Urban Design for MBTA Communities: Using Livability Analysis to Inform Design and Policy in Andover, MA

A Master's Thesis submitted by

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Abstract

This thesis is in response to the MBTA Communities legislation which requires Massachusetts municipalities served by the MBTA to adopt zoning districts that allow for multifamily housing by right. A portion of such a district needs to be within a half mile of a rapid transit or commuter rail station, for those that have a station. Andover, Massachusetts is a commuter rail community and is used as a case study to show how urban design qualities can enhance the livability of the station area. This thesis covers topics of livability and walkability, transit-oriented development, and urban design to accommodate greater residential density in a suburban community. It uses a livability analysis to substantiate design and policy recommendations.

Acknowledgments

I would like to thank my thesis advisor, Christine Cousineau, for being patient with me as I worked over an 18-month period (as a part-time student with a full-time job) to finish this thesis. Christine's encouragement for me to be creative and dive into my areas of interest made this work enjoyable. I am grateful to my wife for taking care of our children while I spent mornings and weekends working and getting to the finish line. I also want to thank my reader, Scott Horsely, for his insight and perspective on the work that I present in this thesis.

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List of Acronyms

EOHLC – Executive Office of Housing and Livable Communities

MBTA – Massachusetts Bay Transportation Authority

MassDOT – Massachusetts Department of Transportation

MVPC – Merrimack Valley Planning Commission

TOD- Transit Oriented Development

CHAPTER I

Introduction

Creating places with urban design qualities such as sense of enclosure and coherence can transform a car-oriented environment into a place that prioritizes the experience of people walking or spending time in pedestrian-oriented spaces. Livability can be achieved by designing an urban environment that allows people to have safe and comfortable access to multiple modes of transportation to arrive at destinations within their neighborhood or region. Incorporating urban design elements that enhance the experience of people using transit or other forms of sustainable transportation can make a place more livable. As communities allow greater housing densities, it is important to focus on the urban design qualities of the environment in which housing will be built. If the design of the built environment prioritizes people spending time in public spaces and walking biking and taking transit, the neighborhood will be more livable. If livable neighborhoods are connected by transit, a livable region can emerge, and car-dependency can be reduced.

In January 2021, Massachusetts enacted legislation encouraging greater housing production by communities that are served by the MBTA transit system. Entitled “Multi-family zoning as-of-right in MBTA communities”, the new Section 3A of Mass General Laws Chapter 30A the Zoning Act requires every MBTA community to have at least one zoning district in which multi-family housing is allowed as of right, and which is located near a transit station. If a community has an MBTA transit service station, such as a commuter rail or rapid transit station, or is adjacent to a city or town that has such service, the community must adopt a multifamily

zone of 15 residential units per gross acre within a half mile of the station. The law, otherwise known as the MBTA Communities legislation, is part of an economic development bill that passed the legislature and was signed into law by Governor Baker in 2021. The legislation presents an opportunity for municipalities and the MBTA to explore ways of improving the land use around transit hubs.

For my thesis, I conducted a livability analysis of the Andover Commuter Rail Station. I sought to explore how local, regional, and state governments can leverage the implementation of the MTA Communities law to improve the livability of station areas.

Reviewing the existing town policies related to the Andover Station area provided a vision for the future the community sees for the station area. I focused on their community engagement process and attended public meetings to see how the community participated in the planning for the MBTA Communities legislation. Through my literature review, a study of the station area, and an analysis of existing conditions, I crafted design recommendations that would enhance the area within walking distance of downtown Andover Station.

My literature review focuses on the concepts of Livability and Walkability, Transit Oriented Development (TOD), its Land Use and Design aspects, and the Urban Design Qualities necessary to enhance livability. I analyzed Andover's comprehensive plan, zoning, and design guidelines and interpreted how the community could build a livable station area. A study of the built environment around the station platforms and along the streets adjacent to the station provided an understanding of the opportunities and challenges of the site.

By completing a livability analysis of the transit station area and crafting urban design recommendations for the Andover Station, my thesis offers perspectives on how Massachusetts

suburban communities can create transit stations that are community assets, support new multifamily housing, and increase livability for all residents. The recommendations seek to push suburban municipalities to consider focusing on the public realm and opportunities for creating places for people as well as fulfilling housing needs. At its core, my thesis seeks to provide urban design recommendations and policies that enhance public life around transit stations for suburban TOD.

Research Questions

Increasing the density around transit stations is one element in an effort toward creating more livable neighborhoods, but there is still more that should be done to create walkable, community centered, environmentally sensitive transit-oriented neighborhoods. My thesis objectives are to (1) analyze the existing land use and urban design elements around the transit station through GIS and viewshed analysis. (2) Use urban design research and interviews with urban design professionals to formulate design criteria for the Andover station area. To meet my objectives, I will seek to find the answers to these questions:

1. How can a livability analysis help inform urban design recommendations?
2. What policies can be implemented at the local, regional, and state level to improve the livability of the station area?
3. What design elements should be implemented by the municipality?
4. What urban design elements can improve the public spaces of the station area?
5. How can the pedestrian experience arriving and leaving the station be improved?

The answers to these questions will help me answer my overall research question: *What is needed for communities to design livable neighborhoods around station areas?*

Methods

This thesis uses a qualitative and quantitative approach to assess the livability of the Andover Station Area and future transportation nodes. The qualitative research methods include policy review, site visit observations, and literature review. The quantitative research method includes a livability assessment of the built environment. The livability assessment is adapted from Ewing and Clemente's (2013) *Measuring Urban Design: Metrics for Livable Places*.

My methodology consisted of five stages of research. First, I started with a literature review of articles related to the MBTA Communities legislation. Second, I conducted a literature review of three topics that were relevant to my study area and the MBTA Communities legislation: transit-oriented development, livability and walkability, and urban design qualities. The third stage of research methodology included a policy review of the Town of Andover's 2023 Comprehensive Plan, zoning codes, and Historic Mill District Design Guidelines. The policy review provided a sense of community perspective on growth and desires of residents. The fourth stage of my research methodology was the livability assessment of the built environment which used GIS and site visit observations and photographs. The fifth stage was hand-drawn sketches of design recommendations which were informed by the previous four stages of research.

Livability Assessment

The livability assessment uses EagleView Connect Explorer GIS application and MiMap, both services provided by the Merrimack Valley Planning Commission that use imagery captured in May of 2023. The GIS applications' measuring tools have been tested by MVPC staff and have proven to be accurate within three inches. I used the measuring tool to assess each built

environment feature on the streets within the study area. For elements such as sidewalk quality, assessments were also informed by site visit observations to ensure the conditions viewed from the aerial imagery were accurate.

Four streets and three intersections were analyzed for their urban design characteristics. Eight elements, listed below, were measured, assessed, and given a ranking.

Streets
Sidewalks
Landscaping
Bike Infrastructure
Buildings
People Orientation
Public Spaces
Housing

The results are displayed in Table 7. Livability Analysis by Street.

Chapter 2

Andover Community Profile

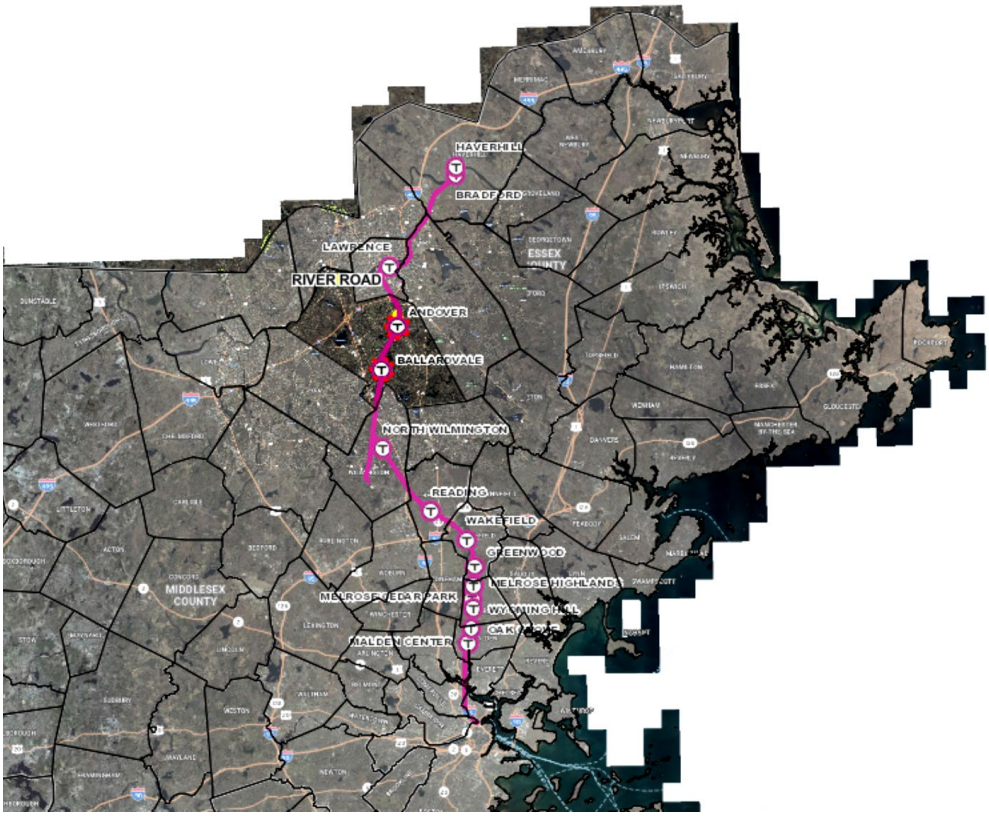


Figure 1. Map of Andover Commuter Rail Stations along the MBTA Haverhill Line in Northeastern Massachusetts. (Source: Town of Andover 2023)

Andover Massachusetts is a New England suburban community about 20 miles north of Boston (Figure 1). Founded in 1646, history is built into the community and has shaped the most imageable districts of the town. Two MBTA Commuter Rail stations on the Haverhill line serve the town: Andover Station, close to downtown, and Ballardvale Station, further south. Downtown Andover runs along Main Street (Route 28) and is home to many restaurants, retail establishments, and professional services, a great number of which run their businesses out of

historic buildings. Ballardvale and Shawsheen Village are both historic neighborhoods in Andover that feature a mix of housing types and some commercial and industrial uses. Outside of the historic neighborhoods, Andover is typical of suburban communities with a housing stock comprised of large, detached single-family homes and industrial parks with short, wide buildings and large surface parking lots.

The streets throughout Andover are built to accommodate drivers. In 2022, the town's Selectboard passed a Complete Streets Policy which states that whenever possible, the town should design and construct streets to accommodate all modes of transportation (Town of Andover 2022a). In 2024, the town plans to apply for its first complete streets project to build an active transportation network that connects the neighborhoods of Andover to community destinations.

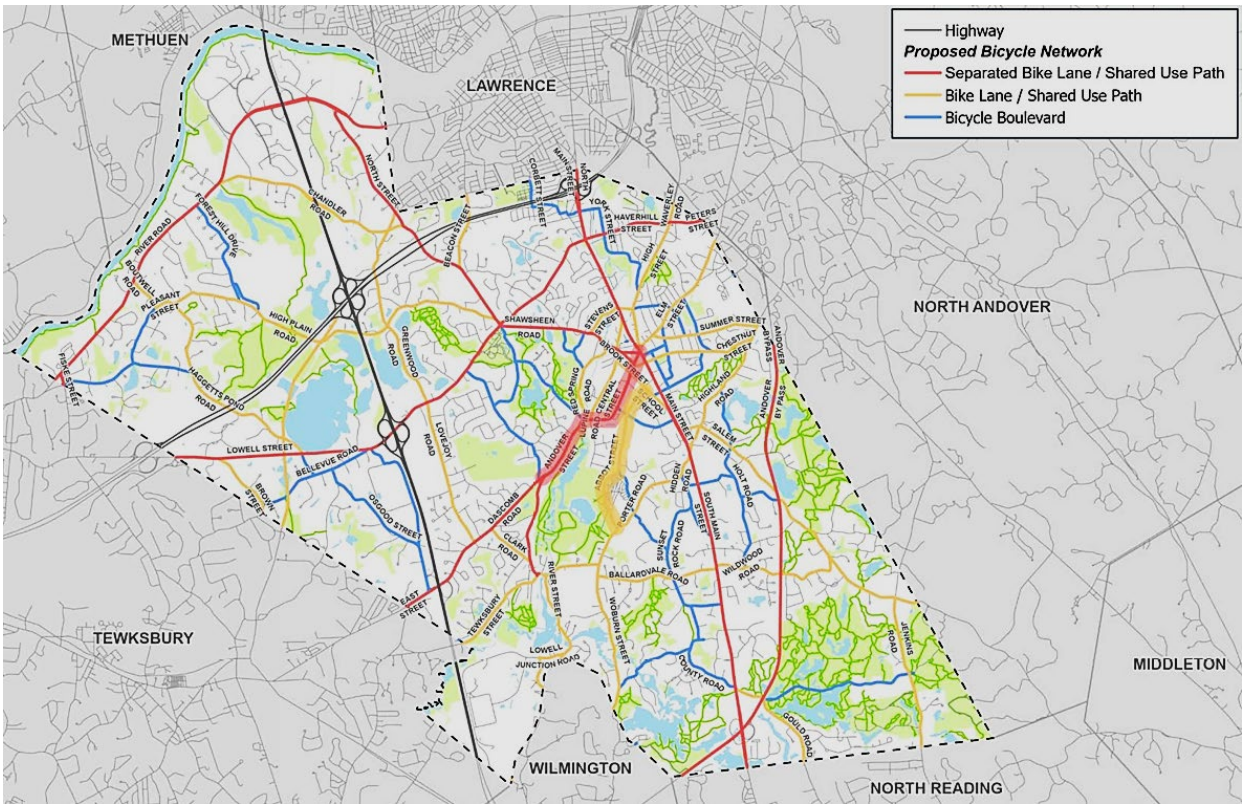


Figure 2: Andover Bicycle Network Map (Source: Andover Complete Streets Presentation 2024)

Andover's population has grown by 10.1% over the past ten years to 36,569 while the number of housing units has only increased by 6.9% (Town of Andover 2023, p. 17). Many people move to Andover because of its schools, geographical location, downtown, and open space and recreational opportunities. Because of the attractiveness of the schools, Andover is home to many young families with children of school age or younger and empty nesters whose children have graduated from the Andover school system and want to age in place (Town of Andover 2021. People aged 25-34 are underrepresented in Andover in large part due to housing affordability, but also likely because Andover does not have the urban amenities that attract young professionals without children (Town of Andover 2021).

Depending on which resident is providing their input, Andover can be described as having a vibrant downtown with many amenities or a place that feels sleepy and does not have amenities that serve them (Town of Andover 2021). Downtown has many retail establishments that cater to high-income earners but lacks retail that serves people in the middle and low-income markets. People often feel priced out of the downtown and feel as though there is a lack of diversity in town that is reflected in the retail establishments that fill the store fronts along Main Street (Town of Andover 2021). The bougie feeling exhibited by the downtown businesses reflects the cost of renting a storefront and the need to charge high prices to stay in business (Town of Andover 2021).

It is not only businesses that do not feel welcoming to all residents. A resident who took part in a focus group for the Comprehensive Plan "Feels there are no public spaces that represent and serve the diverse and changing ethnic background of Andover" (Town of Andover 2021, 1). Other focus group members stated that there is a lack of public space in general and that some of the existing public spaces could be more welcoming. Residents with school-aged children feel as

though there are no places for kids to hangout, especially if their kids do not play sports (Town of Andover 2021).

The focus groups also revealed that residents want a more walkable and bikeable community. Several people referred to the town as car-oriented and were concerned about pedestrian safety. When asked what their perfect day in Andover 10 years from now would be, focus group members stated that they wanted to walk to activities, gathering spaces, affordable places to shop, or a place to get coffee (Town of Andover 2021).

The Study Area

The study area centers on the Andover Station and consists of a roughly 1,000-foot radius around the station platform. This is almost a ¼ mile radius (1,320 feet, or a 5-minute walk) around the station, the widely used planning standard that defines a walkshed. The study area's boundaries are as follows.

- Western edge: Red Spring Road and the Shawsheen River,
- Eastern edge: North Main Street (Route 28) and Central Street
- Northern edge: the Whole Foods parking lot near the intersection of Railroad Street and North Main Street (Route 28)
- Southern edge: the intersection of School Street, Lupine Road, and Ridge Street.

The edges formed by Andover's Street network formed the study area into an oblong shape (Figure 3).

Figure 3. Map of Study Area with Reference Points. (Andover MiMap 2024).

Inspired by Kevin Lynch's *The Image of the City* (1960), I drew a mental map of the study area and uncovered five districts, five landmarks, four nodes, three edges, and eight paths along the existing street network (Figure 4).

Districts

1. Downtown Main Street
2. Historic Mill District east of the rail line
3. Historic Mill District west of the rail line
4. Downtown residential
5. Dundee Park

Landmarks

1. Old Town Hall
2. Memorial Hall Library
3. First Baptist Church
4. St. Augustine's Church
5. Old Train Depot

Nodes

1. Elm Square
2. Whole Foods and Adjacent Businesses
3. Andover Commuter Rail Station
4. Dundee Park Businesses

Edges

1. Shawsheen River
2. MBTA Right of Way
3. North Main Street

Paths

1. Main Street
2. Essex Street
3. Shawsheen Road
4. Railroad Street
5. Brook Street
6. School Street
7. Lupine Road
8. Pearson Street
9. Ridge Street
10. Dundee Park Entrance

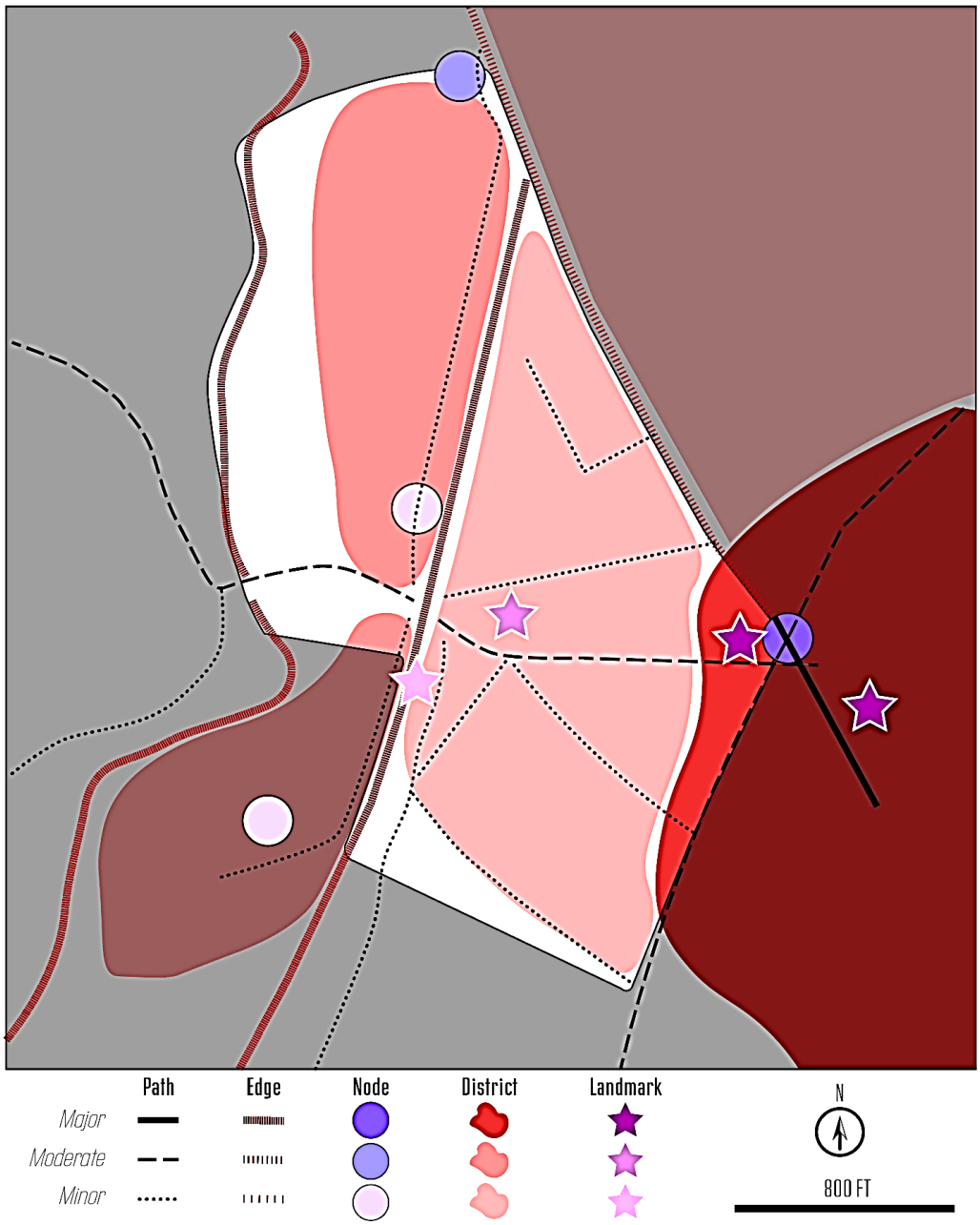


Figure 4. Andover Station Area Mental Map of Paths, Edges, Nodes, Districts, and Landmarks. (Tony Collins)

Study Area Relation to Surroundings

The Andover Station area is directly adjacent to downtown Andover which runs along Main Street. The edge created by the high volumes of traffic along Main Street and the need to navigate the intersection of Elm, Main, and Central streets make the trip from the station area to Main Street uncomfortable. The relationship between the station area and downtown is significant due to the residential density and commercial activity of downtown. Downtown's shops and restaurants make it a regional destination for many in the Merrimack Valley, many of whom could arrive downtown via the commuter rail or MeVa Transit's fixed route bus service.

Beyond the downtown, Andover is home to many larger businesses that make it a commuter destination for many working in the large industrial parks in town. The number of jobs available in Andover is so great that the number of people who commute to Andover is approximately the same as the number of people who commute from Andover to another community, making the daytime population steady (Town of Andover 2023). The industrial parks are not within walking distance of the Andover or Ballardvale Train Station and are only served by limited fixed bus routes, making them car-dependent destinations.

Andover's two commuter rail stations, the Andover and Ballardvale stations, are on the Haverhill line which runs from Haverhill in the north to North Station in Boston in the south. The rail corridor connects small cities and suburban communities and provides commuter services to Boston. On weekdays, the Haverhill line runs 45-minute headways during peak hours, 1-hour-and-20-minute headways during off-peak hours, and 3-hour headways on the weekends. As seen in Table 1, despite infrequent service, in the Merrimack Valley region there are 6,472 daily trips using the Haverhill commuter rail line (MBTA 2024). Likely, a great percentage of

those trips are taken to or from North Station as the average daily boardings and departures at North Station make up 47% of all daily boardings and departures (MBTA 2024).

As seen in Figure 5, MeVa Transit serves a great number of trips between communities within the region, including trips between Andover and Lawrence. The number 32 fixed route bus carries an average of 300 people a day between Andover and Lawrence (MVPC 2023). Lawrence, Andover's neighbor to the north, is home to nearly 90,000 residents within 7.43 square miles for a density of 12,863 people per square mile (MVPC 2023). Interstates 93 and 495 run between Andover and Lawrence making trips by active modes of transportation and bus more difficult.

Table 1: MBTA Commuter Rail, Average Daily Boarding

Community	Average offs	Average ons	Total
Andover	725	778	1503
Ballardvale	430	352	782
Bradford	402	379	781
Haverhill	644	676	1320
Lawrence	1042	1044	2086
Grand Total	*3243*	*3229*	*6472*

Source: MBTA Data Portal: https://mbta-massdot.opendata.arcgis.com/search?tags=commuter%2520rail

Figure 5: Transit Trips Starting in the MVMPO Region (MV Vision 2050, MVPC)

Chapter 3

Policy Review

Reviewing the Andover's comprehensive plan, zoning codes, and Historic Mill District Design Guidelines provided direction for my recommendations and neighborhood level planning.

2023 Comprehensive Plan

Community Outreach

The town of Andover adopted a new *Comprehensive Plan* on August 8, 2023. As part of the plan, town staff, their consultant, and a working group of residents conducted a yearlong community outreach process. The results of the surveys, focus groups, and community meetings showed that many people chose Andover because of its geographic location. They mentioned its proximity to Boston, the coast, and the mountains in New Hampshire as reasons why they decided to settle in the town. However, aspects of living in Andover that did not work for residents were communication with town hall, public transportation, and affordable housing (Figure 6).

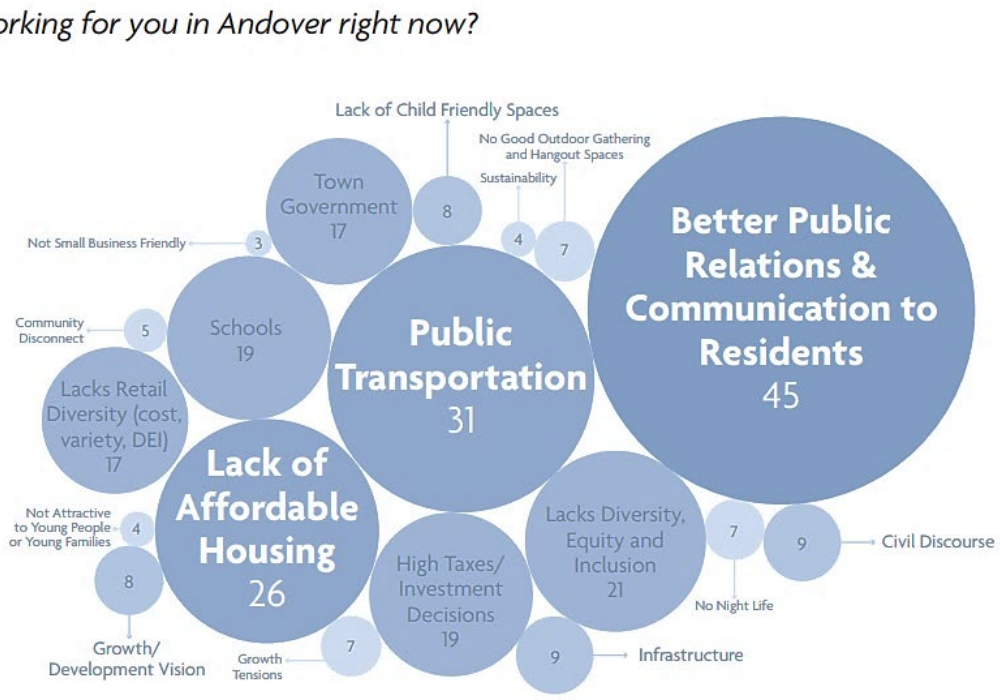


Figure 6. Andover Comprehensive Plan Focus Group Question "What is not working for you in Andover right now?". (Andover Comprehensive Plan 2023, p. 22)

What residents wanted to see more of were social and cultural activities, multimodal transportation, and retail and dining diversity (Figure 7). When asked what the town could do for them, residents answered with “public transportation and multimodal safety” and “placemaking in a vibrant downtown” (Town of Andover 2021). Many people answered that their perfect day in Andover 10 years from now would include walking to an activity, such as a social or cultural event or venue, or to diverse shops and more restaurants, especially affordable ones.

What is your perfect day in Andover ten years from now?

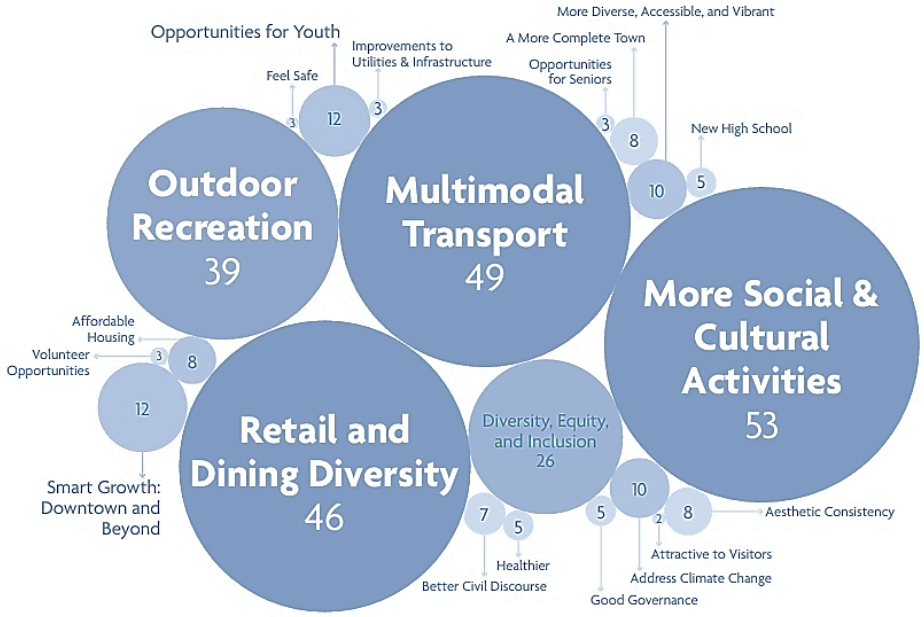


Figure 7. Andover Comprehensive Plan Focus Group Question "What is your perfect day in Andover ten years from now?". (Andover Comprehensive Plan 2023, p. 23).

Vision

The *Comprehensive Plan* broke the town into geographic areas and created visions specific to their context (Figure 8). The Andover train station area is included in the area labeled "Enhance along the Shawsheen (River)". In this section, the plan calls for preserving the existing historic character, and reducing minimum lot sizes, required setbacks, and frontage requirements. Pointing to the train station area, the plan states ""Missing middle" housing can help produce transit-oriented residential infill, which helps create more of a sense of place while still retaining Andover's primary small-town character downtown and near the station" (Town of Andover 2023, 40) In a section titled "New Housing Typology", the plan calls for housing typologies ranging from larger multifamily adaptive reuse and new construction in the Historic Mill Overlay District (HMOD) to smaller buildings of six to twelve units with the footprint of larger single-

family houses (Figure 9). Encouraging the creation of missing middle housing typologies has the benefit of "disaggregating parking" across the site, compared to larger multifamily developments, creating a gentler density, and creating a "village-like feel". The plan states that density yields of these housing typologies would be about 25 units per gross acre.

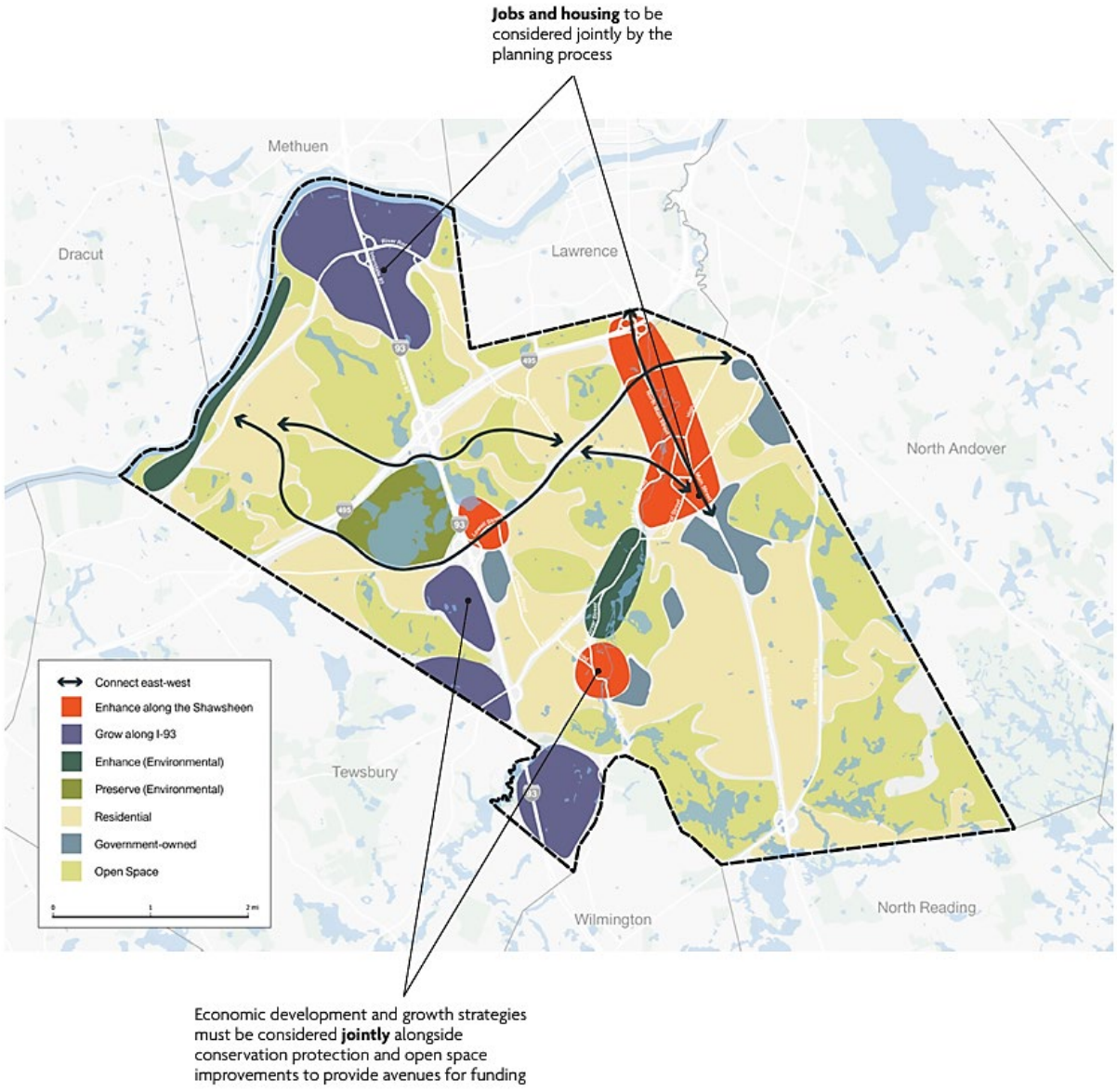


Figure 8. Andover Comprehensive Plan Priority Recommendations Graphic. (Andover Comprehensive Plan 2023, p. 32)

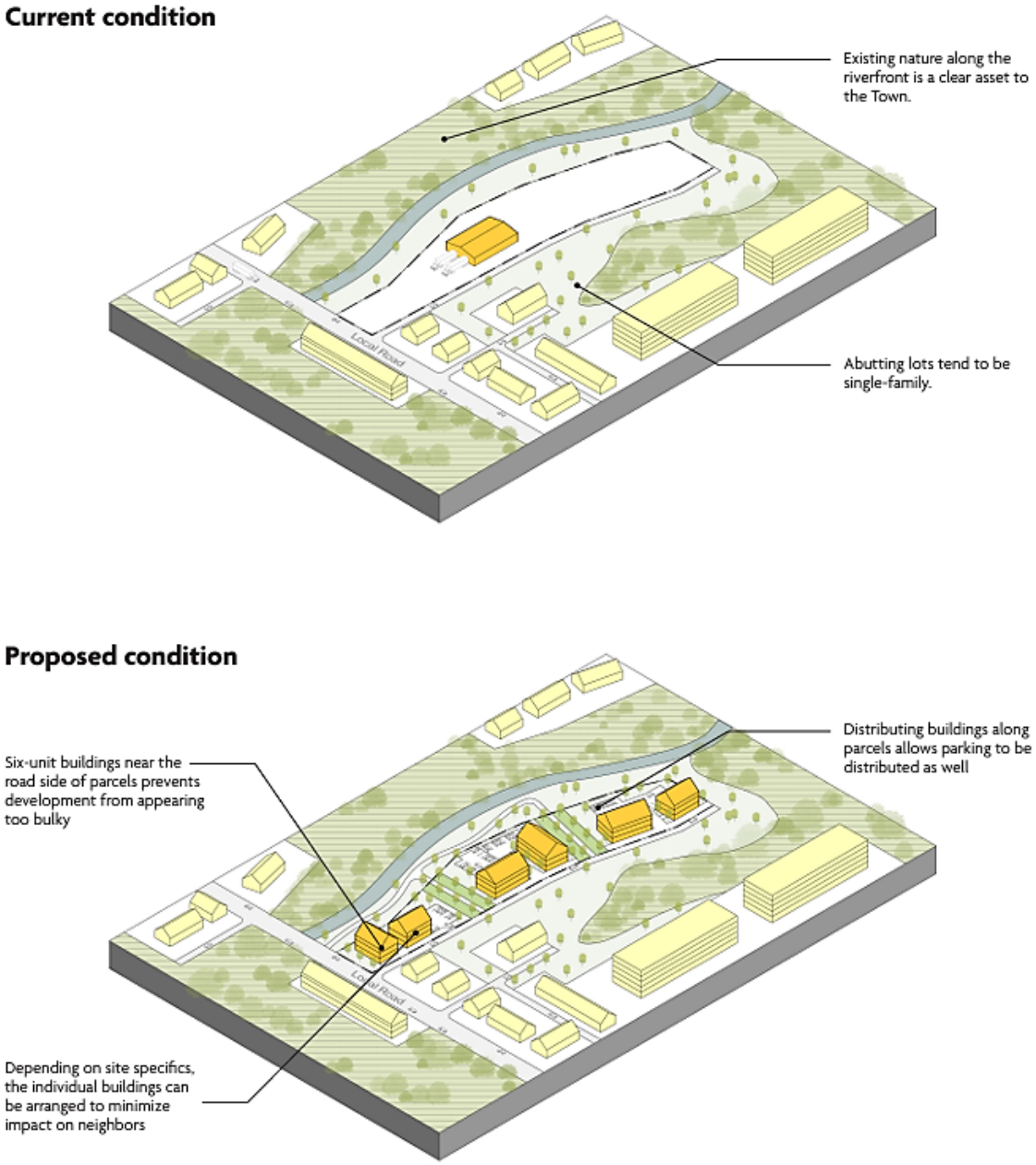


Figure 9. Andover Comprehensive Plan New Housing Typology Infill Graphic. (Andover Comprehensive Plan 2023, p. 40)

Goals

The plan's goals are grouped under five topic areas: Urban Form and Land Use, Housing, Natural Environment, Mobility and Transportation Network, and Economy and Jobs.

Urban Form and Land Use

Under the topic of Urban Form and Land Use, the town's first goal is to focus on targeted growth and enhancement. It states a need for policies that increase the Floor Area Ratio (FAR) and height requirements of development within mixed use zones, such as in the Historic Mill Overlay District (HMD). It calls for the development of design guidelines to "accommodate the design of different densities" and eliminate parking requirements. The next goal is to create neighborhoods within fifteen-minute walks of bike zones that are supported by a "walkable urban form and safe transportation infrastructure" (Town of Andover 2023, 75.

Policies to create robust business and industrial districts follow the walkability theme. Included are steps to "identify areas downtown that can be redeveloped into entertainment venues, spaces for attractive nightlife, and a range of affordable to boutique shops in close proximity to each other" (p. 53). To support this action, the approach is to create a consumer base to support greater retail options and improve the walkability of those neighborhoods. Within those neighborhoods, the plan calls for reuse of existing buildings by encouraging developers with grants and tax incentives.

The rest of the goals under the Urban Form and Land Use topic focus on enhancing the public realm, advancing construction and development, preserving agricultural and ecological heritage, balancing town character, and enhancing historic character. There is a strong sense of interplay between these goals wherein while the town seeks to increase density through infill development and reuse of existing building stock, it should look for opportunities to preserve and better use green and open spaces. For example, the step to create active spaces for all ages and abilities could come in the form of community gardens as stated under the agricultural goal. Some strategies were repeated throughout the various goals, such as reducing parking

requirements, increasing building heights, and creating a walkable built environment, which reinforces the overall vision of creating a vibrant, livable environment.

Housing

This section of the plan suggests that a key housing goal is to create "new housing while staying true to what makes Andover special for its residents" (p.61). The first housing goal is to diversify housing opportunities. Up front, the plan calls for specific zoning changes to improve the flexibility of the existing ADU and single-family to multi-family conversion bylaws, expand inclusionary zoning, and include affordability ranges up to 120% area median income (AMI). The next goal is to "encourage transit-oriented development". As part of that goal, the actions are to comply with the MBTA Communities law, improve sidewalks adjacent to transit access, and create multi-modal infrastructure. Goals to incorporate diversity, equity, and inclusion in housing and create housing for older adults and future generations state the need to change zoning bylaws so that new housing meets the needs of a greater diversity of people and lifestyles. The plan recognizes the monoculture of housing typologies that exists and the need to provide a greater menu of options for people of varying income levels, mobility, and stages of life.

Natural Environment

The natural environment is an asset that residents greatly appreciate about living in Andover. The trails networks and open space are used by residents and visitors. The plan recognizes the benefits that are provided by the various natural resources and amenities in town and calls for bringing those front and center as a part of development and growth. The plan puts forth the acquisition of land along the Shawsheen River for wildlife conservation and recreation. The goal to Showcase the River involves making the Shawsheen River a publicly-accessible

destination. Correlated with making the river a destination is a goal to create multi-modal access to open space.

Mobility and Transportation Network

The plan recognizes the need for better walking and biking connectivity within the town and to transit services. The first goal is to connect transit through multimodal connections along the commuter rail corridor. Strategies also recognize that the town is developing a Complete Streets prioritization plan that will grant access to Complete Streets grant funding from MassDOT. The plan calls for working with MeVa Transit, the regional transit agency (RTA), to provide access to resources in the region. Under the goal to enhance the MBTA Commuter Rail Stations, the plan lists strategies to conduct a feasibility study for modernizing the stations, plan for mixed-use development in proximity to the stations, and make both stations places with activities. The next goals, Include Pedestrian and Bike Infrastructure, Advance Transportation, and Pursue Multimodal Mobility Solutions include policies that provide enhanced mobility options for people. Actions such as enacting policies and guidelines for improving safety for people walking and biking and providing indoor bicycle parking are aimed at making active transportation competitive with driving. Some strategies, such as including green infrastructure in complete streets designs, address environmental concerns outside of reducing GHG emissions. Also included are policies to reduce parking and provide rideshare options to support car-lite lifestyles.

Economy and Jobs

Andover is a regional job center and sees about 35,000 people daily entering town borders to work. About 2,500 residents of Andover also work in town, and about 12,000 leave town to work. The combination of incoming, resident, and outgoing workers “means that the

daytime population rises by more than 20,000 people" (p. 83). The goals in this section of the plan are to diversify and strengthen Andover's economic community, entice employers to Andover, create multiple employment hubs, grow business initiatives, and prioritize arts, culture, and innovation. Strategies supporting these goals include creating flexible, small workspaces that are suitable for creatives. The plan looks to provide affordable studio spaces and live work opportunities for artists, designers, and creatives. There is also a call for the creation of co-working spaces and cafes where people are welcome to work. Mixed-used areas in town, such as downtown, are seen as potential hubs for employment through infill development with smaller units for diverse retail.

Zoning

Andover's train station area is located within the town's Historic Mill District (Table 2, Figure 10). The town passed the Historic Mill Overlay District (HMOD) in 2015, allowing mixed-use development with a net residential density of up to 40 units per acre by special permit granted by the Planning Board (Town of Andover 2022b, 87). The zoning bylaw allows the Special Permit Granting Authority to "require the integration of residential and non-residential uses in a mixed-use structure as a condition of approval" (Ibid., 87). As part of the zoning bylaw, the town established design guidelines that intend "to preserve and augment the architectural qualities, historic character, and pedestrian scale of the district" (89). Parking minimums are reduced from two spaces to one space per residential dwelling unit and two spaces per 1,000 square feet of gross floor area for non-residential uses (90) (Table 3). The purpose of the bylaw is to provide a mechanism for establishing a diverse housing stock for multiple stages of life in accordance with the *Andover Comprehensive Plan*. The mixed-use component is intended to promote economic development and reduce car-dependency.

Table 2. Zoning Districts in the Town of Andover.

KEY	ZONING DISTRICTS	MINIMUM LOT DIMENSIONS (e)			MINIMUM YARD DEPTH (f)			MAXIMUM HEIGHT (g)		MAXIMUM COVERAGE
		AREA	FRONTAGE		FRONT	SIDE	REAR			(Including Access. Bldg.)
		(square feet)	(feet)		(feet)	(feet)	(feet)	(feet)	(stories)	(percent)
SRA	Single Residence A	15,000 (a)	115		35	20 (d)	30	35	*	*
SRB	Single Residence B	30,000 (a)	150		40	25 (c)	30	35	*	*
SRC	Single Residence C	43,560 (a)	180		50	30 (c)	30	35	*	*
APT	Apartment (h)	(i)	(i)		30	20	20	35	3	30 (b)
LS	Limited Service	*	*		30	50	50	40	3	30 (b)
OP	Office Park (j)	43,560	180		30	50	50	40	3	33 1/3 (b)
GB	General Business (k)	*	*		*	*	*	50	4	*
MU	Mixed Use (l)	*	50		10	10	10	50	4	30 (b)
IG	Industrial G (j)	*	*		30	15	15	60	5	50 (b)
IA	Industrial A (j)	*	*		50	40	40	60	4	30 (b)
ID	Industrial D (j)	*	50		100	100	100	50	3	25 (b)
ID2	Industrial D2 (j)	*	50		50	40	40	50	4	30 (b)
SRCOD	Senior Residential Community Overlay District	*	*		*	*	*	*	*	*
WPOD	Watershed Protection Overlay District	*	*		*	*	*	*	*	*
GPOD	Groundwater Protection Overlay District	*	*		*	*	*	*	*	*
MMOD	Medical Marijuana Overlay District	*	*		*	*	*	*	*	*
HMD	Historic Mill District	*	*		*	*	*	*	*	*
*	See sections in ANDOVER ZONING BYLAW for design requirements.									
(a)-(l)	SEE ANDOVER ZONING BYLAW, Appendix A Table 2 for Exceptions and Special Requirements to the above.									

Source: Andover Zoning Map 2015.

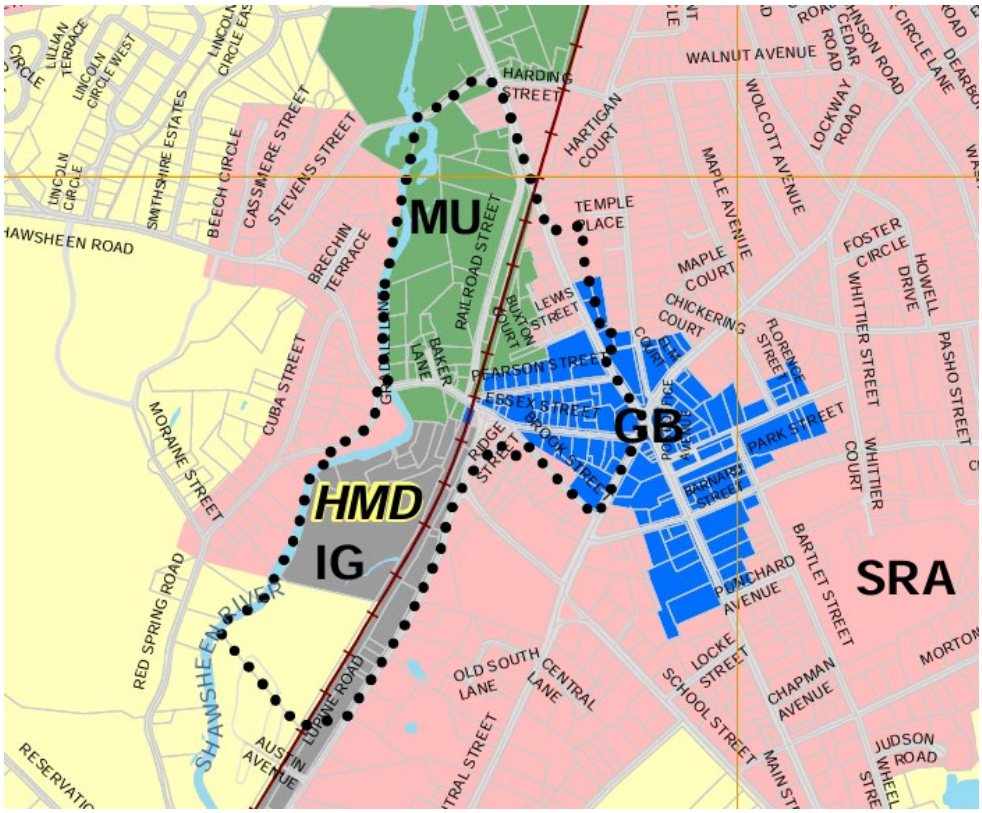


Figure 10. Andover Zoning Map of the Historic Mill District and Surrounding Areas. (Andover Zoning Map 2015)

Table 3. Table of Off-Street Parking Requirements for Residential Uses in Andover, MA

Class of Use	Required Parking Spaces
A. Residential Uses	
1. Detached one-family dwelling	Two parking spaces for each dwelling unit
2. Cluster development	Two parking spaces for each dwelling unit
3. Board or lodging house	One parking space for each room rented
4. Multiple dwellings:	—
a. Conversion or a one-family or a two- or more family dwelling	One parking space for each studio or 1-bedroom unit; two parking spaces for each unit with two or more bedrooms
b. Multiple-dwelling (Apartment Building)	One parking space for each studio or 1-bedroom unit; two parking spaces for each unit with two or more bedrooms
c. Planned Development – Multifamily or Mixed Use	As set forth in Section 7.8.5.2
d. Conversion of an existing structure of 50,000 square feet gross floor area or more to multifamily use	One parking space for each studio or 1-bedroom unit; two parking spaces for each unit with two or more bedrooms
e. Attached Cluster	Two parking spaces per dwelling unit
5. Assisted Living Residence:	—
a. Long-term care facility	One parking space per two beds, plus one parking space per employee
b. Assisted living residence	As set forth in Section 7.3.3.11
c. Congregate Living facility	As set forth in Section 7.3.3.11
d. Independent living residence	One parking space for each studio or 1-bedroom unit; two parking spaces for each unit with two or more bedrooms
6. Subsidized low or moderate-income dwelling	One parking space for each studio and 1-bedroom unit or elderly housing unit; 1.5 parking spaces for each unit with two or more bedrooms

Source: Andover Zoning Bylaw Section 5.1.4 – Table of Off-Street Parking Requirements. Appendix A, Table 3. III Attachment 1:9.

Historic Mill District Design Guidelines

Andover's HMD Design Guidelines address the design of new buildings while not being so restrictive as to lengthen the permitting process. Even though the HMD design guidelines were crafted years prior to the 2023 *Comprehensive Plan*, the guidelines state a purpose for the HMD that is consistent with the plan. It states goals such as encouraging smart growth near transit, a range of housing options, compact development, preservation of open space, and multi-modal transportation options with a focus on walkability (Gamble Associates 2018).

The design guidelines pay attention to the historical context in which the HMD is located. The authors note that in the HMD, a variety of building types already exist, from large mill

buildings to smaller single-family homes and duplexes. The architectural styles vary from 19th c. industrial brick mills to the various styles of 19th and 20th c. residential and commercial buildings and feature a broad palette of materials. Through the guidelines, the existing architecture and urban form can guide new construction and rehabilitation of old buildings to enliven the HMD that has been impacted by suburban development patterns.

The HMD includes Andover's downtown, which is currently divided by the MBTA rail tracks. The design guidelines seek to stitch together the downtown and recognize the infrastructure improvements that are needed to achieve that goal. The guidelines state "Investments in continuous sidewalks, new street trees and pedestrian-scaled lighting will enhance walking circuits, improve safety and security, and more effectively manage stormwater" (11). The guidelines also reference a rational street grid and on street parking that will spur development.

The design guidelines map out two possible routes as ways to bridge downtown together (Figure 11). Both routes have Elm Square on Main Street as a common destination on the east side of the MBTA rail tracks (the easternmost point on the map). Route 1 has the Andover High School and West Middle School as one western destination and Route 2 has the Shawsheen River as another western destination.

Figure 11. Bringing the Downtown Together Graphic (Gamble 2018, p. 13).

As seen on the route map, Route 2 goes along Main Street to Lewis Street and crosses over the MBTA tracks. The guidelines point out the need for a pedestrian bridge at the platform. The bridge would serve as a connection between the former Town Yard Site, a major component of the Historic Mill District, and the potential for development of the MBTA parking lot on Railroad Street (Gamble 2018, 12).

The guidelines recommend improvements to the Essex Street, Pearson Street, and School Street intersection (Figure 12). The recommended street alignment brings School Street through an existing building at the apex of Pearson Street and Essex Street into the Town Yard Site. This recommendation helps bring future development of the site into the street network and encourages circulation from Main Street to Lewis Street by allowing an outlet onto School Street.

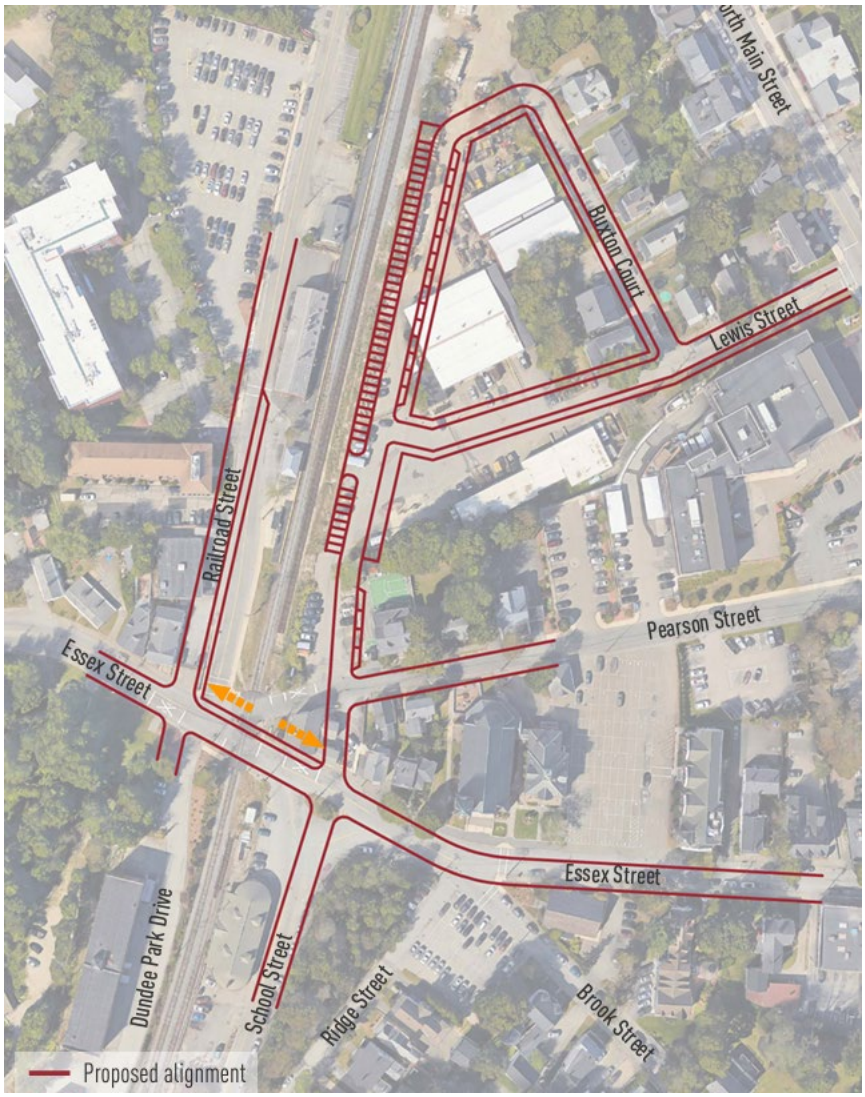


Figure 12. Potential realignment of the Pearson, Essex, and School streets intersection. (HMD Design Guidelines 2018, p. 17)

The design guidelines break the town into three corridors: The River Corridor along the Shawsheen River, The Rail Corridor along the Commuter Rail Line, and the Roadway Corridor along Main Street (Figure 13). The Rail Corridor has the greatest potential for mixed-use development and higher density development. The River Corridor has fewer opportunities for development but could unlock access to a natural resource that would attract surrounding

development. The Road Corridor has the potential for infill development that matches and enhances the already existing commercial uses.

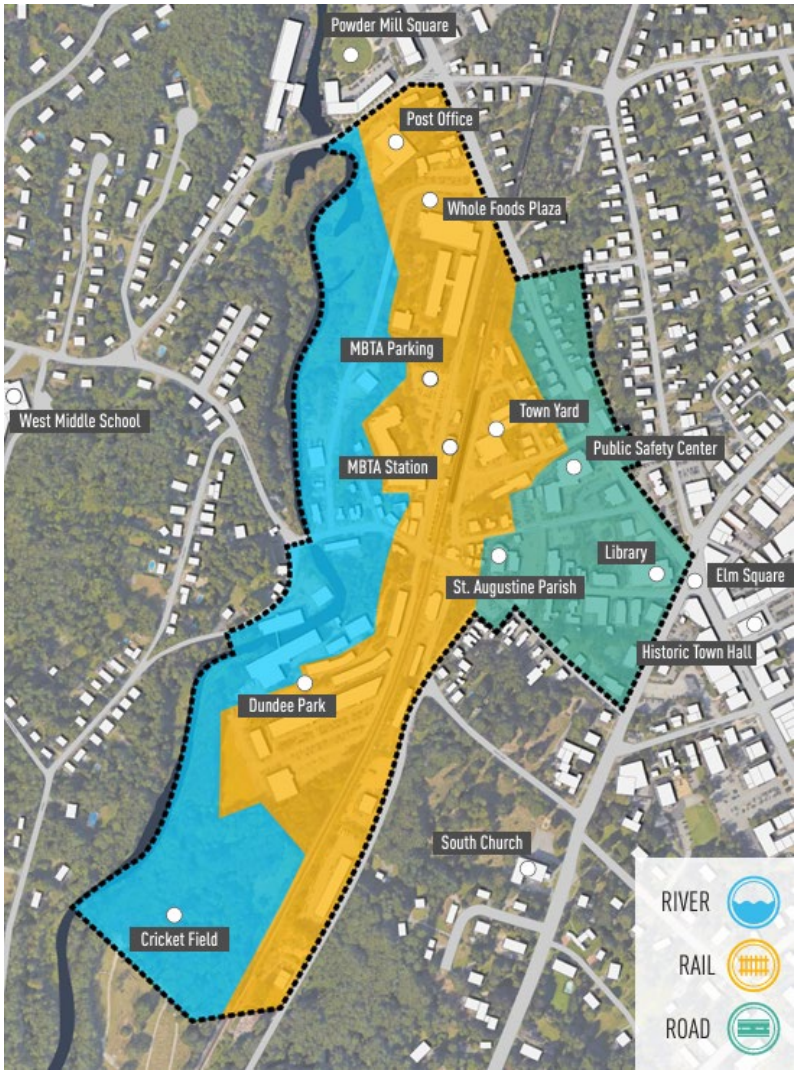


Figure 13. Three Corridors Graphic. (HMD Design Guidelines 2018, p. 20)

The River Corridor

The River Corridor design guidelines call for building heights of 2 to 3 stories with lower elevations toward the river to protect the views of the river. Upper story step-backs would diminish the building height and allow for a smaller scale feel along the corridor. Variations in building facades, terraces, and balconies are suggested to further reduce the scale of the buildings and relate them to the context of the corridor. The design guidelines call for a connection between buildings and the river through paths as well as an "intimate relationship" of public spaces and private spaces. Parking should be located behind or below buildings and be shielded from public view. Open spaces should address runoff and use sustainable techniques to reduce flooding. Wayfinding should be used along pathways to connect people walking and biking from Main Street to the river.

Figure 14. Building Height Graphic. (HMD Design Guidelines 2018, p. 29).

(Left) Figure 15. Building Massing Precedent in Savage, MD. (HMD Design Guidelines 2018, p. 30) (Right) Figure 16. Building Height Precedent in Williamstown, MA (HMD Design Guidelines 2018, p. 28).

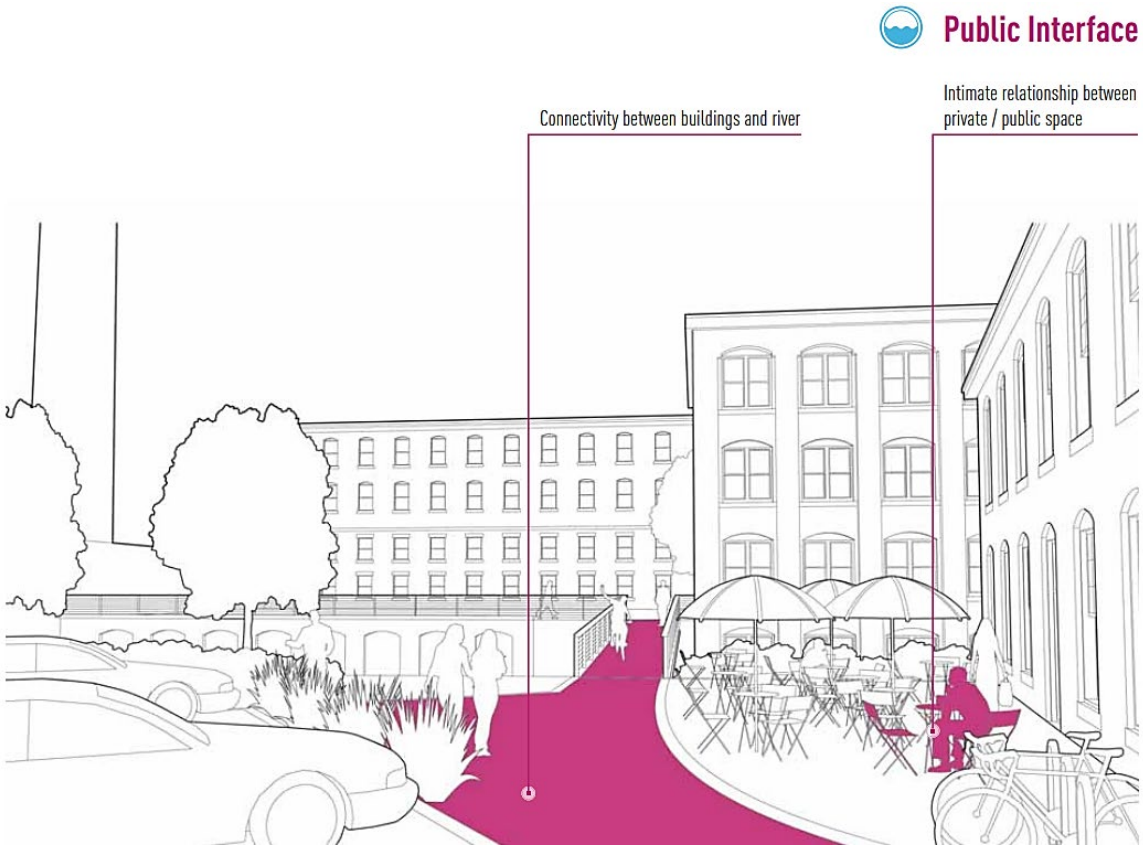


Figure 17. Public interface spaces along the Shawsheen River. (Gamble 2018, p. 33)

Rail Corridor

Larger buildings are suggested along the Rail Corridor to capitalize on TOD opportunities. Greater densities allowed through buildings of 4 to 5 stories for properties adjacent to the Rail Corridor are recommended in the design guidelines. Greater density will also make underground or below building parking financially feasible for developers. Buildings should respect the lower height of existing buildings by stepping back the upper floors. The public realm should welcome people arriving and departing from the station. Public spaces, such as plazas, should enhance the connection between the station, existing buildings, and new development.

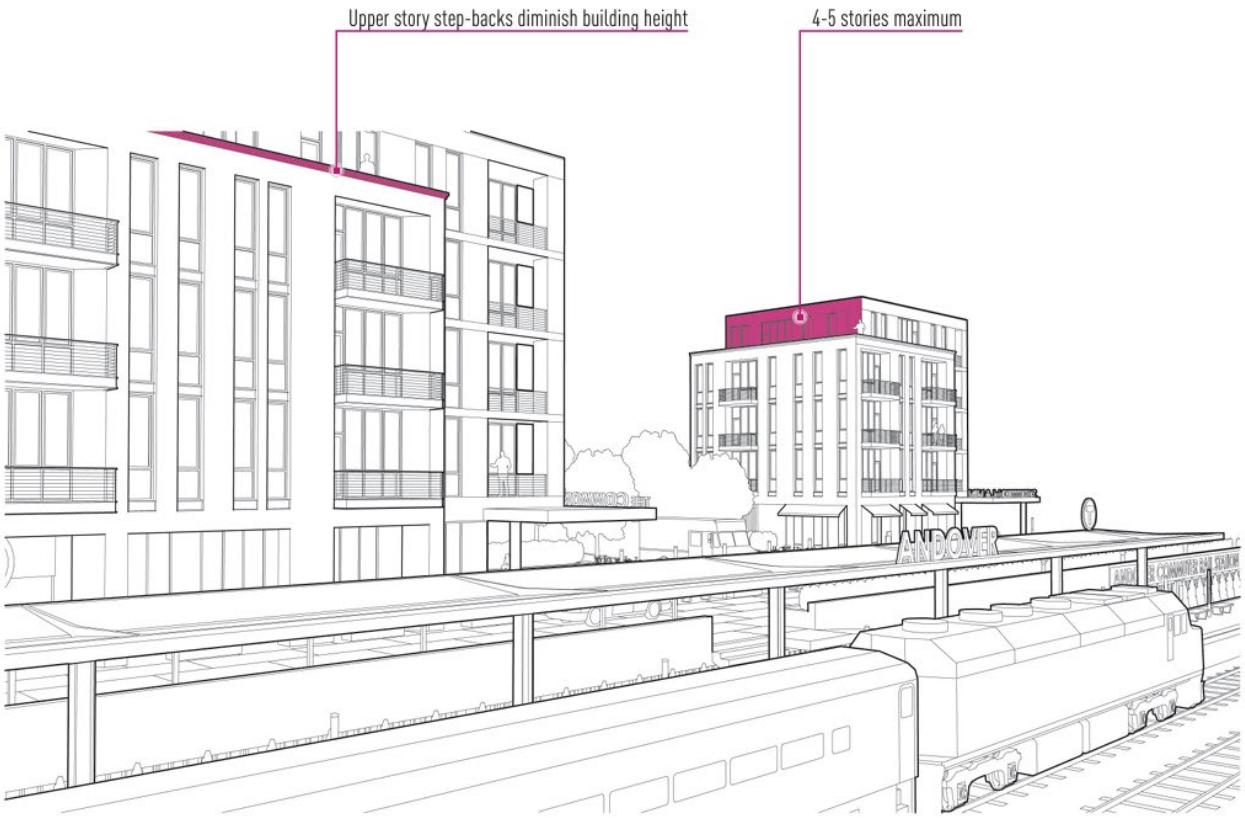


Figure 18. Rail Corridor Building Height Graphic. (HMD Design Guidelines 2018, p. 49).

(Left) Figure 19.Rail Corridor Building Height Precedent in Rochester, NY. (HMD Design Guidelines 2018, p. 48)
(Right) Figure 20. Rail Corridor Building Massing Precedent in Boston, MA. (HMD Design Guidelines 2018, p. 50)

Road Corridor

Along the Road Corridor should be mixed-use buildings of 3 to 4 stories that reinforce the streetwall. Buildings should use step-backs to reduce building heights, and be built to the property line where sidewalks are wide enough to accommodate the anticipated pedestrian activity. Sidewalks should have street furniture and plantings to create coherence with the character of downtown. As in the previous corridors, parking is best located behind, to the side, or underneath buildings. The design guidelines anticipate greater bike activity in the area. Buildings should have high transparency along the ground floor and awnings or other overhead elements should create the feeling of an outdoor room.

(Left) Figure 21. Road Corridor Building Massing Precedent in Rockland, ME. (HMD Design Guidelines 2018, p. 70)
(Right) Figure 22. Road Corridor Public Interface Precedent in Amesbury, MA. (HMD Design Guidelines 2018, p. 72)

Figure 23. Road Corridor Facades and Materials Graphic (HMD Design Guidelines 2018, p. 79).

Table 4. Summary of Design Guidelines by Corridor in Andover, MA.

Design Guidelines Andover, MA October 2017	RIVER	RAIL	ROAD
1 BUILDING HEIGHT	2-3 stories Lower elevations towards the river Include Step-backs to diminish the effect of building height	4 - 5 stories Larger building volumes Taper scale adjacent to existing residential areas	3 - 4 stories Step-backs to diminish the effect of building height Setbacks to address appropriate relationship to surroundings
2 BUILDING MASSING	Lower scale building volumes Variation in building facades by adding bays or terraces Balconies to capitalize on river views	Higher building volumes adjacent to the rail Step-backs to diminish the height adjacent to existing homes	Façade variation – diminish long elevations by providing visual relief Break down large building masses into component elements
3 PUBLIC INTERFACE	Connectivity between buildings and river Intimate relationship between private / public space Wider public path in front of buildings – Riverwalk	Transition zone between tracks and new development Considerations for new transit platform Series of public plazas	Outdoor seating areas Commercial ground floor uses with frequent entries Public art opportunities
4 PARKING + ACCESS	Parking in rear of building Visually shield surface parking Parking below buildings or in floodable garages	Parking towards rail line Utilize grade change for lower-level parking Combine parking in structures or plinths	Shared parking opportunities with adjacent property owners Plantings of adequate height and density to visually buffer parking Surface parking lots behind buildings at the rear or middle of blocks
5 LINKAGES + NETWORKS	Foster public access to the river Open space to address stormwater runoff Sustainable techniques to reduce flooding	Improved access to MBTA station platforms Ensure safe crossing of tracks	Walkways for pedestrian connections Anticipate greater role for bike transportation Overcome limitations of rail infrastructure and excessive roadway width
6 FACADE + MATERIALS	Ground floor interaction with Riverwalk "Natural and sustainable" material palette Balconies to provide river views	Materials that celebrate industrial past Brick, steel, concrete	Increase transparency at ground floor High-quality, durable and natural materials Appropriate relationship to surrounding buildings
7 SIGNAGE + WAYFINDING	Signage sensitive to natural river corridor Wayfinding orientation to downtown Dundee Park and parking	Pedestrian connection signage Enhance wayfinding Integration of signage into architecture of the building	Opportunities to interpret history and enhance wayfinding Branding of cultural district Signage to parking and River Walk

Source: HMD Design Guidelines, p. 86

Chapter 4

Literature Review

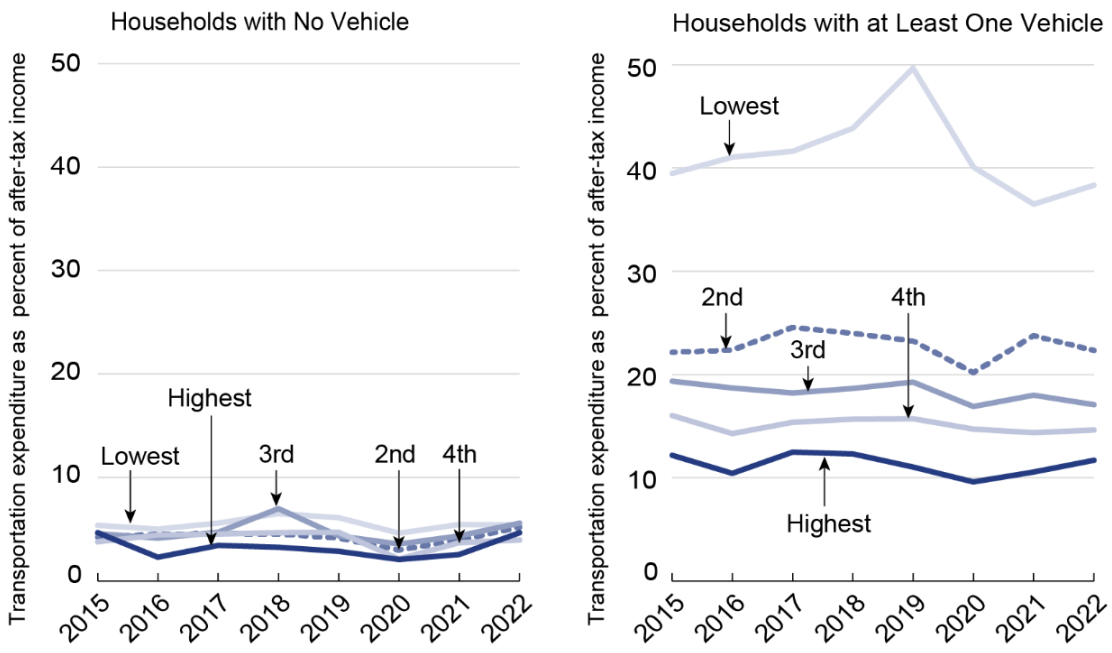
The Literature Review focuses on topics that would enhance the transit-oriented neighborhoods planned as part of the MBTA Communities legislation. What the literature says about Livability and Walkability, Transit Oriented Development (TOD), TOD Land Use and Design, and Urban Design Qualities inform the recommendations.

Livability and Walkability

To create a transit station area that is livable, transportation and land use goals must align to produce a built environment that is conducive to public life. Jane Jacobs' (1961) seminal work, *The Death and Life of Great American Cities*, offered a critical lens on modernist urban design and transportation infrastructure. Her perspective resonated with many people of that time and spawned research on how the built environment impacts people. Donald Appleyard's book, *Livable Streets* (1981), details the impact that traffic had on residential streets across the US. The concept of livability is rooted in people's ability to access opportunities to improve their quality of life (Appleyard et al. 2017). Directly related to quality of life is people's ability to access destinations – job centers, childcare, groceries, social and civic opportunities – within the community and region in which they live. A livable community or region offers opportunities for people to thrive, not just survive. At the center of livability and walkability is the idea that if you don't want or cannot afford to own a car, you do not have to (Appleyard et al. 2014, 63). A neighborhood should have multiple transportation options and provide opportunities for a range of constituencies. The choices, opportunities, and quality of life provided to constituencies are

connected to how livable a place is. Essentially, livability is the collection of opportunities available to people that they can use to achieve a satisfying level of quality of life for themselves and those they care about (Appleyard 2023).

Though the concept of livability is recognized by the US Department of Transportation (USDOT) and Federal Highway Administration (FHWA), the externalities of cars have yet to be fully remedied. Federal, state, most local governments, and the existing transportation infrastructure are still prioritizing the movement of vehicles to the point where, for many people, there is no other choice but to drive. US transportation policy and practices have been slow or resistant to implementing active transportation and transit infrastructure that allows those modes to compete with car travel. In most suburban areas and some urban areas, there is a lack of frequent transit service that would allow people to rely on transit for most trips (Higashide 2019). According to transit planner Jarret Walker (2012), greater frequency allows greater freedom of mobility. A lack of funding to operate frequent transit service is not the only reason why transit cannot compete. Suburban sprawl and car-oriented design have made it difficult for bus services to access destinations spread throughout a region. In the Merrimack Valley, access to jobs granted to those that own a car is far greater than for those that rely on transit (MVPC 2023). The cost of owning a car has contributed to the average American family spending $12,295 on transportation in 2023 which impacts people in the lowest income tax bracket the most (Bureau of Labor Statistics 2023).



NOTE: No vehicle means households do not own or lease a vehicle.

Figure 24. Percent of Household Income Spent on Transportation by Income Quintile. (U.S. Department of Transportation, Bureau of Transportation Statistics from U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey. 9/23)

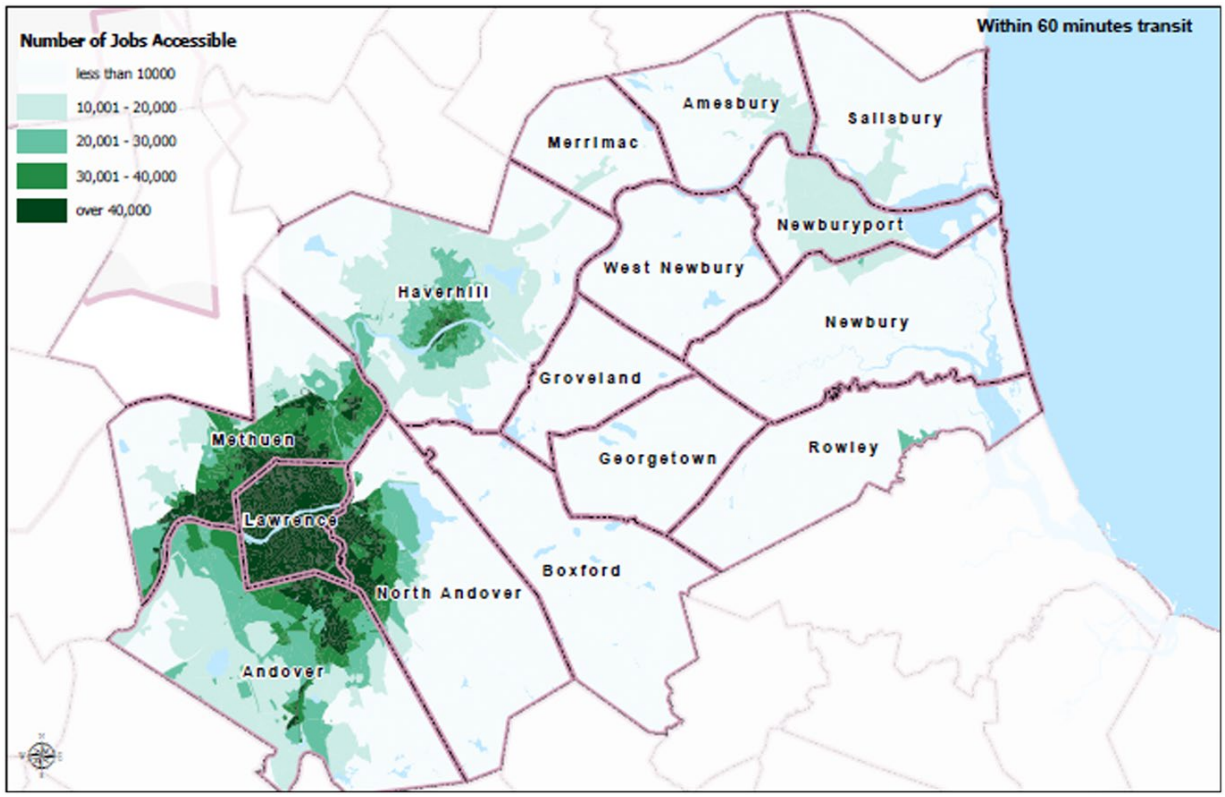


Figure 25. Job Accessibility by Transit. (Merrimack Valley Planning Commission 2023)

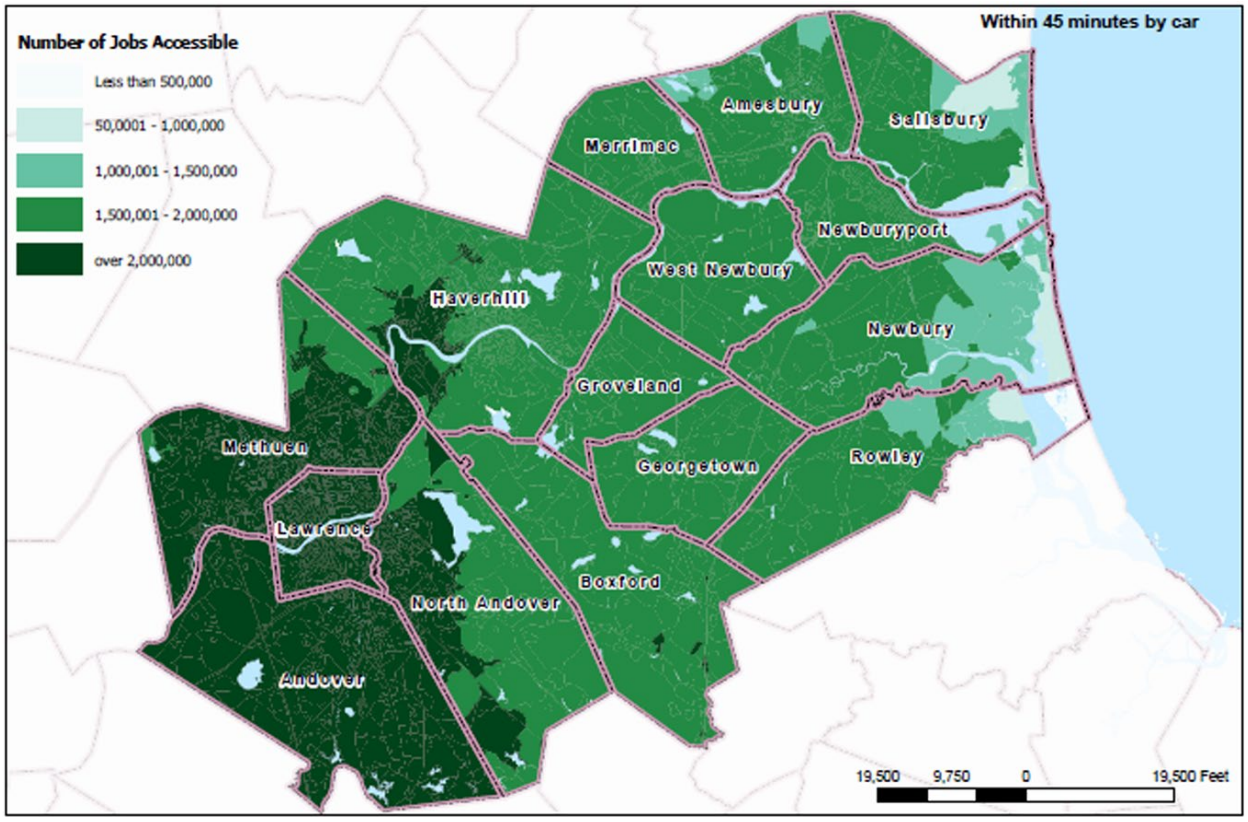


Figure 26. Job Accessibility by Car. (Merrimack Valley Planning Commission 2023)

Reliance on cars does not only impact people's ability to afford transportation, it also has created a transportation system that threatens the lives of people getting from place to place. The year 2022 marked a 40-year high in pedestrian fatalities – the most since 1981 (Kim 2023). The impact that cars have on the safety of people walking, biking, and waiting for transit not only threatens their lives, but also causes people to disconnect from the street space and the people in it (Appleyard 1981). A safe street, at a minimum, is one that allows people to move along a path without fear of getting hit by a car. A livable street removes the threat that a car poses on a person. Removing the constant threat allows people to move at a slower pace and interact with their environment and other people living in it. A people-oriented, human scale neighborhood must also accommodate modes of transportation that are in concert with the surrounding area

(Appleyard et al. 2017). The design of a livable place must prioritize arriving at and being in a place rather than moving through it.

Livable places in isolation may benefit people who are in that place and traveling to that place, but it does not create livability for people of the entire community. Bruce Appleyard's *Livable Streets 2.0* (2020) expands on his father's work to carry forward the topic of livability from the livable residential street or neighborhood to consider livability at a regional scale. Livable transit-oriented development connects livable destinations along a transit corridor. The goal of livability is to build an integrated transit corridor with local and regional destinations connected by transit (Appleyard et al. 2016). The destinations at each stop must then be connected by walking and biking paths – allowing people to access the destination once off the transit corridor by active modes of transportation.

Transit Oriented Development

Transit Oriented Development (TOD) is a term coined in the late 1980s by Peter Calthorpe (1993), a founding member of the Congress for the New Urbanism, which became widely used with the publication of his *The New American Metropolis* (1993). TOD is a concept that, in concert with New Urbanism, promotes sustainable development patterns that are alternatives to suburban sprawl. Key components of TOD are walkable streets, mixed land uses, and increased density (Calthorpe 1993, Dittmar and Ohland 2014). These components allow transit to have reliable ridership from the surrounding residents and make the station a destination for people living along the transit corridor. Walkable streets have four components: they must be safe, they must be comfortable, they must take you somewhere, and they must be interesting (Speck 2012). In the context of TOD walkable streets increase people's desire to walk to transit to travel to a destination outside of their neighborhood instead of choosing to drive

there. Mixed-use zoning surrounding transit stations allows the station to offer more than just a transportation option to people. If people are walking to the station area to work, eat, or play, then they are exposed to transit in their daily lives and will be more likely to use the service (Calthorpe 1993). Increased density, or compact residential development, within a 10-minute walk of a transit station allows a station and its surrounding amenities and businesses to serve more people (Guerra et al. 2012).

The effectiveness of TOD is typically measured by ridership levels or mode choice of residents within walking distance of the station (Ibraeva 2020). There are many variables that influence a transit station's ridership levels or a person's mode choice. Service frequency is a determinant of whether people are willing to rely on transit service for daily activities. Infrequent service – greater than 15-minute headways – causes people to plan around the transit schedule for their daily activities (Higashide 2019). Proximity of the station area to where people live is also a determinant of transit as the primary mode choice. A study of California residents living within walking distance of frequent transit service (headways of 15-minutes or less) found that an average of 26.5% of residents use transit as their primary commute mode compared to 5.4% of people who live outside walking-distance to transit (Lund et al. 2004). Increasing the supply of housing within walking distance of frequent transit service can greatly influence mode choice. Walkability and density of the area are also variables in how integrated the station is and whether the station areas can be considered TOD, a hybrid, or Transit Adjacent Development (TAD) (Renne et al. 2016). TOD station areas often have greater real estate values than hybrids and TADs, but because they are more integrated and have more frequent service, people spend less on transportation – so much so that the overall cost of living is lower in TOD areas (Renne et al. 2016). Transit integration and resulting mode split are greatly influenced by the regional context

of transit service and the destinations that are accessible along the transit corridor (Lund et al. 2016).

TOD Land Use and Design

The fundamental structure of transit-oriented development is to design the station area as a node – with a commercial core within a 5-minute walk (.25 miles) and residential development within a 10-minute walk (.5 miles) of the station. The commercial core can then be served by the ridership along the transit corridor and from the surrounding residential development (Calthorpe 1993, Dittmar and Ohland 2014). The commercial core should be a mix of ground floor retail and services such as convenience stores, small markets, restaurants, health clubs, barbershops, pharmacies, personal care, and professional services. Professional services can also occupy second floors, and office space can be located from second to higher floors in denser areas or occupy a whole building above the ground floor. The commercial core should be highly imageable for residents and people traveling to the station area. Imageability can be achieved through placemaking and activating ground floors to make the core an identifiable social center. Retail located in direct proximity to the station encourages people to shop or dine before or after using transit. Ground floor retail activates the streets and creates an inviting environment for people walking to the station from surrounding residential neighborhoods (Dittmar and Ohland 2014). Office users bring a customer base to the retail locations during the traditional workday hours and encourage activity throughout the day. Although ground floor retail is preferred, offices on the ground floor are desirable when there is not a sufficient consumer base to support the retail (Calthorpe 1993, Dittmar and Ohland 2014).

Table 5. Distribution of Land Uses Necessary for Neighborhood and Urban TODs

	Neighborhood TOD	Urban TOD
Public Open Space	10%-15%	5%-15%
Core Commercial/Employment	10%-40%	30%-70%
Housing	50%-80%	20%-60%

Source: Calthorpe (1993) The New American Metropolis, p. 63)

TOD urban designers and planners have established minimum housing densities that are necessary to support quality transit service. When looking at dwelling units per acre, the standard minimum density given is 15-18 units per acre (Ewing and Bartholomew 2013, Calthorpe 1993). The Capitol Region Council of Governments (CRCOG) has an analysis showing that ridership triples when densities reach 30 units an acre (CRCOG 2016). Other researchers have stated that transit service needs a minimum of 47 people per acre or 30,000 people per square mile (Guckert 2023).

In Massachusetts, the state has enacted legislation that is supported by the established density requirements for transit service. The MBTA Communities legislation has determined a minimum gross density of 15 units per acre must be zoned to comply with the law. A diversity of housing typologies is recommended to support the development of a TOD for people at different stages of life and to create greater affordability. Housing should be a mix of multi-family, townhouses, and single-family housing within a half-mile of the station (Dittmar and Ohland 2014). As one gets further away, larger single-family homes should be allowed (Calthorpe 1993).

Table 6: TOD Typology.

TOD Typology	Housing Density (units/acre)	Housing Type	Example
Urban Downtown	>60	Multifamily	Printers Row (Chicago, Illinois)
Urban Neighborhood	>20	Multifamily, Townhouse, Single Family	Mockingbird Station (Dallas, Texas) Barrio Logan (San Diego, California)
Suburban Center	>50	Multifamily, Townhouse	Clarendon Market Commons (Arlington, Virginia)
Suburban Neighborhood	>12	Multifamily, Townhouse, Single Family	The Crossings (Mountainview, California)
Commuter Town Center	>12	Multifamily, Townhouse, Single Family	Prairie Crossing (Grayslake, Illinois)

Source: Dittmar and Ohland (2004), p.38

The 5-minute and 10-minute walksheds, or catchment areas, for TOD zoning are well established in the literature (Guerra et al. 2012). In addition, researchers have found that the viewsheds from the stations are very different from the viewsheds as people move away from the station. Using viewsheds from existing transit stations to redesign the station area can open new perspectives on how to integrate public spaces. Viewsheds that include public spaces, commercial activity, and public life can create a more inviting public realm (Stojanovski 2020). Since much of the TOD research has been case studies of individual or a collection of transit stations, there is no benchmark for station design (Ibraeva 2020). Studying the viewsheds allows planners to understand the context in which the transit station exists and plan for improving the walkability of the place within its context (Stojanovski 2020).

Urban Design Qualities

Imageability

Essential to planning for TOD and livable places is the design quality of the public realm. Kevin Lynch's book, *The Image of the City* (1960), brought forth the human perspective on what elements make a city a memorable place. The concept of imageability derived from Lynch's work informs the basis of urban design principles for walkable and livable places. Imageable cities are designed with high quality, human-oriented elements (Ewing and Bartholomew 2013). From empirical research with residents of different cities, Lynch (1960) identified the elements of the city as paths, nodes, edges, landmarks, and districts. Recognizing the element that is being designed helps the urban designer fit that element into the larger context of the city. The elements can be designed to create a city that is navigable and recognizable to people walking through for the first time (Lynch 1960). For a city or place to have high imageability, it also must have other urban design qualities that evoke emotions and are memorable (Ewing and Clemente 2013). Creating a sense of place, feelings of safety, well-being, and comfort is key to creating an imageable place. By contrast, a place could be memorable for how inhospitable and unsafe it is – influencing a person's unwillingness to return. Urban design that prioritizes public life and human connection seeks to create urban environments that are pleasant to see, dwell in, and walk through or around. In doing so, highly imageable urban design incorporates qualities such as, enclosure, human-scale, transparency, complexity, coherence, legibility, and linkage (Ewing and Clemente 2013).

Figure 27. The New York City Public Library Entrance on Fifth Avenue in Manhattan is a Landmark Adding Imageability to the City (Source: Wikipedia – https://en.wikipedia.org/wiki/New_York_Public_Library_Main_Branch)

Enclosure

Enclosure is an urban design quality that is essential to making a person feel comfortable in the urban setting (Ewing and Bartholomew 2013). It is often compared to having walls around an outdoor room. Enclosure is a feature that should be applied to all public spaces, such as sidewalks, plazas, and pocket parks. Just as a person driving feels safe enclosed in their car, a person walking needs enclosure to feel safe along a sidewalk. Creating a sense of enclosure is creating a room-like quality where the vertical elements in a space visually frame the view to the sides and ahead of a person (Ewing and Bartholomew 2013). Street trees between a sidewalk and traffic with building façades lining the other side of the sidewalk create the walls as the sky acts as the ceiling of the room. Where buildings are absent, street trees, hedges, on-street parking, fences, and walls can create an edge that defines a sense of enclosure (Ewing and Clemente 2013). Enclosure can also help generate a pleasant microclimate by inviting shade or blocking wind (Sim 2019). Buildings that have an enclosed courtyard create a semi-private common space

for residents. Building blocks can do the same by opening the backyards and defining individual private space and common space (Sim 2019).

Human Scale

The place that is being designed must be designed to the human scale. The human scale includes not only narrow streets and buildings that are proportionate to human beings, but also elements that correspond to the speed at which humans travel (Ewing and Bartholomew 2013, Sim 2019). People moving at a walking pace can take in greater detail than people biking or driving along a street. There are some in the urban design field who believe that buildings should not be taller than six stories to maintain a human scale, but others believe that so long as the floors step back as the building height increases a human scale can be achieved (Krier 2009, Barnett 1982). Jane Jacobs (1961) discussed the benefits of having people be able to look out the window of their building and see the ongoings of the street below. The addition of smaller, articulating elements to larger buildings and places can help build a human scale environment. Taller buildings with awnings over the human height walkable space bordering their façades and smaller signage also create a human scale environment (Hack 2018). Narrow storefront bays and vertical elements expressed along facades create a human-scale walking rhythm. Wide streets with planters, street furniture, bicycle parking, and street trees can create a human scale environment. The amount of detail in the built environment can induce human scale.

Figure 28. Human Scale, Mixed Use on State Street, Newburyport, MA (Source: Jonathan Berk)

Transparency

Transparency is a perception of public life or human activity taking place beyond an edge, such as building facades or streets. Windows, balconies, outdoor dining areas, street streets, and courtyards are all physical elements that induce a level of transparency. A classic example of transparency is a commercial street with display windows that welcome people to look in as they are walking by. Pedestrians have something to look at as they are walking that entices them to either walk further, check out the public life they are seeing, or engage in the local economy by entering a retail establishment. Blank walls and empty lots have the opposite effect on the pedestrian experience by reducing the amount of life people can perceive around them. The less public life people perceive, the more they will want to pass through the place instead of engaging with the place.

Figure 29. Transparency of Shop Windows on Waterfield Street, Winchester, MA (Source: Tony Collins)

Complexity

People tend to prefer a place that is diverse and offers visual variety over a place that is monotonous and offers uniformity. Complex places have physical elements that draw the eye to their detail as the details change while a person moves through space. In this way, the amount of transparency in a place affects the complexity of that place. Diversity in architecture can add complexity to a place by offering a variety of buildings for people to look at as they walk along. In this sense, complex places often have narrower buildings along a block rather than a wide building that dominates a block. A variety of materials and palettes of colors create a uniqueness that can build imageability. Smaller elements, such as signage, planters, street furniture, and lighting can add complexity to the pedestrian experience. Gehl (1987) found that the complexity

of a street can make a walking journey feel shorter because the environment is broken up into "manageable stages".

Complexity is not only derived from physical features, but also from a mix of land uses, transportation modes, activities, and people. Mixed land uses offer a variety of purposes for people to be in a place. If people are in a place for work, but they can also be there to eat or shop, the place meets different needs and desires. If a place meets different needs and desires, then different people will arrive at the place to meet those needs and desires. Jane Jacobs (1961) wrote about the street ballet of a diverse people going about their daily activities in a way that draws one's attention. Street cafes are examples of how a lively street with different people going about their lives can become an impromptu show for people sitting along the sidewalk.

Figure 30. Complexity in the Form of Pop-Up Public Spaces on Broadway, New York, NY (Source: Tony Collins)

Coherence

As a balancing quality to complexity, coherence gives a place a sense of compatibility of urban design elements. Instilling a logical order can make pedestrians feel more comfortable in a place. If a place is unpredictable, it can feel overwhelming and unwelcoming to visitors. Coherence is achieved by creating some commonality of building and public space. Commonality could be found in building heights, materials, or details. Modern architecture is often void of handcrafted details and is typically a patchwork of designs by different architects. In those cases, coherence can be derived from landscaping the public spaces around buildings. Street trees planted at regular intervals can bring unity to a streetscape with consistent patterns of light. Street furniture and lighting can also bring a sense of coherence to the street. Art and signage in the public realm can tie together the urban form and draw interest from people walking along the sidewalk.

Figure 31.Goldilocks of Messy – Balancing Coherence with Complexity in Richmond, VA (Source: Steve Mouzon)

Striking the right balance between coherence and complexity is essential to making the whole place feel unique. Steve Mouzon, a New Urbanist architect, speaks about the goldilocks of messy that places should seek to create a place that is imperfect and feels human. Places can feel "cookie-cutter" if they are too regulated and disordered if there is no structure. Alexander et al.'s book, *A Pattern Language* (1977), describes the hierarchy of spaces at different scales that give order to a place. The rural-to-urban Transect, developed by Andres Duany, is a "system that places all of the elements of the built environment in useful order, from most rural to most urban" (Steuteville 2017). Form-based code is a form of land-use regulation that uses the rural-to-urban transect to control the form of the built environment (Parolek et al. 2008). Land-use and urban design regulations can be useful tools for creating a coherent urban environment.

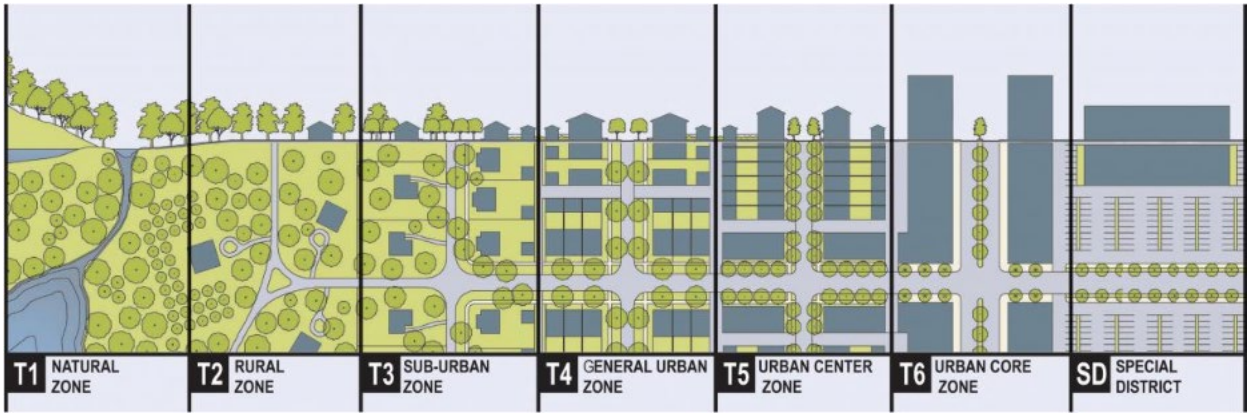


Figure 32. Rural to Urban Transect Diagram. (Steuteville 2017)

Legibility

Lynch (1960) describes a city's legibility as "one whose districts or landmarks or pathways are easily identifiable and are easily grouped into an over-all pattern". When elements come together in a distinguishable pattern, the city is more easily navigated by people. In this way, the city itself can provide wayfinding to the user without the need for signs. Legibility is highly correlated with the urban design quality of coherence (Ewing and Clemente 2013). The ability to identify a landmark or a particular path allows the person walking to orient themselves in space and navigate to their destination. A distinguishable street pattern, such as a grid, is easier to navigate than an irregular street pattern of differing block lengths (Ewing and Clemente 2013). The street grid can also be boring and predictable – leaving little possibility of chance or discovery. Shortening sightlines with pleasant obstructions in the street grid can enhance a sense of arrival and interest in a place (Krier 2009). Landmarks, signage, and street names help distinguish one block from another and, over time, people can build a mental map of a place based on orientation points that they recognize (Ewing and Clemente 2013, Sim 2019). The development of a mental map can make a place feel more comfortable to a person and connect with the public space and the people they share it with (Sim 2019).

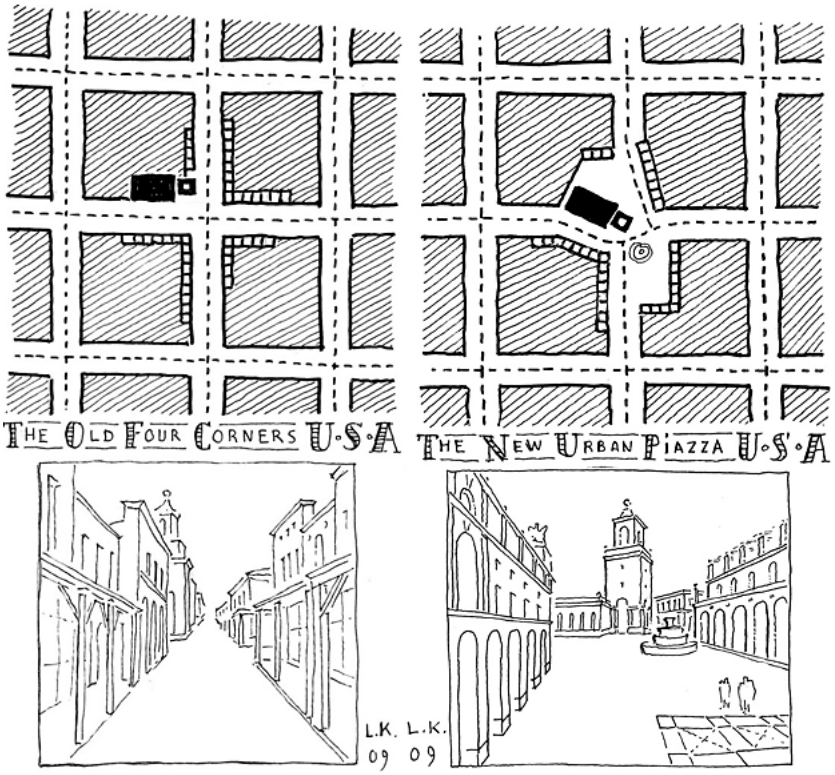


Figure 33. Street Grid or an Urban Piazza. (Leon Krier, 2009)

Linkage

Linkage is the term used for the connectedness of buildings, streets, public spaces, and other urban design elements. The most distinguishable linkage quality is the relationship between path and node and can be identified by block sizes. Urban design professionals have recommendations for block lengths and sizes that promote linkage ranging from 300ft (Jacobs 1993) to 600 ft (Duany et. al. 2000). While smaller block sizes may influence greater connectivity, studies have shown that other factors such as distance between destinations and plot sizes within the block structure also influence walkability (Sevtsuk et.al. 2016, Haynie 2017). Building frontage and street trees are elements that, when ordered in a coherent way, can provide linkage along a path (Ewing and Clemente 2013). Continuous sidewalks can also create linkage by removing curb-cuts and allowing the pedestrian unfettered mobility on their journey (Sim 2019). When designing an urban environment to promote linkage, it is important to consider

pedestrian safety at road crossings to encourage the flow of pedestrian movement unimpeded by traffic.

Figure 34. Continuous Sidewalk (Raised Crosswalk) Along Massachusetts Ave., Cambridge, MA (Source: Google Maps)

Takeaways

Livability can be achieved by activating and enhancing multiple modes of transportation at a regional scale. Designing TOD neighborhoods along a transit corridor with urban design qualities that enhance walkability can create a livable region. The topics covered in the Literature Review inform elements to be included in design recommendations and policy recommendations that enhance the planning of station areas and multifamily housing in MBTA Communities.

Chapter 5

Livability Analysis of Study Area

I have conducted a livability analysis of the Andover Station area to understand the urban design qualities of the neighborhood and to inform design and policy recommendations. A deep understanding of the existing conditions allows for greater reasoning in why certain design elements should be considered for future improvements to the neighborhood.

Natural Systems

Shawsheen River and Rodger's Brook

The Shawsheen River runs 26.7 miles from its headwaters at Hanscomb Military Base in Devens to the south to the confluence at the Merrimack River in Lawrence to the north. According to the State of Massachusetts report on Total Maximum Daily Loads of Bacteria for the Shawsheen River Basin, "Water quality data collected in the watershed show that bacteria concentrations routinely exceed the State water quality standard" (Commonwealth of Massachusetts 2002, 1). Many point sources for bacteria enter the Shawsheen, including stormwater runoff. The report states "Urban stormwater runoff appears to be a significant wet weather source of bacteria not only to the Shawsheen River, but also to its tributaries" (Commonwealth of Massachusetts 2002, 50).

Access to the Shawsheen River is limited to Red Spring Road, at a point outside the study area. Land uses along the river within the study area limit public access. On the northside of Essex, Henry's Automotive shop occupies the river front. On the southside of Essex, Dundee Park and a small multifamily residential building occupy the riverfront.

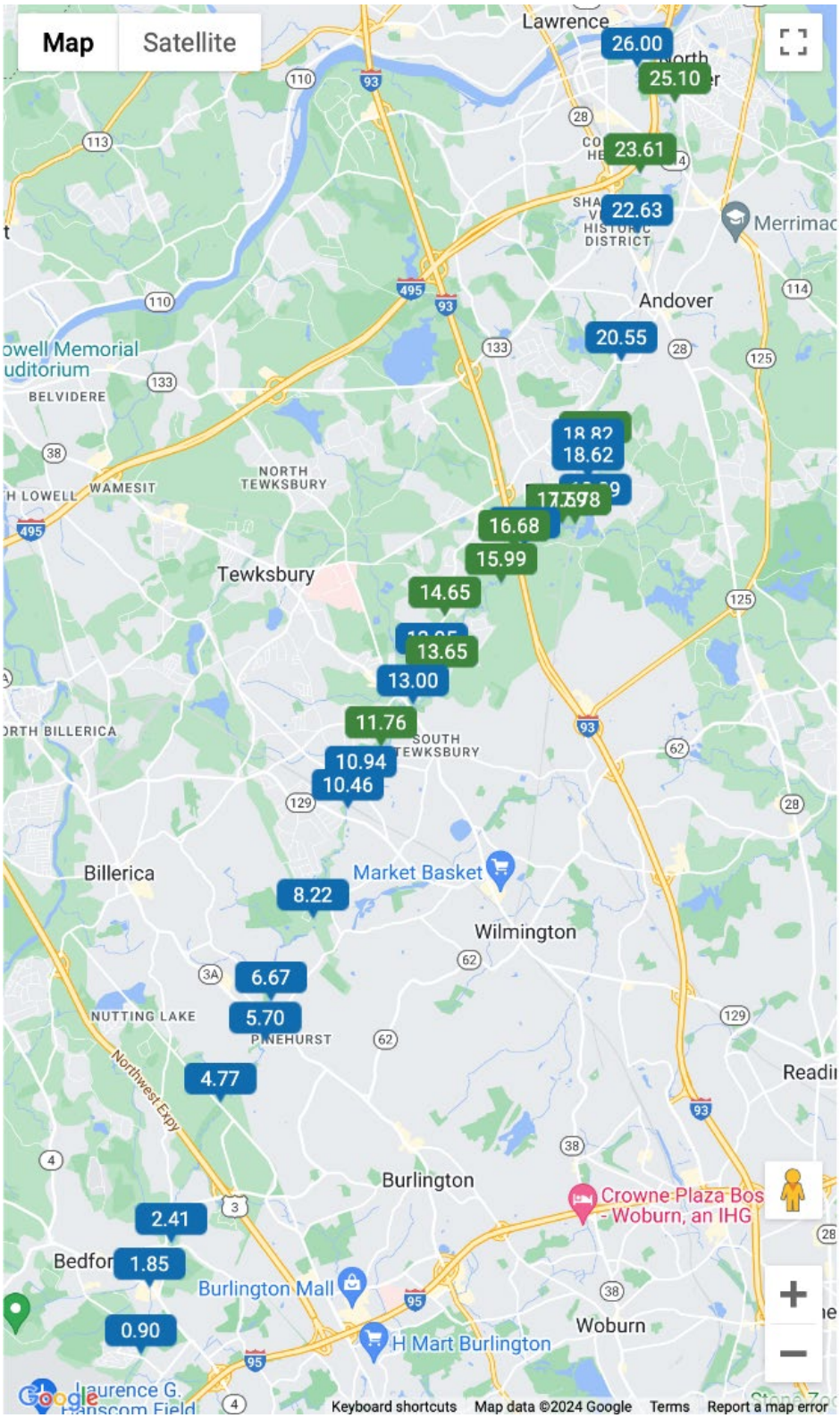


Figure 35. Map of Shawsheen River from Headwaters in Devens, MA to Confluence with the Merrimack River in Lawrence MA. (Shawsheen River Watershed Association 2024 – https://shawsheenriver.net/the-shawsheen-river/online-map/).

Topography

The study area slopes from 157.14’ at the intersection of Essex and Main down to 40’ at the edge of the Shawsheen River at the Essex Street Bridge. The slope suggests a natural drainage pathway for stormwater which presents an opportunity for green infrastructure to capture and treat stormwater before it enters the river. The steep grade up Essex can impact how easily people can move around, especially those with mobility issues. The grade may also influence a person’s willingness to bike with a traditional bicycle – an e-bike would be a preferrable mode to reduce the expenditure of human energy. The variation in elevation can create opportunities for scenic vistas or sightlines, particularly from higher points within the study area, such as from the open space to the east of the Old Train Depot. Topography can influence the layout and density of buildings, streets, and open spaces. Steeper areas might see less intensive development due to the challenges and costs associated with construction on sloped land.

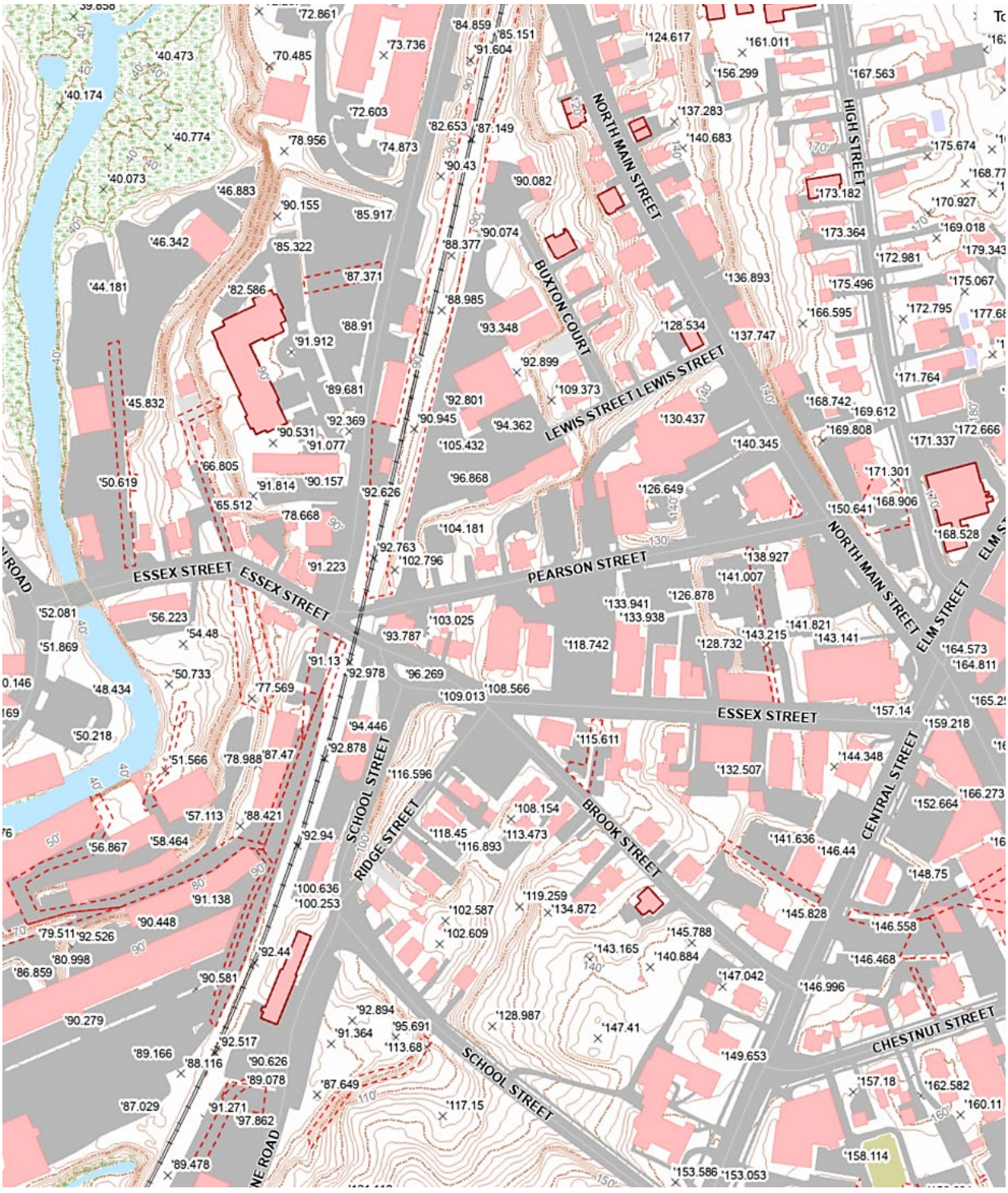


Figure 36. Topographic Map of the Andover Station Area (Andover MiMap 2024)

Flood Map

One-hundred-year flood areas are limited to land directly along the Shawsheen River presenting opportunities for flood capture along the banks of the river. Rodger's Brook presents a considerable area of land vulnerable to a 500-year flood.

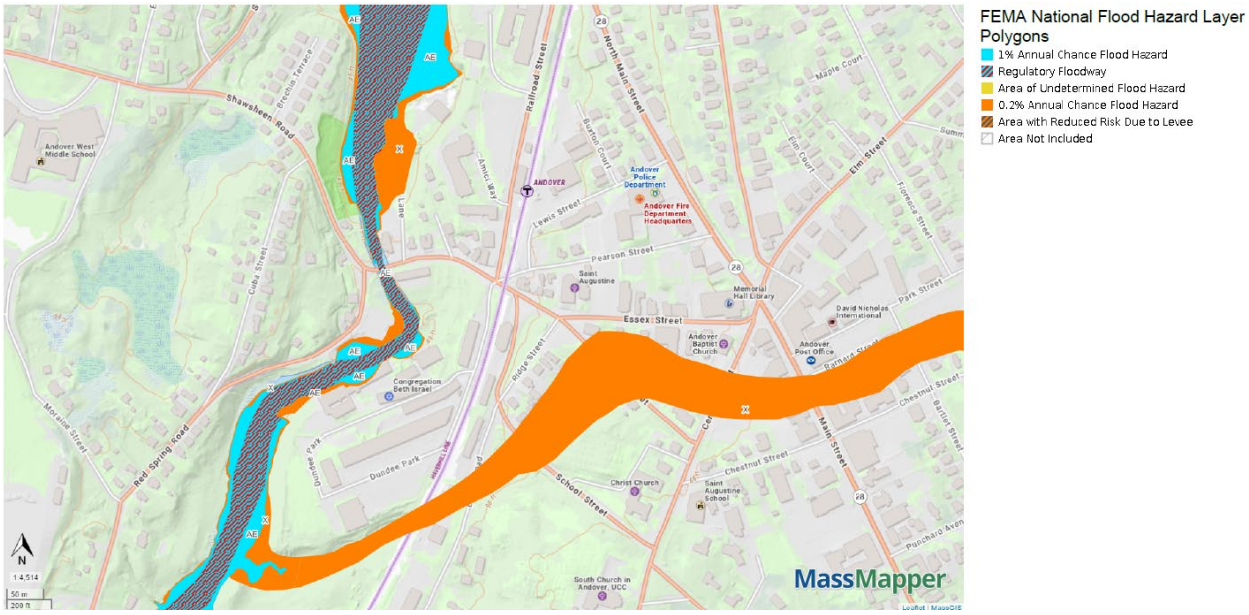


Figure 37. Andover Flood Map. (MassMapper).

Climate

Andover experiences a humid continental climate characterized by cold, snowy winters and warm, humid summers. From 2000-2023, average temperatures in the winter range from 30 to 36 degrees and in the summer, temperatures range from 59 to 74 degrees. The average annual precipitation is 44 inches and projected to increase by as much as 18% above 1971-2000 baseline to 52 inches by the end of the century. Historically, flooding has been the greatest climate risk to Andover. Two major flooding events – in 2006 and 2010 – displaced residents and businesses. In the coming years, heat risks are predicted to increase as Andover and the region are expected to experience between 28 and 46 days with temperatures above 90 degrees each year.

Figure 38. Children Canoeing in their Flooded Backyard During the Mother's Day Flood at 54 Summer Street in downtown Andover. (Source: Eagle Tribune, 2016)

History of Andover's Station Area

Though there is little archeological evidence of indigenous communities along the Shawsheen, "there is a high degree of probability that Indigenous people settled in areas along the Shawsheen river for access to sustenance, fishing, travel, land for agriculture and residence, and woodlands for gathering and hunting" (Clemente 2022, 3). It is written that an Indigenous man named Rodger, of Rodger's Brook and Rodger's Dell, lived on four acres along the river with his families. The Shawsheen river was home to many of the first European families who settled in Andover and lived among indigenous communities.

The Shawsheen was crucial in the development of the first saw, grist, and cider mills in Andover in the 17th century. Mills were so vital to the economy that communities would offer millwrights free land to build a mill. In the 18th century, more mills sprang up along the Shawsheen River producing fulling, paper, and gun powder. Dams and waterways were constructed to give mill owners power over the flow of water and to create mill ponds that served as reservoirs during dry times. As waterpower gave way to coal power, the mill ponds constructed to run the earlier mills were repurposed for recreational uses. Mineral springs, such as Red Spring, that flowed into the river became destinations for people to spend leisure time.

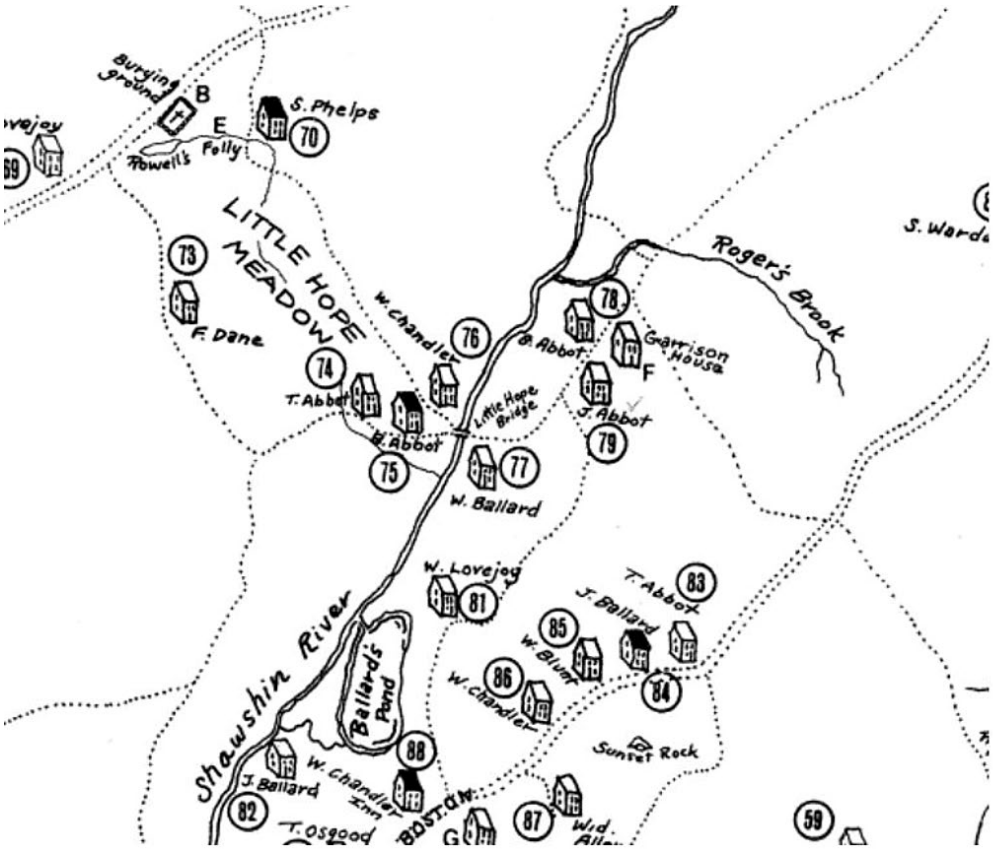


Figure 39. Map of Households Along the Shawsheen River (Source: Andover Historical Society, 2022)

In the 19th century, industrial mills continued to be established along the river and began to have negative impacts on the waterways. At the same time, bicycling, ice skating, and canoeing became popular activities during the industrial period for people who had more leisure time and as the activities offered them freedom of movement.

Smith and Dove Manufacturing opened in 1835 where Dundee Park is now. Housing, recreational areas, places of worship, educational facilities, and the Memorial Hall Library were all built with the support of Smith and Dove. The area that became known as Abbot Village was a complete neighborhood with multifamily housing, small stores, and a daycare facility for working mothers. Abbot Village was "... a convenient place to live and raise a family, and most

workers walked to their jobs. The village remained a vibrant neighborhood until 1927 when the Smith & Dove Mills closed" (Batchelder 2011)

Figure 40. Smith and Dove Mill in Abbot Village, Now Dundee Park (Source: Andover Historical Society)

In the 20th Century, mills began to close and other land uses started to take their place. The Tyer Rubber Company factory built a steam-powered factory along Railroad Street producing a range of rubber-based products, from overshoes to car tires. Tyer was eventually sold to the Converse Rubber Shoe Company, which continued to make footwear. In 1981, Converse sold the building, and it was then converted into housing, which is known as "Andover Commons" today. The Andover station area has developed over a hundred-year period. As such, there are remnants of the town's industrial past mixed into its present suburban development.

Figure 41. Tyer Rubber Factor on Railroad Street, Now Andover Commons (Source: Andover Historical Society)

Andover Train Station Existing Conditions

Because of this historical legacy, a mix of uses is found in the station area, including civic buildings, retail, offices, and low- and high-density residential buildings. There are many public and private surface parking lots in addition to on-street parking. The tree canopy is sparse in some places, but abundant in others. Natural amenities, such as the Shawsheen River, are hidden and not easily accessible.

The Andover Station Platform is inconveniently located as people must walk a tenth of a mile from the entrance at 15 Railroad north to the platform. People arriving at the station from North Main often cut through an informal, more direct path to the platform across from Andover Commons. The informal path is steep and wooded, so users must duck under branches and step over tree roots before reaching a small opening in the fence to access the platform.

Figure 42. Informal Entrance to the Andover Station Platform. (Tony Collins).

At the entrance to the station, there is a covered seating area, a bus pull-in, and covered bike racks. A sidewalk leads from the platform south towards the Essex Street intersection, but there is no northbound sidewalk on Railroad Street. To head north, there is a crosswalk at the entrance to the southbound side of Railroad Street.

Figure 43. Crosswalk from southbound to northbound side of Railroad to the Andover Station Platform. (Tony Collins).

As people exit the train and walk down the platform towards the entrance, they are greeted by a fence along the backs of buildings as the buildings are oriented towards Railroad Street. On the opposite side of the tracks is the site of the former Department of Public Works yard, otherwise known as the Old Town Yard. The Old Town Yard consists of industrial buildings and a parking lot for the heavy machinery used for maintenance of public spaces.

The building at the entrance to the platform was originally built as a freight shed and weighing station in 1890. It is now a commercial building with three retail and office spaces . The northern end of the building is home to a Japanese restaurant that has been there since 2002, a law office occupies the middle space, and the southernmost space is unoccupied.

Figure 44. Old Freight Building with visible cutout of where freight cars would enter to be repaired. (Tony Collins).

Railroad Street

Railroad Street is lined with a mix of large-scale apartment buildings and smaller scale retail, office, and professional services. At the intersection of Railroad Street and North Main Street, sit a Whole Foods Market and a small retail center home to about 10 businesses. The MBTA surface parking lot on the southbound side of Railroad Street occupies a quarter of the street (388 feet of the total 1628 feet). Given the large amount of space taken up by the parking lot and since the average building setback is 21 feet, the street wall along Railroad occupies only 22% of the sidewalk. Along the streetwall, 47% of building facades are transparent. The width of the street, including sidewalks, is 36.5 feet. The width from the edge of the sidewalk to the center line is 20 feet. The average height of the buildings along the street is 33 feet, bringing the

building height to road width ratio to 1.65:1. The ideal building-height-to-street-width ratio, when street width is from façade to fade, is 1:3 (USGBC 2009).

Figure 45. View Down Railroad with Old Freight Building on the Right and the MBTA Parking Lot on the Left. (Tony Collins)

The sidewalk on the northbound side of the street runs from the intersection at Essex to the station platform entrance (about 368 feet). The sidewalk on the southbound side of the street runs the entire length of the street. The sidewalk is an average of five feet wide, has granite curbing, and the pavement conditions are excellent. The sidewalk material changes from pavement to concrete at curb cuts and along the MBTA parking lot. There is no buffer between the sidewalk and the street and the tree canopy only covers 4% of the sidewalk. The presence of hedges, planters, and flower boxes is infrequent – appearing every 117 feet. The breaks in the sidewalk from curb cuts at the entrances of the parking areas total 343 feet or 17% of the length of the street. A particularly large break in the sidewalk of about 150 feet starts at the entrance to

the office building at Amici Way, continues south for the length of the parking lot of the convenience store, and further continues through the entrance to the parking lot of the laundry mat to the south of the convenience store.

Figure 46. Missing Sidewalk on Railroad from Amici Way Through the Laundry Mat Parking Lot. (Tony Collins).

The street has few curves and long sightlines making it feel natural for drivers to pick up speed as they move along the street. Railroad is also one block for the entire 1,628-foot length of the street. There is no posted speed limit, so the statutory speed limit is 25 mph. Because there is little to separate pedestrians from cars, it often feels like people are traveling much faster. As experienced throughout the street network within the study area, pedestrians feel exposed when they traverse breaks in the sidewalk or attempt to cross the street. The lack of streetwall, tree canopy, and human scale elements makes the pedestrian feel out of place. The absence of bike

infrastructure along the street adds to the feeling of discomfort of the person walking since people biking have been observed using the sidewalk, competing for space with people walking.

Figure 47. Long Sightline Along Railroad Street. (Tony Collins).

Essex Street

Essex Street is the main corridor that people choose to walk from the downtown district to the station area. The gateway to Essex is marked with prominent landmarks on both sides of the street. The Memorial Hall Library on the north side of the street opened in 1873 and is a destination for residents. On the south side of the street, Andover Baptist Church is a 200-year-old building with an ornate steeple is a landmark that can be seen from a great distance. The proximity of Essex Street to the complex intersection of Main, Elm, and Central streets requires

a pedestrian walking from Central onto Essex to be on high alert for drivers whose attention is stretched thin by competing variables as they navigate the intersection.

Figure 48. First Baptist Church – a Landmark at the Gateway to Essex. (Tony Collins).

Like Railroad Street, Essex Street is lined with a mix of residential and commercial uses. Smaller scale, multifamily houses and smaller lot sizes give the street a human scale. There are a variety of businesses, including a bike shop, hair salon, and pizza shop that attract people to the street. Essex Street is a one-way street heading westbound towards the railroad tracks, away from Main Street until the intersection of Brook Street, at which point it becomes a two-way street.

Essex is a long street, the longest in the study area, running about 1,680 feet. Sidewalks line both sides of the street for its entire length, but with significant breaks that take away about

29% of the total sidewalk length (911 feet of breaks of the 3,135 feet of sidewalk). The St. Augustine's parking lot takes away approximately 140 feet of the sidewalk, and the School Street Y-intersection takes away another 123 feet. Further west towards the Shawsheen River, Henry's Automotive and adjacent properties account for about a 140-foot break in the sidewalk.

Figure 49. View of St. Augustine's Parking Lot from the Opposite Sidewalk on Essex. (Tony Collins).

Essex has wider sidewalks than other streets in the study area, averaging 8.75 feet. The condition of the sidewalks is good, but there are several areas that would be problematic for persons with disabilities or people who have trouble walking. There are granite curbs throughout, and the sidewalk material is mostly pavement with concrete used at the curb cuts. No buffers separate the sidewalk from travel lanes, except for on-street parking along the eastern end of the street closest to Main. Several mature trees along the street provide a tree canopy that covers 9% of the total sidewalk. Hedges, planters, and flower boxes are present every 58 feet on average.

Bike parking is available in two locations at the library with 10 inverted U or hitch style bike racks.

The streetwall is present along 26% of the sidewalk and 40% of the streetwall is transparent. During the study period, the building at 15-19 Essex was torn down due to fire damage, which contributes to the low percentage of streetwall. The average setback of the buildings is only 12 feet, just above the threshold of 10 feet to be included as part of the streetwall. A completely different feeling greets the pedestrian along Essex Street before and after the St. Augustine parking lot. Before the parking lot, the presence of on-street parking as a buffer, the little plaza outside the library, and the streetwall make the walk feel pleasant. Once the pedestrian reaches the parking lot, a feeling of exposure to cars becomes very apparent. At this point there is less on-street parking, more undefined street width, and a series of awkward intersections and interactions with people driving.

The average building height along Essex is 35 feet – with buildings as low as 16 feet and as high as 90 feet. The street is 50 feet wide and 25 feet from the back of the sidewalk to the centerline, bringing the building-height-to-street-width ratio to 1.4:1.

Pearson Street

Pearson Street is not a significant path for pedestrians as there are no retail businesses along the street and people are less likely to walk along North Main Street to get to the station area because of the high-volume, fast-moving traffic along the road. Along the street are mostly small-scale residential properties and parking lots. Pearson Street serves as the entrance to the Andover Public Safety Center parking lots and the exit of the Memorial Hall Library parking lot.

It is the planned entrance to the future development of the Old Town Yard Site and may become a path for people walking and biking to access the public space planned for the development.

Pearson Street runs 870 feet from the intersection of North Main Street to the intersection of Essex and Railroad. There are sidewalks on both sides of the street, but because of the abundance of parking lots, 29% of the total sidewalk is taken away by breaks and curb cuts. The St. Augustine's parking lot runs through the block between Essex and Pearson streets taking away an additional 127 feet of sidewalk on Pearson.

Sidewalks are an average of six feet wide, and their conditions are good with problematic areas concentrated at the breaks. Overgrown vegetation near the entrance to the Old Town Yard site makes navigating the sidewalk difficult in that area. The material is mostly concrete with granite curbing along the westbound side of the street adjacent to the Public Safety Center. On the eastbound side of the street, the sidewalk is constructed with pavement and granite curbing.

Figure 50. View East on Pearson Toward Main. (Tony Collins).

Pearson Street has the greatest tree canopy of all the streets in the study area with 25% of the sidewalk covered. Several trees are planted along the Public Safety Center and on the westbound side of the street closer to the railroad tracks. Hedges, planters, and flower boxes are present every 86.5 feet on average. An attractive stone retaining wall supports the library parking lot. There is a short section of the westbound sidewalk that has a buffer of more than two feet contributing to 10% of the total sidewalk with a buffer.

Although the average setback of the buildings is 11 feet, only seven buildings contribute to 13% of streetwall along the sidewalk. Only 19% of the streetwall is transparent, due to the residential use of most buildings. The average height of the buildings is 32 feet, and the average width of the street is 44.3 feet. An average of22 feet from the back of the curb to the centerline brings the building-height-to-street-width ratio to 1.45:1.

Brook Street

Brook Street is a residential street on the edge of the station area. It is mostly a mix of small-scale single and multifamily homes with a small playground owned by Christ Church at the westernmost end of the street and a realty office at the corner of Brook and Main. A one-way street, it is used as the route to access Central Street for people driving east from Lupine, Essex, Railroad, and streets further west.

Figure 51. View West on Brook Street Toward St. Augustine's Church. (Tony Collins).

Brook Street runs 759 feet from Central Street to the intersection of Essex and Ridge streets. Sidewalks line both sides of the street, but because of 10 driveways along the street and a 151-foot break to accommodate the overflow parking for St. Augustine's Church, breaks and curb cuts reduce 24% of the total sidewalk.

The sidewalks average 5.5 feet wide and are in excellent condition. The sidewalk material is mostly pavement with granite curbs. The sidewalk material switches to concrete at curb cuts. No buffer separates the sidewalk from the street, except for on-street parking along the north side of the street.

A few mature trees along the street contribute to 14% of the sidewalk being covered by the tree canopy. The households along the street keep nicely planted flower beds and hedges which are present every 36.6 feet on average.

Since Brook is a residential street with homes set back an average of 14 feet, the streetwall is only present for 19% of the street. The average height of houses along the street is 30.25 feet. The street is 34 feet wide in total and 17 feet wide from the back of curb to center line bringing the building-height-to-street-width ratio to 1.78:1.

School Street

School Street was not assessed in as great of detail as the other streets in the study area because only a short segment of the street was included. However, there are significant elements to point out throughout School Street that impact the livability of the station area. Most notable is that the street features the Old Train Depot which is set back about 100 feet from the corner of School and Essex streets. The historic building was built in 1906 and could be a landmark but is underused and the land uses surrounding it are car-oriented. There is no sidewalk along the southbound side of the road leading up to the Old Train Depot. On the north side of the road there is a 5-foot pavement sidewalk with granite curbing buffered by on-street parking.

Figure 52. View North on School Street Toward the Intersection with Essex, with the Old Train Depot on the left. (Tony Collins).

Figure 53. Old Train Depot, 1906 (Source: Andover Center of History and Culture: https://preservation.mhl.org/100-school-street)

The streetwall is limited to two buildings along this segment of School Street. The building to the south of the Old Train Depot is a small-scale, 1.5 story industrial building currently occupied by a small engine repair business. The Old Train Depot houses a small office space for a professional service business. On the northbound side of the street, a wooded area slopes from Ridge towards School streets and along the sidewalk on School Street is a stone retaining wall.

Ridge Street

Ridge Street was not assessed in detail because of the purely residential nature of the street. Ridge is a narrow street, 17-feet wide, with a deteriorating sidewalk on the northbound side and on-street parking on the southbound side. A parking lot at the corner of Ridge and Brook streets, with a capacity of about 35 cars, serves as overflow parking for St. Augustine's Church.

Intersection of Essex, Railroad, and Pearson

The intersection of Railroad, Essex, and Pearson streets is extremely uncomfortable to navigate for all modes of transportation. A person crossing from the southbound to the northbound side of Railroad Street faces eight conflict points at the crosswalk. The sidewalk at the crosswalk is less than five feet and narrows to four feet at the apex of the corner. The feeling of exposure for the pedestrian is greatest at this point as there is no protection from traffic. As a person faces the intersection, there is a short wall to their back, railroad tracks and pavement ahead, no street trees or buffer along the sidewalk, and average annual daily traffic volumes of up to 9,000 vehicles coming from the surrounding streets. The driveway for Dundee Park adds to the number of variables for people navigating the intersection. The corners of the intersection are not significant, though there is a restaurant at the point where Essex and Pearson streets meet the railroad tracks.

Figure 54. View of the Essex, Railroad, and Pearson Intersection Looking East on the Eastbound Side of Essex. (Tony Collins).

Intersection of School and Essex

The intersection of School and Essex streets is only 70 feet to the east of the intersection of Essex, Railroad, and Pearson streets. The same discomfort for people using any mode of transportation in the previous intersection continues through this intersection. The intersection feels unnecessarily wide as it splits to allow people driving with an uninhibited right-turn from School to Essex streets and a wide right turning radius from Essex to School streets. The median at the intersection removes the sidewalk for 278 feet if one were to walk along the edge of Essex Street and 123 feet if one were to deviate their direction of travel onto School Street. There are no significant corners, and structures feel pulled away from the intersection to allow sightlines that may ease the discomfort of people driving through the intersection. When driving or biking on School Street to the station platform, one must be aware of the all the potential movements

others on the road are making as they take a left turn then an immediate right onto Railroad Street. As a pedestrian, one would prefer to be on the southbound side of School Street to cross Essex Street just west of the railroad tracks – although this is not ideal as the sidewalk gives way to a parking area adjacent to the Old Train Depot.

Figure 55. View of the School and Essex Intersection Looking West on the Westbound Side of Essex. (Tony Collins).

Intersection of Brook, Essex, and Ridge

The intersection of Brook, Essex, and Ridge streets is only 100 feet from the intersection of School and Essex streets. This is a less complicated intersection than the two intersections to the west. Ridge Street has a lower volume of drivers, is less than 20 feet wide, and has on-street parking which helps to slow down cars. On the northbound side of Brook Street, the sidewalk is so deteriorated that people prefer to walk in the street, as was observed during this study. Brook

Street is one-way heading east and routes people to Central Street. Essex Street becomes a one-way route at the intersection for people traveling west from Central Street. There are two crosswalks, one crossing Brook and one crossing Essex at the apex of the Y-intersection.

For people walking from the station platform to Central Street, this intersection has two conflict points for people crossing Essex and three conflict points for people crossing Brook. It has shorter crossing distances than previously traversed intersections on their journey. The environment does not feel pedestrian friendly, but it does not feel as hostile as the intersections to the west. There are no significant corner buildings or public spaces that invite people to take part in daily public life. There is, however, observable public life taking place outside St. Augustine's Church on days of worship.

Figure 56. View of the Brook, Ridge, and Essex Intersection Looking West from the Apex of the Intersection. (Tony Collins).

Outdoor Public Spaces

The station area is limited to three significant public spaces for people to gather. Each space serves a different purpose and varies in how frequently they are used.

Memorial Hall Library has a small patio outside the west entrance to the building adjacent to the library parking lot and between Essex and Pearson streets. This space serves as an outdoor workspace, a place to bring lunch to eat outside, and as a place for outdoor programming by the library. The patio features public art, moveable furniture surrounded by planters, and a long bench by the stairs. The stairs are also seating for children during outdoor reading activities, such as stories on the steps.

Roger's Dell is at the apex of the Lupine Road and School Street intersection. It is a small, wooded area with two benches, that abuts the South Church Cemetery. This space has never been observed to be in use during this study but offers a place for respite and passive connection with nature. Invasive species have overgrown the land on the site, and community members have advocated for a cleanup of Roger's Dell.

Figure 57. Roger's Dell. (Tony Collins).

The playground at South Church is small at 1,505 square feet (about half the area of a tennis court) but is often used by young families in the neighborhood to play or when attending the farmers' market held on the church's adjoining parking lot on Saturdays from May to October.

Livability Analysis Table

Using the Connect Explorer GIS application and its measuring tools, I was able to measure the urban form elements that are present in walkable and livable neighborhoods. I measured each element in the table by each street in the study area. I then measured the public spaces and counted the parking spaces, number of public seating, and public spaces, to analyze the space dedicated to cars and people.

Table 7. Livibility Analysis by Street.

Streets		**Railroad**	**Essex**	**Pearson**	**Brook**
	length of street	1628	1680	870	759
	width of street	36.5	50	44	34
	length of sidewalk	1996	3135	1740	1518
Sidewalks					
percent of street	Both sides	23%	100%	100	100
percent of street	No Sidewalk	0%	0	0	0
average width (feet)	Width	5	8.75	6	5.5
0 (poor) – 3 (excellent)	sidewalk quality	3	2	2	3
percent of sidewalk	curb cuts or breaks in sidewalk	17%	29%	29	24%
0 (no curb) – 3 (granite)	curb material	3	3	3	3
percent of sidewalk with at least 2 foot buffer	buffer	0	0	10%	0
0 (pavement) -	sidewalk material	2	2	2	2
Landscaping					
% of sidewalk with	Tree canopy	4%	9%	25%	14%
frequency of (feet)	Hedges, planters, flower boxes	117	58.8	86.5	36.6
Bike Infrastructure					
total number	Bike Parking	13	10	0	0
Buildings					
within 10 feet of sidewalk	Street Wall	22%	26	13%	19%
Percent of Façade	Awnings/Overhangs	2%	0	0	0
Average Height	Height	33	35	32	36.6
Average Ratio of Height to Road Width	Ratio of Height to Road Width	2:1	1.4:1	1.45:1	1.78:1
Percent of building façade	Transparent	47%	40%	19%	20%
Average Setback	Average Setback	21	12	11	14

People Orientation		Total	Per Resident
area (sq ft per res)	Car Space: People	106874	104.6
area (sq ft per res)	Total Public Space	3108	3.0
total res/total parking spaces	Residential Units : Parking Spaces	1057:393	2.7:1
Parking Spaces per res		1057	1.034

Public Spaces		Total SQ Feet	Per Resident
area (sq ft per res)	Public Plaza	1603	1.57
area (sq ft per res)	Public parks	0	0.00
area (sq ft per res)	Public play space	1505	1.47
area (sq ft per res)	Public Gardens	0	0.00
Number of Seats per res	Public Seating	34	0.03
Housing			
Gross residential density Station Area	Residential Units	393	
Total number of people (Dux2.6)	Population	1022	

Site Livability Analysis Takeaways

The station area was not scored for design elements that were missing, such as pedestrian oriented lighting, awnings or overhangs on buildings, wayfinding, or green stormwater infrastructure. These elements exist in other districts in Andover and, if added, would enhance the livability of the station area.

Lack of Density

There is not enough housing in the study area to support transit services with 15-minute headways or a robust local retail economy. The lack of people walking, biking, and milling about the station area makes it feel uncomfortable and uninviting. Increasing building heights to between 5 and 6 stories along Essex Street would allow greater residential density and create a building-height-to-street-width ratio that is closer to 1:3. Allowing more people to live in the station area would create a customer base for local businesses and boost the workforce for regional employees. Increasing density to an average of 15 dwelling units per gross acre is consistent with MBTA Communities legislation and would enhance the livability of the station area.

Allowing taller buildings in the station area would enhance the sense of enclosure for pedestrians and allow layering of uses within the buildings. Currently, there is very little mix of uses within buildings and little variation of building typology in the station area. Essex and Pearson streets present opportunities for development of taller buildings with mixed use components which is a significant factor when creating a livable, transit-oriented neighborhood.

Too Much Parking

The Andover Station Area livability analysis presents opportunities to improve public spaces and plan for future development that enhances the neighborhood feel for residents. The streets lack basic safety elements that would improve the experience of people walking through the district. Reducing the number of sidewalks that are broken up by curb cuts for driveways and parking lots would greatly enhance the feeling of safety and comfort for people walking. Parking lots also reduce the streetwall and create a feeling of exposure for people walking along the sidewalk. The abundance of surface parking lots presents opportunities for greyfield development (previously developed and obsolete or underused sites) that adds coherence to the street and reinforces the streetwall.

The St. Augustine's parking lot presents a great opportunity for development that would reduce the feeling of exposure by creating a continuous streetwall and sidewalk along the development. Although working with the Roman Catholic Church can present obstacles, the long-range vision for the station area must address the missing tooth that the parking lot presents. The Memorial Hall Library parking lot and Andover Public Safety overflow parking lot also present opportunities for development that would create a coherent streetscape along Pearson. Replacing surface parking with housing may seem inconceivable to some who believe there is currently not enough parking, but activating street life along Essex and Pearson streets will create a welcoming environment for people walking between downtown and the station area.

Complex Intersections

The intersections in the study area make walking or biking to or from the station an uncomfortable experience. The complexity of the intersections force drivers to pay attention to many variables in movement patterns. The lack of pedestrian and bicycle activity may cause drivers to have less concern for people outside of vehicles because they are not expecting to see anyone walking. Reducing the crossing distance and conflict points at each intersection would greatly enhance safety for people walking. Creating separation between intersections to make the intersections feel less like one continuous intersection would create a more navigable environment for all road users.

The intersection of Essex, Pearson, and Railroad streets is a confluence of streets that seems to encourage movements that endanger all road users. Eliminating Pearson from the intersection would create a simplified pattern of movements and allow freer movement of people driving east on Essex. While reducing the complexity of the intersection may reduce conflict points for pedestrians, the intersection design must also slow the speed of drivers .

The approach of School Street at its intersection with Essex Street is unnecessarily wide and eliminates the sidewalk for a greater distance than necessary. Narrowing the School Street approach to one lane in each direction would shorten the crossing distance for pedestrians, pull the intersection further east away from the Railroad and Essex intersection, and open the potential for an activating the corners of the intersection.

The Y-intersection at Brook and Essex streets presents opportunities to create a T-intersection and open opportunities for public space. The wide turning radii for people driving from Essex onto Brook streets allows for faster speeds than are appropriate for the station area.

Creating a T-intersection would slow turning movements and create a safer crossing for people walking east on Essex.

The Town of Andover has received grant funding to reconstruct Essex Street and its intersections. The concept plan calls for dead-ending Pearson with a roundabout that would lead to the future development of the Old Town Yard site. There would be a path for pedestrians to continue across the railroad tracks to Railroad. The plan also calls for narrowing the approach from School onto Essex streets. The plan would add non-protected bike lanes throughout the corridor with sharrows in certain segments. Overall, while the concept plan rationalizes the intersections, a lot more could be done to create a people-oriented streetscape.

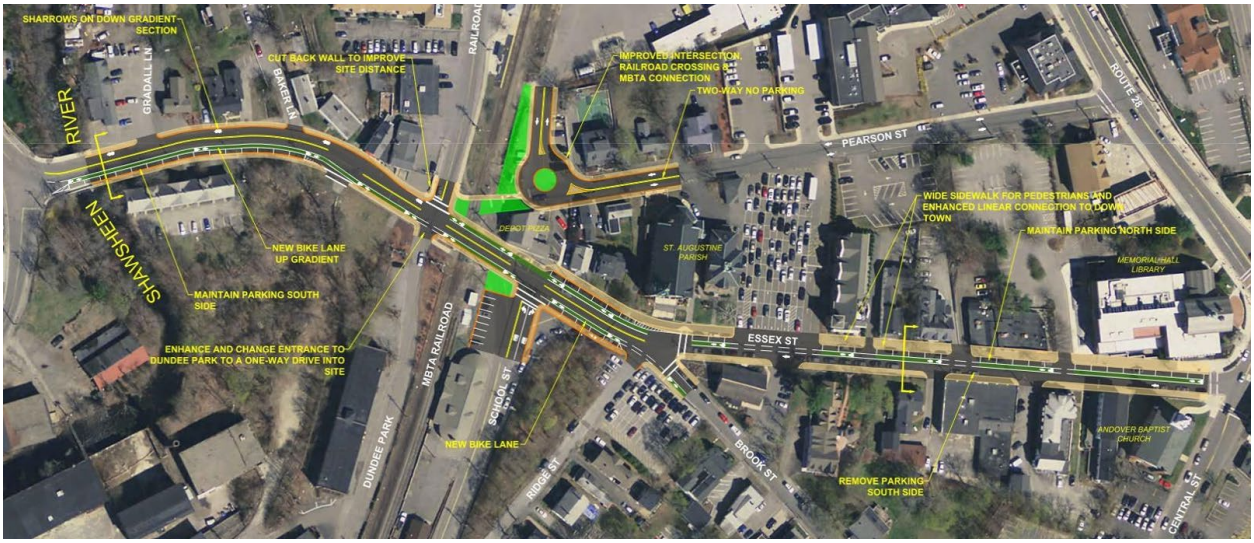


Figure 58. Concept of Essex Street Corridor Improvement Project. (Town of Andover, 2023).

Uncomfortable Intersections

Creating an environment that reduces the strain on drivers' attention span may induce more careless driving. To ensure that drivers are paying attention, street design must encourage slow speeds and prioritize the movement of vulnerable road users. Reducing travel lane width and turning radii at intersections will force drivers to slow down as they move through the study

area. Creating spaces for people walking that are separate from people driving is key to inviting people to walk. The design speed of all the streets should be slow enough for people biking to feel comfortable taking the middle of the travel lane with cars present. If the design speed of the streets within the study area was 10-15 miles an hour, the crash risk would be 5% and the fatality risk reduced to 2% (NACTO 2024). Low risk rates allow for freer movement of people and the creation of spaces that are welcoming to people outside of cars.

Figure 59. View of Driver at 10-15 MPH with Risk Factors. (NACTO 2024).

Public Spaces

The two public spaces in the station area serve a valuable purpose to people in the community. Small public spaces should be created throughout the station area to provide places for people to gather, stop and rest, or engage in activities. Currently, there are very few places to sit and little space which would accommodate street furniture in a comfortable manner. As streets are narrowed, intersections are simplified, and parking lots are developed, public spaces should be carved out and carefully planned to accommodate multiple uses and a variety of users.

Lack of Human Scale Elements

The station area is missing key urban design elements that create a comfortable and interesting environment for people walking, biking, and spending time in the area. The lack of shade may detract people from visiting the area on sunny days since a low percentage of sidewalk is covered by the street tree canopy. The lack of tree canopy also adds to the feeling of exposure for people outside of cars. Trees and other landscaping elements are critical to creating welcoming, attractive, and livable environments. Pedestrian-oriented lighting is also missing from the station area which creates an unsafe environment for people walking at night. Ornate and interesting elements such as lighting or public art would make the station area more interesting. The Memorial Hall Library patio features public art, plantings, and moveable furniture – all of which help create a sense of place. If the elements that are featured in the library's space were disseminated throughout the station area, more people would feel welcome to walk and mill about the area.

The Andover Station Area could have better connectivity within the district and to surrounding districts. There are edges that could be made more permeable to enhance connectivity within the district and to the downtown district.

Chapter 6

Recommendations

The recommendations in this chapter are based on the findings from the literature review, policy review, livability analysis, and the takeaways from each section. The recommendations are responsive to planning for and designing a livable station area in MBTA Communities.

Design Recommendations

Design is the visual interpretation of the policies set by policy makers. Visuals are an important factor when telling the story of how policy can influence the livability of a community. With visuals, policy makers can translate the desires of the community into recognizable elements. Depicting policies in various ways can draw a different audience and emotions from the public. Some people feel as though they are visual learners and understand concepts when shown rather than told. At the same time, people may have liked what they read, but not what they saw. Inviting people who understand policy in a visual form and providing a new perspective can add another dimension to policy making. This is an important step to building consensus around a potential policy. The ability to provide the public with visual representations of community goals can render a more refined decision-making process. The *Andover Comprehensive Plan* achieves that goal with the many graphic elements in the document. My recommendations seek to build upon the work done in the comprehensive plan and define its vision at the station area level.

Following the policies set by the Town of Andover's *Comprehensive Plan* and in response to the State's MBTA Communities legislation, I developed recommendations for improving the

livability of the station area using the criteria for shaping walkable, livable, transit-oriented neighborhoods with high quality urban design. I identified six big ideas that capture the desires of the community outlined in the community engagement portion of the comprehensive plan, follow the goals and strategies outlined in the plan, and incorporate elements defined in the literature. The big ideas also seek to improve the built environment's impact on standards for livability as identified in the livability analysis. The town has set zoning bylaws that allow for greater density, and if the town complies with the MBTA Communities legislation, even greater capacity for housing will be granted. The big ideas take into consideration the potential for greater residential and employment density as development occurs.

1. Pedestrian Pathways
2. Unlocking Historic Buildings
3. Active Corners
4. Multipurpose Public Spaces
5. Andover Station Mobility Hub
6. Riverfront Sponge Park

Pedestrian Pathways

I recommend using the abundance of parking lots in the study area as infill development opportunities and in doing so carving out a path between existing buildings and new developments for pedestrian pathways that connect the existing street network. As seen in Figure 52, the pedestrian pathways would open opportunities to enhance existing public spaces such as the patio at the Memorial Hall Library and improve access to planned public spaces such as the development at the Old Town Yard Site.

Figure 60. Recommended Site Plan Concept Design. (Source: Tony Collins)

Legend:

1. Memorial Hall Library
2. Old Town Yard
3. Andover Station Platform
4. Old Train Depot

Unlocking Historic Buildings

I recommend designing public spaces and infill development that calls attention to historic buildings, such as the Old Train Depot that would add imageability to the study area. The Old Train Depot is an important building for identifying the neighborhood as transit oriented.

Multipurpose Public Spaces

The study area lacks public space and has many sites that present opportunities for the creation of small public spaces that would enhance the livability of the neighborhood. I recommend treating the streets as public spaces by designing traffic calmed streets so that cars travel at a maximum of 10 to 15 mph. This design speed would allow people walking and biking to feel comfortable moving in the middle of the street. Traffic calming elements such as chicanes and curb extensions are opportunities to incorporate rain gardens or bioswales to treat stormwater. The small public spaces in between buildings can be used by the public or by retail for outdoor dining.

Figure 61. Unlocking Historic Buildings with Infill Development and Small Multipurpose Public Spaces. (Source: Tony Collins)

Active Corners

Creating active corners with infill development and public spaces at intersections in the existing street network and the recommended pedestrian pathways will add complexity, linkage, and additional opportunities to engage people as they walk through the study area.

Figure 62. Designing Active Corners with Infill Development along Pedestrian Pathways. (Source: Tony Collins)

Andover Station Mobility Hub

I recommend making the Andover Station a mobility hub. To accommodate multiple modes of transportation, I recommend installing both a bikeshare and car share, and providing information for using transit. The mobility hub would allow people arriving and boarding transit to connect to destinations in a more seamless fashion. Wayfinding signs and maps should be included to share information with people unfamiliar with navigating the area.

Riverfront Sponge Park

The riverfront park recommended in the Historic Mill District Design Guidelines and the *Comprehensive Plan* should incorporate natural elements that treat stormwater and reduce the risk of erosion. Creating a sponge park would prioritize giving land back to nature in a way that enhances the sustainability of the station area. Boardwalks should open access to interact with nature and allow public access to the river for recreational purposes.

Policy Recommendations

Andover Neighborhood Plans

Planning at the neighborhood level would allow municipalities to engage with residents in a more intimate and direct way. Cities with larger budgets for their planning departments can conduct neighborhood plans that incorporate a more defined vision and set of goals and strategies that seek to meet the needs of residents and the future of the community. Andover has established a strong comprehensive plan that should be built upon at the neighborhood level. There are many actions that the town can take to work towards the vision outlined in the comprehensive plan, but the town should also continue to refine the plan with more detail. A neighborhood level plan would allow residents to define what the vision for the town means within walking distance of their home. A granular approach to planning can spur action because the community has defined what it wants to see. The visual representation of policy moves the needle closer to implementing changes to the built environment or programming spaces in the neighborhood. In Andover, neighborhood plans for Ballardvale, Shawsheen Village, and Downtown would generate revitalization through investment in priority projects outlined in the neighborhood plans.

Form Based Codes

Neighborhood planning should also inform the development of form-based codes for the historic neighborhoods in Andover. Form-based codes would better enable the town to develop land use policies that depict the vision for the public realm and shape that development takes than standard Euclidean zoning. Rather than regulating what uses take place in the building, a form-based code regulates the building envelope and the public spaces surrounding the building. Images and graphics bolster the policies expressed in form-based code allowing developers to submit permit applications with a fuller understanding of what is allowed by right. Codes that are informed by neighborhood plans and graphically translate the vision, goals, and strategies of the plan should allow for greater consensus for future development and less public opposition.

Regional Planning

Municipalities in the Merrimack Valley do not have large planning staff. Andover is one of the best-staffed planning departments with five planners and an administrative assistant. The town has a Director of Land Use and Planning, a Senior Planner, a Planner, an Associate Planner, and a Director of Business, Arts, and Cultural Development. . Compliance with the MBTA Communities legislation has occupied staff and consultant technical assistance. Passing zoning changes at Town Meeting is a challenge for communities across the commonwealth and proves that there is room for increasing the capacity of municipal planning departments. The Regional Planning Agency, Merrimack Valley Planning Commission, should support communities by offering a neighborhood planning program for regionally significant activity nodes. The service would be a joint effort between all four of the existing programs, Transportation, Community and Economic Development, Environmental, and Geographic Information Systems (GIS), as well as a newly minted Urban Design Program. The five programmatic areas of MVPC would be well

suited to conduct neighborhood plans using the Metropolitan Planning Organization's (MPO) Planning Level (PL) funds to advance the goals outlined in the Metropolitan Transportation Plan (MTP), Comprehensive Economic Development Strategy (CEDS), the Hazard Mitigation Plan (HMP), and local comprehensive plans.

The neighborhood level plans developed by MVPC would enable the MPO to identify regionally significant projects that would create destinations that are accessible and welcome people arriving by multiple modes of transportation. The MPO should adjust their Transportation Evaluation Criteria (TEC) to promote a Transportation Improvement Program (TIP) that prioritizes projects that enhance the livability of activity nodes, especially around transit stations. MVPC staff regularly provides technical assistance for grant writing upon request by communities. MVPC should alter its grant writing policies to focus on regionally significant projects that align with regional plans and come out of the neighborhood planning program. Targeted grant writing for design and engineering work on public space projects would reduce staff capacity barriers for municipalities seeking TIP funding or other state and federal aid. MVPC would be able to provide a regional livability lens and identify connections between activity nodes by way of transit or active transportation corridors. This perspective would elevate the livability of all communities by making regional destinations accessible by modes of transportation other than driving.

State Policies

The MBTA Communities law is not transit-oriented development legislation, which became clearer as the state promoted its objective to remove barriers to building more housing. The state should revisit its compliance requirements regarding mixed-use development around transit stations as more housing is built. A key component to encouraging transit ridership is

employment density around transit stations (CRCOG 2016, Calthorpe 1993, Dittmar and Olhand 2014). As residential development is built, zoning should be revisited to accommodate demand for greater retail. Currently the law states that "Mixed use projects may be allowed as of right in a multi-family zoning district, as long as multi-family housing is separately allowed as of right" (EOHLC 2023). As the state monitors housing supply creation, it should also monitor commercial development around transit to assess whether further zoning requirements must be made to support transit-oriented development.

While many municipal planners and urban planning professionals agree that the state needed to strengthen their role in the removal of exclusionary zoning policies at the municipal level, their mandate created a lot of work for understaffed municipal departments. The state provided funding for technical assistance to comply with the MBTA Communities Legislation, which helped MVPC support many communities in the region. The state should continue to provide technical assistance funding at greater levels and continue to motivate communities to change zoning.

One way that the state could motivate communities to change zoning is to better fund the Shared Streets and Spaces grant program and limit the grant program to projects implemented within a district compliant with MBTA Communities zoning. The Shared Streets and Spaces grant program funds projects that improve "plazas, sidewalks, curbs, streets, bus stops, parking areas, and other public spaces in support of public health, safe mobility, and strengthened commerce" (MassDOT 2024). The maximum grant awards are $250,000, which is enough funding for small scale projects. If the grant program were able to fund projects of up to $500,000, medium scale projects could be funded, leaving larger scale projects targeted for federal aid. The grant program is aligned with creating livable neighborhoods and would be even

more so if it were administered with a focus on increasing residential density and mixed-use and transit-oriented development.

The MBTA should work with MassDOT, MPOs, RPAs, and municipalities to develop design standards for their commuter rail stations. As seen at Andover Station, there are many improvements that could be made to MBTA property to improve the livability of the station area. Improving the station as well as funding service improvements to the commuter rail lines for greater frequency would encourage greater ridership, which in turn would benefit the MBTA. A goal should be set to provide 15-minute headways for interregional service and 30-minute headways for service to Boston regardless of time of day. Studies should be done to assess the funding required for establishing Electric Multiple Unit (EMU) trains, which are the standard for high-speed service.

Conclusion

The design and policy recommendations are responsive to the findings from the livability analysis, policy review, and literature review completed as part of this thesis. To create a livable neighborhood that accommodates greater housing density, greater attention should be paid to the urban design quality of the station area. The MBTA Communities Legislation is a housing production policy that enables municipalities to plan for livable communities. Municipal capacity is a barrier to completing requisite planning efforts to design livable neighborhoods that comply with the law. Regional and state governments can provide support in the effort to enhance the multifamily-zoned neighborhoods to meet needs beyond housing production.

Study Limitations

Time constraints and availability limitations prevented me from working on other data collection aspects such as people moving counts, activity mapping, and other tasks that would have complemented and enriched the livability analysis. The methodology was limiting in its accuracy for building heights since the tool has not been used for building height measurement in any case studies. While the results are telling for where there are issues, such as missing sidewalks, there is a need to compare the data with other urban environments. The results will serve as a good baseline for analyzing progress in enhancing the built environment but may not translate immediately to reasonable design decisions. More data, such as the pedestrian experience, will be needed to understand the impact of the livability analysis.

Areas for Future Study

Livability is achieved by creating opportunities for people to enjoy a satisfying level of quality of life for themselves and those they care about (Appleyard 2023). This cannot be accomplished at the neighborhood level alone and requires coordination along regional transportation corridors such as an active transportation network or transit line. I would like to see a Merrimack Valley regional study of the station areas along the Haverhill MBTA Commuter Rail to assess livability and provide recommendations for improving access to regional destinations. Taking a regional approach to the work included in this thesis will unlock a path forward for achieving high livability standards for residents across the Merrimack Valley. The regional process and results would inform many suburban communities in Massachusetts and in other states.

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