



Route 38 Transportation Study

Prepared by:
Northern Middlesex Council of Governments

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I. Introduction and Background

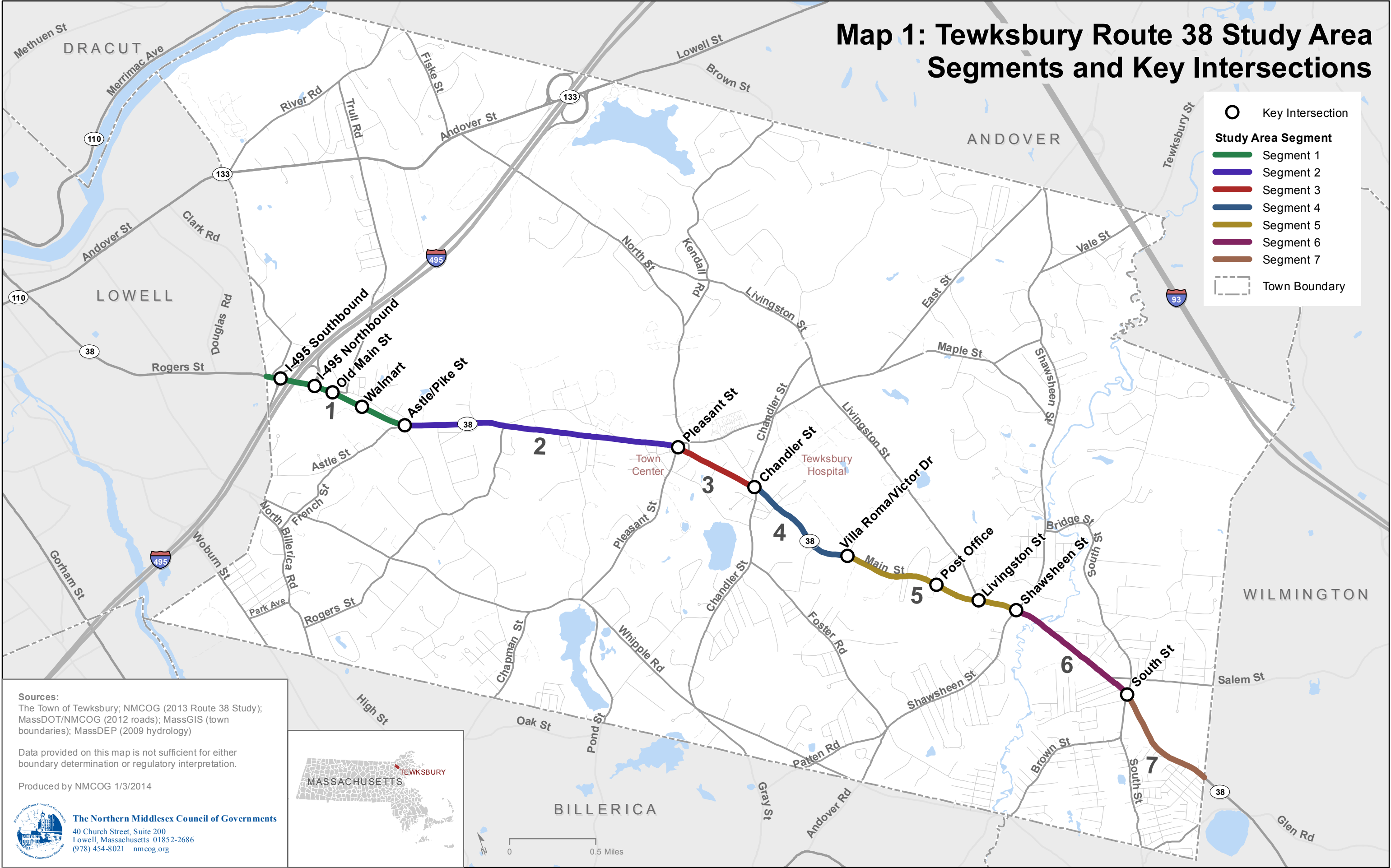
The Route 38 corridor, known as Main Street in Tewksbury, runs in a northwest-southeast direction across the entire length of town, roughly parallel to the old Boston and Maine railroad leg that terminates at the Lowell/Tewksbury line near I-495. Land within the corridor is predominately zoned for commercial development. However the corridor also includes several parcels that are zoned for industrial, residential, multi-family, transitional and municipal uses. The Town Center is located along Route 38 near Pleasant Street, and includes municipal uses such as the Town Hall, and the police and fire departments.

The Commercial zoning district runs the entire length of the Corridor, with residential parcels scattered throughout. In addition, a significant amount of industrially zoned land can be found around the I-495 interchange. Commercial areas along the corridor consist mostly of strip developments with multiple roadway access points, which create conflicts for vehicles trying to enter and exit. The potential exists for substantial increases in traffic volumes based on the traffic generated from future development and redevelopment projects along the already overburdened corridor.

NMCOG has undertaken this traffic study to identify appropriate strategies for improving travel and safety conditions along the corridor. As shown on Map 1, the study area extends 6.3 miles along Main Street from the Lowell line to the Wilmington line. The results of the study will assist the Town in making informed decisions regarding future land use and development, based on the capacity of the roadway and existing operating conditions.

Following completion of the study, NMCOG will continue to work with the Town and MassDOT to implement the recommendations outlined. Such improvements will be needed to accommodate future growth and economic development along the roadway, and to address existing operational and safety concerns.

Map 1: Tewksbury Route 38 Study Area Segments and Key Intersections



II. Land Use and Zoning

The Land Use and Zoning component of the Corridor Study examines past development trends and current land use patterns within the Study Area. Land use refers to the physical arrangement of a community's residential, commercial, industrial and institutional development, along with its transportation network, infrastructure and vacant land. Understanding spatial development patterns, rates of change, and trends is valuable as a basis for discussing the future direction of the town. Land use, zoning and aesthetics play an important role in defining the character of a community. They can also directly impact how well a transportation corridor functions. The town can influence these variables through its local regulations and the local review process. Although Route 38 is designated as a state highway and is owned by the Massachusetts Department of Transportation (MassDOT), the town retains authority over the land uses along the roadway.

The most important land use regulation that governs development along the Route 38 Corridor is Tewksbury's Zoning Bylaw. Future development and redevelopment in Tewksbury will depend to a great extent upon what changes occur to the current zoning bylaw, market conditions and available infrastructure within the community over time. The Route 38 Corridor (Main Street) is Tewksbury's economic backbone, and contains many parcels that offer opportunities for future development and/or redevelopment.

The land use data in this report was compiled from the town's Assessors database. The properties identified within the Route 38 Corridor Study Area generally fall within 200 feet of the centerline of Route 38. For purposes of analysis, the Route 38 Corridor was divided into the following seven (7) roadway segments:

- Segment 1- Lowell City Line to Astle/Pike Street
- Segment 2-Astle/Pike Street to Pleasant Street
- Segment 3-Pleasant Street to Chandler Street
- Segment 4-Chandler Street to Villa Roma/Victor Drive
- Segment 5-Villa Roma/Victor Drive to Shawsheen Street
- Segment 6-Shawsheen Street to South Street
- Segment 7-South Street to Wilmington Town Line

The database for the seven (7) roadway segments contains 431 parcels and 968.63 acres of land. Due to the extensive number of residential and commercial condominiums in the Study Area, it was important to differentiate between parcels and tax properties. Acreage information is generally assigned to individual parcels and not to tax properties, such as for each unit in a condominium, as is reflected in the database included in Appendix A.

A. Land Use Characteristics

As previously mentioned, land within the 6.3 mile corridor is predominately zoned for commercial (270 parcels) development, however the corridor includes several parcels that are zoned for industrial (51 parcels), residential (86 parcels), multi-family (8 parcels), transitional (14 parcels) and municipal (2 parcels) uses. The Commercial zoning district is a commercial strip that runs the entire length of the Corridor except for small pockets for the other zoning districts described above. Residentially zoned land is fragmented throughout the corridor, while a significant amount of industrially zoned land can be found around the I-495 interchange, which extends along the south side of I-495 to Exit 39. There is a small pocket of land near the intersection of Livingston and Main Street that is zoned for transitional uses. The Corridor also contains five overlay zoning districts that are designed to accommodate wireless communication facilities, promote a traditional village center in the area surrounding Town Center, and create character district along other portions of the corridor.

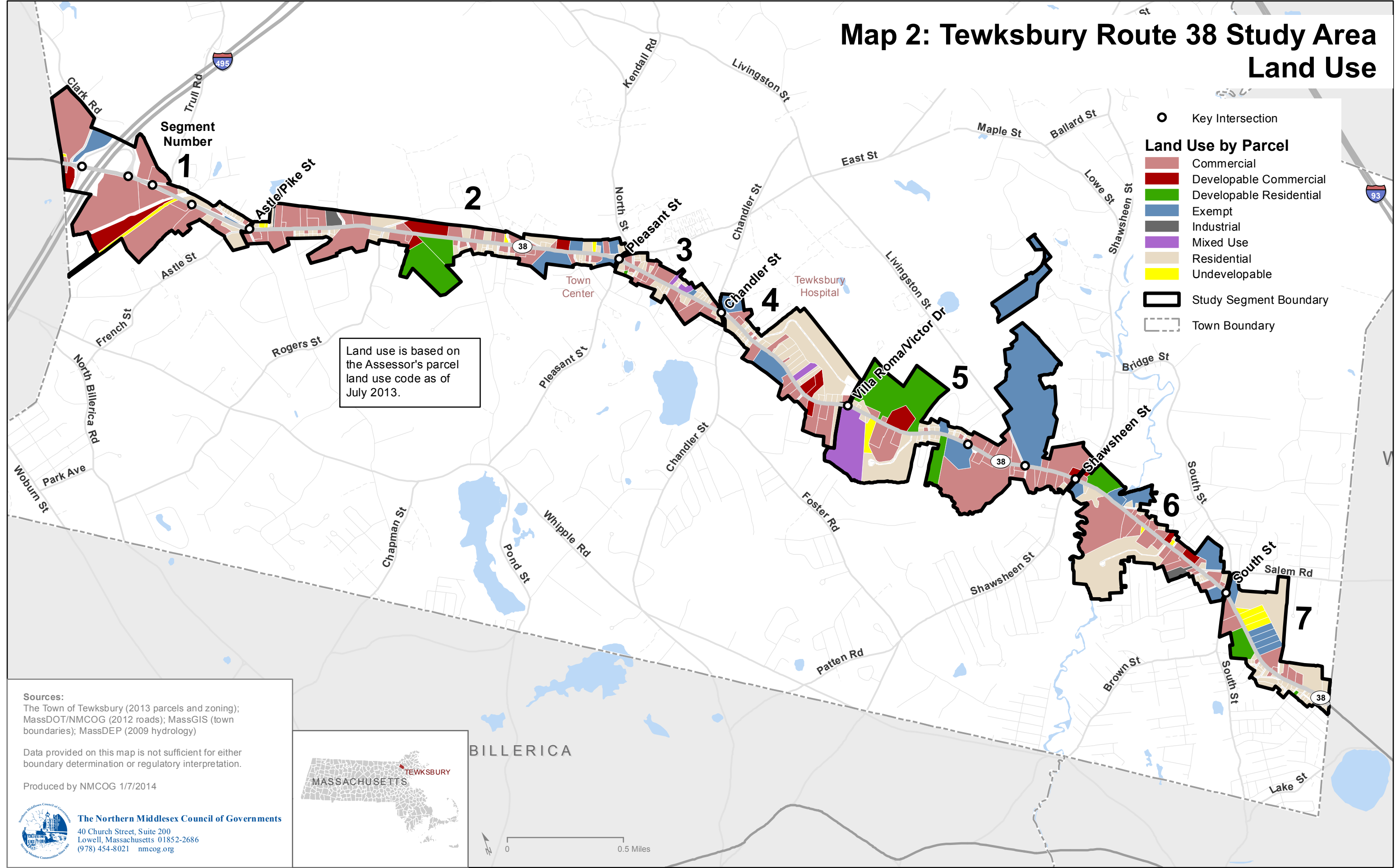
Land Use Trends

The development of any single tract of land seldom changes the overall character of a community. Over time, however, with the development of open land and the corresponding need for support services, changes in overall community character slowly evolved. Table 1 below outlines the changes in land use from 1971 to 2005. This data was compiled by the University of Massachusetts Amherst through aerial photo interpretation. The 2005 UMass data is graphically displayed in Map 2. This information reflects that amount of land covered by a specific use based on physical attributes and is not parcel specific.

As outlined in Table 1 on page 4, the most dramatic land use changes in the Town of Tewksbury overall occurred from 1971-1991, when 317 acres (95%) of industrial lands were developed. However, between 1991 and 2005 industrial land declined by 11% or 60 acres. Commercial land uses significantly increased between 1971-1985 by 46% or 90 acres. Tewksbury's advantageous location to I-495 was largely responsible for its economic vitality and its ability to attract new business and industry, and was a catalyst for the increase in industrial and commercial development.

During the period from 1985-1991 residential land uses significantly increased by 37% or 1,321 acres, however declined by 25% during 1991-2005. During the period from 1991-2005, the rate of commercial uses grew by 25% (68 acres), while industrial development decreased by -11% or 59 acres. As can be seen in Table 1, since 1991, there has been minimal growth in land use within the Town of Tewksbury. This can be attributed to a slowing economy and the nearly built-out nature of the community. By 2005 approximately 54% of the town's land area was developed, with nearly half of the town's land area in residential use.

Map 2: Tewksbury Route 38 Study Area Land Use



Sources:
 The Town of Tewksbury (2013 parcels and zoning);
 MassDOT/NMCOG (2012 roads); MassGIS (town boundaries); MassDEP (2009 hydrology)

Data provided on this map is not sufficient for either boundary determination or regulatory interpretation.

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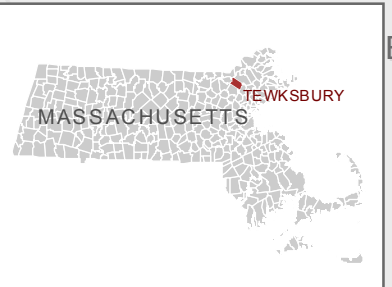


Table 1: Land Use Change in Tewksbury: 1971 to 2005 (Acres)

Class of Land Use	Acres in Use				Percent Change			% Change 1971-2005	Town % 2005
	1971	1985	1991	2005	1971-1985	1985-1991	1991-2005		
Commercial ¹	194.63	284.85	274.18	342.64	46%	-4%	25%	76%	2.5%
Industrial ²	338.63	442.83	656.03	586.22	31%	48%	-11%	73%	4.3%
Residential ³	2,803.53	3,555.56	4,876.41	5,472.25	27%	37%	12%	95%	41%
Summary									
Developed ⁴	3,336.79	4,283.24	5,806.62	7,264.22	28%	17%	25%	65%	53.8%
Undeveloped ⁵	10,234.58	9,288.13	7,764.75	6,247.17	-9%	-16%	-20%	-39%	46.2
Total	13,571.37	13,571.37	13,571.37	13,511.40	N/A	N/A	N/A	N/A	100%

Note: 2005 Land Use was updated from the McConnell Land Use files through orthophotography at a scale of 1 to 400.

*Total from 2005 is due to state methodology changes initiated in 2004

For purposes of this study, NMCOG staff organized and consolidated the Assessor's land use codes into nine (9) broad land use categories: commercial, residential, exempt property, industrial, industrial land (vacant), developable land (vacant), undevelopable land (vacant), potentially developable land and residential open land. As summarized in Table 2 on the following page, commercial uses occupy 36.39% of the total land area along the entire Corridor, and comprise 32.95% (142 parcels) of the total parcels. Residential uses comprise 51.97% of the total parcels along the corridor, but only represent 23.28% of the total acreage. Exempt (municipal, institutional, churches, etc.) land uses represent 4.41% of the total parcels, and comprise the second highest land use area, at 25.32% of the total acreage. Developable vacant land represents 7.90% of the total acreage, with 76.45 acres. Table 2 also breaks this data out for each of the seven roadway segments within the study area. The land use characteristics of the various roadway segments are discussed in greater detail in the following section of this report.

¹ The McConnell Land Use System defines "Commercial" land uses as general urban and shopping centers.

² The McConnell Land Use System defines "Industrial" land uses as light and heavy industrial.

³ The McConnell Land Use System defines "Residential" land uses as of the following: multi-family, smaller than ¼ acre residential lots, ¼ - ½ acre residential lots and larger than ½ acre residential lots.

⁴ The McConnell Land Use System defines "Developed" land uses as of the following: Participation, Spectator, and Water Based Recreation, Multi-Family Residential, High, Medium and Low Density Residential, Commercial, Industrial, Urban Open, Transportation and Waste Disposal uses.

⁵ The McConnell Land Use System defines "Undeveloped" land uses as of the following: Cropland, Pasture, Forest, Wetland, Mining, Open Land, Water and Woody Perennial uses.

Table 2: Land Use Characteristics by Roadway Segment

Study Area	Land Use	Number of Parcels	Acreage	% of Total Acreage
<u>Segment 1</u> Lowell C/L to Astle/Pike St.	Commercial	12	86.47	69.63%
	Residential	14	10.78	8.68%
	Industrial Land (Vacant)	1	4.24	3.41%
	Developable Land (Vacant)	3	16.53	13.31%
	Undevelopable Land (Vacant)	2	0.74	0.60%
	Exempt Property (formerly State Land)	2	5.42	4.36%
	Subtotal	34	124.17	100.00%
<u>Segment 2</u> Astle/Pike St. to Pleasant St.	Commercial	38	56.21	35.63%
	Residential	56	28.18	17.86%
	Industrial	3	5.83	3.70%
	Developable Land (Vacant)	3	8.54	5.41%
	Undevelopable Land (Vacant)	10	45.62	28.92%
	Exempt Property	7	13.39	8.49%
	Subtotal	113	135.98	100.00%
<u>Segment 3</u> Pleasant St. to Chandler St.	Residential	34	14.47	46.41%
	Commercial	14	10.49	33.64%
	Undevelopable Land (Vacant)	2	.669	2.15%
	Developable Land (Vacant)	1	1.56	5.00%
	Residential Open Land	1	4.00	12.83%
	Subtotal	52	31.18	100.00%
<u>Segment 4</u> Chandler St. to Villa Roma Dr.	Commercial	16	28.24	9.38%
	Residential	33	59.35	19.72%
	Developable Land (Vacant)	3	5.01	1.66%
	Potentially Developable Land	1	2.32	0.77%
	Exempt Property	1	206.08	68.46%
	Subtotal	54	301.01	100.00%
<u>Segment 5</u> Villa Roma Dr. to Shawsheen St.	Commercial	27	103.33	54.44%
	Residential	28	30.68	16.17%
	Developable Land (Vacant)	3	44.79	23.60%
	Undevelopable Land (Vacant)	3	3.63	1.91%
	Exempt Property	3	7.36	3.88%
	Subtotal	62	189.79	100.00%
<u>Segment 6</u> Shawsheen St. to South St.	Commercial	25	54.42	48.89%
	Residential	19	44.92	40.35%
	Developable Land (Vacant)	3	1.86	1.67%
	Undevelopable Land (Vacant)	2	0.49	0.44%
	Exempt Property	3	9.62	8.64%
	Subtotal	52	111.32	100.00%
<u>Segment 7</u> South Street to Wilmington T/L	Residential	40	37.15	49.15%
	Undevelopable Land (Vacant)	4	7.64	10.11%
	Commercial	10	13.37	17.69%
	Exempt Property	3	3.36	4.45%
	Industrial Land (Vacant)	7	14.07	18.62%
	Subtotal	64	75.58	100.00%

Study Area	Land Use	Number of Parcels	Acreage	% of Total Acreage
Total for Corridor	Commercial	142	352.53	36.39%
	Residential	224	225.53	23.28%
	Exempt Property	19	245.23	25.32%
	Industrial	3	5.83	0.60%
	Industrial Land (Vacant)	8	18.31	1.90%
	Developable Land (Vacant)	16	76.45	7.90%
	Undevelopable Land (Vacant)	17	36.60	3.78%
	Potentially Developable Land	1	4.16	0.43%
	Residential Open Land	1	4.00	0.41%
	Grand Total	431	968.63	100.00%

B. Land Use Characteristics by Roadway Segment

The land use characteristics of the roadway segments are outlined below. The properties either have frontage on the corridor or were adjacent to major intersections, and generally fall within 300 feet of the centerline of Route 38.

Segment 1: Lowell City Line to Astle/Pike Street

The Lowell City Line to Astle/Pike Street segment area is approximately 0.9 miles in length. Located adjacent to the I-495 interchange, this segment is dominated by “big box” retailers, such as Wal-Mart and Home Depot and also contains several restaurants, the 120-room Motel 6 and an automobile dealership. This segment consists of 34 parcels and has a land area of 124.17 acres.



The land use data for the segment is as follows:

- Commercial uses: 12 parcels covering 86.47 acres, or 69.63% of the segment;
- Residential uses: 14 parcels covering 10.78 acres, or 10.78% of the segment;
- Developable vacant land: 3 parcels covering 16.53 acres, or 13.31% of the segment;
- Exempt uses: 2 parcels covering 5.42 acres, or 5.42 % of the segment;
- Vacant industrial land: 1 parcel covering 4.24 acres, or 3.41% of the segment; and u
- Undevelopable vacant land: 2 parcels covering 0.74 acres or 0.60% of the segment.

Segment 2: Astle/Pike Street to Pleasant Street

The Astle/Pike Street to Pleasant Street segment is approximately 1.5 miles in length. This segment contains three retail plazas, two gas stations, fast food and sit-down restaurants, a florist, a health club, an apartment complex, Tewksbury Police and Fire, the Town Hall, and a motel. The segment is comprised of 113 parcels containing 135.98 acres of land.

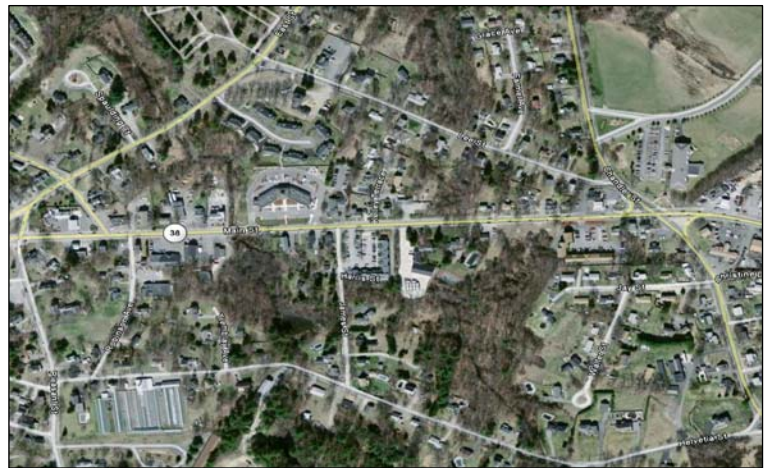


The land uses within Segment 2 are categorized as follows:

- Commercial uses: 38 parcels covering 56.21 acres, or 35.63% of the segment;
- Residential uses: 56 parcels covering 28.18 acres, or 17.86% of the segment;
- Developable vacant land: 3 parcels covering 8.54 acres, or 5.41% of the segment;
- Industrial uses: 3 parcels covering 5.83 acres, or 3.70% of the segment;
- Exempt uses: 7 parcels covering 13.39 acres, or 8.49% of the segment; and
- Undevelopable vacant land: 10 parcels covering 45.62 acres, or 28.92% of the segment.

Segment 3: Pleasant Street to Chandler Street

The Pleasant Street to Chandler Street segment area extends for approximately 0.5 miles. The segment is composed primarily of residences, although a gas station, a liquor store and newsroom are also located here. Segment 3 contains 52 parcels comprising 31.18 acres.



The land uses within Segment are categorized as follows:

- Commercial uses: 14 parcels covering 10.49 acres, or 33.64% of the segment;
- Residential uses: 34 parcels covering 14.47 acres, or 46.41% of the segment;
- Developable vacant land: 2 parcels covering 1.56 acres, or 5.00% of the segment;
- Residential open land: 1 parcel covering 4.00 acres, or 12.83% of the segment; and
- Undevelopable vacant land: 2 parcels covering .67 acres, or 2.15% of the segment.

Segment 4: Chandler Street to Villa Roma/Victor Drive

The Chandler Street to Villa Roma/Victor Drive segment is approximately 0.8 miles in length. The segment contains offices, a garden center, retail uses, including three commercial plazas, and professional condominiums. The State Hospital is located within this segment as well. Segment 4 contains of 54 parcels comprising 301.01 acres.



The land uses in Segment 4 are categorized as follows:

- Commercial uses: 16 parcels covering 28.24 acres, or 9.38% of the segment;
- Residential uses: 33 parcels covering 59.35 acres, or 19.72% of the segment;
- Developable vacant land: 3 parcels covering 5.01 acres, or 1.66% of the segment;
- Potentially developable land: 1 parcel covering 2.32 acres, or .77% of the segment; and
- Exempt uses: 1 parcel covering 206.08 acres, or 68.46% of the segment.

Segment 5: Villa Roma/Victor Drive to Shawsheen Street

The Villa Roma/Victor Drive to Shawsheen Street segment is approximately one mile long. Businesses along this segment include the United States Post Office, three commercial plazas, numerous restaurants and fast food establishments, banks, a gas station and a Market Basket supermarket. This segment consists of 62 parcels comprising 189.79 acres. The land uses located within Segment 5 are as follows:



- Commercial uses: 27 parcels covering 103.33 acres, or 54.44% of the segment;
- Residential uses: 28 parcels covering 30.68 acres, or 16.17% of the segment;

- Developable vacant land: 3 parcels covering 44.79 acres, or 23.60% of the segment;
- Undevelopable land: 1 parcel covering 3.63 acres, or 1.91% of the segment; and
- Exempt uses: 3 parcels covering 7.36 acres, or 3.88% of the segment.

Segment 6: Shawsheen Street to South Street

The Shawsheen Street to South Street segment area consists of approximately 0.8 miles of roadway. Businesses located along this segment include a commercial plaza, a bank, car wash, restaurant, an automobile dealership, a hardware store and other retail establishments. Segment 6 consists of 52 parcels comprising 111.32 acres.

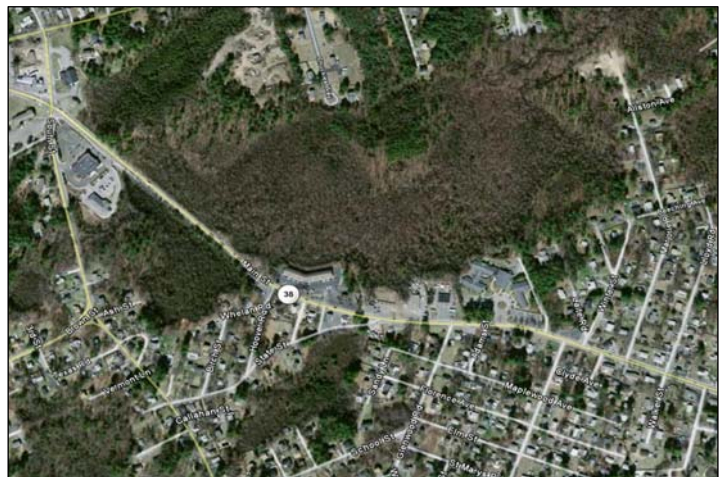


The land use categories within Segment 6 are categorized as follows:

- Commercial uses: 25 parcels covering 54.42 acres, or 48.89% of the segment;
- Residential uses: 19 parcels covering 44.92 acres, or 40.35% of the segment;
- Developable vacant land: 3 parcels covering 1.86 acres, or 1.67% of the segment;
- Undevelopable land: 2 parcels covering 2 acres, or .44% of the segment; and
- Exempt uses: 3 parcels covering 9.62 acres, or 8.64% of the segment.

Segment 7: South Street to Wilmington Town Line

The South Street to Wilmington Town Line segment extends for approximately 0.7 miles, and is developed at a lower density than the rest of the corridor. Walgreens Pharmacy, a small commercial plaza, residences and the Tewksbury Fire Department are located along this segment. Segment 7 consists of 64 parcels comprising 75.58 acres.



The land uses located along Segment 7 are categorized as follows:

- Commercial uses: 10 parcels covering 13.37 acres, or 17.69% of the segment;
- Residential uses: 40 parcels covering 37.15 acres, or 49.15% of the segment;
- Undevelopable vacant land: 4 parcels covering 7.64, acres or 10.11% of the segment;
- Vacant industrial land: 7 parcels covering 14.07 acres, or 18.62% of the segment; and
- Exempt uses: 3 parcels covering 3.36 acres or 4.45% of the segment.

C. Zoning Characteristics by Roadway Segment

The Town's Zoning Bylaw policies and practices will continue to impact the quality, density and appearance of future development and redevelopment within the study area. Tewksbury's zoning Bylaw includes twelve distinct zoning districts, as shown in Table 3 below.

Table 3: Zoning Districts and Intended Uses

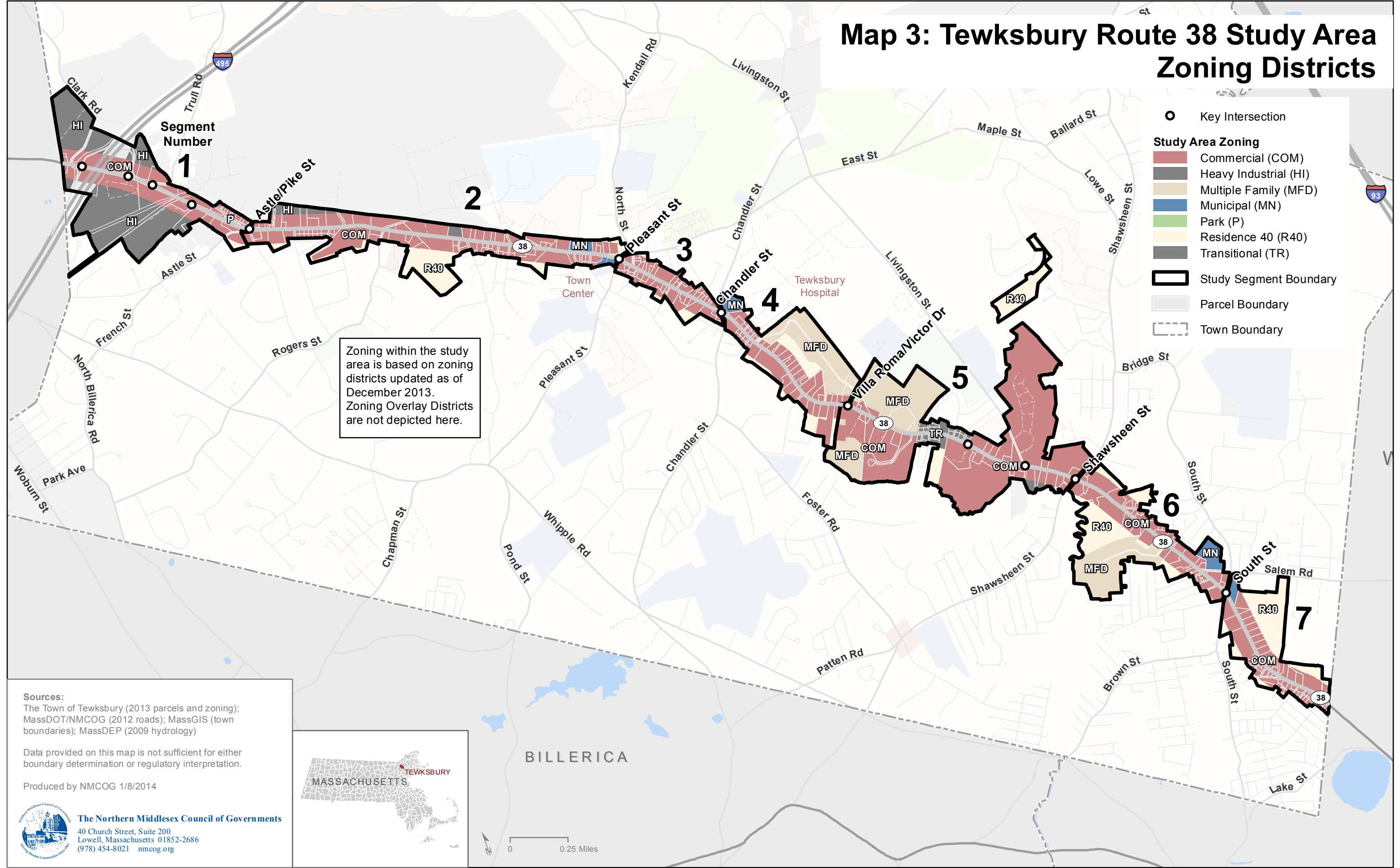
Land Use Category	Zoning District	Intended Uses
Residential	Residence 40 District (R40)	Single-family residences
	Multiple Family District (MFD)	Development of multiple family dwellings
	Multiple Family Dwelling/55 (MFD/55)	Multiple family dwelling units for individuals over age 55 years
	Community Development District (CDD)	Alternative housing for elderly residents; specifically targeted for Independent Living Facilities, Assisted Living/Long-term Care
Municipal	Municipal District (MN)	Public uses owned and managed by the Town
	Park District (P)	Municipal Park Land
Commercial/Office	Commercial District (COM)	Retail, professional and personal services
	Limited Business District (LB)	Neighborhood scale retail and personal services
	Transitional District (TR)	Small scale retail and restaurants
Industrial / R&D	Heavy Industrial(HI)	Multiple commercial and industrial uses including manufacturing, warehouses, and major commercial projects
	Office Research District (OR)	R&D, manufacturing of equipment, laboratory facilities
Agricultural	Farming District (FA)	Agriculture

Six (6) of the twelve zoning districts can be found within the Route 38 Study Area: Commercial, Heavy Industrial, Multifamily Dwelling, Residence 40, Municipal and Transitional. The Corridor is also located in three (3) overlay districts: the Town Center Overlay District (TCOD), Village Residential Overlay District (VROD) and the Village Mixed-Use Overlay District (VMOD). Table 4 on the following page and Map 3 on page 14 summarize the zoning designations within each of the seven study area segments.

Table 4: Roadway Segments and Zoning Districts

Study Area	Zoning District	Number of Parcels	Acreage	% of Total Acreage
<u>Segment 1</u> Lowell C/L to Astle/Pike St.	Commercial	16	101.29	81.57%
	Heavy Industrial	15	17.94	14.45%
	Multiple Family District	1	1.38	1.11%
	Residence 40 District	2	3.56	2.87%
	Subtotal	34	124.17	100.00%
<u>Segment 2</u> Astle/Pike St. to Pleasant St.	Commercial	76	101.92	74.95%
	Residence 40 District	19	20.44	15.03%
	Heavy Industrial	13	6.72	4.94%
	Municipal	2	2.57	1.89%
	Multiple Family	3	4.33	3.18%
	Subtotal	113	135.98	100.00%
<u>Segment 3</u> Pleasant St. to Chandler St.	Commercial	32	23.66	75.88%
	Residence 40 District	16	5.77	18.51%
	Heavy Industrial	4	1.75	5.61%
	Subtotal	52	31.18	100.00%
<u>Segment 4</u> Chandler St. to Villa Roma Dr.	Commercial	44	57.72	19.18%
	Residence 40 District	10	207.98	69.09%
	Multiple Family District	1	35.31	11.73%
	Subtotal	54	301.01	100.00%
<u>Segment 5</u> Villa Roma Dr. to Shawsheen St.	Commercial	35	108.65	57.25%
	Residence 40 District	5	2.10	1.11%
	Multiple Family District	2	64.55	34.01%
	Transitional	14	11.41	6.01%
	Heavy Industrial	6	3.08	1.62%
	Subtotal	62	189.79	100.00%
<u>Segment 6</u> Shawsheen St. to South St.	Commercial	33	61.50	55.25%
	Residence 40 District	12	7.79	6.99%
	Multiple Family District	1	35.78	32.1%
	Heavy Industrial	6	6.25	5.61%
	Subtotal	52	111.32	100.00%
<u>Segment 7</u> South St. to Wilmington T/L	Commercial	34	46.76	61.87%
	Heavy Industrial	7	3.49	4.62%
	Residence 40 District	22	25.33	33.51%
	Subtotal	64	75.58	100.00%
Total for the Corridor	Commercial	270	501.10	51.73%
	Residence 40 District	86	272.97	28.18%
	Multiple Family District	8	141.35	14.59%
	Transitional	14	11.41	1.18%
	Heavy Industrial	51	39.23	4.05%
	Municipal	2	2.57	0.27%
	Grand Total	431	968.63	100.00%

Map 3: Tewksbury Route 38 Study Area Zoning Districts



Zoning Overlay Districts

There are eleven zoning overlay within the Town of Tewksbury:

- Wireless Communications Facilities
- Multiple Family Dwellings in the Senior Village District/55 (SVD/55)
- Flood Plain District
- Ground Water Protection District
- Interstate Overlay District
- Highway Corridor Overlay District
- Town Center Overlay District
- Village Residential Overlay District
- Village Mixed-Use Overlay District
- South Village Overlay District
- Community Village Overlay District.

Of these, six are found within the study area: the Wireless Communications Facilities, Village Mixed-Use Overlay District, Village Residential Overlay District, Town Center Overlay District, Community Village Overlay District, and South Village Overlay District. Each overlay district serves a unique purpose and has a distinct set of requirements.

As the name implies, the Wireless Communications Facilities (WCF) regulations provide a special permitting process for the siting of wireless communication facilities through a Wireless Communications Facilities Special Permit granted by the Planning Board. The intent of the overlay bylaw is to minimize adverse impacts on adjacent properties and to protect the visual and aesthetic value of the community.

The Town Center Overlay District (TCOD) is designed to encourage a mix of business, residential, cultural, educational and civic uses, and to promote compact development that is pedestrian-oriented and preserves the historic value and character of the area. All uses and structures in the TCOD are subject to a Special Permit and Site Plan Special Permit from the Planning Board. Furthermore, all projects in the TCOD must follow design criteria described in the Town Center Design Guidelines.

Similar to the Town Center Overlay District, the Village Residential Overlay District is designed to encourage a mix of business, residential, cultural, educational and civic uses, and to promote compact development that is pedestrian-oriented and preserves the historic value and character of the area. The VROD is located along Route 38 west of the TCOD. All uses and structures in the VROD are subject to a Special Permit and Site Plan Special Permit from the Planning Board.

Furthermore, all projects in the VROD must follow design criteria described in the Village Residential Design Guidelines.

The Village Mixed-Use Overlay District (VMOD) is designed to encourage a mix of business, residential, cultural, educational and civic uses, and to promote compact development that is pedestrian-oriented and preserves the historic value and character of the area. The VMOD is located along Route 38 east of the TCOD. All uses and structures in the VMOD are subject to a Special Permit and Site Plan Special Permit from the Planning Board. Furthermore, all projects in the VMOD must follow design criteria described in the Village Mixed-Use Design Guidelines.

The South Village Overlay District (SVOD) is designed to encourage a mix of business, residential, cultural, educational and civic uses, and to promote compact development that is pedestrian-oriented and preserves the character of the area. The SVOD is located along Route 38 between Shawsheen Street and South Street. All uses and structures in the SVOD are subject to a Special Permit and Site Plan Special Permit from the Planning Board. Furthermore, all projects in the SVOD must follow design criteria described in the Village Residential Design Guidelines.

The Community Village Overlay District (CVOD) is designed to encourage a mix of business, residential, cultural, educational and civic uses, and to promote compact development that is pedestrian-oriented and preserves the character of the area. The CVOD is located along Route 38 just west of the SVOD. All uses and structures in the CVOD are subject to a Special Permit and Site Plan Special Permit from the Planning Board. Furthermore, all projects in the CVOD must follow design criteria described in the Village Residential Design Guidelines.

Potential Development and Redevelopment Sites

Currently, there is one development project in the permitting pipeline which consists of an 8,000 square foot medical office building near the intersection of Route 38 and Chandler Street. Given the limited availability of vacant developable land within Tewksbury, much of the town's development activity in the future will consist of redevelopment or reuse projects. Town officials and town staff have identified several locations appropriate for future commercial and industrial development or reuse in the vicinity of the study area. These locations are described in Table 5 on the following page.

Table 5: Commercial and Industrial Parcels Identified for Future Development/Reuse

Commercial / Industrial Locations		
Street Address	Zoning Designation/ Parcel ID	Use / Reuse Description
890 East Street	HI/102-15	27,000 sf for lease
1023/1029 East Street	HI/103-80,103-129	Construct 27,000 sf commercial/industrial building
558 Clark Road	HI/12-9	Existing 79,070 sf beverage distribution warehouse on 6.8 acres
Retail Locations		
Street Address	Zoning Designation/ Parcel ID	Use / Reuse Description
345 Main Street	COM, HI and R40/10-91	Two retail buildings of 17,920 sf and 7,090 sf, with a restaurant (3,500 sf) with drive through
960 Main Street	COM/47-77	Construct 3,000 sf bank with drive thru
1777 Main Street	COM/85-1	84,000 sf on 34 acre lot
1879 Main Street	COM and HI/84-18	100,724 sf (floodplain and access issues)
2131 Main Street	COM and R40/96-53	2.5 acres previously permitted
2230 Main Street	COM/96-104	Construct retail building (10,000 sf first floor and 11,000 sf on the second floor)

III. Roadway Characteristics

Route 38 (Main Street) is a two-lane two-way arterial and is approximately 28 feet wide. North of the Astle/Pike Road intersection, Route 38 widens to four lanes, with two lanes designated for each direction of travel. Near I-495, left turning lanes exist for vehicles accessing the interstate, increasing the roadway to five lanes. In this location the roadway is over 60 feet in width. There are several minor street approaches that form key intersections along the corridor. MassDOT classifies Pleasant Street and Shawsheen Street as urban minor arterials. Old Main Street, Astle/Pike Streets, Chandler Street, and South Street are classified as urban collectors.

As discussed in the previous Land Use and Zoning sections, Route 38 has been divided into seven segments for analysis purposes:

- Segment 1- Lowell City Line to Astle/Pike Street
- Segment 2-Astle/Pike Street to Pleasant Street
- Segment 3-Pleasant Street to Chandler Street
- Segment 4-Chandler Street to Villa Roma/Victor Drive
- Segment 5-Villa Roma/Victor Drive to Shawsheen Street
- Segment 6-Shawsheen Street to South Street
- Segment 7-South Street to Wilmington Town Line.

A brief description of transportation network characteristics of each roadway is provided below.

Segment 1 extends 0.9 miles from the Lowell city line to the intersection of Astle Street/Pike Street and Veranda Avenue, and consists of four travel lanes and a center lane for left turns. The width of pavement is approximately 65 feet. This area of Route 38 has the highest average daily traffic (ADT) volume (32,400 vehicles per day) of any segment along the corridor. Access to and from Route 38 is controlled by traffic signals. Adjacent locations requiring access to Route 38 include the Home Depot Plaza, Old Main Street, and the Wal-Mart Plaza, as well as several restaurants, a motel and an automobile dealership.

Segment 2 extends 1.62 miles from the intersection of Astle Street/Pike Street and Veranda Avenue to Pleasant Street. Starting at this point and continuing south to Wilmington, Route 38 is a two-lane bi-directional road. The ADT along this segment is 22,900 vehicles per day. The northern portion of this segment contains two plazas, a gas station, fast food and sit-down restaurants, a florist, a health club and a motel. The southern portion of this segment includes the Town Center where Town Hall, the police department, fire department and various businesses and residences are located. There are many access points to and from Route 38 clustered along this segment.

Segment 3 extends 0.49 miles from East and Pleasant Streets to Chandler Street. This segment is comprised primarily of residences, and also includes a gas station, a newsroom and a liquor store. Signalized intersections are located at each end of the segment.

Segment 4 extends 0.8 miles from Chandler Street to Victor Drive. This segment contains a variety of businesses including offices, a garden center, three commercial plazas and professional condominiums. The ADT along Segments 4 is approximately 20,000 vehicles per day. The signalization intersection of Main Street, Chandler Street and Victor Drive is found along this segment.

Segment 5 extends 1.0 mile from Victor Drive to Shawsheen Street. The ADT along this segment is approximately 22,100 vehicles per day. Businesses include the United States Post Office, three commercial plazas, numerous restaurants and fast food establishments, banks, a gas station and a MarketBasket supermarket. There are traffic signals installed at the Post Office and at Livingston Street intersections.

Segment 6 extends 0.8 miles from Shawsheen Street to South Street. The ADT on this portion of the corridor is approximately 20,000 vehicles per day. Several businesses, including a commercial plaza, a bank, a car wash, a restaurant, an automobile dealership, and hardware store, require access along this segment, creating multiple driveway intersections.

Segment 7 extends 0.7 miles from South Street to the Wilmington town line. This is the southernmost section of Route 38 within Tewksbury, and is also the most undeveloped portion of the corridor. With the exception of Walgreens Pharmacy, a small commercial plaza and residential driveways, this segment contains very few access points. The Tewksbury Fire Department is located at the intersection of Route 38 and South Street.

IV. Intersection Characteristics

These are twelve signalized intersections along the Route 38 corridor:

- Route 38 and I-495 SB Ramps
- Route 38 and I-495 NB Ramps/Home Depot Plaza
- Route 38 and Old Main Street
- Route 38 and Wal-Mart Center
- Route 38 and Astle/Pike/ Veranda Streets
- Route 38 and Pleasant Street
- Route 38 and Chandler Street
- Route 38 and Victor Drive
- Route 38 and Post Office Drive
- Route 38 and Livingston Street
- Route 38 and Shawsheen Street
- Route 38 and South Street



The following narrative describes the geometric and traffic control for each intersection:

Route 38 and the I-495 Southbound Ramps form a modified four-way signalized intersection. At this location, Route 38 is a four lane, bi-directional road with a width of 65 feet. Northbound Route 38 has an exclusive left turn lane for movements onto I-495 Southbound. Southbound Route 38 has an exclusive right turn lane for access I-495 southbound. The I-495 southbound off ramp is a one- way approach divided by a traffic island, and splits into two movements on to Route 38. All signing and pavement markings are appropriate and adequate at this intersection.

Route 38 and the I-495 Northbound Ramps/Home Depot Plaza Driveway form a four-way signalized intersection with all turns permitted. Route 38 is 65 feet wide with exclusive left turn lanes in each direction, as well as two through movement lanes. The Route 38 northbound right turning movements access the I-495 ramp before the intersection, and then merge with other traffic on the ramp. The Route 38 southbound movements use a right-turn lane for vehicles accessing the Home Depot plaza. The Home Depot plaza exit driveway has three lanes, one for each individual movement out of the shopping area. The I-495 northbound off ramp has two exclusive left-turn lanes, one through lane, and a right-turn lane separated by a traffic island. All

pavement markings and signage are up to date at this intersection.

Route 38 and Old Main Street form a signalized “T” intersection with all turns permitted.

Northbound Route 38 consists of two travel lanes, while southbound Route 38 has two travel lanes and an exclusive left-turn lane. Left turns are protected only when vehicles queue to the end of the exclusive lane. At all other times in the signal cycle these vehicles must yield on green.

Northbound Route 38 is on the downgrade side of a vertical curve approaching the intersection. This vertical curve hinders sight of the intersection until the vehicle is almost upon it. Thus, a warning sign has been installed ahead of the intersection cautioning drivers of the upcoming intersection, and indicates when the traffic signal is red.



Old Main Street is one-lane approaching the intersection. However, the pavement markings have faded, and vehicles form two lanes at the signal, providing the room needed for vehicles to make right turns on the red signal phase. Left turning vehicles stay to the left at the intersection, and frequently do not trip the sensors, thus increasing their delay. Restriping the intersection may cause vehicles to stay further right, causing the sensors to recognize that a vehicle is present, thereby prompting a green phase for the minor approach.

Route 38 and the Walmart Plaza Driveway form a “T” intersection with all turns permitted. The Walmart Plaza approach consists of two left-turn lanes and one exclusive right-turn lane. Route 38 northbound consists of two through lanes and one exclusive left-turn lane. Route 38 southbound has two through lanes and one exclusive right-turn lane.



Route 38 and Astle/Pike/Veranda Streets form a five-approach intersection with all turns permitted. In addition, Old Main Street connects with the intersection as a one-way northbound segment. Route 38 southbound has two lanes approaching the intersection, one for left turns onto Veranda Street and one for right and through movements. Route 38 northbound has two lanes at the intersection as well, with one lane designated for left turning movements. Astle Street and Pike Street intersect just west of the intersection with Route 38. Astle Street is stop- controlled at the Pike Street intersection.

Route 38 and Pleasant Street form a four-legged intersection with all turns allowed. Both southbound and northbound Route 38 has one exclusive left-turn lane, and one shared through and right- turn lane for vehicles entering the intersection. Pleasant Street westbound has one lane for each movement through the intersection. Right turning vehicles eastbound use East Street, which is separated and stop-controlled at Route 38. Through and left turns move through the intersection with one lane serving both movements.

Route 38 and Chandler Street form a four-way intersection with all turns allowed. Both southbound and northbound Route 38 contains one exclusive left-turn lane and one through and right-turn lane for vehicles entering the intersection. Chandler Street has exclusive left-turn lanes, as well as shared right and through lanes for each approach to the intersection. All pavement markings and signage are installed appropriately.

Route 38 and Victor Drive form four-legged intersection with all turns allowed. A traffic signal was installed at this location as a result of recent development located on the west side of the intersection.

Route 38 and Post Office Drive form a four-legged intersection with the driveway of the retail plaza located opposite Post Office Drive. The plaza access is limited to exiting vehicles only at the intersection, with a



restriction in place for left turns on Route 38 southbound and right turns on Route 38 northbound. Post Office Drive contains two lanes, one designated solely for right turns and the other for left turns. Route 38 northbound has one exclusive left- turn lane and one through lane. Route 38 southbound has one exclusive right-turn lane and one through lane.

Route 38 and Livingston Street forms a four-legged signalized intersection with the entrance to the Airport Commercial Building, which is not part of the cycle unless activated by a vehicle. The Livingston Street approach has an exclusive left-turn lane, and a shared through and right-turn lane. The Southbound Route 38 approach has an exclusive left-turn lane for movements onto Livingston Street. Northbound Route 38 has an exclusive right-turn lane for vehicles travelling to Livingston Street. Currently, delay at this location is high due to the large traffic volumes on Route 38.

Route 38 and Shawsheen Street is a four-legged signalized intersection with all turns permitted. The Route 38 approaches in each direction have exclusive left-turn lanes and shared right and through lanes. Shawsheen Street has one lane in each direction for all movements. The intersection experiences long delays for the minor street movements, which in turn affect the Route 38 traffic flow.



Route 38 and South Street form a four-way signalized intersection with all turns allowed. Both northbound and southbound Route 38 has exclusive left-turn lanes and combined through and right-turn lanes. South Street approaches have one designated all purpose lane, but the width of the roadway leads to small right turn pocket lanes for turning right on red signals.

V. Intersection Level of Service

Intersection level of service (LOS) qualitatively measures the operating conditions that occur at a given intersection under various traffic conditions. Like mainline level of service, intersection LOS designations range from A to F, with LOS A representing the best condition and LOS F representing the worst condition. Acceptable levels of service in an urban area have designations of LOS D or better. Intersections operating at LOS E and F are considered to have unacceptable levels of congestion.

Twelve signalized intersections were analyzed using the signalized intersection criteria. To complete this analysis, turning movement counts were conducted during peak hours (7:00-9:00 AM and 4:00-6:00 PM). Figures 1 and 2 show the peak hour turning movement volumes each key intersection within the study area. The AM and PM peak hour turning movements were analyzed using Highway Capacity Software.

Signalized intersection levels of service represent the overall operating conditions of the intersection in terms of control delay. Control delay involves initial deceleration, move up time in the queue, stopped time, and re-acceleration for vehicles entering an intersection. Table 6 on the following page shows how vehicle delay correlates with level of service.

TABLE 6: LOS CRITERIA FOR SIGNALIZED INTERSECTIONS	
LOS	Control Delay per Vehicle (s/veh)
A	≤ 10
B	$> 10-20$
C	$> 20-35$
D	$> 35-55$
E	$> 55-80$
F	> 80

Results of the intersection operational analysis show that the following intersections currently experience poor level of service during the peak periods of the day:

- Route 38 at Shawsheen Street; and
- Route 38 at South Street.

The intersection of Route 38 and Shawsheen Street experiences poor levels of service during the peak hours of the day. In the PM peak hour, northbound Route 38, as well as both Shawsheen Street left turn approaches, experience unacceptable delays. This is mainly due to the fact that the exclusive left turn phasing for all approaches adds time to the signal cycle. These phases were included in an effort to improve safety rather than minimize congestion, as this location was previously had one of the highest crash rates of the intersections located in the Northern Middlesex region.

Route 38 at South Street experiences poor levels of service mainly due to the signal phasing. The east-west movement on South Street is divided into two separate exclusive phases. This leads to longer delays on mainline Route 38 for vehicles waiting through multiple minor street phases. Combining the two minor street phases into one and adding a few seconds to the phase, would result in acceptable operating conditions at this location.

Table 7 summarizes the results of the operational analysis, showing control delays and LOS for each intersection during both peak travel periods. Map 4 visually displays the level of service ratings for each intersection along the corridor.

Table 7: Intersection Operational Analysis Results Summary

Location	AM Peak Hour		PM Peak Hour	
	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS
Route 38 and I-495 SB Ramps	29.8	C	47.7	D
Route 38 and I-495 NB Ramps	47	D	39.7	D
Route 38 and Old Main Street	13	B	7.1	A
Route 38 and Walmart Plaza	4.8	A	13	B
Route 38 and Astle/Pike Street	18.9	B	45.7	D
Route 38 and Pleasant Street	26.5	C	39.8	D
Route 38 and Chandler Street	11.4	B	15.3	B
Route 38 and Victor Drive	11.7	B	11.4	B
Route 38 and Post Office Drive	7.2	A	10.1	B
Route 38 and Livingston Street	16.8	B	40	D
Route 38 and Shawsheen Street	54.5	D	72.4	E
Route 38 and South Street	60.7	E	68.8	E

VI. Traffic Volumes and Mainline Level of Service

Traffic volumes were collected by NMCOG and MassDOT in 2007. A review of traffic growth rates over the past decade shows that traffic growth has been relatively flat along the corridor, with an annual growth rate ranging from 0.06% near the I-495 interchange to -0.44% near South Street. Traffic growth in the area has been minimal and for purposes of this study the 2007 volumes have not been updated or adjusted. However, all traffic volumes have been seasonally adjusted to arrive at the average daily traffic (ADT) volumes. Table 8 on the following page shows the location of the counts and corresponding ADT volumes along the corridor.

Traffic volumes are heaviest near the I-495 interchange and in the Town Center, with volumes reaching near 33,000 (16,500 in each direction) and 32,000 (16,000 in each direction) vehicles per day respectively. Traffic is lightest at the southern end of the corridor near the Wilmington Town Line, with volumes near 13,000 vehicles per day (6,500 in each direction).

Table 8: Average Daily Traffic (ADT) Volumes for Route 38 (2007)

Count Location (Segment #)	Average Daily Traffic (Vehicles Per Day)
Route 38 @ Lowell City Line (1)	29,400
Route 38 North of I-495 Ramps (1)	32,400
Route 38 under I-495 (1)	33,000
Route 38 South of I-495 (1)	27,300
Route 38 North of Capitol Avenue (2)	23,200
Route 38 North of Dewey Street (3)	22,100
Route 38 South of Pleasant Street (4)	31,900
Route 38 South of Chandler Street (5)	20,100
Route 38 North of Shawsheen Drive (6)	22,400
Route 38 South of DeCarlois Drive (7)	19,700
Route 38 South of South Street (8)	15,100
Route 38 @ Wilmington Town Line (8)	12,900

Existing peak hour traffic volumes along the mainline of Route 38 are shown in Table 9. Peak hour traffic volumes are heaviest around the I-495 interchange. The afternoon peak hour volumes are higher than the morning peak hour volumes for all locations. This is most likely due to the fact that the roadway is accommodating commuter traffic, as well as traffic destined for the many commercial establishments located along Route 38.

Table 9: Roadway Peak Hour Traffic Volumes

Location	AM Peak Hour (vph)			PM Peak Hour (vph)			ADT (vpd)	AM Peak % of ADT	PM Peak % ADT
	SB	NB	Total	SB	NB	Total			
Lowell Line to I-495 ramps	1,019	1,109	2,128	1,552	1,632	3,184	25,300	8.4	12.6
I-495 SB Ramps to I-495 NB ramps	899	1,087	1,986	1,136	1,904	3,040	39,300	5.1	7.7
I-495 NB Ramps to Old Main St.	1,071	791	1,862	1,073	1,510	2,583	29,400	6.3	8.8
Old Main St. to Pike/Astle St.	897	724	1,621	1,058	1,113	2,171	23,200	7.0	9.4
Pike/Astle Street to Rogers Street	1,104	739	1,843	848	885	1,733	23,200	7.9	7.5
Rogers Street to Marshall St.	1,191	698	1,889	865	1,119	1,984	22,100	8.5	9.0
Marshall Street to Pleasant St.	1,210	782	1,992	859	1,113	1,972	22,100	9.0	8.9
Pleasant Street to Chandler St.	774	615	1,389	674	792	1,466	31,900	4.4	4.6
Chandler Street to Livingston St.	808	639	1,447	929	897	1,826	20,100	7.2	9.1

Table 9 (cont'd): Roadway Peak Hour Traffic Volumes

Location	AM Peak Hour (vph)			PM Peak Hour (vph)			ADT (vpd)	AM Peak % of ADT	PM Peak % of ADT
	SB	NB	Total	SB	NB	Total			
Livingston Street to Shawsheen St.	662	792	1,454	779	1,186	1,965	22,400	6.5	8.8
Shawsheen Street to South St.	719	845	1,564	598	969	1,567	19,700	7.9	8.0
South St. to Wilmington Town Line	775	607	1,382	412	953	1,365	15,100	9.2	9.0

Evaluation of the mainline roadway is completed through the analysis of travel time performance runs. Travel time runs are performed using a “floating car” technique in which the test vehicle flows along with traffic throughout the corridor. Travel time runs were performed for the two peak periods of the day in each direction on Route 38. The peak periods of the day included the morning peak (7:00-9:00 AM) and the afternoon peak (4:00-6:00 PM) hours.

The Level of Service (LOS) is a qualitative measure used to describe how well traffic moves along each segment of the roadway. There are six levels of service, each with a corresponding letter designation. LOS A represents free flow speeds, while LOS E-F represents congested conditions. The performance measure used to determine the LOS is average travel speed over the roadway segment. The Highway Capacity Manual (Exhibit 15-1) defines arterial levels of service by classifying arterials based on free flow speeds outlined in Table 10. Route 38 in Tewksbury is designated as a Type III urban principal arterial.

Table 10: Urban Street Level of Service

	ARTERIAL CLASSIFICATION			
	I	II	III	IV
Range of Free Flow Speeds (MPH)	45-55	35-45	30-35	25-35
Typical Free Flow Speeds (MPH)	50	40	33	30
LEVEL OF SERVICE	AVERAGE TRAVEL SPEED (MPH)			
A	≥ 42	≥ 35	≥ 30	≥ 25
B	≥ 34	≥ 28	≥ 24	≥ 19
C	≥ 27	≥ 22	≥ 18	≥ 13
D	≥ 21	≥ 17	≥ 14	≥ 9
E	≥ 16	≥ 13	≥ 10	≥ 7
F	< 16	< 13	< 10	< 7

Results of travel time monitoring on Route 38 show poor operating conditions in the morning peak period around the I-495 interchange and at the Shawsheen Street intersection. In the PM peak period, results are similar with congestion evident at both the I-495 interchange and Shawsheen Street. Table 11 shows the results of NMCOG's travel time monitoring efforts and provides both peak period levels of service by roadway segment and direction of travel. Congested segments are identified in red type.

Two-Way Left Turn Lane (TWLTL) Analysis

Delays along Main Street in Tewksbury are exacerbated from the queues that form as a result of vehicles turning left into businesses, residences or side streets along the corridor. Left turn lanes can often alleviate this problem at an intersection, but high density mid-block areas often do not have the room for exclusive left turn lanes. The addition of continuous two-way left turn lanes (TWLTLs) are sometimes used to mitigate the delays caused by left turning vehicles in high trafficked areas. The TWLTL is a lane placed in the middle of the roadway between opposite directions of travel to allow left turning vehicles to make their turning movements without hindering the main line of traffic.



One of the advantages of the TWLTL is that it can reduce rear-end, sideswipe, and head-on type crashes, while reducing delay on the main line of traffic. In addition, TWLTLs can serve as a temporary lane for emergency vehicles. Safety analysis of the corridor has shown numerous rear-end type crashes as a result of turning vehicles.

There are several factors to be considered when determining whether a TWLTL is appropriate. Geometric design of the roadway must be considered, especially in terms of sight distance and curvature. Right-of-way issues must be adequate to ensure that there is enough room to expand the roadway for another lane of traffic without sacrificing shoulder width. The typical minimum length of a TWLTL is ¼ mile, with a typical width of 12-14 feet.

In analyzing the Main Street corridor, the following four candidate areas for a TWLTL have been identified, as shown on Figure 1 below:

1. Main Street between Astle/Pike Street and 623 Main Street (Nissan Dealership);
2. Main Street between Marshall Street and Dewey Street;
3. Main Street between North Street and Chandler Street; and
4. Main Street between Chandler Street and Victor Drive.

In general, each location presently includes a 28-foot roadway with two 12-foot travel lanes and two-foot shoulders on each side. In order to install a TWLTL, the roadway will need to be expanded an additional 12-14 feet, for a total pavement width of 42 feet. The existing right-of-way averages 50 feet, so the expansion would remain within the limits of the right-of-way. The expansion may limit the ability to install 5-foot sidewalks on both sides of the roadway without acquiring another two feet of right-of-way along these segments. A professional survey and engineering review must be performed before such improvements can move forward into design.

Figure 1: Two Way Left Turn Lane Candidate Locations

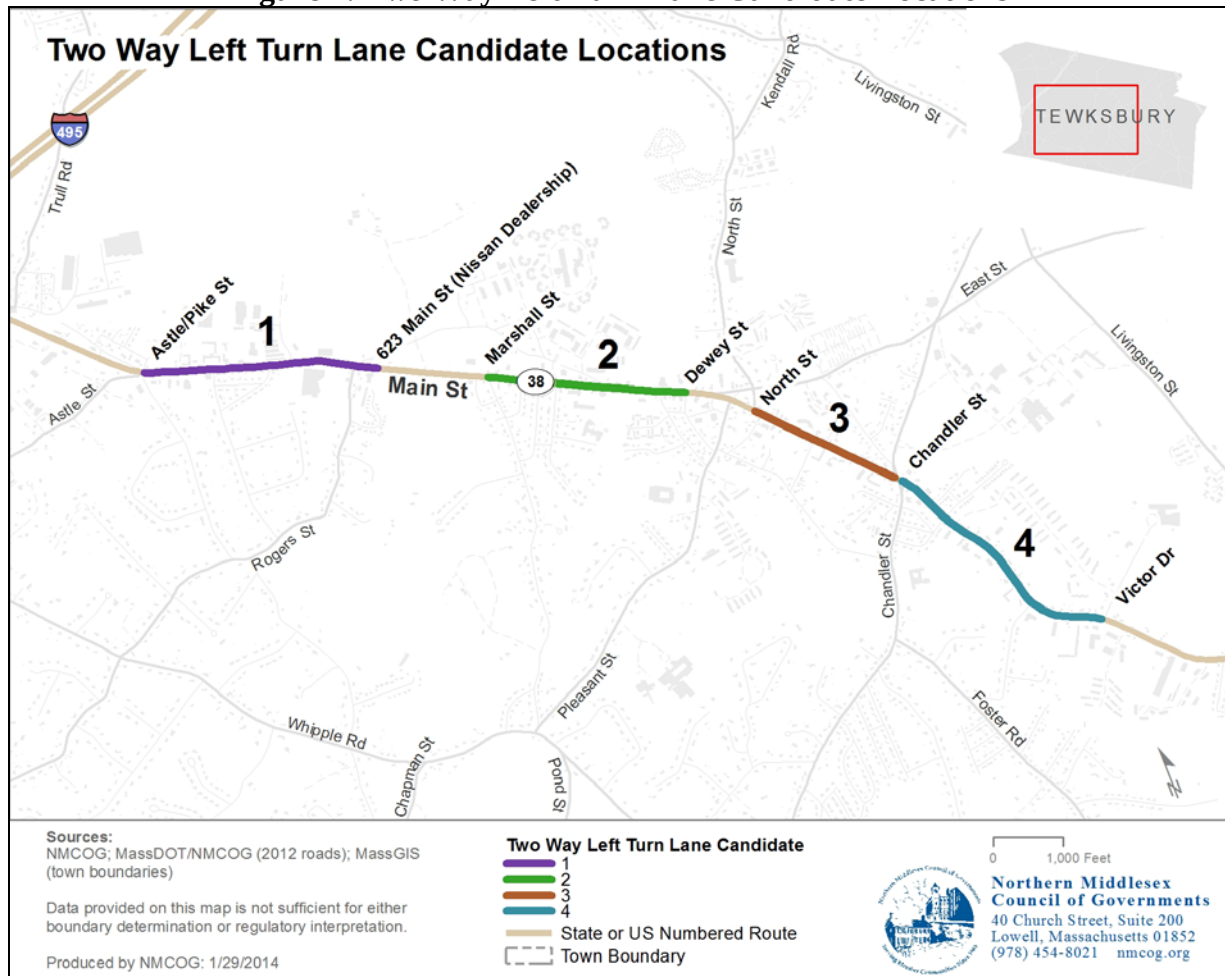


Table11: Travel Time Monitoring Results for Route 38 Mainline

Facility	Segment Name	Direction	Distance	Speed Limit	Speed Limit Travel Time	Avg AM Travel Time	Avg AM Speed	AM Delay	AM LOS	Avg PM Travel Time	Avg PM Speed	PM Delay	PM LOS
State Route 38	Lowell C.L. to I-495 SB Ramps	SB	0.07	35	7.20	32.25	7.81	25.05	F	7.25	34.76	0.05	A
	I-495 SB Ramps to I-495 NB Ramps	SB	0.21	35	21.60	37.75	20.03	16.15	C	45.50	16.62	23.90	D
	I-495 NB Ramps to Old Main St	SB	0.12	35	12.34	17.00	25.41	4.66	B	20.50	21.07	8.16	C
	Old Main St to Walmart Plaza	SB	0.19	35	19.54	20.75	32.96	1.21	A	23.75	28.80	4.21	B
	Walmart Plaza to Astle/Pike St	SB	0.27	35	27.77	48.00	20.25	20.23	C	28.00	34.71	0.23	A
	Astle/Pike St to Pleasant St	SB	1.62	45	129.60	186.50	31.27	56.90	B	183.50	31.78	53.90	B
	Pleasant St to Chandler St	SB	0.49	35	50.40	68.50	25.75	18.10	B	96.25	18.33	45.85	C
	Chandler St to Victor Dr	SB	0.72	35	74.06	78.50	33.02	4.44	A	82.00	31.61	7.94	A
	Victor Dr to Post Office Dr	SB	0.56	35	57.60	67.50	29.87	9.90	B	68.75	29.32	11.15	B
	Post Office Dr to Livingston St	SB	0.25	35	25.71	49.75	18.09	24.04	C	43.50	20.69	17.79	C
	Livingston St to Shawsheen St	SB	0.23	35	23.66	67.25	12.31	43.59	E	73.00	11.34	49.34	E
	Shawsheen St to South St	SB	0.82	35	84.34	106.00	27.85	21.66	B	133.00	22.20	48.66	C
	South St to Wilmington T.L.	SB	0.69	40	62.10	70.50	35.23	8.40	A	67.50	36.80	5.40	A
	Lowell C.L. to I-495 SB Ramps	NB	0.07	35	7.20	28.00	9.00	20.80	F	43.50	5.79	36.30	F
	I-495 SB Ramps to I-495 NB Ramps	NB	0.21	35	21.60	34.75	21.76	13.15	C	30.75	24.59	9.15	B
	I-495 NB Ramps to Old Main St	NB	0.12	35	12.34	29.00	14.90	16.66	D	20.25	21.33	7.91	C
	Old Main St to Walmart Plaza	NB	0.19	35	19.54	30.75	22.24	11.21	C	23.50	29.11	3.96	B
	Walmart Plaza to Astle/Pike St	NB	0.27	35	27.77	35.50	27.38	7.73	B	36.50	26.63	8.73	B
	Astle/Pike St to Pleasant St	NB	1.62	45	129.60	182.50	31.96	52.90	B	195.50	29.83	65.90	B
	Pleasant St to Chandler St	NB	0.49	35	50.40	73.00	24.16	22.60	B	106.50	16.56	56.10	D
	Chandler St to Victor Dr	NB	0.72	35	74.06	99.00	26.18	24.94	B	87.25	29.71	13.19	B
	Victor Dr to Post Office Dr	NB	0.56	35	57.60	72.50	27.81	14.90	B	83.00	24.29	25.40	B
	Post Office Dr to Livingston St	NB	0.25	35	25.71	29.50	30.51	3.79	A	35.50	25.35	9.79	B
	Livingston St to Shawsheen St	NB	0.23	35	23.66	36.75	22.53	13.09	C	51.00	16.24	27.34	D
	Shawsheen St to South St	NB	0.82	35	84.34	94.75	31.16	10.41	A	130.75	22.58	46.41	C
	South St to Wilmington T.L.	NB	0.69	40	62.10	87.00	28.55	24.90	B	82.00	30.29	19.90	A

Figure 2: Tewksbury Route 38 Corridor A.M. Peak Hour
Turning Movements

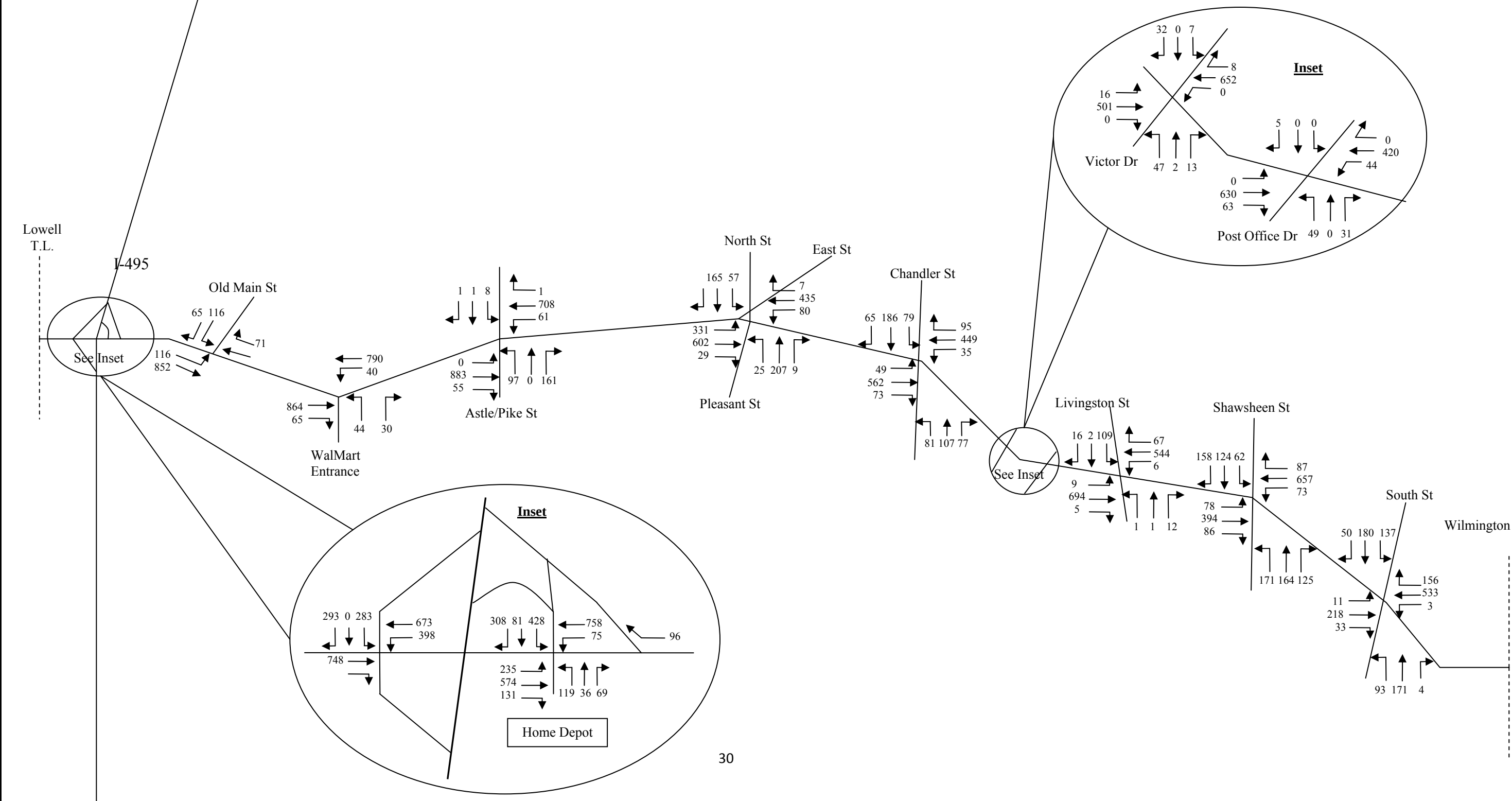
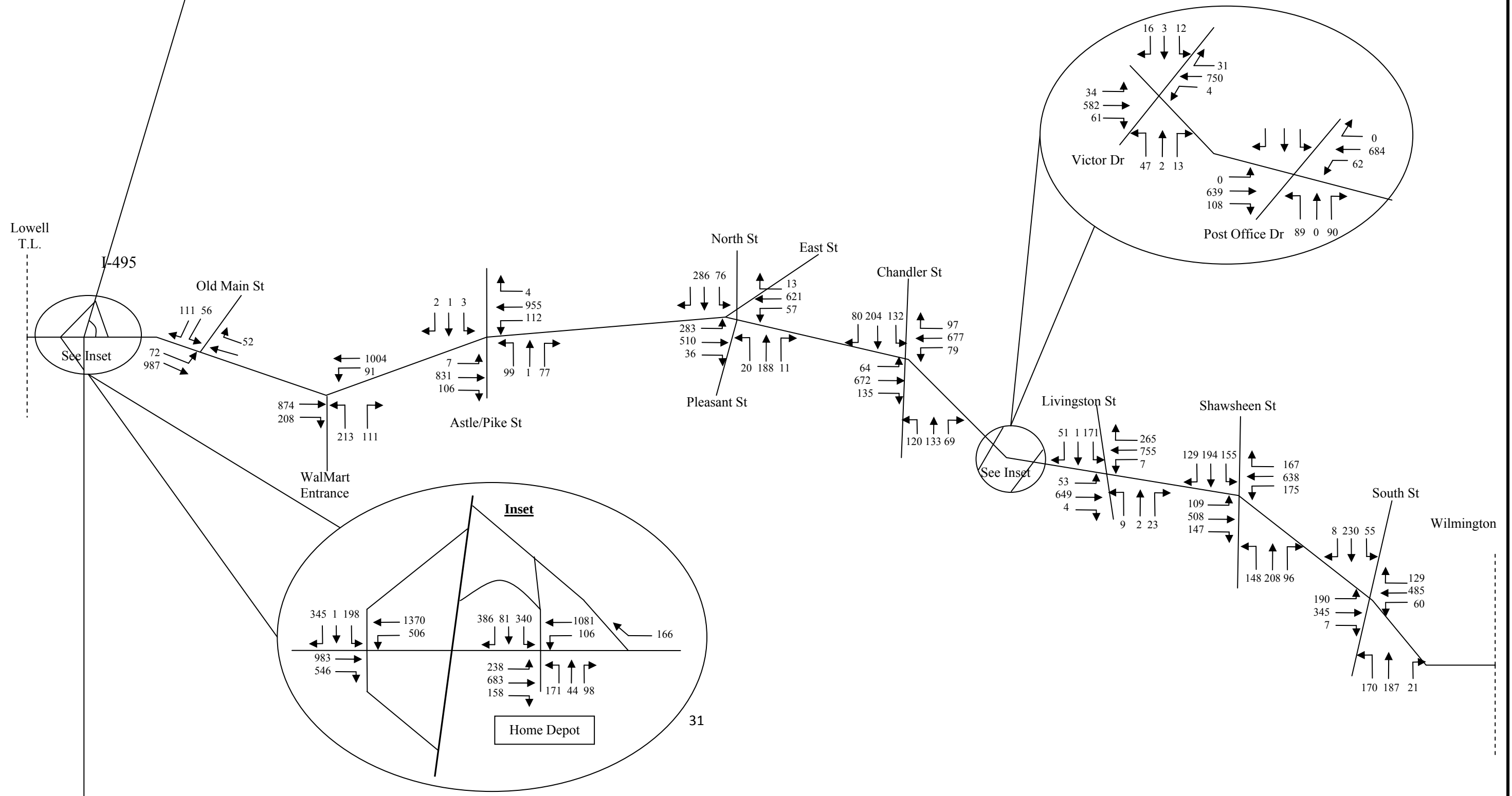
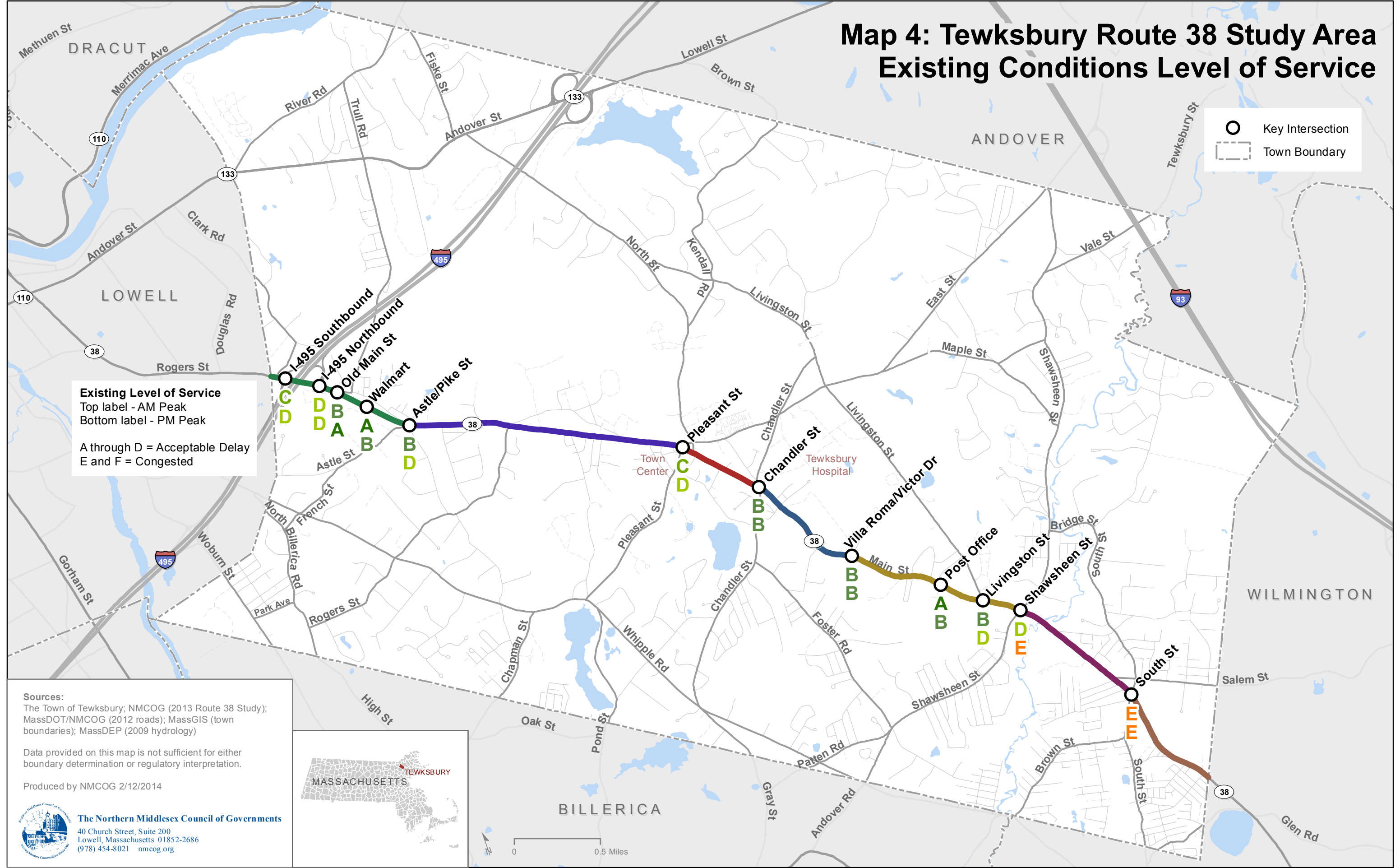


Figure 3: Tewksbury Route 38 Corridor P.M. Peak Hour Turning Movements



Map 4: Tewksbury Route 38 Study Area Existing Conditions Level of Service



VII. Safety Analysis

In general, traffic crashes are caused by failure of one of the three major elements of a transportation system: the human, the vehicle, or the environment/roadway, and improvements in these areas can be expected to enhance safety on the road. The three elements can be further specified to include driver error, vehicle malfunction, roadway design problems, and weather conditions.

In analyzing safety conditions along Route 38, patterns of crash occurrence and type are analyzed to determine the causes, which are generally related to design and control elements at specific locations. Table 12 shows the crash history of the study area intersections from 2008-2010 based on data provided by MassDOT. This data does not include any information relative to highway interchanges.

Table 12: Crash Analysis for Route 38 Intersections (2008-2010)

Intersection	Total Crashes	Property Damage Only Crashes	Injury Crashes	Fatal Crashes	EPDO	Regional Rank
Route 38 at Shawsheen Street*	69	56	13	0	121	7
Route 38 at Astle/Pike/Veranda Street	58	34	6	0	58	43
Route 38 at Pleasant Street	26	19	7	0	54	53
Route 38 at Capitol Avenue	32	28	4	0	48	71
Route 38 at Livingston Street	28	26	2	0	36	114
Route 38 at East Street	14	9	5	0	34	119
Route 38 at South Street	16	12	4	0	32	124
Route 38 at Chandler Street	15	11	4	0	26	132
Route 38 at Salem Street	13	9	4	0	29	140
Route 38 at Newton Avenue	17	15	2	0	25	158
Route 38 at Victor Drive	9	8	1	0	13	230
Route 38 at Colonial Drive	7	7	0	0	7	267
* The intersection of Shawsheen Street and Route 38 was reconstructed in 2005						

The intersections of I-495 and Route 38 were not included in the intersection analysis due to the lack of accurate reporting at the interchanges. Locations of crashes within the interchange were often vague given the descriptions available.

Based on information provided by the Tewksbury Police Department and MassDOT, there were 301 reported crashes that did not occur at study area intersections. A discussion of the crash data for each segment along the Route 38 corridor is provided in the following sections.

Segment 1: Lowell City Line to Astle/Pike Street

During the three year study period, there were 25 non intersection related crashes reported along the 0.9 mile long segment extending from the Lowell line to the intersection of Astle/Pike Street. This number is fairly low considering the high volumes of traffic that flow through the segment. Access is controlled throughout the roadway with few exceptions, one being the car dealership located south of the I-495 northbound ramps. This has led to multiple angle crashes (48%) in the area. Sideswipe crashes (28%) are also prevalent due to multiple lanes being present in each direction leading drivers to change lanes throughout the segment. Most crashes result in property damage only (84%) and occur during off peak hours (76%) under dry roadway conditions (72%).

Segment 2: Astle/Pike Street to Pleasant Street

There were 114 crashes reported along the roadway segment that extends from the Astle/Pike Street intersection to Pleasant Street. This 1.6 mile segment contains numerous curb cuts for businesses and residences. There are no left turn lanes along the roadway, leading to angle (35%) and rear end (47%) type incidents caused by turning vehicles. Thirty-six crashes resulted in personal injury (32%) under both dry (55%) and wet (40%) roadway conditions, with most crashes occurring during off peak hours (77%).

Segment 3: Pleasant Street to Chandler Street

There were 21 crashes along the segment extending from Pleasant Street to Chandler Street over a three-year period. Analysis of crash data has shown that angle crashes occurred primarily at the intersection of Route 38 and North Street. This stop controlled intersection, located just south of the Pleasant Street intersection, provides a cut-through route around the traffic signal to the north. In addition, Route 38 experiences congestion along this section of the corridor. As a result, vehicles attempt to cross multiple lanes of traffic during congested peak hour conditions. Given the congested conditions, rear end collisions account for 57% of all crashes. Thirty-eight percent (38%) of crashes along this segment happened during the AM and PM peak hours on weekdays.

Segment 4: Chandler Street to Victor Drive

There were 27 crashes reported along the segment of the corridor extending from Chandler Street to Victor Drive. The majority of crashes were rear-end type incidents (59%) resulting from vehicles turning in and out of the numerous businesses and residential areas located in this segment. With the large volumes of traffic in the area, and the relatively narrow roadway, drivers waiting to turn are rear-ended by motorists unable to stop in a timely manner. Such accidents are mainly due to driver inattention or excessive speed. Most crashes took place during off peak hours (89%) and under dry roadway conditions (74%).

Segment 5: Victor Drive to Shawsheen Street

There were 55 crashes reported along the segment extending from Victor Drive to Shawsheen Street during the three year study period. Angle type crashes (49%) were most prevalent, due to the high volumes of traffic entering and exiting the many driveways and curb cuts serving the business establishments located along this section of the corridor. Most crashes resulted in property damage only (84%), with five crashes resulting in personal injury.

Segment 6: Shawsheen Street to South Street

During the three-year study period, there were 41 crashes reported along the segment extending from Shawsheen Street to South Street. Rear-end type crashes were predominant, comprising 51% of the total crashes, while angle incidents made up 29% of the total crashes. Most crashes occurred during off peak hours (73%) and under dry roadway conditions (78%). The majority of accidents resulted with property damage (66%). There are numerous access point located along this section of the corridor, given its commercial character.

Segment 7: South Street to Wilmington Town Line

There were 14 crashes reported along this southernmost segment of Route 38 in Tewksbury. The majority of these crashes were rear end (29%) or angle (43%) types. Most occurred during non peak hours (79%), resulting in property damage only (57%) in terms of severity. It should be noted that crashes were evenly split between dry and wet roadway conditions, with 7 crashes noted for each type.

VIII. Bicycle and Pedestrian Accommodations

An extensive sidewalk network is a primary component to having a walkable community. In addition sidewalks should be ADA accessible to accommodate all users of the network. Most of the existing sidewalk network is not ADA accessible. Route 38 is presently not a bicycle or pedestrian friendly corridor given the limited roadway width for bicyclists and a lack of accessible sidewalks for pedestrians.

Currently, the Route 38 corridor consists of a patchwork of sidewalks and there is not consistent or safe pedestrian access to commercial and residential areas. Map 4 shows the location of all existing sidewalks and crosswalks along the main corridor within Tewksbury. Table 13 provides an inventory the sidewalk network, listing the locations and length of the sidewalks along Main Street. Table 14 outlines the location and number of crosswalks along the corridor.

Map 5: Tewksbury Route 38 Study Area Sidewalk and Crosswalk Inventory

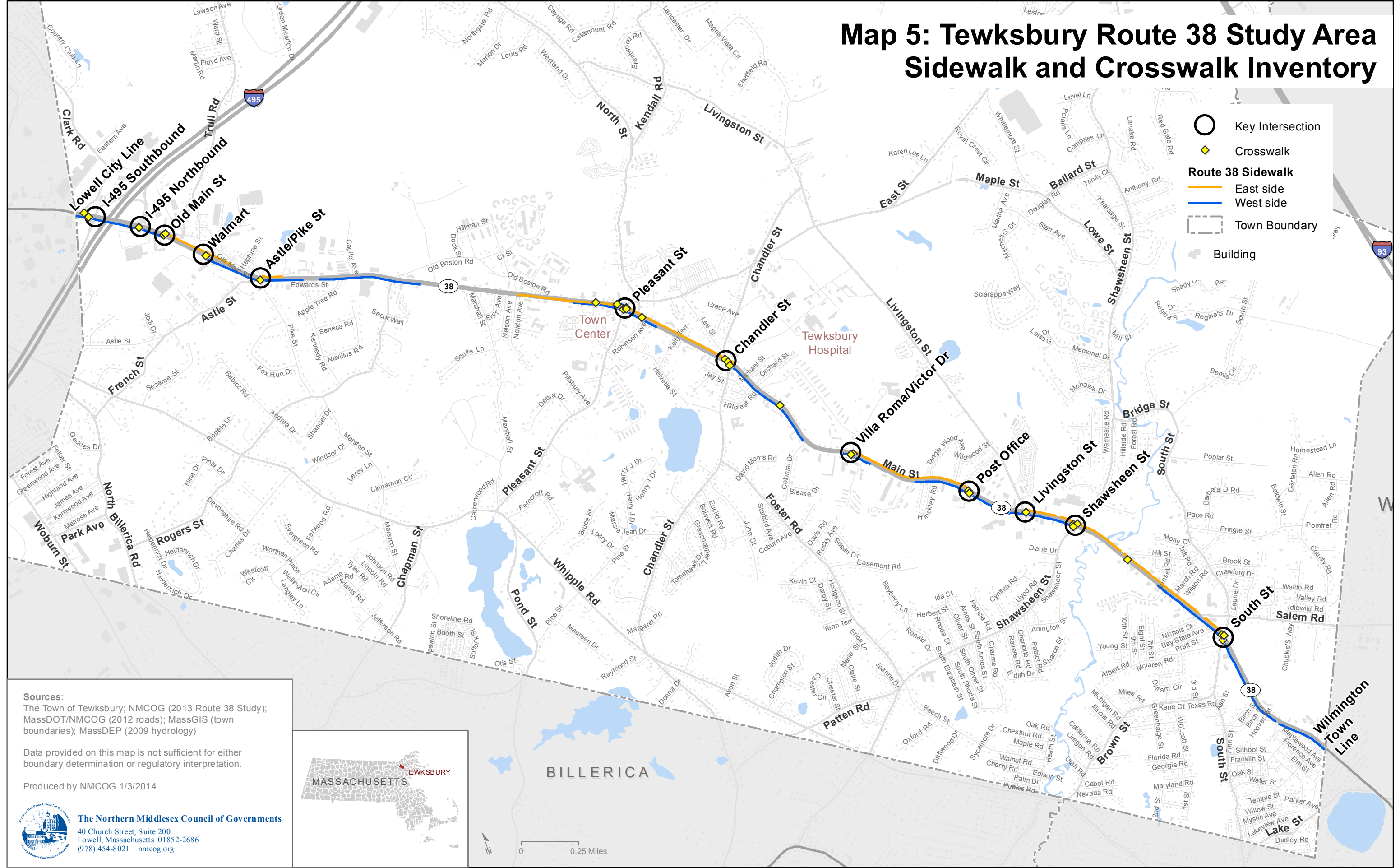


Table 13: Sidewalk Inventory

Roadway Segment	Start Point	End Point	Sidewalk	Linear feet
Segment 1: Lowell line to Astle/Pike Sts.				
<i>West side of Rte. 38</i>	Lowell C.L.	Old Main St.	Yes	2,196.48
	Old Main St.	Walmart Entrance	No	1,071.84
	Walmart Entrance	Astle/ Pike Sts.	Yes	1,483.68
<i>East side of Rte. 38</i>	Lowell C.L.	Old Main St.	No	2,196.48
	Old Main St.	Astle/ Pike Sts.	Yes	2,555.52
Section 2: Astle/Pike Sts. to Pleasant St.				
<i>West side of Rte. 38</i>	Astle/ Pike Sts.	433 Main St.	Yes	1,034.88
	433 Main St.	468 Main St.	No	300.00
	468 Main St.	663 Main St.	Yes	580.80
	663 Main St.	Marshall St.	No	1,683.35
	Marshall St.	945 Main St.	No	3,036.59
	945 Main St.	Pleasant St.	Yes	1,092.96
<i>East side of Rte. 38</i>	Astle/ Pike St.	Colab Rd.	Yes	522.72
	Colab Rd.	Marshall St.	No	2,430.45
	Marshall St.	Archstone Ave.	No	1,630.67
	Archstone Ave.	Pleasant St.	Yes	1,092.96
Section 3: Pleasant St. to Chandler St.				
<i>West side of Rte. 38</i>	Pleasant St.	1099 Main St.	Yes	918.72
	1099 Main St.	Chandler St.	No	1,990.56
<i>East side of Rte. 38</i>	Pleasant St.	Chandler St.	Yes	2,909.28
Section 4: Chandler St. to Victor Dr.				
<i>West side of Rte. 38</i>	Chandler St.	Colonial Dr.	Yes	2,544.96
	Colonial Dr.	Villa Roma Dr.	No	712.80
<i>East side of Rte. 38</i>	Chandler St.	1258 Main St.	Yes	255.79
	1258 Main St.	Victor Dr.	No	3,640.81
Section 5: Victor Dr. to Shawsheen St.				
<i>West side of Rte. 38</i>	Victor Dr.	Villa Roma Dr.	Yes	281.61
	Villa Roma Dr.	Villa Roma Rd.	Yes	765.60
	Villa Roma Rd.	Hinkley Rd.	No	1,525.92
	Hinkley Rd.	Shawsheen St.	Yes	3,774.40
<i>East side of Rte. 38</i>	Villa Roma Dr.	1777 Main St.	Yes	3,637.92
	1777 Main St.	Livingston St.	No	913.44
	Livingston St.	Shawsheen St.	Yes	1,224.96
Section 6: Shawsheen St. to South St.				
<i>West side of Rte 38</i>	Shawsheen St.	2171 Main St.	No	2,550.24
	2171 Main St.	South St.	Yes	1,705.44
<i>East side of Rte 38</i>	Shawsheen St.	South St.	Yes	4,255.68
Section 7: South St. to Wilmington line				
<i>West side of Rte. 38</i>	South St.	Wilmington line	Yes	3,680.16
<i>East side of Rte. 38</i>	South St.	Wilmington line	No	3,680.16

Table 14: Route 38 Crosswalk Inventory

Section	Crosswalk Locations
Section 1: Lowell Line to Astle/Pike Sts.	Clark Relocation Rd intersection - one crosswalk crossing Clark Relocation Rd
	I-495 SB Intersection – One crosswalk at I-495 SB Entrance Ramp
	I-495 NB intersection – One crosswalk across Home Depot Entrance
	Old Main St intersection – One crosswalk across Rte. 38 and one across Old Main St
	Walmart Entrance – One crossing Rte. 38 on the South side of the intersection
	Astle/Pike St intersection – one crosswalk on west side (no crossing of Rte. 38)
Section 2: Astle Pike Sts. to Pleasant St.	Astle St./Pike St. intersection – one crosswalk across Astle/Pike (no crossing of Rte 38)
	Mid Block Crosswalk across Rte. 38 at Foster's Place
	Pleasant St. Intersection – all legs have crosswalks
Section 3: Pleasant Street to Chandler Street	Pleasant St. Intersection – all legs have crosswalks
	Robinson Ave. intersection - crossing Rte. 38 at 1060 Main St.
	Chandler St. Intersection – South side crossing Rte 38 and East side crossing Chandler
Section 4: Chandler St. to Victor Dr.	Chandler St. Intersection – South crossing Rte 38 and East (Chandler) sides
	Mid-Block Crosswalk on Rte. 38 at 1351 Main St
	Victor Dr. intersection – South side crossing Rte. 38 and West side crossing Victor Dr.
Section 5: Victor Dr. to Shawsheen	Victor Dr. intersection – South side crossing Rte. 38 and West side crossing Victor Dr.
	Post Office Intersection – North side crossing Rte. 38 and West (PO entrance) side
	Livingston St. intersection – South side of intersection crossing Rte. 38
Section 6: Shawsheen St. to South	Shawsheen St. intersection – North, East and West sides of the intersection
	Mid-block Crosswalk at 2100 Main St
	South St. intersection – North, East and West sides of the intersection
Section 7: South St. to Wilmington line	South St. intersection – North, East and West sides of the intersection

The Route 38 corridor does not have dedicated bicycle facilities, forcing bicyclists to share the road with vehicular traffic. Whenever possible future roadway improvements should incorporate bicycle accommodations in accordance with MassDOT policies. Bicycle loop detectors have been installed at the signalized intersections that have been upgraded in the last few years, for example at the Post Office and Victor Street. “Share the Road” signage should be installed along Route 38 to remind motorists of the possible presence of with bicyclists within the traveled way.

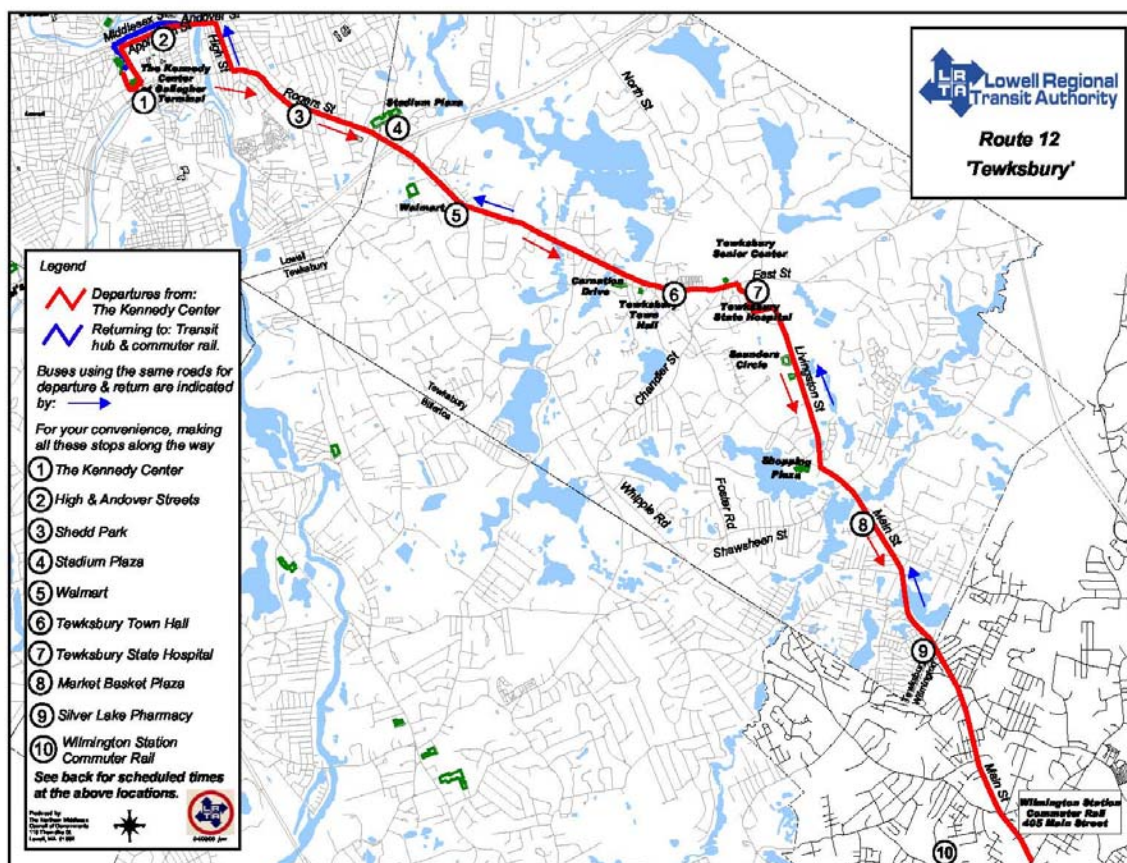
IX. Public Transportation

The Lowell Regional Transit Authority (LRTA) provides weekday bus service along Route 38 generally between 7:00 AM and 7:40 PM. Saturday service is provided between 7:00 AM and 5:30 PM. Route 12 runs along Route 38 from the Lowell Line to the Town Center at Pleasant Street. From there, the route continues along East Street, stopping at the Tewksbury State

Hospital. The route then turns right onto Livingston Street on its return to Route 38. Once back on Route 38, the bus travels south on Main Street to the Wilmington MBTA Commuter Rail station. Map 6 shows the LRTA route as it extends along Route 38.

LRTA also provides paratransit service in Tewksbury as part of its Road Runner program. This curb-to-curb service is available to residents within the LRTA service area who are 60 years of age or more. All of the Road Runner services are shared ride services, intended to safely and efficiently transport as many passengers at a time as possible. The service can be used for many purposes including work, medical, shopping, social and recreational trips. The hours of operation are between 8:00AM and 4:00 PM on weekdays only.

Road Runner ADA paratransit services are also provided, as required by the Americans with Disabilities Act of 1990. Curb-to-curb paratransit service is available to persons with disabilities who are unable to use the LRTA fixed-route bus service. All services are provided with wheelchair accessible vehicles.



MAP 6: LRTA FIXED ROUTE SERVICE

X. Future Conditions Analysis

Traffic volumes within the study have been projected to 2022, reflecting a 10-year planning horizon consistent with MassDOT guidelines. The traffic volume projections incorporate specific developments that have occurred since the traffic count data was originally collected, as well as traffic that is expected to be generated by projects that are in the permitting pipeline. In addition, an average annual growth rate in the study area was applied based on historic traffic volume data. Historical traffic volume data along Main Street indicates that an estimated to be 1.0% per year is appropriate and conservative.

The trip generation calculations used to estimate volumes focused on the following development projects along Route 38, using the Institute of Transportation Engineers (ITE) Trip Generation Manual, 7th edition based on their designated Land Use Codes (LUC):

- 553 Main Street – Ocean State Job Lots has opened a store at this location and submitted a traffic signal justification analysis to MassDOT for the main entrance across from Capitol Avenue. 10,000 sf of storefront remains vacant on this parcel. The trip generation for this project was calculated using LUC 820, “Shopping Center”, and was analyzed by Bryant Associates before Ocean State Job Lots moved into the site.
- 2230 Main Street – A two-story 21,000 sf mixed use building was permitted at this location, comprised of retail on the first floor and commercial/office space on the second floor. The first story trip generation was calculated as LUC 814, “Specialty Retail Center”, and the second story as LUC 710, “General Office”.
- 0 Victor Drive – This project included the development of 80 townhouse units. The trip generation rates for LUC 230, “Condo/Townhouse”, were utilized for this site.
- 2087 Main Street – This site was the formerly an outdoor entertainment complex. Recent development proposals have included proposed entertainment uses, and retail uses. This site was analyzed using the “multipurpose recreational facility” land use code (LUC 435).
- 2131 Main Street – Currently zoned for 9,000 sf commercial/restaurant use. Recent development proposals have focused on fast food establishments with drive thru. The land use designation 934, “Fast Food Restaurant with drive thru”, was utilized to calculate future trips generated from this site.
- 1777 Main Street – The former Heath Brook Plaza has been targeted for redevelopment. Now known as Main Street Marketplace, this strip mall consists of 60,000 sf of existing retail space, with the potential development of an additional 83,000 sf. Six of the existing nine storefronts are currently vacant and available for lease. Total vacant square footage is estimated to be 34,600 sf. For this report, the entire potential footprint of 143,000 sf has been used to calculate trip generation under LUC 820, “Shopping Center”.

Table 15 summarizes the weekday trips and peak hour trips generated by each of the above projects. The trip generation numbers are further broken down into trips entering and exiting each project site.

Table 15: Trip Generation Results for Planned Projects along Route 38

Location	ITE Land Use Code	Weekday Trips		AM Peak Trips		PM Peak Trips	
		In	Out	In	Out	In	Out
1777 Main Street	820 Shopping Center	3,070	3,070	90	57	257	279
2087 Main Street	435 Multipurpose Recreational Facility	275	275	9	3	21	14
2131 Main Street	934 Fast Food Restaurant with Drive Thru	1,489	1,488	163	156	108	100
2230 Main Street	710 General Office	58	58	14	2	3	13
2230 Main Street	814 Specialty Retail Center	232	233	35	37	12	16
0 Victor Drive	230 Condo/ Townhouse	235	234	6	29	28	14
553 Main Street	820 Shopping Center	1,053	1,051	18	53	77	83

Once the trip generation along the corridor is calculated, the trips are distributed throughout the roadway network. Figures 4 and 5 show future year peak hour baseline turning movements along Route 38, while Figures 6 and 7 show the projected turning movement counts with the additional trips generated by the development/redevelopment project outlined in Table 16 above.

The twelve intersections along Route 38 were analyzed under future conditions using the methodology described on pages 22 and 23. The future year analysis utilized the turning movement counts projected using the methodology described above. No potential traffic improvements were considered in the analysis. Results of the intersection operational analysis showed that by 2022 the following intersections will operate at a poor level of service during one or both the peak periods of the day:

- Route 38 at the I-495 NB ramp interchange (A.M. peak only)
- Route 38 at Astle/Pike Streets (both peak periods)
- Route 38 at Livingston Street (P.M. peak only)
- Route 38 at Shawsheen Street (both peak periods)
- Route 38 at South Street (both peak periods)

Table 15 on the following page and Map 7 on page provide summarize the results of the 2022 operational analysis, quantifying the control delays and LOS for each intersection during both A.M. and P.M. peak periods.

Table 16: 2022 Intersection Operations Analysis for Route 38

Location	AM Peak Hour		PM Peak Hour	
	Control Delay (seconds/vehicle)	LOS	Control Delay (seconds/vehicle)	LOS
Route 38 and I-495 SB ramps	29.6	C	53.0	D
Route 38 and I-495 NB Ramps	59.0	E	55.0	D
Route 38 and Old Main Street	13.5	B	8.0	A
Route 38 and Wal-Mart Plaza	5.1	A	10.7	B
Route 38 and Astle/Pike Street	56.1	E	90.2	F
Route 38 and Pleasant Street	41.9	D	51.6	D
Route 38 and Chandler Street	12.9	B	33.7	C
Route 38 and Victor Drive	18.3	B	22.1	C
Route 38 and Post Office Drive	9.4	A	13.3	B
Route 38 and Livingston Street	31.0	C	185.0	F
Route 38 and Shawsheen Street	352.1	F	114.8	F
Route 38 and South Street	127.0	F	60.8	E

Figure 4: Route 38 A.M. Peak Hour Turning Movements – Future Baseline Conditions

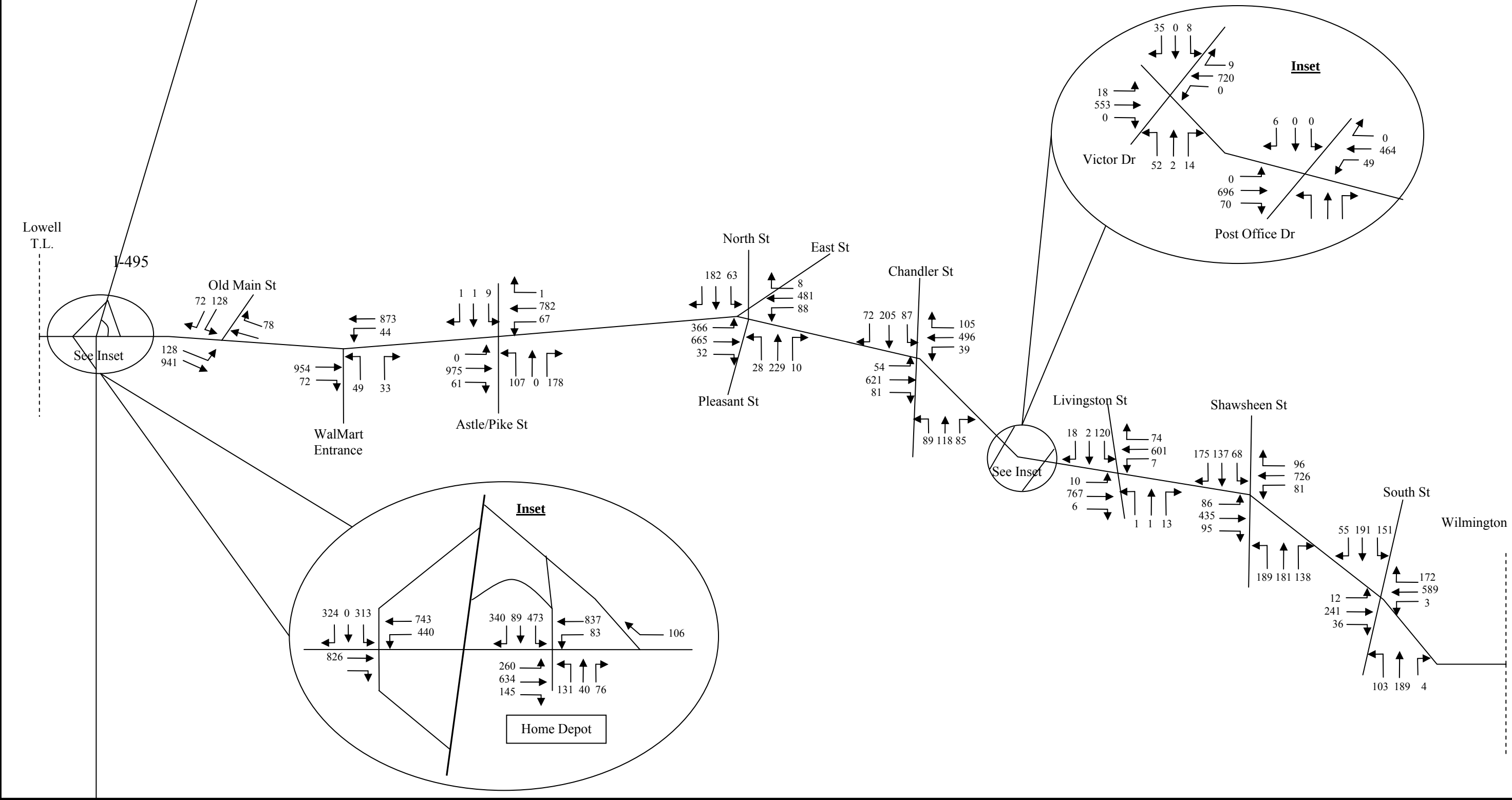
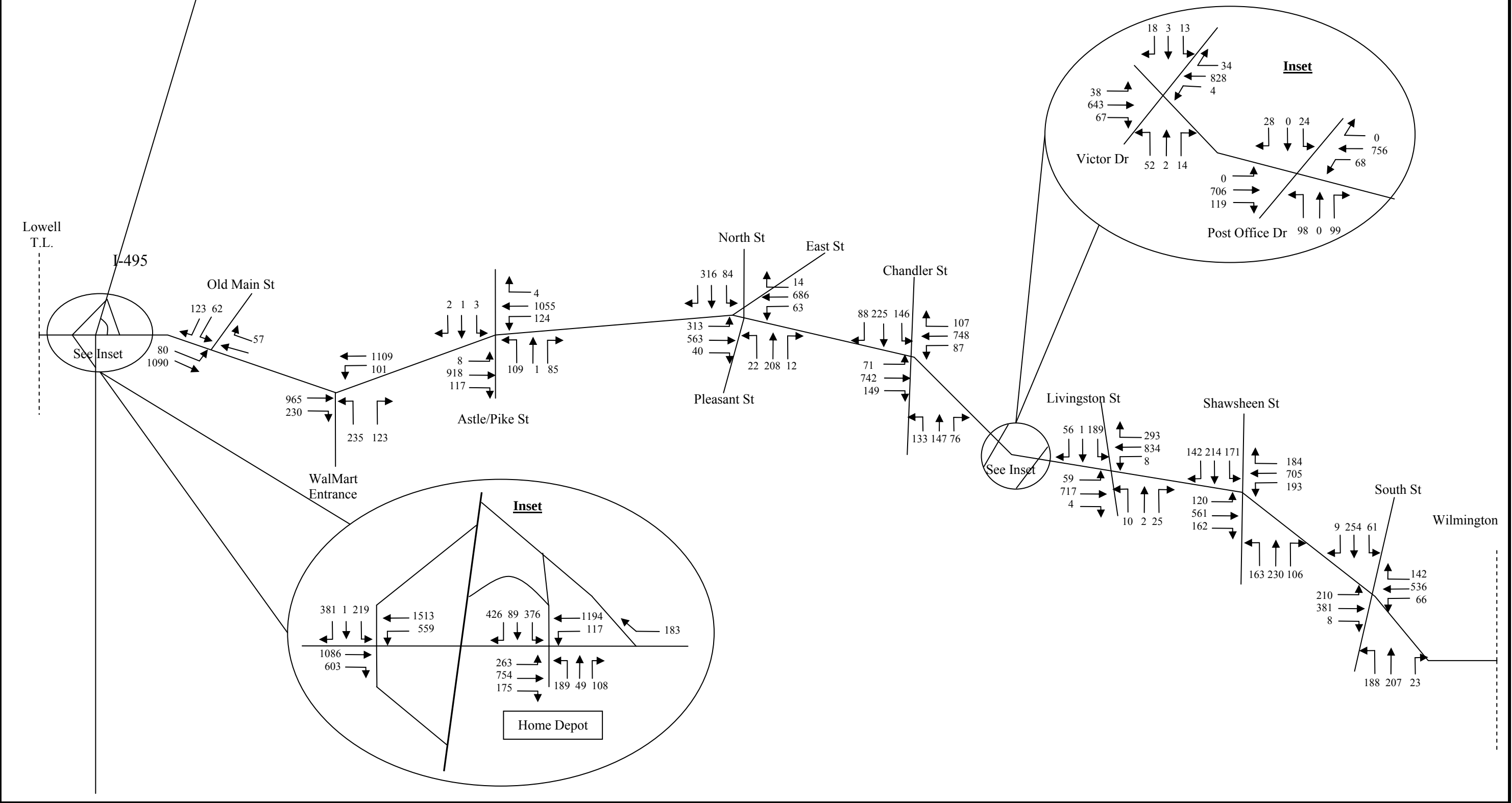
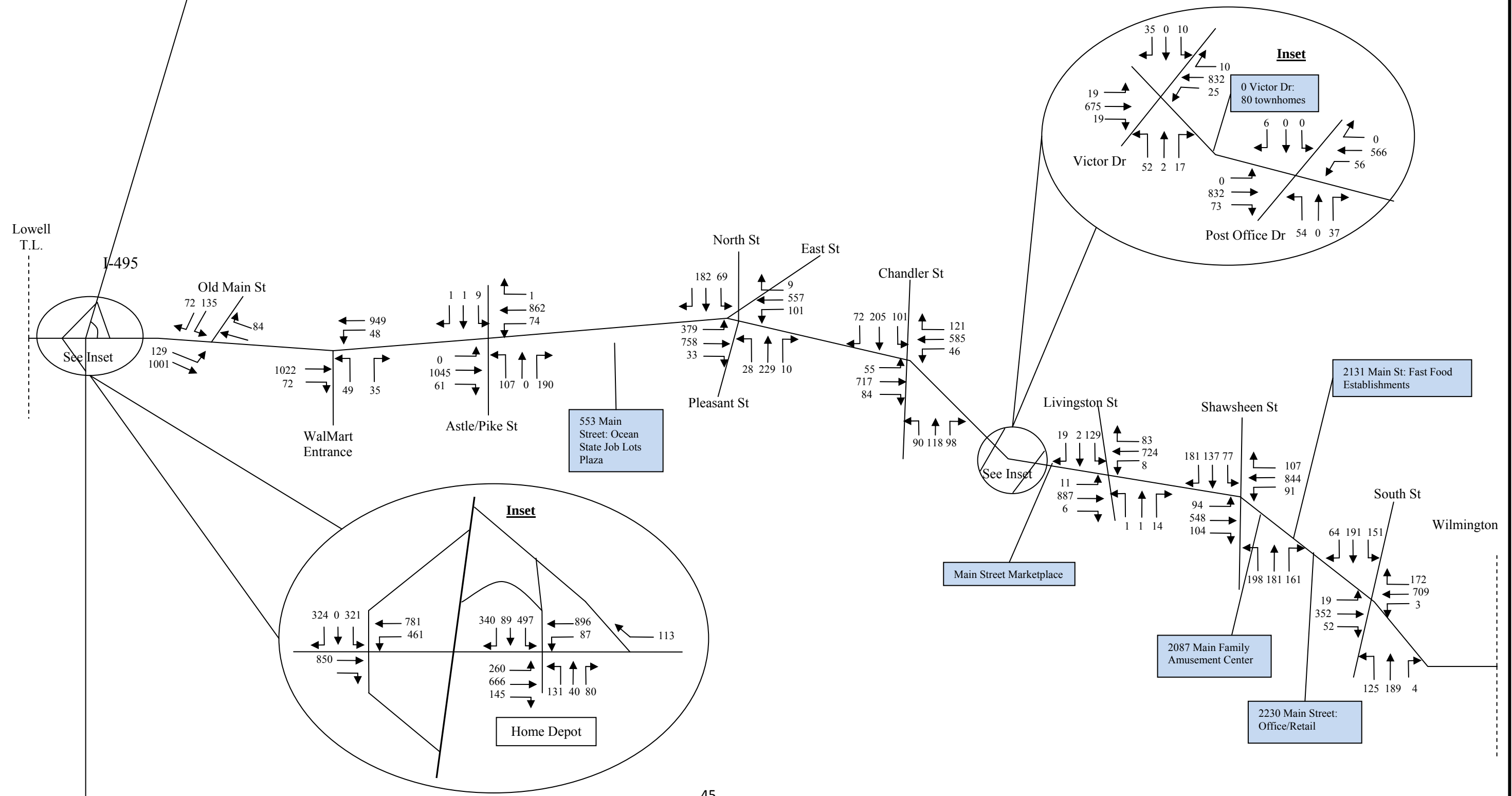


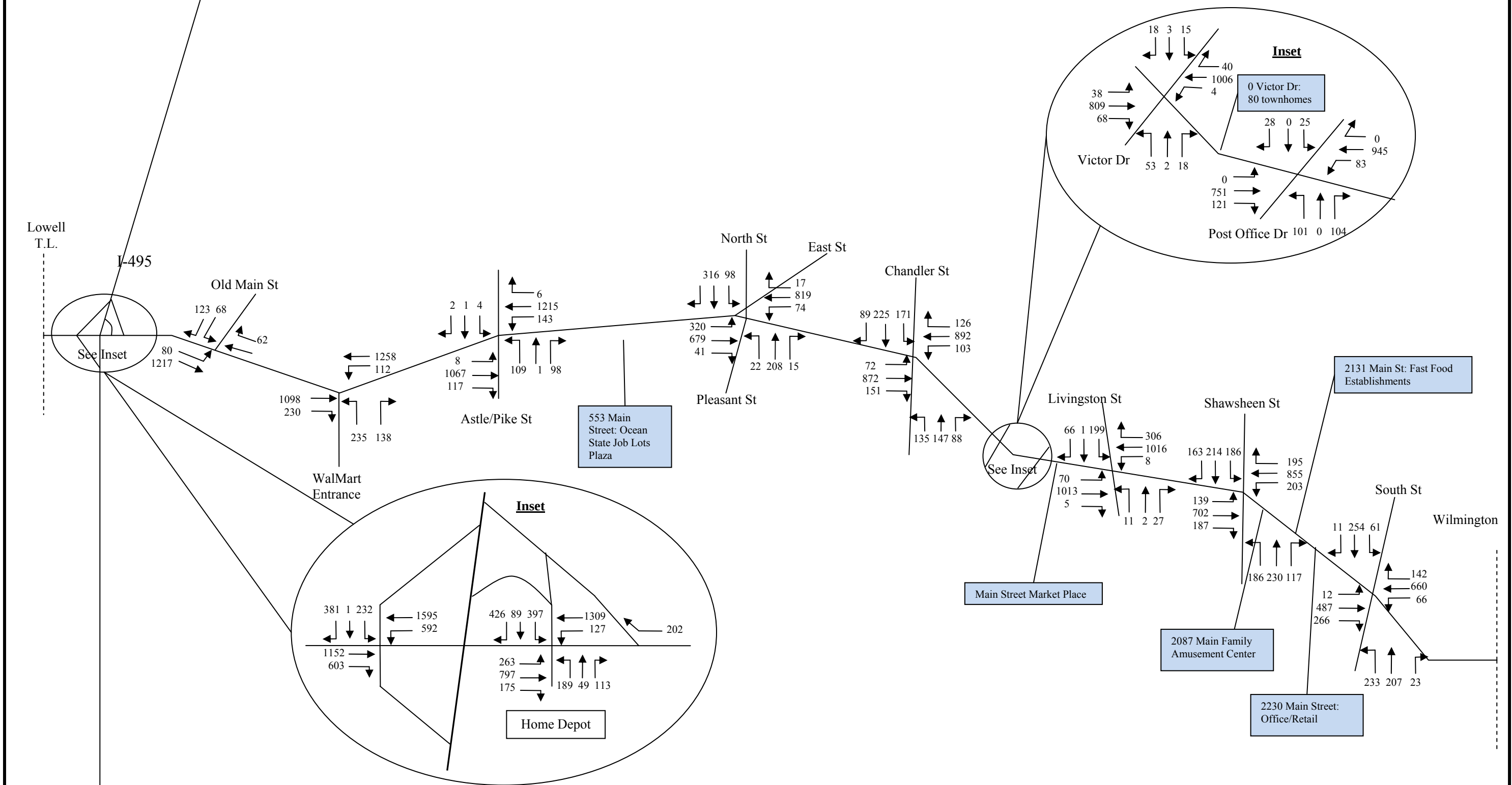
Figure 5: Route 38 P.M. Peak Hour Turning Movements – Future Baseline Conditions



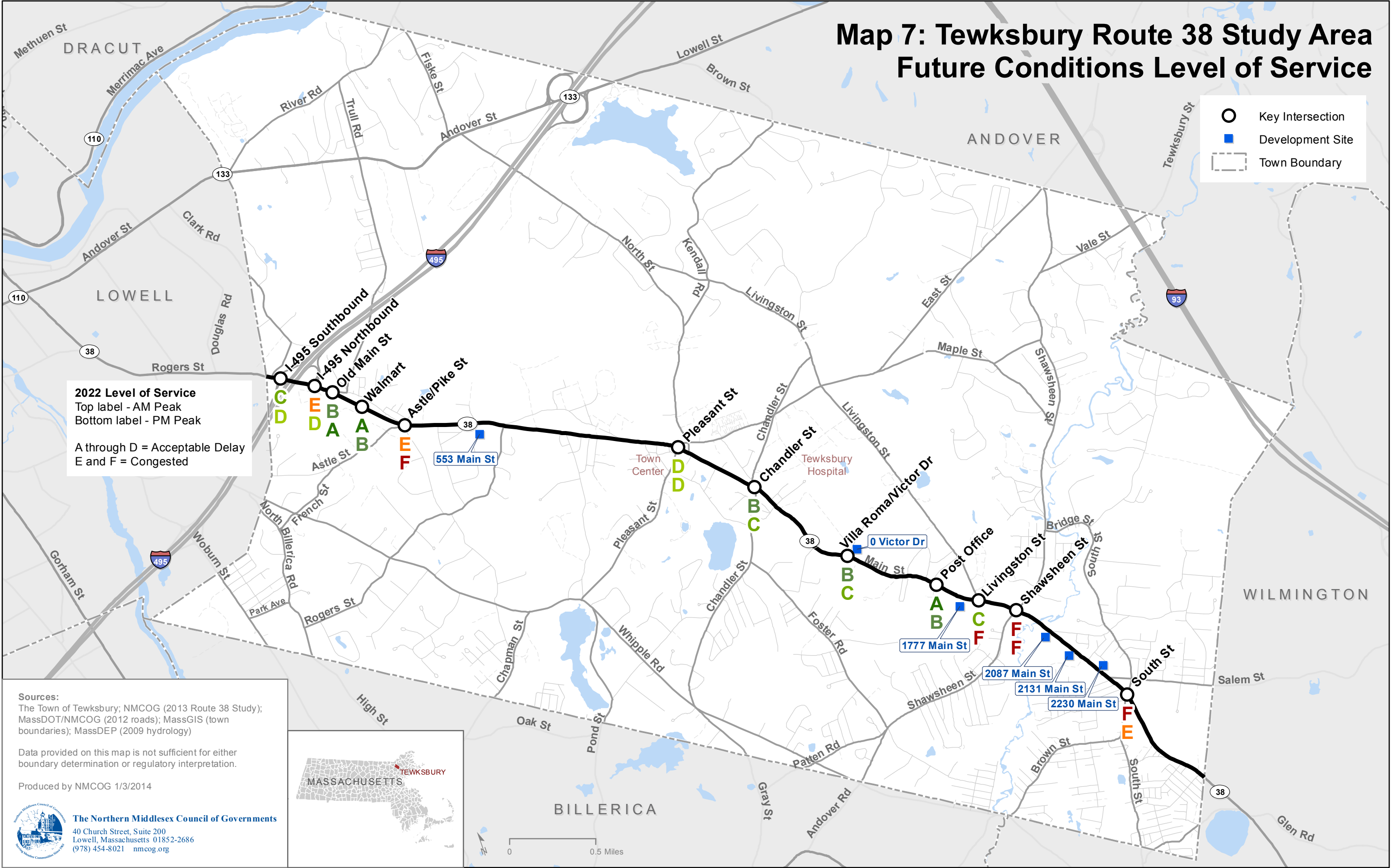
**Figure 6: Route 38 2022 A.M. Peak Hour Turning Movements –
With Future Development/Redevelopment Projects**



**Figure 7: Route 38 2022 P.M. Peak Hour Turning Movements –
With Future Development/Redevelopment Projects**



Map 7: Tewksbury Route 38 Study Area Future Conditions Level of Service



XI. Recommendations

There are several improvement strategies that could improve operating and safety conditions along for the Route 38 corridor. These include access management, transportation demand management, traffic operational improvements, management of construction and maintenance projects, and planning initiatives.

A. Access Management

Numerous studies have shown that controlling and limiting access to highways is a cost-effective way to help maintain the safety, capacity, and functional integrity of a roadway. Adding more lanes to an existing roadway is expensive and difficult. Controlling access, particularly by advocating the internal shared circulation of adjacent developments, is a proactive and cost-effective way to accomplish this objective. Given that Route 38 is under state jurisdiction while the Town has permitting authority for development and redevelopment projects and for changes in use, MassDOT and the Town will need to establish a partnership in order to address future access issues along the corridor.

The development of an access management program which coordinates land use planning decisions by local government and investments in the state highway system, will serve to control the proliferation curb cuts and other access approaches. Without such a program, the safety of the public is at risk, due to the fact that uncontrolled access is a significant contributing factor to the congestion and crashes seen along the corridor. Having a robust access management policy would help to increase the traffic- carrying capacity of the roadway and reduce the incidences of traffic accidents, personal injury, and property damage or loss; mitigate environmental degradation; promote sound economic growth and the growth management goals; reduce maintenance costs; and shorten response time for emergency vehicles.

Developing and implementing effective access management strategies that improve safety requires considering the location of driveways in the context of current and future access and intersection operation needs and mobility for pedestrians and bicyclists. According to the Federal Highway Administration, studies have shown that access management improvements result in a 25-31 percent reduction in severe (injury/fatal) crashes along urban/suburban arterials.⁶ Implementing the following access management techniques along Route 30 would help to maintain or improve roadway safety, capacity, and function:

- Limit the Number of Conflict Points at Driveway Locations - Points of potential conflict between different vehicular movements are good indicators of the potential for accidents at an intersection. The potential for vehicular crashes increases as the number of conflict points increases. Therefore, limiting the number of conflict points, most often

accomplished by restricting certain turning movements at an access point, can be an effective safety measure. When left turns and cross movements are restricted at an intersection, the number of conflict points is significantly reduced.

- Separate Conflict Points-Intersections created by public streets and driveways represent basic conflict areas. Adequate spacing between these conflict areas is promoted through entrance and street spacing standards. Separating conflict areas reduces the complexity of interactions between vehicles and allows more room for drivers to negotiate speed changes and turning movements.
- Reduce the interference of Through Traffic -Safety is compromised when through traffic has to slow down for vehicles exiting, entering, or turning across the roadway. Turning lanes provide a dedicated area on which speed changes and turning maneuvers can occur, reducing the disruption of normal traffic flow. Similarly, designing driveways with large turning radii and restricting turning movements in and out of driveways reduces interference with through traffic. This study has identified four specific areas where Two-Way Left Turn Lanes could be installed:
 - Main Street between Astle/Pike Street and 623 Main Street;
 - Main Street between Marshall Street and Dewey Street;
 - Main Street between North Street and Chandler Street; and
 - Main Street between Chandler Street and Victor Drive

Additional information on the Two-Way Left Turn Lane recommendation can be found on pages 27 and 28.

- Provide Adequate On - Site Circulation and Storage - The design of good internal vehicle circulation in parking areas and proper consideration of stacking for drive-through lanes reduces the number of driveways that businesses need for access to the major roadway. Increasing the separation between the roadway access point and on-site traffic conflict points reduces the possibility of traffic queuing back to the main roadway.

B. Transportation Demand Management

Transportation Demand Management, or TDM, is a general term for strategies that increase overall system efficiency by encouraging a shift from single-occupant vehicle trips to non-single occupant modes, or shifting trips out of the peak travel period. TDM strategies are used to reduce auto trips and vehicle miles traveled. The objectives of a TDM program include congestion reduction, improved air quality, energy conservation, increased livability and accessibility, and improved public health.

⁶ http://safety.fhwa.dot.gov/provencountermeasures/fhwa_sa_12_006.htm

The Town of Tewksbury should consider adopting a TDM policy as part of its site plan review process that focuses on workplace travel. Such a policy could encourage the use of transit (where available), ridesharing, bicycling and walking, or travel outside of peak periods, as well participation in a Transportation Management Association (TMA), such as the River Road TMA. TDM needs to be a cooperative endeavor involving transportation system users, employer, developers, residents and local and state government.

Other TDM measures that could be implemented in Tewksbury include the following:

- o Promotion of existing public transit services
- o Alternative work programs such as telecommuting or flextime: The largest congestion occurs during the evening peak hour when most drivers are commuting to and from their workplace.
- o Promotion of Non-Motorized Modes of Travel
 - Provide ADA compliant sidewalks throughout the corridor and encourage walking. Approximately 35% of corridor does not have existing sidewalks.
 - Make alternative travel modes more attractive through the use of landscaping, street trees and streetscaping, and by providing bicycle racks at key locations, as well as benches, and directional signage.
 - Continue to promote mixed use development so trip chaining can be conducted without use of single occupancy vehicles.
 - Encourage bicycling either through inclusion of shared use of the road markings (Sharrows) or designated bike lanes, where appropriate.

C. Traffic Operational Improvements

Efforts to address public demand for improved travel have shifted from focusing on providing additional capacity to one of improving the operations of existing transportation infrastructure. The primary goal of the improvement recommendations outlined below is to enhance and maximize traffic operations rather than adding capacity of the existing roadway network. Table 17 summarizes current operating conditions, 2022 operating conditions with anticipated development projects, and 2022 operating conditions with the improvements in place that are recommended in this report.

A number of efficiencies could be gained along the corridor by improving signal operations through corridor-wide signal retiming/optimization. This includes the coordination of signals along the corridor segment extending from Post Office Drive to Shawsheen Street. Signal timing adjustments in the area around the I-495 interchange would also improve overall operating conditions. In addition, alterations to the signal phasing and timing for the minor approaches at the intersection of Route 38 and South Street could improve operating conditions in this area of the corridor so that an acceptable level of service is achieved.

In some cases, traffic demand exceeds the existing capacity along certain sections of the corridor or at a particular intersection, creating congested conditions. In such situations, the need to add capacity to the roadway is the only option for mitigating congestion and delay problems. The intersection of Main Street and Livingston Street is expected to operate at a poor level of service under future conditions during the evening peak hour. The addition of a right turn lane for westbound Livingston Street traffic, and the addition of a second northbound through travel lane would improve overall level of service from F to C. The additional right turn lane can be constructed within the existing right of way, but the additional northbound travel lane would likely require the acquisition of additional right of way.

Under future conditions, the intersection of Astle/Pike St and Route 38 will experience poor levels of service during both the morning and evening peak periods. By adding a southbound right turn lane and a northbound exclusive through lane, and implementing minor signal timing changes, intersection operations could improve to LOS D in the both morning and evening peak hours.

The intersection of Main Street and Shawsheen Street, though reconstructed in 2005, experiences poor levels of service during both peak periods of the day. Given the proximity to Livingston Street, it is recommended that the roadway be widened to allow two lanes in each direction between Livingston Street and Shawsheen Street. Thus, an additional through travel lane would be available for northbound and southbound Main Street movements through the Shawsheen Street intersection. Under this improvement scenario, operational analysis shows that the intersection would operate at acceptable levels of service during each peak period of the day. The widening of the roadway may involve additional right-of-way acquisition. South of the Shawsheen Street intersection, the bridge over the Shawsheen River limits the ability to expand the roadway further south.

Table 17: Route 38 Corridor Level of Service Summary: Existing Conditions, 2022 with Anticipated Future Development Project, and 2022 with Recommended Improvements

Location	Existing Conditions				2022 with Anticipated Future Development Projects in Place and No Additional Improvements				2022 Conditions with Recommended Improvements				Recommended Operational Improvements
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		
	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)	LOS	
Route 38 and I-495 SB Ramps	29.8	C	47.7	D	29.5	C	53.0	D	29.5	C	53.0	D	None
Route 38 and I-495 NB Ramps	47	D	39.7	D	59.0	E	54.9	D	49.0	D	54.9	D	Signal timing only: added time to westbound left turn phase
Route 38 and Old Main Street	13	B	7.1	A	13.4	B	8.0	A	13.4	B	8.0	A	None
Route 38 and Walmart Plaza	4.8	A	13	B	5.1	A	10.6	B	5.1	A	10.6	B	None
Route 38 and Astle/Pike Street	18.9	B	45.7	D	56.1	E	90.2	F	54.5	D	38.9	D	Add a SB Main St right turn lane, a NB Main St exclusive through lane, signal timing
Route 38 and Pleasant Street	26.5	C	39.8	D	40.5	D	51.6	D	40.5	D	51.6	D	None
Route 38 and Chandler Street	11.4	B	15.3	B	12.9	B	33.1	C	12.9	B	33.1	C	None
Route 38 and Victor Drive	11.7	B	11.4	B	17.6	B	21.7	C	17.6	B	21.7	C	None
Route 38 and Post Office Drive	7.2	A	10.1	B	9.2	A	13.2	B	9.2	A	13.2	B	None
Route 38 and Livingston Street	16.8	B	40	D	27.4	C	182.1	F	18.3	B	24.6	C	Add a NB Main St exclusive through lane, add a WB Livingston St Right turn lane, signal timing
Route 38 and Shawsheen Street	54.5	D	72.4	E	88.2	F	113.8	F	34.4	C	44.3	D	NB and SB Main St Exclusive Through lanes, signal timing changes
Route 38 and South Street	60.7	E	68.8	E	125.9	F	60.2	E	46.3	D	47.7	D	Combine EB and WB South Street Signal Phases, altered signal timing

D. Bicycle and Pedestrian Accommodations

According to MassDOT engineering directive E-14-001, on arterial or collector roadways that allow bicycles, bicycle lanes or shoulders wide enough to accommodate bicycles must be provided on both sides of the roadway. The minimum shoulder width or bicycle lane must be five (5) feet in width. Currently there are no bicycle facilities along Main Street in Tewksbury. Mass DOT will require that improvements to Route 38 provide for bicycle accommodations.

In addition, for commuting purposes, expanding the use of bicycles requires accommodations to be provided at destination points. For example, bicycle storage facilities are a necessity for people commuting to work, restaurants, or to shopping locations.

Since virtually everyone is a pedestrian, providing accommodations for people traveling by foot or wheelchair is essential to the transportation system of any community. Whether prompted by the need to exercise or to simply reach a destination, there are a number of factors that influence a person's desire to walk. As with bicycle facilities, the most active approach toward addressing the needs of pedestrians is the development of a continuous network of sidewalks throughout the community. By increasing the coverage of sidewalks, more direct access is provided, thereby encouraging more people to walk. This desire to increase pedestrian travel is reflected in MassDOT's policy directive requiring that any state-funded transportation improvement project located in an urbanized area provide sidewalk facilities on both sides of the roadway, unless a design exception is in place.

Currently, the existing sidewalk network along Main Street is incomplete and/or non ADA compliant. Sidewalks will need to be provided as part of any future transportation project along the corridor, and existing sidewalks should be brought into compliance with ADA standards. The following roadway segments along Main Street presently have an incomplete sidewalk network:

- 433 Main Street to 461 Main Street;
- 655 Main Street to 935 Main Street;
- 1099 Main Street to 1239 Main Street;
- 1475 Main Street to 1519 Main Street;
- 1579 Main Street to Stonebury Way; and
- Shawsheen Street to 2171 Main Street.

The Town has created a number of Zoning Overlay Districts along the corridor (as discussed in the land use section of this report) that encourage the provision of bicycle and pedestrian amenities in the case where a developer is undertaking a project under an overlay bylaw. This requirement is addresses within the Design Guidelines that are applied to the overlay districts. Additional relevant performance criteria could be added to the town's zoning bylaw for projects

proposed under the base zoning within these areas. The performance criteria should focus on roadway and intersection level of service, access control, and pedestrian and bicycle accommodations and amenities.