CHAPTER V – TRANSPORTATION

INTRODUCTION

Land use and transportation are integral elements in the spatial layout and growth of a community. The dominant use of the automobile contributed to the transformation of the character of Hudson from rural to suburban during the latter part of the twentieth century. The rise in motor vehicle use has enabled residents to commute longer distances, businesses to improve services for their customer base, and communities to broaden their tax bases through economic growth. The rise in motor vehicle use has also created traffic congestion problems, especially along major highway corridors. The key to preserving and enhancing Hudson's transportation network is to ensure that roadway capacity and regional connections are enhanced and maintained and that incremental improvements to the complete transportation network that includes transit, sidewalks, and bicycle routes, are implemented.

The purpose of the Transportation Chapter of the Master Plan is to discuss strategies for an efficient and safe transportation system that will preserve the community’s character, accommodate growth, and increase the availability of transportation choices. This chapter includes a discussion of: 1) the existing transportation network, including the roadway classification system, existing traffic conditions, highway capacity, crashes, bridge conditions and travel patterns; 2) future traffic projections; 3) transportation solutions, including regulations, access management, community character guidelines, traffic calming and scenic road designation; 4) alternative transportation, including transit, bicycle and pedestrian facilities; and 5) recommendations.

Note: During the course of drafting and review of this chapter, the Nashua Regional Planning Commission performed a Townwide Traffic Study independent of the analysis contained herein. This study is included as part of this chapter in the Appendix V-1.

EXISTING TRANSPORTATION NETWORK

Roadway Classification

Chase Street – A Class IV Road

Based on the New Hampshire Department of Transportation (NH DOT) road mileage inventory, there are 194.4 miles of roads in the Town of Hudson. The State of New Hampshire classifies roadways in two ways. The first is by a state funding category (the State Aid classification system) and the second is by federal funding category (the Functional classification system). The State Aid classification system was developed by the State of New Hampshire, as defined by RSA 229–231, to determine responsibility for construction, reconstruction, and maintenance as well as eligibility for use of state aid funds. Descriptions of the State Aid classification system are included in Appendix V-2. The State Aid classification road mileage in Hudson is summarized in Table V-1 and illustrated on Map V-1.

Table V-1. State Aid Classification Road Mileage

Legislative Class	Miles	Percentage
Private Roads	25.93	13.34%
Class I: Primary State Highway	2.89	1.49%
Class II: Secondary State Highway	12.92	6.64%
Class III: Recreational Roads	0	0.00%
Class IV: Roads in Urban Compact Area	7.61	3.91%
Class V: Local Roads	142.01	73.03%
Class VI: Non-Maintained Local Roads	3.09	1.59%
Total	**194.44**	**100.00%**

Source: NH DOT, 2020.

The functional classification system was also developed by the State of New Hampshire as required by the Federal Highway Administration (FHWA). The Functional classes were set according to the criteria defined by the FHWA and the American Association of State Highway and Transportation Officials (AASHTO). This system classifies roads and highways into different categories according to their functions and was developed to define eligibility for funds under federal programs. Descriptions of the functional classification system characteristics are included in Appendix V-2. Arterial and Collector roadways in Hudson are listed in Table V-2 and illustrated on Map V-2.

Table V-2. Statewide Roadway Functional Classification*

Functional Classification	Roadways
Urban Other Principal Arterial	NH 111, NH 102 From Library street to Litchfield Line, NH 102 from Litchfield line to Londonderry, Sagamore Bridge, Taylor Falls Bridge, NH 3A from Sagamore Bridge to Elm Ave
Urban Minor Arterial	NH 3A from Elm Ave to Litchfield line, Library St, Central St from NH 3A to NH 111, Belknap St from County Rd to Central St, County Rd from NH 3A to Belknap Rd, NH 3A from MA line to Sagamore Bridge
Urban Major Collector	Dracut Rd, Wason Rd, Bush Hill Rd, Kimball Hill Rd, Greeley St, Highland Ave from 3A to Highland St, Highland St, Old Derry Rd from NH 102 to Greeley St

Source: NH DOT, 2020.
* Other classifications are used for the NH DOT, but do not apply to the Town of Hudson.

In addition to the statewide roadway classification, the Town of Hudson has adopted its own functional classification scheme within the Town's zoning ordinance for certain roads. Table V-3 summarizes the Town's official functional classification.

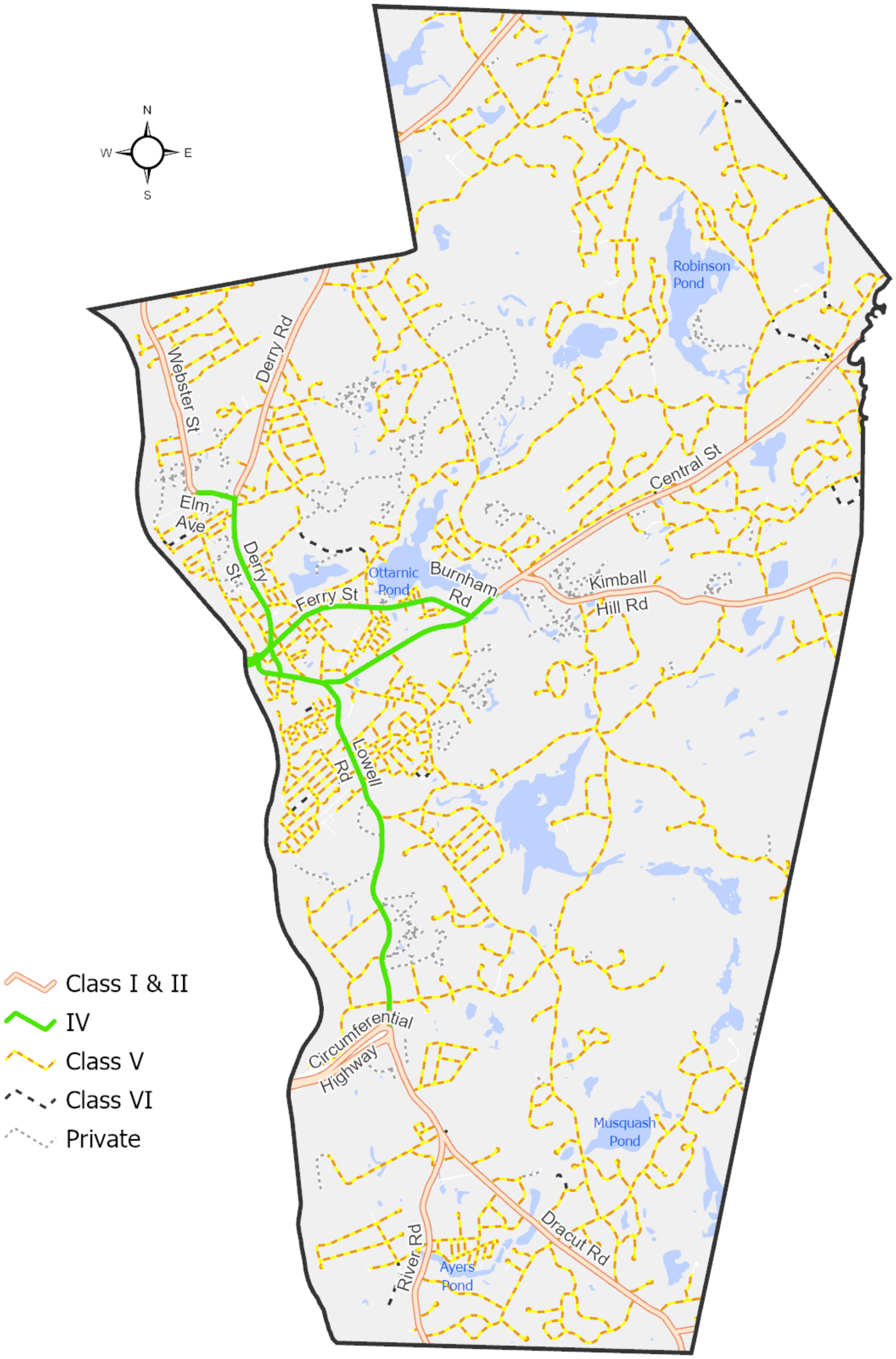
Lowell Road (NH 3A) – A Class IV Arterial

Table V-3. Town Designated Roadway Functional Classification

Functional Classification	Roadways
Arterial	1) NH 3A (Elm Street, Lowell Road, Webster Street, and River Road). 2) NH 102 (Derry Street) 3) NH 111 (Central Street) 4) Dracut Road
Collector	1) Barretts Hill Road 2) Belknap Road 3) Burns Hill Road 4) Bush Hill Road 5) Greeley Street 6) Highland Street 7) Kimball Hill Road 8) Lawrence Road 9) Musquash Road 10) Old Derry Road 11) Pelham Road 12) Pine Road 13) Robinson Road 14) Wason Road 15) West Road 16) Windham Road

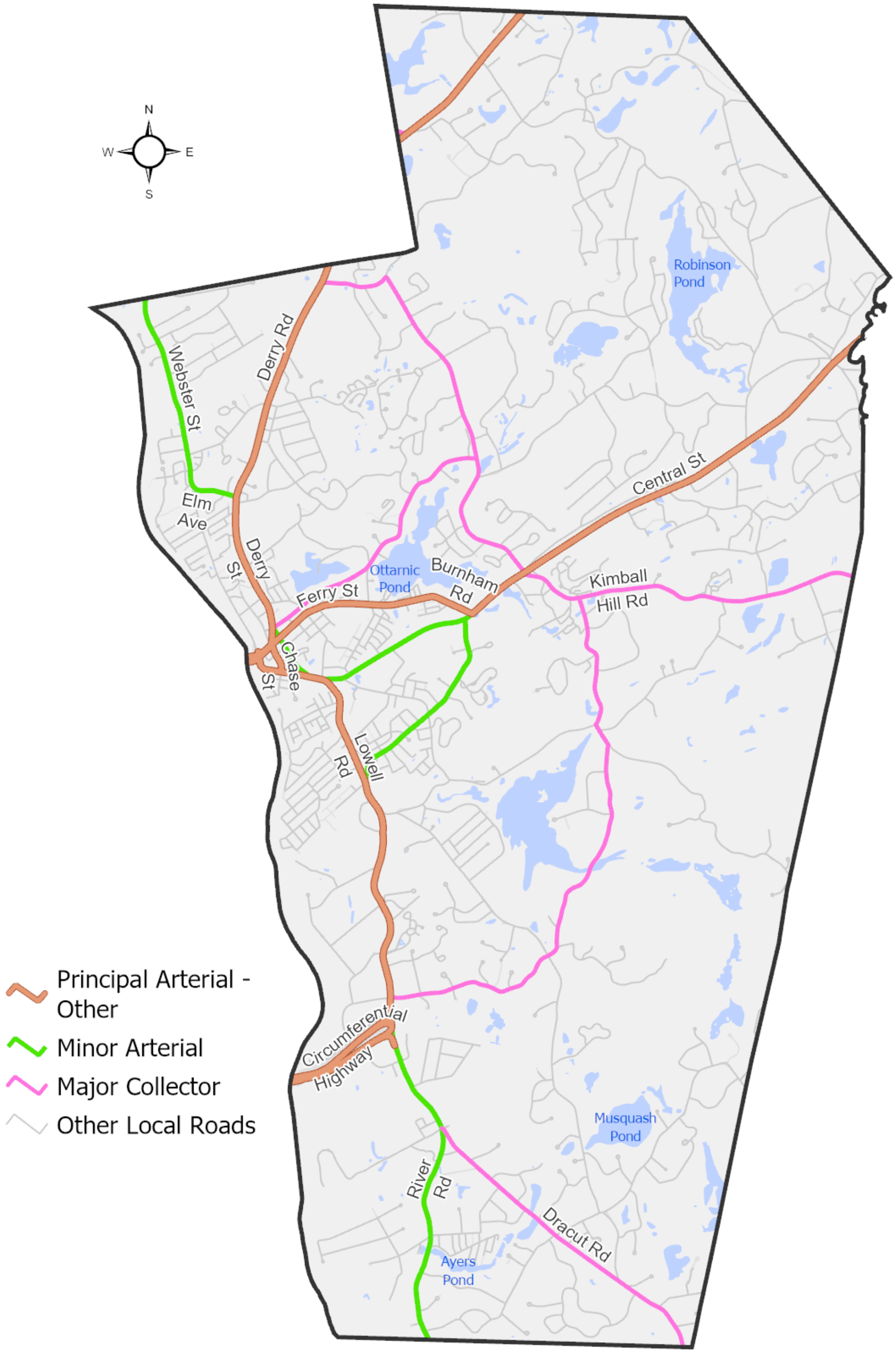
Source: Hudson Zoning Ordinance.

Map V-1. State Aid Classification of Roadways in Hudson



Source: NH DOT, 2020.

Map V-2. Statewide Functional Classification of Roadways in Hudson



Source: NH DOT, 2020.

Existing Traffic Conditions, Trends and Level of Service

The Hudson Master Plan resident survey conducted by NRPC provides data on the level of concern among citizens over the level of traffic congestion along the town's roadways. Forty-three percent (43%) are "very concerned" and 30% are "concerned." The remaining 27% is split between "neutral" and "not concerned." Fifty-eight percent (58%) said the Town should "do more" to address congestion and 32% said "maintain current efforts." The remaining 10% did not favor action by the Town.

Historic traffic volume data for the Town of Hudson has been compiled primarily from the Nashua Regional Planning Commission (NRPC) traffic count program. Traffic counts are conducted for the NH DOT in accordance with federal guidelines under the Federal Highway Performance Monitoring System (HPMS). The HPMS guidelines describe federal procedures for sampling highway and road volumes. These procedures provide the Federal Highway Administration (FHWA) with highway volumes for design standards and meet the Environmental Protection Agency's (EPA) requirements for estimating vehicular highway travel. In addition to NH DOT's annual traffic counting program, NRPC maintains an ongoing traffic count program to validate the region's traffic model and provide data for residential and commercial trip generation rates. NRPC also provides traffic counts for member communities upon request.

Using the observed traffic count data, it is possible to evaluate the performance of highway facilities through the use of highway capacity analysis. The principal objective of this procedure is the estimation of the maximum amount of traffic that can be accommodated by a given facility. It provides tools for the analysis, improvement of existing facilities and for the planning and designs of future facilities.

Traffic on Lowell Road

"Level of Service" (LOS) is a term which denotes the type of operating conditions which occur along a roadway or at a particular intersection for a given period of time, generally a one-hour peak period. It is a qualitative measure of the effect of a number of operational factors including roadway geometrics, travel delay, freedom to maneuver and safety. Level of service categories for roadway segments and descriptions are explained below.

Level of Service "A" represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream.

Level of Service "B" is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is still relatively unaffected.

Level of Service "C" is in the range of stable flow but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. Occasional backups occur behind turning vehicles.

Level of Service "D" represents high-density, but stable, flow. Speed and freedom to maneuver are restricted, and the driver experiences a below average level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level of Service "E" represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform level. Freedom to maneuver within the traffic stream is extremely difficult and is generally accomplished by forcing other vehicles to give way. Congestion levels and delay are very high.

Level of Service "F" is representative of forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point that results in lengthy queues.

Table V-4 indicates the relationship between traffic volumes and level of service for various roadway types. Table V-5 provides the daily weekday volumes for important HUdson roadways, along with the levels of service for each particular road.

Table V-4: Maximum Daily Traffic for Each Level of Service by Roadway Type (Per Two-Way Single Lane Volume)

	LOS A	LOS B	LOS C	LOS D	LOS E
Expressway	10,000	19,000	27,000	32,000	38,000
At-grade Principal Arterial	4,200	7,500	12,000	18,000	28,000
Minor Arterial	4,000	7,000	11,500	17,000	26,500
Major Collector	3,600	6,300	10,400	15,300	23,800
Minor Collector	3,200	5,700	9,400	13,800	21,400
Local (Paved)	2,500	4,500	7,500	11,000	17,000

Source: Derived from procedures in the 1985 Highway Capacity Manual.

Existing traffic counts, historic trends and level of service are shown in Table V-5. Map V-3 illustrates the Average Weekday Traffic (AWDT) for roads of higher functional classification in Hudson.

The Taylor Falls/Veterans Bridge, NH 3A south of Wason Road and the Sagamore Bridge carry the highest traffic loads and operate at LOS E. While the TF/Veterans Bridge volume has remained flat for the last ten years and the Sagamore Bridge has experienced only moderate growth, NH 3A has averaged a 3.4% annual growth rate since 2009. Other NH 3A locations have shown low or no growth in recent years. NH 111 east of the town center to the Windham line has seen moderate annual growth in the

1.1% to 1.7% range. High growth has occurred on some local roads which enable drivers to bypass the NH 111 and NH 3A arterials through the town center to reach south Hudson. Bush Hill Road and Wason Road, in particular, have absorbed the growing traffic demand.

Wason Road, pictured above, has experienced high Levels of traffic growth

Table V-5. Average Weekday Traffic (AWDT) and Growth Trends

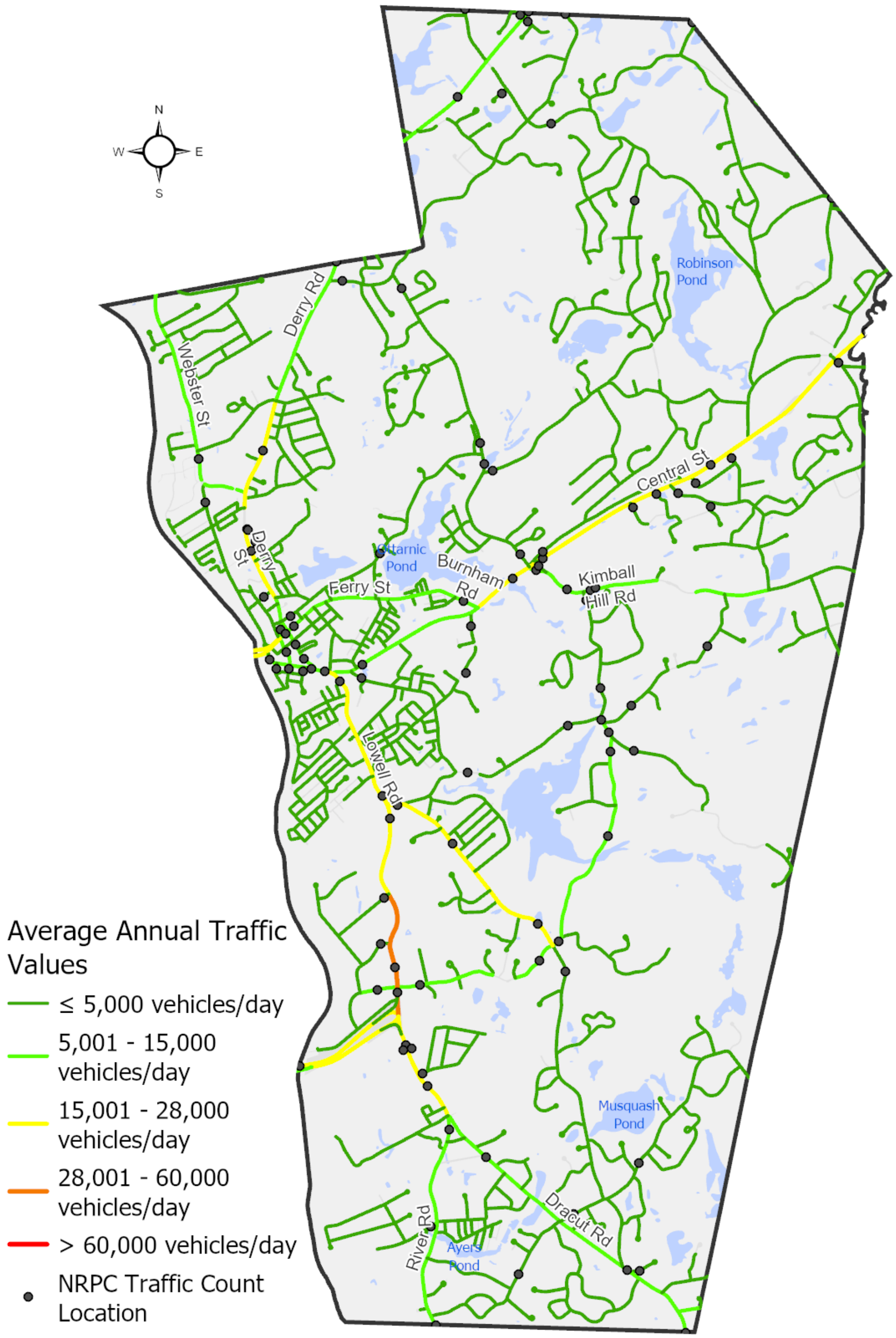
Facility	Location	Prior Count	Prior AWDT	Current Count	Current AWDT	Annual % Change	LOS
NH 111 TF/Vet Mem Br	over Merrimack River	2009	37,870	2019	37,150	-0.2%	E
NH 111 Ferry St.	E. of Library St.	2010	13,250	2019	13,200	0.0%	D
NH 111 Burnham Rd.	N. of Central St.	2013	13,130	2019	12,550	-0.8%	D
NH 111 Central St.	E. of Kimball Hill Rd.	2011	16,920	2017	18,670	1.7%	E
NH 111 Central St.	at Windham TL	2012	15,490	2018	16,530	1.1%	D
NH 102	at Londonderry TL	2009	15,750	2019	17,770	1.3%	D
NH 102	at Litchfield TL	2010	16,380	2019	16,800	0.3%	D
NH 3A/102 Derry St	N. of Ledge Rd.	2008	28,690	2017	26,330	-0.9%	D
NH 3A/102 Derry St	N. of NH 111 Ferry St.	2009	18,640	2018	15,750	-1.9%	D
NH 3A Lowell Rd	S. of Central St.	2008	23,360	2017	22,640	-0.3%	E
NH 3A Lowell Rd	S. of Pelham Rd.	2008	25,450	2017	25,400	0.0%	D
NH 3A Lowell Rd	S. of Wason Rd.	2009	30,450	2017	39,700	3.4%	E
NH 3A Lowell Rd	S. of Rena St.	2011	24,300	2017	23,580	-0.5%	D
NH 3A River Rd	S. of Dracut Rd.	--	--	2019	9,950	--	C
NH 3A River Rd	at Mass. SL	2011	7,805	2017	7,710	-0.2%	C
Belknap Rd.	S. of Central St.	2013	5,470	2019	5,140	-1.0%	B
Burns Hill Rd.	N. of Wason Rd.	2009	2,780	2019	2,810	0.1%	A
Bush Hill Rd.	S. of Kimball Hill Rd.	2012	4,470	2018	5,470	3.4%	B
Bush Hill Rd.	S. of Speare Rd.	2008	5,760	2017	6,760	1.8%	C
Bush Hill Rd.	E. of Wason Rd.	2009	1,280	2019	1,780	3.4%	A
Central St.	S. of NH 111	--	--	2019	5,540	--	B
Central St.	E. of Adelaide St.	2009	5,326	2018	5,770	0.9%	B
County Rd.	E. of NH 3A	2008	4,140	2017	4,520	1.0%	B
Dracut Rd.	S. of Musquash Rd.	2012	13,550	2018	15,300	2.0%	D
Dracut Rd.	Mass. SL	2013	8,070	2019	9,690	3.1%	C
Executive Dr	W. of NH 3A	--	--	2018	2,730	--	A
Flagstone Dr.	W. of NH 3A	--	--	2018	4,340	--	B
Greeley St.	N. of NH 111 Central St.	--	--	2019	5,310	--	B
Highland St.	N. of George St.	2011	3,740	2017	3,990	1.1%	B
Kimball Hill Rd.	S. of NH 111 Central St.	2010	7,175	2017	8,200	1.9%	C

Table V-5. Average Weekday Traffic (AWDT) and Growth Trends (Cont.)

Facility	Location	Prior Count	Prior AWDT	Current Count	Current AWDT	Annual % Change	LOS
Library St.	N. of NH 3A Central St.	2009	10,420	2018	9,000	-1.6%	C
Melendy Rd.	S. of Central St.	2009	2,880	2018	1,970	-4.1%	A
Musquash Rd.	S. of Burns Hill Rd.	--	--	2019	2,240	--	A
Old Derry Rd.	E. of NH 102	2013	3,180	2019	2,820	-2.0%	A
Park Ave	S. of NH 111	--	--	2018	2,230	--	A
Pelham Rd.	W. of Bush Hill Rd.	2009	2,310	2018	2,150	-0.8%	A
Sagamore Bridge	Hudson/Nashua CL	2009	45,055	2018	49,600	1.1%	E
Sherburne Rd	at Pelham TL	2014	8,180	2017	9,190	4.0%	C
Speare Rd.	E. of Bush Hill Rd.	2009	1,830	2019	2,360	2.6%	A
Wason Rd.	E. of Musquash Rd.	2009	5,850	2018	9,330	5.3%	C
Wason Rd.	E. of NH 3A	2009	8,590	2018	9,330	0.9%	C

Source: NRPC & NHDOT traffic counts

Map V-3. Average Daily Traffic on Hudson Roads



Source: NH DOT, 2020.

Planned Intersection Improvements

At the request of the Towns of Hudson and Litchfield, a traffic study was completed to determine future impacts of the Circumferential Highway on traffic operations at various essential intersections within the local road network. The *Hudson-Litchfield Traffic Study, 2002* was funded through a grant from the NH DOT. The engineering consultant firm of Vollmer Associates was contracted to evaluate existing and future traffic conditions at those intersections. The main purpose of the study was to evaluate traffic conditions over a twenty-year horizon and to consider improvements needed as a result of the impacts of the Circumferential Highway and the Airport Access Road in Manchester. The study identified specific needed improvements at the study area intersections. A number of these improvements have since been implemented. Table V-6 summarizes the remaining recommended improvements that have yet to be implemented. In 2019, the Planning Board commissioned design studies for the Belknap Road/Birch Street/NH 3A area but no construction has been planned.

Table V-6. Recommended Intersection Improvements in Hudson

Intersection Location	Recommended Improvements
Belknap Road **NH 3A/Birch Street**	• Extend Belknap Road from County Road to a new four-way signalized intersection with NH 3A and Birch Street. • Construct sidewalk along the northern side of the Birch Street extension. • Add a left turn storage lane on the NH 3A southbound approach at the newly signalized intersection. • Install raised island at the southwest corner of the intersection to better define driveway openings.
County Road	• Convert the southern end of County Road to one-way northbound. • Maintain existing two-way traffic from ball fields to Belknap Road.

Source: Vollmer Associates, *Hudson-Litchfield Traffic Study, 2002*.

New Hampshire State Transportation Improvement Program (STIP) in Hudson

The New Hampshire State Transportation Improvement Program (STIP) includes the following two projects in Hudson, shown in Table V-7. Construction has started on NH 3A to add a southbound right turn lane, During the 2022 solicitation of projects for the Ten Year Plan, Hudson submitted three new projects with one being successfully added. A sidewalk infill and pedestrian improvements project for NH 102 (Derry Road) between Ledge Road and Alvirne High School is currently on the draft NH DOT Ten Year Plan.

Table V-7. NH STIP Projects in Hudson

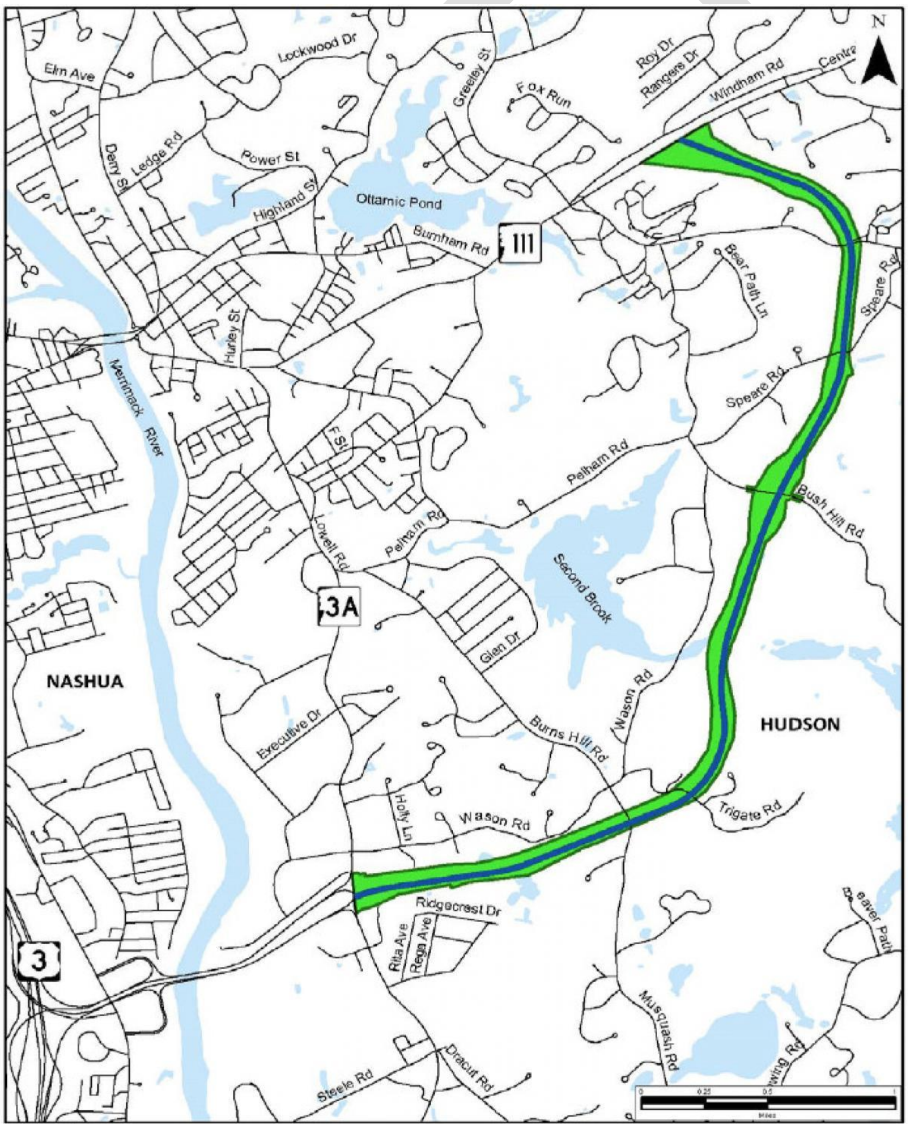
Location	Improvements
NH 3A	Construct a third southbound right turn lane on NH 3A between Wason Rd. and Sagamore Bridge Rd. Construction in FY 2023. Project cost of $1.55 million is 80% federal, 20% Town funding.
Hudson Blvd	Preliminary engineering in FY 24-25 of a new roadway between Rte. 3A and Rte. 111. Construction TBD. All project cost of $55.68 million. Feasibility study cost ~$1 million, 80% federal, 20% Town funding.

Source: NH State Transportation Improvement Program

Hudson Boulevard

The Hudson Boulevard has evolved as a scaled down southern segment of what was formerly known as the Circumferential Highway. Although this project was removed from the NH Ten Year Transportation Plan programming in 2005, it has since been re-added with preliminary engineering slated to start in 2024-2025. In contrast to the limited-access, high-speed expressway once envisioned, the project now is seen as an approximate 40 mph, controlled access roadway (no frontage) along the southern Circumferential Highway right-of-way between NH 3A and NH 111 with at-grade intersections and a parallel, separate multi-use path for bicycles and pedestrians. The estimated project cost is about $56 million as of the 2023-2032 plan, increasing to $60 million in the 2025-2034 draft. Traffic impacts of the project are presented later in the future year traffic forecast.

Map V-4. Proposed Hudson Boulevard



Vehicle Crashes

Road safety is a transportation issue running a close second to traffic congestion among Hudson citizens. Twenty-eight percent (28%) of respondents said they are “very concerned” about speeding and traffic safety, while 36% replied “concerned.” Thirty-five percent (35%) said the Town should “do more” to address speeding, 55% favor “maintaining current efforts” and 10% did not favor Town action on this issue.

Recent Crash in Hudson - Source: *ABC Boston*

The State of New Hampshire since 2017 has maintained vehicle crash data through a system known as the NH VISION database. This system replaced a legacy database that had been managed by two departments, the NHDOS and NHDOT, which had resulted in data inconsistencies. The most recent crash data available is for 2018. Since the 2017 data had many incidents which were coded to municipality but not a roadway, NRPC is processing and analyzing crash data for years 2018 and going forward.

Crash rates are developed based on the number of crashes per million vehicle miles traveled annually. Table V-8 provides these rates for 2018. One year of data is insufficient to develop conclusive findings; NRPC will update its crash database statistics annually from the NH Vision database and will review the data to determine if intersection-level statistics can be reliably developed.

The Town should consider further detailed studies for the highest crash rate intersections to develop improvements and strategies to reduce crashes. The Town of Hudson Highway Safety Committee should consider requesting that the NH DOT perform safety studies for the highest crash rate intersections. The studies should include collision diagrams and an analysis of the physical road features and traffic control, road conditions at the time of the crashes (latest three years), the severity of the crashes, and a summary tabulation of crashes. Any further detailed crash studies should include input from the public and include the following six steps:

1. Identify the locations that are candidates for improvements.
2. Quantify the main crash trend(s) at a particular location.
3. Determine the source of the problem(s).
4. Evaluate types of improvements to address the crash problem(s).
5. Obtain an expert opinion about safety improvement(s).
6. Obtain funding to implement a safety improvement.

New Hampshire offers several programs and funding sources to aid in improvements to road and multi-modal transit safety. Some broad programs for funding include Safe Streets and Roads for All (SS4A) grants, as well as Highway Safety Improvement Program (HSIP) funds. A comprehensive safety plan is often-times a requirement for towns to access larger pools of state and federal funding for safety improvements, so the adoption of a Complete Streets policy may be a first step in improving local safety for drivers and pedestrians.

Table V-8 Vehicle Crash Rate by Street, 2018

	Length	ADT	MVM/Year	Crashes	Crashes/ MVM/Yr
Lowell Rd					
Central St-County Rd	0.51	20,400	3.80	31	8.16
County Rd-Executive Dr	1.06	23,000	8.90	25	2.81
Executive Dr-Sagamore Br	0.82	30,000	8.98	57	6.35
Sagamore-Dracut Rd	0.74	23,500	6.35	48	7.56
Derry Rd					
Ferry St-Elm Ave	1.01	25,000	9.22	59	6.40
Elm Ave-Derry Ln	0.64	15,400	3.60	10	2.78
Derry Ln-Alvirne HS	0.43	15,200	2.39	11	4.61
Alvirne HS-Londonderry TL	2.66	14,900	14.47	17	1.18
Central St					
Ferry St-Lowell Rd	0.47	15,000	2.57	12	4.66
Lowell Rd-Burnham Rd	1.05	5,150	1.97	7	3.55
Burnham Rd-Kimb Hill Rd	0.43	21,900	3.44	18	5.24
Kimb Hill Rd-Windham TL	2.71	17,000	16.82	6	0.36
Wason Rd	2.64	7,200	6.94	38	5.48
Ferry St	1.28	11,900	5.56	36	6.48
Dracut Rd	2.16	13,200	10.41	28	2.69
Bush Hill Rd	4.61	4,600	7.74	22	2.84
Robinson Rd	3.35	NA	NA	18	NA
Library St	0.40	8,200	1.20	17	14.20
Sagamore Br	1.07	45,000	17.57	17	0.97
Walmart Dr	0.18	9,500	0.62	10	16.02
Kimball Hill Rd	2.15	7,500	5.89	10	1.70
Musquash Rd	2.27	2,000	1.66	10	6.03
River Rd	1.45	8,000	4.23	9	2.13
Old Derry Rd	2.69	2,500	2.45	9	3.67
Pelham Rd	1.60	1,900	1.11	8	7.21
Executive Dr	0.43	2,500	0.39	8	20.39
Melendy Rd	1.10	1,800	0.72	7	9.69
Burnham Rd	0.28	11,300	1.15	6	5.20

Source: NH Vision Database, 2018

Bridge Conditions

NH DOT inspects locally-owned bridges as well as state-owned bridges. NH DOT defines a bridge as a structure with a span of at least 10 feet. Inspection and maintenance of culverts and other structures that do not meet this 10-foot span definition on local roads are the responsibility of the town (NH RSA 234). NH DOT inspects bridges on Class IV and V roads (local roads) every two years and the records of these inspections must be kept by the town. The state inspections are a prerequisite for a town's participation in the State Bridge Aid program.

The municipality bears the responsibility for the installation of signs for posting load restrictions on local bridges, although the NH DOT recommends these load restrictions after inspection. The Town should develop routine inspection and maintenance for culverts and other structures on local roads that are not inspected or maintained by the state.

The State of New Hampshire lists ten bridges in the Town of Hudson that are regularly inspected and rated by the NH DOT. The "Structurally Deficient" rating for a bridge denotes that there are deficiencies in the bridge structure and a load restriction is recommended, or repairs for those bridges that need significant maintenance. The "Functionally Obsolete" rating refers to the bridge's capacity for traffic operations in relation to the function of the approach road. NH DOT lists one bridge in Hudson as "Structurally Deficient." The NH 3A bridge over First Brook was listed as structurally deficient for its culvert, which is rated as poor condition. The NH DOT lists two bridges (Taylor Falls/Veterans Bridge over the Merrimack River, owned evenly between Hudson & Nashua) as "Functionally Obsolete." The "Functionally Obsolete" status for the Taylor Falls/Veterans Bridge refers to the fact that these bridges are not wide enough to provide the capacity needed to avoid traffic congestion based on the traffic demand at this location. These bridges have been programmed in the NH Ten Year Highway Plan for moderate rehabilitation and are scheduled for construction in 2024/2025. The project cost is 80% funded by the State and the local share will be split between Hudson and Nashua.

In addition to inspecting and rating bridges for weight restrictions, NH DOT publishes a list of bridges statewide that are included on its "red list." NH DOT defines "red list" bridges as those bridges "…requiring interim inspections due to known deficiencies, poor conditions, weight restrictions, or type of construction. These structures are inspected twice yearly." No bridges in Hudson are included on the "red list."

Travel Patterns

Information on origin and destination patterns for travel to workplace is available from the American Community Survey (ACS) through the OnTheMap tool. As shown on table V-9 for 2020, about 29% of Hudson residents commute within the town or to Nashua, while another 35% travel to locations in Massachusetts for work. The remaining 36% are distributed primarily among several New Hampshire municipalities.

Information on commuting is available from 2017 -2021 ACS 5-year data. 82% of Hudson's workers commuted by single occupant vehicle, which, while a decrease from a fairly steady rate of about 87% since the 2000 Census, it is still and higher than the national average of 76%. This decrease may be due to an increase in the number of people working from home. The mean travel time to work stands at 31.6 minutes, which is 14% higher than it was in 2000. This may be due to both longer travel distances and more congested highway arterials.

Table V-9 Commuting Destinations of Hudson Residents

Place of Work	Total Workers	Percentage
Nashua	2,495	18%
Hudson	1,525	11%
Merrimack	514	4%
Other Nashua Area	524	4%
Manchester	870	6%
Salem	488	3%
Londonderry /Derry	692	5%
Bedford	288	2%
Windham	150	1%
Concord	197	1%
Other NH	1,073	1%
New Hampshire Subtotal	**8,816**	**64%**
Lowell	602	4%
Burlington	231	2%
Boston /Cambridge	504	4%
Other Massachusetts	3,515	25%
Massachusetts Subtotal	**4,852**	**35%**
Other	56	0%

Source: American Community Survey

The Town should encourage alternative modes to single occupancy auto use to help decrease traffic congestion and provide greater choices for Hudson commuters. The Town should work with the NRPC and the NH DOT to plan for and promote alternative modes of transportation. Programs should include efforts to increase commuter participation in existing region-wide carpooling and vanpooling programs, commuter bus lines and commuter rail. In addition, the Town should work with the NRPC and the Nashua Transit System to extend the existing bus routes from Nashua to Hudson to provide for an alternative mode for commuting within the Nashua region. The Town should also support the NH DOT's region-wide effort to extend the commuter rail line from Boston and Lowell to Nashua recognizing this will require capacity improvements to the regional transportation network to serve it. The commuter rail sites identified by the NH DOT on Daniel Webster Highway in South Nashua and on Crown Street in Nashua are both a short driving distance for most Hudson commuters. In addition to working on and coordinating the alternative transportation effort with government agencies, the Town should also explore the option of working directly with large employers in the Town to coordinate the alternative modes initiative.

Table V-10. Means of Transportation to Work (Workers 16 years and over)

Means of Transportation	2021		2020	
	Estimate	**Margin of Error**	**Estimate**	**Margin of Error**
Drove alone	82.4%	+/- 3.3	85.4%	+/- 3.3
Carpooled	5.3%	+/- 1.5	6.0%	+/- 1.9
Public transportation (excl. taxi)	1.0%	+/- 0.7	0.4%	+/- 0.4
Bicycle	0.1%	+/- 0.2	0.3%	+/- 0.3
Walked	0.3%	+/- 0.5	0.1%	+/- 0.2
Taxi, motorcycle or other means	0.5%	+/- 0.4	0.7%	+/- 0.5
Worked at home	10.4%	+/- 3.4	7.1%	+/- 2.9
Total	**15,237**		**15,508**	

Source: US Census Bureau, American Community Survey (5-year estimates)

Table V-11. Travel Time to Work (Not Working from Home)

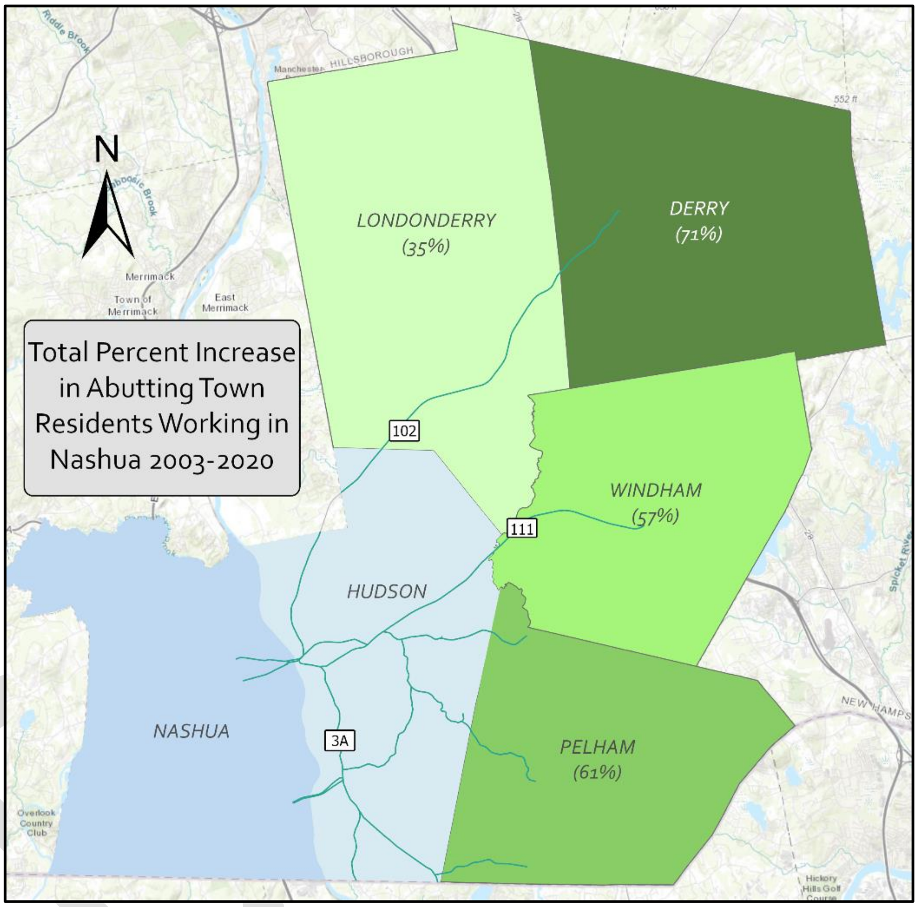
Travel Time	2021		2020	
	Estimated Total	**Margin of Error**	**Estimated Total**	**Margin of Error**
Less than 10 minutes	7.3%	+/- 2.5	8.6%	+/- 2.3
10 to 14 minutes	13.3%	+/- 2.8	13.3%	+/- 3.2
15 to 19 minutes	12.1%	+/- 2.9	13.5%	+/- 2.9
20 to 24 minutes	11.5%	+/- 2.6	11.3%	+/- 2.3
25 to 29 minutes	8.1%	+/- 1.8	8.4%	+/- 1.8
30 to 34 minutes	13.9%	+/- 3.0	14.3%	+/- 3.1
35 to 44 minutes	10.1%	+/- 1.9	8.5%	+/- 1.9
45 to 59 minutes	10.5%	+/- 2.8	8.2%	+/- 2.5
60 minutes or more	13.3%	+/- 3.2	13.9%	+/- 2.8
Mean Travel Time to Work (min.)	31.6	+/- 2.2	30.7	+/- 2.3

Source: US Census Bureau, American Community Survey (5-year estimates)

Hudson Through Traffic Pattern

While many commuter trips on Hudson roadways are workers either living or working within Hudson town borders, a major contributor to congestion during peak hours is through-commuters from towns east of Hudson driving to Nashua, and vice versa. These commuters use NH 111 (Central/Burnham/Ferry), NH 102 (Derry Rd.) and NH 3A (Webster/Lowell) to cross the Veteran's Bridge, as well as local residential roads such as Wason and Bush Hill Road as mentioned prior to reach Lowell Road, in order to cross the Sagamore Bridge. Unlike other communities, Hudson current lacks a strong east-west thru-way for commuter traffic.

Map V-5. Towns Commuting Through Hudson to Nashua



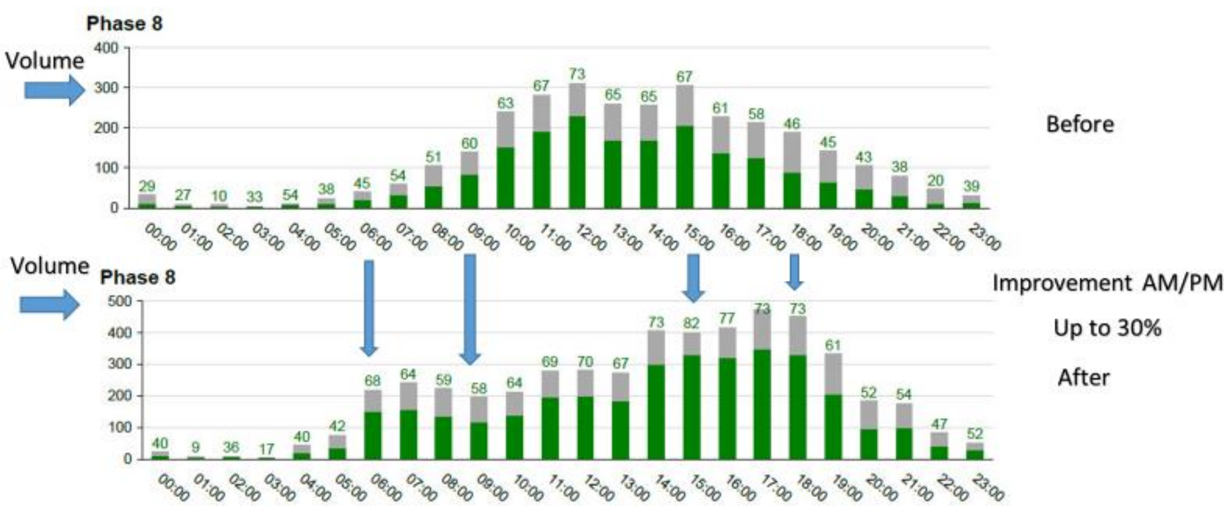
Over the time period of 2003-2020, the American Community Survey (ACS) documented an aggregate increase of 40% in trips originating from east of Hudson and arriving in Nashua. This represents a year-on-year increase of ~2%. It should be noted that due to COVID-19 the years of 2019 and 2020 may not be representative of greater patterns in transit over time. Of note, these increases in traffic are concentrated around the morning and evening peak commute hours as the recorded trips are for work only, thus exacerbating the already most congested times of day. While the aggregate increase was 2% year on year, the rate varied notably between years and between towns as conditions have fluctuated. The total percent change for the four nearest towns eastward can be seen above. While conditions have changed over the past two decades, there are no indicators that growth will subside or that problems related to through traffic will be remediated without intervention.

Hudson's Traffic Management System

The Town of Hudson is the municipal leader in the Nashua area with respect to implementation of state-of-the-art traffic management control. The Town employs the GRIDSMART single camera system for actuation. GRIDSMART gathers and interprets traffic data, enabling staff to adjust signal timing and traffic flow strategies, and conduct real-time monitoring and visual assessment. The system is now proceeding toward total coverage of Hudson's signalized intersections.

A variety of data is obtained from the system for planning purposes, in addition to the real-time operational adjustments that can be implemented. Performance packets provide daily volumes, turning movement counts, vehicle length classification, green/red arrivals, red light violation counts and speed. Figure V-2 below illustrates how the system has improved green phase traffic signal arrivals.

Figure V-2. Before & After Green Arrivals on Library Street



Source: Town of Hudson

FUTURE TRAFFIC PROJECTIONS

Future traffic forecasts can be estimated utilizing the NRPC regional traffic model. The projections in this section were conducted mid-2020 whereas the projections in the Hudson Townwide Traffic Study were done in 2022 (Appendix V-1). The NRPC model uses 25-year regional land use forecasts to estimate future trip generation and zones of trip attraction and production within the region. The road network in the model is revised to reflect changes in the system due to the completion of major roadway capacity projects for future traffic estimation. The future revised road network, along with changes in land use assumptions, yields future trips and trip distribution within the region. Model calibration is achieved by comparing ground counts taken in the field with a base year model run that reflects existing network and land use conditions. The model is then revised to reflect future network and land use conditions based on the planned road projects and the land use growth assumptions. One issue that must be emphasized is that the traffic model adjusts its forecast of traffic for the anticipated levels of congestion. As a roadway becomes highly congested, with traffic in excess of roadway volume, the model calculates the degree to which delay is resulting from the traffic congestion and switches traffic to alternate routes. These alternate routes are often longer mileage routes but due to lower levels of congestion, they are the fastest path the model can find between an origin point and a destination.

Table V-12 shows the estimated forecasts for daily traffic volumes, in vehicles per weekday for roads within the Town of Hudson, as compared with the existing average weekday traffic. These volumes represent the future baseline condition, i.e. only projects in the Nashua Area Metropolitan Transportation Plan (MTP) that have identifiable funding sources are included in the scenario. Construction of the Hudson Boulevard does not have secured funding sources and is therefore modeled as a separate scenario, with the results shown in Table V-13.

Under the baseline scenario, traffic overall is forecasted to increase by 12% over Hudson's roadways by 2045. While the town's arterials are anticipated to grow at rates at or around the average, a number of local roads may expect to experience high rates of growth, as drivers find alternative paths to congested arterials, particularly in the town center area. Wason Road and Bush Hill Road are prime examples of roadways which will increasingly accommodate the overflow traffic.

The construction of Hudson Boulevard, linking NH 3A to NH 111 in the southern half of Hudson, is projected to carry between 20,000-23,000 vehicles per day over most of its length. A 10% decrease in Taylor Falls Bridge traffic is forecasted, along with a 13% increase in Sagamore Bridge volume, due to a faster travel path to the turnpike and south Nashua via this route. Significant decreases in traffic on NH 3A and NH 111 are projected as the Boulevard diverts traffic away from the town center area. Wason Road and Bush Hill Road, which now provide a local road path in close proximity to the right-of-way originally reserved for the southern segment of the Circumferential Highway, would experience significant traffic relief. In contrast, the model shows an increase of traffic on Burns Hill Road, perhaps as it is used to reach the Boulevard from locations near the Pelham Road area. Future studies should examine this scenario for mitigation of this potential increase.

Table V-12. 2045 Forecasted Weekday Traffic Volumes in Hudson

		Current	2045 Proj	Pct.	
Facility	Location	AWDT	AWDT	Growth	LOS
NH 111 TF/Vet Mem Br	over Merrimack River	37,150	43,160	16%	E
NH 111 Ferry St.	E. of Library St.	13,200	14,280	8%	D
NH 111 Burnham Rd.	N. of Central St.	12,550	13,160	5%	D
NH 111 Central St.	E. of Kimball Hill Rd.	18,670	20,200	8%	E
NH 111 Central St.	at Windham TL	16,530	17,760	7%	D
NH 102	at Londerry TL	17,770	18,950	7%	E
NH 102	at Litchfield TL	16,800	17,270	3%	D
NH 3A/102 Derry St	N. of Ledge Rd.	26,330	28,280	7%	D
NH 3A/102 Derry St	N. of NH 111 Ferry St.	15,750	18,010	14%	E
NH 3A Lowell Rd	S. of Central St.	22,640	23,390	3%	D
NH 3A Lowell Rd	S. of Pelham Rd.	25,400	27,490	8%	D
NH 3A Lowell Rd	S. of Wason Rd.	39,700	44,940	13%	E
NH 3A Lowell Rd	S. of Rena St.	23,580	25,850	10%	D
NH 3A River Rd	S. of Dracut Rd.	9,950	9,780	-2%	C
NH 3A River Rd	at Mass. SL	7,710	8,590	11%	C
Belknap Rd.	S. of Central St.	5,140	6,220	21%	B
Burns Hill Rd.	N. of Wason Rd.	2,810	3,140	12%	A
Bush Hill Rd.	S. of Kimball Hill Rd.	5,470	6,330	16%	B
Bush Hill Rd.	S. of Speare Rd.	6,760	8,830	31%	C
Bush Hill Rd.	E. of Wason Rd.	1,780	2,990	68%	A
Central St.	E. of Adelaide St.	5,770	6,290	9%	B
County Rd.	E. of NH 3A	4,520	5,520	22%	B
Dracut Rd.	S. of Musquash Rd.	15,300	17,590	15%	D
Dracut Rd.	Mass. SL	9,690	9,670	0%	C
Executive Dr	W. of NH 3A	2,730	2,530	-7%	A
Flagstone Dr.	W. of NH 3A	4,340	4,260	-2%	B
Greeley St.	N. of NH 111 Central St.	5,310	5,850	10%	B
Highland St.	N. of George St.	3,990	5,590	40%	B
Kimball Hill Rd.	S. of NH 111 Central St.	8,200	9,280	13%	C
Library St.	N. of NH 3A Central St.	9,000	9,930	10%	C
Melendy Rd.	S. of Central St.	1,970	2,590	32%	A
Musquash Rd.	S. of Burns Hill Rd.	2,240	2,560	14%	A
Old Derry Rd.	E. of NH 102	2,820	4,000	42%	B
Park Ave	S. of NH 111	2,230	2,500	12%	A
Pelham Rd.	W. of Bush Hill Rd.	2,150	2,930	36%	A
Sagamore Bridge	Hudson/Nashua CL	49,600	56,790	14%	E
Sherburne Rd	at Pelham TL	9,190	11,120	21%	D
Speare Rd.	E. of Bush Hill Rd.	2,360	3,460	47%	B
Wason Rd.	E. of Musquash Rd.	9,330	13,870	49%	D
Wason Rd.	E. of NH 3A	9,330	12,650	36%	D

Source: NRPC traffic forecast based on population & employment forecasts

Map V-6. 2045 Forecasted Traffic Increases

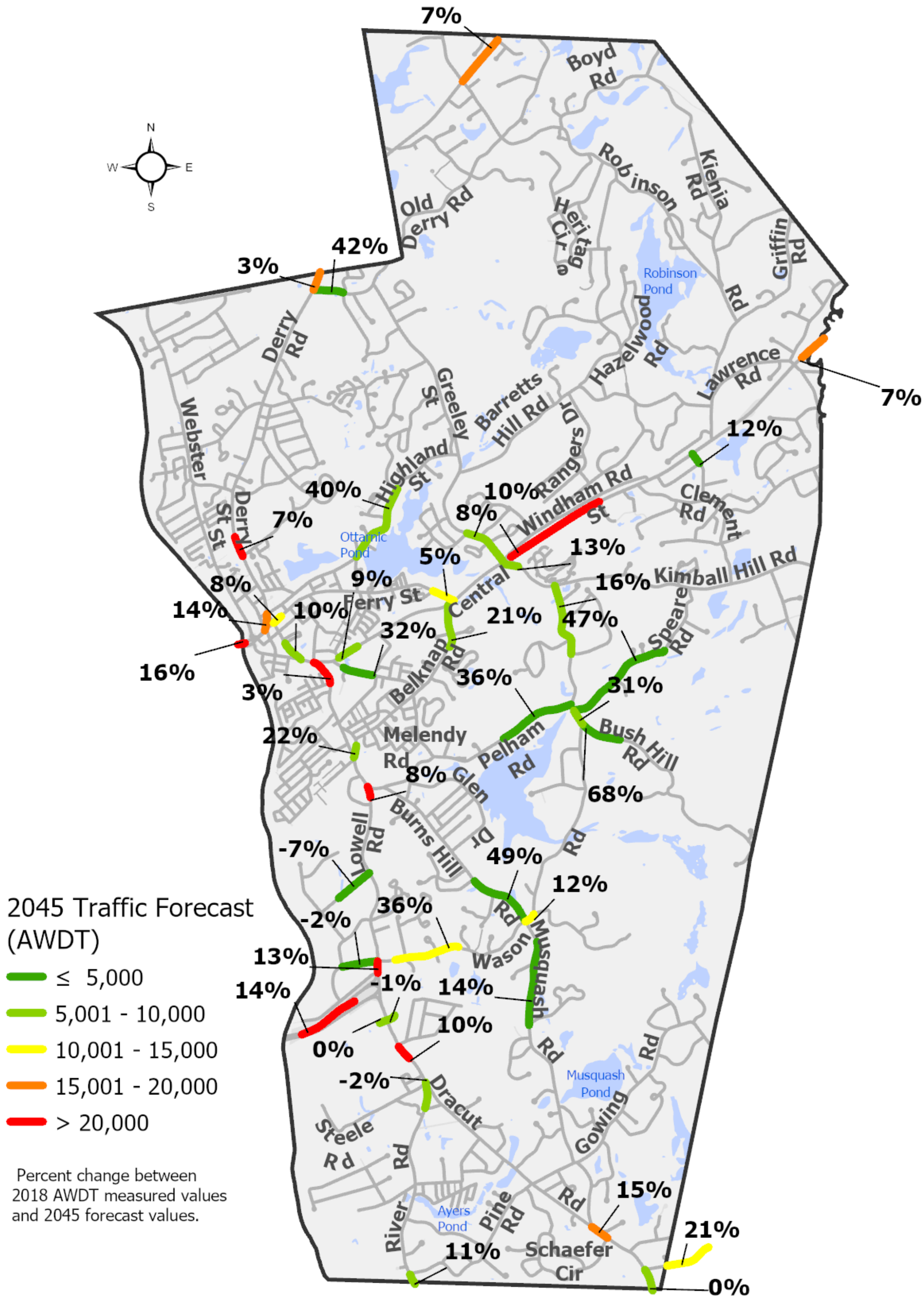


Table V-13. 2045 Forecasted Traffic with Hudson Boulevard

		2045	2045 Bld	Base to Build
-	-	Base Vol.	Hud Blvd	% Change
Hudson Blvd	NH 3A to Musquash Rd.		23,620	-
Hudson Blvd	Musquash Rd to Bush Hill Rd		21,740	-
Hudson Blvd	Bush Hill Rd to Kimball Hill Rd		20,380	-
Hudson Blvd	Kimball Hill Rd to NH 111		12,995	-
Taylor Falls Bridge	Hudson/Nashua CL	43,160	39,050	-10%
Sagamore Bridge	Hudson/Nashua CL	56,790	63,970	13%
NH 111 Central St.	E. of Kimball Hill Rd.	20,200	14,300	-29%
NH 111 Central St.	E. of Greeley St.	25,100	20,200	-20%
NH 111 Burnham Rd.	N. of Central St.	13,160	11,470	-13%
NH 111 Ferry St.	E. of Library St.	14,280	12,720	-11%
NH 3A/102 Derry St	N. of Ledge Rd.	28,280	27,320	-3%
NH 3A/102 Derry St	N. of Ferry St.	18,010	16,810	-7%
NH 3A Lowell Rd	S. of Central St.	23,390	21,220	-9%
NH 3A Lowell Rd	S. of Pelham Rd.	27,490	23,290	-15%
NH 3A Lowell Rd	S. of Wason Rd.	44,940	33,940	-24%
Library St.	N. of NH 3A Central St.	9,930	9,390	-5%
Speare Rd.	E. of Bush Hill Rd.	3,460	2,620	-24%
Greeley St.	N. of NH 111 Central St.	5,850	5,830	0%
Central St.	E. of Adelaide St.	6,290	3,950	-37%
Melendy Rd.	S. of Central St.	2,590	2,180	-16%
Belknap Rd.	S. of Central St.	6,220	5,620	-10%
County Rd.	E. of NH 3A	5,520	4,950	-10%
Kimball Hill Rd.	E. of Bush Hill Rd.	5,450	4,200	-23%
Kimball Hill Rd.	S. of NH 111 Central St.	9,280	8,490	-9%
Bush Hill Rd.	S. of Kimball Hill Rd.	6,330	2,550	-60%
Bush Hill Rd.	S. of Speare Rd.	8,330	3,340	-60%
Bush Hill Rd.	E. of Wason Rd.	2,990	1,670	-44%
Pelham Rd.	W. of Bush Hill Rd.	2,930	2,270	-23%
Burns Hill Rd.	N. of Wason Rd.	3,140	4,150	32%
Wason Rd.	E. of Musquash Rd.	13,870	6,570	-53%
Wason Rd.	E. of NH 3A	12,650	7,410	-41%

Source: NRPC traffic model estimate

Existing Regulations

Impact Fees

The Town of Hudson Zoning Ordinance currently assesses impact fees on developments to raise funds for the mitigation of traffic and transportation impacts attributable to the development. The fees are assessed based on a schedule developed by the Planning Board which is reviewed annually for necessary revision and update. At present, improvements are on the town's CIP that are in progress include: Twin Bridges Rehabilitation, Lowell Road First Brook Bridge Rehabilitation and traffic light upgrades.

Road and Sidewalk Layout

At present, the Town's subdivision regulations require that the width of the right of way for a new residential street be at least 50 feet wide with a pavement width of 24 feet, or 28 feet for streets greater than 1,000 feet in length (§289-28). Major streets, collector streets and commercial streets require a paved width of 36 feet or wider, if deemed necessary (§289-28). The subdivision regulations require that streets be laid out to intersect as nearly as possible at right angles and not less than 60 degrees. Street grades should not exceed 4% for major streets and 7% for local streets. In addition, the subdivision regulations require that sidewalks be constructed in new subdivisions where deemed essential by the Planning Board to provide access to schools, playgrounds, shopping centers and other community facilities. The sidewalks must be at least four feet wide and provide for pedestrian comfort and safety. New roads that are to be classified by the Town code as major streets, collector streets, and commercial streets are required to have a pavement width of 36 feet. The definition of the Town code street classification scheme is included in the Appendix V-2.

A number of criteria should be considered in updating the design standards for local streets:[1]

- *Design and maintain street space for the comfort and safety of residents*. Local residential streets should be designed with consideration to the needs of children, pedestrians, and bicyclists. The main function of the local street is to provide access to adjacent residential properties. Long distance travel and high speeds are not priorities for local streets, therefore, the Town should reconsider its subdivision requirement for a 24 foot width for residential streets. A residential street with pavement width of 20 feet is sufficient to allow for emergency vehicle access with *no* on-street parking. A pavement width of 24 to 26 feet is sufficient for a residential street to allow for emergency vehicle access *with* on-street parking.

- *Provide a well connected, interesting pedestrian network*. Convenient and safe pedestrian access to schools, shopping, recreation, employment and other destinations should be provided. This may include the development of an interconnected pedestrian pathway system. The Town should reconsider its 4 foot width requirement for sidewalks. The Americans' with Disabilities Act (ADA) guidelines call for a minimum sidewalk pavement width of at least five feet.[2] Sidewalks on high volume roads should be required to be at least eight feet wide with a three foot landscaped buffer between the curb and paved surface. This buffer provides a margin of safety between the pedestrian flow and high speed and high volume traffic.

- *Provide convenient access for people who live on the street, but discourage through traffic; allow traffic movement, but do not facilitate it*. Traffic control measures should be considered to eliminate extensive through traffic on local streets. The Town should consider traffic calming measures on streets that serve as cut-throughs in neighborhoods. The traffic calming measures should be implemented with input from the Town Highway Safety Committee and the public.

- *Differentiate streets by function.* Streets should be clearly distinguished within the network in terms of the functional differences between local residential streets and major collectors or arterials in the overall street design.

- *Relate street design to the natural and historical setting.* Street design should relate to and express the terrain, natural character, and historic traditions of the locale. Irregularities of a site such as large rocks or trees and slopes should be incorporated rather than removed. Street

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[1] Southworth and Ben-Joseph, *Streets and Shaping of Towns and Cities*, page 143.

[2] United States Department of Justice, *Americans' with Disabilities Act Standards for Accessible Design, Excerpt from 28 CFR Part 36*, July 1, 1994 at: http://www.usdoj.gov/crt/ada/adastd94.pdf.

details including curb design, sidewalk paving or signs must relate to the regional vernacular rather than being anonymous from a handbook.

- *Reduce impervious surfaces by minimizing the amount of land devoted to streets.* There are several factors that should shape a plan including a design concept, on-street parking needs, traffic volumes and land constraints (steep slopes, wetlands, etc.). Narrower residential streets reduce the amount of impervious surfaces and allow for better groundwater recharge.
- *Roundabouts to reduce conflicts at intersections.* There are instances in which roundabouts can improve traffic flow, reduce congestion and improve safety for pedestrians and motorists alike. They should be considered in future road layouts.

Access Management

Access Management "…*involves providing (or managing) access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity and speed.*"[3] The speed and volume of traffic on a roadway is greatly reduced due to vehicles entering and exiting side streets and driveways. In general, access management techniques involve the regulation of the number, spacing and width of access points, the design of those access points, and the provision of alternative transportation methods to reduce vehicle trips. The primary goal of access management is to preserve roadway capacity by reducing turning movement conflicts with through traffic.[4]

NH 3A and NH 102 represent the main north-south roadways in Hudson. NH 111 serves as the main corridor for east-west travel. To preserve the existing road capacity, which has a theoretical limit, and to enhance safety for vehicles entering and exiting driveways, access management techniques should be applied to Hudson's major corridors including NH 3A, NH 102, NH 111 and Dracut Road. The Town should coordinate access management policies with NH DOT's access management initiatives. The following general access management techniques can be implemented through the subdivision, site plan and/or driveway regulations, and/or the zoning ordinance:

- Reduce the number of curb cuts along arterials and encourage the use of common driveways.
- Encourage the development of service roads parallel to arterials that allow for access to adjacent commercial developments.
- Require developers to fund road improvements such as turn lanes, medians, consolidation or alignment of access points and/or pedestrian facilities that reduce the impedance of through traffic.
- The minimum distance allowed between curb cuts along roads and arterials should be at least the minimum distances recommended in Table V-14. With the exception of a 100-foot minimum separation between driveways and intersections, there are no minimum driveway separation requirements in the subdivision or site plan regulations.

Table V-14. Minimum Access Separation Distances

Posted	Spillback Rate*			
Speed (mph)	5%	10%	15%	20%
30	335	265(a)	210(b)	175(c)
35	355	265(a)	210(b)	175(c)

[3] AASHTO, *Policy on the Geometric Design of Highways and Streets*, 2001.
[4] Nashua Regional Planning Commission, *Access Management Guidelines*, April 2002.

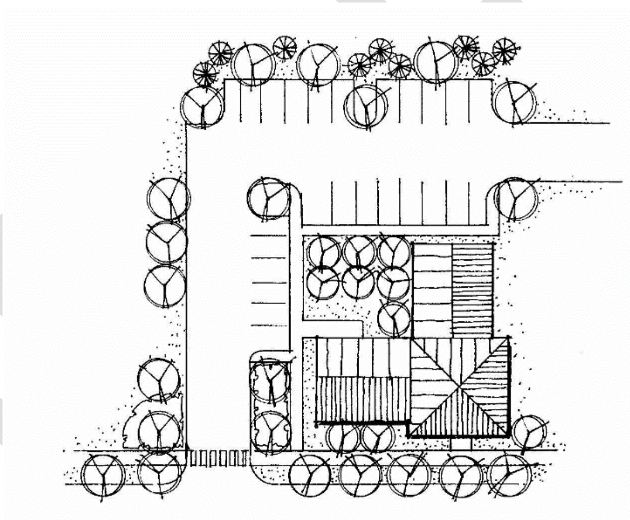
40	400	340	305	285
45	450	380	340	315
50	520	425	380	345
55	590	480	420	380

Source: Gluck, J.S., Haas, G., Levinson, H.S., and Jamal Mahmood, *Driveway Spacing and Traffic Operations*, TRB Circular E-C019, December 2000.

*Spillback occurs when a right-lane through vehicle is influenced by right-turn-in to or beyond a driveway upstream of the analysis driveway. The spillback rate represents the percentage of right-lane through vehicles experiencing this occurrence.
(a) Based on 20 driveways per mile; (b) Based on 25 driveways per mile; (c) Based on 30 driveways per mile.
*Based on an average of 30-60 right turns per driveway.

- Place parking behind or beside buildings (Figure V-3) to allow for adequate driveway throat length and to screen parking when possible to make the building the focal point of the destination. Use green spaces to articulate the differences between driveways, parking and pedestrian areas.

Figure V-3. Parking to Rear and Side of Building



- Encourage easements between parcels for the interconnection of non-residential sites that allow employees and customers to move from site to site without repeatedly entering and exiting the roadway.
- Encourage easements or future right of way access between residential subdivisions in order to encourage an interconnected street system.
- Allow for pedestrian access between developments. Crossing points for pedestrians should be across driveways rather than through parking areas. Encourage separate sidewalks and walking paths in parking lots for non-residential uses.
- Enter into a Memorandum of Understanding (MOU) with NH DOT to coordinate review of access points. Until recently, NH DOT would issue permits with limited input from the local decision makers. To improve the coordination of local and state planning objectives along the state's road system, NH DOT has developed a MOU which is a formal agreement between NH DOT and the community to coordinate on the review and issuance of driveway permits to access state roads.

Community Character Guidelines

The adoption of "community character guidelines" for non-residential development can result in development that is compatible with the community's character, enhances traffic safety and preserves highway capacity. The NRPC publication, *Non-Residential Development Community Character Guidelines*,[5] includes guidelines relating to building orientation, building design, access management, parking lot landscaping, offsite parking, site lighting guidelines, loading and service facilities guidelines, and public spaces and landscaping guidelines. The Town should assess the existing site plan, subdivision and zoning requirements based on recommendations included in this document.

Traffic Calming

Excess traffic and speeding on local roads through residential neighborhoods have been a byproduct of growth experienced by the Town and the region. Traffic calming is an integrated approach to traffic planning that seeks to maximize mobility while reducing the undesirable effects of that mobility.[6] There are several techniques that are described to achieve the goals of traffic calming:

- Reduce the speed at which automobiles travel by altering roadway design. These techniques include speed bumps and speed tables, rumble strips or changes in the roadway surface, center medians, diagonal diverters, dead-end streets or cul-de-sacs, neck downs, chicanes, chokers and protected parking, narrower streets and roundabouts (see photos[7], below).
- Change the psychological feel of the street through design or redesign. The use of traffic control devices, signs, pavement markings and landscaping should enhance the image of the residential street as a place that is safe for pedestrians.
- Discourage the use of private motor vehicles. Encourage other modes of transportation.
- Create strong viable local neighborhoods. Create compact neighborhoods with a range of facilities on hand so that people can drive shorter distances to where they want to go and make more trips by foot, bicycle or public transportation.

A primary way to slow down traffic is to narrow the real or perceived horizontal width of the pavement. Streets can be narrowed in various ways. A so-called "curb extension" is generally the best and perhaps most widely used option. It slows down traffic, shortens the crossing distance for pedestrians and a sidewalk can be added along the road if necessary.[8]

Center Median

Speed Table

Chicane

Choker

[5] Nashua Regional Planning Commission, *Non-Residential Development Community Character Guidelines*, 2000.
[6] Cynthia L. Hoyle, *Traffic Calming*, PAS Report 456, pg. 9.
[7] Photo Source: Fehr & Peers, Associates, Transportation Consultants at www.trafficcalming.org.
[8] Conservation Law Foundation, *Take Back Your Streets*, May 1995, pg. 32.

Scenic Road Designation

As New Hampshire's residential, commercial, and industrial development has grown, so has the need to improve the road system. To prevent the elimination of scenic roads, communities are enabled by NH RSA 231:157 to designate roads other than state highways as Scenic Roads. This law protects such roads from repair or maintenance which would involve the cutting or removal of medium and large-sized trees within the right of way, except with the written consent of an official body. The law is an important tool in protecting the scenic qualities of roads. The large trees and stone walls that line many rural roads are irreplaceable and contribute heavily to the New England character of the region's towns. There are no designated scenic roads in Hudson. Consideration should be given to designating appropriate routes.

Road Surface Management System (RSMS)

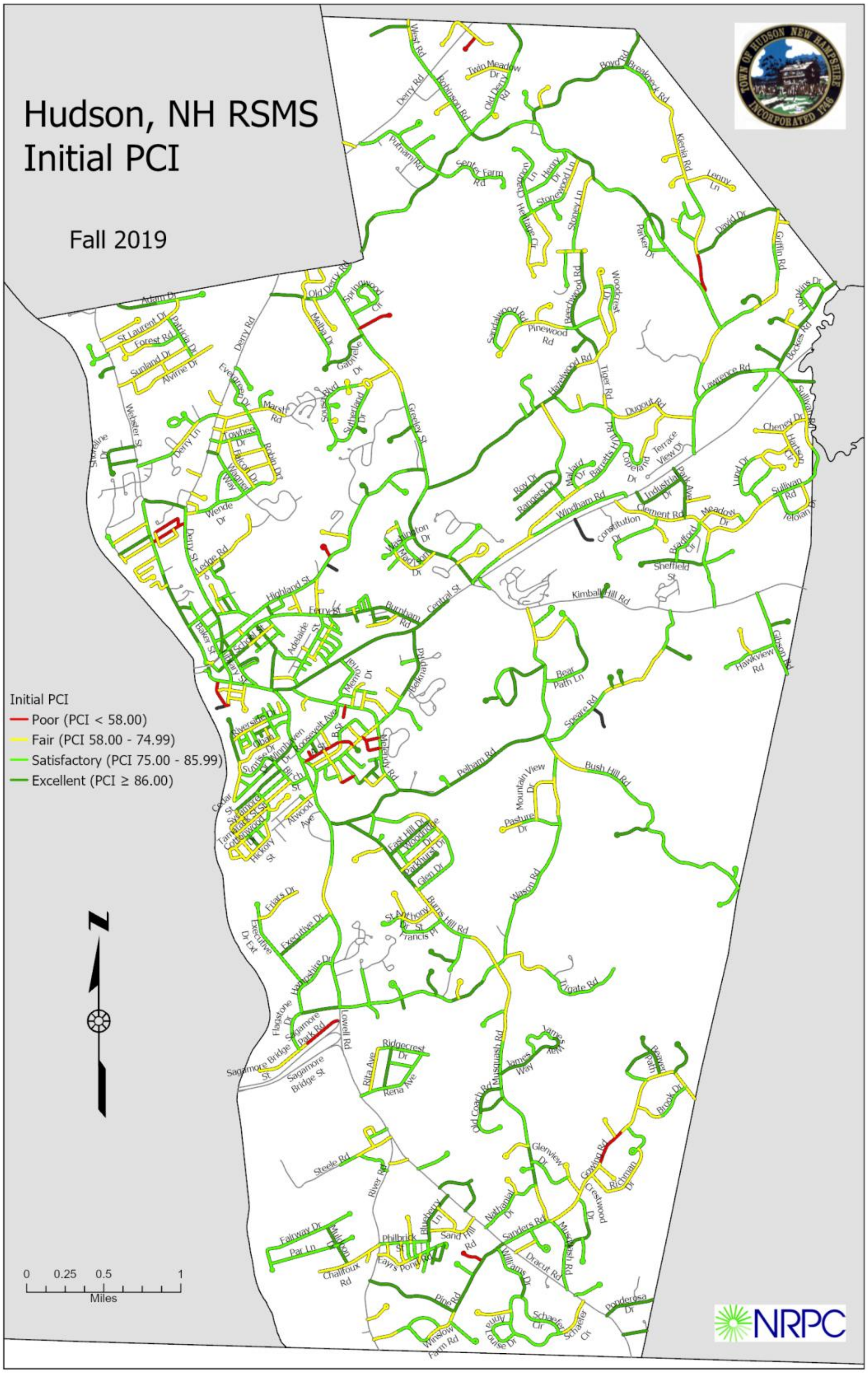
In the Fall of 2019, Nashua Regional Planning Commission (NRPC) conducted a Road Surface Management System (RSMS) assessment for the Town of Hudson. This assessment followed methodology and software developed by the Department of Civil Engineering at the University of New Hampshire. The technology platform for this assessment was provided by the NH Statewide Asset Data Exchange System (SADES), a partnership between New Hampshire Department of Transportation (NH DOT) and the UNH Technology Transfer Center.

The RSMS assessment had two phases: 1) a town-wide inventory of pavement condition on all town-owned paved roads (phase 1), and 2) an analysis examining changes in pavement condition, repair treatment effect, and repair cost over a 10-year period (phase 2). This assessment is not intended to constrain the decision-making process of the Hudson Department of Public Works (DPW) in selecting roads for repairs and treatment types. Instead, the RSMS assessment will serve as a tool for DPW and town officials to assess current and future pavement condition and as a guide for budgeting the cost of future repairs.

Results from phase 1 of the 2019 Hudson RSMS assessment are below in Map V-7 2019 Initial Pavement Conditions.

Hudson should consider developing a multi-year paving and road surface improvement plan based on the RSMS assessment and incorporate the plan into the Town’s Capital Improvements program.

Map V-7. 2019 Initial Pavement Condition



Data Source: NRPC

Non-Motorized Transportation

Introduction

Although most trips in Hudson are taken by automobile, opportunities exist for developing a multi-modal transportation network that would expand upon the exiting sidewalk network and include additional bicycle, pedestrian, and public transit facilities. Each trip taken by bicycle, foot or transit removes one private vehicle from the roadway, thereby enhancing the capacity of the road network, potentially reducing traffic congestion, and providing options for those who cannot or do not wish to drive.

Most of the road network in Hudson can technically be used today by non-motorized users. However, after engaging with Hudson residents, it is clear that most people do not consider these routes to be safe, multimodal spaces.

During the public outreach component for developing this document many residents who responded to the survey or participated in the public input sessions expressed a need for more sidewalks, bike lanes, and mitigation of traffic congestion. Public comments contributed by Hudson residents included:

> "*Complete streets design with space for walkers, bicyclists and cars would be a welcome relief from the mostly car only street design of today".*

> *"[] I wish we could get some sidewalks. I can't go for a walk except on my side road…but can't go anywhere else due to speeding, windy roads and cars can't see us. We need sidewalks."*

> *"Sidewalks and bicycle lanes would be useful throughout town, especially 111, 102, and 3a".*

> *"I would not be opposed to the smaller (single lane) version of the Hudson Boulevard project, especially if it had an adjacent bike path".*

> *"I would love to see the current Circumferential highway aka Hudson Blvd land turned into a stunning bike path connecting Lowell road all the way to Bensons park".*

> *"Lowell road has grown so much. Needs bike lane".*

The community vision that emerged as a result of citizen involvement in this planning process indicates a clear desire for a transportation network with increased and expanded mobility options including public transportation, sidewalks, bicycles, and commuter rail. This vision includes:

- A defined, walkable town center that provides a sense of place and a venue to bring the community together.
- A walkable economic center in the vicinity of the town's historic Library Park.
- Increased walkability near the town's "official" historic center near Benson Park in the vicinity of the intersection of Central and Greeley Streets.
- Increased walkability, bikeability and overall mobility at locations along Lowell Road and Derry Street.

This section attempts to incorporate this vision into the Hudson transportation system.

Bicycle and Pedestrian Network Connectivity

A connected bike network provides a safe and comfortable transportation experience, enabling people of all ages and abilities to get where they want to go. The network functions just like the road network. It offers people multiple ways to get where they want to go and provides a safe, comfortable experience for people of all ages and abilities. To meet the needs of everyone, a connected bike network should be, by definition, low-stress and high-comfort. Such a network can include a variety of facilities, from a protected bike lane or a quiet neighborhood street to a shared-use path. High-stress facilities such as a conventional bike lane on a street with a 45mph speed limit may not meet the needs of people of all ages and abilities and would therefore not be considered part of a connected bike network. A connected bike network gets people where they want to go and offers a comfortable way to get there[9].

For pedestrians, the most basic feature of walkability is a complete, continuous, and safe walkway network that provides clear protection from motor vehicles and is accessible to all people, including those with disabilities[10]. Crosswalks are necessary for safely connecting the walkway network across vehicle traffic and are a critical part of making walkable areas accessible to all people, including those with disabilities. Connectivity that prioritizes walking over motorized forms of transportation improves walkability by making walking more convenient relative to other modes of transportation.

A network that is town-wide will consider multimodal treatments for all areas in town, not just a select few locations. While the primary goal of this network should be to work toward safety for all users as a key element of design, the next-most important characteristic of this network should be its ability to integrate places. A town-wide network should not require multimodal users to first drive to a location where they can then elect to use another mode of transportation. Rather, the network should seek to connect to all people, all areas, all points of interest, and with other towns.

The town of Hudson should consider bicycle and pedestrian network connectivity as it plans for the future. The rest of this chapter describes the current bicycle and pedestrian network and offers ideas for improvements.

Existing Conditions - Sidewalks, Bike Routes, Off Road Trails and Destinations

Library Common and Historic Town Center – Ferry and Central Streets

There are various residential areas within walking or biking distance of the Library Common (downtown) area and the Historic Town Center area just east of Kimball Hill Road, as illustrated on Map V-8.

Destinations in this general area include the Hudson town office, St. John the Evangelist Church, Library Street School, Dr. H. O. Smith School, the Hudson Community Center, Hudson Memorial School, and numerous businesses. The Hudson Senior Center and Benson Park are on Kimball Hill Road, near Central Street at the eastern edge of the downtown area.

There are sidewalks along Library, Chase, Ferry, and Central Streets, and Derry Road, in the historic town center and Library Common area, as illustrated on Map V-8.

The sidewalk along Central Street is continuous from Taylor Falls Bridge to the Ferry Street intersection. There are sidewalks on both sides of Ferry Street from the vicinity of Taylor Falls Bridge to Gloria Avenue. There are no sidewalks between Gloria Avenue and Burnham Road and then no sidewalks along Burnham Road to Central Street.

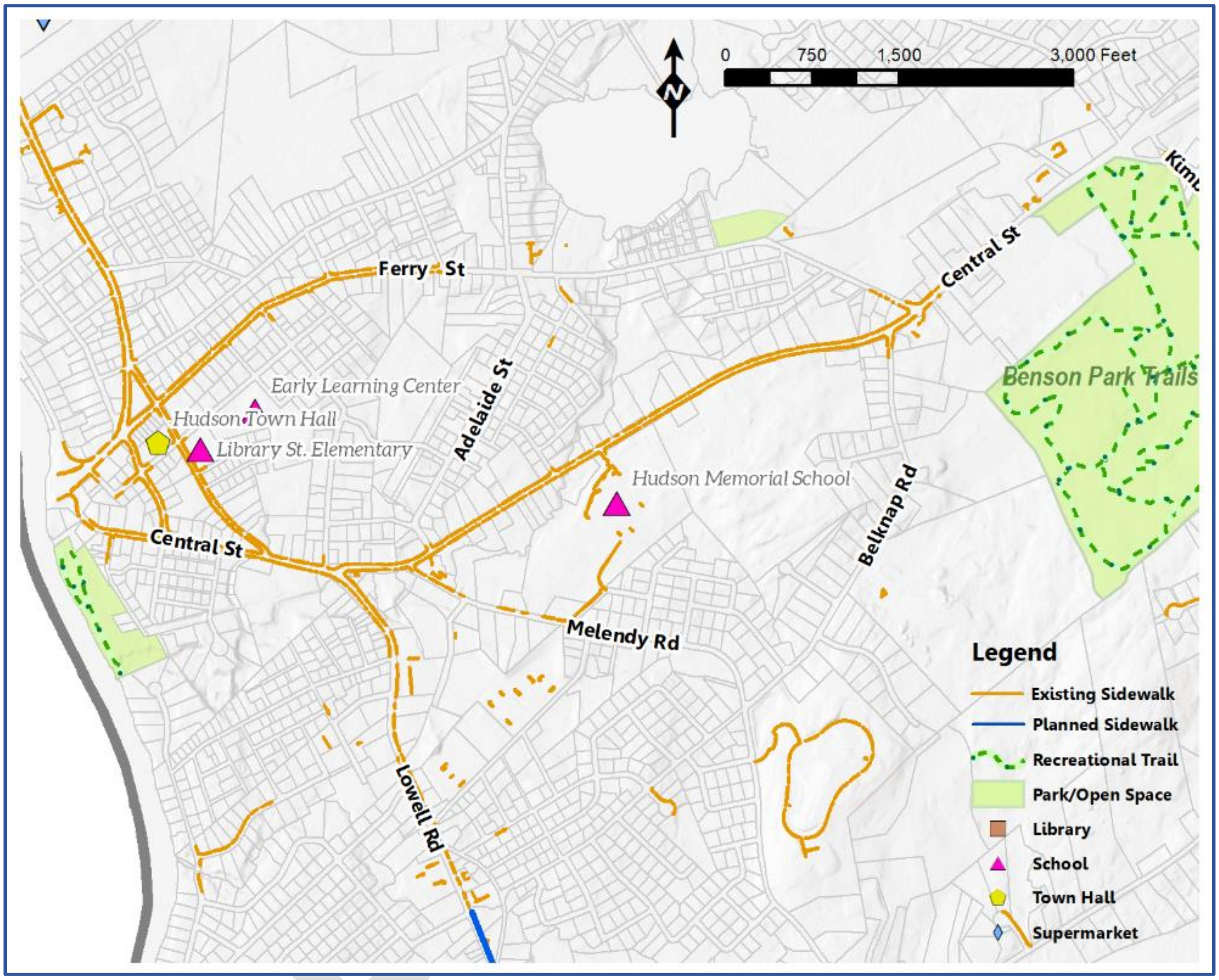
On Ferry Street, there are signalized intersections at Derry Road, Library Street, and the intersection with Central Street. The Derry Road signals do not include pedestrian phases or crosswalks. The signalized intersection at Library Street does have a pedestrian phase and crosswalks on all four legs.

[9] http://www.pedbikeinfo.org/cms/downloads/InfoBrief_PBIC_Networks.pdf
[10] https://www.itdp.org/2018/02/07/pedestrians-first-walkability-tool/

On Central Street there are signalized intersections at Library Street, Lowell Road, Ferry Street (Burnham Rd) and at Kimble Hill Road. There are pedestrian phases and crosswalks at the Library Street and Lowell Road intersections. There are no crosswalks or pedestrian phases at the Ferry Street (Burnham Road) intersection. There are no crosswalks or pedestrian phases at the Kimble Hill Road intersection and there are no dedicated bicycle accommodations along the Ferry Street or Central Street corridors.

Infill of this sidewalk network was submitted for consideration for NH DOT's Ten Year Plan but was not selected at this time. However, it will be places on NRPS's long range transportation plan.

Map V-8.Central Sidewalk Network



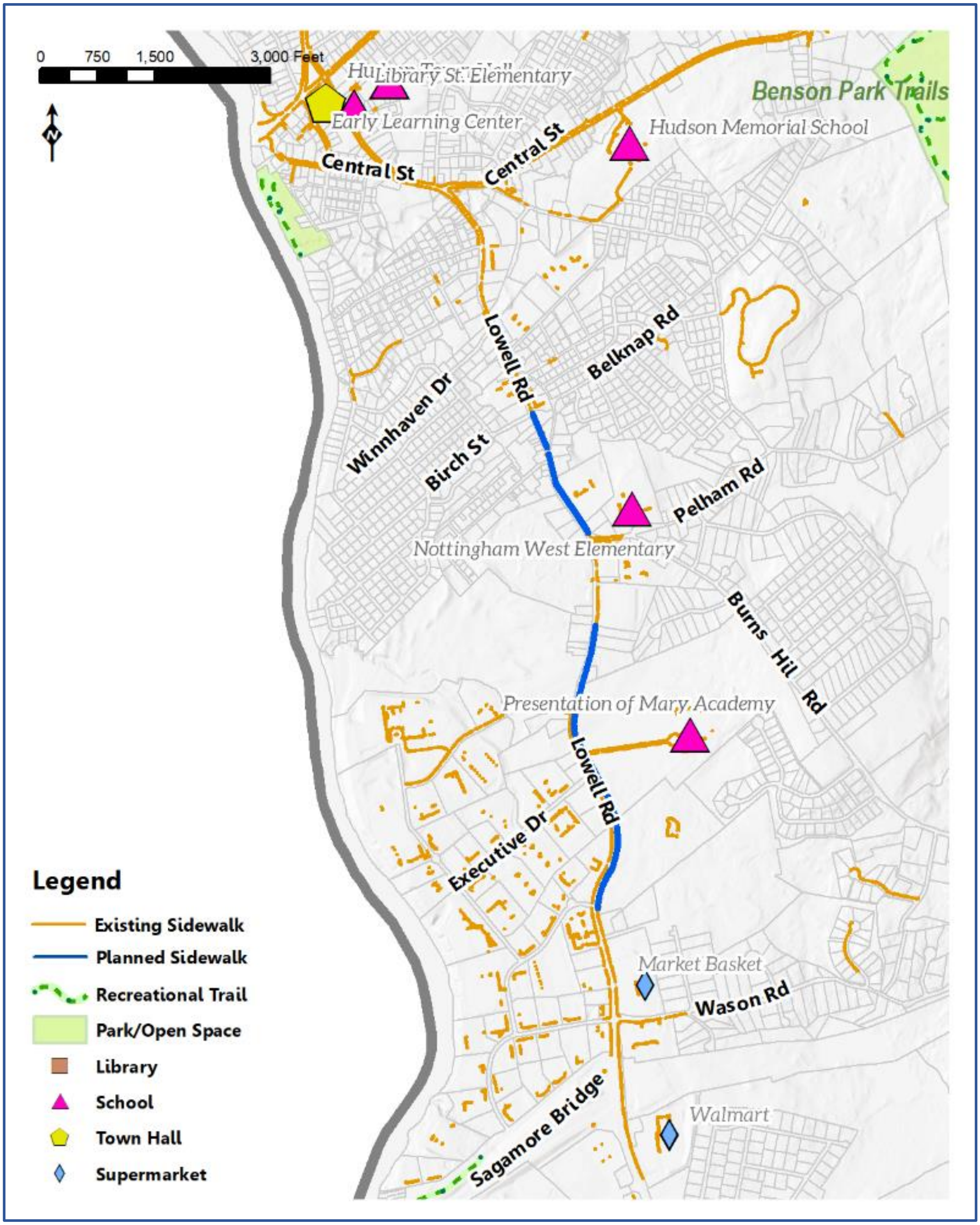
Lowell Road (NH3A)

Lowell Road is a significant commercial corridor in Hudson. Destinations include shopping centers, numerous restaurants, large supermarkets, Walmart, and Sam's Club. The corridor includes the Sagamore Business Park and plans for one of the largest distribution centers in the state has been approved. Additional destinations include Presentation of Mary Academy, Nottingham West Elementary School, Stonewood School and Jette Field.

There are residential areas within biking and walking distance along the corridor, particularly between Central Street and Pelham Road. There are intermittent sidewalk segments along Lowell Rd (NH3A) from Central Street southward to Walmart (just south of the Sagamore Bridge). New sidewalks are planned

(NRPC 2019-2045 Metropolitan Transportation Plan) from Birch Street to Pelham Road, and from Nottingham Square to Executive Drive which will close some of the gaps in sidewalks along the corridor.

Map V-9. Lowell Road Sidewalk Network



Signalized intersections are provided at Pelham Road, Fox Hollow Drive, Executive Drive, Hampshire Drive, Wasson Road/Flagstone Drive, Sagamore Bridge, Walmart Boulevard, Rena Avenue, and Dracut Road. There is a crosswalk and pedestrian phase on Pelham Road at the Pelham Road/ Lowell Rd intersection, and there are crosswalks and pedestrian phases on Lowell Road and Fox Hollow Drive at that intersection. There is a pedestrian phase and crosswalk on Executive Drive on the west side of the Lowell Road intersection but no crosswalk or pedestrian phase on Lowell Road itself. There is no pedestrian phase at the Hampshire Drive intersection. There are crosswalks and pedestrian phases on all four legs of the Wasson Road/Flagstone Drive intersection. There are no crosswalks or pedestrian phases at Sagamore Bridge, Walmart Boulevard, Rena Avenue or Dracut Road intersections.

There are no dedicated bicycle accommodations along the corridor, but there is a dedicated bike and pedestrian path on the Sagamore Bridge between the Sagamore Industrial Park in Hudson and the residential and commercial area along the Daniel Webster Highway in South Nashua.

Pedestrian improvements were submitted for consideration for NH DOT's Ten Year Plan but was not selected at this time. However, it will be places on NRPS's long range transportation plan.

Derry Road

There are various residential areas within biking and walking distance along this corridor.

Destinations include the Hudson Mall Shopping Center, Hannaford Supermarket, numerous retail establishments and small businesses. The Rogers Library, Alvrine High School and the Hills Garrison Elementary school are also located on this corridor.

There are intermittent sidewalks along Derry Road from the downtown area to the intersection of NH3A/NH102, and then along NH102 from Towhee Drive to Old Derry Road, which is just beyond Alvrine High School, Hills Garrison Elementary School and Rogers Library.

There are new sidewalks proposed between the Hudson Mall Shopping Center and Phillips Drive (north entrance) and from Marsh Road to Towhee Drive which will complete the sidewalk connection between the schools, library, and downtown Hudson.

There are signalized intersections at Highland/Library Street, Hudson Mall Shopping Center, and Elm Avenue intersections.

There is a crosswalk and pedestrian phase on Derry Road at Highland Avenue intersection. There are no crosswalks or pedestrian phases at the Hudson Mall entrance nor at the Elm Avenue intersection.

There are no dedicated bicycle accommodations along the corridor.

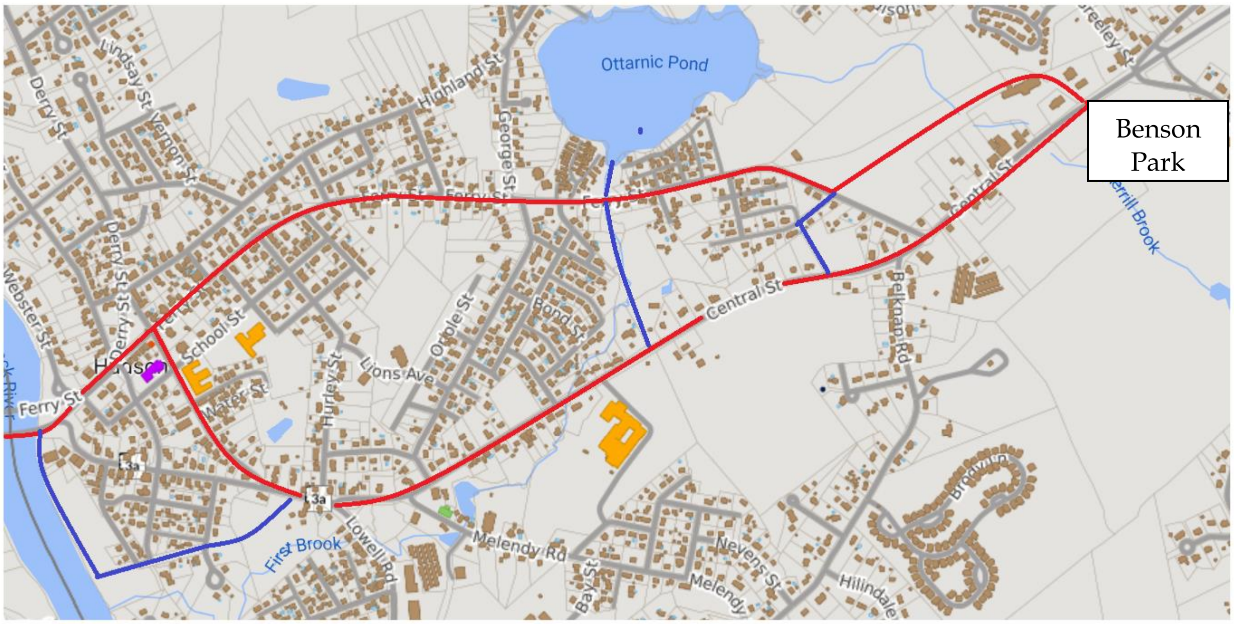
Infill of the sidewalks, pedestrian improvements and drainage improvements are currently part of NH DOT's draft Ten Year Plan, a significant milestone.

Town-wide Loop Concept

This section is conceptual in nature for the purpose of introducing an idea for a local and regional recreational and transportation asset. In considering the potential to fill in gaps of the bicycle and pedestrian network, a long term vision or aspiration could be a town-wide bicycle/pedestrian loop that connects both bridges, Benson Park and other areas of community interest while providing a centralized loop to access various part of town. This vision could being with "Phase One" - a loop connecting the twin bridges from the Souehgan Rail Trail in Nashua up Ferry St. to Benson Park (a 166 acre preserved conservation and historical asset for the region). The return path could down Central and either up Library St. (past the Alvirne Memorial Library) or through private easements to the Merrimack River accessing Merrill Park. This conceptual loop is illustrated in Map V-10.

“Phase Two” of this concept could include the use of the Right Of Way for the Circumferential Highway (aka Hudson Blvd). This ROW is already owned by the NH DOT, and this concept aligns with the proposed Hudson Boulevard that includes a parallel, separated multi-use path. Implementing this leg completes the town-wide loop in conjunction with the Phase One Central Loop.

Map V-10. Phase One - Central/Ferry Loop to Benson Park



Red lines indicate targeted pedestrian loop. Blue lines indicate other potential options to connect other natural and town assets.

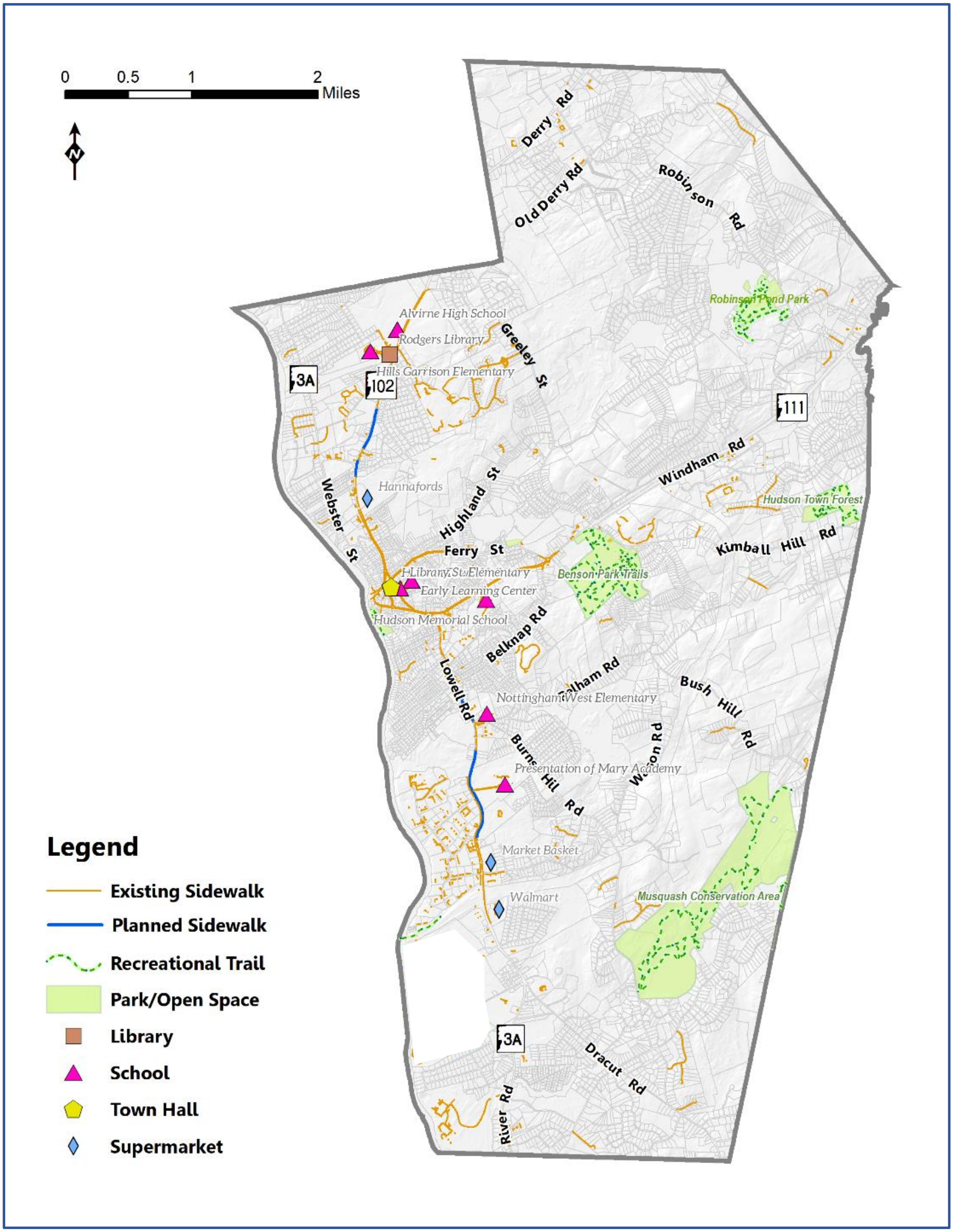
Other Sidewalks and Trails

In addition to the sidewalks along the key corridors that have already been described, there are numerous sidewalk segments in neighborhoods throughout Hudson, as can be seen in Map V-11 on the following page. Additionally, there are sidewalk segments throughout the Sagamore Industrial Park.

There is also an existing separated bicycle and pedestrian path across the Merrimack River on the Sagamore Bridge that connects the industrial park with the residential and commercial area along Daniel Webster Highway in Nashua.

Map V-11 also shows various recreational trail systems throughout town, including in Benson Park, Musquash Conservation Area, the Hudson Town Forest, and Robinson Pond Park.

Map V-11 Existing & Planned Sidewalks



Bicycle Level of Traffic Stress (BLTS)

For a bicycling network to attract the widest possible segment of the population, its most fundamental attribute should be low-stress connectivity, that is, providing routes between people's origins and destinations that do not require cyclists to use links that exceed their tolerance for traffic stress, and that do not involve an undue level of detour[11].

BLTS is a rating given to a road segment or crossing indicating the traffic stress it imposes on bicyclists[12]. Levels of traffic stress range from 1 to 4 as shown:

- LTS 1: Strong separation from all traffic except low speed, low volume traffic and simple intersection crossings. *Suitable for kids and beginners.*
- LTS 2: Except in low speed / low volume traffic situations, cyclists have their own place to ride that keeps them from having to interact with traffic except at formal crossings. Physical separation from higher speed and multilane traffic and intersections that are easy for an adult to negotiate. A level of traffic stress that *most adults can tolerate (willing and wary).* This is the BLTS that Hudson's bicycle network should strive to meet.
- LTS 3: Involves interaction with moderate speed or multilane traffic, or proximity to higher speed traffic. A level of traffic stress *acceptable to those classified as comfortably confident.*
- LTS 4: Involves interaction with higher speed traffic or proximity to high speed traffic. A level of stress *acceptable only to those who are the most traffic tolerant*.

NRPC used ArcGIS technology to develop a BLTS analysis and associated map of the Hudson road network (Map on next page). Staff used similar methodology that was used during the recent statewide BLTS study (the analysis did not include intersections). The methodology used existing NRPC road attribute data including speed (derived from posted speed or functional class), number of lanes, traffic direction, bike lane width, parking lane width, shoulder type, and shoulder width. Staff collected supplemental roadway data using a combination of aerial imagery (Google Maps and Google Streetview), a point file of speed signposts and locally or regionally collected speed and volume data. These additional attributes included: bike and parking lane widths, posted/prevailing speed, and residential area designations. These road characteristics influence how stressful it is for an individual to ride a bike on a segment of roadway.

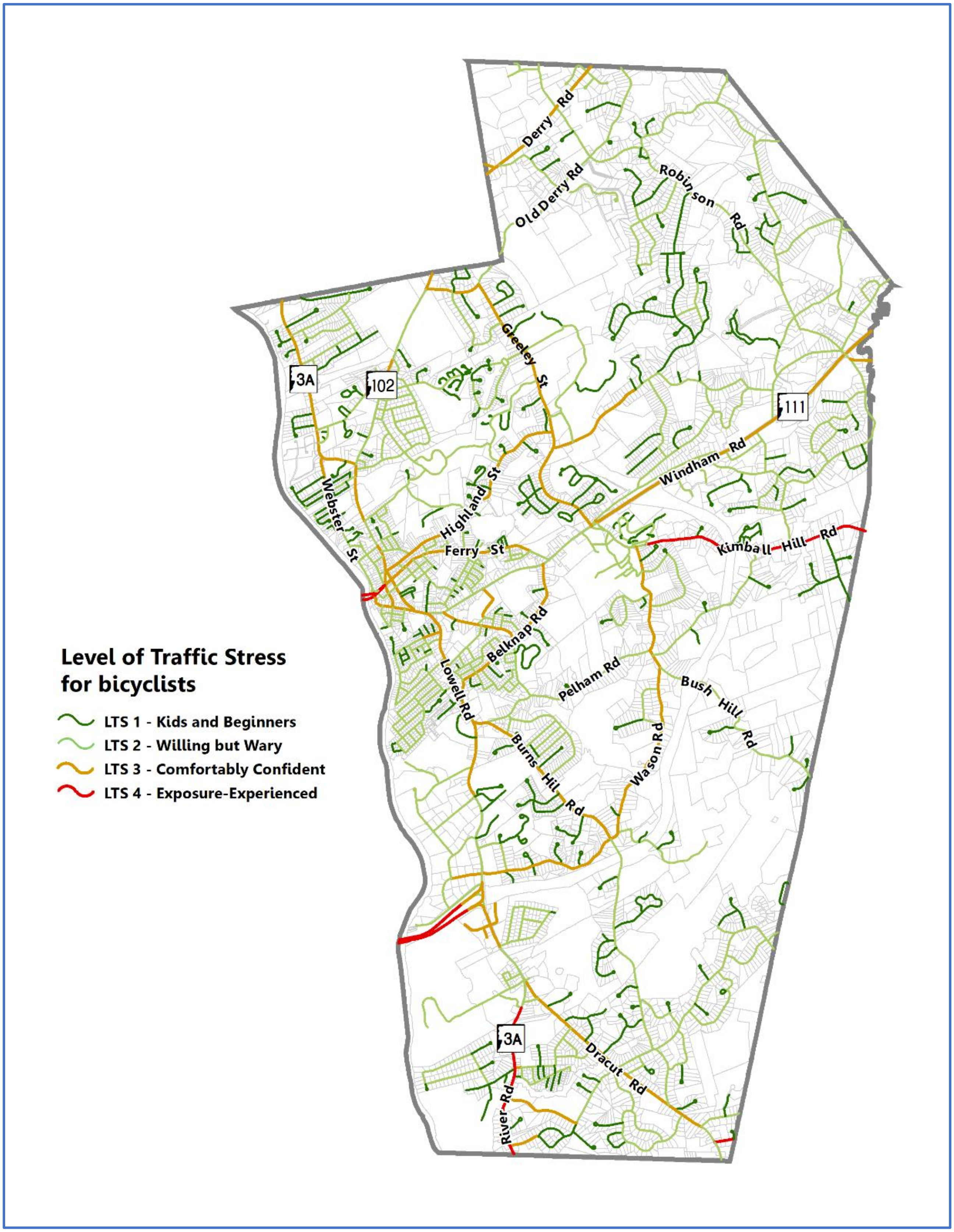
Map V-12 shows that residential neighborhoods with low traffic volumes and low posted speed limits generally experience low levels (BLTS 1 or 2) of traffic stress. This is true even without the existence of bike lanes or sidewalks. On the east side of downtown, Central Street between Lowell and Kimble Hill Roads experiences a BLTS 2 (tolerable for most adults). Moving north from downtown, segments of Derry Road from Highland Street to the Litchfield town line vary between BLTS 2 and 3 because in some areas there are sidewalks and shoulders and in other locations there are not. Webster Street/NH3A is generally BLTS 3 because of minimal shoulders and high traffic volume and speed.

[11] Mineta Transportation Institute
[12] Peter G. Furth, Northeastern University College of Engineering.

Higher levels of traffic stress can be seen in areas with higher volumes of traffic, higher posted speed limits, lack of bike lanes, narrow or non-existent shoulders and other factors. Taylor Falls bridge shows a BLTS of 4 (most stressful) because there is a high volume of traffic and no bike lanes. Derry Road and Highland, Ferry, Library, Chase, and Central Streets in the historic downtown area experience BLTS 3 (only suitable for confident and experienced riders) because of high traffic volume, narrow shoulders, and absence of bike lanes. Kimble Hill Road east of Benson Park is BLTS 4 because the speed limit increases to 40mph and there are minimal shoulders. Lowell Road between Central Street and the Sagamore Bridge is mostly BLTS 3 because of narrow shoulders and high traffic volume**,** with some exceptions where the level of stress is 2. Dracut Road is generally BLTS 3, and River Road is BLTS 4.

Bicyclists Gather at the Statehouse in 2009

Map V-12 Level of Traffic Stress



Crash Data

Table V-15. Crash Data

Motor Vehicle - Bicycle - Pedestrain Crashes (2010-2018)							
Accident Street	**Accident Type**	**# Fatals**	**# Injuries**	**Accident Street**	**Accident Type**	**# Fatals**	**# Injuries**
ADAM DR (#27)	Pedestrian	0	1	KIMBALL HILL RD	Bicyclist	0	1
BARRETTS HILL RD (#32)	Pedestrian	0	1	KIMBALL HILL RD	Pedestrian	0	1
BURNS HILL RD (#45)	Pedestrian	0	0	KIMBALL HILL RD	Pedestrian	0	0
CENTRAL ST	Pedestrian	0	2	LIBERTY ST (#15)	Pedestrian	0	1
CENTRAL ST	Pedestrian	0	1	LIBRARY ST (#40)	Pedestrian	0	1
CENTRAL ST (#36)	Pedestrian	0	1	LIBRARY ST (#27)	Pedestrian	0	1
CENTRAL ST	Pedestrian	1	0	LIBRARY ST (#38)	Pedestrian	0	0
CONSTITUTION DR (#33)	Pedestrian	0	0	LOWELL RD (#77)	Pedestrian	0	1
DERRY (#64)	Pedestrian	0	1	LOWELL RD (#64)	Pedestrian	0	1
DERRY ST (#194)	Pedestrian	0	0	LOWELL RD (#254)	Pedestrian	0	0
DERRY ST	Pedestrian	0	0	LOWELL RD	Bicyclist	1	0
DERRY ST (#15)	Pedestrian	0	1	LOWELL RD (#125)	Pedestrian	0	1
DERRY ST (#86)	Pedestrian	0	1	LOWELL RD (#254)	Pedestrian	0	1
DERRY ST (#65)	Bicyclist	0	1	LOWELL RD (#253)	Pedestrian	0	1
DERRY ST (#102)	Pedestrian	0	1	LOWELL RD (#77)	Pedestrian	0	1
DERRY ST (#77)	Pedestrian	0	1	LOWELL RD (#254)	Pedestrian	0	1
DERRY ST (#106)	Pedestrian	0	1	LOWELL RD (#212)	Pedestrian	0	2
DERRY ST	Pedestrian	0	1	OLD DERRY RD (#145)	Pedestrian	0	1
DERRY ST	Pedestrian	0	1	PARK AVE	Bicyclist	0	1
DERRY ST	Pedestrian	0	1	PELHAM RD (#10)	Pedestrian	0	1
DERRY ST (#26)	Pedestrian	0	1	PELHAM RD (#2)	Pedestrian	0	0
DERRY ST (#82)	Pedestrian	0	1	PELHAM RD (#5)	Pedestrian	0	1
DRACUT RD (#133)	Pedestrian	0	1	ROBINSON RD (#154)	Pedestrian	0	1
DUGOUT RD	Pedestrian	0	1	SCOTTSDALE DR	Pedestrian	0	1
ELMWOOD DR	Pedestrian	0	1	WASON RD	Pedestrian	0	0
FERRY ST (#57)	Bicyclist	0	1	WASON RD (#2)	Pedestrian	0	1
FLAGSTONE DR (#21)	Pedestrian	0	1	WEBSTER ST (#229)	Pedestrian	0	1
GRAND VIEW (#6)	Bicyclist	0	1	WEBSTER ST	Pedestrian	0	1
HAVERHILL ST (#1)	Bicyclist	0	0	WINHAVEN DR (#6)	Pedestrian	0	1
HIGHLAND ST (#83)	Pedestrian	0	1			**Total Crashes:**	**60**
HIGHLAND ST (#1)	Bicyclist	0	1			**Total Pedestrian:**	**52**
						Total Bicycle:	**8**
						Total Injuries:	**50**
Crash data courtesy of NHDOT						**Total Fatal Injuries:**	**2**

NRPC reviewed motor vehicle crash data within the town. The preceeding table provides information about each reported crash.

The table indicates 60 crashes involving bicycles or pedestrians were reported over the 10-year period (approx. 6 per year). There were 50 total injuries and 2 fatalities.

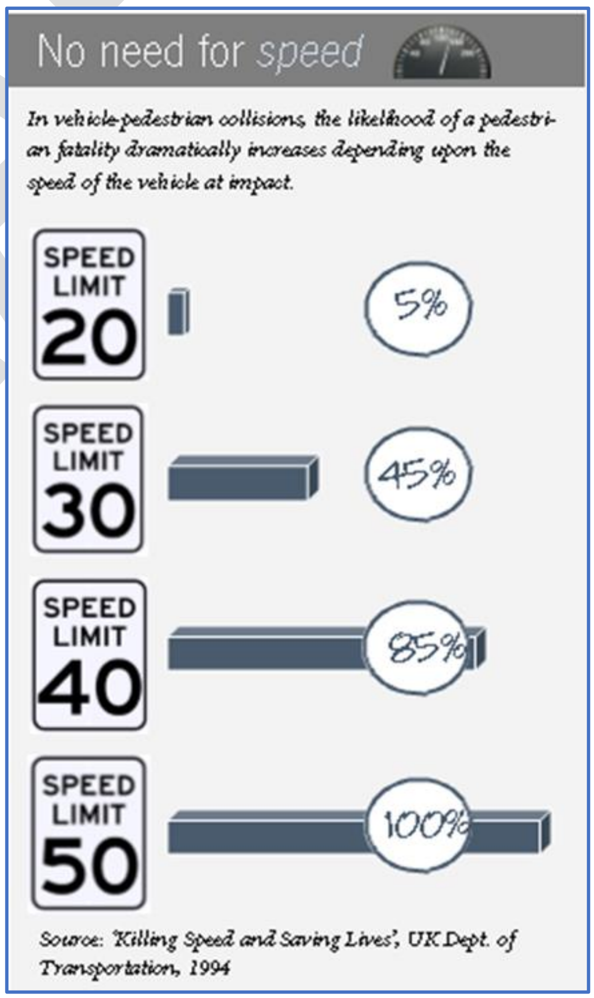
Fifty-two crashes involved pedestrians and 8 involved bicyclists.

Roadway Design and Safety

The area that is now Hudson was incorporated in 1746 (as Nottingham West, NH), and then renamed Hudson in 1830. Town roads in those early days bear little resemblance to Hudson's modern roads. In fact, roadways in Hudson, as in the majority of American communities, have for decades been designed with the primary mission of optimizing the flow of motorized vehicles efficiently, with little (if any) consideration of how to safely accommodate other modes of transportation.

Driver Behavior and Roadway Design

It is important to recognize that roadways which are designed solely for motor vehicles fail to adequately accommodate the needs of users of other modes of transportation. In order to have roadways that effectively incorporate multimodal users, the town should re-consider the idea that all roadways are exclusive to motor vehicles and embrace the idea that town roadways should be designed to accommodate a variety of transportation modes.



Transportation engineers now acknowledge that motor vehicle driver behavior is mostly influenced by how the road is designed[13]. Drivers feel safe when there are long sight distances, wide painted lanes, and no visible obstructions, and when they feel safe, they by nature drive faster. If a road in a downtown business district or neighborhood is designed the same way as a highway, drivers feel safe and will therefore tend to drive fast, regardless of the speed limit, signage, or if pedestrians or bicyclists are present. If a roadway is engineered exclusively for motor vehicles, other attempts to influence driver behavior (for example, posted speed limits) will probably have a minor or temporary impact. Additionally, painted bike lanes and sharrows do not necessarily provide an incentive for individuals to bike more often. In fact, bike lanes may instill a false sense of security. For this reason, painted bike lanes are not included in the design guidelines that are described later in this document. Instead, the design guidelines encourage roadway treatments that provide clearly defined spaces for all modes which will provide more incentive for non-motorized users.

If residents of Hudson want to improve walkability and bikeability in the community, future roadway improvements need to be designed with the

13 Amherst (NH) Multimodal Master Plan

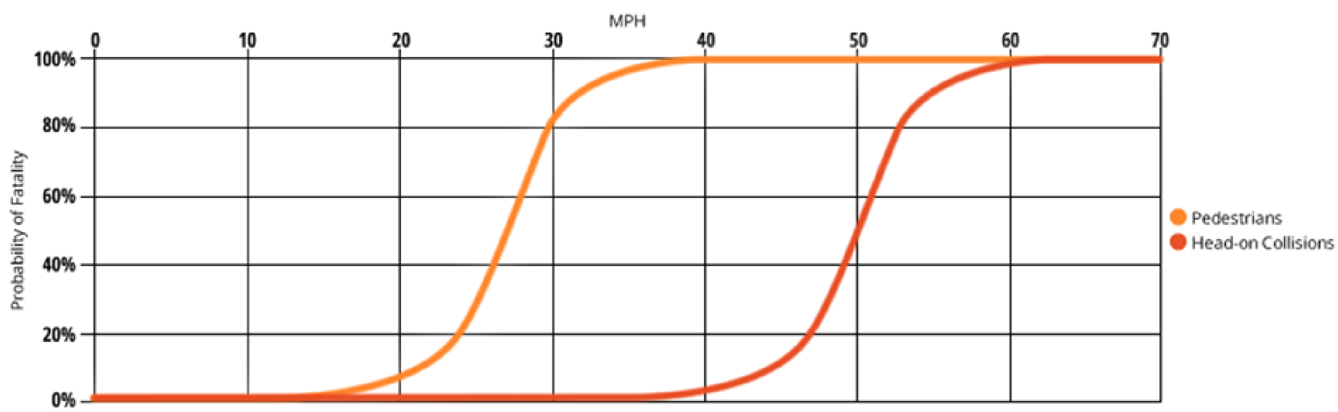
intention of providing visual cues that automatically encourage drivers to slow down. Examples include physically narrowing travel lanes, using different colors or materials on roadway shoulders, incorporating trees or other objects into the driver's peripheral vision along the roadway edge, and other design treatments. The goal is to make the driver feel less comfortable and therefore encourage slower speeds. If an intersection feels unsafe to a driver, for example, the driver will approach and enter the intersection with more caution and at slower speed.

Incorporating Systematic Safety into Roadway Design

The Amherst (NH) Multimodal Master Plan provides a useful explanation of how the relationship between motor vehicle speed and severity of crashes with other vehicles or with vulnerable users (pedestrians, bicyclists) is key to safe roadway design.

There is a maximum safe speed for every type of conflict on a roadway[14]. For crashes between motor vehicles and vulnerable road users, various data show a similar pattern in fatality risk. The risk increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly – the increase is between 3.5 and 5.5 times from 30 mph to 40 mph. For passengers in motor vehicles, fatality rates increase dramatically at approximately 50 mph, though side impact figures indicate even greater risk at lower speeds. This information helps define general categories of roadways, each with their own design characteristics that help to minimize safety risks to.

Where vulnerable road users are more commonly found and may cross the street anywhere or act in an unpredictable manner, the target speed achieved by the road design should be 30 mph or less (preferably 20mph) because at higher speeds, the chance of a pedestrian or bicyclist surviving a collision falls rapidly. At the highest speeds, road design should separate vehicles from other vehicles by direction, based on the physical limitations of vehicles to absorb energy from head-on collisions without resulting in fatality. The following graph shows the relationship between speed of motor vehicles (horizontal axis) and the probability of a fatality (vertical axis) from collisions involving vehicles/pedestrians and collisions involving vehicles/vehicles.



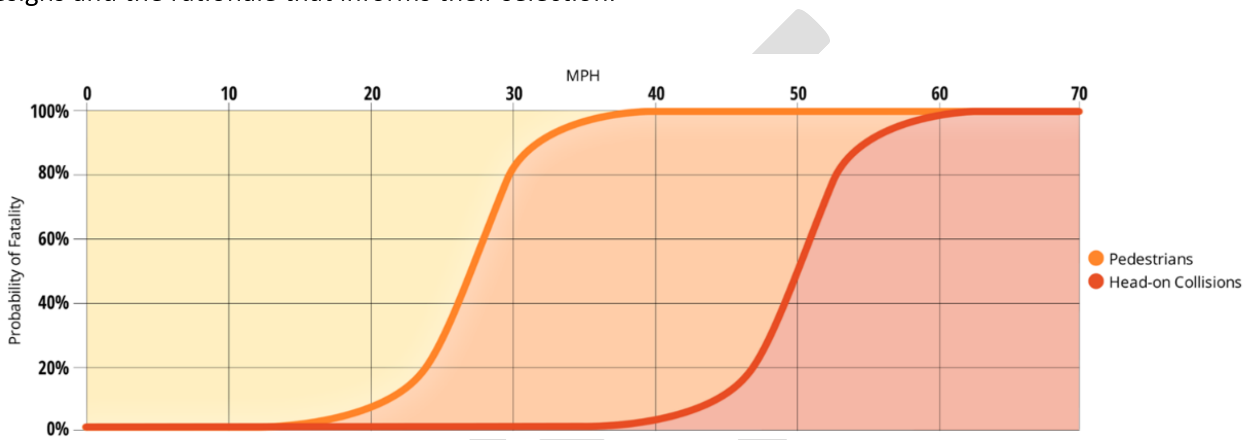
The graph suggests that when considering the relationship between speed and safety risk, and how to incorporate vulnerable users into the road network, there are three types of roads:

- Low-speed/low-volume (local) streets in which motor vehicles and multimodal users may safely mix so long as the design speed of the roadway is kept below ~30 mph.

[14] Ibid.

- Medium speed/higher volume (connecting) streets in which motor vehicles and multimodal users should be separated from each other due to risk of serious injury/death in the event of a collision.
- High speed roads (highways) in which motor vehicles should be separated from multimodal users *and* motor vehicles (by direction) due to risk of serious injury/death in the event of a head-on collision.

Each of these street categories has unique needs and requires appropriate designs to maximize safety for all users. These categories are arranged below to illustrate their corresponding recommended designs and the rationale that informs their selection.



		Local Roads	Connecting Streets	Highways
Roadway Characteristics	Speed	~30 mph & below	~30 mph to ~50 mph	~50 mph & above
	Volume	~5,000 AADT or below	~5,000 AADT or greater	Doesn't matter
	Functional Use	Local/ neighborhood access	Local access & through traffic	Highways
Relationship to vulnerable Road Users	Method of Protection	Permanent speed limitiation through roadway design (traffic calming, etc)	Permanent speed limitiation through roadway design, additional measures at intersections & crossings	Wide margins and/or physical barriers
	Placement	Mixing of Pedestrians/bikes/ motor vehicles	No mixing of pedestrians/bikes/ motor vehicles except at crossings	Motor vehicles completely separated from pedestrians/bikes

Design Guidelines

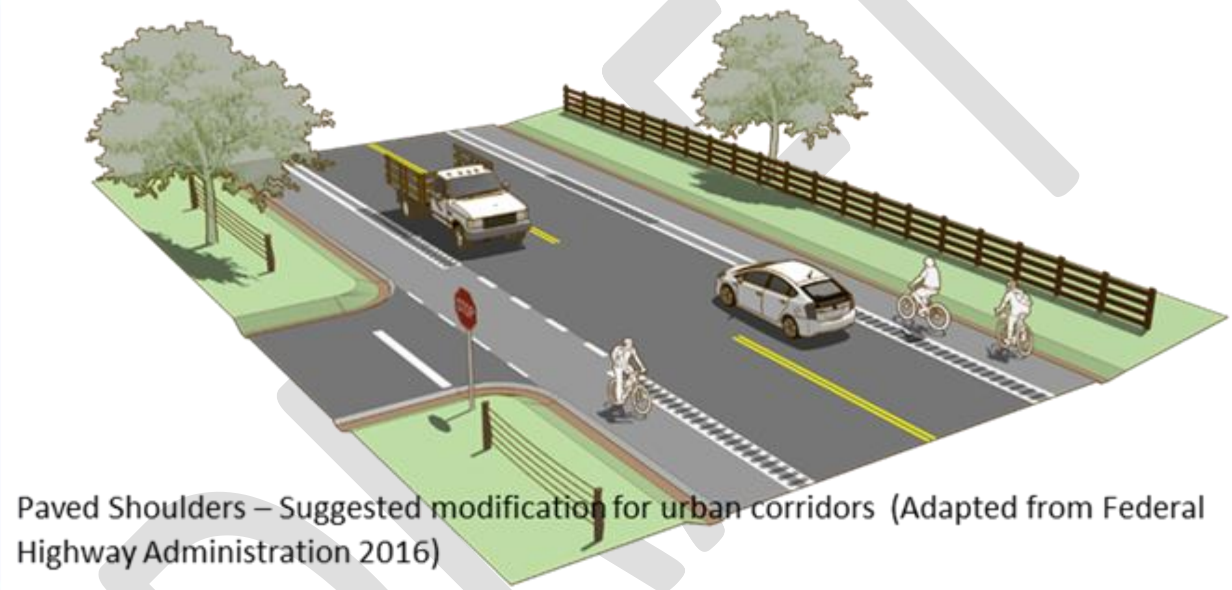
The Town of Hudson has a mixture of local streets that are just fine for pedestrians and bicyclists of all abilities, as well as road corridors that are urbanized and developed to the level and extent where comprehensive pedestrian and bicycle facilities are appropriate.

The following design guidelines should be considered whenever maintenance, rehabilitation or new construction occurs within the right of way of any street in Hudson. This will allow multimodal accommodations to be implemented on a gradual basis over time as part of the road maintenance and/or town capital improvement program. This will also minimize the cost of bicycle and pedestrian infrastructure improvements.

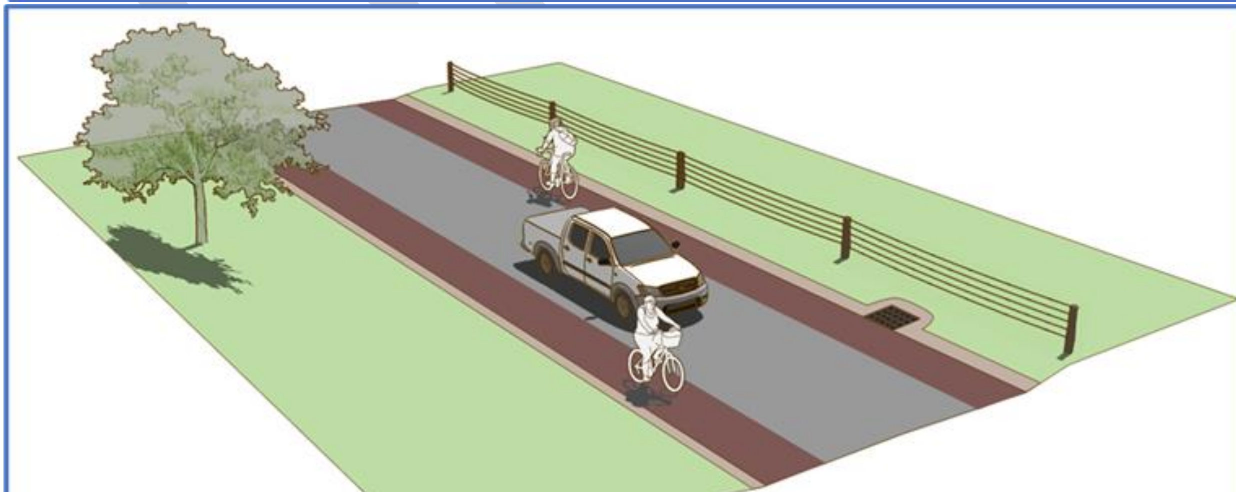
Local Roads – Enhanced Paved Shoulders

Local roads are defined by their ability to safely mix motorized and non-motorized traffic at low speeds. These roads are generally neighborhood streets characterized by their lower vehicular traffic volumes and (comparatively) higher volumes of multimodal users. The upper limit of this category is defined by exponentially higher risk of death in a collision between a vehicle and a vulnerable road user at ~30 mph. Local roads are specifically defined by vehicular traffic speeds of ~30 mph and below and volumes of ~5000 Average Daily Traffic (ADT) and below.

On local roads it is unnecessary and impractical to physically segregate motor vehicles from vulnerable road users. In many cases, such as on typical cul-de-sacs, nothing at all needs to be done to encourage pedestrians or cyclists to travel on the road. In other cases, when motor vehicle speed and volume



Paved Shoulders – Suggested modification for urban corridors (Adapted from Federal Highway Administration 2016)



Paved Shoulders – Rural areas (Federal Highway Administration 2016) – image modified to mirror recommendation approach the upper level of this category, visual separation of road users is appropriate. The Federal Highway Administration (FHWA) provides guidance for visually separating motor vehicles from pedestrians and bicyclists. Paved shoulders along the edge of roadways can improve bicycle safety in areas where traffic speed and volume begin to approach the upper end of what could be considered a local road. The enhanced shoulder design takes existing road design and uses visual traffic calming techniques that create roadways where motorists feel the need to drive slower, thereby providing a more comfortable space for non-motorized modes.

Space occupied by non-motorized users should be defined from traditional road space in a distinctive way. It is therefore recommended that when paved shoulders are installed, hot mix asphalt colorant should be utilized as it tends to color the surface for the life of the asphalt, as opposed to surface-applied paints, which require regular maintenance. FHWA-approved color should be used universally in these spaces and in most cases terra cotta is the recommended color.

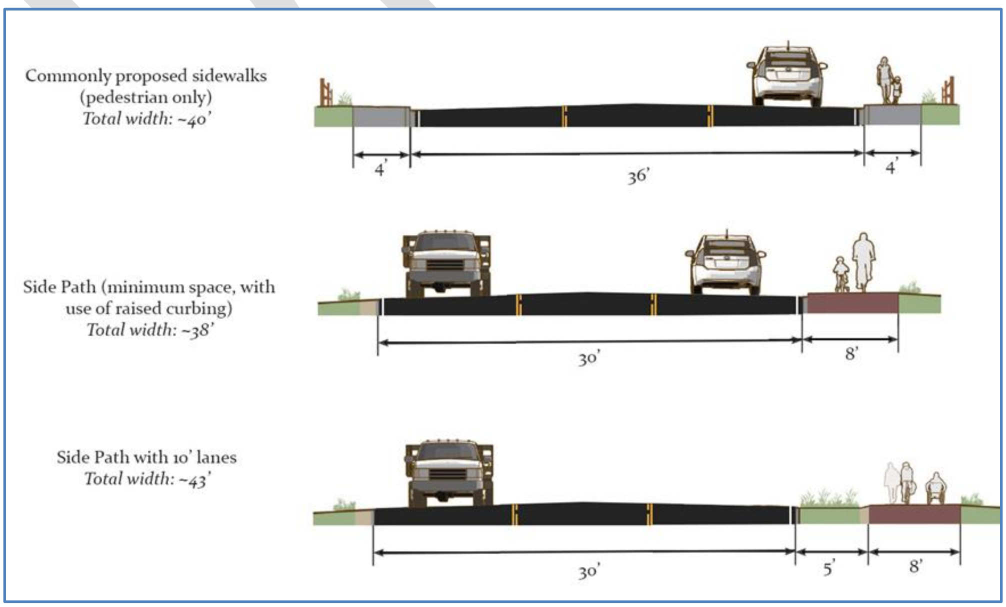
This design can be used on rural road segments as well as more urban areas, as shown in the figures above. For rural areas, the design may include only the painted shoulder. In more urban areas, the design can include painted striping and rumble strips to further distinguish between the motor vehicle travel lane and the shoulder.

Technically, none of these design elements are MUTCD traffic control devices, therefore the regulatory perspective and use of this roadway is completely identical to conventional roadways.

Connector Streets – Sidewalks and Side Paths

Connector streets are streets generally characterized by traffic speeds above 30 mph which, as noted earlier, presents a high risk of death or serious injury in a collision between a vehicle and a vulnerable road user. Additionally, high traffic volumes factor into a high level of bicycle and pedestrian traffic stress. For this type of roadway, mixing of motorized traffic with vulnerable road users is not the safest solution and therefore segregation of vulnerable users away from motorized traffic is the preferred means of protection.

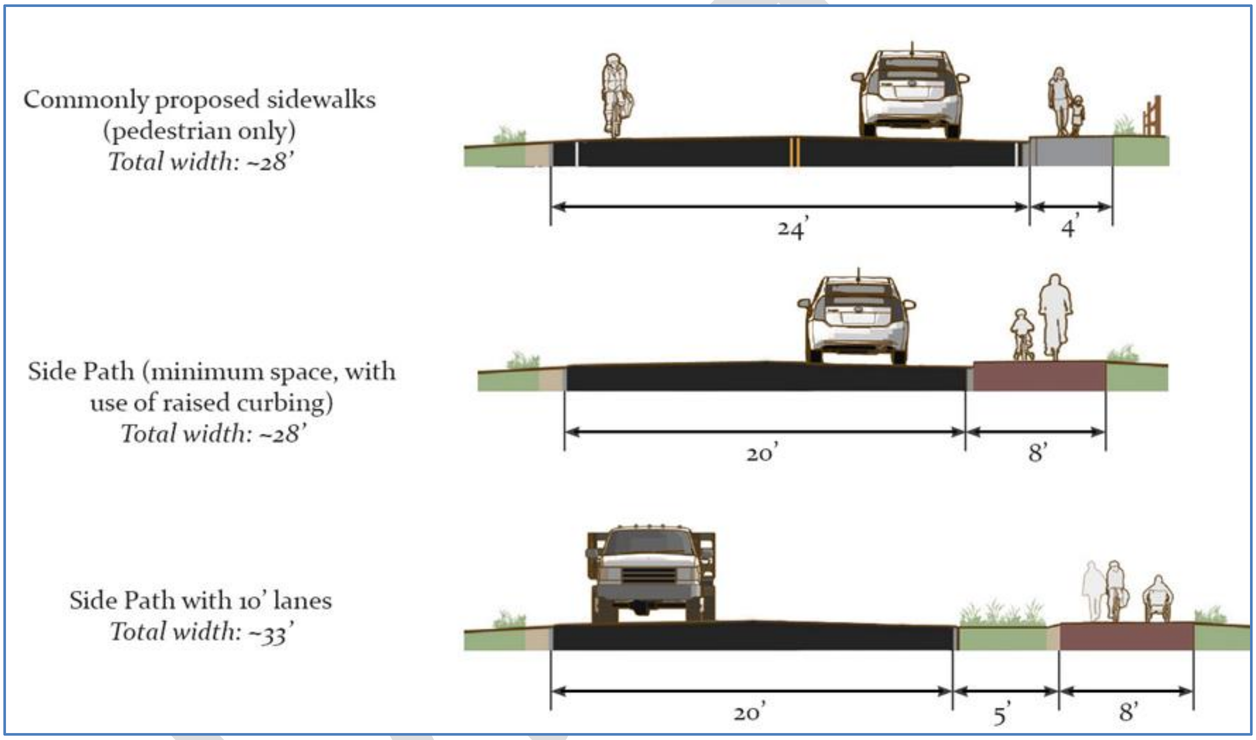
Ideally, the recommended roadway treatment for this type of road would be a side path–a paved, minimum of eight feet wide, bidirectional, multiuse space beside the street. A side path is simply a wider-than-normal sidewalk. The images on the right (top) show a typical cross section of 12-foot travel lanes and 4-foot sidewalk. Notice that if travel lanes are narrowed to 10-feet, an 8-foot side path can be incorporated into a narrower right of way. The image to the right (bottom) shows how a side path can be



incorporated into a center turn lane cross section using less right of way than is typical of existing conditions on Ferry Street or Lowell Road. It is also possible to incorporate a side path into a 5-lane cross section, using less right of way than is typical.

A side path may still be possible in certain areas along various corridors in Hudson where land use has not fully encroached into the right-of-way or where redevelopment may occur in the future. In these cases, a side path should be considered. In areas where a side path is not realistic, sidewalks should continue to be required and travel lanes should be narrowed to allow for the widest possible shoulder, thus allowing more room for bicycles and enhanced shoulders.

As explained earlier, space occupied by non-motorized multimodal users should be defined from traditional road space in a distinctive way. It is therefore recommended that when asphalt sidewalks and side paths are installed, the same hot mix asphalt colorant be used that was used for paving enhanced shoulders.



Crosswalks at Uncontrolled Pedestrian Crossings

Raised Crosswalk in Nashua

Federal Highway Administration guidance states that pedestrians are especially vulnerable at non-intersection locations, where 72 percent of pedestrian fatalities occur. FHWA guidance addresses safety issues at uncontrolled pedestrian crossing locations, which occur where sidewalks or designated walkways intersect a roadway at a location where no traffic control (for example, traffic signal or STOP sign) is present. These common crossing types occur at intersections (where they may be marked or unmarked) and at non-intersection or midblock locations (where they must be marked as crossings). Overall, uncontrolled pedestrian crossing locations correspond to higher pedestrian crash rates than controlled locations, often due to inadequate pedestrian crossing accommodations.

Improvements could include crosswalk visibility enhancements, Pedestrian Hybrid beacons, raised or textured crosswalks, road diets, and rectangular rapid flashing beacons.

The engineering of specific improvements is beyond the scope of this Master Plan. Best practices for design guidelines and road treatments that accommodate all modes of transportation continue to evolve and this document strongly recommends that best practices always be followed. The following resources provide clear and up-to-date guidance.

- **NATCO Urban Bikeway Design Guide (2014)** HTTPS://NACTO.ORG/PUBLICATION/URBAN-BIKEWAY-DESIGN-GUIDE/
- **FHWA, Bikeway Selection Guide (2019)** https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwasa18077.pdf

- **FHWA, Small Town & Rural Multimodal Networks (2016)**
  HTTPS://WWW.FHWA.DOT.GOV/ENVIRONMENT/BICYCLE_PEDESTRIAN/PUBLICATIONS/SMALL_TOWNS/FHWAHEP17024_LG.PDF
- **FHWA, Safe Transportation for Every Pedestrian (STEP) Guidance**
  HTTPS://SAFETY.FHWA.DOT.GOV/PED_BIKE/STEP/RESOURCES/
- **FHWA, Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (2018)**
  HTTPS://SAFETY.FHWA.DOT.GOV/PED_BIKE/STEP/DOCS/STEP_GUIDE_FOR_IMPROVING_PED_SAFETY_AT_UNSIG_LOC_3-2018_07_17-508COMPLIANT.PDF
- **AASHTO, Guide for the Development of Bicycle Facilities (2012)**
  HTTPS://NACTO.ORG/REFERENCES/AASHTO-GUIDE-FOR-THE-DEVELOPMENT-OF-BICYCLE-FACILITIES-2012/
- **AASHTO, Guide for the Planning, Design, and Operation of Pedestrian Facilities (2021)**
  HTTPS://STORE.TRANSPORTATION.ORG/ITEM/COLLECTIONDETAIL/224
- **Safe Routes to School Guide**
  HTTP://GUIDE.SAFEROUTESINFO.ORG/ENGINEERING/MARKED_CROSSWALKS.CFM
- **Safe Routes to School - School Area Traffic Control**
  HTTPS://WWW.ITE.ORG/PUB/?ID=E2660E01%2D2354%2DD714%2D51EB%2DF2E399C901F9

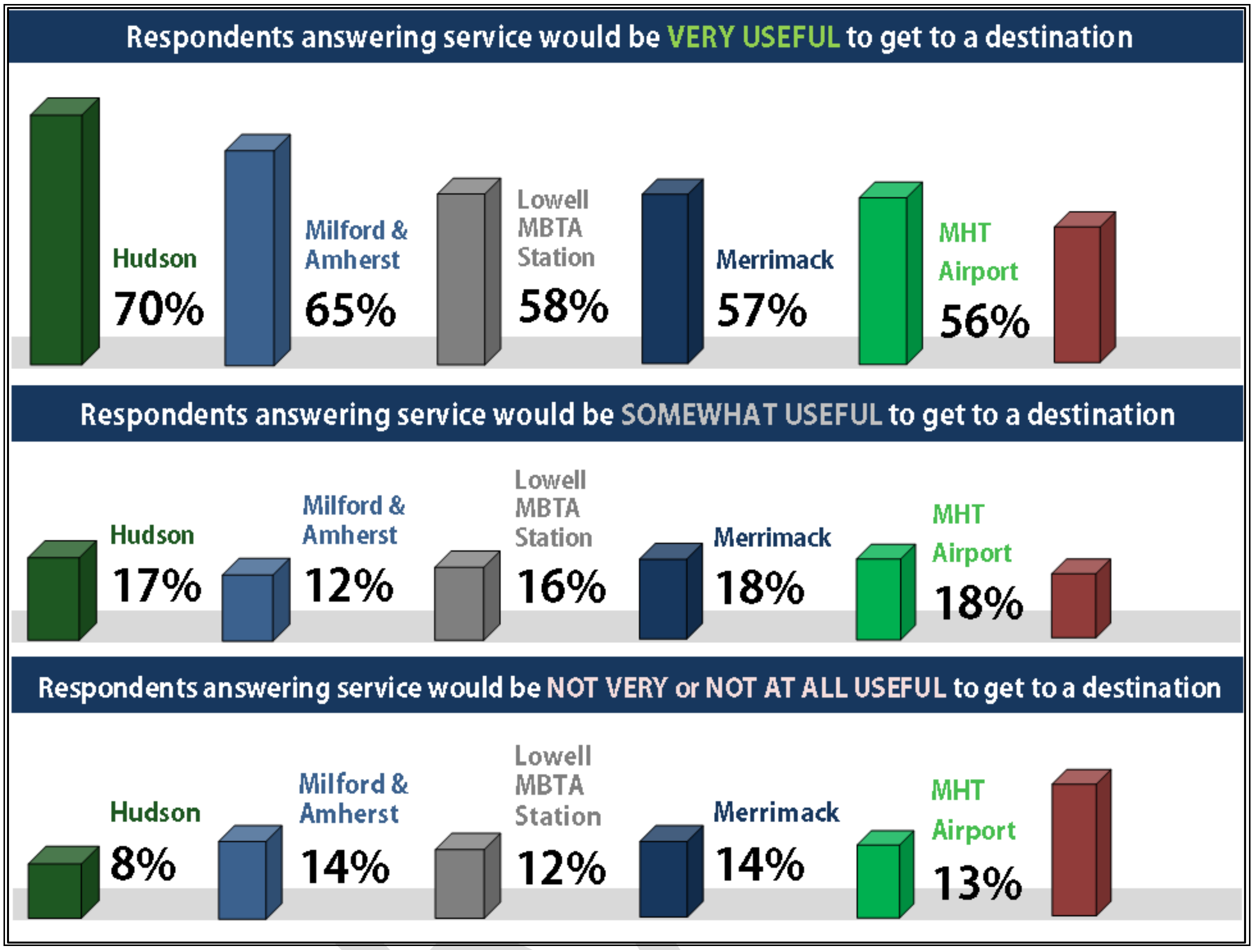
Public Transit

Previous Master Plans have recommended that the Town of Hudson give consideration to supporting Nashua Transit Service route extensions into the Town, primarily to the Town Center and commercial/industrial areas along NH 3A. Introducing fixed route transit service to areas of lower-income households and economic activity areas would facilitate mobility and increase access to employment opportunities, commercial and retail establishments, and connecting service to Lowell Regional Transit Authority routes, which runs to the state line at Ayotte's Market. There have been several public outreach efforts in recent years which have included questions aimed at gauging public interest in additional fixed-route services. In a survey conducted in 2015, Hudson was selected by 70% of respondents as a destination for which transit would be a useful option. While this should not be construed to mean that this percentage of the population desires to take transit as a regular mode, it does show that the proximity of Hudson to existing NTS routes does generate a level of interest in services. In 2018, NRPC conducted an on-board survey of NTS riders, with one purpose being to obtain feedback on desired service extension areas. Table V-16 provides the distribution of responses. Walmart is the leading preferred destination, cited by 46% of all existing riders. As the respondents to this survey are regular riders of NTS Citybus with 80% riding three times a week or more often, these preferences should be given significant weight in terms of evaluating potential new service areas. Only 20% of NTS riders report an auto available for their trip and about half are making work trips via the bus. Extension of transit service to Hudson would enable opportunities to reach work areas now only accessible by private auto.

Table V-16. Nashua Transit System On-Board Survey Desired Transit Destinations in Hudson

Hudson Town Center	20%
Hannaford, Hudson	21%
Ayotte's Stateline Market, Hudson	10%
Walmart, Hudson	46%
Hudson, Any Location	**53%**

Figure V-4. 2015 Public Outreach Survey



A survey of the general public was also conducted by NRPC in 2018 in which respondents were asked to identify preferred bus destination. This survey reached primarily non-users of transit to determine the highest potential destinations for those who are not likely using NTS at present. In this survey, Hudson destinations do not fare as well; Walmart is the preferred stop in the town but less preferred than Walmart in Amherst or the Premium Outlets in Merrimack.

Most recently, the 2019 Hudson resident survey indicated 15% of Hudson residents are "very concerned" about the lack of public transportation and 18% are "concerned." While only one-third of citizens indicated a level of need for transit, this still represents a significant portion of the public in the town.

In 2019 the NRPC conducted a study to evaluate the potential for fixed-route transit extensions within the region. Both the estimated travel demand and costs of service for the new route were developed. The transit use forecasting procedure utilizes the relationship between rider demographics and activity center size with levels of transit use. These correlations were developed through regression analysis, using independent variables that are likely to correlate highly with transit use. The estimation was done for four trip purposes: home-based work (HBW), home-based medical (HBM), home-based school (HBSC and other home-based trips (HBO).

Table V-17. General Public On-Line Survey Preferred Bus Destinations

Preferred Bus Stop Locations	Total	% Total
Milford Medical Care, Milford	34	16%
Milford Oval	49	23%
Market Basket, West Milford	48	23%
Lowe's Shopping Plaza, Amherst	45	22%
Shopping Plaza, Amherst	66	32%
Walmart, Amherst	92	44%
Hudson Town Center, Hudson	17	8%
Hannaford, Hudson	21	10%
Ayotte's Market, Hudson	11	5%
Walmart, Hudson	39	19%
Premium Outlets, Merrimack	73	35%
YMCA, Merrimack	42	20%
Shaw's Plaza – Exit 11, Merrimack	49	23%
King Kone and Surrounding Residences, Merrimack	29	14%
CVS/Senior Center/Town Center, Merrimack	43	21%
Shaw's – Exit 12, Merrimack	33	16%
Target, Bedford	37	18%
Manchester-Boston Regional Airport, Manchester	74	35%
Other Merrimack-Milford-Hudson	9	4%
Total	**209**	

To develop the regression equations, the NTS service area was divided into 60 transit analysis zones that are conveniently walkable to NTS routes. Both trip productions (the trip end to or from a home) and trip attractions (the trip end to or from an activity center) were estimated. For home-based trip productions, zero-auto households were found to be the strongest independent variable. For attractions to activity centers, various employment categories constituted the dominant variable, with school enrollment and level of transit service also included in the estimation.

Map V-13 shows the Hudson transit route that was evaluated, along with the eight transit analysis zones (80 through 87) that were estimated for new transit ridership based on the calibrated regression equations. The route traverses both Merrimack River bridges connecting with downtown Nashua via the Taylor Falls/Veterans Memorial Bridges and the south Nashua business district via the Sagamore Bridge.

The route provides new transit to the following:

- Hudson Mall
- Dr. H.O. Smith School
- Hudson Municipal Offices
- Hudson Gardens Apartments

- Stonewood School Day Care
- Walmart, Sam's Club, Market Basket, and numerous other commercial establishments on NH 3A
- Executive Drive/Flagstone Drive office buildings (Sagamore Business Park)

It was found that Hudson does not have the high transit-dependent population as seen along the DW Highway in Merrimack nor does it have as strong a commercial attraction base for transit as does the NH 101A corridor. Table V-14 presents the total estimated trips by transit zone, trip purpose and whether they are production to attraction (P→A) or vice versa. The 16,700 annual trips (58 per average weekday, 36 per average Saturday) that are estimated are about 25% household production trips and 75% commercial/office attracted trips. The differential between production and attraction trips indicates that Nashua residents would provide a significant amount of the home end trips to Hudson destinations.

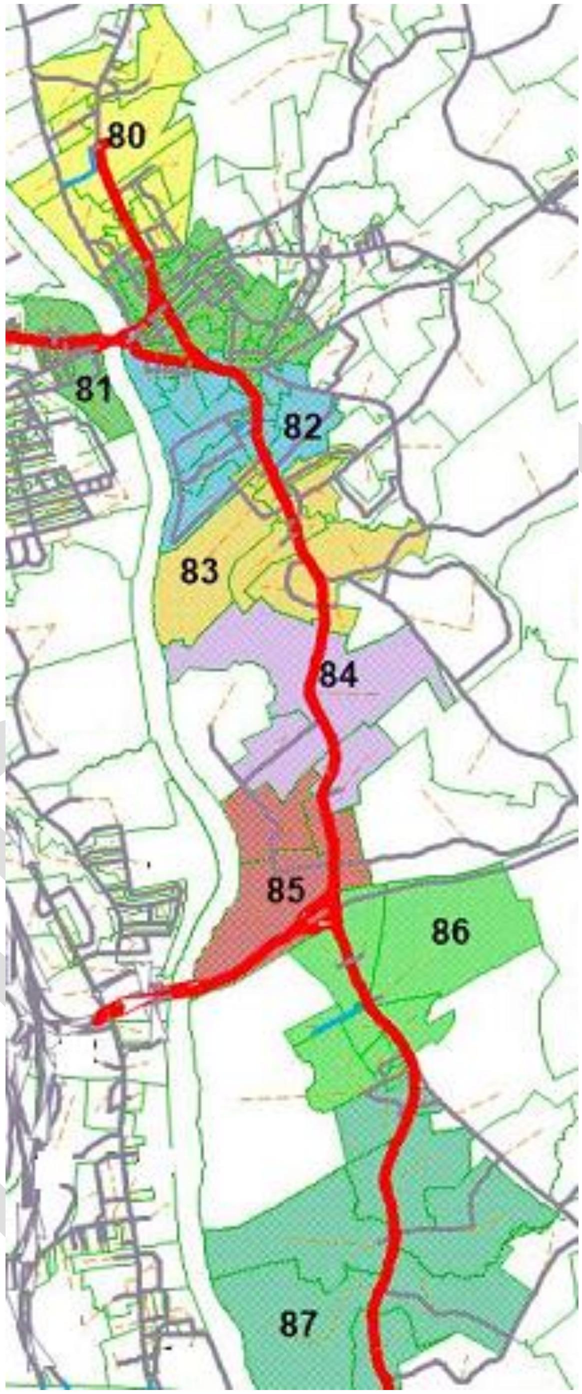
The ridership potential for Hudson is somewhat less than is projected for a Merrimack transit route along US 3 (17,800) and significantly lower than estimated for the extension of the NH 101A transit route to western Milford (27,500).

Table V-18 NH 3A Transit Route Ridership Estimates by Transit Zone and Trip Purpose

Town	Area	HBW P-->A	HBW A-->P	HBO P-->A	HBO A-->P	HBM P-->A	HBM A-->P	HBSC P-->A	HBSC A-->P	Total P-->A	Total A-->P	NHB Trips	**Total Trips**
Hudson	80	135	1,308	87	366	20	62	17	0	259	1,736	120	**2,114**
Nash/Hud	81	1,217	521	779	0	184	0	150	88	2,330	609	176	**3,116**
Hudson	82	372	265	238	0	56	0	46	0	712	265	59	**1,036**
Hudson	83	68	508	43	0	10	0	8	124	129	632	46	**807**
Hudson	84	68	479	43	0	10	0	8	0	129	479	37	**645**
Hudson	85	68	2,842	43	1,142	10	348	8	0	129	4,333	268	**4,730**
Hudson	86	34	2,061	22	796	5	0	4	0	65	2,858	175	**3,098**
Hudson	87	135	760	87	75	20	0	17	0	259	835	66	**1,160**
Total: NH 3A Rte		**2,096**	**8,745**	**1,342**	**2,380**	**316**	**410**	**259**	**212**	**4,013**	**11,747**	**946**	**16,706**

The Hudson NH 3A transit route is 9.35 miles in one direction and would operate 64,850 revenue miles annually, assuming twelve weekday runs and eight Saturday runs. With 16,700 trips projected, the riders per vehicle revenue mile is calculated at 0.26, which would not compare favorably with existing NTS routes. The annual net cost (total expenses less farebox revenue) is estimated at $282,000. Eliminating the section of the route south of Walmart to the Massachusetts state line would improve productivity to a degree, as this is a low ridership segment, while reducing the net operating cost to under $250,000.

Map V-13.
NH 3A Transit Extension to Hudson & Transit Zones



Demand Response Service

There is no fixed-route bus service in Hudson, but limited demand response service is available to eligible Hudson residents through the Nashua Transit System City Lift service. City Lift is a public transportation service for individuals who qualify as disabled under the Americans with Disabilities Act (ADA) who are not able to use the fixed route CityBus services. Service is also available to seniors 65 years old or older. The service operates Monday through Friday between the hours of 8:00 am and 4:00 pm including travel time to and from destinations in Nashua.

The table below provides ridership data from fiscal years 2019 and 2020. It can be seen that ridership was trending up in fiscal year 2020 as compared to fiscal year 2019 and then dropped off in the last 3 months (April-June) of fiscal year 2020 as a result of the Covid-19 pandemic.

Table V-19 City Lift Ridership Data

FY 2019		FY 2020	
FY 2019 Months	**Total Trips**	**FY 2020 Months**	**Total Trips**
July	51	July	47
August	32	August	56
September	19	September	68
October	37	October	42
November	38	November	62
December	44	December	37
January	43	January	35
February	38	February	25
March	37	March	35
April	47	April	
May	37	May	
June	37	June	
Totals	**460**	**Totals**	**407**

The Locally Coordinated Transportation Plan for the Greater Nashua and Milford Region (2020-2024) (LCTP) identified community transportation needs in Hudson and laid out a vision for how communities in the Nashua region, including Hudson, could be integrated into a more robust community transportation system.

The specific needs that were identified in Hudson included:

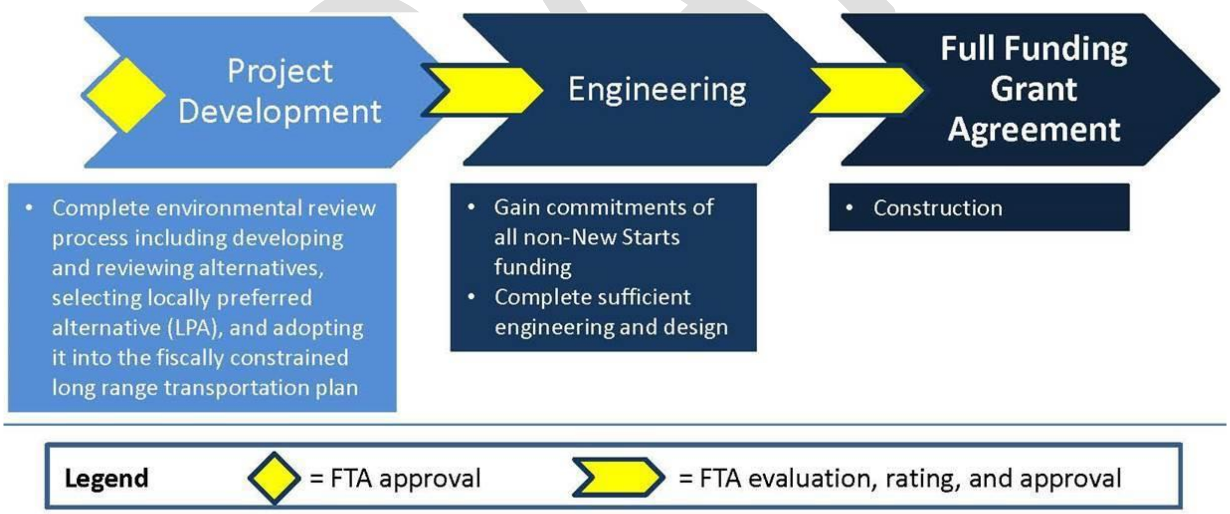
- Need to evaluate and adjust paratransit services for destinations within Hudson and not just to and from Nashua.
- Daily or weekly service for Hudson residents to destinations within Hudson and to Nashua. Destinations may include locations that cater to grocery, shopping, entertainment, etc.

The LCTP recommended the establishment of regularly scheduled, and/or demand response service for residents of Hudson, to destinations within those communities, and to destinations in Nashua. The recommendations in the plan were supported by stakeholders throughout the region and in Hudson.

Passenger Rail

The extension of passenger rail into southern New Hampshire has been advanced in various incarnations over the past several years with intermittent periods of progress interspersed by periods of setbacks and inaction. Though Concord Coach Lines' inter-city bus service does meet the needs of many Boston-bound commuters, the buses still suffer from the same congestion and traffic-related delays that impact all driving commuters. Passenger or commuter rail on the other hand, is not affected by highway congestion and during peak hours can provide considerably faster service. The most promising recent proposal, the Capital Corridor initiative, would involve the extension of the existing MBTA commuter rail service from Lowell, MA to Manchester with an eventual extension to Concord. The project would include stations in south Nashua near FE Everett Turnpike Exit 2, downtown Nashua, an Airport station in Bedford near the junction of the Turnpike and NH 101 and a station in downtown Manchester. The service is envisioned to provide 11 roundtrips (weekdays) directly to downtown Boston's North Station. Hudson residents would have easy access to both the downtown Nashua (Crown Street) and south Nashua stations. In 2019, Senate Bill 241 passed into law which enabled NHDOT to access $5 million in federal funding to complete the Project Development phase of the project. The project development process is outlined in Figure V-3 below but is currently halted.

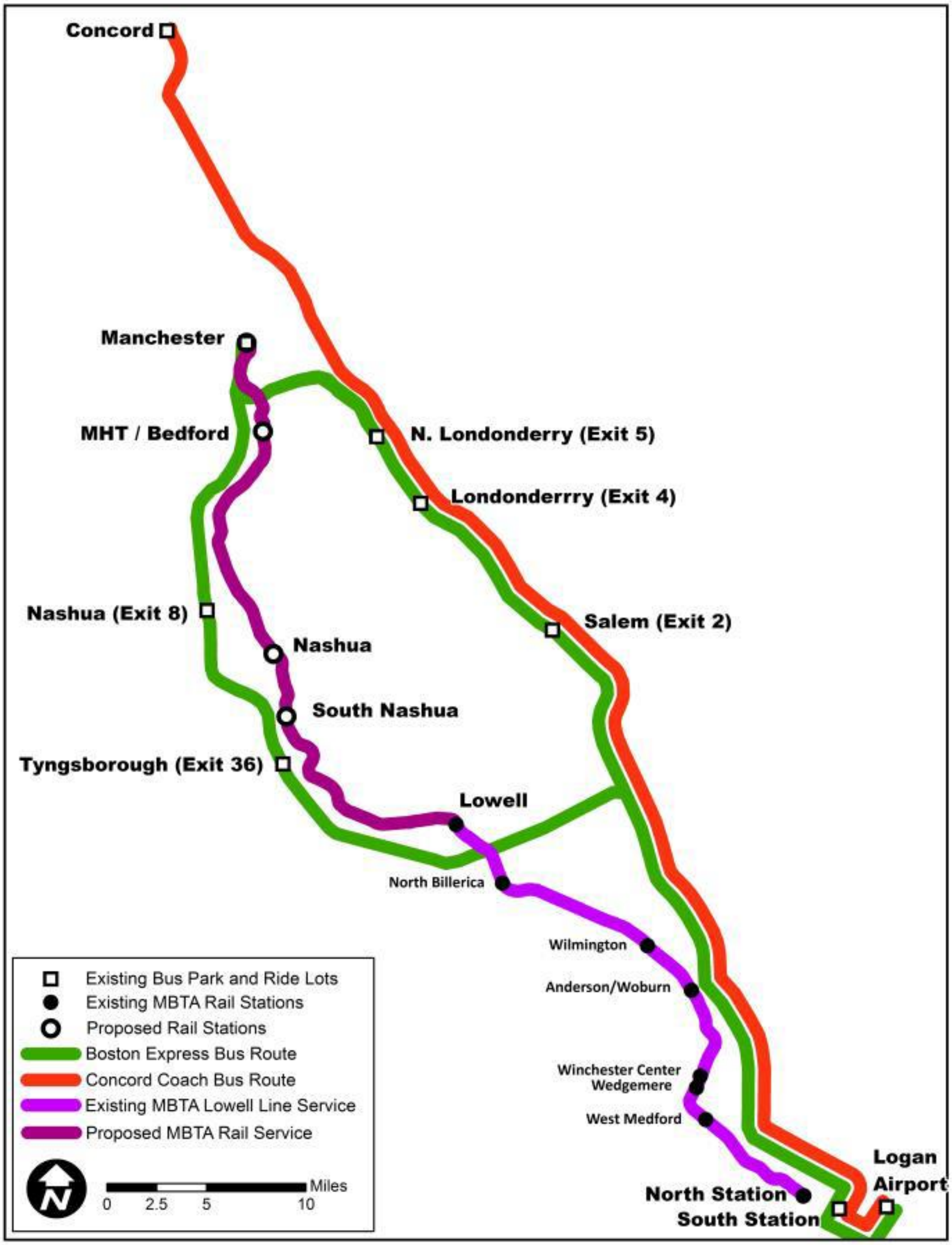
Figure V-5
Capital Corridor Project Development Phase



Source: NHDOT

A second alternative is inter-city passenger rail such as Amtrak's Downeaster service that connects Portland and other Maine communities to Boston with service to Exeter, Durham and Dover in New Hampshire. As noted previously, 35% of Hudson's labor force commutes to Massachusetts, a percentage that has increased notably over recent years. The extension of passenger rail service to the region could enhance the commutes of many current Hudson residents while serving to attract new residents who work or plan to work in Boston.

Map V-14
Existing Inter-City Bus Service and Proposed Extension of MBTA Commuter Rail
(NH Capital Corridor)



CONNECTED AND AUTONOMOUS VEHICLES

Connected and autonomous vehicles (CAVs) include a wide range of technologies ranging from communication systems that allow vehicles to communicate with third parties to technologies that enable vehicles to operate partially or fully without human control. While fully automated or autonomous vehicles have not yet been deployed outside the realm of testing, varying CAV technologies are already being implemented in a variety of ways that impact the transportation system, and fully connected and automated vehicles will likely become commercially available within the planning horizon. How these technologies will impact the transportation system remains subject to speculation and debate, however, there is little doubt that significant impacts to mobility, safety, street capacity, congestion, land use and the environment will occur. This section provides a brief overview of CAV technologies and their possible impacts.

Connected Vehicles

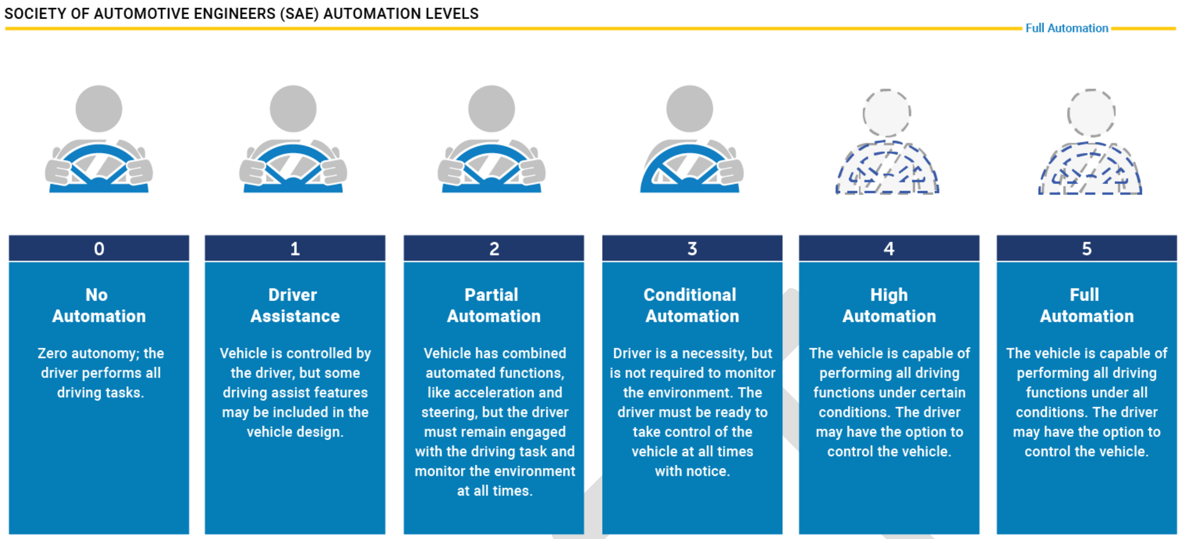
Connected vehicles are vehicles that use any of a number of different devices or communication technologies to communicate with the driver, other cars on the road (vehicle-to-vehicle or V2V), roadside infrastructure (vehicle-to-infrastructure or V2I), and the "Cloud" (V2C). These technologies can be used to improve vehicle safety and efficiency, improve navigation and improve commute times.

Examples of vehicle connectivity already in use include GPS systems and E-ZPass as well as General Motor's OnStar, Ford's Sync and Chrysler's Uconnect. Transit Signal Priority technologies that allow emergency vehicles or public transit vehicles to communicate with traffic signals have also been deployed in many locations. In New Hampshire, the state legislature passed a law enabling the use of Transit Signal Priority technology and the City of Dover is currently implementing a Signal Phase and Timing (SPaT) Challenge to test V2I strategies at signalized intersections. NHDOT is also moving forward with a corridor-wide Intelligent Transportation Systems (ITS) improvement project for the F.E. Everett Turnpike which will allow for a wider variety of communication systems to be deployed. Currently, Android Auto, Apple CarPlay, and Amazon Alexa are combining those earlier technologies with lessons from the smartphone industry to increase connectivity and integrate information across devices. Although adding connectivity to vehicles has its benefits, it also has challenges. By adding connectivity, there can be issues with security, privacy, and data analytics and aggregation due to the large volume of information being accessed and shared.

Automated Vehicles

Automated vehicles are vehicles that use devices and technology to take over a portion or potentially all of the decision making related to the driving task (aka Autonomous Vehicles, Self-Driving Vehicles, Driverless Cars, or Robotic Cars). The U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) has adopted the Society of Automotive Engineers' (SAE) six levels of automation definition as illustrated in Figure V- below.

Figure V-6



Source: Society of Automotive Engineers' (SAE) 6 Levels of Automation

<u>Potential CAV Safety Benefits</u>

Driver behavior and driver error are believed to be contributing factors in more than 90% of crashes nationwide. CAVs mitigate human error issues and are expected to substantially reduce crashes. By eliminating human error, transportation planners would be able to better focus safety improvement resources in areas with true infrastructure deficiencies.

<u>Potential CAV Capacity Benefits</u>

- FHWA research suggests that, in the long-term, CAVs could safely travel at closer headways (platoon), which could increase traditional volume/capacity ratios.
- CAVs could utilize real-time traffic data that allows for efficient optimization across the entire transportation network.
- Due to the prevalence of Zero Occupant Vehicle (ZOV) circulation and dead-head trips, VMT, VHT, and delay are likely to increase when CAVs begin to gain market share. Reductions in delay are only likely to be realized when CAV technology is fully integrated and ubiquitous (e.g. close to 100% utilization).

<u>Potential CAV Special Mobility Benefits</u>

- CAVs could facilitate independent living by improving mobility for elderly, disabled, and visually-impaired populations.
- The need for human assistance and accessible vehicles will still exist.
- Deploying CAV technology is expected to be more cost effective than demand response human service transportation, particularly in rural areas.

<u>Potential CAV Environmental Benefits</u>

- Vehicles will accelerate and decelerate more efficiently
- Aerodynamic drafting (platooning) resulting in improved traffic flow dynamics

- Fewer unnecessary stops
- Many CAVs are likely to be Zero Emission Vehicles
- May reduce need to consume land with large parking areas

Potential Environmental Drawbacks

- Zero-occupant Vehicles will increase VMT and VHT (in the medium-term)
- Convenience of CAVs could increase the proliferation of suburban sprawl land use patterns
- Faster driving speeds

It should also be noted that the current car ownership model will likely change as fully automated vehicles become more widely available. Though the extent of such changes is unknowable at this time, the high cost of fully automated vehicles coupled with likely early adoption of the technology by ride-hailing services such as Uber and Lyft, suggest that shared autonomous vehicle models, whether through ride-hailing or subscription-based services, may come to dominate the automobile market.

Electric Vehicles

Electric vehicles (EVs) are emerging as part of the mainstream transportation landscape and are anticipated to become increasingly common and widespread as newer consumer models become more efficient and affordable and EV technology spreads to commercial truck, bus and utility vehicle fleets. The term EV, as defined by the New Hampshire Department of Environmental Services (NHDES), "refers to a vehicle propelled solely by an electric motor with a battery as the motor's energy storage device." The NHDES website notes that "there are presently two forms of EV:

- "Battery Electric Vehicle or BEV," which uses an electric motor to propel the vehicle, powered by battery packs that are recharged directly from a source of electricity (Nissan Leaf, e.g.).

- "Plug-In Electric Hybrid Vehicle or PHEV," which can be driven by an electric motor and internal combustion engine (Ford C-Max Energi, e.g.) or can be driven only by its electric motor with an internal combustion engine and generator to recharge the battery (Chevy Volt, e.g.).

An EV uses an external electricity source to recharge the battery by connecting it to an electrical supply through a connector system that is designed specifically for this purpose (plugging in)."

There are three types or levels of EV charging stations:

- Level 1 chargers use a 120 V AC plug and can be plugged into a standard outlet. Unlike other chargers, Level 1 chargers do not require the installation of any additional equipment. These chargers typically deliver two to five miles of range per hour of charging and are most often used at home. Level 1 chargers are the least expensive option, but they also take the most time to charge a vehicle battery. EV owners can use a level 1 charger to charge their vehicles at home overnight by plugging into a typical garage outlet.

- Level 2 chargers use a 240 V (for residential) or 208 V (for commercial) plug. Unlike Level 1 chargers, they can't be plugged into a standard wall outlet and are usually installed by a professional electrician. Level 2 EV chargers deliver 10 to 60 miles of range per hour of charging and can fully charge an electric car battery in as little as two hours. Level 2 chargers can be installed at home and are ideal options for public facilities, parking lots and businesses.
- Level 3 or DC Fast Chargers (also known as CHAdeMO EV charging stations) can offer 60 to 100 miles of range for an electric car in just 20 minutes of charging. However, they are typically only used in commercial and industrial applications and require highly specialized, high-powered

equipment to install and maintain. Further, not all electric cars can be charged with the use of DC Fast Chargers.

EV Charging station in Derry, NH

The primary drivers behind the growth of EVs are the reductions in air pollution and greenhouse gas emissions that can be realized when the electricity used is obtained from cleaner burning fuels such as natural gas or more importantly, renewable energy sources such as solar, wind or hydro power. Given the potential benefits of EV adoption, state, federal and local governments together with environmental advocacy organizations and private industry are actively encouraging and incentivizing the deployment of EVs. As of September 2022, there were an estimated 44,000 public charging stations in the US classified as level 2 and DC fast charging (*US Department of Energy*). Growth of the EV sector, however, is dependent of the development of a reliable network of conveniently located EV charging infrastructure at private homes, public facilities, and commercial settings such as shopping centers, office buildings and other sites where vehicle owners are likely to remain for one or more hours. At the local government level, ideal sites include town halls, police and fire stations, schools, public works garages and other publicly-owned facilities.

The point at which the adoption of EV technology becomes widespread remains uncertain, however communities can take proactive steps to encourage local infrastructure development to ensure that they are *EV ready*. To become EV ready, Hudson should consider creating a plan to deploy strategically placed EV charging stations throughout the community at both public and private commercial sites. The plan should consider key regulatory areas such as zoning, site plan regulations, parking requirements and the creation of opportunities for both the public and private-sector charging station development.

NHDOT has published a Plan for Electric Vehicle Infrastructure Deployment centered on the creation of alternative fuel corridors. The plan is currently in the Request for Proposal stage, and is scheduled for contract selection in April 2024. This plan is to invest $17 million in funding over five years for the identification and construction of charging stations every 50 miles and within 1 mile of the corridor. Two of the identified corridors are Rte.3 and I-93, both quite close to Hudson. While this may provide stations nearby to Hudson, the development and encouragement of stations and private chargers within Hudson's borders is still worth developing ordinance and planning for.

Recommendations

The Town should budget for traffic improvements in its Capital Improvement Program and undertake a systematic transportation system improvement program. The Town should include in its CIP improvement projects for the NH 102/NH 111/Chase Road intersection, the NH 111/Kimball Hill Road/Greeley Road intersection and the NH 3A/County Road (south) and County Road/Belknap Road intersections. Hudson should also work closely with NH DOT and NRPC to secure federal funding for eligible road projects. In addition, the Town should refer to the Townwide Traffic Study completed in 2023 to assess the impact of changing patterns of future traffic conditions, especially along the corridors of NH 3A, Dracut Road, and NH 111. Additional overall reccomendations include the following:

- The Town should reconsider its pavement width requirements for local streets and sidewalks based on function and needs.
- The Town should employ access management techniques for the purpose of preserving roadway capacity and ensuring safe movement for vehicles entering and exiting curb cuts and side roads. These techniques should be applied to major corridors in the Town including NH 3A, NH 102, NH 111 and Dracut Road. Access management techniques that should be pursued include implementing minimum driveway separation distances based on roadway speed, entering into a Memorandum of Understanding with the NH DOT for review of access points and other techniques as recommended in the NRPC *Access Management Guidelines*, 2002.
- The Town should utilize traffic calming measures where appropriate based on traffic flow and right of way constraints to direct and control traffic through neighborhoods.
- The Planning Board should maintain close contact with the NH DOT to ensure ample opportunity for public and Town input regarding any planned changes to state roads within Hudson or routes feeding traffic into Town.
- The Town should consider utilizing the State's scenic designation statute to preserve the rural integrity of specific roads, with input from the Town's Highway Safety Committee and the public.
- The Town should work with NRPC and NH DOT to continue to study regional traffic patterns.

Road and Sidewalk Layout

As noted earlier in this chapter, local residential streets should be designed with consideration to the needs of children, pedestrians, and bicyclists. A residential street with pavement width of 20 feet is sufficient to allow for emergency vehicle access with *no* on-street parking. A pavement width of 24 to 26 feet is sufficient for a residential street to allow for emergency vehicle access *with* on-street parking. Hudson's subdivision and site plan regulations should be designed to accomplish the following.

- Provide a well connected, interesting pedestrian network. Convenient and safe pedestrian access to schools, shopping, recreation, employment and other destinations should be provided. This may include the development of an interconnected pedestrian pathway system. The Town should reconsider its 4 foot width requirement for sidewalks. The Americans with Disabilities Act (ADA) guidelines call for a minimum sidewalk pavement width of at least five feet. Sidewalks on high volume roads should be required to be at least eight feet wide with a three foot landscaped buffer between the curb and paved surface. This buffer provides a margin of safety between the pedestrian flow and high speed and high volume traffic.
- Provide convenient access for people who live on the street, but discourage through traffic; allow traffic movement, but do not facilitate it. Traffic control measures should be considered to eliminate extensive through traffic on local streets. The Town should consider traffic calming measures on streets that serve as cut throughs in neighborhoods. The traffic calming measures should be implemented with input from the Town Highway Safety Committee and the public.
- Differentiate streets by function. Streets should be clearly distinguished within the network in terms of the functional differences between local residential streets and major collectors or arterials in the overall street design.
- Relate street design to the natural and historical setting. Street design should relate to and express the terrain, natural character, and historic traditions of the locale. Irregularities of a site such as large rocks or trees and slopes should be incorporated rather than removed. Street details including curb design, sidewalk paving or signs must relate to the regional vernacular rather than being anonymous from a handbook.
- Reduce impervious surfaces by minimizing the amount of land devoted to streets. There are several factors that should shape a plan including a design concept, on-street parking needs, traffic volumes and land constraints (steep slopes, wetlands, etc.). Narrower residential streets reduce the amount of impervious surfaces and allow for better groundwater recharge.

Access Management

NH 3A and NH 102 represent the main north-south roadways in Hudson. NH 111 serves as the main corridor for east-west travel. In order to preserve the existing road capacity and to enhance safety for vehicles entering and exiting driveways, access management techniques should be applied to Hudson's major corridors including NH 3A, NH 102, NH 111 and Dracut Road. The Town should coordinate access management policies with NH DOT's access management initiatives. The following general access management techniques can be implemented through the subdivision, site plan and/or driveway regulations, and/or the zoning ordinance:

- Reduce the number of curb cuts along arterials and encourage the use of common driveways.
- Encourage the development of service roads parallel to arterials that allow for access to adjacent commercial developments.
- Require developers to fund road improvements such as turn lanes, medians, consolidation or alignment of access points and/or pedestrian facilities that reduce the impedance of through traffic.
- The minimum distance allowed between curb cuts along roads and arterials should be at least the minimum distances recommended in Table V-14 on Page 24 above. With the exception of a 100-foot minimum separation between driveways and intersections, there are no minimum driveway separation requirements in Hudosn's subdivision or site plan regulations.

Safety

The Town should consider further detailed studies for the highest crash rate intersections to develop improvements and strategies to reduce accidents. The Town of Hudson Highway Safety Committee should consider requesting that the NH DOT perform safety studies for the highest crash rate intersections. The studies should include collision diagrams and an analysis of the physical road features and traffic control, road conditions at the time of the crashes (latest three years), the severity of the crashes, and a summary tabulation of crashes. Any further detailed crash studies should include input from the public and include the following six steps:

1. Identify the locations that are candidates for improvements.
2. Quantify the main crash trend(s) at a particular location.
3. Determine the source of the problem(s).
4. Evaluate types of improvements to address the crash problem(s).
5. Obtain an expert opinion about safety improvement(s).
6. Obtain funding to implement a safety improvement.

Alternative Transporation Modes

The Town should work with the NRPC, NHDOT and neighboring communities to encourage alternative modes to single occupancy auto use to help decrease traffic congestion and provide greater choices for Hudson commuters. Specific recommendations are provided below.

- Work with the NRPC and the Nashua Transit System to explore extending a bus route from downtown Nashua to south Hudson to serve the Sagamore Business Park and other destinations along Lowell Road and to connect to the terminus of an existing Lowell Regional Transit Bus that stops at Ayotte's Market on the Hudson/Massachusetts border.
- Hudson should support efforts to extend the commuter rail line from Boston and Lowell to New Hampshire. The commuter rail sites identified by the NH DOT on Daniel Webster Highway in South Nashua and on Crown Street in Nashua are both a short driving distance for most Hudson commuters. This would likely increase housing demand within walkable distances of these areas where transit-oriented development patterns may be appropriate (e.g. vicinity of Library Common). This would also require improvements to the regional infrastructure that would support the potential rail stations.
- The Town should explore the option of working directly with large employers in the Town to coordinate the alternative modes initiative. Large employers have a significant impact on traffic in the Town and reduction in work trips to those locations will result in the greatest possible reduction in traffic.

Electric Vehicles

Hudson should develop an Electric Vehicle (EV) Charging Station implementation plan with a focus on key public facilities including the Municipal facilities, schools and certain commercial sites. Consider amending the Site Plan Review Regulations to require EV charging stations at large commercial sites and multi-family developments.

New Hampshire is poised to experience a rapid increase in Electric Vehicles (EV) over the next 10-15 years. Tourism is the 2nd largest industry in the state, bringing EVs from other states to our downtowns, state parks and other popular destinations. EV adoption is much higher in neighboring states (especially Massachusetts), and they are driving into New Hampshire. Where will they charge? Charging infrastructure, and its fee structures, can influence the places they visit. As EV owners plan their trips

(whether it is daily or a vacation), they will look for charging infrastructure to determine where to get groceries, shop, eat dinner, or vacation.
On May 30, 2018, New Hampshire Senate Bill 517 (SB 517) was passed establishing the Electric Vehicle Charging Stations Infrastructure Commission to make recommendations on various policies, programs and initiatives related to the use and support of zero emission vehicles in New Hampshire.

When planning for EV locations plans should consider:

- Currently available electrical service. EV charging stations may require additional circuits and electrical capacity at municipal sites. All new charging station installations should have a load analysis performed on the facility's electrical demand to determine if there is capacity to add EV charging stations. AC Level 2 stations will need a dedicated 240-volt (40 amp) circuit and upgrading electrical service may be necessary.

- Distance between the electrical panel and the charging station. A longer distance between the electrical panel and the EV charging station means higher installation costs because it increases the amount of necessary trenching (and repair), conduit, and wire. It is desirable to minimize the distance between the electrical panel and EV charging station as much as possible while also considering the location of the charging station on the property.

- Location of charging station on the property. Do you want the EV charging stations close to the entrance of building(s) to incentivize EV drivers, or out of the way to maximize the number that can be installed? Consider the impact of placing the charging station at a particular location on the property. Placing charging station spaces away from a building might discourage their use, but other customers may be upset if a charging station is installed in prime parking spaces that often remain vacant because there currently are fewer EV drivers.

- Consider the location of existing infrastructure. Construction costs are largest added expense for EV charging stations, and the cost differential depends on the work required. Existing elements such as landscaping, walkways, curb cuts and other structural elements should be considered in site plan for EV charging stations. These elements add costs for removal or relocation, in addition to acting as barriers to accessible charging. Trenching, curb cuts and drilling through hardscaping or structural elements to add new conduits to connect EV charging stations to power sources can also be cost prohibitive. When possible, consider trenching through landscaping, although the EV charging stations should always be mounted on a concrete or other solid surface pad and protected from traffic.

- Availability of networks and communications. Most public EV charging stations will contain an advanced metering system and link to a network that tracks usage, bills customers, and manages electrical loads. Some EV charging stations will connect to telecommunications networks using wi-fi, Ethernet or cellular connections. This type of communication is especially important for managing user messaging and other advancements in technology that regulate information about available charging stations and when a driver's charge is complete. Complications for network connections arise in garages, where repeaters may need to be installed to guarantee network signals. Potential installation sites should be assessed for their network connection ability.

- Accessibility standards still apply. The US Access Board has basic guidelines for how to make EV charging stations parking spaces accessible. Spacing requirements are detailed within their guide and other design guidelines.

- Consider general parking lot management practices. As with any parking area, please consider best practices when installing the EV charging stations such as installing and maintaining adequate lighting (especially where and when stations are available for use 24 hours a day), providing clear signage, and keeping the area maintained (i.e., cutting away vegetation and keeping snow cleared)."

Bicycle/Pedestrian Infrastructure Recommendations

The following recommendations and priorities are meant to encourage pedestrian and bicycle travel in Hudson. They should be considered whenever maintenance, rehabilitation or new construction occurs within the right of way of any street in Hudson. This will allow multimodal accommodations to be implemented on a gradual basis over time as part of the road maintenance and/or town capital improvement program. This will also minimize the cost of bicycle and pedestrian infrastructure improvements.

Regulatory

It is recommended that bicycle and pedestrian improvements be achieved through Site Plan Review and Subdivision Regulations. The Planning Board should therefore incorporate the design guidelines suggested in this document into those ordinances. In addition to the proposed design guidelines, regulations could call for internal sidewalks at commercial properties, the interconnectivity of adjacent commercial and/or multifamily properties (both for vehicles and pedestrians), and the dedication of sidewalk rights of way along key corridor and local roads where insufficient space exists within the current public right of way.

Planning Studies

The Town should consider detailed corridor studies to determine the specific design treatments, costs, and engineering that will be necessary to improve conditions for bicycle and pedestrian travel. The following key corridors are candidates for in-depth corridor studies:

- Central Street from Taylor Falls Bridge to Kimble Hill Road
- Lowell Rd/NH3A from Central Street to Dracut Road
- Derry Road from Taylor Falls Bridge to Old Derry Road
- Ferry Street from Taylor Falls Bridge to Central Street

Physical Improvements

The Town should adopt a consistent roadway cross section along all key corridors like those described in the design guidelines section of this document. This cross section should be considered whenever maintenance, rehabilitation or new construction occurs within the corridor right of way. This will allow multimodal accommodations to be implemented on a gradual basis over time as part of the road maintenance and/or town capital improvement program. As explained earlier in this document, painted bike lanes are not recommended. Instead, the following recommendations incorporate design guidelines that encourage roadway treatments that provide clearly defined spaces for all modes which will provide more incentive for non-motorized users.

Sidewalks and Side Paths

Sidewalks or side paths should be required on both sides of the road in the downtown area and along all key corridors a (see priorities below); sidewalks should be to ADA standards and should be a minimum of 5 feet wide with minimum 6" granite curbing. Where right of way allows, minimum 8-foot wide, bidirectional side paths should be considered.

Travel Lanes and Enhanced Shoulders

- Use pavement markings to define 10-foot-wide travel lanes wherever possible.
- Use the additional shoulder width to accommodate bicycles.
- Enhanced shoulders should be used on local roads where traffic volume approaches 5,000 AADT and prevailing speed is greater than approximately 30 MPH.
- Use FHWA-approved color to define shoulders.

Crosswalks

- Best practices should be used when considering installation or upgrades to crosswalks.
- Existing crosswalks should be maintained or upgraded as noted in the following priorities section.
- New crosswalks should be installed as noted in the following priorities, and through additional public outreach.

Traffic Calming (alternative road surfaces, raised crosswalks, edge friction, sidewalk bump outs, etc.)

- Traffic calming treatments should be considered where motor vehicle operating speeds exceed posted speed by @ least 5 MPH
- Speed studies along key corridors should be undertaken to identify where traffic calming is needed.

Hudson Boulevard Multi-Purpose Path

The Town should prioritize the development of a 10-foot-wide (minimum), bidirectional, non-motorized, multi-use path along the right-of-way that is reserved for the future construction of the Hudson Boulevard. The path should be designed to accommodate the future construction of the Boulevard. This path would provide access from neighborhoods along the corridor to nearby recreational and employment opportunities. Recreational attractions include nearby Benson Park, Musquash Recreational Area, and the Hudson Town Forest. Employment attractions include the large industrial park near the Sagamore Bridge and the future Target flow distribution center at the former Green Meadow Golf Club. If NH DOT disposes of the Right-of-Way, the land should still be planned for this path as part of future development and/or conservation efforts.

Multi-Purpose Path along Albuquerque Ave. in Litchfield

Litchfield's Albuquerque Avenue multi-use path is a good example of a successful development process. In 2007, Litchfield secured funding to construct an eight-foot wide pedestrian path/bikeway along this two-mile corridor. The path runs parallel to Albuquerque Ave on the westerly side of the road between Route 3A and Hillcrest Road and where it then shifts to the easterly side. Construction of the path leveraged approximately $470,000 in federal grant funds together with $18,500 of local money for design and construction.

Since its completion in 2010, the Albuquerque multi-use path has become a valuable community asset. Throughout the day, the path serves a wide range of users including early morning joggers, evening strollers, people walking dogs, people biking and students walking to Campbell High School. In addition to the High School, the path connects two Town parks and a golf course as well as the Town Hall/Police Station and Fire Department complex.

Kimball Hill Road

Benson Park is an important community asset and connections along Kimball Hill Road are an important component of a complete non-motorized network in Hudson.

- Sidewalks and side paths:
  - Wherever right of way allows, incorporate a minimum 8-foot wide, bidirectional side path with a 5-foot buffer along one edge of the road from Central Street, past the Benson Park entrance, ending at Bush Hill Road.
- Enhanced Shoulders:
  - Minimum 4-foot wide terra cotta-colored shoulders on both sides of Bush Hill Road to the vicinity of the Hudson Town Forest.
  - Rumble strips should be included between travel lanes and painted shoulder, where appropriate, and where the sound will not disturb residential areas.

Connections to Musquash Conservation Area and Hudson Town Forest

In future road construction projects and where right-of-way exists, the Town should prioritize access to the Musquash Conservation Area and the Hudson Town Forest in the following manner:

- Enhanced Shoulders:
  - Minimum 4-foot wide terra cotta-colored shoulders on both sides of Musquash Road and Kimball Hill Road. Rumble strips should be included between travel lanes and painted shoulder, where appropriate, and where the sound will not disturb residential areas.

Improvements to Key Corridors

Central Street Corridor: Taylor Falls Bridge to Kimball Hill Road

- Sidewalks and side paths:
  - *Taylor Falls Bridge to Lowell Road intersection* – maintain the existing sidewalks on both sides of the road and upgrade to a minimum of 5 feet wide and 6" granite curbing in future road upgrades.
  - *Lowell Road to Burnham Road* - maintain the existing sidewalks on both sides of the road and upgrade to a minimum of 5 feet wide and 6" granite curbing in future road upgrades.
  - *Burnham Road to Kimball Hill Road* – incorporate minimum 8-foot wide, bidirectional side path along southeast edge of Road.
- Enhanced Shoulders:
  - Minimum 4-foot wide terra cotta-colored shoulders on both sides of Central Street for entire length of corridor between Taylor Falls Bridge and Burnham Road intersection. Rumble strips should be included between travel lanes and painted shoulder, where appropriate, and where the sound will not disturb residential areas.
- Signalized intersections
  - Library Street – upgrade to include signalized pedestrian phase for all legs. Incorporate best design practices for accommodating bicycle passage through intersection
  - Lowell Rd – upgrade to include pedestrian phase for all legs. Incorporate best design practices for accommodating bicycle passage through intersection.

- Burnham Road/Central Street - upgrade to include pedestrian phase for all legs. Incorporate best design practices for accommodating bicycle passage through intersection.

- Memorial Drive (Hudson Memorial School entrance)
    - Crosswalks at this intersection should be upgraded to communicate to motor vehicle operators that extreme caution is needed when children are present. Raised crosswalks, alternative materials, colored pavement or other best practice should be used.
- Crosswalks on Central Street
    - Use best practices to ensure that all crosswalks in the corridor provide incentive for pedestrian travel.
    - Upgrade crosswalks on all side street approaches to the corridor.
    - Install crosswalks on Central Street to provide pedestrian access across the corridor at key locations. Locations to be determined during future public outreach.
- Travel Lanes
    - Use pavement markings to define 10-foot-wide travel lanes wherever possible.
    - Use the additional shoulder width to accommodate bicycles.

Ferry Street (NH111) Corridor: Derry Street to Central Street (including Burnham Road)

- Sidewalks and side paths:
    - *Derry Street to Gloria Avenue* – maintain the existing sidewalks on both sides of the road and upgrade to a minimum of 5 feet wide and 6” granite curbing in future road upgrades.
    - *Gloria Avenue to George Street* – incorporate sidewalks on both sides of the road and at a minimum of 5 feet wide and 6” granite curbing in future road upgrades.
    - *George Street to Central Street* – incorporate a minimum 8-foot wide, bidirectional side path along one edge of the road.
    - It is also recommended that wherever right of way allows a side path should be considered as an alternative to sidewalks.
- Enhanced Shoulders:
    - Minimum 4-foot wide terra cotta-colored shoulders on both sides of Ferry Street for entire length of corridor between Derry Street and George Street intersection.
    - In the short term, extend enhanced shoulders all the way to Central Street intersection. Remove when side path is incorporated into the pavement cross section.
    - Rumble strips should be included between travel lanes and painted shoulder, where appropriate, and where the sound will not disturb residential areas.
- Signalized intersections
    - @ Library Street – upgrade to include signalized pedestrian phase for all legs. Incorporate best design practices for accommodating bicycle passage through intersection.
    - @ Central Street/Burnham Road– upgrade to include pedestrian phase for all legs. Incorporate best design practices for accommodating bicycle passage through intersection.

- Crosswalks on Ferry Street
    - Use best practices to ensure that all crosswalks in the corridor provide incentive for pedestrian travel.
    - Upgrade crosswalks on all side street approaches to the corridor.
    - Install crosswalks on Ferry Street to provide pedestrian access across the corridor at key locations; locations to be determined during future public outreach.
- Travel Lanes
    - Ten-foot travel lanes along entire corridor

Lowell Road (NH3A) Corridor

- Access Management:
    - Numerous driveways and the associated curb cuts pose challenges to improving biking conditions along this corridor. Some improvement could be achieved if access management practices were implemented to consolidate driveways and cut down on the curb cuts. It is recommended that a corridor study be undertaken to determine how access management principles could be implemented.
- Sidewalks and side paths:
    - Wherever right of way allows, incorporate a minimum 8-foot wide, bidirectional side path along one edge of the road.
    - *Central Street to Birch Street* – maintain the existing sidewalks and upgrade to a minimum of 5 feet wide and 6" granite curbing in future road upgrades and include sidewalks on both sides of road where there are currently sidewalks on only one side.
    - *Birch Street to Pelham Road, and Nottingham Square to Executive Drive* – follow through on plans (NRPC 2019-2045 Metropolitan Transportation Plan) to incorporate sidewalks along these segments.
- Signalized intersections:

  Pelham Road, Fox Hollow Drive, Executive Drive, Executive Drive, Hampshire Drive, Wason Road intersections – maintain the existing signals including pedestrian phases.
- Crosswalks on Lowell Road:
    - Use best practices to ensure that all crosswalks in the corridor provide incentive for pedestrian travel.
    - Upgrade crosswalks on all side street approaches to the corridor.
    - Install crosswalks on Lowell Road to provide pedestrian access across the corridor at key locations. Locations to be determined during future public outreach.
- Travel Lanes
    - Ten-foot travel lanes along entire corridor

Derry Road Corridor

- Sidewalks and side paths:
  - Wherever right of way allows, incorporate a minimum 8-foot wide, bidirectional side path along one edge of the road. The segment between Elm Avenue and Old Derry Road could most likely accommodate this type of roadway cross section.
  - *Ferry Street to Elm Avenue* – maintain the existing sidewalks and upgrade to a minimum of 5 feet wide and 6” granite curbing in future road upgrades and include sidewalks on both sides of road where there are currently sidewalks on only one side. Fill in sidewalk gap between Hudson Mall shopping Center and Phillips Drive (north entrance).
  - *Elm Avenue to Old Derry Road* – complete sidewalk system between Marsh Road to Towhee Drive which will complete the sidewalk connection between the schools, library, and downtown Hudson.
- Signalized intersections:
  - *Highland Road intersection* – maintain the existing signals including pedestrian phases.
  - *Hudson Mall Entrance* – incorporate pedestrian phase.
  - *Elm Avenue* – incorporate pedestrian phase.
- Crosswalks:
  - Use best practices to ensure that all crosswalks in the corridor provide incentive for pedestrian travel.
  - Upgrade crosswalks on all side street approaches to the corridor.

APPENDIX V-2

Classification Schemes

State Aid Classification[15]

Class I, Primary State Highway System, consists of all existing or proposed highways on the primary state highway system, excepting all portions of such highways within the compact sections of towns and cities, provided that the portions of turnpikes and interstate highways within the compact sections of those cities are Class I highways.

Class II, Secondary State-Highway System, consists of all existing or proposed highways on the secondary state highway system, excepting portions of such highways within the compact sections of towns and cities. All sections improved to the satisfaction of the Commissioner are maintained and reconstructed by the State. All unimproved sections, where no state and local funds have been expended, must be maintained by the town or city in which they are located until improved to the satisfaction of the highway commissioner. All bridges improved to state standards with state aid bridge funds are maintained by the State. All other bridges shall be maintained by the city or town until such improvement is made.

Class III, Recreational Roads, consist of all such roads leading to, and within state reservations designated by the Legislature. The NH DOT assumes full control of reconstruction and maintenance of such roads.

Class IV, Local Roads, consist of all local roads within the urban compact sections of cities and towns listed in RSA 229:5, V. The urban compact section of any such city or town shall be the territory within such city or town where the frontage on any road, in the opinion of the Highway Commissioner, is mainly occupied by dwellings or buildings in which people live or business is conducted, throughout the year. No highway reclassification from Class I or II to Class IV shall take effect until all rehabilitation needed to return the road surface to reputable condition has been completed by the State.

Class V, Rural Local Roads, consist of all other traveled roads which the town or city has the duty to maintain regularly.

Class VI, Local Roads, Not Maintained, consist of all other existing public ways, including roads subject to gates and bars, and roads not maintained in suitable condition for travel for five years or more.

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[15] NH Department of Transportation, 2004.

APPENDIX V-2 (Continued)

Classification Schemes

Functional Classification[11]

Principal Arterial, provides corridor movement suitable for substantial statewide or interstate travel and provides continuity for all rural arterials which intercept the urban area. Serves the major traffic movements within urbanized areas such as between central business districts and outlying residential areas, between major inter-city communities or between major suburban centers. Serves a major portion of the trips entering and leaving the urban area, as well as the majority of the through traffic desiring to bypass the central city.

Minor Arterial, serves trips of moderate length at a somewhat lower level of travel mobility than principal arterials. Provides access to geographic areas smaller than those served by the higher system. Provides intra-community continuity, but does not penetrate identifiable neighborhoods.

Collector, collects traffic from local roads and channels it into the arterial system. Provides land access and traffic circulation within residential neighborhoods and commercial and industrial areas.

Local, comprise all facilities not on higher systems. Provides access to land and higher systems. Through traffic usage is discouraged.

Town of Hudson Street Classification

Major Streets - Streets designed, or required, to carry large volumes of traffic to, from, or through the Town.

Collector Streets- Streets designed, or required, to collect traffic from minor streets and distributing traffic to major streets.

Commercial Streets - Streets designed, or required, to serve industrial or mercantile concentrations and carry traffic to major streets.

Residential Streets - Streets designed, or required, to provide vehicular access to abutting residential properties.

Service Streets - Streets designed, or required, to provide vehicular access to abutting commercial or industrial properties.

Access Streets - Streets or minor ways, designed, or required, to provide vehicular access to off-street loading or off-street parking facilities.

[11] NH Department of Transportation, 2004.

APPENDIX V-3

Federal Aid

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) significantly restructured the federal-aid transportation program. ISTEA was re-authorized and revised in 1998 (the Transportation Equity Act for the 21st Century, TEA-21). Descriptions of the various programs which emerged from these transportation bills are as follows:

National Highway System (NHS): This program funds projects on the designated national highway system on an 80% federal, 20% state/local basis. There are no highway routes in Hudson designated as part of the National Highway System

Surface Transportation Program (STP): This program targets the funding of projects by states and localities for any facility with a higher functional classification than rural minor collector. The flexibility of the STP also allows for funding of lower functional classification roadways at the discretion of states and localities. Funding is based upon an 80% federal and 20% state/local share. Projects selected by the Town using their allocated municipal funds or Enhancements require a 20% municipal match. There are four subcategories of STP funds as described below:

- STP < 200,000 - This category of STP exists to fund projects in small urban areas with a population under 200,000. There are statewide and municipal apportionments.
- STP Any Area - This category of STP funds may be used in urban or rural areas.
- STP Transportation Enhancements - This category funds projects submitted by municipalities and chosen through a statewide selection process. Eligible projects include: bicycle and pedestrian facilities, scenic improvements, and preservation of abandoned railroad corridors, historic preservation, rehabilitation of historic transportation facilities and mitigation of water pollution from highway runoff.
- STP Hazard Elimination - These funds are earmarked for minor projects designed to eliminate hazardous roadway or traffic conditions

Bridge Rehabilitation and Replacement: This category includes bridges which are on-system, i.e. those that are functionally classified as higher than local, and off-system, which are municipally owned. The 80% federal/20% local share applies to the bridge category.

Congestion Mitigation and Air Quality (CMAQ): CMAQ funds are eligible for transportation related projects in ozone and carbon monoxide non-attainment areas. Projects must contribute to meeting attainment of national ambient air quality standards, through reductions in vehicle miles traveled, fuel consumption, reduced delay or other factors. Construction of roadway capacity serving single occupancy vehicles is not eligible for CMAQ funding. Funding is 80% federal, 20% state/local.