Town of Westwood

Fire Department Infrastructure Analysis

May 2007

Emergency Services Consulting inc.

Westwood Fire Department

Infrastructure Analysis
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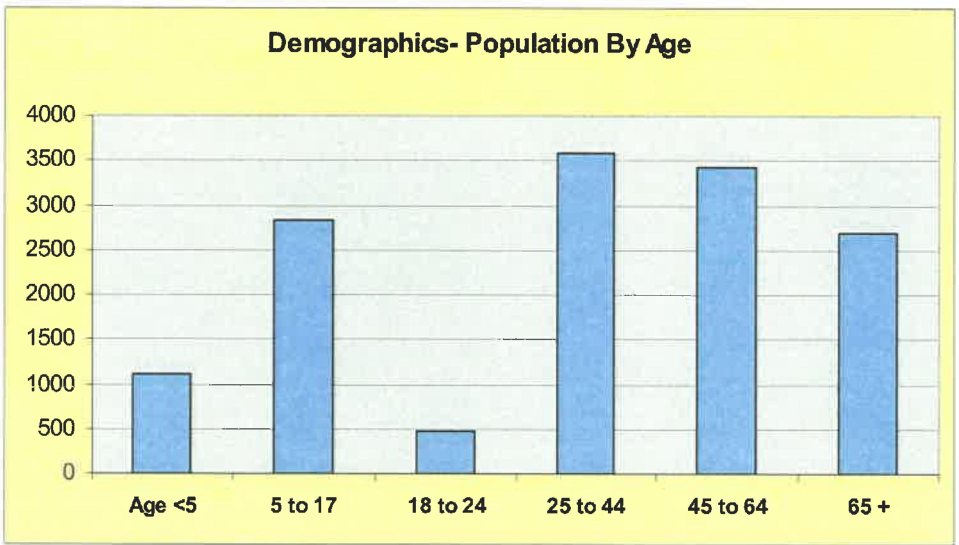
Westwood Station Development
Fire Service Impact Analysis

Westwood Fire Department Current Conditions

Current Population Information

The Westwood Fire Department (WFD) provides primary fire protection and emergency medical services to the residents and visitors of the Town of Westwood, Massachusetts, which is located 12 miles southeast of the city of Boston. The population of Westwood was 14,117 persons according to the 2000 U.S. Census. Although this is an increase from the 1990 population of 12,557, the rate of growth has been a low 1.2 percent. The 2005 estimated population by the U.S. Census Bureau for Westwood was 13,900, while the estimate of the Town Clerk is now 15,500. The following figures provide demographic information on population and housing for Westwood.[1]

Figure 1: 2000 Population by Age

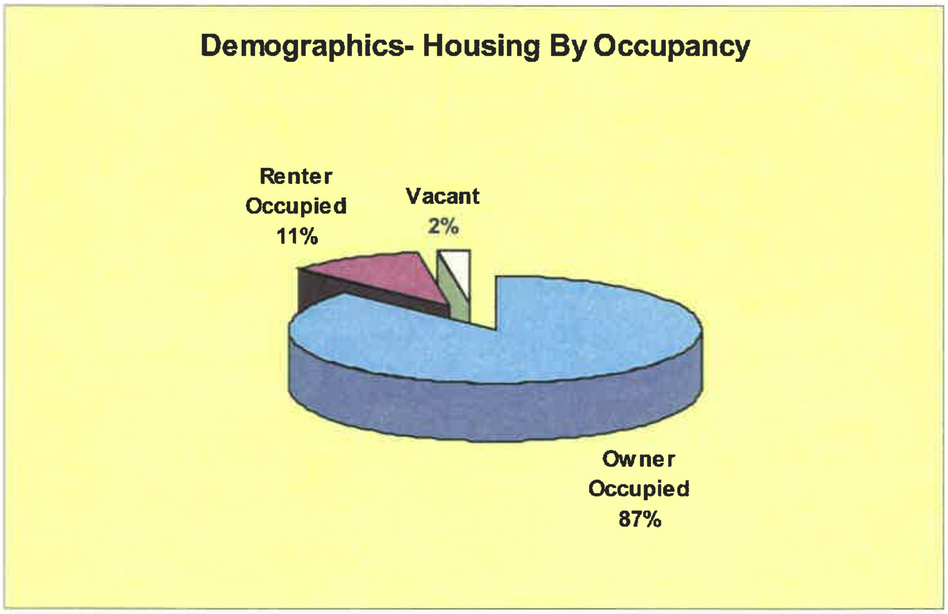


The figure illustrates the population of Westwood is mainly over the age of 25. In fact, the median age is 39 years old, which is six years older than the state's 33-year-old median. It can be seen that 19 percent of the population is over age 65 and 8 percent is less than five years of age. This places 27 percent of the population within the significant target age groups that pose the highest risk in residential fire incidents. Although the largest age group is 25-44 years, seven years has passed since the last decennial census from which this information is taken. An aging population brings a higher propensity of medical ailments that increases the demand for emergency medical services.

[1] Data from the 2000 U.S. Census Bureau Table SF-1.

Housing characteristics influence emergency service demands as well. The majority of housing within Westwood is owner-occupied, and most are single-unit structures rather than multi-unit dwellings. The following figure illustrates housing occupancy in the year 2000 and growth in the previous decade.

Figure 2: Housing by Occupancy

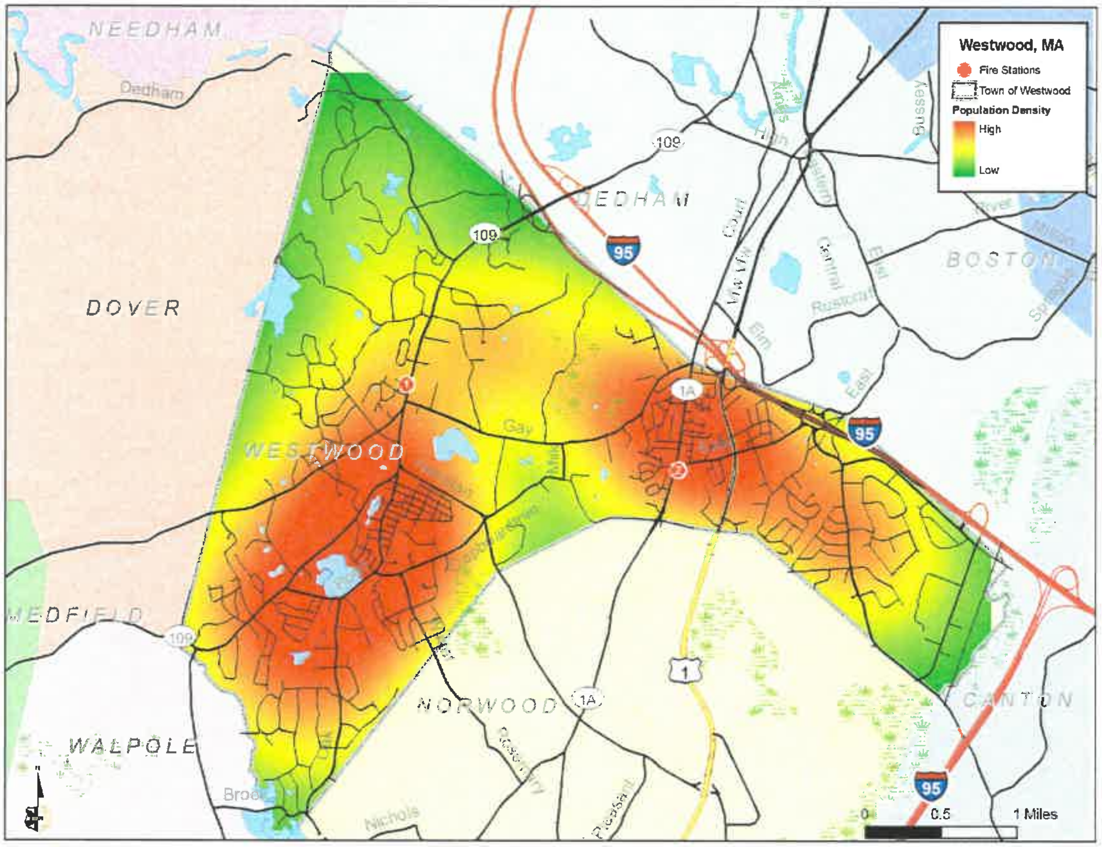


Selected Housing Information- 1990 to 2000				
	Housing Units	Owner Occupied	Renter Occupied	Vacant
2000	5251	4568	554	129
1990	4511	3848	596	107
change	16%	19%	-7%	21%

According to the U.S. Census Bureau, an average of 2.86 persons live in an owner-occupied dwelling in Westwood while 1.67 persons live in a rental property unit.

It is also useful to assess population distribution within the fire department, since there is a direct correlation between population density and service demand. The following map displays the population density of the area, based on information from the 2000 U.S. Census.

Figure 3: Westwood Population Density



The most densely populated areas of Westwood exist in Islington and neighborhoods surrounding Buckmaster Pond south of Station 1. It would be expected that most service demand occurs within these areas.

The Census Bureau estimates a daytime population based on employment and commuting figures.[2] The following table illustrates estimated daytime population for the surrounding communities; unfortunately, a listing for Westwood is not available. The average daytime population growth for neighboring communities is 12.6 percent, which ESCi expects to be similar to Westwood's experience during daylight hours. This would bring Westwood's daytime population to 15,651, based on the 2005 U.S. Census estimate.

[2] Census 2000 PHC-T-40, Estimated Daytime Population and Employment-Residence Ratios, 2000.

Figure 4: Estimated Daytime Population for Neighboring Communities

Total resident population	Total workers working in the place	Total workers living in the place	Estimated daytime population	Daytime population change due to commuting		Workers who lived and worked in the same place		Employ-ment residence ratio	Place name[1/]
				Number	Percent	Number	Percent		
23,464	13,779	11,412	25,831	2,367	10.1	2,296	20.1	1.21	Dedham CDP, MA
28,911	18,230	13,687	33,454	4,543	15.7	3,437	25.1	1.33	Needham CDP, MA
28,587	22,727	14,817	36,497	7,910	27.7	3,608	24.4	1.53	Norwood CDP, MA
5,867	2,888	3,070	5,685	-182	-3.1	395	12.9	0.94	Walpole CDP, MA
						Average	12.6		

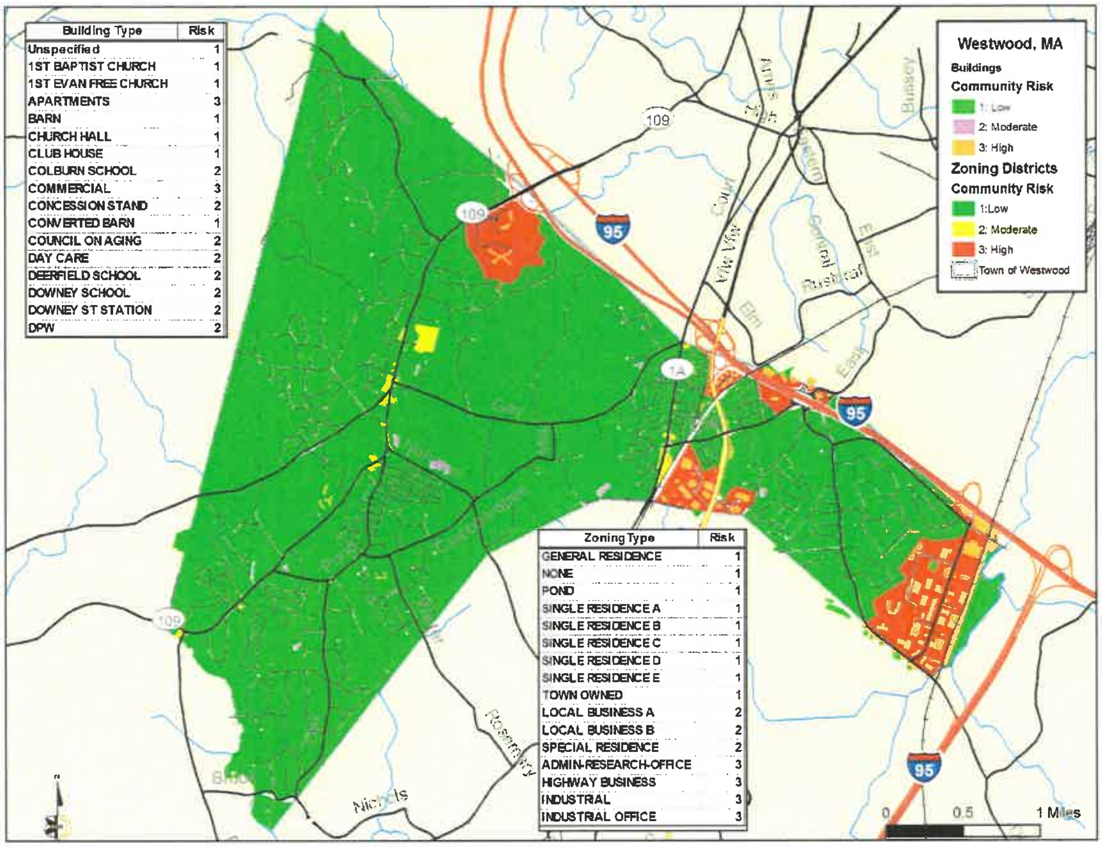
Current Community Risk

The fire service assesses the relative risk of properties based on a number of factors. Properties with high fire and life risk often require greater numbers of personnel and apparatus to effectively mitigate a fire emergency. Staffing and deployment decisions should be made with consideration of the level of risk within geographic sub-areas of a community.

The community's risk assessment has been developed based on potential land use within its boundaries. These potential uses are found in the Town's development plans and zoning designations. The following map translates land use (potential scale and type of development within geographic sub-areas) and building uses to categories of relative fire and life risk.

- Low risk – Areas or buildings zoned and used for agricultural purposes, open space, low-density residential, and other low intensity uses.
- Moderate risk – Areas or buildings zoned for medium-density single family properties, small commercial and office uses, low-intensity retail sales, and equivalently sized business activities.
- High risk – Higher-intensity business districts, mixed use areas, high-density residential, industrial, warehousing, and large mercantile centers.

Figure 5: Community Risk Assessment

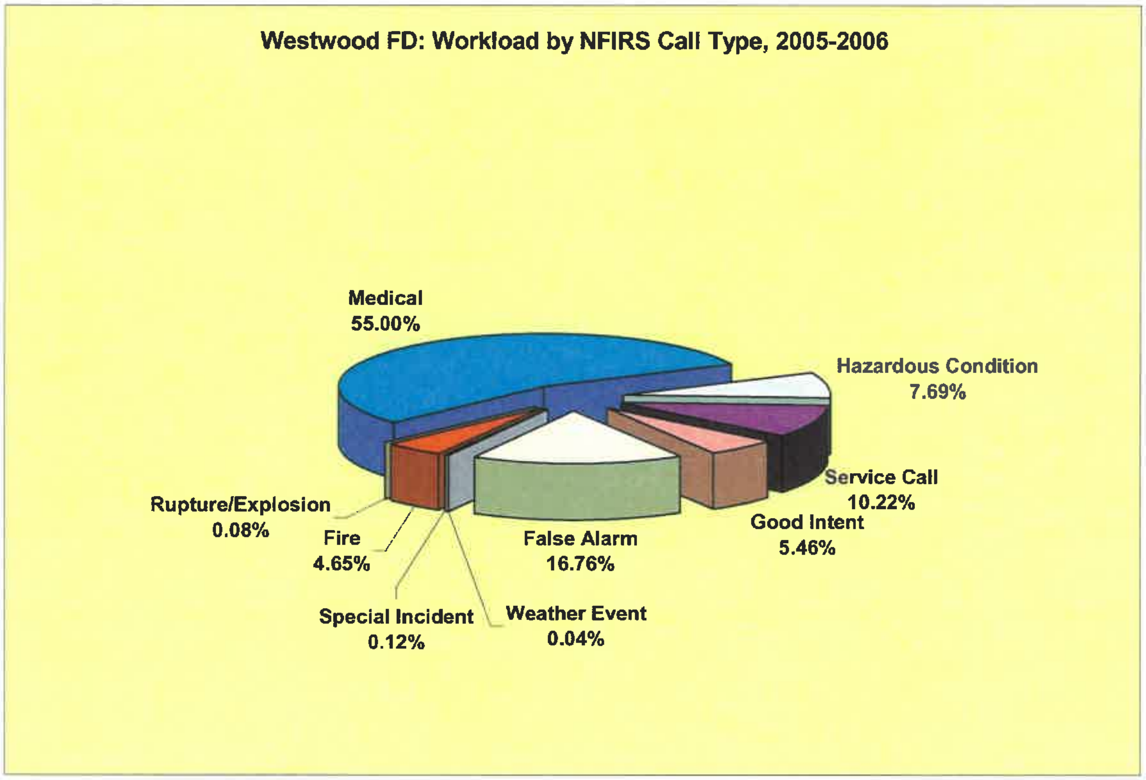


The community contains mostly low and moderate risk properties. As expected, the predominance of highest risk is located near highway interchanges and major arterial corridors. These properties include heavy commercial, mid-rise, mixed-use, institutional, and multi-family occupancies. These land use patterns generally contribute to development of an efficient fire resource deployment configuration.

Current Service Demand Analysis

The Westwood Fire Department has provided two years of data (1/1/2005-12/31/2006) to be analyzed for service demand levels. Each year, the Department responded to approximately 2,500 requests for service due to fires, medical emergencies, or other hazardous conditions. The following chart illustrates the breakdown of responses over the two-year period by call type.

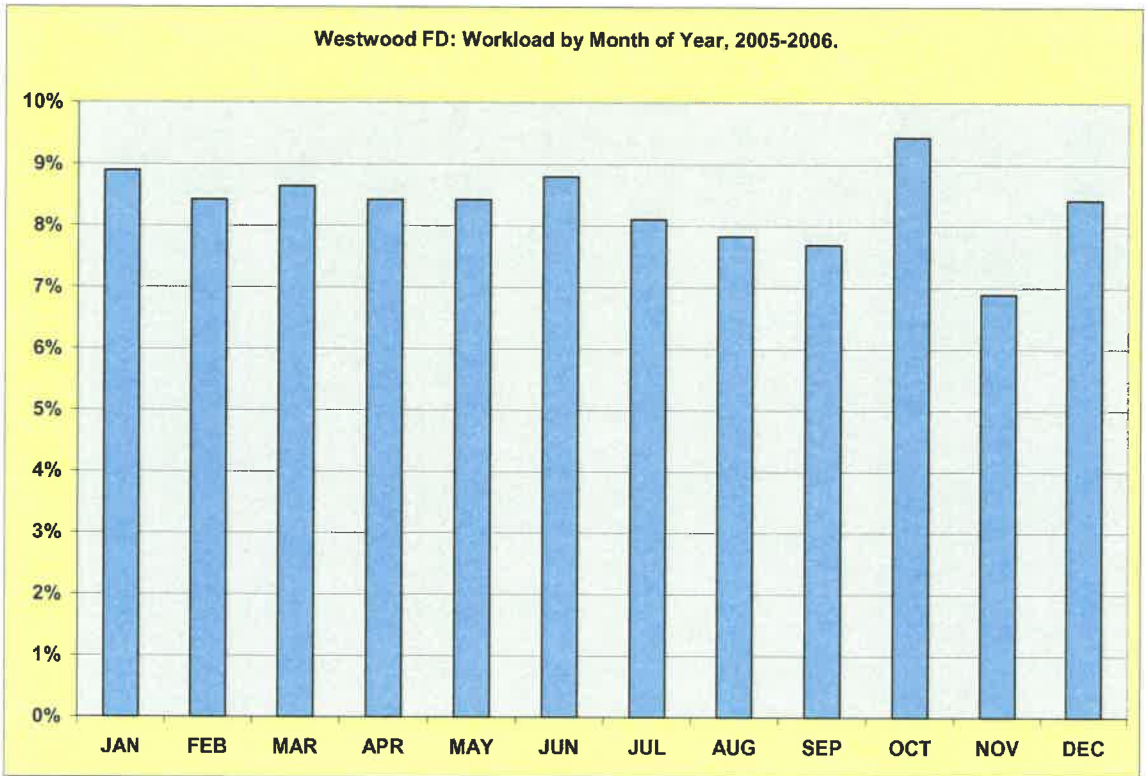
Figure 6: Workload by Call Type



Medical requests for service account for a slight majority of fire department service demand. This will affect available fire company response. The Department uses a cross-staffing arrangement, wherein a single station crew is shared between the ambulance and engine and responds in whichever unit is dispatched first.

A review of incidents by time of occurrence reveals when the greatest response demand is occurring. The following charts show how activity and demand changes for the WFD based on various measures of time. ESCi began by breaking down yearly workload into monthly increments.

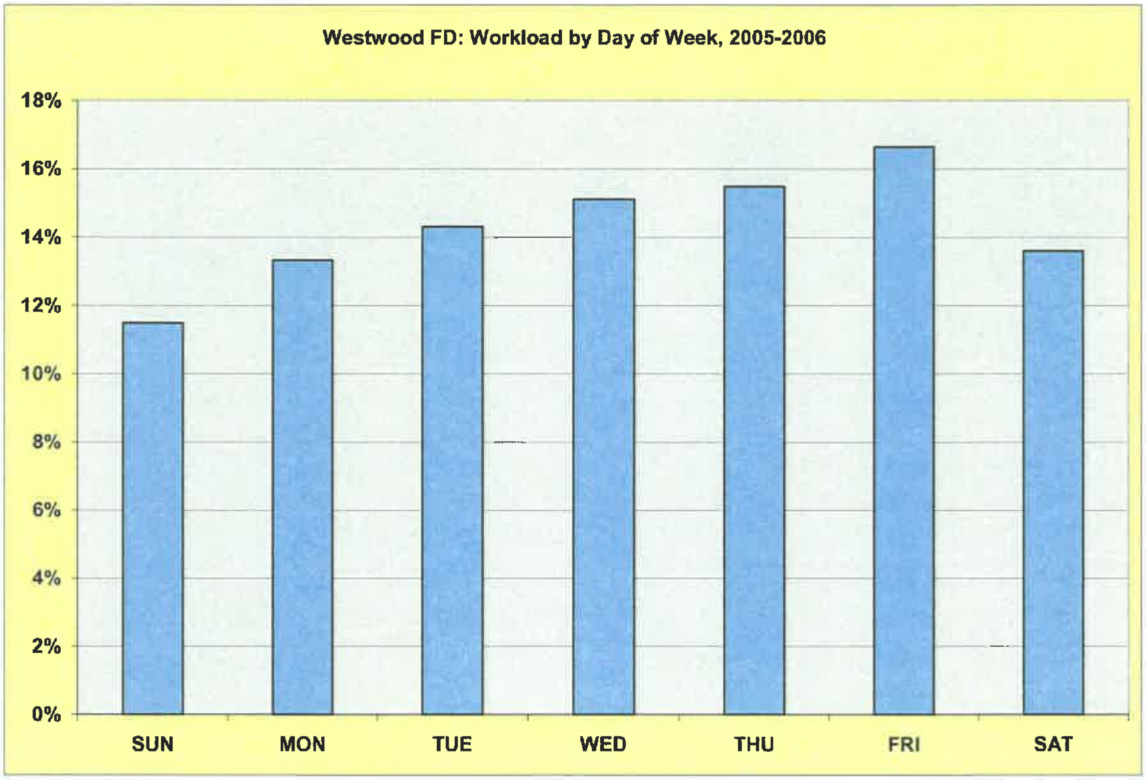
Figure 7: Monthly Workload



Monthly workload for all types of calls within the Department decreases through summer months and into the autumn. An increase in demand during October is contradictory to the trend, before December's rise in call volume is experienced.

In further analysis, workload is examined by day of the week. The following depicts the Department's workload by day of week for all calls.

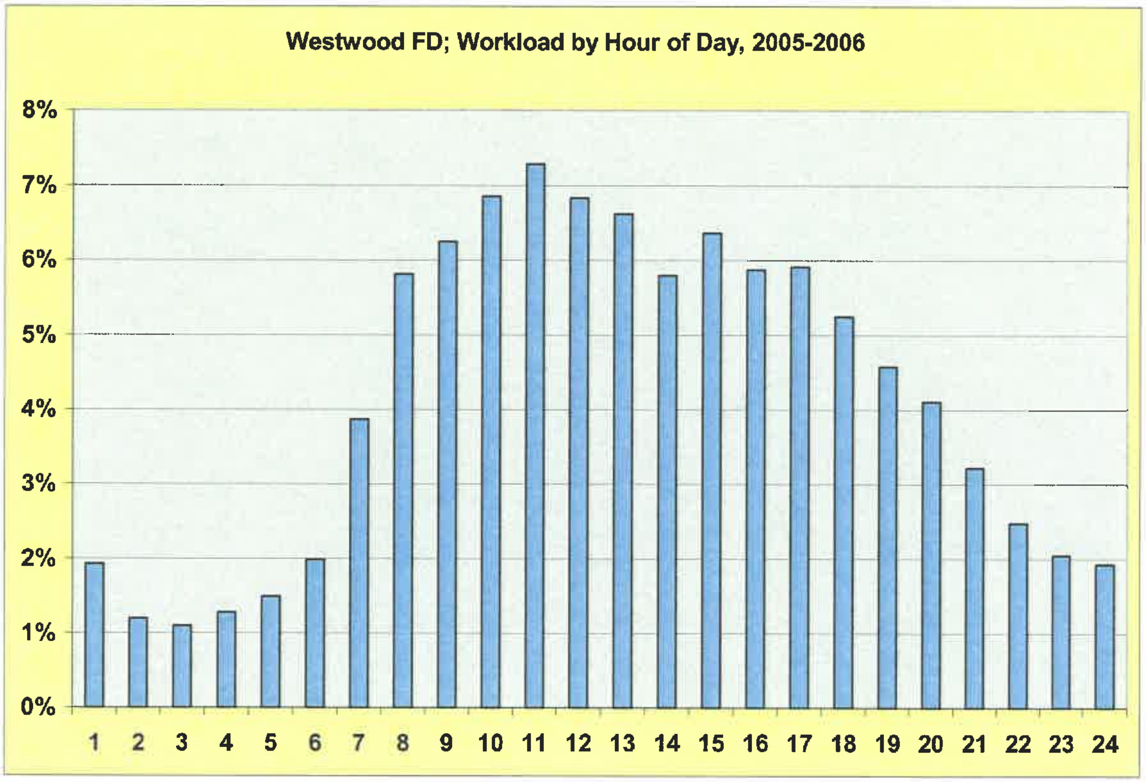
Figure 8: Workload by Day of Week



The Department experiences a rising workload during the week, peaking on Fridays and reducing on the weekend.

The final analysis of historical workload concludes with examination of call types by hour of day. Peak activity hours can strain an under-equipped or under-staffed department. Understanding when peak activity occurs begins the process of developing deployment strategies and needs assessment.

Figure 9: Workload by Hour of Day

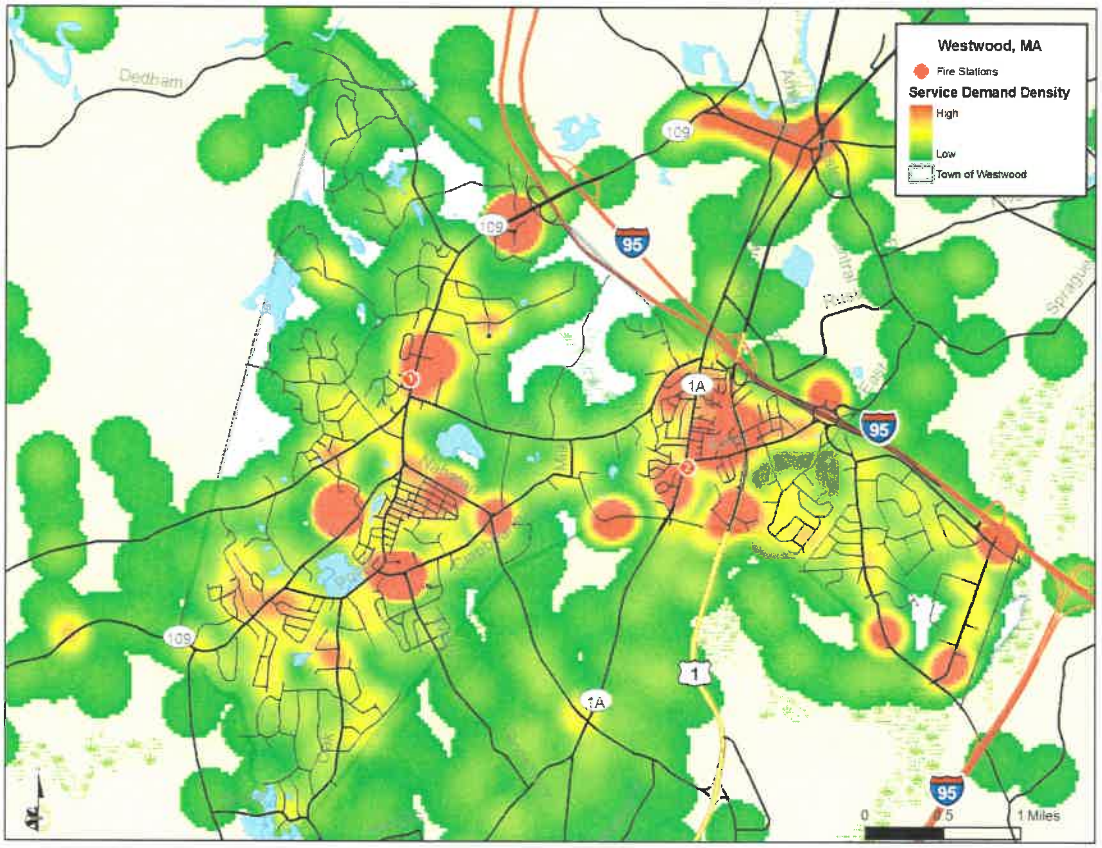


Activity for calls begins to climb by 4:00 a.m. reaching peak by 11:00 a.m.. Service demand steadily decreases for the remaining hours of the day. This pattern follows the typical active hours of most people's daily lives.

Peak activity times can be reflected in response time performance in certain cases. The impact of response time on the outcome of emergency incidents has been exhaustively studied, both in the laboratory and in historical data, with predictable correlation between the two. Though seemingly intuitive, it is still useful to review how longer response times can have a negative effect on the ability to suppress fires, particularly in structures, or to successfully intervene in a life-threatening medical emergency. Response time performance is examined in a separate section of this study.

In addition to the temporal analysis of the current service demand, it is useful to examine geographic distribution of service demand. An examination of geographic distribution is provided later in this study and will allow for assessing the location of stations in comparison to the actual service demand predicted within the town. The following map indicates the distribution of emergency incidents responded to by the Department over the last full 24 months.

Figure 10: Service Demand - WFD Incident Density



Most of the highest service demand areas are located in areas of high residential population density and are nearest to the fire stations. High service demand can also be found near commercial areas along arterial routes, highway interchanges, and industrial areas by the transit train station. A few pockets of moderate service demand outside the fire department's area can be seen in the figure.

The following table describes the Department's capability to cover service demand within specified response time periods. The table provides the percentage of incidents that can be reached within four minutes, and the percentage of incidents that can be reached within six minutes.

Figure 11: Incident Coverage Percentage by Response Time

Travel Time	Service Demand
4 minutes	83.43%
6 minutes	99.37%

Call Concurrency and Resource Drawdown

Another way to look at resource workload is to examine the amount of time multiple calls happen within the same time frame on the same day. ESCi examined the last full year of data to find the frequency during which WFD apparatus are handling multiple calls simultaneously. This information is important, since more calls occurring at one time can stretch available resources and extend response times as more distant apparatus responds.

Figure 12: Call Concurrency Table

	Single	2 concurrently	3 concurrently	4 concurrently	5 concurrently	6 concurrently
All	1995 79.86%	391 15.65%	77 3.08%	16 0.64%	6 0.24%	4 0.16%
Fire	104 96.30%	4 3.70%				
EMS	1200 85.71%	175 12.50%	21 1.50%	4 0.29%		
Other	888 90.43%	66 6.72%	17 1.73%	4 0.41%	3 0.31%	1 0.10%

As in most communities, the majority of calls happen singularly. However, as communities grow, the propensity for concurrent calls increases. When the concurrency reaches a level to which it stretches resources to near capacity, response times begin to extend. Although multiple medical calls will cause resource drawdown, especially as concurrency increases, they usually only occupy one unit at a time. Concurrent fire calls, however, are of more concern as they may require multiple unit responses for each call depending on the dispatch criteria. Fortunately, no simultaneous structure fire incidents were recorded in the previous year. Nonetheless, *Other Calls* that are not actual fires or medical calls do have higher rates of concurrency and, depending on the dispatch criteria, may create period of resource drawdown.

Response Time Performance Objectives and Benchmarks

The ultimate goal of any emergency service delivery system is to provide sufficient resources (personnel, apparatus, and equipment) to the scene of an emergency in time to take effective action to minimize the impacts of the emergency. This goal applies to fires, medical emergencies, and any other emergency situation to which the fire department responds.

ESCi has developed materials regarding the dynamics of fire and emergency medical events. A synopsis of that material is offered in the Appendix and is suggested reading for those individuals that are not familiar with these dynamics.

NFPA 1710

The National Fire Protection Association (NFPA) has issued a response performance standard for all career or mostly career staffed fire departments. This standard, among other things, identifies a target response time performance objective for fire departments and a target staffing standard for structure fires. Though not a legal mandate, *NFPA 1710*[3] does provide a useful benchmark against which to measure the fire department's performance.

NFPA 1710 contains time performance standards for structure fire response as well as emergency medical response. Each will be discussed individually.

NFPA 1710 recommends that the first company arrive at the scene of a structure fire within five minutes of dispatch, 90 percent of the time. NFPA uses the 90th percentile rather than the average. This allows an evaluation of a department's performance on the vast majority of its incidents.

The standard establishes that a response *company* consists of four personnel. The standard does not require that all four be on the same vehicle but does expect that the four will operate as a single functioning unit once on scene. The *NFPA 1710* response time standard also requires that all four personnel be on scene within the recommended five minutes, 90 percent of the time.

There is another reason the arrival of four personnel is critical for structure fires. As mentioned earlier, current safety regulations require that before personnel can enter a building to extinguish a fire, at least two personnel must be on scene and assigned to conduct search and

[3] *NFPA 1710: Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, 2004.

rescue in case the fire attack crew becomes trapped. This is referred to as the *two-in, two out* rule. The only exception to this regulation is if it is known that victims trapped are inside the building.

Given WFD's typical staffing of engines, the time it takes for the second unit to arrive becomes very important to achievement of the NFPA standard. If additional help is a considerable amount of time away, the fire will continue to grow rapidly, contributing to significantly more damage to the property.

Finally, the NFPA standard calls for the arrival of the entire initial assignment (sufficient apparatus and personnel to effectively combat a fire based on its level of risk) within nine minutes of dispatch, 90 percent of the time. This is to ensure that enough people and equipment arrive soon enough to be effective in controlling a fire before substantial damage occurs.[4]

NFPA 1710 describes the following performance as meeting the structure fire response criteria of the standard:

- *Turnout time within one minute, 90 percent of the time*
- *Arrival of the first "company" within five minutes of dispatch, 90 percent of the time,* ***or***
- *Arrival of the entire initial response assignment (all units assigned to the call) within nine minutes of dispatch, 90 percent of the time*

There are three time standards within *NFPA 1710* for emergency medical responses. They are:

- *Turnout time within one minute, 90 percent of the time*
- *Arrival of a unit with first responder or higher level of capability (basic life support) within five minutes of dispatch, 90 percent of the time*
- *Arrival of an advanced life support unit, where this service is provided by the fire department, within nine minutes of dispatch, 90 percent of the time.*

Westwood Fire Department Response Time Performance Objective

WFD has not established a written response time objective for its emergency services. However, the Fire Chief's expressed goal is to be as close to the *NFPA 1710* national standard

[4] See the Appendix for the *time/temperature curve* and the effects of flashover discussion.

as possible. Therefore, the *NFPA 1710* will be used in comparison to the current performance of the primary response units within Westwood.

Recorded System Response Performance

Throughout this document, certain descriptive statistical measures are utilized which may not be familiar to all readers. In an effort to reduce confusion or the drawing of inaccurate conclusions, this section seeks to provide a brief explanation of these measures. The measures most often used which require clarification are the use of *average* and *percentile* measures.

Average

The average measure is a commonly used descriptive statistic also called the mean of a data set. It is a measure which is a way to describe the central tendency or the center of a data set. The average is the sum of all the points of data in a set divided by the total number of data points. In this measurement, each data point is counted and the value of each data point has an impact on the overall performance. Averages should be viewed with a certain amount of caution because the average measure can be skewed if an unusual data point, known as an outlier, is present within the data set. Depending on the sample size of the data set, the skewness can be either very large or very small.

For example, assume that a particular fire station, with a response time objective of six minutes or less, had five calls on a particular day. If four of the calls had a response time of eight minutes and one of the calls was across the street and only a few seconds away, the average would indicate the station was achieving its performance goal. However, four of the five calls, or 80 percent, were beyond the stated response time performance objective.

The opposite can also be true, where one call with an unusually long response time can make otherwise satisfactory performance appear unacceptable. These calls, with unusually short or long response time, have a direct impact on total performance measurements; the farther they are from the desired performance, the greater the impact.

One reason to compute an average is because of its common use and the ease of understanding it. The most important reason for not using an average for performance standards is that it does not accurately reflect the performance for the entire data set. As illustrated above, one extremely good or bad call can skew the entire average. While it does reflect all values, it does not really speak to the level of accomplishment in a strong manner.

Percentile

With the average measure, it is recognized that some data points are below the average and some are above the average. The same is true for a median measure which simply arranges the data set in order and finds the value in which 50 percent of the data points are below the median and the other half are above the median value. This is also called the 50^{th} percentile.

When dealing with fractiles or percentages, the actual value of individual data does not have the same impact as it did in the average. The reason for this is that the fractile is nothing more than the ranking of the data set. The 90th percentile means that 10 percent of the data is greater than the value stated, and all other data is at or below this level.

Higher fractile measurements are normally used for performance objectives and performance measurement because they show that the large majority of the data set has achieved a particular level of performance. This can be compared to the desired performance objective to determine the degree of success in achieving the goal.

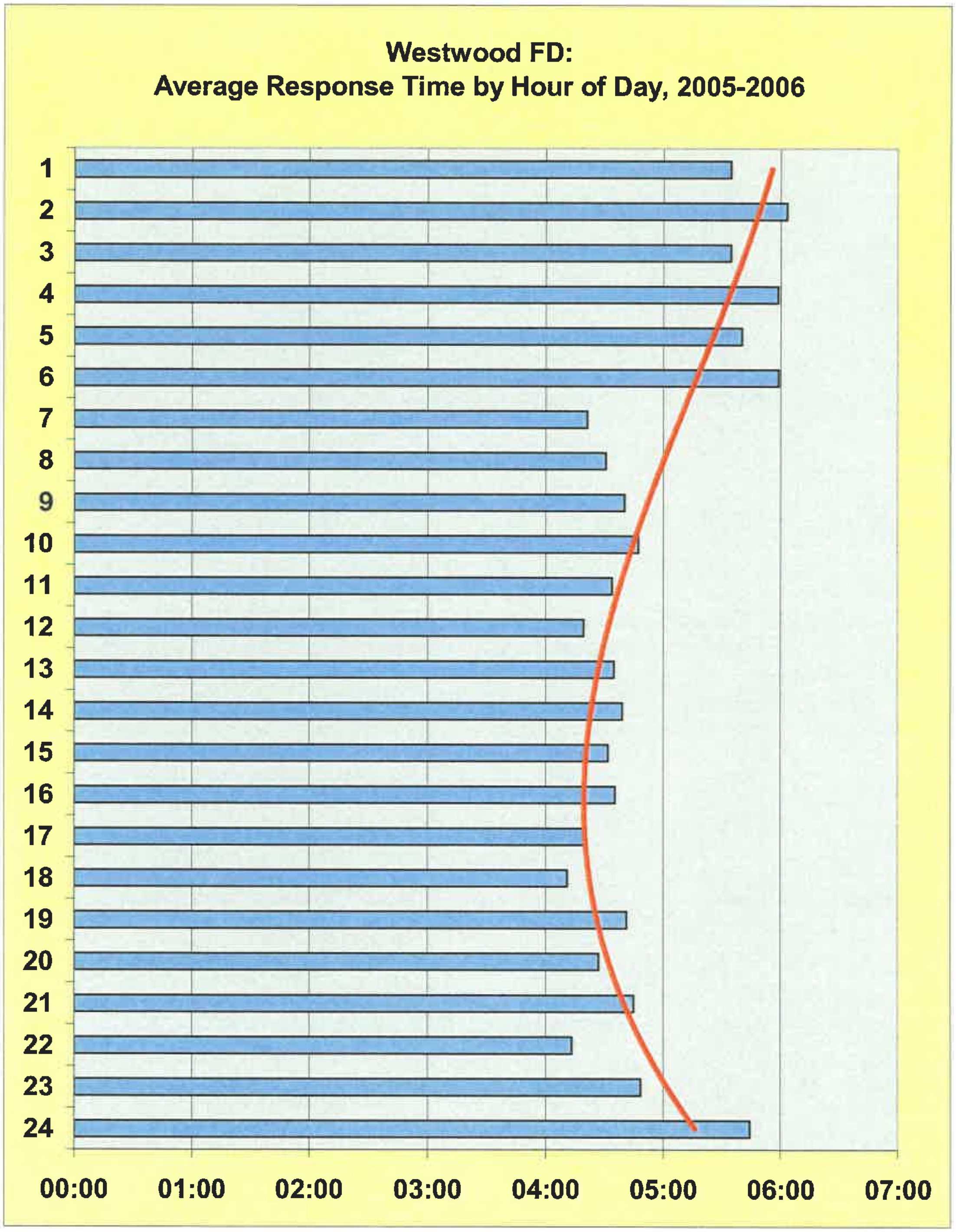
As previously discussed, *NFPA 1710* sets response time performance for first arriving fire apparatus at five minutes or less, 90 percent of the time. The *1710* standard does not include call processing time, which is covered in other related NFPA standards that call for a performance of one minute or less for this activity. WFD should establish a performance objective that is consistent with the *NFPA 1710* standard and based on nationally accepted scientific data regarding the effect of time on fire growth, life and property outcomes, and medical crisis survivability.

Although there are many factors which can inhibit response times such as weather, traffic volume, street connectivity, and traffic calming devices, there is one element that the fire department can control. Turnout time, as explained previously, is the duration of time it takes after being dispatched for a unit to become enroute to a scene. NFPA recommends career staffed departments strive for less than one minute. Unfortunately, the time that the units were enroute to the scene was not captured in the data set provided. The total response time figures that follow are measured from dispatch to arrival at the scene.

The most frequently recorded response time was within the four to five minute range; however the average of calls is 4 minutes and 40 seconds. Ninety percent of all calls are answered within 7 minutes and 51 seconds department-wide.

Response times can vary by time of day as a reflection of service demand, travel speeds, and the variations in location of service demand at various times of day. The *average* response time for emergency incidents ranged from a high average of six minutes and three seconds for calls between the hours of 2:00 a.m. and 3:00 a.m., to a low average of 4 minutes and 11 seconds for incidents between the hours of 6:00 p.m. and 7:00 p.m.. The lowest average response time is noted during a time period of reported high traffic congestion, which is contrary to expected results but reflects the closer proximity of service demand to the fire stations during those time periods.

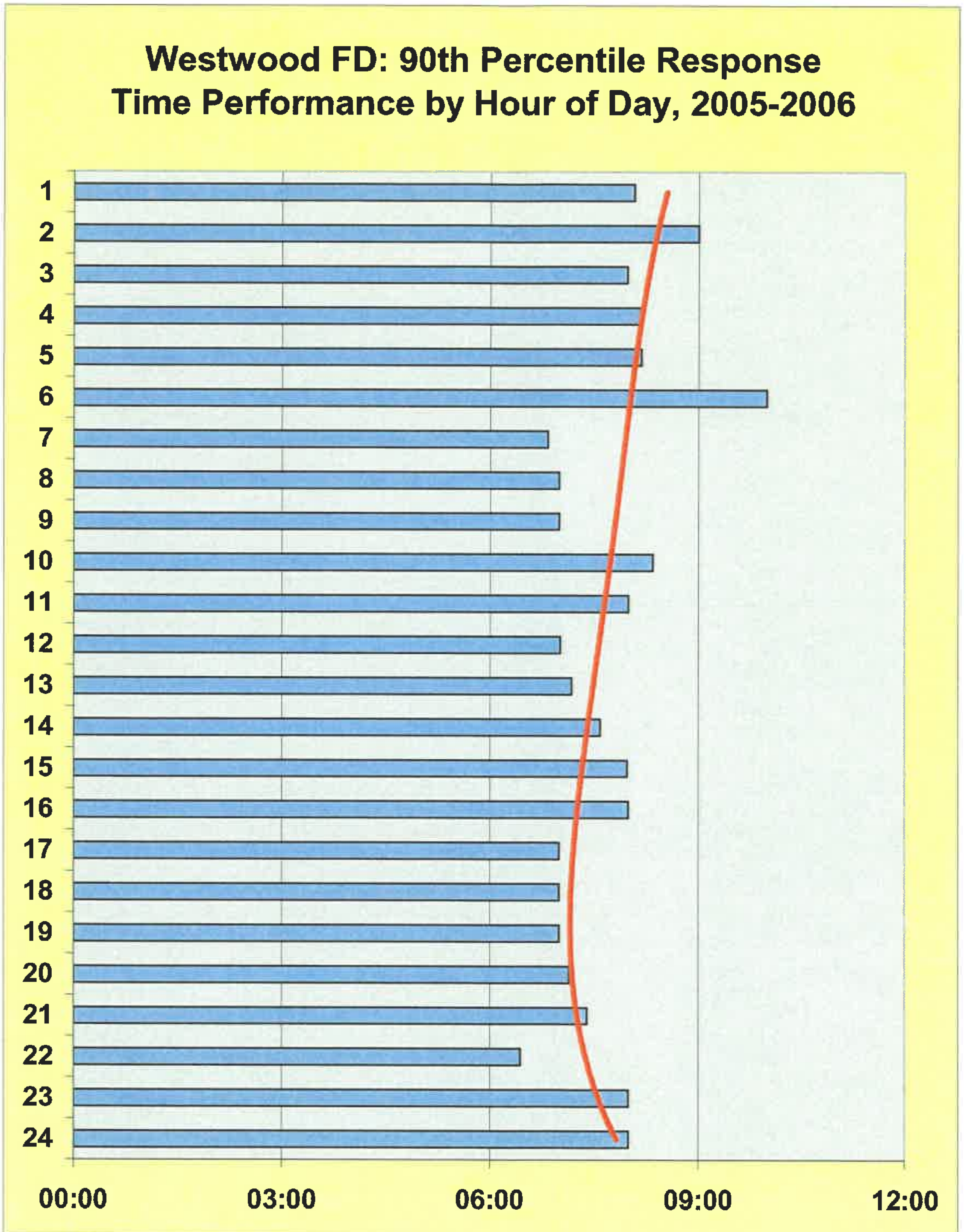
Figure 13: Average Response Time by Hour of Day



Average response time is a useful measure to determine how well geographic-based coverage is achieved. More significant is how well the majority of emergency response demand is being serviced. One way to determine how well demand-based coverage is achieved is by determining maximum response time to a larger percentage of the incidents, in this case 90 percent.

The *90th percentile* response time for emergency incidents occurring within the WFD district ranged from a high of nine minutes during the 2:00 a.m. to 3:00 a.m. hours to a low of 6 minutes and 26 seconds during the 10:00 p.m. to 11:00 p.m. hours. The overall 90th percentile response time within its primary jurisdiction was **7 minutes and 51 seconds** for all call types. The following figure displays the 90th percentile response time performance by hour of day for all calls within the district.

Figure 14: 90th Percentile Response Time by Hour of Day

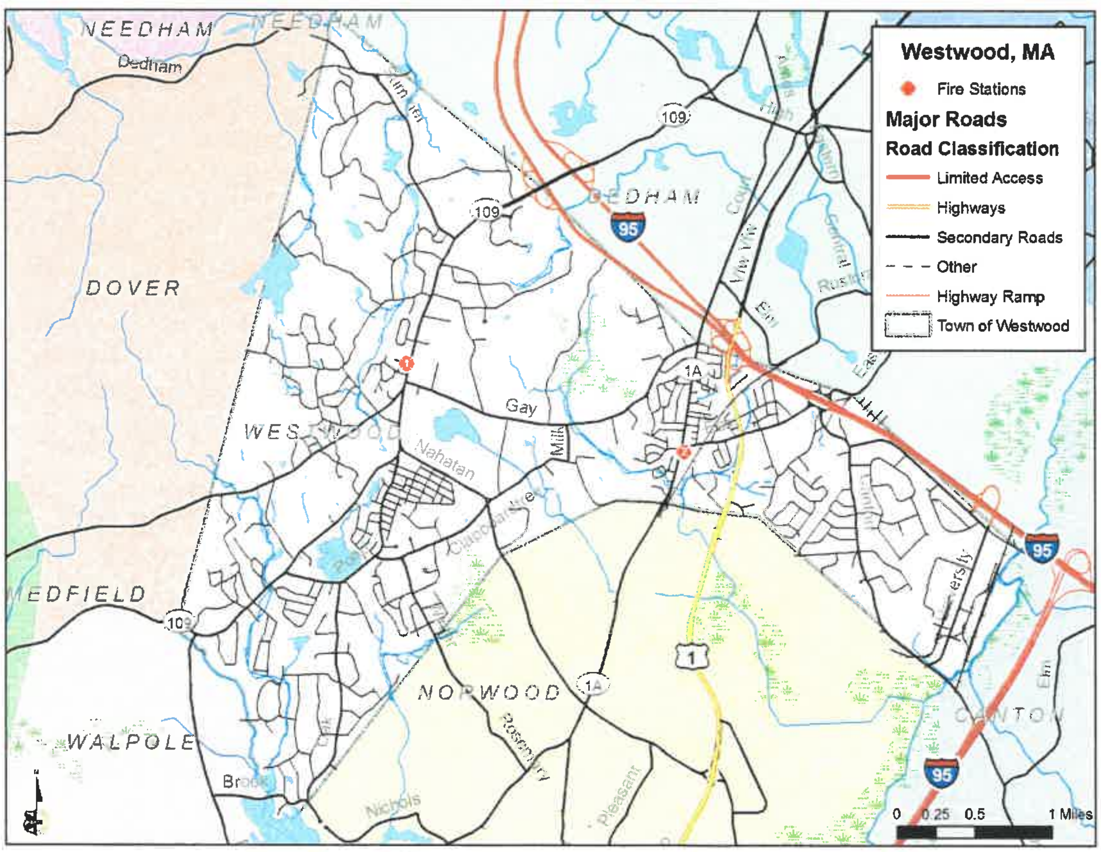


The proposed development of Westwood Station will impact the ability of the fire department to provide services in similar fashion to that which it currently performs. Now that ESCi has benchmarked the Department's current performance and capability, the next section discusses this impact and provides several strategies to provide adequate fire protection and medical services in light of the increased growth and service demand.

Current Facility Deployment

The WFD operates from two locations within town borders. Fire Headquarters, Station 1, is located near the Town Hall on High Street (Route 109). It is sited on a main north-south arterial with access to east-west collector roads of Gay Street, Hartford, Street, and Nahatan Street. Station 2 is located within the Islington Community at the corner of Washington Street (Route 1A) and East Street. It has access to Everett Street and Canton Street for routes to the east of the Providence Highway (Route U.S. 1). The following figure depicts these locations within the town limits and the surrounding communities.

Figure 15: Westwood Fire Department Current Facility Deployment

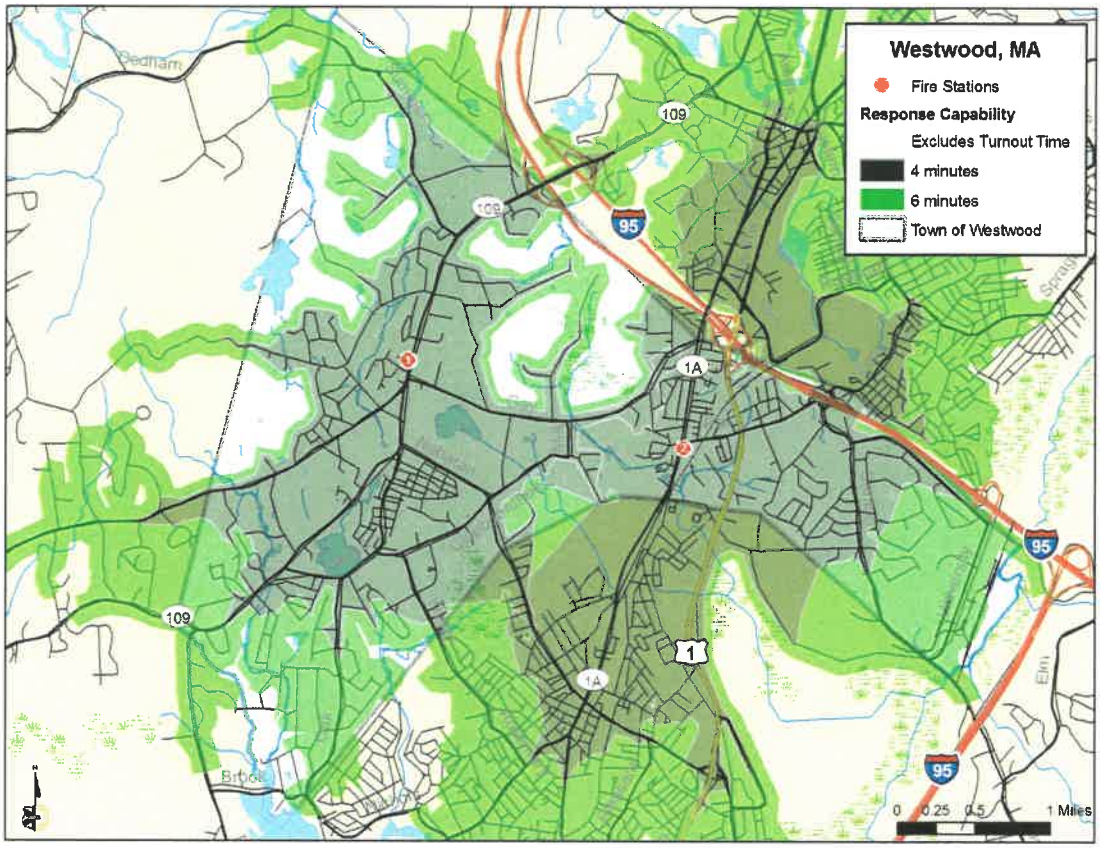


In order to visualize response time capabilities, the following map demonstrates areas within various modeled travel time capabilities of the stations. The travel time is modeled excluding turnout time[5] on the actual roadway network. Reduction of speed has been calculated to account for apparatus maneuvering turns enroute. Areas shaded dark gray are within the five-minute response profile of a city fire station, while the green shaded areas are within six-minute travel time.

In addition, the Chief reported that crews avoid Interstate 95 unless an incident occurs on the highway. This is due to commuter congestion from 6:00 to 9:30 a.m., and from 3:00 through 7:00 p.m. Additional weekend traffic load, due to retail shopping venues and limited lane options, also restricts apparatus use. To reflect this, the travel model restricted use of the interstate, forcing the apparatus to utilize local streets, collectors, and arterial roadways.

[5] Turnout time is the amount of time after dispatch to assemble an apparatus crew, don equipment, and begin enroute to an assignment.

Figure 16: Westwood Fire Department Station Response Capability



Although most of the town can be reached within a four-minute travel model, areas south of Pond Street and east of Canton and Everett Streets require additional time in order for apparatus to arrive on scene. The geographic area of Westwood is approximately 11 square miles. The following table illustrates the area of Westwood that can be covered within the travel time model.

Figure 17: Geographic Response Time Coverage of Westwood

Travel Time	Area
4 minutes	53.79%
6 minutes	83.66%

The matter of response time is obviously critical in the case of an emergency, but only as it applies to structures being protected and the population being served. If areas exist in which there are no structures or population to be served, the risk is reduced and longer response time to these areas is considered acceptable. A complete discussion of the importance of time in emergencies will be discussed in a later section. It is important to examine the population that is being served, as well as the risk that various land uses and buildings pose to the community.

Current Facilities Evaluation

Station 1
637 High Street

Built circa more than 50 years ago, this two-story with basement facility consists of four apparatus bays. Station also serves as the fire administration and is in generally good condition. There are four apparatus back-in bays. The apparatus bays are very full with vehicles and equipment limiting work space for routine maintenance and station activities.

Any specific problems with this facility can be classified into the following seven categories.

• **Design:**	Station facilities have inadequate space based on its current layout, for amount of apparatus, equipment, personnel, and processes. The station does have facilities available for female firefighters. The kitchen area is small and not efficient for use by 24-hour crews. The bathroom/shower capacity is very limited for the number of personnel. The station has potential for redesign to maximize space management.
• **Construction:**	Original portion of the station was built more than 50 years ago; an addition was built in 1975. The station construction is brick and frame with a wood frame roof over the living quarters and tar and gravel on steel bar joist roof over the bay areas. The station is heated by forced hot air heated by natural gas.
• **Safety:**	The station has space limitations, especially in the bay area, that create a potential for safety challenges. The physical training/weight lifting area is in the bay and includes a mixture of equipment in varying degrees of age. The building is not sprinklered. The station houses an SCBA Compressor and has a back-up station generator that is wired for automatic transfer. It is fueled by an above-ground diesel tank. No uniform washing facilities are available on site; firefighters must transport soiled uniforms home for laundering.
• **Environment:**	Apparatus bays are fitted with direct connect apparatus exhaust systems. There were no underground storage tanks; however, the apparatus floor drains and oil separators were in use.
• **Code Compliance:**	The station entrance and restroom facilities are not ADA compliant due to the age of the building. Fire Prevention Code Issues: There are several flammable liquid containers stored on shelves or floor of the bay instead of in an approved flammable liquids cabinet. There were no mounted fire extiguishers inside the station living quarters. There were electrical outlets, conduit boxes, and light switches that had no cover, leaving wires exposed. The prevention code issues are being addressed ASAP by Westwood.
• **Staff Facilities:**	Firefighters commented that they have to pull apparatus out of the bays onto the front ramp to perform many of their daily vehicle and equipment maintenance responsibilties. This includes during inclement weather.
• **Efficiency:**	The station's operational and administrative staff perform remarkably well considering the facility limitations.

Station 2
300 Washington Street

Built circa 1950, this one-story facility consists of two apparatus bays. Station location provides for excellent access to major roads. The station itself is in fair to poor overall condition. There are two apparatus back-in bays. The front ramp also serves as a parking lot with limited space.

Any specific problems with this facility can be classified into the following seven categories.

• **Design:**	Station facilities have inadequate space for the amount of apparatus, equipment, personnel, and processes performed. The kitchen area is small and problematic for efficient use by 24-hour crews. The bathroom/shower capacity is very limited for the number of personnel. There is inadequate space for fitness training. The age and condition of the station makes significant redesign projects financially problematic.
• **Construction:**	Original portion of the station was built in the 1950s; an addition was built in the 1960s. The station construction is of wood frame. The station uses forced air heated by natural gas.
• **Safety:**	The station has space limitations that directly impact staff operations, training, and maintenance. The station is not sprinklered and has a back-up station generator that is wired for automatic transfer. It is fueled by natural gas. No uniform washing facilities are available on site; firefighters must transport soiled uniforms home for laundering.
• **Environment:**	Apparatus bays are fitted with direct connect apparatus exhaust systems. There were no underground storage tanks, floor drains or oil separators in use.
• **Code Compliance:**	The station entrance and restroom facilities are not ADA compliant due to the age of the building. Fire Prevention Code Issues: There are several flammable liquid containers stored on shelves or floor of the bay instead of in an approved flammable liquids cabinet. There were no mounted fire extiguishers inside the station living quarters. The prevention code issues are being addressed ASAP by Westwood.
• **Staff Facilities:**	All fire staff interviewed commented that the station's age and space limitations make it difficult for daily operations. However, they all believe that the location is ideal for a fire station.
• **Efficiency:**	The station's operational staff perform remarkably well considering the facility limitations.

Current Apparatus Evaluation

Engine 5

2004 E-1 Typhoon Pumper

Seating Capacity: **5**
Pump Capacity: **1,500**
Tank Capacity: **750**
Condition: **Excellent**
Mileage:**19,050**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation.

Ladder 1

2002 E-1 Cyclone Aerial

Seating Capacity: **6**
Pump Capacity: **1,500**
Tank Capacity: **270**
Condition: **Excellent**
Mileage:**6,000**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation.

Ambulance 1

2006 International Horton Ambulance

Seating Capacity: **2**
Pump Capacity: **N/A**
Tank Capacity: **N/A**
Condition: **Excellent**
Mileage:**15,100**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation.

Car 3

2000 Ford Expedition Command

Seating Capacity: **4**
Pump Capacity: **N/A**
Tank Capacity: **N/A**
Condition: **Good**
Mileage:**68,730**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation. Although mileage is relatively low for its age, consideration should be given to replacement based on a cost evaluation of its annual maintenance.

Squad 1

1991 E-1 International Brush

Seating Capacity: **3**
Pump Capacity: **1,500**
Tank Capacity: **750**
Condition: **Good**
Mileage:**23,530**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation. Although mileage is relatively low for its age, consideration should be given to replacement based on a cost evaluation of its annual maintenance and its need for use.

Engine 1 (Reserve)

1991 E-1 Cyclone Pumper

Seating Capacity: **4**
Pump Capacity: **1,500**
Tank Capacity: **750**
Condition: **Fair**
Mileage:**60,300**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation, however, the age and amount of use has diminished its condition. Consideration should be given to its need for replacement based on set schedule and emergency service demand.

Ambulance 2 (Reserve)

1999 Freightliner Horton Ambulance

Seating Capacity: **2**
Pump Capacity: **N/A**
Tank Capacity: **N/A**
Condition: **Good**
Mileage:**10,0164**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation. As a spare apparatus with high mileage, consideration should be given to a set replacement schedule based on a cost evaluation of its annual maintenance.

Engine 2

2004 E-1 Typhoon Pumper

Seating Capacity: **5**
Pump Capacity: **1,500**
Tank Capacity: **750**
Condition: **Excellent**
Mileage:**31,000**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation.

Squad 2

1990 E-1 International Brush/Spare Pump

Seating Capacity: **3**
Pump Capacity: **1,000**
Tank Capacity: **750**
Condition: **Good**
Mileage:**30,452**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation. Although mileage is relatively low for its age, consideration should be given to replacement based on a cost evaluation of its annual maintenance.

Brush 1

2001 Ford F450 Brush

Seating Capacity: **3**
Pump Capacity: **250**
Tank Capacity: **300**
Condition: **Excellent**
Mileage:**1,244**

Additional Comments or Observations: There were no readily visible signs of damage that impairs operation.

Current Staffing Deployment

Westwood Fire Department (WFD) utilizes full-time career personnel to accomplish its mission and responsibilities to the town. The Department provides service through staffing two stations. Additional manpower resources are available via callback response, mutual aid, and through automatic aid agreements with neighboring jurisdictions. Administrative and support functions are generally the responsibility of staff officers and part-time administrative and maintenance employees. Staffing for emergency response to fire, emergency medical, hazardous materials, technical rescues and other related incidents is provided by career personnel on 24-hour rotating shifts.

Administration and Support Staff

One of the primary responsibilities of the Department's administration and support staff is to ensure that the operational entities of the organization have the ability and means to accomplish their responsibilities on an emergency incident. Efficient and effective administration and support are critical to the success of the Department. Without sufficient oversight, planning, documentation, training, and maintenance, the operational entities of the Department will fail any operational test. Like any other part of the Department, administration and support require appropriate resources to function properly.

Analyzing the ratio of administration and support positions to the total positions of the department facilitates an understanding of the relative number of resources committed to this important function. The appropriate balance of the administration and support component to the operational component is crucial to the success of the department's mission and responsibilities.

The administration and support complement of the WFD is comprised of the fire chief, deputy chief, administrative assistant, and a 20-hour per week maintenance technician. The following figure summarizes the personnel currently assigned to administration and support.

Figure 18: Administrative/Support Staffing Summary

Administrative/Support Personnel	
Position Title and Type	**Number**
Fire Chief	1.00
Deputy Chief	1.00
Administrative Assistant	1.00
Maintenance (PT-20 hrs)	.50
TOTAL	**3.50**

The administration and support staff for WFD is comprised of an authorized complement of three full-time employees and one part-time employee. Each organization should determine the proper ratio of administration and support staff to operational positions dependent upon local need. Statistically, WFD maintains a ratio of 11 percent of administration and support staff to total personnel.

Emergency Services Staff

Adequate resources and well-trained emergency responders are vital to safely, effectively, and efficiently mitigating emergency incidents. The following figures summarize the career personnel assigned to *street-level* service delivery.

Figure 19: Field Operations Career Staffing Summary

Operations/Field Personnel	
Position Title	***Number (FTE)***
Lieutenant/Shift Commander	4.00
Firefighters	24.00
Total	**28.00**

Regardless of the raw numbers of personnel available to a department, what matters most is actual numbers of responders the agency is able to produce at an emergency scene. This almost always relates to the actual number of emergency responders available for immediate deployment. Due to sick leave, vacation, injuries, and other circumstances, the actual number of on-duty personnel often falls below the number assigned to a shift. WFD policy allows the shift staffing level to fall to a minimum of 6 personnel, not including the Chief or Deputy Chief.

WFD personnel, assigned to operational duty, work a 24/24 rotating work schedule involving four different shifts (A, B, C, and D). This results in an annual average of 42 hours per week. Each shift works 24 hours on, 24 hours off, and 24 hours on – followed by five days off.

The following chart summarizes the assignment of operational personnel by station and position per shift.

Figure 20: Minimum Operational Personnel by Station and Position per Shift

Station	Lieutenant	Firefighter	Total
One	1	3	4
Two	0	3	3
Shift Total	**1**	**6**	**7**

Westwood Fire Department provides a staffing standard at the station level and not at the apparatus level. Both stations are staffed with three firefighters supervised by a lieutenant assigned to Station 1. It is important to note that these personnel are not assigned to apparatus singularly, rather they are cross-staffed and respond to emergencies on the apparatus appropriate for the type of alarm. For example, Station 1 houses an engine, an ambulance, and an aerial ladder. Station personnel respond to emergencies in the apparatus appropriate for the emergency incident. Thus for a medical emergency, two firefighters staff the ambulance leaving the station with one emergency responder. This leaves the engine and aerial truck below the department standard of three personnel to respond firefighting apparatus. Subsequent calls for service are managed via response from Station 2 and/or mutual aid assistance.

The aerial truck assigned to Station 1 has no permanent staffing resources assigned to it, which necessitates off-duty personnel to respond on a callback basis to respond this resource to an emergency. This directly impacts the response time of the aerial apparatus as well as the department's capacity to mitigate certain types of emergencies that require this resource, such as multi-story structure fires. The aerial also responds as a first alarm resource to certain addresses per an organizational memo to all personnel by Deputy Chief Morrison, dated 24 March 2004. This scenario necessitates callback personnel to staff the engine as needed.

Station 2 has no company officer/lieutenant directly assigned to provide on-site supervision of that station's firefighters. An off-site shift commander/lieutenant assigned to Station 1 provides supervision to both stations. This lack of direct supervision was cited during stakeholder interviews as having a negative affect on shift morale, efficiency, and effectiveness at Station 2. The daily impacts noted were authority conflicts among the assigned firefighters and inconsistency in daily activities such as training. The downstream affects of this lack of direct on-site supervision could potentially impact service delivery and safe operations during emergency incidents.

Analysis of Critical Tasks and Current Staff Response

Based on consideration of the analysis of fire risk, service demand, land use, historical workload, and population, we established the following risk categories for consideration in the development of deployment standards and evaluation of response staffing capability.

Figure 21: Westwood Fire Department Risk

Fire Risk:	
Low	Areas with mobile property, outbuildings, structures with less than 1,000 gpm needed fire flow, and/or a BAR (building area ratio — % of land covered by building) of less than 10%.
Moderate	Areas with single occupancy structures with a needed fire flow 1,000 to 2,500 gpms and/or a BAR greater than 10% and less than 75%.
High	Areas with multi-occupancy structures with a needed fire flow above 2,500 gpm, structures over three stories in height and/or a BAR greater than 75%.
Rescue Risk:	
Low	Areas with a history or potential for rescue situations that require only the tools and knowledge set available on first due apparatus. Examples include: persons needing assistance up or down an elevation difference where simple solutions such as a rope or ladder will complete the rescue. Normally a single unit response.
Moderate	Areas with a history or potential for rescue situations requiring the use of specialty equipment carried WFD apparatus. Examples include: traffic accidents with persons trapped, persons needing to be moved up or down an elevation while unable to walk or help themselves, multiple vehicle accidents, etc. Normally a two or three vehicle response.
High	Areas with a history or potential for rescue calls requiring specialized equipment and training. Examples include: technical rescues of persons trapped by equipment, buildings or earth that will require extended and complex rescue solutions. Normally a three vehicle or more response with mutual aid.
Special	Disaster responses to floods, landslides, tomados and other situations where large numbers of people are at risk. Types of rescues involved might include: extrication, low/high angle, trench, confined space, and building collapse.
Medical Risk:	
Low	Areas with a history or potential for emergency incidents where predominately a Basic Life Support level of care is provided routinely (closest unit). Calls requiring basic first aid/EMT-1 skills. These areas would normally have low population densities and/or limited residential or commercial development. Tasks would normally include incident command, triage, patient handling, patient treatment, and patient transportation packaging and loading.
High	Areas with a history or potential for needing multiple levels of emergency medical response. Paramedic level response may be summoned simultaneously. These areas would normally have high population densities and/or large numbers of "at risk" populations. Examples might include building collapse, multiple casualties. This risk level would normally be incident specific and would involve mutual aid.
Special	Disasters such as tornado, flood, pandemic, mass casualty incidents, etc. This risk level would normally be event specific.
Special Hazards Risk:	
	Hazardous Materials
Low	Areas with hazards that would require Level D entry. Incidents that require only the tools and knowledge set available on first due apparatus. This risk would include incidents related to common chemicals such as those used in the home or business.
High	Areas with hazards that would require Level A entry. Incidents involving "Acutely Hazardous" materials that require encapsulation of the workers and multiple specialized teams with a level of decontamination that is potentially hazardous. The WFD would not currently be the primary mitigation organization for this incident, but would support a regional response.

The department has not conducted or documented a formal field validation and critical task analysis for its risk categories to date. This should be done in the future to ensure that the effective response force is valid for the community's specific risks and risk levels and to address the relationship between resource distribution and staffing patterns.

The first 15 minutes is the most crucial period in the suppression of a fire. How effectively and efficiently firefighters perform during this period has a significant impact on the overall outcome of the event. This general concept is applicable to fire, rescue, and medical situations.

Critical tasks must be conducted in a timely manner in order to control a fire or to treat a patient. Three scenarios are commonly utilized by fire departments when conducting field validation and critical tasking: a medium risk structure fire, a traffic collision with a trapped victim, and a cardiac arrest. Each scenario is conducted using standard operating procedures and realistic response times based on actual system performance. Each scenario is normally run multiple times with a variety of fire companies to validate and verify observations and times.

To further validate the analysis process, results are compared with records from actual working fires and similar incidents from previous years. Overall results are reviewed to determine if the actions taken within the early minutes of an incident resulted in a stop loss or not and if additional resources were required. The critical task analysis process demonstrates the rate in which the current deployment plan results in stopping loss a high percentage of time within initial critical time goals.

The critical task analysis may demonstrate important differences based on apparatus configuration and staffing in the ability to enter a building on a working structure fire when it comes to executing the *two-in, two-out* rule and fire ground operations.

Again, critical tasks are those activities that must be conducted in a timely manner by firefighters at emergency incidents in order to control the situation, stop loss, and to perform necessary tasks required for a medical emergency. The WFD is responsible for assuring that responding companies are capable of performing all of the described tasks in a prompt, efficient, and safe manner.

Critical tasking for fire operations is the minimum number of personnel to perform the tasks required to effectively control a fire in the listed risk category. Major fires (beyond first alarm) will require additional personnel and apparatus. Critical tasking for emergency medical incidents is the minimum number of personnel to perform the tasks required to support the identified strategy based on the department's adopted medical protocol.

An example of a critical task analysis summary is provided in the Standards of Coverage Guidelines of the Commission on Fire Accreditation International and is shown below. Although not directly applicable to WFD, the summary can provide some guidance in the industry standard methodology for matching critical tasking to community risk.

Figure 22: CFAI Example Critical Tasking Summary by Risk

Minimum Firefighting Personnel Needed Based on Level of Risk				
Critical Task	**Maximum Risk**	**High Risk**	**Moderate Risk**	**Low Risk**
Attack line	4 (16-18*)	4	2	2
Search and rescue	4	2	2	
Ventilation	4	2	2	
Back-up line	2	3	3	
Pump operator	1	1	1	1
Water supply	1	1	1	
Utilities	1	1	1	
Command/safety	2	2	1	1#
Forcible entry	*			
Accountability	1			
Salvage	*			
Overhaul	*			
Communication	1*			
Chief's aide	1	1		
Operations officer	1			
Administration	*			
Logistics	1			
Planning		1*		
Staging		1*		
Rehabilitation	1			
Sector officers	1 (4*)			
High-rise evacuation	10-30*			
Stairwell support	10*			
Relief	*			
Investigation	*			
Totals	**25-65***	**17**	**13**	**3-4**

 # Can often behandled by the first due officer
** At maximum and high-risk fires, additional personnel may be needed*

In order to ensure sufficient personnel and apparatus are dispatched to an emergency event, the alarm response assignments and objectives on the following page have been established for the Westwood Fire Department.

Figure 23: Comparison of Critical Tasking to WFD Staff Response Assignments

General Incident Type	Critical Tasking from CFAI Example	Actual WFD Staff Assignment
Low Rise Residential Structure Fire	13	6-7
High Rise Residential Structure Fire	17	6-7
Moderate Risk Commercial Structure Fire	13	6-7
High Risk Commercial Risk Structure Fire	17	6-7
Grass / Brush Fire	3-4	3-4
Car Fire	3-4	3-4
EMS	3-4	2-5
Motor Vehicle Accident	4-8	6-7
HAZ MAT	13	6-7
Technical Rescue	13	6-7
Water Rescue	13	6-7

WFD's staffing capacity provides for safe response to a majority of emergencies such as medical emergencies, vehicle accidents, vehicle fires, small brush fires, and non-emergency calls. For more resource intensive emergencies such as structure fires, Westwood has secured mutual aid and automatic aid agreements with the surrounding local fire and emergency medical service agencies. Westwood also makes use of callback personnel to supplement on-duty personnel.

Westwood has personnel trained in initial response and mitigation of a variety of special alarms or non-fire related emergencies such as hazardous materials incidents, water rescue, and heavy and technical rescue. Staffing and resource limitations require that external assistance be requested for the safe management of significant incidents. Sources of this mutual aid include surrounding local departments as well as state resources.

Adequate staffing for a low-risk incident may be available from initial response at the time of dispatch. However, current procedures and available resources do not provide consistent four-person engine company staffing as outlined by *NFPA 1710*[6]. Four-person companies can only be assembled by combining the crews from multiple units arriving at the incident from various resources.

This issue is significant whenever there is an incident that involves the use of self-contained breathing apparatus (SCBA) due to the potential for an atmosphere considered *Immediately Dangerous to Life and Health* (IDLH). In such cases, OSHA regulations (29 CFR *Respiratory Protection* - 1910.134[g][4], *Procedures for Interior Structural Firefighting – two in, two out*) would require the presence of at least four persons in air packs. Based on these comparisons, WFD may wish to reconsider its standard response assignment to certain types of calls, by re-evaluating its critical tasking analysis on incidents involving required use of SCBAs.

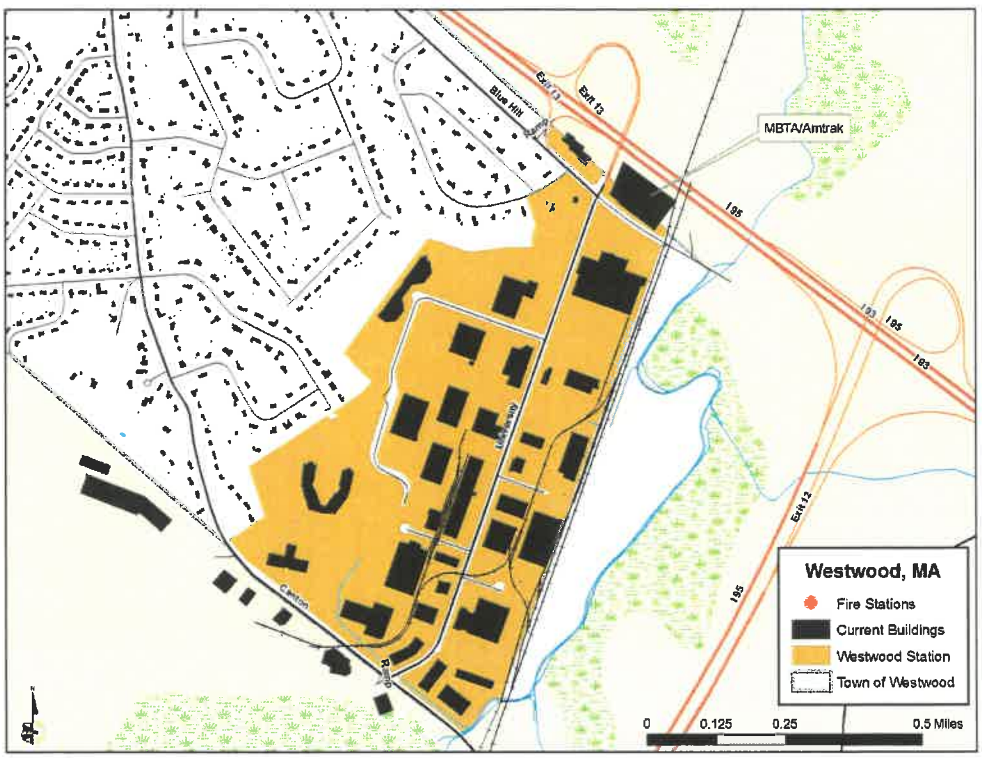
Interviews of fire personnel indicated that WFD does not regularly practice a *two in, two out* policy that standardizes the establishment and use of a *Rapid Intervention Team (RIT)* as required by OSHA regulations mentioned above. This RIT requirement provides a necessary measure of safety for firefighting personnel. The lack of a policy, training, and implementation of RITs could also negatively impact the capacity to mitigate emergencies as well as open the Department and Town to liability related to injuries sustained during operations.

[6] *National Fire Protection Association 1710: Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Careers Fire Departments*, 2004.

Impact Analysis For Westwood Station Development

Westwood Station is a mixed-use development project proposed to redevelop the University Avenue Commercial District. The area has been zoned for such use by the Town. A full proposal and project description has been submitted by the developers and will not be reiterated here. The plan portions that will affect the fire service the most will be emphasized and utilized in analyses in order to project the impact of this development on WFD operations. The following image illustrates the location of Westwood Station within the town and the current buildings.

Figure 24: Westwood Station Area with Current Buildings and Roadway Configuration



Located on the eastern border of the town, this project is taking advantage of a bustling commuter rail station and will redevelop a former commercial area into a community with residential, retail, and office space. A hotel complex, supportive utilities, and a fitness facility are expected to add to the amenities of the project. Multiple parking lots and garages will provide ample space for the residents, shoppers, and employees that will converge into this community during the daylight hours. Over 4.5 million square feet of living, working, and shopping space is proposed for the area. A view of the proposed development[7] is offered below.

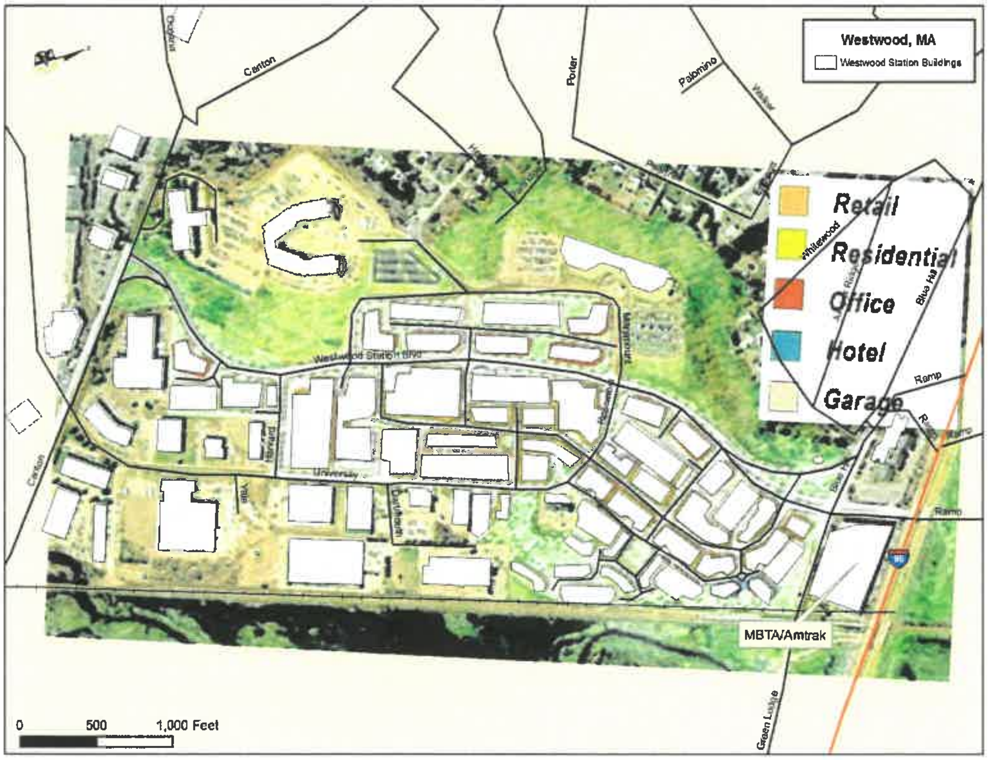
Figure 25: Westwood Station Proposed Development

This image was utilized to reconstruct the street network for the computerized travel time model and the buildings for other analyses within this report. The following figures illustrate how the image and the new street network and buildings are coordinated.

[7] From website of the Westwood Station Project, www.wscommunityonline.com.

Figure 26: Westwood Station Street Network

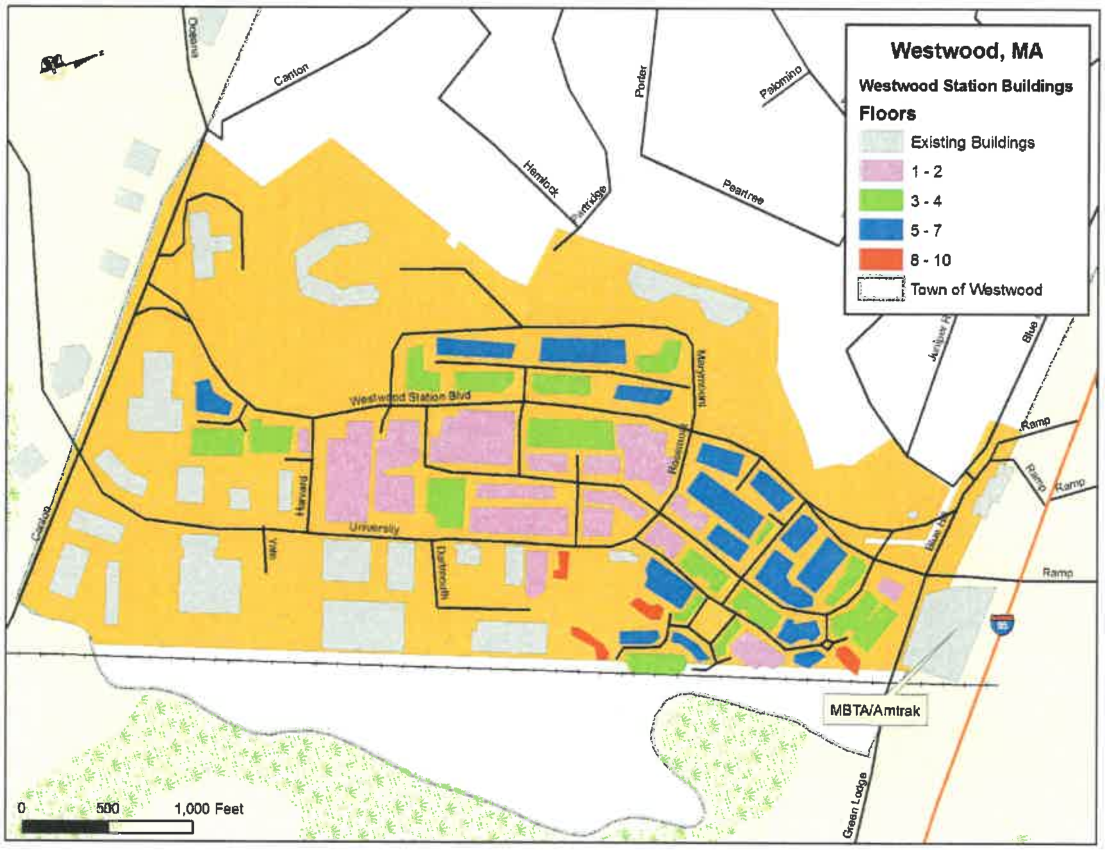
Figure 27: Westwood Station Buildings



Discussion of New Structure Risk

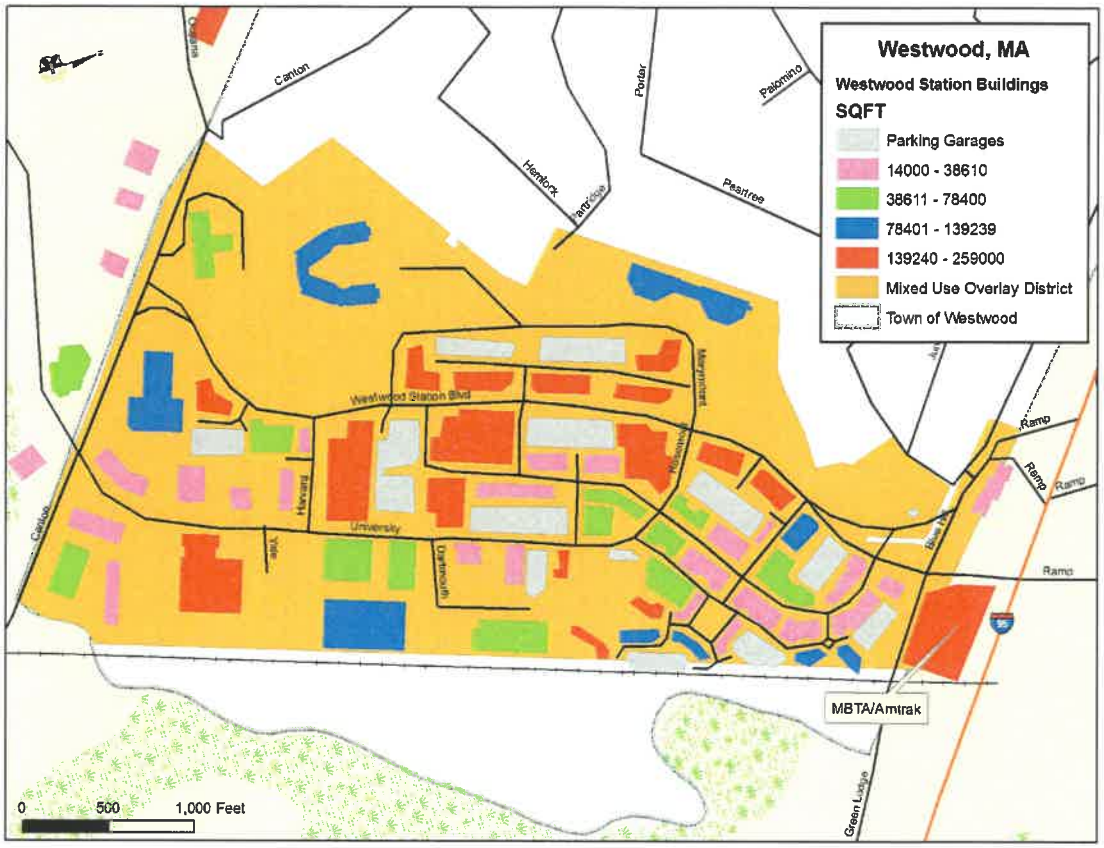
One of the department's concerns is the height of proposed buildings. Buildings over three stories and/or greater than 35,000 square feet qualify for recommended aerial fire truck apparatus for firefighting operations by the Insurance Services Office (ISO) in the Community Fire Protection Rating. The following map details the building heights proposed in Westwood Station. The information provided to ESCi did not have height data for the existing buildings in the area; although it is evident, through aerial photography, that multi-story structures currently exist.

Figure 28: Westwood Station Building Heights



Square footage data was supplied within both the existing building data and the plans for Westwood Station. The following map illustrates the size of structure area based on this information.

Figure 29: Building Square Footage



Projected Fire Department Service Demand of Westwood Station Development

Westwood Station is proposed to be built in two phases. Each phase can include elements of residential, office, retail, or hotel space. Each element will be considered separately for population projections. Most emergency responses, whether fire or medical, are a result of human activity rather than mechanical malfunction or weather-related, such as lightning strikes. Increases in human activity in any location can trigger an increase in the demand for emergency services as the probability increases for fire and medical emergencies.

Residential

Residential Occupied Unit Method

Westwood Station will have 1,000 residential units (RU) by project completion. The potential buyers or tenants that this development will be marketed to include young couples, singles, and *empty-nesters*, with a provision for limited affordable housing as required.[8] It is not expected to attract many large families due to the high-rise design and limited bedroom space. The developers project that just 54 school-aged children may impact the local school system.[9]

Given these assumptions, the persons per household (PPU) would be closer to the rental rate of 1.67 PPU currently experienced in Westwood rather than the higher owner-occupied rate of 2.86 PPU. Therefore, the increase to population resulting from this new development can be estimated according to the following formula:

1,000 RU x 1.67 PPU = 1,670 New Residents (NR)

The number of emergency incidents experienced by WFD in 2006 (2,130) divided by the estimated Census population (13,900) yields an average of approximately 0.153 incidents per person per year. To project service demand in Westwood Station based solely on the projection of new residents, the following equation was use:

1,670 NR x 0.153 IPP = 256 New Residential Calls

This projection would represent a 12 percent increase in service demand. The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 30: Residential Service Demand (Occupied Unit Method)

Residential	Phase 1	Phase 2	Full Build Out
Units	495	505	1,000
New Residents	827	843	1,670
Projected Demand	*127*	*129*	*256*
Fire	5	5	10
EMS	71	72	143
Other	51	52	103

Residential Parking Demand Method

In planning for adequate parking needs for the residential facilities, the developers estimated the number of needed residential parking spaces based upon a shared use demand model.[10] The adjusted peak demand spaces for residential units will be utilized to reflect the majority of

[8] Westwood Station Area Master Plan Volume 1, Page 1-11, 12.
[9] Westwood Station Area Master Plan Volume 1, Page 10-1
[10] Westwood Station Area Master Plan Volume 1, Tab 13 by Walker Parking Consultants, Inc.

residents being present in the development. There are multi-occupant households that may have one or no vehicles, where residents may utilize other means such as walking, bicycle, or commuter train service. This was estimated to be 4 percent of the resident population.

A total of 1,325 parking spaces (PS) would be utilized by residents during peak demand hours, although 1,650 spaces were planned for installation. This number assists in validating the previous occupied unit method's population estimate of 1,670 persons. However, the peak demand estimate of 1,325 reflects the times in which residents may vacate spaces due to shopping, commuting to work, and other errands or travel. This adjustment may more accurately reflect potential emergency service demand when the same methodology is employed. Therefore:

1,325 (PS) x 0.153 IPP = 203 New Residential Calls

This would result in a 9.5 percent increase in service demand over last year. The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 31: Residential Service Demand (Parking Demand Method)

Residential	Phase 1	Phase 2	Full Build Out
Parking Spaces	655	670	1,325
Projected Demand	*100*	*103*	*203*
Fire	4	4	8
EMS	56	57	113
Other	40	42	82

Residential Square Footage Method

Westwood Station is adding nearly 1.3 million more square feet of residential space (RES sqft) into the Town of Westwood, which has an existing total of 8.8 million RES sqft. This increases the living space by almost 15 percent. Using square footage as a parameter to estimate service demand is another method of projecting service demand.

When using square footage as a parameter in projecting residential service demand, it must be remembered that more emergency calls generally occur in areas with smaller per unit square footage when compared to larger residential units. This can be a reflection of differences in socioeconomic factors that relate to service demand, such as education and health care access.

A total of 1,522 calls were located in residential zoned areas in 2006. Divided into the existing residential square footage, this creates a ratio of approximately one emergency call a year for every 5,783 residential square feet of space.

8,801,156.4949 RES sqft/1522 calls = 5,783 RES sqft per call

The proposed residential square footage for Westwood Station divided, applied to the above ratio, yields 224 new calls for the fire department utilizing this method.

1,295,000 new RES sqft/5,783 RES sqft per call = 224 New Residential Calls

This calculation results in a 10.5 percent increase in service demand over last year. The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 32: Residential Service Demand (Square Footage Method)

Residential	Phase 1	Phase 2	Full Build Out
Square Feet	620,000	675,000	1,295,000
Projected Demand	*107*	*117*	*224*
Fire	4	5	9
EMS	60	65	125
Other	43	47	90

Residential Service Demand Summary

The range of projected residential service demand is a rather narrow range from 203 to 256 new calls, with an average of **228 calls**. However, this reflects only the residential service demand impact on the fire department. The scope of retail, hotel, and employment centers will also bring more people into this area. The next section summarizes these additional aspects of Westwood Station and projects service demand based on projected use and size of structure.

Retail

Retail Occupied Unit Method

In 2006, 247 incident calls were reported within the 134 business or industrial zoned areas of Westwood. This provides a ratio of 1.84 calls per business unit.

247 incidents/134 business parcels = 1.84 Calls per Business Unit

Westwood Station plans call for over 1.3 million square feet of retail space. The exact number of units and their respective sizes has not yet been determined; however 13 retail units have been quantified, including the fitness facility.[11] The remaining 1,059,000 square feet has, for the purposes of this analysis, been divided by 10,000 square feet per general retail unit[12] to yield 106 retail units. By multiplying the ratio of 1.84 calls per business unit to the projected 119 retail units within Westwood Station, the resulting projected emergency service demand in the retail sector is 219 calls.

1,059,000 unspecified square feet/10,000 estimated space per unit = 106 Units Derived

106 units derived + 13 units specified = 119 Retail Units

119 retail units x 1.84 calls per business unit = 219 New Retail Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 33: Retail Service Demand (Occupied Unit Method)

Retail	Phase 1	Phase 2	Full Build Out
Retail Units	119	0	119
Projected Demand	*219*	*0*	*219*
Fire	9	0	9
EMS	122	0	122
Other	88	0	88

Retail Parking Demand Method

Peak parking demand for retail shoppers and employees has been estimated at 4,525 spaces. Though some carpooling of shoppers and employees may occur, this is traditionally a very small percentage of the population. Between 4 and 5 percent of this population is expected to arrive via alternate forms of transportation. In addition, this figure takes into account non-captive ratios, in which users of one land use patronize another so as to not be counted twice for parking space analysis. Therefore, Westwood Station is expected to attract at least an additional 4,525 persons to shop and dine within the community during peak hours. This equates to a 32 percent increase over current census residential population and a 29 percent increase over the currently estimated daytime population within the Town of Westwood.

[11] Westwood Station Area Master Plan Volume 1, page 13-1.
[12] Industry Average Retail Square Footage (C. Quaresima, Commercial Interior Designer/Project Manager).

Dividing the number of calls that were geographically located in commercial zones in 2006 by the estimated daytime population, yields a population per call based only on incidents that occurred near places of business.

502 incidents/15,651 persons = 0.032 Incidents per Person

4,525 new retail population X 0.032 incidents per person = 145 New Retail Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 34: Retail Service Demand (Parking Demand Method)

Retail	Phase 1	Phase 2	Full Build Out
Shoppers and Employees	1,430	3,095	4,525
Projected Demand	*46*	*99*	*145*
Fire	2	4	6
EMS	26	55	81
Other	18	40	58

Retail Square Footage Method

Utilizing square footage to project service demand must be viewed with caution. As stated previously, emergency incidents are usually triggered by human activity, which makes population-based emergency service demand projections more reliable. Although this square footage method is another means to estimate demand, it is subject to overestimations due to warehousing, low occupancy, and vacant space.

Westwood Station plans for over 1.3 million square feet of retail space. This is a 33 percent increase over the existing 3,982,134 square feet of commercial space. The incidents occurring during 2006 in commercial land uses (502) are divided into the existing commercial square footage to yield a square footage per call ratio.

3,982,134 sqft/502 incidents = 7,933 Commercial sqft per Call

Dividing this ratio into the proposed Westwood retail square footage yields a projected service demand.

1,348,000 sqft/7,933 commercial sqft per call = 170 New Retail Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based upon historical proportions.

Figure 35: Retail Service Demand (Square Footage Method)

Retail	Phase 1	Phase 2	Full Build Out
Square Feet	1,348,000	0	1,348,000
Projected Demand	*170*	*0*	*170*
Fire	7	0	7
EMS	95	0	95
Other	68	0	68

Retail Projected Service Demand Summary

The range of projected retail service demand is a rather narrow range from 203 to 256 new calls, with an average of **178 calls** between the various methods.

Office Space

Office Occupied Unit Method

Westwood Station plans call for nearly 1.5 million square feet of office space. The exact number of units and their respective sizes has not yet been determined. For the purposes of this analysis, this space has been divided by 20,000 square feet per tenant[13] unit to yield 74 business units. By multiplying the ratio of 1.84 calls per business unit (utilized previously in the retail occupied unit method) to the projected business units within Westwood Station, the resulting projected emergency service demand in the office space sector is 136 calls.

1,490,000 unspecified sqft/20,000 sqft estimated space per unit = 74.5 Office Units

74 office units x 1.84 calls per business unit = 136 New Office Building Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 36: Office Service Demand (Occupied Unit Method)

Office	Phase 1	Phase 2	Full Build Out
Office Occupied Units	6	68	74
Projected Demand	*12*	*124*	*136*
Fire	0	6	6
EMS	7	69	76
Other	5	50	55

[13] Industry average for one floor of a multi-story structure, average one tenant per floor (C. Quaresima, Commercial Interior Designer / Project Manager).

Office Parking Demand Method

Peak parking demand for employees and visitors at the office buildings has been estimated at 5,525 spaces. Some carpooling of employees may occur, and some employees may live in the community, so this figure takes into account the non-captive ratios (where users of one land use patronize another) as to not be counted twice for parking space analysis. Therefore, Westwood Station is expected to attract at least an additional 5,525 persons to work within the community during peak hours. This equates to a 39.7 percent increase versus current census residential population and a 35 percent increase over the currently estimated daytime population within the Town of Westwood.

Our calculation uses the incidents per person ratio that was calculated in the retail parking demand method analysis for commercially zoned spaces and multiplies it by the potential office population to yield a projected service demand of 177 new calls.

5,525 new office population X 0.032 incidents per person = 177 New Office Building Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 37: Office Service Demand (Parking Demand Method)

Office	Phase 1	Phase 2	Full Build Out
Visitors and Employees	27	5,498	5,525
Projected Demand	*1*	*176*	*177*
Fire	0	7	7
EMS	1	98	99
Other	0	71	71

Office Square Footage Method

As noted previously, Westwood Station plans for nearly 1.5 million square feet of new office space. This is a 37 percent increase over the existing 3,982,134 square feet of commercial space within the town. Coupled with the newly proposed retail and commercial space, the Westwood will have increased by an astonishing 71 percent by full-build out of Westwood Station. The commercial square feet per call ratio developed previously is applied to the proposed square footage of new office space in Westwood Station.

1,490,000 sqft/7,933 commercial square feet per call = 415 New Office Building Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 38: Office Service Demand (Square Footage Method)

Office	Phase 1	Phase 2	Full Build Out
Square Feet	125,000	1,365,000	1,490,000
Projected Demand	*222*	*193*	*415*
Fire	9	8	17
EMS	123	108	231
Other	89	78	167

Office Projected Service Demand Summary

Projected office building service demand is a wide range from 136 to 415 new calls. The average of the methods utilized equals **243 new calls**.

Hotel

Hotel Occupied Unit Method

A 328-room full service hotel which will occupy two multi-story buildings is planned for the Westwood Station development. In order to estimate the population of guests and employees, a vacancy rate of 35 percent is used to average the cyclical nature of hotel occupancy across a year's time. As a result, it is estimated that an average of 220 guests and staff would be registered or working in the hotel properties. The peak population time for hotels is typically from 7:00 p.m. to 9:00 a.m.

Utilizing the incidents-per-person ratio that was calculated in the retail parking demand method analysis for commercially zoned areas multiplied by the potential hotel population yields a projected service demand of 177 new calls.

220 hotel population X 0.032 incidents per person = 7 New Hotel Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 39: Hotel Service Demand (Occupied Unit Method)

Hotel	Phase 1	Phase 2	Full Build Out
Occupied 65%	220	0	220
Projected Demand	*7*	*0*	*7*
Fire	0	0	0
EMS	4	0	4
Other	3	0	3

Hotel Parking Demand Method

Peak parking demand for employees and guests at the hotel has been estimated at 165 spaces. This takes into account that some guests may arrive via train or taxi. As a suburban hotel, many guests may not feel comfortable or knowledgeable about the train service. Due to the distance, or perhaps lack of direct train service to the guest's ultimate destination, many guests will arrive via personal or rental vehicle. Therefore, the hotel is expected to attract at least an additional 165 persons to the community during peak hours. Utilizing the historical persons-per-call ratio for commercially-zoned areas that was calculated in the retail parking demand analysis, a projected service demand of five new calls was yielded.

165 hotel population X 0.032 incidents per person = 5 New Hotel Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 40: Hotel Service Demand (Parking Demand Method)

Hotel	Phase 1	Phase 2	Full Build Out
Rooms	328	0	328
Guests/employees*	137	28	165
Projected Demand	*4*	*1*	*5*
Fire	0	0	0
EMS	2	1	3
Other	2	0	2

**@ 65% occupancy*

Hotel Square Footage Method

The hotel square footage for the two multi-storied buildings is proposed to be 230,000 square feet. It is important to emphasize that this methodology accounts for space that might typically be uninhabited, such as conference rooms and vacant guest rooms. As such, it is likely to overestimate service demand when compared to the other methods used in this study. The commercial square feet per call ratio developed previously is applied to the proposed square footage of the hotel in Westwood Station:

230,000 sqft/7,933 commercial sqft per call = 33 New Hotel Calls

The following table summarizes this method by project phase and estimates the new service demand by call type based on historical proportions.

Figure 41: Hotel Service Demand (Square Footage Method)

Hotel	Phase 1	Phase 2	Full Build Out
Square Feet	230,000	0	230,000
Projected Demand	*33*	*0*	*33*
Fire	2	0	2
EMS	18	0	18
Other	13	0	13

Hotel Projected Service Demand Summary

Hotel service demand is expected to be comparatively light, ranging from 5 to 33 new calls at full build out. The average of the methods utilized equals **15 new calls**.

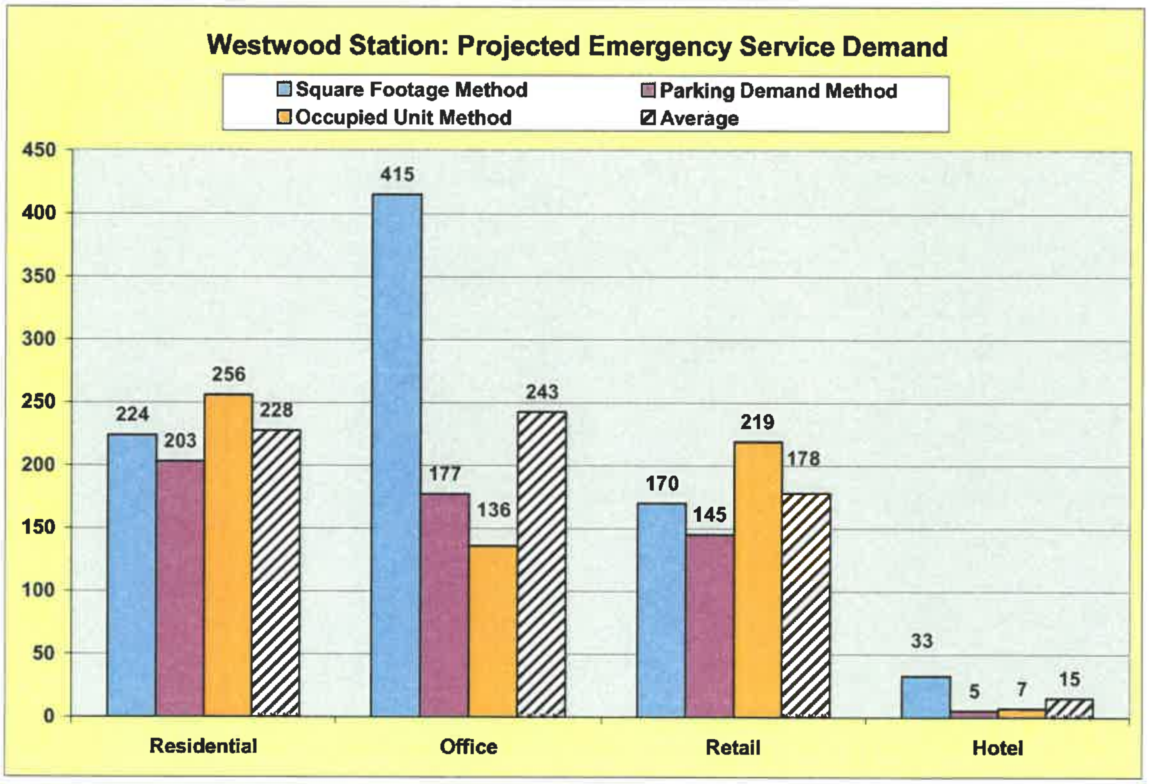
Summary

The following will summarize expected peak time population within Westwood Station along with the projected service demand changes based on method, call type, and collective effects on fire department responses.

Projected Service Demand Summary

The following chart summarizes projected calls by land use for each of the analysis methods discussed previously.

Figure 42: Projected Service Demand by Land Use and Method of Analysis



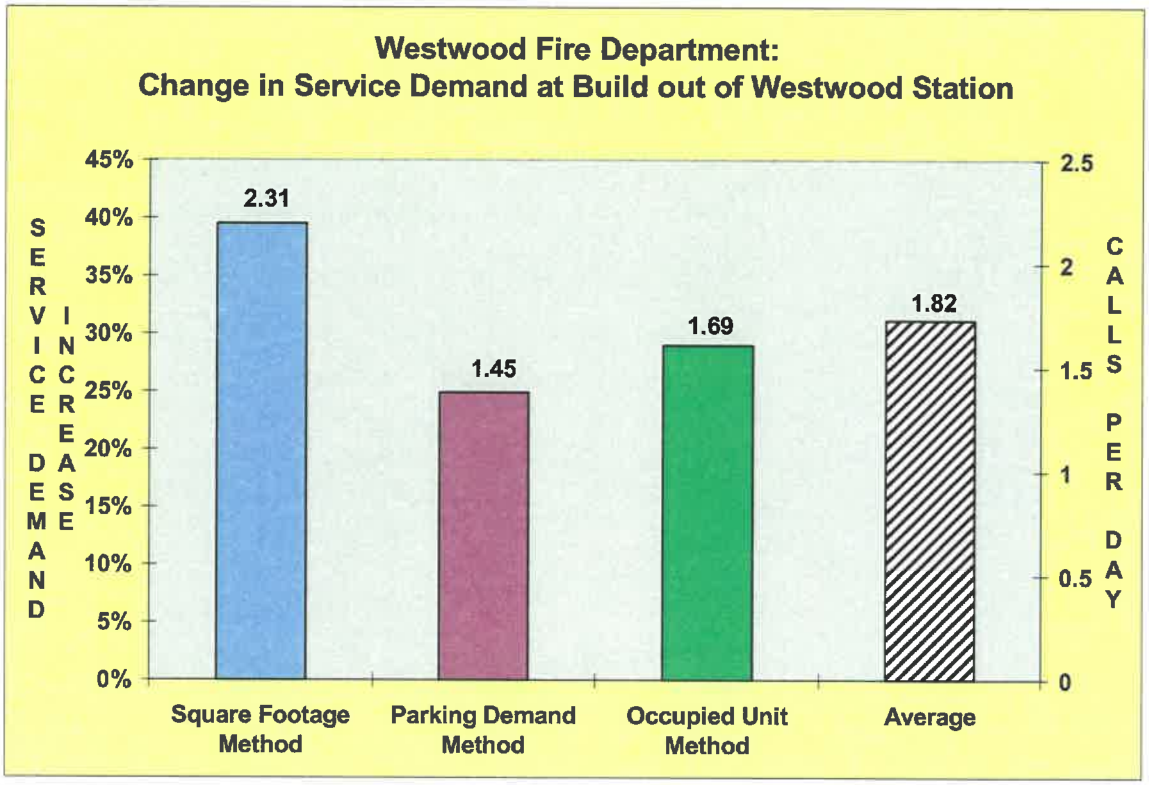
Collectively, the methods of analysis place residential land use as a higher propensity for emergency service calls. The following table summarizes the land use elements into projected service demand totals by method of analysis.

Figure 43: Service Demand Totals by Analysis Method

Analysis Method	Service Demand
Square Footage Method	842
Parking Demand Method	530
Occupied Unit Method	618
Average Demand	*663*

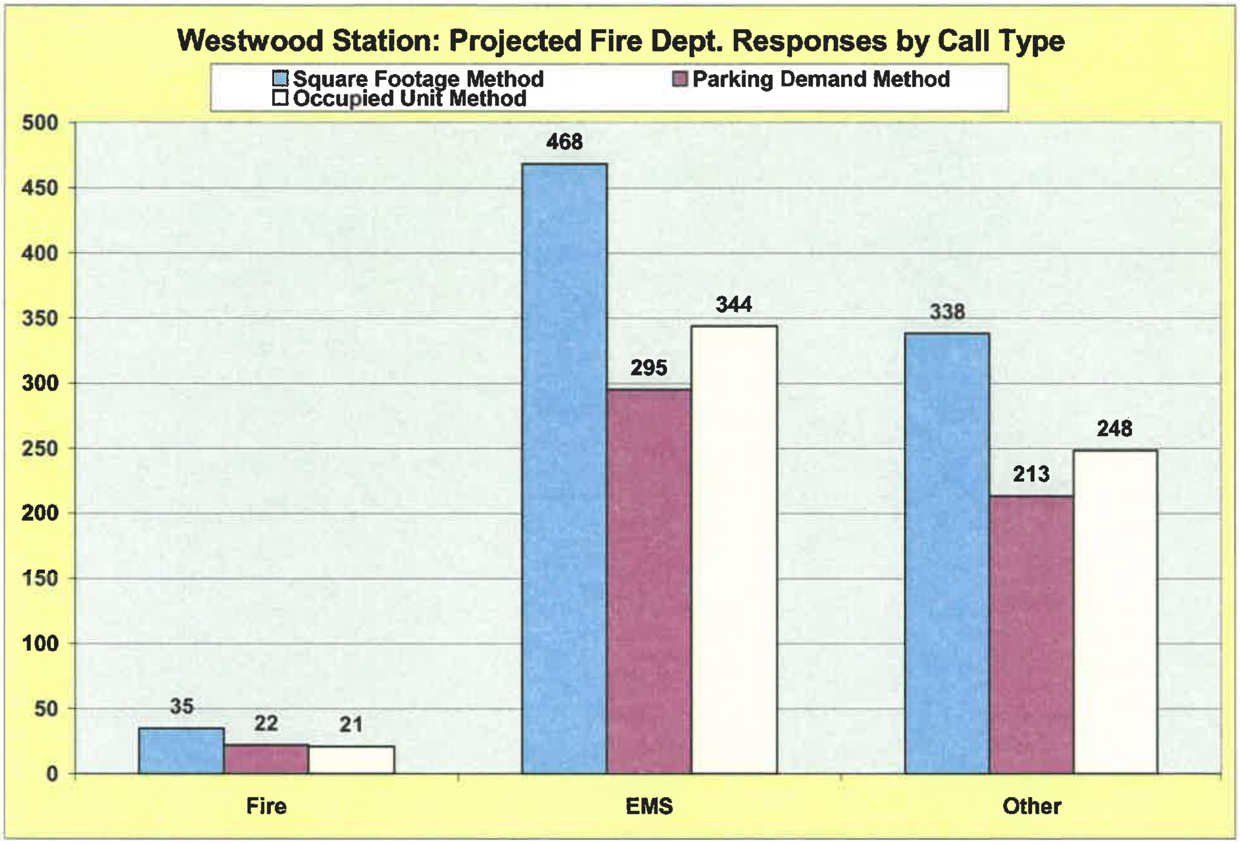
These figures translate to between **1.45 and 2.31 new calls per day** within Westwood Station at project completion, and total service demand is projected to increase from 25 to 40 percent for the WFD. The follow chart illustrates these values based on method of analysis.

Figure 44: Service Demand Changes for the Westwood Fire Department



New calls will vary in type and amount with regard to fire-related incidents and calls for medical aid. The following chart delineates the workload of the projected service demand by these call types. Fires are estimates of actual fire incidents ranging from cooking fires, room/content fires, brush, vehicles, dumpsters, and outbuildings, to structures themselves (NFIRS 100 Series Conditions). Medical aid calls are classified as EMS-Emergency medical services (NFIRS Series 300 Conditions). Other denotes fire-related calls such as alarms, spills, ruptures, and all other aid (ALL other NFIRS Series Conditions).

Figure 45: Projected Service Demand by Call Type in Westwood Station



This increase in service demand for the Westwood Fire Department may result in the necessity for added facilities, staff, and apparatus. The increased calls will certainly affect the amount of simultaneous calls and increase the workload of the current staff. As medical aid calls are projected to account for the majority of new service demand, consideration of an additional ambulance is warranted. More specific recommendations for fire stations, fire apparatus and staffing will be discussed in another section of this report.

Existing Station 2 Response to Westwood Station Development

This section examines response capability in the new development area based on current fire department deployment and new population and structures planned for Westwood Station.

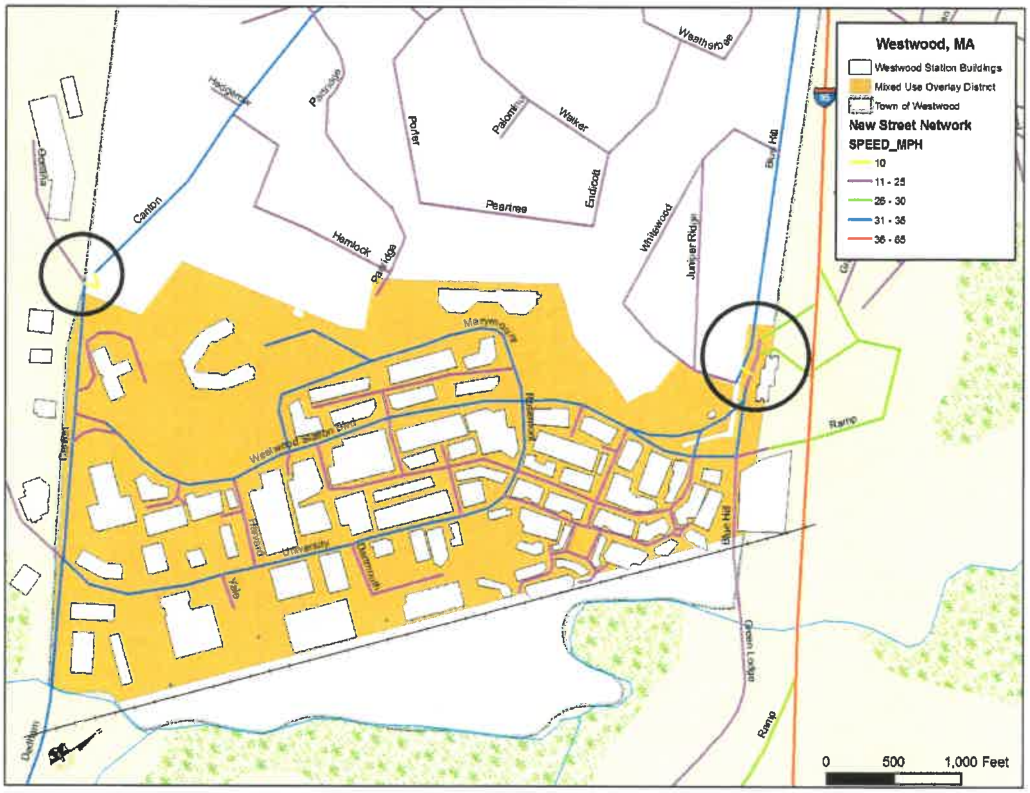
Although Figure 16 illustrates that Engine 2 could reach into the current University Avenue area within six minutes of travel time, the new street network configuration within Westwood Station will provide additional challenges to the department. According to correspondence received from Traffic Solutions, Inc., a firm that is working with the Westwood Station developer, the roads are being designed for 35 miles per hour (MPH).[14] However, this may not ultimately be the posted speed limit, especially within the retail and residential districts of the plan. It does speak to the planned turns for roadways, width of streets, and safety markers. The greatest concern outside the speed capability of roadways is the turns that will need to be negotiated. As with any large vehicle, a wide turn radius is necessary for fire apparatus, much the same as for delivery trucks and tractor-trailers. Considering potential retail tenants and the necessity for larger delivery vehicles along with the designed speed for streets, access should be adequate.[15]

Unfortunately in many areas, access by large vehicles usually becomes limited to area of delivery, such as freight docks. This results in smaller streetscapes in areas designed for vehicles such as cars and vans to access garages, alleys, and building frontages (such as hotels). The developers need to be reminded that firefighting operations can commence on any side of a structure and quick access is essential. It is also important to note that the current ambulance is also a larger vehicle which requires similar street access elements.

The following map illustrates the speed limits for this area. The new streets within Westwood Station have been assigned an assumed speed based on probable determination by the State Department of Transportation.

[14] 3/12/07 William Lyons of Traffic Solutions. Email response to inquiry.
[15] Exact street widths and turn radii have not been provided for specific examination by ESCi in order to make detailed recommendations for improvement (if any).

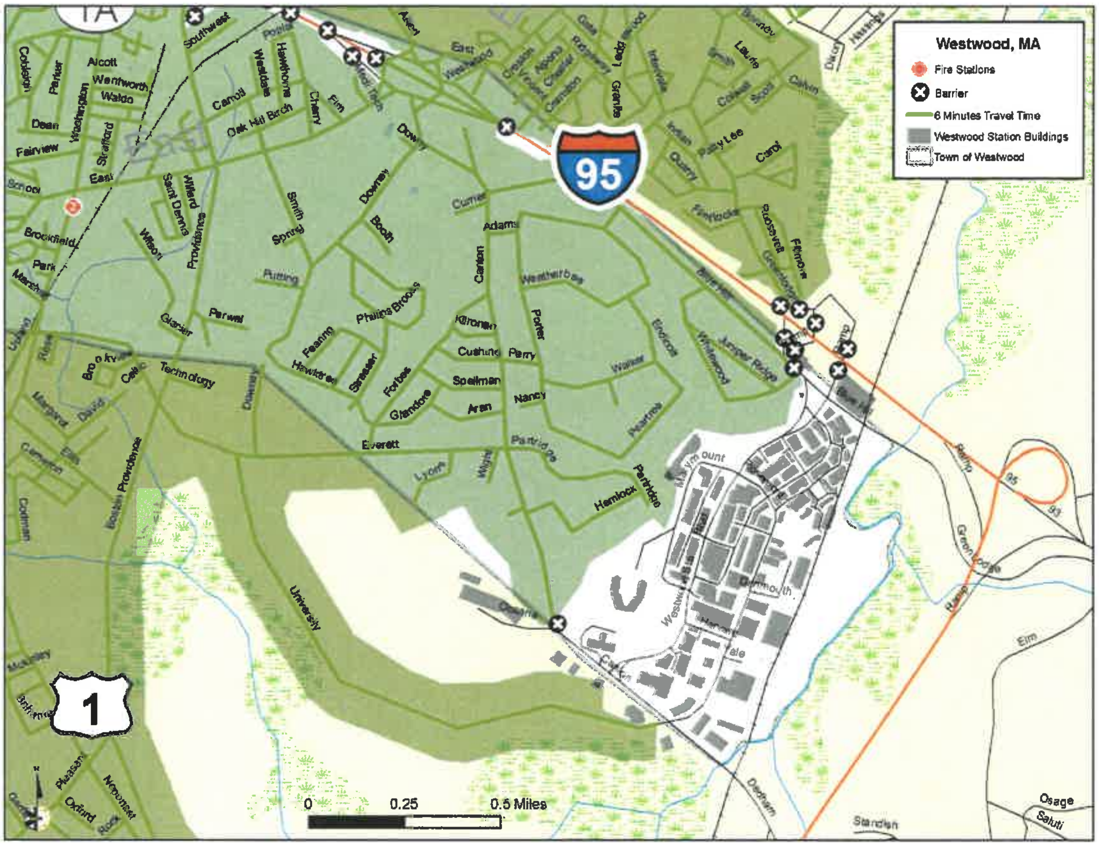
Figure 46: New Street Network Speed Limits



The areas circled in black are street connectivity issues that are of concern to the fire department. During stakeholder interviews, it was expressed that Westwood Station is designed with limited access from local streets and that the areas circled in black would not necessarily exist. The latest information indicates that access to this area may be limited or non-existent from Canton Street on the south and Blue Hill Drive on the north. These streets currently flow uninterrupted into this area. Main access would occur from the Interstate ramp in the north and University Avenue to the south.

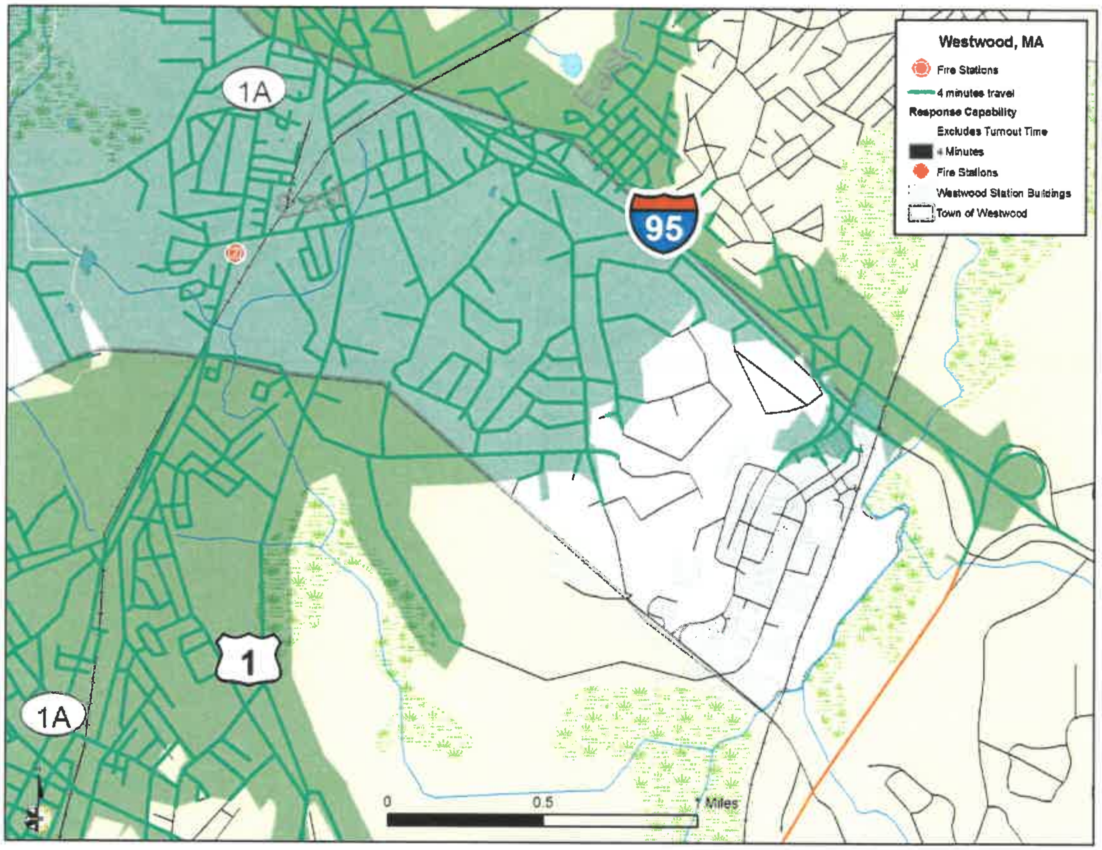
The following map exhibits how the area would be effectively sealed off from existing fire protection if access is denied from Blue Hill and Canton Streets, even with an extended six-minute travel time from Station 2. As stated earlier in this report, the Interstate becomes congested to the point of avoidance if possible. According to the Fire Chief, the preferred route is via local streets.

Figure 47: Westwood Station Limited Access



Even if the Interstate was traversable during lighter traffic hours, the following map demonstrates that this does not improve the response capability dramatically into this area within five minutes of dispatch. The Interstate would provide coverage of Westwood Station within seven minutes of dispatch by Engine 2.

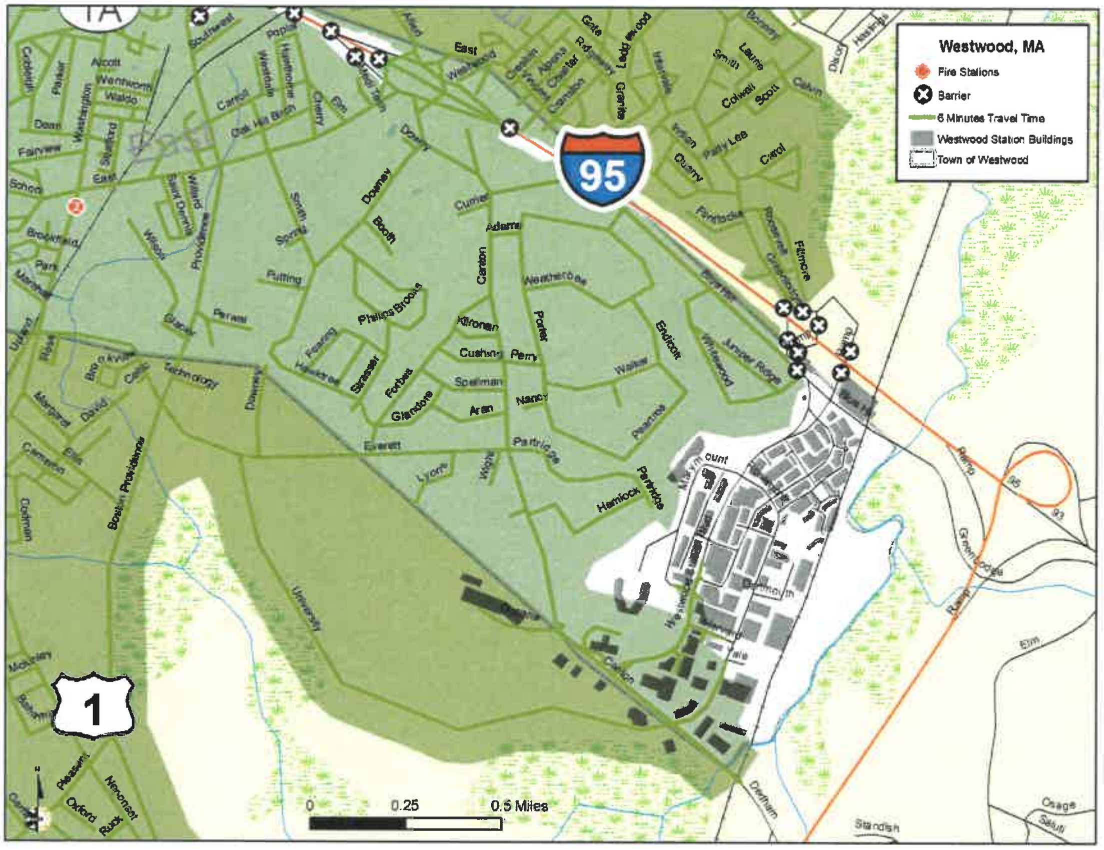
Figure 48: Four-Minute Travel Time from Station 2 with Interstate Use



An alternative plan has called for a double cul-de-sac with a narrow emergency access route on Canton Road. This still requires the apparatus to slow and navigate a tight '*S*' turn. No provisions have been proposed for Blue Hill Drive except that it turns south into Whitewood Road.

The following map illustrates the six-minute travel time from Station 2 into Westwood Station without use of the Interstate. The coverage of Westwood Station is still inadequate in this scenario.

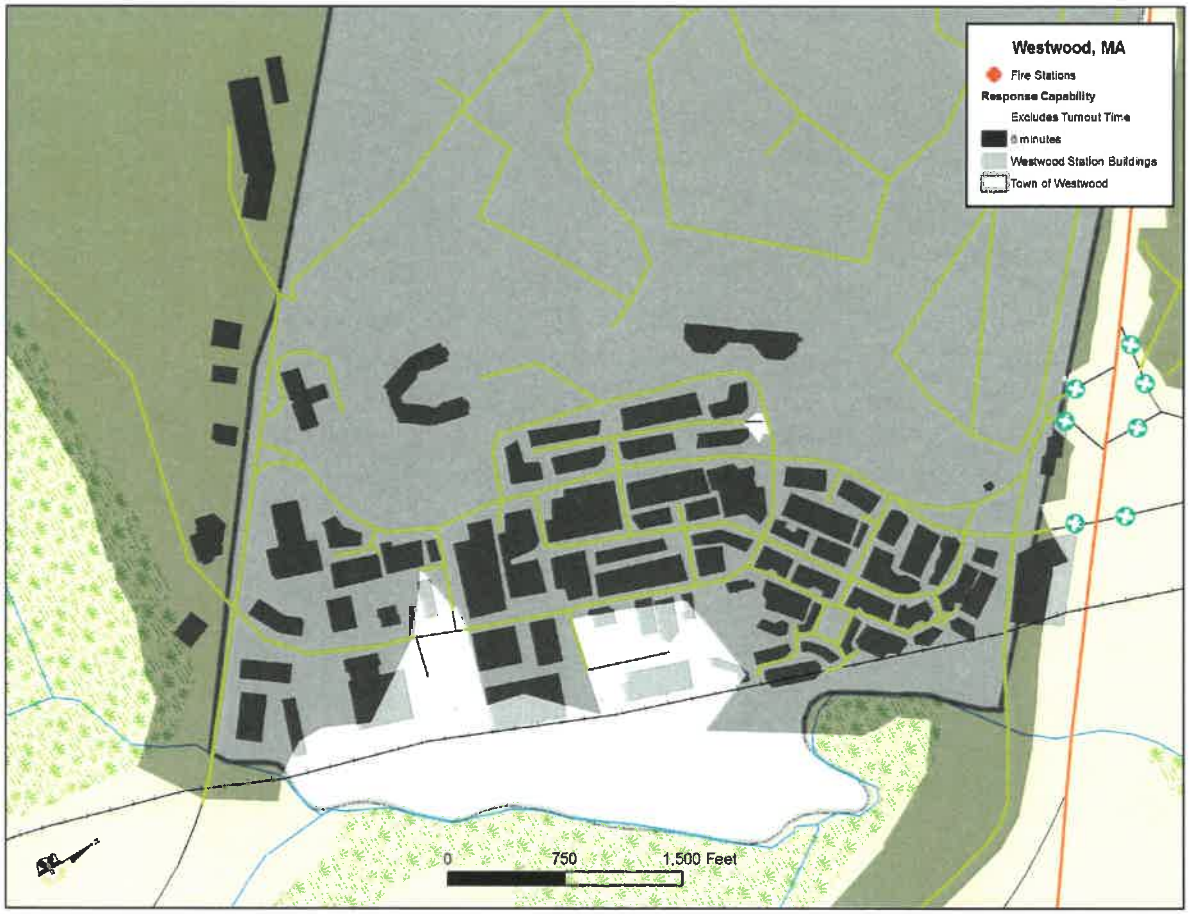
Figure 49: Station 2 Response with Reconfigured Canton St. Access



Although it is best from the fire department perspective that both Canton Street and Blue Hill Road remain unimpeded, at the very least it is recommended that a gated access on both roads be equipped with an automatic sensor[16] which will recognize authorized vehicles (response apparatus, ambulance, police cars, snow plows, etc.) to allow access with minimal delay in response time. The following map shows the extent of apparatus from Station 2 into Westwood Station with gated access on both roadways and restricting Interstate use. A slightly smaller area in Figure 16 is serviceable within seven minutes' response time.

[16] Such as Opticom™.

Figure 50: Seven-Minute Response Time with Gated Access on Both Streets



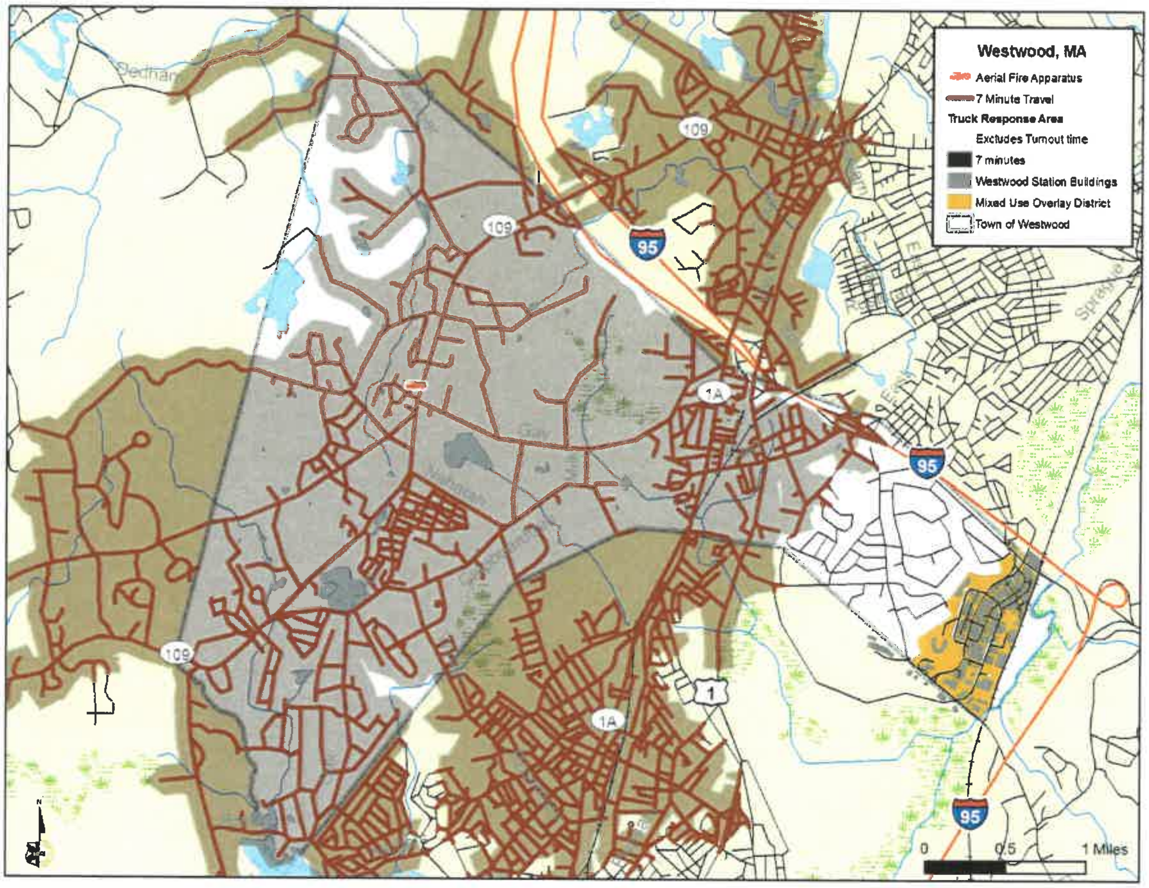
A seven-minute response time is not within fire department goals and has been proven ineffective in firefighting experience. Patients with critical medical incidents also suffer detrimentally from extended response times. As an additional consideration, in order to achieve optimum credit for the distribution of engine companies, the Insurance Services Office (ISO) reviews the response area of each existing engine For ISO purposes, the response area is measured at 1.5 miles of travel distance from each engine company on existing roadways. ISO would consider the engine at Station 2 to be too far from properties within Westwood Station for purposes of distribution credit. Increasing the risk to Westwood Station, the ambulance responding from Station 1 is also currently unable to reach this area within five minutes of dispatch.

Existing Ladder Truck Service to Westwood Station Development

To achieve optimum credit for the distribution of truck or service companies, ISO also reviews the response area of each existing truck or service company. For ISO purposes, the response area is measured at 2.5 miles of travel distance from each engine company on existing roadways.

A truck/service company is not required to have an elevating ladder or aerial device unless there are a sufficient number of buildings that would meet the three-story height and square footage limits. Other areas can receive credit for a service company without the requirement of an elevated device and can even receive partial credit for a service company if other apparatus, such as an engine, carries a complement of truck company equipment. It is clear from the analysis of projected building heights and sizes that the Westwood Station area would be expected to meet the necessary requirements for aerial devices or elevated ladders. The following map displays the areas of the district that are within 2.5 miles of the existing staffed truck company with an aerial device. Westwood Station is obviously well outside this response area.

Figure 51: Truck Travel Map



Benchmark Comparisons

A comparative analysis with several similar developments nationwide and their effect on emergency services within their communities was attempted. Five communities with similar square footage and uses were researched. However, only one of the communities was able to produce any quantitative information for analysis.

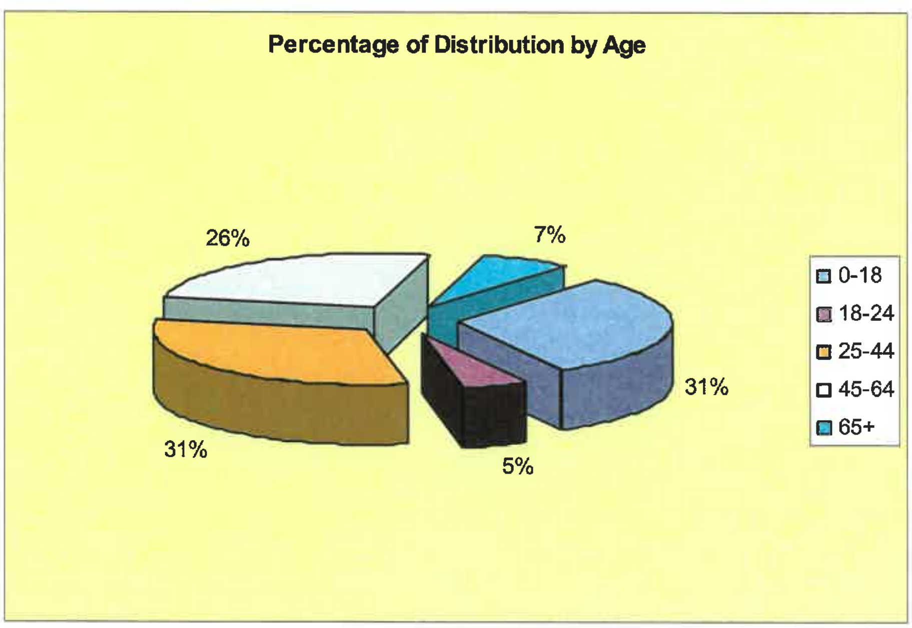
Community Name	City/State	Retail/Ofc Sq. Ft	Housing Units	FD Info Available
Mashpee Commons	Mashpee, MA	340,654	Unknown*	No
Celebration (c. 2000)	Kissimmee, FL	395,000	1,093	Yes
Celebration (today)	Kissimmee, FL	1,100,000	3,500	Yes
Southern Village	Chapel Hill, NC	252,500	1,150	No
North Point	Cambridge, MA	2,200,000	2,700	No
Ramsey Town Center	Ramsey, MN	1,160,000	2,500	No (Just Started)

Most of the surveyed fire departments that responded, which covered Traditional Neighborhood Developments (TNDs), stated that, given the lack of adequate geographic breakdown in their records management systems, there was no way to show the direct affect the TND had on the service delivery system. They did state that there was an increase in their call volume. However, it was gradual, was accompanied by growth in the whole community, and therefore could be comparative to the effect of regular call change year to year.

The TND that did have quantitative information was Celebration, Florida. Even though the current size of Celebration is quite a bit larger than Westwood Station is planned for, the 2000-2001 figures would be in the nature of what would be expected for Westwood.

Originally founded in 1994, Celebration did not show any significant settlement or commercial growth until the years 1998 to 2000. As of the year 2000, Celebration had grown to 2,736 residents dispersed throughout 1,093 housing units. When compared to Westwood Station, these figures are close to the approximate number of housing units planned. Using the aforementioned numbers, Celebration showed an average of 2.5 residents per housing unit. The following figure illustrates the demographic breakdown by age of residents in Celebration.

Figure 52: Celebration, Florida, Population Distribution by Age[17]



[17] Osceola County Economic Profile website.

Celebration is serviced by Osceola County Fire and Rescue Station No. 72. Although part of a county department, this station is located in the town of Celebration and responds to all the calls within the settlement's limits and also some incidents within the county. The following table shows the call volume of Station No. 72 in relation to the residents of Celebration.

Figure 53: Call Volume for Celebration, Florida

Year	# of Residents	# of Calls
2000	2,736	1,226
2001	2,957	1,409

As indicated, not all of the calls responded to were within Celebration's city limits. Unfortunately, Osceola County had no way of delineating which calls were actually in the settlement as opposed to in the county.

Overall, the effort to conduct quantitative analysis with like communities was met with limited success and provided no statistically valid data from which to draw conclusions.

Potential Deployment Strategies

This section will describe various deployment strategies that can be considered by the Town, the WFD, and the developers of Westwood Station. An examination of facility location and design attributes, necessary apparatus, staffing configurations, and cost are detailed below.

Three-Station Strategy

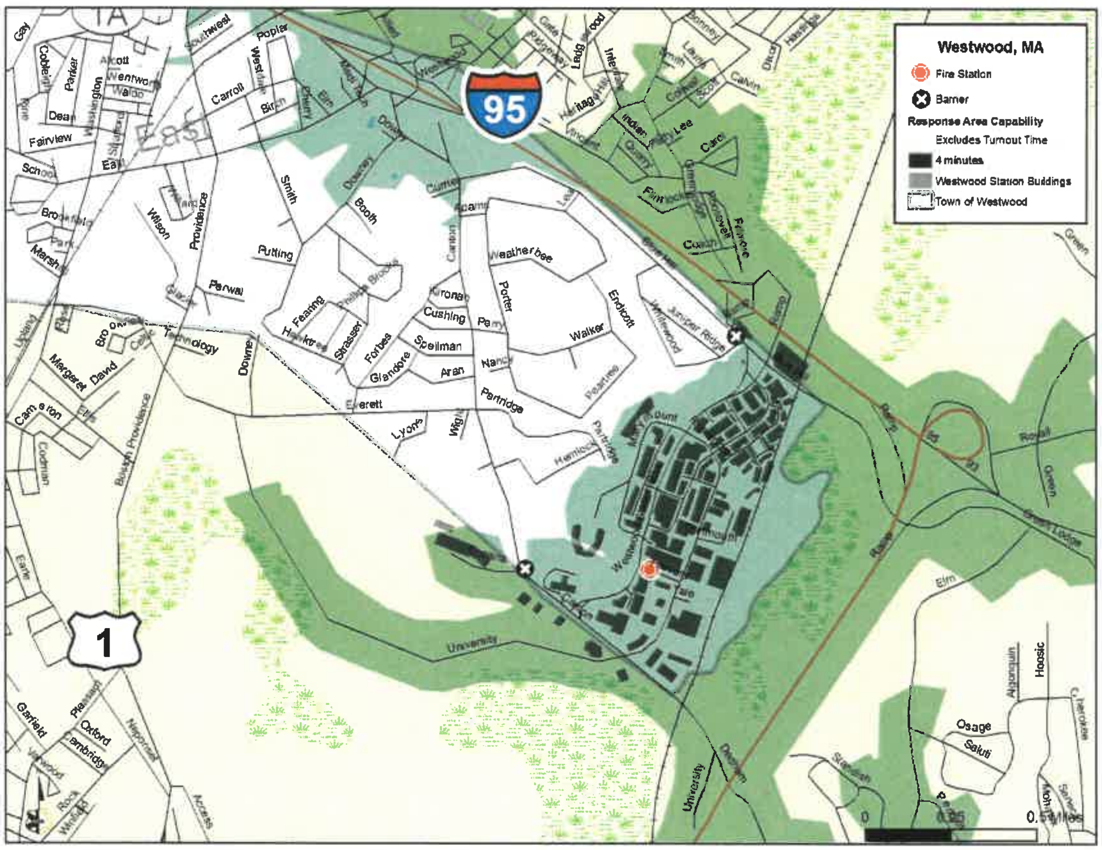
This strategy examines the possibility of an additional fire station within the proposed development of Westwood Station.

Facility

Space has been proposed by the developer of Westwood Station for an additional fire station within the new development. The proposed site is near the intersection of Westwood Station Boulevard and Harvard Street. Apparatus would exit onto Harvard Street to begin enroute to incidents. Although this would solve the issues of fire protection for Westwood Station, it would be supported through taxes paid by all residents of the town.

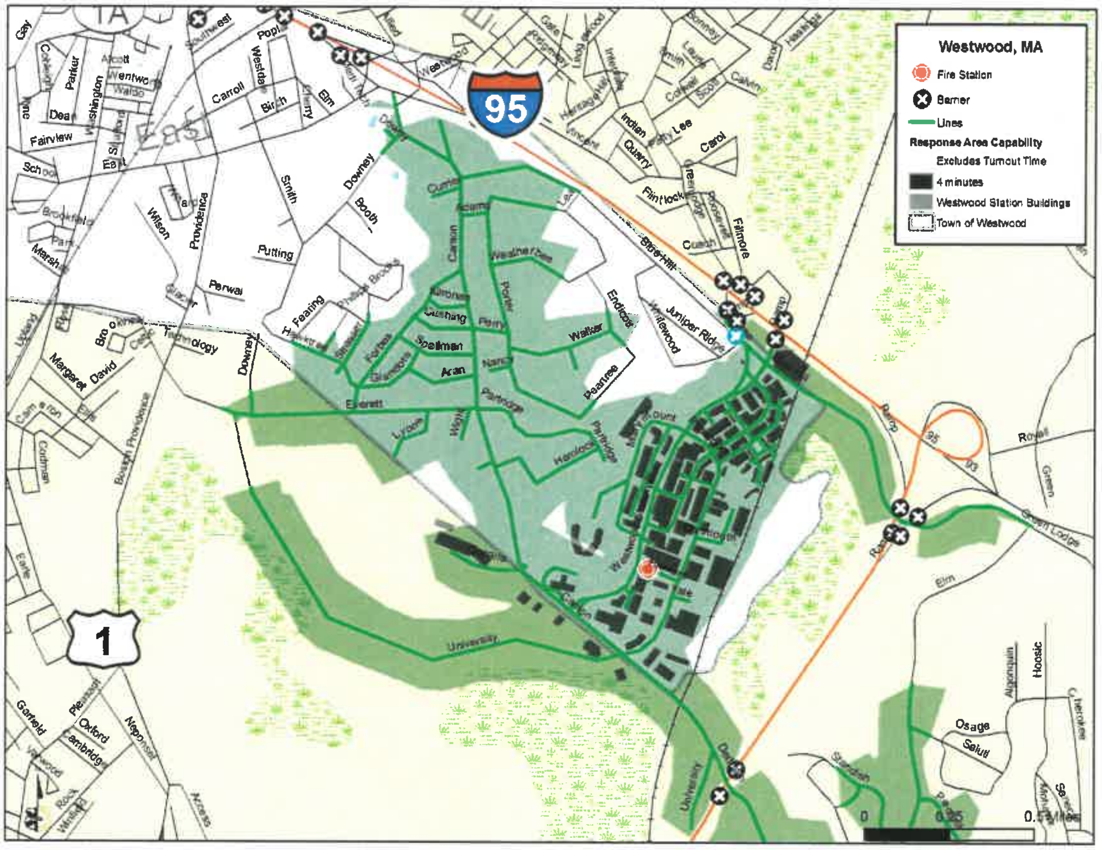
As seen in Figure 16, there are areas on the east of town which are outside of the five-minute response capability of Station 2. These areas could be served by an additional fire station in Westwood Station, but only if access via Canton Street and Blue Hill Drive were possible. Even with interstate access, which would allow for an exit near the Rotary, the apparatus would have to backtrack. A similar, extended route would occur as apparatus would need to travel on University Avenue to Everett Street before backtracking could commence. To illustrate this point, the following map restricts this new station's access to Canton Street and Blue Hill Drive.

Figure 54: Fire Station 3 with Local Street Barriers and Interstate Use



Taxpayers on either side of Canton Street and south of Blue Hill Drive who, through the town taxes, support the Westwood Station fire facility, would not benefit from it should limited access plans be approved. The following map illustrates the response capability of gated access only on Canton Street and no access on Blue Hill Drive.

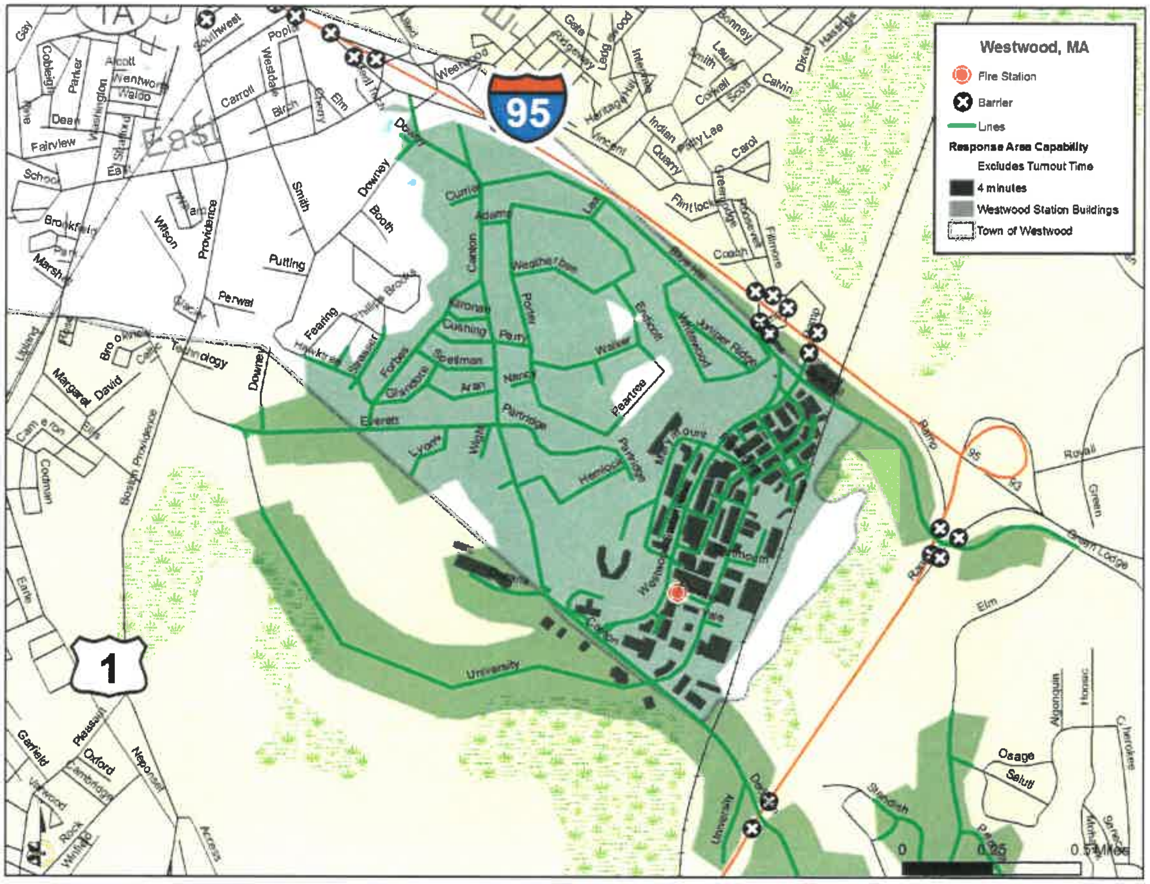
Figure 55: Station 3 Response Capability with Canton Street Access and No Interstate Use



Taxpayers southwest of Blue Hill Drive, up to and including Lea Road, would have extended response times from Station 3. The existing deployment travel time analysis does indicate that Station 2 can reach down Blue Hill Drive to the first intersection of Whitewood Road. Nonetheless, limiting access to either local route reduces the optimal response capability for fire apparatus to the taxpayers who support them.

The following figure illustrates gated access capability on both Canton Street and Blue Hill Drive.

Figure 56: Station 3 Response Capability with Gated Access and Interstate Restricted



At its proposed location, this station would provide necessary and timely fire protection not only to the Westwood Station but also to the nearby neighborhoods if dual gated access is installed. To reiterate, unrestricted local access is favored over the gated option.

The following map adds the other existing stations within the town, and color codes the streets by station, to indicate the closest station apparatus for future districting. The dual gated access option is shown in the figure and all stations are shown with a four-minute travel model.

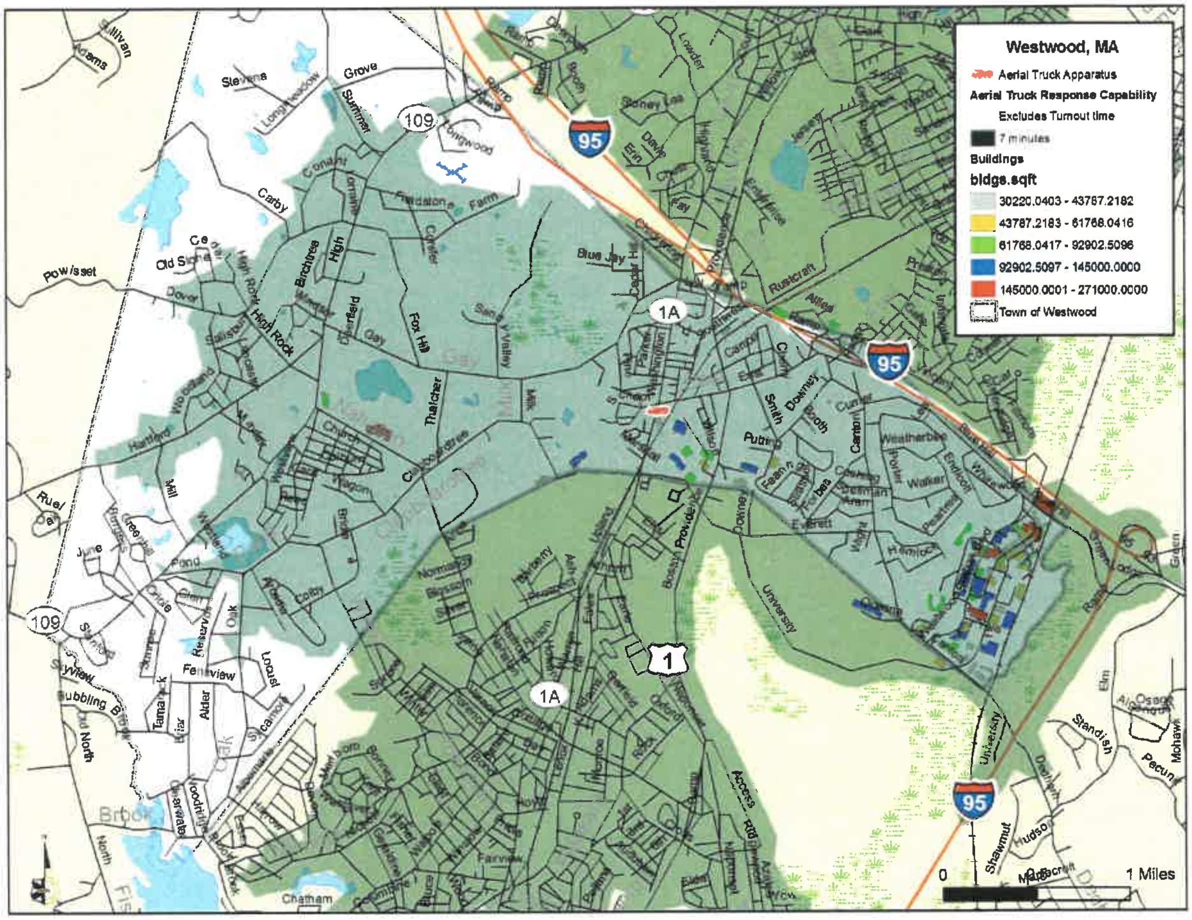
Station 3 Quint and Ambulance Option

A quint-type apparatus has similar capabilities as an aerial truck apparatus. It is a combination engine with an elevated master stream capability that meets the requirements for additional credit as a ladder truck. The limitation of this apparatus is that it cannot be staffed with enough firefighters to perform all the tasks capable with this vehicle until more manpower arrives. The next nearest staff would either be the ambulance personnel (if cross-staffing is eliminated) or personnel responding from Station 2. However, it is an industry-recognized option that is widely used in many parts of the country

Truck Relocation Option

If the current aerial apparatus were relocated from Station 1 to Station 2, it would be able to service the vast majority of the area and the larger square footage buildings within seven minutes of travel time as shown in the following figure. This would allow an engine-type of apparatus within Station 3 and have adequate staff and apparatus within NFPA parameters for an effective firefighting force. The truck for WFD must remain *longer, rather than taller* due to the East Street underpass, and it may have difficulty negotiating streets within Westwood Station. This fact favors either a quint or separate truck apparatus at Station 3.

Figure 58: Aerial Apparatus at Station 2



If Station 2 is determined to be inadequate in its current condition to house the aerial apparatus, either renovation of the site or relocation may be necessary if space is restrictive. This may also serve as sufficient justification for implementing the quint option listed above.

Staffing

Under a three-station option, the cross-staffing of the ladder company at Station 1, while not necessarily desirable, may continue to be an acceptable situation. Station 3 would require, at minimum, a fully staffed fire company due to the risks presented by the proposed land uses; and, due to the increased ambulance workload, a staffed ambulance company for the eastern end of the town is also highly advisable. Even with continued cross-staffing of the units at Station 1, a full structure alarm response within the town could produce two engines and a ladder company using resources from all three stations. This would be true regardless of the type of apparatus assigned to Station 3.

Three-Station Strategy Staffing and Cost Projections

This deployment plan calls for the continuing use of the two existing stations and the construction of one new station. For purposes of cost projection, the following assumptions were used:

- The new fire station is estimated at 6,325 square feet. This includes two drive-through bays and living space for up to eight personnel. Cost is estimated at $280 per square foot,[18] plus 7 percent for design fees and $750,000 for land acquisition and site preparation on an estimated three acres.

- The new fire station would require at least one engine company (or quint) and one ambulance company, 24 hours per day. The new engine company consists of one lieutenant and two firefighters per shift and the ambulance company consists of two firefighters per shift. All staffing costs[19] are estimated at $72,206 annually for each firefighter and $90,212 for each lieutentant[20]. Additional FTE's are added to accommodate the need to fill in for vacation and leave time at an estimated 30 percent leave ratio, though it is acknowledged that this leave time may be accommodated by overtime. A total of 20.8 firefighters and 5.2 lieutenants are included in this strategy cost projection. It should be noted that there would also be some initial costs at hiring for new equipment, uniforms, and training.

- Annual operating costs for new facilities (maintenance, supplies, and utilities only) are estimated at $4.00 per square foot.

- Although some redistribution of existing apparatus may occur, additional apparatus would be needed to meet the proposed number of fire stations. In this analysis, we assume the current ladder truck remains at Station 1 due to constraints of the current Station 2. Thus, we anticipate the option of assigning a quint apparatus to the new Station 3. One new quint is estimated at $550,000.[21] One new ambulance is estimated at $210,000, including equipment.

The following table projects capital and operating costs for this strategy. These costs are in addition to current operating costs of the department and, thus, would represent new funds needed to support the strategy.

[18] Square footage costs are detailed in the station cost addendum of this report and are derived from the D4 Cost Estimating System produced by DCD "Design Cost Data Magazine".
[19] All staffing costs include city pension and benefit contributions, worker's comp., and other benefits calculated at 25% of salary. Salary estimates are derived from the current draft 2008 budget.
[20]Amount used was average cost of a position in the classification.
[21] In this analysis, we project the cost of a quint (combination pumper with 75 foot aerial device) to permit maximum scoring in the ISO rating for ladder service.

Figure 59: Cost Projections, Three-Station Strategy

Three-Station Strategy Capital Costs	
New Fire Station #3	$ 2,644,970
Apparatus Additions	$ 760,000
TOTAL CAPITAL COSTS	**$ 3,404,970**
Strategy Annual Operating Cost Increases	
Annual Staffing	$ 1,970,987
Annual Operating Costs	$ 25,300
TOTAL ANNUAL OPERATING COSTS	**$ 1,996,287**

Two-Station Strategy

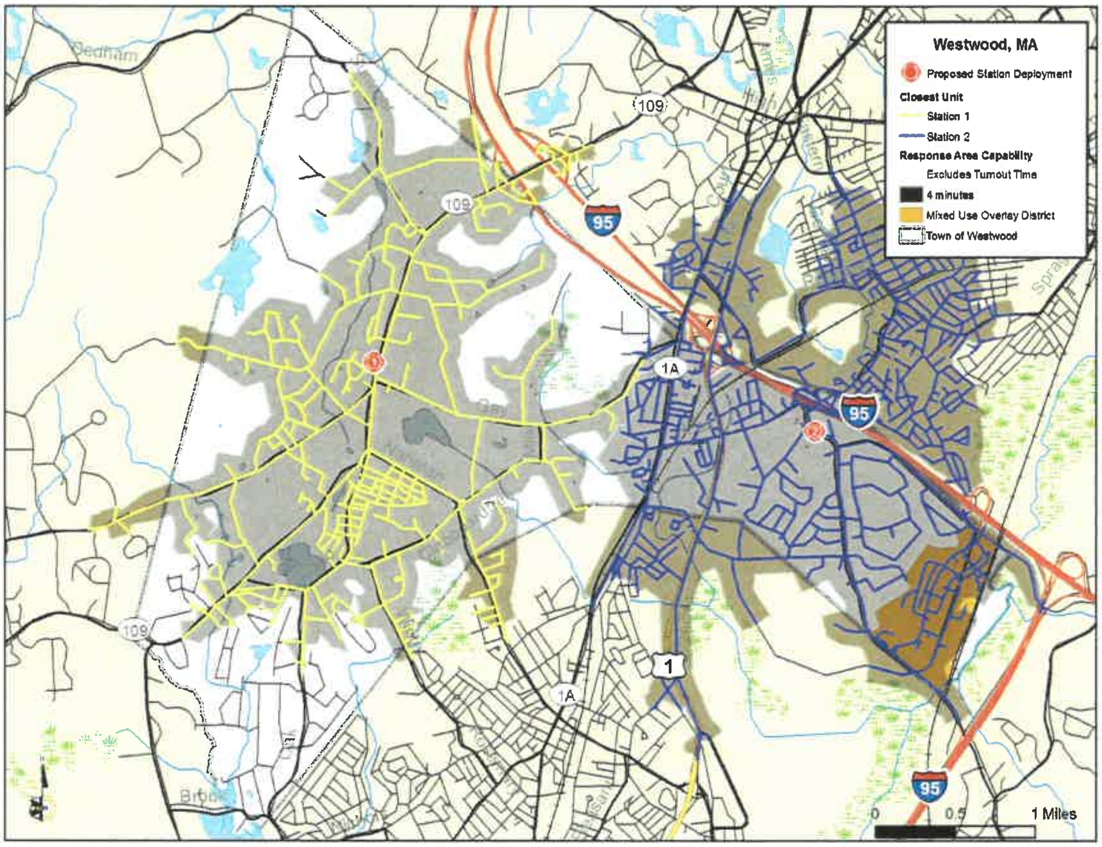
This strategy was explored due to the condition of Station 2 and its small size, limiting the ability to house additional apparatus. The option also looks at a potential relocation of Station 2 to an area in which no loss of current target response-time coverage would occur, but additional coverage in Westwood Station would be possible.

In this strategy, a specific location is described for future fire station construction or relocation. It should be noted that the specific location provides the point at which performance projection data was achieved and represents ESCi's recommended *best case* location. It is understood that additional factors such as land availability, zoning, traffic patterns, etc. will impact any decision on a specific fire station site. For these reasons, variations to the listed location are acceptable within a range of the equivalent of two or three city blocks. Any such variations will impact the performance projection of the strategy but not significantly enough to render it inaccurate.

Facility

The following map illustrates an alternate site for Station 2 on Canton Street, near the corner of Downey Street. Aerial photography shows several parcels in the area that are wooded while the parcel data provided to ESCi indicated that many are already owned by the Town.

Figure 60: Two-Station Strategy with Restricted Interstate Use



The new location for Station 2 provides improved coverage to the eastern side of Westwood, including the new development area of Westwood Station. This travel model restricts the use of the Interstate due to congestion and allows apparatus access to Westwood Station via dual gated access points. Some loss of coverage to neighborhoods north of Gay Street near the Interstate is noted. Fifteen calls were located within this area over the last two years.

Although the financial advantage of operating two stations versus three is intuitively more fiscally conservative, this strategy has some limitations. The response time into Westwood Station would be longer than the earlier strategy with a new Station 3 but less than from the current location of Station 2. The ISO recommended distance for engine companies (1.5 miles) and truck companies (2.5 miles) may not include all properties within Westwood Station. Additional manpower is still responding from Station 1 or mutual aid departments.

Apparatus

The new Station 2 would need to be able to house the current apparatus in addition to the aerial apparatus and an additional ambulance. It has been proven that a relocation of the aerial apparatus to this area of town would be beneficial throughout the jurisdiction. The additional ambulance would also need to be stationed at this facility to accommodate increased EMS service demand of Westwood Station.

Staffing

Under a two-station option, the cross-staffing of the ladder company is no longer an advisable practice. If the ladder was moved to Station 2 and cross-staffing continued, the department would not be able to produce a full structure alarm response of two engines and a ladder company. Given the increased risks presented by the multi-use occupancies and the increased possibility of call concurrency, the ladder unit is recommended for regular dedicated staffing. As stated in the previous strategy, due to the increased ambulance workload, a staffed ambulance company for the eastern end of the town is also highly advisable.

Two-Station Strategy Staffing and Cost Projections

This deployment plan calls for the continuing use of existing Station 1, and the construction of a new station to replace the current Station 2. For purposes of cost projection, the following assumptions were used:

- The new fire station is estimated at 14,000 square feet, adequate to provide training space and room for future relocation of administrative functions to the facility. This includes three drive-through bays and living space for up to ten personnel. Cost is estimated at $240 per square foot,[22] plus seven percent for design fees and $750,000 for land acquisition and site preparation on an estimated three acres.

- The new fire station would accommodate the existing engine company from Station 2, but would require staffing of the ladder company and one ambulance company 24 hours per day. The new ladder company consists of one lieutenant and two firefighters per shift and the ambulance company consists of two firefighters per shift. All staffing costs[23] are estimated at $72,206 annually for each firefighter and $90,212 for each lieutenant[24]. Additional FTE's are added to accommodate the need to fill in for vacation and leave time at an estimated 30 percent leave ratio, though it is acknowledged that this leave time may be

[22] Square footage costs are detailed in the station cost addendum of this report and are derived from the D4 Cost Estimating System produced by DCD "Design Cost Data Magazine".
[23] All staffing costs include city pension and benefit contributions, worker's comp., and other benefits calculated at 25 percent of salary. Salary estimates are derived from the current draft 2008 budget.
[24]Amount used was average cost of a position in the classification.

accommodated by overtime. A total of 20.8 firefighters and 5.2 lieutenants are included in this strategy cost projection. It should be noted that there would also be some initial costs at hiring for new equipment, uniforms, and training.

- Annual operating costs for new facilities (maintenance, supplies, and utilities only) are estimated at $4.00 per square foot.

- Although some redistribution of existing apparatus may occur, additional apparatus would be needed to meet the proposed number of fire stations. In this analysis, we assume the current ladder truck moves to the new Station 2, along with the existing Station 2 engine. One new ambulance is estimated at $210,000, including equipment.

The following table projects capital and operating costs for this strategy. These costs are in addition to current operating costs of the department and, thus, would represent new funds needed to support the strategy.

Figure 61: Cost Projections, Two-Station Strategy

Two-Station Strategy Capital Costs	
Replacement of Station #2	$ 4,345,200
Apparatus Additions	$ 210,000
TOTAL CAPITAL COSTS	**$ 4,555,200**
Strategy Annual Operating Cost Increases	
Annual Staffing	$ 1,970,987
Annual Operating Costs	$ 56,000
TOTAL ANNUAL OPERATING COSTS	**$ 2,026,987**

Findings and Conclusions

ESCi conducted service demand projections for the Westwood Station development using multiple methods of analysis. These figures translate to between **1.45 and 2.31 new calls per day** within Westwood Station at project completion, and total service demand is projected to increase from 25 to 40 percent for the WFD.

It is clear from the analysis of projected building heights and sizes that the Westwood Station area would be expected to meet the necessary requirements for aerial devices or elevated ladders. Buildings over three stories and/or greater than 35,000 square feet qualify for recommended aerial fire truck apparatus for firefighting operations by the Insurance Services Office (ISO) in the Community Fire Protection Rating.

ISO would consider the engine at Station 2 to be too far from properties within Westwood Station for purposes of distribution credit. At best, from its current location, Station 2 could achieve a seven-minute response time into Westwood Station. A seven-minute response time is not within fire department goals. Given the projected quantity of calls expected in Westwood Station, this response time would significantly degrade the department's overall average and 90th percentile response time performance, thereby achieving a significant negative impact from the presence of the development unless fire department capability is altered to accommodate the development.

ESCi has provided two strategies within this report for accommodating the growth in service demand expected from Westwood Station. The first is a three-station strategy that would require the construction of a new fire station within the Westwood Station development. For optimum results from this strategy, we recommend the placement of a combination pumper/ladder, known as a quint, along with an additional ambulance. Required staffing for these two companies would necessitate the addition of between 20 and 26 new personnel (depending on the method of overtime accommodation). Capital costs in this strategy are projected at $3,404,970, while annual operating costs can be expected to increase by $1,996,287.

The second strategy is a two-station strategy that would require the replacement of the current Station 2 with a new facility located further east. For optimum results from the strategy, and to permit the department to initiate a full structural response at dispatch, we recommend that the department's ladder truck be relocated to this station and staffed with a full-time crew. The station should also be assigned an ambulance with a crew. Again, required staffing for these two companies would necessitate the addition of between 20 and 26 new personnel. Capital costs in this strategy are projected at $4,555,200, while annual operating costs can be expected to increase by $2,026,987.

Emergency Services Consulting inc. believes that good master planning decisions are best made by informed local elected officials and we have endeavored to provide adequate data and analysis in this report to support the decision-making effort. The Town of Westwood can use the information and performance projections in this report to confidently select an appropriate future deployment strategy, knowing that the decision is based on sound principles of data analysis.

Appendix

Fire and Emergency Medical Event Dynamics

Dynamics of Fire in Buildings

Most fires within buildings develop in a predictable fashion, unless influenced by highly flammable material. Ignition, or the beginning of a fire, starts the sequence of events. It may take some minutes or even hours from the time of ignition until flame is visible. This smoldering stage is very dangerous, especially during times when people are sleeping, since large amounts of highly toxic smoke may be generated during early phases.

Once flames do appear, the sequence continues rapidly. Combustible material adjacent to the flame heats and ignites which in turn heats and ignites other adjacent materials if sufficient oxygen is present. As the objects burn, heated gases accumulate at the ceiling of the room. Some of the gases are flammable and highly toxic.

The spread of the fire continues quickly. Soon the flammable gases at the ceiling reach ignition temperature. At that point, an event termed *flashover* takes place; the gases ignite, which in turn ignites everything in the room. Once flashover occurs, damage caused by the fire is significant and the environment within the room can no longer support human life.

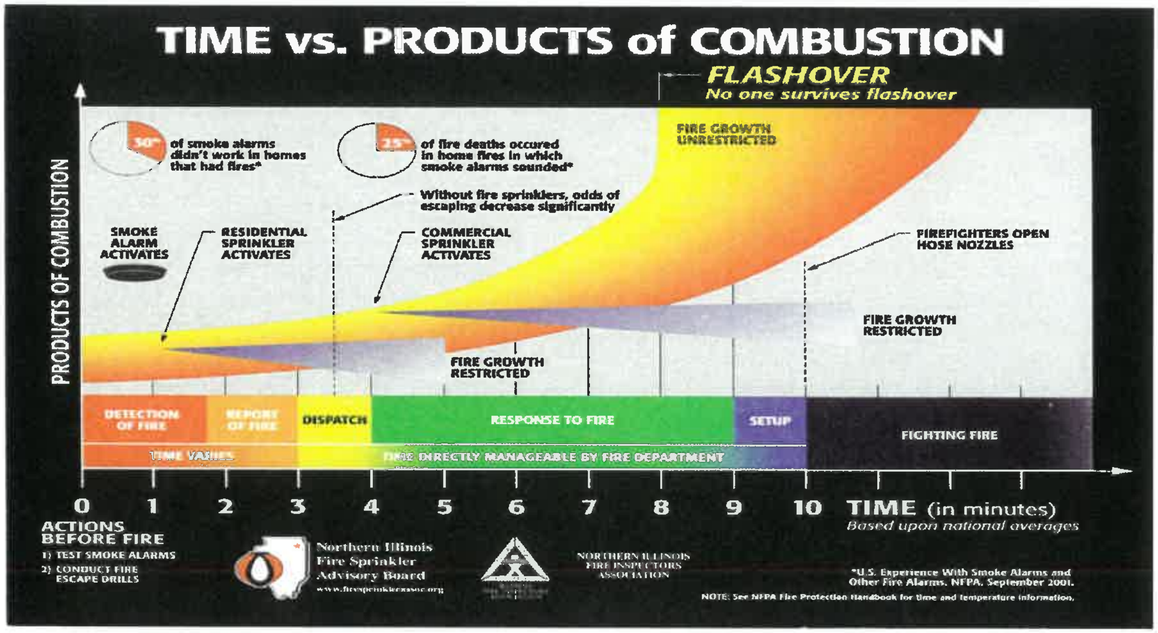
Flashover usually happens about five to eight minutes from the appearance of flame in typically furnished and ventilated buildings. Since flashover has such a dramatic influence on the outcome of a fire event, the goal of any fire agency is to apply water to a fire before flashover takes place.

Perhaps as important as preventing flashover is the need to control a fire before it does damage to the structural framing of a building. Materials used to construct buildings today are often less fire resistive than the heavy structural skeletons of older frame buildings. Roof trusses and floor joists are commonly made with lighter materials more easily weakened by the effects of fire. *Light weight* roof trusses fail after five to seven minutes of direct flame impingement. Plywood I-beam joists can fail after as little as three minutes of flame contact. This creates a very dangerous environment for firefighters.

In addition, the contents of buildings today have a much greater potential for heat production than in the past. The widespread use of plastics in furnishings and other building contents rapidly accelerate fire spread and increase the amount of water needed to effectively control a fire. All of these factors make the need for early application of water essential to a successful fire outcome.

A number of things must happen quickly to make it possible to achieve fire suppression prior to flashover. The figure below illustrates the sequence of events.

Figure 62: Fire Growth vs. Reflex Time



The reflex time continuum consists of five steps, beginning with ignition and concluding with the application of (usually) water. The time required for each of the five components varies. The policies and practices of the fire department directly influence three of the steps, but two are only indirectly manageable. The five parts of the continuum are:

1. **Detection**: The detection of a fire may occur immediately if someone happens to be present or if an automatic system is functioning. Otherwise, detection may be delayed, sometimes for a considerable period.

2. **Report**: Today most fires are reported by telephone to the 9-1-1 center. Call takers must quickly elicit accurate information about the nature and location of the fire from persons who

are apt to be excited. A citizen well trained in how to report emergencies can reduce the time required for this phase.

3. **Dispatch**: The dispatcher must identify the correct fire units, subsequently dispatch them to the emergency, and continue to update information about the emergency while the units respond. This step offers a number of technological opportunities to speed the process including computer aided dispatch and global positioning systems.

4. **Turnout and Response**: Firefighters must don firefighting equipment, assemble on the response vehicle, and begin travel to the fire. Good training and proper fire station design can minimize the time required for this step. The distance between the fire station and the location of the emergency influences reflex time the most. The quality and connectivity of streets, traffic, driver training, geography, and environmental conditions are also a factor.

5. **Set up**: Last, once firefighters arrive on the scene of a fire emergency, fire apparatus are positioned, hose lines stretched out, additional equipment assembled, and certain preliminary tasks performed (such as rescue) before entry is made to the structure and water is applied to the fire.

As is apparent by this description of the sequence of events, application of water in time to prevent flashover is a serious challenge for any fire department. It is critical, though, as studies of historical fire loss data can demonstrate.

The National Fire Protection Association studied data from residential structures occurring between 1994 and 1998 in order to analytically quantify the relationship between the growth of a fire beyond the room of origin and losses in life and property. As the figure below clearly indicate, fires contained to the room of origin (typically extinguished prior to or immediately following flashover) had significantly lower rates of death, injury, and property loss when compared to fires that had an opportunity to spread beyond the room of origin (typically extinguished post-flashover). Incidents in which a fire spreads beyond the room where it originates are likely to experience six times the amount of property loss and have almost nine times greater chance of resulting in a fatality.

Figure 63: Fire Growth to Life and Property Loss, National Data

Fire Extension in Residential Structure Fires 1994 - 1998			
Extension	***Rates per 1,000 Fires***		
	Civilian Deaths	***Civilian Injuries***	***Dollar Loss Per Fire***
Confined to room of origin	2.32	35.19	$3,385
Beyond room of origin; confined to floor of origin	19.68	96.86	$22,720
Beyond floor of origin	26.54	63.48	$31,912

Emergency Medical Event Sequence

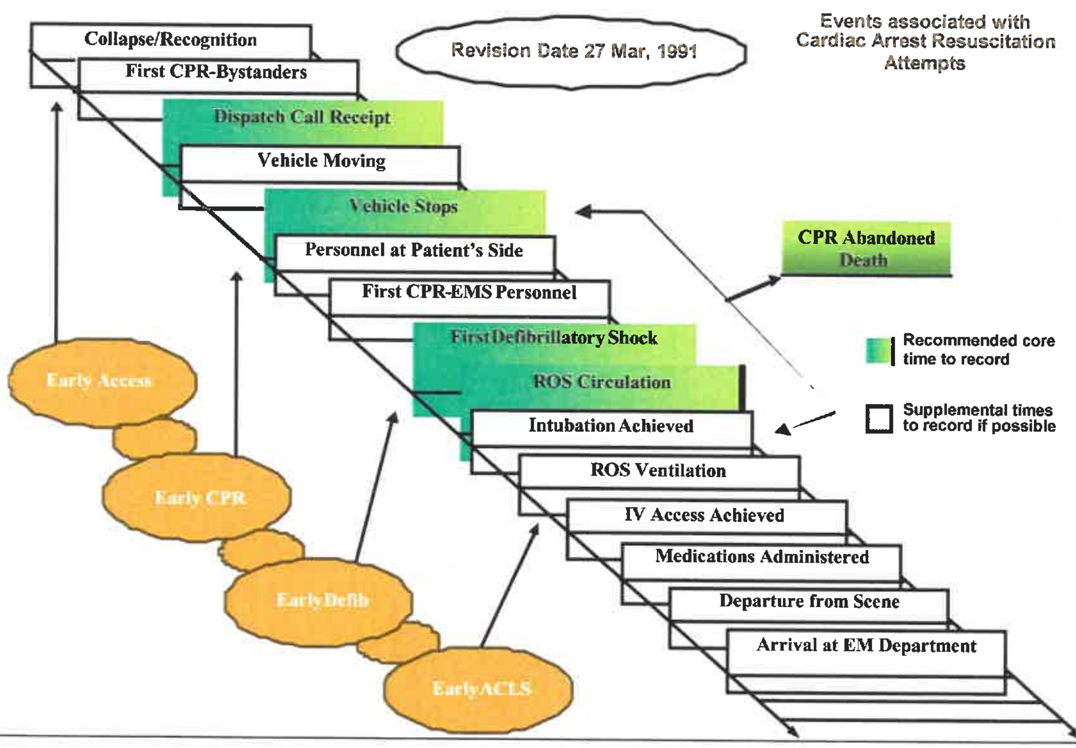
Cardiac arrest is the most significant life threatening medical event. A victim of cardiac arrest has mere minutes in which to receive definitive lifesaving care if there is to be any hope for resuscitation.

Recently, the American Heart Association (AHA) issued a new set of cardiopulmonary resuscitation guidelines designed to streamline emergency procedures for heart attack victims, and to increase the likelihood of survival. The AHA guidelines include new goals for the application of cardiac defibrillation to cardiac arrest victims.

Heart attack survival chances fall by seven to ten percent for every minute between collapse and defibrillation. Consequently, the AHA now recommends cardiac defibrillation within five minutes of cardiac arrest.

As with fires, the sequence of events that lead to emergency cardiac care can be visually shown, as in the following figure.

Figure 64: Cardiac Arrest Event Sequence (Utstein Criterion)



The percentage of opportunity for recovery from cardiac arrest drops quickly as time progresses. The stages of medical response are very similar to the components described for a fire response. Recent research stresses the importance of rapid cardiac defibrillation and administration of certain drugs as a means of improving the opportunity for successful resuscitation and survival. An Oregon fire department recently studied the effect of time on cardiac arrest resuscitation and found that nearly all of their *saves* were within one and one-half miles of a fire station, underscoring the importance of quick response.

People, Tools, and Time

Time matters a great deal in the achievement of an effective outcome to an emergency event. Time, however, isn't the only factor. Delivering sufficient numbers of properly trained, appropriately equipped, personnel within the critical time period completes the equation.

For medical emergencies this can vary based on the nature of the emergency. Many medical emergencies are not time critical. However, for serious trauma, cardiac arrest, or conditions that may lead to cardiac arrest, response time is very critical.

Equally critical is delivering enough personnel to the scene to perform all of the concurrent tasks required to deliver quality emergency care. For a cardiac arrest this can be up to six personnel; two to perform CPR, two to set up and operate advanced medical equipment, one to record the actions taken by emergency care workers, and one to direct patient care.

Thus, for a medical emergency the real test of performance is the time it takes to provide the personnel and equipment needed to deal effectively with the patient's condition, not necessarily the time it takes for the first person to arrive.

Fire emergencies are even more resource critical. Again, the true test of performance is the time it takes to deliver sufficient personnel to initiate application of water on the fire. This is the only practical method to reverse the continuing internal temperature increases and ultimately prevent flashover. The arrival of one person with a portable radio does not provide fire intervention capability and should not be counted as *arrival* by the fire department.

In order to legally enter a building to conduct interior firefighting operations, at least four personnel must be on scene. The initial arrival of effective resources should be measured at the point in time when at least four personnel, properly trained and equipped, have assembled at the fire.

Emergency service agencies should have clearly defined response performance objectives established to allow evaluation of capability and service delivery. An organization's performance objectives should clearly state both the current and desired emergency service capabilities in very measurable terms. For emergency response, performance objectives should define response performance using both time and resource criteria. For example:

- *Provide for the arrival of adequate resources to initiate basic emergency medical services at the scene of any medical emergency within "X" minutes following dispatch, 90 percent of the time.*

- *Provide for the arrival of adequate resources to initiate interior fire suppression operations at the scene of any fire within "X" minutes following dispatch, 90 percent of the time.*

With specific performance criteria, a fire department can develop deployment methodologies to achieve desired levels of performance, and can quickly identify when conditions in the environment degrade performance.

New Fire Station Cost Projections

New Fire Station 3 Cost Estimate

Project Information			
Projected Size	6,325	Projected Location	MA - Boston
Building Height	30.6	Projected Date	Jan 2008
Building Use	Civic/Gov.	Foundation	CON
Number of Buildings	2	Exterior Wall	CMU
Site Size	39,360	Interior Wall	WOD
1st Floor Size		Roof Type	MET
1st Floor Height		Floor Type	TIL
Number of Floors	1	Project Type	NEW

Building Costs				
Division #	Label	Projected %	Projected Sq. Cost	Projected
00	Bidding Requirements	9.76 %	$25.58	$161,811.38
	Bidding Requirements	9.76 %	$25.58	$161,811.38
01	General Requirements	4.89 %	$12.82	$81,089.27
	Specifications	4.89 %	$12.82	$81,089.27
03	Concrete	11.69 %	$30.63	$193,744.57
	Concrete	11.69 %	$30.63	$193,744.57
04	Masonry	13.54 %	$35.48	$224,442.59
	Masonry	13.54 %	$35.48	$224,442.59
05	Metals	2.75 %	$7.21	$45,582.58
	Metals	2.75 %	$7.21	$45,582.58
06	Wood & Plastics	7.69 %	$20.16	$127,509.39
	Woods & Plastics	7.69 %	$20.16	$127,509.39
07	Thermal & Moisture Protection	5.01 %	$13.13	$83,070.61
	Thermal & Moisture Protection	5.01 %	$13.13	$83,070.61
08	Doors & Windows	6.19 %	$16.22	$102,608.18
	Doors & Windows	6.19 %	$16.22	$102,608.18
09	Finishes	5.74 %	$15.05	$95,180.28
	Finishes	5.74 %	$15.05	$95,180.28
10	Specialties	1.33 %	$3.49	$22,055.27
	Specialties	1.33 %	$3.49	$22,055.27
11	Equipment	1.66 %	$4.34	$27,456.14
	Equipment	1.66 %	$4.34	$27,456.14
12	Furnishings	2.74 %	$7.19	$45,472.60
	Furnishing	2.74 %	$7.19	$45,472.60
13	Special Construction	2.80 %	$7.33	$46,360.90
	Special Constructions	2.80 %	$7.33	$46,360.90

Building Costs				
Division #	Label	Projected %	Projected Sq. Cost	Projected
15	Mechanical	14.01 %	$36.72	$232,283.34
	Mechanical	14.01 %	$36.72	$232,283.34
16	Electrical	10.20 %	$26.72	$169,026.09
	Electrical	10.20 %	$26.72	$169,026.09
	Total Building Costs	100 %	$262.09	$1,657,693.20

Site Costs				
Division #	Label	Projected %	Projected Sq. Cost	Projected
02	Site Work	100.00 %	$2.92	$115,056.25
	Site Work	100.00 %	$2.92	$115,056.25
	Total Site Costs	100 %	$2.92	$115,056.25

Total Project Costs				
		Projected %	Projected Sq. Cost	Projected
	Total Project Costs	--	--	$1,772,749.45

Project Notes

Cost estimate based on Los Angeles County Fire Station #131, Palmdale, California

Cost projected to Boston, Massachusetts construction market for January 2008.

Special Project Notes

The facility is a 6,000-square-foot fire station/site development project. The facility is located on a main street corner between an established residential neighborhood and a newly developed commercial center. Major station activity occurs at either the front, where fire trucks exit onto a major thoroughfare, or the rear, where vehicle parking, maintenance, fueling, hose drying or personnel training occurs.

Efficiently designed to eliminate connecting hallways, this fire station employs a "split'" floor plan design concept which uses the apparatus room to separate active group areas from more passive areas. The "active" side contains the entry, station office, public restroom, kitchen, dining and recreation room. The "passive" side contains the dormitory, locker cubicles, bathrooms and exercise room. Both sides connect to the 2-bay apparatus room where vehicles are parked. Special features include a glass walled entry to greet visitors at the main street entrance, an open plan kitchen/dining/recreation room with patio access; and semi-private sleeping cubicles which contain a bed, study desk and lockers.

Replacement Fire Station 2 Cost Estimate

Project Information			
Projected Size	14,000	Projected Location	MA - Boston
Building Height	36.8	Projected Date	Jan 2008
Building Use	Civic/Gov.	Foundation	CON
Number of Buildings	1	Exterior Wall	MAS
Site Size	217,156	Interior Wall	GYP
1st Floor Size		Roof Type	MEM
1st Floor Height		Floor Type	CON
Number of Floors	1	Project Type	NEW

Building Costs				
Division #	Label	Projected %	Projected Sq. Cost	Projected
01	General Requirements	13.64 %	$30.97	$433,640.14
	General Conditions	13.64 %	$30.97	$433,640.14
03	Concrete	7.78 %	$17.67	$247,310.39
	Cast-in-place	7.10 %	$16.13	$225,854.24
	Misc Laborer	0.14 %	$0.32	$4,517.08
	Pre-cast	0.53 %	$1.21	$16,939.07
04	Masonry	15.13 %	$34.36	$481,069.53
	Mason	0.07 %	$0.16	$2,258.54
	Unit	15.06 %	$34.20	$478,810.99
05	Metals	11.37 %	$25.81	$361,366.78
	Structural Steel/Misc Metal	11.37 %	$25.81	$361,366.78
06	Wood & Plastics	3.13 %	$7.10	$99,375.87
	Architectural Woodwork	0.78 %	$1.77	$24,843.97
	Misc Carpenter	0.21 %	$0.48	$6,775.63
	Rough Carpentry	2.13 %	$4.84	$67,756.27
07	Thermal & Moisture Protection	10.48 %	$23.80	$333,135.00
	Roofing	10.30 %	$23.39	$327,488.65
	Sealants	0.18 %	$0.40	$5,646.36
08	Doors & Windows	4.33 %	$9.84	$137,771.09
	Glass & Glazing	2.06 %	$4.68	$65,497.73
	Sectional Overhead Doors	0.78 %	$1.77	$24,843.97
	Steel Doors & Frames	1.49 %	$3.39	$47,429.39
09	Finishes	8.31 %	$18.87	$264,249.46
	Acoustical Ceilings	0.36 %	$0.81	$11,292.71
	Carpet & VCT	0.57 %	$1.29	$18,068.34

Building Costs				
Division #	**Label**	**Projected %**	**Projected Sq. Cost**	**Projected**
	Ceramic Tile	0.78 %	$1.77	$24,843.97
	Metal Stud & Gypsum Board	5.54 %	$12.58	$176,166.31
	Misc Painter	0.14 %	$0.32	$4,517.08
	Painting	0.92 %	$2.10	$29,361.05
10	Specialties	1.28 %	$2.90	$40,653.76
	Specialties	1.28 %	$2.90	$40,653.76
11	Equipment	0.82 %	$1.86	$25,973.24
	Food Service	0.11 %	$0.24	$3,387.81
	Misc Equipment	0.71 %	$1.61	$22,585.42
15	Mechanical	15.10 %	$34.28	$479,969.62
	Above Ground DWV	0.63 %	$1.42	$19,875.17
	Ductwork, Connectors, Liner	1.66 %	$3.76	$52,624.04
	Fans, Heat Exchangers	2.02 %	$4.60	$64,368.46
	Heat Pumps, Electric Heaters	2.49 %	$5.65	$79,048.98
	Outside & Ug. Geothermal Wells	3.48 %	$7.90	$110,668.58
	Plumbing	1.03 %	$2.34	$32,748.86
	Pre- construction planning	0.72 %	$1.65	$23,037.13
	Start-up of the HVAC	0.60 %	$1.37	$19,226.97
	Underground DWV	1.12 %	$2.55	$35,684.97
	Water, Air & Gas Piping	1.34 %	$3.05	$42,686.45
16	Electrical	8.64 %	$19.61	$274,521.31
	Conduit & Rough-in	1.71 %	$3.89	$54,518.96
	Hookups to Equipment	0.57 %	$1.30	$18,147.39
	Lighting	3.32 %	$7.54	$105,577.82
	Mobilization	0.43 %	$0.97	$13,551.25
	Paging	0.53 %	$1.20	$16,864.54
	Switchgear & Panel Boards	1.36 %	$3.09	$43,242.05
	Wire & Wire Pulling	0.71 %	$1.62	$22,619.30
	Total Building Costs	100 %	$227.07	$3,179,036.20

Site Costs				
Division #	Label	Projected %	Projected Sq. Cost	Projected
02	Site Work	100.00 %	$0.82	$178,224.65
	Bituminous Paving	38.65 %	$0.32	$68,879.09
	Earthwork	30.92 %	$0.25	$55,103.27
	Landscaping	15.46 %	$0.13	$27,551.64
	Septic Tanks	6.76 %	$0.06	$12,053.84
	Water Production Well	8.21 %	$0.07	$14,636.81
	Total Site Costs	100 %	$0.82	$178,224.65

Total Project Costs				
		Projected %	Projected Sq. Cost	Projected
	Total Project Costs	--	--	$3,357,260.85

Project Notes

Cost estimate based on new fire station in Ramsey, Minnesota

Cost projected to Boston, Massachusetts construction market for January 2008.

Special Project Notes

The existing fire response facility for the City of Ramsey was inadequate because of the lack of training space capabilities and inadequate space to house the new fire truck recently purchased by the fire squad. To protect new and existing equipment and provide quicker response times, a new fire station was built for the Ramsey community. The design challenge was to provide an emergency response service in a quiet, residential neighborhood.

The design of the administration area took advantage of the open southern exposure to the sun. Office space and conference rooms were arranged around the perimeter of the floor plan to maximize natural light and heat gain during the winter. The open apparatus bay with clerestory windows was painted white to reflect natural light and make the space seem brighter, emphasizing the cleanliness that is associated with a fire station.

The mechanical system consists of geothermal heating and cooling units. The city received a rebate and a reduced per-kilowatt-hour rate.

DISCLAIMER

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