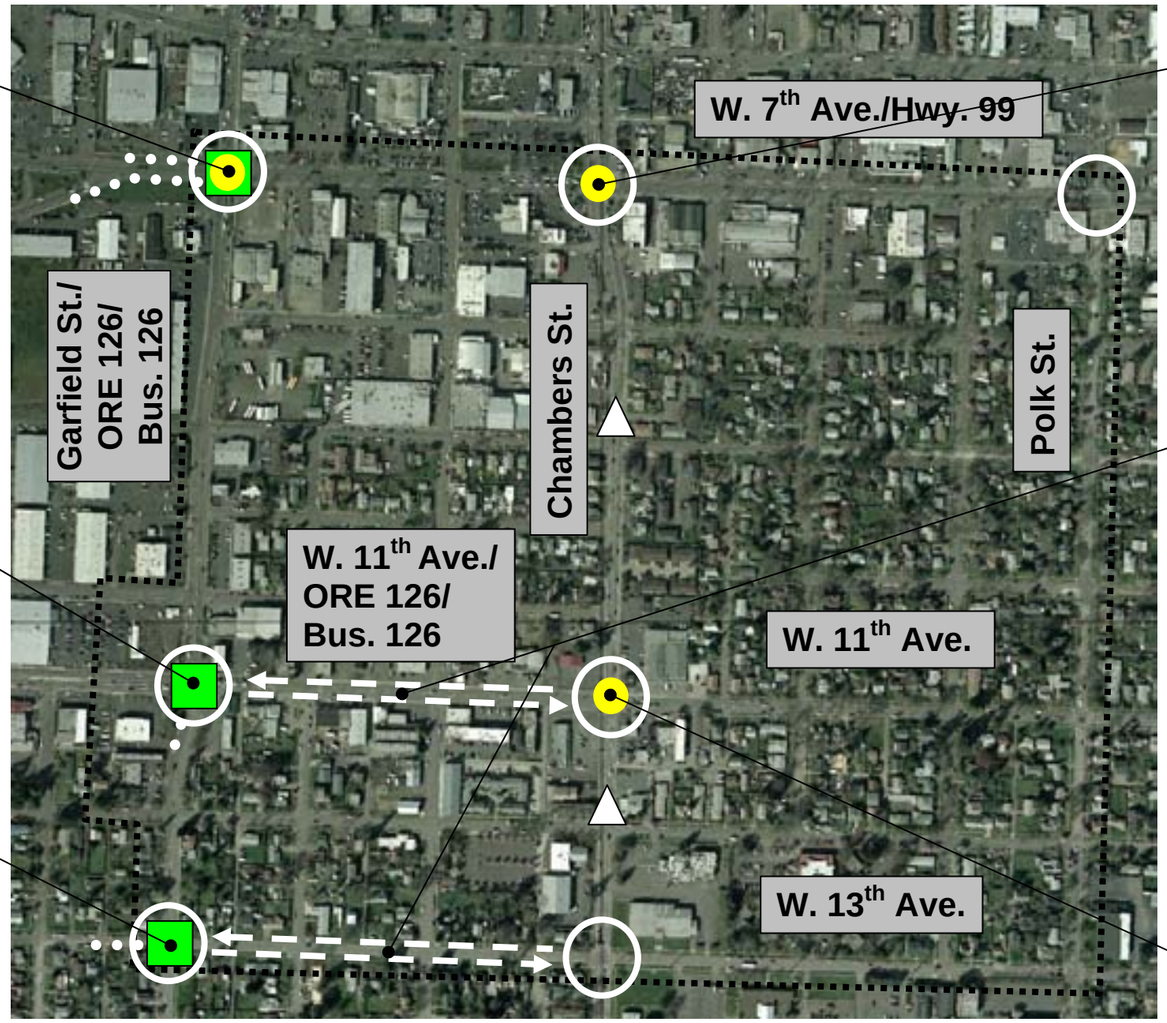
11th at Garfield

- Geometry – no change
- Add pedestrian overlap phase
- Trim vegetation encroaching on sidewalk



13th at Garfield

- Add sidewalk bulbs northwest and southwest corners
- Stripe crosswalk on west leg
- Trim vegetation above sidewalk southwest corner



7th at Chambers

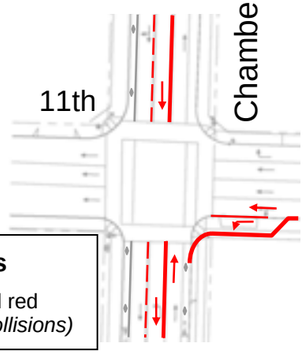
- Add ½ second all red *(19 right angle collisions)*

11th and 13th between Garfield and Chambers

- Future 1-way to 2-way conversion study

All Study Area Signals

- Optimize timings



11th at Chambers

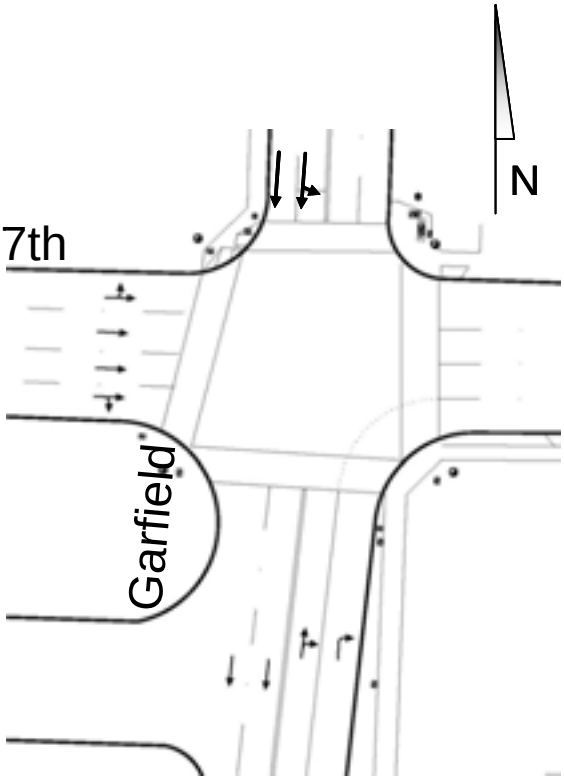
- Add ½ second all red *(11 right angle collisions)*

Figure 21. Operations and Pedestrian Safety Recommendations

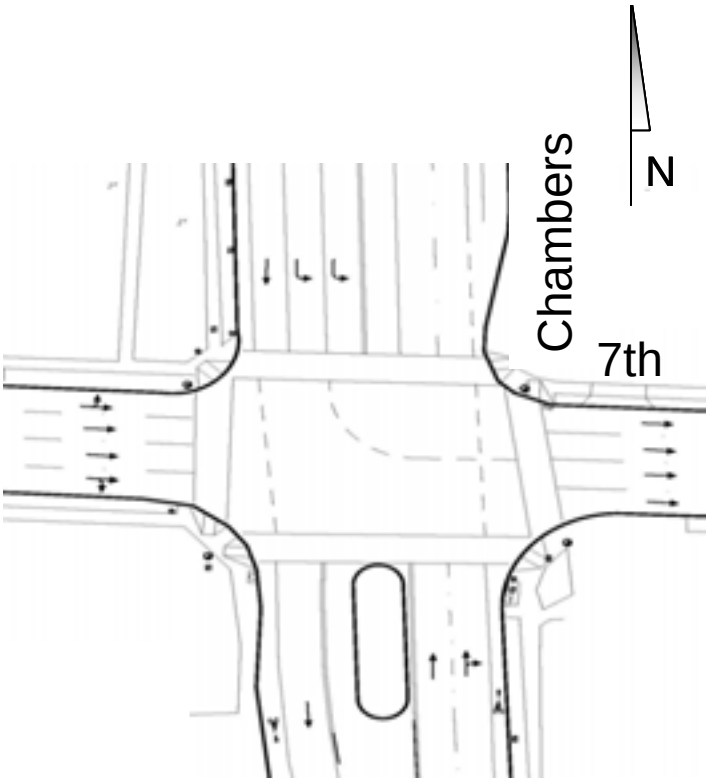
APPENDIX A

BASE (2004)

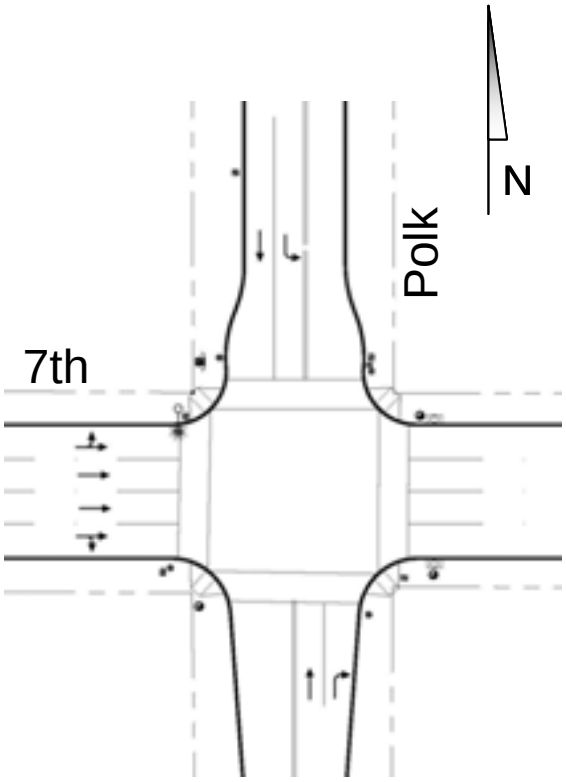
Scenario Data



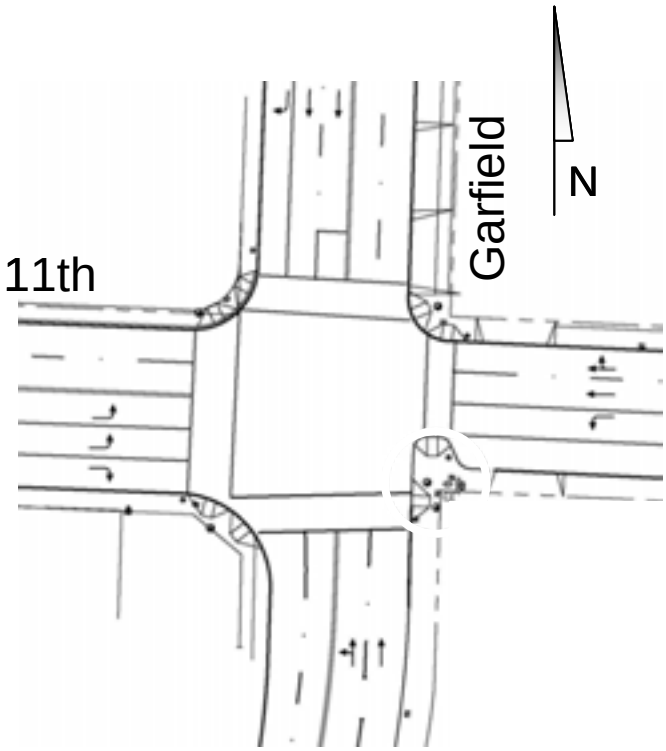
7th at Garfield – Existing (2004) Geometry



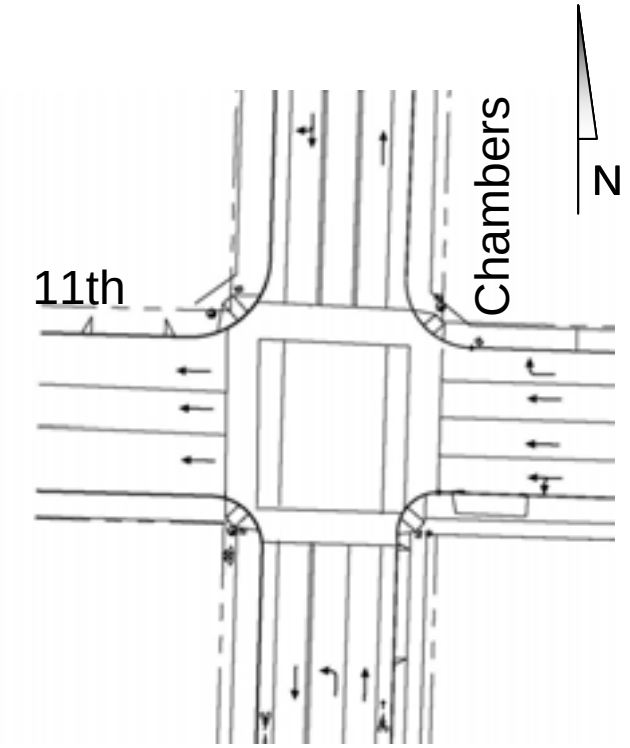
7th at Chambers – Existing (2004) Geometry



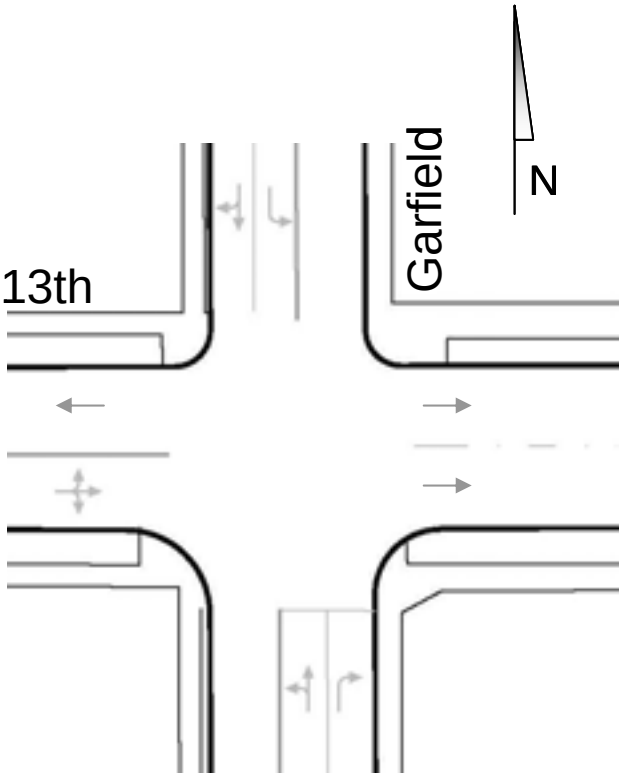
7th at Polk – Existing (2004) Geometry



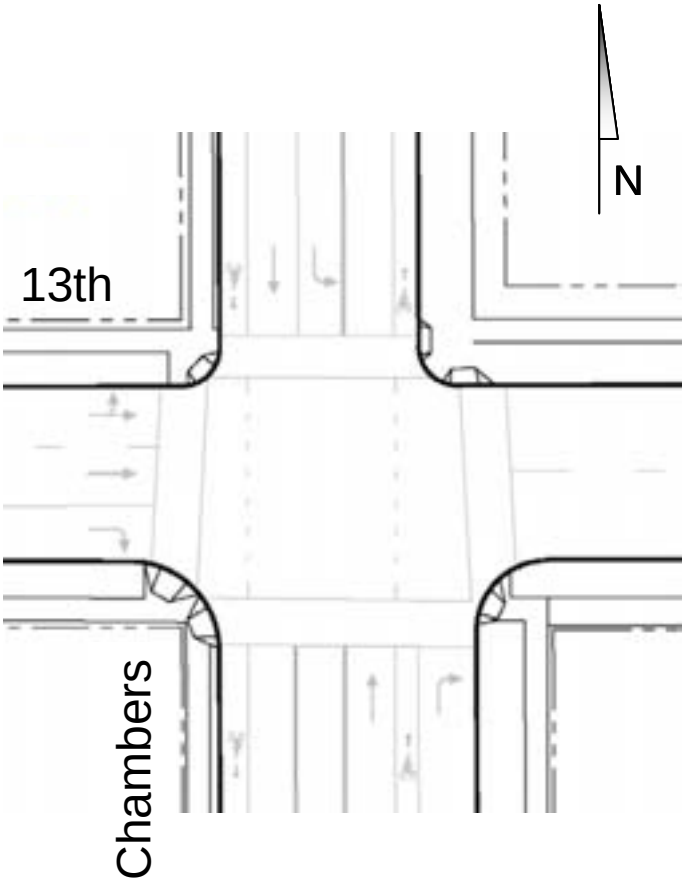
11th at Garfield – Existing (2004) Geometry



11th at Chambers – Existing (2004) Geometry



13th at Garfield – Existing (2004) Geometry



13th at Chambers – Existing (2004) Geometry

Lane Utilization Factors[1]

Measure	11th at Garfield						11th at Chambers		
	EB Left		NB Thru		WB Thru		WB Thru		
	Left Lane	Right Lane	Left Lane	Right Lane	Left Lane	Right Lane	Left Lane	Center Lane	Right Lane
Volume	406	264	31	65	570	441	70	419	457
Proportion	61%	39%	32%	68%	56%	44%	7%	44%	48%
Lane Utilization Factor (f_{LU})[2]	0.83		0.74		0.89		0.69		

1. PM-peak hour
2. Lane utilization factor is equal to the total volume divided by the highest volume lane multiplied by the number of lanes.

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis
10: 7th & Garfield 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0		4.0	
Lane Util. Factor		0.86						0.95	0.95		0.95	
Frpb, ped/bikes		1.00						0.99	0.99		1.00	
Flpb, ped/bikes		1.00						1.00	1.00		1.00	
Frt		0.99						0.91	0.85		1.00	
Flt Protected		1.00						1.00	1.00		1.00	
Satd. Flow (prot)		6321						1611	1498		3530	
Flt Permitted		1.00						1.00	1.00		0.78	
Satd. Flow (perm)		6321						1611	1498		2749	
Volume (vph)	81	1766	109	0	0	0	0	208	763	49	536	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	1920	118	0	0	0	0	226	829	53	583	0
Lane Group Flow (vph)	0	2126	0	0	0	0	0	574	481	0	636	0
Confl. Peds. (#/hr)	2		2						1			
Confl. Bikes (#/hr)			3						1			2
Heavy Vehicles (%)	2%	2%	6%	2%	2%	2%	2%	1%	1%	0%	2%	2%
Turn Type	Perm								Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2								8	4		
Actuated Green, G (s)		32.0						32.0	32.0		32.0	
Effective Green, g (s)		32.0						32.0	32.0		32.0	
Actuated g/C Ratio		0.44						0.44	0.44		0.44	
Clearance Time (s)		4.0						4.0	4.0		4.0	
Vehicle Extension (s)		3.0						2.0	2.0		2.0	
Lane Grp Cap (vph)		2809						716	666		1222	
v/s Ratio Prot								o0.36				
v/s Ratio Perm		0.34							0.32		0.23	
v/c Ratio		0.76						0.80	0.72		0.52	
Uniform Delay, d1		16.7						17.3	16.4		14.5	
Progression Factor		1.00						1.00	1.00		1.00	
Incremental Delay, d2		2.0						9.2	6.7		1.6	
Delay (s)		18.7						26.5	23.0		16.0	
Level of Service		B						C	C		B	
Approach Delay (s)		18.7			0.0			24.9			16.0	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.1%	ICU Level of Service	E

o Critical Lane Group

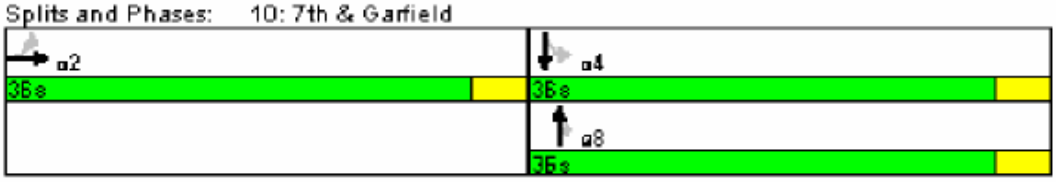
BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

Timings
10: 7th & Garfield 2/25/2005

Lane Group	EBT	NBT	NBR	SBL	SBT
Lane Configurations					
Volume (vph)	1766	208	763	49	536
Turn Type			Perm	Perm	
Protected Phases	2	8			4
Permitted Phases			8	4	
Detector Phases	2	8	8	4	4
Minimum Initial (s)	10.0	3.0	3.0	3.0	3.0
Minimum Split (s)	22.0	29.0	29.0	29.0	29.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0
Total Split (%)	50%	50%	50%	50%	50%
Maximum Green (s)	32.0	32.0	32.0	32.0	32.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	12.0	12.0	12.0	12.0
Pedestrian Calls (#/hr)	0	0	0	0	0

Intersection Summary
Cycle Length: 72
Actuated Cycle Length: 72
Offset: 71 (99%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 10: 7th & Garfield



BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis
2: 7th & Chambers 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		0.86						0.95		0.97	1.00	
Frpb, ped/bikes		1.00						1.00		1.00	1.00	
Flpb, ped/bikes		1.00						1.00		1.00	1.00	
Frt		0.99						0.97		1.00	1.00	
Flt Protected		1.00						1.00		0.95	1.00	
Satd. Flow (prot)		6157						3219		3433	1827	
Flt Permitted		1.00						1.00		0.18	1.00	
Satd. Flow (perm)		6157						3219		667	1827	
Volume (vph)	212	2091	105	0	0	0	0	592	178	403	536	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	230	2273	114	0	0	0	0	643	193	438	583	0
Lane Group Flow (vph)	0	2617	0	0	0	0	0	836	0	438	583	0
Confl. Peds. (#/hr)	3		2	2		3	1		3	3		1
Confl. Bikes (#/hr)						6			5			8
Heavy Vehicles (%)	4%	5%	4%	2%	2%	2%	2%	8%	7%	2%	4%	2%
Turn Type	Perm									pm+pt		
Protected Phases		2						8		7	4	
Permitted Phases	2									4		
Actuated Green, G (s)		32.9						18.0		31.1	31.1	
Effective Green, g (s)		32.9						18.0		31.1	31.1	
Actuated g/C Ratio		0.46						0.25		0.43	0.43	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						2.0		2.0	2.0	
Lane Grp Cap (vph)		2813						805		635	789	
v/s Ratio Prot								c0.26		0.09	c0.32	
v/s Ratio Perm		0.43								0.21		
v/c Ratio		0.93						1.04		0.69	0.74	
Uniform Delay, d1		18.5						27.0		24.7	17.1	
Progression Factor		0.60						1.00		1.00	1.00	
Incremental Delay, d2		4.8						42.1		2.5	3.1	
Delay (s)		15.9						69.1		27.2	20.2	
Level of Service		B						E		C	C	
Approach Delay (s)		15.9			0.0			69.1			23.2	
Approach LOS		B			A			E			C	

Intersection Summary			
HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.5%	ICU Level of Service	D

c Critical Lane Group

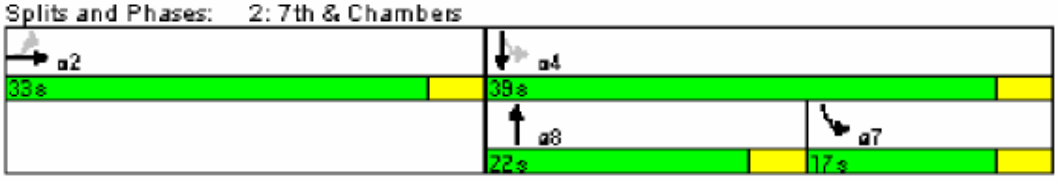
BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

Timings
2: 7th & Chambers 2/25/2005

Lane Group	EBT	NBT	SBL	SBT
Lane Configurations				
Volume (vph)	2091	592	403	536
Turn Type			pm+pt	
Protected Phases	2	8	7	4
Permitted Phases			4	
Detector Phases	2	8	7	4
Minimum Initial (s)	10.0	3.0	5.0	3.0
Minimum Split (s)	29.0	22.0	9.0	22.0
Total Split (s)	33.0	22.0	17.0	39.0
Total Split (%)	46%	31%	24%	54%
Maximum Green (s)	29.0	18.0	13.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0
Lead/Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	
Vehicle Extension (s)	3.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0
Recall Mode	Coord	Max	None	None
Walk Time (s)	7.0	6.0		6.0
Flash Dont Walk (s)	18.0	12.0		12.0
Pedestrian Calls (#/hr)	0	0		0

Intersection Summary
Cycle Length: 72
Actuated Cycle Length: 72
Offset: 17 (24%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 70
Control Type: Actuated-Coordinated

Splits and Phases: 2: 7th & Chambers



BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis
1: 7th & Polk 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		0.86						1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00						1.00	0.99	1.00	1.00	
Flpb, ped/bikes		1.00						1.00	1.00	1.00	1.00	
Frt		1.00						1.00	0.85	1.00	1.00	
Flt Protected		1.00						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		6381						1863	1562	1803	1863	
Flt Permitted		1.00						1.00	1.00	0.69	1.00	
Satd. Flow (perm)		6381						1863	1562	1314	1863	
Volume (vph)	31	2501	59	0	0	0	0	92	100	39	135	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	2718	64	0	0	0	0	100	109	42	147	0
Lane Group Flow (vph)	0	2816	0	0	0	0	0	100	109	42	147	0
Confl. Peds. (#/hr)	9		3	3		9	5		1	1		5
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	2%	2%	2%	0%	2%	2%
Turn Type	Perm								Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2								8	4		
Actuated Green, G (s)		39.0						25.0	25.0	25.0	25.0	
Effective Green, g (s)		39.0						25.0	25.0	25.0	25.0	
Actuated g/C Ratio		0.54						0.35	0.35	0.35	0.35	
Clearance Time (s)		4.0						4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0						2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)		3456						647	542	456	647	
v/s Ratio Prot								0.05			c0.08	
v/s Ratio Perm		0.44							0.07	0.03		
v/c Ratio		0.81						0.15	0.20	0.09	0.23	
Uniform Delay, d1		13.5						16.2	16.5	15.8	16.7	
Progression Factor		0.39						1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.0						0.5	0.8	0.0	0.1	
Delay (s)		6.4						16.7	17.3	15.9	16.7	
Level of Service		A						B	B	B	B	
Approach Delay (s)		6.4			0.0			17.0			16.5	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	72.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	C
c Critical Lane Group			

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

Timings
1: 7th & Polk 2/25/2005

Lane Group	EBT	NBT	NBR	SBL	SBT
Lane Configurations					
Volume (vph)	2501	92	100	39	135
Turn Type			Perm	Perm	
Protected Phases	2	8			4
Permitted Phases			8	4	
Detector Phases	2	8	8	4	4
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	21.0	22.0	22.0	22.0	22.0
Total Split (s)	43.0	29.0	29.0	29.0	29.0
Total Split (%)	60%	40%	40%	40%	40%
Maximum Green (s)	39.0	25.0	25.0	25.0	25.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Max	Max	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	10.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0

Intersection Summary
Cycle Length: 72
Actuated Cycle Length: 72
Offset: 48 (67%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 1: 7th & Polk

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — Base (2004)
12: 11th & Chambers — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	
Lane Util. Factor				1.00	*0.69	1.00	1.00	1.00			1.00	
Frpb, ped/bikes				1.00	1.00	0.98	1.00	1.00			1.00	
Flpb, ped/bikes				1.00	1.00	1.00	1.00	1.00			1.00	
Frt				1.00	1.00	0.85	1.00	1.00			0.98	
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)				1796	2571	1551	1805	1863			1839	
Flt Permitted				0.95	1.00	1.00	0.17	1.00			1.00	
Satd. Flow (perm)				1796	2571	1551	314	1863			1839	
Volume (vph)	0	0	0	218	921	184	143	501	0	0	558	115
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	237	1001	200	155	545	0	0	607	125
Lane Group Flow (vph)	0	0	0	237	1001	200	155	545	0	0	732	0
Confl. Peds. (#/hr)	4		4	4		4	6		3	3		6
Confl. Bikes (#/hr)			6			7			3			7
Heavy Vehicles (%)	2%	2%	2%	0%	2%	2%	0%	2%	2%	2%	0%	3%
Turn Type				Perm		Perm	pm+pt					
Protected Phases					6		3	8			4	
Permitted Phases				6		6	8					
Actuated Green, G (s)				25.7	25.7	25.7	29.6	29.6			20.2	
Effective Green, g (s)				25.7	25.7	25.7	29.6	29.6			20.2	
Actuated g/C Ratio				0.41	0.41	0.41	0.47	0.47			0.32	
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)				729	1044	630	274	871			587	
v/s Ratio Prot					c0.39		0.05	c0.29			c0.40	
v/s Ratio Perm				0.13		0.13	0.22					
v/c Ratio				0.33	0.96	0.32	0.57	0.63			1.25	
Uniform Delay, d1				12.9	18.3	12.8	14.4	12.7			21.6	
Progression Factor				1.00	1.00	1.00	1.00	1.00			1.00	
Incremental Delay, d2				0.3	18.5	0.3	2.7	1.4			124.9	
Delay (s)				13.1	36.8	13.1	17.1	14.1			146.5	
Level of Service				B	D	B	B	B			F	
Approach Delay (s)		0.0			29.6			14.8			146.5	
Approach LOS		A			C			B			F	

Intersection Summary			
HCM Average Control Delay	55.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	63.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	D

c Critical Lane Group

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

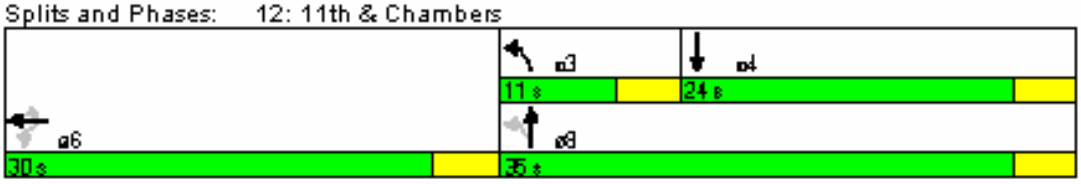
Timings
12: 11th & Chambers

Base (2004)
4/20/2005

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT
Lane Configurations						
Volume (vph)	218	921	184	143	501	558
Turn Type	Perm		Perm	pm+pt		
Protected Phases		6		3	8	4
Permitted Phases	6		6	8		
Detector Phases	6	6	6	3	8	4
Minimum Initial (s)	10.0	10.0	10.0	3.0	3.0	3.0
Minimum Split (s)	20.0	20.0	20.0	7.0	20.0	20.0
Total Split (s)	30.0	30.0	30.0	11.0	35.0	24.0
Total Split (%)	46%	46%	46%	17%	54%	37%
Maximum Green (s)	26.0	26.0	26.0	7.0	31.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lead/Lag				Lead		Lag
Lead-Lag Optimize?				Yes		Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Ped	Ped	Ped	None	None	None
Walk Time (s)	5.0	5.0	5.0		5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0

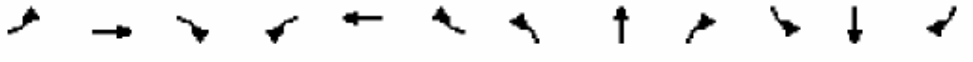
Intersection Summary
Cycle Length: 65
Actuated Cycle Length: 62.3
Natural Cycle: 90
Control Type: Semi Act-Uncoord

Splits and Phases: 12: 11th & Chambers



BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis
13: 11th & Garfield 2/27/2005



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	*0.83		1.00	1.00	*0.89			*0.74			0.95	1.00
Frpb, ped/bikes	1.00		0.98	1.00	1.00			1.00			1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00			1.00			1.00	1.00
Frt	1.00		0.85	1.00	0.99			1.00			1.00	0.85
Flt Protected	0.95		1.00	0.95	1.00			0.99			1.00	1.00
Satd. Flow (prot)	2938		1553	1762	3279			2781			3471	1599
Flt Permitted	0.95		1.00	0.95	1.00			0.80			1.00	1.00
Satd. Flow (perm)	2938		1553	1762	3279			2250			3471	1599
Volume (vph)	684	0	503	140	1032	62	27	95	0	0	273	419
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	743	0	547	152	1122	67	29	103	0	0	297	455
Lane Group Flow (vph)	743	0	547	152	1189	0	0	132	0	0	297	455
Confl. Peds. (#/hr)	3		4	4		3	2					2
Confl. Bikes (#/hr)			4			4			2			5
Heavy Vehicles (%)	2%	2%	2%	2%	2%	5%	0%	0%	2%	2%	4%	1%
Turn Type	Prot		custom	Perm			Perm					pt+ov
Protected Phases	5				6			8			4	4 5
Permitted Phases			5	6			8					
Actuated Green, G (s)	24.8		24.8	33.8	33.8			11.0			11.0	39.8
Effective Green, g (s)	24.8		24.8	33.8	33.8			11.0			11.0	39.8
Actuated g/C Ratio	0.30		0.30	0.41	0.41			0.13			0.13	0.49
Clearance Time (s)	4.0		4.0	4.0	4.0			4.0			4.0	
Vehicle Extension (s)	1.5		1.5	1.5	1.5			1.5			1.5	
Lane Grp Cap (vph)	893		472	730	1358			303			468	780
v/s Ratio Prot	0.25				c0.36						0.09	c0.28
v/s Ratio Perm			c0.35	0.09				0.06				
v/c Ratio	0.83		1.16	0.21	0.88			0.44			0.63	0.58
Uniform Delay, d1	26.5		28.4	15.3	22.0			32.4			33.4	15.0
Progression Factor	1.00		1.00	1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	6.4		92.9	0.1	6.4			0.4			2.1	0.7
Delay (s)	32.8		121.3	15.4	28.4			32.8			35.5	15.7
Level of Service	C		F	B	C			C			D	B
Approach Delay (s)		70.4			26.9			32.8			23.5	
Approach LOS		E			C			C			C	

Intersection Summary			
HCM Average Control Delay	42.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	C

c Critical Lane Group

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

Timings
13: 11th & Garfield 2/27/2005

Lane Group	EBL	EBR	WBL	WBT	NBL	NBT	SBT	SBR
Lane Configurations								
Volume (vph)	684	503	140	1032	27	95	273	419
Turn Type	Prot	custom	Perm		Perm			pt+ov
Protected Phases	5			6		8	4	4 5
Permitted Phases		5	6		8			
Detector Phases	5	5	6	6	8	8	4	4 5
Minimum Initial (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Minimum Split (s)	26.0	26.0	26.0	26.0	19.0	19.0	24.0	
Total Split (s)	34.0	34.0	39.0	39.0	24.0	24.0	24.0	58.0
Total Split (%)	35%	35%	40%	40%	25%	25%	25%	60%
Maximum Green (s)	30.0	30.0	35.0	35.0	20.0	20.0	20.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Lead/Lag	Lag	Lag	Lead	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Minimum Gap (s)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None	None	None	None	None	None	
Walk Time (s)	7.0	7.0	7.0	7.0	5.0	5.0	5.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	10.0	10.0	15.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	

Intersection Summary
Cycle Length: 97
Actuated Cycle Length: 81.9
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 13: 11th & Garfield

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis
7: 13th & Chambers 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00					1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	0.97					1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3567	1523					1863	1587	1804	1881	
Flt Permitted		1.00	1.00					1.00	1.00	0.26	1.00	
Satd. Flow (perm)		3567	1523					1863	1587	498	1881	
Volume (vph)	23	461	154	0	0	0	0	615	202	48	697	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	501	167	0	0	0	0	668	220	52	758	0
Lane Group Flow (vph)	0	526	167	0	0	0	0	668	220	52	758	0
Confl. Peds. (#/hr)	5		4	4		5	3		2	2		3
Confl. Bikes (#/hr)			2			6			9			7
Heavy Vehicles (%)	0%	1%	3%	2%	2%	2%	2%	2%	0%	0%	1%	2%
Turn Type	Perm		Perm						Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2		2						8	4		
Actuated Green, G (s)		19.0	19.0					33.0	33.0	33.0	33.0	
Effective Green, g (s)		19.0	19.0					33.0	33.0	33.0	33.0	
Actuated g/C Ratio		0.32	0.32					0.55	0.55	0.55	0.55	
Clearance Time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)		1130	482					1025	873	274	1035	
v/s Ratio Prot								0.36			c0.40	
v/s Ratio Perm		0.15	0.11						0.14	0.10		
v/c Ratio		0.47	0.35					0.65	0.25	0.19	0.73	
Uniform Delay, d1		16.4	15.7					9.5	7.1	6.8	10.2	
Progression Factor		1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.4	2.0					3.2	0.7	1.5	4.6	
Delay (s)		17.8	17.7					12.7	7.7	8.3	14.8	
Level of Service		B	B					B	A	A	B	
Approach Delay (s)		17.8			0.0			11.5			14.3	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
c Critical Lane Group			

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

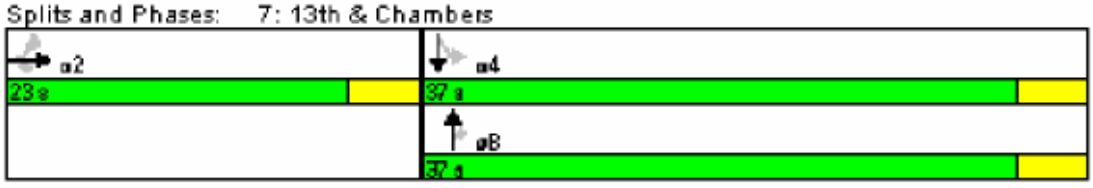
Timings
7: 13th & Chambers 2/25/2005

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	461	154	615	202	48	697
Turn Type		Perm		Perm	Perm	
Protected Phases	2		8			4
Permitted Phases		2		8	4	
Detector Phases	2	2	8	8	4	4
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	23.0	23.0	37.0	37.0	37.0	37.0
Total Split (%)	38%	38%	62%	62%	62%	62%
Maximum Green (s)	19.0	19.0	33.0	33.0	33.0	33.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 60
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 60
Control Type: Pretimed

Splits and Phases: 7: 13th & Chambers



BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

TWO-WAY STOP CONTROL SUMMARY

Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume				661	320	80
Peak-Hour Factor, PHF				0.92	0.92	0.92
Hourly Flow Rate, HFR				718	347	86
Percent Heavy Vehicles		--	--	2	--	--
Median Type	Undivided					
RT Channelized?						
Lanes				1	1	0
Configuration				L		TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	147			3	23	3
Peak Hour Factor, PHF	0.92			0.92	0.92	0.92
Hourly Flow Rate, HFR	159			3	24	3
Percent Heavy Vehicles	2			2	2	2
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?						No
Lanes	1			0	1	1
Configuration	L			LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L			LT		R
v (vph)		718	159			27		3
C(m) (vph)		1617	21			42		653
v/c						0.64		0.00
95% queue length						3.64		0.01
Control Delay						219.3		10.5
LOS						F		B
Approach Delay							198.4	
Approach LOS							F	

BASE (2004) Scenario PM-Peak Hour – Signal Timing Plans

HCS2000: Unsignalized Intersections Release 4.1

TWO-WAY STOP CONTROL SUMMARY

Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		661				
Peak-Hour Factor, PHF		0.92				
Hourly Flow Rate, HFR		718				
Percent Heavy Vehicles		--	--		--	--
Median Type	Undivided					
RT Channelized?						
Lanes		1				
Configuration		T				
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume		147	17	26		
Peak Hour Factor, PHF		0.92	0.92	0.92		
Hourly Flow Rate, HFR		159	18	28		
Percent Heavy Vehicles		2	2	2		
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?			No			
Lanes		1	1	1		
Configuration		T	R	L		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				T	R	L		
v (vph)				159	18			
C(m) (vph)				352	426			
v/c				0.45	0.04			
95% queue length				2.41	0.13			
Control Delay				23.6	13.8			
LOS				C	B			
Approach Delay				22.6				
Approach LOS				C				

APPENDIX D

Transit Data

Chambers Node Transit Summary

Bus stop #	Location	Existing Conditions	Current LTD Facility	Dir*	Weekday Frequency of Service Route (minutes betw trips)	Avg. Wkday Boardings +	Avg. Wkday Alightings +	Desired City Improvement #	Proposed LTD Improvement
972	S/S of 8th E of Garfield	6' sidewalk	small Branch shelter	ES	41 (:30), 43 (:30)	62	23	None	replace with WBGS type shelter
973	N/S of 8th E of Garfield	8' sidewalk	sign and seat	OB	41 (:30)	14	44	None	
974	S/S of 8th E of Chambers	5' sidewalk, 8' setback	sign and seat	ES	41 (:30), 43 (:30)	21	8	None	
975	N/S of 8th W of Chambers	8' sidewalk	sign only	OB	41 (:30)	3	11	None	
976	S/S of 8th W of Almaden	5' sidewalk, 8' setback	sign and seat	ES	41 (:30), 43 (:30)	22	7	None	
977	N/S of 8th W of Almanden	5' sidewalk, 5' setback	sign only	OB	41 (:30)	3	16	None	
978	N/S of 8th W of Polk	5' sidewalk, 5' setback	sign only	OB	41 (:30)	6	32	None	
979	S/S of 8th E of Polk	5' sidewalk, 8' setback	sign and seat	ES	41 (:30), 43 (:30)	38	13	None	monitor boardings for future new shelter
992	N/S of 11th W of Polk	5' sidewalk, 8' setback	sign and seat	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	14	34	None	
993	N/S of 11th W of Almaden	5' sidewalk, 8' setback	sign only	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	10	29	None	
994	N/S of 11th W of Chambers	10' sidewalk	sign and seat	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	13	34	None	
995	N/S of 11th W of Grant	6' sidewalk	sign and seat	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	15	34	None	
1031	S/S of 13th E of Polk	5' sidewalk, 10' setback	WBGS shelter	ES	30 (:30), 32 (limited), 76UO (:30), 93 & 430 (limited)	45	8	None	
1029	S/S of 13th E of Chambers	4' sidewalk, 10' setback	WBGS shelter	ES	30 (:30), 32 (limited), 76UO (:30), 93 & 430 (limited)	40	16	Increase s/w width	
1028	S/S of 13th E of Hayes	4' sidewalk, 10' setback	Branch shelter	ES	30 (:30), 32 (limited), 76UO (:30), 93 & 430 (limited)	32	6	Increase s/w width	replace with WBGS type shelter
1027	W/S of Garfield S of 12th	5' sidewalk, 5' setback	sign and seat	ES	30 (:30), 32 (limited), 76UO (:30), 93 (limited)	7	9	None	

* OB = outbound (westbound)
ES = Eugene Station is terminal point
UO = UO is terminal point

+ APC counts # ADA ramp access at all nearby intersections is adequate from Feb 2005

APPENDIX B

FUTURE (2024) NO BUILD

Scenario Data

Safety Improvement Project

Garfield: West 6th to West 7th

Proposed Configurations
Source: City of Eugene

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
10: 7th & Garfield — 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0		4.0	
Lane Util. Factor		0.86						0.95	0.95		0.95	
Frpb, ped/bikes		1.00						0.99	0.99		1.00	
Flpb, ped/bikes		1.00						1.00	1.00		1.00	
Frt		0.98						0.94	0.85		1.00	
Flt Protected		1.00						1.00	1.00		1.00	
Satd. Flow (prot)		6215						1675	1498		3530	
Flt Permitted		1.00						1.00	1.00		0.73	
Satd. Flow (perm)		6215						1675	1498		2571	
Volume (vph)	139	2045	337	0	0	0	0	362	720	35	380	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	151	2223	366	0	0	0	0	393	783	38	413	0
Lane Group Flow (vph)	0	2740	0	0	0	0	0	640	536	0	451	0
Confl. Peds. (#/hr)	2		2						1			
Confl. Bikes (#/hr)			3						1			2
Heavy Vehicles (%)	2%	2%	6%	2%	2%	2%	2%	1%	1%	0%	2%	2%
Turn Type	Perm								Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2								8	4		
Actuated Green, G (s)		48.0						44.0	44.0		44.0	
Effective Green, g (s)		48.0						44.0	44.0		44.0	
Actuated g/C Ratio		0.48						0.44	0.44		0.44	
Clearance Time (s)		4.0						4.0	4.0		4.0	
Lane Grp Cap (vph)		2983						737	659		1131	
v/s Ratio Prot								c0.38				
v/s Ratio Perm		0.44							0.36		0.18	
v/c Ratio		0.92						0.87	0.81		0.40	
Uniform Delay, d1		24.2						25.4	24.4		19.0	
Progression Factor		1.00						0.27	0.25		1.00	
Incremental Delay, d2		5.9						1.4	1.1		1.1	
Delay (s)		30.0						8.3	7.3		20.1	
Level of Service		C						A	A		C	
Approach Delay (s)		30.0			0.0			7.8			20.1	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.6%	ICU Level of Service	E
c Critical Lane Group			

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

Timings
10: 7th & Garfield

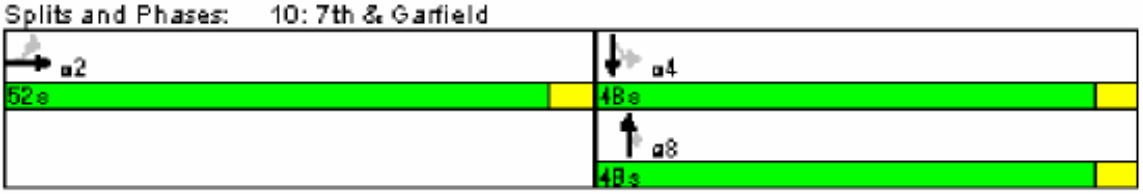
FUTURE NO BUILD (2024)
2/25/2005

Lane Group	EBT	NBT	NBR	SBL	SBT
Lane Configurations					
Volume (vph)	2045	362	720	35	380
Turn Type			Perm	Perm	
Protected Phases	2	8			4
Permitted Phases			8	4	
Detector Phases	2	8	8	4	4
Minimum Initial (s)	10.0	3.0	3.0	3.0	3.0
Minimum Split (s)	22.0	29.0	29.0	29.0	29.0
Total Split (s)	52.0	48.0	48.0	48.0	48.0
Total Split (%)	52%	48%	48%	48%	48%
Maximum Green (s)	48.0	44.0	44.0	44.0	44.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	12.0	12.0	12.0	12.0
Pedestrian Calls (#/hr)	0	0	0	0	0

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 8 (8%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 70
Control Type: Pretimed

Splits and Phases: 10: 7th & Garfield



FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
2: 7th & Chambers — 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0		4.0	4.0	
Lane Util. Factor		0.86						0.95		0.97	1.00	
Frpb, ped/bikes		1.00						0.99		1.00	1.00	
Flpb, ped/bikes		1.00						1.00		1.00	1.00	
Frt		1.00						0.97		1.00	1.00	
Flt Protected		1.00						1.00		0.95	1.00	
Satd. Flow (prot)		6177						3216		3433	1827	
Flt Permitted		1.00						1.00		0.12	1.00	
Satd. Flow (perm)		6177						3216		425	1827	
Volume (vph)	179	2590	85	0	0	0	0	708	213	421	667	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	2815	92	0	0	0	0	770	232	458	725	0
Lane Group Flow (vph)	0	3102	0	0	0	0	0	1002	0	458	725	0
Confl. Peds. (#/hr)	2		3	3		2	1		3	3		1
Confl. Bikes (#/hr)			6						8			5
Heavy Vehicles (%)	4%	5%	4%	2%	2%	2%	2%	8%	7%	2%	4%	2%
Turn Type	Perm									pm+pt		
Protected Phases		2						8		7	4	
Permitted Phases	2									4		
Actuated Green, G (s)		49.0						30.0		43.0	43.0	
Effective Green, g (s)		49.0						30.0		43.0	43.0	
Actuated g/C Ratio		0.49						0.30		0.43	0.43	
Clearance Time (s)		4.0						4.0		4.0	4.0	
Vehicle Extension (s)		3.0						2.0		2.0	2.0	
Lane Grp Cap (vph)		3027						965		453	786	
v/s Ratio Prot								0.31		0.09	c0.40	
v/s Ratio Perm		0.50								c0.34		
v/c Ratio		1.02						1.04		1.01	0.92	
Uniform Delay, d1		25.5						35.0		40.0	26.9	
Progression Factor		0.58						1.01		1.00	1.00	
Incremental Delay, d2		18.2						38.0		45.1	16.0	
Delay (s)		32.9						73.3		85.1	42.9	
Level of Service		C						E		F	D	
Approach Delay (s)		32.9			0.0			73.3			59.2	
Approach LOS		C			A			E			E	

Intersection Summary			
HCM Average Control Delay	46.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	E

c Critical Lane Group

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

Timings
2: 7th & Chambers

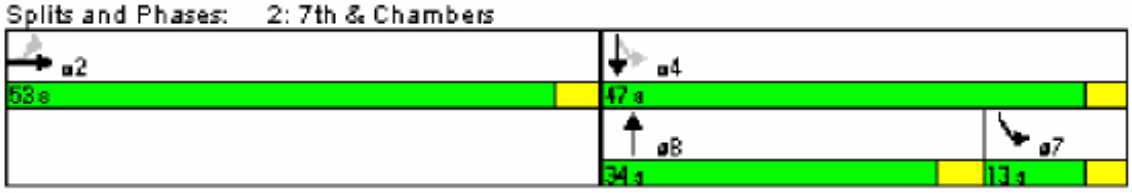
FUTURE NO BUILD (2024)
2/25/2005

Lane Group	EBT	NBT	SBL	SBT
Lane Configurations				
Volume (vph)	2590	708	421	667
Turn Type			pm+pt	
Protected Phases	2	8	7	4
Permitted Phases			4	
Detector Phases	2	8	7	4
Minimum Initial (s)	10.0	3.0	5.0	3.0
Minimum Split (s)	29.0	22.0	9.0	22.0
Total Split (s)	53.0	34.0	13.0	47.0
Total Split (%)	53%	34%	13%	47%
Maximum Green (s)	49.0	30.0	9.0	43.0
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0
Lead/Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	
Vehicle Extension (s)	3.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0
Recall Mode	Coord	Max	None	None
Walk Time (s)	7.0	6.0		6.0
Flash Dont Walk (s)	18.0	12.0		12.0
Pedestrian Calls (#/hr)	0	0		0

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 27 (27%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 2: 7th & Chambers



FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
1: 7th & Polk — 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		0.86						1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00						1.00	0.99	1.00	1.00	
Flpb, ped/bikes		1.00						1.00	1.00	1.00	1.00	
Frt		1.00						1.00	0.85	1.00	1.00	
Flt Protected		1.00						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		6383						1863	1562	1803	1863	
Flt Permitted		1.00						1.00	1.00	0.61	1.00	
Satd. Flow (perm)		6383						1863	1562	1154	1863	
Volume (vph)	32	3095	59	0	0	0	0	125	100	46	160	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	3364	64	0	0	0	0	136	109	50	174	0
Lane Group Flow (vph)	0	3463	0	0	0	0	0	136	109	50	174	0
Confl. Peds. (#/hr)	4		11	11		4	6		1	1		6
Confl. Bikes (#/hr)			10			10						2
Heavy Vehicles (%)	0%	2%	0%	2%	2%	2%	2%	2%	2%	0%	2%	2%
Turn Type	Perm								Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2								8	4		
Actuated Green, G (s)		68.0						24.0	24.0	24.0	24.0	
Effective Green, g (s)		68.0						24.0	24.0	24.0	24.0	
Actuated g/C Ratio		0.68						0.24	0.24	0.24	0.24	
Clearance Time (s)		4.0						4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0						2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)		4340						447	375	277	447	
v/s Ratio Prot								0.07			c0.09	
v/s Ratio Perm		0.54							0.07	0.04		
v/c Ratio		0.80						0.30	0.29	0.18	0.39	
Uniform Delay, d1		11.2						31.2	31.0	30.2	31.9	
Progression Factor		0.17						1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1						1.8	2.0	0.1	0.2	
Delay (s)		2.0						32.9	33.0	30.3	32.1	
Level of Service		A						C	C	C	C	
Approach Delay (s)		2.0			0.0			32.9			31.7	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	D

c Critical Lane Group

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

Timings
1: 7th & Polk

FUTURE NO BUILD (2024)
2/25/2005

Lane Group	EBT	NBT	NBR	SBL	SBT
Lane Configurations					
Volume (vph)	3095	125	100	46	160
Turn Type			Perm	Perm	
Protected Phases	2	8			4
Permitted Phases			8	4	
Detector Phases	2	8	8	4	4
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	21.0	22.0	22.0	22.0	22.0
Total Split (s)	72.0	28.0	28.0	28.0	28.0
Total Split (%)	72%	28%	28%	28%	28%
Maximum Green (s)	68.0	24.0	24.0	24.0	24.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Max	Max	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	10.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 63 (63%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 1: 7th & Polk

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
13: 11th & Garfield — 2/28/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	*0.83		1.00	1.00	*0.89			*0.74			0.95	1.00
Frpb, ped/bikes	1.00		0.98	1.00	1.00			1.00			1.00	1.00
Flpb, ped/bikes	1.00		1.00	0.99	1.00			1.00			1.00	1.00
Frt	1.00		0.85	1.00	0.99			1.00			1.00	0.85
Flt Protected	0.95		1.00	0.95	1.00			0.99			1.00	1.00
Satd. Flow (prot)	2938		1548	1758	3264			2775			3471	1599
Flt Permitted	0.95		1.00	0.95	1.00			0.69			1.00	1.00
Satd. Flow (perm)	2938		1548	1758	3264			1938			3471	1599
Volume (vph)	1183	0	539	132	1277	110	31	89	0	0	360	341
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1286	0	586	143	1388	120	34	97	0	0	391	371
Lane Group Flow (vph)	1286	0	586	143	1508	0	0	131	0	0	391	371
Confl. Peds. (#/hr)	3		5	5		3	2					2
Confl. Bikes (#/hr)			5			5			2			6
Heavy Vehicles (%)	2%	2%	2%	2%	2%	5%	0%	0%	2%	2%	4%	1%
Turn Type	custom		custom	Perm			Perm					pt+ov
Protected Phases	5				6			8			4	45
Permitted Phases	5		5	6			8					
Actuated Green, G (s)	33.0		33.0	40.2	40.2			14.8			14.8	51.8
Effective Green, g (s)	33.0		33.0	40.2	40.2			14.8			14.8	51.8
Actuated g/C Ratio	0.33		0.33	0.40	0.40			0.15			0.15	0.52
Clearance Time (s)	4.0		4.0	4.0	4.0			4.0			4.0	
Vehicle Extension (s)	1.5		1.5	1.5	1.5			1.5			1.5	
Lane Grp Cap (vph)	970		511	707	1312			287			514	828
v/s Ratio Prot	c0.44				c0.46						c0.11	0.23
v/s Ratio Perm			0.38	0.08				0.07				
v/c Ratio	1.33		1.15	0.20	1.15			0.46			0.76	0.45
Uniform Delay, d1	33.5		33.5	19.5	29.9			38.9			40.9	15.1
Progression Factor	1.00		1.00	0.44	0.42			1.00			1.08	1.23
Incremental Delay, d2	153.8		87.0	0.1	68.2			0.4			4.6	0.1
Delay (s)	187.3		120.5	8.7	80.7			39.3			48.6	18.7
Level of Service	F		F	A	F			D			D	B
Approach Delay (s)		166.4			74.5			39.3			34.0	
Approach LOS		F			E			D			C	

Intersection Summary			
HCM Average Control Delay	105.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.1%	ICU Level of Service	F

c Critical Lane Group

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

Phasings
13: 11th & Garfield

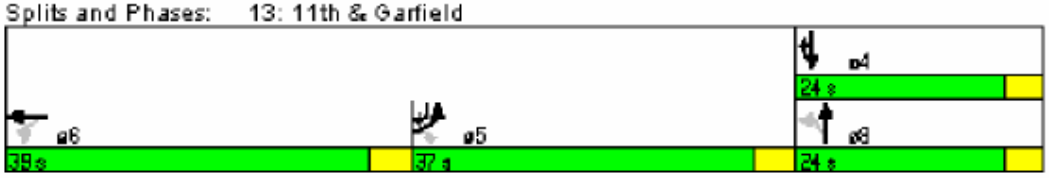
FUTURE NO BUILD (2024)
2/28/2005

Lane Group	EBL	EBR	WBL	WBT	NBL	NBT	SBT	SBR
Lane Configurations								
Volume (vph)	1183	539	132	1277	31	89	360	341
Turn Type	custom	custom	Perm		Perm			pt+ov
Protected Phases	5			6		8	4	4 5
Permitted Phases	5	5	6		8			
Detector Phases	5	5	6	6	8	8	4	4 5
Minimum Initial (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Minimum Split (s)	26.0	26.0	26.0	26.0	19.0	19.0	24.0	
Total Split (s)	37.0	37.0	39.0	39.0	24.0	24.0	24.0	61.0
Total Split (%)	37%	37%	39%	39%	24%	24%	24%	61%
Maximum Green (s)	33.0	33.0	35.0	35.0	20.0	20.0	20.0	
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Lead/Lag	Lag	Lag	Lead	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes	Yes				
Vehicle Extension (s)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Minimum Gap (s)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Recall Mode	None	None	Coord	Coord	None	None	None	
Walk Time (s)	7.0	7.0	7.0	7.0	5.0	5.0	5.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	10.0	10.0	15.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 80 (80%), Referenced to phase 2: and 6:WBTL, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 13: 11th & Garfield



FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
12: 11th & Chambers — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	
Lane Util. Factor				1.00	*0.69	1.00	1.00	1.00			1.00	
Frpb, ped/bikes				1.00	1.00	0.97	1.00	1.00			0.99	
Flpb, ped/bikes				0.99	1.00	1.00	1.00	1.00			1.00	
Frt				1.00	1.00	0.85	1.00	1.00			0.97	
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)				1788	2571	1543	1805	1863			1829	
Flt Permitted				0.95	1.00	1.00	0.09	1.00			1.00	
Satd. Flow (perm)				1788	2571	1543	177	1863			1829	
Volume (vph)	0	0	0	241	1178	209	183	568	0	0	585	143
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	262	1280	227	199	617	0	0	636	155
Lane Group Flow (vph)	0	0	0	262	1280	227	199	617	0	0	791	0
Confl. Peds. (#/hr)	5		5	5		5	7		4	4		7
Confl. Bikes (#/hr)			7			8			8			4
Heavy Vehicles (%)	2%	2%	2%	0%	2%	2%	0%	2%	2%	2%	0%	3%
Turn Type				Perm		Perm	pm+pt					
Protected Phases					6		3	8			4	
Permitted Phases				6		6	8					
Actuated Green, G (s)				39.1	39.1	39.1	52.9	52.9			39.0	
Effective Green, g (s)				39.1	39.1	39.1	52.9	52.9			39.0	
Actuated g/C Ratio				0.39	0.39	0.39	0.53	0.53			0.39	
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)				699	1005	603	255	986			713	
v/s Ratio Prot					c0.50		c0.08	0.33			c0.43	
v/s Ratio Perm				0.15		0.15	0.34					
v/c Ratio				0.37	1.27	0.38	0.78	0.63			1.11	
Uniform Delay, d1				21.7	30.4	21.7	45.6	16.6			30.5	
Progression Factor				1.00	1.00	1.00	0.74	1.23			0.32	
Incremental Delay, d2				1.5	131.0	1.8	10.7	0.9			57.0	
Delay (s)				23.3	161.4	23.5	44.6	21.4			66.7	
Level of Service				C	F	C	D	C			E	
Approach Delay (s)		0.0			123.3			27.0			66.7	
Approach LOS		A			F			C			E	

Intersection Summary			
HCM Average Control Delay	86.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.5%	ICU Level of Service	E

c Critical Lane Group

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

Timings
12: 11th & Chambers

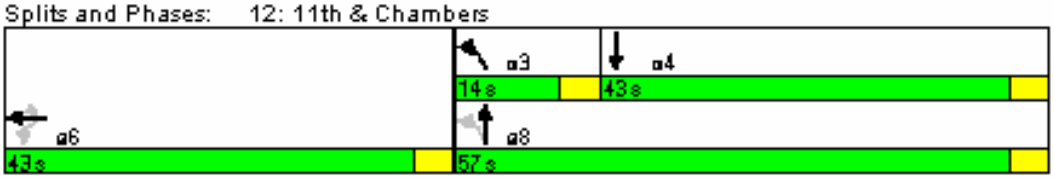
FUTURE NO BUILD (2024)
4/20/2005

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT
Lane Configurations						
Volume (vph)	241	1178	209	183	568	585
Turn Type	Perm		Perm	pm+pt		
Protected Phases		6		3	8	4
Permitted Phases	6		6	8		
Detector Phases	6	6	6	3	8	4
Minimum Initial (s)	10.0	10.0	10.0	3.0	3.0	3.0
Minimum Split (s)	20.0	20.0	20.0	7.0	20.0	20.0
Total Split (s)	43.0	43.0	43.0	14.0	57.0	43.0
Total Split (%)	43%	43%	43%	14%	57%	43%
Maximum Green (s)	39.0	39.0	39.0	10.0	53.0	39.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lead/Lag				Lead		Lag
Lead-Lag Optimize?				Yes		Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Coord	Coord	None	None	None
Walk Time (s)	5.0	5.0	5.0		5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 51 (51%), Referenced to phase 2: and 6:WBTL, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 12: 11th & Chambers



FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
7: 13th & Chambers — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00					1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	0.96					1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3568	1511					1863	1584	1805	1881	
Flt Permitted		1.00	1.00					1.00	1.00	0.22	1.00	
Satd. Flow (perm)		3568	1511					1863	1584	415	1881	
Volume (vph)	23	622	230	0	0	0	0	731	198	47	770	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	676	250	0	0	0	0	795	215	51	837	0
Lane Group Flow (vph)	0	701	250	0	0	0	0	795	215	51	837	0
Confl. Peds. (#/hr)	6		5	5		6	4		2	2		4
Confl. Bikes (#/hr)			2			7			11			8
Heavy Vehicles (%)	0%	1%	3%	2%	2%	2%	0%	2%	0%	0%	1%	2%
Turn Type	Perm		Perm						Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2		2						8	4		
Actuated Green, G (s)		29.0	29.0					63.0	63.0	63.0	63.0	
Effective Green, g (s)		29.0	29.0					63.0	63.0	63.0	63.0	
Actuated g/C Ratio		0.29	0.29					0.63	0.63	0.63	0.63	
Clearance Time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)		1035	438					1174	998	261	1185	
v/s Ratio Prot								0.43			c0.44	
v/s Ratio Perm		c0.20	0.17						0.14	0.12		
v/c Ratio		0.68	0.57					0.68	0.22	0.20	0.71	
Uniform Delay, d1		31.4	30.2					11.9	7.9	7.8	12.3	
Progression Factor		0.82	0.47					1.00	1.00	0.65	1.09	
Incremental Delay, d2		3.2	4.8					3.1	0.5	0.7	1.6	
Delay (s)		29.0	19.0					15.1	8.4	5.8	15.0	
Level of Service		C	B					B	A	A	B	
Approach Delay (s)		26.4			0.0			13.7			14.5	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.5%	ICU Level of Service	C
c Critical Lane Group			

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

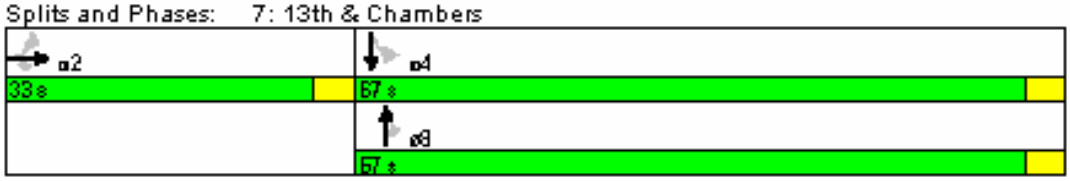
Timings
7: 13th & Chambers

FUTURE NO BUILD (2024)
4/20/2005

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	622	230	731	198	47	770
Turn Type		Perm		Perm	Perm	
Protected Phases	2		8			4
Permitted Phases		2		8	4	
Detector Phases	2	2	8	8	4	4
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	33.0	33.0	67.0	67.0	67.0	67.0
Total Split (%)	33%	33%	67%	67%	67%	67%
Maximum Green (s)	29.0	29.0	63.0	63.0	63.0	63.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0

Intersection Summary
Cycle Length: 100
Offset: 3 (3%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 60
Control Type: Pretimed

Splits and Phases: 7: 13th & Chambers



FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE NO BUILD (2024)
7: 13th & Chambers — 2/25/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95	1.00					1.00	1.00	1.00	1.00	
Frpb, ped/bikes		1.00	0.96					1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00	1.00					1.00	1.00	1.00	1.00	
Frt		1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected		1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)		3568	1511					1863	1584	1805	1881	
Flt Permitted		1.00	1.00					1.00	1.00	0.22	1.00	
Satd. Flow (perm)		3568	1511					1863	1584	415	1881	
Volume (vph)	23	622	230	0	0	0	0	731	198	47	770	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	676	250	0	0	0	0	795	215	51	837	0
Lane Group Flow (vph)	0	701	250	0	0	0	0	795	215	51	837	0
Confl. Peds. (#/hr)	6		5	5		6	4		2	2		4
Confl. Bikes (#/hr)			2			7			11			8
Heavy Vehicles (%)	0%	1%	3%	2%	2%	2%	0%	2%	0%	0%	1%	2%
Turn Type	Perm		Perm						Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2		2						8	4		
Actuated Green, G (s)		29.0	29.0					63.0	63.0	63.0	63.0	
Effective Green, g (s)		29.0	29.0					63.0	63.0	63.0	63.0	
Actuated g/C Ratio		0.29	0.29					0.63	0.63	0.63	0.63	
Clearance Time (s)		4.0	4.0					4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)		1035	438					1174	998	261	1185	
v/s Ratio Prot								0.43			c0.44	
v/s Ratio Perm		0.20	0.17						0.14	0.12		
v/c Ratio		0.68	0.57					0.68	0.22	0.20	0.71	
Uniform Delay, d1		31.4	30.2					11.9	7.9	7.8	12.3	
Progression Factor		0.82	0.47					1.00	1.00	0.66	0.99	
Incremental Delay, d2		3.2	4.8					3.1	0.5	0.2	0.3	
Delay (s)		29.0	19.1					15.1	8.4	5.3	12.5	
Level of Service		C	B					B	A	A	B	
Approach Delay (s)		26.4			0.0			13.7			12.1	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.5%	ICU Level of Service	C
c Critical Lane Group			

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

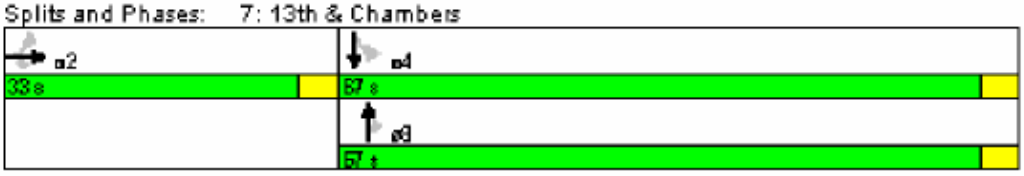
Phasings
7: 13th & Chambers

FUTURE NO BUILD (2024)
3/1/2005

Lane Group	EBT	EBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	622	230	731	198	47	770
Turn Type		Perm		Perm	Perm	
Protected Phases	2		8			4
Permitted Phases		2		8	4	
Detector Phases	2	2	8	8	4	4
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	33.0	33.0	67.0	67.0	67.0	67.0
Total Split (%)	33%	33%	67%	67%	67%	67%
Maximum Green (s)	29.0	29.0	63.0	63.0	63.0	63.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0

Intersection Summary
Cycle Length: 100
Offset: 3 (3%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 60
Control Type: Pretimed

Splits and Phases: 7: 13th & Chambers



FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

HCS2000: Unsignalized Intersections Release 4.1

TWO-WAY STOP CONTROL SUMMARY

Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume				903	264	85
Peak-Hour Factor, PHF				0.92	0.92	0.92
Hourly Flow Rate, HFR				981	286	92
Percent Heavy Vehicles		--	--	2	--	--
Median Type	Undivided					
RT Channelized?						
Lanes				1	1	0
Configuration				L		TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	152			3	26	3
Peak Hour Factor, PHF	0.92			0.92	0.92	0.92
Hourly Flow Rate, HFR	165			3	28	3
Percent Heavy Vehicles	2			2	2	2
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?						No
Lanes	1			0		1
Configuration	L			LT		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		L	L			LT		R
v (vph)		981	165			31		3
C(m) (vph)		1617	0			15		704
v/c		0.61				2.07		0.00
95% queue length		4.56				11.91		0.01
Control Delay		10.6						10.1
LOS		B	F			F		B
Approach Delay								
Approach LOS							F	

FUTURE (2024) NO BUILD Scenario PM-Peak Hour – Signal Timing Plans

TWO-WAY STOP CONTROL SUMMARY

Intersection Orientation: EW Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		903				
Peak-Hour Factor, PHF		0.92				
Hourly Flow Rate, HFR		981				
Percent Heavy Vehicles		--	--		--	--
Median Type	Undivided					
RT Channelized?						
Lanes		1				
Configuration		T				
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume		152	25	29		
Peak Hour Factor, PHF		0.92	0.92	0.92		
Hourly Flow Rate, HFR		165	27	31		
Percent Heavy Vehicles		2	2	2		
Percent Grade (%)		0			0	
Median Storage						
Flared Approach: Exists?						
Storage						
RT Channelized?			No			
Lanes		1	1	1		
Configuration		T	R	L		

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config				T	R	L		
v (vph)				165	27	31		
C(m) (vph)				247	300	82		
v/c				0.67	0.09	0.38		
95% queue length				5.34	0.30	1.71		
Control Delay				47.6	18.2	75.0		
LOS				E	C	F		
Approach Delay				43.5			75.0	
Approach LOS				E			F	

APPENDIX C

Obstacles in Sidewalk Width

Obstacles Located in Sidewalk in Vicinity of Study Intersections

Intersection	Corner			
	Northwest	**Northeast**	**Southeast**	**Southwest**
7th at Garfield				
	Pedestrian push-button pole			
7th at Chambers				
		Signal shaft	Signal shaft	
7th at Polk				
	Controller cabinet	Signal shaft	Signal shaft	Signal shaft
		Pedestrian push-button pole	Pedestrian push-button pole	Pedestrian push-button pole
			Sign post	
11th at Garfield				
	Signal shaft	Signal shaft	Signal shaft	Signal shaft
		Pedestrian push-button pole	2 Pedestrian push-button poles	
			Sign post	
			Utility pole	
			Signal cabinet	
11th at Chambers				
	Signal shaft	Signal shaft	Pedestrian push-button pole	Utility pole
		Fire hydrant		Controller cabinet
13th at Garfield				
	Utility pole	Sign Post	Sign post	
13th at Chambers				
	Signal shaft	Signal shaft		Signal shaft

Appendix D

Transit Data

Chambers Node Transit Summary

Bus stop #	Location	Existing Conditions	Current LTD Facility	Dir*	Weekday Frequency of Service Route (minutes betw trips)	Avg. Wkday Boardings +	Avg. Wkday Alightings +	Desired City Improvement #	Proposed LTD Improvement
972	S/S of 8th E of Garfield	6' sidewalk	small Branch shelter	ES	41 (:30), 43 (:30)	62	23	None	replace with WBGS type shelter
973	N/S of 8th E of Garfield	8' sidewalk	sign and seat	OB	41 (:30)	14	44	None	
974	S/S of 8th E of Chambers	5' sidewalk, 8' setback	sign and seat	ES	41 (:30), 43 (:30)	21	8	None	
975	N/S of 8th W of Chambers	8' sidewalk	sign only	OB	41 (:30)	3	11	None	
976	S/S of 8th W of Almaden	5' sidewalk, 8' setback	sign and seat	ES	41 (:30), 43 (:30)	22	7	None	
977	N/S of 8th W of Almanden	5' sidewalk, 5' setback	sign only	OB	41 (:30)	3	16	None	
978	N/S of 8th W of Polk	5' sidewalk, 5' setback	sign only	OB	41 (:30)	6	32	None	
979	S/S of 8th E of Polk	5' sidewalk, 8' setback	sign and seat	ES	41 (:30), 43 (:30)	38	13	None	monitor boardings for future new shelter
992	N/S of 11th W of Polk	5' sidewalk, 8' setback	sign and seat	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	14	34	None	
993	N/S of 11th W of Almaden	5' sidewalk, 8' setback	sign only	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	10	29	None	
994	N/S of 11th W of Chambers	10' sidewalk	sign and seat	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	13	34	None	
995	N/S of 11th W of Grant	6' sidewalk	sign and seat	OB	30 (:30), 32 (limited), 43 (:30), 76 (:30), 93 (limited)	15	34	None	
1031	S/S of 13th E of Polk	5' sidewalk, 10' setback	WBGS shelter	ES	30 (:30), 32 (limited), 76UO (:30), 93 & 430 (limited)	45	8	None	
1029	S/S of 13th E of Chambers	4' sidewalk, 10' setback	WBGS shelter	ES	30 (:30), 32 (limited), 76UO (:30), 93 & 430 (limited)	40	16	Increase s/w width	
1028	S/S of 13th E of Hayes	4' sidewalk, 10' setback	Branch shelter	ES	30 (:30), 32 (limited), 76UO (:30), 93 & 430 (limited)	32	6	Increase s/w width	replace with WBGS type shelter
1027	W/S of Garfield S of 12th	5' sidewalk, 5' setback	sign and seat	ES	30 (:30), 32 (limited), 76UO (:30), 93 (limited)	7	9	None	

* OB = outbound (westbound)
ES = Eugene Station is terminal point
UO = UO is terminal point

+ APC counts # ADA ramp access at all nearby intersections is adequate from Feb 2005

APPENDIX E

COLLISION DATA

1998 – 2002

COLLISION SUMMARY: 1998 - 2002

Intersection		SB					WB					NB					EB					Total	Night	Ped	Bike	Injury	Fatality	Property Damage Only
		RA	LT	RT	SS	Other	RA	LT	RT	SS	Other	RA	LT	RT	SS	Other	RA	LT	RT	SS	Other							
W. 7th Ave./Hwy. 99 & Polk St.																												
	2002											2							1			3			1	3		0
	2001																1		4			5				1		4
	2000															DA			1		PC	2						2
	1999		1												1		2		1			5	2	1		4		1
	1998																		1	1		2	1			1		1
	Totals	0	1	0	0	0	0	0	0	0	0	2	0	0	1	1	3	0	8	1	1	22	3	1	1	9	0	8
				1					0					4					13									
W. 7th Ave./Hwy. 99 & Chambers St.																												
	2002	3	1	1										3	1		3		4	1		17			3	6		12
	2001	1		2	1							1		1			1	1	1	1		10				1		9
	2000		1	1				1				1		2			2		1	2		11	1			6		6
	1999	1	1	1			1								1		2		6	2		17	2			3		14
	1998	2											1				1		2	1		7	1		1	4		3
	Totals	7	3	5	1	0	1	1	0	0	0	2	0	7	2	0	8	1	19	7	0	62	3	0	3	19	0	44
				16					2					11					33									
W. 7th Ave./Hwy. 99 & Garfield St.																												
	2002			2					1			1	1	3	1		1		3	5		16	2			8		10
	2001	1		2	1	FO						1		1	3				3	4		17	2		1	6		12
	2000											1		3	1			1	1	1		8	1			2		6
	1999	1	2	1	1							2		1	2		1			2		13	2	1		6		6
	1998	1			1							1		1			1		2	1		11	1			3		8
	Totals	3	2	5	3	1	0	0	1	0	0	6	1	9	7	0	3	1	9	13	0	67	8	1	1	23	0	44
				14					1					23					29									
Garfield St./Hwy. 126 & W. 11th Ave./Hwy. 126																												
	2002			1					3				1	1					1			7				1		6
	2001								2			1		1		DA			2	1		6	1					5
	2000			2					1	1								1				5				2		3
	1999				1		2	2	3					2	1		1	1	1			11	3			5		9
	1998			3	1				1					2	1		1		1			11	3			3		8
	Totals	0	0	6	2	0	2	2	10	1	0	1	1	6	2	1	2	2	5	2	0	43	7	0	0	11	0	31
				8					15					11					21									
Garfield St./Hwy. 126 and W. 13th Ave.																												
	2002				1																	1						1
	2001			1													2					3	1		1	2		1
	2000										FODUI											1	1					1
	1999												1									1						1
	1998				1																	1						1
	Totals	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	2	0	0	0	0	7	2	0	1	2	0	5
				3					1					1					2									
W. 11th Ave. and Chambers St.																												
	2002						1		2	1				2			1		1			8				2		6
	2001	1		2					1			1				BAPC						6	1			2		4
	2000	1		1		FO, BA	2	1	1	1		2	1	1							PC	11	4		3	4		10
	1999			3	2		1		2	3	FO			1	1							14	1		1	6		8
	1998	1		3					2	3				1					1			11				5		6
	Totals	3	0	9	2	2	4	1	8	8	1	3	1	5	1	1	1	0	2	0	1	32	6	0	4	19	0	34
				16					22					11					4									
W. 13th Ave. and Chambers St.																												
	2002			3										1					3			8	1			1		4
	2001			1																3		4						4
	2000				3							1		1							FODUI	6	2			2		2
	1999	1										1							1			3						3
	1998													1			1			2		4	1			1		3
	Totals	1	0	4	3	0	0	0	0	0	0	2	0	3	0	0	1	0	4	5	1	25	4	0	0	4	0	17
				8					0					5					10									

Annual Totals		SB					WB					NB					EB					Total	Night	Ped	Bike	Injury	Fatality	Property Damage Only
		RA	LT	RT	SS	Other	RA	LT	RT	SS	Other	RA	LT	RT	SS	Other	RA	LT	RT	SS	Other							
	2002	3	1	6	3	0	1	0	6	1	0	3	2	10	2	0	5	0	12	6	0	59	3	0	3	20	0	35
	2001	3	0	6	2	1	0	3	3	0	0	4	0	3	3	2	4	1	10	9	0	53	5	0	2	11	0	43
	2000	1	1	4	3	2	3	2	2	3	1	6	1	7	1	1	2	3	3	3	3	47	9	0	3	15	0	32
	1999	3	4	5	4	3	4	2	5	3	1	3	1	4	6	0	6	1	10	5	3	67	11	2	1	23	0	44
	1998	4	0	7	2	3	0	3	3	3	0	1	3	5	1	0	4	0	7	3	0	47	7	0	1	17	0	30
	Totals	14	6	30	11	3	8	10	19	10	2	17	7	29	13	3	21	5	42	27	3	273	35	2	10	86	0	181
				64					41					69					102									

Legend

HO - Head On
BA - Backing
FO - Fixed Object
FODUI - Fixed Object Driving Under Influence
PC - Parked Car
BAPC - Backing into Parked Car

APPENDIX F

FUTURE (2024) MITIGATION

Scenario Data

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE (2024) Policy/Context Sensitive
10: 7th & Garfield — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0		4.0	
Lane Util. Factor		0.86						1.00	0.88		0.95	
Frpb, ped/bikes		1.00						1.00	0.99		1.00	
Flpb, ped/bikes		1.00						1.00	1.00		1.00	
Frt		0.98						1.00	0.85		1.00	
Flt Protected		1.00						1.00	1.00		1.00	
Satd. Flow (prot)		6215						1881	2775		3530	
Flt Permitted		1.00						1.00	1.00		0.88	
Satd. Flow (perm)		6215						1881	2775		3102	
Volume (vph)	139	2045	337	0	0	0	0	362	720	35	380	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	151	2223	366	0	0	0	0	393	783	38	413	0
Lane Group Flow (vph)	0	2740	0	0	0	0	0	393	783	0	451	0
Confl. Peds. (#/hr)	2		2						1			
Confl. Bikes (#/hr)			3						1			2
Heavy Vehicles (%)	2%	2%	6%	2%	2%	2%	2%	1%	1%	0%	2%	2%
Turn Type	Perm								Perm	Perm		
Protected Phases		2						8			4	
Permitted Phases	2								8	4		
Actuated Green, G (s)		52.5						38.5	38.5		38.5	
Effective Green, g (s)		53.0						39.0	39.0		39.0	
Actuated g/C Ratio		0.53						0.39	0.39		0.39	
Clearance Time (s)		4.5						4.5	4.5		4.5	
Lane Grp Cap (vph)		3294						734	1082		1210	
v/s Ratio Prot								0.21				
v/s Ratio Perm		c0.44							c0.28		0.15	
v/c Ratio		0.83						0.54	0.72		0.37	
Uniform Delay, d1		19.8						23.5	25.9		21.8	
Progression Factor		1.00						0.37	0.34		1.00	
Incremental Delay, d2		2.6						0.3	0.4		0.9	
Delay (s)		22.4						8.9	9.2		22.7	
Level of Service		C						A	A		C	
Approach Delay (s)		22.4			0.0			9.1			22.7	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM Average Control Delay	18.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
c Critical Lane Group			

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

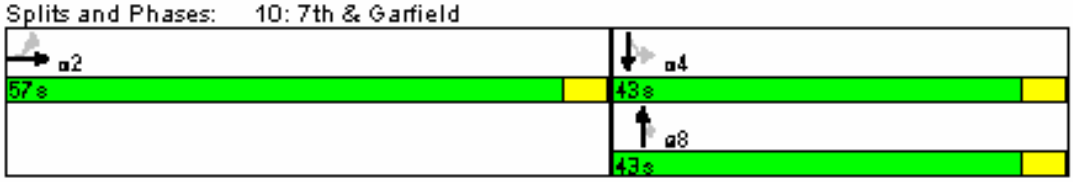
Timings
10: 7th & Garfield

FUTURE (2024) Policy/Context Sensitive
4/20/2005

Lane Group	EBT	NBT	NBR	SBL	SBT
Lane Configurations					
Volume (vph)	2045	362	720	35	380
Turn Type			Perm	Perm	
Protected Phases	2	8			4
Permitted Phases			8	4	
Detector Phases	2	8	8	4	4
Minimum Initial (s)	10.0	3.0	3.0	3.0	3.0
Minimum Split (s)	57.0	43.0	43.0	43.0	43.0
Total Split (s)	57.0	43.0	43.0	43.0	43.0
Total Split (%)	57%	43%	43%	43%	43%
Maximum Green (s)	52.5	38.5	38.5	38.5	38.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	12.0	12.0	12.0	12.0
Pedestrian Calls (#/hr)	0	0	0	0	0

Intersection Summary
Cycle Length: 100
Offset: 7.5 (8%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 100
Control Type: Pretimed

Splits and Phases: 10: 7th & Garfield



FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE (2024) Policy
2: 7th & Chambers — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.86	1.00					0.95	1.00	0.97	0.95	
Frpb, ped/bikes	1.00	1.00	0.97					1.00	0.98	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1732	6225	1507					3343	1472	3433	3471	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.15	1.00	
Satd. Flow (perm)	1732	6225	1507					3343	1472	535	3471	
Volume (vph)	179	2590	85	0	0	0	0	708	213	421	667	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	2815	92	0	0	0	0	770	232	458	725	0
Lane Group Flow (vph)	195	2815	92	0	0	0	0	770	232	458	725	0
Confl. Peds. (#/hr)	2		3	3		2	1		3	3		1
Confl. Bikes (#/hr)			6						8			5
Heavy Vehicles (%)	4%	5%	4%	2%	2%	2%	2%	8%	7%	2%	4%	2%
Turn Type	Perm		Perm						Perm	pm+pt		
Protected Phases		2						8		7	4	
Permitted Phases	2		2						8	4		
Actuated Green, G (s)	54.5	54.5	54.5					22.5	22.5	36.5	36.5	
Effective Green, g (s)	55.0	55.0	55.0					23.0	23.0	37.0	37.0	
Actuated g/C Ratio	0.55	0.55	0.55					0.23	0.23	0.37	0.37	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0					2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	953	3424	829					769	339	488	1284	
v/s Ratio Prot		c0.45						c0.23		c0.09	0.21	
v/s Ratio Perm	0.11		0.06						0.16	0.25		
v/c Ratio	0.20	0.82	0.11					1.00	0.68	0.94	0.56	
Uniform Delay, d1	11.4	18.5	10.8					38.5	35.2	39.3	25.1	
Progression Factor	0.66	0.52	0.44					0.90	0.88	1.00	1.00	
Incremental Delay, d2	0.2	1.1	0.1					31.2	9.8	25.6	0.3	
Delay (s)	7.7	10.7	4.9					65.9	40.7	64.9	25.4	
Level of Service	A	B	A					E	D	E	C	
Approach Delay (s)		10.4			0.0			60.1			40.7	
Approach LOS		B			A			E			D	

Intersection Summary			
HCM Average Control Delay	26.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	D

c Critical Lane Group

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

Timings
2: 7th & Chambers

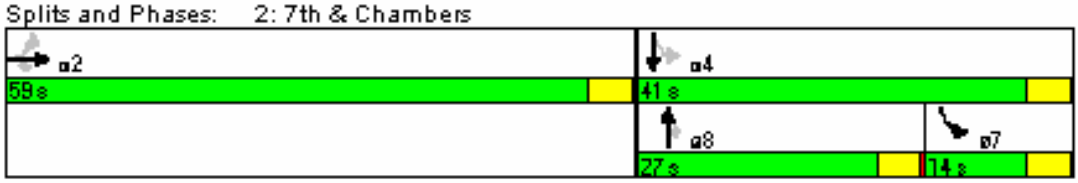
FUTURE (2024) Policy
4/20/2005

Lane Group	EBL	EBT	EBR	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (vph)	179	2590	85	708	213	421	667
Turn Type	Perm		Perm		Perm	pm+pt	
Protected Phases		2		8		7	4
Permitted Phases	2		2		8	4	
Detector Phases	2	2	2	8	8	7	4
Minimum Initial (s)	10.0	10.0	10.0	3.0	3.0	5.0	3.0
Minimum Split (s)	59.0	59.0	59.0	26.0	26.0	14.0	40.0
Total Split (s)	59.0	59.0	59.0	27.0	27.0	14.0	41.0
Total Split (%)	59%	59%	59%	27%	27%	14%	41%
Maximum Green (s)	54.5	54.5	54.5	22.5	22.5	9.5	36.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag				Lead	Lead	Lag	
Lead-Lag Optimize?				Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	3.0	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Coord	Coord	Max	Max	None	None
Walk Time (s)	7.0	7.0	7.0	6.0	6.0		6.0
Flash Dont Walk (s)	21.0	21.0	21.0	12.0	12.0		18.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 26.5 (27%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 2: 7th & Chambers



FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE (2024) Context Sensitive
2: 7th & Chambers — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0						4.0	4.0	4.0	4.0	
Lane Util. Factor		0.86						0.95	1.00	0.97	0.95	
Frpb, ped/bikes		1.00						1.00	0.98	1.00	1.00	
Flpb, ped/bikes		1.00						1.00	1.00	1.00	1.00	
Frt		1.00						1.00	0.85	1.00	1.00	
Flt Protected		1.00						1.00	1.00	0.95	1.00	
Satd. Flow (prot)		6177						3343	1472	3433	3471	
Flt Permitted		1.00						1.00	1.00	0.15	1.00	
Satd. Flow (perm)		6177						3343	1472	535	3471	
Volume (vph)	179	2590	85	0	0	0	0	708	213	421	667	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	2815	92	0	0	0	0	770	232	458	725	0
Lane Group Flow (vph)	0	3102	0	0	0	0	0	770	232	458	725	0
Confl. Peds. (#/hr)	2		3	3		2	1		3	3		1
Confl. Bikes (#/hr)			6						8			5
Heavy Vehicles (%)	4%	5%	4%	2%	2%	2%	2%	8%	7%	2%	4%	2%
Turn Type	Perm								Perm	pm+pt		
Protected Phases		2						8		7	4	
Permitted Phases	2								8	4		
Actuated Green, G (s)		54.5						22.5	22.5	36.5	36.5	
Effective Green, g (s)		55.0						23.0	23.0	37.0	37.0	
Actuated g/C Ratio		0.55						0.23	0.23	0.37	0.37	
Clearance Time (s)		4.5						4.5	4.5	4.5	4.5	
Vehicle Extension (s)		3.0						2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)		3397						769	339	488	1284	
v/s Ratio Prot								c0.23		c0.09	0.21	
v/s Ratio Perm		c0.50							0.16	0.25		
v/c Ratio		0.91						1.00	0.68	0.94	0.56	
Uniform Delay, d1		20.3						38.5	35.2	39.3	25.1	
Progression Factor		0.51						0.90	0.88	1.00	1.00	
Incremental Delay, d2		2.5						31.2	9.8	25.6	0.3	
Delay (s)		12.9						65.9	40.7	64.9	25.4	
Level of Service		B						E	D	E	C	
Approach Delay (s)		12.9			0.0			60.1			40.7	
Approach LOS		B			A			E			D	

Intersection Summary			
HCM Average Control Delay	28.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	E

c Critical Lane Group

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

Timings
2: 7th & Chambers

FUTURE (2024) Context Sensitive
4/20/2005

Lane Group	EBT	NBT	NBR	SBL	SBT
Lane Configurations					
Volume (vph)	2590	708	213	421	667
Turn Type			Perm	pm+pt	
Protected Phases	2	8		7	4
Permitted Phases			8	4	
Detector Phases	2	8	8	7	4
Minimum Initial (s)	10.0	3.0	3.0	5.0	3.0
Minimum Split (s)	59.0	26.0	26.0	14.0	40.0
Total Split (s)	59.0	27.0	27.0	14.0	41.0
Total Split (%)	59%	27%	27%	14%	41%
Maximum Green (s)	54.5	22.5	22.5	9.5	36.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag		Lead	Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes	
Vehicle Extension (s)	3.0	2.0	2.0	2.0	2.0
Minimum Gap (s)	3.0	2.0	2.0	2.0	2.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Max	Max	None	None
Walk Time (s)	7.0	6.0	6.0		6.0
Flash Dont Walk (s)	21.0	12.0	12.0		12.0
Pedestrian Calls (#/hr)	0	0	0		0

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 26.5 (27%), Referenced to phase 2:EBTL, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 2: 7th & Chambers

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE (2024) Policy
12: 11th & Chambers — 4/20/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0	4.0	4.0			4.0	
Lane Util. Factor				1.00	*0.69	1.00	1.00	1.00			1.00	
Frpb, ped/bikes				1.00	1.00	0.97	1.00	1.00			0.99	
Flpb, ped/bikes				0.99	1.00	1.00	1.00	1.00			1.00	
Frt				1.00	1.00	0.85	1.00	1.00			0.97	
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	
Satd. Flow (prot)				1788	3856	1543	1805	1863			1829	
Flt Permitted				0.95	1.00	1.00	0.09	1.00			1.00	
Satd. Flow (perm)				1788	3856	1543	177	1863			1829	
Volume (vph)	0	0	0	241	1178	209	183	568	0	0	585	143
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	262	1280	227	199	617	0	0	636	155
Lane Group Flow (vph)	0	0	0	262	1280	227	199	617	0	0	791	0
Confl. Peds. (#/hr)	5		5	5		5	7		4	4		7
Confl. Bikes (#/hr)			7			8			8			4
Heavy Vehicles (%)	2%	2%	2%	0%	2%	2%	0%	2%	2%	2%	0%	3%
Turn Type				Perm		Perm	pm+pt					
Protected Phases					6		3	8			4	
Permitted Phases				6		6	8					
Actuated Green, G (s)				37.7	37.7	37.7	53.3	53.3			38.5	
Effective Green, g (s)				38.2	38.2	38.2	53.8	53.8			39.0	
Actuated g/C Ratio				0.38	0.38	0.38	0.54	0.54			0.39	
Clearance Time (s)				4.5	4.5	4.5	4.5	4.5			4.5	
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)				683	1473	589	271	1002			713	
v/s Ratio Prot					c0.33		c0.08	0.33			c0.43	
v/s Ratio Perm				0.15		0.15	0.32					
v/c Ratio				0.38	0.87	0.39	0.73	0.62			1.11	
Uniform Delay, d1				22.4	28.6	22.4	44.7	16.0			30.5	
Progression Factor				1.00	1.00	1.00	0.74	1.28			0.30	
Incremental Delay, d2				1.6	7.2	1.9	7.3	0.8			57.0	
Delay (s)				24.0	35.8	24.3	40.2	21.2			66.3	
Level of Service				C	D	C	D	C			E	
Approach Delay (s)		0.0			32.6			25.8			66.3	
Approach LOS		A			C			C			E	

Intersection Summary					
HCM Average Control Delay	38.9	HCM Level of Service		D	
HCM Volume to Capacity ratio	0.96				
Actuated Cycle Length (s)	100.0	Sum of lost time (s)		12.0	
Intersection Capacity Utilization	88.8%	ICU Level of Service		D	

c Critical Lane Group

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

Timings
12: 11th & Chambers

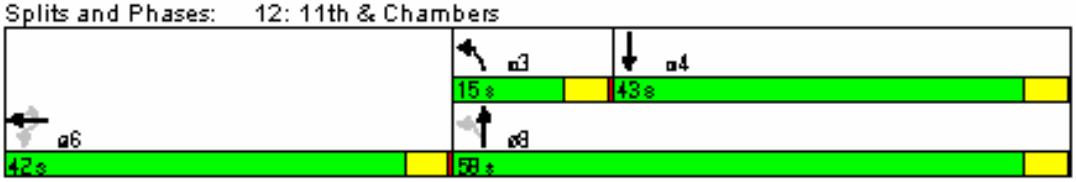
FUTURE (2024) Policy
4/20/2005

Lane Group	WBL	WBT	WBR	NBL	NBT	SBT
Lane Configurations						
Volume (vph)	241	1178	209	183	568	585
Turn Type	Perm		Perm	pm+pt		
Protected Phases		6		3	8	4
Permitted Phases	6		6	8		
Detector Phases	6	6	6	3	8	4
Minimum Initial (s)	10.0	10.0	10.0	4.0	3.0	3.0
Minimum Split (s)	20.5	20.5	20.5	12.0	20.5	20.5
Total Split (s)	42.0	42.0	42.0	15.0	58.0	43.0
Total Split (%)	42%	42%	42%	15%	58%	43%
Maximum Green (s)	37.5	37.5	37.5	10.5	53.5	38.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag				Lead		Lag
Lead-Lag Optimize?				Yes		Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Coord	Coord	None	None	None
Walk Time (s)	5.0	5.0	5.0		5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0		0	0

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 50.5 (51%), Referenced to phase 2: and 6:WBTL, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 12: 11th & Chambers



FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

HCM Signalized Intersection Capacity Analysis — FUTURE (2024) Context Sensitive
12: 11th & Chambers — 4/21/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0			4.0	
Lane Util. Factor				1.00	*0.69	1.00		1.00			0.95	
Frpb, ped/bikes				1.00	1.00	0.98		1.00			0.99	
Flpb, ped/bikes				0.99	1.00	1.00		1.00			1.00	
Frt				1.00	1.00	0.85		1.00			0.97	
Flt Protected				0.95	1.00	1.00		1.00			1.00	
Satd. Flow (prot)				1788	3856	1544		1863			3465	
Flt Permitted				0.95	1.00	1.00		1.00			1.00	
Satd. Flow (perm)				1788	3856	1544		1863			3465	
Volume (vph)	0	0	0	241	1178	209	0	705	0	0	585	143
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	262	1280	227	0	766	0	0	636	155
Lane Group Flow (vph)	0	0	0	262	1280	227	0	766	0	0	791	0
Confl. Peds. (#/hr)	5		5	5		5	7		4	4		7
Confl. Bikes (#/hr)			7			8			8			4
Heavy Vehicles (%)	2%	2%	2%	0%	2%	2%	0%	2%	2%	2%	0%	3%
Turn Type				Perm		Perm						
Protected Phases					6			8			4	
Permitted Phases				6		6						
Actuated Green, G (s)				46.0	46.0	46.0		45.0			45.0	
Effective Green, g (s)				46.5	46.5	46.5		45.5			45.5	
Actuated g/C Ratio				0.46	0.46	0.46		0.46			0.46	
Clearance Time (s)				4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)				831	1793	718		848			1577	
v/s Ratio Prot					c0.33			c0.41			0.23	
v/s Ratio Perm				0.15		0.15						
v/c Ratio				0.32	0.71	0.32		0.90			0.50	
Uniform Delay, d1				16.8	21.4	16.8		25.2			19.2	
Progression Factor				1.00	1.00	1.00		1.05			0.34	
Incremental Delay, d2				1.0	2.5	1.2		9.9			0.2	
Delay (s)				17.8	23.9	17.9		36.2			6.7	
Level of Service				B	C	B		D			A	
Approach Delay (s)		0.0			22.2			36.2			6.7	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C

c Critical Lane Group

FUTURE (2024) POLICY and CONTEXT SENSITIVE Scenarios
PM-Peak Hour – Signal Timing Plans

Timings
12: 11th & Chambers

FUTURE (2024) Context Sensitive
4/21/2005

Lane Group	WBL	WBT	WBR	NBT	SBT
Lane Configurations					
Volume (vph)	241	1178	209	705	585
Turn Type	Perm		Perm		
Protected Phases		6		8	4
Permitted Phases	6		6		
Detector Phases	6	6	6	8	4
Minimum Initial (s)	10.0	10.0	10.0	3.0	3.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	42.0	42.0	42.0	58.0	58.0
Total Split (%)	42%	42%	42%	58%	58%
Maximum Green (s)	37.5	37.5	37.5	53.5	53.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Coord	Coord	Coord	None	None
Walk Time (s)	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 50.5 (51%), Referenced to phase 2: and 6:WBTL, Start of Yellow
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 12: 11th & Chambers