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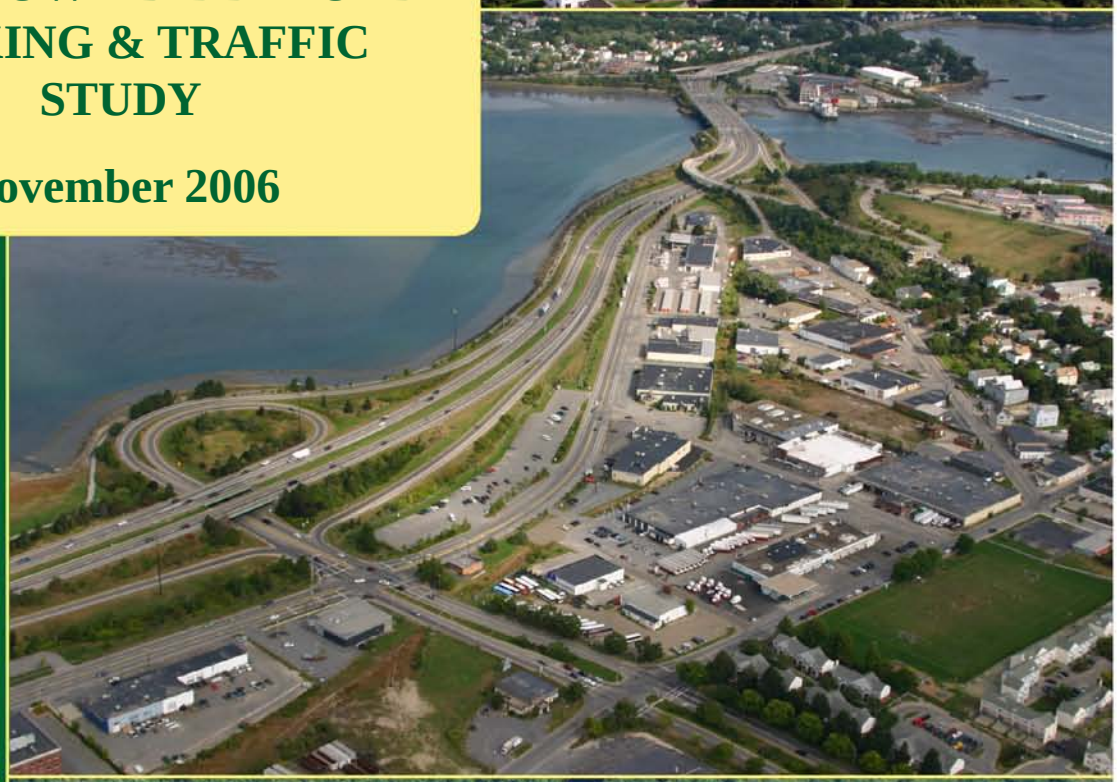
Gorrill-Palmer Consulting Engineers, Inc.

FINAL REPORT
DOWNTOWN BIDDEFORD PARKING & TRAFFIC STUDY

November 2006



Traffic Engineering

- Impact Studies
- Corridor Studies
- Parking Studies
- Pedestrian Studies
- Roadway Design
- Peer Review
- Traffic Calming

Civil Engineering

- Site Plan Design
- Stormwater Management
- Erosion Control
- Utility Design
- Permitting
- Feasibility Studies

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Downtown Traffic Circulation and Parking Management Plan

Biddeford, Maine

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Acknowledgements

The Consultant Team wishes to acknowledge the valuable assistance of the members of the Downtown Parking and Traffic Advisory Committee and City Staff in preparing this study for the City of Biddeford. (Listed in alphabetical order.)

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John Duncan –Director, PACTS
Kenneth Farley – City Councilor
David Flood – Heart of Biddeford
Brian Keely – Downtown Development Commission
John McCurry – City Councilor
David O'Connor – University of New England
Rachael Weyand – Heart of Biddeford

City Staff

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Executive Summary

Project Background

Biddeford, with a population of approximately 22,000 people, is a thriving community with ever-increasing transportation demands. Downtown Biddeford, once home to a strong textile mill center, is being redeveloped with a blend of technology-based businesses, service-based businesses, retail and residential uses. The City is seeing a renewed interest in the Downtown, via the redevelopment of existing buildings and the potential for redevelopment within the Mill District.

As downtown redevelopment and growth continues, traffic destined to and from downtown businesses and residences will likely increase. The street network of Downtown Biddeford will need to continue to accommodate a variety of users, including through traffic, truck, bicyclists and pedestrians. With this increased activity and traffic will come the need for an efficient parking management plan and the creation of new parking.

As part of the City's strategy to providing safe and efficient travel, as well as adequate parking, the City and PACTS retained Gorrill-Palmer Consulting Engineers Inc. to conduct both a traffic circulation and a parking management study for Downtown Biddeford. An Advisory Committee was formed, consisting of City Staff and Elected Officials, and downtown business and property owners. This committee served the role of advisors to Gorrill-Palmer Consulting Engineers Inc. and provided valuable input throughout the study process. Regular meetings were held, with the process moving forward by a consensus of the committee.

This plan will outline the existing conditions, including deficiencies, with the traffic circulation and parking supply and demand within the downtown, as well as the future needs scenarios, based on anticipated growth and development. The major purpose of this plan is to develop a set of alternatives that will improve the overall operations, safety and efficiency of Downtown Biddeford. This plan will also identify potential locations for new parking, and recommendations to manage this parking.

Study Area

The overall study area is bounded by Main Street, Lincoln Street, Pearl Street, Elm Street, Mason Street, Graham Street, Birch Street, and Hill Street. As the study progressed, the Committee determined that the study should really focus on the core downtown area, which is the Main Street corridor and the immediate vicinity. The study area thus focused on the streets that really define downtown Biddeford, and is shown in Figure 1 in Appendix A. It should be noted that the Mill District was not included as part of the study area.

This area is well served by transit. The ShuttleBus operates the daily Tri-Town service between Biddeford, Saco and Old Orchard Beach, as well as daily Intercity service that connects to Scarborough, South Portland, and Portland. An Amtrak station, for the Downeaster service between Portland and Boston, is located on Saco Island, just a short walk from Downtown Biddeford. The Regional Transportation Program, Inc. (RTP) is available for those who require door-to-door service for medial appointments, work, etc. In addition, there are multiple taxicab

companies that provide service to and through downtown Biddeford. The City of Biddeford should continue to encourage the use of alternative transportation to help reduce vehicle dependency, which can reduce traffic and parking in the Downtown.

Future Development Forecast

City staff prepared a twenty-year build out scenario of future development of over 100,000 square feet within the Downtown, based on existing square footage of available space and an anticipated mix of uses. From a traffic standpoint, this scenario includes only a portion of the Mill District, and does not realize the full potential for development within the former mill buildings. Additionally, for the purposes of parking management, the Committee determined that this plan should not account for any significant redevelopment within the Mill District. The consensus was that any redevelopment within the mills would likely be of such a scale that on-site parking, within the Mill District itself, would be part of the development plans.

Traffic Circulation

The streets within the Downtown area are two-lane roadways, most with on-street parking, that carry between 5,000 and 14,000 vehicles per day. These volumes and the many varied turning movements at the intersections combine to create an inefficient traffic circulation system that is operating at or beyond capacity. Given the geometrics of the Downtown, and the bounds created by the Saco River, the two major intersections that control the overall traffic flow are Main Street at Elm Street, and Main Street at Hill Street and Water Street. Currently, both of these intersections are operating at a Level of Service (LOS) "F" during the peak hours. This results in congestion, excessive delays, and overall inefficient circulation throughout the Downtown.

Traffic Circulation – Improvement Alternatives

This study considered ten alternatives to improve traffic circulation within the Downtown. Of these ten alternatives, four combinations were evaluated in depth. These four alternative combinations include:

- Relocate the access to the North Dam Mill and retime the traffic signals throughout Downtown. (These improvements are assumed to be inherent to the other alternative combinations, and will not be directly identified.)
- Eliminate Hill Street access to Main Street. Hill Street would remain a two-way street, but the northbound lane would be dead-ended just prior to the Main Street intersection. Traffic would still be able to enter Hill Street from Main Street.
- Construct a roundabout at the intersection of Main Street with Hill Street, Water Street, and the access to North Dam Mill. This also includes the installation of all-way stop control for the intersection of Main Street and Alfred Street.
- Close a portion of Main Street to vehicular traffic, from Alfred Street to Adams Street and Lincoln Street. This alternative evaluation also includes the installation of all-way stop control at the Jefferson Street and Adams Street intersection, as well as the Main Street, Adams Street, Lincoln Street intersection.

Traffic Circulation - Recommendations

A combination of alternatives will be required to truly provide improved operational efficiency throughout Downtown Biddeford. Listed below are the improvements or combinations of alternatives that should be implemented in order to maintain or improve operational efficiency and safety within Downtown.

Steps that could be taken in the immediate future include the following:

- Retime all the traffic signals throughout the Downtown, maintaining the coordination of the Elm Street signals at Spruce Street and Main Street;
- Extension of the left-turn lanes at the intersection of Main Street and Elm Street;
- Re-stripe all marked crosswalks;
- Install new and/or additional Pedestrian Crossing signage at crosswalks.

Steps that could be planned for the 2008-2009 Biennial Capital Work Plan include:

- Relocate access to/from North Dam Mill to better align with Water Street, so that it becomes part of the intersection;
- Consider the implementation of an all-way stop at Jefferson Street and Adams Street;
- Rehabilitate existing sidewalks and ramps to meet the Americans with Disabilities Act (ADA) standards (This could be done as a stand alone project to include all intersections; of as an addition to other projects at each intersection, as they move forward);
- Upgrade all traffic signals to 12-inch lenses with back plates and provide one signal head per lane. (This also could be completed as a stand alone project, or as part of other intersection improvement projects.)

Steps that would be appropriate to plan for 2010 and beyond include:

- Construct a roundabout at the intersection of Main Street, Hill Street, Water Street, and the North Dam Mill;
- Implement all-way stop at the intersection of Main Street, Alfred Street and Laconia Street (This is critical if the roundabout is constructed as described above).

Parking Management

Within the focused area of this study, there are 940 public parking spaces, and an additional 429 off-street private parking spaces. This study only looked at the management of the 940 public parking spaces, which include a mix of on-street and off-street (municipal parking lots) parking. On November 17, 2005, Gorrill-Palmer Consulting Engineers Inc. conducted an hourly count of usage of all municipal parking spaces within the study area. The summary data sheets from this count are included in Appendix E.

This survey showed that within Downtown, regular parking demand is at approximately 60-percent of the available supply. However, some locations operate at near full capacity, while other locations for parking are severely underutilized. For example, the City Hall Lot and the Franklin Street Lot are both used at upwards of 80-percent of their capacity. Conversely, the

on-street parking along Main Street, from Hill Street to Alfred Street, sees usage of less than 25-percent.

When parking demand begins to approach 80 to 90 percent of capacity, the supply begins to seem inadequate. There needs to be some excess parking supply throughout the Downtown to allow for circulation, peak usage, and finding available spaces. There are roughly 150 excess parking spaces available today before reaching that 80-percent threshold. However, there are spot shortages within some sub-areas. This excess could easily be consumed by just one or two development projects. The City is taking a proactive approach by anticipating future growth and needs. By having a parking management plan in place, the City of Biddeford will be ready when future development or redevelopment opportunities come along.

Based on the future development scenario developed by City staff, Downtown Biddeford will see a parking deficit of approximately 100 spaces, assuming 100-percent usage. To allow for circulation and finding an available space, the City of Biddeford should be looking to create between 200 and 300 additional parking spaces within the next twenty years. Given the lack of available land, construction of a parking structure should be considered.

Gorrill-Palmer Consulting Engineers Inc. contracted with Carl Walker, Inc. to prepare a conceptual layout of a parking structure on the Franklin Street Lot. This location is centrally located within the Downtown, is already owned by the City, and is currently used for parking and would therefore not require the displacement of businesses or residences. In this location, a four-level structure would be needed to accommodate the needed parking, with a net increase of approximately 275 spaces.

Parking Management Plan - Recommendations

An effective parking management plan requires a combination of actions that will create the appropriate balance of short-term parking (customers, clients, etc.) and long-term parking (eight-hour, employee, etc.), as well as an adequate supply of overnight parking for residents. Short-term parking should continue to be located on-street and closest to the businesses, with employees parking further away, typically in the municipal lots. Improved signage, including wayfinding signage, can assist with encouraged use of underutilized parking lots. Continued enforcement of parking restrictions, time limits, etc, will also be very effective in managing municipal parking. Parking meters and/or permit parking systems should also be considered. Meters, or some other type of pay to park system, aide in keeping the 'prime' locations available for high turnover. Finally, the City of Biddeford should be planning for construction of a parking structure to meet the demand of future downtown growth and development.

The phasing described in this section is based on priorities, as well as an awareness of the City Council review process and funding and budget cycles. The phasing is a suggestion. Development may dictate changes to the priorities.

Phase I

The following measures are recommended in the short-term horizon:

- Replace or install new signage for wayfinding and locations of parking
- Revise City Ordinances to reflect changes in parking time restrictions

- Establish or revise parking fee and fine structures as necessary

It should be noted that as signage is installed, great care should be taken to prevent an unnecessary proliferation of parking and/or directional signs within the downtown. By designating entire lots all for the same time limits, signs need not be installed at each individual parking space; rather they can be installed only at the entrance to the lots. The same theory holds true for on-street parking. By keeping entire streets or segments of streets to the same time limits, the number of signs can be minimized.

Phase II

The following measures are recommended in the mid-term horizon:

- Install parking meters
  - On-Street
    - Main Street
    - Alfred Street
    - Adams Street
    - Washington Street
    - Lincoln Street
  - Municipal Lots
    - Alfred Street Lot
- Implement parking permit system (could be an alternative to metered parking) in the following Municipal Lots
  - Federal Street (Old Courthouse) Lot
  - Franklin Street Lot
  - Washington Street Lot
  - Foss Street Lot

Phase III

The need for a parking structure is directly tied to the rate and types of growth and development within the downtown. The construction of a parking structure should be considered for long-term implementation. The planning and design for this structure should be an on-going process beginning with the adoption of this parking management plan. Various options exist for the construction of this parking garage.

- The City could have the foundation and structure designed for a five or six level parking structure, but only actually construct the first three levels at the onset, with the additional levels built when needed at a later date. This phased construction will require careful coordination with the engineer/designer of the structure. The cost effectiveness of such a plan will need to be thoroughly evaluated with the engineer at that time.

- The parking structure could be constructed in conjunction with the construction of a new office building or other such large scale redevelopment. A large enough development could create the critical need for a parking structure; and a public/private partnership of sorts could be used for the garage construction. A certain number of

spaces would be dedicated to the new development, while the remainder of the structure would be available for public use.

Upon acceptance or adoption by the Biddeford City Council, the implementation of this parking management plan will be an on-going process. This plan is also intended to be a dynamic plan for the City of Biddeford, which should be evaluated on a regular basis, and updated as needed.

Part I - Introduction

Project Background

Biddeford, with a population of approximately 22,000 people, is a thriving community with ever-increasing transportation demands. Downtown Biddeford, once home to a strong textile mill center, is being redeveloped with a blend of technology-based businesses, service-based businesses, retail and residential uses.

Traffic volumes in Downtown Biddeford have remained relatively constant since 2000. With the on-going interest in locating in the downtown, and the potential for redevelopment of the Mill District, the area is poised for significant new traffic, particularly with its proximity to the Amtrak station. As the downtown corridor for the City, it is critical for Main Street to remain a viable and usable transportation corridor, not only for motorized vehicles, but for pedestrians and bicyclists as well.

With this increase in development, and increased traffic, comes the need for an efficient parking management plan, which will likely include the creation of new parking within the Downtown.

Biddeford's Comprehensive Plan calls for "safe and efficient travel throughout the existing roadway system" as well as the need to provide "adequate parking to accommodate existing conditions and future development". As part of that strategy, Gorrill-Palmer Consulting Engineers Inc. was retained by PACTS and the City of Biddeford to conduct both a traffic circulation and a parking management study for Downtown Biddeford. A Downtown Traffic and Parking Committee was formed, consisting of City Staff, City Councilors, and downtown business and property owners.

Study Area

The overall study area is bounded by Main Street, Lincoln Street, Pearl Street, Elm Street, Mason Street, Graham Street, Birch Street, and Hill Street. As the study progressed, the Committee determined that the study should really focus on the core downtown area, which is the Main Street corridor and the immediate vicinity. The study area thus focused on the streets that really define downtown Biddeford, and is shown in Figure 1 in Appendix A:

- Main Street, Hill Street/Water Street to Elm Street
- Lincoln Street, Main Street to Pearl Street
- Elm Street, Pearl Street to South Street
- South Street, Elm Street to Adams Street
- Jefferson Street, Main Street to Alfred Street
- Adams Street, Main Street to end
- Alfred Street, Jefferson Street/Pool Street to Main Street

Project Goals

The main purpose of this study is to develop a set of alternatives that will improve the operations, safety and efficiency of the roadways of Downtown Biddeford, without negatively impacting the various business and residential uses.

Although it is of the utmost importance to provide long-term designs for Main Street and the adjacent streets as carriers of vehicular traffic, other concerns must be kept in mind as well. Downtown Biddeford, like the downtowns of most cities, is very densely developed, with many buildings located very close to the roadways. This limits the availability of right-of-way for any potential road widening. Given the sensitivity of this area to short and long-term traffic growth, any improvement plan must keep the needs of residents as well as businesses in mind.

As is to be expected in a vibrant, thriving Downtown, pedestrian and bicyclist activity is widespread. The diversity of uses in the downtown, including residential, office and retail, among others, creates the potential for increased multi-modal travel. The plan for this corridor should strive to balance the needs of these other users with that of vehicular traffic.

Part II - Traffic Circulation

Chapter 1
Existing Conditions

Main Street is the primary corridor through downtown Biddeford. As such, it accomodates a variety of users along the roadway, including through traffic, bicyclists, pedestrians, and traffic destined to/from downtown businesses or residences. Main Street is a two-lane roadway with on-street parking, and a posted speed limit of 25 miles per hour within the study area. Main Street, which is also State Route 9 from the Saco city line to Alfred Street, is one of the connections over the Saco River between the Cities of Biddeford and Saco.

The other roadways within the study area are descibed as follows:

Lincoln Street
Lincoln Street is a two-lane roadway that runs in a generally north-south direction between Main Street and Elm Street. There is on-street parking along both sides of the road, from Main Street to Pearl Street. Lincoln Street provides access to the MERC facility, as well as into the 'Mill District'.

Elm Street
Elm Street, which is U.S. Route 1, connects the Cities of Biddeford and Saco, over the Saco River. As U.S. Route 1, Elm Street carries a significant amount of through traffic. Within the study area, Elm Street is a two-lane roadway with limited on-street parking in the vicinty of Center Street and South Street.

South Street
Within the study area, South Street is a local two-lane roadway between Elm Street and Adams Street. However, from Jefferson Street, South Street is one-way to Adams Street. South Street runs in a generally east-west direction, and has on-street parking on both sides, from Green Street to Adams Street. From Elm Street to Green Street, there is parking along the north side of the street only.

Jefferson Street
Jefferson Street is a two-lane roadway from Alfred Street to Main Street. From Alfred Street to South Street, Jefferson Street is a parallel route to Main Street. Parking is prohibited along most of the corridor. On-street parking is only allowed on the easterly side of the street, from South Street to Main Street.

Adams Street
Adams Street intersects with Main Street opposite Lincoln Street, and continues southerly to its end southwesterly of Jefferson Street. Adams Street provides access to the City Hall parking lot. There is on-street parking along both sides of Adams Street, from Main Street to the end.

Alfred Street

Alfred Street is State Route 111, which runs from downtown Biddeford to Alfred. Within the study area, Alfred Street is a two-lane road with on-street parking along both sides of the road, from Main Street to Franklin Street.

Data Collection

In order to evaluate existing and future traffic flow, and to assist in the evaluation of alternatives, our office collected the following PM peak hour turning movement counts:

- November 10, 2005:
  - Alfred Street at Birch Street
  - Alfred Street at Pool Street
  - Main Street at Alfred Street
  - Main Street at Hill Street/Water Street
- November 14, 2005:
  - Elm Street at South Street
  - Main Street at Adams Street
  - Main Street at Elm Street
  - Main Street at Jefferson Street
- November 15, 2005:
  - Jefferson Street at Adams Street
  - Jefferson Street at South Street/Crescent Street
- July 17, 2006:
  - Hill Street at Pool Street/Jefferson Street
  - Main Street at Spruce Street

In addition to the turning movement counts, our office collected directional ATR data, including traffic volumes and vehicle classifications from Wednesday afternoon, November 9, 2005, through Saturday morning, November 19, 2005, at four locations within the downtown. The Annual Average Daily Traffic volumes for each are as follows:

- Alfred Street, between Main Street and Bacon Street – AADT 8,430 vehicles
- Elm Street, between Cutts Street and Center Street – AADT 13,810 vehicles
- Main Street, between Elm Street and Jefferson Street – AADT 6,830 vehicles
- South Street, between Wentworth Street and Green Street – AADT 4,980 vehicles

A review of historical data obtained from the Maine Department of Transportation (MaineDOT) shows that the average volumes within the downtown, while fluctuating slightly within the past ten years, have remained relatively stable. Graphs of these historical trends are included in Figure 4 of Appendix A.

The raw turning movement volumes and the ATR data are shown on Figure 2 of Appendix A.

Bicycle and Pedestrian Amenities

Our office conducted a visual survey of the downtown area to collect information on bicycle and pedestrian amenities. There are no bicycle lanes within the downtown, and the current traffic volumes, combined with the relatively narrow travel lanes and on-street parking, make for a less than ideal situation for bicycle riders. There are sidewalks throughout the downtown that generally vary in width from five feet to seven feet or more. Marked crosswalks exist at virtually all of the intersections, varying from on one to all legs of the intersections. As part of the collection of turning movement data, our office also collected data on the number of pedestrian movements at the intersections during the peak hour. This pedestrian data is summarized below:

Table 1.1: Peak Hour Pedestrian Volumes – November, 2005

Intersection	Number of Pedestrians
Main Street @ Hill Street/Water Street	12
Main Street @ Alfred Street	18
Main Street @ Adams Street/Lincoln Street	85
Main Street @ Jefferson Street	137
Main Street @ Elm Street	39
Elm Street @ South Street	37
Jefferson Street @ South Street	68
Jefferson Street @ Adams Street	29
Alfred Street @ Jefferson Street/Pool Street	65
Alfred Street @ Birch Street	45

Transit Facilities

Downtown Biddeford is served well by transit. The ShuttleBus operates the daily Tri-Town service between Biddeford, Saco and Old Orchard Beach, as well as daily Intercity service that connects to Scarborough, South Portland, and Portland. An Amtrak station, for the Downeaster service between Portland and Boston, is located on Saco Island, just a short walk from Downtown Biddeford. The Regional Transportation Program, Inc. (RTP) is available for those who require door-to-door service for medial appointments, work, etc. In addition, there are multiple taxicab companies that provide service to and through downtown Biddeford.

Capacity and Level of Service

Our office performed an analysis of the capacity and level of service of the existing conditions in terms of delays and queues. All analyses were done using the Synchro/SimTraffic software. Level of service rankings are similar to the academic ranking system where and 'A' is very good with little control delay and an 'F' represents very poor conditions with long delays. A Level of Service (LOS) 'D' or higher is desirable for a signalized intersection. At an unsignalized intersection, if the level of service falls below a 'D', an evaluation should be made to determine if a traffic signal is warranted.

The following tables summarize the relationship between control delay and level of service:

Table 1.2: Level of Service Criteria for Unsignalized Intersections

Level of Service (LOS)	Control Delay per Vehicle (sec)
A	Up to 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	Greater than 50.0

Table 1.3: Level of Service Criteria for Signalized Intersections

Level of Service (LOS)	Control Delay per Vehicle (sec)
A	Up to 10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	Greater than 80.0

The Synchro/SimTraffic software model was used to evaluate the 2005 conditions to get a baseline of information for comparison with future growth and needs. The results of the capacity and queue analyses are shown in the following tables:

Table 1.4: Level of Service for Downtown Signalized Intersections - 2005

Intersection/ Approach	2005 Volumes		Intersection/ Approach	2005 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Elm St			**Jefferson St & Alfred St**		
Main St – EBL	64.0	E	Jefferson St – EBL	>100	F
Main St – EBTR	47.8	D	Jefferson St – EBTR	>100	F
Elm St – NBL	64.0	E	Alfred St – NBL	>100	F
Elm St – NBTR	46.9	D	Alfred St – NBTR	>100	F
Main St – WBL	34.9	C	Jefferson St – WBL	87.9	F
Main St – WBTR	15.7	B	Jefferson St – WBTR	>100	F
Elm St – SBL	82.2	F	Alfred St – SBL	64.8	E
Elm St – SBTR	40.5	D	Alfred St – SBTR	41.9	D
Overall Intersection	**41.1**	**D**	**Overall Intersection**	**>100**	**F**
South St @ Elm St			**Main St & Hill St/ Water St**		
South St – EBLTR	55.6	E	Main St – EBTR	47.9	D
Elm St – NBLTR	>100	F	Hill St – NBL	>100	F
South St – WBLTR	40.7	D	Hill St – NBR	>100	F
Elm St – SBLTR	28.0	C	Water St - NBL	>100	F
Overall Intersection	**>100**	**F**	Main St - WBTL	25.0	C
Hill St @ Pool St			**Overall Intersection**	**87.0**	**F**
Pool St – EBL	49.5	E	**Elm St @ Spruce St**		
Pool St – EBTR	19.5	B	Spruce St – EBLR	22.8	C
Hill St – NBLTR	>100	F	Elm St – NBL	19.8	B
Pool St – WBL	>100	F	Elm St – NBT	4.9	A
Pool St – WBTR	>100	F	Elm St – SBTR	27.7	C
Hill St – SBLTR	26.2	C	**Overall Intersection**	**18.2**	**B**
Overall Intersection	**79.5**	**E**			

Table 1.5: Level of Service for Downtown Unsignalized Intersections – 2005

Intersection/ Approach	2005 Volumes		Intersection/ Approach	2005 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Jefferson St			**Jefferson St & Adams St**		
Main St – EBTR	28.3	D	Jefferson St – EBLTR	31.3	D
Jefferson St – NBLR	38.0	E	Adams St – NBLTR	70.7	F
Main St – WBLT	3.1	A	Jefferson St – WBLTR	26.3	D
Overall Intersection	**20.1**	**C**	Adams St – SBLTR	>100	F
Main St & Lincoln St/Adams St			**Overall Intersection**	**46.9**	**E**
Main St – EBLTR	62.1	F	**Jefferson St & South St**		
Adams St – NBLT	16.8	C	South St – EBLTR	>100	F
Adams St – NBR	6.3	A	Crescent St – EBLTR	82.4	F
Main St – WBLTR	68.2	F	Jefferson St – NBLTR	21.5	C
Lincoln St – SBLTR	>100	F	Jefferson St – SBLTR	25.2	D
Overall Intersection	**>100**	**F**	**Overall Intersection**	**60.9**	**F**
Main St & Alfred St			**South St & Adams St**		
Main St – EBLTR	7.9	A	South St – EBLR	>100	F
Alfred St – NBLTR	88.6	F	Adams St – NBT	0.4	A
Main St – WBLTR	43.9	E	Adams St – SBT	95.1	F
Overall Intersection	**50.3**	**F**	**Overall Intersection**	**88.5**	**F**

The tables above indicate that, overall, the downtown area is currently operating at congested levels during the peak hour. This is not unusual for am urban area such as Biddeford.

Table 1.6: Queue Analysis for Downtown Signalized Intersections - 2005

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Elm St			
Main St – EBL	55	25	65
Main St – EBTR	500	140	355
Elm St – NBL	65	15	50
Elm St – NBTR	550	285	650
Main St – WBL	70	50	105
Main St – WBTR	350	105	240
Elm St – SBL	60	40	90
Elm St – SBTR	520	390	655
South St @ Elm St			
South St – EBLTR	500	150	345
Elm St – NBLTR	1000	865	1240
South St – WBLTR	400	105	970
Elm St – SBLTR	500	230	885
Jefferson St & Alfred St			
Jefferson St – EBL	40	60	85
Jefferson St – EBTR	550	345	705
Alfred St – NBL	60	45	95
Alfred St – NBTR	350	490	895
Jefferson St – WBL	115	25	100
Jefferson St – WBTR	350	315	675
Alfred St – SBL	60	45	95
Alfred St – SBTR	300	225	450
Hill St & Pool St			
Pool St – EBL	50	15	45
Pool St - EBTR	375	100	220
Hill St – NBLTR	650	205	515
Pool St – WBL	75	40	100
Pool St – WBTR	600	295	700
Hill St - SBLTR	420	115	255
Elm St & Spruce St			
Spruce St – EBLR	125	50	90
Elm St – NBL	100	20	50
Elm St – NBT	300	60	170
Elm St - SBTR	400	205	495
Main St & Hill St/ Water St			
Main St – EBT	500	310	580
Main St - EBR	20	35	60
Hill St – NBL	700	610	1240
Hill St – NBR	20	45	60
Water St - NBL	280	100	175
Main St – WBL	500	125	185
Main St – WBT	500	135	150

Table 1.7: Queue Analysis for Downtown Unsignalized Intersections - 2005

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Jefferson St			
Main St – EBTR	450	45	215
Jefferson St – NBLR	100	70	170
Main St – WBLT	400	30	115
Main St & Lincoln St/Adams St			
Main St – EBLTR	450	95	365
Adams St – NBLT	300	30	65
Adams St – NBR	55	15	45
Main St - WBLTR	450	135	510
Lincoln St – SBLTR	700	335	740
Main St & Alfred St			
Main St – EBLTR	300	25	125
Alfred St – NBLTR	250	400	720
Main St - WBLTR	150	275	580
Jefferson St & Adams St			
Jefferson St – EBLTR	200	65	190
Adams St – NBLTR	500	15	50
Jefferson St – WBLTR	250	70	370
Adams St – SBLTR	200	120	205
Jefferson St & South St			
South St – EBLTR	250	160	555
Crescent St – EBLTR	300	55	170
Jefferson St – NBLTR	150	75	145
Jefferson St – SBLTR	200	50	130
South St & Adams St			
South St – EBLR	200	80	210
Adams St – NBT	150	N/A	N/A
Adams St – SBT	200	95	250

As the above tables indicate, the available storage lengths of most of the intersection approaches within the downtown area are adequate for the average queues during the peak hour. However, the 95th percentile queues either approach or exceed the available storage lengths on many of the approaches. This creates spillback through adjacent intersections, further exacerbating the congestion problems.

Collision History

Our office obtained the collision history for the downtown area from the Maine Department of Transportation (MaineDOT). A location is classified as a High Crash Location (HCL) if it meets both of the following criteria:

1. Eight or more crashes over a three-year period, and;

2. A Critical Rate Factor (CRF) of 1.00 or greater for the same three-year period. A CRF compares the actual crash rate of each intersection or road segment to the Statewide crash rate of similar locations. A CRF less than 1.00 indicates a lower than average crash rate.

The following tables summarize the collision history for the study area for the three-year period 2002-2004.

Table 1.8: Maine DOT Crash Data for 2002-2004: Intersections with CRF >1.00

Node	Intersection	# of Collisions	CRF	HCL?
7141	**Route 1 (Elm St) at Lincoln St**	**13**	**1.41**	**Yes**
7139	**Route 1 (Elm St) at Spruce St**	**12**	**1.58**	**Yes**
7134	**Route 1 (Elm St) at South St**	**29**	**1.08**	**Yes**
9232	**Main St at Lincoln St/Adams St**	**18**	**4.07**	**Yes**
9233	Main St at Washington St	6	1.11	No
5065	**Main St at Alfred St**	**10**	**1.54**	**Yes**
5068/5069	**Main St at Hill St/Water St**	**27**	**2.03**	**Yes**
9315	**Hill St at Bacon St**	**9**	**2.19**	**Yes**
5056	**Route 111 (Alfred St) at Birch St**	**11**	**1.69**	**Yes**
9424	Birch St at Graham St	3	1.13	No
5059	Route 111 (Alfred St) at Washington St	7	1.11	No
9314	Foss St at Bacon St	7	3.72	No
5045	Foss St at Pool St (Route 9)	6	1.23	No
9507	Federal St at Washington St	2	1.04	No
9504	**Washington St at Jefferson St**	**16**	**3.48**	**Yes**
9503	**Adams St at Jefferson St**	**9**	**2.30**	**Yes**
9490	Green St at Center St	1	1.73	No
9509	Center St at Kossuth St	1	1.88	No

Table 1.9: Maine DOT Crash Data for 2002-2004: Road Segments with CRF>1.00

Nodes	Street	From	To	# of Collisions	CRF	HCL?
7138-9253	Elm St	St Mary's St	Pearl St	4	1.45	No
7137-7138	**Elm St**	**Main St**	**St Mary's St**	**8**	**1.44**	**Yes**
7136-7137	Elm St	Cutts St	Main St	6	1.20	No
7135-7136	Elm St	Center St	Cutts St	7	1.42	No
7137-9231	**Main St**	**Elm St**	**Jefferson St**	**12**	**3.53**	**Yes**
9231-9232	**Main St**	**Jefferson St**	**Adams St**	**11**	**2.25**	**Yes**
9232-9233	Main St	Adams St	Washington St	7	2.50	No
5056-5057	Alfred St	Birch St	Cote Ct	3	1.02	No
5060-5061	Alfred St	Summer St	Southerly of Jefferson St	5	1.35	No
5061-5062	Alfred St	Southerly of Jefferson St	Jefferson St	4	1.33	No
5065-5066	Main St	Alfred St	Foss St	5	1.52	No
5066-5067	Main St	Foss St	Emery St	5	1.25	No
5067-5068	Main St	Emery St	Hill St	6	1.46	No
9216-9217	South St	Jefferson St	Adams St	4	4.08	No
9490-9509	Center St	Green St	Kossuth St	1	1.69	No
9502-9509	Center St	Kossuth St	Jefferson St	1	1.37	No
9251-9254	Lincoln St	Pearl St	Stone St	6	2.06	No
9232-9254	Lincoln St	Main St	Stone St	5	2.63	No
5044-5045	Pool St	Hill St	Foss St	7	1.60	No
9218-9232	Adams St	South St	Main St	4	3.58	No
9218-9503	Adams St	South St	Jefferson St	3	1.25	No
9503-9506	Adams St	Jefferson St	End	5	23.51	No
9233-9507	Washington St	Main St	Federal St	3	1.11	No
9504-9507	Washington St	Jefferson St	Federal St	2	1.00	No
5068-9315	Hill St	Main St	Bacon St	6	1.20	No
9500-9501	Crescent St	Graham St	Jefferson St	1	1.14	No
5045-9317	Foss St	Pool St	King St	2	1.72	No
9314-9317	Foss St	Bacon St	King St	1	1.02	No

As shown in the tables above, there are thirteen High Crash Locations within the downtown study area. Our office examined the collision reports for all of these thirteen locations, and prepared a collision diagram for each, which are shown in Appendix C.

It is interesting to note that within the three-year period of our evaluation of the thirteen high crash locations, there were eight separate collisions involving a total of ten pedestrians. Of these collisions, seven occurred with the pedestrian(s) within the marked crosswalk. There were also three collisions involving bicyclists during this same period. Based on the crash reports, visibility appears to be a contributing factor in most of these collisions.

Overall, within the Downtown area, the general safety issues can be broken down into the following categories:

- Disregard of traffic control devices/failure to yield;
- Lack of left turn lanes/inadequate turn lanes at some intersections;
- Sight distance obstructions due to on-street parking; or
- Improper lane changes and improper turns.

Traffic Forecast for Year 2025

The design year for alternatives for Downtown Biddeford is the year 2025. The turning movement volumes were adjusted to 2025 volumes based on anticipated future development within the Downtown area. The information relative to future development was provided by City Staff. Our office then determined the expected trip generation for each development area based on commonly accepted data from the Instisture of Transportation Engineers (ITE). These additional trips were then applied to the study area based on current travel patterns. The 2025 adjusted volumes are shown in Appendix C. The following table outlines the development included in this growth and its anticipated additional traffic volumes in the study area.

Table 1.10: Anticipated Downtown Development by 2025

Development Area	Size	Trips Generated (PM Peak)	Assumptions	Enter/Exit Development
Lincoln Street Area	10,000 s.f. Office 10,000 s.f. Retail	79	30% of retail trips are primary	26/53
Main Street Area 1 (Adams St, South St area)	10 Residential Units 7,000 s.f. Office 7,000 s.f. Retail	68	30% of retail trips are primary	26/42
Main Street Area 2 (Washington St, Franklin St area)	20,000 s.f. Office 20,000 s.f. Retail	150	30% of retail trips are primary	53/97
Main Street Area 3 (Hill St to Alfred St)	750 s.f. Office 750 s.f. Retail	8	All primary trips	3/5
North Dam Mill Redevelopment	Approximately one-third of developable building area	186	Mixed use: residential, retail, office, & commercial spaces (20% shared trips; 30% of retail trips are primary)	74/112

Our office also reviewed the forecasts from the regional TRIPS model, maintained by PACTS, as part of the design year forecasting. This model, while very useful at a regional level, is sometimes harder to understand at a 'sub-regional' level. A function of the TRIPS model is that as roads reach capacity, the traffic is shifted to an alternate route, using something of an 'all or nothing' assignment. For this reason, given the capacity restraints of the downtown road network, the TRIPS model actually shows a slight decrease in traffic volumes along sections of Main Street, while showing fairly significant increases within other areas of Downtown.

Upon review of the model output with both City staff and PACTS staff, the determination was made that as Downtown Biddeford continues to redevelop, traffic will continue to increase. Even though there will be congestion and delay, drivers will still need to be going to or through Downtown to get to employment or residences. As mixed uses continue to develop, there is the potential for more people to both live and work in Downtown, thereby reducing some vehicle trips. The City of Biddeford should strive for a mix of development, including residential, so that residents can also shop and work in the downtown, thereby reducing dependency on vehicles. However, for the purposes of this study, we are evaluating the design year traffic conditions based on the anticipated future development.

Summary of Existing Deficiencies

As the preceding data indicates, the street network in downtown Biddeford is currently functioning near capacity during the peak hours, even exceeding capacity in some locations, most notably the intersection of Main Street with Hill Street and Water Street and the access for the North Dam Mill. There are excessive queues at the signalized intersections and some unsignalized intersections as well, a large number of collisions throughout the downtown, including many collisions involving pedestrians, and heavy volumes of both vehicular and pedestrian traffic.

The presence of cars parked along the corridor often limits the sight distances for those trying to access the corridor from the side streets and driveways. Also, vehicles merging from on-street parking spaces into the travel lanes create additional conflicts and add to the high rate of crashes within the downtown area. Additionally, this on-street parking reduces the capacity of the roadway. While on-street parking is appropriate for traditional downtown uses, the impact on the roadway capacity needs to be considered. Some on-street parking could be eliminated in order to improve the overall safety and efficiency of the Downtown. However, adequate and appropriate sites for additional off-street parking will need to be determined.

With the continued 'in-fill' redevelopment within the downtown, as well as the proposed redevelopment of the North Dam Mill on Main Street and numerous other projects in Biddeford, the downtown area is poised for significant new traffic. As the downtown corridors for the City, as well as part of the connection to the Maine Turnpike, it is critical for Main Street, Alfred Street, and Elm Street to remain viable and usable transportation corridors.

Chapter 2
Identification of
Improvement Alternatives

A variety of improvement alternatives are available for consideration within the downtown. Given the myriad of deficiencies and prospective growth of the downtown as a whole, a combination of alternatives could be implemented to ensure that Main Street, Alfred Street and Elm Street remain viable and usable transportation corridors through the Downtown of the City. Following are descriptions of ten different improvements that can be considered. Many of these improvement alternatives are the direct result of comments and ideas from the Advisory Committee.

Improvement Alternative 1 – Retime traffic signals

When evaluating various improvement alternatives, one needs to always consider the baseline for comparison, which is typically considered to be the 'do nothing' alternative. In this case, this alternative would consist of the re-timing of the traffic signals throughout the downtown, with no other improvements.

For evaluation purposes, retiming of the traffic signals is an inherent aspect of all other alternatives.

Improvement Alternative 2 – Relocate Access to North Dam Mill to better align with Water Street

As redevelopment of the North Dam Mill continues, access should be evaluated. The current location of the Mill access is slightly off-set from the intersection of Main Street with Hill Street and Water Street. Moving the access to the south, where the corner most building is today, will align the entrance with Water Street, thereby making the Mill access part of the signalized intersection.

For evaluation purposes, this alternative is assumed to be part of all other alternatives.

Improvement Alternative 3 – Eliminate Hill Street access to Main Street and Water Street

This signalized intersection currently has to run as four separate phases because of the conflicting movements and the high volumes. In order to improve the operational efficiency of this signal, one movement should be eliminated. The most logical of these movements to eliminate is the approach from Hill Street. Traffic would still be able to enter Hill Street from Main Street, but Hill Street would not outlet onto Main Street. Traffic will have to be redirected to Water Street via surrounding streets, such as High Street and Clifford Street.

Improvement Alternative 4 – Construct roundabout at Main Street at Hill Street/Water Street

An alternative to the traffic signal at this intersection is the construction of a roundabout. Gorrill-Palmer Consulting Engineers Inc. contracted with Michael Wallwork of Alternative Street Designs, to investigate the feasibility of a roundabout at this intersection. While noting that the elevation changes within the vicinity may be troublesome, a roundabout does appear to be feasible here.

Improvement Alternative 5 – Install all-way stop at Main Street/Alfred Street/Laconia Street

The left turn from Main Street to Alfred Street includes a significant volume of traffic, which is opposed by a fairly heavy northbound through volume on Main Street. An all-way stop at this intersection can create the gaps necessary for the heavy left-turn volumes. This can improve the overall efficiency of this intersection without the need to create additional travel lanes or turn lanes.

Improvement Alternative 6 – Install all-way stop at Jefferson Street/Adams Street

Traffic on Jefferson Street currently has the right of way at this intersection, while the Adams Street southbound approach carries a high volume of left-turning vehicles. The heavy volumes of traffic on Jefferson Street make it difficult for vehicles on Adams Street, especially left-turning traffic, to find the necessary gap to proceed. An all-way stop at this intersection can create the gaps necessary for the heavy left-turn volumes. This can improve the overall efficiency of this intersection without the need to create additional travel lanes or turn lanes.

Improvement Alternative 7 – Install traffic signal at Main Street/Alfred Street/Laconia Street

The left turn from Main Street to Alfred Street includes a significant volume of traffic, which is opposed by a fairly heavy northbound through volume on Main Street. A traffic signal with a protected left turn at this intersection can create the gaps necessary for the heavy left-turn volumes. However, in order to gain the most improvement from this alternative, the Main Street westbound approach will need a left turn lane.

Improvement Alternative 8 – Eliminate select on-street parking spaces to improve sight lines and safety

While on-street parking should be maintained within the downtown area, the presence of on-street parking can impede sight lines from intersecting streets or driveways. For this reason, some selected parking spaces along Main Street should be eliminated in favor of increased safety.

These spaces include:

- The north side of Main Street, east of the Lincoln Street intersection;
- The north side of Main Street, between Lincoln Street and the driveway to Bank of America.

Improvement Alternative 9 – Close Main Street from Alfred Street to Adams Street to create pedestrian mall

There has been considerable discussion regarding the closure of a portion of Main Street to create a pedestrian mall. The section of Main Street between Alfred Street and Adams Street would be the most likely section that could be converted to pedestrian use only. Jefferson Street is parallel to Main Street in this area, and the connections via Alfred Street and Adams Street already exist. This alternative would shift heavy volumes of traffic onto Jefferson Street, which would require additional turn lanes and travel lanes on the affected streets to carry these volumes.

Improvement Alternative 10 – Create turn lanes at Alfred Street and Main Street

The predominant movement at the intersection of Main Street and Alfred Street is left turns from Main to Alfred and right turns from Alfred to Main. The addition of turn lanes for these two movements, even short "pockets" will help improve the efficiency of this intersection. In order to create these lanes, approximately two parking spaces on the east side of Alfred Street will need to be eliminated, as well as approximately three parking spaces on the north side of Main Street.

Chapter 3
Operational Evaluation of Alternatives

Our office performed an analysis of the capacity and level of service of various combinations of the improvement alternatives discussed above, in terms of delays and queues. All analyses were done using the Synchro/SimTraffic software. The software model was used for the 2005 conditions to get a baseline of information, then again for each of four various combinations of the most viable improvement alternatives. The tables are all based on the SimTraffic software reports. Level of service rankings are similar to the academic ranking system where and 'A' is very good with little control delay and an 'F' represents very poor conditions with long delays. A Level of Service (LOS) 'D' or higher is desirable for a signalized intersection. At an unsignalized intersection, if the level of service falls below a 'D', an evaluation should be made to determine if a traffic signal is warranted.

The following tables summarize the relationship between control delay and level of service:

Table 3.1: Level of Service Criteria for Unsignalized Intersections

Level of Service	Control Delay per Vehicle (sec)
A	Up to 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	Greater than 50.0

Table 3.2: Level of Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec)
A	Up to 10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	Greater than 80.0

Some of the improvement alternatives are really only effective when constructed in conjunction with other improvements. Therefore, the improvement alternatives were not evaluated individually. This combining of improvements that operate efficiently together resulted in four distinct combinations to be evaluated.

Alternatives 1 and 2: 2025 Analysis with Retiming of Traffic Signals and Relocated Mill Access

This analysis looks at the impact of the increased traffic on the existing roadway network with only the retiming of the signals within the Downtown. The results for the capacity and queue analyses are shown in the following tables:

Table 3.3: Level of Service for Downtown Signalized Intersections - 2025

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Elm St			**Hill St & Pool St**		
Main St – EBL	>100	F	Pool St – EBL	13.6	B
Main St – EBTR	>100	F	Pool St – EBTR	10.3	B
Elm St – NBL	>100	F	Hill St – NBLTR	>100	F
Elm St – NBTR	>100	F	Pool St – WBL	>100	F
Main St – WBL	59.9	E	Pool St – WBTR	>100	F
Main St – WBTR	25.1	C	Hill St – SBLTR	>100	F
Elm St – SBL	>100	F	**Overall Intersection**	**>100**	**F**
Elm St – SBTR	76.1	E	**Main St & Hill St/ Water St**		
Overall Intersection	**>100**	**F**	Main St – EBL	>100	F
South St & Elm St			Main St – EBT	>100	F
South St – EBLTR	>100	F	Main St – EBR	>100	F
Elm St – NBLTR	>100	F	Hill St - NBLTR	>100	F
South St – WBLTR	>100	F	Water St - NBLT	>100	F
Elm St – SBLTR	66.5	E	Main St – WBL	37.5	D
Overall Intersection	**>100**	**F**	Main St – WBT	72.4	E
Jefferson St & Alfred St			Main St – WBR	5.8	A
Jefferson St – EBL	>100	F	North Dam Mill – SBLT	>100	F
Jefferson St – EBTR	>100	F	North Dam Mill – SBR	>100	F
Alfred St – NBL	>100	F	**Overall Intersection**	**>100**	**F**
Alfred St – NBTR	>100	F	**Elm St @ Spruce St**		
Jefferson St – WBL	>100	F	Spruce St - EBLR	>100	F
Jefferson St – WBTR	>100	F	Elm St – NBL	24.5	C
Alfred St – SBL	49.1	D	Elm St – NBT	8.9	A
Alfred St – SBTR	49.0	D	Elm St – SBTR	>100	F
Overall Intersection	**>100**	**F**	**Overall Intersection**	**>100**	**F**

Table 3.4: Level of Service for Downtown Unsignalized Intersections – 2025

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Jefferson St			**Jefferson St & Adams St**		
Main St – EBTR	>100	F	Jefferson St – EBLTR	>100	F
Jefferson St – NBLR	>100	F	Adams St – NBLTR	>100	F
Main St – WBLT	23.3	C	Jefferson St – WBLTR	62.1	F
Overall Intersection	**>100**	**F**	Adams St – SBLTR	>100	F
Main St & Lincoln St/Adams St			**Overall Intersection**	**>100**	**F**
Main St – EBLTR	>100	F	**Jefferson St & South St**		
Adams St – NBLT	13.4	B	South St – EBLTR	>100	F
Adams St – NBR	6.3	A	Crescent St – EBLTR	>100	F
Main St – WBLTR	>100	F	Jefferson St – NBLTR	59.8	F
Lincoln St – SBLTR	>100	F	Jefferson St – SBLTR	>100	F
Overall Intersection	**>100**	**F**	**Overall Intersection**	**>100**	**F**
Main St & Alfred St			**South St & Adams St**		
Main St – EBLTR	35.9	E	South St – EBLR	>100	F
Alfred St – NBLTR	>100	F	Adams St – NBT	0.4	A
Main St – WBLTR	>100	F	Adams St – SBT	>100	F
Overall Intersection	**>100**	**F**	**Overall Intersection**	**>100**	**F**

As the above tables indicate, while the retiming of the signals can improve a few individual intersections, the existing Downtown roadway network configuration cannot handle the additional traffic volumes without any improvements. With the projected development, many of the intersections will be operating at or beyond capacity. The primary intersection for the downtown, Main Street at Hill Street and Water Street, will continue to fail due to volumes exceeding the current capacity.

Table 3.5: Queue Analysis for Downtown Signalized Intersections - 2025

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Elm St			
Main St – EBL	80	16	57
Main St – EBTR	N/A	396	855
Elm St – NBL	100	7	42
Elm St – NBTR	N/A	377	966
Main St – WBL	95	35	100
Main St – WBTR	N/A	83	241
Elm St – SBL	100	57	137
Elm St – SBTR	N/A	335	623
South St @ Elm St			
South St – EBLTR	N/A	381	792
Elm St – NBLTR	N/A	691	1185
South St – WBLTR	N/A	172	443
Elm St – SBLTR	N/A	228	709
Jefferson St & Alfred St			
Jefferson St – EBL	40	56	69
Jefferson St – EBTR	N/A	509	679
Alfred St – NBL	60	18	67
Alfred St – NBTR	N/A	604	865
Jefferson St – WBL	115	14	69
Jefferson St – WBTR	N/A	548	789
Alfred St – SBL	60	20	65
Alfred St – SBTR	N/A	137	380
Hill St & Pool St			
Pool St – EBL	75	3	19
Pool St - EBTR	N/A	40	117
Hill St – NBLTR	N/A	388	700
Pool St – WBL	50	16	57
Pool St – WBTR	N/A	521	916
Hill St - SBLTR	N/A	420	984
Elm St & Spruce St			
Spruce St – EBLR	N/A	146	374
Elm St – NBL	100	11	37
Elm St – NBT	N/A	29	121
Elm St - SBTR	N/A	220	538
Main St & Hill St/ Water St			
Main St – EBL	75	2	25
Main St - EBT	N/A	279	700
Main St – EBR	20	21	51
Hill St – NBLTR	N/A	148	365
Water St – NBLT	N/A	99	166
Main St – WBL	N/A	72	175
Main St - WBT	N/A	110	138
Main St – WBR	40	6	29
North Dam Mill – SBLT	N/A	28	80
North Dam Mill – SBR	N/A	35	115

Notes: N/A – Not applicable in travel lane

Table 3.6: Queue Analysis for Downtown Unsignalized Intersections - 2025

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Jefferson St			
Main St – EBTR	N/A	162	453
Jefferson St – NBLR	N/A	118	259
Main St – WBLT	N/A	27	117
Main St & Lincoln St/Adams St			
Main St – EBLTR	N/A	250	562
Adams St – NBLT	N/A	21	58
Adams St – NBR	55	7	30
Main St - WBLTR	N/A	433	960
Lincoln St – SBLTR	N/A	500	832
Main St & Alfred St			
Main St – EBLTR	N/A	48	218
Alfred St – NBLTR	N/A	495	734
Main St - WBLTR	N/A	483	883
Jefferson St & Adams St			
Jefferson St – EBLTR	N/A	136	256
Adams St – NBLTR	N/A	50	145
Jefferson St – WBLTR	N/A	73	348
Adams St – SBLTR	N/A	142	191
Jefferson St & South St			
South St – EBLTR	N/A	499	1081
Crescent St – EBLTR	N/A	145	296
Jefferson St – NBLTR	N/A	73	175
Jefferson St – SBLTR	N/A	138	283
South St & Adams St			
South St – EBLR	N/A	168	297
Adams St – NBT	N/A	N/A	N/A
Adams St – SBT	N/A	162	281

Notes: N/A – Not applicable in travel lane

As the above tables indicate, the queues are either approaching or exceeding the available storage capacity at virtually all of the intersections. The Main Street southbound queues at the Hill Street/Water Street intersection extend back into Saco, much like the 2005 conditions. Overall, the simple retiming of the traffic signals provides very little improvement to the flow of traffic through Downtown Biddeford. It becomes readily apparent that additional improvements must be incorporated.

For evaluation purposes, the relocated mill access and the retiming of the traffic signals, are assumed to be inherent to all other alternatives and combinations and will not be directly identified.

Alternatives 1, 2, 3 and 10: Elimination of Hill Street access to Main Street

This analysis looks at the impact of eliminating access from Hill Street to Main Street. This will eliminate one approach to that intersection, thereby allocating that additional green time to the other approaches. Traffic can still access Hill Street from Main Street. A conceptual plan of this alternative is shown in on Figure C.6 in Appendix C. The majority of the volumes from the Hill Street approach, approximately 250 vehicles in the PM peak hour, have been redirected to the Water Street approach via High Street and Clifford Street. The remaining vehicles, approximately 25 in the PM peak hour, have been shifted to Alfred Street. The analysis includes

the addition of a short right turn lane on Alfred Street as well. The results for the capacity and queue analyses are shown in the following tables:

Table 3.7: Level of Service for Downtown Signalized Intersections – No Hill Street Access

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Elm St			**Jefferson St & Alfred St**		
Main St – EBL	46.4	D	Jefferson St – EBL	>100	F
Main St – EBTR	35.1	D	Jefferson St – EBTR	>100	F
Elm St – NBL	33.9	C	Alfred St – NBL	>100	F
Elm St – NBTR	18.2	B	Alfred St – NBTR	>100	F
Main St – WBL	36.9	D	Jefferson St – WBL	55.1	E
Main St – WBTR	28.7	C	Jefferson St – WBTR	80.8	F
Elm St – SBL	43.2	D	Alfred St – SBL	55.6	E
Elm St – SBTR	19.4	B	Alfred St – SBTR	47.7	D
Overall Intersection	**24.5**	**C**	**Overall Intersection**	**95.2**	**F**
South St @ Elm St			**Main St & Hill St/ Water St**		
South St – EBLTR	54.3	D	Main St – EBL	>100	F
Elm St – NBLTR	>100	F	Main St – EBT	92.8	F
South St – WBLTR	47.7	D	Main St – EBR	95.1	F
Elm St – SBLTR	20.2	C	Water St – NBLT	46.3	D
Overall Intersection	**96.0**	**F**	Main St – WBL	24.6	C
Hill St @ Pool St			Main St – WBT	7.3	A
Pool St – EBL	19.3	B	Main St – WBR	0.2	A
Pool St – EBTR	14.3	B	North Dam Mill – SBLT	48.8	D
Hill St – NBLTR	28.2	C	North Dam Mill – SBR	6.9	A
Pool St – WBL	39.9	D	**Overall Intersection**	**43.8**	**D**
Pool St – WBTR	28.0	C	**Elm St @ Spruce St**		
Hill St – SBLTR	15.5	B	Spruce St – EBLR	21.4	C
Overall Intersection	**22.3**	**B**	Elm St – NBL	14.3	B
			Elm St – NBT	3.3	A
			Elm St – SBTR	5.3	A
			Overall Intersection	**5.5**	**A**

Table 3.8: Level of Service for Downtown Unsignalized Intersections – No Hill Street Access

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Jefferson St			**Jefferson St & Adams St**		
Main St – EBTR	2.2	A	Jefferson St – EBLTR	16.2	C
Jefferson St – NBLR	22.5	C	Adams St – NBLTR	15.5	C
Main St – WBLT	3.3	A	Jefferson St – WBLTR	2.1	A
Overall Intersection	**8.7**	**A**	Adams St – SBLTR	83.7	F
Main St & Lincoln St/Adams St			**Overall Intersection**	**27.1**	**D**
Main St – EBLTR	14.6	B	**Jefferson St & South St**		
Adams St – NBLT	19.0	C	South St – EBLTR	58.5	F
Adams St – NBR	6.6	A	Crescent St – EBLTR	44.2	E
Main St – WBLTR	30.0	D	Jefferson St – NBLTR	10.7	B
Lincoln St – SBLTR	>100	F	Jefferson St – SBLTR	13.2	B
Overall Intersection	**68.2**	**F**	**Overall Intersection**	**28.1**	**D**
Main St & Alfred St			**South St & Adams St**		
Main St – EBLTR	6.5	A	South St – EBLR	>100	F
Alfred St – NBLT	>100	F	Adams St – NBT	0.4	A
Alfred St – NBR	79.9	E	Adams St – SBT	37.4	E
Main St – WBL	14.0	B	**Overall Intersection**	**45.1**	**E**
Main St – WBTR	28.0	D			
Overall Intersection	**32.6**	**D**			

As the above tables indicate, the elimination of one approach to this heavily traveled intersection significantly improves the efficiency of the intersection, as well as other downtown intersections.

Table 3.9: Queue Analysis for Downtown Signalized Intersections – No Hill Street Access

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Elm St			
Main St – EBL	80	28	78
Main St – EBTR	N/A	158	298
Elm St – NBL	100	16	58
Elm St – NBTR	N/A	172	336
Main St – WBL	95	70	133
Main St – WBTR	N/A	180	331
Elm St – SBL	100	37	98
Elm St – SBTR	N/A	251	497
South St @ Elm St			
South St – EBLTR	N/A	161	299
Elm St – NBLTR	N/A	892	1235
South St – WBLTR	N/A	138	262
Elm St – SBLTR	N/A	216	438
Jefferson St & Alfred St			
Jefferson St – EBL	40	64	79
Jefferson St – EBTR	N/A	378	690
Alfred St – NBL	60	58	107
Alfred St – NBTR	N/A	509	892
Jefferson St – WBL	115	24	93
Jefferson St – WBTR	N/A	287	602
Alfred St – SBL	60	48	96
Alfred St – SBTR	N/A	279	507
Hill St & Pool St			
Pool St – EBL	75	8	38
Pool St - EBTR	N/A	104	197
Hill St – NBLTR	N/A	123	289
Pool St – WBL	50	38	78
Pool St – WBTR	N/A	139	354
Hill St - SBLTR	N/A	94	181
Elm St & Spruce St			
Spruce St – EBLR	N/A	46	84
Elm St – NBL	100	18	46
Elm St – NBT	N/A	28	91
Elm St - SBTR	N/A	84	249
Main St & Hill St/ Water St			
Main St – EBL	75	13	54
Main St – EBT	N/A	552	818
Main St – EBR	20	37	53
Water St – NBLT	N/A	58	108
Main St – WBL	N/A	127	158
Main St – WBT	N/A	91	155
Main St – WBR	45	1	9
North Dam Mill – SBLT	N/A	24	71
North Dam Mill – SBR	N/A	0	0

Notes: N/A – Not applicable in travel lane

Table 3.10: Queue Analysis for Downtown Unsignalized Intersections – No Hill Street Access

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Jefferson St			
Main St – EBTR	N/A	9	59
Jefferson St – NBLR	N/A	82	189
Main St – WBLT	N/A	31	100
Main St & Lincoln St/Adams St			
Main St – EBLTR	N/A	44	200
Adams St – NBLT	N/A	41	86
Adams St – NBR	55	19	49
Main St - WBLTR	N/A	106	459
Lincoln St – SBLTR	N/A	284	653
Main St & Alfred St			
Main St – EBLTR	N/A	62	202
Alfred St – NBLT	N/A	352	693
Alfred St – NBR	50	68	106
Main St – WBL	100	99	151
Main St – WBTR	N/A	152	480
Jefferson St & Adams St			
Jefferson St – EBLTR	N/A	50	164
Adams St – NBLTR	N/A	15	42
Jefferson St – WBLTR	N/A	10	99
Adams St – SBLTR	N/A	117	200
Jefferson St & South St			
South St – EBLTR	N/A	116	355
Crescent St – EBLTR	N/A	51	158
Jefferson St – NBLTR	N/A	76	138
Jefferson St – SBLTR	N/A	45	95
South St & Adams St			
South St – EBLR	N/A	79	215
Adams St – NBT	N/A	0	0
Adams St – SBT	N/A	66	208

Notes: N/A – Not applicable in travel lane

As the above tables indicate, the queues are still either approaching or exceeding the available storage capacity at many intersections. The Main Street southbound queues at the Hill Street/Water Street intersection extend back into Saco, much like the 2005 conditions. Overall, however, the queues and delays are lessened throughout the Downtown.

This alternative would have the greatest impact on adjacent neighborhoods. Approximately 250 vehicles would be redstributed through primarily residential streets in the peak hour. In addition to these streets being primarily residential in nature, they are also narrow and steep, and are not designed for those volumes of traffic.

Alternatives 1, 2, 4 and 5: Construction of roundabout at Main Street at Hill Street/Water Street

This analysis looks at the impact of eliminating the traffic signal at this intersection in favor of a single lane roundabout. A conceptual plan of this alternative is shown in Figure C.5 in Appendix C. In this alternative, all existing approaches to the intersection remain. As the

efficiency of this major intersection improves, traffic reaches the intersection of Main Street and Alfred Street more quickly. With no improvements at that intersection, congestion and failure will occur there instead. Therefore, the analysis of the roundabout also includes an all-way stop at the intersection of Main Street and Alfred Street. The results for the capacity and queue analyses are shown in the following tables:

Table 3.11: Level of Service for Downtown Signalized Intersections - Roundabout

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Elm St			**Jefferson St & Alfred St**		
Main St – EBL	44.1	D	Jefferson St – EBL	55.2	E
Main St – EBTR	27.8	C	Jefferson St – EBTR	38.3	D
Elm St – NBL	36.8	D	Alfred St – NBL	69.2	E
Elm St – NBTR	19.3	B	Alfred St – NBTR	45.9	D
Main St – WBL	35.5	D	Jefferson St – WBL	24.0	C
Main St – WBTR	24.8	C	Jefferson St – WBTR	36.8	D
Elm St – SBL	36.7	D	Alfred St – SBL	38.5	D
Elm St – SBTR	17.2	B	Alfred St – SBTR	22.0	C
Overall Intersection	**22.2**	**C**	**Overall Intersection**	**39.0**	**D**
South St @ Elm St			**Main St & Hill St/ Water St**		
South St – EBLTR	64.8	E	Main St – EBLTR	41.8	D
Elm St – NBLTR	>100	F	Hill St – NBLTR	7.7	A
South St – WBLTR	53.3	D	Water St – NBLTR	6.3	A
Elm St – SBLTR	18.9	B	Main St – WBLTR	21.9	C
Overall Intersection	**99.5**	**F**	North Dam Mill – SBLTR	>100	F
Hill St @ Pool St			**Overall Intersection**	**27.3**	**C**
Pool St – EBL	17.1	B	**Elm St @ Spruce St**		
Pool St – EBTR	12.3	B	Spruce St – EBLR	20.3	C
Hill St – NBLTR	11.7	B	Elm St – NBL	11.9	B
Pool St – WBL	24.4	C	Elm St – NBT	3.3	A
Pool St – WBTR	10.8	B	Elm St – SBTR	4.5	A
Hill St – SBLTR	11.8	B	**Overall Intersection**	**5.1**	**A**
Overall Intersection	**12.2**	**B**			

Table 3.12: Level of Service for Downtown Unsignalized Intersections – Roundabout

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Jefferson St			**Jefferson St & Adams St**		
Main St – EBTR	1.8	A	Jefferson St – EBLTR	1.5	A
Jefferson St – NBLR	15.9	B	Adams St – NBLTR	10.7	B
Main St – WBLT	2.3	A	Jefferson St – WBLTR	2.1	A
Overall Intersection	**6.1**	**A**	Adams St – SBLTR	15.9	C
Main St & Lincoln St/Adams St			**Overall Intersection**	**5.8**	**A**
Main St – EBLTR	1.6	A	**Jefferson St & South St**		
Adams St – NBLT	16.4	C	South St – EBLTR	11.0	B
Adams St – NBR	6.8	A	Crescent St – EBLTR	7.5	A
Main St – WBLTR	2.9	A	Jefferson St – NBLTR	10.1	B
Lincoln St – SBLTR	43.7	E	Jefferson St – SBLTR	7.7	A
Overall Intersection	**16.2**	**C**	**Overall Intersection**	**9.5**	**A**
Main St & Alfred St			**South St & Adams St**		
Main St – EBLTR	94.6	F	South St – EBLR	6.4	A
Alfred St – NBLTR	20.2	C	Adams St – NBT	0.3	A
Main St – WBLTR	88.9	F	Adams St – SBT	2.1	A
Overall Intersection	**62.7**	**F**	**Overall Intersection**	**2.4**	**A**

As the above tables indicate, the construction of a roundabout at such a key location within the Downtown has significant impacts throughout the area. The overall efficiency improves dramatically, with most intersections operating at greatly improved levels of service, even with higher traffic volumes.

Table 3.13: Queue Analysis for Downtown Signalized Intersections - Roundabout

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Elm St			
Main St – EBL	80	26	69
Main St – EBTR	N/A	132	231
Elm St – NBL	100	19	69
Elm St – NBTR	N/A	189	337
Main St – WBL	95	70	134
Main St – WBTR	N/A	163	287
Elm St – SBL	100	39	103
Elm St – SBTR	N/A	223	422
South St @ Elm St			
South St – EBLTR	N/A	179	349
Elm St – NBLTR	N/A	851	1253
South St – WBLTR	N/A	154	284
Elm St – SBLTR	N/A	195	402
Jefferson St & Alfred St			
Jefferson St – EBL	40	63	79
Jefferson St – EBTR	N/A	235	471
Alfred St – NBL	60	60	103
Alfred St – NBTR	N/A	297	604
Jefferson St – WBL	115	26	85
Jefferson St – WBTR	N/A	182	333
Alfred St – SBL	60	51	97
Alfred St – SBTR	N/A	189	307
Hill St & Pool St			
Pool St – EBL	75	8	39
Pool St - EBTR	N/A	103	183
Hill St – NBLTR	N/A	95	170
Pool St – WBL	50	35	70
Pool St – WBTR	N/A	82	142
Hill St - SBLTR	N/A	86	152
Elm St & Spruce St			
Spruce St – EBLR	N/A	52	100
Elm St – NBL	100	18	46
Elm St – NBT	N/A	29	85
Elm St – SBTR	N/A	83	211
Main St & Hill St/ Water St			
Main St – EBLTR	N/A	274	590
Hill St – NBLTR	N/A	58	103
Water St – NBLTR	N/A	59	77
Main St – WBLTR	N/A	247	728
North Dam Mill - SBLTR	N/A	56	108

Notes: N/A – Not applicable in travel lane

Table 3.14: Queue Analysis for Downtown Unsignalized Intersections - Roundabout

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Jefferson St			
Main St – EBTR	N/A	3	19
Jefferson St – NBLR	N/A	71	148
Main St – WBLT	N/A	29	80
Main St & Lincoln St/Adams St			
Main St – EBLTR	N/A	11	50
Adams St – NBLT	N/A	39	73
Adams St – NBR	55	20	46
Main St - WBLTR	N/A	12	38
Lincoln St – SBLTR	N/A	174	365
Main St & Alfred St			
Main St – EBLTR	N/A	290	506
Alfred St – NBLTR	N/A	166	408
Main St - WBLTR	N/A	477	894
Jefferson St & Adams St			
Jefferson St – EBLTR	N/A	9	53
Adams St – NBLTR	N/A	10	33
Jefferson St – WBLTR	N/A	8	94
Adams St – SBLTR	N/A	83	143
Jefferson St & South St			
South St – EBLTR	N/A	57	103
Crescent St – EBLTR	N/A	25	56
Jefferson St – NBLTR	N/A	77	134
Jefferson St – SBLTR	N/A	41	67
South St & Adams St			
South St – EBLR	N/A	30	48
Adams St – NBT	N/A	0	0
Adams St – SBT	N/A	5	37

Notes: N/A – Not applicable in travel lane

As the above tables indicate, the queues are either approaching or exceeding the available storage capacity at many of the intersections. However, the queues at the roundabout are much shorter and move much quicker than for a traditional signalized intersection.

Alternatives 1, 2, 6 and 9: Closure of Main Street from Alfred Street to Adams Street

This analysis looks at the impact of closing Main Street to vehicular traffic, from Alfred Street to Adams Street. Traffic is redistributed to Jefferson Street via Alfred Street and Adams Street. In order to accommodate the increased turning movements at the impacted intersections, all-way stops are included at the Main Street/Adams Street/Lincoln Street intersection and the Jefferson Street/Adams Street intersection. The results for the capacity and queue analyses are shown in the following tables:

Table 3.15: Level of Service for Downtown Signalized Intersections – Main St Closed

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Elm St			**Jefferson St & Alfred St**		
Main St – EBL	>100	F	Jefferson St – EBL	>100	F
Main St – EBTR	>100	F	Jefferson St – EBTR	>100	F
Elm St – NBL	29.0	C	Alfred St – NBL	>100	F
Elm St – NBTR	>100	F	Alfred St – NBTR	>100	F
Main St – WBL	36.5	D	Jefferson St – WBL	>100	F
Main St – WBTR	26.1	C	Jefferson St – WBTR	>100	F
Elm St – SBL	>100	F	Alfred St – SBL	>100	F
Elm St – SBTR	41.9	D	Alfred St – SBTR	>100	F
Overall Intersection	**>100**	**F**	**Overall Intersection**	**>100**	**F**
South St @ Elm St			**Main St & Hill St/ Water St**		
South St – EBL	>100	F	Main St – EBL	30.1	C
South St – EBTR	>100	F	Main St – EBT	29.2	C
Elm St – NBLTR	>100	F	Main St – EBR	29.8	C
South St – WBL	58.3	E	Water St – NBLT	>100	F
South St – WBTR	>100	F	Main St – WBL	17.9	B
Elm St – SBLTR	34.4	C	Main St – WBT	45.2	D
Overall Intersection	**>100**	**F**	Main St - WBR	0.3	A
Hill St @ Pool St			North Dam Mill – SBLT	>100	F
Pool St – EBL	26.4	C	North Dam Mill – SBR	>100	F
Pool St – EBTR	16.6	B	**Overall Intersection**	**52.9**	**D**
Hill St – NBLTR	>100	F	**Elm St @ Spruce St**		
Pool St – WBL	>100	F	Spruce St – EBLR	>100	F
Pool St – WBTR	>100	F	Elm St – NBL	12.4	B
Hill St – SBLTR	>100	F	Elm St – NBT	2.9	A
Overall Intersection	**>100**	**F**	Elm St – SBTR	>100	F
			Overall Intersection	**>100**	**F**

Table 3.16: Level of Service for Downtown Unsignalized Intersections – Main St Closed

Intersection/ Approach	2025 Volumes		Intersection/ Approach	2025 Volumes	
	Delay (sec)	LOS		Delay (sec)	LOS
Main St & Jefferson St			**Jefferson St & Adams St**		
Main St – EBTR	>100	F	Jefferson St – EBLTR	63.6	F
Jefferson St – NBLR	72.1	F	Adams St – NBLTR	>100	F
Main St – WBLT	61.8	F	Jefferson St – WBLTR	>100	F
Overall Intersection	**>100**	**F**	Adams St – SBLTR	>100	F
Main St & Lincoln St/Adams St			**Overall Intersection**	**>100**	**F**
Main St – EBLR	>100	F	**Jefferson St & South St**		
Adams St – NBLT	7.3	A	South St – EBLTR	>100	F
Lincoln St – SBTR	>100	F	Crescent St – EBLTR	>100	F
Overall Intersection	**>100**	**F**	Jefferson St – NBLTR	69.5	F
Main St & Alfred St			Jefferson St – SBLTR	>100	F
Alfred St – NBTR	1.6	A	**Overall Intersection**	**>100**	**F**
Main St – WBTR	>100	F	**South St & Adams St**		
Overall Intersection	**86.1**	**F**	South St – EBLR	>100	F
			Adams St – NBT	0	A
			Adams St – SBT	>100	F
			Overall Intersection	**>100**	**F**

As the above tables indicate, the closure of a section of Main Street results in increased delay at virtually every intersection, which translates into decreased levels of service.

Table 3.17: Queue Analysis for Downtown Signalized Intersections – Main St Closed

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Elm St			
Main St – EBL	80	18	64
Main St – EBTR	N/A	333	788
Elm St – NBL	100	8	42
Elm St – NBTR	N/A	316	830
Main St – WBL	95	20	68
Main St – WBTR	N/A	74	191
Elm St – SBL	100	48	123
Elm St – SBTR	N/A	259	549
South St @ Elm St			
South St – EBL	75	16	51
South St – EBTR	N/A	298	733
Elm St – NBLTR	N/A	853	1248
South St – WBL	75	24	79
South St – WBTR	N/A	105	316
Elm St – SBLTR	N/A	164	529
Jefferson St & Alfred St			
Jefferson St – EBL	40	61	84
Jefferson St – EBTR	N/A	370	730
Alfred St – NBL	60	81	94
Alfred St – NBTR	N/A	631	883
Jefferson St – WBL	115	15	72
Jefferson St – WBTR	N/A	462	743
Alfred St – SBL	60	31	91
Alfred St – SBTR	N/A	508	683
Hill St & Pool St			
Pool St – EBL	75	5	27
Pool St - EBTR	N/A	71	152
Hill St – NBLTR	N/A	276	611
Pool St – WBL	50	23	69
Pool St – WBTR	N/A	368	813
Hill St - SBLTR	N/A	198	425
Elm St & Spruce St			
Spruce St – EBLR	N/A	110	309
Elm St – NBL	100	12	39
Elm St – NBT	N/A	19	70
Elm St - SBTR	N/A	164	460
Main St & Hill St/ Water St			
Main St – EBL	75	6	33
Main St – EBT	N/A	170	367
Main St - EBR	20	27	55
Water St – NBLT	N/A	90	159
Main St – EBL	N/A	73	175
Main St – WBT	N/A	97	150
Main St – WBR	45	1	8
North Dam Mill – SBLT	N/A	23	66
North Dam Mill – SBR	N/A	33	109

Notes: N/A – Not applicable in travel lane

Table 3.18: Queue Analysis for Downtown Unsignalized Intersections – Main St Closed

Intersection/Approach	Available (Ft)	50th Percentile (Ft)	95th Percentile (Ft)
Main St & Jefferson St			
Main St – EBTR	N/A	151	424
Jefferson St – NBLR	N/A	73	269
Main St – WBLT	N/A	59	204
Main St & Lincoln St/Adams St			
Main St – EBLR	N/A	256	534
Adams St – NBLT	N/A	32	83
Lincoln St – SBTR	N/A	531	847
Main St & Alfred St			
Alfred St – NBTR	N/A	0	0
Main St - WBLR	N/A	408	886
Jefferson St & Adams St			
Jefferson St – EBLTR	N/A	91	222
Adams St – NBLTR	N/A	54	178
Jefferson St – WBLTR	N/A	368	696
Adams St – SBLTR	N/A	163	189
Jefferson St & South St			
South St – EBLTR	N/A	643	1260
Crescent St – EBLTR	N/A	145	300
Jefferson St – NBLTR	N/A	125	186
Jefferson St – SBLTR	N/A	104	305
South St & Adams St			
South St – EBLR	N/A	169	299
Adams St – NBT	N/A	0	7
Adams St – SBT	N/A	190	269

Notes: N/A – Not applicable in travel lane

As the above tables indicate, the queues are either approaching or exceeding the available storage capacity at virtually all of the intersections. The closure of a portion of Main Street results in near grid-lock conditions during the peak hour.

Chapter 4
Recommendations

As the preceding data indicates, a combination of alternatives will be required to truly provide improved operational efficiency throughout Downtown Biddeford. Any improvements are limited by the overall constraints within the area. The close proximity of buildings to the streets and limited right-of-way effectively prevent widening of the roadways. Additionally, given the nature of a vibrant downtown like Biddeford's, the availability and accessibility of parking must be maintained, as well as the accessibility, comfort and safety of pedestrians and bicyclists.

The following improvements or combinations of should be implemented in order to maintain operational efficiency throughout Downtown at approximately the same levels of service as 2005 or better, as well as to improve safety and efficiency within Downtown:

- Relocate access to/from North Dam Mill to better align with Water Street, so that it becomes part of the intersection;
- Retime all the traffic signals throughout the Downtown, maintaining the coordination of the Elm Street signals at Spruce Street and Main Street;
- Construct a roundabout at the intersection of Main Street, Hill Street, Water Street, and the North Dam Mill;
- Implement all-way stop at the intersection of Main Street, Alfred Street and Laconia Street (This is critical if the roundabout is constructed as described above);
- Construct left-turn lanes at the intersection of Main Street and Alfred Street if the intersection does not become an all-way stop;
- Consider the implementation of an all-way stop at Jefferson Street and Adams Street;
- Extension of the left-turn lanes at the intersection of Main Street and Elm Street;
- Re-stripe all marked crosswalks;
- Rehabilitate existing sidewalks and ramps to meet the Americans with Disabilities Act (ADA) standards;
- Install new and/or additional Pedestrian Crossing signage at crosswalks;
- Upgrade all traffic signals to 12-inch lenses with back plates and provide one signal head per lane.

While some improvements need to be undertaken together to gain the full benefit, some can be implemented in phases or individually. At a minimum, the traffic signals should all be retimed based on latest traffic volumes. The installation of Pedestrian Crossing signage, the re-striping of the crosswalks, and the upgrade of sidewalks to be ADA compliant should all be done. The extension of the left-turn lanes at Main Street and Elm Street can be completed regardless of any other alternatives. The relocation of the access for North Dam Mill should be completed as redevelopment proceeds there.

Conversely, some of the improvement alternatives should only be undertaken if other improvements are not implemented. For example, left-turn lanes at Alfred Street and Main Street should only be installed if the intersection does not become all-way stop controlled.

Suggested Implementation Phasing

Steps that could be taken in the immediate future include the following:

- Retime all the traffic signals throughout the Downtown, maintaining the coordination of the Elm Street signals at Spruce Street and Main Street;
- Extension of the left-turn lanes at the intersection of Main Street and Elm Street;
- Re-stripe all marked crosswalks;
- Install new and/or additional Pedestrian Crossing signage at crosswalks.

Steps that could be planned for the 2008-2009 Biennial Capital Work Plan include:

- Relocate access to/from North Dam Mill to better align with Water Street, so that it becomes part of the intersection;
- Consider the implementation of an all-way stop at Jefferson Street and Adams Street;
- Rehabilitate existing sidewalks and ramps to meet the Americans with Disabilities Act (ADA) standards (This could be done as a stand alone project to include all intersections; of as an addition to other projects at each intersection, as they move forward);
- Upgrade all traffic signals to 12-inch lenses with back plates and provide one signal head per lane. (This also could be completed as a stand alone project, or as part of other intersection improvement projects.)

Steps that would be appropriate to plan for 2010 and beyond include:

- Construct a roundabout at the intersection of Main Street, Hill Street, Water Street, and the North Dam Mill;
- Implement all-way stop at the intersection of Main Street, Alfred Street and Laconia Street (This is critical if the roundabout is constructed as described above);

Part III – Parking Management

Chapter 5
Existing Conditions

Downtown Biddeford is home to a variety of uses, ranging from office to commercial/retail to light industrial to residential. All of these uses combine to create varied and dynamic parking needs. These various uses all have their own typical parking requirements concerning number of parking spaces and time of day of usage, as well as duration of usage. For example, an office likely requires that long-term parking (eight-hours) be available from approximately 8:00 AM to 6:00 PM. Retail establishments may require more parking spaces than an office, but for shorter durations. Parking for residential uses typically is at its peak in the evening hours.

In order to best evaluate the parking needs within Downtown Biddeford, an accurate outline of the parking supply and demand is required. In November 2005, Gorrill-Palmer Consulting Engineers Inc. surveyed Downtown Biddeford to determine the parking supply. All on-street parking spaces were counted and diagramed, as well as all off-street municipal parking lots. This survey also identified all parking restrictions, such as Handicap, Time Limits, etc., by space. The number and type of parking spaces within private parking lots were also counted.

Within the focused study area, there are 567 on-street parking spaces, 373 off-street parking spaces in municipal lots, and an additional 429 off-street parking spaces in privately owned lots. The following tables summarize the municipal parking space supply in Downtown Biddeford.

Table 5.1: Off-Street Parking Supply – Municipal Lots

Location	Type of Space	Number of Spaces
Washington Street Lot		**33**
	Unrestricted	*31*
	Handicap	*2*
Foss Street Lot		**43**
	Unrestricted	*43*
Downtown Lot		**26**
	2-Hour	*24*
	Handicap	*2*
Franklin Street Lot		**88**
	Unrestricted	*88*
Alfred Street Lot		**86**
	Police	*20*
	Police, Handicap	*2*
	2-Hour	*42*
	4-Hour	*22*
City Hall Lot		**47**
	Unrestricted	*32*
	1-Hour	*10*
	Reserved	*3*
	Handicap	*2*
Federal Street (Old Courthouse) Lot		**50**
	Unrestricted	*30*
	2-Hour	*6*
	Handicap	*1*
	Reserved & Bank	*13*
Total Municipal Parking Lot Spaces		**373**

Table 5.2: On-Street Parking Supply

Type of Space	Number of Spaces
Unrestricted	333
2-Hour	216
15-Minute	6
Handicap	7
Loading	2
Taxi	3
Total On-Street Spaces	**567**

With this information a detailed eight-hour parking count was conducted. On November 17, 2005, all parking spaces within the study area were counted and notation was made of which spaces were being used. The counts were conducted hourly, beginning at 9:00 AM and ending at 5:00 PM. Within the municipal lots, where parking duration is limited, vehicle license plate information was also collected. This information was used to determine vehicle turnover rates to help determine the adequacy of current parking restrictions and time limitations. The following tables summarize the typical parking demand. The count data sheets are included in Appendix E.

Table 5.3: Average Usage of Municipal Parking Lots

Location	Type of Space	Number of Spaces	Average Number of Spaces Used
Washington Street Lot		**33**	**19**
	Unrestricted	*31*	*19*
	Handicap	*2*	*0*
Foss Street Lot		**43**	**26**
	Unrestricted	*43*	*26*
Downtown Lot		**26**	**15**
	2-Hour	*24*	*15*
	Handicap	*2*	*0*
Franklin Street Lot		**88**	**79**
	Unrestricted	*88*	*79*
Alfred Street Lot		**86**	**67**
	Police	*20*	*13*
	Police, Handicap	*2*	*1*
	2-Hour	*42*	*35*
	4-Hour	*22*	*18*
City Hall Lot		**47**	**38**
	Unrestricted	*32*	*28*
	1-Hour	*10*	*7*
	Reserved	*3*	*2*
	Handicap	*2*	*1*
Federal Street (Old Courthouse) Lot		**50**	**38**
	Unrestricted	*30*	*26*
	2-Hour	*6*	*2*
	Handicap	*1*	*1*
	Reserved & Bank	*13*	*9*
Total Municipal Parking Lot Spaces		**373**	**282**

Table 5.4: Average Usage of On-Street Parking Spaces

Type of Space	Number of Spaces	Average Number of Spaces Used
Unrestricted	333	157
2-Hour	216	105
15-Minute	6	3
Handicap	7	3
Loading	2	0
Taxi	3	0
Total On-Street Spaces	**567**	**265**

These counts show that the municipal lots, on average, are used more extensively than the on-street parking. The seven Municipal Parking Lots averaged 75-percent occupancy during that count, versus slightly less than 50-percent occupancy of the on-street parking spaces. However, as is the case in most areas, some municipal lots operate at much closer to capacity than others.

Also, some sections of the Downtown experience near full usage of the on-street parking spaces, while other spaces go mostly unused all day.

Looking at the data by sub-areas provides additional information. For example, the Downtown Lot, the Foss Street Lot, and the Washington Street Lot all average around 60-percent occupancy, while both the City Hall Lot and the Franklin Street Lot are consistently being used at upwards of 80-percent of their capacity. Perhaps the most noticeable variation in parking demand is along Main Street itself. Less than 25-percent of the parking spaces along Main Street, between Hill Street and Alfred Street, are used regularly. However, the other end of Main Street, from Adams Street to Elm Street, sees usage of the on-street parking spaces at around 70-percent of capacity. This variation in parking demand is likely due to a combination of factors, including concentration and intensity of uses in some areas, as well as type of uses and parking needs for various uses.

Overall, within the immediate Downtown area of Biddeford, parking supply today is sufficient for current development levels. Typical parking demand is around 60-percent of the available supply. When parking demand begins approaching 80 to 90 percent of the capacity, the supply begins to seem inadequate. There needs to be some excess supply throughout the downtown to allow for circulation and finding available parking spaces. There are roughly 150 excess parking spaces available before reaching that 80-percent threshold. This excess could be consumed by just one or two developments within the Downtown, such as a call center. The City is now at a critical stage in planning and preparing for the future of its Downtown.

Chapter 6
Future Parking Demand And Recommendations

City staff has completed a thorough assessment of potential redevelopment in the downtown. The majority of this development would come in the form of conversion of uses, for example from industrial to retail or office. This development, projected to occur within the twenty-year horizon of this study, could result in over 75,000 square feet of new business and residential uses. This square footage does not include any redevelopment within the Mill District, adjacent to Main Street. For the purposes of parking supply, the Committee determined that any redevelopment within the Mills would likely be of such a scale that on-site parking, within the Mill District, would be included as part of the development. The anticipated breakdown of building square footage by general use, with typical parking requirements, is as follows:

Table 6.1: Parking Requirements for Anticipated Downtown Growth

Development Area	Size	Parking Spaces Required
Lincoln Street Area	10,000 s.f. Office 10,000 s.f. Retail	79
Main Street Area 1 (Adams St, South St area)	10 Residential Units 7,000 s.f. Office 7,000 s.f. Retail	68
Main Street Area 2 (Washington St, Franklin St area)	20,000 s.f. Office 20,000 s.f. Retail	150
Main Street Area 3 (Hill St to Alfred St)	750 s.f. Office 750 s.f. Retail	8
TOTAL		**305**

This mix of development results in an overall parking deficit of approximately 100 spaces, assuming 100-percent usage. If we include between ten to twenty percent excess, 200 to 300 additional parking spaces would be required within the Downtown in the next twenty years.

Given the lack of available land for surface parking, the construction of a parking structure should be considered in the future. The Committee concluded that the Franklin Street area is the best location for a municipal parking structure. That area encompasses the Franklin Street Lot, the Downtown Lot, and the Federal Street (Old Courthouse) Lot. The land is centrally located to the Downtown of Biddeford and is already owned by the City and is currently used for parking. Therefore, conversion of this land to a parking structure would not result in the relocation of businesses or residents.

Gorrill-Palmer Consulting Engineers Inc. contracted with Carl Walker, Inc. to prepare a conceptual layout of a parking structure on the Franklin Street lot. This concept identifies a

structure that is approximately 120 feet wide by 235 feet long. With this layout, a four-level structure would be needed to accommodate the parking required for future growth and development. A four-level structure would provide approximately 365 parking spaces, which would be a net increase of approximately 275 spaces since the area is currently used for surface parking. The conceptual layout for this parking structure is included in Appendix E.

In addition to the need for new parking spaces, the parking restrictions that are currently in place need to be re-evaluated. As business uses change, parking needs also change accordingly. As such, certain time restrictions for parking no longer make sense. One such example is along Main Street, from Hill Street to Alfred Street, where the typical parking spaces are signed as a two-hour limit. However, the majority of uses in that area now tend to be more office based, which often times require eight-hour parking.

The following tables outline the recommendations to the current parking ordinances.

Table 6.2: On-Street Parking Restrictions – Recommended Changes

Street	Location	Current Restrictions		Recommended Restrictions	
		Type	Number of Spaces	Type	Number of Spaces
Main Street	Hill Street to Alfred Street	15-Minute	2	15-Minute	2
		2-Hour	35	2-Hour	10
		Unrestricted	2	Unrestricted	27
Water Street	Main Street to Pierson's Lane	2-Hour	4	4-Hour	4
Adams Street	Main Street to Jefferson Street	Unrestricted	22	Unrestricted	15
				1-Hour	7

Table 6.3: Municipal Lot Parking Restrictions – Recommended Changes

Municipal Lot	Current Restrictions		Recommended Restrictions	
	Type	Number of Spaces	Type	Number of Spaces
Downtown Lot	2-Hour	24	2-Hour	12
	Handicap	2	Handicap	2
	Unrestricted	0	Unrestricted	12
City Hall Lot	Unrestricted	32	Unrestricted	26
	1-Hour	10	1-Hour	16
	Reserved	3	Reserved	3
	Handicap	2	Handicap	2

Chapter 7
Parking Management Plan

An effective Parking Management Plan for the downtown will require a combination of actions. There needs to be an appropriate balance of short-term (i.e. one-hour or two-hour) parking for customers, clients, etc. and long-term (i.e. day long) parking for employees. There also needs to be an adequate supply of overnight parking for residents.

The short-term parking should continue to be located closest to the businesses, with employee parking shifted further away. One of the best tools for this to happen effectively is signage. Throughout most of Downtown, adequate signage is already installed. However, improved wayfinding signage could help encourage the use of some the under-utilized municipal parking lots, such as the Foss Street Lot, the Washington Street Lot, and the Downtown Lot. Combined with signage is the need for continued parking enforcement.

The City of Biddeford currently maintains a parking enforcement officer position through the Police Department and has a parking fine structure in place. This is an effective tool for the management of municipal parking, and this program should be continued. The City could also consider the creation of a separate Downtown Parking District, where a portion of the parking fees generated within that District are used to provide infrastructure improvements or enhancements to the Downtown.

Parking meters should also be considered as an effective tool for parking management. The eventual installation of on-street parking meters, as well as in some of the municipal lots, will aide in keeping the 'prime' parking locations available for high-turnover use. Parking meters can also be used as an effective precursor to a parking structure. Streets that could be managed with parking meters include the following: Main Street, Alfred Street, Adams Street, Washington Street, and Lincoln Street. In addition to on-street parking, the Alfred Street Lot could be suitable for parking meters as well.

An alternative to parking meters could be the implementation of a parking permit system. The Federal Street (Old Courthouse) Lot, as well as the Franklin Street, Washington Street, and Foss Street Lots could all be suitable locations for permit parking.

Parking Fees and Fines

With parking enforcement comes the need for parking fees and or fines. The City of Biddeford's parking fine structure has not been updated since 1998. A comparison of the parking fine structure for Biddeford to that of Portland, Lewiston, and Westbrook, shows that while some of the fines in Biddeford are lower than the average, they are still comparable.

The following table provides the comparison of parking fines between the Cities of Biddeford, Portland, Lewiston and Westbrook

Table 7.1: Comparison of Parking Fines

Parking Violation	Biddeford	Portland	Lewiston	Westbrook
Parking exceeding time limit	$10.00	$15.00	$15.00	$20.00
Parking in taxi stand, bus stop, or loading zone	$15.00	$20.00	$20.00	$40.00
Parking all night	$10.00	$10.00	$20.00	$20.00
Parking double	$25.00	$20.00	$20.00	$40.00
Parking too near fire hydrant	$25.00	$25.00	$30.00	$60.00
Parking in prohibited area	$20.00	$20.00	$20.00	$40.00
Parking on wrong side of street	$10.00	$20.00	$20.00	$20.00
Parking too near cross or corner	$20.00	$20.00	$20.00	$20.00
Parking in fire lane	$25.00	$25.00	$20.00	$60.00
Parking in crosswalk	$20.00	$25.00	$20.00	$40.00
Obstructing snow removal	$10.00	$20.00	$25.00	$60.00
Parking in handicapped space (State Legislation $200)	$100.00	$200.00	$75.00	$40.00
Parking in front of public or private driveway	$25.00	$20.00	$20.00	$40.00
Other		$100.00		$20.00

The introduction of parking meters and the ultimate construction of a parking structure will present the need for parking fees. A suggested fee structure for metered parking is as follows:

- All meters have a two-hour maximum to help eliminate confusion;
- Twenty-five cents for every 30 minutes

For a parking garage, the committee recommends both short-term and monthly parking rates. Suggested rates, based on 2006 data, are as follows:

- Short-term parking rates:
  - $1.00 per hour, with first half hour free.
  - Consider a "Park-n-Shop" program, where customers can park for free with validated parking tickets (stamped by the businesses)
- Monthly parking rates:
  - $60.00-$80.00 per month

A quick survey of local communities with parking garages or surface lots for paid parking shows that monthly parking rates vary from $35.00 to $48.00 per month in Lewiston-Auburn, and from $65.00 to $110.00 per month in Portland.

Implementation and Phasing

Upon acceptance or adoption by the Biddeford City Council, the implementation of this parking management plan will be an on-going process. This plan is also intended to be a dynamic plan for the City of Biddeford, which should be evaluated on a regular basis, and updated as needed.

The phasing described in this section is based on priorities, as well as an awareness of the City Council review process and funding and budget cycles. The phasing is a suggestion. Development may dictate changes to the priorities.

Phase I

The following measures are recommended in the short-term horizon:

- Replace or install new signage for wayfinding and locations of parking
- Revise City Ordinances to reflect changes in parking time restrictions
- Establish or revise parking fee and fine structures as necessary

It should be noted that as signage is installed, great care should be taken to prevent an unnecessary proliferation of parking and/or directional signs within the downtown. By designating entire lots all for the same time limits, signs need not be installed at each individual parking space; rather they can be installed only at the entrance to the lots. The same theory holds true for on-street parking. By keeping entire streets or segments of streets to the same time limits, the number of signs can be minimized.

Phase II

The following measures are recommended in the mid-term horizon:

- Install parking meters
  - On-Street
    - Main Street
    - Alfred Street
    - Adams Street
    - Washington Street
    - Lincoln Street
  - Municipal Lots
    - Alfred Street Lot
- Implement parking permit system (could be an alternative to metered parking) in the following Municipal Lots
  - Federal Street (Old Courthouse) Lot
  - Franklin Street Lot
  - Washington Street Lot
  - Foss Street Lot

Phase III

The need for a parking structure is directly tied to the rate and types of growth and development within the downtown. The construction of a parking structure should be considered for long-term implementation. The planning and design for this structure should be an on-going process beginning with the adoption of this parking management plan. Various options exist for the construction of this parking garage.

- The City could have the foundation and structure designed for a five or six level parking structure, but only actually construct the first three levels at the onset, with the additional levels built when needed at a later date. This phased construction will require careful

coordination with the engineer/designer of the structure. The cost effectiveness of such a plan will need to be thoroughly evaluated with the engineer at that time.

- The parking structure could be constructed in conjunction with a new office building or other such large scale redevelopment. A large enough development could create the critical need for a parking structure; and a public/private partnership of sorts could be used for the garage construction. A certain number of spaces would be dedicated to the new development, while the remainder of the structure would be available for public use.

Preliminary Opinion of Probable Construction Costs

Carl Walker, Inc. performed a preliminary opinion of the probable construction costs associated with a parking garage, based on three different options. These costs are based on the following assumptions: there are no land purchase costs; soil conditions are adequate for spread footings; no shoring/resupport of adjacent buildings is required; minor architectural treatments are assumed. The three options and cost opinions are as follows:

- Construction of a four-level parking garage, for an approximate net increase of 200 spaces - $4,300,000

- Construction of a two-level parking garage, but with the foundation to accommodate up to five or six levels, for an initial net increase of approximately 72 spaces - $2,400,000 (initial construction costs; does not include the costs for expansion at a later date)

- Construction of a six-level parking garage, for a net increase of approximately 386 spaces - $6,100,000

These cost estimates are based on early 2006 costs, which were increased by four-percent to reflect late 2006 costs.

Conclusion

The recommended parking management plan will involve a combination of short-term and long-term parking, parking meters, continued enforcement of parking regulations, and the future construction of a parking structure. Implementation of this plan will need to occur over a period of time.

Additionally, this parking management plan is meant to be a dynamic plan; one that is reviewed and updated on a regular basis. It is the intent of this plan that action by the City Council will be required in order for any portions of the plan to be implemented. The Advisory Committee anticipates that a more detailed study to determine the preferred location and layout for a parking structure will be conducted prior to any final decisions being made by the City Council.

Appendix A

Study Area Map

2005 Traffic Volumes

Historical Traffic Volumes

Appendix B

Collision Diagrams

Appendix C

Forecasted 2025 Traffic Volumes

Appendix D

Capacity and Queuing Analyses

Appendix E

Parking Survey Data

Appendix F

Parking Garage Concepts

Appendix G

Public Comments

Appendix H

Meeting Notes