

# Balancing People, Place and the Automobile: Recommendations for the Redesign of Belmont's Trapelo Road

by  
William J. Carry

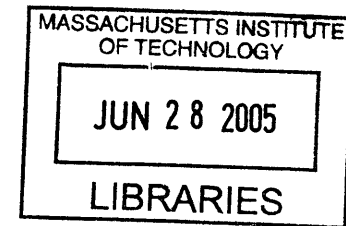
A.B. in Public Policy  
Princeton University  
Princeton, New Jersey

Submitted to the Department of Urban Studies and Planning  
in partial fulfillment of the requirements for the degree of


Master in City Planning

at the


Massachusetts Institute of Technology  
June 2005



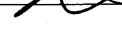
Signature of Author: \_\_\_\_\_

  
William J. Carry  
May 17, 2005  
Department of Urban Studies and Planning

Certified by: \_\_\_\_\_

  
Adjunct Associate Professor Terry S. Szold  
Department of Urban Studies and Planning  
Thesis Advisor

Accepted by: \_\_\_\_\_

  
Professor Dennis Frenchman  
Department of Urban Studies and Planning  
Chair, MCP Committee

© 2005 William J. Carry. All Rights Reserved.  
The author hereby grants to MIT permission to reproduce and to distribute publicly  
paper and electronic copies of this thesis document in whole or in part.

**ROTCH**



# Balancing People, Place and the Automobile: Recommendations for the Redesign of Belmont's Trapelo Road

by  
William J. Carry

Submitted to the Department of Urban Studies and Planning in partial fulfillment  
of the requirements for the degree of Master in City Planning  
at the Massachusetts Institute of Technology June 2005

## **Abstract**

This thesis presents a case study of the planning process for the redesign of Trapelo Road in Belmont, Massachusetts, a Boston suburb. The case is an on-going planning controversy that deals with a number of key issues facing inner-ring suburbs: the impact of sprawl development on older commercial areas, the difficulties inherent in encouraging alternate modes of transportation in the suburban context, and the challenge of addressing regional forces on the local level. Within the Belmont community, there is considerable conflict over the redesign of the Trapelo corridor. On one side are advocates of narrowing the road to two lanes who see Trapelo as an opportunity to create a neighborhood "Main Street" with an enhanced sense of place. On the other side are advocates of maintaining the road in its current four-lane configuration who see the corridor as an important artery for local and regional traffic and are most concerned with traffic congestion.

The thesis endeavors to learn from and inform the Trapelo Road planning debate and to answer the following research question: on suburban roads such as Trapelo, to what extent does there exist a trade-off between improving the pedestrian environment and neighborhood character, and preserving road capacity and traffic flow? In other words, is the redesign of Trapelo Road a zero-sum game? The promise of smart growth and new urbanism is that more balanced approaches to street design and transportation planning can benefit everyone, including drivers, pedestrians, bicyclists, and local business owners. The thesis examines the Trapelo corridor through three lenses: the regional context, the neighborhood context, and at the intersection level. The analysis indicates that Trapelo redesign does entail real trade-offs between congestion reduction, and pedestrian safety and neighborhood character. However, narrowing the road would impose fewer costs than turning Trapelo into a major suburban arterial.





---

# Acknowledgements

I would like to thank: my advisor, Terry Szold, and my reader, Mikel Murga, for their help in giving me feedback and guidance throughout this project; the public officials and community members who offered their time, insights, and assistance, especially Andy McClurg of the Belmont Planning Board and Mary Jo Frisoli of Belmont's Traffic Advisory Committee; the Belmont residents who provided feedback on Trapelo Road through the practicum class's public meetings; my father, Peter Carry, for diligently copy editing the final draft; my sister, Jessie Carry Saunders, for providing the nifty chapter heading pictures; and my mother, Virginia Carry, for moral support.



---

# Table of Contents

Chapter 1: Introduction .....	9
Chapter 2: Literature Review .....	17
Chapter 3: Existing Conditions .....	25
Chapter 4: Redesign Options .....	48
Chapter 5: Conclusion .....	64
Bibliography .....	71



---

# Chapter 1: Introduction

In the fall of 2004, I participated in a workshop that focused on the Belmont Street-Trapelo Road corridor in Belmont, Massachusetts, an inner ring suburb a few miles from Boston. The corridor is a suburban two- to four-lane road that passes through several commercial and residential areas. A local community group had taken an interest in redeveloping and redefining the road, and asked our class to come up with ideas and implementation strategies to make Trapelo a more pedestrian friendly, economically vibrant, and aesthetically inviting place. Our class held two public meetings, met with public officials, and talked to residents. Through this process it became clear that the future of Trapelo Road was a contentious issue in Belmont and residents had conflicting ideas about how the corridor should be redeveloped. Some envisioned a traffic-calmed and pedestrian-oriented “Main Street” that would become a community destination, while others saw a four-lane arterial road that would support traffic-dependent businesses and prevent congestion.

Overall, residents expressed trepidation over the prospect of change on Trapelo Road. Perhaps the most divisive issue was the redesign of the thoroughfare, including the number of lanes the road should have, how much space, if any, should be redistributed to pedestrians and bicyclists, and whether the redesign should employ traffic calming measures.

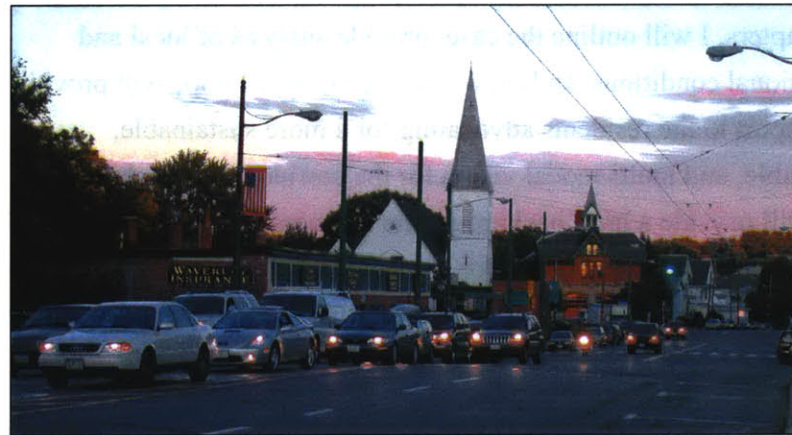


Image: Looking east on Trapelo from Waverly Square

I was intrigued by the intensity of the debate over the future of the Trapelo Road-Belmont Street corridor. The case is an on-going planning controversy that deals with a number of key issues facing inner-ring suburbs: the impact of sprawl development on local streets and older commercial areas, the difficulties inherent in encouraging alternate modes of transportation in the suburban context, the challenge of addressing regional forces on the local level, and the barriers to approaching street design from outside the traditional capacity-

oriented focus of transportation planning. With this rich mix of issues, I decided to use my thesis as an opportunity to explore the case of the Trapelo planning process, with a focus on street design and its impact on quality of life and travel behavior.<sup>1</sup> I also wanted to examine to what degree there were trade-offs between road capacity and auto mobility on the one hand, and suburban livability and environmental quality on the other. In the coming chapters, I will outline the case, provide analysis of local and regional conditions, and draw conclusions that I hope will provide support to the residents advocating for a more sustainable, livable, and multi-modal vision for the corridor. In this chapter, I will provide a brief background on Belmont and the Trapelo Road-Belmont Street corridor (henceforth referred to as “the Trapelo corridor”), present my research question, and outline my methodology.

**Background: Belmont and the Trapelo Road Corridor**

Trapelo Road is one of a handful of main roads in Belmont, Massachusetts, an affluent bedroom community of 24,000 people seven miles from downtown Boston.<sup>2</sup> Belmont underwent most of its development in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries and was a classic streetcar suburb, served by several trolley lines and commuter rail service. In many ways, Belmont embodies the design principles of the new urbanist movement, with a picturesque town center, attractive homes with garages in the rear, walkable streets, and a traditional street grid. Despite extensive

development in the surrounding municipalities, including Boston, Cambridge, and Waltham, Belmont has maintained its quiet residential character. Belmont now finds itself wedged between the high-density growth of Boston and Cambridge to the east, and the low-density sprawl development of Waltham and Lexington to the west. In some ways, the Trapelo corridor represents this growing tension between local identity and regional pressures. The chart below highlights key demographic and community characteristics of Belmont.

Chart: Belmont Community Profile<sup>3</sup>

<b>Belmont Characteristics</b>	
Population	24,194
Total Area	4.71 square miles
Residential Density	3.3 units per acre
Percent Open Space	17.3%
Median Household Income	\$80,295
Percent Non-White Population	8.5%
Median Home Value	\$450,000

Historically, the Trapelo corridor was a model of multi-modal street design. Until the 1950’s, the corridor carried a streetcar line, which provided access to the local shopping areas, Harvard Square in Cambridge, and commuter rail service at Waverly Square. Beyond Waverly Square, where the streetcar terminated, the road became a two lane rural route through more sparsely-populated Waltham and Lincoln. The increasing dominance of the automobile in the post-war era, however, has changed the balance. In the 1950s, the streetcar was removed



and replaced by bus service, effectively widening the road from two to four lanes in most sections. Beyond Waverly, Trapelo is now lined by residential subdivisions and new condominium complexes. The junction with Route 128 in Lincoln is home to numerous office parks and warehouse facilities, most inaccessible

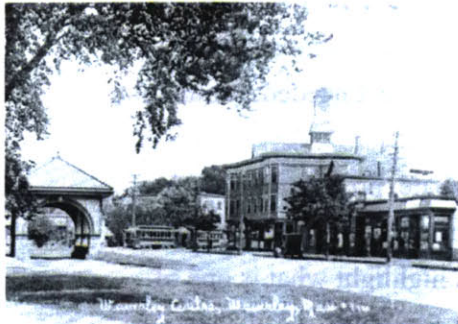


Image: Waverly Square circa 1910<sup>4</sup>



Image: Trapelo streetcar circa 1910<sup>5</sup>

by transit. Local retail on Trapelo has declined in the face of new competition from strip centers and shopping malls, such as the Alewife shopping area and Burlington Mall, which provide more parking, larger stores, and national chains.

Today the Trapelo corridor is defined by the constant rumble of car traffic, rather than the clatter of streetcars, and lacks a distinct identity or sense of place. Part typical Main Street, part car-oriented shopping strip, and part arterial route, Trapelo has become

not much of a place at all. When the streetcar was removed, the road was simply striped down the middle for two lanes but is still wide enough to carry four lanes of traffic. This created a somewhat chaotic and ad hoc configuration, making the street dangerous for drivers and pedestrians alike. Due to the high speed

of traffic, poor pedestrian amenities, and the difficulty of crossing the road, Trapelo is unsuccessful as a pedestrian-oriented Main Street. With shops and parking facilities built to the standards of the 1920's, it cannot compete with newer suburban shopping areas. Its main commercial centers, including Waverly Square, Cushing Square, and Harvard Lawn, are continuing to lose their relevance, customers, and neighborhood character. New development also threatens to put more cars on the road, thus further eroding the area's appeal to pedestrians and transit users, who must walk through the area to access bus and rail service.

That said, Trapelo retains substantial assets that could be leveraged to turn the corridor into a much more inviting, dynamic, and attractive place. Despite its historical economic decline, Trapelo is still home to a number of vibrant businesses.



Image: Retail shops in Cushing Sq.



Image: Trapelo looking west near Palfry Sq.



Image: Triple deckers near Hawthorne St.

---

The Shaws supermarket in Waverly Square and the new CVS Pharmacy in Palfry Square draw a considerable number of shoppers to the area, and the corridor also has an eclectic mix of independent businesses. Although the wide four lane road dominates the streetscape, sections of Trapelo include attractive historical buildings that would fit nicely into any New England village center. The town recently invested in a new fire station that should spruce up one the road's most drab stretches. The streetcar may be gone, but the corridor is served by frequent trolley-bus service to Harvard Square in Cambridge and connects with MBTA commuter rail service at Waverly Square. The corridor is surrounded by residential streets and dotted with some multi-family homes, providing a pool of potential shoppers and visitors who are within easy walking distance of the area. As compared to most generic suburban shopping strips, the Trapelo corridor has much more potential for becoming a unique destination.

### **Thesis Question**

The heart of the debate over Trapelo Road centers on how local residents differ in their view of the corridor's current function and its future. On one side are advocates of narrowing the road and taming the traffic; they see Trapelo as an opportunity to create a new urbanist "Main Street" with an expanded pedestrian environment, new mixed-use development, and an enhanced sense of place. These residents believe the road is

overly dominated by auto traffic, dangerous to pedestrians, and uninviting to visitors. On the other side are advocates of maintaining the road in its current configuration; they see the corridor as an important artery for local and regional traffic, are concerned with traffic congestion and adequate parking, and believe that narrowing the road would be bad for local businesses. These residents believe that the road is functioning as it should and that any improvements, if they are in fact needed, should not reduce the corridor's vehicle capacity.

This characterization of the debate, provided by a town official, is admittedly simplified, and there are people between these two extremes. It does, however, highlight what is one of the most contentious issues regarding Trapelo Road: whether or not the street redesign, including road width, lane configuration, pedestrian amenities, and traffic calming measures, should favor the needs of pedestrians or of automobiles. Each side in the debate has its predictions of what will happen if the pedestrian camp wins. Opponents of the pedestrian position argue that narrowing the road and expanding traffic calming measures will produce a traffic nightmare and doom auto-dependant businesses, while advocates counter that an expanded and enhanced pedestrian environment will foster economic vibrancy and a sense of place. In this context, the controversy over the road is framed as a zero-sum game: either the pedestrians and urban environment win and the drivers and businesses lose, or vice versa.

I plan to use my thesis as an opportunity to learn from and



inform the Trapelo Road redesign planning debate. My research question is as follows: *on suburban roads such as Trapelo, to what extent does there exist a trade-off between improving the pedestrian environment and neighborhood character, and preserving road capacity and traffic flow? In other words, is the redesign of Trapelo Road really a zero-sum game?* The promise of smart growth and new urbanism is that more balanced approaches to street design and transportation planning can benefit everyone, including drivers, pedestrians, bicyclists, and local business owners. Applied to Trapelo, these ideas [i.e., smart growth and new urbanism] suggest that significant improvements can be made to the pedestrian environment, neighborhood character, and travel options without significant negative impact on road capacity and congestion. Pedestrian improvements stimulate more walking, the area becomes an attractive and vibrant destination point for the community, and the increase in alternate modes mitigates congestion. But is this in fact the case?

The answer to this question has implications for the potential of implementing multi-modal street designs in suburbs and of overcoming local and institutional opposition to reducing road capacity. As I will discuss at more length in the next chapter, the challenges faced by Belmont are typical of suburbs across the country. The less dramatic the trade-offs in Belmont, the more politically feasible it will be to implement a multi-modal and pedestrian-oriented design on the corridor. Conversely, the more severe the trade-offs, the more difficult the task of implementing

a pedestrian-oriented design, as congestion becomes a cost that town residents must bear in order to enjoy such a design's benefits. If congestion is going to increase and drivers are to be inconvenienced, then how best can the case be made that these costs are acceptable given the less quantifiable benefits of improved community character, pedestrian access, and local environmental quality? I do not endeavor to resolve all these questions; my aim is that this case study will shine some light on these issues and offer some options and solutions for the Trapelo Corridor and beyond.

Given the ambiguity that surrounds the terms "quality of life," "neighborhood character," and "pedestrian environment." I will briefly discuss what I mean by these concepts. By neighborhood character, I am referring to the physical characteristics of the street and their effect on how pedestrians, drivers, and bicyclists experience the area. Do the buildings relate well to each other well and create a distinct identity, as in a place like Davis Square in Somerville, or do clash with each other and fail to create a cohesive streetscape, as in the retail strips on Route 1 north of Boston? Is the area attractive and interesting, and is it a place where residents would want to go for a walk or sit on bench and observe the happenings on the street? Part of neighborhood character is also how an area is perceived by people. Do residents think of Trapelo Road as distinct place, like Newbury Street in Boston, or do they view it more as route to get to other places? Strong neighborhood character can become an asset for local

---

businesses, as shoppers are drawn to the area both for the stores and the ambiance. Harvard Square is bustling retail district due in part to fact that it offers a more interesting and authentic alternative to area shopping centers like the Burlington Mall or the Cambridgeside Galleria.

By pedestrian environment, I refer to the quality of pedestrian facilities, including sidewalks, crosswalks, and public spaces for sitting, the level of safety for pedestrians using the area, and the perception of residents about the area. Is the street a place where residents feel safe walking or letting their children walk? What proportion of the street's area does the average pedestrian feel is usable space? In other words, is most of the space for cars or is there more of a balance between space for motorists and space for pedestrians and bicyclists? The speed and noise of passing traffic can also have an impact on the pedestrian environment. Simply slowing cars down may make pedestrians feel more comfortable and that they have ownership over more space on the street. The pedestrian environment also includes more concrete indicators of pedestrian safety, such as the frequency of pedestrian accidents and fatalities and the ease or difficulty in crossing major intersections. The poor quality of the pedestrian environment on the street can dissuade pedestrians from using the area and deprive local residents of a place to walk and wander, to window shop, or to linger and observe other people.

Overall, I try to limit the use of quality of life, since the

term can mean so many different things to different people. The very debate over Trapelo Road indicates that some residents measure their quality of life by how long it takes to drive to work or to shop, while others are more concerned with the physical attractiveness of their neighborhood. In general, I use quality of life to refer to the bundle of community characteristics, including neighborhood character, local shopping, pedestrian safety, traffic congestion, ambient noise, and pollution, that make a community a more or less pleasant place to live and work.

## **Methodology**

I will present a brief review of the literature, examine the existing conditions on the Trapelo corridor, layout and evaluate the different design and policy alternatives available to the town, and make a recommendation on how the corridor should be redesigned. In addition, I will try to draw conclusions from the case as to the challenges that generally arise when attempting to implement multi-modal street designs in inner-ring suburbs. Chapter 2 includes an overview of the literature on the relationship between road design and travel behavior, pedestrian safety, and the quality of the urban environment. The chapter also includes a brief discussion of the broader relevance of the Trapelo Corridor case.

In Chapter 3, I will analyze current conditions on the Trapelo corridor and present an overview of the road's

configuration and transit service. I will then examine the corridor through three lenses:

1. *The Neighborhood Context:* I will examine the role the corridor plays in the local context and how it used by Belmont residents. What are the current levels of traffic, pedestrian activity, and transit ridership on the corridor? How is the corridor used for shopping and services: do people drive, walk, or bike? I will present a basic modal split for the corridor. This analysis is based on census data related to local travel behavior, ridership data from the Massachusetts Bay Transit Authority (MBTA), interviews with town officials and residents, and observations of current conditions.
2. *The Regional Context:* I will then examine the role the corridor plays in the regional transportation system and how this role may change in the face of new development. Is the corridor a major commuter route? Are there alternate routes or transit alternatives? How will new development, especially in Waltham and Lincoln, effect traffic on Trapelo? This analysis is based on interviews with regional officials, a survey of new development planned for the area, observations of current conditions, and regional traffic data collected by the Central Transportation Planning Staff (CTPS) of the Boston Metropolitan Planning Organization.

3. *Intersection context:* I will also look closely at the working of three intersections: Waverly Square, Cushing Square, and School Street. This analysis will gauge how these intersections are being used (or not being used) by drivers, pedestrians, and bicyclists. What are the points of conflict? How does the current road design impact the character of the area? What are the current levels of traffic, pedestrian activity, and transit ridership? How are these spaces being used? This analysis is based on observation and counts of pedestrian and traffic activity, interviews with public officials and business owners, and feedback from the practicum's public meetings.

At the end of the chapter, I will attempt to draw some conclusions about how the corridor is functioning and the challenges facing Belmont in the Trapelo redesign.

Having analyzed the role the corridor serves regionally and locally in Chapter 4, I will present and evaluate three alternatives for how the street can be redesigned. First, I will begin with a more in-depth discussion of community conflict and describe the planning process that the town has mapped out. I will then present three conceptual design alternatives:

1. *No Change Alternative:* maintaining the road in its current ad hoc two-lane/four-lane configuration and making no substantive modifications to the streetscape.

- 
2. *Congestion Relief Alternative*: configuring the road for four lanes throughout and designing intersections to maximize system efficiency, while investing in some streetscape and pedestrian improvements.
  3. *Multi-Modal Alternative*: configuring the road for two to three lanes and providing enhanced pedestrian and bicycle facilities, while accommodating car and truck traffic.

I will evaluate the impact of each of these alternatives on the character of the corridor and discuss the political constraints on each scenario. I will make recommendations for the corridor as whole and also examine how these recommendations would impact key intersections. Finally, I will discuss the presence or absence of trade-offs between auto mobility on the one hand, and pedestrian accessibility and neighborhood character on the other. In my concluding chapter, I will revisit the conclusions from my study of the existing conditions and of the redesign scenarios, and offer some final thoughts on the Trapelo Corridor redesign and the broader lessons learned from the case.

## Notes

<sup>1</sup> The practicum class produced a report that covered a range of topics, including economic development, land use, open space, and streetscape improvements. This thesis builds on the ideas presented in the report and provides a foundation of analysis. A copy of the report can be downloaded online: <http://web.mit.edu/11.360/www/>

<sup>2</sup> “Belmont Community Profile”, Metropolitan Area Planning Council, March 2004. Online: [http://www.mapc.org/data\\_gis/data\\_files/Profiles2004.pdf](http://www.mapc.org/data_gis/data_files/Profiles2004.pdf)

<sup>3</sup> Ibid, with supplemental data from the 2000 US Census, Summary 3 File, Online: [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)

<sup>4</sup> *Belmont Massachusetts: The Architecture and Development of the Town of Homes*. The Belmont Historic District Commission, 1984. p. 55

<sup>5</sup> Ibid, p. 28

---

# Chapter 2:

## Literature Review

This chapter will explore the relevance of the Trapelo case in the larger policy context, examine the academic literature on the relationship between the physical configuration of streets and travel behavior, and look at evidence on the impact of other road-narrowing projects in the United States.

### Relevance

The issues raised by the debate over Trapelo Road are not unique to Belmont or the Boston region. Like many older inner-ring suburbs in the United States, Belmont is struggling to maintain its identity in the face of sprawl development and rising demands on its transportation infrastructure. Suburbs across the country are increasingly faced with decisions about growth and transportation that involve similar trade-offs between auto mobility on the one hand, and quality of life and environmental sustainability on the other. A growing number of community members, planners, and public officials are beginning to question the

wisdom of the traditional approach to suburban road design, particularly in town centers and older communities.<sup>1</sup> States such as Massachusetts, New Jersey, Oregon, and Washington have begun implementing more flexible guidelines for street design and have broadened the transportation planning process beyond its traditional myopic focus on level of service (LOS) and system efficiency. Other values, including neighborhood character, accessibility for non-motorists, and environmental quality, are being incorporated into the design process.

“Context sensitive design,” “complete streets,” and “road diets” have all become catch phrases in the world of transportation planning.<sup>2</sup>

The Trapelo redesign provides insight into how one community is struggling to balance concerns over pedestrian access and neighborhood character with congestion and road capacity. Although its impact will be relatively small, the decision on how to redesign the Trapelo corridor will be one of many similar decisions made by suburban municipalities in the Boston region and beyond. Cumulatively, these choices will have significant consequences for the future of America’s suburbs. Street design is an important part of the broader planning and transportation issues facing the suburbs, including land use mix, density, economic development, open space, and transit access. Will suburban communities try to change how they function and to address environmental, social, and quality of life concerns? Or will they decide, out of habit or by choice,

---

to continue to promote unsustainable patterns of development and total reliance on the automobile? The design approach that Belmont ultimately chooses will be one small part of the answer to this question.

Belmont is also an interesting case because it is an older suburb that embodies many of the features promoted by new urbanism, including a traditional town center, a classic street grid, extensive pedestrian facilities, and comparatively good access to transit. Inner ring suburbs like Belmont often have higher densities, more transit options, and easier access to the urban core. They also tend to be built on more of a human scale than post-war suburbs, with narrower streets and more village-style retail districts. Unlike residents in newer subdivisions, most folks in Belmont are able to walk to the corner store, local park, or school. Inner ring suburbs also offer greater mobility options to those with limited access to cars, including the elderly, children, and low-income residents. Overall, there is more of an opportunity in these types of communities to realistically promote walking, transit and biking, to improve public spaces, and to reduce dependence on the automobile. Urban planners need to look for niche opportunities to promote sustainable transportation and development patterns. Trapelo Road represents one such opportunity.

But how much of a role does street design actually play in these issues? Much of the above commentary is premised on the assumption that street design has some impact on pedestrian

accessibility and safety, travel behavior and transit usage, and neighborhood character. Street design alone most likely has a small impact on neighborhood conditions and travel behavior. When used in combination with economic development, land use, and transportation policy, however, it can become a much more effective planning tool. The sections below briefly summarize the academic literature on the relationship between modal choice and the physical environment, and also examine more conclusive research on pedestrian safety, a key issue on the corridor. Given the interplay between street design, density, and land use in influencing place and behavior, it is not unexpected that researchers have had difficulty isolating the role that street design plays in creating community and determining how people travel. Finally, I look at the limited research on innovative street design projects from around the country.

### **Travel Behavior and the Urban Environment**

What is the impact of urban form, specifically street pattern and design, on travel behavior, including vehicle miles traveled (VMT), modal choice, number of trips, trip length, and number of walking and transit trips? In order to assess the research on this question, I consulted two comprehensive literature reviews: "Travel and the Built Environment: A Synthesis," a review of more than 50 recent studies by Reid Ewing and Robert Cervero, which categorized the studies it reviewed by area of focus, and *Travel by Design: the influence of urban form on travel*, a review

conducted as part of Marlon Boarnet and Randall Crane's study on the same topic.<sup>3</sup> Boarnet and Crane categorize the studies they reviewed by methodological approach.

Overall, Reid and Cervero are more affirmative on the existence of a relationship between the built form and travel behavior. The bulk of the studies on this issue focus on larger factors, such as density, land use mix, and the transportation network, rather than discreet factors like road design. Reid and Cervero argue that there is convincing evidence that residents in more traditional neighborhoods, like Belmont, walk and use transit more frequently than their counterparts in newer and lower-density subdivisions.<sup>4</sup> There is debate, however, whether this phenomenon is the result of the land use and urban design features of neighborhoods, or of the self-selection of residents. Based on their research, Xinyu Coa and Susan Handy find some evidence that "the connection between the built environment and pedestrian behavior may be more a matter of residential location choice than of travel choice."<sup>5</sup> In other words, folks who prefer to walk or take transit choose neighborhoods with pedestrian amenities and transit access, and folks who prefer to drive chose more auto-oriented neighborhoods. Putting the preference issues aside, Reid and Cervero do find evidence that average trip lengths are generally shorter at locations that are more accessible, have higher densities, or feature mixed uses. These findings indicate that the residents in traditional neighborhood drive less often, drive fewer total miles, walk more, and take transit more often.

Overall, modal choice is most affected by local land use patterns and residential density.<sup>6</sup>

In their review of similar studies, Boarnet and Crane are more cautious in their conclusions, arguing, "Very little is known regarding how the built environment influences travel, and there is little agreement on how to reliably learn more."<sup>7</sup> Overall, the authors are critical of the methodological approach of most studies, arguing that preferences are too often not taken into account as factor, that models are oversimplified, and that not enough attention is paid to non-work trips, which now constitute almost 80 percent of all trips.<sup>8</sup> The authors also point out that advocates of traditional neighborhood design may overlook the unintended consequences of more compact, mixed-use neighborhoods. In presenting data from their own model, Boarnet and Crane argue that reducing the distances between origins and destinations (such as shopping areas and home) may serve to increase auto trips as well as or opposed to walking and transit trips.<sup>9</sup> Overall, the authors say, "It is premature to conclude that at the margin, neighborhood design can be a consistently effective transportation policy tool. But it is also premature to dismiss that possibility that land use does influence travel behavior."<sup>10</sup>

In terms of studies that look more specifically at the impact of road design, both literature reviews find that few studies have been able to make a connection between travel behavior and discreet urban design features. Compared to the numerous studies on land use and density, Cervero and Reid state that there

---

are relatively few studies that test the relationship between urban design features and travel behavior. This research has the greatest bearing on the Trapelo case but offers few conclusions. According to the authors, individual design features, such as sidewalk width or the presence of bike lanes, seldom prove to have a statistically significant impact on indicators of travel behavior. They argue that this not surprising given that any individual change, such as the addition of crosswalk pavers, is not likely to impact travel behavior.<sup>11</sup> Other studies have correlated composite measures, such as “pedestrian quality” and “transit friendliness,” to higher pedestrian and transit modal shares. These indices, however, suffer from subjectivity and a lack of consistency across different studies. The authors draw no firm conclusions and state the need for further research in this emerging area of study.<sup>12</sup> Boarnet and Crane also reach no conclusions, citing two studies on pedestrian access and VMT that provide conflicting results.<sup>13</sup>

In sum, there is evidence from the literature that residents in more compact, pedestrian-oriented, and transit-accessible areas drive less, walk and use transit more, and are generally less reliant on the automobile. There is particularly strong evidence correlating density with transit usage. However, there is far less consensus on the factors, i.e. personal preferences, land use mix, and density, that are producing these patterns of behavior. In any case, there is no evidence that pedestrian amenities, traffic calming, and transit access do not play a role in determining travel behavior. At minimum, I would argue that pedestrian

features are necessary prerequisites for achieving a significant non-auto modal share. In the absence of adequate sidewalks, safe crossing points, or easy access to transit, residents are going to have no choice but to drive. Will the redesign of the Trapelo Corridor, on its own, have a major impact on travel behavior? Based on the existing research, probably not. On the other hand, are pedestrian, transit, and traffic-calming improvements a requisite part of a successful redevelopment plan for the corridor? I would argue yes.

### **Road Design and Pedestrian Safety**

Compared to the literature on travel choice and the urban environment, the literature on the relationship between pedestrian safety and road conditions is much more conclusive. Overall, roads with faster traffic result in more pedestrian accidents. Researchers have found that pedestrian crash rates (i.e., the number of accidents per pedestrian using the street) are primarily the function of traffic speed. One study found that an increase in average vehicle speed from 20 to 30 mph was associated with a 7.6-times increase in the risk of pedestrian accident.<sup>14</sup> Speed also has a dramatic impact on the risk of serious or fatal injury. According to studies of crash data, the risk of physical harm to a pedestrian increases dramatically as the speed of the vehicle involved exceeds 20 miles per hour. The probability of a pedestrian receiving fatal injuries from being hit by vehicle rises from 3.5% at 15 mph, to 37% at 31 mph, and to 83% at 44 mph.<sup>15</sup>



Crossing at un-signalized intersections, which are common on the Trapelo corridor, also becomes more difficult as speeds increase. Research from Maine has demonstrated that the higher the driving speed, the lower the percentage of drivers who stop and yield to pedestrians in these types of crosswalks.<sup>16</sup>

In addition, wider roads are more dangerous for pedestrians than narrower ones. Studies have shown that pedestrian crash risk was reduced when pedestrians crossed two- and three-lane roads, compared to roads with four or more lanes.<sup>17</sup> Overall, research has demonstrated that several measures are effective in improving pedestrian safety, including making roads narrower, installing pedestrian refuge islands, and reducing vehicular speeds.<sup>18</sup> The research on pedestrian safety indicate the choices made on the width of the road and the desired speed of traffic on the Trapelo corridor will have a significant impact on pedestrian safety, a key issue in Belmont. Choosing to convert Trapelo into a four-lane facility, which will allow for increases in speed, will impose costs in terms of accidents and potential pedestrian fatalities. A more in depth discussion of safety conditions on Trapelo will be presented in the next chapter.

In terms of traffic safety, including vehicle-to-vehicle accidents, studies on the impact of road narrowing have yielded more conflicting results. A recent evaluation of the safety impacts of 30 “road diet” projects—roads that were narrowed from four travel lanes to two travel lanes with a center two-way left turn lane—indicated that narrowing produces a modest reduction in

accidents of six percent.<sup>19</sup> Two other studies, however, indicate that four- to three-lane conversion projects can result in more substantial reductions in accidents, ranging from 17% to 62%.<sup>20</sup> In theory, three-lane conversions reduce accident rates, because the three-lane configuration reduces conflict points and improves sight distances for turning and crossing traffic. Three-lane configurations can also slow traffic, because more conservative drivers set the pace. Trapelo, which is crossed by multiple side streets and provides access to frequent residential and commercial driveways, could benefit from a conversion to a three-lane road. At many intersections, as will be discussed later, Trapelo is functioning as a de facto three-lane facility.

### **Street Design and Neighborhood Character**

Numerous studies have been done by architects, urban designers, and city planners on the relationship between street design and the urban environment.<sup>21</sup> This literature is of a different quality than the statistical studies discussed above and usually entails subjective commentary on the nature of places and communities. Case studies of successful urban streets can shed light on the important design elements that are absent or present on the Trapelo corridor. In his study of great streets from across the world, Alan Jacobs identifies a host of qualities that contribute to streets that are vibrant, inviting, and visually interesting.<sup>22</sup> These qualities include:

- Pedestrian amenities: an inviting pedestrian environment that “invites leisurely, safe walking.”
- Shade and sunlight: a design that provides “reasonable protection from the elements, while not trying to avoid or negate the natural environment.”
- Physical definition: “boundaries that communicate where the edges of the street are, that set the street apart.”
- Visual interest: “physical characteristics that help the eyes do what they want to do, must do: move.”
- Architectural consistency: buildings that “get along with each other. They are not the same but they express respect for one another.”
- Good maintenance: “Care of trees, materials, buildings, and all parts of the street make up is essential.”

Trees are also often a key element, helping to provide shade, definition, and visual interest. As the next chapter will demonstrate, many of these features are missing on the Trapelo corridor, helping to contribute the corridor’s placeless feel. In addition, Jacobs admits that design alone is not enough; “it is people and activities,” he says, “more than what is physical and build-able that make the best streets.”<sup>23</sup> As mentioned earlier, in order to be successful, changes in the streetscape along Trapelo must be coordinated with parallel efforts to implement economic development, zoning, and transit policies.

## Precedents

Finally, I reviewed the available research and case studies on suburban road redesign projects in the United States. Although the evidence is anecdotal, road-narrowing projects have been successful on suburban streets similar to Trapelo Road. Dan Burden and Peter Lagerwey examined 18 “road diet” projects, in which a four-lane road was narrowed to two travel lanes with a center two-way left turn lane (TWLTL). These roads, which carried average daily traffic (ADT) ranging from 10,000 to 23,000 before conversion, continued to convey comparable levels of traffic after narrowing, while also providing enhanced facilities for pedestrians and bicyclists.<sup>24</sup> Burden and Lagerwey argue that road diets can be applied to streets that carry 12,000 to 18,000 auto trips per day, similar to the roughly 15,000 vehicles on Trapelo Road.<sup>25</sup>

Other case studies have identified similarly successful projects, including the narrowing of Euclid Avenue in Lexington, Kentucky, which carries more than 20,000 vehicles per day.<sup>26</sup> Like Trapelo Road, Euclid is a busy suburban street that serves local and regional commuters and passes through a hodgepodge of residential and retail shopping areas. Two studies of four- to three-lane road conversions, which combined examined about 20 such projects in the Midwest and on the Pacific Coast, concluded that narrowing can increase road safety for both drivers and pedestrians without serious impacts on level of service.<sup>27</sup> Based on an examination of existing conditions and computer

simulations of key intersections, Keith Knapp et al. conclude that four-lane roads with peak hour volumes of as many as 875 vehicles per hour per direction can be converted to three-lanes without significant increases in traffic congestion.<sup>28</sup> As will be discussed in greater detail in the next chapter, most portions of Trapelo Road handle traffic volumes at or below this range.

In addition, I interviewed Cara Seiderman, a Transportation Program Manager for the City of Cambridge who was involved in the narrowing and redesign of Massachusetts Avenue in Central Square in the early 1990s.<sup>29</sup> Massachusetts Avenue carries about 21,000 vehicles a day, including considerable truck and bus traffic, and is susceptible to minor congestion. According to Seiderman, these counts are roughly the same as they were 10 years ago before the road was narrowed, despite extensive new development and commercial activity in the area. Seiderman believes that policies supporting sustainable transportation, including the narrowing of the road to provide for wider sidewalks, bike lanes, and public spaces, have been key to revitalizing the area. Pedestrian, bike, and transit mode shares have increased, while single occupant vehicles mode share has decreased. The area is more vibrant, and businesses are flourishing. Granted there are significant differences between Massachusetts Avenue and Trapelo Road. However, the Central Square experience demonstrates that road narrowing projects can help diversify modal share and promote the health of local businesses by bringing in more foot traffic.

## Notes

<sup>1</sup> A study by the Voorhees Transportation Policy Institutes “discovered a burgeoning national movement away from strict reliance on highway design templates and toward flexible highway design.” Reid Ewing and Michael King, “Flexible Design of New Jersey’s Main Streets.” The New Jersey Department of Transportation, Trenton New Jersey, undated. p. 1

<sup>2</sup> The Transportation Research Board defines context-sensitive design “as the project development process, including geometric design, that attempts to address safety and efficiency while being responsive to or consistent with, the road’s natural and human environment.” Transportation Research Board, “Context-Sensitive Design Around the Country: Some Examples.” TRB, Transportation Research Circular No. E-C067, July 2004, p. 1.

<sup>3</sup> Ewing, Reid and Cervero, Robert, “Travel and the Built Environment: A Synthesis,” in Transportation Research Record. No. 1780, Transportation Research Board, Washington D.C., 2001. &

Boarnet, Marlon and Crane, Randall, *Travel by Design: the influence of urban form on travel*. Oxford University Press, Oxford, UK, 2001.

<sup>4</sup> Ewing and Cervero, p. 88-89

<sup>5</sup> Xinyu Cao and Susan L. Handy, “The Influence of the Built Environment and Residential Self-Selection on Pedestrian Behavior.” Conference paper presented at the Transportation Research Board 2005 Conference, Washington DC, January 2005, p. 2,

<sup>6</sup> Ewing and Cervero, p. 92

<sup>7</sup> Boarnet and Crane, p. 4

<sup>8</sup> Boarnet and Crane, p. 73

<sup>9</sup> Boarnet and Crane, p. 65-66

<sup>10</sup> Boarnet and Crane, p. 103

<sup>11</sup> Ewing and Cervero, p. 101-102

<sup>12</sup> Ewing and Cervero, p. 106

<sup>13</sup> Boarnet and Crane, p. 49-52

<sup>14</sup> Ewing and King, p. 14

<sup>15</sup> Institute of Transportation Engineers, “ITE Traditional Neighborhood Development: Street Design Guidelines; A Recommended Practice of the Institute of Transportation Engineers.” ITE, Washington D.C., October 1999. p. 18

<sup>16</sup> Per E. Garder, “The impact of speed and other variable on pedestrian safety in Maine,” in *Accident Analysis & Prevention*. No. 36, 2004, p. 536

<sup>17</sup> Federal Highway Administration, “Evaluation of Lane Reduction ‘Road Diet’ Measures and Their Effects on Crashes and Injuries.” FHA, U.S.

---

Department of Transportation, 2002. p. 1

<sup>18</sup> Garder, p. 540

<sup>19</sup> FHA, p. 6

<sup>20</sup> Thomas M. Welch, "The Conversion of Four-Lane Undivided highways to Three-Lane Facilities." Conference Paper presented at Transportation Research Board's Urban Street Symposium, Dallas, TX, June 1999. p. 3-4 & Keith K. Knapp, Karen L. Giese, and Wochil Lee, "Urban Four Lane Undivided to Three-Lane Roadway Conversion Guidelines." Conference Paper presented at the 2003 Mid-Continent Transportation Research Symposium, Ames, IA, August 2003.

<sup>21</sup> See Donald Appleyard (1976), Jan Gehl (1996), and Allan Jacobs (1993).

<sup>22</sup> Alan Jacobs, *Great Streets*. The MIT Press, Cambridge, MA, 1993. p. 272-288

<sup>23</sup> Ibid, p. 303

<sup>24</sup> Dan Burden and Peter Lagerwey, "Road Diets: Fixing the Big Roads." Walkable Communities, Inc. March 1999. p. 8-9

<sup>25</sup> Burden and Lagerwey, p. 3

<sup>26</sup> Transportation Research Board, "Context-Sensitive Design Around the Country: Some Examples." TRB, Transportation Research Circular No. E-C067, July 2004. p. 2

<sup>27</sup> Knapp, Giese, and Lee, 2003.  
Welch, 1999.

<sup>28</sup> Knapp, Giese, and Lee, 2003.

<sup>29</sup> Cara Seiderman, Transportation Program Manager, Cambridge Department of Community Development, telephone interview 9 March, 2005.

---

# Chapter 3: Existing Conditions

This chapter analyzes current conditions on Trapelo Road for all user groups, including drivers, pedestrians, and bicyclists. It also looks at some emerging trends, particularly in the region, and comments on how these forces may impact Trapelo in the future. The chapter begins with a brief overview of the road's route through Belmont and Waltham, a description of the existing land uses and growth patterns, and a review of the transit services available. As outlined in the introduction, the heart of the chapter is focused on examining the corridor through three lenses: the Belmont context, the regional context, and at the intersection level. The chapter will close with a brief discussion of how existing conditions impact trade-offs between auto mobility, and pedestrian accessibility and place-making.

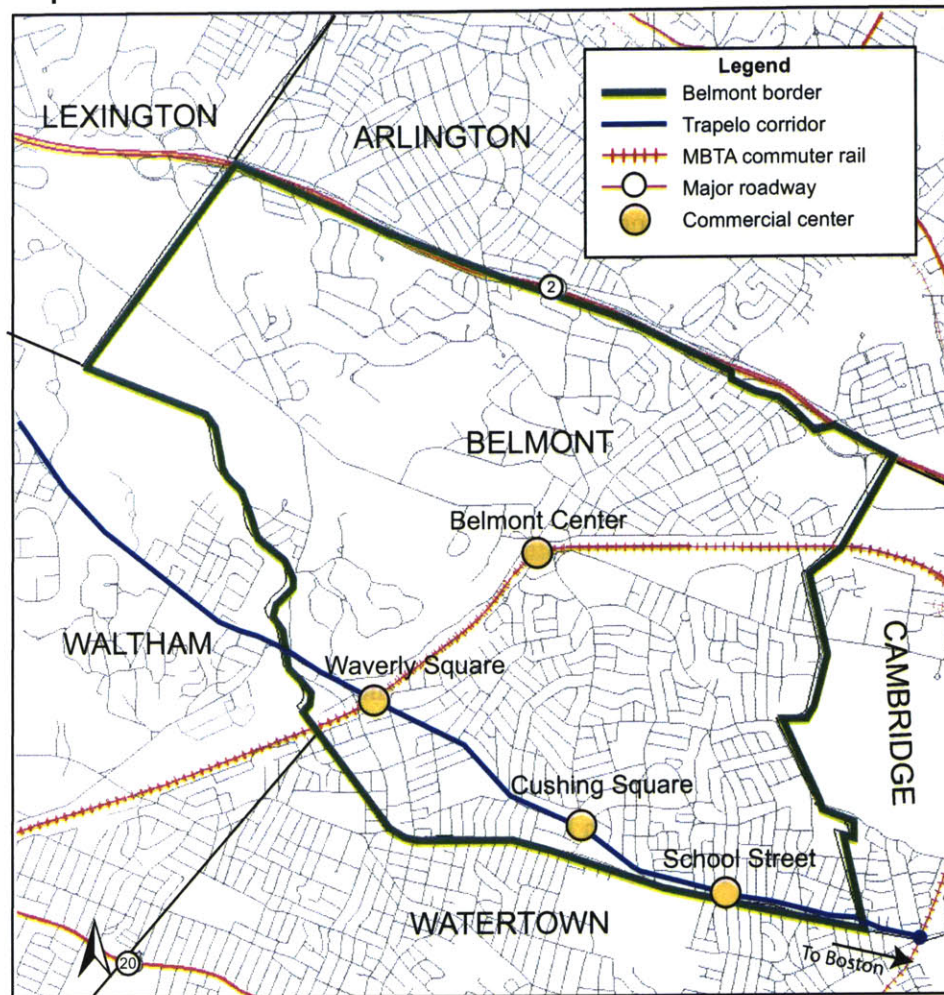
## **Overview**

The Trapelo Road-Belmont Street corridor extends about 10 miles from the Belmont-Cambridge border at Mount Auburn Street to

the junction with Bedford Road in Lincoln, Massachusetts. Along the way it passes through older residential and commercial areas in Belmont, post-war residential subdivisions and strip malls in Waltham, and sprawling office and warehouse complexes around the ramps leading to and from Route 128, Boston's major circumferential highway. There is still some undeveloped open space along the corridor east of Route 128, including the Beaverbrook Reservation and grounds of the former Middlesex County and Metropolitan State Hospitals, but most of the privately held land has been developed. In the first half of the twentieth century, Trapelo was a streetcar route in Belmont and a sleepy two-lane highway beyond the town line. Since the post-WWII suburban expansion, however, the road has served as a suburban collector, providing access to major roads and highways like Route 2, Route 128, and Memorial Drive. At the same time, the role of transit has diminished, with the replacement of the streetcar line with trolley bus service in the 1960s. Except for the section in Belmont, which has the ambiguous two-lane/four-lane configuration discussed earlier, the corridor is a two-lane road. The map on the following page places the corridor within the Belmont context and shows the main highways, roads, and transit routes in the area.

West of Belmont, transit service on the corridor is limited or non-existent, making driving the dominant mode. The corridor is served by frequent trolley bus service

Map: Belmont Context



on the number 73 Line from Waverly Square to Harvard Square, providing connections to the Boston subway's Red Line and additional bus lines. Buses of the 73 Line

come every five minutes during peak periods, and service is reasonably convenient. Riders can also take Massachusetts Bay Transportation Authority (MBTA) commuter rail service to Boston's South Station from Waverly Square (a 17-minute trip), although there are only 9 inbound trains a day.<sup>1</sup> Further west in Waltham, the number 70A bus provides service from North Waltham (Trapelo between Lexington and Wyman Streets) to Waltham Center and to Central Square in Cambridge via Watertown. The trip takes about an hour, and service is limited with 20 departures a day. There are also a few non-MBTA services. Bentley College in Waltham runs a shuttle bus for its students to apartment complexes on Trapelo and to the Red Line Stops in Alewife and Harvard Square. The 128 Business Council runs commuter shuttles (morning and evening peak hours only) from Waltham Center and Alewife to some of the office parks clustered on Route 128.<sup>2</sup> These services are useful for Route 128 employees and students but don't provide regular access to shopping areas or other destinations. There is no transit service on Trapelo Road from Waverly Square to Lexington Street.\*

According to the MBTA's published reports and interviews with public officials, the MBTA is not currently pursuing any proposals to expand transit service on the corridor.<sup>3</sup> The MBTA's Capital Investment Program for FY 2006 – FY 2010 includes no plans to extend subway, bus rapid transit, or commuter rail service into the corridor or the surrounding region in the next five years.<sup>4</sup> In addition, the MBTA's Preliminary

\* For a regional map, please refer to page 32.



2004 Service Plan, which covers bus service modifications, does not change or add service on the 73 or 70A bus lines, the two lines that serve the corridor.<sup>5</sup> In 2002, the MBTA did approve an increase in service frequency on the 73 Line, owing to increased demand.<sup>6</sup> Paul Salomon, chairman of the Belmont Board of Selectmen, also stated that the town has discussed the idea of expanding bus service to connect Waverly Square and Belmont Center.<sup>7</sup> Pedestrian access on the Waltham portion of the corridor is limited, with sections of the road lacking such basics as sidewalks or signalized crosswalks. These poor pedestrian connections would need to be addressed before expanding transit services into the Waltham section of the corridor.

### **Belmont Context**

How Belmont residents use their section of the Trapelo corridor will impact its potential to become a pedestrian-oriented destination. If residents are accustomed to driving to Trapelo, are wary of the level of pedestrian safety, and perceive the area as uninviting or uninteresting, than the task of creating a more vibrant shopping and pedestrian district on Trapelo will be difficult. Why try to create a pedestrian destination in place that is generally avoided by pedestrians? Why allocate space to bike lanes on a road without bikers? In addition, if most road users drive—a fair assumption in suburban Belmont—than costs created by congestion in terms of inconvenience and lost time will be born by the majority user group, i.e. local drivers and

commuters. These factors, if present, will make trade-offs on the corridor more dramatic, and the potential for a place-based approach more politically challenging. This section examines the available data on these issues and tries to draw some conclusions on local travel patterns.

### *Modal Split and Traffic Levels*

Although the corridor often seems dominated motorists and devoid of street life, Trapelo is a fairly successful multi-modal route. In evaluating the travel choices of Belmont residents and of travelers on the corridor, three sources of data were analyzed: (1) 2000 U.S. Census data on the travel choices of Belmont residents; (2) my counts of vehicle, pedestrian, and bicycle traffic at three intersections; and (3) my data on the average travel time for drivers on the corridor between the Belmont Street and Mount Auburn Street intersection and the Trapelo Road and Lexington Street intersection at Waverly Square.

The U.S. Census provides information on work trips by Belmont residents, including travel mode, duration of journey, and destination. Unfortunately the census does not ask respondents about non-work trips—such as those to the grocery store, to see a friend, or to pick up the kids from school—which make up the majority of a household’s total trips.<sup>8</sup> I would speculate that the auto modal share is even greater for these non-work trips, especially for those to the supermarket or to run multiple errands in which the convenience advantage of the

automobile is greater. In addition, the census survey only asked about the primary mode of travel and not about trip links, such as the 10-minute walk to the transit stop or the drive to the park-and-ride lot. The census data do, however, provide some perspective on how the residents of Belmont get around. The chart below presents the data on mode choice for work trips and includes Belmont and four comparison cities and towns in Massachusetts: Boston, Cambridge, Waltham, and Lexington. I chose these comparison cities because they provide a range of urban types, from center city (Boston and Cambridge) to outer suburb (Waltham and Lexington).

Overall, about 12,600 Belmont residents are employed, and of those the vast majority, about 80%, drive to work. High auto modal share is, in part, a product of the high level of car ownership among residents, the low-density layout of the

town (only 3.3 units per acre), and the convenience advantage of driving over transit. Ninety-three percent of households in Belmont own at least one car, and fully 54% own two or more vehicles.<sup>10</sup> Why wait for the bus when your second car is just sitting in the driveway and the bus stop is a 10-minute walk? In addition, commutes by car are significantly quicker than commutes by transit (assuming that trip length is roughly comparable between car and transit trips). The census data show that work trips by transit take noticeably longer for Belmont residents, with 81.7% of transit trips taking more than 30 minutes compared to only 35% of car trips.<sup>11</sup> Belmont residents do seem somewhat more inclined to car pool than their counterparts in the lower density suburbs farther west.

A significant number of residents do chose to ride transit, however, and Belmont's transit modal share for work

trips (12.1%) is higher than in the neighboring suburbs of Waltham (8.5%) and Lexington (6.5%). On the other hand, it is less than half the share of Cambridge or a third of the share of Boston. The modal share of transit for the residential areas near the Trapelo corridor is likely to be higher, given the proximity to bus and rail service, the higher residential density, and lower household incomes.

Chart: Work Trip Modal Choice for Belmont and Surrounding Region<sup>9</sup>

Mode	Belmont	Boston	Cambridge	Waltham	Lexington
<i>Drove</i>	79.7%	50.7%	40.4%	81.4%	84.6%
<i>Drove alone</i>	70.0%	41.5%	35.0%	73.0%	78.5%
<i>Carpooled</i>	9.7%	9.2%	5.4%	8.4%	6.1%
<i>Rode transit</i>	12.1%	32.3%	25.1%	8.5%	6.5%
<i>Bus</i>	5.6%	12.2%	7.1%	4.7%	1.7%
<i>Subway</i>	4.8%	16.3%	16.8%	2.0%	4.2%
<i>Com. rail</i>	1.5%	1.0%	0.4%	1.4%	0.2%
<i>Walked</i>	1.5%	13.0%	24.4%	6.7%	1.7%
<i>Biked</i>	.8%	1.0%	3.9%	0.6%	0.3%
<i>Work at home</i>	5.3%	2.4%	5.3%	2.4%	6.7%
<i>Pop. density*</i>	3.3	7.9	9.8	2.7	1.1

\*Unit: housing units per acre



Not surprising given that Belmont is a bedroom community with no major employment centers, very few residents walk to work (1.5%). That said, many of the roughly 1500 transit riders per day presumably start their daily commute with a walk to the nearest bus stop or the commuter rail station at Waverly Square. Biking was not a significant mode in Belmont and was only above one percent in Cambridge, which has disproportionately high number of students.

To get a better sense of travel patterns in the corridor, I conducted traffic, pedestrian, and bicycle counts for the corridor and referenced ridership data from the MBTA for both the 73 bus and the commuter rail service at Waverly Square. As expected, these data show a more diverse modal picture than the one revealed by the census figures. The chart below presents an admittedly rough modal split derived from these counts and presented for three observation points in Belmont: the intersection of School and Belmont streets, Cushing Square, and Waverly Square.<sup>12</sup> These points were chosen because they are major intersections and are located at equidistant intervals along the Trapelo corridor. As expected, the modal share for bus transit (about 30%) is considerably higher for the corridor than for Belmont overall. Commuter rail service, however, is very lightly used, perhaps owing to limited parking at the Waverly Square station and infrequent service.<sup>13</sup> Similar to the census data, walking and biking comprise a very small proportion of travel on the corridor. All of the intersections observed were surprisingly

devoid of pedestrian activity in the morning and evening peak hours, and also during the day and weekends. That said, most of the bus trips likely started with a walking trip to the nearest bus stop. Trapelo is functioning fairly successfully as a multi-modal street, with a healthy transit modal share of more than 30%.

Chart: Trapelo Corridor Modal Split during the peak hour<sup>14</sup>

Mode	School St.	%	Cushing	%	Waverly	%
Drive	1,930	68.6%	1,478	62.6%	1,762	64.5%
Walk	18	0.6%	33	1.4%	51	1.9%
Bike	15	0.5%	0	0%	9	0.3%
Bus	850	30.2%	850	36%	850	31.1%
Rail	NA	NA	NA	NA	58	2.1%
<b>TOTAL</b>	<b>2,813</b>	<b>100%</b>	<b>2,361</b>	<b>100%</b>	<b>2,757</b>	<b>100%</b>

\*Unit: Number of travelers per mode

#### *Traffic Levels and Congestion*

Although congestion was often cited as a concern by residents and business owners in Belmont, traffic flows smoothly on the corridor in both the morning and evening peak periods. Based on traffic counts conducted at the aforementioned three points, average daily traffic (ADT) on the corridor is less than 20,000 vehicles. As the chart on the next page shows, traffic volumes were slightly higher at the eastern and western ends of the Belmont section of the corridor, nearest to the junctions with Pleasant and Mount Auburn streets, both arterial roads. Although there is some truck and bus traffic on the corridor, heavy vehicles comprise a modest proportion of total traffic. In several hours of on-site traffic observation, I saw just a hand full of semi-trucks on the corridor. Most of the “heavy vehicles” I counted were MBTA

buses and delivery vans. Overall, Trapelo is not a major truck route, and the truck drivers seem to share the road well with other users. The corridor functions fairly well despite the fact that its nine traffic signals are not coordinated.<sup>15</sup>

Chart: Traffic Levels at Three Key Intersections

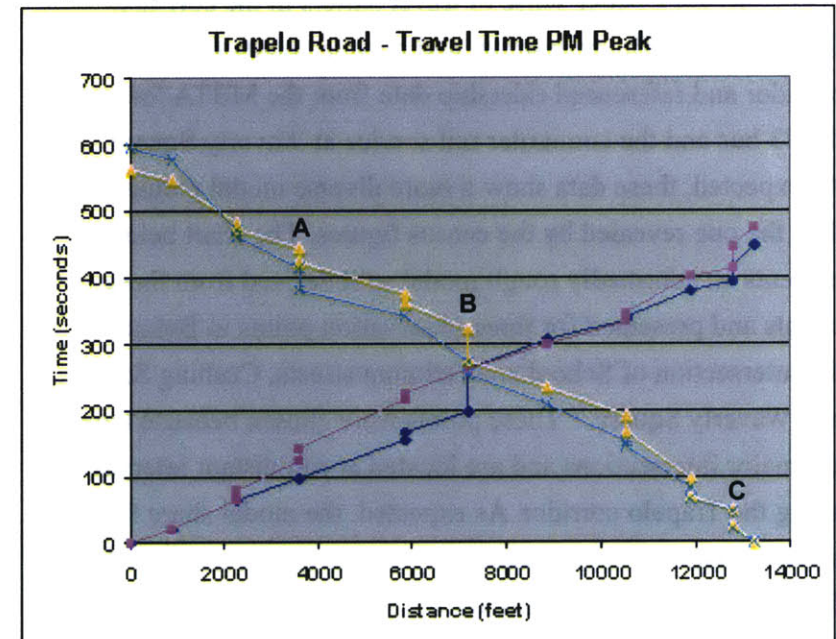
Indicator	School St.	Cushing Sq.	Waverly Sq.
AM peak hour	1,755	*	1,578
% heavy vehicles	6.1%	*	6%
PM peak hour	1,518	1,344	1,509
% heavy vehicles	1.9%	2.9%	2.1%
ADT	17,555	13,444	15,780
Level of Service	B	C to D	C

\* Data missing.

In order to better gauge traffic conditions, I conducted a simple test: I measured the time it took to travel the length of the corridor during the morning and evening peak periods and kept track of the delay at each intersection. I drove the corridor from Mount Auburn Street to Waverly Square and back four times, two times during the morning rush starting at 8:30 a.m. and two times during the evening rush starting at 5:30 p.m. The graph below presents my results for the evening peak, plotting distance traveled on the x-axis against time on y-axis. Each line represents a single trial and the vertical sections represent time stopped at a red light. Although the corridor's nine traffic signals are not coordinated with each other, I was able to drive the 2.2 miles in less than 10 minutes in all eight trials.<sup>16</sup> Average speed ranged from 15 to 22 miles an hour, including delay (i.e., time total spent

stopped at red signals), which averaged 1 minute and 51 seconds. Although traffic slowed at points, including in the Waverly and Cushing Square sections (as seen in the center of the graph), delays were brief, and I never had to wait more than one signal cycle to drive through an intersection. In addition, during six hours of direct traffic observation over four days I never observed serious backups or stop-and-go traffic.

Graph: Trapelo Corridor Average Travel Times PM Peak



\*Intersections

A: School Street B: Cushing Square C: Waverly Square

### *Traffic Accidents and Pedestrian Safety*

As I will discuss in greater depth in the next chapter, residents and public officials both expressed concern over traffic and pedestrian safety on the corridor. The unstriped configuration of the road produces unclear traffic patterns, with some drivers acting as if Trapelo were a two-lane road, while others drive as if it had four lanes.<sup>17</sup> At certain intersections, including at School and Grove streets, cars turning left onto Trapelo cut in front of through traffic coming from the opposite direction. I witnessed several close calls at School Street. There were 137 traffic accidents on the corridor in 2004, 14 of which resulted in an injury. According to Sgt. Ken Hamilton, head of the Traffic Division at the Belmont Police Department, Trapelo is the site of many of the town's worst accident trouble spots, including the Trapelo and Mill Street, Trapelo and Pleasant Street, Trapelo and Common Street, and Belmont Street and School Street intersections.<sup>18</sup> Speeding is also a problem on the corridor, particularly on the section between Mount Auburn Street and the junction of Trapelo and Belmont streets, and I often observed cars accelerating to high speeds as they drove down the hill towards Cambridge.

Pedestrian accidents are a significant concern on the corridor, particularly in light of the Trapelo's fatal history. Since 1980, seven pedestrians have been killed while trying to cross the road, all of them over the age of 65.<sup>19</sup> Most recently, Rita Scafidi, an 80 year-old Belmont resident, was struck and killed by a truck in 2003 while crossing Trapelo Road near Waverly

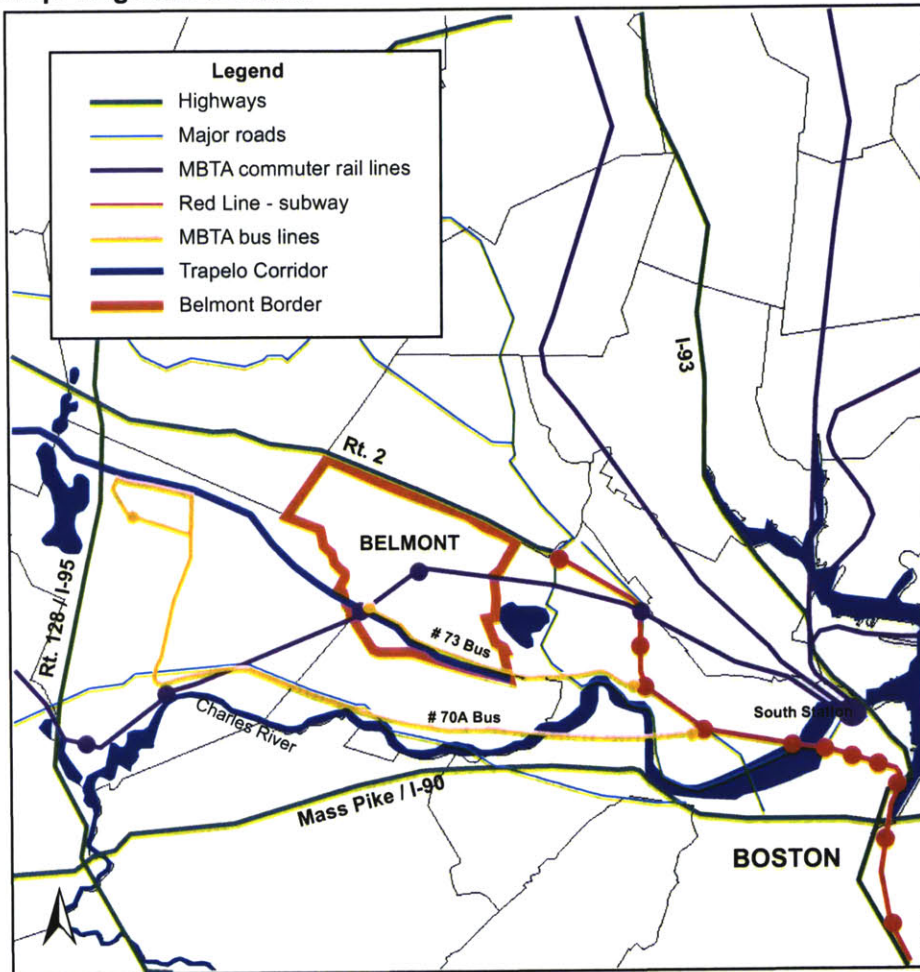
Square.<sup>20</sup> The number of traffic accidents involving pedestrians was fairly low in 2003, when there were only four incidents.<sup>21</sup> All of these accidents, however, resulted in an injury to the pedestrian involved (including two children), while only 11 of the 133 vehicle-to-vehicle accidents resulted in injury. These statistics reinforce the well-documented fact that pedestrians tend to fare far worse in vehicle-to-pedestrian accidents than drivers and passengers. As noted in the previous chapter, the risk of serious harm to a pedestrian increases dramatically as the speed of the vehicle involved exceeds 20 miles per hour. According to research on accident data, the probability of a pedestrian receiving fatal injuries in an collision with a vehicle is 3.5 % at 15 mph, 37% at 31 mph, and 83% at 44 mph.<sup>22</sup>

### **Regional Context**

The significance of the corridor in the regional transportation system will also effect the trade-offs between auto mobility, and pedestrian accessibility and neighborhood character. In fact, regional forces may exert a stronger influence over these relationships than local conditions. If the road plays a relatively minor role in the regional system and carries little through traffic, then there are greater possibilities for slowing traffic and redistributing right of way for sidewalks and bike lanes without significantly increasing congestion, inconveniencing commuters, or pushing traffic onto residential streets. If, on the other hand, Trapelo does carry significant regional traffic or if continued



Map: Regional Context



sprawl development threatens to put more drivers onto the road, there will be more dramatic trade-offs between enhancing pedestrian access and neighborhood quality, and increasing

congestion and delay for drivers. More severe trade-offs will create an uphill battle for community groups and town officials who are pushing for a pedestrian-oriented and place-focused design. This section examines the available data on these issues and tries to draw some conclusions on the corridor's role in the regional system.

#### *Regional Travel Patterns*

Although the available evidence is limited, the corridor does appear to play some role in the regional transportation system (see map on left). The absence of survey data on travel behavior along the corridor makes it difficult to quantify what proportion of the travel on the corridor is regional, but observational and anecdotal evidence indicate that commuters do use the corridor to reach Boston and Cambridge to the east and the Route 128 employment centers to the west.<sup>23</sup> According to the 2000 census, about 17,500 Waltham residents (55% of all employed workers) work outside their town, including 3,800 in Boston and 1,600 in Cambridge. A larger share of Belmont's 12,900 workers (82%) work elsewhere in the region, including 3,000 in Boston and 2,500 in Cambridge.<sup>24</sup> Some portion of these commuters, the vast majority of whom drive to work, undoubtedly use Trapelo Road for part of their journey into the city. Finally, some residents I spoke with suggested that Trapelo may serve as a cut-through for commuters seeking to avoid chronic congestion on Route 2 and at the Concord Avenue rotaries.<sup>25</sup>

That said, the Trapelo corridor's regional significance should not be overstated, as the corridor carries a small proportion of the total east-west regional traffic. Route 2 to the north, which runs parallel to Trapelo Road between Route 128 and Alewife, carries more than 75,000 vehicles a day. Concord Avenue west of the Alewife rotaries carries an additional 10,000 vehicles a day. The Massachusetts Turnpike, several miles to the south, carries yet another 111,000 vehicles daily.<sup>26</sup> As noted in the previous section, Trapelo only carries 15,000 vehicles a day on the Belmont sections of the corridor, a small number when compared to the hundreds of thousands of vehicles carried by the regional highway system along the Boston region's east-west axis. Finally, much of the regional traffic is likely to occur during the morning and evening rush hours when motorists are commuting to Boston, Cambridge, or suburban job centers. Traffic during the day is much more likely to be local, i.e. driving from home to shop, visit friends, or pick up the kids from school. Therefore, during most of the day Trapelo is primarily a local road.

#### *New Development and Traffic Generation*

The amount of regional through traffic may increase, however, as the result of significant new development in the Waltham section of the corridor, almost all of which will be auto-dependent. According to a review of recent news articles on development activity in Waltham and Belmont and interviews with residents and town officials, over 1,500 new housing units

Chart: Potential New Development along the Trapelo Corridor<sup>27</sup>

Project	Location	Description	Status
<i>Indian Ridge Development</i>	Waltham, near Trapelo and Lexington St.	Residential: 264 unit 40-B development by Lincoln Property.	Under Construction
<i>McLean Hospital</i>	Belmont, near Waverly Sq.	Residential and commercial: 122 townhouses, 480 units of senior housing, 150k sqft R&D facility, 141 acres open space.	Under Construction
<i>Veteran's Memorial Fields</i>	Waltham, south of Trapelo Road	Residential and other: 200 unit Bentley College dormitory, new Gant School campus, ball fields.	Approved
<i>Metropolitan State Hospital</i>	Hospital campus, Waltham, north side of Trapelo	Residential and recreational: golf course, 387 units of housing by Avalon Bay development corporation.	Approved
	Lot 1 Site Waltham, north side of Trapelo	Undetermined: state in dispute with Waltham over plans to auction 54 acres of undeveloped land.	For Sale
<i>Middlesex County Hospital</i>	Waltham, north side of Trapelo	Residential: 268 condominiums on former hospital campus by JPI development corporation.	Approved
<i>The Fernald Center</i>	Waltham, south of Trapelo	Undetermined: 200 acres former psychiatric hospital currently in planning; could include housing, commercial, and recreational uses.	Planning
<i>Our Lady Comforter of the Afflicted</i>	Waltham,	Open space and residential: 25 acres sold by Catholic archdiocese of Boston to Waltham for \$4.5 million; some senior housing.	Planning
<i>Belmont Uplands</i>	Belmont, near Alewife	Residential: 300 unit 40-B apartment development by O'Neil Properties on portion of the former Arthur D. Little Site.	In 40-B process

will be constructed along the Trapelo corridor in the next few years. Much of the new development is being driven by the conversion of hospital campuses, including McLean Hospital, Middlesex County Hospital, and Metropolitan State Hospital, to

---

residential use. The futures of two large sites, the Fernald Center and a the “Lot 1” portion of Metropolitan State Hospital, are still the subject of considerable debate and conflict. The chart on the previous page summarizes these projects, their location, and status.

The volume of new construction has raised community concerns in Waltham and Belmont about traffic, open space preservation, storm water runoff, and a lack of adequate zoning controls. In Belmont, a group of citizens fought a long and ultimately unsuccessful legal battle to stop McLean Hospital from building new housing and R&D space on its campus.<sup>28</sup> In Waltham, residents also tried to stop Lincoln Properties from building a 264-unit residential complex at Indian Ridge through the state’s 40-B process, a development that is now under construction.<sup>29</sup> Town officials are currently fighting the state over its plan to sell an additional 54 undeveloped acres of the former Met State Hospital property ( know as the Lot 1 property) in June.<sup>30</sup> According to Dave Kaloupek, a member of the Trapelo Neighborhood Association, Waltham residents are worried about the impact these new developments will have on the town’s character and quality of life, as well as traffic conditions on Trapelo Road.<sup>31</sup> The controversy over new development in Waltham was seen by some residents as a factor in the defeat of incumbent Waltham Mayor David Gately by Jeannette McCarthy in 2003.<sup>32</sup> Kaloupek said that McCarthy has been more responsive to concerns about new development and the need for zoning

reform.

Although the change in administration in Waltham promises a more restrained and comprehensive approach to future development, it does not change the reality of the projects already approved or under construction. Few of these development projects will have direct access to MBTA bus or rail lines or are located within convenient walking distance of local shopping or other destinations. In addition, there is apparently no new transit service proposed in conjunction with any of the development plans. To get almost anywhere, these new residents will have to drive. Except for the 387-unit housing development on the Lexington portion of the Met State site, all of these projects will be connected to the local road network via the Waltham portion of Trapelo Road, which is already experiencing congestion problems according to local residents.<sup>33</sup> The McLean development will eventually be connected to Trapelo Road via a new entrance on Pleasant Street.<sup>34</sup>

In the absence of viable alternatives to driving and a reduction of the congested conditions on alternate routes such as Route 2 and Concord Avenue, the new development will put additional pressure on the capacity of Trapelo Road, especially in Waltham. Using standard trip generation rates from the Institute of Transportation Engineer’s *Trip Generation* manual, I calculated that the new residential and commercial development, both proposed and approved, would create about 11,000 new vehicle trips per day and about 820 new vehicle trips during

the morning peak hour.<sup>35</sup> These figures represent a considerable increase in traffic. That said, only a portion of these new trips will likely include travel on the Belmont portion of Trapelo Road. Furthermore, the design of the road will have an impact on whether Waltham drivers headed into Boston choose to use Trapelo or Concord Avenue or Route 2. Making it clear that Trapelo is a traffic calmed zone may induce some drivers to use alternate routes.

### **Three Intersections: School Street, Waverly Square, and Cushing Square**

It is beyond the scope of this thesis to examine the entire corridor in detail down to the intersection level. Rather, drawing on observations from School Street, Cushing Square and Waverly Square (see context map on page 26), I will provide an analysis of pedestrian conditions and activity, facilities for transit users and bicyclists, and traffic conflicts at these sites. I have chosen these three intersections because they are focal points of local shopping, intersect with key north-south routes, provide access to bus and rail transit, and present many of the typical opportunities and constraints found along the corridor. These intersections are also located at roughly equal intervals along the corridor and thereby provide insight into changing travel patterns. I chose not focus on the residential portions of the corridor, which are interspersed among the corridor's commercial nodes, because these sections have fewer problems. With rows of two to three-

story houses and apartments, ample shade trees and greenery, and adequate sidewalks and planting strips, these areas are more pleasant to walk on and provide a sense of enclosure for pedestrians. Although the road could potentially be narrowed in these sections, they don't cry out for as much intervention as the commercial areas on the corridor.

#### *The Pedestrian Environment*

As it is currently configured, the Trapelo corridor provides modest facilities for pedestrians, while catering more generously to the needs of drivers. Take the School Street intersection pictured on the next page. The road is quite wide, with a width from curb to curb of about 60 feet. This provides for the equivalent of four travel lanes, although the road is only striped for two. Cars have ample room to pass each other, facilitating higher speeds and producing significant traffic noise. In contrast, the widths of the sidewalks here are modest, between eight and 12 feet. Utility poles and signal posts further narrow the usable portions of these sidewalks, which are often exposed to passing traffic. Although street parking is permitted, it is limited to two hours and not well used after 5 pm. Also, there are few trees on Trapelo Road. As urban designers like Alan Jacobs have noted, trees are an essential component to creating successful streets.<sup>36</sup> They provide shade, protection from wind and rain, and help to create a sense of enclosure. As is the case with most intersections on the corridor, the commercial buildings on left side of School





Image: School Street intersection looking south



Image: School Street intersection looking east

Street are one to two stories. Taken together, the wide street, lack of a tree canopy, and low buildings leave the pedestrian feeling exposed and the street without definition. As the chart on the right demonstrates, these shortcomings are typical to the corridor's

Chart: Inventory of Pedestrian and Bicycle Facilities

	School St.	Cushing Sq.	Waverly Sq.
Road Width	60'	60'	60' – 70'
Lane Configuration	4	3 to 4	2 to 4
Turning Radii	15'-20'	25'-30'	25'-30'
On Street Parking	Yes	Yes	Yes
Sidewalks	8'-10'	8'-16'	8'-10'
Bulb Outs	None	None	None
Bus Shelters	None	1, inbound	1, terminus
Bike Lanes	None	None	None
Crosswalks	Angled	Angled	Straight
Trees & Greenery	Minimal	Minimal	Minimal
Pocket Parks	Yes	Yes	Yes
Bicycle Activity	Low	Low	Low
Pedestrian Activity	Low	Moderate	Moderate

other commercial areas.

The three intersections I examined were structured to maximize the flow of vehicles rather than the convenience and comfort of pedestrians. Pedestrians are very sensitive to out-of-the-way travel, and the absence of adequate crossing points, sidewalks, or pedestrian amenities can lead them to avoid certain areas.<sup>37</sup> The turning radii at Cushing Square and Waverly Square, for example, are wide (between 25 and 30 feet), allowing vehicles to make turns onto or off of Trapelo Road at high speeds. Pedestrians can be hard to spot for turning drivers, who tend to focus more on avoiding opposing traffic. The wide turning radii also extend the distance a pedestrian must walk to cross the street and move them farther from the street edge, making them less



visible to passing vehicles. Walk signals on the corridor are push button activated, which are only recommended for intersections with very low levels of pedestrian activity.<sup>38</sup> During a January visit to Waverly Square, I twice had to jaywalk because a button was missing and another was inaccessible behind a mound of plowed snow.

Beyond aesthetic and convenience concerns, the poor pedestrian facilities on Trapelo pose a safety risk to residents trying to cross the corridor. As noted earlier, Trapelo has been the sight of several fatal pedestrian accidents over the years. Take Cushing Square, one of the more charming commercial spots on the corridor and home to attractive period structures such as the Belmont Saving Bank building, pictured below. These assets are overshadowed, however, by the large and difficult-to-cross expanse of asphalt in the center of the intersection. As the picture



Image: Belmont Savings Bank



Image: Cushing Sq. Looking West

above shows, the crosswalks across Trapelo are at an angle, which lengthens the distance a pedestrian must walk. The crosswalk across Common Street on the north side of the intersection requires pedestrians to cross three pedestrian islands. The walk signals for the segments are not coordinated, so a pedestrian must wait at each island or jaywalk. The final leg requires crossing a right turn only lane, where cars can turn onto Trapelo during the red signal. Overall, the pleasant village character of Cushing Square is overtaken by the road and traffic noise.

Facilities for transit riders and bicyclists are similarly minimal. There are no bike lanes on Trapelo, and the chaotic traffic patterns and high speeds driven by motorists make it an unattractive route for bicyclists. The bicyclists I observed appeared to be of the most serious type: young men and women

in full biking gear, rather than older adults or children out to run an errand or on their way to school. Sections of the corridor, including the stretch east of Waverly Square, do have a fog line that marks the outer edge of the two travel lanes. This feature provides space for bicyclists between the parking lane and the traffic lane and also indicates to motorists that the corridor is a two-lane facility. There are some facilities for the Transit riders, including bus shelters at Waverly and Cushing squares, but most stops on the corridor do not provide protection from the elements. Buses often don't pullover, which does not appear to be much of a problem, since only a few riders are typically getting on or off. There are few benches and no water fountains or other amenities for pedestrians at each of the intersections. All three intersections have a pocket park with a bench, but these green spaces were exposed to traffic and not well used.

Taking into account the quality of pedestrian facilities, crosswalk safety concerns, and the low pedestrian modal share, it's not surprising that I observed low levels of pedestrian activity at all three intersections. School Street was the most devoid of pedestrian activity, with only 24 pedestrians walking through during the evening peak. Despite the presence of a couple restaurants, a pharmacy and gift store, and an ice cream shop, the sidewalks were empty. In Cushing and Waverly squares, which had 33 and 84 pedestrians, respectively, during the evening peak, activity was slightly higher. At Cushing, as at most points on the corridor, most shoppers appear to drive to the area. On numerous

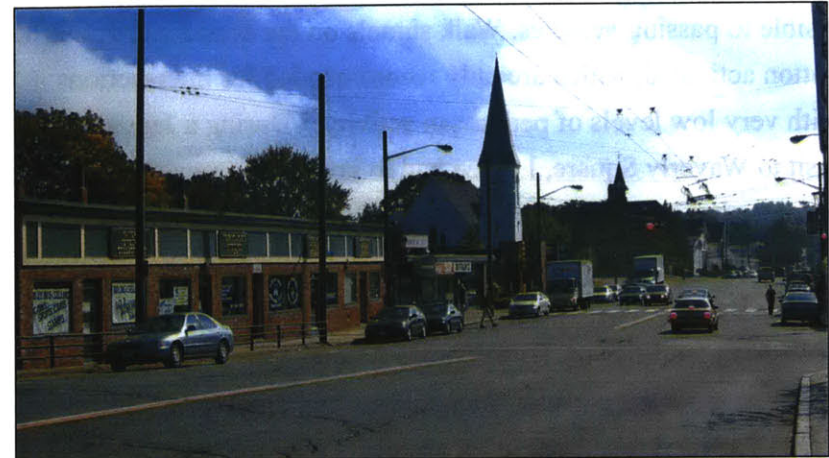


Image: Waverly Square looking east



Image: Waverly Square bus stop and rail station parking

occasions, I saw residents drive up to a shop, park, pop in to the store, and then get right back in their car. Waverly enjoyed higher levels of pedestrian activity, most likely because the 73



bus terminates there. The Shaw’s supermarket, across from the railroad station, also appeared to be something of a draw for pedestrians.

The experience of walking along Trapelo is far better than that on overtly pedestrian-hostile landscapes, such as the ubiquitous strip developments located near most highway interchanges, but it also far less than what it could be given the corridor’s assets. With shopping opportunities, attractive pre-war retail commercial buildings at spots like Cushing Square, and a fairly good transit connections both to Boston and Harvard Square, the area’s potential as neighborhood destination is far from being met.

*Lane Configurations and Traffic Conflicts*

Finally, I also conducted detailed analysis of vehicular traffic patterns at these three intersections. This analysis included: (1) traffic, pedestrian, and bicycle counts during the weekday morning and evening rush hours (these figures were presented earlier and are also included in the chart on the right); and (2) an analysis of level of service (LOS), traffic signaling, and average delay using the McTrans Highway Capacity Software (HCS). Level of Service is a measure used by traffic engineers to represent how smoothly traffic flows and is represented on a scale from A, for free flowing traffic, to F, for stop-and-go traffic. An LOS of C or better indicates no congestion and is considered desirable by traffic engineers. In the context of intersections,

LOS refers to the average delay experienced by drivers, i.e. how long, on average, a car must wait at a red light before it passes through intersection. Longer average delays indicate that a driver may have to wait more than one signal cycle. The chart below combines both my data and the HCS analysis.

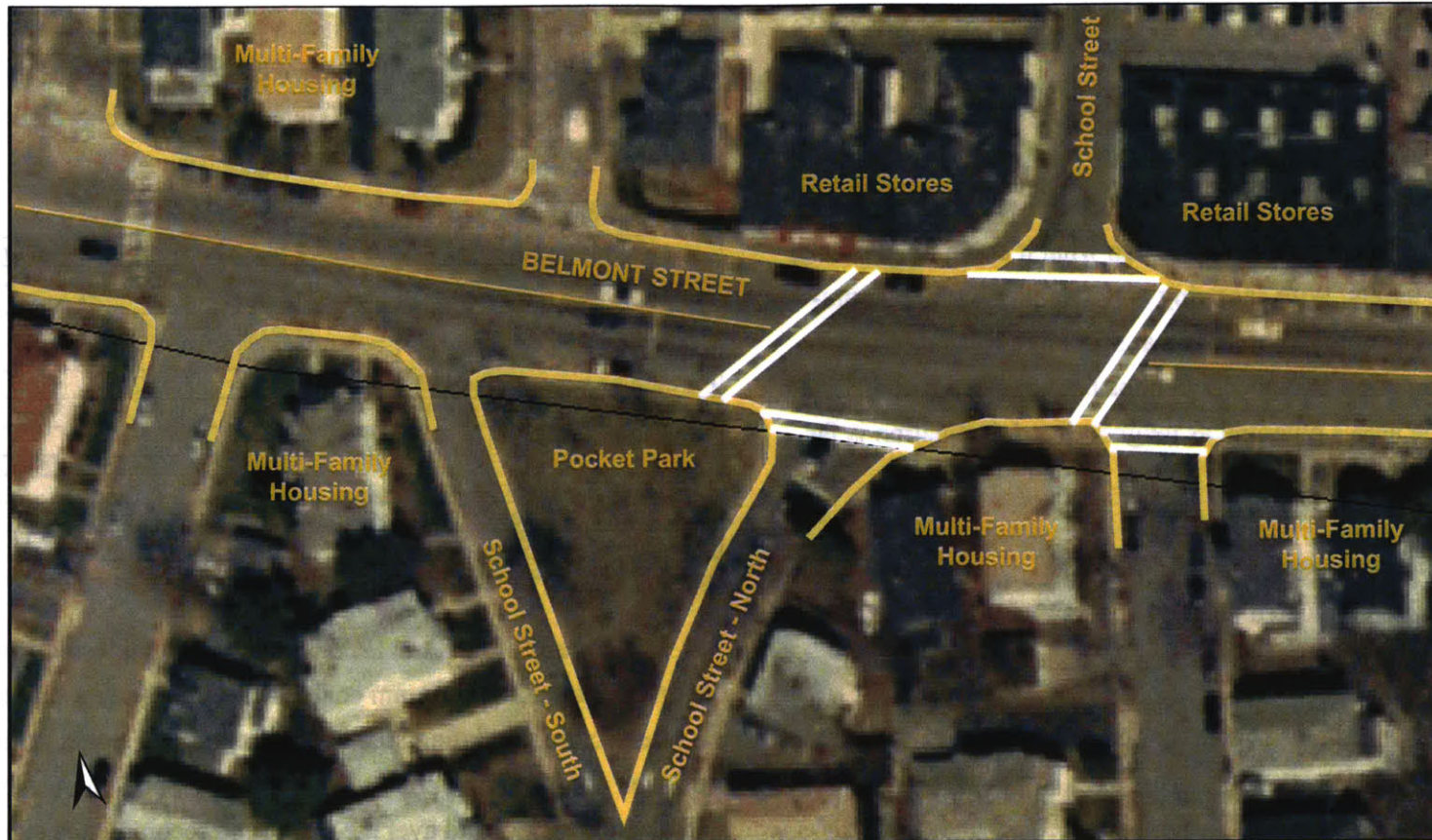
Chart: Traffic Levels at Three Key Intersections<sup>39</sup>

Indicator	School St.	Cushing Sq.	Waverly Sq.
AM peak hour (veh. per hr.)	1,755	*	1,578
PM Peak Hour	1,518	1,344	1,509
Percent heavy vehicles AM	6.1%	*	6%
Percent heavy vehicles PM	1.9%	2.9%	2.1%
Average Daily Travel (ADT)	17,555	13,444	15,780
Signal cycle (seconds)	60	110	120
Average Delay (seconds)	19	57	35
LOS based on observations	B to C	C to D	C
LOS based on HCS model	B	E	C

\*Data missing

Overall, I found the HCS analysis of the intersections to be problematic. The program enables users to create a model of an intersection, including lane configuration and signal timing, and then plug in traffic counts. The model then calculates the intersection’s LOS and average delay, and recommends signal timing changes to improve level of service and reduce conflict points. I was hopeful that I could use the HCS modeling software not only to evaluate existing conditions but also to evaluate the traffic impact of alternate road configurations (i.e. a two- or three-lane configuration instead of a four-lane one). Unfortunately, I encountered difficulty accurately representing existing

**Aerial Map: Belmont and School Streets**

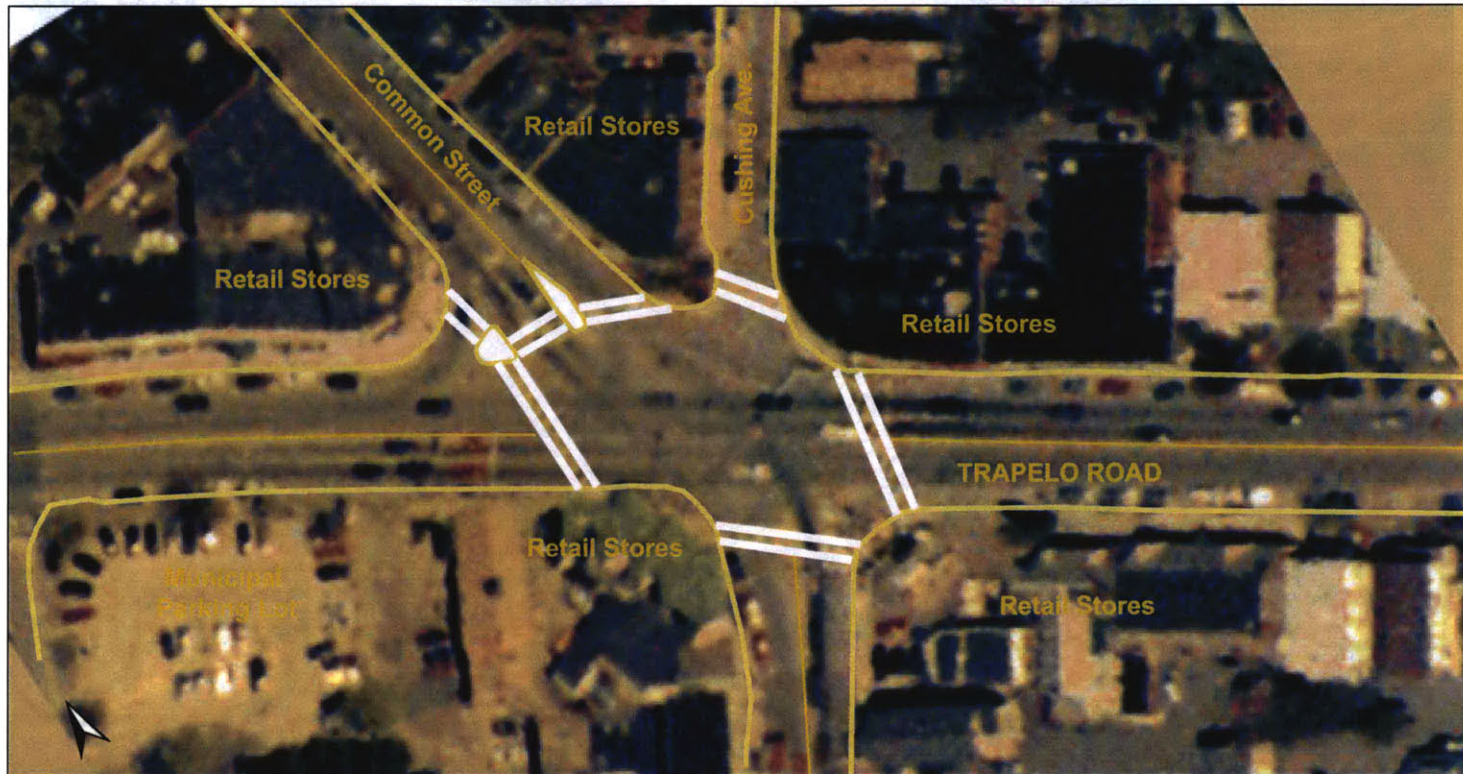


configurations of the main intersections because of the ambiguous reality of Trapelo road. In addition, I found that the level of service and average delay figures produced by the model tended to under- or overestimate congestion and delay as compared with

my own observations, traffic counts, and experiences driving on the corridor.

In any case, both the HCS analysis and my observations lead to me the following conclusion regarding each intersection:



**Aerial Map: Trapelo Road and Common Street*****School Street***

As the aerial view on the previous page shows, Belmont Street is four lanes at this point and is crossed at a slight angle by School Street, a two-way, two-lane road. Inbound vehicles can turn right onto School via a separate lane that branches off the corridor.

This is a fairly busy intersection. Belmont Street just east of the intersection carries about 17,000 cars a day on four lanes. About 60% of morning rush hour traffic is heading towards Boston, the remaining 40% towards Route 128. Presumably, the road is used



**Aerial Map: Trapelo Road and Lexington Street**



by commuters to reach employment centers both east and west of Belmont.

Despite the traffic, I observed no congestion at School Street, and drivers experienced only brief delays at the signal.

Both my observations and the HCS model indicated a LOS of about B to C. As noted earlier, vehicles tended to accelerate in the inbound direction towards the Cambridge border, some reaching speeds of more than 40 mph. In terms of conflicts, cars

turning left off of School onto Belmont often come into conflict with through traffic on School coming the other way. With the exception of the occasional aggressive passer, there were no conflicts on Belmont Street itself. Using the HCS model, I experimented with a three-lane configuration that included two travel lanes and a left turn lane on either side of the intersection. The model indicated that such a change would degrade the LOS from B to D and substantially increase delay and congestion.

#### *Cushing Square*

Near Cushing Square, Trapelo Road has an ambiguous three or four lane configuration. It is crossed at an angle by Common Street, an important north-south route, as shown in the aerial map on page 41. The intersection is further complicated by another small street, Cushing Street, that juts out, creating a space for a small pocket park. Cushing Square is also fairly busy, but somewhat less so than School Street or Waverly Square. Trapelo here carries about 13,500 cars a day. As at School Street, 60% of traffic is heading inbound during morning rush hour. Significant traffic crosses Trapelo via Common. There do not appear to be any serious vehicle-to-vehicle conflicts.

Compared to School Street, traffic speeds are more moderate on Trapelo as it reaches Cushing Square. Cars seem to slow down rather than accelerate in this area, although they do make fast turning movements around the intersection's rounded corners. Despite the slower speeds, I did not observe any backups

and estimated that the intersection operated at an LOS of C, far better than the HCS model's indicated LOS of E. According to the HCS, narrowing the intersection to three lanes would result in a LOS of F. I'm skeptical of this result, given the model's inaccuracy in representing current conditions.

#### *Waverly Square*

Like Cushing Square, Waverly Square is a complicated intersection. As shown in the aerial map on the previous page, Trapelo, with four marked lanes, T-junctions with Lexington Street to the South and also receives traffic from the Shaw's parking lot to the north. The intersection was redesigned when the supermarket was constructed in the 1990's. Trapelo narrows to two lanes as you move east. Waverly Square is also fairly busy, carrying about 15,000 vehicles per day. Unlike at the School Street and Cushing square intersections, the split here between inbound and outbound traffic is fairly even during both peaks.

Traffic flows smoothly at the intersection, and I observed no congestion or serious back-ups. Drivers heading northbound on Lexington did experience some delay. Both my observations and the HCS model indicate a LOS of C. There do not appear to be any serious vehicle-to-vehicle conflicts.

### **Conclusions**

My analysis presents a mixed picture, one of both opportunities to improve the pedestrian environment on the corridor and of the

---

constraints imposed by local travel preferences and the impacts of sprawl development. On the one hand, there are a number of factors which will make the trade-offs between congestion and place-making more significant:

- Driving is the dominant mode of travel in Belmont, and drivers are the largest user group on the Trapelo corridor. The strong preference for driving calls into question whether residents would take advantage of enhanced facilities for pedestrians, transit users, and bicyclists.
- Although the road is currently operating without delays, a reduction in capacity may cause congestion during peak periods. Therefore, the costs of congestion will be born by the majority user group, i.e. drivers, while the benefits of narrowing the road and calming traffic will go to minority user groups, i.e. current and future pedestrians and bicyclists. Congestion will also inconvenience riders of the 73 bus.
- Auto-dependent development, especially in Waltham, will put additional traffic pressure on the Trapelo corridor in the future. The potential congestion costs of narrowing will thus be greater as new residential and commercial developments are completed. Regional forces represent a major political obstacle to embracing a pedestrian-

oriented design.

- There are currently no plans to expand rail or bus transit to Belmont or high growth areas in Waltham, ensuring that growth in travel demand will have to be accommodated by the existing road network, much of which (including Route 2 and Route 128) are chronically congested.

These challenges illustrate the difficulty of changing one small piece of the region's transportation system. Whatever changes take place on Trapelo, the rest of the system will remain in place, including the extensive auto-oriented network in the western suburbs.

Nevertheless, there do appear to be some opportunities to provide benefits to all user groups on the corridor and to reduce the trade-offs between enhancing the pedestrian environment and limiting congestion. There are a number of factors that may reduce trade-offs:

- Trapelo is successfully functioning as a multi-modal street, with a transit share of over 30 percent during the peak period. The substantial number of transit riders requires that the redesign pay special attention to pedestrian connections between key bus stops and surrounding neighborhoods. The popularity of the 73 bus also indicates that transit can successfully compete with



the automobile on the corridor and in Belmont generally.

- Increasing the transit modal share by improving pedestrian accessibility to both the 73 bus and the Waverly Square commuter rail station has the potential to soften the congestion-place making trade-off. By taking drivers off the road, increased transit usage and walking will reduce traffic pressures on the Trapelo corridor.
- The village character of places like Cushing Square are not being fully taken advantage of to create inviting local destinations. These intersections work fairly well for drivers but provide minimal facilities and amenities for other users and can be dangerous to pedestrians.
- There are a number of changes to these intersections that could be implemented without reducing lane capacity and that could significantly improve pedestrian safety, including bulb outs, pedestrian refugee islands, tightened turning radii, added trees and greenery, and improved paving and crosswalk markings.

By encouraging walking, transit, and biking, a multi-modal design could mitigate congestion, while also improving pedestrian accessibility, local street life, and neighborhood character.

Overall, however, I'm left with the conclusion that the

trade-offs are more real than imaginary. If a multi-modal design is to become a reality, residents and public officials will need to think outside the traditional box of transportation planning, with its focus on level of service, system efficiency, and congestion. If decisions are made as a reaction to regional pressures or based on LOS calculations, then the potential for a truly multi-modal design solution is slim. Concerns over traffic need to be balanced against other community values, including pedestrian safety and accessibility and neighborhood character. Pedestrian safety should be a particularly effective issue, given that record of fatal accidents and the safety concerns of residents. As one Belmont official stated, the question becomes: are Belmont residents willing to put up with some rush hour congestion in order to promote other community values, including pedestrian safety and neighborhood character? In the next chapter, I will lay out three scenarios and take a closer look at the dynamics of the trade-offs identified above.

---

## Notes

<sup>1</sup> MBTA Fitchburg Line timetable, online: [http://www.mbta.com/traveling\\_t/schedules\\_commuter\\_linedetail.asp?line=fitchburg](http://www.mbta.com/traveling_t/schedules_commuter_linedetail.asp?line=fitchburg)

<sup>2</sup> Rt. 128 Business Council, online: <http://www.128bc.org/index.htm>

<sup>3</sup> Conrad Misek, Senior Transportation Planner Analyst, MBTA. Email correspondence, 4 April, 2005.

<sup>4</sup> “Capital Investment Program, FY2006-FY2010,” Massachusetts Bay Transportation Authority, March 2005. Online: <http://www.mbta.com/insidethet/capital.asp#>

<sup>5</sup> “Preliminary 2004 Service Plan: Proposed Bus Service and Policy Modifications,” Massachusetts Bay Transportation Authority, March 2004. Online: [http://www.mbta.com/insidethet/2004\\_service\\_plan.asp#](http://www.mbta.com/insidethet/2004_service_plan.asp#)

<sup>6</sup> “Preliminary 2002 Service Plan: Proposed Bus Service and Policy Modifications,” Massachusetts Bay Transportation Authority, October 2001. Online: <http://www.mbta.com/insidethet/pdf/2002ServicePlan.pdf>

<sup>7</sup> Paul Solomon, Chair, Belmont Board of Selectmen, telephone interview 22 March, 2005.

<sup>8</sup> “NHTS: Highlights of the 2001 National Household Travel Survey,” Bureau of Transportation Statistics, U.S. Department of Transportation, 2003. p. 10

<sup>9</sup> 2000 U.S. Census, Summary File 4, Online: [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)

& “Community Profiles: Growth Trends in Greater Boston’s 101 Communities—Revised for 2004,” Metropolitan Area Planning Council, 2004. Online: [http://www.mapc.org/metro\\_area/cities\\_towns.html](http://www.mapc.org/metro_area/cities_towns.html)

<sup>10</sup> 2000 US Census

<sup>11</sup> Ibid.

<sup>12</sup> A note on the data: Traffic, bike, and pedestrian counts were compiled using video footage of the three intersections. Counts were tallied from 20 minutes of video and then multiplied by three to calculate the peak hour average. AM peak hour and PM peak hour counts were filmed on a weekday beginning at 8:15 AM and at 5:30 PM respectively. The “heavy vehicles” category includes: trucks, buses, and large delivery vans.

<sup>13</sup> In 2004, the Town and the MBTA proposed building a park-and-ride garage and an apartment, and commercial complex using the air rights over the rail station at Waverly Square. The plan was later scrapped due to community opposition.

<sup>14</sup> Drive, walk, and bike data: AM travel counts for School Street and Waverly Square and PM counts for Cushing Square. Bus ridership data: “Trip Summaries, MBTA Bus Data Collection: Selected Routes from Spring 2003,” Massachusetts Bay Transportation Authority, 2003. Ridership is based on total boardings for number 73 from 8:15 to 9:15 AM. This most likely inflates the transit mode share somewhat. Rail ridership data: “Commuter Rail North Side Station Boardings (Inbound): Typical Weekday”, Massachusetts Bay Transportation Authority, 2004.

<sup>15</sup> Glenn Clancy, Town Engineer & Acting Director of Community Development, telephone interview 31 March, 2005.

<sup>16</sup> Interview, Glenn Clancy & my own observations.

<sup>17</sup> While observing traffic at School Street, I witnessed an accident where a driver sideswiped one car while trying to squeeze past another.

<sup>18</sup> Sgt Ken Hamilton, Traffic Control Division Sgt., Belmont Police Department, interview 7 March, 2005.

<sup>19</sup> I reviewed the Belmont Police Department’s fatal accident records from 1970 to the present.

<sup>20</sup> Ibid.

<sup>21</sup> I reviewed the Belmont Police Department’s record of all accidents on Trapelo Road for the year 2004.

<sup>22</sup> Institute of Transportation Engineers, “ITE Traditional Neighborhood Development: Street Design Guidelines; A Recommended Practice of the Institute of Transportation Engineers.” ITE, Washington, D.C., October 1999. p. 18.

<sup>23</sup> Glen Clancey, the Belmont Town Engineer, commented that the road does have some regional significance.

<sup>24</sup> “Community Profiles”, MAPC

<sup>25</sup> Dave Kaloupek, member, Trapelo Neighborhood Association, telephone interview 10 March, 2005.

<sup>26</sup> “2004 Congestion Management Report,” Central Transportation Planning Staff, 2004. Appendix B8, Figure 3.2b & data from the CTPS Boston metropolitan traffic model.

<sup>27</sup> Chart compiled from the following articles:

Kathleen Conti, “Hospital’s Zoning Change Upheld: Development Work May Begin Next Year,” in *The Boston Globe*. 28 November 2002, *Globe Northwest*, p. 1.

David Desjardins, “Town Fights Sate on Plan to Auction Land,” in *The Boston Globe*. 13 March, 2005, *Globe Northwest*, p. 1.

Christine McConville, “Apartment Proposal Gets Boost But Citizens Group

Wants Site Preserved for Wildlife,” in *The Boston Globe*. 24 February, 2005. Globe Northwest, p. 1.

Emily Sweeney, “City can Buy Church Parcel, Council Approves Borrowing \$4.5M,” in *The Boston Globe*. 5 August, 2004, Globe West, p. 1.

Emily Sweeney, “Hospital Will be Razed to Build 268 Condo Unit, Historic Wellington Manse Will Remain, Developers Say,” in *The Boston Globe*. 14 December, 2003, Globe West, p. 1.

Emily Sweeney, “Indian Ridge Developer to Move Forward,” in *The Boston Globe*. 13 February 2005, Globe West. p. 1.

Emily Sweeney, “Waltham Civic Groups Target Rash of New Development: 1,500 Prospective Units Prompt Talks,” in *The Boston Globe*. 24 June, 2004, Globe West p. 3.

<sup>28</sup> Conti, *Boston Globe*

<sup>29</sup> Sweeney, *Boston Globe*, 13 February 2005

<sup>30</sup> Desjardins, *Boston Globe*

<sup>31</sup> Dave Kaloupek, interview.

<sup>32</sup> Emily Sweeney, “Magic of Incumbency Didn’t Work for Gately McCarthy, Stanley Ready for Hard Campaign,” in *The Boston Globe*, 21 September, 2003. Globe West, p. 1.

<sup>33</sup> Lisa Kocian, “You Can’t Get There From Here – On Time, Trapelo Road Traffic Spiraling Out of Control,” in *The Boston Globe*. 25 January, 2001, Globe West, p. 1.

<sup>34</sup> Glenn Clancy, interview.

<sup>35</sup> *Trip Generation Vol. 1 & 2*, Institute of Transportation Engineers, Washington D.C., 1997. p. 262, 299, 327, 360, and 462.

<sup>36</sup> Alan Jacobs, *Great Streets*. The MIT Press, Cambridge, Massachusetts, 1993.

<sup>37</sup> Charles V. Zegee and Cara B. Seiderman, “Designing for Pedestrians,” in *The Traffic Safety Toolbox: A Primer on Traffic Safety*. The Institute of Transportation Engineers, Washington D.C., 1999. p. 181

<sup>38</sup> *Ibid*, p. 192

<sup>39</sup> A note on the data: refer to note 12 for traffic count methodology; ADT is equal to the AM Peak volume multiplied by 10; average delay calculated by the HCS software; I also calculated my own average delay, but omitted the data due to the small sample size.

# Chapter 4: Redesign Options

Based on my interviews with Belmont public officials and on comments from residents and business owners, there is no consensus on how Trapelo Road should be redesigned. Overall, I came away feeling that dealing with change of any kind is difficult for Belmont’s government and its residents. Almost all of the public officials I spoke with, including Board of Selectmen Chairman Paul Solomon, said that Belmont residents can be resistant to change and prone to NIMBY-ism.<sup>1</sup> When it comes to the redesign of Trapelo Road, passions seem to run particularly high. One public official recounted a public meeting during which an irate Trapelo business owner began screaming at her committee over the construction of a neckdown on the corridor.<sup>2</sup> At the practicum’s first public meeting in October, the tenor of discussion became heated when one attendee sharply questioned the value of narrowing Trapelo.<sup>3</sup> The past history of our client, the Belmont Citizens Forum, seemed to further stir emotion on the issue. The Forum was involved in a controversial lawsuit against

the town, stemming from the proposed redevelopment of McLean Hospital. Needless to say, creating a consensus on the corridor will be a daunting task for Belmont’s public officials.

Most of the public officials and many of the residents I spoke with voiced support, at least in principle, for enhancing the corridor’s physical character, economic vibrancy, and pedestrian accessibility. Paul Solomon said that he wanted to “make Trapelo more of a destination, not just a pass through.”<sup>4</sup> Andy McClurg, a member of the Belmont Planning Board, and Mary Jo Frisoli, chairman of the Belmont Traffic Advisory Committee, both said that the redesign should address concerns on pedestrian safety and should be sensitive to the local context. McClurg voiced his support for a multi-modal “Main Street” vision for the corridor. Paul Winters, a local business owner, expressed dismay that Cushing Square’s vitality had eroded over the years and argued that streetscape improvements were needed to reverse the economic decline.<sup>5</sup> Overall, my interviews suggested that there was concern that Trapelo was not the place that it once was and that the redesign

Chart: Stakeholder Groups

Local	Regional	Organizations	Government
Business owners	Residents of adjacent towns	Watertown-Belmont Chamber of Commerce	Mass Highway MAPC
Abutting residents	Auto commuters	Advocacy groups	The Boston MPO
Belmont residents	Transit commuters	Belmont Citizens Forum	
Senior citizens	Bike commuters		
School children			
Bicyclists			

should be part of an effort restore vibrancy to the corridor. From the viewpoint of an outsider, this would seem to be a fairly uncontroversial vision. Why wouldn't an older town want one its main streets to be attractive, economically vibrant, and accessible to pedestrians?

The debate is not so much over this vision, but over how it would be implemented and what the implications would be for traffic patterns and local congestion. As stated earlier, the configuration of Trapelo, especially the number of lanes (four versus two or three) and the use of traffic calming measures, is the most divisive issue. Most of the public officials I spoke with didn't explicitly advocate a specific design concept; instead they said their role was to balance different interests and concerns in the planning process. A number of residents, however, had fairly strong opinions on the matter. At the practicum's initial public meeting, one attendee argued that traffic was hurting the corridor and that the road should be narrowed, asking the audience rhetorically, "What do we want, a freeway?" In an email response to the meeting, another resident wrote that Trapelo's role "as a vehicular thoroughfare should be minimized. ... if there is any chance of creating a truly vibrant residential/commercial mixed-use in the commercial areas, the key will be slowing down the traffic and making everything as pedestrian friendly as possible. Cushing Square is a perfect example of an intersection with far too much paving and fast traffic."<sup>6</sup> Proponents of narrowing Trapelo want a design that discourages through traffic, slows

cars down, and prioritizes neighborhood character and pedestrian accessibility.

There are several equally strong voices whose primary concern is traffic congestion and maintenance of the road's current vehicle capacity. The public officials I spoke with, including Solomon and Frisoli, stated that business owners on the corridor are opposed to a reduction in the number of lanes on Trapelo. Many see their businesses as dependent on the level of traffic. At the initial public meeting, the owner of a local print shop argued that narrowing would make it more difficult for trucks to make deliveries and for customers to get to his store.<sup>7</sup> There is also a constituency of residents on this side of the debate. One resident wrote in a response email:

I have commuted from Belmont to my job in the Rt 495 area for the last 23 years. ... One of the great advantages of living in Belmont is that you can get to major highways [including Route 128, Route 2, and Route 495] rather quickly. Many of Belmont's working population make use of their cars to get to work. As much as we'd like to believe that public transportation and bicycle traffic are the preferred way to commute from Belmont to their jobs, it is a small minority of folks that actually take that path. We are very dependent on getting from our homes to these highways quickly and safely. Trapelo Road is a very important road to all folks that need to get to Rt 128. ... If you make lane reduction adjustments to Trapelo Rd, I envision that we will have the type of traffic and delays that are now experienced on [heavily congested] Concord Avenue.<sup>8</sup>

Other residents raised concerns that narrowing would push traffic

---

onto residential streets, cause congestion, and ignore new traffic pressures from residential development in Waltham. According to McClurg, many residents hold a “if it ain’t broke, don’t fix it” attitude toward the corridor. The road carries a lot of traffic, it works fairly well now, most people in Belmont drive, so why change it?<sup>9</sup> It’s also important to note that parking is also a big issue, for both business owners, who want more parking spaces, and residents, who don’t want non-residents parking on local side streets.

### **The Planning Process**

In an attempt to address these issues and come up with a plan, the town has developed a novel planning process for the redesign. The Planning Board, the Traffic Advisory Committee, the Board of Selectmen, and the Town Engineer and Planner will all be involved. Frisoli and McClurg laid out the details of the process:

1. The Planning Board will come up with broad set of goals for the redesign and submit them to Traffic Advisory Board (TAC);
2. The TAC will hold public meetings to solicit feedback and hire a consultant to conduct a transportation study of the corridor;

3. Based on the goals, study, and public feedback, the TAC will work with their consultant on a detailed design proposal for the corridor. This phase will be funded through the town’s Chapter 90 funds;
4. The proposal will be submitted to Mass Highway for consideration for the State’s Transportation Improvement Program (TIP) list (TIP provides state money for local transportation projects);
5. Belmont will work with Mass Highway on any changes to the plan or the project budget, a process that will occur within the context of new and more flexible state road design standards;
6. If accepted, the project will go into construction once funds are made available, with the Board of Selectmen having the role of ensuring that the process moves forward as each step in completed.

As of early April, the TAC was preparing to release a request for qualifications (RFQ) for consultants.<sup>10</sup> Frisoli and McClurg expect the redesign process to be a long one, lasting about 10 years. McClurg also hopes that there will be a parallel effort on land use changes by the Planning Board, particularly to implement the recommendations of an earlier economic development study

by the Cecil Group, which urged zoning, parking policy, and streetscape improvements for Trapelo.<sup>11</sup>

Its far from clear what the result of the planning process will be, but a range of options will be considered. Glenn Clancy, the Town Engineer, commented that “everything is on the table,” including tightening corners, narrowing the road, adding sidewalk space and bike lanes, and using traffic calming. McClurg hoped to use the process as an opportunity for Belmont to think of “what the street should be” and to place congestion in context.<sup>12</sup> Is congestion really the most important value? Is the town willing to put up with a bit of congestion at certain times to achieve other community goals? Frisoli believed that in the end the plan will have to balance competing goals. The plan will probably “throw everyone a bone, but not everyone will be completely happy.”<sup>13</sup> In the end, most of the public officials I spoke with saw the debate and the redesign in terms of trade-offs between the two competing visions, the “Main Street” vision and the congestion-free arterial vision. Frisoli saw congestion as an inevitability within the next years given annual increases in traffic and regional traffic pressures.

Less clear is how Belmont’s plan will be coordinated with adjoining towns, including Waltham and Watertown, and with state and regional agencies, including the Metropolitan Area Planning Council (MAPC), Mass Highway, and the Boston Metropolitan Planning Organization. Solomon said that Belmont had tried to engage Watertown, which has jurisdiction over

part of Belmont Street, in a discussion about the redesign but Watertown officials had been unresponsive. In a parallel effort, the MAPC is conducting a land-use and transportation study in Belmont, Lexington, and Waltham, and will be looking at Trapelo Road. The study was prompted by the flurry of new development proposals on the region and will involve a task force, including representatives from Belmont. The implications of this study on content of Belmont’s proposed redesign and the town’s negotiations with Mass Highway and the Boston MPO are yet unclear.<sup>14</sup>

In the interim, the TAC has plans for three neckdowns (i.e. pinch-points which will narrow the road to two lanes) on the Trapelo corridor. The neckdowns are intended to reduce vehicle speeds and to create safer crossing points for pedestrians. According to McClurg, these are temporary measures and not part of the overall plan for Trapelo. One neckdown has already been installed at Hawthorne Street near Waverly Square and narrows traffic entering the Square to two lanes. Although there was much grumbling about its installation, especially from local businesses, it appears to be functioning successfully. In addition, the town will place neckdowns on either side of Cushing Square, one at Willow Street and one at Poplar Street. Their purpose is to control traffic entering the square and to indicate to drivers that they are entering a low-speed pedestrian zone. Construction is to begin soon. Again, local business owners attempted to block the installation of these traffic-calming measures.<sup>15</sup>



---

## Redesign Options

In light of the current conditions on the corridor, the growth pressures in the region, and the diverse preferences of residents, I will present three redesign alternatives:

- (1) *No change alternative*: repave but otherwise retain the current road configuration and street design.
- (2) *Congestion relief alternative*: convert into a formal four-lane arterial; give vehicles priority at intersections and accommodate pedestrians and bicyclists as far as possible given vehicle priority.
- (3) *Multi-modal alternative*: focus on enhancing neighborhood character; expand and improve facilities for pedestrians and bicyclists and accommodate motorists as far as possible given other priorities.

For each alternative, I will present overall goals, implementation tools, and a sample road cross section. I will envision the application of each alternative application to one of three key intersections I have been focusing on throughout. I will then analyze the potential impacts of these changes and comment on the extent of trade-offs between automobility, and community character and pedestrian accessibility. I will also comment on the political obstacles to each approach.

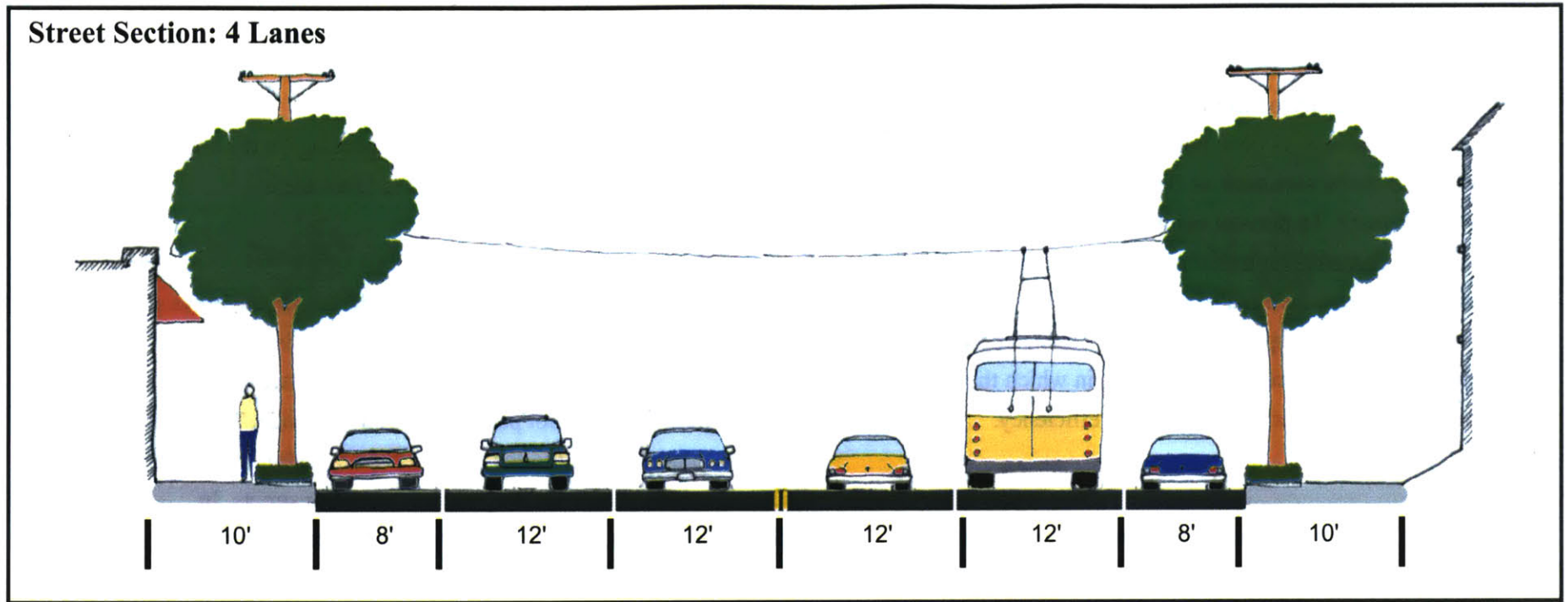
## *No Change Alternative*

Given the extensive analysis of existing conditions, my discussion of this alternative will be brief. Belmont could propose to repave the Trapelo corridor without making any major changes to the road configuration or streetscape. The street would retain its ambiguous two-lane and four-lane configuration, pedestrian and transit facilities would be unchanged, and no new facilities would be added for bicyclists. The goal would be to maintain existing conditions and minimize the impact of the project on residents. This alternative is highly unlikely given that the new design has to conform to Massachusetts state standards and that the town will be engaging in a formal planning process. In terms of trade-offs, such a plan would please neither side of the redesign debate. It would fail to improve pedestrian conditions but would also not explicitly create a four-lane facility for drivers. Although resistance to change is an undercurrent in Belmont politics, no one explicitly advocated this approach.

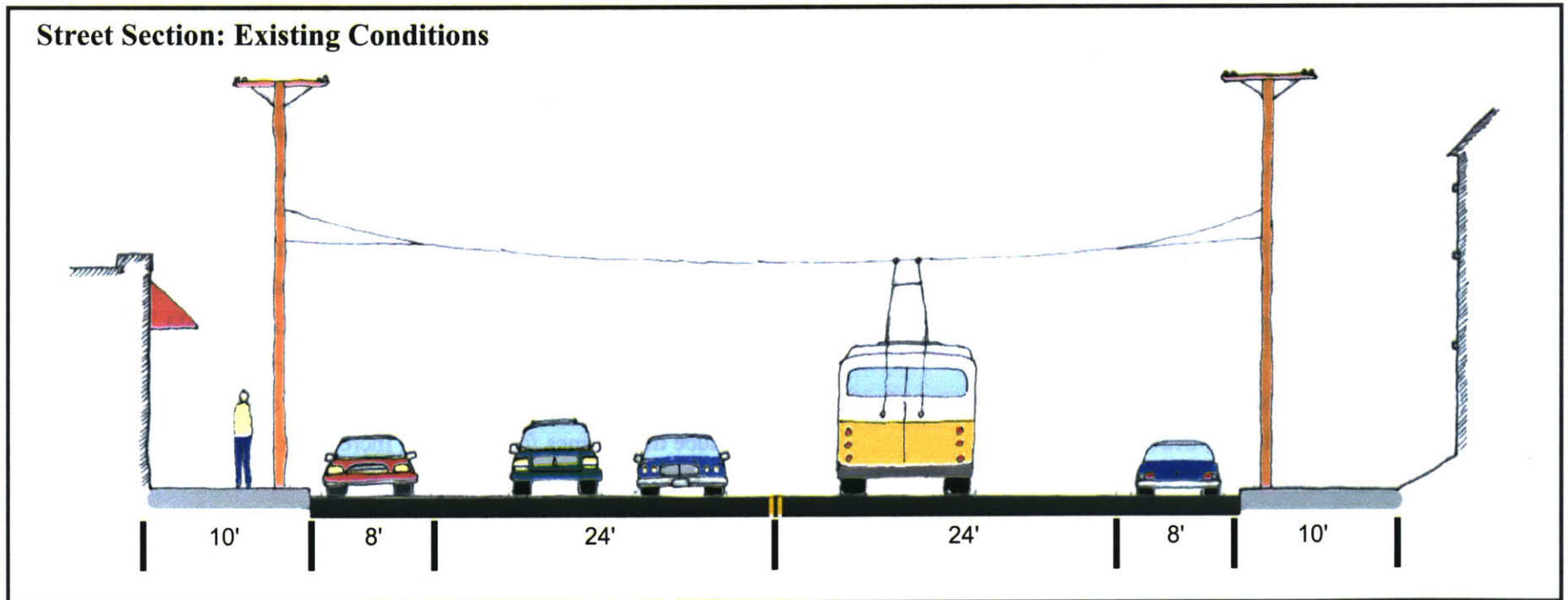
## *Congestion Relief Alternative*

Under this vision, the primary role of the corridor is as a carrier for local and regional traffic and an access point to major arterials and highways. As advocates of this approach would argue, the dominant mode of travel in Belmont and the surrounding region is the automobile, a fact that is not likely to change, and the redesign should prioritize drivers, while accommodating pedestrians, transit users, and bicyclists where possible.

**Street Section: 4 Lanes**



**Street Section: Existing Conditions**



---

Congestion is a quality-of-life issue for residents and an economic one for local business owners, particularly the proprietors of auto-oriented businesses such as Belmont Car Wash & Detailing at Waverly Square. To prevent congestion and to accommodate new regional demands on traffic capacity, the redesign should maintain or increase the road's capacity and allow for the maximum safe driving speeds. This is the classic approach taken by transportation engineers and planners, in which the key drivers of design are level of service and system efficiency.

### Goals

The goals of the congestion relief alternative would be to:

- Maintain adequate capacity to handle existing and projected traffic growth in the area, including traffic generated from new development in Waltham;
- Maximize vehicle speeds while remaining within the bounds of safe traffic engineering practice;
- Configure intersections to maximize vehicle flow, eliminate vehicle conflicts, and improve or maintain the current level of service;
- Design the cross section to facilitate the movement of trucks, buses, and other heavy vehicles;

- Maintain or increase the supply of parking on the corridor to ensure easy access by drivers to retail areas.

### Design and Analysis

A sample cross section could look like the design on the previous page, rendered with the School Street intersection in mind.

The road would accommodate four 12-foot lanes, two in each direction, plus an eight-foot parking lane on each side. This cross section would be applied to the length of the corridor, including the intersections at School, Waverly and Cushing streets. In addition, this design would maintain wide corner turning radii and current sidewalk widths to facilitate easy turning movements, retain the current push-button pedestrian signals, and use dedicated right turn lanes at key intersections. In addition, it would include street trees, sidewalk repaving, and some street furniture.

The four-lane cross section would provide capacity for 3,200 to 3,600 vehicles per hour, more than twice the current peak hour traffic flow of about 1,700 vehicles at School Street.<sup>16</sup> The configuration would more than accommodate current vehicular traffic and provide excess capacity to handle increased future demand. Better coordination of intersection traffic lights could provide further efficiency benefits and maintain a level of service of C or better. Higher speeds, especially during the off peak, would reduce travel times for motorists. Increased capacity would

benefit commuters both in Belmont and in the region who use the corridor to reach major highways such as routes 2 and 128. The wide street would easily accommodate buses, trucks, and emergency vehicles, and there would be room for commercial vehicles to make deliveries. Auto-oriented businesses, such as the corridor's gas stations, would likely benefit. Such a design would also include some aesthetic improvements that would improve the streetscape, including street trees, bus shelters, and new sidewalk paving. The focus, however, would be on creating an efficient suburban arterial.

Although good for motorists, this approach would impose significant costs on pedestrians and bicyclists. By striping four lanes, speeds would likely increase to 40 miles an hour, especially during the off-peak, as drivers would feel more comfortable passing in the left lane. Instead of traffic speeds being set by conservative drivers, as is the case on two-lane roads, the pace would be set by more aggressive motorists in the left lane. High speeds would, in turn, deter bicyclists from using Trapelo and would make crossing the corridor more difficult for pedestrians, particularly at un-signalized crosswalks. Research has shown that the higher the average speed of traffic, the lower the percentage of drivers who will stop and yield to pedestrians in crosswalks.<sup>17</sup> Higher speeds could also lead to more accidents, both between motorists and between motorists and pedestrians. As I noted earlier, the fatality rates for accidents involving pedestrians rises dramatically as the speed of the vehicle exceeds 20 miles

per hour. Children walking home from the Butler School near Hawthorne Street or elderly residents heading to Belmont's Senior Citizens Center near Waverly Square would have to contend with more dangerous intersections. Transit riders, who make up 30% of travelers on the corridor, would have a more dangerous and unpleasant walk to and from their bus stop or the Waverly Square train station.

Furthermore, such a design would have a negative impact on the neighborhood environment and could further contribute to the economic decline of local businesses. As I will argue in greater depth in the next section, any redesign of the corridor should try to take advantage of Trapelo's strengths, i.e., its potential as a village-style shopping district, when competing for customers with other shopping areas. Attempting to compete with auto-oriented shopping centers and malls, which have more parking and bigger stores, will be less effective. More traffic noise and concerns about pedestrian safety and access would deter pedestrians from using the area, and might lead residents to shop elsewhere. Placing a four-lane arterial road carrying substantial through traffic on the corridor could undermine parallel efforts to improve the corridor's economic outlook. High traffic volumes may help the Dunkin Donuts in Waverly Square or local gas stations, but, overall, could end up hurting the corridor's small businesses.

Finally, the congestion-relief alternative may have unforeseen consequences that undercut its principal benefits.

---

By expanding the capacity and operating speed of the road, the design will encourage more regional commuters to use the corridor, especially those seeking to avoid chronic congestion on Route 2 and Concord Avenue. Induced demand will increase the potential for congestion and longer travel times. In addition, pedestrians, including those who use the corridor to reach transit, may choose to drive because of degraded pedestrian safety and sidewalk facilities. Again, less transit usage would lead to more cars on the road and the potential for traffic bottlenecks. Even if these forces do not come into play, congestion may well overtake the road during the morning and evening peaks under any of the three design alternatives. Mary Jo Frisoli, the chairman of the TAC, said that, in her opinion, congestion is inevitable in the future and Trapelo will reach its saturation point in the next 10 years. Based on historical trends in Belmont and Boston, congestion may be taken as a given. The issues, then, is how to manage congestion, not how to eliminate it. A better strategy may be to create disincentives for additional commuters to use the corridor as a through route.

#### *Multi-Modal Alternative*

Under this vision, the corridor is not simply a conduit for car traffic but is seen as a neighborhood destination, a local shopping district, and a route for pedestrians, transit riders, and bicyclists. The street is understood in its multiple contexts: as a transportation facility, as a public space, as a village center, and

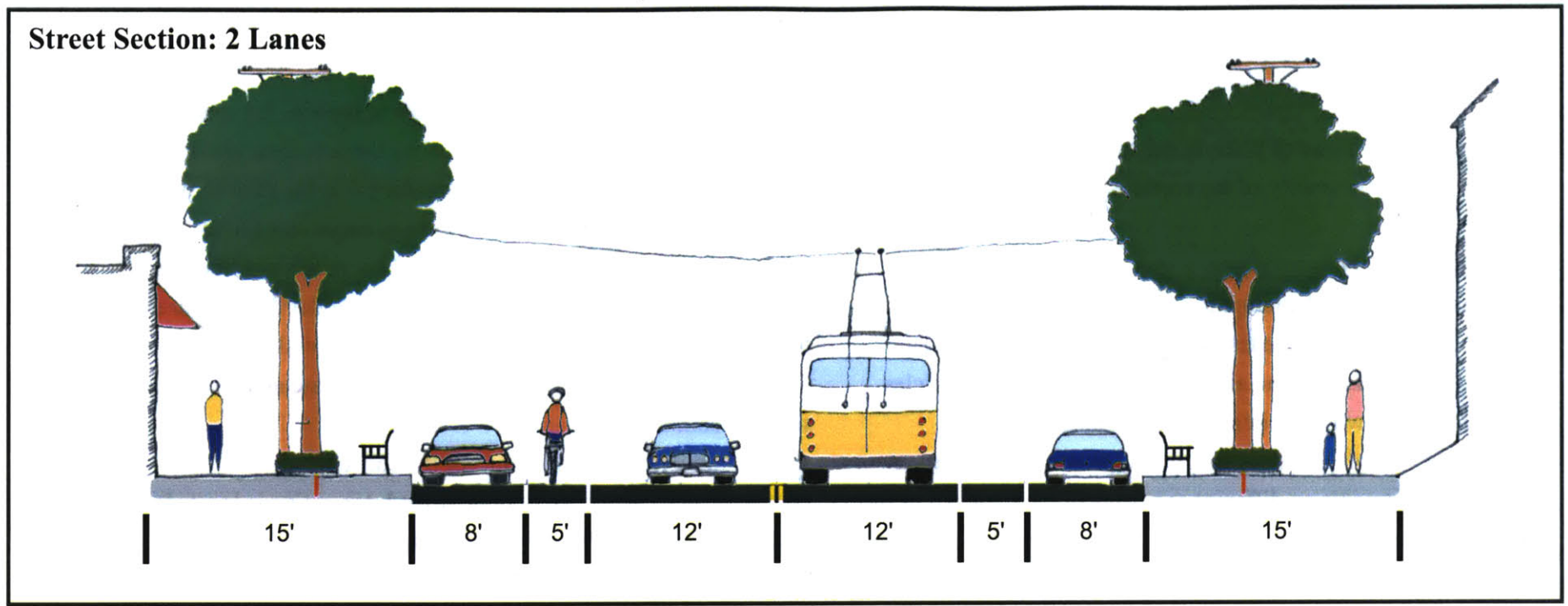
as part of a larger residential neighborhood. Rather than letting regional pressures dictate conditions and design, this approach attempts to assert the corridor's identity and principal function. The emphasis is on balancing the street's multiple roles, while accommodating, rather than giving priority to, current levels of traffic. Values such as neighborhood character and pedestrian safety are put on equal footing with more quantifiable measures such as level of service. This design is also context specific, taking into account the varying conditions and qualities of different portions of the corridor. It is beyond the scope of this thesis to analyze every section and intersection, instead I will provide some general design recommendation and then illustrate their application to Cushing Square.

#### Goals:

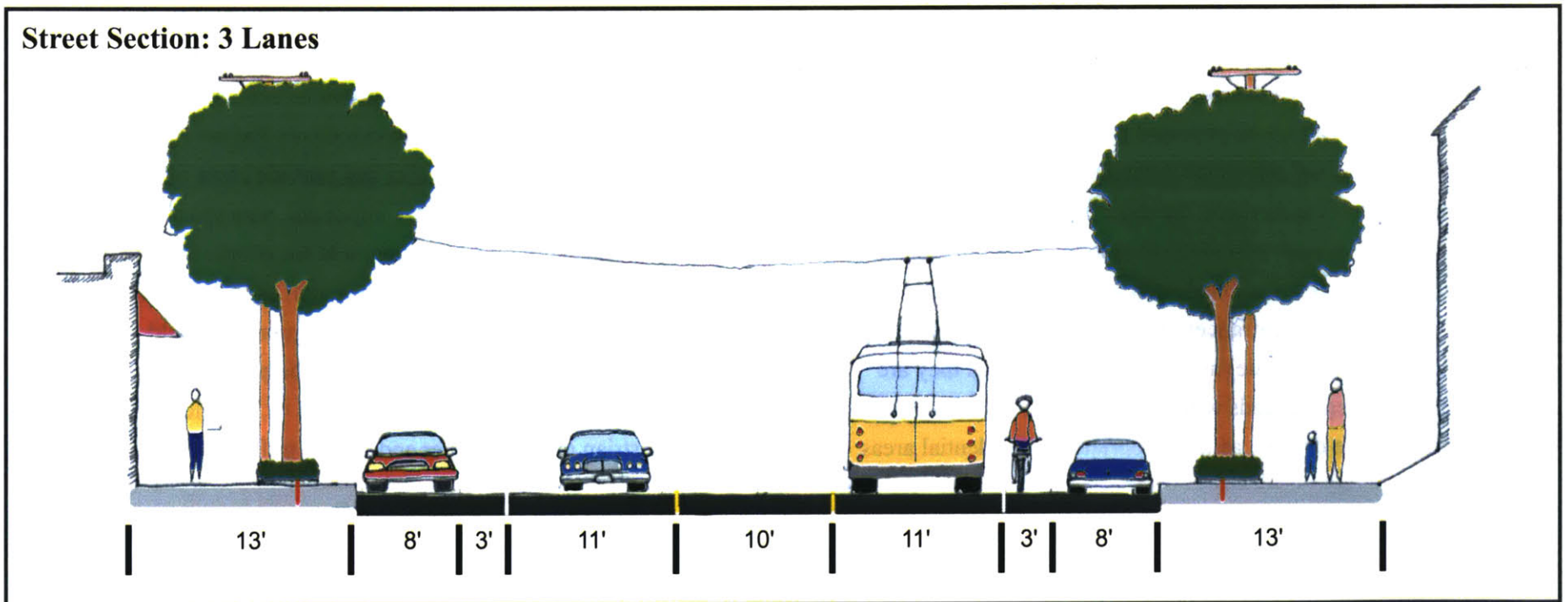
The goals of the multi-modal main street alternative would be to:

- Increase pedestrian safety and accessibility to encourage street activity and reduce pedestrian accidents;
- Improve the neighborhood character of the corridor to promote local business activity;
- Promote alternate modes of travel, including walking, biking, and transit, to reduce traffic congestion and increase accessibility;

### Street Section: 2 Lanes



### Street Section: 3 Lanes



- 
- Create a sense of place to enhance the social and economic vitality of the corridor.

### Design and Analysis

This approach would attempt to slow traffic, reclaim street space for an expanded pedestrian realm, better accommodate bicyclists on the road, and aim to reduce the speed of vehicles on the corridor while maintaining reasonable traffic flow.

Instead of a single cross section, this approach would implement different treatments on different segments of the road. All of the configurations on the previous page meet or exceed the minimum geometric standards of the American Association of State Highway and Transportation Officials (AASHTO).<sup>18</sup>

For example, the residential sections between major intersections could be narrowed to two 12-foot lanes with a five-foot bike lane on each side, as shown in the cross section on page 57. The extra width provided by the bike lanes would also provide space for cars to get around stopped buses or for emergency vehicles to navigate the road. Excess right of way could be used to expand planting strips to make the area greener or to widen sidewalks. The residential areas have few high volume driveways and entrances, thus turning movements (and the conflicts they can create) are a lesser concern than they are in commercial areas. Speeds would be moderate and set by the more conservative drivers, as is appropriate for residential areas.

Less traffic could help corridor residents to reclaim the space of the street, which is not well used now by them or their children. Studies on the impact of traffic on residential areas have shown that streets with heavy traffic tend to have much less social interaction and street activity. Neighbors are much less likely to know each other, to socialize in the street, or to let their children play in front of their homes. Conversely, residential streets with little traffic tend to promote a richer social climate and a stronger sense of community.<sup>19</sup>

In the mixed use sections of the corridor, such as Harvard Lawn (where the School Street Intersection is located) or the approaches to Waverly and Cushing squares, a three-lane configuration, including bike lanes, could be used. The configuration would provide for two 11-foot travel lanes, one in each direction, and a center two-way left-turn lane (TWLTL). The TWLTL reduces backups by clearing vehicles making left turns out of through traffic. The lane also provides extra space for trucks, buses, and emergency vehicles to maneuver. Excess right of way could be used to widen sidewalks and provide more of a buffer for pedestrians from traffic. More important, new space could be used to create an inviting environment for people to stroll, shop, or relax on benches and people watch, as seen in the photos on the right. Speeds for a three-lane configuration would be lower than those on a four-lane road because the pace is set by conservative drivers. Lower speeds, around 15 to 20 miles an hour, make pedestrian crossing easier and reduce traffic noise.

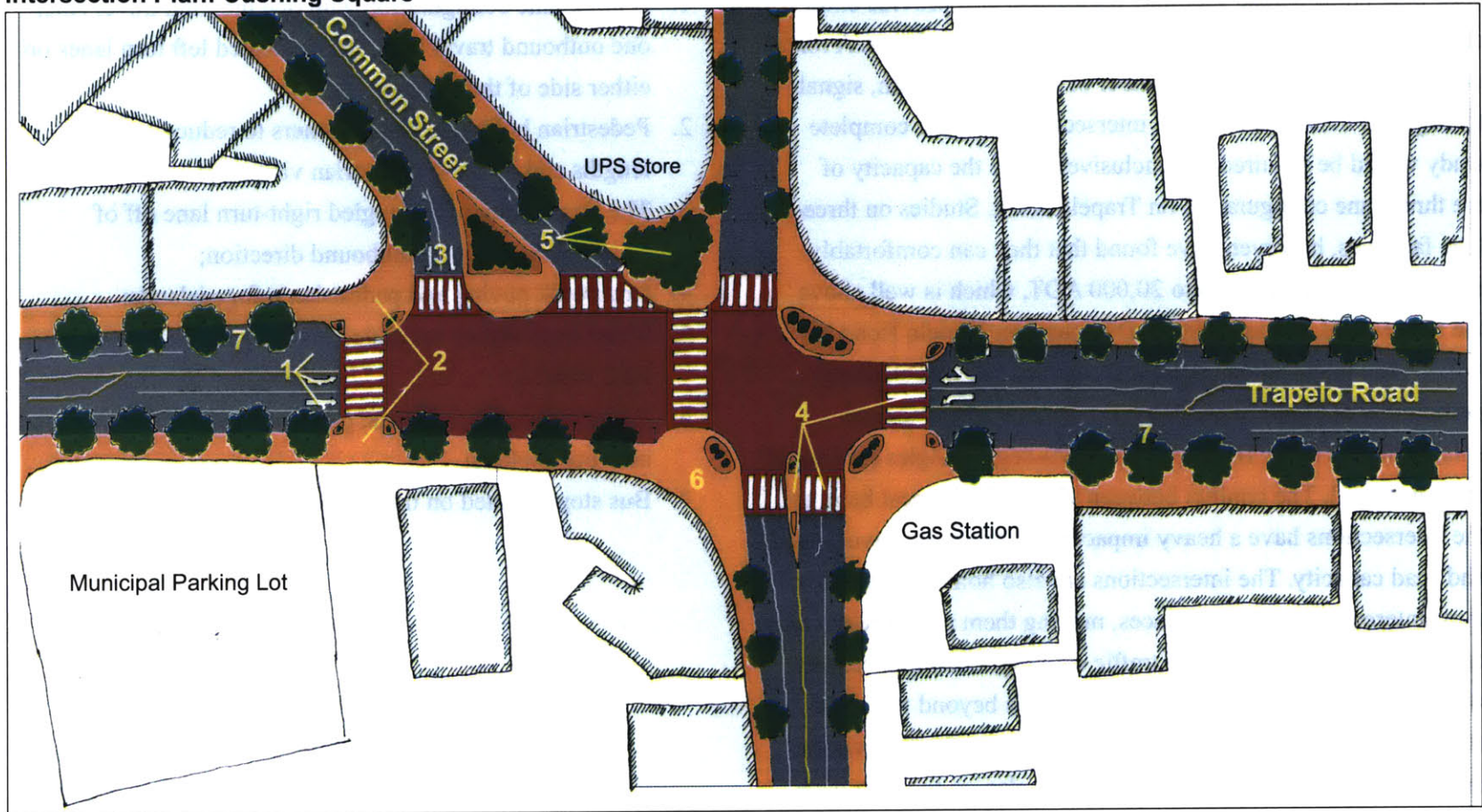


New bike lanes would facilitate biking and also provide extra room for trucks making deliveries or double-parked cars. A road's capacity is a product of the number of lanes, lane width, signal timing, and distances between intersections. A more complete study would be required to conclusively state the capacity of the three-lane configuration on Trapelo Road. Studies on three-lane facilities, however, have found that they can comfortably accommodate volumes up to 20,000 ADT, which is well above the range of 13,500 to 17,000 ADT found on Trapelo Road.<sup>20</sup>

The intersections present the greatest design challenge, particularly at Cushing and Waverly squares where several smaller streets cross Trapelo at a non-90-degree angles (see aerial map, page 41). The conflict between visions is sharpest here, as the intersections have a heavy impact on congestion, travel speed, and road capacity. The intersections are also home to Trapelo's most interesting and lively places, making them the more obvious candidates for narrowing and traffic calming. Each intersection will have to be treated individually, and it is beyond the scope of this thesis to examine all nine of the signalized intersections on the corridor. As an example, the street plan on the next page presents a conceptual plan for the redesign of Cushing Square. As was shown in the previous chapter, this square is currently dominated by a wide expanse of asphalt and has difficult crossing points for pedestrians. The multi-modal configuration would include:

1. A three-lane configuration with one inbound travel lane, one outbound travel lane, and dedicated left turn lanes on either side of the intersection;
2. Pedestrian bulb-outs on all corners to reduce crossing lengths and increase pedestrian visibility;
3. The elimination of the angled right-turn lane off of Common St. in the southbound direction;
4. Crosswalk paving and pedestrian refuge islands;
5. Street trees and an expanded pocket park in front of the UPS store;
6. Wider sidewalks, benches, period decorative lighting, and new bus shelters;
7. Bus stops located on the far side of the intersection.

### Intersection Plan: Cushing Square



#### Design Features:

1. A three-lane configuration
2. Pedestrian bulb-outs
3. The elimination of the angled right-turn lane off of Common St.
4. Crosswalk paving and pedestrian refuge islands;
5. Street trees and an expanded pocket park in front of UPS store;
6. Wider sidewalks and street furniture;
7. Bus stops located on the far side of the intersection.



Pedestrian islands and street paving would signal to drivers to slow down and be attentive to pedestrian activity. Lower speeds would result in fewer accidents, safer crossing conditions, and a more inviting environment. This approach would help stimulate more street life and support local businesses and create an identity for an area that is struggling to stand out in the midst of traffic and asphalt. To compete regionally, areas like Cushing and Waverly squares need to capitalize on their strengths: attractive historical buildings, the potential for a village or “Main Street” atmosphere, and unique local retail, such as the Ohlin’s Bakery in Cushing Square or the Wheelworks bike shop in Waverly Square, shown on the right. This strategy has been a very successful business model for places like Harvard Square in Cambridge and Davis Square in Somerville, Massachusetts. The extra public space could be used to allow a sidewalk café, as in Harvard Square, or to place benches and place-markers, as in Arlington Heights in Arlington, Massachusetts. Parking will continue to be an issue, but the redesign’s priority should be to get drivers to slow down, to get them out of their cars and onto the sidewalks, and to create a local destination that folks would walk to from the surrounding residential areas.

Assuming that traffic on Trapelo would be apportioned a green signal for half of each cycle (i.e. 30 seconds of green for a 60 second cycle), the three-lane configuration could accommodate current levels of traffic at Cushing Square. The two travel lanes would have a capacity of approximately 900 vehicles

per hour in each direction, enough to handle the 555 westbound and 768 eastbound vehicles observed during the evening rush hour. In addition, a left-turn-only lane for outbound vehicles with its own green signal (similar to the current configuration)

would provide capacity for 250 left-turning vehicles, more than twice the 81 vehicles observed making a left turn onto Common Street during the peak period. Few inbound vehicles (only 21 during the peak hour) turn left onto Common Street, so Belmont could consider banning this movement during rush hour. The road would provide enough capacity for existing traffic, while not inviting more drivers. As argued in the previous section, this approach could also increase the pedestrian and transit modal shares, thus taking cars off the road.

The three-lane configuration would, however, create the potential for greater congestion. A broken down car, a double-parked truck, or a slow-to-move bus could cause a back up with only one through lane. Increases in traffic resulting from new development,



Image: Bikers congregating outside of Wheel Works in Waverly Square



Image: Sidewalk café in Harvard Square

---

population growth, and changes in travel behavior would likely put additional strain on the capacity of the Cushing Square intersection at some point in the future. These inconveniences, however, would most likely be limited to peak hours. A greater challenge is posed by the Waverly Square and School Street intersections, which both carry more through traffic. A nightmare scenario is unlikely, however. Massachusetts Avenue in the Central Square area in Cambridge, which also has three lanes, carries 21,000 cars a day, more than any of the three intersections I examined. Although traffic certainly slows through Central Square during the peak hour, the intersection is more of minor nuisance than a major bottleneck. There is also the limited risk that traffic would spill over onto adjacent residential streets. Although possible, there are no continuous parallel residential streets near Cushing Square, Waverly Square, or School Street. Traffic could move to Belmont Street, Washington Street, or Concord Avenue, but these routes are already main roads.

Because of the heated nature of the debate over the Trapelo corridor, it may be preferable to experiment with the two- or three-lane configurations before committing to a final design. A low cost option would be for the town to use paint, planters, and traffic cones to simulate the three-lane design option for, say, six months. The corridor would be striped for two lanes in residential areas and three lanes in mixed-use and commercial zones. Planters, cones, and temporary signage could be used to create bulb outs at key intersections. The town would have the

opportunity to then evaluate the impact of the design changes, and residents would get to see for themselves the impact of them on their daily lives and commutes. If problems or conflicts arose, they could then be addressed and the responses integrated into the final plan. If successful, such an experiment could create an easy “win” for proponents of a more multi-modal and place-based approach and build momentum for a pedestrian-friendly final design.

In the next chapter, I will reflect on my thesis question, the larger implications of the Trapelo case, and make a final recommendation as to the scenario that best minimizes trade-offs.

## Notes

<sup>1</sup> I interviewed the following public officials:

Mary Jo Frisoli, Chair Belmont Traffic Advisory Committee, telephone interview 23 February, 2005.

Tim Higgins, Senior Planner, Town of Belmont, interview at Office of Community Development November 17th with Linda Pizzuti and Alan Williams of the practicum class.

Andy McClurg, Member, Belmont Planning Board and Senior Associate, Sasaki and Associates, telephone interview 16 February 16, 2005.

Paul Solomon, Chair, Belmont Board of Selectmen, telephone interview 22 March, 2005.

<sup>2</sup> Interview, Mary Jo Frisoli

<sup>3</sup> Initial Public Meeting, held at Belmont City Hall, 14 October, 2004.

<sup>4</sup> Interview with Paul Solomon

<sup>5</sup> Paul Winters, Cushing Square business owners, interview 17 November, 2004.

<sup>6</sup> Resident email response to Initial Public Meeting, 16 October, 2004

<sup>7</sup> Initial Public Meeting, public comment by Jason Joyan, owner, Alba Press.

<sup>8</sup> Resident email response to Initial Public Meeting, 10 November, 2004

<sup>9</sup> Interview, Mary Jo Frisoli

<sup>10</sup> Glenn Clancy, Town Engineer & Acting Director of Community Development, telephone interview 31 March, 2005.

<sup>11</sup> The Cecil Group, "Town of Belmont Economic Development Study," Consultant report prepared for the Town of Belmont, September 2003.

<sup>12</sup> Interview, Andy McClurg

<sup>13</sup> Interview, Mary Jo Frisoli

<sup>14</sup> Anonymous public official, telephone interview 5 April, 2005

<sup>15</sup> Interview, Mary Jo Frisoli

<sup>16</sup> Based on 1800 vehicle capacity per lane divided by the signal cycle share of 50%, i.e. 30 seconds out of 60.

<sup>17</sup> Garder, p. 536

<sup>18</sup> AASHTO minimums for suburban streets: 10' for travel lanes, 8' for parking lanes, 4' for bike lanes, and minimum curb radius of 10' Source: Reid Ewing and Michael King, "Flexible Design of New Jersey's Main Streets." New Jersey Department of Transportation, undated.

<sup>19</sup> Donald Appleyard, *Livable Urban Streets: Managing Auto Traffic in Neighborhoods*. Federal Highway Administration, Washington D.C., 1976. p. 23.

<sup>20</sup> Dan Burden and Peter Lagerwey, "Road Diets: Fixing the Big Roads."

Walkable Communities, Inc. March 1999. & Thomas M. Welch, "The Conversion of Four-Lane Undivided highways to Three-Lane Facilities." Conference Paper from the Transportation Research Board's Urban Street Symposium, Dallas, TX June 1999, p. 3-4.

---

# Chapter 5: Conclusion

Is the redesign of Trapelo Road a zero-sum game? If pedestrians, bicyclists, and transit riders win, must drivers lose? Based on the analysis of existing conditions and design options, it is clear that the Trapelo redesign does entail real trade-offs between congestion reduction, and pedestrian safety and neighborhood character. Both the multi-modal and the congestion-relief alternatives (discussed in the previous chapter) will benefit some groups, while imposing costs on others. The dynamics of these two options, however, are quite different.

As the discussion of the congestion -relief alternative in Chapter 4 demonstrates, transforming Trapelo into a four-lane arterial will impose significant costs on pedestrians and bicyclists. The four-lane configuration would increase vehicle speeds, traffic noise, and the risk of pedestrian accidents. In addition, adding new capacity would likely induce more traffic, because commuters might seek to take advantage of Trapelo Road as an alternative to Route 2 or Concord Avenue. Transit

users, many of whom walk to the 73 bus, would incur many of the same safety and accessibility costs as pedestrians. In the context of increased traffic volumes and speeds, investments in streetscape improvements, such as trees and street furniture, would do little to improve the neighborhood environment. If Belmont chooses to pursue some variant of the four-lane approach, the corridor will become a place for cars, not a place for people. The larger community will also lose the opportunity to create a local amenity and shopping destination. Overall, the analysis indicates that trade-offs between drivers and other groups will be dramatic if Belmont chooses some variant of the congestion-relief alternative.

The multi-modal alternative would also impose costs. Expanding the pedestrian environment, providing facilities for bicyclists, and slowing traffic will cause some congestion and inconvenience drivers, particularly those who commute on the corridor during the morning and evening rush hours. The data from Chapter 3 illustrate that motorists are the dominant user group on the corridor and that Belmont residents show a preference for their cars over walking or transit. Drivers, the majority group, would thus bear the congestion costs of a pedestrian-oriented design, while the benefits would go primarily to the minority user groups, i.e., pedestrians, cyclists, and, to a lesser extent, transit users. In addition, new residential and commercial development, especially in Waltham, threatens to significantly increase traffic levels. With much of the

regional road system at capacity, many of these drivers will likely end up on the Trapelo corridor. More than local conditions, regional traffic pressures will complicate any plan to narrow and traffic-calm the corridor.

That said, the costs imposed on drivers by the multi-modal alternative are less severe than those imposed by the congestion-relief alternative on pedestrians and other user groups. Observed traffic volumes during off-peak periods, including midday and the weekend, were lower than during the morning and evening peak. Therefore, residents would only be inconvenienced by congestion during rush hour. In addition, there is little evidence that a rise in congestion would force spillover traffic onto neighboring residential streets, as the street grid is not conducive to short-cuts. Finally, the inconvenience and lost time experienced by drivers may be offset by other benefits. A resident who routinely drives to the corridor to run errands may appreciate that he can park and then shop in more pleasant surroundings. A parent who uses Trapelo to drive to her job may value that her children enjoy safer conditions on their walk home from school. A resident who lives on the corridor may realize an increase in the value of his home because of the reduction in traffic noise and exhaust. Over time, if the multi-modal alternative is successful in drawing more pedestrians to the area, there would also be a larger constituency of people who benefit.

The dynamics of the multi-modal alternative could, in the long-term, mitigate some of the congestions costs. By promoting

walking, biking, and transit, the redesign will help diversify the corridor's modal split and reduce the number of drivers on the road. Narrowing the road and reducing speeds could also help reduce through traffic by encouraging drivers to use alternate routes, such as Route 2 or Concord Avenue. Furthermore, some congestion is inevitable in the long term, regardless of the design approach taken. The main benefits of the congestion-relief alternative will, therefore, be short-lived. Conversely, the multi-modal approach would help create a new public space and a neighborhood amenity that would serve the community for many years. The trade-offs between congestion, and pedestrian accessibility and neighborhood character are less dramatic for the multi-modal alternative. Therefore, I recommend that Belmont pursue a variant of this approach. As argued throughout, changes in the streetscape along Trapelo must be coordinated with parallel efforts to implement economic development, zoning, and transit policies if they are to be effective in creating a sense of place on the corridor.

### **Challenges to Implementing the Multi-Modal Alternative**

In writing this thesis, I had hoped to show that improving suburban streets and public spaces doesn't have to be a zero-sum game and that street design improvements could enhance the pedestrian environment without impairing automobility. Getting the Town Belmont, or any suburban municipality, to adopt a more balanced approach to street design is difficult given the



---

ingrained belief among many public officials, traffic engineers, business owners, and residents that congestion prevention needs to take priority over other community values. Despite my hope for finding a mutually beneficial solution, the case demonstrates that the trade-offs between a more pedestrian-friendly design and one that favors motorists are more fact than fiction, and that design features may mitigate costs but cannot eliminate them. The physical, political, and social configuration of suburbs presents a serious challenge to providing more inviting pedestrian spaces, encouraging alternative modes, and promoting a sense of community. My findings were somewhat frustrating and complicated the task of coming up with a set of recommendations on how to successfully implement a multi-modal design for Trapelo Road.

In addition, the Trapelo case demonstrates the inadequacy of the tools available to planners and suburban residents to analyze street design alternatives. The traditional quantitative and standards-driven approach to street design tends to favor the needs of motorists over pedestrians and bicyclists. Traffic analysis typically focuses on quantitative measures, such as level of service and average delay, while placing less emphasis on equally important qualitative measures, such as the quality of the urban environment or the pedestrian network. In planning processes, including the one on Trapelo Road, traditional traffic analysis can create false certainty over how a street or intersection should be redesigned by mandating that a certain level of service

or capacity must be maintained. Some planners and engineers have responded to these problems by experimenting with new quantitative indicators, such as measures of pedestrian or transit level of service. These measures will no doubt be helpful, but some values, such as neighborhood character, simply do not translate well into quantitative terms. Additionally, quantitative measures tend to reinforce the reactive approach inherent in traditional transportation planning.

Finally, the case illustrates the difficulty of trying to encourage sustainable transportation patterns by changing one small piece of the larger suburban puzzle. The old adage that all politics is local certainly applies to transportation and urban planning. The lack of coordination between municipalities and regional agencies in the Trapelo case makes it more difficult to develop a comprehensive response to the challenges posed by new residential development in Waltham. The lack of clarity over how new regional travel demand will be accommodated has confused the debate and placed advocates of the multi-modal approach at a disadvantage. Proponents of widening the road can point to the need to increase capacity in the face of more commuters from the western suburbs. Although the Metropolitan Area Planning Council does have a study planned for the Waltham portion of the corridor, this effort is not well coordinated with Belmont's on-going planning process for Trapelo Road. Better coordination could provide more momentum for the multi-modal approach, by, for example, addressing regional traffic

pressures through expanded transit services and land use policies.

### Next Steps

Given these challenges, what steps can Belmont residents, public officials, and planners take to promote a multi-modal and place-based approach to the redesign of Trapelo Road? This section presents a few recommendations and final thoughts for how Belmont can overcome the challenges to implementing a multi-modal design on the Trapelo corridor. These recommendations are meant to have implications beyond the Trapelo case and to speak to the similar challenges faced by suburbs struggling to balance growing travel demand with concerns over quality of life and the environment.

*Recommendation 1:* Planners, residents, and public officials in Belmont and other suburban communities should use a new process for evaluating street design alternatives that deemphasizes traditional traffic engineering measures, such as level of service, and that better incorporates concerns over community context, pedestrian amenities, and quality of life.

Suburban communities and public officials need to free themselves from strict adherence to level of service and geometric standards and be willing to use more qualitative criteria. Street design should be seen as a community building process rather than solely a transportation planning one. The New Jersey Department of Transportation, for example, has

developed a comprehensive guide for transportation planners and public officials on street design for suburban Main Streets.<sup>1</sup> The guide frames traditional traffic analysis as just one part of a larger process of quantitative and qualitative analysis, and states explicitly that level of service should not be the ultimate determinant of street and intersection design. Using existing resources on context-sensitive design is a low-cost way the town can identify a process and the necessary tools for implementing the multi-modal alternative.

*Recommendation 2:* In a similar vein, planners, residents, and public officials in Belmont and other suburban communities should be proactive rather than reactive in their approach to street design.

It is up to suburban residents and public officials to decide what is most important to them about their communities, and to then implement a vision for the future growth of their neighborhoods. Congestion is becoming a fact of life in most suburbs. The planning process for Trapelo Road should compel residents to consider whether they are willing to sacrifice a few more minutes behind the wheel each day to have a more livable and accessible neighborhood. Part of the challenge here is helping residents and public officials to conceive of potential alternatives. What does a road with an ADT of 15,000 or 30,000 actually look and sound like? What would a walk along Trapelo feel like with expanded sidewalks, new shade trees, and a sidewalk cafe?

---

Computer visualization techniques are becoming increasingly advanced and affordable, and can realistically simulate walking through a redesigned street or how an intersection will operate with different traffic and pedestrian flows. With a modest investment, towns like Belmont can use these tools to help residents evaluate different design visions. In this way, residents and public officials can choose a vision for their community, rather than simply reacting to local and regional traffic pressures. Strong leadership by public officials and planners is required to foster this type of process and to advocate for funding for consultants to put together computer simulations of design alternatives.

*Recommendation 3:* Despite the existence of trade-offs, town officials in Belmont and other suburban municipalities need to look for “win-win” measures that can build momentum for a multi-modal and place-based approach to street design.

It will be at least five or more years before Belmont begins construction on rebuilding Trapelo Road. As I argued in Chapter 4, this time provides an opportunity to experiment with temporary changes to road configuration. Using traffic cones, planters, and painted-on lane configurations, the town could, for example, reconfigure Cushing Square as a three-lane intersection. Residents could then experience these changes first hand. Town officials and planners could incorporate the lessons learned from a six month experiment into the final plans for the corridor. In addition

to demystifying the impacts of the multi-modal alternative, this approach would be relatively low-cost and, obviously, reversible.

*Recommendation 4:* State governments, regional agencies, and municipalities should work more closely with each other to implement smart growth policies, including encouraging multi-modal street designs.

Poor regional coordination is a persistent problem in the United States due to local control over land use and the weak position of Metropolitan Planning Organizations (MPOs), the regional bodies responsible for transportation planning. In Massachusetts, Governor Mitt Romney has articulated a smart growth policy and created a new department, the Office of Commonwealth Development, for its implementation. In Belmont, however, the state has been largely absent in the debate over Trapelo Road and has arguably exacerbated sprawl and traffic problems by encouraging the development of state owned properties in Waltham without funding new transit. The MAPC, the Boston MPO, Mass Highway, the MBTA, the Town of Belmont, and the Town of Waltham should work together on addressing the challenges facing the Trapelo corridor. A regional planning process is required that helps each town implement its vision for the corridor to the extent possible. The lack of coordination up to this point has created confusion and fueled the conflict over the Trapelo redesign.

As I have argued throughout, changes to the design of the street need to be coordinated with efforts to increase density and land use mix in the village squares, to promote local businesses, to create an identity for the corridor, and to connect Trapelo Road with Belmont's open spaces and parks. Trapelo will not become a place that residents will want to walk to and linger in, unless new life and commercial activity is injected into the area. Implementing the multi-modal alternative without a comprehensive set of land use and economic development policies would greatly reduce the benefits of a more pedestrian-oriented street design. Hopefully, town officials will continue to move forward with their plans to implement the land use and economic development recommendations of the Cecil Group Report. Overall, Belmont and other suburbs are at a crucial moment. Creating more livable and environmental-friendly communities requires suburban communities to take action now to develop and implement a new vision for their future.

**Notes**

<sup>1</sup> Reid Ewing and Michael King, "Flexible Design of New Jersey's Main Streets." The New Jersey Department of Transportation, Trenton, New Jersey, undated.

---

# Epilogue

On the 11<sup>th</sup> of April, 2005, the Belmont Board of Selectmen voted on the Planning Board's proposed set of guidelines for the redesign of Trapelo Road. These guidelines included broad goals for the project and recommended lane configurations for specific segments of the corridor.<sup>1</sup> The objectives used to develop the planning standards included:

- To develop a plan for the road that clearly delineates the number and width of travel lanes.
- To control traffic speeds.
- To narrow the road, to the degree compatible with continued acceptable levels of vehicular service.
- To beautify the street and the corridor as a whole.

- To make the town squares attractive places to shop.
- To enhance the streetscape of the residential districts.
- To establish a consistent approach to the accommodation of bicycles throughout the corridor.
- To enhance public safety.
- To take into account the burden that any changes may place on public agencies such as the Public Works Department.

The Board of Selectmen adopted these broad goals, but stopped short of endorsing the segment recommendations, which advocated a four lane configuration on most portions of the corridor. Unsurprisingly, this aroused opposition, particularly among vocal advocates for a two- to three-lane design. These broad guidelines will be passed on the Traffic Advisory Committee, where the debate over the future of Trapelo Road will no doubt continue.

## Notes

<sup>1</sup> Belmont Planning Board, "Planning Standards for East Belmont Street/ Trapelo Road." Adopted by the Planning Board 29 March, 2005. Adopted with revisions by the Belmont Board of Selectmen, 11 April 2005. Melody Hanatani, "Trapelo Road-Belmont St. Next," in *The Belmont Citizen-Herald*. Wednesday, 13 April, 2005.

---

# Bibliography

## Books and Journal Articles

Appleyard, Donald, *Livable Urban Streets: Managing Auto Traffic in Neighborhoods*. Federal Highway Administration, Washington D.C., 1976. p. 23.

The Belmont Historic District Commission, *Belmont: The Architecture and Development of the Town of Homes*. The Belmont Historic District Commission, Belmont Massachusetts, 1984.

Boarnet, Marlon and Crane, Randall, *Travel by Design: the influence of urban form on travel*. Oxford University Press, Oxford, UK, 2001.

Burden, Dan and Lagerwey, Peter, "Road Diets: Fixing the Big Roads." Walkable Communities, Inc. March 1999.

Cao, Xinyu Cao and Handy, Susan L., "The Influence of the Built Environment and Residential Self-Selection on Pedestrian Behavior." Conference paper presented at the Transportation Research Board 2005 Conference, Washington DC, January 2005.

Ewing, Reid, "From Highway to My Way," in *Planning*. January 2001.

Ewing, Reid and Cervero, Robert, "Travel and the Built Environment: A Synthesis," in *Transportation Research Record*. Transportation Research Board, Washington D.C., No. 1780, 2001.

Federal Highway Administration, "Evaluation of Lane Reduction 'Road Diet' Measures and Their Effects on Crashes and Injuries." FHA, U.S. Department of Transportation, 2002.

Garder, Per E., "The impact of speed and other variable on pedestrian safety in Maine." in *Accident Analysis & Prevention*. No. 36, 2004.

Handy, Susan and Clifton, Kelly, "Local shopping as a strategy for reducing automobile demand" in *Transportation*. No. 28, 2001.

Jacobs, Alan, *Great Streets*. The MIT Press, Cambridge, Massachusetts, 1993.

Knapp, Keith K., Giese, Karen L., and Lee, Woochil, "Urban Four Lane Undivided to Three-Lane Roadway Conversion Guidelines." Conference paper presented at the 2003 Mid-Continent Transportation Research Symposium, Ames, IA, August 2003.

Welch, Thomas M., "The Conversion of Four-Lane Undivided highways to Three-Lane Facilities." Conference Paper from

---

the Transportation Research Board's Urban Street Symposium, Dallas, TX June 1999, p. 3-4.

### **Standards and Codes**

Burden, Dan, "Street Guidelines for Healthy Neighborhoods." Conference Paper presented at the Transportation Research Board's Urban Street Symposium, Dallas, TX June 1999.

Institute of Transportation Engineers, "ITE Traditional Neighborhood Development: Street Design Guidelines: A Recommended Practice of the Institute of Transportation Engineers." ITE, Washington D.C., October 1999.

Institute of Transportation Engineers, *The Traffic Safety Toolbox: a primer on traffic safety*, ITE, Washington D.C., 1999.

Institute of Transportation Engineers, *Trip Generation Vol. 1 & 2*. ITE, Washington D.C., 1997.

Ewing, Reid and King, Michael, "Flexible Design of New Jersey's Main Streets." The New Jersey Department of Transportation, Trenton, New Jersey, undated.

Ewing, Reid, "Pedestrian and Transit-Friendly Design: A Primer for Smart Growth." The Smart Growth Network, Washington D.C., 1999.

Transportation Research Board, "Context-Sensitive Design Around the Country: Some Examples." TRB, Transportation Research Circular No. E-C067, July 2004.

### **Government Documents**

Bureau of Transportation Statistics, "NHTS: Highlights of the 2001 National Household Travel Survey," BTS, U.S. Department of Transportation, 2003.

The Cecil Group, "Town of Belmont Economic Development Study," Consultant report prepared for the Town of Belmont, September 2003.

Central Transportation Planning Staff, "2004 Congestion Management Report." CTPS, Boston Metropolitan Planning Organization, 2004.

Central Transportation Planning Staff "Plan 2004: Regional Transportation Plan 2004-2025 of the Boston Region MPO." CTPS, Boston Metropolitan Planning Organization, 2004.

Massachusetts Bay Transportation Authority, "Capital Investment Program, FY2006-FY2010." MBTA, March 2005.

Massachusetts Bay Transportation Authority, "Commuter Rail North Side Station Boardings (Inbound): Typical Weekday." MBTA, 2004.

Massachusetts Bay Transportation Authority, "Preliminary 2004 Service Plan: Proposed Bus Service and Policy Modifications." MBTA, March 2004.

Massachusetts Bay Transportation Authority, "Preliminary 2002 Service Plan: Proposed Bus Service and Policy Modifications." MBTA, October 2001.



Massachusetts Bay Transportation Authority, “Trip Summaries, MBTA Bus Data Collection: Selected Routes from Spring 2003,” MBTA, 2003.

Metropolitan Area Planning Council, “Community Profiles: Growth Trends in Greater Boston’s 101 Communities—Revised for 2004.” MAPC, 2004.

Rizzo Associates, “Traffic Impact Study: Metropolitan State Hospital Redevelopment, Lexington, Massachusetts.” Consultant report prepared for AvalonBay Communities, Inc., December 2003.

### **Newspaper Articles**

Conti, Katheleen, “Hospital’s Zoning Change Upheld: Development Work May Begin Next Year,” in *The Boston Globe*. 28 November 2002, Globe Northwest, p. 1.

Desjardins, David, “Town Fights State on Plan to Auction Land,” in *The Boston Globe*. 13 March, 2005, Globe Northwest, p. 1.

Kocian, Lisa, “You Can’t Get There From Here – On Time, Trapelo Road Traffic Spiraling Out of Control,” in *The Boston Globe*. 25 January, 2001, Globe West, p. 1.

McConville, Christine, “Apartment Proposal Gets Boost But Citizens Group Wants Site Preserved for Wildlife,” in *The Boston Globe*. 24 February, 2005, Globe Northwest, p. 1.

Sweeney, Emily. “City can Buy Church Parcel, Council Approves Borrowing \$4.5M,” in *The Boston Globe*. 5 August, 2004, Globe West, p. 1.

Sweeney, Emily, “Hospital Will be Razed to Build 268 Condo Unit, Historic Wellington Manse Will Remain, Developers Say,” in *The Boston Globe*. 14 December, 2003, Globe West. p. 1.

Sweeney, Emily, “Indian Ridge Developer to Move Forward,” in *The Boston Globe*. 13 February 2005, Globe West. p. 1.

Sweeney, Emily, “Magic of Incumbancy Didn’t Work for Gately McCarthy, Stanley Ready for Hard Campaign,” in *The Boston Globe*, 21 September, 2003, Globe West. p. 1.

Sweeney, Emily, “Waltham Civic Groups Target Rash of New Development: 1,500 Prospective Units Prompt Talks,” in *The Boston Globe*. 24 June, 2004, Globe West. p. 3.

### **Interviews**

Glenn Clancy, Town Engineer & Acting Director of Community Development, telephone interview 31 March, 2005.

Mary Jo Frisoli, Chair Belmont Traffic Advisory Committee, telephone interview 23 February, 2005.

Sgt Ken Hamilton, Traffic Control Division, Belmont Police Department, interview 7 March, 2005.

Tim Higgins, Senior Planner, Town of Belmont, interview 17 November, 2004 with Linda Pizzuti and Alan Williams of the

---

practicum class.

Dave Kaloupek, member, Trapelo Neighborhood Association, telephone interview 10 March, 2005.

Andy McClurg, member, Belmont Planning Board, telephone interview 16 February, 2005.

Cara Seiderman, Transportation Program Manager, Cambridge Department of Community Development, telephone interview 9 March, 2005.

Paul Solomon, Chair, Belmont Board of Selectmen, telephone interview 22 March, 2005.

Paul Winters, Cushing Square business owner, interview 17 November, 2004.