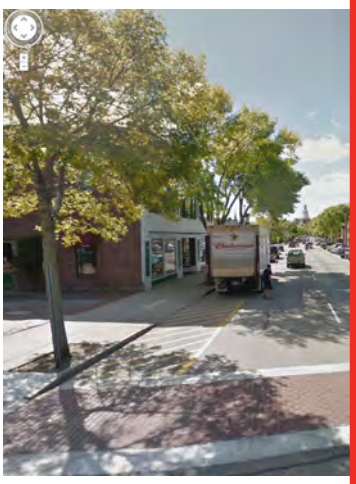
EXISTING CONDITIONS

Downtown Dover Pedestrian and Vehicular Access and Streetscape Study



March 2014

Prepared for **The City of Dover**
by **The Cecil Group** *with* **Resource Systems Group** *and* **Gibbs Planning Group**

Undated aerial photograph of downtown Dover, courtesy of the Dover Public Library.

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Historic photograph, undated, of Washington Street, looking into Central Square, courtesy of the Dover Public Library.

1 SUMMARY

1.1 Study Overview

The City of Dover is undertaking a study to rebalance the circulation within downtown Dover while preserving and enhancing the neighborhood's character, businesses, and pedestrian and vehicular experience. While the study will include all of downtown, it will primarily focus on the northern portion with specific care given to the intersection of Washington Street and Central Avenue, Chestnut Street from Washington Street to Central Avenue, and Central Avenue from Sixth Street to Washington Street. As shown in **"Figure 1. Aerial Photograph with Study Area"**, the boundaries of the study are as follows (and include properties on both sides of these streets):

- Sixth Street to the north
- Washington Street to the south
- Main Street to the east
- Chestnut Street to the west

The study will have two key elements: a report and 25% design plans. The report will consist of a 10-year plan that includes short-, middle-, and long-term improvements with potential phasing scenarios. It will also identify and summarize the analysis of a sustainable public realm, infrastructure and connectivity improvements, future development, and potential impacts from these improvements and developments. In addition, the report will propose a streetscape design and a vehicular and pedestrian circulation plan, and examine future development and economic opportunities in downtown Dover as they may relate to the public realm improvements. The report will establish a well-defined action program with general cost estimates and short- and long-term recommendations for phased projects for the subsequent preparation of bid documents for infrastructure recommendations. The 25% design plans will be computer drafted drawings conforming to City Standards to serve as a reference and resource for future design.

The first major deliverable in the Study includes the formulation of a Technical Memorandum summarizing the analysis and findings from Task One: Data Collection and Review of Existing Conditions.

Figure 1. Aerial Photograph with Study Area

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CITY OF DOVER

1.2 Purpose of Technical Memorandum

The purpose of the Technical Memorandum is to provide a summary of the data gathered, assessed, analyzed, and evaluated during the initial phases of the overall Study. The analysis focused on understanding the past and present vehicular and pedestrian patterns in relation to streetscape and business conditions in downtown Dover. The results of the analysis provide a basis for the ensuing tasks of the Study and the final report. The data gathered derived from several site visits, previous reports, studies, internet research, two TAC Meetings, a Public Workshop, two Stakeholder Workshops and various phone interviews.

1.3 Information Sources

The following data and reports were referenced as a basis for the analysis and information to support the results reported in this memorandum.

- City of Dover, New Hampshire Master Plan, 2012 Update
- New Police Facility Concept for the City of Dover by Lavallee Brensinger Architects, December 11, 2013
- Strafford Regional Planning Commission, 2012 Annual Building Permit Inventory
- Economic and Labor Market Information Bureau, New Hampshire Employment Security, 2010
- City Assessor's Data, April 2013
- Downtown Property Infill Increment, January 2014
- City Parcel Database, February 2014
- City Synchro 8 Report, January 2014
- U.S Census Bureau, Census 2010 Summary
- Downtown / Riverfront Redevelopment Traffic Circulation and Parking Plan by Rizzo Associates, Inc., February 2005
- Downtown Parking Facility and Management Study by LMG, March 2005

The assessment of existing transportation conditions in the downtown area used data provided by the City as well as on-site field observations to evaluate the current traffic volumes and congestion, safety issues, parking utilization, and transit routes.

Undated photograph of the Dover railroad station, courtesy of the Dover Public Library.

2 TRANSPORTATION AND CIRCULATION

2.1 Vehicle Circulation

A. CIRCULATION FACTORS

Regional Context

The City of Dover sits at the convergence of several major routes and is served by three interchanges off the Spaulding Turnpike. While this accessibility and route convergence benefits downtown Dover's merchants and residents, it also leads to instances of focused traffic demands at the major confluence points such as Lower Square and Upper Square.

Given the existing roadway network patterns and downtown business offerings, the traffic converging in the downtown core is comprised of both "through" and "to" traffic. That is, some portion of the traffic stream is using the downtown street network to reach a destination outside of the core, while another portion of the traffic stream is headed for a specific downtown location.

A significant portion of the "through" trips, particularly during the morning and evening peak hours, are comprised of commuters headed either to or from work. **"Table 1. Dover Commuting Data (2000 Census)"** summarizes the commuting trends for both Dover residents and those working in Dover. The data show an interesting phenomenon occurring where the majority of Dover residents are heading south (primarily Portsmouth) for work, while those working in Dover are largely commuting in from the north (primarily Rochester).

Table 1. Dover Commuting Data (2000 Census)

	DOVER RESIDENTS WORK IN…	DOVER EMPLOYEES LIVE IN…
Dover	33%	37%
Portsmouth	20%	3%
Durham	6%	4%
Rochester	5%	18%
Somersworth	5%	8%
Newington	5%	<2%
Barrington	<2%	5%

Patterns

As shown in **"Figure 2. Project Area and Traffic Flow",** the downtown traffic circulation pattern is dominated by the one-way clockwise loop of Central Avenue, Washington Street, and Main Street. The major streets feeding into this central loop are Central Avenue from the north and south, Washington Street from the west, and Portland Avenue from the northeast. The Locust Street and Chestnut Street corridor provides a key alternative or bypass route for drivers looking to avoid the downtown loop.

To understand downtown traffic flow patterns in more detail, the *Downtown/ Riverfront Redevelopment Traffic Circulation and Parking Plan* (2005, Rizzo Associates) included a large license plate survey to identify where cars were entering and exiting the downtown network. This information, which is shown in **"Figure 3. Origin-Destination Flow (PM)"**, confirms the following key points:

- Multiple routes pass through the downtown loop
- The largest convergence of routes and flow paths occurs in Lower Square
- A significant level of traffic uses Chestnut Street to bypass the downtown loop
- The largest flows were seen in vehicles heading south from Upper Central Avenue to Lower Central Avenue (6% of total traffic), from Lower Central Avenue to Portland Street (5% of total traffic), and from Lower Central Avenue to Upper Central Avenue (4% of total traffic).

Trends

Traffic volumes in and around Dover have remained largely level over the last eight years, as shown in **"Figure 4. Historic Traffic Trends (2005 to 2012)".** This graphic is based on historic count data from NHDOT and shows that traffic has generally been decreasing over the last eight years at an average rate of 1% per year. The only location where growth was not negative between 2005 and 2012 was along US 4 in Northwood where growth was flat.

This trend is consistent when compared with regional and statewide traffic count data and is reflective of the downturn in the economy during this time period, relatively modest population and employment growth trends, and the shifting demographic landscape with a higher percentage of older and younger people choosing to drive less or not at all.

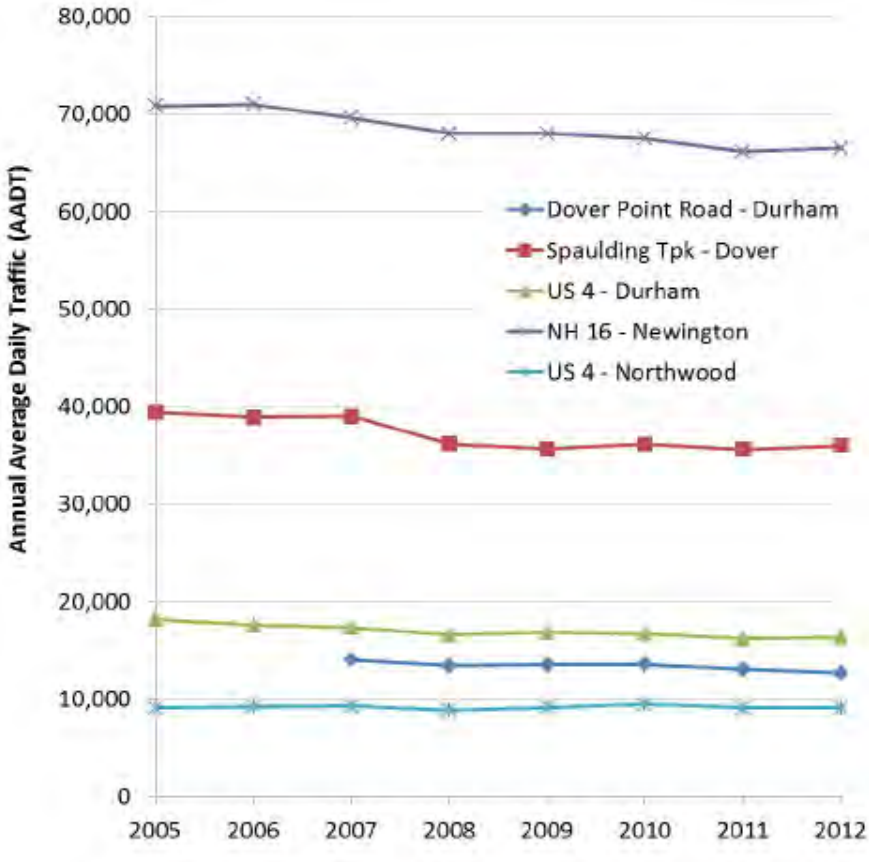
Figure 2. Project Area and Traffic Flow

Figure 3. Origin-Destination Flow (PM)

DOVER | Pedestrian and Vehicular Access and Streetscape Study

Origin-Destination Flow (PM)

Figure 4. Historic Traffic Trends (2005 to 2012)



B. TRAFFIC VOLUMES AND OPERATIONS

Existing: Volume and Capacity

The most recent Automatic Traffic Recorder (ATR) data[1] is presented in **"Figure 5. AADT (2011 to 2013)"**, and shows that Central Avenue, and the Central Avenue/Main Street/Washington Street one-way circulator, carries the highest traffic volumes in the study area. Chestnut Street and Portland Avenue also experience relatively high traffic volumes with Annual Average Daily Traffic (AADT) volumes of 12,000 and 11,000 vehicles, respectively.

1 Sources: Strafford Regional Planning Commission and NHDOT

Figure 5. AADT (2011 to 2013)

Existing: Intersection and Operations

Level of Service Definition

Level-of-service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. LOS is estimated using the procedures outlined in the 2000 and 2010 Highway Capacity Manuals.[2] In addition to traffic volumes, key inputs include the number of lanes at each intersection and the traffic signal timing plans. The LOS results are based on the existing lane configurations and control types (signalized or unsignalized) at each study intersection.

The 2010 Highway Capacity Manual defines six qualitative grades to describe the level of service at an intersection. Level-of-Service is based on the average control delay per vehicle. **"Table 2. Level-Of-Service Criteria for Signalized and Unsignalized Intersections"** shows the various LOS grades and descriptions for signalized and unsignalized intersections.

The delay thresholds for LOS at signalized and unsignalized intersections differ because of the driver's expectations of the operating efficiency for the respective traffic control conditions. According to HCM procedures, an overall LOS cannot be calculated for two-way stop-controlled intersections because not all movements experience delay. In signalized and all-way stop-controlled intersections, all movements experience delay and an overall LOS can be calculated.

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

Table 2. Level-Of-Service Criteria for Signalized and Unsignalized Intersections

LOS	CHARACTERISTICS	UNSIGNALIZED TOTAL DELAY (SEC)	SIGNALIZED TOTAL DELAY (SEC)
A	Little or no delay	≤ 10.0	≤ 10.0
B	Short delays	10.1-15.0	10.1-20.0
C	Average delays	15.1-25.0	20.1-35.0
D	Long delays	25.1-35.0	35.1-55.0
E	Very long delays	35.1-50.0	55.1-80.0
F	Extreme delays	> 50.0	> 80.0

Level of Service Results

This congestion analysis examines design hour vehicle delays and queues at 13 critical intersections around downtown Dover. Turning movement data was obtained from 2014 RSG counts as well as from the *Downtown/Riverfront Redevelopment Traffic Circulation and Parking Plan* (2005, Rizzo Associates). Given the flat to declining trend in traffic volumes over the last 10 years, and based on the similarity of the 2014 count data with 2004 traffic volumes from the Rizzo study, RSG chose to evaluate the traffic conditions using the more detailed 2004 volumes.[3] These volumes were adjusted for seasonal variation and design hour in the Rizzo study, and thus no adjustments were made to these volumes.

The Highway Capacity Manual congestion reports within Synchro (v8), a traffic analysis software package from Trafficware, routinely relied upon by transportation engineering professionals, were used to assess congestion at the study intersections. Existing traffic signal timing and phasing information was obtained from the City and was integrated into the congestion analysis to evaluate current delays and LOS. A tabular summary of the congestion analysis is shown in **"Table 3. Peak Hour LOS Results"** and **"Table 4. Estimated 2014 Peak Queues"**. Detailed Synchro LOS worksheets are available in **Appendix A**.

"Figure 6. AM Level of Service, 2014" and **"Figure 7. PM Level of Service, 2014"** below present the 2014 morning and evening peak hour Levels of Service at the thirteen study area intersections. As shown in these figures, all four signalized intersections operate at LOS D or better during the AM peak hour. During the PM peak hour, Washington Street/Central Avenue operates at LOS F. The other three signalized intersections operate at LOS D or better. At least one of the stop-controlled approaches at the following intersections operates at a LOS E or F.

- Central Ave/Chestnut St (PM)
- Chestnut St/Sixth St (PM)
- Chestnut St/Third St (AM & PM)
- Central Ave/Preble St (PM)
- Central Ave/Second St (PM)
- Main St/Portland Ave (AM)

3 2004 existing condition volumes were found to be 16% and 29% higher than the 2014 counts at the Central Ave/Third St/Broadway and Washington St/Central Ave intersections, respectively.

Table 3. Peak Hour LOS Results

Intersections	2014 Peak Hour					
	LOS	AM Delay	v/c	LOS	PM Delay	v/c
Central Ave/Chestnut St						
EB, exiting Chestnut St	C	20	0.45	F	>100	1.08
Chestnut St/Sixth St						
EB, along Sixth St	C	17	0.56	E	39	0.84
WB, along Sixth St	B	13	0.28	C	20	0.47
NB, along Chestnut St	C	16	0.52	F	70	1.14
SB, along Chestnut St	C	24	0.73	E	44	0.86
Chestnut St/Third St						
EBL, exiting Third St	C	21	0.01	E	49	0.17
EBR, exiting Third St	B	12	0.04	B	14	0.10
WBL, exiting Third St	E	37	0.53	F	>100	1.26
WBR, exiting Third St	B	11	0.06	B	14	0.11
NB, along Chestnut St	A	9	0.02	A	9	0.06
SB, along Chestnut St	A	8	0.00	A	9	0.00
Chestnut St/Orchard St						
WB, exiting Orchard St	B	15	0.08	C	24	0.27
SBL, exiting Chestnut St	A	8	0.03	A	9	0.05
Chestnut St/Washington St						
Overall	C	33	0.52	D	40	0.71
EB, along Washington St	C	24	-	D	44	-
WB, along Washington St	D	43	-	D	51	-
NB, along Chestnut St	E	61	-	E	61	-
SB, along Chestnut St	C	26	-	C	27	-
Washington St/Locust St						
NBL, exiting Locust St	B	13	0.11	C	16	0.11
NBR, exiting Locust St	A	10	0.15	B	12	0.32
Washington St/Central Ave						
Overall	D	53	0.71	F	>100	1.04
EB, along Washington St	E	57	-	F	85	-
NB, along Central St	E	62	-	F	>100	-
SB, along Central St	A	<1	-	E	61	-
Central Ave/Preble St						
EB, from Sixth St	B	12	0.20	C	25	0.54
WB, from Preble St	C	18	0.12	F	58	0.24
NBL, along Central Ave	A	8	0.11	A	10	0.19
SB, along Central Ave	A	8	0.00	A	9	0.00
Central Ave/Third St						
Overall	C	29	0.43	D	46	0.62
EB, along Third St	C	29	-	C	25	-
WB, along Third St	D	40	-	D	41	-
NB, from Main St	C	29	-	D	36	-
SB, along Chestnut St	C	21	-	E	60	-
Central Ave/Second St						
WB, from Chapel St	D	34	0.81	E	35	0.83
Main St/Chapel St						
Overall	B	10	0.25	B	12	0.34
NB, along Main St	A	9	-	B	11	-
SB, along Main St	C	27	-	C	28	-
Main St/Portland Ave						
WBR, exiting Portland Ave	E	48	0.95	D	35	0.71
Main St/Washington St						
WBR, from Washington St	B	13	0.00	D	26	0.35

Table 4. Estimated 2014 Peak Queues

		2014 Peak Hour	
		AM	PM
Central Ave/Chestnut St			
	EB	3	4
	NB	0	0
	SB	1	16
Chestnut St/Sixth St			
	EB	3	29
	WB	2	2
	NB	3	17
	SB	4	5
Chestnut St/Third St			
	EB	1	2
	WB	2	4
	NB	0	10
	SB	0	0
Chestnut St/Orchard St			
	WB	1	2
	NB	0	0
	SB	1	2
Chestnut St/Washington St			
	EB	5	29
	WB	5	6
	NB	7	34
	SB	7	9
Washington St/Locust St			
	EB	1	10
	WB	0	0
	NB	2	26
Washington St/Central Ave			
	EB	7	10
	NB	32	100
	SB	30	28
Central Ave/Preble St			
	EB	1	4
	WB	1	1
	NB	1	9
	SB	0	4
Central Ave/Third St			
	EB	1	2
	WB	8	22
	NB	4	6
	SB	7	23
Central Ave/Second St			
	WB	6	7
	SB	1	0
Main St/Chapel St			
	NB	10	29
	SB	1	9
Main St/Portland Ave			
	WB	6	6
	NB	0	6
	SB	0	0
Main St/Washington St			
	EB	0	9
	WB	0	10

Figure 6. AM Level of Service, 2014

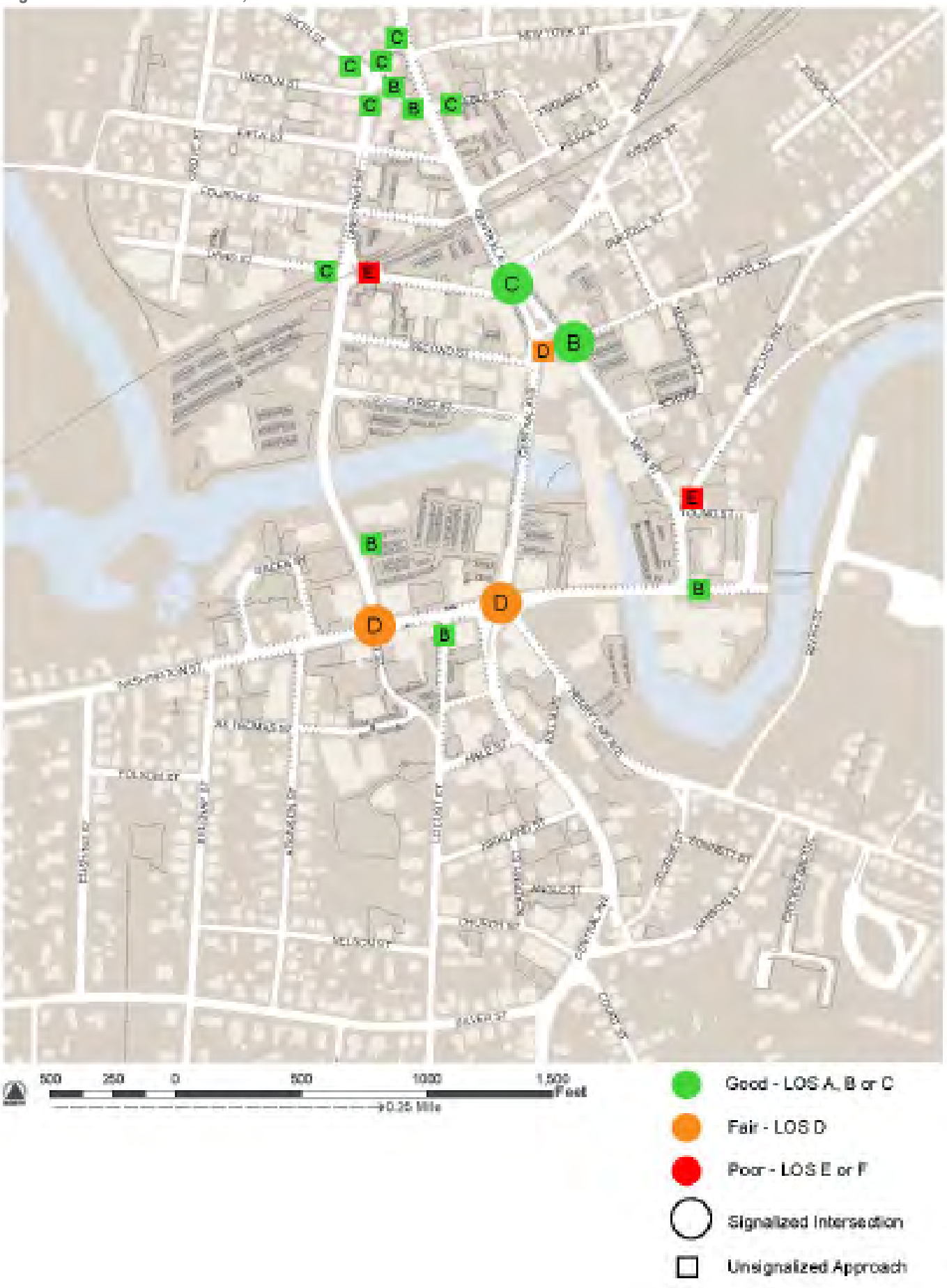
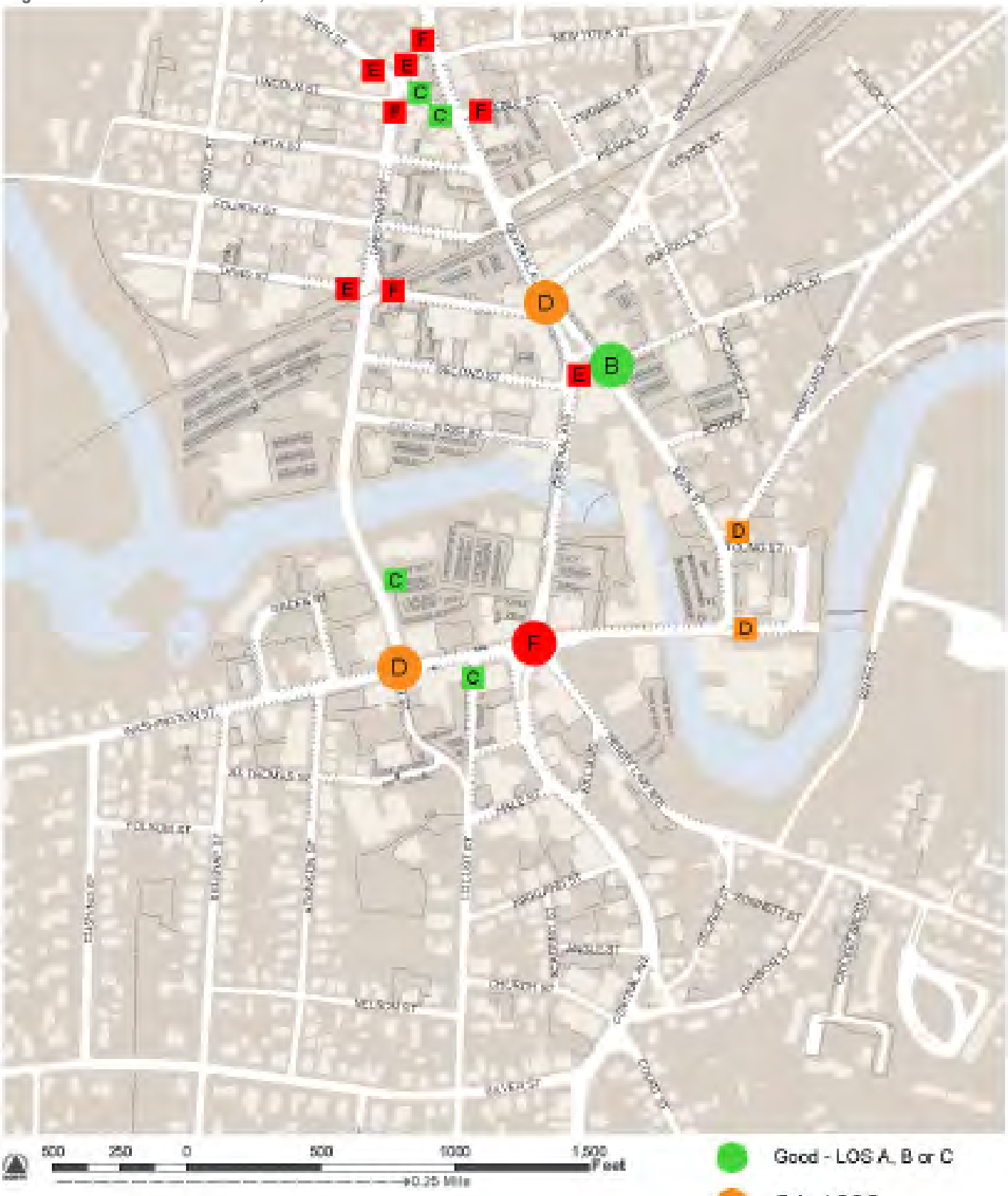


Figure 7. PM Level of Service, 2014



Lower Square Operational Observations

Based on the results of the analysis indicating that Lower Square experienced the greatest level of vehicle delay, RSG conducted a field visit on January 30, 2014 to observe overall traffic operations. During this site visit, the following queues were observed during the PM peak hour:

- EASTBOUND – Maximum queues extended west through the Washington Street/Locust Street intersection. For the most part, queues would fully clear every cycle.
- NORTHBOUND – Queues extended south to approximately the Central Avenue/Angle Street intersection, which is a quarter of a mile south of the Washington Street/Central Avenue intersection.
- SOUTHBOUND – Queues extended through the Central Avenue/Second Street occasionally. Queues extended through the Central Avenue/Third Street/Broadway intersections twice during the PM peak hour Queues were almost exclusively in the right lane along Central Avenue. This is mostly due to the large proportion of southbound through traffic at Lower Square. Unclear pavement markings and signage could be a contributing factor, resulting in some drivers staying in the right lane when they could be using the left lane.
- EASTBOUND (EXITING) – Vehicles exiting Lower Square to the east were observed to strongly favor the right travel lane. This uneven lane distribution continued to nearly the Main Street/Chapel Street intersection. This uneven lane distribution could be the result of unclear pavement markings, poor signage, and/or roadway geometry.

In addition, we observed queues at all other signalized intersections and they were found to be negligible, with queues fully clearing at nearly each cycle.

Figure 8. Crashes

C. ACCIDENT DATA

Vehicular Accidents

RSG collected historic vehicle crash data from NHDOT (January 2003-December 2012) to analyze the quantity and severity of the crashes in the downtown study area. NHDOT maintains a statewide database of all reported crashes along all state highways and federal aid road segments. A figure presenting the locations of all reported crashes between 2003 and 2012 is shown in **"Figure 8. Crashes"**.

Bike and Pedestrian Accidents

Cyclist and pedestrian injuries were found to be especially high along Chestnut Street, Central Avenue, and Main Street with 8 cyclist injuries and 19 pedestrian injuries, 8 of which were incapacitating or fatal. A figure identifying the locations of severe bicycle and pedestrian-related crashes is shown in **"Figure 9. Bike/Pedestrian Injuries (2003 to 2012)"**.

Beyond this relatively high cluster of bicycle and pedestrian-related crashes, no recurring themes were found for these crashes regarding locations, time of day, time of year, type of crash, or contributing circumstances.

Figure 9. Bike/Pedestrian Injuries (2003 to 2012)

2.2 Transit Services

The downtown Dover area has a number of public transit providers, including the following:

- Cooperative Alliance for Seacoast Transportation (COAST)
- University of New Hampshire Wildcat Transit
- Amtrak Downeaster rail service

All of these transit providers provide access to downtown Dover via a number of bus stops, which converge on the Dover Transportation Center, located adjacent to the rail line, a few minute walk from the core downtown area. See **"Figure 10. Transit Routes and Stops"**.

In addition, C&J Trailways offers intercity bus service to the Boston Logan Airport and South Station via a recently constructed (2009) park-and-ride lot located off Exit 9 of the Spaulding Turnpike, minutes from downtown Dover. These public transit service providers are detailed below.

A. BUS

COAST

The Cooperative Alliance for Seacoast Transportation (COAST) is a regional and local transit provider serving Rockingham and Strafford Counties in New Hampshire and Berwick, Maine. Fares for most routes are $1.50 per trip, while the Clipper Connection is $3.00 and the North Bus is $5.00 round trip; transfers are not allowed between bus routes. Currently, four COAST routes serve the downtown Dover area, as shown in **"Table 5. Coast Transit Route Descriptions".**

All COAST routes that service the downtown area stop at the Dover Transportation Center, where connections can be made to UNH's Wildcat Transit or to the Downeaster.

UNH Wildcat Transit

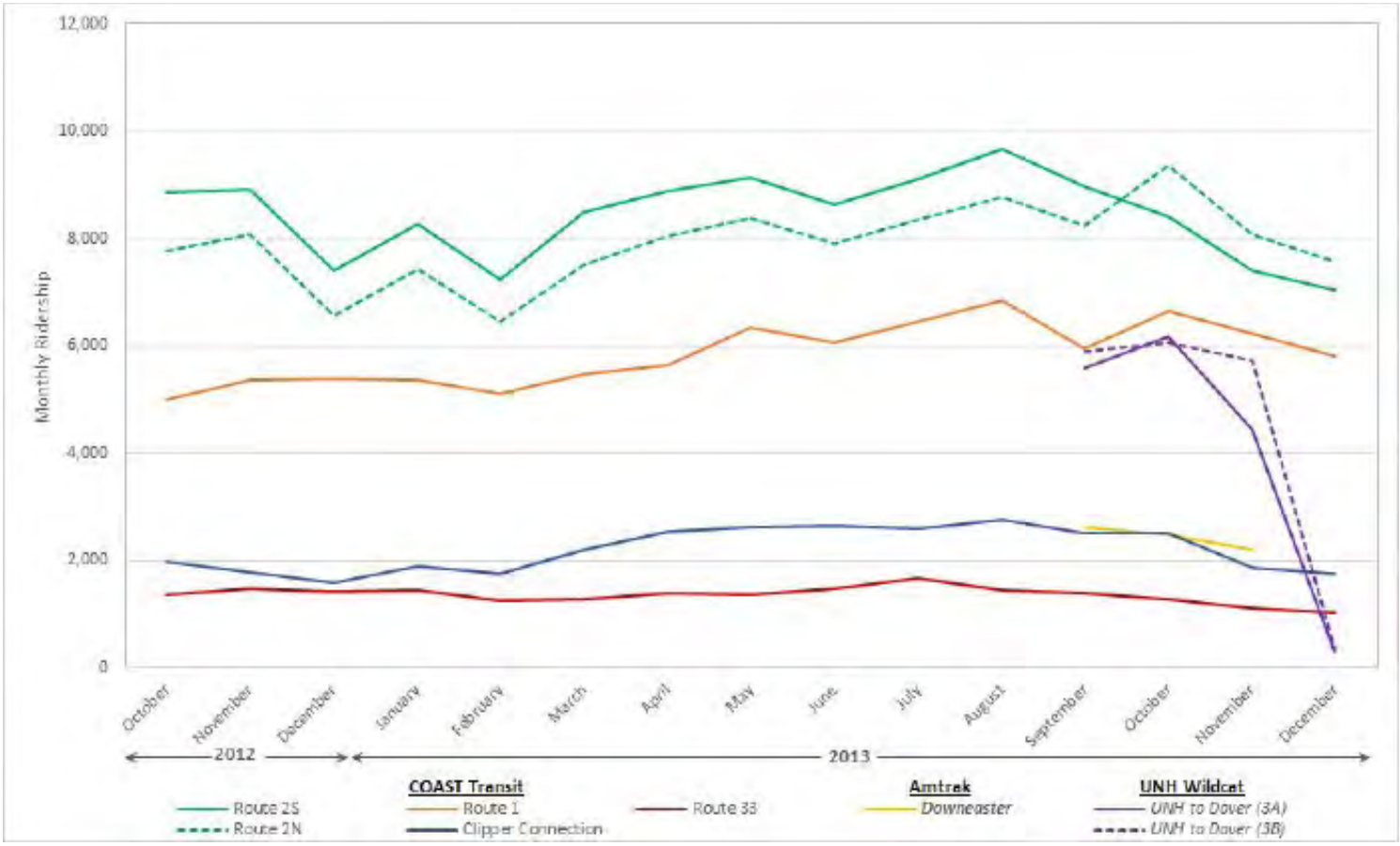
The University of New Hampshire (UNH) provides transit service to its students and the general public. This service includes local transit campus connector routes serving the Dover, Newington, Newmarket, and Portsmouth communities. Route 3 is the route that serves Dover, including stops within the downtown area. Route 3 includes a stop at the Dover Transportation Center, where connections can be made to COAST service or the Downeaster. Service runs from 6:45 AM to 11:00 PM Monday through Friday.

Figure 10. Transit Routes and Stops

Table 5. Coast Transit Route Descriptions

ROUTE	DESCRIPTION	ADULT FARE	DAYS OF WEEK	TIMES OF DAY
Route 1	Dover to Berwick	$1.50	M-F, Sat	5:30 AM – 7:30 PM
Route 2	Portsmouth to Rockester	$1.50	M-F	5:45 AM – 9:30 PM
Route 33	Dover FastTrans route	$1.50	M-F	6:30 AM – 5:00 PM
Route 101	Clipper Connection: Dover to Kittery	$3.00	M-F	Mornings/ Afternoons
Dover FastTrans	Dover FastTrans	(Discontinued in September 2013)		

Figure 11. Public Transit Monthly Ridership Trends by Transit Provider



C&J Trailways

C&J Trailways, an intercity transit provider, serves the Dover area via a transit bus stop located near Exit 9 off the Spaulding Turnpike. C&J Trailways offers service between Dover and the Boston Logan Airport or South Station via the Dover bus stop, with additional stops in Portsmouth and Newburyport. Currently, the schedule includes 30 departure times on weekdays and 21 departure times on weekend days from the Dover bus stop. Adult fares range from $18.00 one-way to South Station to $24.00 one-way to Logan Airport.

B. RAIL

Amtrak Downeaster

The Downeaster is an intercity rail service provided by Amtrak that runs between Boston, MA (North Station) and Brunswick, ME, serving 10 additional communities between these end points, including Dover. The train stops at the Dover Transportation Center, where connections can be made to both COAST and UNH Wildcat Transit. The Downeaster has five southbound and five northbound trains that stop at the Dover station each day (both weekdays and weekend days). Fares are dependent on start and end location.

C. RIDERSHIP TRENDS

"Figure 11. Public Transit Monthly Ridership Trends by Transit Provider" reports the monthly ridership trends, by service provider and route for COAST, UNH Wildcat, and Amtrak services. Available data were limited for Wildcat and Amtrak to the last few months of 2013. Generally, ridership trends remain relatively steady for COAST routes, with slight dips in monthly ridership during winter months (presumably due to UNH students being on vacation). Wildcat service also is fairly steady, although shows a sharp decline in ridership during December. Amtrak Downeaster ridership boardings at the Dover station remain relatively steady close to 2,500 boardings in a given month. While ridership data were not available for C&J Trailways, on their website they report that for all their intercity services, they serve over 2,000 individuals each day.

2.3 Pedestrian Circulation

A. PATTERNS

As shown in **"Figure 12. Street Crossing Conditions"**, higher concentrations of pedestrians are found along specific corridors within the downtown. The highest level of pedestrian activity is found at the core area along Central Avenue from Upper Square to Lower Square. Moderate levels of pedestrian activity have been identified at the following locations:

- Washington Street from Central Avenue to Main Street
- Main Street from Portland Avenue to Upper Square
- Third Street from Central Avenue to Grove Street
- Chestnut Street from the railroad crossing to the Cochecho River

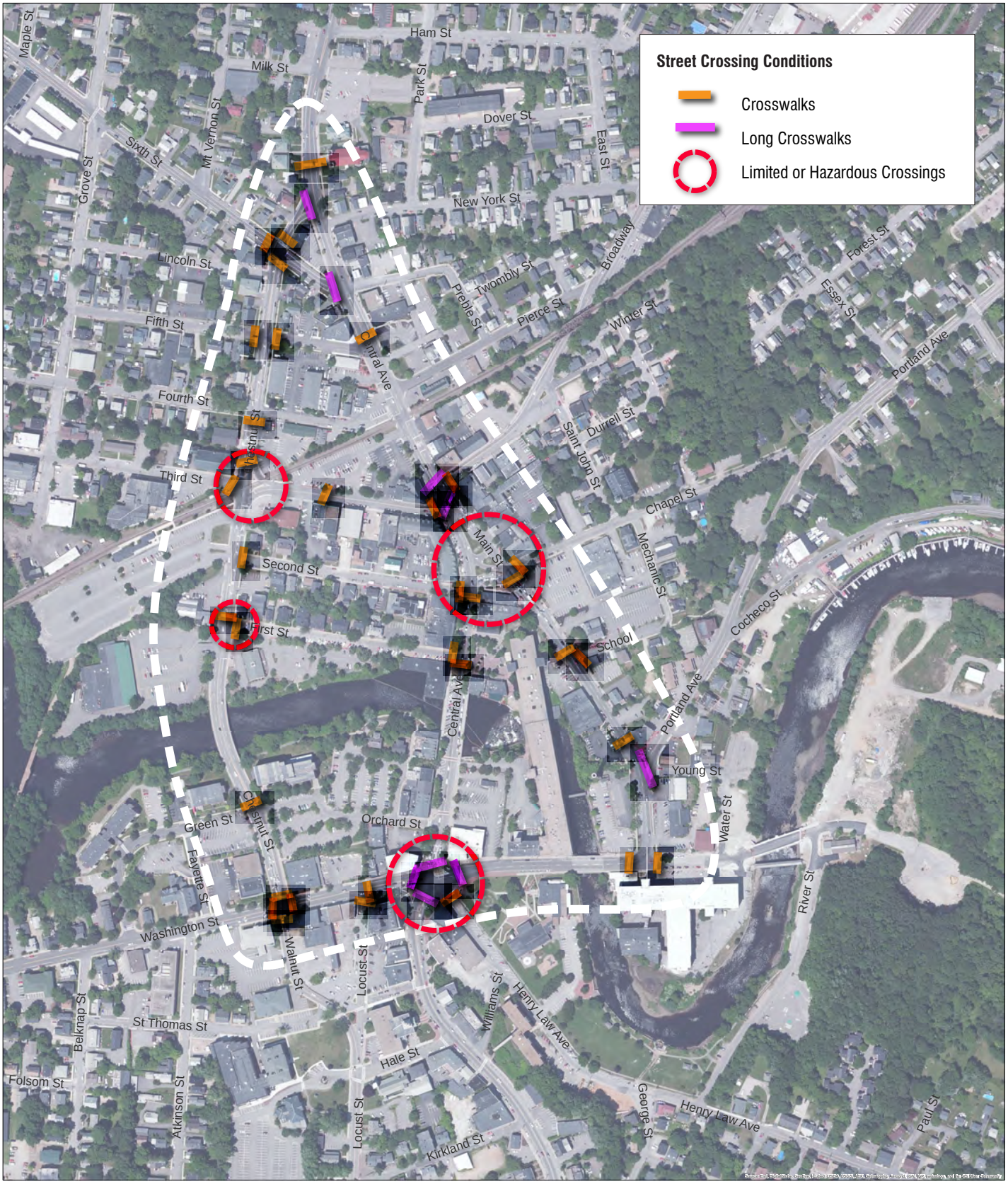
Various intersections also have high levels of pedestrian activity due to key destinations in downtown. Third Street at the railroad crossing attracts many pedestrians as they make their way to the railroad station from the northwest neighborhood and downtown areas. Lower Square at Washington Street also has a higher concentration of pedestrians due to the attraction and events held at the Children's Museum and the Washington Square Mill throughout the year. Upper Square has a high concentration of pedestrians focused along its edges at Main Street and Central Avenue. Additionally, pedestrian circulation becomes a challenge in Upper Square navigating amongst the various traffic movements. While crosswalks are present, they are unusable due to their locations and high levels of vehicle activity. The intersection at Third Street and Chestnut Street has also presented a challenge for pedestrians. Vehicles travel at higher speeds along Chestnut Street with minimal traffic calming measures. Crosswalks are unidentifiable and the traffic signal does not operate appropriately, resulting in less frequent stopping of traffic making it more difficult and hazardous for pedestrians to navigate.

B. ACCESSIBILITY

Pedestrian circulation is impacted by the level of accessible paths within the downtown area. Lateral streets running east and west are primarily flat and easily accessible, while the main pedestrian corridors of Central, Main and Chestnut Streets slope dramatically from Upper Square to the north extending down to the Cochecho River.

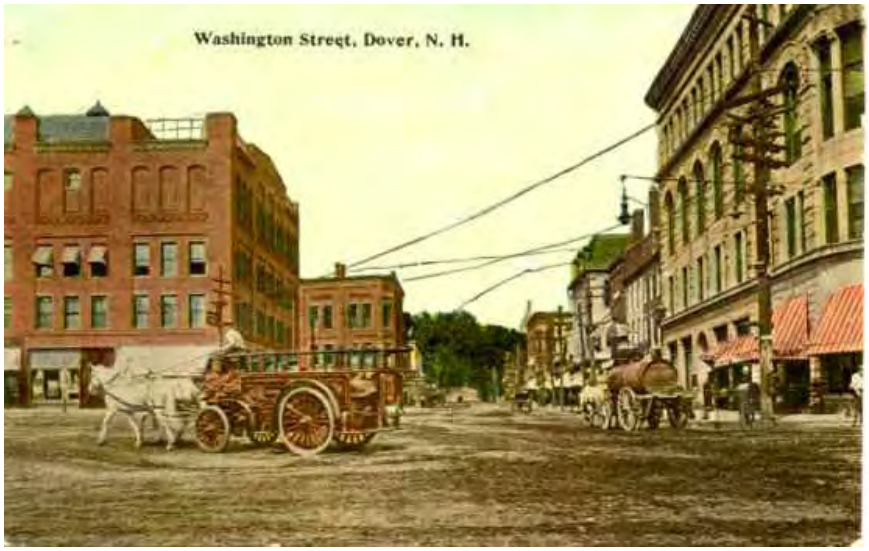
Recent improvements to ADA ramps have improved pedestrian accessibility for all users. While these improvements have improved the overall pedestrian circulation, there are still many influences that affect the overall accessibility and pedestrian circulation within downtown. See Topography for additioanl details.

Figure 12. Street Crossing Conditions



2.4 Bicycle Circulation

Bicycle circulation is concentrated at Chestnut Street and Central Avenue. Since there is no clearly defined travel way, bicycles have been seen on the sidewalks of Central Avenue to avoid the high level of vehicles and confusing traffic movements. There are very limited bicycle facilities in the downtown.



Undated historic photograph of Washington Street, courtesy of the Dover Public Library.

3 PARKING ANALYSIS

3.1 Parking Inventory

RSG analyzed the parking recommendations from prior reports and conducted a parking inventory site visit to observe the conditions during peak hours.

According to the *Rizzo* Study,[1] Downtown Dover had over 800 on-street and 3,000 off-street parking spaces, amounting to roughly an 80-20 split with significantly more off-street parking availability. Based on data available on the City's Parking Bureau website,[2] the Amtrak Downeaster station information,[3] and from correspondences with the Dover Parking Manager, there are 530 parking lot spaces available to the public, both unrestricted or metered with time constraints. In addition, there are over one thousand on-street parking spaces, many of which are metered in the central downtown area, and serve to fill in the gaps between the public lots. **"Figure 13. Downtown Dover Parking Inventory"** details the current parking space counts and designations by the City within the downtown area. The figure does not include parking that is private owned.

The 2004 study divided the downtown area into eight zones, where Zone 8 (south of Washington and east of Central Ave) and Zone 1 (area located within the Central/Washington/Main St loop) had the highest PM utilization of parking: 65.9% and 57.5% respectively. The subsequent 2008 LMG *Downtown Parking Facility and Management Study*[4] observed that the peak parking utilization period occurred in the afternoon between 1pm and 2pm, which was not previously studied in the 2004 report. The 2008 study observed that the on-street parking utilization was approximately 10% higher than observed in 2004 and the off-street parking utilization was 5% lower than in 2004. The LMG study recommended that underutilized on-street parking spaces be permitted for monthly employee parking, suggesting a demand for more permit parking.

A. PARKING INVENTORY SITE VISIT

RSG conducted an overview parking inventory site visit on Friday, January 17, 2014 between the hours of 1:00PM and 3:00PM to observe the utilization of on and off-street parking within the core downtown area during this peak utilization period. During the two-hour period, we counted the utilization for a total of 1,068 spaces (both public and private), 76% of which were

1 Downtown/Riverfront Redevelopment Traffic Circulation and Parking Plan Dover, New Hampshire by Rizzo Associates, Inc. (February 14, 2005)

2 Dover Parking Bureau. Dover Police Department. Accessed on February 20, 2014. http://www.ci.dover.nh.us/pdparking.htm.

3 Dover Transportation Center. Amtrak Downeaster Station Information. Accessed on February 20, 2014. https://www.amtrakdowneaster.com/station/dover.

4 Downtown Parking Facility and Management Study. Dover, New Hampshire by LMG. (March 2008)

in lots, and 24% on-street. Overall, the off-street parking lots had higher levels of utilization, with an average of 52% of the spaces filled. The downtown on-street parking was less utilized, particularly those along Main Street, where only one out of the 16 spaces counted was occupied.

The Orchard Street lot was the most heavily utilized public lot observed, with 78% of the spaces filled. The most utilized on-street parking corridor was Central Avenue, where over 73% of the metered parking spaces were filled, and only one space was observed vacant between First and Second Street. A figure mapping out the parking utilization rates observed in detail along each corridor and parking lot, including both public and private commercial spaces, is shown in **"Figure 14. Parking Inventory: Site Visit"**.

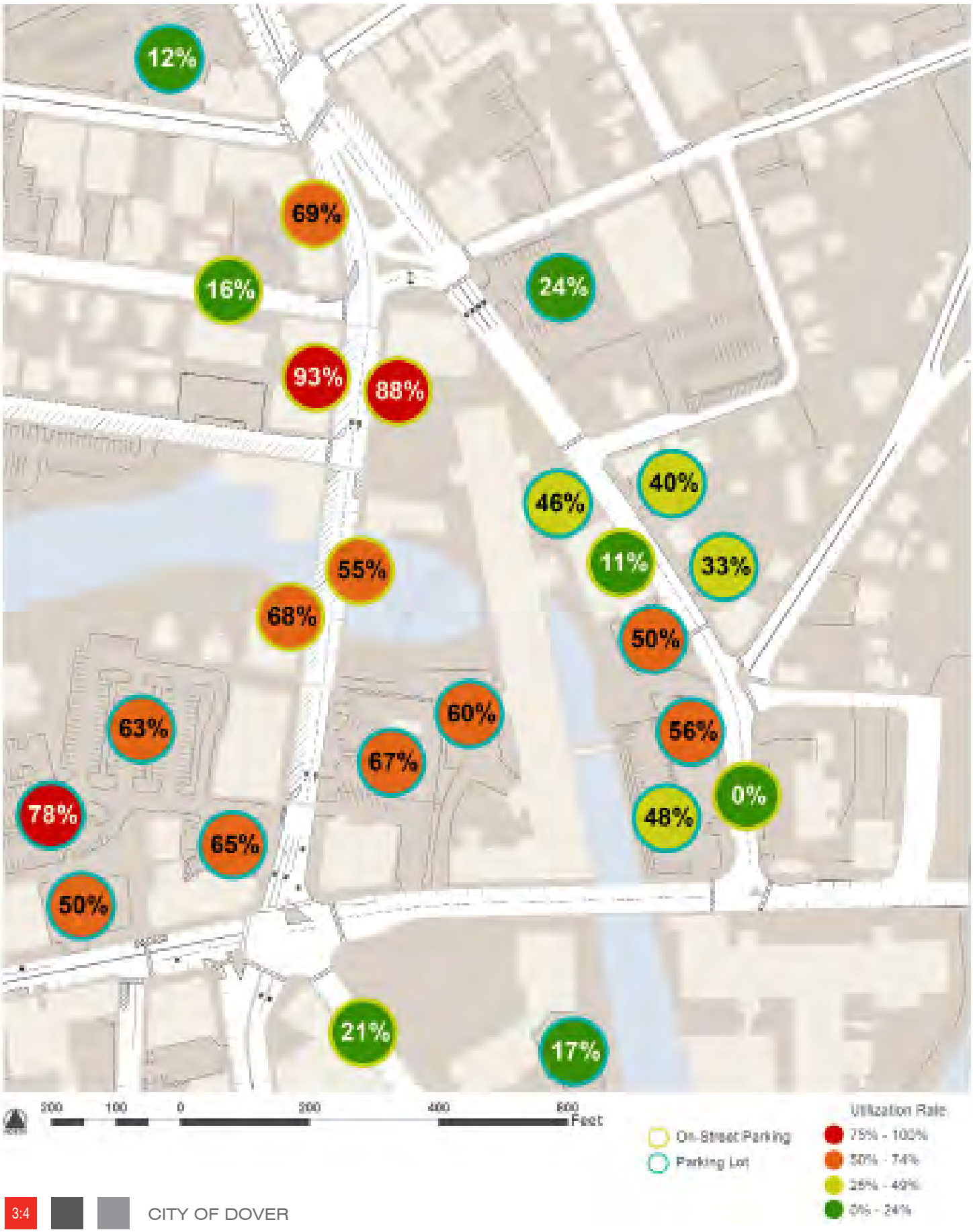
3.2 Parking Patterns

From our site observation, there is a greater demand for parking on the west side of downtown, particularly on- and off-street parking along Central Avenue and adjacent to the retail shops. There is also a wide range in utilization rates, particularly in private commercial lots, with the need for better signage and wayfinding to highlight the differences between private and public spaces. Further detail and photos from the parking inventory site visit can be found in **Appendix B**.

Undated historic photograph of a bridge on Central Avenue, looking north, courtesy of the Dover Public Library.

Figure 13. Downtown Dover Parking Inventory

Figure 14. Parking Inventory: Site Visit



4 URBAN DESIGN AND DEVELOPMENT ANALYSIS

4.1 Land Use

The analysis of land use provides a frame of reference relative to various alternative configurations of the future downtown circulation network and its relationship to supporting appropriate pedestrian connections, directing traffic, allocating on-street and public parking, and providing access to public parking. The information has been assembled from the City's maps and a review of probable near-term changes in land use associated with approved projects. The information has been assembled to provide an overview of predominate patterns, which is appropriate for the purposes of this design project. Because downtown buildings and sites often contain multiple uses, and because changes in some individual occupancies and tenancies occur fairly frequently in a downtown, the circumstances associated with individual sites may vary somewhat from the general assessment in this report.

A. EXISTING LAND USE PATTERNS

Existing land use patterns affect the location of and transit patterns for motor vehicles and pedestrians. **"Figure 16. Existing Land Use Patterns"** shows current land uses grouped into simplified clusters of similar uses. For this study, the importance of land use categories is in how they relate to parking and pedestrian access. Residential uses require dedicated parking either on-site or immediately adjacent to the site. Under certain conditions, remote parking may be acceptable, but access from the parking to the residence must be easily walkable. These conditions are also true of hotels and, to a certain extent, restaurants.

Retail and commercial uses have a higher tolerance for remote parking for employees, however, customers generally prefer to park closer to their destination. Park-once solutions, where customers park in a lot and walk from shop to shop, can work in areas with compatible destinations close to each other.

All uses need to be connected to each other and to parking with safe and accessible sidewalks and pedestrian crossings.

Figure 15. Open Space and Natural Features

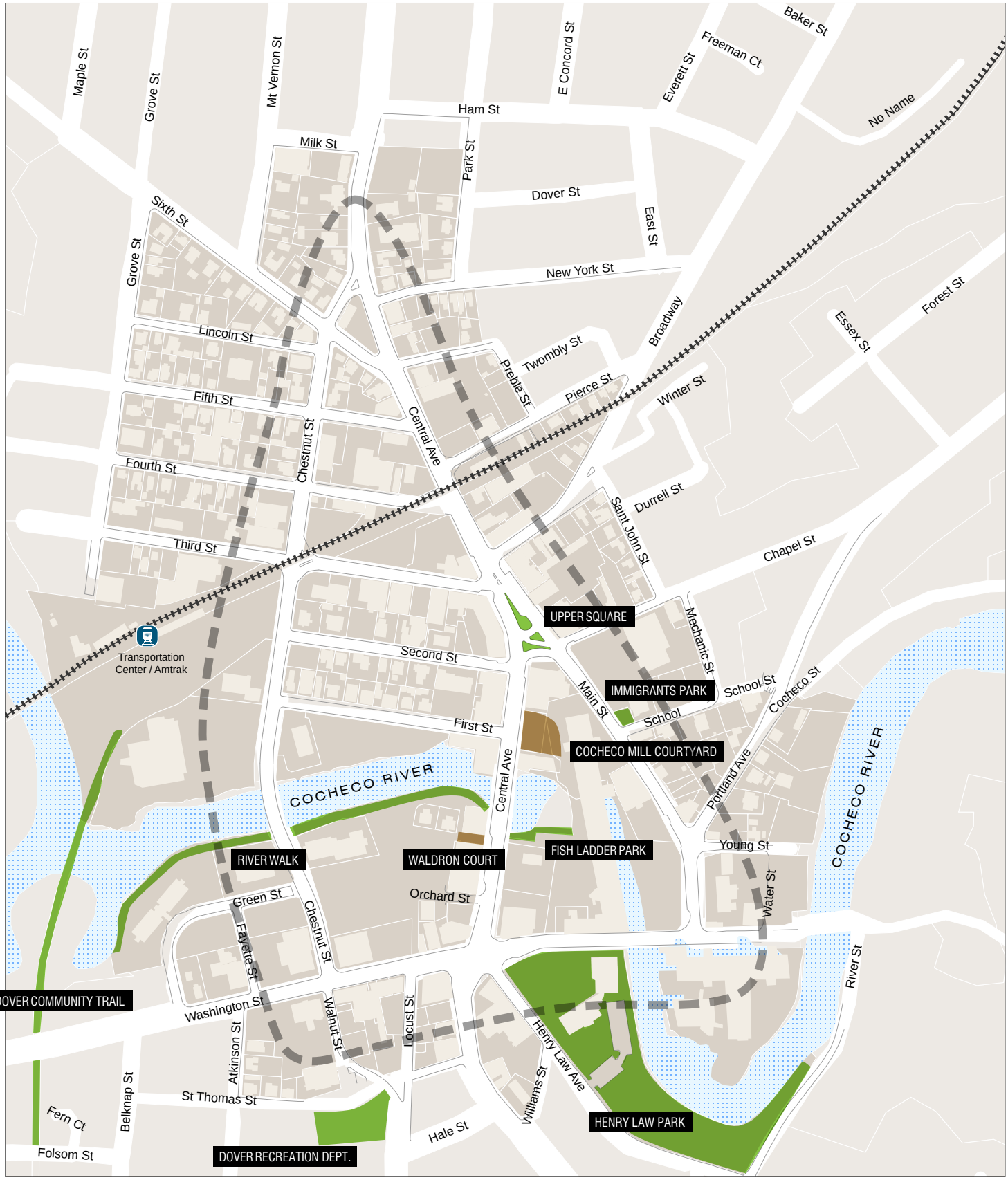
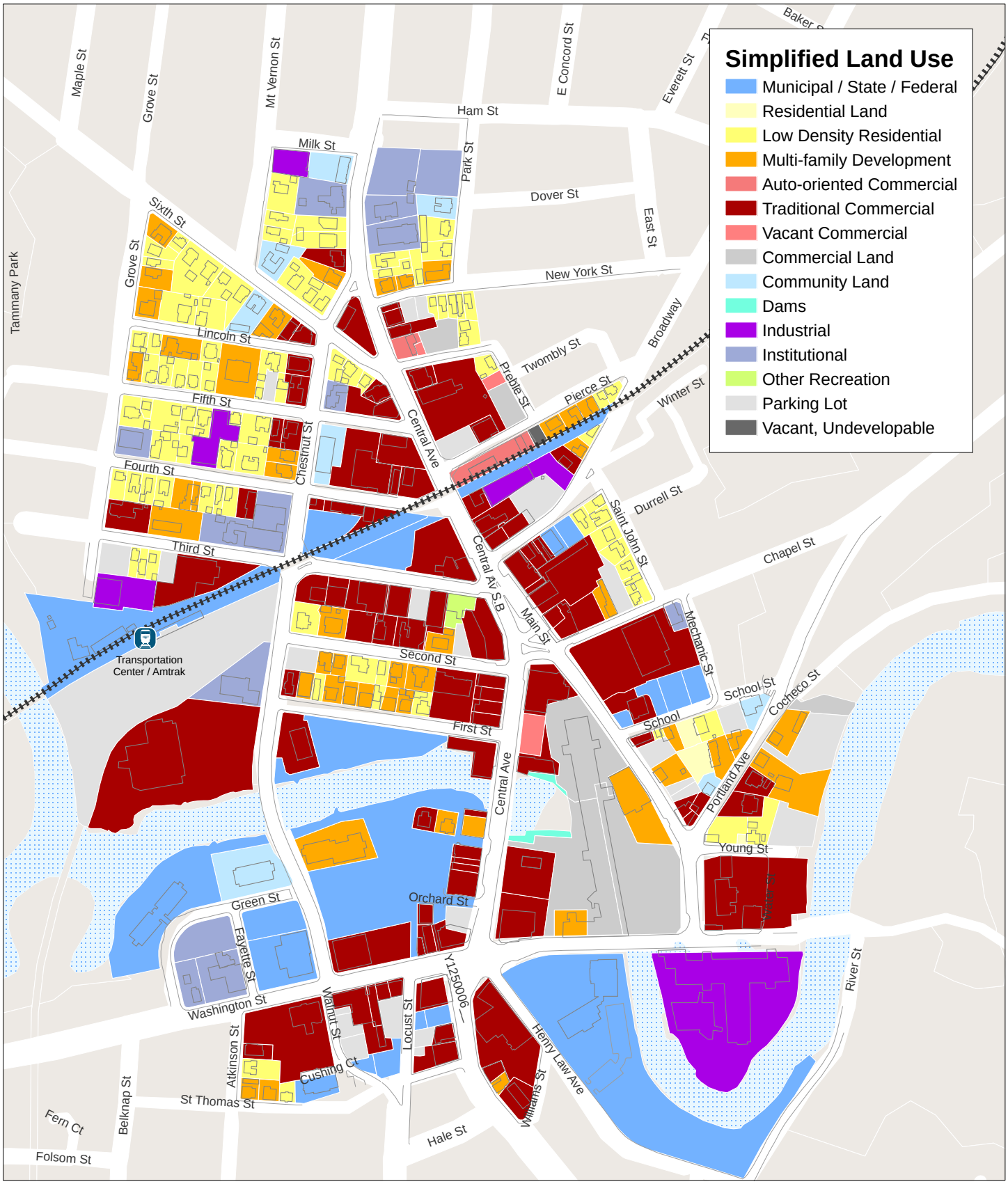
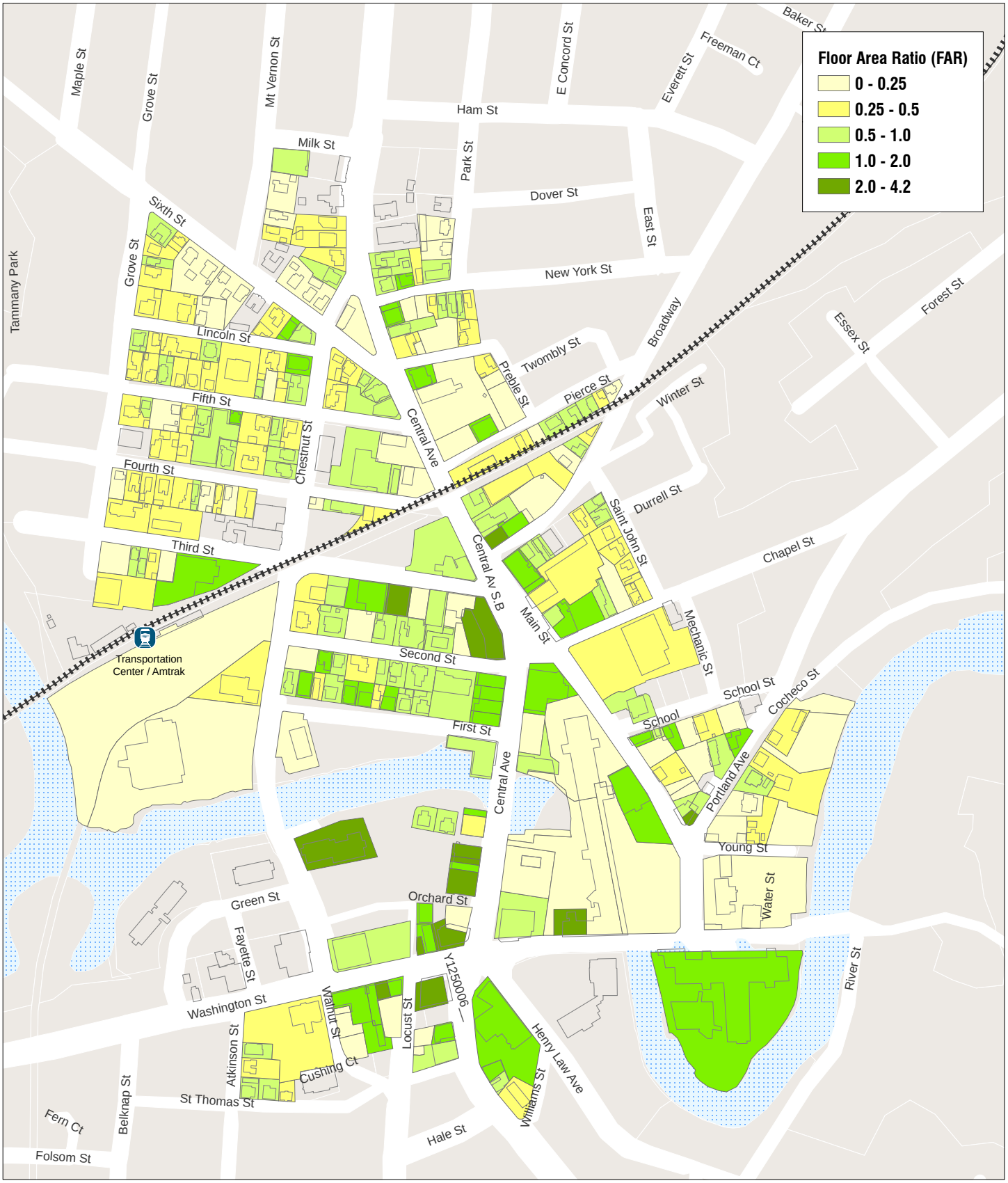


Figure 16. Existing Land Use Patterns



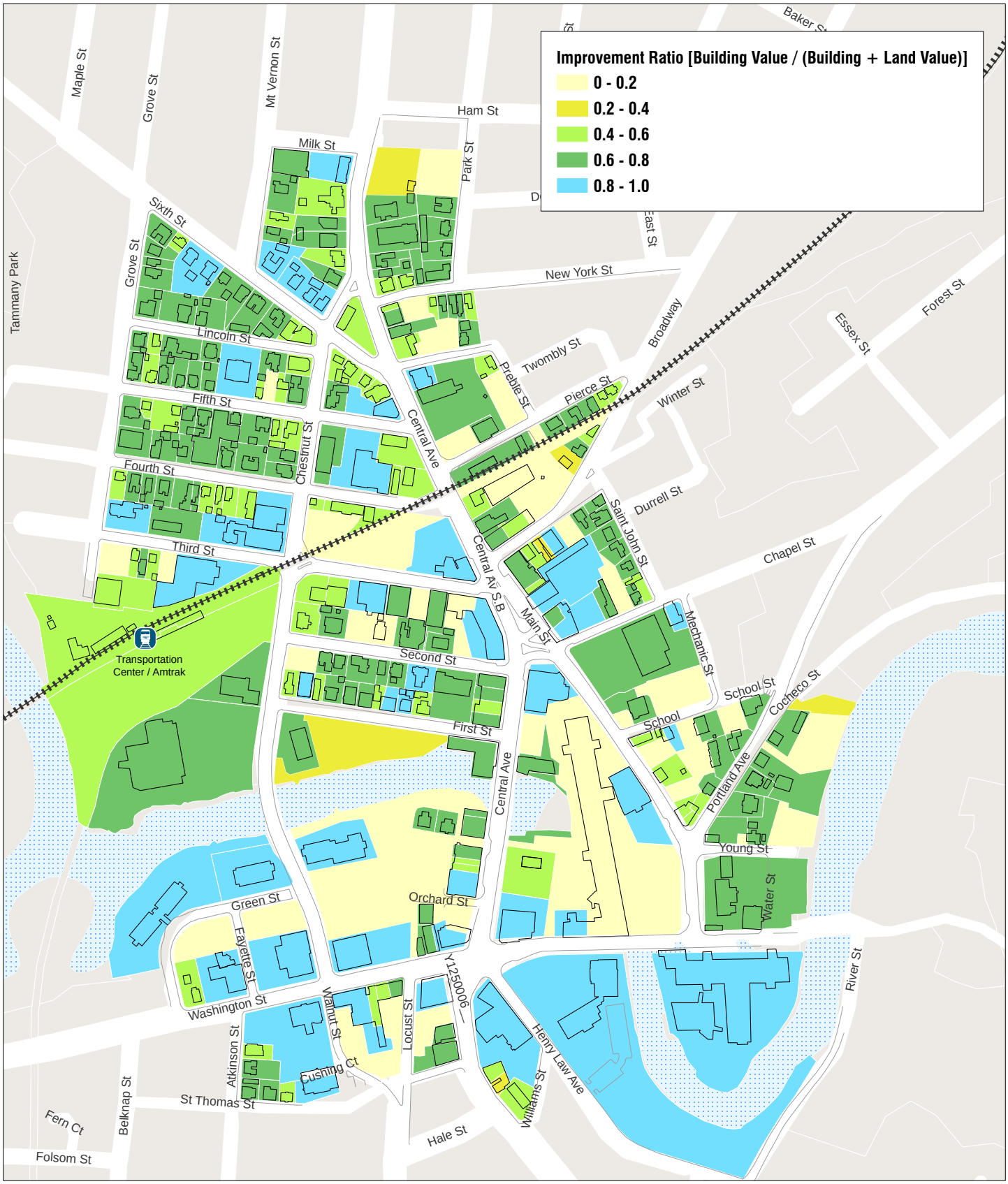
Note: land uses are taken from April 2013 City of Dover assessor data

Figure 17. Existing Development Intensity



Note: Floor Area Ratio (FAR) was computed from April 2013 City of Dover assessor data. FAR is the total floor area of all building on a parcel, excluding basements, divided by parcel area.

Figure 18. Property Improvement Ratios



Note: Improvement Ratios are derived from April 2013 City of Dover assessor data on dollar valuations. Improvement Ratios were calculated as building value divided by the total of building value plus land value.

B. ANTICIPATED DEVELOPMENT

A number of projects are either in the planning process now or expected to be initiated soon for Downtown Dover. These potential projects are mixed-use, usually, but not always, a mix of commercial or retail on the ground floor and residential above. As these projects are developed, the land use in the downtown core will begin to shift towards these mixed-use developments, and the need for parking and pedestrian connection from these buildings to their related parking and to the remainder of the downtown must be carefully considered. For example, the addition of public parking in the garage attached to the new police station will address parking needs for current uses and potential development in the area. How the connections are made between this parking and existing and proposed uses will be important in establishing a safe and attractive route for pedestrians.

4.2 Urban Design Analysis

The "urban design" of a downtown refers to the overall physical composition of the district. There are many elements that compose the downtown including the built and natural environments. In addition to the design characteristics of private land and buildings, the urban design of the downtown encompasses and the public realm of streets, sidewalks, waterways, and open spaces. The urban design evaluation for this project focuses particularly on the interplay among these components to inform how the public realm can best be enhanced.

A. URBAN DESIGN CHARACTER

Downtown Dover is a complex district that has emerged in response to its distinctive geography and the relationships between the river, transportation and the evolution of the community and its economy. A series of diagrams have been created to express the following observations.

The Interaction of the Downtown, Transportation and the Cochecho River

As shown in **"Figure 19. Urban Design: Interactions"**, Downtown Dover was sited on both sides of a narrow valley leading along a winding stretch of the Cochecho River. The bridge crossings have been distributed in several locations to respond to the transportation modes and routes. For the roadways, this has limited the circulation choices and concentrates movements in a pattern that responds to the bends in the river. The north/south connectors are aligned to accommodate the slopes that rise from the river's edge. These streets crest and turn as they cross these slopes, creating a picturesque sequence of views that unfold for those moving along them.

Like many historic New England communities, the relatively narrow valley along a flowing river drew water-powered mill development. Mill buildings of enormous scale relative to the surrounding residences and commercial buildings were located strategically both across and along the river. The streets and ways were threaded along and around these structures. Central Avenue has long formed the principal street of the downtown, crossing the river and climbing the slopes on either side. The mass of the Cochecho Mill serves as a barrier that results in a series of indirect and awkward intersections for connections to the east and northeast of the downtown. Because of the complexity of these central streets and intersections, Chestnut and Locust Streets have formed a convenient alternate route across the river and completing the north/south links. Washington Street extends along relatively level ground at the base of the valley and, with the new bridge, will connect the Cochecho River development which will emerge as an extension of Dover's historic downtown.

The rail alignment needed to follow relatively flat grades as it crossed the Cochecho River. Its alignment results in a conveniently located station area in the northwest quadrant of the downtown. The convergence of the street pattern at either end of the Cochecho Mills defines the complex intersections and open space that form the appropriately-named Upper and Lower Squares.

Layers of Density and Uses

One method to characterize the urban design of a district is to consider the "fabric" of buildings, uses, and blocks that emerge as patterns. Downtown Dover has, at its core, a traditional layering of density and uses extending from its center and out towards the residential neighborhoods and other districts beyond the perimeter of this study. See **"Figure 20. Urban Design: Layers of Density and Uses"**. As the diagram suggests, traditional multi-story development is concentrated along the edges of the principal streets that serve the downtown circulation system. The next layer is composed of dense urban fabric with a mixture of uses but with relatively little open space. The next layers are composed of urban neighborhood blocks at a more moderate density extending away from the downtown core. Separate subareas can be identified within this basic pattern. Housing and other uses have extended along the riverfront, taking advantage of available land and views. A civic campus has been created with municipal buildings and uses. Remnants of industrial uses remain near the rail corridor in certain locations.

Destinations and Gaps

Within the downtown there are a series of existing and potential destinations which help form the physical image of the downtown. See **"Figure 21. Urban Design: Destinations and Gaps"**. So, for example, the Town Hall and

Figure 19. Urban Design: Interactions

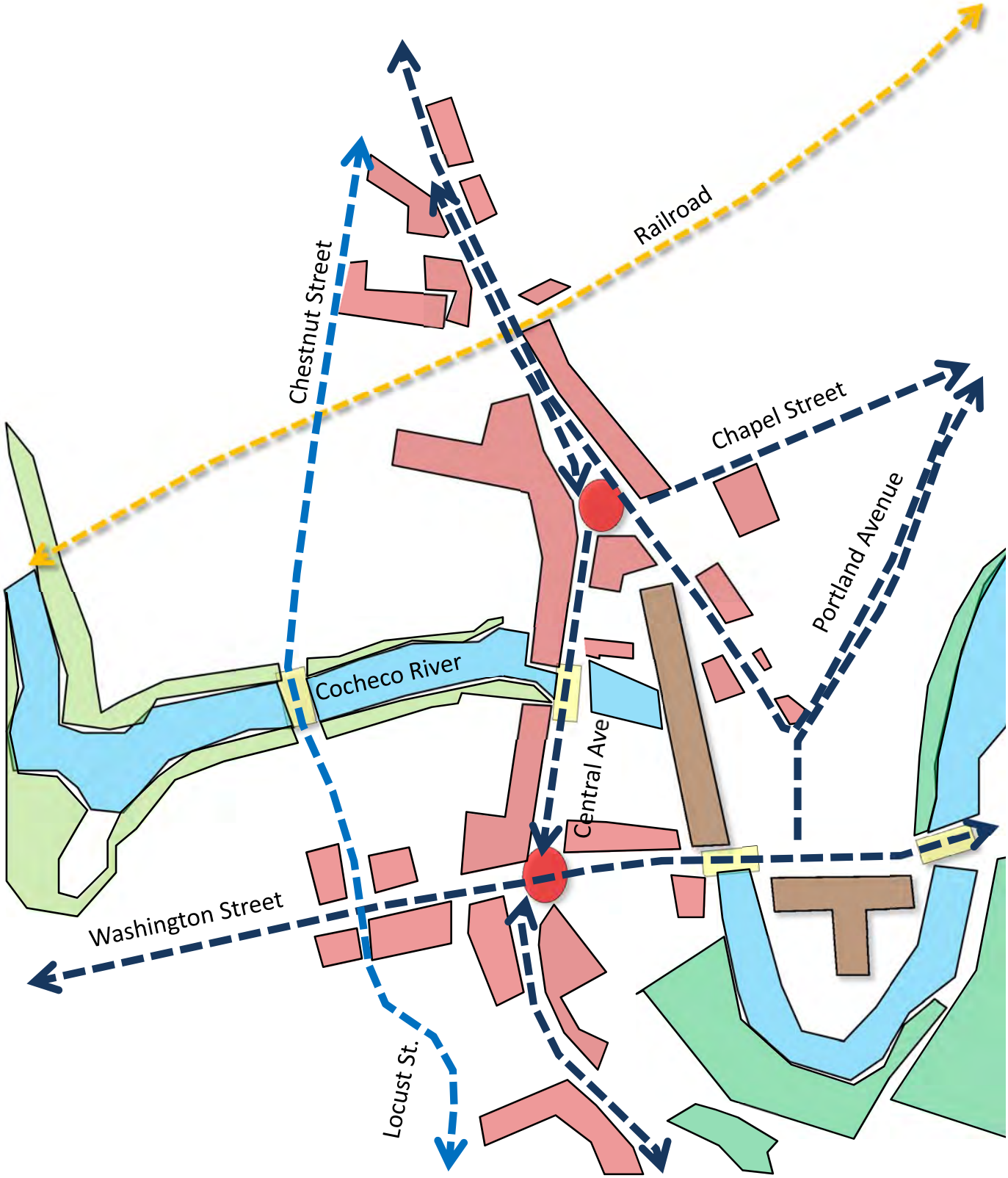


Figure 20. Urban Design: Layers of Density and Uses

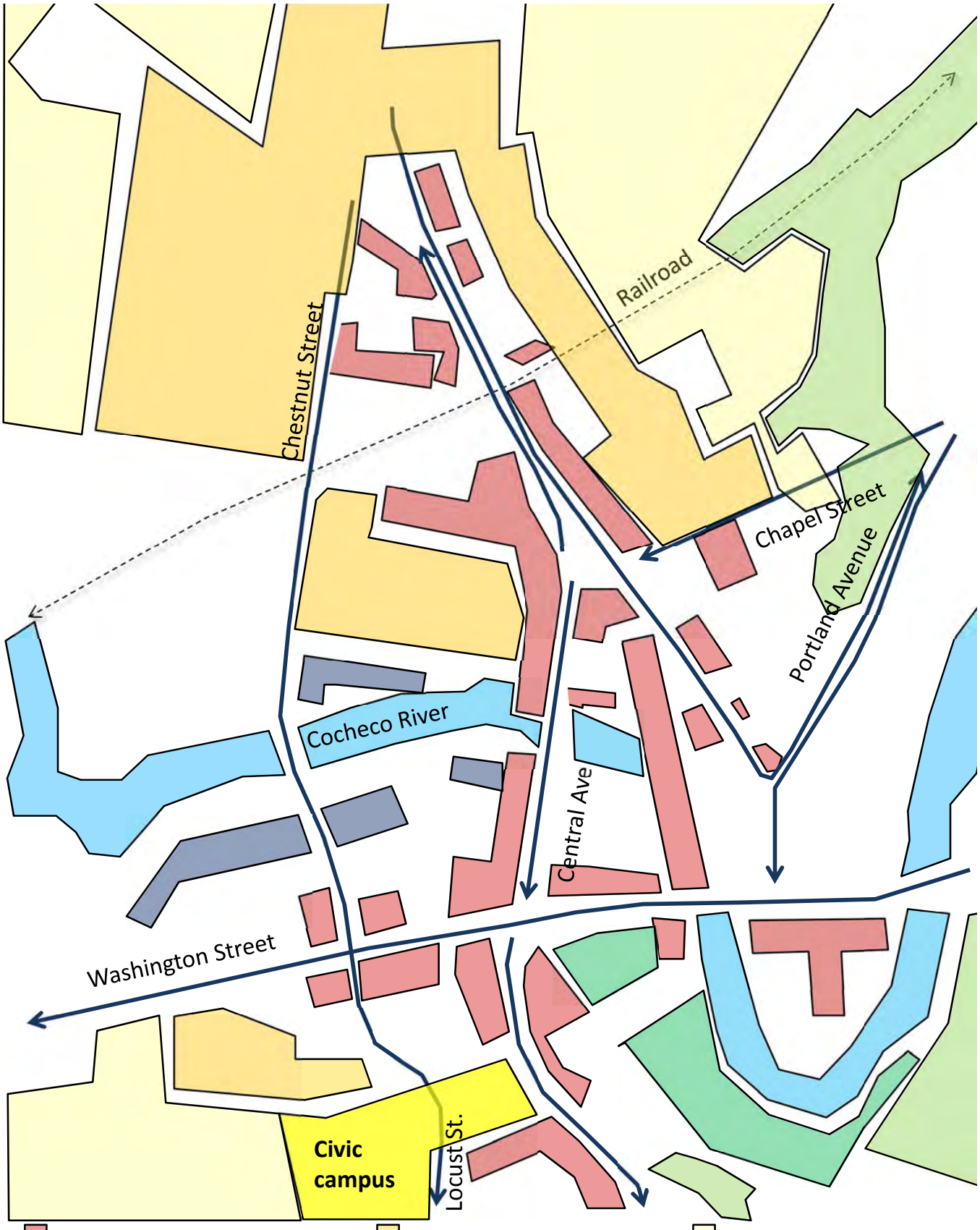


Figure 21. Urban Design: Destinations and Gaps

the historic library become important markers within the downtown fabric. The identity of the rail station and its location within the downtown represents another type of destination. There are other destinations which become reference points for the civic life of the community – the Children's Museum, the Chamber of Commerce, and the historic theater, to name a few.

In contrast, the fabric of the downtown is interrupted by gaps where the automobile has replaced buildings or open space as the dominant physical element. Surface parking lots that line sidewalks and streets provide convenient locations for motorists, but significantly inhibit the pedestrian environment because of their visual qualities. The disadvantage of gaps is that they place barriers to comfortable pedestrian environments.

B. TOPOGRAPHY

The previous discussions have noted the relationship between the urban design of the downtown and the topography (see **"Figure 22. Topography"**) in which it is placed. Several additional observations apply to the streetscape and circulation design:

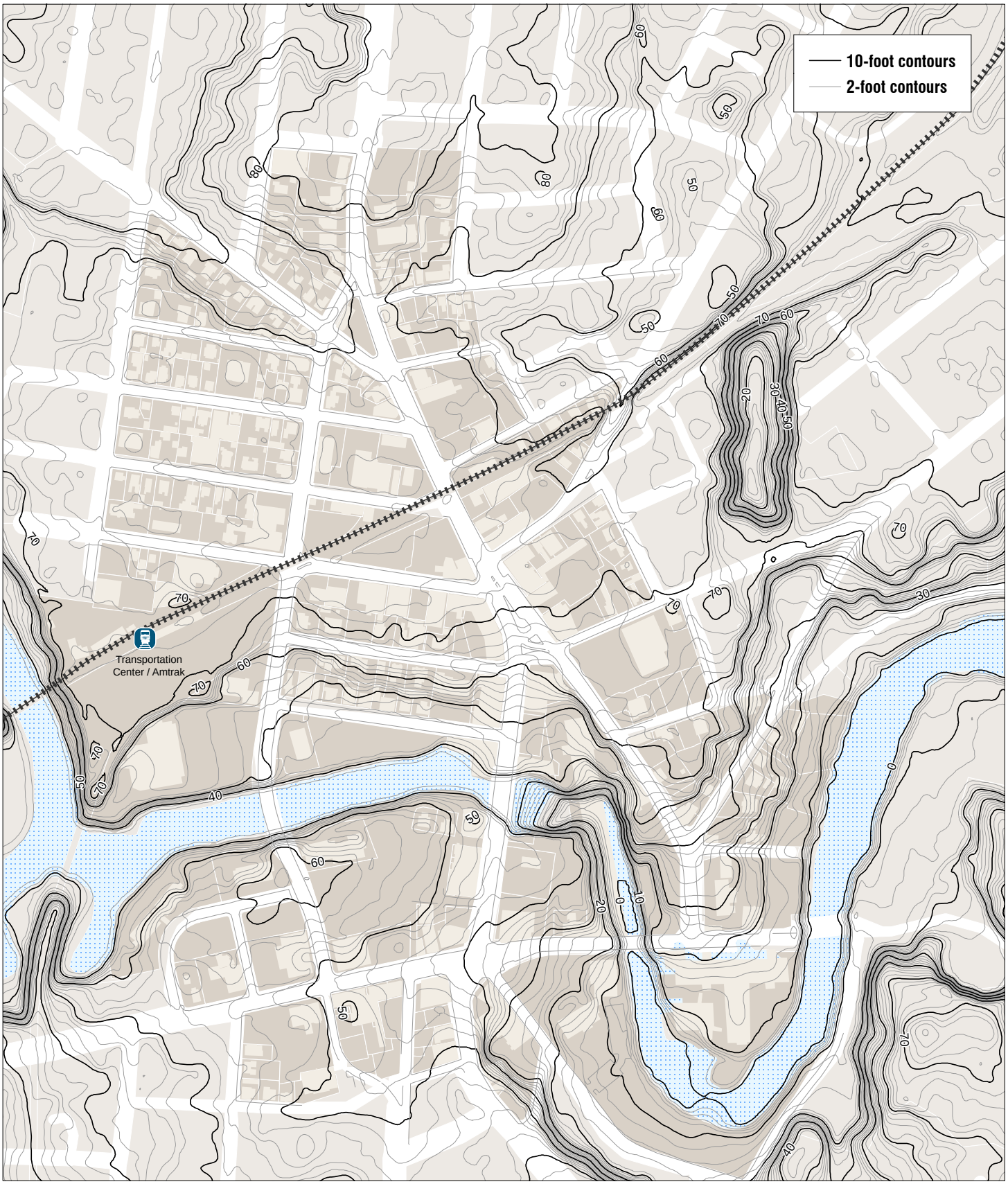
- PEDESTRIAN PATTERNS – Pedestrian patterns in retail areas are somewhat influenced by grade. Pedestrians will seek paths which are relatively flat and can be somewhat resistant to walking up hills. This simple fact needs to be taken into account in planning sidewalks and crossing in retail areas.
- CRESTS – When the slope changes between relatively flat and steep sections, crests are crated. For motorists, these crests block views to the subsequent segments of street or roadway. So, for example, segments of Main, Central and Chestnut pass over topographic crests and visibility of pedestrians and crosswalks can be diminished in these locations. Cresting slopes also lead to potential glare issues with streetlights. Motorists approaching a crest may look directly at the luminaries of streetlight beyond, creating a safety and visibility issue under certain conditions.

C. BLOCK AND PARCEL CONFIGURATION

The current configuration of blocks and parcels will continue to affect the pattern of development in the Dover Downtown. Geographic conditions, including the Cochecho River and the topography, and historical development patterns, including the diagonal orientation of Main Street and Central Avenue affected the division of land into blocks and the subdivision of blocks into parcels. Dover's history of fire and flood also had an effect on building patterns.

From Grove Street to Central Avenue, most blocks are uniform in shape and size, with the exception of those blocks affected by the junction of Sixth Street and Central Avenue. The blocks closest to the Cochecho are broken by the path of the river; the Third Street, Second Street and First Street blocks be-

Figure 22. Topography



tween Grove Street and Chestnut have been absorbed into the Transportation Center superblock. (See **"Figure 23. Block Size"**.) To the east of Central Avenue, while the block sizes are relatively similar, the block shapes are less regular due to the pattern of diagonal streets connected by smaller side streets. This section includes the Cochecho Mills superblock bounded by Central Avenue, Washington Street, and Main Street which is bisected by the Cochecho River and Mill.

South of the Cochecho River, the blocks sizes and shapes are irregular, bounded by the river and a series of streets that break the grid-like pattern to the north. Two superblocks exist, the Orchard Street block which is bisected by an internal street, and the Henry Law Park, containing the Children's Museum of New Hampshire.

The block configurations are reflected by the configuration of parcels within each block – blocks with a rectangular configuration tend to be subdivided into rectangular parcels; irregular blocks tend to be subdivided into irregular parcels. This is not always true – for example, the railway line bisects a few regular blocks, creating an irregular arrangement of parcels within them. Other blocks, for example, the Cochecho Mills superblock or the Orchard Street superblock, have an arrangement of fairly regular parcels along the main road (Central Avenue) with the remainder of the block subdivided into larger, more irregular parcels. South of Washington Street, the arrangement of parcels within the blocks is almost random.

The expectation would be for parcels with more regular shapes to be more easily developable. And, in general, this is true. Rectangular lots tend to have buildings with frontages on the principal street with parking behind the principal building. Subdistricts 1, 2, 3, 6, and the northern part of 4 are examples of this pattern. Subdistricts 7, 10, 11 and the southern part of 4 are examples of a second pattern. (See **"Figure 24. Parcel Size"**.) In this pattern, the street wall has been broken by parking. (A street wall is a continuous line of buildings with their principal entrances facing the street.) For example, Main Street between School Street and Chapel Street is a combination of parking lots and park, with both buildings set well back from the street. In contrast, Main Street between Chapel Street and Broadway has a street wall that is broken only once by an access driveway.

The implications of irregular parcel shapes are as follows:

- Developers have more difficulties placing buildings and associated parking on a site with an irregular shape. Parking may be in front of or adjacent to the principal building, and may be next to the street.
- Because on-site parking is necessary to support certain uses, developers may add additional parking on adjacent parcels so that parking is next to the street rather than behind the building.

Figure 23. Block Size

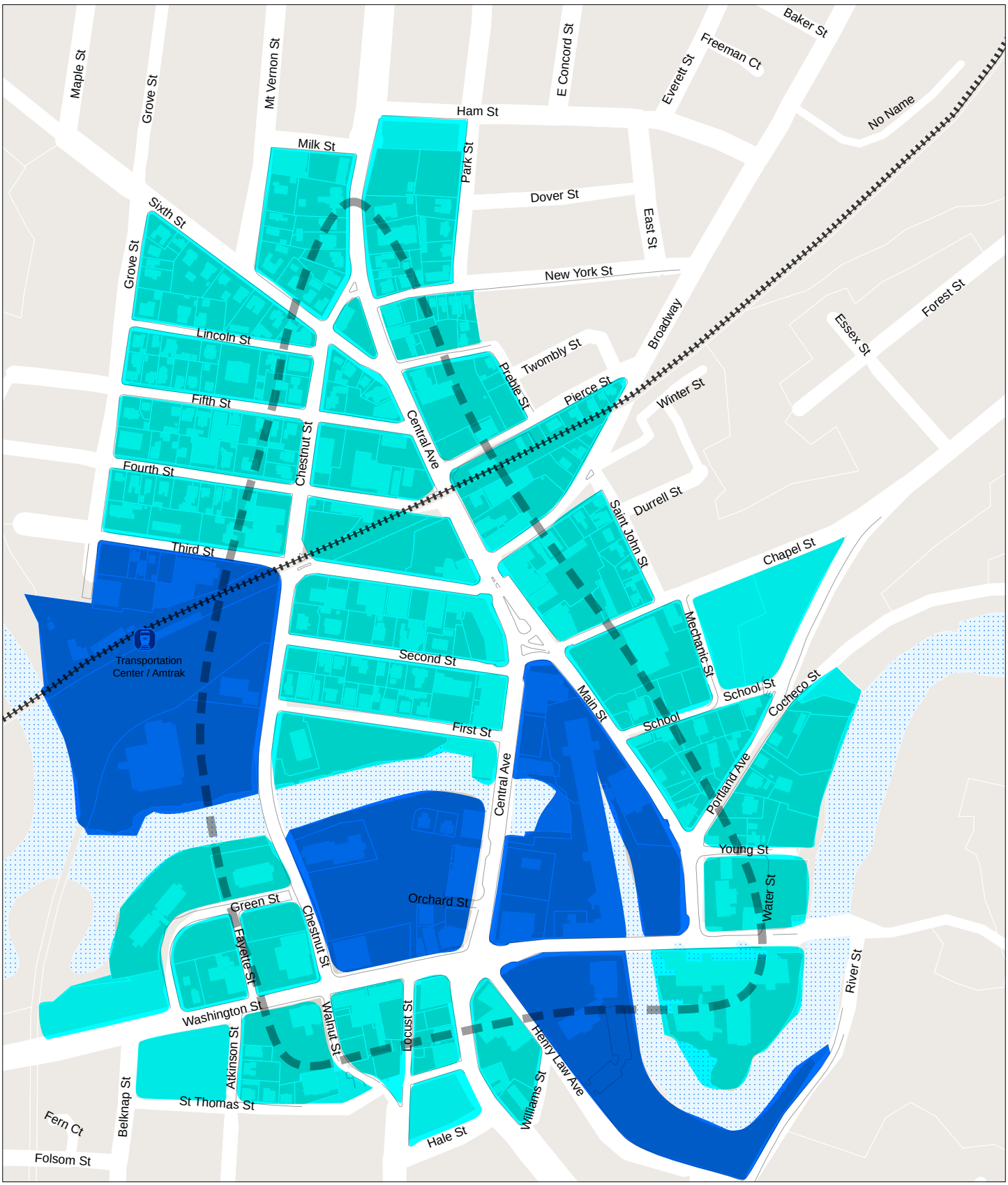
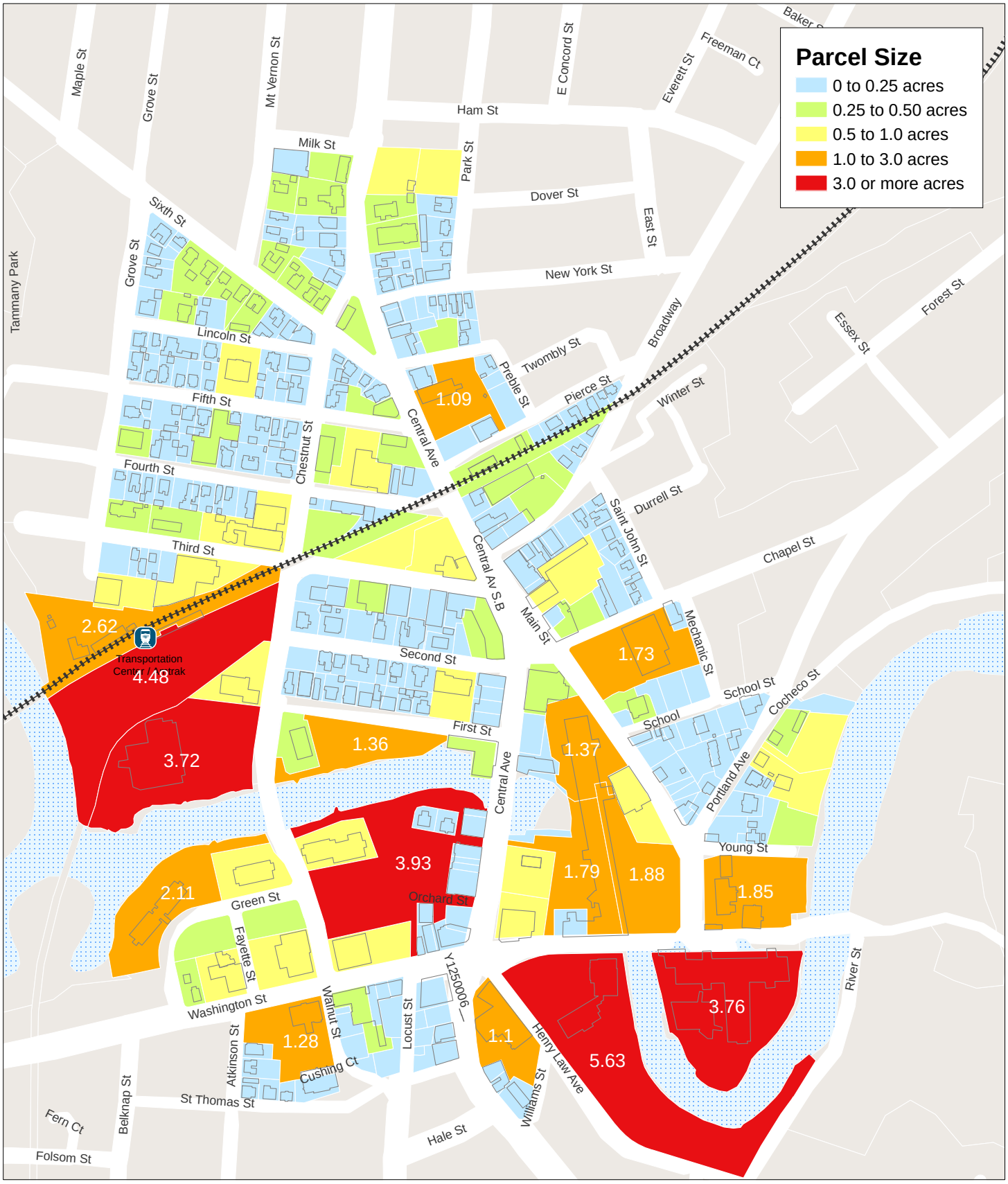
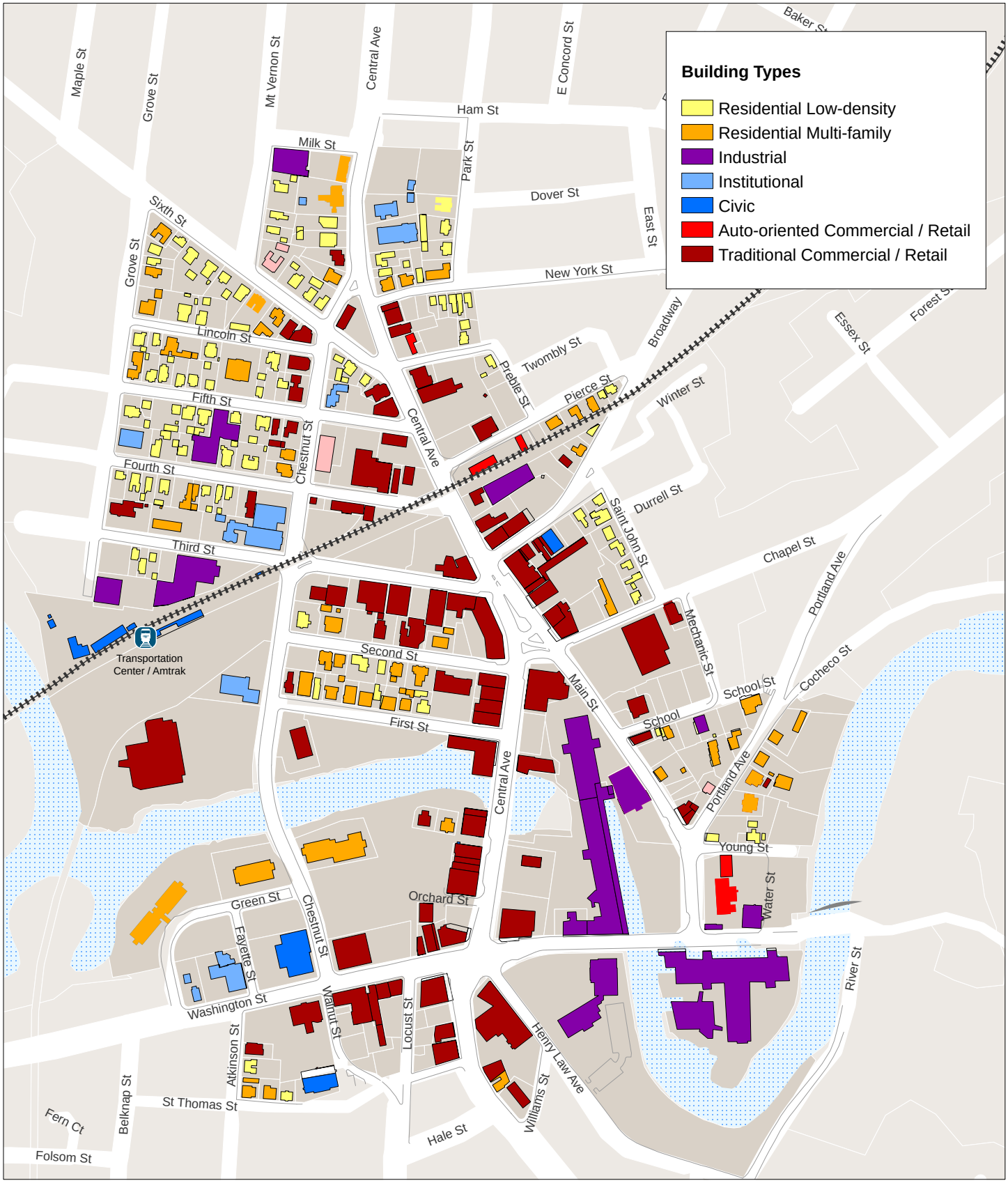


Figure 24. Parcel Size



Note: Parcels over 1.0 acres in size are labeled with their acreage.

Figure 25. Existing Building Typologies



Note: Building Type data is based on April 2013 City of Dover assessor data on existing land use, augmented by visual inspection and site visits. Buildings are colored according to the original intended building type, rather than current use. For example, an old industrial building now used as housing is shown as industrial.

- Off-site parking along a main street breaks the street wall and, if improperly screened, creates unattractive walking conditions for pedestrians.

The block and parcel configurations have created two distinct building patterns – densely packed smaller buildings (as found in Subdistricts 1, 2, and 14 and parts of 3, 4, 6, 7, 9, 11 and 13) and larger, free-standing buildings with off-site parking lots (Subdistricts 5, 8, 10, 12, 15 and 16 and parts of 3, 4, 6, 7, 9, 11 and 13).

The implications of these building patterns are as follows:

- Blocks that are more densely built up are likely to require greater use of on-street parking as less land is available for off-site parking and are therefore **less likely** to experience significant change in use or increases in square footage the near team.
- Blocks with unbuilt land are more able to support uses that require significant off-street parking and are therefore **more likely** to change uses or add square footage in the short term.

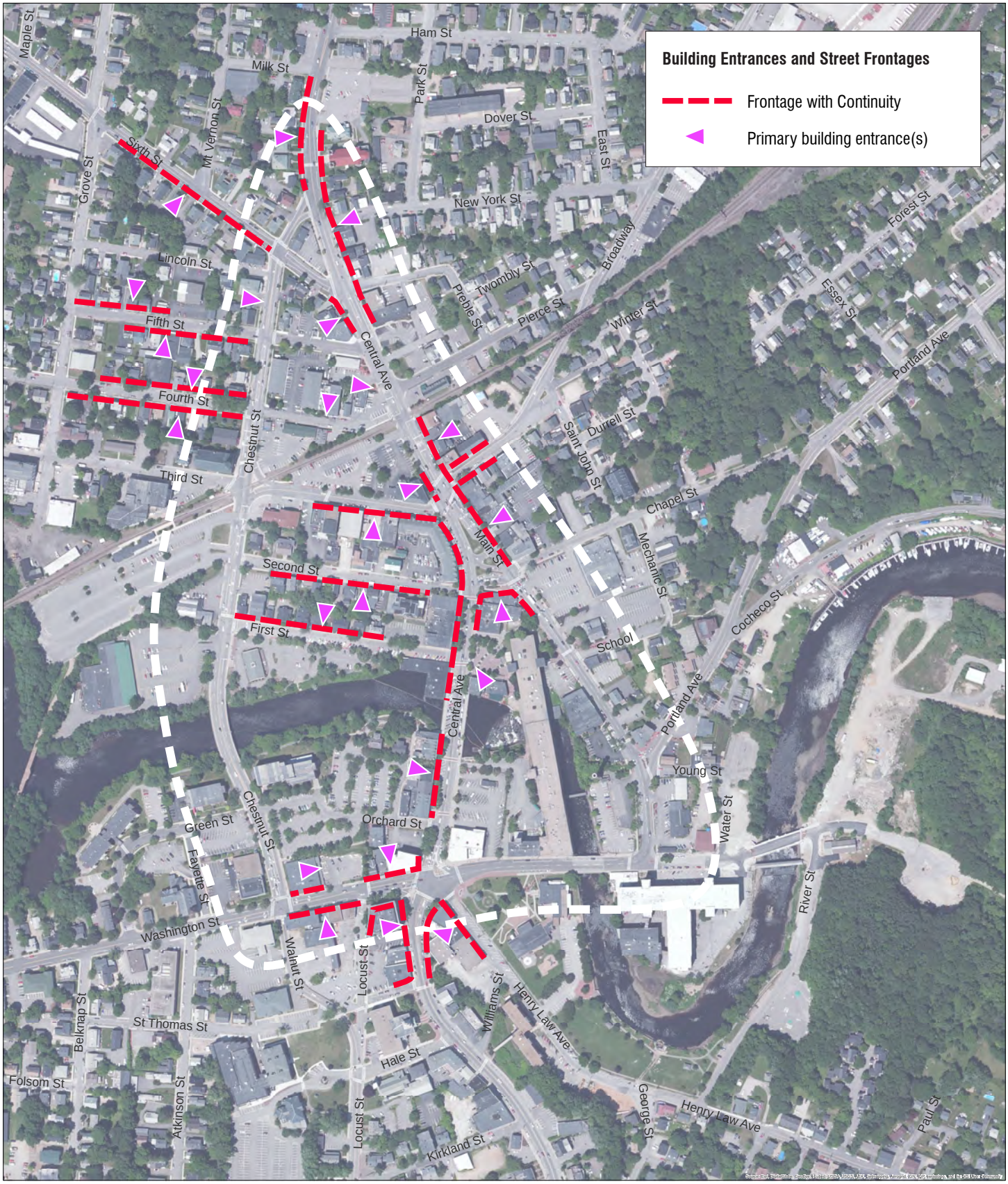
D. BUILDING TYPOLOGY

Building typology is the study the forms and configurations of typical buildings that compose an area. Building typology is of principal interest in the context of streetscape and circulation relative to the orientation of buildings and their entrances relative to the streets and open spaces in the center. **"Figure 25. Existing Building Typologies"** indicates some of the principal building types that are present in the downtown today. The distribution of these building types corresponds directly with the characterization of the downtown's urban design described previously. Building types are different from the actual uses within the building. So, for example, an industrial building may be retro-fitted to serve as housing, but it remains an industrial-type building. Or, a former single family home may be retrofitted to serve as a real estate office. Nevertheless, it has the form of a single family home.

The evaluation of the building types in the downtown leads to the following relevant observations:

- TRADITIONAL COMMERCIAL BUILDING TYPES – A substantial portion of the downtown streets are lined with traditional commercial buildings. That depend upon direct access and create an orientation both towards the side and streets and along their edges. This tends to be compatible with pedestrian circulation patterns along the adjacent sidewalks.
- CIVIC BUILDING TYPES – These buildings tend to be derived from classical styles, and benefit from formal open spaces or plazas that serve as transitions between their principal façades and the streets and sidewalks near them.
- LOW-DENSITY RESIDENTIAL TYPES – In New England environments, low-density residential buildings are typically associated with informal

Figure 26. Principal Building Entrances and Frontage Orientation



planning landscapes and trees which fill appropriate and available space. The relationship between street tree planting and mature tree plantings near residential buildings is a factor in design.

- INDUSTRIAL BUILDING TYPES – The industrial types are well-represented in downtown Dover by the historic mills as well as other structures. The orientation, scale and site location of such buildings types are typically the result of pragmatic requirements associated with their original use. As a result, their relationship to surrounding streets, sidewalks, and open spaces is often unclear and less resolved than other building types.
- OTHER BUILDING TYPES – There is a scattering of other building types in the downtown which represent secondary patterns that are less dominant as a whole, but may be considered on an individual basis regarding the apparent orientation of front back, and side and their relationships to surround street, sidewalks and open space.

E. BUILDING FRONTAGES

Building frontages are derived from the building types, and the specific architecture of the buildings as they have been sited. From a streetscape design perspective, it is important to provide direct access to the principal building façades and the frontages that they present within the downtown fabric. **"Figure 26. Principal Building Entrances and Frontage Orientation"** indicates the frequency and pattern of building frontages.

F. ACTIVITY AND DEVELOPMENT NODES

The Dover Downtown has a number of "activity generators" or sites of interest that draw people to them. These activity generators will affect traffic patterns for both vehicles and pedestrians.

Downtown Activity Generators

Activity generators include civic buildings, parks, transportation options, areas of dense residential or retail development and parking lots. These generators are clustered in different places throughout the Study Area. Civic buildings are located in Subdistrict 8 (the United State Post Office), Subdistrict 13 (the Dover District Court), south of Subdistrict 13 (the Dover Public Library) and south of Subdistrict 14 (Dover City Hall). The proposed police station/parking garage in Subdistrict 9 will add to the cluster of civic uses south of the Cochecho. (See **"Figure 27. Activity Generators"**.)

Parks are scattered throughout the southern half of the Study Area. Henry Law Park is the largest. It is in Subdistrict 15 and contains both the Children's Museum of New Hampshire and the Dover Indoor Swimming Pool – a major draw for families. Fish Ladder Park and Cochecho Mill Park in Subdistrict

Figure 27. Activity Generators

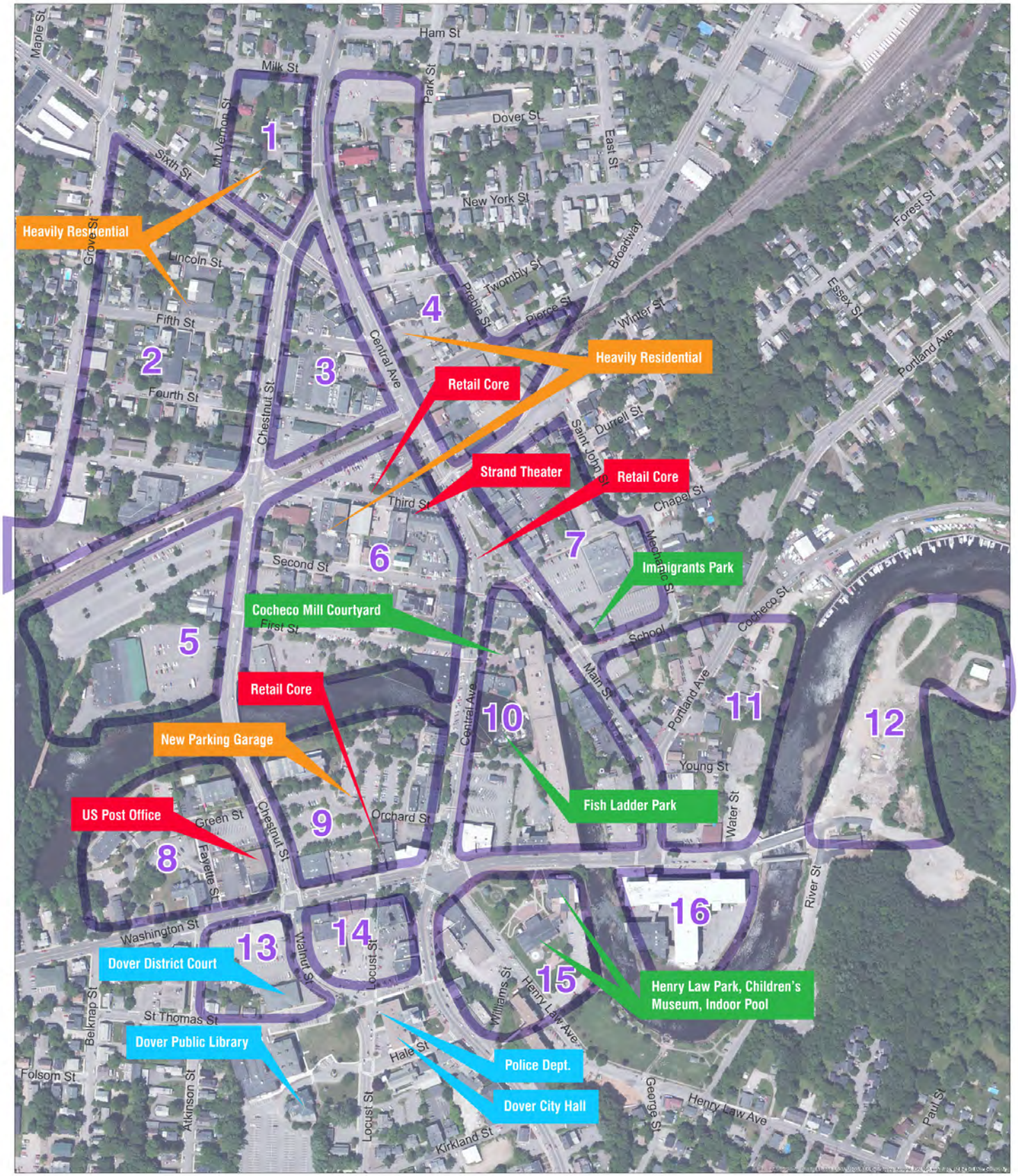
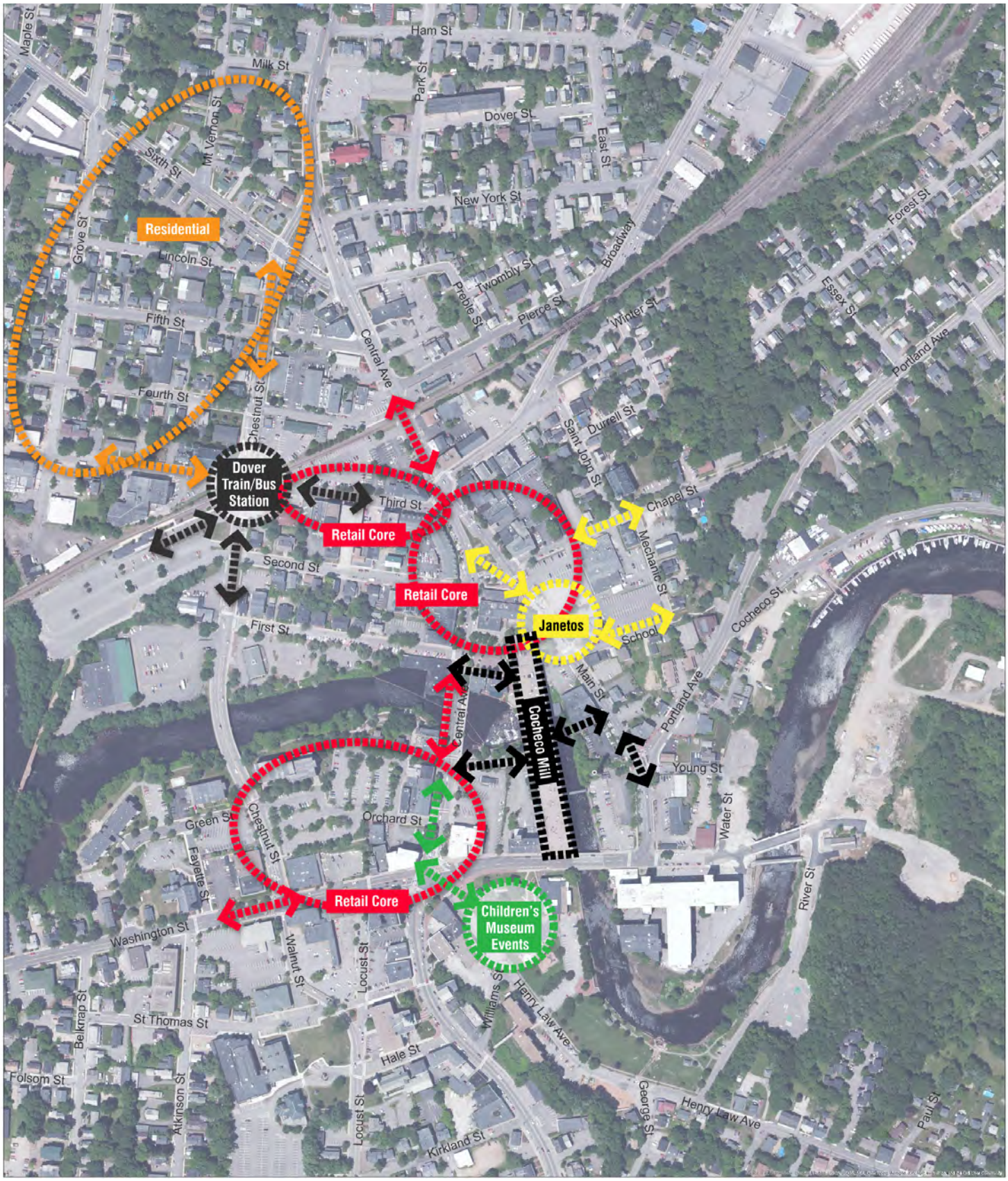


Figure 28. Pedestrian Circulation Patterns



10 and Immigrants Park in Subdistrict 7 are small parks, clustered relatively close to each other.

Transportation options include the Amtrak Rail Station in Subdistrict 5. This station also acts as a center for multiple bus lines – routes 1, 2, 3, 33, and 101 have stops here. Routes 2, 3, and 33 service the Dover Downtown.

Areas of dense residential development are the starting place for many trips. Subdistricts 1 and 2 and parts of Subdistricts 4 and 6 are heavily residential. Subdistricts 3, 7, 9, 10, 11, 13, 14 and the remainder of Subdistricts 4 and 6 are mostly commercial – with a mix of office, retail and some residential. According to *Initial Field Analysis and Proposed Economic Approach* by the Gibbs Planning Group, Inc. (see **Appendix C**) the main retail core includes Third Street, Upper Main Street and Washington Street. Subdistrict 3 also includes the Strand cinema.

The parking lots scattered throughout the Downtown, including the lots on Third Street, School Street, and the proposed parking garage on Orchard Street, are draws for people parking their cars and continuing the remainder of their journey on foot.

Downtown Activity Patterns

These Activity Generators create patterns of travel among them. Residents in Subdistricts 1 and 2 walking to the retail areas will have to cross the train tracks to get to the retail core. Primary streets for pedestrians include Third Street and Chestnut Street – connecting the residential neighborhoods and the Dover Amtrak Station to the retail core – and the triangle of Central Avenue, Washington Street and Main Street. (See **"Figure 28. Pedestrian Circulation Patterns"**.) The safety of these patterns of pedestrian travel are affected by the location and length of pedestrian crosswalks, was shown in **"Figure 12. Street Crossing Conditions"**.

Residents wishing to drive to these activity generators, for example, from Subdistrict 1 to the Henry Law Park, must plan for a return trip that takes into account the one-way pattern of travel on Central Avenue on outgoing trip and on Main Street on the return. Residents will be used to this; out of town visitors drawn to the Children's Museum of New Hampshire or the retail core may be confused by the current travel pattern.

The implications for these patterns of travel are as follows:

- Encouraging people to walk to these activity generators would reduce the number of vehicles in the area. People are more likely to walk in areas that feel safe.
- Conflict between pedestrians and vehicles exists at those intersections where primary pedestrian travel routes meet primary vehicular travel routes. These

intersections include the intersection of Chestnut Street and Third Street, the intersection of Central Avenue and Main Street, and the intersection of Central Avenue and Washington Street.

4.3 Analysis of Future Development

The section provides the scenario used to ask the question, "What are the constraints on future development?" In this vehicular access and streetscape study, the effects of future development on parking and traffic are examined.

Future development within the Downtown depends on demand for additional residential, retail and commercial space. Demand is driven by demographics and by which goods and services people expect to find within a certain radius of where they live and work.

Appendix C contains a report by Gibbs Planning Group, Inc., (*Initial Field Analysis and Proposed Economic Approach*) which provide a detailed analysis of the retail environment and likely increase in retail demand between 2013 and 2018. This report also provides demographic data for the increase in the number of households over the same period of time. Both sets of data have been used in the analysis of future development scenarios discussed below. A conversation with Christopher Parker, Planning Director of Dover, is another source of information about future development scenarios.

A. FUTURE DEVELOPMENT SCENARIO

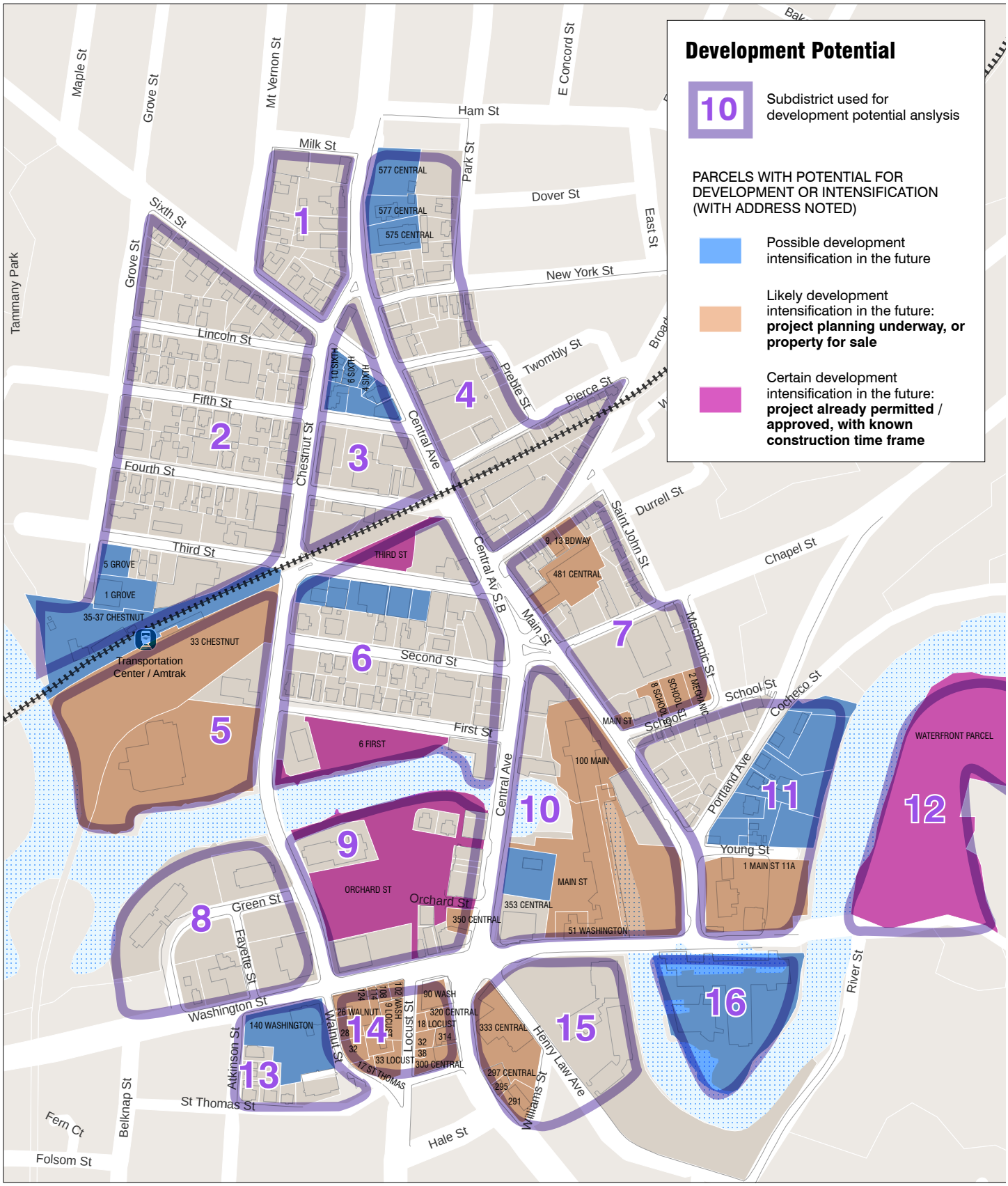
The future development scenario in this section is shown in **"Figure 29. Areas of Development Potential"** and in **"Table 6. Growth Analysis (Probable Development)"**. The project team calculated a High Demand Scenario for future additional residential dwelling units and for future additional commercial and retail square footage. The project team then calculated additional parking spaces needed at a rate of 1.25 spaces per residential dwelling unit and three spaces per thousand square feet of commercial and residential development ("**Table 7. Future Additional Parking Demand Analysis").** Finally, the project team used these projections to examine the implications of future development on parking and traffic circulation.

The High Demand scenario is based on the market and demographic assumptions and the exiting utilization of parking, as detailed below.

Market and Demographic Assumptions

The *Initial Field Analysis and Proposed Economic Approach* (**Appendix C**) projects an existing demand about 64,000 square feet for retail and restaurant and looks at the sales that would be generated by that amount of square footage

Figure 29. Areas of Development Potential



Note: Subdistricts were defined to assess development potential and parking utilization, and reflect areas that are self-contained in terms of walkability to parking. Development type and timing based on conversation with Director of Planning, City of Dover, February 2014.

now and in 2018. The report notes that this is not all new square footage – some new retail/restaurant could be absorbed within existing buildings.

This report also notes that the number of households in Dover is expected to increase at an annual rate of 0.42% between 2013 and 2018. This increase in households will drive demand for residential units – again, this demand could be absorbed in part by existing residential stock.

Table 6. Growth Analysis (Probable Development)

Subdistrict	Current Occupancy *		Additional Growth (High ** Demand Scenario)		Total	
	Residential	Commercial and Retail	Residential	Commercial and Retail	Residential	Commercial and Retail
	Households	Square Feet	Households	Square Feet	Households	Square Feet
1	35	27,766	6	-	41	27,766
2	158	129,485	29	4,273	187	133,758
3	29	63,308	5	4,273	34	67,581
4	94	113,189	17	7,122	111	120,311
5	4	39,155	1	4,273	5	43,428
6 ***	37	63,852	63	32,050	100	95,902
7	32	28,848	6	7,122	38	35,970
8	117	138,438	21	-	138	138,438
9	98	137,369	18	32,050	116	169,419
10 ****	28	49,532	65	7,122	33	56,654
11	28	20,982	5	7,122	33	28,104
12 *****	-	-	200	7,122	-	7,122
13	17	25,278	3	4,273	20	29,552
14	5	75,611	1	7,122	6	82,733
15	3	22,712	1	4,273	4	26,986
16	1	271,072	0	-	1	271,072
Total	686	1,206,597	441	128,200	867	1,334,797

*Current occupancy levels based on existing residential units and commercial square footage times modified parking utilization rate
**Residential and commercial at double Gibbs except for Subdistrict 6
***Subdistrict 6 at 63 units; commercial includes 12,000 office per Parker
****Subdistrict 10 includes 60 units based on partial conversion of mill to residential
*****Subdistrict 12 includes 200 new residential units from expected development

Table 7. Future Additional Parking Demand Analysis

Subdistrict	Parking Multipliers		Future Additional Parking Demand		Total Additional Demand
	Residential	Commercial and Retail **	Residential	Commercial and Retail	
1	1.25	0.003	22	-	22
2	1.25	0.003	121	13	134
3	1.25	0.003	15	13	28
4	1.25	0.003	55	21	76
5	1.25	0.003	1	13	14
6	1.25	0.003	90	96	186
7	1.25	0.003	32	21	53
8	1.25	0.003	26	-	26
9	1.25	0.003	23	96	119
10	1.25	0.003	6	21	27
11	1.25	0.003	19	22	41
12	1.25	0.003	-	22	22
13	1.25	0.003	11	13	24
14	1.25	0.003	2	22	24
15	1.25	0.003	-	12	12
16	1.25	0.003	-	-	-
Total			423	385	808

*1.25 spaces per dwelling unit; calculation of additional 5% of spaces for visitors not included
** 3 spaces per thousand

No information is available specific to future demand for commercial space in Dover, however, the New Hampshire Employment Security website has data about expected occupational increases by county from 2010-2020.[1] For Strafford County, business and financial operations are expected to increase by 8.8%, computer specialists by 14.9%, legal occupations by 7.7%, and office and administrative support occupations by 4.9%. These professions were chosen to illustrative the possible demand for office space in the Dover area. The *Initial Field Analysis and Proposed Economic Approach* notes that Dover is close to regional highways and more than ten miles away from both Rochester and Portsmouth – making it an easy-to-access center for retail. It seems reasonable to suggest that Dover's central location for retail also makes it an attractive location for office space.

B. EXISTING UTILIZATION

However, the currently available retail, commercial and residential space is not fully occupied. Although specific vacancy rates for the Downtown were

1 *Occupational Projections by County, 2010-2020*, New Hampshire Employment Security, June 2013, accessed March 7, 2014.

not available, the CBRE New England *New Hampshire Market Outlook 2013*[2] provides a vacancy rate of 15.6% for office space in Dover. This is slightly higher than the average of 14.2% for the total I-93/Route 3 corridor. For industrial space, Dover's vacancy rate of 13.8% is higher than the average vacancy rate of 12.1% for the I-93/Route 3 corridor. (Note that in both cases, Dover's average asking rent is also lower than that of the total I-93/ Route 3 corridor at $9/sf vs. $11.05/sf for office and $3.75/sf vs $6.13/sf for industrial.)

This data suggests two possible conclusions, as follows:

- Future retail or commercial development may occur in existing space rather than be built as new development.
- The lower rates per square foot could be a helpful factor in making Dover an attractive place for new businesses.

The project team reviewed parking utilization rates in the core of the Downtown and found on-street utilization rates of between 11% and 69% and off-street parking utilization rates of between 17% and 78%. These numbers reinforce the picture of a downtown core whose buildings are not at their full capacity.

2 *New Hampshire Market Outlook 2013*, CBRE New England, accessed March 7, 2014.

Table 8. New Trips Generated by Subdistrict

Subdistrict	Residential		Commercial		Total	
	Enter	Exit	Enter	Exit	Enter	Exit
1	2	1	0	0	2	1
2	10	6	9	7	19	13
3	2	1	9	7	11	8
4	6	3	15	11	21	15
5	0	0	9	7	9	7
6	18	9	65	51	83	60
7	2	1	15	11	16	12
8	6	3	0	0	6	3
9	5	3	65	51	70	54
10	18	9	15	11	33	21
11	2	1	15	11	16	12
12	72	40	15	11	86	51
13	1	0	9	7	10	7
14	0	0	15	11	15	12
15	0	0	9	7	9	7
16	0	0	0	0	0	0
Total	144	78	261	205	406	283

C. PROJECTED FUTURE DEVELOPMENT

The goal of the project team was to create a future development scenario to test the current capacity of both the system of on-street and off-street parking and the system of traffic flows. The future development scenario required the following projections:

- Number of future residential units.
- Amount of future square footage for commercial and retail.
- Location of the additional units and square footage.
- Number of parking spaces required for the uses.

Although these projections had to be reasonable, they did not have to be precise. The goal was not to estimate the precise amount of development, but to test the parking and circulation systems based on an assumption of growth over a twenty-year period that took into account current knowledge of future development and reasonable projections based on growth expectations. For such a test, it is better to err on that side of slight overdevelopment rather than underdevelopment in order to place some stress on projections for the parking and circulation systems.

The High Demand scenario depended upon the following assumptions:

- Household growth was estimated at twice the annual rate of 0.42% noted above. The possibility of transit-oriented development – development centered on a rail station – suggested that with the right factors in place, Dover could see additional growth beyond the projections through 2018.
- Retail was estimated at the level suggested above, around 64,000 square feet, and doubled as a proxy for commercial growth.
- Both sets of calculations were modified by information related to current planned developments, including the new police station and parking garage (Subdistrict 9), probable mill and waterfront developments (Subdistricts 10 and 12), and other development planned for the near future (Subdistrict 6).

The number of additional residential units and commercial and retail square footage then generated expected parking demand at 1.25 spaces per dwelling unit (slightly more than traditional transit-oriented development; slightly less than current requirements for two spaces per dwelling unit) and three spaces per thousand square feet of commercial or retail development. The assumption was also made that these would be new required spaces – although there are existing underutilized parking spaces, the point of this exercise is to test the systems.

4.4 Implications for Traffic

Figure 30. Projected Increase in Traffic Volumes, PM Peak Hour (2014 - 2034)

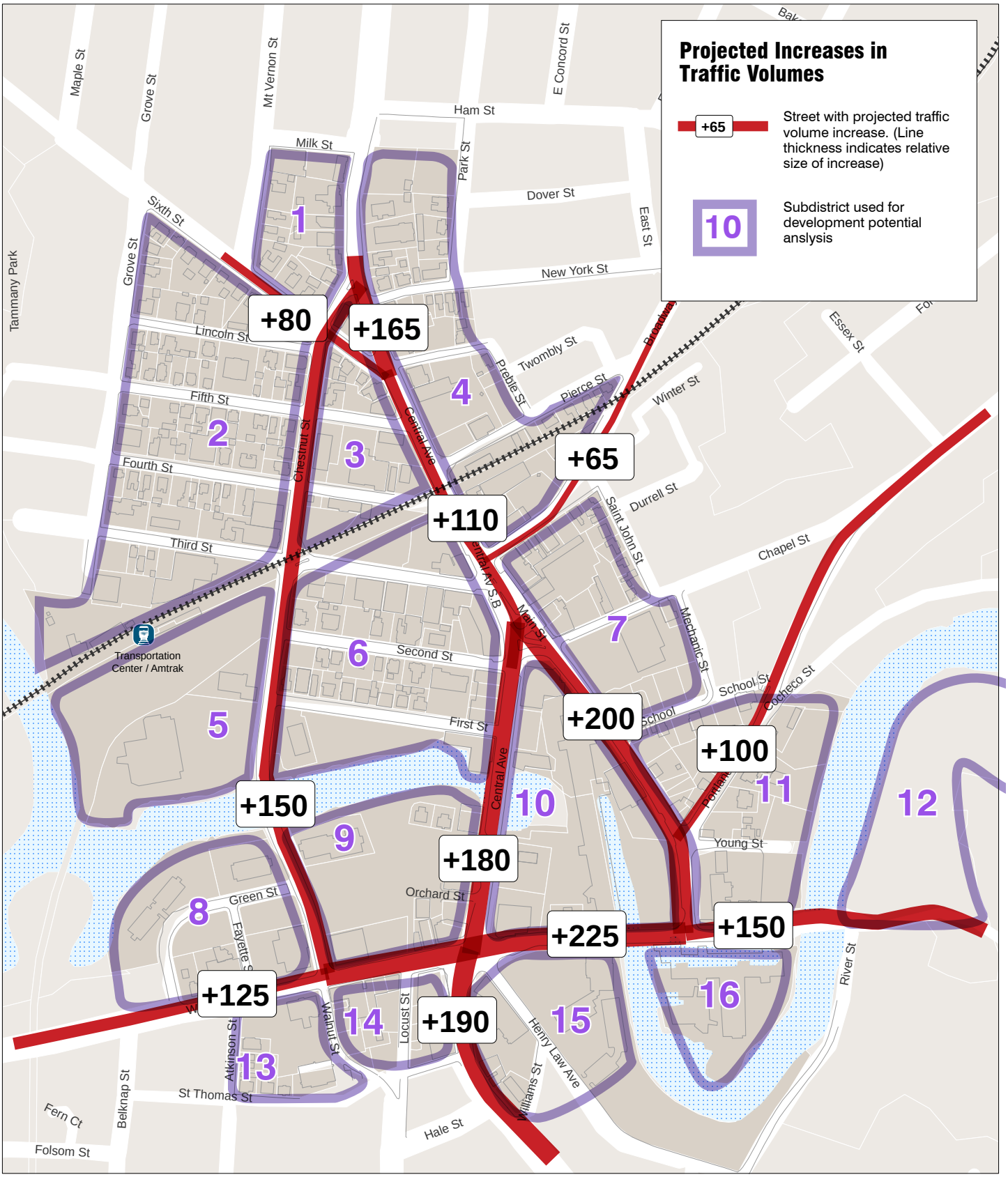
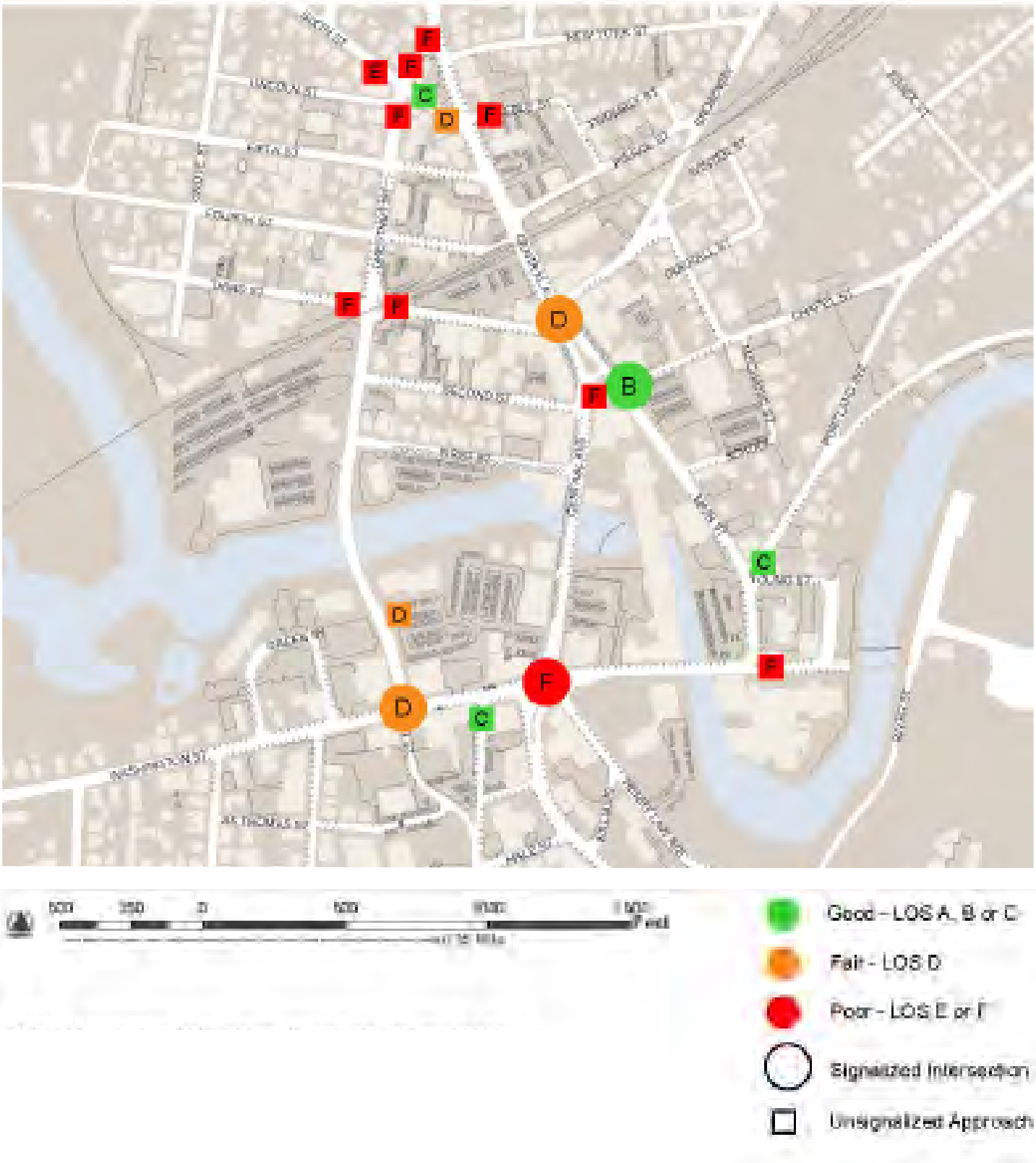


Figure 31. Level of Service, PM Peak, 2034 Projection



PROJECTIONS: TRAFFIC VOLUME AND CAPACITY

Growth projections for 2034 were used to estimate future trip generation in downtown Dover. Trip generation refers to the number of new vehicle trips originating at or destined for a particular development. For this study, trip generation was estimated at the subdistrict level instead of at specific sites because many of the projected developments are in a preliminary planning phase and exact development details are not available.

All rates were obtained from the Institute of Transportation Engineer's Trip Generation Manual. Commercial growth was assumed to be a blend of Specialty Retail Center, High Turnover (Sit-Down) Restaurant, Quality Restaurant, and General Office Building. Residential growth was assumed to a blend of Apartment, Residential Condominium/Townhouse, and Single-Family Detached Housing. Due to the mixed-use and pedestrian friendly nature of downtown Dover, a reduction factor was applied to account for greater non-vehicular trips and internal capture trips. See **"Table 8. New Trips Generated by Subdistrict"**.

Due to stagnant traffic growth trends (see **"Figure 4. Historic Traffic Trends (2005 to 2012)"**) and conservatively high trip generation rates, it was assumed that additional background growth would be negligible between 2014 and 2034.

Trips were distributed onto the downtown road network based on the current proportion of trips entering and exiting the study area. The total net growth in traffic volumes along key sections of roadway is shown in **"Figure 30. Projected Increase in Traffic Volumes, PM Peak Hour (2014 - 2034)"**. Washington Street and Main Street are predicted to have the largest increase in traffic during the PM peak hour. This is largely due to the proposed Cochecho Waterfront Development and the future parking garage and mixed-use developments proposed between Central Avenue and Chestnut Street.

PROJECTIONS: INTERSECTIONS AND OPERATIONS

Traffic operations are expected to worsen by 2034 due to significant increase in traffic on several major downtown roads. The 2014 PM peak hour conditions were shown in **"Figure 7. PM Level of Service, 2014"** and 2034 PM peak hour conditions are shown in **"Figure 31. Level of Service, PM Peak, 2034 Projection"**. The signalized intersection at Lower Square is projected to experience unacceptable traffic operations in 2034, with conditions degrading to LOS F. The unsignalized intersections at two locations—Central Avenue/Second Street and Main Street/Washington—are expected to worsen from acceptable traffic operations (LOS D or better) to unacceptable traffic operations (LOS E or F).

Figure 32. Existing Zoning

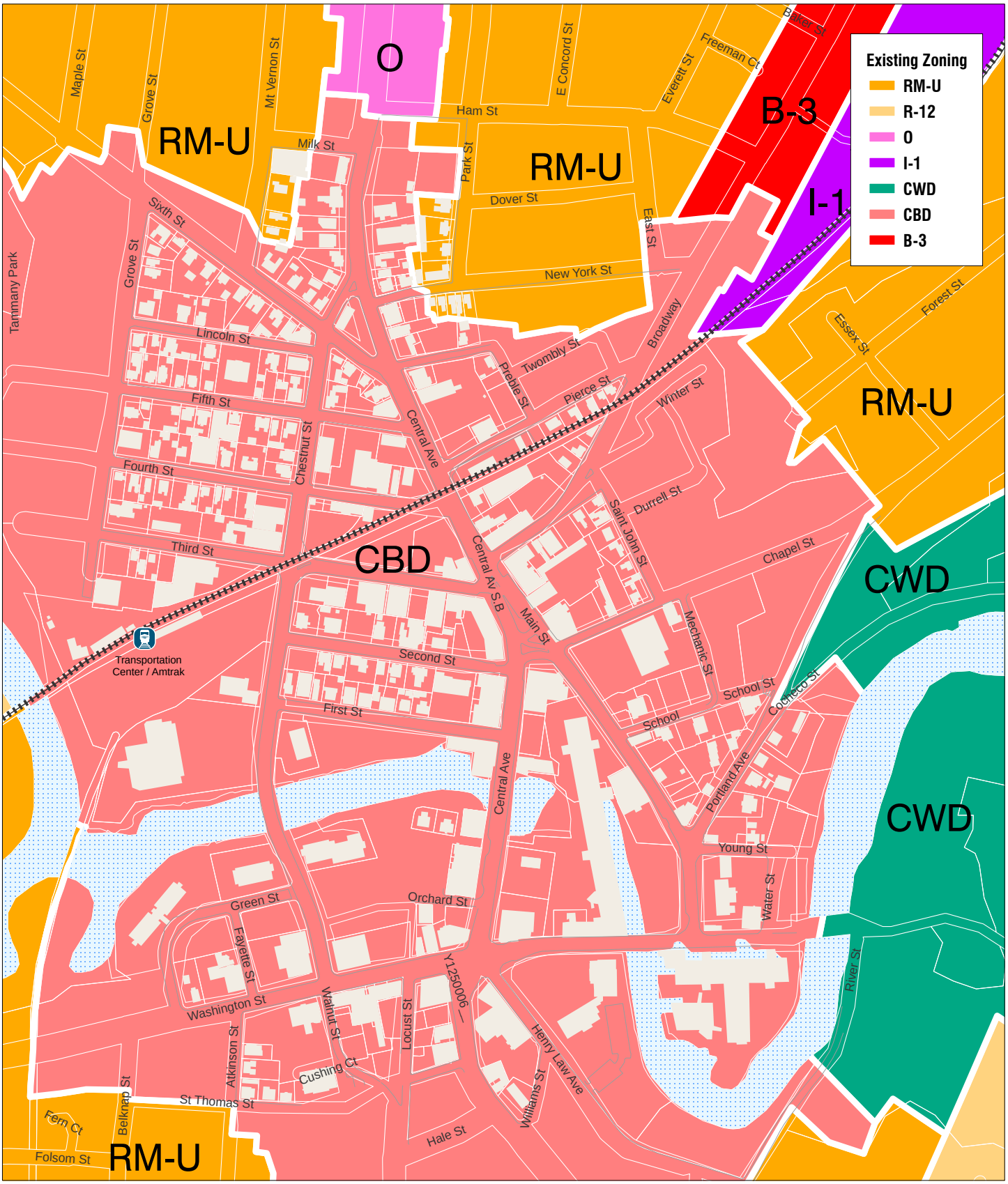
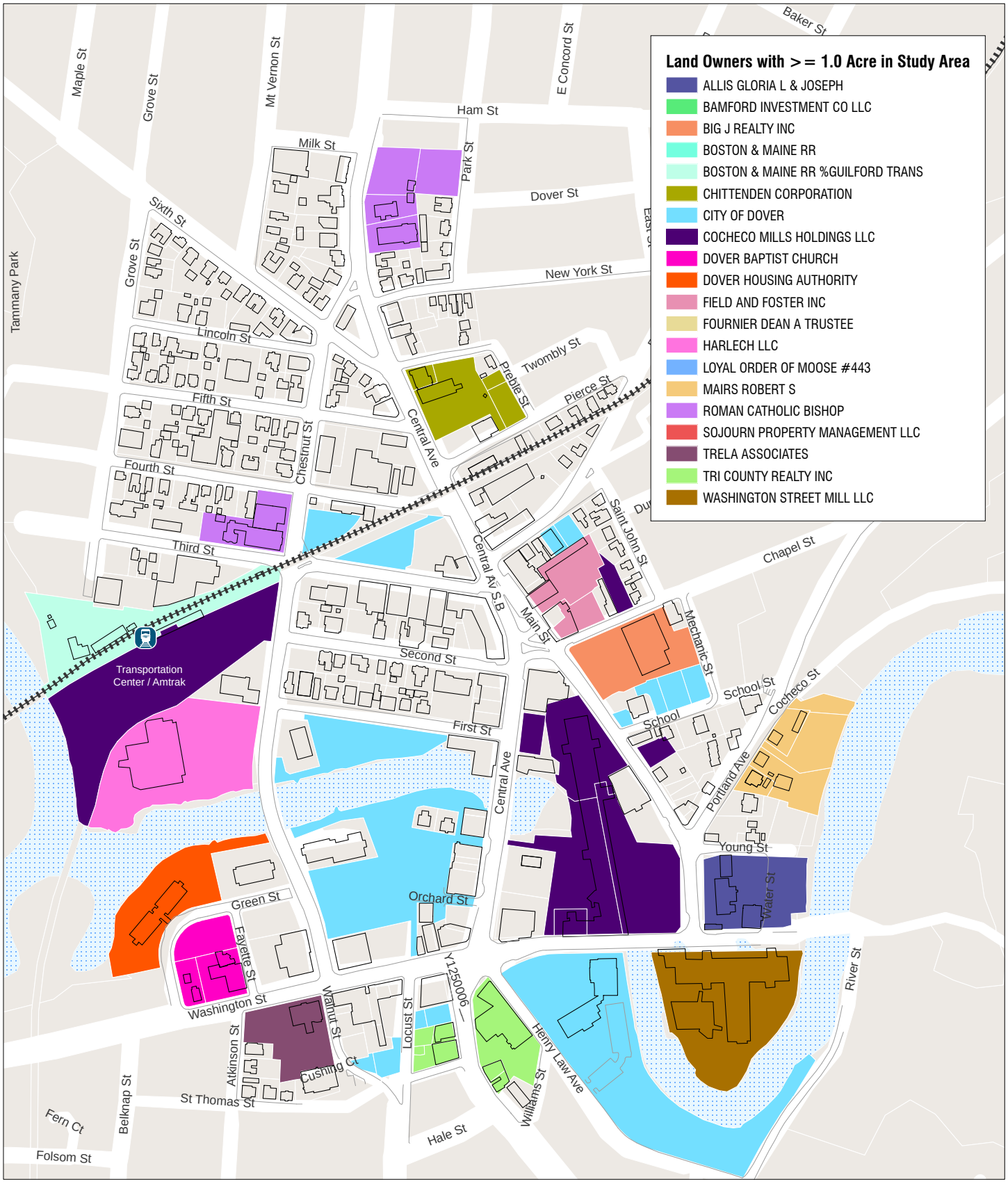


Figure 33. Major Land Owners



Note: Based on 2013 City of Dover assessor data, this map colors the parcels owned by landowners who each own at least 3.0 acres within the study area. Each parcel alone may be smaller than 3.0 acres, but the total of parcels in ownership by one person or entity is 3.0 or more acres.

Undated historic photograph of Upper Square, courtesy of the Dover Public Library.

5 STREETSCAPE

5.1 Accessibility

The downtown poses many accessibility challenges as highlighted in previous sections. While most walkways are generous in width, there is a significant grade change within the core downtown and a number of the pedestrian routes do not meet accessibility standards. Many curb cut ramps have been recently updated, but other ramps and crossings remain that do not meet state code. Additionally, puddles form at various ramp bases. Some crosswalks, such as those in Lower Square, span undesirably long distances, creating a safety hazard for pedestrians. Several sections of sidewalk have been constructed of brick entirely. They are in relatively good condition, but display unevenness and heaving due to tree root growth, which poses a long term accessibility issue as the trees grow larger. Other issues include:

- Walkways are reasonably wide, but the paving material is inconsistent, transitioning from brick to scored concrete in many locations.
- Many crosswalks are not clearly defined and others exceed a standard maximum distance without a pedestrian refuge area.
- Many driveways intersect the sidewalks with no detectable warning strips to warn visually impaired individuals. Some driveway are very narrow located between street buildings, limiting site distance from vehicles exiting and entering these alleys with no warning to pedestrians on the sidewalks.
- Sidewalks on Third Street and Chestnut Street at the corner of Third Street simply disappear.

5.2 Sidewalks and Crosswalks

Streetscape features are shown in **"Figure 37. Streetscape"**.

SIDEWALKS

Paving on sidewalks consists primarily of scored concrete; most are in relatively good condition. Most street tree pits within the sidewalks contain dirt and/or mulch and are bordered by a brick bands. Some brick bands are

Sidewalks with street tree planter pits.

impacted by tree roots. As previously mentioned, there are several locations within the downtown where sidewalks are constructed of all brick:

- The eastern portion of Second Street near Central Avenue.
- The southern portion of Main Street at the Mill entrance and near Portland Avenue.
- Lower Square along the southern sidewalk of Washington Street and Central Avenue along with the brick walkway in front of City Hall just south of Lower Square.

An intersection showing the two most common crosswalk types in downtown Dover.

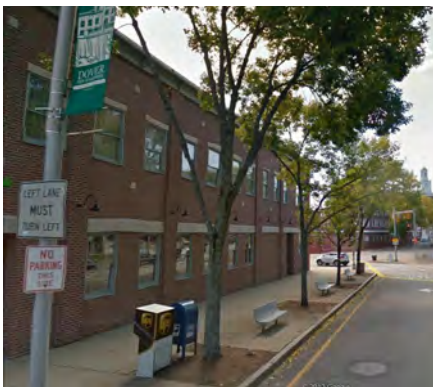
CROSSWALKS

Crosswalks within the downtown are either white paint with angled striping or a colored brick pattern with white stripes on the outside edges. The highest concentration of brick pattern crosswalks is located along Central Avenue in the core downtown area between Upper and Lower Squares. An additional brick patterned crosswalk is located on Chestnut Street at Orchard Street that includes a pedestrian refuge island. Several crosswalks, primarily along Chestnut Street and within Upper and Lower Squares, are aligned in a way that does not comply with state or federal guidelines.

Refer back to **"Figure 12. Street Crossing Conditions"** for the location of existing crosswalks.

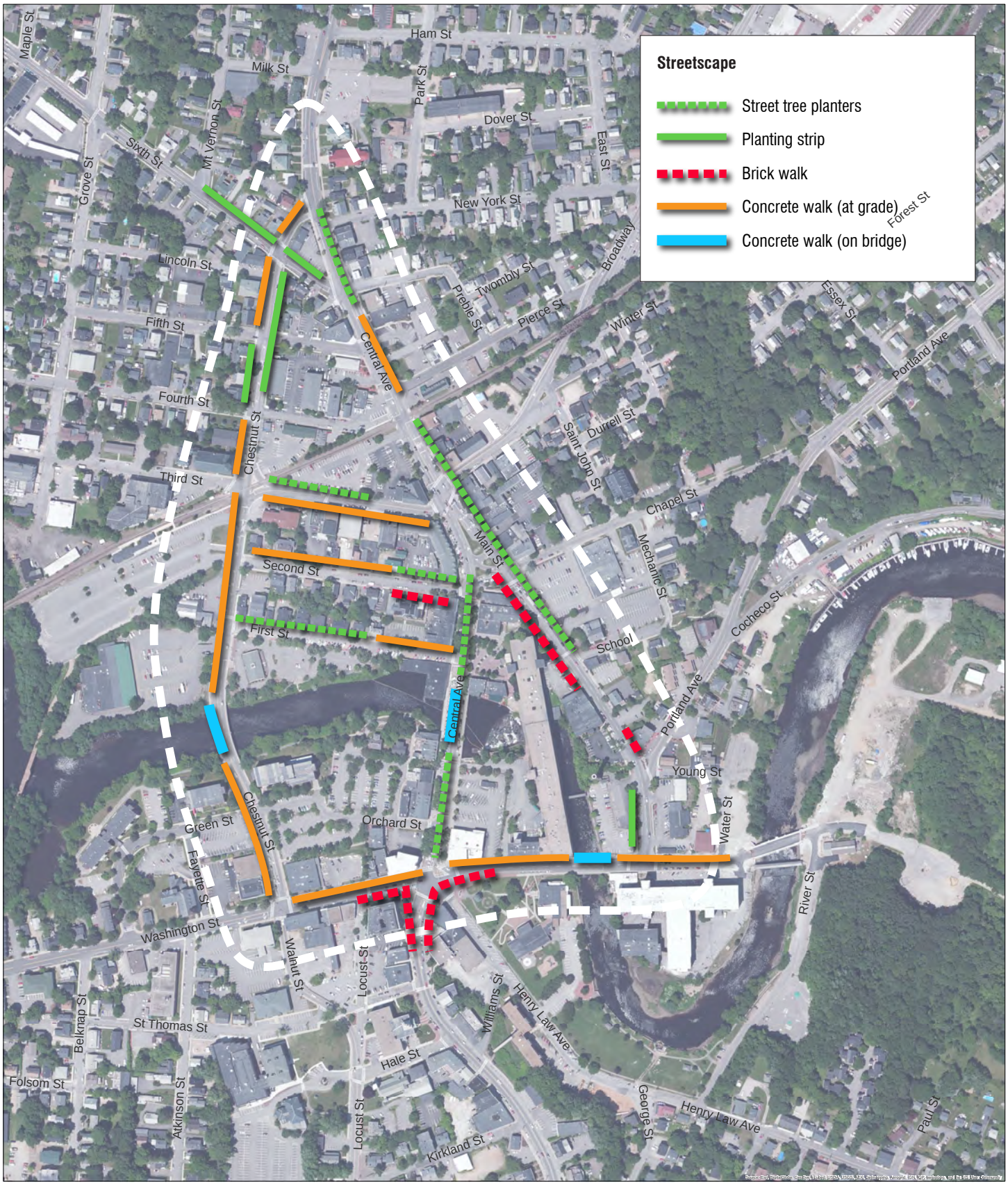
5.3 Street Trees and Buffers

STREET TREES



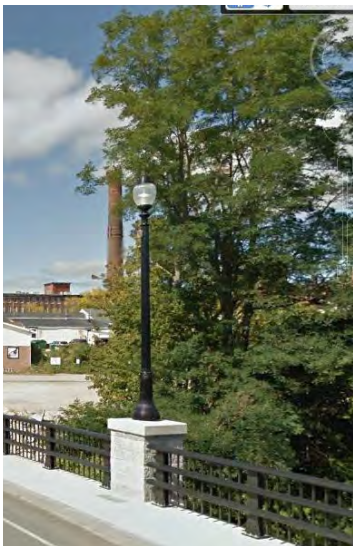
Street trees abound in downtown Dover, but are not planted in a regular, coherent pattern.

Figure 37. Streetscape



A smaller parking lot in downtown that lacks any frontage planting or walls/ fences along the street to buffer and soften the appearance.

Street trees are located throughout downtown Dover, but in an irregular pattern within the overall streetscape. Primary concentrations of streetscape trees can be found along Central Avenue between Upper Square and Lower Square and along Main Street from Washington Street to the railroad tracks. In many locations, utility wires limit street trees to one side of the road. Trees that are planted under the utility wires are impacting the wires and have been pruned. Most street trees appear to be Ash trees, which are susceptible to the Ash borer that can significantly impact these trees, especially ones that are under stress. Trees along First, Second, and Third Streets are limited to specific properties where buildings do not abut immediately against the right-of-way. While some new trees have been planted along Chestnut Street, many gaps without street trees still exist. The newly planted trees appear to be a mixture between Crabapples and Cherry trees planted within a narrow grass strip approximately three to four feet wide. The Crabapples have been primarily planted under the utility wires along the east side of Chestnut Street north of the railroad tracks. A similar irregular pattern of street trees exists along Washington Street.



Examples of different street light fixtures throughout downtown.

BUFFERS

Parking lots abound in downtown Dover, and many of them are immediately adjacent to the public right-of-way. Some are moderately buffered with ornamental trees, Yew hedges, and Mugo Pines, while many other parking lots have narrow perennial or mulch strips with sparse plantings. The north end of downtown along Chestnut Street and Central Avenue is speckled with smaller irregular shaped parking lots with little to no buffer strips.

5.4 Street and Holiday Lighting

Street lighting also has an irregular pattern of fixtures within the downtown. Several different types of lights exist, including a pedestrian-scale ornamental glass fixture, a shoebox-shaped light, and the standard Cobra head fixture. Most fixtures do not comply with Dark Sky or the IESNA guidelines, instead creating an alternating pattern of unpleasant glare and dark spots at night time, contributing to an unsafe atmosphere for vehicles and pedestrians. New ornamental acorn style fixtures have been recently installed along Water Street in front of One Washington Center Mill and on the new bridge; however, these may also conflict with Dark Sky standards.

A pedestrian walkway between buildings is a small but inviting space thanks to attractive brick paving, regularly-spaced trees, and granite plinths.

5.5 Urban Spaces

There are many urban open spaces that complement the downtown area and that are directly linked to the streetscape. Many of the spaces are not clearly identified, accessible, or linked to the streetscape. Refer back to **"Figure 15. Open Space and Natural Features"**.

The Cochecho Mill Courtyard has pedestrian-scale street lamps, trees, grass, and small plantings.

The main open space within the downtown is the Cochecho River and river walk. While visually it is easily recognizable when traveling down Central Avenue, the river walk is not clearly identified or accessible. Recent improvements have been completed on the west side of Central Avenue, but are not clearly signed. Additionally, the east side of Central Avenue at the river has been improved as well. An attractive pedestrian path has been constructed adjacent to the Cochecho Mill parking lot known as Fish Ladder Park, but it is not clearly marked or identified.

An old stone watering trough sits at one of the green islands within Upper Square.

Trash receptacles are scattered throughout downtown Dover.

Directional signage.

Another prominent open space in downtown is the Cochecho Mill Courtyard on Central Avenue in the core downtown area. The courtyard is an attractive space constructed primarily of brick and used for various events and community gatherings. The space is pleasant, but lacks a strong sense of identity considering its location. Accessibility routes are limited and are not easily identifiable.

Upper Square, originally known as Franklin Square, was once visited by Theodore Roosevelt. Upper Square includes several small green open spaces or traffic islands that are isolated by a web of roadways and vehicle traffic, making them in practice only visually rather than physically accessible. Pedestrian access is limited, with no crosswalks or ramps connecting them to the overall streetscape. One island includes a historic watering trough. The City apparently closes Upper Square to vehicles once during the summer to allow pedestrians to enjoy this large urban space in the core downtown.

5.6 Furniture

The streetscape furniture in downtown includes older style benches and a mix of new and older trash receptacles. Recent updates to recycling receptacles have been added to the downtown streetscape, but still many older trash receptacles exist. The older wood benches can be found along Central Avenue at the following locations:

- South side of Upper Square.
- Curb bump outs at Second and Third Streets.
- South end of Central Avenue.

Main Street also has similar benches located at select bump outs near Upper Square and at the south end of Main Street in front of the Cochecho Mill parking lot. Beyond Central Avenue and Main Street, similar benches can only be found along the River Walk and the green space on the north side of the river at First Street.

More period style benches are located in the Cochecho Mill courtyard and Immigrant's Park at the corner of Main and School Streets. Most benches within the streetscape are located close to curb lines and face the streets. Additional styles of benches exist in open spaces such as Henry Law Park.

5.7 Wayfinding and Signage

WAYFINDING SIGNS

Wayfinding or directional signs are limited or unidentifiable within the downtown area. Wayfinding signage primarily consists of train station and bus stop signs mounted on Cobra head light poles, which are small and difficult to

identify, especially when traveling in vehicles. Signs for municipal facilities also exist, but are very small and difficult for vehicles to recognize. While there are many parking lots scattered throughout the downtown, their directional signage does not notify drivers effectively. The signs are small and become visually lost within the streetscape.

INTERPRETIVE SIGNS

Several interpretive signs exist in the downtown. All signs are similar in style and each sign announces various historical events or data pertaining to each location. They are located along Central Avenue on the Cochecho River Bridge and within Waldron Courtyard and at the Lower Square intersection. Additional signs can also be found along Main Street in Upper Square. Some interpretive signs are located immediately adjacent to the curbs and are removed during the winter months to avoid damage from snow maintenance.

Signage in downtown includes wayfinding and interpretive signage (at the Children's Museum and the Cochecho River), directional signage, and event signs.

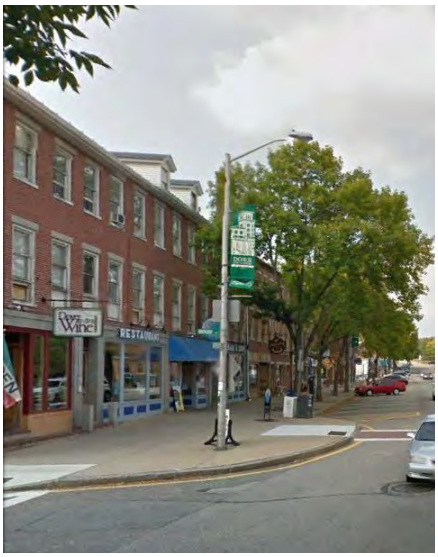
PEDESTRIAN CROSSING SIGNS

Many of the plentiful pedestrian crosswalks throughout the downtown are identified with brilliant yellow pedestrian crossing signs. Some crossings are marked with two signs on both sides of the road, while some are only marked with one. Many pedestrian crossings do not have any signs.

5.8 Banners and Flags

BANNERS

Banners vary in size, color and style within the downtown area. Smaller ones are often mounted to the pedestrian scale light poles within the core area, while larger banners are mounted to the Cobra head light fixture poles at the



Banners of different sizes are scatted throughout downtown.

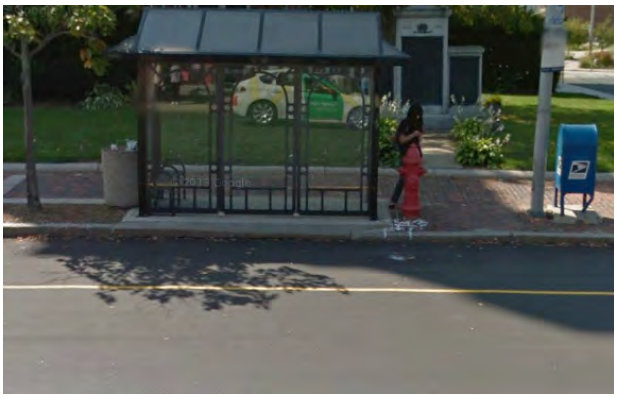
southern end of downtown. The banners on the pedestrian scale lights are approximately 18 by 24 inches and tend to become lost within the streetscape or are hidden by street trees. The larger banners, approximately 24 by 60 inches, are mounted approximately 15 feet high on the Cobra poles, and are spaced approximately 160 feet apart on one side of the road. The graphics on the banners that were on display during this analysis have text with an image of the Historic Cochecho Mill on one side, and a flower on the other side. The text is small and hard to read, especially when driving in a vehicle.

FLAGS

Flags were noticed sporadically along Central Avenue and Washington Street as well as along the northern section of Main Street at Upper Square and the railroad crossing. Flags are mounted to various elements including pedestrian and Cobra Head light poles, utility poles, and to the facades of some buildings.

5.9 Bus Shelters

There are approximately 15 bus stops within Downtown Dover and only two bus shelters. They appear to be fairly new and are located at the southernmost edge of downtown on Central Avenue in front of City Hall and the Central Towers residential community.



One of only a few bus shelters in downtown, in front of City Hall.

5.10 Other Elements

Granite markers and plinths are located throughout the downtown and compliment the streetscape character and adjacent urban spaces. They can be found at the south end of Upper Square; within the Cohceco Mill Courtyard and on Central Avenue at Lower Square.

A APPENDIX: SYNCHRO 8 REPORT

The following pages provide details of the Synchro traffic congestion / Level of Service model output for 2014 existing conditions at various intersections throughout downtown Dover.

Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	124	48	0	340	339	389
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	138	53	0	378	377	432

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	755	377	377	0	-	0
Stage 1	377	-	-	-	-	-
Stage 2	378	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	376	670	1181	-	-	-
Stage 1	694	-	-	-	-	-
Stage 2	693	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	376	670	1181	-	-	-
Mov Cap-2 Maneuver	376	-	-	-	-	-
Stage 1	694	-	-	-	-	-
Stage 2	693	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1181	-	428	-	-
HCM Lane V/C Ratio	-	-	0.447	-	-
HCM Control Delay (s)	0	-	20	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	2.2	-	-

Intersection	
Intersection Delay, s/veh	18.7
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	13	104	178	0	16	110	1	0	96	158	8
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	116	198	0	18	122	1	0	107	176	9
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	16.9	12.8	16.4
HCM LOS	C	B	C

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	37%	4%	13%	1%
Vol Thru, %	60%	35%	87%	93%
Vol Right, %	3%	60%	1%	6%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	262	295	127	387
LT Vol	158	104	110	361
Through Vol	8	178	1	23
RT Vol	96	13	16	3
Lane Flow Rate	291	328	141	430
Geometry Grp	1	1	1	1
Degree of Util (X)	0.521	0.562	0.276	0.726
Departure Headway (Hd)	6.438	6.173	7.035	6.079
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	559	583	508	593
Service Time	4.505	4.236	5.116	4.137
HCM Lane V/C Ratio	0.521	0.563	0.278	0.725
HCM Control Delay	16.4	16.9	12.8	23.7
HCM Lane LOS	C	C	B	C
HCM 95th-tile Q	3	3.5	1.1	6.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	3	361	23
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	3	401	26
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	23.7
HCM LOS	C

Lane

Two Way Analysis cannot be performed on an All Way Stop Intersection.

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	0	20	110	0	39	19	315	68
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	Stop	-	-	Free
Storage Length	20	-	0	0	-	125	-	-	150
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	22	122	0	43	21	350	76

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	937	937	541	937	944	350	548	0	-
Stage 1	545	545	-	392	392	-	-	-	-
Stage 2	392	392	-	545	552	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	245	265	541	245	262	693	1021	-	0
Stage 1	523	519	-	633	606	-	-	-	0
Stage 2	633	606	-	523	515	-	-	-	0
Platoon blocked, %								-	
Mov Cap-1 Maneuver	225	258	541	230	255	693	1021	-	-
Mov Cap-2 Maneuver	225	258	-	230	255	-	-	-	-
Stage 1	509	518	-	617	590	-	-	-	-
Stage 2	578	590	-	501	514	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	12.3	30.1	0.5
HCM LOS	B	D	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1021	-	225	541	230	693	1209	-	-
HCM Lane V/C Ratio	0.021	-	0.005	0.041	0.531	0.063	0.002	-	-
HCM Control Delay (s)	8.6	0	21.1	11.9	37.1	10.5	8	0	-
HCM Lane LOS	A	A	C	B	E	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	0	0.1	2.8	0.2	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	2	480	13
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	2	533	14

Major/Minor	Major2		
Conflicting Flow All	350	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1209	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1209	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

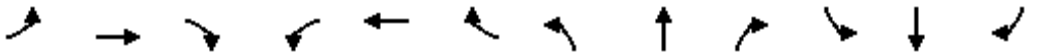
Intersection	
Int Delay, s/veh	0.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	13	16	396	36	25	712
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	14	18	440	40	28	791

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	911	460	0	0	480	0
Stage 1	460	-	-	-	-	-
Stage 2	451	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.12	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.218	-
Pot Cap-1 Maneuver	289	600	-	-	1082	-
Stage 1	635	-	-	-	-	-
Stage 2	609	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	276	600	-	-	1082	-
Mov Cap-2 Maneuver	276	-	-	-	-	-
Stage 1	635	-	-	-	-	-
Stage 2	581	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	15	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	393	1082	-
HCM Lane V/C Ratio	-	-	0.082	0.026	-
HCM Control Delay (s)	-	-	15	8.4	0.2
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	172	206	29	8	152	44	0	216	2	79	286	359
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	0.98			1.00	0.85		1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1828			1858	1583		1861		1770	1863	1583
Flt Permitted	0.34	1.00			0.97	1.00		1.00		0.24	1.00	1.00
Satd. Flow (perm)	639	1828			1806	1583		1861		443	1863	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	191	229	32	9	169	49	0	240	2	88	318	399
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	0	244
Lane Group Flow (vph)	191	256	0	0	178	49	0	242	0	88	318	155
Turn Type	pm+pt	NA		Perm	NA	pt+ov		NA		pm+pt	NA	pt+ov
Protected Phases	1	6			2	2 3		4		3	8	8 1
Permitted Phases	6			2						8		
Actuated Green, G (s)	30.2	30.2			12.4	22.2		13.7		23.5	23.5	35.3
Effective Green, g (s)	30.2	30.2			12.4	22.2		13.7		23.5	23.5	35.3
Actuated g/C Ratio	0.33	0.33			0.14	0.24		0.15		0.26	0.26	0.39
Clearance Time (s)	6.0	6.0			6.0			6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	359	607			246	386		280		170	481	614
v/s Ratio Prot	c0.07	0.14				0.03		c0.13		0.02	c0.17	0.10
v/s Ratio Perm	0.11				c0.10					0.11		
v/c Ratio	0.53	0.42			0.72	0.13		0.86		0.52	0.66	0.25
Uniform Delay, d1	23.2	23.6			37.6	26.8		37.7		27.2	30.1	18.9
Progression Factor	1.00	1.00			1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.5			10.1	0.1		23.1		2.6	3.4	0.2
Delay (s)	24.7	24.0			47.7	26.9		60.8		29.8	33.5	19.1
Level of Service	C	C			D	C		E		C	C	B
Approach Delay (s)		24.3			43.2			60.8			26.0	
Approach LOS		C			D			E			C	

Intersection Summary			
HCM 2000 Control Delay	32.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.9	Sum of lost time (s)	28.0
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	287	0	0	152	51	113
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	20	-	-	70	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	319	0	0	169	57	126

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	319	0	488	159
Stage 1	-	-	-	-	319	-
Stage 2	-	-	-	-	169	-
Critical Hdwy	-	-	4.14	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.22	-	3.519	3.319
Pot Cap-1 Maneuver	-	-	1238	-	524	859
Stage 1	-	-	-	-	710	-
Stage 2	-	-	-	-	860	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1238	-	524	859
Mov Cap-2 Maneuver	-	-	-	-	524	-
Stage 1	-	-	-	-	710	-
Stage 2	-	-	-	-	860	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	10.8
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	524	859	-	-	1238	-
HCM Lane V/C Ratio	0.108	0.146	-	-	-	-
HCM Control Delay (s)	12.7	9.9	-	-	0	-
HCM Lane LOS	B	A	-	-	A	-
HCM 95th %tile Q(veh)	0.4	0.5	-	-	0	-

Movement	EBT	EBR	EBR2	NBL	NBR	SBL2	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	289	19	90	46	603	120	71	699	106
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	0.95		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.99		0.85	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00		1.00	0.95	1.00	0.95	0.95	1.00	1.00
Satd. Flow (prot)	3507		1583	1770	1583	1770	1770	1863	1583
Flt Permitted	1.00		1.00	0.95	1.00	0.95	0.95	1.00	1.00
Satd. Flow (perm)	3507		1583	1770	1583	1770	1770	1863	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	321	21	100	51	670	133	79	777	118
RTOR Reduction (vph)	0	0	80	0	0	75	0	0	53
Lane Group Flow (vph)	342	0	20	51	670	58	79	777	65
Turn Type	NA		pm+ov	Prot	Prot	pm+pt	pm+pt	NA	Perm
Protected Phases	4		5	5	2	1	1	6	
Permitted Phases			4	5	2	6	6		6
Actuated Green, G (s)	18.3		26.4	8.1	59.1	59.1	59.1	59.1	59.1
Effective Green, g (s)	18.3		26.4	8.1	59.1	59.1	59.1	59.1	59.1
Actuated g/C Ratio	0.14		0.20	0.06	0.44	0.44	0.44	0.44	0.44
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	477		310	106	695	777	777	818	695
v/s Ratio Prot	c0.10		0.00	0.03	c0.42	0.00	0.01	c0.42	
v/s Ratio Perm			0.01			0.03	0.04		0.04
v/c Ratio	0.72		0.06	0.48	0.96	0.08	0.10	0.95	0.09
Uniform Delay, d1	55.6		44.0	61.2	36.7	21.9	22.1	36.3	22.0
Progression Factor	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1		0.1	3.4	25.3	0.0	0.1	20.0	0.1
Delay (s)	60.7		44.1	64.6	62.0	21.9	22.2	56.3	22.1
Level of Service	E		D	E	E	C	C	E	C
Approach Delay (s)	56.9							46.1	
Approach LOS	E							D	

Intersection Summary			
HCM 2000 Control Delay	53.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	134.5	Sum of lost time (s)	22.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	1	3	109	8	5	19	118	319	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	3	121	9	6	21	131	354	12

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1015	1008	371	1065	1004	361	372	0	0
Stage 1	379	379	-	623	623	-	-	-	-
Stage 2	636	629	-	442	381	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	217	240	675	200	242	684	1186	-	-
Stage 1	643	615	-	474	478	-	-	-	-
Stage 2	466	475	-	594	613	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	188	213	675	148	214	684	1186	-	-
Mov Cap-2 Maneuver	188	213	-	148	214	-	-	-	-
Stage 1	572	613	-	422	425	-	-	-	-
Stage 2	396	423	-	483	611	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	12.2	18.4	2.2
HCM LOS	B	C	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1186	-	-	625	304	1192	-	-
HCM Lane V/C Ratio	0.111	-	-	0.201	0.117	0.004	-	-
HCM Control Delay (s)	8.4	-	-	12.2	18.4	8	0	-
HCM Lane LOS	A	-	-	B	C	A	A	-
HCM 95th %tile Q(veh)	0.4	-	-	0.7	0.4	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	4	332	3
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	4	369	3

Major/Minor	Major2		
Conflicting Flow All	367	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1192	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1192	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0.1
HCM LOS	

Minor Lane/Major Mvmt

Movement	EBR2	WBL	WBT	WBR	SBT	SBR	NWL	NWR	NWR2
Lane Configurations									
Volume (vph)	44	236	39	26	514	7	15	366	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0		6.0	6.0	
Lane Util. Factor	1.00		1.00		0.95		1.00	0.88	
Frt	0.86		0.99		1.00		1.00	0.85	
Flt Protected	1.00		0.96		1.00		0.95	1.00	
Satd. Flow (prot)	1611		1771		3532		1770	2787	
Flt Permitted	1.00		0.96		1.00		0.95	1.00	
Satd. Flow (perm)	1611		1771		3532		1770	2787	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	49	262	43	29	571	8	17	407	126
RTOR Reduction (vph)	34	0	4	0	1	0	0	53	0
Lane Group Flow (vph)	15	0	330	0	578	0	17	480	0
Turn Type	Perm	Split	NA		NA		Perm	Prot	
Protected Phases		8	8		6			2	
Permitted Phases	6						2		
Actuated Green, G (s)	28.1		23.0		28.1		28.1	28.1	
Effective Green, g (s)	28.1		23.0		28.1		28.1	28.1	
Actuated g/C Ratio	0.30		0.25		0.30		0.30	0.30	
Clearance Time (s)	6.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	485		437		1064		533	840	
v/s Ratio Prot			c0.19		0.16			c0.17	
v/s Ratio Perm	0.01						0.01		
v/c Ratio	0.03		0.76		0.54		0.03	0.57	
Uniform Delay, d1	22.9		32.5		27.2		23.0	27.5	
Progression Factor	1.00		1.00		1.00		0.87	0.74	
Incremental Delay, d2	0.1		7.3		2.0		0.0	0.9	
Delay (s)	23.1		39.8		29.2		20.1	21.3	
Level of Service	C		D		C		C	C	
Approach Delay (s)			39.8		29.2		21.3		
Approach LOS			D		C		C		

Intersection Summary			
HCM 2000 Control Delay	28.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

HCM research expects at least one 'Stop' controlled approach at the intersection.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	0	397	118	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	441	131	0	0	0	0

Major/Minor	Minor1		
Conflicting Flow All	389	813	0
Stage 1	0	0	-
Stage 2	389	813	-
Critical Hdwy	7.54	6.54	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	-
Pot Cap-1 Maneuver	544	311	-
Stage 1	-	-	-
Stage 2	606	390	-
Platoon blocked, %			
Mov Cap-1 Maneuver	544	0	-
Mov Cap-2 Maneuver	544	0	-
Stage 1	-	0	-
Stage 2	606	0	-

Approach	WB
HCM Control Delay, s	
HCM LOS	-

Minor Lane/Major Mvmt	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	544	-	-	-	-
HCM Lane V/C Ratio	0.811	-	-	-	-
HCM Control Delay (s)	34.1	-	0	-	-
HCM Lane LOS	D	-	A	-	-
HCM 95th %tile Q(veh)	7.9	-	-	-	-

Intersection	
Int Delay, s/veh	

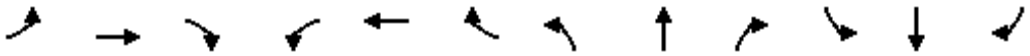
Movement	SBL	SBT	SBR
Vol, veh/h	0	700	32
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	778	36

Major/Minor	Major2		
Conflicting Flow All	0	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	-
Pot Cap-1 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

HCM research expects at least one 'Stop' controlled approach at the intersection.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	515	480	41	48	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)							6.0	6.0	6.0	6.0		
Lane Util. Factor							0.91	0.91	1.00	1.00		
Frt							1.00	1.00	0.85	1.00		
Flt Protected							0.95	0.99	1.00	0.95		
Satd. Flow (prot)							1610	3343	1583	1770		
Flt Permitted							0.95	0.99	1.00	0.95		
Satd. Flow (perm)							1610	3343	1583	1770		
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	0	0	572	533	46	53	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	139	42	32	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	221	703	14	53	0	0
Turn Type							Prot	NA	Perm	Prot		
Protected Phases							2 8	2		8		
Permitted Phases									2			
Actuated Green, G (s)							57.1	57.1	28.1	23.0		
Effective Green, g (s)							57.1	57.1	28.1	23.0		
Actuated g/C Ratio							0.61	0.61	0.30	0.25		
Clearance Time (s)								6.0	6.0	6.0		
Vehicle Extension (s)								3.0	3.0	3.0		
Lane Grp Cap (vph)							986	2048	477	436		
v/s Ratio Prot							0.14	c0.21		0.03		
v/s Ratio Perm									0.01			
v/c Ratio							0.22	0.34	0.03	0.12		
Uniform Delay, d1							8.1	8.9	22.9	27.3		
Progression Factor							1.00	1.00	1.00	1.00		
Incremental Delay, d2							0.1	0.1	0.0	0.1		
Delay (s)							8.2	9.0	23.0	27.4		
Level of Service							A	A	C	C		
Approach Delay (s)		0.0			0.0			9.3			27.4	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	30.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

Intersection	
Int Delay, s/veh	17.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	568	596	420	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	50	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	631	662	467	0	0

Major/Minor	Minor1		Major1	
Conflicting Flow All	662	330	0	0
Stage 1	662	-	-	-
Stage 2	0	-	-	-
Critical Hdwy	7.54	6.94	-	-
Critical Hdwy Stg 1	6.54	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-
Pot Cap-1 Maneuver	347	666	-	-
Stage 1	417	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	347	666	-	-
Mov Cap-2 Maneuver	347	-	-	-
Stage 1	417	-	-	-
Stage 2	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	48.1	0
HCM LOS	E	

Minor Lane/Major Mvmt	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	666
HCM Lane V/C Ratio	-	-	0.948
HCM Control Delay (s)	-	-	48.1
HCM Lane LOS	-	-	E
HCM 95th %tile Q(veh)	-	-	13.4

Intersection	
Int Delay, s/veh	0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1065	61	0	0	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1183	68	0	0	0	1

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	1217	625
Stage 1	-	-	1217	-
Stage 2	-	-	0	-
Critical Hdwy	-	-	7.54	6.94
Critical Hdwy Stg 1	-	-	6.54	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	137	428
Stage 1	-	-	192	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-		
Mov Cap-1 Maneuver	-	-	137	428
Mov Cap-2 Maneuver	-	-	137	-
Stage 1	-	-	192	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	13.4
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	428	-	-
HCM Lane V/C Ratio	0.003	-	-
HCM Control Delay (s)	13.4	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0	-	-

Intersection	
Int Delay, s/veh	17

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	173	54	0	553	537	361
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	100
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	192	60	0	614	597	401

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1211	597	597	0	-	0
Stage 1	597	-	-	-	-	-
Stage 2	614	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	201	503	980	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	540	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	201	503	980	-	-	-
Mov Cap-2 Maneuver	201	-	-	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	540	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	126	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	980	-	234	-	-
HCM Lane V/C Ratio	-	-	1.078	-	-
HCM Control Delay (s)	0	-	126	-	-
HCM Lane LOS	A	-	F	-	-
HCM 95th %tile Q(veh)	0	-	10.9	-	-

Intersection	
Intersection Delay, s/veh	48.8
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	10	171	174	0	32	138	3	0	251	214	12
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	11	190	193	0	36	153	3	0	279	238	13
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	38.8	19.7	70.4
HCM LOS	E	C	F

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	53%	3%	18%	1%
Vol Thru, %	45%	48%	80%	89%
Vol Right, %	3%	49%	2%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	477	355	173	361
LT Vol	214	171	138	322
Through Vol	12	174	3	35
RT Vol	251	10	32	4
Lane Flow Rate	530	394	192	401
Geometry Grp	1	1	1	1
Degree of Util (X)	1	0.833	0.475	0.869
Departure Headway (Hd)	7.829	7.737	8.892	7.798
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	466	469	406	465
Service Time	5.868	5.737	6.92	5.816
HCM Lane V/C Ratio	1.137	0.84	0.473	0.862
HCM Control Delay	70.4	38.8	19.7	44
HCM Lane LOS	F	E	C	E
HCM 95th-tile Q	13.1	8.1	2.5	9

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	4	322	35
Peak Hour Factor	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	4	358	39
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	44
HCM LOS	E

Lane

Two Way Analysis cannot be performed on an All Way Stop Intersection.

Intersection	
Int Delay, s/veh	21.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	15	0	43	112	0	48	47	572	113
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	Stop	-	-	Free
Storage Length	20	-	0	0	-	125	-	-	150
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	0	48	124	0	53	52	636	126

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1392	1392	645	1392	1406	636	659	0	-
Stage 1	652	652	-	740	740	-	-	-	-
Stage 2	740	740	-	652	666	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	119	142	472	~ 119	139	478	929	-	0
Stage 1	457	464	-	409	423	-	-	-	0
Stage 2	409	423	-	457	457	-	-	-	0
Platoon blocked, %								-	
Mov Cap-1 Maneuver	98	129	472	~ 99	126	478	929	-	-
Mov Cap-2 Maneuver	98	129	-	~ 99	126	-	-	-	-
Stage 1	417	462	-	373	386	-	-	-	-
Stage 2	332	386	-	409	455	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	22.7	181.7	0.7
HCM LOS	C	F	

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	929	-	98	472	99	478	947	-	-
HCM Lane V/C Ratio	0.056	-	0.17	0.101	1.257	0.112	0.004	-	-
HCM Control Delay (s)	9.1	0	49.1	13.5	253.8	13.5	8.8	0	-
HCM Lane LOS	A	A	E	B	F	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	0.6	0.3	8.6	0.4	0	-	-

Notes

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

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	3	568	25
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	3	631	28

Major/Minor	Major2		
Conflicting Flow All	636	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	947	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	947	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

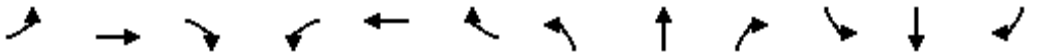
Intersection	
Int Delay, s/veh	1.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	26	36	630	36	21	898
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	40	700	40	23	998

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1266	720	0	0	740	0
Stage 1	720	-	-	-	-	-
Stage 2	546	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.12	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.218	-
Pot Cap-1 Maneuver	173	427	-	-	867	-
Stage 1	481	-	-	-	-	-
Stage 2	545	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	163	427	-	-	867	-
Mov Cap-2 Maneuver	163	-	-	-	-	-
Stage 1	481	-	-	-	-	-
Stage 2	512	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	24.4	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	254	867	-
HCM Lane V/C Ratio	-	-	0.271	0.027	-
HCM Control Delay (s)	-	-	24.4	9.3	0.3
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0.1	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	287	305	48	18	170	74	0	305	17	96	342	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	0.98			1.00	0.85		0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1825			1854	1583		1849		1770	1863	1583
Flt Permitted	0.30	1.00			0.93	1.00		1.00		0.16	1.00	1.00
Satd. Flow (perm)	556	1825			1723	1583		1849		302	1863	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	319	339	53	20	189	82	0	339	19	107	380	539
RTOR Reduction (vph)	0	5	0	0	0	0	0	2	0	0	0	290
Lane Group Flow (vph)	319	387	0	0	209	82	0	356	0	107	380	249
Turn Type	pm+pt	NA		Perm	NA	pt+ov		NA		pm+pt	NA	pt+ov
Protected Phases	1	6			2	2 3		4		3	8	8 1
Permitted Phases	6			2						8		
Actuated Green, G (s)	39.0	39.0			17.9	29.9		25.1		37.1	37.1	52.2
Effective Green, g (s)	39.0	39.0			17.9	29.9		25.1		37.1	37.1	52.2
Actuated g/C Ratio	0.34	0.34			0.16	0.26		0.22		0.33	0.33	0.46
Clearance Time (s)	6.0	6.0			6.0			6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	353	628			272	418		409		176	610	729
v/s Ratio Prot	c0.12	0.21				0.05		c0.19		0.03	c0.20	0.16
v/s Ratio Perm	c0.19				0.12					0.17		
v/c Ratio	0.90	0.62			0.77	0.20		0.87		0.61	0.62	0.34
Uniform Delay, d1	31.5	30.9			45.7	32.3		42.5		29.6	32.1	19.5
Progression Factor	1.00	1.00			1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	25.4	1.8			12.3	0.2		18.0		5.8	2.0	0.3
Delay (s)	56.8	32.7			57.9	32.6		60.5		35.4	34.1	19.8
Level of Service	E	C			E	C		E		D	C	B
Approach Delay (s)		43.5			50.8			60.5			26.7	
Approach LOS		D			D			E			C	

Intersection Summary			
HCM 2000 Control Delay	39.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	113.2	Sum of lost time (s)	28.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	418	0	0	223	38	222
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	20	-	-	70	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	464	0	0	248	42	247

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	464	0	712	232
Stage 1	-	-	-	-	464	-
Stage 2	-	-	-	-	248	-
Critical Hdwy	-	-	4.14	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.22	-	3.519	3.319
Pot Cap-1 Maneuver	-	-	1094	-	383	771
Stage 1	-	-	-	-	600	-
Stage 2	-	-	-	-	793	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1094	-	383	771
Mov Cap-2 Maneuver	-	-	-	-	383	-
Stage 1	-	-	-	-	600	-
Stage 2	-	-	-	-	793	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	383	771	-	-	1094	-
HCM Lane V/C Ratio	0.11	0.32	-	-	-	-
HCM Control Delay (s)	15.6	11.9	-	-	0	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.4	1.4	-	-	0	-

Movement	EBT	EBR	EBR2	NBL	NBR	NBR2	SBL2	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	475	35	129	86	958	6	152	107	781	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0
Lane Util. Factor	0.95		1.00	1.00	1.00		1.00	1.00	1.00	1.00
Frt	0.99		0.85	1.00	0.85		1.00	1.00	1.00	0.85
Flt Protected	1.00		1.00	0.95	1.00		0.95	0.95	1.00	1.00
Satd. Flow (prot)	3503		1583	1770	1583		1770	1770	1863	1583
Flt Permitted	1.00		1.00	0.95	1.00		0.95	0.95	1.00	1.00
Satd. Flow (perm)	3503		1583	1770	1583		1770	1770	1863	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	528	39	143	96	1064	7	169	119	868	152
RTOR Reduction (vph)	0	0	112	0	52	0	92	0	0	52
Lane Group Flow (vph)	567	0	31	96	1019	0	77	119	868	100
Turn Type	NA		pm+ov	Prot	Prot		pm+pt	pm+pt	NA	Perm
Protected Phases	4		5	5	2		1	1	6	
Permitted Phases			4	5	2		6	6		6
Actuated Green, G (s)	24.0		33.0	9.0	68.0		68.0	68.0	68.0	68.0
Effective Green, g (s)	24.0		33.0	9.0	68.0		68.0	68.0	68.0	68.0
Actuated g/C Ratio	0.16		0.22	0.06	0.45		0.45	0.45	0.45	0.45
Clearance Time (s)	6.0		6.0	6.0	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	560		348	106	717		802	802	844	717
v/s Ratio Prot	c0.16		0.01	0.05	c0.64		0.01	0.01	c0.47	
v/s Ratio Perm			0.01				0.04	0.06		0.06
v/c Ratio	1.01		0.09	0.91	1.42		0.10	0.15	1.03	0.14
Uniform Delay, d1	63.0		46.6	70.1	41.0		23.4	24.0	41.0	23.9
Progression Factor	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	41.2		0.1	57.9	197.7		0.1	0.1	38.5	0.1
Delay (s)	104.2		46.7	128.0	238.7		23.5	24.1	79.5	24.0
Level of Service	F		D	F	F		C	C	E	C
Approach Delay (s)	92.6								60.7	
Approach LOS	F								E	

Intersection Summary			
HCM 2000 Control Delay	129.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	97.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	7	4	174	6	4	9	164	537	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	4	193	7	4	10	182	597	20

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	1575	1578	592	1667	1570	607	594	0	0
Stage 1	597	597	-	971	971	-	-	-	-
Stage 2	978	981	-	696	599	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-
Pot Cap-1 Maneuver	89	109	506	77	111	496	982	-	-
Stage 1	490	491	-	304	331	-	-	-	-
Stage 2	301	328	-	432	490	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	72	89	506	39	90	496	982	-	-
Mov Cap-2 Maneuver	72	89	-	39	90	-	-	-	-
Stage 1	399	490	-	248	270	-	-	-	-
Stage 2	236	267	-	264	489	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	25	58.4	2.2
HCM LOS	D	F	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	982	-	-	381	88	963	-	-
HCM Lane V/C Ratio	0.186	-	-	0.54	0.24	0.002	-	-
HCM Control Delay (s)	9.5	-	-	25	58.4	8.7	0	-
HCM Lane LOS	A	-	-	D	F	A	A	-
HCM 95th %tile Q(veh)	0.7	-	-	3.1	0.9	0	-	-

Intersection	
Int Delay, s/veh	

Movement	SBL	SBT	SBR
Vol, veh/h	2	531	4
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	2	590	4

Major/Minor	Major2		
Conflicting Flow All	617	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	963	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	963	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

Movement	EBR2	WBL	WBT	WBR	SBT	SBR	NWL	NWR	NWR2
Lane Configurations									
Volume (vph)	115	268	40	36	673	29	41	627	174
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0		6.0		6.0	6.0	
Lane Util. Factor	1.00		1.00		0.95		1.00	0.88	
Frt	0.86		0.99		0.99		1.00	0.85	
Flt Protected	1.00		0.96		1.00		0.95	1.00	
Satd. Flow (prot)	1611		1767		3517		1770	2787	
Flt Permitted	1.00		0.96		1.00		0.95	1.00	
Satd. Flow (perm)	1611		1767		3517		1770	2787	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	128	298	44	40	748	32	46	697	193
RTOR Reduction (vph)	91	0	4	0	3	0	0	54	0
Lane Group Flow (vph)	37	0	378	0	777	0	46	836	0
Turn Type	Perm	Split	NA		NA		Perm	Prot	
Protected Phases		8	8		6			2	
Permitted Phases	6						2		
Actuated Green, G (s)	28.1		25.9		28.1		28.1	28.1	
Effective Green, g (s)	28.1		25.9		28.1		28.1	28.1	
Actuated g/C Ratio	0.29		0.27		0.29		0.29	0.29	
Clearance Time (s)	6.0		6.0		6.0		6.0	6.0	
Vehicle Extension (s)	3.0		3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	471		476		1028		517	814	
v/s Ratio Prot			c0.21		0.22			c0.30	
v/s Ratio Perm	0.02						0.03		
v/c Ratio	0.08		0.79		0.76		0.09	1.03	
Uniform Delay, d1	24.6		32.6		30.9		24.7	34.0	
Progression Factor	1.00		1.00		1.00		0.84	0.72	
Incremental Delay, d2	0.3		8.8		5.2		0.1	37.5	
Delay (s)	25.0		41.4		36.1		20.9	62.0	
Level of Service	C		D		D		C	E	
Approach Delay (s)			41.4		36.1		60.0		
Approach LOS			D		D		E		

Intersection Summary			
HCM 2000 Control Delay	46.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	96.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

HCM research expects at least one 'Stop' controlled approach at the intersection.

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	0	0	0	371	113	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	412	126	0	0	0	0

Major/Minor	Minor1		
Conflicting Flow All	448	968	0
Stage 1	0	0	-
Stage 2	448	968	-
Critical Hdwy	7.54	6.54	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	6.54	5.54	-
Follow-up Hdwy	3.52	4.02	-
Pot Cap-1 Maneuver	494	252	-
Stage 1	-	-	-
Stage 2	560	330	-
Platoon blocked, %			
Mov Cap-1 Maneuver	494	0	-
Mov Cap-2 Maneuver	494	0	-
Stage 1	-	0	-
Stage 2	560	0	-

Approach	WB
HCM Control Delay, s	
HCM LOS	-

Minor Lane/Major Mvmt	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	494	-	-	-	-
HCM Lane V/C Ratio	0.834	-	-	-	-
HCM Control Delay (s)	39.3	-	0	-	-
HCM Lane LOS	E	-	A	-	-
HCM 95th %tile Q(veh)	8.3	-	-	-	-

Intersection	
Int Delay, s/veh	

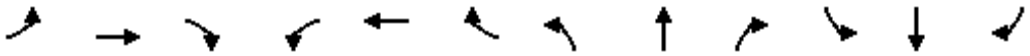
Movement	SBL	SBT	SBR
Vol, veh/h	0	806	65
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	90	90	90
Heavy Vehicles, %	2	2	2
Mvmt Flow	0	896	72

Major/Minor	Major2		
Conflicting Flow All	0	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	-
Pot Cap-1 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	-	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SB
HCM Control Delay, s	0
HCM LOS	

Minor Lane/Major Mvmt

HCM research expects at least one 'Stop' controlled approach at the intersection.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	0	0	484	786	149	129	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)							6.0	6.0	6.0	6.0		
Lane Util. Factor							0.91	0.91	1.00	1.00		
Frt							1.00	1.00	0.85	1.00		
Flt Protected							0.95	1.00	1.00	0.95		
Satd. Flow (prot)							1610	3376	1583	1770		
Flt Permitted							0.95	1.00	1.00	0.95		
Satd. Flow (perm)							1610	3376	1583	1770		
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	0	0	0	538	873	166	143	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	172	7	74	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	0	285	947	92	143	0	0
Turn Type							Prot	NA	Perm	Prot		
Protected Phases							2 8	2		8		
Permitted Phases									2			
Actuated Green, G (s)							60.0	60.0	28.1	25.9		
Effective Green, g (s)							60.0	60.0	28.1	25.9		
Actuated g/C Ratio							0.62	0.62	0.29	0.27		
Clearance Time (s)								6.0	6.0	6.0		
Vehicle Extension (s)								3.0	3.0	3.0		
Lane Grp Cap (vph)							1005	2107	462	477		
v/s Ratio Prot							0.18	c0.28		0.08		
v/s Ratio Perm									0.06			
v/c Ratio							0.28	0.45	0.20	0.30		
Uniform Delay, d1							8.2	9.4	25.5	27.9		
Progression Factor							1.00	1.00	1.00	1.00		
Incremental Delay, d2							0.2	0.2	0.2	0.4		
Delay (s)							8.4	9.6	25.8	28.2		
Level of Service							A	A	C	C		
Approach Delay (s)		0.0			0.0			10.9			28.2	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	12.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	96.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Two Way Analysis cannot be performed on Signalized Intersection.

Intersection	
Int Delay, s/veh	3.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	264	1170	786	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	50	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	293	1300	873	0	0

Major/Minor	Minor1		Major1	
Conflicting Flow All	1300	649	0	0
Stage 1	1300	-	-	-
Stage 2	0	-	-	-
Critical Hdwy	7.54	6.94	-	-
Critical Hdwy Stg 1	6.54	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-
Pot Cap-1 Maneuver	119	412	-	-
Stage 1	170	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %			-	-
Mov Cap-1 Maneuver	119	412	-	-
Mov Cap-2 Maneuver	119	-	-	-
Stage 1	170	-	-	-
Stage 2	-	-	-	-

Approach	WB	NB
HCM Control Delay, s	32.6	0
HCM LOS	D	

Minor Lane/Major Mvmt	NBT	NBR	WBLn1
Capacity (veh/h)	-	-	412
HCM Lane V/C Ratio	-	-	0.712
HCM Control Delay (s)	-	-	32.6
HCM Lane LOS	-	-	D
HCM 95th %tile Q(veh)	-	-	5.4

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1721	13	0	0	0	80
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1912	14	0	0	0	89

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	1919	962
Stage 1	-	-	1919	-
Stage 2	-	-	0	-
Critical Hdwy	-	-	7.54	6.94
Critical Hdwy Stg 1	-	-	6.54	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	41	256
Stage 1	-	-	69	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-		
Mov Cap-1 Maneuver	-	-	41	256
Mov Cap-2 Maneuver	-	-	41	-
Stage 1	-	-	69	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	26.4
HCM LOS		D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	256	-	-
HCM Lane V/C Ratio	0.347	-	-
HCM Control Delay (s)	26.4	-	-
HCM Lane LOS	D	-	-
HCM 95th %tile Q(veh)	1.5	-	-

Undated historic photograph of Lower Central Square, courtesy of the Dover Public Library.

Undated historic photograph of Central Avenue, courtesy of the Dover Public Library.

B APPENDIX: PARKING UTILIZATION

Please see the following five pages for diagrams showing parking utilization on the parking survey date in these locations:

- Downtown North
- Downtown Central East
- Downtown Central West
- Downtown South
- Downtown West

Each colored dot includes the number of parking spaces occupied compared to the total number of spaces in that location. Pink dots refer to off-street parking lots, while blue dots refer to on-street parking spaces.

Third Street Lot

Central Street West

Central Avenue East

Central Avenue North

Janetos Market

Taste of India

Mill Northeast Lot

Second Street

PARKING UTILIZATION - DOWNTOWN NORTH

In-Motion Chiropractic

Picker House Mill Lot

Cocheco Mills - Upper Lot

Main Street North

Cocheco Mills - Lower Lot

Main Street South

Washington Street East

PARKING UTILIZATION - DOWNTOWN CENTRAL EAST

TD Bank Lot

Millworks Lot

Between TD Bank and Millworks Lot

Washington Street West

Central Avenue West On-Street Parking

Central Avenue East On-Street Parking

PARKING UTILIZATION - DOWNTOWN CENTRAL WEST


Henry Law Ave North


Henry Law Ave South


Williams St Lot


Children's Museum Lot


St. Thomas Street


Belknap Lot


Locust Lot


Walnut St Lot

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PARKING UTILIZATION - DOWNTOWN SOUTH




Orchard Street West Lot



Orchard Street East Lot


Chop Shop Lot

Aubuchon Hardware Lot

PARKING UTILIZATION - DOWNTOWN WEST

C APPENDIX: OBSERVATIONS ON RETAIL AND ECONOMIC FACTORS

Executive Summary

Historic Downtown Dover is comprised of a collection of small unique shops and restaurants that primarily service local residents and workers. The businesses are grouped into four walkable districts, defined by the Cochecho River, a hill and two large former mill buildings. Dover is easily accessable from the surrounding region and parking is generally adequate for its size. Recently, its historic mills have been creatively converted for residental and commercial use.

Commercial, shopping centers and hotel growth is focused two miles north of the downtown and along the Spaulding Turnpike's interchanges. Given the region's strong demographics and Dover's relative lack of strong competition, this study initially finds that the downtown has considerable potential to expand its retail mix and market share. A preliminary retail market study completed by GPG estimates that the downtown can presently support up to 64,100 square feet (sf) of additional retail and restaurant space generating $19.5 million in annual sales.

Retail Mix

Dover's 35-acre downtown includes an attractive selection of local and regional retailers, restaurants and offices including apparel, a bakery, books, a century-old hardware, cards, gifts, a grocery market, jewelry, home furnishings, restaurants and a renowned music shop. The downtown lacks any popular regional or national retailers, however, limiting its appeal to many demographic groups and the overall performance of its commerce. The downtown's first level retail is approximately 195,000 sf in total area and grouped into the following districts:

Figure 38. Walkable Shopping Districts in Downtown Dover

THIRD STREET: Located at the north end of the downtown, Third Street's businesses include the historic cinema (now closed), a bakery, personal services and several restaurants. The area has limited visibiilty from Main Street and is somewhat isolated from the other areas of the downtown by the Cochecho River and the hill.

UPPER MAIN STREET: Upper Main represents the downtown's most active business area and benefits from two-way traffic for a section of Main Street, which offers a significant amount of office and continuous retail frontage along both sides of the street. Its businesses include a bakery, books, restaurants and gift shops.

MAIN STREET: The Main Street area is generally isolated from the other downtown districts by the Cochecho Falls Mill and its one-way (north-bound) street alignment. Although the home-bound one-way pattern offers desirable traffic to some of the area's businesses, this pattern likely confuses some visitors and discourages access from the north neighborhoods. Many of the area's buildings are set back from Main Street or surrounded by surface parking lots, limiting the walkability between each business. The area is anchored by Janetos Market and the historic Cochecho Falls Mill. Most of the businesses are local-serving retailers and service businesses.

Figure 39. Central Avenue Looking North Towards Upper Main Street

WASHINGTON STREET: Located at the south side of the downtown, the Washington Street area is anchored with the post office, restaurants and a hardware store. Two-way traffic and strong anchors create a potential for retail growth in the corridor. The Central-Washington and Chestnut-Washington intersections are overly wide and challenging for pedestrian movement, limiting access and cross-shopping to other areas of the downtown.

Anchors

Although the downtown does not include department stores, fortunately, it has a large hardware and specialty grocery market. The city has also managed to maintain a wide array of civic anchors including: the library, post office, city hall, community center and a district court area. In addition, a popular children's museum recently opened in the downtown. These anchors attract visitors and workers to the downtown shops on a regular basis and are essential for its commerical sustainabilty. A closed historic cinema could, if reopened, attract additional shoppers downtown on weekends and evenings, improving sales for restaurants and some retailers.

Parking

The downtown's public surface lots and on-street metered parking provides shoppers with generally adequate parking. It's likely that most visitors can park within a short walk of their destination during most times. A proposed parking deck between Chestnut and Central Avenues will provide parking for workers and longer-time shoppers. Parking management should be carefully planned and generally the most successful downtowns offer two hours of free parking in all surface lots and structures while charging $.50 to $1.00 per hour for metered street parking.

Figure 40. Metered Parking Downtown

Dover's existing good-will policy of free parking for the first 15 minutes, although well intended, is likely counter-productive as it encourages shoppers to make abbreviated store visits and return to their cars as quickly as possible.

Vehicular Circulation

Downtown Dover's commerce benefits from the confluence of two state highways (NH 9 and NH4). The vehicular traffic allows for the downtown's businesses to have high visability and easy access from the greater Dover region. On the other hand, the existing one-way alignment of Central and Main Streets confuses shoppers and impedes access for surrounding residents. In addition, the extraordinarily wide intersections at Second-Central, Central-Washington and Washington-Chestnut limit walkabilty and cross-shopping in between each of the four districts.

Retail Market Study

This study finds that Downtown Dover, New Hampshire has an existing demand for 64,100 sf of additional retail development producing up to $19.5 million in sales. By 2018, this demand will likely generate up to $21.8 million in gross sales. This new retail would be absorbed by existing businesses or with the opening of new retailers and restaurants including: a full-service and a limited-service restaurant, 1-3 general merchandise stores, a retailer carrying department store goods, 2-3 apparel and shoe stores, special food services, a specialty food and drink store, a drug store/pharmacy, and a bar or pub. Please find below a summary of the statistically supportable retail in 2013 & 2018*.

12,800 sf	Full-Service and Limited-Service Restaurants
12,600 sf	General Merchandise Stores
9,400 sf	Department Store Merchandise

Figure 41. Central Avenue looking South towards City Hall

6,700 sf Apparel and Shoe Stores
4,100 sf Special Food Services
3,300 sf Hardware & Garden Supply Stores
2,900 sf Bars & Pubs
2,800 sf Pharmacy
2,700 sf Specialty Food & Drink Stores
1,700 sf Miscellaneous Store Retailers
1,500 sf Sporting Goods & Hobby Stores
1,500 sf Electronics Stores
1,100 sf Office Supplies & Gift Stores
1,000 sf Book & Music Stores
64,100 sf Total Supportable Retail

Trade Area Analysis

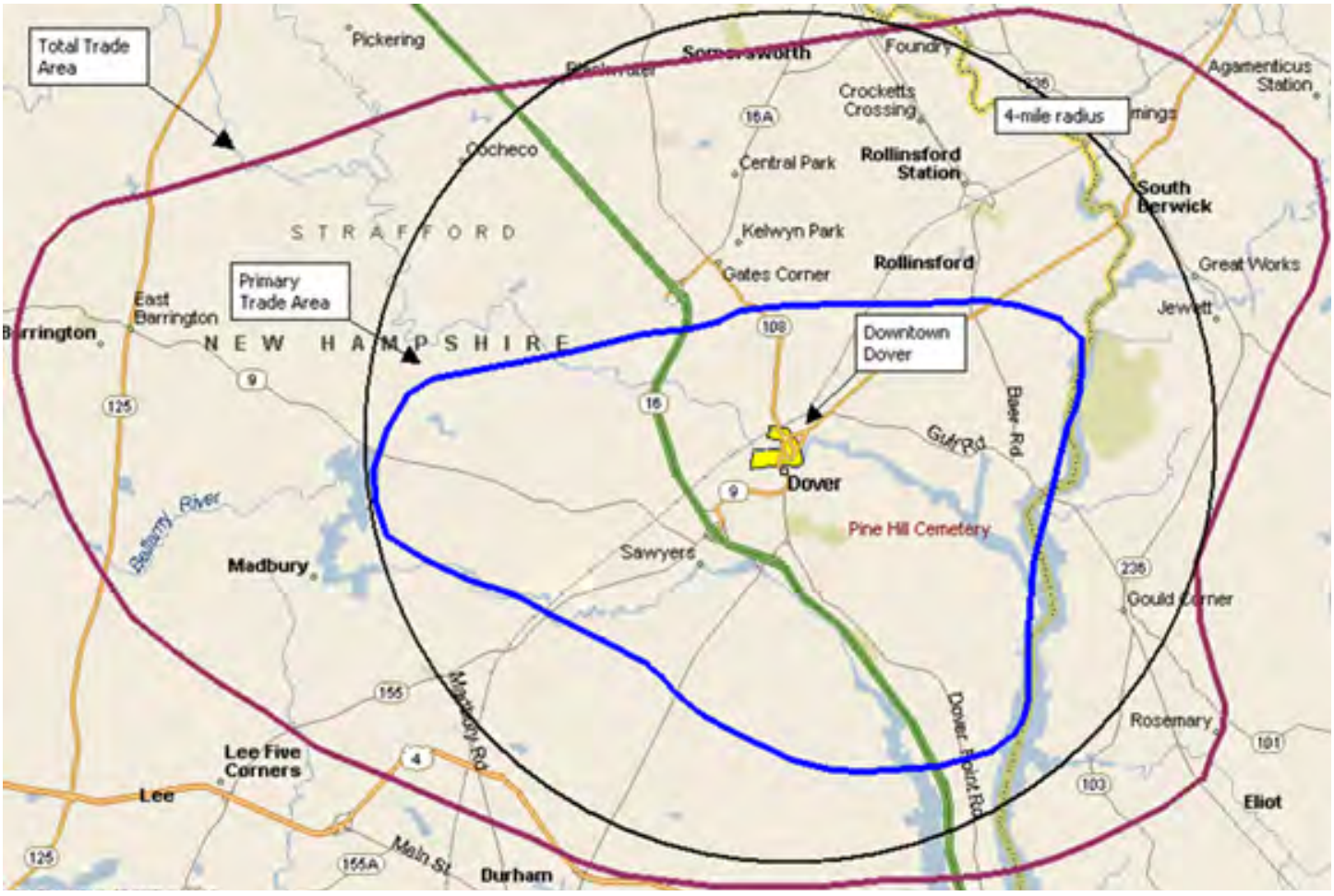
TRADE AREA BOUNDARIES

This study estimates that Downtown Dover has an approximate three- to four-mile primary trade area, extending east to the New Hampshire-Maine state line and incorporating many of the neighborhoods to the south and west along Spaulding Turnpike and Littleworth Road, which could account for approximately 60-70 percent of the new retail's households (shown below in blue). Furthermore, a larger, total trade area for the subject site was identified. This trade area, which extends east and west to incorporate the communities of Barrington, South Berwick and the southern portion of Somersworth, shown below in purple, could account for approximately 75-80 percent of the site's retail sales.

Thanks to its geographical location, Downtown Dover and the primary trade area can be accessed via three points: NH-16 (Spaulding Turnpike) running north and south parallel to downtown and connecting to the cities of

Figure 42. Shops and Offices along Upper Main Street

Figure 43. Trade Area Boundaries for Downtown Dover



Rochester and Portsmouth; Littleworth Avenue/Portland Avenue (NH-9/NH-4) which meanders east and west connecting to the towns of Barrington and South Berwick; and NH-108 which is a local thoroughfare parallel to Spaulding Turnpike. Due to the historic settlement patterns of Dover and its surrounding residential areas, in part driven by their location along the Cochecho, Salmon Falls and Piscataqua Rivers, most trade area residents can access downtown in a less than a 10-minute drivetime.

This easy access can be better appreciated when the distance to the next closest cities is considered: Rochester and Portsmouth, New Hampshire are both over ten miles from Downtown Dover. Convenient location and regional connectivity suggest that the downtown could serve as the primary shopping destination for the majority of trade area residents. Furthermore, residential population demand in the trade area is fortified by over 14,500 workers who can access downtown within a ten-minute drivetime. Approximately 50 percent of workers are concentrated in service sector employment, with elevated levels of employment in the manufacturing sector. Office workers, of which there are over 5,000 within a 10-minute drive of downtown, are known to contribute an estimated $175 per week in retail expenditure and could be a significant source of sales growth for existing retailers if effectively attracted to downtown. In total, this study estimates trade area workers generate $27 million in annual expenditure which could be captured by existing and future retailers.

Existing concentrations of retail within the trade area include several shopping centers located along Central Avenue and Indian Brook Drive, including Tri-City Plaza, Hannaford's Shopping Center, Shaw's Plaza Shopping Center/Dover Crossing, Indian Brook Commons and many stand-alone retailers such as Home Depot, Target and Walmart . These centers are conventionally suburban and offer a wide array of shopping and ample parking. The nearest regional shopping mall, The Mall at Fox Run, is located 9.2 miles from Downtown Dover in nearby Portsmouth and includes 603,000 sf of retail anchored by JC Penny, Macy's and Sears.

Figure 44. Specialty Businesses Located in Attractive Historic Structures

TRADE AREA DEMOGRAPHICS

The Downtown Dover primary trade area includes 23,300 people and is expected to grow to 23,700 by 2018, at an annual rate of 0.33 percent. Current 2013 households include 10,400 growing to 10,600 by 2018, at an annual rate of 0.42 percent. The primary trade area's 2013 average household income is $73,800 and is estimated to increase to $83,400 by 2018. Median household income in the trade area in 2013 is $55,700 and estimated to increase to $62,700 by 2018. Moreover, 36.1 percent of the households earn above $75,000 per year. The average household size of 2.20 persons in 2013 is expected to decrese marginally by 2016 to 2.19 persons; the 2013 median age is 35.6 years old.

Table 9. Demand for New Retail and Restaurants

Retail Category	2013			2018		
	Supportable Retail SF	Estimated Sales/SF	Estimated Sales	Supportable Retail SF	Estimated Sales/SF	Estimated Sales
Retailers						
Apparel Stores	5,418	$275	$1,489,917	5,418	$307	$1,661,258
Books & Music Stores	1,059	$255	$270,106	1,059	$284	$301,168
Department Store Merchandise	9,361	$305	$2,855,129	9,361	$340	$3,183,469
Electronics Stores	1,492	$330	$492,507	1,492	$368	$549,145
General Merchandise Stores	12,643	$288	$3,641,264	12,643	$321	$4,060,009
Hardware & Garden Supply Stores	3,331	$269	$897,255	3,331	$300	$1,000,439
Jewelry Stores	584	$350	$204,375	584	$390	$227,878
Miscellaneous Store Retailers	1,058	$250	$264,609	1,058	$279	$295,039
Office Supplies & Gift Stores	1,119	$225	$251,699	1,119	$251	$280,645
Pharmacy	2,816	$330	$929,375	2,816	$368	$1,036,253
Shoe Stores	1,287	$305	$392,648	1,287	$340	$437,803
Specialty Food & Drink Stores	2,686	$364	$979,897	2,686	$407	$1,092,585
Sporting Goods & Hobby Stores	1,523	$280	$426,377	1,523	$312	$475,410
Retailer Totals	**44,379**	**$294**	**$13,095,159**	**44,379**	**$328**	**$14,601,103**
Restaurants						
Bars & Pubs	2,932	$305	$894,149	2,932	$340	$996,976
Full-Service Restaurants	6,840	$350	$2,394,162	6,840	$390	$2,669,490
Limited-Service Eating Places	5,927	$315	$1,867,053	5,927	$351	$2,081,764
Special Food Services	4,074	$320	$1,303,636	4,074	$357	$1,453,554
Retaurant Totals	**19,773**	**$323**	**$6,459,000**	**19,773**	**$360**	**$7,201,785**
Retailer & Restaurant Totals	**64,152**	**$307**	**$19,554,159**	**64,152**	**$336**	**$21,802,887**

The Downtown Dover total trade area includes 45,400 people, and 18,900 households. The former is projected to grow at an annual rate of 0.33 percent, and the latter is projected to grow at an annual rate of 0.42 percent by 2018, when the total trade area's projected population will be 46,100 with 19,300 households. Average household income in 2013 for this trade area is $78,200, estimated to grow to $88,200 by 2018; median household income in 2013 is $60,000, estimated to grow to $69,400. Over 36 percent of the total trade area's population earned more than $75,000 annually in 2013. Average household size is 2.34 persons, projected to decrease slightly to 2.33 person by 2018; the 2013 median age is 38.0 years old.

Table 10. Key Demographic Characteristics of Dover's Primary and Total Trade Areas

DEMOGRAPHIC CHARACTERISTIC	PRIMARY TRADE AREA	TOTAL TRADE AREA
2013 Population	23,300	45,400
2013 Households	10,400	18,900
2018 Population	23,700	46,100
2013-2018 Annual Population Growth Rate	0.33%	0.33%
2013 Average Household Income	$73,800	$78,200
2018 Average Household Income	$83,400	$88,400
2013 Median Household Income	$55,700	$60,000
2018 Median Household Income	$62,700	$69,400
% Households w. incomes $75,000 or higher	36.1%	36.4%
% Bachelor's Degree	25.0%	23.5%
% Graduate or Professional Degree	13.8%	13.3%
Average Household Size	2.20	2.34
Median Age	35.6	38.0

ASSUMPTIONS

The projections of this study are based on the following assumptions:

- No other major retail centers are planned or proposed at this time and, as such, no other retail is assumed in our sales forecasts.
- No other major retail will be developed within the trade area of the subject site.
- The region's economy will stabilize at normal or above normal ranges of employment, inflation, retail demand and growth.
- The new retail development will be planned, designed, built, leased and managed as a walkable town center, to the best shopping industry center practices of The American Planning Association, Congress for the New Urbanism, International Council of Shopping Centers and The Urban Land Institute.

- Parking for the area is assumed adequate for the proposed uses, with easy access to the retailers in the development.
- Visibility of the shopping center or retail is assumed to meet industry standards, with signage as required to assure good visibility of the retailers.

Limits of Study

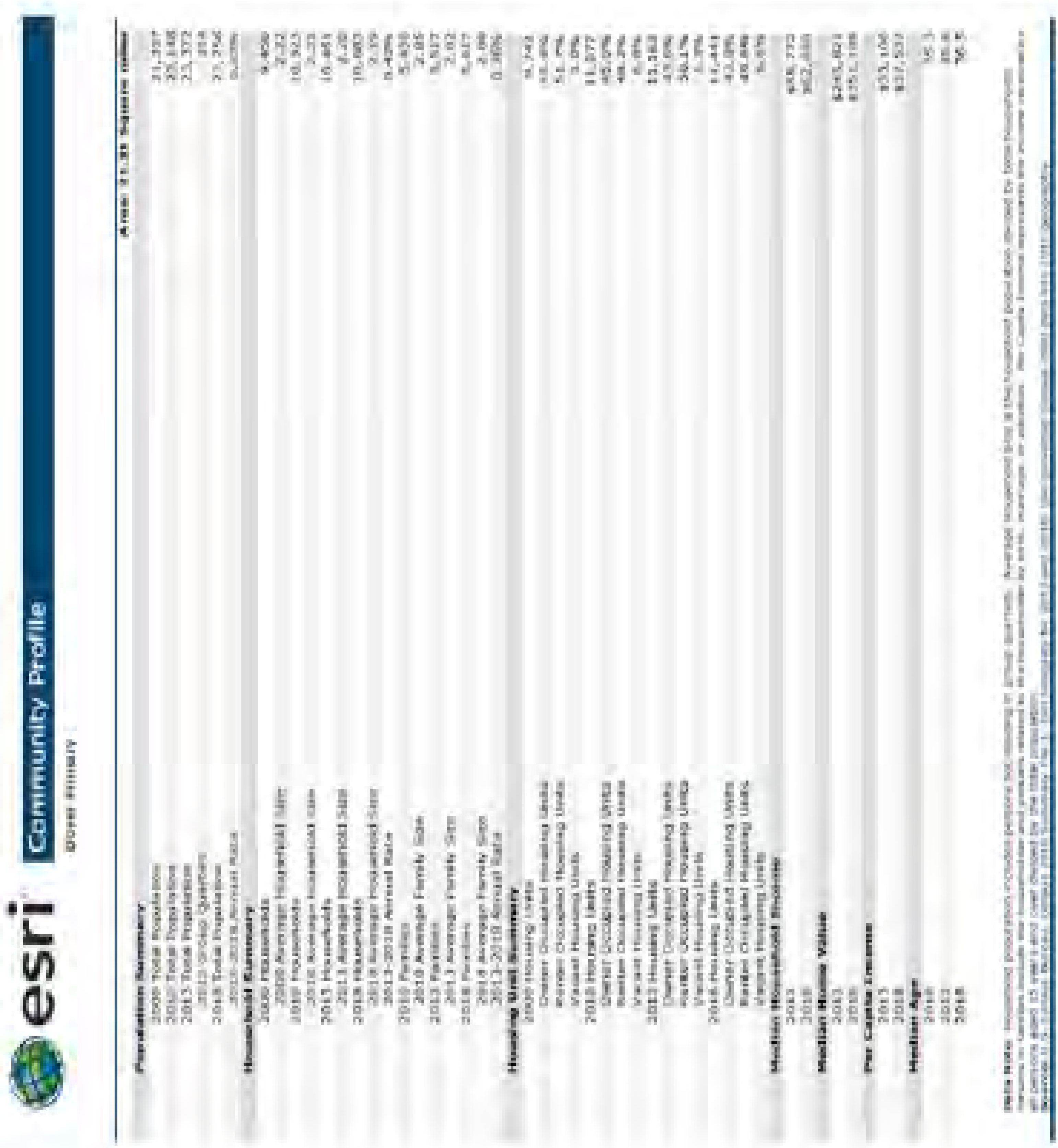
The findings of this study represent GPG's best estimates for the amounts and types of retail tenants that should be supportable in the Downtown Dover, New Hampshire trade area by 2018. Every reasonable effort has been made to ensure that the data contained in this study reflect the most accurate and timely information possible and are believed to be reliable. It should be noted that the findings of this study are based upon generally accepted market research and business standards. It is possible that the Downtown Dover study site's surrounding area could support lower or higher quantities of retailers and restaurants yielding lower or higher sales revenues than indicated by this study, depending on numerous factors including respective business practices and the management and design of the study area.

This study is based on estimates, assumptions, and other information developed by GPG as an independent third party research effort with general knowledge of the retail industry, and consultations with the client and its representatives. This report is based on information that was current as of February 10, 2014 and GPG has not undertaken any update of its research effort since such date.

This report may contain prospective financial information, estimates, or opinions that represent GPG's view of reasonable expectations at a particular time. Such information, estimates, or opinions are not offered as predictions or assurances that a particular level of income or profit will be achieved, that particular events will occur, or that a particular price will be offered or accepted. Actual results achieved during the period covered by our market analysis may vary from those described in our report, and the variations may be material. Therefore, no warranty or representation is made by GPG that any of the projected values or results contained in this study will be achieved.

This study should not be the sole basis for designing, financing, planning, and programming any business, real estate development, or public planning policy. This study is intended only for the use of the client and is void for other site locations, developers, or organizations.

Figure 45. Primary Trade Area Community Profile



esri **Community Profile**

Dover Primary

	Area: 21.31 Square miles
Population Summary	
2000 Total Population	21,337
2010 Total Population	25,148
2013 Total Population	23,372
2013 Group Quarters	214
2018 Total Population	23,756
2013-2018 Annual Rate	0.33%
Household Summary	
2000 Households	9,450
2000 Average Household Size	2.22
2010 Households	10,523
2010 Average Household Size	2.23
2013 Households	10,451
2013 Average Household Size	2.20
2018 Households	10,683
2018 Average Household Size	2.19
2013-2018 Annual Rate	0.42%
2010 Families	5,450
2010 Average Family Size	2.85
2013 Families	5,517
2013 Average Family Size	2.82
2018 Families	5,617
2018 Average Family Size	2.80
2013-2018 Annual Rate	0.36%
Housing Unit Summary	
2000 Housing Units	9,743
Owner Occupied Housing Units	45.4%
Renter Occupied Housing Units	51.7%
Vacant Housing Units	3.0%
2010 Housing Units	11,077
Owner Occupied Housing Units	45.0%
Renter Occupied Housing Units	48.2%
Vacant Housing Units	6.8%
2013 Housing Units	11,163
Owner Occupied Housing Units	43.6%
Renter Occupied Housing Units	50.1%
Vacant Housing Units	6.3%
2018 Housing Units	11,441
Owner Occupied Housing Units	43.8%
Renter Occupied Housing Units	48.8%
Vacant Housing Units	6.5%
Median Household Income	
2013	$58,772
2018	$62,880
Median Home Value	
2013	$245,821
2018	$251,109
Per Capita Income	
2013	$33,108
2018	$37,532
Median Age	
2010	36.3
2013	35.8
2018	36.5

Data Note: Household population includes persons not residing in group quarters. Average Household Size is the household population divided by total households. Persons in families include the householder and persons related to the householder by birth, marriage, or adoption. Per Capita Income represents the income received by all persons aged 15 years and over divided by the total population.

Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2013 and 2018. Esri converted Census 2000 data into 2010 geography.

esri

Community Profile

Dover Primary

	Area: 3.38 Square miles
2013 Households by Income	
Household Income Base	10,851
<$15,000	8.3%
$15,000 - $24,999	7.4%
$25,000 - $34,999	12.4%
$35,000 - $49,999	15.1%
$50,000 - $74,999	20.4%
$75,000 - $99,999	11.0%
$100,000 - $149,999	16.7%
$150,000 - $199,999	4.3%
$200,000+	4.2%
Average Household Income	$73,805
2018 Households by Income	
Household Income Base	10,883
<$15,000	8.3%
$15,000 - $24,999	6.0%
$25,000 - $34,999	8.8%
$35,000 - $49,999	13.0%
$50,000 - $74,999	18.8%
$75,000 - $99,999	11.0%
$100,000 - $149,999	19.3%
$150,000 - $199,999	7.7%
$200,000+	7.0%
Average Household Income	$83,476
2013 Owner Occupied Housing Units by Value	
Total	4,882
<$50,000	0.7%
$50,000 - $99,999	4.8%
$100,000 - $149,999	6.8%
$150,000 - $199,999	15.7%
$200,000 - $249,999	20.4%
$250,000 - $299,999	17.8%
$300,000 - $399,999	18.7%
$400,000 - $499,999	6.4%
$500,000 - $749,999	3.2%
$750,000 - $999,999	0.6%
$1,000,000 +	0.3%
Average Home Value	$273,592
2018 Owner Occupied Housing Units by Value	
Total	5,007
<$50,000	0.4%
$50,000 - $99,999	3.1%
$100,000 - $149,999	3.8%
$150,000 - $199,999	8.5%
$200,000 - $249,999	13.8%
$250,000 - $299,999	13.2%
$300,000 - $399,999	31.4%
$400,000 - $499,999	19.1%
$500,000 - $749,999	13.1%
$750,000 - $999,999	3.6%
$1,000,000 +	0.0%
Average Home Value	$372,469

Data Note: Income represents the preceding year, expressed in current dollars. Household income includes wage and salary earnings, interest dividends, net rents, pensions, SSI and welfare payments, child support, and alimony.
Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2013 and 2018. Esri converted Census 2000 data into 2010 geography.

Gibbs Planning Group

Community Profile

Dover Primary

	Area: 21.31 Square miles
2010 Population by Age	
Total	23,144
0 - 4	6.3%
5 - 9	5.5%
10 - 14	5.1%
15 - 24	15.4%
25 - 34	17.4%
35 - 44	13.7%
45 - 54	14.2%
55 - 64	10.1%
65 - 74	5.8%
75 - 84	4.3%
85 +	2.3%
18 +	79.9%
2013 Population by Age	
Total	23,371
0 - 4	6.0%
5 - 9	5.6%
10 - 14	5.2%
15 - 24	13.4%
25 - 34	18.9%
35 - 44	13.1%
45 - 54	13.9%
55 - 64	10.8%
65 - 74	6.5%
75 - 84	4.2%
85 +	2.3%
18 +	80.1%
2018 Population by Age	
Total	23,755
0 - 4	6.1%
5 - 9	5.5%
10 - 14	5.3%
15 - 24	12.2%
25 - 34	18.8%
35 - 44	13.3%
45 - 54	12.7%
55 - 64	11.9%
65 - 74	7.8%
75 - 84	4.3%
85 +	2.4%
18 +	80.1%
2010 Population by Sex	
Males	11,311
Females	11,833
2013 Population by Sex	
Males	11,446
Females	11,925
2018 Population by Sex	
Males	11,665
Females	12,091

Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2013 and 2018. Esri converted Census 2000 data into 2010 geography.

Gibbs Planning Group

Community Profile

Dover Primary

	Area: 21.31 Square miles
2010 Population by Race/Ethnicity	
Total	23,149
White Alone	90.8%
Black Alone	1.8%
American Indian Alone	0.2%
Asian Alone	4.2%
Pacific Islander Alone	0.0%
Some Other Race Alone	0.6%
Two or More Races	2.3%
Hispanic Origin	2.3%
Diversity Index	21.1
2013 Population by Race/Ethnicity	
Total	23,371
White Alone	90.5%
Black Alone	1.9%
American Indian Alone	0.2%
Asian Alone	4.2%
Pacific Islander Alone	0.1%
Some Other Race Alone	0.7%
Two or More Races	2.4%
Hispanic Origin	2.5%
Diversity Index	22.0
2018 Population by Race/Ethnicity	
Total	23,757
White Alone	89.5%
Black Alone	2.1%
American Indian Alone	0.3%
Asian Alone	4.6%
Pacific Islander Alone	0.1%
Some Other Race Alone	0.8%
Two or More Races	2.6%
Hispanic Origin	3.1%
Diversity Index	24.4
2010 Population by Relationship and Household Type	
Total	23,148
In Households	98.6%
In Family Households	69.1%
Householder	23.3%
Spouse	16.8%
Child	24.7%
Other relative	3.6%
Nonrelative	2.4%
In Nonfamily Households	29.5%
In Group Quarters	1.4%
Institutionalized Population	0.9%
Noninstitutionalized Population	0.5%

Data Note: Persons of Hispanic Origin may be of any race. The Diversity Index measures the probability that two people from the same area will be from different race/ethnic groups.
Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2013 and 2018. Esri converted Census 2000 data into 2010 geography.

Community Profile

Dover Primary

	Area: 21.31 Square miles
2013 Population 25+ by Educational Attainment	
Total	16,294
Less than 9th Grade	2.9%
9th - 12th Grade, No Diploma	6.7%
High School Graduate	23.6%
Some College, No Degree	18.9%
Associate Degree	10.1%
Bachelor's Degree	25.0%
Graduate/Professional Degree	13.8%
2013 Population 15+ by Marital Status	
Total	19,428
Never Married	38.8%
Married	44.2%
Widowed	5.5%
Divorced	11.4%
2013 Civilian Population 16+ in Labor Force	
Civilian Employed	94.3%
Civilian Unemployed	5.7%
2013 Employed Population 16+ by Industry	
Total	12,799
Agriculture/Mining	0.4%
Construction	4.5%
Manufacturing	11.0%
Wholesale Trade	3.1%
Retail Trade	10.4%
Transportation/Utilities	2.8%
Information	2.2%
Finance/Insurance/Real Estate	7.2%
Services	55.2%
Public Administration	3.1%
2013 Employed Population 16+ by Occupation	
Total	12,797
White Collar	65.6%
Management/Business/Financial	15.0%
Professional	28.0%
Sales	10.3%
Administrative Support	12.2%
Services	18.9%
Blue Collar	15.5%
Farming/Forestry/Fishing	0.1%
Construction/Extraction	4.0%
Installation/Maintenance/Repair	1.8%
Production	5.4%
Transportation/Material Moving	4.3%

Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2013 and 2018. Esri converted Census 2000 data into 2010 geography.

Community Profile

Dover Primary

	Area: 21.31 Square miles
2010 Households by Type	
Total	10,323
Household with 1 Person	33.3%
Households with 2+ People	66.7%
Family Households	52.6%
Husband-wife Families	37.9%
With Related Children	16.5%
Other Family (No Spouse Present)	14.7%
Other Family with Male Householder	3.9%
With Related Children	2.5%
Other Family with Female Householder	10.8%
With Related Children	7.6%
Nonfamily Households	14.1%
All Households with Children	26.9%
Multigenerational Households	1.6%
Unmarried Partner Households	10.3%
Male-female	9.3%
Same-sex	1.0%
2010 Households by Size	
Total	10,324
1 Person Household	33.3%
2 Person Household	34.7%
3 Person Household	15.4%
4 Person Household	11.5%
5 Person Household	3.8%
6 Person Household	1.1%
7 + Person Household	0.3%
2010 Households by Tenure and Mortgage Status	
Total	10,323
Owner Occupied	48.3%
Owned with a Mortgage/Loan	35.5%
Owned Free and Clear	12.8%
Renter Occupied	51.7%

Data Note: Households with children include any households with people under age 18, related or not. Multigenerational households are families with 3 or more parent-child relationships. Unmarried partner households are usually classified as nonfamily households unless there is another member of the household related to the householder. Multigenerational and unmarried partner households are reported only to the tract level. Esri estimated block group data, which is used to estimate polygons or non-standard geography.
Source: U.S. Census Bureau, Census 2010 Summary File 1. Esri forecasts for 2013 and 2018. Esri converted Census 2000 data into 2010 geography.

D APPENDIX: SUMMARY OF PUBLIC INPUT

PUBLIC WORKSHOP #1

The first public work shop was held on January 21, 2014 at 6pm in City Hall. The two hour workshop included a half hour PowerPoint Presentation followed by a one hour workshop session. While attendance was relatively low (approximately 5 people) due to a snow storm, relevant topics were discussed and valid input received from the individuals who were present. Three topics were reviewed in detail including: issues, patterns, and priorities. The comments that were recorded for each topic are listed below, and shown on a map of the study area in **"Figure 46. Issues and Priorities from Workshop No. 1"**.

Patterns

Vehicle

- Heavy trucking circulation is prominent from Maine (Portland Ave and Cochecho Street) heading west passing through downtown to Chestnut Street and Locust Streets in order to bypass tolls
- Truck maneuvering issues occur at intersection of Chestnut and Washington
- Truck turning movements southbound on Chestnut are difficult
- Tend to drive through downtown to get to other destinations, but then return to visit
- Busiest traffic occurs during afternoon from 12 to 8pm on Central Avenue
- Congestion is not prolonged but only between 3-4pm
- Orchard Street backs up to Third Street occasionally
- Some backups in the morning between 7:30 and 8:15, but limited
- Vehicles tend to stop for crossing pedestrians
- Vehicles travel fast on Washington Street at one way section at river crossing, makes for difficult/dangerous pedestrian crossing at Main/Water Street intersection

Pedestrian

- Pedestrian circulation from the northwest neighborhoods to train station
- Heavier pedestrian circulation from Central Ave to Washington Street to Children's Museum
- Concert series at Children's Museum creates pedestrian activity along Washington Street on a periodic basis during summer months
- The Cochecho Mill generates pedestrian traffic to and from the Mill

- People like to walk to Janetos
- Parking meter access during winter months can be difficult due to snow embankments
- Bicycle circulation tends to use the sidewalk on Central Ave. and also Chestnut Street to Washington Street heading west

Rail

- Freight trains can occasionally cause traffic problems (15-20 minute wait)

Parking

- Orchard Street parking lot fills up during the day
- The 3rd Street parking tends to fill up during the evening hours

Issues

- Signals in Upper Square tend to be confusing and cannot understand meaning; "No Turn on Steady Red Arrow" signal is not clear or effective
- The left turn from Chapel Street onto Central Avenue at 2nd Street is a hazard because drivers are looking north up Central Avenue and often do not notice pedestrians crossing Central Avenue just south of the intersection.
- Way-finding signage is a major issue (for parking and destinations)
- No apparent gateways or way-finding signage at:
    * Columbus Ave and Route 9
    * Spaulding and Exit 7
- Lighting is not sufficient, dim and creates an unsafe downtown atmosphere
- The downtown defined by district transitions areas at the railroad/Pierce Street north, the downtown core at mid Central Ave and Washington Street south to Hale Street and the less desirable district at Hale Street south
- Vehicles become disoriented trying to locate parking with no signage and one-way circulation pattern
- Miracle Mile is located to the north including: Shaws, Hannaford's and other retail shops attracting more vehicles to travel through downtown
- The preferred downtown area is perceived as just south of the River on Central Ave.
- Large trucks traveling through downtown from the east
- Fast traffic along the one way section of Washington Street near Brew pub at Mill building
- Liquor store on Chestnut creates a traffic problem with no turning lane
- The train station parking lot is undifferentiated and difficult for pedestrians to navigate

Priorities

- Fix Upper Square

- Traffic calming at Chestnut Street particularly at the train station
- Add more trees and landscaping
- Provide better lighting
- Clean up garbage
- Make waterfront a primary feature
- Improve Ladder Park and its identity
- Slow traffic at one way section along Washington Street
- Improve streetscape edge along large parking lot on Central Avenue at the Mill
- Dover lacks a prominent central area/space within downtown

Figure 46. Issues and Priorities from Workshop No. 1