CITY OF DOVER, NEW HAMPSHIRE MASTER PLAN

2016 Transportation Chapter

Moving Toward Tomorrow

TRANSPORTATION CHAPTER

Moving Toward Tomorrow

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Glossary

AASHTO	American Association of State Highway and Transportation Officials
ADA	American with Disabilities Act
C&J	C&J Bus Lines
CIP	Capital Improvement Plan
CMAQ	Congestion Mitigation and Air Quality
COAST	Cooperative Alliance for Seacoast Transportation
DTC	Dover Transportation Center
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global Positioning System
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System
MITIP	Multimodal Intelligent Transportation Infrastructure Plan
MPH	Miles Per Hour
NHDOT	New Hampshire Department of Transportation
NNEPRA	Northern New England Passenger Rail Authority
SLM	Shared Lane Markings
TAC	Transportation Advisory Commission
TAP	Transportation Alternative Program
UNH	University of New Hampshire

Executive Summary

This section summarizes the goals and objectives of the Transportation Chapter and outlines the tasks that form the implementation plan for the City to accomplish its vision.

When it comes to sustaining a vibrant and thriving community, a safe and efficient transportation system is essential. The same is true in the City of Dover, where the 2023 Vision depicts "an excellent and fully interconnected transportation system for pedestrians, bicyclists, motor vehicles and a public transportation system that is supportive of, and responsive to, new technology and continuous improvement."

By building on concepts from the Dover 2023 Vision plan—primarily, connectivity, traffic calming, and technology as the keys to a robust and healthy system—the 2016 Transportation Chapter Update identifies the path toward achieving this Vision. Recommendations within the Chapter also leverage progress made toward the action items included in the 2000 Transportation Chapter. Ultimately, the 2016 Transportation Chapter of the Master Plan identifies the activities needed to realize the City's transportation vision for the next 10 years.

About the Process
The 2016 Transportation Chapter Update was a collaborative effort, with input from City Staff, a volunteer Steering Committee, and the general public. As part of the process, feedback collected through workshops and online surveys was used to help prioritize recommended actions.

The process also entailed gathering data about the existing transportation system; analyzing the components individually, as well as in relation to one another, land use, and demographics; and developing a comprehensive set of transportation recommendations to further the City's Vision.

Overview of Recommendations
The recommendations presented in the implementation plan are organized by the categories derived from the Vision's transportation elements: Connectivity, Traffic Calming, and Technology. Performance measures are provided to assist the City with measuring progress and accountability for moving the plan forward effectively. The plan also identifies responsible parties and time periods for prioritization.

Objectives for the three key areas include:

- Connectivity
    - Build and maintain attractive infrastructure that accommodates pedestrians and connects neighborhoods.
    - Expand transit service and improve facilities to attract more users.
    - Provide a bicycle network that is integrated into the City's transportation system.
- Traffic Calming
    - Transform mobility through the City via Complete Streets and streetscape efforts to create an inviting and vibrant community for all modes of travel.
    - Determine street speed limits that are appropriate and consistent with the character of the existing environment; post accordingly.
    - Capitalize on opportunities to implement connectivity and traffic calming measures through on-going annual City projects and maintenance.
- Technology
    - Actively and continually build the components of a smart city.
    - Respond quickly and effectively in the event of unanticipated major traffic incidents.

Section 1: State of the City

Section 1

This section describes the progress made by the City of Dover toward accomplishing the goals of the 2000 Transportation Chapter; examines the current state of the City's transportation system; and outlines the vision for the next decade, which collectively form the baseline for this chapter update.

The City of Dover's 2000 Transportation Chapter establishes the community's goals for investing in and maintaining transportation infrastructure as a means of enhancing residents' quality of life, as well as the experience of visitors—all while preserving and maintaining local character and strategic advantages. As a result, residents, business owners, and visitors are fortunate to have access to a multimodal transportation system that provides a variety of options for mobility throughout the City. However, with the desire to do better, the visioning process completed in 2012 raises the bar and challenges Dover to improve connectivity throughout the community. Areas of focus include walkability, bicycling, access to public transit, and reclaiming the quality of travel on neighborhood streets through traffic calming and wayfinding signage. This chapter provides a 10-year plan of the steps to be taken by the City to reach those goals.

Introduction

In 2012, Dover embarked on a goal: developing a vision for the community as it approaches 2023, the 400th anniversary of its first settlement. The Dover 2023 Vision foresees "a dynamic community with an outstanding quality of life." This Vision seeks to create a safe and inviting environment for families, pedestrians, and bicyclists of all abilities; introduce traffic-calming measures that enhance the downtown experience, as well as protect neighborhoods; and enable interconnectedness through public transportation. At the same time, the Vision includes preserving the City's historic character and integrating sustainability whenever possible. These and other ideas set forth in the Vision statement are closely tied to the City's transportation plan. For this reason, this update to the Transportation Chapter of Dover's Master Plan focuses on the City's Vision and devises an implementation plan to realize these goals. The 2016 Transportation Chapter Update uses and builds upon the successful historical efforts that have connected Dover, both regionally and locally.

Recent years have brought transportation improvements to the City of Dover.

15 Years of Progress

Over the past 15 years, the City of Dover has worked under the guidance of the 2000 Transportation Master Plan to advance the establishment of a fully integrated, multimodal, citywide transportation system. The City is fortunate to have an extensive transportation system and network that connects the community within Dover and beyond. The launch of Amtrak's Downeaster in 2001, as well as the opening of the Dover Transportation Center (DTC) in 2001, enhanced the City's regional connectivity by opening the door for a new mass-transit opportunity, with rail service reaching from Brunswick, Maine to Boston, Massachusetts.

The DTC is an essential component to Dover's regional connectivity. It is conveniently located downtown, within walking distance of the core of the business district. In addition to the rail service provided here, the DTC serves as the multimodal hub for bus and taxi services. For instance, the Cooperative Alliance for Seacoast Transportation (COAST) and the University of New Hampshire's (UNH) Wildcat system provide scheduled bus service from the DTC to nearby communities, including—but not limited to—Portsmouth,

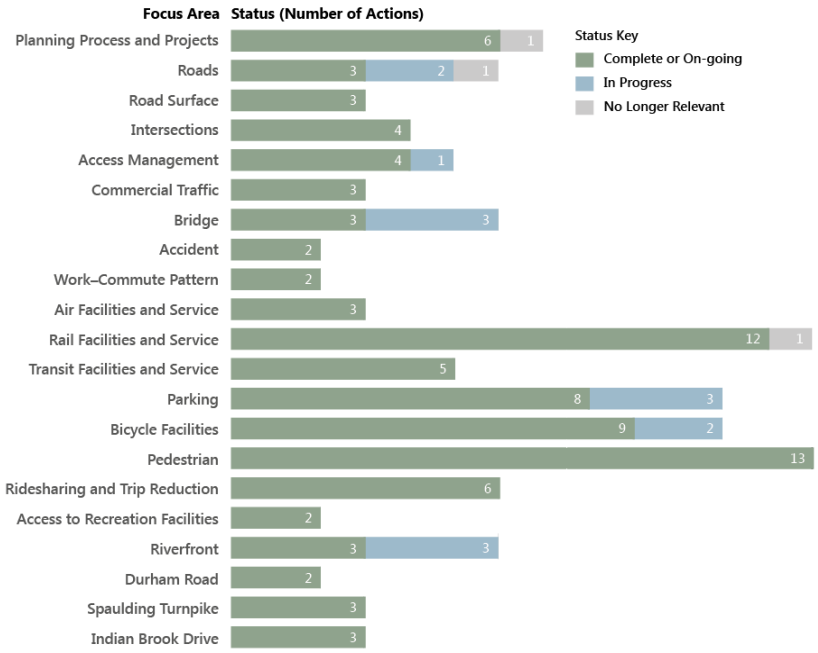
Newington, Durham, and Rochester. In 2008, C&J Bus Lines (C&J) introduced regional bus service at the Spaulding Turnpike's Exit 9 Park and Ride, located on Indian Brook Drive. In addition to the mass-transit options, regional connectivity for motor vehicles is conveniently provided by the Spaulding Turnpike, with five interchanges located throughout the City.

From the local perspective, Dover recognizes that the safe and efficient movement of people and goods is crucial to the vitality of the downtown and the quality of life for its residents. For this reason, the City proactively maintains a roadway network of arterial, collector, and local streets that traverse the community, as well as an extensive sidewalk network. Local transit service by COAST and Wildcat covers most of the more densely populated areas of the City. However, formalized and designated bike routes are limited in nature.

Looking back over the previous 15 years, the City of Dover has aggressively pursued the long-term transportation goals of the Transportation Chapter adopted in October 2000 and amended in March 2005. The approach of the 2000 Transportation Chapter was all-encompassing, including recommendations related to policies; road, intersection and bridge improvements; air, rail, and transit services; pedestrian, bicycle, and ridesharing options; and downtown and riverfront needs to support economic vitality. The end result was an extensive list of actions needed to address the existing and future transportation and multimodal mobility needs of the City's residents and businesses. Overall, the chapter included 17 transportation policies and 116 specific recommendations covering 21 different focus areas.

Through the diligence of City officials and staff, as well as the dedication of citizen volunteers, Dover has taken major steps toward accomplishing its goals for transportation. **Figure 1** provides a snapshot of the status and accomplishments of the 2000 Transportation Chapter. As shown, of the total 116 recommendations, approximately 85% have either been successfully completed or are part of an on-going action, 12% are actively in progress, and approximately 3% are no longer being pursued.

Figure 1. Status of the 2000 Transportation Chapter Recommendations



	NUMBER OF RECOMMENDATIONS	COMPLETE OR ON-GOING	IN PROGRESS	NO LONGER RELEVANT
Total	116	99	14	3
Percent	100%	85%	12%	3%

The successful execution and continued dedication to follow through on the recommendations of the 2000 Transportation Chapter have propelled the City to a point where recommendations and strategies in the 2016 chapter update can be more targeted and detailed in nature—and directed at specifically fulfilling the transportation elements of the Vision.

Moving Forward

As mentioned previously, there are a number of "on-going" and "in progress" recommendations from the 2000 Transportation Chapter (amended March 8, 2005); these will be carried forward under this 2016 update. In addition, as it continually looks to improve upon the existing local network, the City of Dover has completed several citywide transportation planning efforts over the past decade. These include the 2005 Downtown/Riverfront Redevelopment Traffic Circulation and Parking Plan and the 2007 Downtown Dover Parking Facility and Management Study. The recommendations from these studies were further examined and built upon with the completion of the 2015 Downtown Dover Pedestrian and Vehicular Access and Streetscape Study. Carrying forward and putting into action the recommendations from these efforts is also an important component of this 2016 update.

The Steering Committee reviewed all outstanding recommendations from the 2000 chapter and determined which ones should be carried forward as part of the 2016 update. Through the below tracked changes, **Table 1** provides updated language where necessary for the "on-going" and "in progress" items from the 2000 chapter based on the Steering Committee's review.

Table 1. 2000 Transportation Chapter Recommended Modifications

Source		Recommendation
Transportation Planning Process and Projects		
On-going	2.	Continue to be persistent in pursuing funds from sources such as Federal ~~Transportation Enhancement (TE)~~ Transportation Alternative Program (TAP) and Congestion Mitigation and Air Quality (CMAQ) improvement programs. Successful funding of these types of projects will continue to allow Dover to keep the mix of transportation improvements balanced, with due attention given to the lesser utilized modes of transportation such as bicycle and pedestrian. The City should prioritize its applications through the local TIP process and develop no more than three solid, well-supported applications in each funding cycle. It should also be prepared to advocate and present on behalf of those applications before the State selection committees.
On-going	7.	The City, through its Commissioners and staff, should remain actively engaged in the ~~Seacoast MPO~~ Strafford Regional Planning Commission and should clearly and actively advocate for the interests of Dover and the Seacoast region of the state.
Rail Facilities and Services Recommendations		
~~To Be Reviewed~~ Not Recommended	10.	Work with private operators and public entities to explore the potential of the return of increased service to the Lakes Region including the potential of the return of passenger, commuter or tourist rail in the corridors.
Parking Recommendations		

To Be Reviewed	4.	Consider supply strategies such as preferential parking for carpools. Measures such as these have no infrastructure cost associated yet can have a positive impact on the availability of parking through the more efficient use of existing supply. Areas for investigation should include Spaulding Turnpike Exits 7 and 8, and at the Dover Ice Arena. *(Steering Committee recommended that this recommendation be actively pursued with the status to be upgraded to On-going upon commencement.)*
Riverfront Recommendations		
~~On-going~~ In Progress (2016)	4.	Design a new street network on the riverfront property that is in scale with the historical street design if the city, focused on livable streetscapes and constructed with a first class sidewalk system.
~~On-going~~ In Progress (2019)	5.	Provide full accommodation in the design for the planned Dover Downtown trolley system including pullouts and integral bus shelter center.
~~On-going~~ In Progress (2019)	6.	Implement improvements to Henry Law Avenue, including full sidewalks and reconstruction of the street to accommodate all users in a speed-controlled setting using cost-effective, appropriate traffic calming techniques.
Rizzo Downtown Traffic and Circulation Study Addendum 1 - Short Term Capital Improvements		
~~To Be Reviewed~~ Not Recommended	7.	Portland Avenue / Chapel Street. Consolidating this intersection simplifies circulation and provides better sigh distance for Chapel Street right turns. *(Determined not to be feasible.)*
Rizzo Downtown Traffic and Circulation Study Addendum 1 - Long Term Riverfront		
~~To Be Reviewed~~	~~3.~~	~~Water Street Extension.~~ *(City discontinued street.)*
Central Avenue Corridor Study Addendum 2 – Other Short Term Improvement Actions		
To Be Reviewed	5.	~~Convert the Merry Street connection to Central Avenue to "in only" – no existing permitted.~~ City should pursue an easement from Hannaford's to eliminate Merry Street.

Dover's Vision and the Process

Dover decided to make the most recent visioning effort a separate, stand-alone process for the new master plan. This approach allowed for more emphasis on community involvement and offered residents more time and opportunity to focus their attention on what they want the city to become in the future. The Vision Chapter, completed in 2012, is available on the City's website with the other Master Plan chapters.

The Dover 2023 Vision seeks to integrate the City's historic character with goals for creating a safe and inviting environment.

The five-month process that was undertaken for this visioning effort intentionally placed no boundaries on what issues or ideas could be included in the discussion. The final result is a vision statement and vision elements that are far-reaching and, in many cases, go beyond policies and actions that municipal government can accomplish. In that regard, this vision is truly a community vision and not just a city government vision. It establishes goals and objectives that can be embraced by the entire community to make the City an even more desirable place in coming decades.

The Dover 2023 Vision

When Dover celebrates its 400th anniversary in 2023 it will be a dynamic community with an outstanding quality of life because it has achieved the following interconnected characteristics:

- Residents celebrate safe, family-friendly neighborhoods, a strong sense of community, and an excellent school system.
- The historic downtown is alive with a wide variety of retail, dining, entertainment, cultural opportunities, and a mix of housing choices that make it the vibrant focal point of the community.
- Municipal government and schools are run effectively and efficiently with full transparency, resulting in high-quality services, well-maintained buildings and infrastructure, a great recreation system, and a competitive property tax burden.
- The community is fully served by public transportation and is very accessible for walking, bicycling, and persons with disabilities.
- Vehicular traffic volumes and speeds are well managed.
- Dover attracts and retains stable, well-paying employers because it is business friendly and has a high quality of life.
- Rural character is preserved, and well-designed development is encouraged in and around the downtown core and waterfront.
- Enhanced environmental quality and sustainability are actively pursued and inherent in all the city's activities.

Ideals set forth in the Dover 2023 Vision, as seen above, have been and will be used in the design of specific implementation actions that will guide future transportation changes toward Dover's chosen vision.

The goal of the Transportation Chapter is to present a set of recommendations that are true to the theme and elements defined by the community with regard to mobility in the City, while promoting and enhancing the quality of life for its residents. The following sub sections present the transportation theme and specific elements defined by the vision. They also describe the process undertaken to develop the Transportation Chapter, including the role and activities of the steering committee, as well as the efforts to solicit community input.

Transportation Theme and Elements

The Vision Chapter presents a transportation theme that states: *Dover has an excellent and fully interconnected transportation system for pedestrians, bicyclists, motor vehicles and a public transportation system that is supportive of, and responsive to, new technology and continuous improvement.*

This theme is further articulated and defined by the transportation elements presented below. These elements were ranked by priority through the visioning process, with the first being the most important. They are:

1. A walkable community complemented by citywide pedestrian, bicycle, and wheelchair-accessible features
2. A public transit system that services the entire community
3. Traffic-calming measures to manage speed and "pass through" traffic in the downtown and neighborhoods
4. Physical and directional signage improvements designed to facilitate legal, safe traffic flow for vehicles and pedestrians throughout the City

The Transportation Chapter of the Master Plan is intended to identify the transportation actions needed for the next 10 years to realize the City's transportation vision. Therefore, the transportation theme and elements are the foundation from which the Transportation Chapter recommendations were derived.

Steering Committee and Community Input

The members of the Steering Committee for the Transportation Chapter were selected with the goal of assembling a group of citizen volunteers with diverse backgrounds and interests who could assist in shaping a set of well-rounded recommendations for the City. The committee members include a range of age demographics, recent arrivals to life-long residents of the community, avid to recreational bicyclists, and users of the public transit system. Some members have been engaged in volunteer services in the City for many years, while for others, this was their first time for public service. The different perspectives of these individuals promoted the development of a balanced set of recommendations.

Steering Committee Members

- Daniel Toland, Citizen Volunteer and Committee Chair
- Dana Lynch, Citizen Volunteer and Committee Vice Chair
- Lee Skinner, Planning Board and Minute Taker
- Moe Olivier, Transportation Advisory Committee
- Eric Swanson, Citizen Volunteer
- Matt Hanson, Citizen Volunteer
- Jon Niehof, Citizen Volunteer

The role of the Steering Committee is to act as the voice of the community, encourage public participation in the process, provide guidance and serve as a sounding board to the consulting team, review and refine materials prepared throughout the process, and support and promote the process and the final recommendations. Over the course of the 12-month process, the Steering Committee was called upon during the various phases of the chapter development—including data collection, analysis, evaluation of strategies, and report preparation—as seen in **Figure 2**.

The assistance of the Steering Committee was supplemented with public workshops and online surveys. Two public workshops were held to solicit community input during the chapter development process. The first workshop was held on October 22, 2015 and focused on sharing the results of Task 1: Data Collection with residents and local business owners. Work stations were set up for Traffic Congestion/Crash Locations, Transit/Bike/Pedestrian Connectivity, and Neighborhoods/Traffic Calming/Land Use Patterns. Facilitators were present at each work station to answer questions regarding the data collection efforts and encouraged the public to provide input with regard to their concerns, issues, and desires related to Dover's future transportation system. Facilitators then provided a summary of the major themes heard at each station at the end of the evening.

Figure 2. Transportation Chapter Development Process

This workshop was followed by an online survey that sought public input on the transportation needs and priorities for the future. Participants were asked to rank the importance of the various modes of transportation offered in the City (such as vehicular, pedestrian, bicycle, bus, and train), and to prioritize specific areas of concern. The survey also provided opportunity for comments. The survey results included responses from 139 participants, as well as more than 350 additional individual comments.

The second public workshop was held on May 23, 2016. This two-part workshop was incorporated in the May Transportation Advisory Commission (TAC) meeting. The first part of the workshop consisted of a formal presentation to the TAC and the public regarding the preliminary recommendations to be included in the Transportation Chapter. The second part of the workshop featured an open-house format that immediately followed the TAC meeting. TAC members and the public were invited to view plan recommendations presented on large-scale maps of the City; attendees were encouraged to ask questions and provide input. An example of a sample survey question is shown below.

How important is vehicular mobility? (ability to travel safely and efficiently by automobile)

Answer	0% 100%	Number of Response(s)	Response Ratio
Extremely important		86	61.8 %
Very important		37	26.6 %
Average importance		12	8.6 %
Somewhat important		3	2.1 %
Not important		1	<1 %
No Response(s)		0	0.0 %
	Totals	139	100%

A second online survey was launched at the end of May and remained open for two weeks. This survey outlined the preliminary recommendations for the Transportation Chapter, as presented to TAC, and sought input on the level of public support for the various components. Similar to the first online survey, an opportunity for additional commentary was also provided. The survey received approximately 41 participants, as well as 16 additional individual comments.

Existing Components of the System

The first step in developing the 2016 Transportation Chapter was establishing a thorough understanding of Dover's existing transportation system. This understanding includes both the physical infrastructure and the characteristics and trends of the existing components of the system. Reviews were conducted of all the City's available databases, as well as those relevant from the Strafford Regional Planning Commission. The City's geographic information system (GIS) is very extensive and played a significant role in establishing the existing conditions—as did traffic volume, speed, and crash data obtained from the Dover Police Department. The following highlights the most important components of the system as they relate to the Vision Chapter's transportation element.

Dover Community Trail

The Dover Community Trail is a multi-use trail that follows the former railroad grade through central portions of the City. The trail consists of an in-town urban segment that extends from the DTC to Fisher Street. The rural section of the trail connects Watson Road (trailhead with parking) to Beckwith Park, located off Sixth Street. In 2015, the City received a Transportation Alternative Program (TAP) grant from the New Hampshire Department of Transportation (NHDOT) to construct the final segments of the trail. This funding will be used to improve the south end of the trail by providing connection from Fisher Street to Central Avenue and between the DTC and Beckwith Park. Final construction is planned for 2017, and once complete, the Community Trail will provide Dover residents with approximately four miles of walking/biking trails, as well as access to adjacent open lands with additional recreational activities.

Downtown Transportation Center and Exit 9 Park and Ride

The DTC, located just west of the downtown area at 33 Chestnut Street, opened in 2001 to support the Amtrak Downeaster passenger rail service. In addition to providing access to passenger rail and the community trail, the center is serviced by COAST and Wildcat Transit bus services. At the DTC, a large parking lot with metered parking is available to passengers. The Exit 9 Park & Ride/Bus Terminal—located at 23 Indian Brook Drive, just off the Spaulding Turnpike—is operated by C&J. The bus terminal was constructed in 2008 and provides service to/from Dover to Boston and New York City.

Mass Transit System

COAST provides public transportation within the Seacoast region of New Hampshire. Headquartered in Dover, COAST operates four bus routes within the City of Dover. Currently, the fare to ride the bus is $1.50 one-way for regional and local routes, and $3.25 one-way for express routes (Clipper Connection). COAST is subsidized by the Federal Transit Administration (FTA), and it receives financial contributions from the cities and towns it services. COAST provides weekday and Saturday service on the following routes:

- Route 1: Dover/Somersworth/Berwick
- Route 2: Rochester/Somersworth (108)/Dover/Newington/Portsmouth
- Dover FastTrans (Route 33): Provides service between Dover's Downtown area and the Strafford County, including the Exit 9 Park and Ride
- Clipper Connection (Route 101): Commuter express route operated Monday through Friday between Dover and the Portsmouth Naval Shipyard

In total there are 112 bus stops (inbound/outbound) located along these four routes in Dover, several of which are timed stops with covered shelters. All COAST buses provide at least two bicycle racks, with some newer buses equipped with three-bike capacity racks. Rackspace is available on a first-served basis.

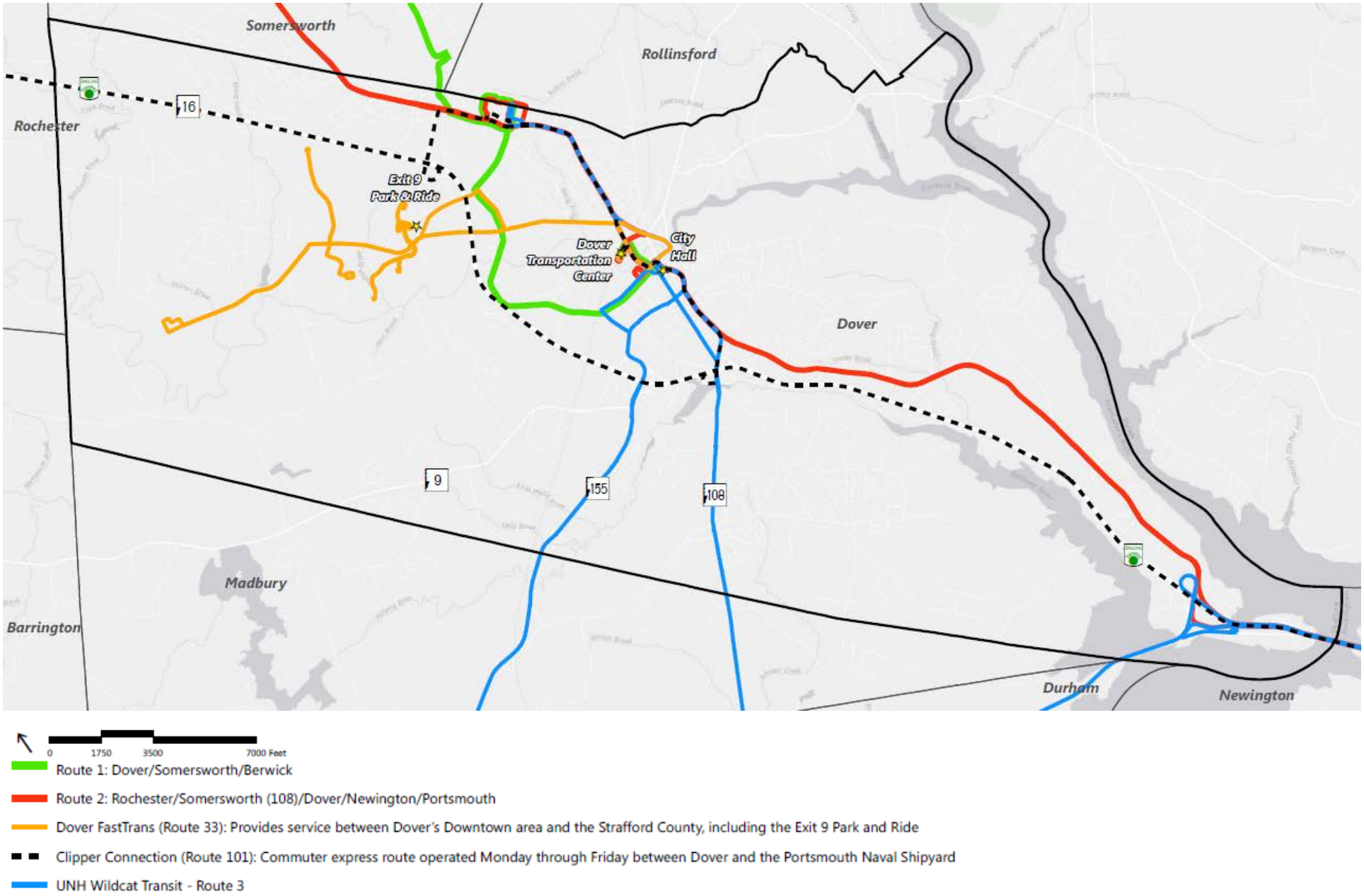
In addition to COAST, UNH's Wildcat Transit System operates within the City. Although it primarily serves UNH's students, faculty, and staff, residents of Dover are welcome aboard the Wildcat Transit System for a fare of $1.50 one-way. UNH's Wildcat Transit and COAST are not affiliated with one another, but they coordinate their services, and Wildcat honors COAST monthly passes and single-ride tickets. Within the City of Dover, Wildcat operates along Route 3, providing 48 stops (inbound/outbound); it also services Route 108 (UNH/Durham to Dover) and Route 155 (Dover to UNH/Durham). As with COAST, Wildcat Transit provides bike racks on all their buses, with rack space available on a first-come-first-served basis. **Figure 3**, on the following page, shows COAST and Wildcat Bus routes within the City.

Key components of Dover's transportation system currently include the Dover Community Trail, UNH Wildcat System, and 112 COAST bus stops throughout the City.

Dover residents also have access to regional transit services through C&J's bus service. C&J operates the Exit 9 Park and Ride on Indian Brook Drive, which provides an alternative transportation option for traveling to Boston and New York City. C&J provides scheduled stops in Portsmouth; Newburyport, MA; Boston's Logan International Airport and South Station; and New York City.

Dover's public transportation system also includes passenger rail service. The Amtrak Downeaster, managed by the Northern New England Passenger Rail Authority (NNEPRA), provides a 145-mile rail corridor from Brunswick, ME to North Station in Boston, MA. The Amtrak Downeaster provides 10 rail platforms, one of which is located in Dover at the DTC, with five daily round trips.

Figure 3. COAST and Wildcat Bus Routes



Pedestrian Infrastructure and Easement Mapping

The City GIS system includes mapping for sidewalks, crosswalks, and easement locations as seen in **Figure 4** on the following page. The City has compiled the GIS mapping for these features based on as-built subdivision plans, as well as planimetric mapping based on aerial photographs. The mapping does not contain any descriptive attribute information, but it provides a general sense of whether or not a feature is present within a given area. The GIS mapping for sidewalk locations was verified in the field for areas located within a 10-minute walk to public transportation (see **Section 2**). These features were used in the analysis and evaluation of strategies discussed in **Section 2**.

There are limitations in working with the data. For example, the sidewalk mapping contains the front and back of curb in some locations, but only the approximate centerline in other locations. It is not possible to generate an accurate linear measurement of sidewalks throughout the City. However, the mapping provides the ability to spatially evaluate sidewalk connectivity within the City. Based on the mapping, sidewalk connectivity is greatest within the central core of the City, specifically from the Spaulding Turnpike east to Central Avenue. West of the Spaulding Turnpike, the land use pattern becomes more rural, with subdivisions spread across the landscape. There are a few corridors where the sidewalk extends west of the Spaulding Turnpike. These areas include Durham Road (Route 108), Sixth Street, and Knox Marsh Road (Route 155).

Crash Record Inventory

The NHDOT maintains a database of all reported crashes where property damage is greater than $1,000. The crash database is based on crash records submitted by the New Hampshire State Police and local municipal police departments. This information was reviewed as part of the update to the Transportation Chapter of the Master Plan. For the years 2009 through 2013 (representing the most up-to-date data available at the time of the analysis), 1,914 crashes were reported in the City of Dover (this does not include the Spaulding Turnpike). Of this number, 1,023 of the crashes were geolocated and mapped by NHDOT. Some crash reports do not include enough information to geolocate the crash on the transportation network.

2009–2013 Crash Data Summary

- 1,914 Total Crashes
- 43 Bike- or Pedestrian-Related Crashes
- Crash Severity:
  - 6 Fatalities
  - 25 Incapacitating Injuries
  - 335 Non-Incapacitating Injuries
  - 86 Possible Injuries

A detailed crash analysis was not conducted as part of the Master Plan update process. However, the crash data was used in the traffic-calming assessment, where it was used to identify crash locations where speed was reported as a contributing factor. The data was used to produce a heat map identifying high-crash clusters within the City. As shown in **Figure 5**, two areas were identified as having a high intensity of crashes: Weeks Crossing and the heart of the downtown at Washington Street, Central Avenue, Main Street, and Chestnut Street. The latter substantially represents the area covered by the City's 2015 Downtown Dover Pedestrian and Vehicular Access and Streetscape Study.

Figure 4. Sidewalk, Crosswalk, and Easement Locations

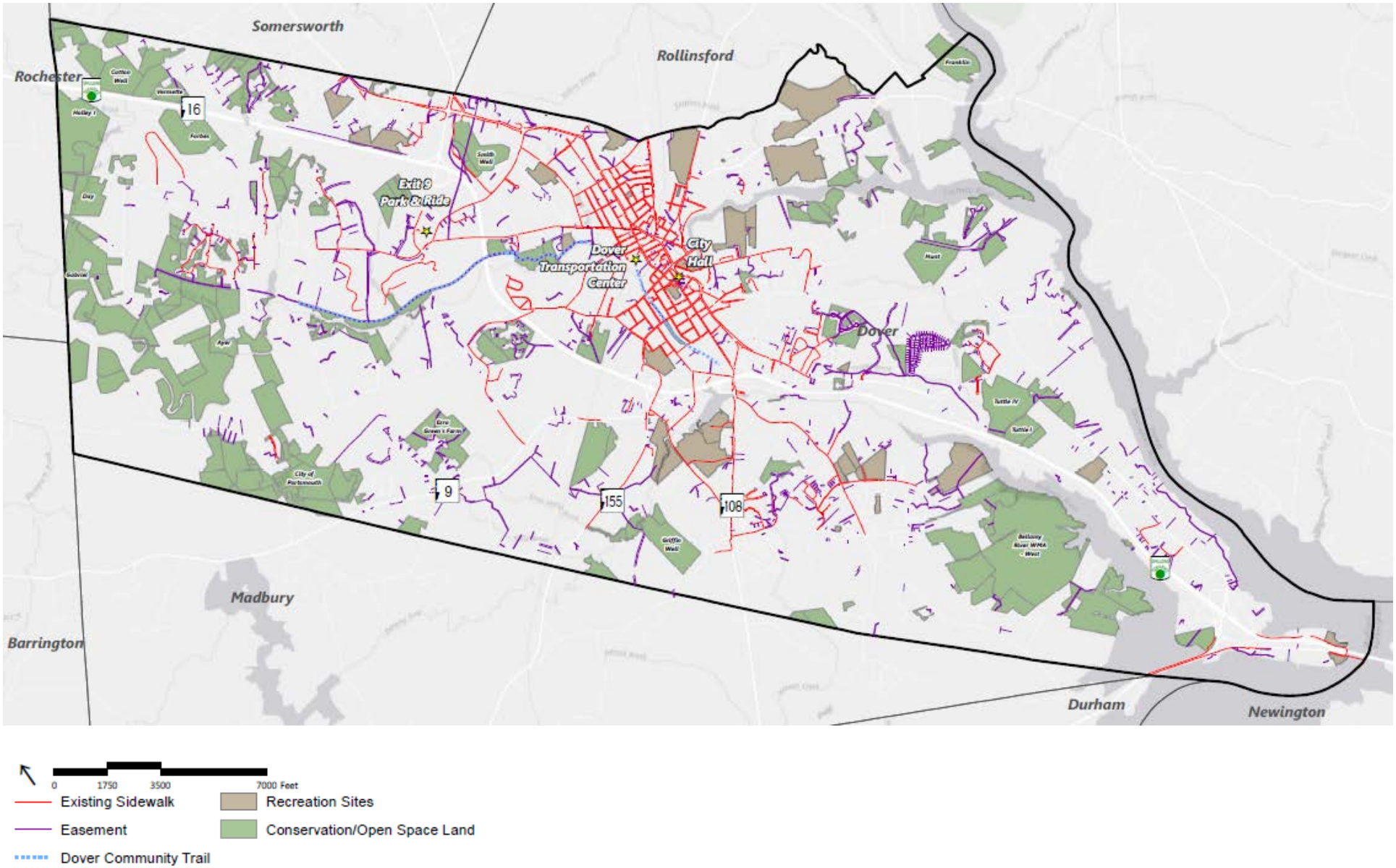
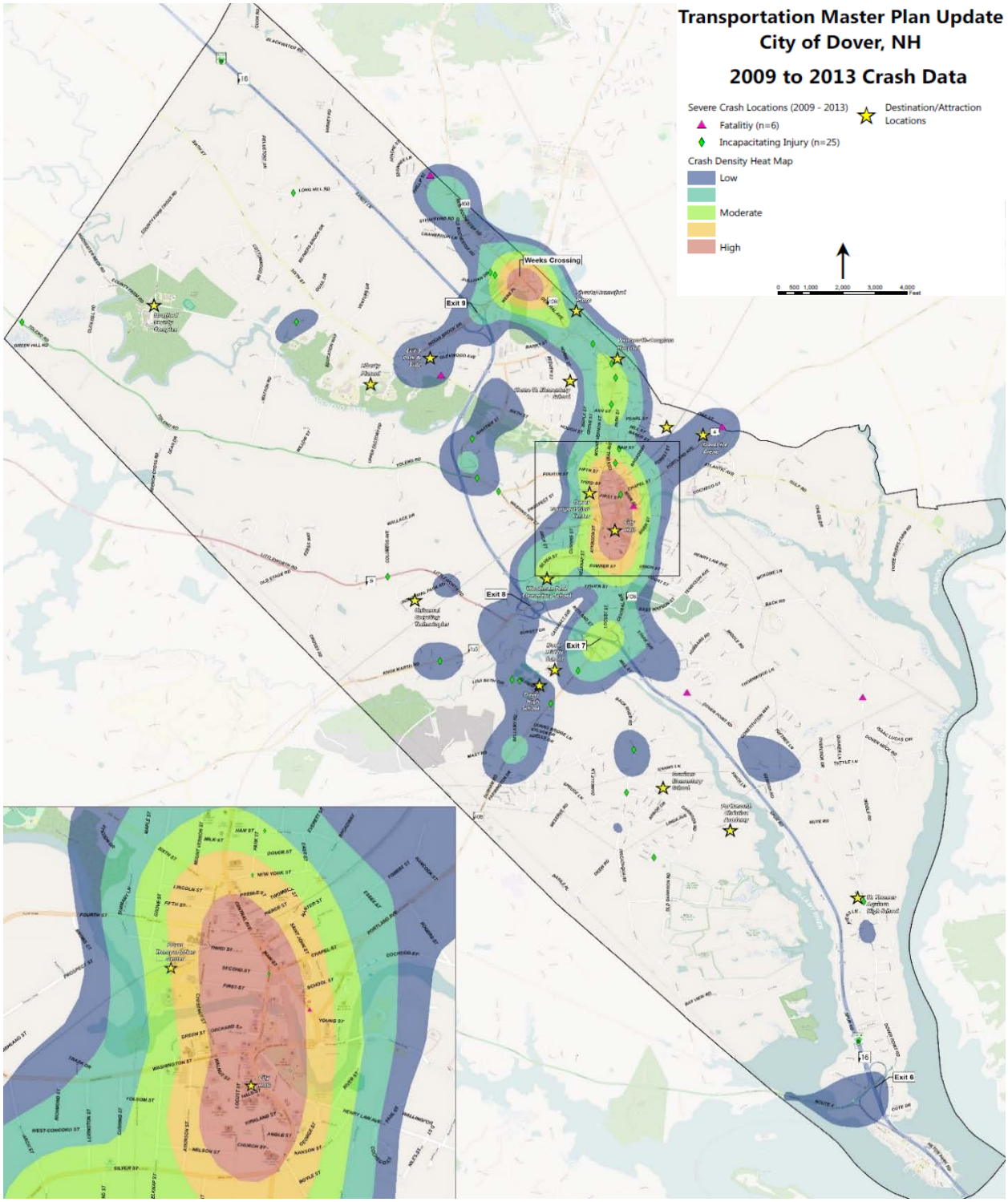


Figure 5. High-Crash Clusters in Dover



Travel Speeds

The Dover Police Department conducts vehicle speed measurements in response to speed-related concerns raised by the public. Between 2010 and 2015, 26 locations throughout the City have been measured. As part of the Master Plan update process, speed measurements were recorded at six additional locations for a total of 32. The additional locations were selected based on crash data, local knowledge, and recommendation by the Steering Committee. **Table 2** presents the posted speed limit, as well as the 85th percentile and mean speeds, in miles per hour (mph). The 85th percentile speed represents the speed at or below which 85% of the vehicles travel, which—according to Federal Highway Administration's (FHWA) *Manual on Uniform Traffic Control*—is a reasonable indicator for evaluating roadway posted speeds. Analysis revealed that the 85th percentile speed was 10 mph or greater than the posted speed limit at eight of the 32 speed measurement locations. The largest deviations from the posted speed limit were recorded on 6th Street, French Cross Road, Long Hill Road, and County Farm Cross Road.

Table 2. Dover Speed Measurements

ID	Location	Posted Speed Limit (mph)	85th Percentile (mph)	Mean Speed (mph)	Average Daily Traffic (ADT)
1	48 Varney Rd.	35	39	34	750
2	89 County Farm Cross Rd.	30	**41**	36	1,350
3	91 Long Hill Rd.	30	**41**	36	1,550
4	36 Wildewood Ln.	**NP***	29	22	240
5	6th St. between Cherrywood & Reyners Brk Dr.	30	**43**	38	4,550
6	County Farm Rd. east of Erik Dr.	35	**45**	40	2,900
7	72 Glenwood Ave.	30	**40**	34	3,000
8	7-9 Wedgewood Rd.	**NP***	21	14	70
9	12 Whittier St.	30	**39**	34	3,400
10	37 Oak St.	30	**35**	31	8,650
11	41-47 Watson Rd.	35	**41**	37	3,900
12	Tolend Rd. between Watson Rd & Dean Dr.	30	**38**	35	4,750
13	French Cross Rd. 100' south of #62	30	**42**	37	3,650
14	Atlantic Ave. 100' east of Magnolia Dr.	30	**39**	33	1,950
15	Arch St. 20' north of W.Concord St.	30	**38**	32	6,500
16	28 Lexington St.	25	26	20	1,000
17	36-38 Cushing St.	25	**30**	25	2,800
18	37 Belknap St.	**NP***	30	24	1,150
19	43 Atkinson St.	**NP***	32	25	800
20	34 Fisher St.	**NP***	29	25	600
21	10-12 Trakey Rd.	25	25	19	1,000
22	39 Middle Rd.	30	**40**	34	1,900
23	28 Spruce Ln.	30	**39**	36	3,000
24	Fourth St east of Grove St.	30	29	24	2,200
25	38 Grove St.	**NP***	26	22	1,400

26	Stark Ave. North of Renaud St.	30	**39**	36	13,700
27	Horne St. south of School	30	**35**	31	2,150
28	Cocheco St. east of Rogers St.	30	**37**	30	800
29	Hawthorn Rd. east of Stark Ave.	**NP***	31	24	400
30	Piscataqua Rd. north of Hidden Valley Dr.	30	**40**	37	4,000
31	Columbus Ave. north of Lucy Ln.	35	**40**	36	3,150
32	Glenwood Ave. west of Horne St.	30	**38**	34	6,500

***NP**	Non-posted. The presumed speed limit on a non-posted road is 30 mph.
XX	85th percentile speed is 5–9 mph greater than the posted speed limit.
XX	85th percentile speed is 10 mph or greater than the posted speed limit.

Section 2. Analysis Approach and Evaluation of Strategies

Section 2

This section describes the existing conditions data and how it was evaluated in concert with the Vision transportation elements to establish recommendations and strategies that target and promote a successful implementation plan to reach the City's vision.

An Integrated and Holistic Approach

Figure 6 shows the data driven process used to generate the recommendations in this chapter, which focused directly on the transportation theme and elements from the Vision Chapter.

In Step 1, the existing conditions data for the City's transportation system – including roadways, sidewalks, bike routes, and transit routes – were inventoried to establish a full understanding of each component and to identify gaps in the City's network. While the individual elements of the system all play an important role, it is the integration and balance of those elements that create the best plans.

For this reason, Step 2 went beyond examining the individual components. Synthesizing the data involved layering the individual components so that multimodal connectivity between them could be evaluated. Meanwhile, land use information and citywide demographics, such as population density, age, and income, were similarly layered into the analysis so that need and value to the community could also be considered. This holistic and comprehensive approach grants equal weight and voice to all users of the system, as well as all modes of travel. In this way, the greatest benefits to the community can be achieved.

Finally, the evaluation of strategic alternatives in Step 3 involved applying the synthesized data to the transportation elements from the Vision statement to create a detailed list of recommendations—found in **Section 3**—that are specifically targeted at promoting the future transportation environment sought by Dover.

Figure 6. Approach to Transportation Chapter Update

Synthesizing the Data and Demographics

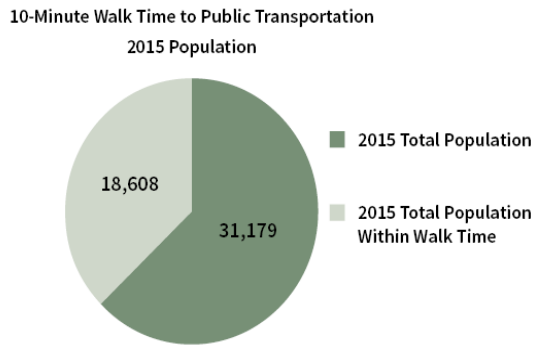
The City's GIS database, as well as GIS data from State and Federal agencies, was used to evaluate the following components of the Transportation Vision:

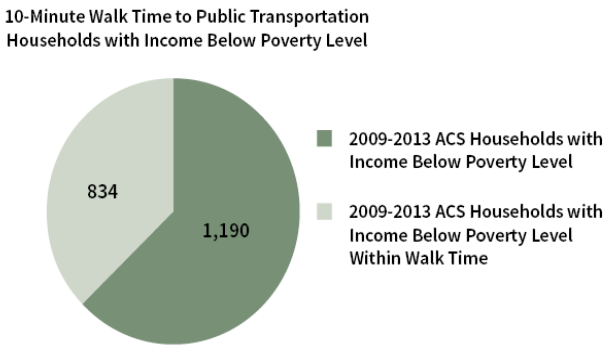
- A walkable community complemented by citywide pedestrian, bicycle, and wheelchair accessible features
- A public transit system that serves the entire community

To get started, an investigation into the walk times to public transportation was performed for all the active bus stops for routes currently in service by COAST or UNH Wildcat Transit, which includes the Exit 9 Park and Ride and the DTC. The analysis included a 10-minute walk to public transportation, as well as a 15-minute walk to public transportation. The Steering Committee chose to move forward with a detailed demographic analysis using the 10-minute walk to public transportation. The 10-minute walk (which represents a walking distance of approximately 0.5 miles) was favored over the 15-minute walk due to sometimes-harsh winter conditions.

The output of the walk-time analysis was then used to conduct a spatial demographic analysis, where various demographic datasets were overlaid with the 10-minute walk to public transportation, as seen in the example provided in **Figure 7**.

Figure 7. Sample Results of 10-Minute Walk-Time Analysis





The following demographic characteristics were included in the analysis:

- Existing land use patterns[1]
- Zoning[2]
- Poverty[3]
  - Households with income below poverty level
  - Total households at/above the poverty level
- Population[4]
  - Senior citizens (age 65+)
  - Minority population
- Housing units[5]
- Employment[6]–
  - Total businesses
  - Total employees

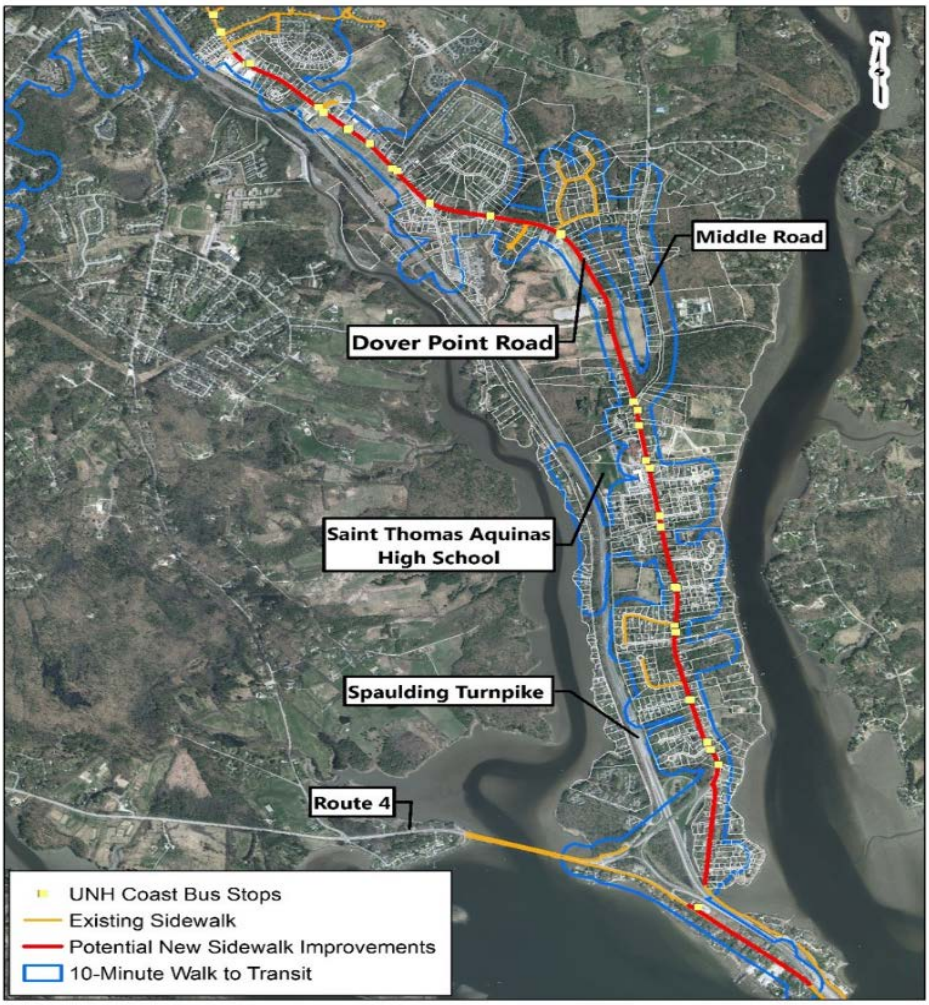
[1] Based on tax parcel assessment records.
[2] Based on information from the City of Dover.
[3] Based on US Census Bureau's 2009-2013 American Community Survey.
[4] Based on 2015 data from Environmental Systems Research Institute (Esri).
[5] Based on 2015 data from Esri.
[6] Based on 2015 data from Esri and InfoGroup.

In addition to the demographic analysis, a sidewalk evaluation was conducted to assess the sidewalk connectivity within the 10-minute walk to public transportation. The evaluation was conducted by overlaying the City's GIS sidewalk layer within the walk area. Prior to completing the analysis, the City's existing sidewalk layer was verified and updated based on a windshield survey of the roads within the 10-minute walk to public transportation. The overlay analysis identified gaps in the sidewalk network within the 10-minute walk to public transportation, which were then prioritized based on the results of the demographic analysis (density and population diversity). **Figure 8**, for example, identifies missing sidewalk within the 10-minute walk to transit along Dover Point Road.

Field reconnaissance and observations helped identify sidewalk gaps.

In addition to the sidewalk evaluation, the Steering Committee asked for recommendations on identifying neighborhood connections, as well as residential areas that were not connected by sidewalk, but were in close proximity to one another. A review of the City's easement database (GIS mapping) identified a number of locations where there are some form of easement in place (to be further researched in more detail by City Staff). These may allow for the creation of non-vehicular, pedestrian, and bicycle pathways between neighborhoods.

Figure 8. Sample Recommendations Resulting from Sidewalk



To assess bicycle use within the City, utilization data from a October 1, 2013 to September 30, 2014 obtained from Strava Metro[7] was evaluated. The metrics reviewed and evaluated included:

- Count of unique cyclists on a segment of street by direction
- Count of bike trips (regardless of unique riders) on a segment of street by direction
- Total number of unique cyclists on a segment of street
- Total number of bike trips on a segment of street regardless of the direction of travel
- Recreational trips vs. commuter trips

Bicycle Connectivity Analysis

Traffic Calming Approach

Locations for the implementation of traffic calming measures were identified based on input from the public, a review of the data sources, and field reconnaissance. While the implementation of appropriate traffic-calming measures should be considered anytime a change is being made to the transportation system or routine maintenance is being performed, a citywide effort is not practical due to the lack of resources and the cost of modifying infrastructure and installing improvements. Public input from the Steering Committee, the first public workshop, and the first online transportation survey were used to develop an initial list of candidate areas to be considered. The crash data, speed data (if available), and the City's Capital Improvement Plan (CIP) were then reviewed. Finally, field reconnaissance and observations were then performed to hone in on the most sensitive locations. This update to the Transportation Chapter recommends priority areas to be studied in detail to determine the appropriate measures to be installed and techniques to be applied in each neighborhood.

Resulting Strategies

This strategic evaluation of transportation improvement alternatives resulted in a number of detailed and specific recommendations that will assist Dover in building their 2023 transportation vision. These recommendations support the framework of the implementation plan outlined in **Section 3**. Recommendations derived from the strategic evaluation of alternatives were classified under the following categories:

- **Connectivity**
  - Pedestrian
  - Bicycle
  - Public Transit
- **Traffic Calming**
  - Downtown Dover Pedestrian and Vehicular Access and Streetscape Study
  - Access Management
  - Traffic
  - Streetscape and Reconstruction
  - Neighborhood Speed

[7] Strava Metro is a private company that collects, summarizes, and distributes bicycle data. The source of such information is from the Strava App, a free bicycle app that collects and stores a user's cycling records. The Strava Metro data was purchased by the NHDOT as part of a statewide effort to support bicycle and pedestrian improvements. The information available for use in this project was collected from all of the uploaded cycling data in New Hampshire between October 1, 2013 and September 30, 2014.

- Neighborhood Street Typical Section
- Wayfinding and Signage

- **Technology**
  - Smart City
  - Incident Planning
  - Bus Prioritization

Connectivity

One of the underlying themes of the Vision's transportation elements is connectivity, the components of which can be found in **Figure 9**. Connectivity gives residents and visitors quality options beyond the motor vehicle for mobility throughout the City. Using the existing transportation data and City's demographics, a number of specific neighborhoods were identified as being in need of additional infrastructure or services in order to enable residents to enjoy the same level of connectivity as others. As mentioned previously, it is important to note that the evaluation criteria sought to identify areas where connectivity improvements would have greatest potential benefit to the City.

Figure 9. Elements of Connectivity

The following sub sections outline specific recommendations associated with pedestrian, bicycle, and public transit mobility.

Pedestrian---Sidewalks

Annually, Dover allocates $100,000 for sidewalk improvements through its CIP. Currently, there is no formal sidewalk inventory in place that categorizes the condition of the existing sidewalk infrastructure—nor is there an improvement program in place that identifies the gaps in sidewalk throughout the community.

For the purposes of managing the City's existing sidewalk infrastructure, one priority should be to establish a sidewalk asset management plan and conduct an existing conditions inventory. The asset management plan could be implemented in a format that easily integrates into the City's existing management systems, such as GIS and the Public Works Department. The asset management plan could be used to allocate CIP sidewalk improvement funds to the sidewalk locations most in need of improvement and to identify those needed to provide connectivity to recreation sites, public facilities, and destination locations. The program could be initiated through a desktop identification of existing infrastructure using as-built plans, existing data, and aerial photography—and built upon with field reconnaissance. A citywide sidewalk inventory and the system/platform for the asset management plan would include elements such as:

- Surface Material Type
- Curbing Presence/Type
- End Treatments (Intersection, Driveway, Etc.)
- Compliance with the Americans with Disabilities Act of 1990 (ADA)
- Condition
- Vertical/Horizontal Faults
- Spalling
- Obstructions
- Cracking
- Cross Slope
- Ponding
- Cleanliness

A review of the City's existing GIS sidewalk data, windshield survey, aerial photography, and sources such as Google Streetview reveals there are a number of potential new sidewalk improvements for Dover to consider. While there are many locations within the City where sidewalks are not present, these potential new locations were identified as those that would connect large neighborhoods or areas to the existing multimodal system. Please note, however, that additional engineering study and evaluation is needed to determine full feasibility. These potential locations include the following:

- *Dover Point Road.* This corridor is serviced by COAST, with several bus stops on both sides of the roadway (inbound/outbound stops). However, there is no existing sidewalk present on either side of the road. Along this stretch of road there are **approximately 620 parcels located within the 10-minute walk to a Coast bus stop.** The majority of Dover Point Road is posted at 40 mph, with 4-foot paved shoulders. There are several residential neighborhoods with sidewalks terminating at the intersection point of Dover Point Road. Installing sidewalks (or an alternative, such as a widened shoulder) along Dover Point Road would also provide pedestrian and bicycle access to the existing path leading to Pomeroy Cove and Hilton Park. This is a state-owned road; therefore, given the length of the route, such a project would likely need to be implemented in multiple phases. In addition, although Dover Point Road is state-owned, the City of Dover would be required to sign a maintenance agreement for the sidewalk in order to receive permission for its construction.

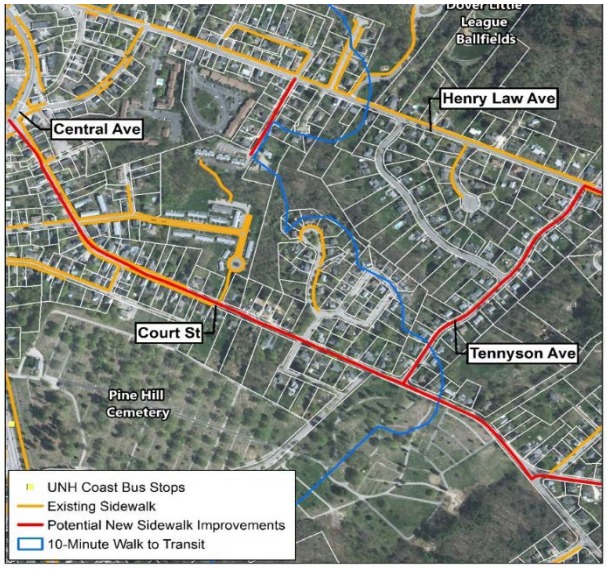
Dover Point Road

- *Long Hill Road.* Currently only a small portion of Long Hill Road—the segment between Old Rochester Road and New Rochester Road—includes sidewalk. Installing sidewalk from the intersection of Old Rochester Road west to Phillip Street for this very short distance would provide access to Long Hill Memorial Park and connect into the City's existing sidewalk network on New Rochester Road (NH Route 108). Several neighborhoods in the Mohawk Drive/Apache Street/Cheyenne Street vicinity **(approximately 115 homes) would gain dedicated pedestrian access to the park, and tie into the existing sidewalk network.**

Long Hill Road

- *Old Rochester Road.* Extending the existing sidewalk on the south end of Old Rochester Road from Sullivan Drive north to Apache Street would connect **more than 200 homes to City's existing sidewalk network via New Rochester Road (NH Route 108)**, and tie into the above recommended sidewalk improvements on Long Hill Road. Almost all of the neighborhoods abutting this area are **within a 10-minute walk to a COAST bus stop**, but they lack a sidewalk connection. This connection would also provide additional access to the Sullivan Drive ballfields and park.

- *Court Street.* Only the westerly end of Court Street, from Central Avenue to approximately 500 feet east of South Pine Street, currently provides sidewalk access. Better community access to Maglaras Park and the Pine Hill Cemetery can be achieved by replacing the existing, deteriorating sidewalk and extending it east to Tennyson Avenue, continuing north on Tennyson Avenue to Henry Law Avenue. A larger project could include extending the sidewalk further to the east on Court Street to connect to existing sidewalk on Henry Law Avenue. **This connection would provide a two-mile loop network around these neighborhoods, with connections to Maglaras Park and Pine Hill Cemetery.**



In addition to the sidewalk improvements identified above, there are other sidewalk improvement projects that could connect missing segments of sidewalk along existing facilities. These include:

- *NH Route 9/Littleworth Road.* Extend the sidewalk from Industrial Park Drive to Columbus Avenue (perhaps an opportunity for a widened shoulder to serve in lieu of a sidewalk).
- *Cochecho Street/Atlantic Avenue/Gulf Road.* Fill in missing segments and provide connectivity from Gulf Road to Portland Avenue.
- *Broadway Street.* Extend the sidewalk from the railroad grade north to Ham Street.
- *East Side of Portland Avenue.* Connect the sidewalk from Granite Street to 153 Portland Avenue and tie to the existing crosswalk to Dover Ice Arena.

Also identified through the evaluation of alternatives is the need for a program targeted at providing better pedestrian connections to land use. Upon completion of the existing conditions sidewalk inventory discussed herein, the City could develop a list of prioritized corridors for improving pedestrian connectivity with the City's most valuable resources. Targeted areas could include:

- Eliminating gaps in the existing network between the residential neighborhoods adjacent to the downtown area
- Identifying and designating continuous sidewalk corridors to public facilities, parks, etc.; potential opportunities include Horne Street School/Beckwith Ballfields/Dover Community Trail, as well as Woodman Park School/Fields/Dover Community Trail
- Improving and creating a more attractive connection from the DTC to the downtown area; building off the 2015 Downtown Dover Pedestrian and Vehicular Access and Streetscape Study to improve aesthetics along First, Second, and Third Streets

Pedestrian—Alternatives to Sidewalks

As mentioned above, when examining locations that are in need of pedestrian facilities, widened roadway shoulders as an alternative to sidewalks could be considered for some locations. While sidewalks or pathways are the more appropriate measure for urban areas with frequent pedestrian activity, transit services, and school zones, widened paved shoulders could be considered for less developed areas with lower pedestrian activity. A full existing conditions and safety review should be performed in order to determine the appropriateness for this treatment. Use of widened paved shoulders for pedestrian travel should also be accompanied with appropriate signage and pavement markings to inform motorists and

walkers of the intended use. Additional measures, such as rumble strips, could also be considered for further safety measures. Published in March 2012, the *FHWA's Non-Motorized User Safety, A Manual for Local Rural Road Owners* can provide useful guidance in determining where paved shoulders can be considered in lieu of sidewalks.

Pedestrian—Neighborhood Connections

Improving the bicycle and pedestrian connectivity between individual neighborhoods was also identified as an alternative to sidewalk improvements. Rather than building sidewalk infrastructure along busy streets, connecting neighborhoods through undeveloped parcels, existing open space land, or easements for pedestrian and bicycle use is a good alternative. There are currently several existing facilities that provide such access:

- Court Street/Niles Drive sidewalk/path
- Union Drive connection to Bois Terrace
- Hawthorne Road connection to Augusta Way
- Danielle Lane connection to Back River Road (city-owned land through a utility corridor)
- Danielle Lane connection to Harlans Way

There are a number of such connections throughout the City where there is an existing easement or open space land that could be further investigated for potential use in constructing a path between neighborhoods. The following easements were identified through the City's GIS database. However, a further review of the easements is required to determine if this type of use was anticipated and is allowed. These areas include those found in **Figure 10** found on the following page.

Bicycle

In order to address long-term bicycle needs, the City should formalize a citywide bike plan that identifies existing gaps, determines recommended routes with specific treatments and amenities, and establishes targeted improvement projects (either standalone or in conjunction with other on-going improvement projects within the City). These can be incorporated and programmed into the City's CIP for implementation. A focus area of the plan should prioritize and seek opportunities to connect bicycle use to the community trail in a way that makes riders feel safe. The plan should also include an inventory of existing bicycle racks and feature recommendations for future rack placement. Additional consideration could be given to developing a separate plan that targets navigating through the downtown area.

Example of a bike lane being added to Central Avenue.

Aside from a long-term plan, the previously mentioned Strava data provides some insight into roads currently being used for bicycle travel in the City. Using this information—in conjunction with a future, more-detailed engineering review—consideration could be given to evaluating and designating bike loops for recreational use with shared lane markings (SLMs or "sharrows") at:

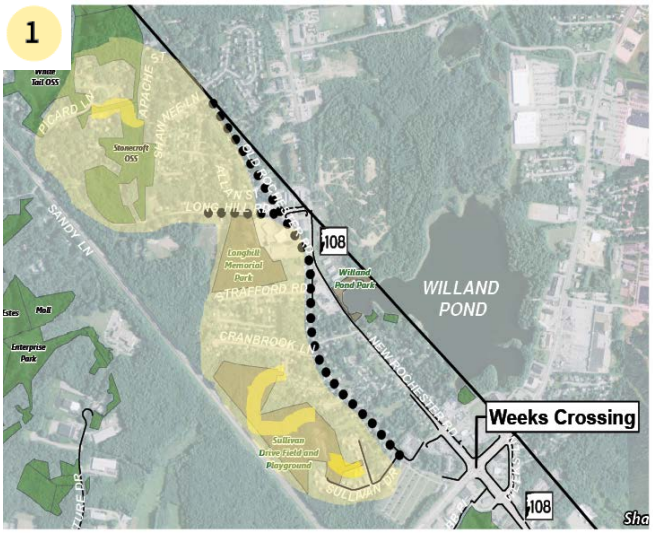
- Henry Law Avenue/Back Road/Court Street/Central Avenue
- Back Road/Middle Road Loop
- Sixth Street/County Farm Cross Road/County Farm Road

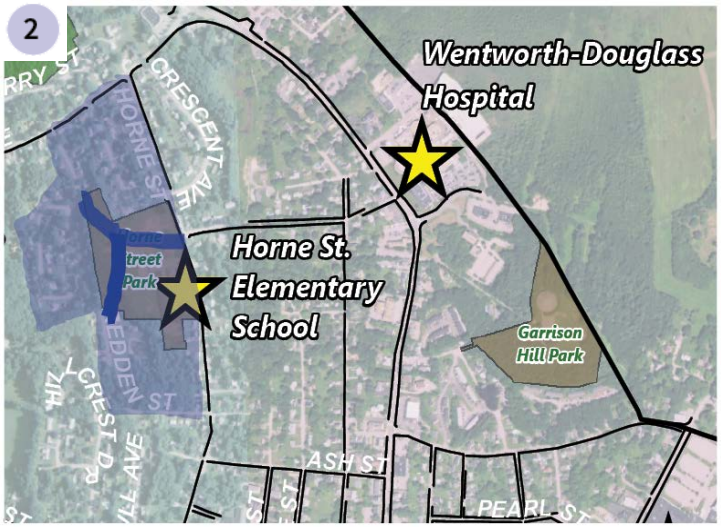
And **designating bike routes** at:

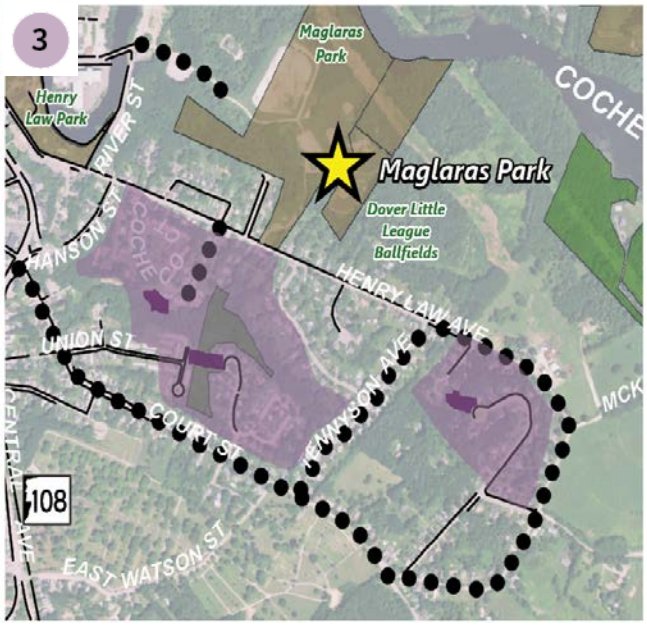
- Sixth Street
- Tolend Road
- Watson Road
- Whittier Street
- Central Avenue (additional improvements may be needed from Sixth Street to Stark Avenue and from Chestnut Street to Washington Street)
- Route 108 (currently being studied by City)

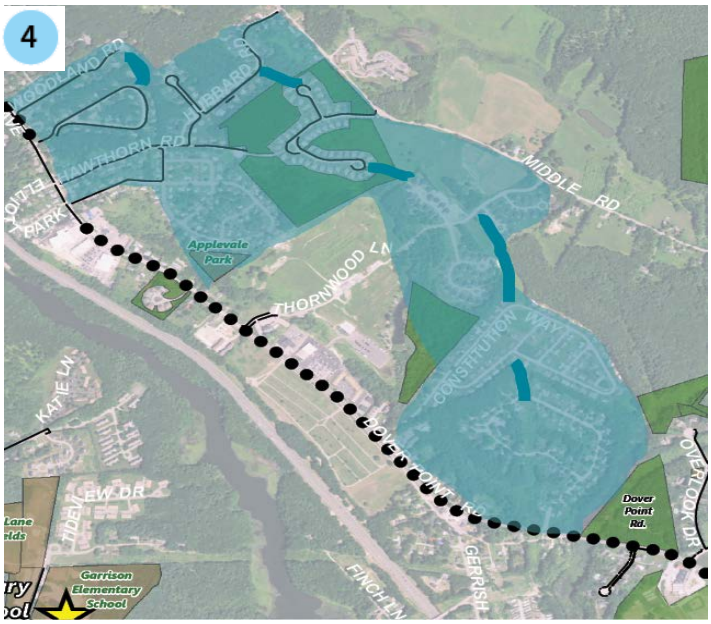
Figure 10. Easements for Review

Potential New Sidewalk Improvements
Recreation Sites
Conservation/Open Space Land
Destination/Attraction Locations
Existing Sidewalk









Conceptual Neighborhood Connections and Connected Areas:

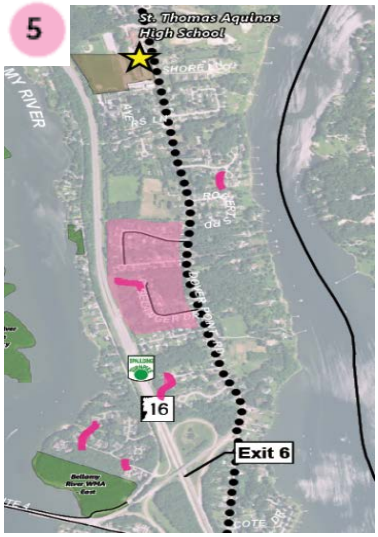
1 **Neighborhood Area 1**
- Picard Lane, Carriage Hill Lane, to Apache Street
- Maplewood Avenue to Stiles Lane to Sullivan Drive and Evergreen Valley Drive

2 **Neighborhood Area 2**
- Glencrest Avenue and Horne Street to Redden Street and Oak Hill Drive

3 **Neighborhood Area 3**
- Union Street to Cobble Hill Drive and Elmview Circle off of Court Street (Cobble Hill open space land)
- Penny Lane to Samuel Hanson Way; Mulligan Drive off of Henry Law Avenue
- Cricket Brook to Union Street

4 **Neighborhood Area 4**
- Augusta Way to Thornwood Lane, Teresa Drive
- Independence Drive and Constitution Way to Toftree Lane (utility corridor)
- Thornwood Lane to Constitution Way and Independence Drive (utility easement)
- Hubbard Road to Saint Andrews Circle and Augusta Way off of Court Street

5 **Neighborhood Area 5**
- Lillians Lane and Roberta Drive to Belanger Drive



Public Transit

The 10-minute walk-time analysis performed for the existing bus service in Dover revealed that the majority of the major roadways in the City, and almost all of the core residential areas in the downtown vicinity, are included in the coverage area. Statistically, the 10-minute walk to transit reaches 52% of the land area in the City and connects approximately 5,400 of the 8,500 (64%) tax map parcels in the City. However, there are a number of large, rural subdivisions outside of the 10-minute walk to transit. These neighborhoods are relatively spread out, without existing sidewalks on the collector road network; this will make it difficult to expand bus service into these areas.

The analysis did identify one relatively large area within the City with dense residential development that does not have access to transit: the Spruce Lane/Garrison Road/Back River Road neighborhood area. The City should work with COAST to expand bus service in this area, as it is densely populated, with residential development,[1] two schools (Garrison Elementary and Portsmouth Christian Academy), and one nursing home (Bellamy Fields). The demographic profile of this area indicates that are ***approximately 3,000 residents in this area, including one of the larger elderly (age 65+) populations*** within the City. The conceptualized expanded route creates a loop via Mast Road, Spruce Lane, and Back River Road, with the following additional improvements:

- Extending the existing sidewalks on Mast Road from the intersection with Spruce Lane to Back River Road
- Installing sidewalks along Spruce Lane to Back River Road
- Extending the sidewalks improvement to the intersection of Garrison/Old Garrison Road, which would provide access to the Bellamy River Wildlife Management Area (connection to the largest block of conservation/public land in the City with existing trail network)
- Assessing the condition and accessibility of the existing sidewalk infrastructure in this area

Furthermore, the City should consider the targeted installation of new bus shelters, such as the one seen in the rendering in **Figure 11.** Providing bus shelters to protect from the weather and provide a place to sit could create a more attractive environment and increase use of the transit system. A review of existing bus routes (COAST and Wildcat Transit), stop locations (with and without shelters), bus ridership data, adjacent land uses, and roadway geometry resulted in the following list of locations where the placement at new bus shelters, as seen in **Figures 12A, B, C, and D** on the following pages.

Figure 11. Bus Shelter Rendering

County Farm Road Existing Condition

County Farm Road with New Shelter

[8] Residential development is characterized by primarily single-family homes, but there are several condominium developments in this area as well.

Figure 12A. Potential Bus Shelter Locations

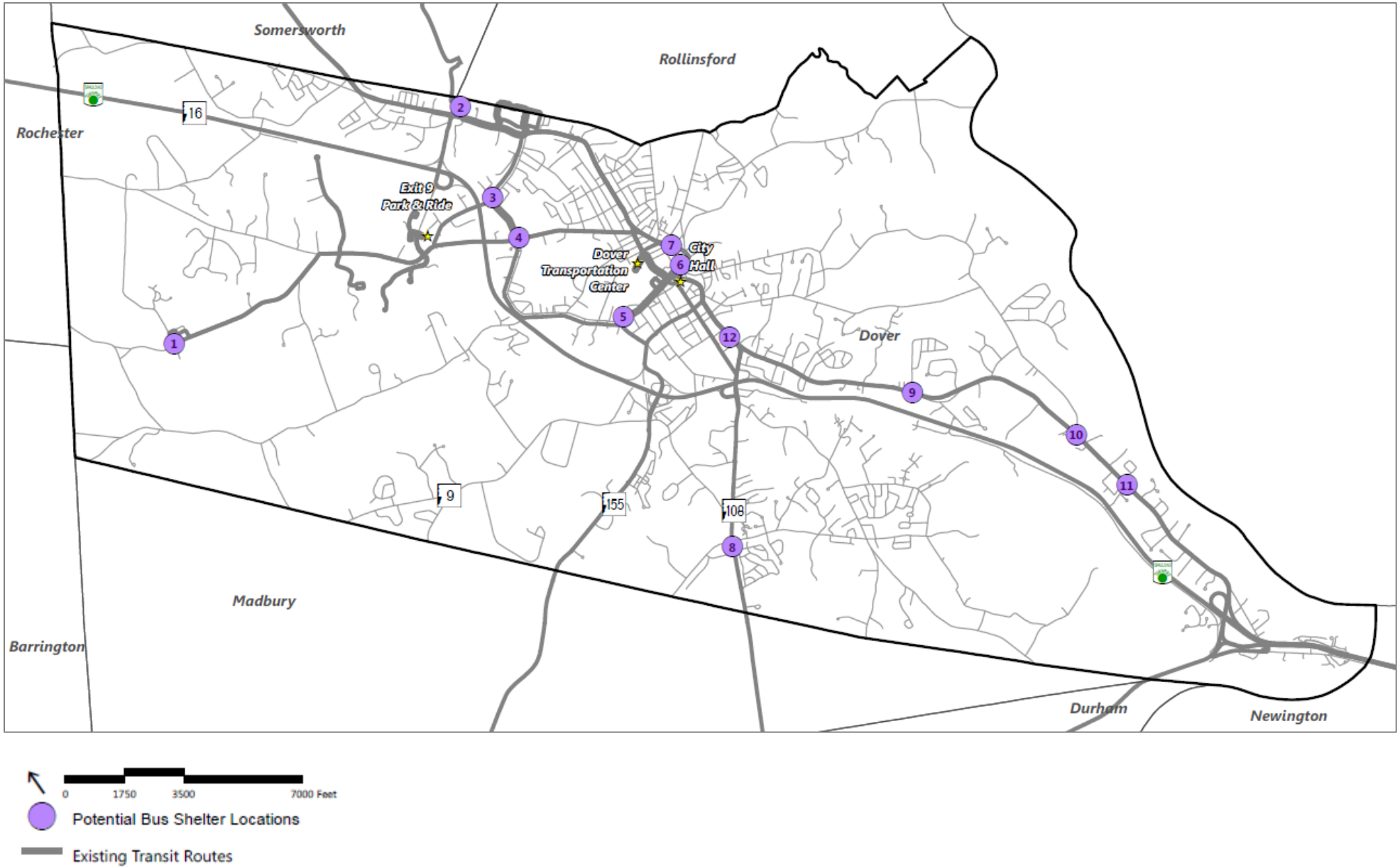
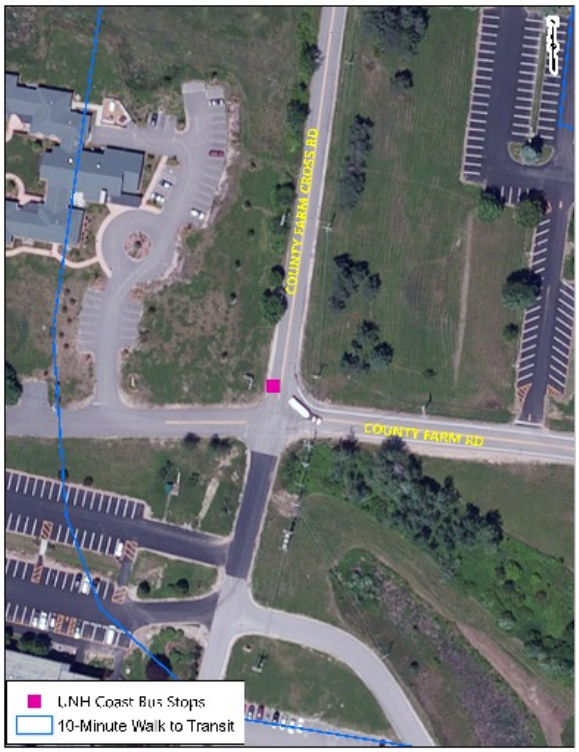
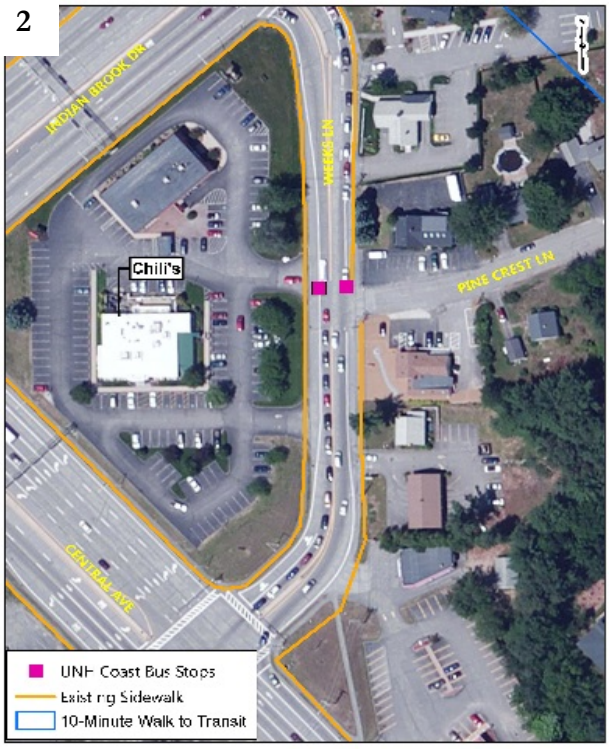
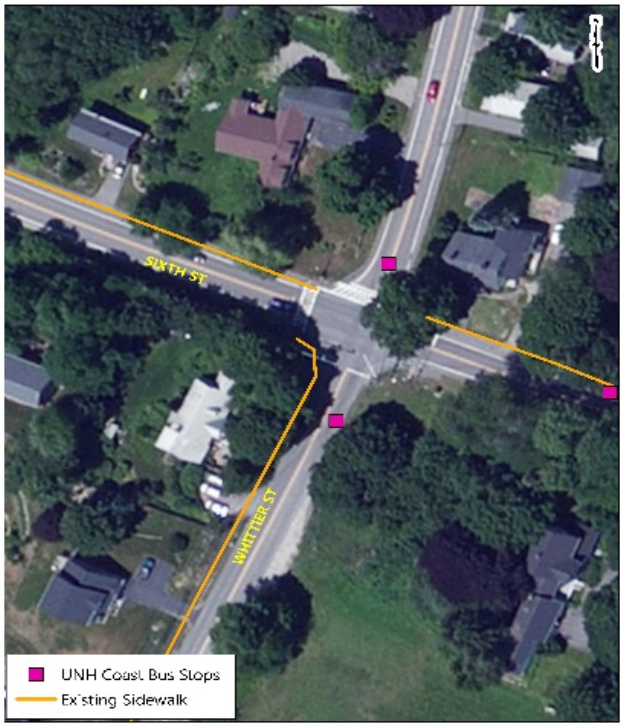


Figure 12B. Potential Bus Shelter Locations







Photos:
1--County Farm Cross Road at County Farm Road
2--Weeks Lane by Chili's
3--Glenwood Avenue at Plaza Drive
4--6th Street at Whittier Street

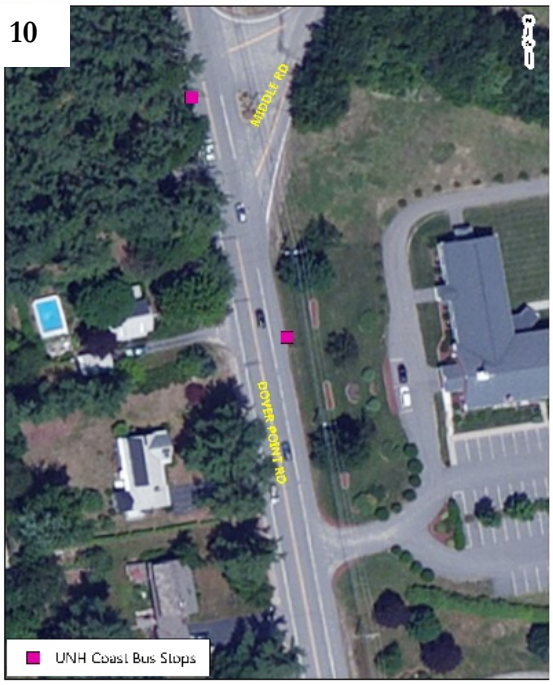
Figure 12C. Potential Bus Shelter Locations

Photos:
5--Washington Street east of Arch Street
6--Washington Street by Henry Law Park
7--Main Street north of School Street
8--Durham Road north of Grapevine Drive

Figure 12D. Potential Bus Shelter Locations

9

10



Photos:
9--Dover Point Road at Constitution Drive
10--Dover Point Road at Middle Road
11--Dover Point Road at New Bellamy/Ayers Lanes
12--Central Avenue at CVS and at Pine Hill Cemetery

Lastly, the Wildcat System is supported by NextBus, which employs live global positioning system (GPS) data to keep riders informed of where the next bus is and when it is predicted to arrive at stops. Live bus locations and anticipated bus stop arrival information can be received on a computer, iPad, or mobile phone; through a texting service; or even by calling an ordinary telephone number. This tool aids in the convenience of using public transit. It is recommended that the City work with COAST to implement similar technology to increase the attractiveness and convenience of COAST service within Dover.

Traffic Calming

The third and fourth transportation elements of the Vision Chapter seek to promote well-directed and -managed travel on the City streets through traffic-calming measures. The City's on-going efforts to manage speeds in neighborhoods, improve mobility in the downtown, and change the overall character of major corridors have taken an initial step in transforming the roadway network. The following traffic calming recommendations look to use policy, planning, and infrastructure to continue the transformation and work toward the City's vision in the next decade.

Downtown Dover Pedestrian and Vehicular Access and Streetscape Study

In 2015, the Downtown Dover Pedestrian and Vehicular Access and Streetscape Study was completed. The preferred design that resulted from this effort is a critical component to rebalancing traffic flow, improving pedestrian and transit connectivity, and incorporating bike facilities into the downtown area—which is generally bound by Chestnut Street, Central Avenue/Main Street, and Washington Street. This streetscape improvement plan incorporates traffic-calming measures, urban-design elements, signage and wayfinding, and lighting and landscape to produce an active and vibrant district for the community. The estimated project cost ranges between $6.75 and $9.50 million, implementable in three phases. It is strongly recommended that the City prioritize and carry out this improvement plan, as it addresses a substantial number of the transportation circulation and congestion issues in the downtown area through one cohesive project.

Access Management

As a result of the recommendations from the 2000 Transportation Chapter of the Master Plan, the City has completed several efforts to actively promote access management. Among these is an update to the Site Plan and Subdivision Regulations. Through on-going efforts from the City's 2000 Transportation Chapter recommendations, results from the online transportation survey, discussions at the public workshop, and feedback from the Steering Committee, four specific corridors were identified as being in need of access management measures in order to improve mobility, reduce congestion, and improve safety. These corridors are:

- Central Avenue from Weeks Crossing to Glenwood Avenue
- Broadway from Reds Shoe Barn to Oak Street
- Portland Avenue from Oak Street South to the Royal Oak Apartments
- Central Avenue from Trakey Street to Stark Avenue

Existing sections of Central Avenue that could benefit from access management.

Two approaches to access management were considered at these and/or other locations within the City. The first approach allows the City to employ access management as development proposals come before the Planning Board through the establishment of overlay districts. Within these

districts, prospective developers of properties along the corridors would be required to incorporate and construct appropriate components of the overlay district requirements into their development plans. Typical components of an overlay district include minimum distances between driveways, widths of driveways, maximum driveways per lot, shared driveways between sites, and interconnecting roads between sites.

The second approach addresses access management through targeted projects facilitated by the City through programming separate access management feasibility studies for each individual corridor. Opportunities could also be sought through partnership with developers and property owners. Such individual planning studies would evaluate the physical constraints that could limit access management improvements. They could also result in a plan that minimizes curb cuts in a manner that improves the environment but adequately services the existing (and future) businesses. It is worth noting that the second approach places more financial burden on the City. Therefore, the Steering Committee recommended the first approach of adopting regulations that create access management overlay districts.

Traffic Calming Studies

A review of crash data, the transportation survey results, speed data, and the City's CIP was conducted to establish the possible locations where traffic calming studies and measures could be taken to slow traffic and improve safety. These locations (not ranked by priority) include:

- Bellamy Road (currently under study)
- Dover Point Road
- Middle Road
- Columbus Avenue
- Garrison Road/Spruce Lane
- Cushing Street
- Back River Road
- Stark Avenue

It is important to note that there is no "one size fits all" traffic calming solution to be implemented within the City. Each individual location requires a thoughtful look at the existing issues and an evaluation of the physical constraints. Most importantly, the neighborhood needs and surrounding land uses is a key consideration in selecting the most appropriate treatments.

Streetscape and Reconstruction Projects

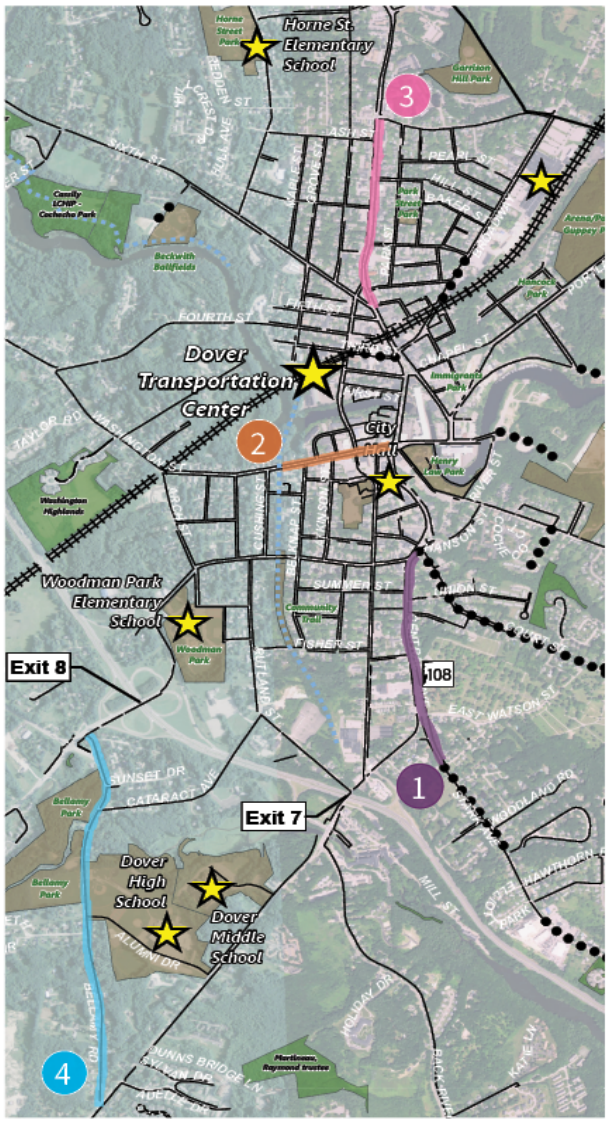
The City continues to transform the downtown through streetscape and reconstruction projects to create an inviting multimodal transportation system, and is currently enjoying the success of the recently completed Silver Street reconstruction. Several projects currently exist in the CIP to continue this effort. Additional projects for future inclusion in the CIP include those found in **Figure 13** on the following page.

Neighborhood Speed

Like most municipalities, Dover's neighborhoods are sometimes victim of aggressive driving and higher-than-desired travel speeds. The City of Dover has been very responsive to speed-related concerns expressed by residents, as indicated by the number of speed investigations that have been conducted. As indicated by the speed data provided in **Table 2 in Section 1**, mean and 85th percentile speeds generally exceed the posted speed. The FHWA's *Manual on Uniform Traffic Control Devices* indicates that the speed distribution of free-flowing vehicles is the primary factor to consider when establishing speed limits, and that the speed limit should be set at or near the 85th percentile speed.

However, raising speed limits to comply with this suggestion may or may not be a desirable outcome for the City, depending on the surrounding environment. Conversely, lowering speed limits to respond to public requests where speed data does not support the adjustment is not recommended, as altering the posted speed below the 85th percentile speed does not in itself encourage compliance.

Figure 13. Potential Streetscape and Reconstruction Projects



1 Avenue from Stark Avenue to Silver Street

- Gateway improvements to mark transition to downtown area
- Improve pedestrian facilities, specifically east/west crossing in this area
  - Sidewalks in this area are dated and lack ADA facilities
- Streetscape improvements to connect with Silver Street improvements
  - Neckdowns and enhanced crosswalks from Trakey to Silver Street
  - Geometry is tight, but on-street parking on the south side may be possible
- Enhanced lighting
- Improve intersection geometry at Central/Stark/East Watson
- Crosswalk improvements

2 Washington Street from Central Avenue to Dover Community Trail

- Intersection improvement at Chestnut Street
- Improve traffic flow in this area
- Crosswalk enhancement needed at Community Trail

3 Central Avenue from Sixth Street to Oak Street

- Cross section could support neckdowns and bulb outs in certain locations
- Balance traffic congestion
- Enhance crosswalks

4 Bellamy Road (currently under study)

- Address traffic-calming needs and improve pedestrian bicycle facilities
- Raised crosswalk or enhanced crosswalk to access Bellamy River Park (no existing crosswalk)
- Consider replacing existing midblock enhanced crosswalk at the ballfields with a raised crosswalk
- Consider speed humps
- Gateway installations on Portland Avenue (at Chapel Street fork) and Broadway approaching the downtown area

Central-Stark Intersection

Crosswalk by Community Trail

Crosswalk Improvements

Intersection with Chestnut Street

The City currently does not have a specific approach or policy for setting speed limits on the local streets. It relies on State law for guidance, but the regulations are somewhat limited in nature and can be open to interpretation. Therefore, it is recommended that the City adopt a policy that outlines a procedure for determining posted speed limits on the local streets. The FHWA's Methods and Practices for Setting Speed Limits: An Information Report (April 2012) provides five different methodologies that can be employed to set speed limits. The Engineering approach based on operating speed and Expert System approach are the two most common methodologies used in the United States. Based on the City's available technical resources within the Engineering Department and the Police Department, and the data sets already commonly collected and reviewed by the City, the use of both the Engineering and Expert System approaches combined appears to be a good fit for Dover.

Under the Engineering approach (based on operating speed), the speed limit is based on the 85th percentile speed, but may be adjusted based on the specific road and traffic conditions and the crash history. Other than the speed data, other data sources considered and reviewed under this approach include pedestrian and bicycle activity, on-street parking, and safety performance. The benefit of this approach is that using the 85th percentile speed provides residents and businesses with a valid indication of actual travel speeds based on data. Using the other data sources mentioned, provides the justification and support needed to post speeds below the 85th percentile speed.

Under the Expert System, "speed limits are set by a computer program that uses knowledge and inference procedures that simulate judgement and behavior of speed limit experts". To assist state and local agencies with this approach, the FHWA adopted the USLIMITS2 program with enhancements and made it available with user/customer support on the FHWA server at http://safety.fhwa.dot.gov/uslimits/. USLIMITS2 is a web-based tool designed to help practitioners set credible and consistent speed limits for specific segments of roads. This tool can be used to assess speed limits on all types of roads, ranging from rural, local roads and residential streets to urban freeways. The program is user-friendly, logical, and objective, and it is of particular benefit to local communities and agencies without ready access to engineers experienced in conducting speed studies for setting appropriate speed limits. Input factors go beyond just using the 50th and 85th percentile speeds and include route type, section length, annual average daily traffic, statutory speed limit, and terrain, among others. The output is a recommended speed limit and a list of issues that might be further investigated.

Given the variability throughout the City and the need to appropriately post speed limits, the City should consider the use of both methodologies to have flexibility in making the best decision. Inevitably, there may be cases where the data produces a recommended speed limit that is not consistent with the desire of the City. Under these situations, physical traffic calming devices and measures may be necessary to change the physical character of the roadway and/or adjust driver behavior.

Neighborhood Street Typical Cross-Section

City Wide Bike Accommodations
There are two positive bike accommodation strategies that can be phased in on a City-wide basis as follows.

Restriping within Existing Road Width
A low cost method for improving bike accommodations within the City is to reconsider striped travel lane and shoulder widths when completing scheduled resurfacing projects. On some roads it may be possible to narrow the travel lanes and widen the shoulders without changing the overall paved widths. For example, reconfiguring a roadway from 12' lanes and 2' shoulders to 11' lanes and 3' shoulders provides cyclists with what is considered the minimum operating width of 3', and often without negative impacts to motor vehicle operations. There are a handful of factors that should be consider when deciding on the appropriate lane and shoulder widths for a given roadway as listed below:

- Traffic Volumes

- Traffic Speeds
- Percentage of Large Trucks
- On-Street Parking
- Emergency Response Routes
- Bike Demand / Location within Bike Network

In some instances restriping wider shoulders may result in sufficient width to create designated bike lanes. The minimum bike lane width should be 4 feet (5 feet if along curb or guard rail), and wider shoulders are preferred if there is a high percentage of trucks, high speeds (50 mph) or it is a high use bike route where passing may be frequent. If bike lanes are installed they should include proper pavement markings and signs designating them as bike lanes.

Though rare, there may also be instances where the on-street parking can be reconfigured or the number of travel lanes can be reduced to provide adequate space for improved bike accommodations, including bike lanes, buffered bike lanes or protected bike lanes. These road diet techniques typically require planning studies to adequately understand the resulting impacts and benefits for all users.

Shared Lane Markings (SLM's)

Shared Lane Markings (SLM's) convey information to motorists and cyclists alike. They alert motorists that they are in an environment where they should expect to share the road with cyclists. The SLM's also provide guidance to cyclists on proper lane positioning when sharing a lane. SLM's are provided on roads where bike lanes are not appropriate due to space or other limitations. They are not used where speeds exceed 35 mph, and are generally appropriate on collector streets and minor arterials. Their implementation should initially be along continuous routes or corridors as opposed to spot treatments. The lateral placement of the SLM is dependent on width and parking conditions. Guidance on SLM placement under varying conditions is available through American Association of State Highway and Transportation Officials (AASHTO) and Institute of Transportation Engineers (ITE).

State of the Practice Continues to Evolve

The design of on-street bike accommodations continues to evolve and the City should be open to emerging treatments that may fill a specific need that approved practices do not cover. An example of one such treatment is dashed bike lanes which define bicycle space that is not wide enough to be considered a formal bike lane. Dashed bicycle lanes can be used as an alternative to shared lane markings. Until they are an accepted practice the City must apply to FHWA for approval under experimental use.

Wayfinding and Signage

The Downtown Dover Pedestrian and Vehicular Access and Streetscape Study completed in 2015 includes the recommendation of signage and wayfinding for both vehicles and pedestrians. The intention of that plan is to link destinations, identify parking locations and transit options, and highlight the location of local businesses. The City should implement this plan and then continue to expand the wayfinding program throughout the downtown. The City can capitalize on the recent success of the Silver Street reconstruction project to build upon the importance and benefit of a vibrant wayfinding signage program throughout the Downtown. In addition, the City could use the opportunity of the City's 400th anniversary in 2023 to create a signage brand that could be incorporated into the sign design—and to create excitement for the celebration and support for the reaching the City's vision.

Technology

Dover's transportation vision seeks to use technology for the advancement and improvement of the City's transportation system. Planning for the transportation future should include the consideration of elements beyond

today's normal infrastructure. The implementation of improved Intelligent Transportation Systems (ITS) technology will change the way traffic flows throughout the City. The progression of big data will provide accurate and real-time travel information at the fingertips of commuters through mobile phones, tablets, and computers—potentially resulting in evolving and changing travel characteristics in the City. Embracing such technological advances will help the City promote efficient travel, manage speeds and parking, and implement environmentally friendly elements.

Electric car charging facilities and bike sharing programs are among the emerging intelligent infrastructure improvements the City may consider implementing.

Smart City

Emerging sensor technology, big data, use of smart devices, and intelligent transportation data are improving traffic operations and mobility within communities. The use of smart devices by residents is creating more connected citizens who want access to mobile applications and to provide feedback to community. It is recommended that the City establish a Transportation Technology Committee to plan for intelligent infrastructure improvements that would allow the City to better use emerging technology. Elements of a Smart City could include:

- Application for citizen's to report pot holes, opportunities for sidewalk improvements, etc.
- Connected and autonomous vehicles
- Electric car charging facilities
- Bike sharing programs
- Ridesharing programs
- Public parking applications
- Transit applications (real time arrival predictions on local bus routes) to improve convenience
- ITS improvements in sensor technology to help alleviate traffic congestion (Bluetooth sensors)

The Transportation Technology Committee will be charged with developing and promoting a Citywide Multimodal Intelligent Transportation Infrastructure Plan (MITIP) that will create the framework for the City of Dover to become a smart city. The MITIP and future City policies should be mindful to embrace and be supportive of new programs and approaches to improving mobility throughout the community. For example, the City's policies on services such as Uber and Lyft, in addition to traditional taxi service, should continue to be monitored and updated as appropriate.

Bus Prioritization

Bus Priority, also known as Transit Signal Priority, uses signalized intersection technology to facilitate the improved and efficient movement of transit vehicles in an urban environment. Sensors are used to detect approaching transit vehicles and to alter signal timings to improve transit performance. Systems can extend the duration of green signals for public transportation vehicles when necessary. ITS America's *Transit Signal Priority: A Planning and Implementation Handbook* states that transit signal priority use across the country generally results in average bus travel time savings ranging from 2–20%, with minimal impacts to the overall street system. Application of transit signal priority use in New Hampshire is currently not allowed. However, as technology continues to improve and the desire for convenient transit services increases across the State, the restriction may someday be lifted and/or modified for the technology to be used in a limited nature. The City should continue to work with local service providers and State officials to explore such possibilities.

Incident Planning

The City continues to invest in upgrading and maintaining its traffic signal equipment and systems. On an annual basis Dover allocates $75,000 toward signalization upgrades. As technology progresses, signal systems are becoming smarter and more flexible in meeting the on-demand needs placed upon them. In addition to using this technology to manage traffic flow through the City on a daily basis, the system can be used to assist with managing traffic operations during unanticipated incidents. Planning and being prepared for traffic incidents within Dover, including on the Spaulding Turnpike, would benefit the community and could avoid potential gridlock conditions along City streets that otherwise might result from a major incident.
The City should develop a Strategic Plan for Traffic Incident Management that can be employed for unanticipated traffic events. Traffic simulation models can be developed to evaluate alternative signal timing plans and other measures that would be engaged under various traffic incident scenarios. For example, a closure on the Spaulding Turnpike that detours traffic to the City streets would be devastating to normal activities. Having plans readily available for implementation in an instant, that have already contemplated the constraints and issues and been shared with responsible parties for execution, would help minimize undue hardships and assist in a quicker recovery.

Performance Measures

A performance measure is the monitoring of on-going progress toward pre-established goals. The update of the Transportation Chapter introduces the concept of performance measurement into the Master Plan process. Establishing performance measures for the 2016 Transportation Chapter will allow the goals and objectives of the transportation plan to be tracked over time, inform the public of progress made, and provide guidance to City officials in making informed decisions on the state of the transportation system and associated investments.

Performance measures consist of four components:

- **Indicator**: what change is to be measured
- **Unit of Measure**: how the indicator is going to be quantified (i.e., a number or percent)
- **Baseline**: starting reference point
- **Target**: the desired performance

Consider the following example:

Performance Measure:

Statement: The City will expand public transit access within a 10-minute walk time to 1,500 additional residents by the year 2023.

Indicator: Expanded public transit access
Unit of Measure: Number of residents
Baseline: Existing condition in 2016
Target: 1,500 residents by 2023

Performance measures have been developed for each goal and objective provided in the Implementation Plan. The performance measures can be found in the Technical Appendix.

National Performance Review

The National Performance Review describes performance measurement as, "A process of assessing progress toward achieving predetermined goals, including information on the efficiency with which resources are transformed into goods and services (outputs), the quality of those outputs (how well they are delivered to clients and the extent to which clients are satisfied) and outcomes (the results of a program activity compared to its intended purpose), and the effectiveness of government operations in terms of their specific contributions to program objectives."

Section 3: Recommendations and Implementation Plan

Section 3

This section provides direction on the actions to be taken to assist Dover in reaching its transportation vision of the future.

The following implementation plan is intended to provide the framework and guidance for the City to achieve Dover's 2023 transportation future, as imagined in the 2012 Vision Chapter of the Master Plan. Specifically, the Vision Chapter notes: *Dover has an excellent and fully interconnected transportation system for pedestrians, bicyclists, motor vehicles and a public transportation system that is supportive of, and responsive to, new technology and continuous improvement.*

While Dover's past efforts have resulted in a City that is well connected at the regional level, the Vision for 2023 focuses inward. In so doing, the City seeks to better internally connect the community for all users of the transportation network and to promote transportation characteristics that improve the quality of life and quality of experience for residents and visitors, alike.

Dover's existing transportation system is multimodal in nature and has the necessary components for the parts to be fully integrated over time. The recommendations in this chapter provide a multifaceted approach that uses policies and planning strategies alongside infrastructure improvements to forge progress from a variety of angles in order to help expedite the results. In addition, as discussed previously, this update also assumes that the successful "on-going" and "in progress" recommendations from the 2000 Transportation Chapter will continue.

The recommendations presented in the implementation plan are organized by the categories derived from the Vision's transportation elements: Connectivity, Traffic Calming, and Technology. Performance measures are provided to assist the City with measuring progress and accountability for moving the plan forward effectively. The plan also identifies a responsible party and time periods for prioritization, such as:

- **On-going:** Actions which are continuous or already being carried out
- **Immediate:** Actions which should be undertaken in 1–2 years
- **Short:** Actions which should be undertaken in 3–5 years
- **Long:** Actions which will take more than 5 years to initiate and complete

Connectivity (C)

Goal/Objective/Action		Priority	Responsibility	Chapter Reference
Connectivity Goal	**Dover provides an attractive, integrated transportation network that supports and promotes pedestrian, bicycle, and public transit travel throughout the City.**			
Objective C 1	**Build and maintain attractive infrastructure that accommodates pedestrians and connects neighborhoods.**			
Action C 1.1	Conduct a citywide existing conditions sidewalk inventory and establish a sidewalk asset management plan that will be used to set annual sidewalk budgets and set priorities for implementation into the CIP.	Immediate	Transportation Advisory Commission	
Action C 1.2	Use the sidewalk asset management plan to target the construction of sidewalk that connects people to land use (such as connecting the Dover Transportation Center to the downtown or connecting neighborhoods to the Community Trail and other recreational facilities).	Long	Planning and Community Services	
Action C 1.3	Construct sidewalks to connect densely populated areas to the existing sidewalk network and public transit service.	Short	Community Services	
Action C 1.4	Utilize existing easements (if allowed) and/or open space parcels to build new off-road pedestrian and bicycle paths between existing neighborhoods.	Ongoing	Community Services	
Objective C 2	**Expand transit service and improve facilities to attract more users.**			
Action C 2.1	Investigate the potential to expand COAST transit service to cover the densely populated neighborhood of Spruce Lane/Garrison Road/Back River Road and construct other supporting elements.	Long	Planning	
Action C 2.2	Install new, comfortable bus shelters to encourage more ridership.	Short	Planning and Community Services	
Action C 2.3	Construct sidewalk (or alternative, such as a widened shoulder) on primary roadways within the 10-minute walk distance of bus service that currently have no pedestrian accommodations.	Long	Community Services	
Objective C 3	**Provide a bicycle network that is integrated into the City's transportation system.**			
Action C 3.1	Prepare a citywide bike plan that identifies existing gaps, determines recommended routes with specific treatments and amenities, and	Immediate	Planning	

	establishes an implementation strategy, including the location and supply of bike racks.			
Action C 3.2	Seek opportunities to connect bicycle routes to the community trail.	Short	Planning	
Action C 3.3	Evaluate and implement bike routes via formal lanes or sharrows on the more heavily used City streets.	Short	Transportation Advisory Commission	
Action C 3.4	Evaluate and implement recreational bike loops via sharrows.	Short	Transportation Advisory Commission	

Traffic Calming (TC)

Goal/Objective/Action		Priority	Responsibility	Chapter Reference
Traffic Calming Goal	**Dover's streets are well-directed and well-managed in an environment that supports and enhances the most desirable characteristics of the downtown and the City's residential neighborhoods.**			
Objective TC 1	**Transform mobility through the City via Complete Streets and streetscape efforts to create an inviting and vibrant community for all modes of travel.**			
Action TC 1.1	Implement the Preferred Alternative of the 2015 Downtown Dover Pedestrian and Vehicular Access and Streetscape Plan.	Short	Planning	
Action TC 1.2	Adopt regulations that create access management overlay districts for the four corridors identified.	Short	Planning Board	
Action TC 1.3	Complete traffic calming studies and implement recommendations for the eight corridors identified.	On-going	Planning and Community Services	
Action TC 1.4	Program and fund streetscape/reconstruction projects identified.	Short	Planning Board and City Council	
Action TC 1.5	Establish a wayfinding and signage program for the downtown that can implemented in phases.	Short	Planning	
Objective TC 2	**City streets are posted with speed limits that are appropriate and consistent with the character of the existing environment.**			
Action TC 2.1	Adopt a formal policy for posting speed limits on City streets by 2018.	Immediate	Transportation Advisory Commission and City Council	
Objective TC 3	**The City capitalizes on opportunities to implement connectivity and traffic calming measures through on-going annual City projects and maintenance.**			
Action TC 3.1	Implement a policy that evaluates the possibility of restriping City Streets during the routine paving/maintenance to incorporate bike lanes or sharrows before the work is performed.	Immediate	Community Services	
Action TC 3.2	Implement a policy that considers the application of widened shoulders in lieu of formal sidewalks where safe and applicable.	Immediate	Community Services	

Technology (T)

Goal/Objective/Action		Priority	Responsibility	Chapter Reference
Technology Goal	**Dover's transportation system utilizes advanced technology to promote safe and efficient multimodal mobility throughout the City and provides users with real-time travel and parking data to enhance convenience.**			
Objective T 1	**Dover is actively and continually building the components of a smart city.**			
Action TC 1.1	Establish a Transportation Technology Committee to explore and evaluate technology components that will advance Dover's transportation system, and develop a multimodal intelligent transportation infrastructure plan (MITIP).	Immediate	Planning	
Action TC 1.2	Prioritize and implement action items that result from the MITIP.	Immediate	Planning	
Action TC 1.3	Continue to work with State government in adopting regulations that allow the use of bus prioritization in urban areas.	On-going	Planning	
Action TC 1.4	Work with COAST to implement technology such as NextBus to provide real time data of bus arrivals for riders.	Short	Planning	
Objective T 2	**Dover is ready and prepared to be responsive in the event of unanticipated major traffic incidents.**			
Action TC 2.1	Develop incident management plans that are ready for immediate implementation as needed to address unanticipated traffic events in the City.	Long	Police Department	
Action TC 2.2	Establish an annual meeting where those responsible for the implementation and execution of plans (emergency responders and other City officials) review its components and update it accordingly.	Long	Fire Department	