STUDY REPORT

MAPLEWOOD AVENUE COMPLETE STREET STUDY

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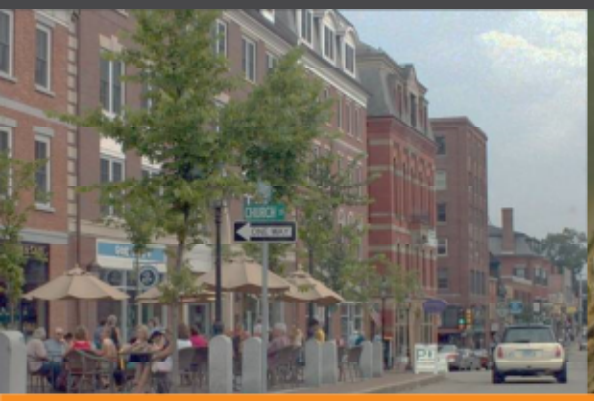
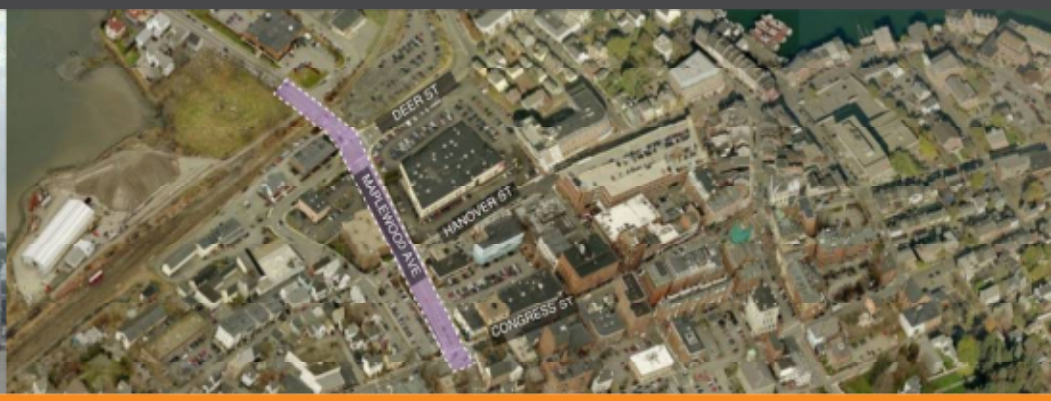
the science of insight

4.17.2014





PREPARED FOR:
CITY OF PORTSMOUTH

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CONTENTS

APPENDICIES

1.0 INTRODUCTION

In response to a request from Mayor Eric Spear in 2013 and following a meeting with the Portsmouth Parking and Traffic Safety Committee, the Portsmouth Planning Department began evaluating opportunities for adding on-street parking along Maplewood Avenue north of Congress/Islington Street. During the evaluation process, the scope of work was expanded to consider improvements to the street in support of *Complete Street* principles (i.e., ways to improve the street for all modes of travel including automobile, truck, bicycle, pedestrian, and transit).[1]

The project study area (Figure 1) has been designated to include the area(s) of potential improvements and extends along Maplewood Avenue from Vaughan Street through Congress Street and Islington Street. This Study applies *Complete Streets* principles to this section of Maplewood Avenue and develops alternatives that include: 1) the addition of on-street parking; 2) improvements to traffic flow; and 3) enhanced accommodations for pedestrians, cyclists, and buses.[2]

FIGURE 1: STUDY AREA

This study presents opportunities in this corridor to implement *Complete Street* elements, but does not make a selection of a preferred alternative. The results of this study will provide guidance for decisions about future improvements to Maplewood Avenue.

[1] In October 2013, the Portsmouth City Council adopted a Complete Streets Policy that supports the balance of transportation options within a street corridor.
[2] Two public transit stops within the study area provide local and regional access. These will continue to serve at the same level in all alternatives evaluated.

2.0 PURPOSE AND NEEDS

The purpose of the *Maplewood Complete Streets Study* is to analyze street design alternatives that address parking, pedestrian facilities, bicycle connections, and traffic congestion. Maplewood Avenue is approximately 50-feet wide from curb to curb and consists of vehicle travel and turn lanes. Potential design alternatives for the project study area include repurposing portions of the roadway currently allocated to vehicles for future parking, transit, and bicycle accommodations.

FIGURE 2: MAPLEWOOD AVENUE LOOKING EAST

Specific needs identified for this corridor are presented below:

Limited Downtown Parking.

- *There is a need to provide additional parking along Maplewood Avenue.* Currently there is unmet parking demand for downtown Portsmouth businesses. No on-street parking exists along Maplewood Avenue between Vaughan Street and Congress Street. New on-street spaces along Maplewood Avenue could serve local businesses and be used to help increase the overall downtown parking supply.

Maintain and Improve Pedestrian Environment.

- *There is a need to maintain existing pedestrian accommodations and improve accessibilility, where possible.* Sidewalks currently line both sides of Maplewood Avenue and all three study area signalized intersections include signalized pedestrian actuated crossings. Pedestrian activity is critical to the vibrancy of downtown Portsmouth and character of the area, and while the existing pedestrian environment does well to promote pedestrian travel, an effective improvement strategy will maintain or improve on the overall quality of the pedestrian environment.

Improve Bicycle Network Connectivity.

- *There is a need to provide for safe and efficient bicycle travel through the study area.* Bike lanes currently exist along Maplewood Avenue west of Vaughan Street and additional bike lanes are planned for Middle Street east of Congress Street. However, the section of Maplewood Avenue between Vaughan Street and Congress Street remains a missing link in this bicycle corridor. This gap in connectivity between bicycle facilities creates a significant safety concern. The

existing shoulders on Maplewood Avenue in the study area are too small (<2 feet) to safely accommodate bicyclists and there are currently no shared lane markings in place in the corridor.

Maintain Effective Traffic Operations and Enhance Mobility for All Users.

- *There is a need to maintain effective traffic operations on Maplewood Avenue.* Maplewood Avenue provides a vital transportation route to and from downtown Portsmouth. Changes in the road cross-section could affect traffic operations along this corridor and effective improvements for all roadway users should not reduce roadway capacity (or increase vehicle delays) to undesirable levels.
- *There is a need to better allocate the existing curb-to-curb street width for travel lanes, turn lanes, on-street parking, and bicycle lanes.* The current roadway configuration along Maplewood Avenue, which consists of turn lanes in each direction, and overly wide travel lanes, is heavily weighted towards optimizing vehicle through-put.

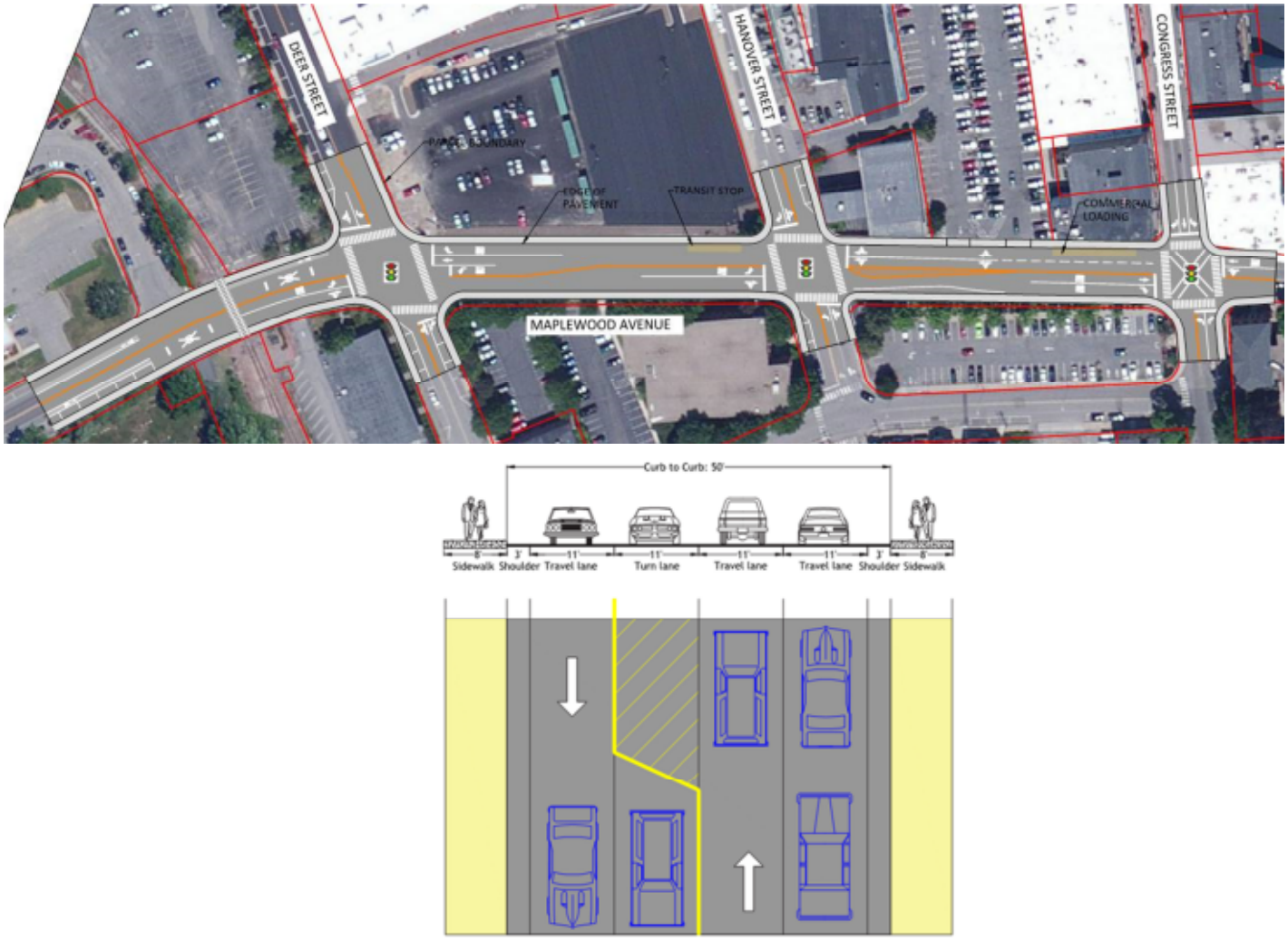
3.0 EXISTING CONDITIONS AND PROPOSED ALTERNATIVES

RSG developed three design alternatives for the study area section of Maplewood Avenue. All three of the design alternatives include some degree of vehicle lane reduction in favor of increased parking and bicycle accommodations. An overview of existing conditions and the proposed design alternatives is presented below. Full-scale schematic drawings are presented in Appendix A.

3.1 | EXISTING CONDITIONS

Figure 3 presents the existing configuration and cross-section of Maplewood Avenue within the study area. Maplewood Avenue is approximately 50-feet wide from curb to curb and, as can be seen below, currently consists of vehicle travel and turn lanes in both directions. Bicycle lanes exist on Maplewood from Dennett Street to the railroad crossing west of the study area but do not continue east. There are eight-foot wide sidewalks on both sides of Maplewood Avenue and no on-street parking.

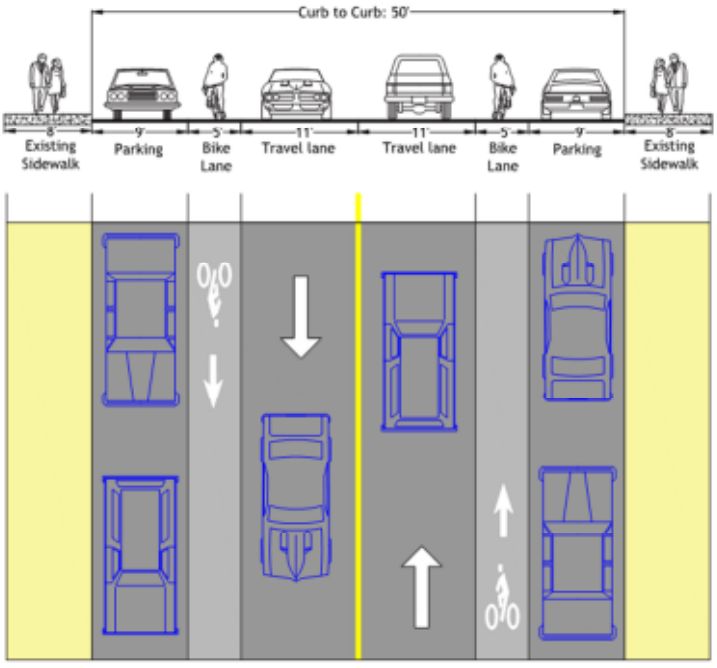
FIGURE 3: MAPLEWOOD AVENUE EXISTING CONDITIONS AND CROSS SECTION



3.2 | ALTERNATIVE #1: ROAD DIET

Alternative #1 presents a typical "road diet" configuration, in which all existing turn lanes are repurposed for use as designated on-street parking and 5-foot wide bike lanes. This scenario maintains left-turn lanes beyond Deer Street and Congress Street but reduces vehicle travel to single lanes in each direction between these two cross-streets. This alternative provides the greatest number of new downtown parking spaces (33 new spaces) and adds bike lanes in each direction but sacrifices intersection vehicle capacity by eliminating all turn lanes between Deer Street and Congress Street.

FIGURE 4: ALTERNATIVE #1 ROADWAY CONFIGURATION AND CROSS-SECTION

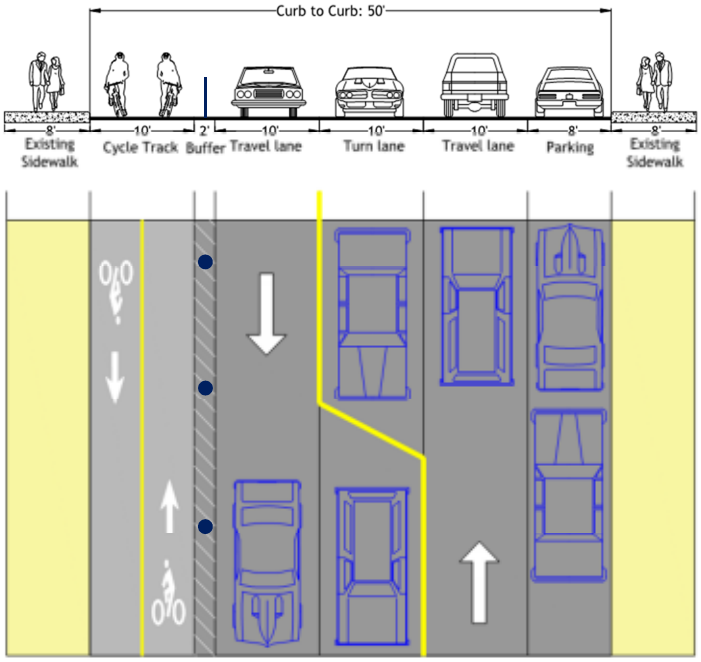


3.3 | ALTERNATIVE #2 – CYCLE TRACK

Alternative #2 eliminates one vehicle lane but maintains one exclusive vehicle turn lane at all intersections. Repurposed pavement would be converted into on-street parking on the east side of Maplewood Avenue and a 10-foot wide, two-way, protected cycle track along the west side of Maplewood Avenue.

This scenario adds 8 new parking spaces, provides new bicycle connectivity, and maintains a higher degree of intersection capacity than Alternative #1.

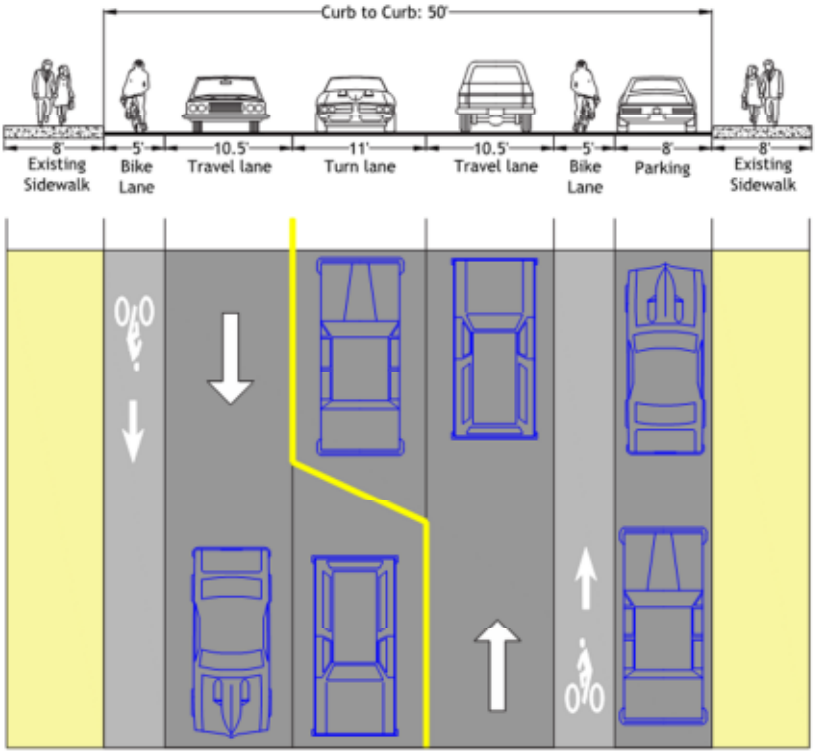
FIGURE 5: ALTERNATIVE #2 ROADWAY CONFIGURATION AND CROSS-SECTION



3.4 | ALTERNATIVE #3 – BIKE LANES

Alternative #3 includes the same vehicle lane configuration as Alternative #2, with an exclusive turn lane at each intersection, but replaces the cycle track with 5-foot wide bike lanes on both sides of Maplewood Avenue. This scenario also adds 10 new parking spaces on the east side of Maplewood Avenue.

FIGURE 6: ALTERNATIVE #3 ROADWAY CONFIGURATION AND CROSS-SECTION



4.0 DESIGN ALTERNATIVES SCORING METRICS

The metrics used to score the three alternatives are presented in detail below.

4.1 | PARKING

Based on two recent Parking studies[3,4], it was determined that there is little to no reserve parking capacity in the downtown core and no reserve capacity within a 5-minute walk of Market Square. The Maplewood Avenue study area is within a 5-minute walk of Market Square and currently has no on-street parking. Any increase in parking within the study area is viewed as a benefit to downtown Portsmouth.

4.2 | PEDESTRIAN TRAVEL

Pedestrian accommodations between scenarios are compared using pedestrian level-of-service (LOS) and delay calculations. Although the pedestrian facilities in this corridor are existing and no changes are proposed, the analysis is included as an example for use on other *Complete Street* projects in the City.

The Highway Capacity Manual (HCM) provides an approach for analyzing pedestrian level of service, which results in a qualitative ranking (LOS A-F) based on the measurement of pedestrian flow and sidewalk space. The pedestrian flow rate includes speed, density and volume and is obtained by taking the pedestrian 15-minute flow rate and dividing by the effective width of the sidewalk. Pedestrian delay is calculated by the length of time a pedestrian needs to wait to cross an intersecting street. Figure 7 presents the various levels of pedestrian LOS and the corresponding levels of delay.

FIGURE 7: PEDESTRIAN LEVEL OF SERVICE

Delay *(seconds/pedestrian)*	Level of Service	Likelihood of Noncompliance
0 to 10	A	Low
10 to 20	B	
20 to 30	C	Moderate
30 to 40	D	
40 to 60	E	High
>60	F	Very high

All proposed design alternatives maintain the existing 8-foot wide sidewalks on both sides of Maplewood Avenue and retain the existing pedestrian actuated signalized intersection crossings. Federal Highway Administration (FHWA) guidelines[5] suggest sidewalks be designed to provide approximately 2.5 feet of sidewalk width per person (Figure 8). The existing sidewalk width along Maplewood Avenue of 8 feet is sufficient to allow two people to walk side by side and simultaneously leaves enough room for one person to pass comfortably.

[3] Parking, Transit & Downtown Development Consulting, Parking Supply and Demand Strategies; Portsmouth, NH Final Report, John M. Burke, PE, CAPP (May 2012).
[4] Nelson/Nygard, Parking Supply and Demand Analysis Final Report (January 2012).
[5] FHWA Designing Sidewalks and Trails for Access, 1999.

FIGURE 8: RECOMMENDED SIDEWALK WIDTHS (2.5 FT/PERSON)

Desired Functionality	Needed Width
1 person alone	3 ft
1 + 1	5 ft
2 + 1	7.5 ft
2 + 2	10 ft

While all alternatives for the study corridor maintain the existing sidewalk area, any potential reduction in pedestrian delay and improved pedestrian LOS is viewed as a benefit to downtown Portsmouth.

FIGURE 9: PEDESTRIAN ACTIVITY AT THE MAPLEWOOD AVE/CONGRESS ST INTERSECTION

4.3 | BICYCLE TRAVEL

Bicycle accommodations between scenarios are compared using the following three evaluation metrics: Bicycle Level of Service (LOS), Bicycle Compatibility Index (BCI), and Levels of Traffic Stress (LTS).

While the Highway Capacity Manual does not define level of service criteria specifically for bicycles, the qualitative LOS scale of LOS A thru LOS F has traditionally been extended to pedestrian facilities by transportation planning professionals. For this study, bicycle LOS grades based on the FHWA Bicycle Compatibility Index (BCI) are used to evaluate alternatives. The BCI metric reflects the comfort level of bicyclists on a basis of observed geometric and operating conditions. The correlation of these comfort levels with the conditions of the roadway in the development of the BCI model allows the user to determine bicycle LOS (BLOS) for roadway segments. Figure 10 presents the BLOS and BCI compatibility levels.

FIGURE 10: BICYCLE LEVEL OF SERVICE & BICYCLE COMPATIBILITY INDEX

BLOS	BCI Range	Compatibility Level
A	< 1.50	Extremely High
B	1.51 to 2.30	Very High
C	2.31 to 3.40	Moderately High
D	3.41 to 4.40	Moderately Low
E	4.41 to 5.30	Very Low
F	> 5.30	Extremely Low

The Bicycle Level of Service and Compatibility Index has some shortcomings. One is that there is no clear correspondence between BLOS and the user tolerance (level of comfort bicyclists feel). Based on the Dutch Design Manual for Bicycle Traffic (CROW 2007), researchers are developing new schemes for classifying road segments by four *Levels of Traffic Stress* (LTS)[6].

- LTS 1: for children
- LTS 2: for traffic tolerant adult
- LTS 3: for enthused and confident
- LTS 4: highest stress

FIGURE 11: BIKE LANES WEST OF STUDY AREA

[6] Low-Stress Bicycling and Network Connectivity, Mineta Transportation Institute, May 2012

Criteria are proposed for classifying road segments by LTS depending on traffic characteristics (e.g., road width, traffic speed, the presence of a parking lane) and whether bikes are in mixed traffic, in bike lanes, or on segregated paths. A low level of stress can be achieved in mixed traffic on local streets with low traffic speeds. As the number of lanes, traffic speed and traffic volume increase, providing a low level of stress requires progressively more protective measures, such as dedicated bike lanes and, ultimately, physically segregated bikeways. Figure 12 presents the various criteria for each LTS level.

FIGURE 12: LTS SCORING CRITERIA[7]

Criteria (along Parking Lane)	LTS>1	LTS>2	LTS>3	LTS>4
Street Width (thru lanes per direction)	1	(n.a.)	2 or more	(n.a)
Sum of bike lane and parking lane width	15 ft or more	14 or 14.5 ft	13.5 ft or less	(n.a.)
Speed limit or prevailing speed	25 mph or less	30 mph	35 mph	40 mph or more
Bike lane blockage	rare	(n.a.)	frequent	(n.a.)

4.4 | VEHICLE TRAVEL

Vehicle traffic operations are compared between design alternatives based on a vehicle level of service (LOS), which is a qualitative method used by transportation professionals to characterize traffic congestion according to the average delay per vehicle, measured in seconds and calculated for a peak hour of traffic. LOS is estimated using the procedures outlined in the 2000 and 2010 Highway Capacity Manuals.[8] Key inputs for signalized intersection LOS analyses include traffic volumes, number of lanes, and signal timings. Alternatives are also compared based on corridor travel times and vehicle queuing.

The 2010 Highway Capacity Manual defines six qualitative grades to describe the level of service at an intersection. Level-of-Service is based on the average control delay per vehicle. Figure 13 shows the various LOS grades and descriptions for signalized intersections.

FIGURE 13: LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

LOS	CHARACTERISTICS	SIGNALIZED TOTAL DELAY (SEC)
A	Little or no delay	≤ 10.0
B	Short delays	10.1-20.0
C	Average delays	20.1-35.0
D	Long delays	35.1-55.0
E	Very long delays	55.1-80.0
F	Extreme delays	> 80.0

[7] Low-Stress Bicycling and Network Connectivity, Mineta Transportation Institute, May 2012

[8] The HCM 2010 does not provide methodologies for calculating intersection delays at certain intersection types including signalized intersections with exclusive pedestrian phases and signalized intersections with non NEMA-standard phasing. Because of these limitations, HCM 2000 methodologies are employed where necessary.

Design hour traffic volumes for the weekday AM and PM peak hours of traffic on Maplewood Avenue in 2013 and 2023 are used in the level-of-service analysis. These volumes are calculated from intersection turning movement counts conducted by RSG and from intersection turning movement counts included in the recent Portwalk Place Traffic Impact Study[9], that are scaled to design hour conditions using the following three adjustment factors.

1. Peak month adjustment factors are based on NHDOT permanent traffic count station 345001 located on US 1 in North Hampton, NH.[10]
2. An annual adjustment factor of 1% per year, which represents general background traffic growth, is based on estimated growth in the area. The future year adjustment increases volumes by 3% between 2010 (Portwalk Place counts) and 2013 and by 10% between 2013 and 2023.
3. A peak hour factor adjustment for each intersection approach for the capacity analysis, which reflects each intersection's peak 15 minute period during the peak hour.

Weekday AM and PM peak hour traffic volumes in the 2013 and 2023 design years are presented in Appendix B.

In addition to the HCM LOS analysis, corridor travel times and queues are evaluated for each scenario using SimTraffic,[11] a microsimulation program from Trafficware. For this study, average maximum queues, which represents the average of the largest queues simulated every two minutes over the peak hour, are calculated for all intersection approaches.

FIGURE 14: MAPLEWOOD AVENUE FACING WEST

[9] Portwalk Place Traffic Impact and Access Study, Vanasse Hangen Brustlin, Inc., April 2007
[10] DHV factors for May 2013 turning movement counts project a negative adjustment. To remain conservative, we have used a factor of 1.0.
[11] Five hour-long simulations were averaged together to estimate queue lengths. As each run is different, a difference in a few cars should not be seen as significant.

5.0 ALTERNATIVES ANALYSIS

All three design alternatives for Maplewood Avenue reduce vehicle capacity by eliminating one or more of the existing travel lanes between Deer Street and Congress Street. However, all alternatives add new bike lanes and some amount of new downtown parking spaces. Figure 15 presents a summary of overall analysis results and scoring for parking, vehicle travel, pedestrian travel, and bicycle travel for each scenario.

FIGURE 15: MAPLEWOOD AVENUE ALTERNATIVES SCORING MATRIX

(See fold out figure next page)

5.1 | ALTERNATIVE 1 RESULTS

As can be seen in the Scoring Matrix, Alternative 1 adds the greatest number of new parking spaces (33 spaces), but results in a significant reduction in vehicle capacity. Vehicle queues, delays, and travel times are projected to increase substantially with the reduction of travel lanes associated with Alternative 1. Pedestrian facilities in Alternative 1 are identical to the existing condition.

5.2 | ALTERNATIVE 2 RESULTS

Alternative 2 is projected to operate well from a vehicle standpoint and is projected to accommodate AM and PM peak hour traffic in both 2013 and 2023 even with the reduction of one vehicle lane throughout the corridor. Alternative 2 provides new bike lanes in a 10 foot wide, two-direction cycle track along the west side of Maplewood Avenue, which would provide for a very high level of bicycle accommodations within the study area but would have to transition to more typical bike lanes at the project extents, forcing westbound cyclists to cross traffic east of Congress Street and west of Vaughan Street to connect with the existing and planned bike lanes.

Alternative 2 includes the same sidewalk facilities as the existing condition but requires slightly longer signal cycle lengths during the PM peak hour to accommodate vehicle traffic, resulting in a slightly longer pedestrian delay than current conditions. Alternative 2 adds eight new parking spaces.

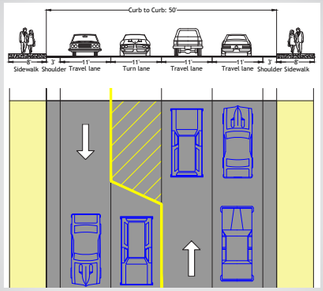
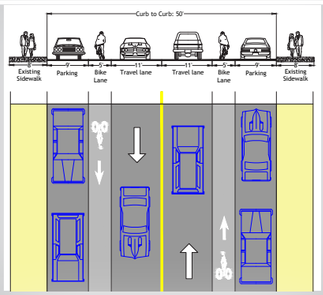
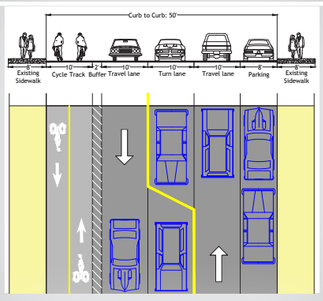
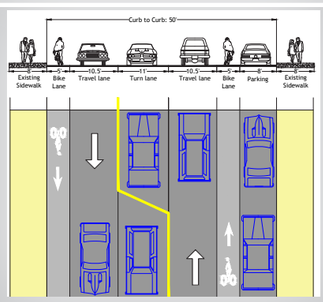
5.3 | ALTERNATIVE 3 RESULTS

Alternative 3 includes the same vehicle lane configuration as Alternative 2 and is also projected to operate well from a vehicle standpoint, accommodating AM and PM peak hour traffic in both 2013 and 2023 even with the reduction of one vehicle lane throughout the corridor. Alternative 3 provides new 5 foot bike lanes that would transition seamlessly with the existing bike lanes west of Vaughan Street and the planned bike lanes east of Congress Street.

Alternative 3 includes the same sidewalk facilities as the existing condition but, as with Alternative 2, requires slightly longer signal cycle lengths during the PM peak hour to accommodate vehicle traffic resulting in a slightly longer pedestrian delay. Alternative 3 adds ten new parking spaces.

Maplewood Avenue Complete Streets Matrix

Portsmouth, New Hampshire

		Parking	Pedestrian		Bicycle			Vehicular				Pro/Cons
		# Spaces	LOS	Delay (seconds)	LOS	BCI	LTS	Queue (feet)	Travel Time (seconds)	LOS	Delay (seconds)	
		New spaces added	Range of ped LOS at each of the three study intersections	Sum of ped delay at all three study area intersections		Bike comfort: geometric + operating conditions	Traffic stress: Traffic, width, speed, parking	Sum of all average maximum queues for the three study area intersections	Longest travel time of two directions by time period	Range from min to max of overall LOS scores at the three study intersections	Sum of overall intersection delays for the three study intersections	
Existing		n/a	AM C / PM C-D	AM 82 / PM 96	D	4.30	3	AM 620 / PM 1192	AM 27 / PM 40	AM A-C / PM B-C	AM 50 / PM 67	
Alternative 1		+33	AM C / PM C-D	AM 82 / PM 96	D	4.00	2	AM 808 / PM 2759	AM 34 / PM 297	AM B-C / PM C-E	AM 53 / PM 110	▪ **Pro:** Adds the greatest number of new parking spaces ▪ **Con:** Reduction in vehicle capacity resulting in substantial increase in queues, delays, and travel times.
Alternative 2		+8	AM C / PM C-D	AM 82 / PM 101	C	3.05	1	AM 669 / PM 1344	AM 29 / PM 60	AM B-C / PM B-C	AM 50 / PM 68	▪ **Pro:** Accommodates projected vehicles and adds a new cycletrack lane for bicyclists. ▪ **Con:** Transitional conflicts between cycletrack and bike lane. Longer signal cycles lead to longer pedestrian delays.
Alternative 3		+10	AM C / PM C-D	AM 82 / PM 101	D	3.60	2	AM 669 / PM 1344	AM 29 / PM 60	AM B-C / PM B-C	AM 50 / PM 68	▪ **Pro:** Accommodates projected vehicles and adds 5' bike lanes in both directions that connect to existing facilities. ▪ **Con:** Longer signal cycles lead to longer pedestrian delays.

More / Same / Less

Better / Same / Worse

6.0 CONCLUSIONS

At present Maplewood Avenue is approximately 50 feet wide from curb-to-curb, and while effective at processing existing traffic volumes, does not provide bicycle connectivity between existing bike lanes west of Vaughan Street and planned bike lanes east of Congress Street. Additionally, parking in downtown Portsmouth is a valuable commodity and any increase in parking that could be achieved in this area would be a benefit to area merchants and downtown Portsmouth.

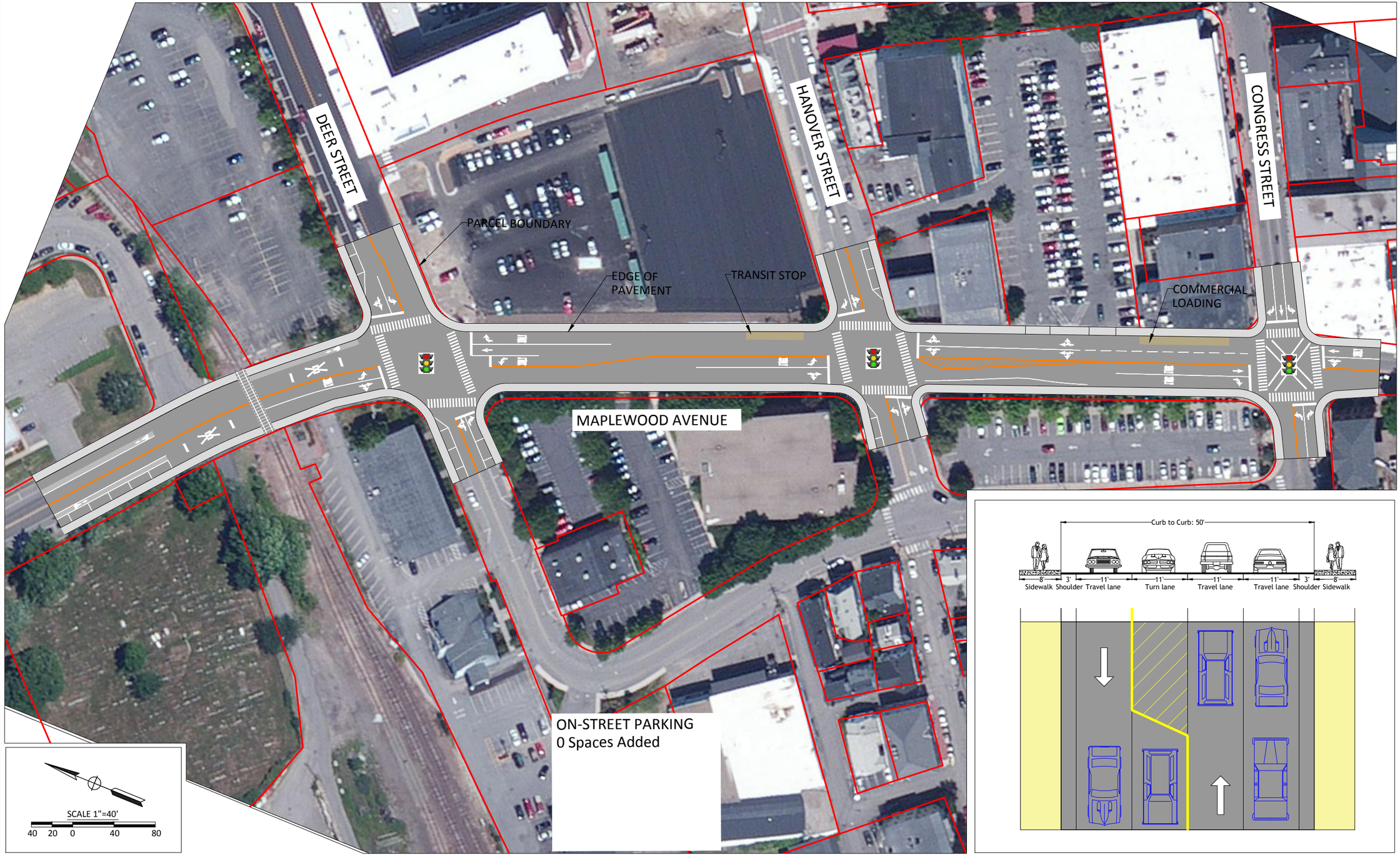
Three design alternatives were developed to reconfigure Maplewood Avenue to increase parking and provide additional bicycle connectivity. These alternatives have been assessed for relative benefit to parking, pedestrian accommodations, bicycle travel, and traffic operations.

While Alternative 1 provides the largest increase in downtown parking, it comes at the expense of vehicle operations and long queues and delays are projected with this most-aggressive repurposing of existing vehicle lanes.

Alternatives 2 and 3 strike a balance between repurposing vehicle lanes and providing additional parking and bike lanes. While these scenarios offer more modest increases in parking (8 and 10 spaces, respectively) they are able to maintain effective processing of peak hour vehicle traffic, while providing new bicycle connectivity.

We believe Alternative 2 and Alternative 3 are both viable options that differ in their approach to accommodating bicycles. While both provide new dedicated bike lanes through this corridor, Alternative 2 would require westbound bicycle traffic to stop and cross vehicle traffic east of Congress Street and west of Vaughan Street to connect with the existing and planned bike lane at these locations. Alternative 3 would provide seamless bicycle connectivity between existing and planned bike lanes west and east of the study corridor by adding new dedicated 5 foot wide bike lanes on either side of Maplewood Avenue.

APPENDIX A. SCHEMATIC DRAWINGS



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CITY OF PORTSMOUTH, NH

MAPLEWOOD AVENUE COMPLETE STREETS

PORTSMOUTH, NH

EXISTING CONDITIONS

	REVISIONS	
DATE	DESCRIPTION	BY

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DESIGNED BY:	FG
CHECKED BY:	DJG
DATE:	Feb 2014
PROJ.NO:	13015

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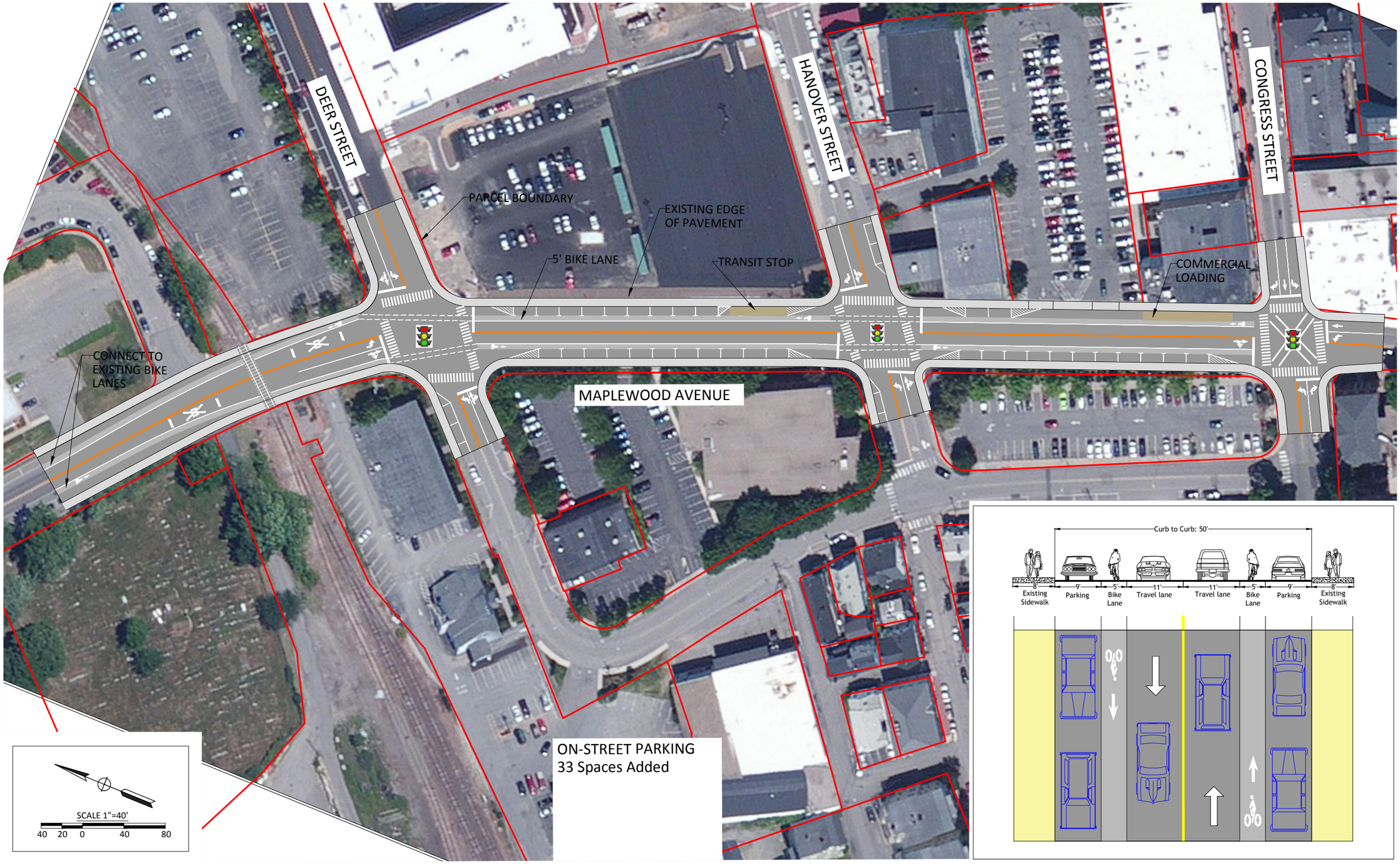

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MAPLEWOOD AVENUE COMPLETE STREETS

PORTSMOUTH, NH

ALTERNATIVE 1

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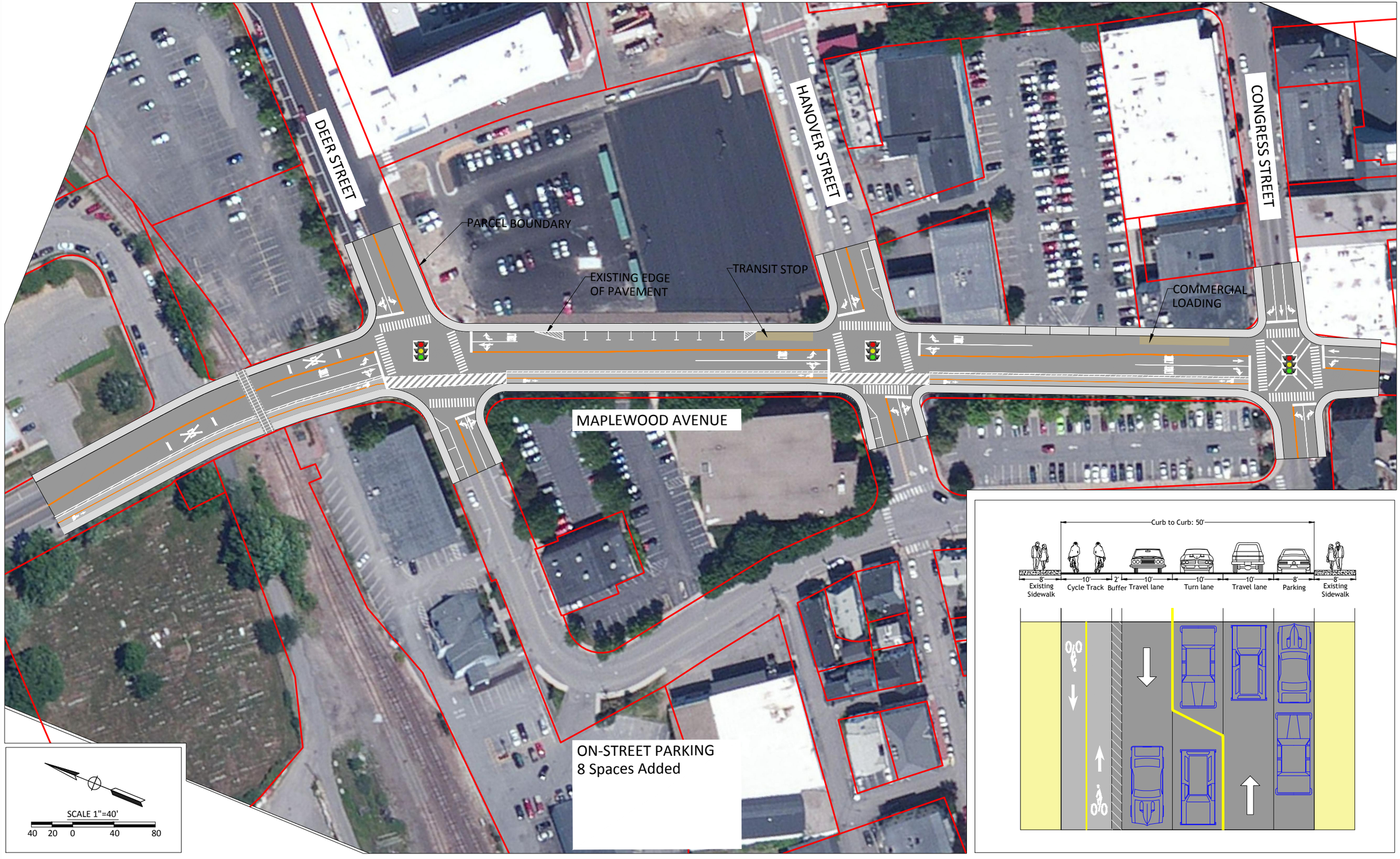

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MAPLEWOOD AVENUE COMPLETE STREETS

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ALTERNATIVE 2

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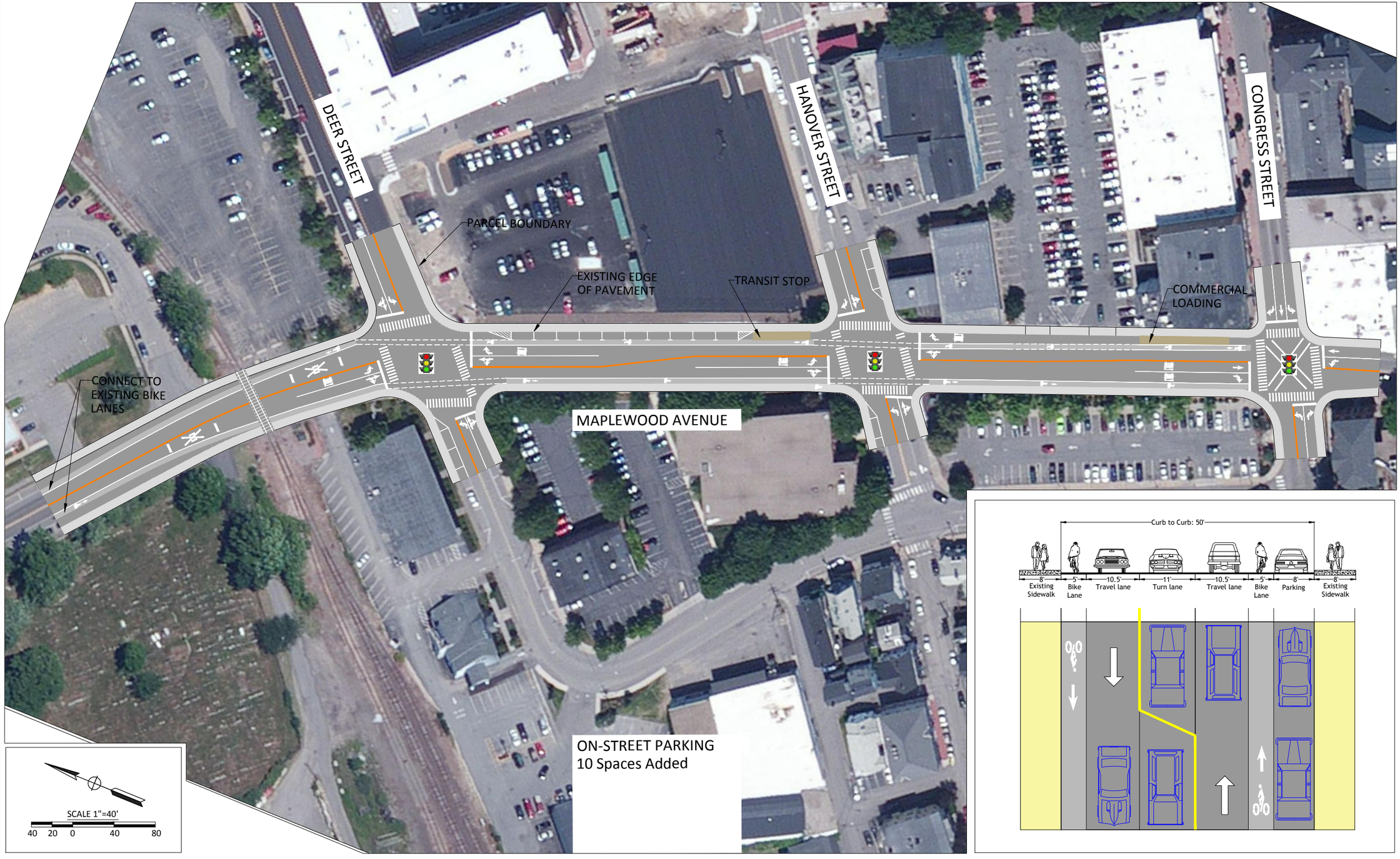

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ALTERNATIVE 3

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SHEET 4 OF 4

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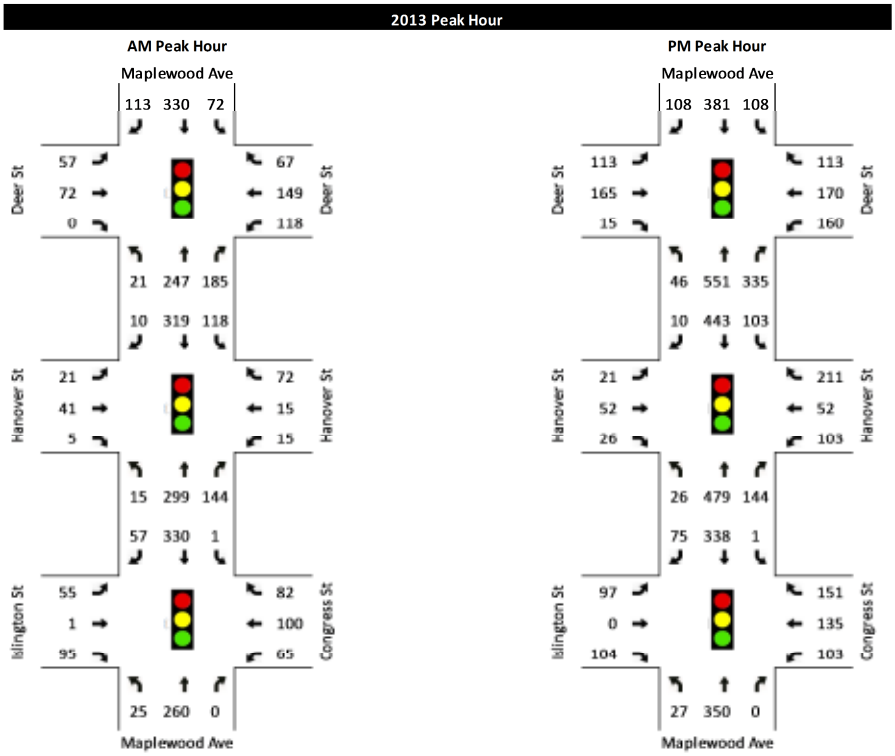
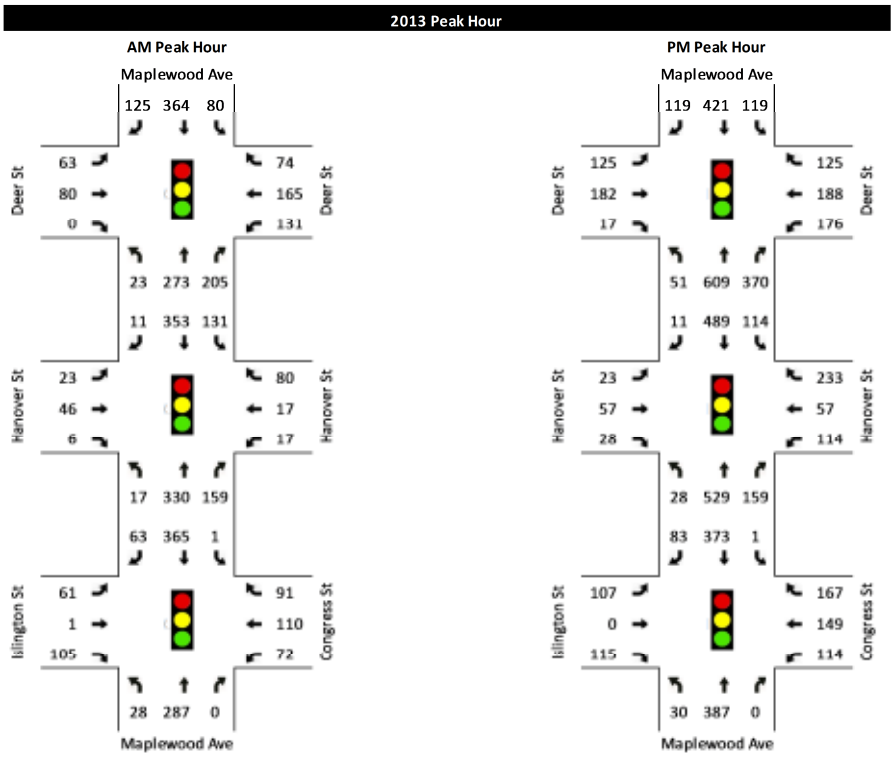
APPENDIX B. TRAFFIC VOLUMES AND ANALYSIS

2013 PEAK HOUR VOLUMES



2023 PEAK HOUR VOLUMES



2013 AM PEAK HOUR LEVEL-OF-SERVICE RESULTS

2013 AM	Base - No Build					Alt 1 - 2 Lanes					Alt 2&3 - 3 Lanes				
	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c
Maplewood Ave/Deer St															
Overall	B	20	-	-	0.53	C	22	-	-	0.57	B	20	-	-	0.53
EB, Deer St	D	41	42	98	0.65	D	44	44	98	0.7	D	41	47	125	0.65
WB, Deer St	D	43	127	274	0.58	D	45	129	295	0.6	D	43	128	282	0.58
NB, Maplewood Ave	A	7	42	125	0.25	B	11	96	243	0.47	A	6	55	140	0.28
SB, Maplewood Ave	A	8	95	216	0.4	A	7	91	203	0.39	A	8	93	225	0.4
Maplewood Ave/Hanover St															
Overall	A	10	-	-	0.3	B	11	-	-	0.52	B	10	-	-	0.34
EB, Hanover St	D	46	37	111	0.41	D	46	39	106	0.41	D	46	40	112	0.41
WB, Hanover St	D	40	32	80	0.35	D	41	30	81	0.35	D	40	32	89	0.35
NB, Maplewood Ave	A	4	28	106	0.25	A	5	51	176	0.44	A	5	33	106	0.31
SB, Maplewood Ave	A	2	33	98	0.25	A	5	86	271	0.47	A	2	32	83	0.25
Maplewood Ave/Islington St															
Overall	C	20	-	-	0.36	C	20	-	-	0.41	C	20	-	-	0.36
EB, Islington St	D	45	38	90	0.43	D	45	40	97	0.43	D	45	40	95	0.43
WB, Congress St	D	42	71	163	0.51	D	42	74	152	0.51	D	42	71	149	0.51
NB, Maplewood Ave	A	8	27	80	0.15	A	8	46	125	0.23	A	8	51	133	0.23
SB, Maplewood Ave	A	6	48	132	0.29	A	6	82	210	0.35	A	6	47	129	0.29

LOS - Level of Service
v/c - volume to capacity ratio
average delay in seconds
queues reported in feet

poor level of service excessive queue length

2013 PM PEAK HOUR LEVEL-OF-SERVICE RESULTS

2013 PM 0	Base - No Build					Alt 1 - 2 Lanes					Alt 2&3 - 3 Lanes				
	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c
Maplewood Ave/Deer St															
Overall	C	24	-	-	0.72	E	58	-	-	1.12	C	23	-	-	0.76
EB, Deer St	D	49	124	272	0.85	F	>100	490	865	1.4	C	31	121	367	0.63
WB, Deer St	D	44	182	401	0.74	E	78	844	1125	1.02	C	31	172	393	0.59
NB, Maplewood Ave	B	13	160	321	0.62	D	53	328	349	1.03	C	24	243	345	0.77
SB, Maplewood Ave	B	11	125	274	0.45	A	9	101	206	0.41	B	13	122	249	0.48
Maplewood Ave/Hanover St															
Overall	B	18	-	-	0.5	C	26	-	-	0.76	B	19	-	-	0.61
EB, Hanover St	D	40	50	126	0.3	D	43	53	133	0.38	D	40	52	148	0.31
WB, Hanover St	D	41	118	288	0.74	E	59	149	355	0.92	D	42	125	299	0.75
NB, Maplewood Ave	A	10	64	213	0.39	B	13	234	332	0.65	B	11	108	302	0.54
SB, Maplewood Ave	A	6	61	199	0.38	B	15	173	336	0.63	A	6	60	218	0.38
Maplewood Ave/Islington St															
Overall	C	26	-	-	0.43	C	26	-	-	0.5	C	26	-	-	0.44
EB, Islington St	D	50	74	124	0.57	D	50	74	124	0.57	D	50	72	124	0.57
WB, Congress St	D	45	93	178	0.62	D	45	92	189	0.62	D	45	91	178	0.62
NB, Maplewood Ave	B	10	54	127	0.22	B	12	132	370	0.34	B	12	93	221	0.34
SB, Maplewood Ave	A	10	87	215	0.33	A	9	89	278	0.41	A	9	85	195	0.33

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2013 AM PEAK HOUR LEVEL-OF-SERVICE RESULTS

2023 AM	Base - No Build					Alt 1 - 2 Lanes					Alt 2&3 - 3 Lanes				
	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c
Maplewood Ave/Deer St															
Overall	C	21	-	-	0.58	C	24	-	-	0.65	C	22	-	-	0.59
EB, Deer St	D	45	52	173	0.75	D	51	49	128	0.81	D	49	49	159	0.79
WB, Deer St	D	43	144	331	0.61	D	46	145	301	0.63	D	45	142	313	0.62
NB, Maplewood Ave	A	7	56	180	0.28	B	13	115	289	0.54	A	8	74	240	0.32
SB, Maplewood Ave	A	8	121	276	0.45	A	8	111	254	0.44	A	8	119	261	0.44
Maplewood Ave/Hanover St															
Overall	A	10	-	-	0.33	B	12	-	-	0.61	A	10	-	-	0.38
EB, Hanover St	D	46	44	126	0.45	D	46	44	119	0.45	D	46	44	118	0.45
WB, Hanover St	D	39	32	83	0.39	D	41	31	72	0.39	D	39	33	92	0.39
NB, Maplewood Ave	A	4	33	120	0.28	A	5	55	146	0.49	A	4	42	134	0.34
SB, Maplewood Ave	A	2	31	77	0.28	A	5	109	296	0.55	A	2	35	83	0.28
Maplewood Ave/Islington St															
Overall	C	20	-	-	0.4	C	21	-	-	0.45	C	21	-	-	0.4
EB, Islington St	D	46	48	101	0.46	D	46	45	106	0.46	D	46	49	104	0.46
WB, Congress St	D	42	74	161	0.54	D	42	74	147	0.54	D	42	74	160	0.54
NB, Maplewood Ave	A	8	32	96	0.17	A	9	59	149	0.26	A	9	65	173	0.26
SB, Maplewood Ave	A	6	54	172	0.33	A	6	90	217	0.39	A	7	54	178	0.33

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2023 PM PEAK HOUR LEVEL-OF-SERVICE RESULTS

2023 PM	Base - No Build					Alt 1 - 2 Lanes					Alt 2&3 - 3 Lanes				
	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c	LOS	Delay	Avg. Q	Max. Q	v/c
Maplewood Ave/Deer St															
Overall	C	32	-	-	0.86	F	97	-	-	1.33	C	29	-	-	0.81
EB, Deer St	F	85	248	529	1.14	F	>100	1091	1431	1.76	D	42	254	613	0.75
WB, Deer St	E	55	280	682	0.9	F	97	915	1295	1.16	D	41	322	716	0.67
NB, Maplewood Ave	B	16	199	336	0.69	F	>100	341	351	1.2	C	26	333	348	0.8
SB, Maplewood Ave	B	12	158	347	0.49	A	10	124	314	0.46	B	16	177	407	0.53
Maplewood Ave/Hanover St															
Overall	B	18	-	-	0.56	C	32	-	-	0.89	B	19	-	-	0.69
EB, Hanover St	D	39	54	160	0.33	D	44	136	291	0.43	D	39	57	148	0.34
WB, Hanover St	D	43	129	283	0.8	E	79	532	988	1.09	D	45	161	401	0.83
NB, Maplewood Ave	A	10	82	245	0.44	B	12	325	337	0.72	B	11	231	332	0.62
SB, Maplewood Ave	A	6	67	192	0.43	B	20	194	352	0.75	A	6	87	297	0.42
Maplewood Ave/Islington St															
Overall	C	27	-	-	0.48	C	27	-	-	0.55	C	28	-	-	0.49
EB, Islington St	D	51	74	122	0.61	D	51	877	1480	0.61	D	51	79	123	0.61
WB, Congress St	D	44	99	191	0.64	D	44	141	322	0.64	D	44	104	220	0.64
NB, Maplewood Ave	B	11	64	154	0.24	B	13	197	395	0.39	B	13	216	398	0.39
SB, Maplewood Ave	B	13	96	257	0.37	B	12	203	312	0.46	B	15	218	327	0.37

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