FIRE STATION LOCATION STUDY FOR THE TOWN OF STONEHAM, MASSACHUSETTS

December 3, 2017

Project Contact
The Carlson Group
Travis Miller
978.327.3112
travis@carlsonmed.com

Contents

Mr. Travis Miller
The Carlson Group
16 Balmoral Street, Unit 114
Andover, MA 01810

December 3, 2017

Mr. Matt Grafton
Fire Chief
Town of Stoneham
25 Central St
Stoneham, MA 02180

Chief Grafton,

The Carlson Group is pleased to present the Station Location Study for the Stoneham Fire Department. It has been a true pleasure to work with you, during this process. The Town of Stoneham is a dynamic community, and you are all fortunate to live and work there!

The Town of Stoneham is evolving in a number of ways that are impacting the Fire Department, and that are impacting the delivery of "all hazards", i.e.: fire, emergency medical (EMS), in the community and in several neighboring communities. Growth in call volume has continued at a steady pace over the years, and given current developments and planned developments it appears that this trend will continue. Adapting to these changes, and findings ways to continue to provide exceptional services with rapid response times will need to be a major focus of the Fire Department, the Town Administrator, and the Town for years to come.

This document focuses on evaluating several specific sites as a location for a sub-station for the Fire Department. The documents also examines the question about where to locate the headquarters were a new sub-station be built. This was done using several years of current data, inflated to account for known or planned developments.

If you have any questions, please do not hesitate to contact Travis Miller via email: travis@carlsonmed.com.

Sincere Regards,

The Carlson Group

The Town of Stoneham retained the Carlson Group, a national public safety management consulting firm, to conduct an evaluation of the potential for siting a Fire Department sub-station. This analysis is primarily focused on the following issues:

- One of the legislators who represents the Town of Stoneham has indicated that a parcel of land on North Border Road across the street from the Hall Memorial Pool.
- Are there other sites in Town that would make better sense as a sub-station location?
- If a sub-station is constructed on one of the tested locations, where should headquarters go if the decision is ever taken to repurpose that location?

The Station Location Study for the Stoneham Fire Department was developed through the work of an outside consultant from the Carlson Group. Data and other support to the consultant was provided by staff from the Fire Department.

1. Methodology

The Carlson Group was retained by the Town of Stoneham to work with the Stoneham Fire Department to evaluate several specific sites as potential locations for a new Fire Department sub-station. The current headquarters, while much beloved within the Department, is beginning to be challenging in terms of space and modernization. There are questions about the value of the site as an alternative use as well, and so the study addresses some options for a future relocation of the headquarters station.

In order to accomplish this study, the project team from the Carlson Group utilized a methodology which we have developed over the course of many such projects. That approach is briefly described below:

- We collect several years of detailed data regarding calls for service handled by the Fire Department.
- Concurrently, we collect data regarding on-going development projects as well as planned projects, so that we can ascribe future workload to those locations.
- Using all but one year of data, we build a response-time model using a GIS system, against which we predict the year of data we held back so we can make adjustments to travel speeds, intersection delays and the like, until the model predicts within 95% the actual response-time experience of the Town.
- In this case, where we are examining specific locations, we calculate the drive-times to those call locations that make up 50%+1 of the calls handled by the Fire Department. We do this for several reasons:

    - It reduces the computational requirements to something which can be reasonably done.
    - It ensures that the system is designed to be able to effectively respond to those call locations which make up the majority of the Department's workload.
- After the GIS system has calculated the travel time from each possible station location to each of the call locations included in the 50%+1, the project team then calculates an expected response time. This is a weighted average response time for these call locations. For comparison sake, we calculate it for the existing system (it differs from actual average response time) and for each scenario.

The next section briefly describes the current deployment within the Stoneham Fire Department.

2. Current Situation

The Stoneham Fire Department operates as a first responder to EMS calls within the Town of Stoneham, and provides first response to all other life / safety concerns including fires, accidents, etc. To do this, the Fire Department currently operates from a single station, located roughly in the center of town located at 25 Central Street, and depicted in the photo on the right.

The Fire Department does not staff any ambulances (this is handled by Action Ambulance) but does staff the following:

- Engine 2: Lieutenant and 2 or 3 Firefighters;
- Engine 3: 2 Firefighters when staffing permits (shown to the left);
- Ladder 1: 1 Captain and 2 or 3 Firefighters (shown to the right).

This approach to staffing would enable the Fire Department, with perhaps the addition of some personnel, to shift one of the engines to a new sub-station with minimal disruption to operations.

3. ANALYSIS AND RESULTS

Working closely with the Fire Chief, our project team toured the Town of Stoneham to physically inspect the original proposed location on North Border Road. We also examined the locations of currently underway, as well as planned developments in the Town. This included gaining an understanding of the road network, and challenges, in the Town.

The locations identified include:

- Current Headquarters at 25 Central Street
- Parcel(s) on North Border Road
- Lot across from Stoneham High School
- William / Central Street (near the school)
- Fellsway East

Each of these scenarios was run using our GIS models, and the expected response time (ERT) was calculated for each option. The resulting ERT is shown, as well as the "rank" of each option.

Figure 1: Expected Response Times

Scenario	Location(s) of Fire Stations	Calculated: Expected Response Time [1]	Rank
1	Current Headquarters	2.51 Mins	5
2	Current Headquarters & North Border	2.32 Mins	3
3	Current Headquarters & Near Stoneham High School	2.32 Mins	4
4	North Border & William Street / Central Street	2.02 Mins	1
5	Current Headquarters & Fellsway East (Metro)	2.14 Mins	2

Note that the single station option, despite its excellent original location, is the least effective at provide rapid response times. However, the two-stations models, on average, reduce the response time between 10 and 35 seconds, on average, per call.

- Adding a sub-station on North Border Road (either at the location intended for a VFW hall, or across the street adjacent to the pool) would cut 15-20 seconds off response times on average.

[1] Calculated Expected Response Time: take current calls that are 50%+1 call, calculate drive times from closest available station in each scenario. Weight by the number of calls for each location. Calculate average response time.

- Doing that in conjunction with eventually shifting the headquarters slightly to the north of its current location would reduce response times more than any other option considered, by more than 35 seconds on average.
- The other options fall in between these two, depending on the location of the sub-stations.
- It should be noted that the proposes site for the VFW location on North Border Road would be a very challenging construction site. The site includes visible ledge, visible wetlands, elevation changes, and site line issues with respect to traffic in both directions.

CONCLUSION: The Town should work closely with its delegation to explore the possibility of building a sub-station on the land adjacent to the pool. This site is already graded, has no visible ledge or wetlands, and has excellent site lines for entering the roadway.

The project team has provided maps for each of these alternatives on the following pages.

Figure 2: Response Times – Scenario 1: Current Headquarters

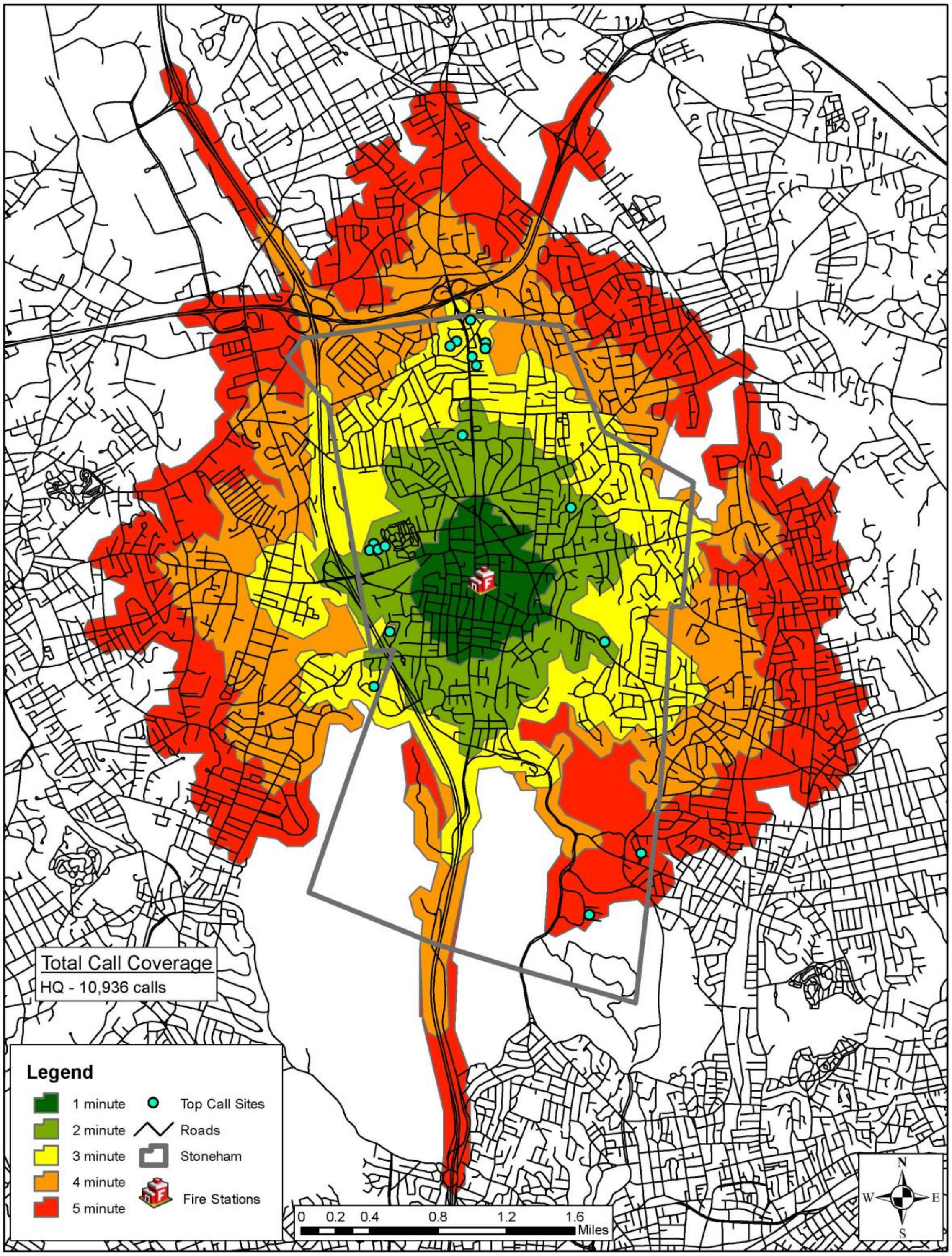


Figure 3: Response Times – Scenario 2: Current Headquarters & North Border

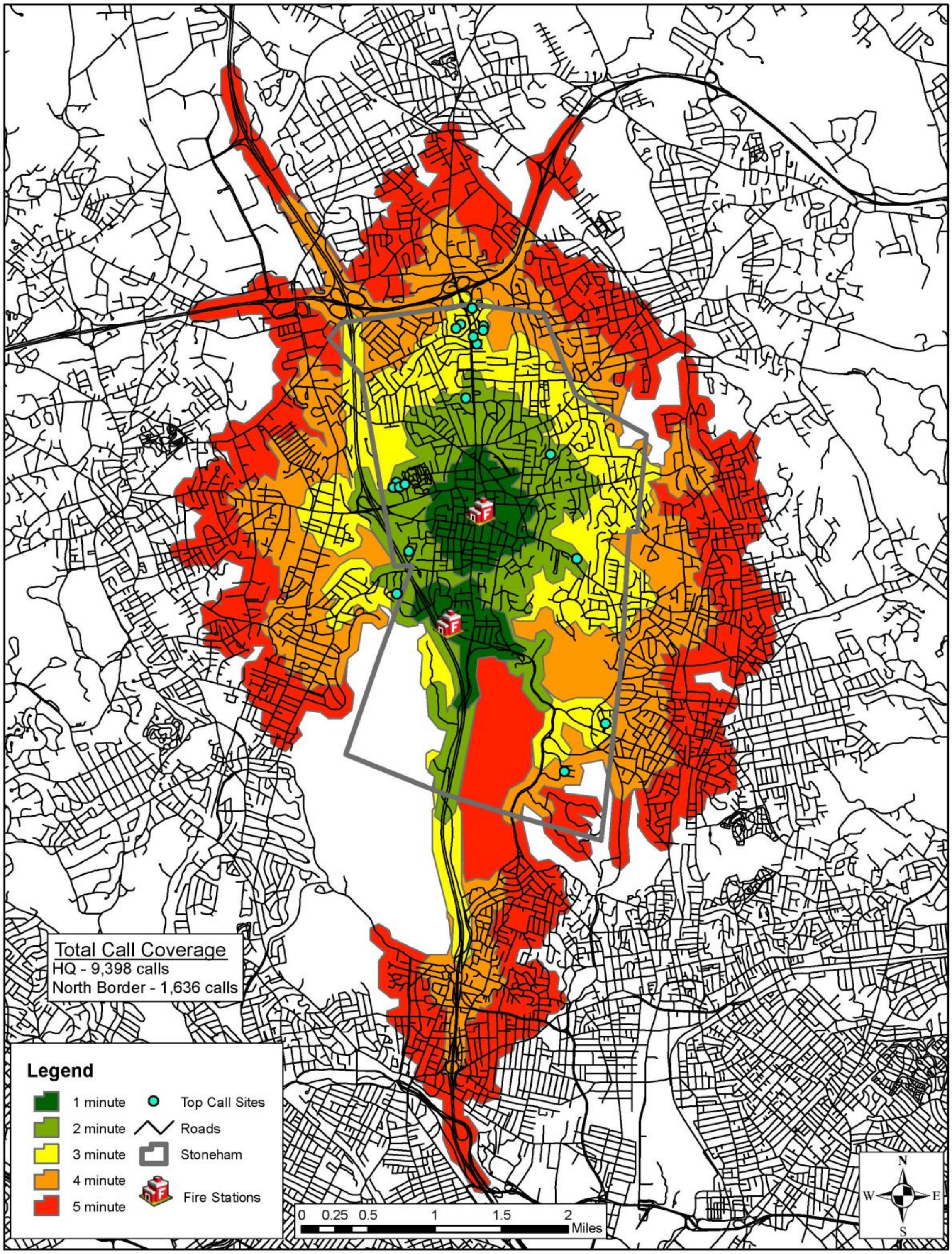


Figure 4: Response Times – Scenario 3: Current Headquarters & Near the High School

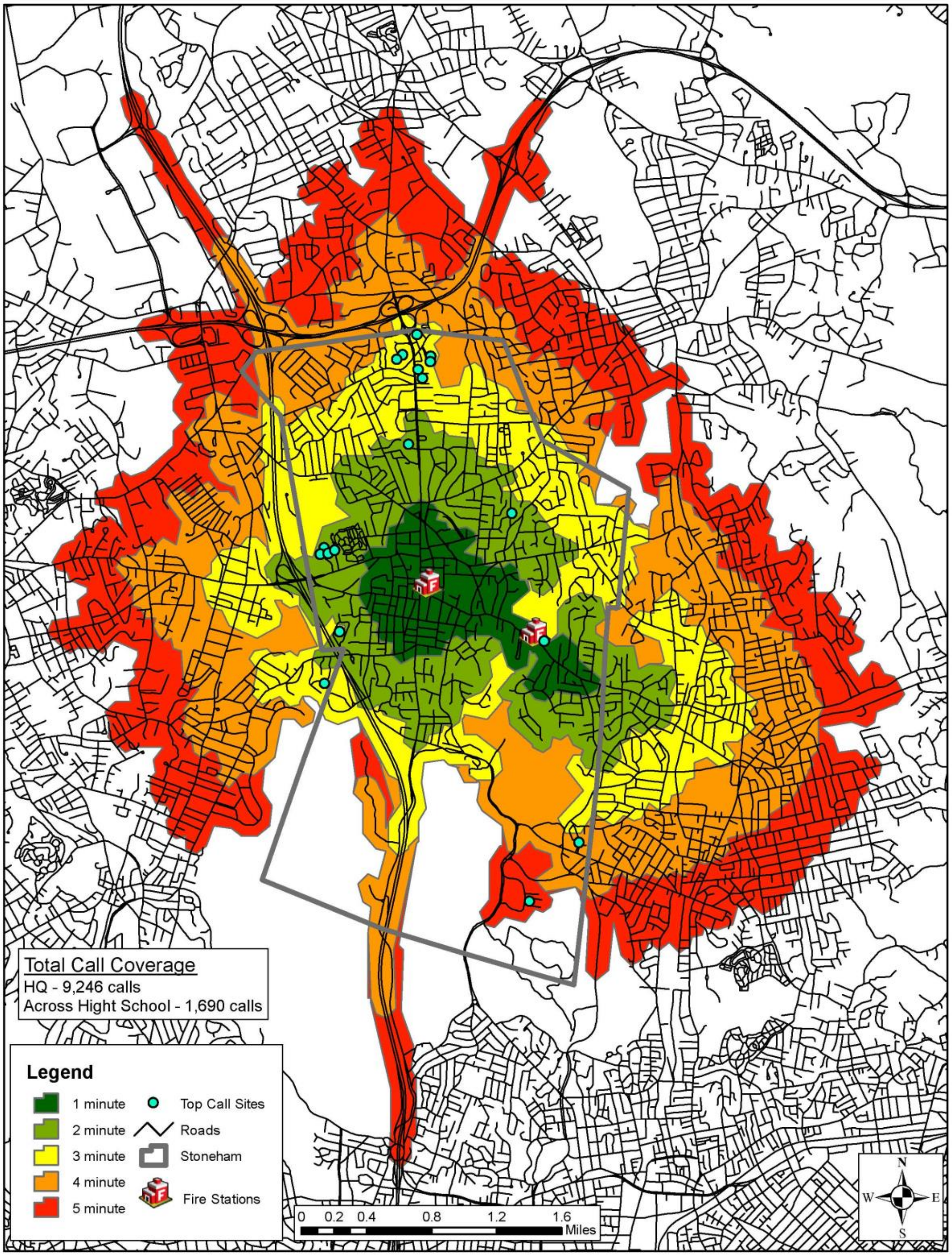


Figure 5: Response Times – Scenario 4: North Border & William Street / Central Street

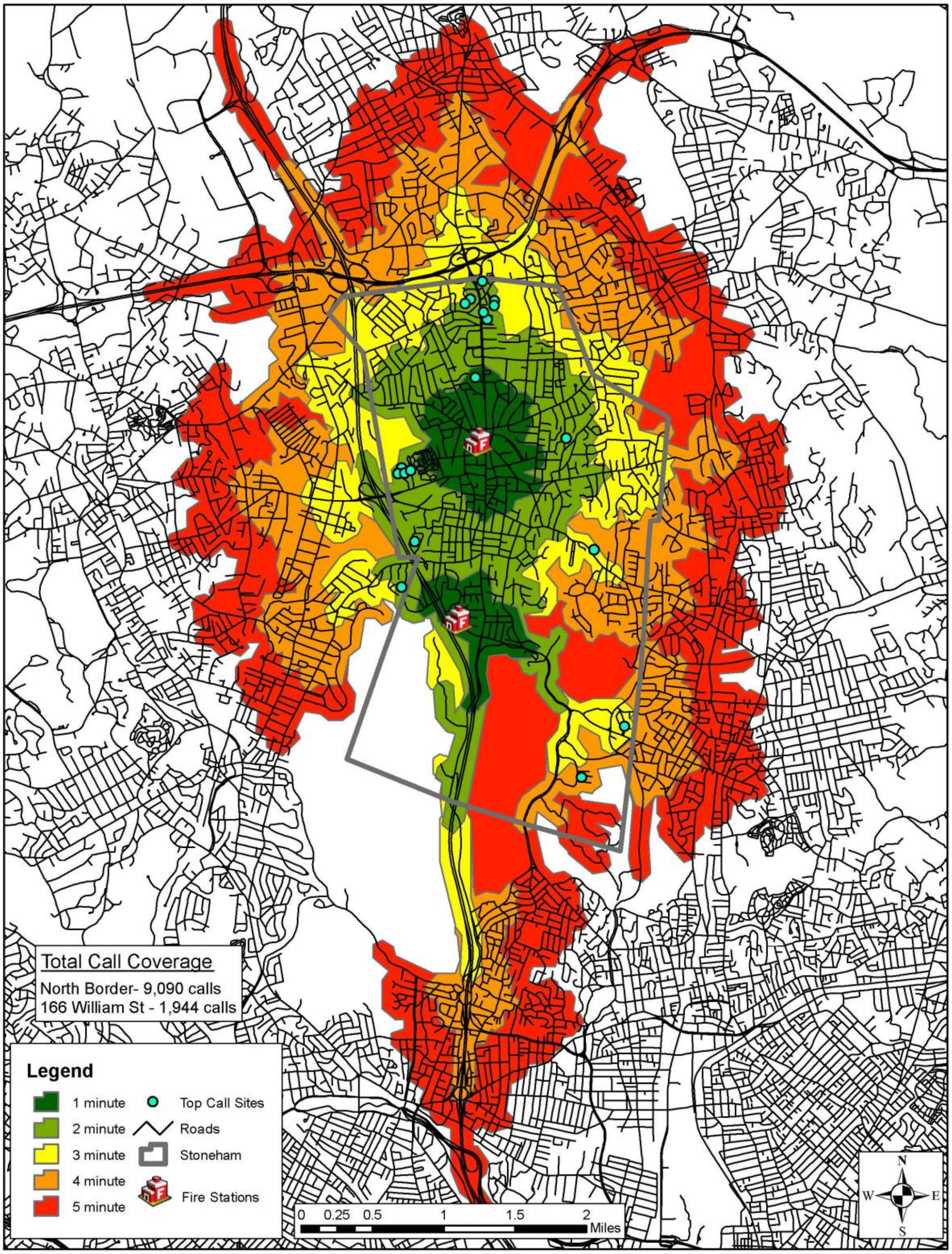
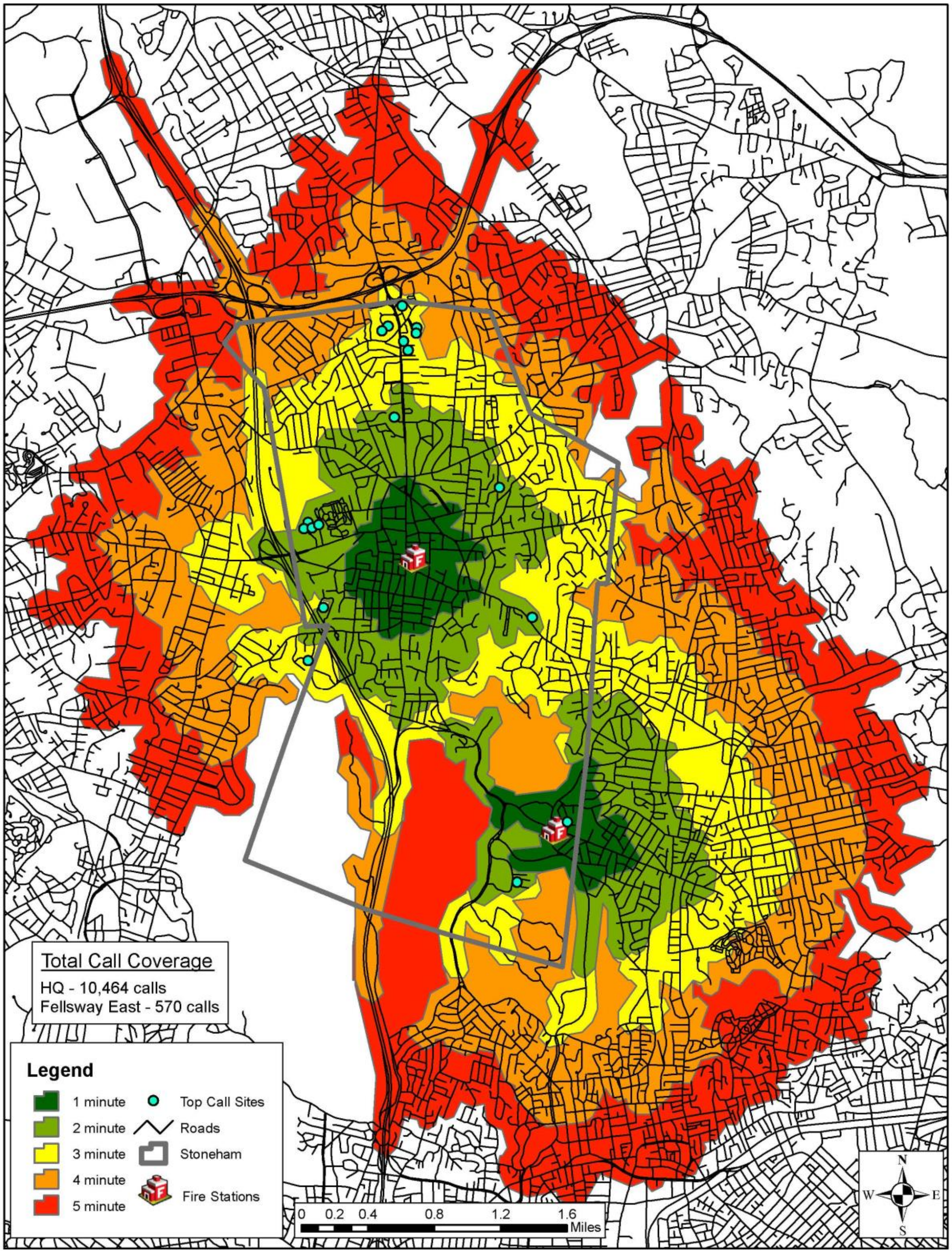


Figure 6: Response Times – Scenario 5: Current Headquarters & Fellsway East (Metro)



4. APPENDIX – SERVICE LEVELS

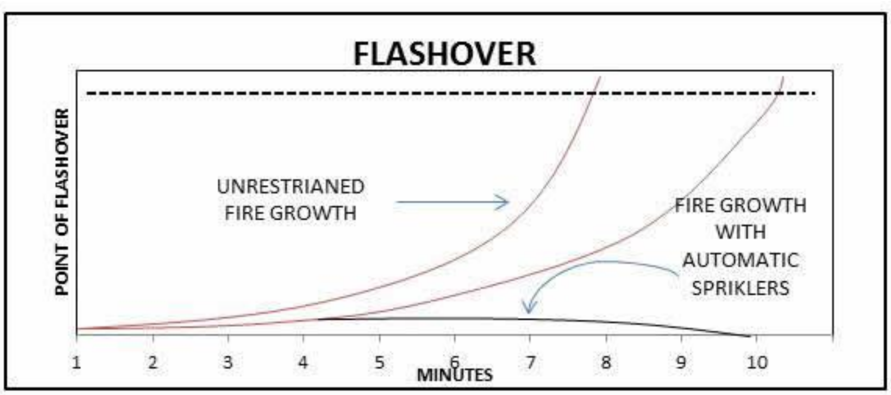
The adoption of performance standards for fire and EMS response is a critical first step in the evaluation of service levels and staffing alternatives. While there are national standards that can be used to evaluate fire and EMS service delivery, each community must identify the key risks and necessary level of protection it needs based on its own unique circumstances. Once these performance standards are established a community can assess its performance and determine if current resources support the desired level of service.

Nationwide, a great deal of effort and research has been put into developing performance objectives for the delivery of fire and EMS services. This effort is critical for agencies making decisions about deployment and location of emergency resources. The objectives promoted for fire/rescue and EMS have their basis in research that has been conducted into two critical issues:

- What is the critical point in a fire's "life" for gaining control of the blaze while minimizing the impact on the structure of origin and on those structures around it?
- What is the impact of the passage of time on survivability for victims of cardiac arrest?

The exhibit, that follows, shows a typical "flashover" curve for interior structure fires. The point in time represented by the occurrence of "flashover" is critical because it defines when all of the contents of a room become involved in the fire. This is also the point at which a fire typically shifts from "room and contents" to a "structure" fire – involving a wider area of the building and posing a potential risk to the structures surrounding the original location of the fire.

Figure 24: Typical Fire Flashover Timeline



DETECTION OF FIRE	REPORT OF ALARM 911 OR DIRECT	FIRE RESPONSE TIME			
		DISPATCH UNITS	TURN OUT	RESPONSE TIME	SET UP
TIME VARIES	TIME DIRECTLY MANAGEABLE				

Note that this exhibit depicts a fire from the moment of inception – not from the moment that a fire is detected or reported. This demonstrates the criticality of early detection and fast reporting as well as rapid dispatch of responding units. This also shows the critical need for a rapid (and sufficiently staffed) initial response – by quickly initiating the attack on a fire, "flashover" can be averted. The points, below, describe the major changes that occur at a fire when "flashover" occurs:

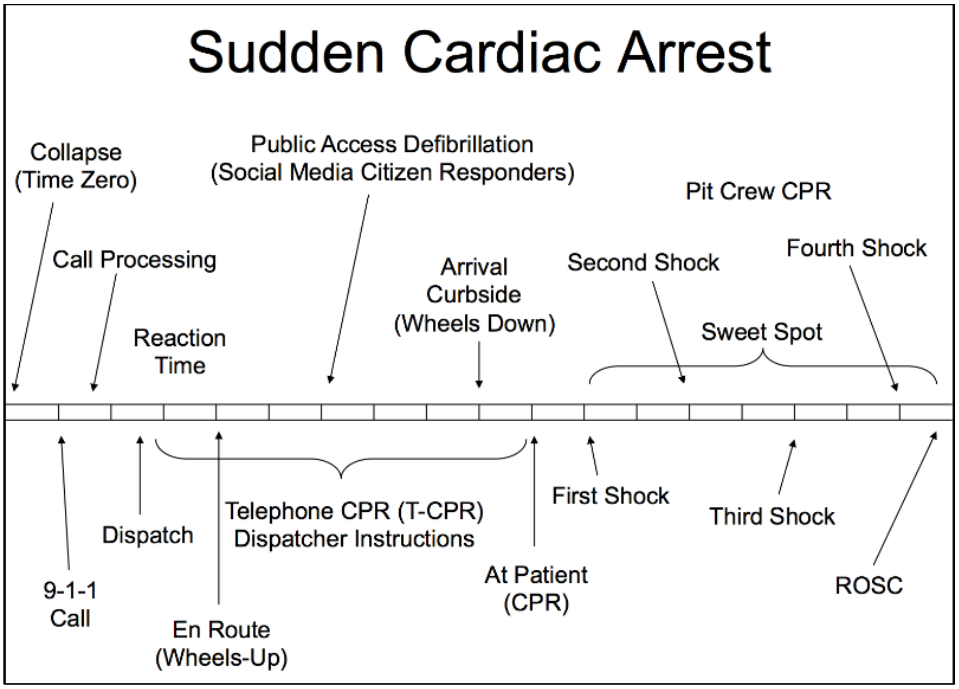
- It is the end of time for effective search and rescue in a room involved in the fire. It means that likely death of any person trapped in the room – either civilian or firefighter.
- After this point in a fire is reached, potable extinguishers can no longer have a successful impact on controlling the blaze. Only larger hand-lines will have enough water supply to affect a fire after this point.
- The fire has reached the end of the "growth" phase and has entered the fully developed phase. During this phase, every combustible object is subject to the full impact of the fire.
- This also signals the changeover from "contents" to "structure" fire. This is also the beginning of collapse danger for the structure. Structural collapse begins to become a major risk at this point and reaches the highest point during the decay stage of the fire (after the fire has been extinguished).

It should be noted that not every fire will reach flashover – and that not every fire will "wait" for the 8-minute mark to reach flashover. A quickly responding fire crew can do things to prevent or delay the occurrence of flashover. These options include:

- Application of portable extinguisher or other "fast attack" methodology.
- Venting the room to allow hot gases to escape before they can cause the ignition of other materials in the room.
- Not venting a room – under some circumstances this will actually stifle a fire and prevent flashover from occurring.

Each of these techniques requires the rapid response of appropriately trained fire suppression resources that can safely initiate these actions. In the absence of automatic fire suppression systems, access to interior fires can again limited by a safety requirement related to staffing levels. OSHA and related industry standards require the presence of at least 2-firefighters on the exterior of a building before entry can be made to a structure in which the environment has been contaminated by a fire. In the absence of a threat to life demanding immediate rescue, interior fire suppression operations are limited to the extent a fire service delivery system can staff to assure a minimum of 4-people actively involved in firefighting operations. The second issue to consider is the delivery emergency medical services. One of the primary factors in the design of emergency medical systems is the ability to deliver basic CPR and defibrillation to the victims of cardiac arrest. The exhibit, that follows, demonstrates the survivability of cardiac patients as related to time from onset:

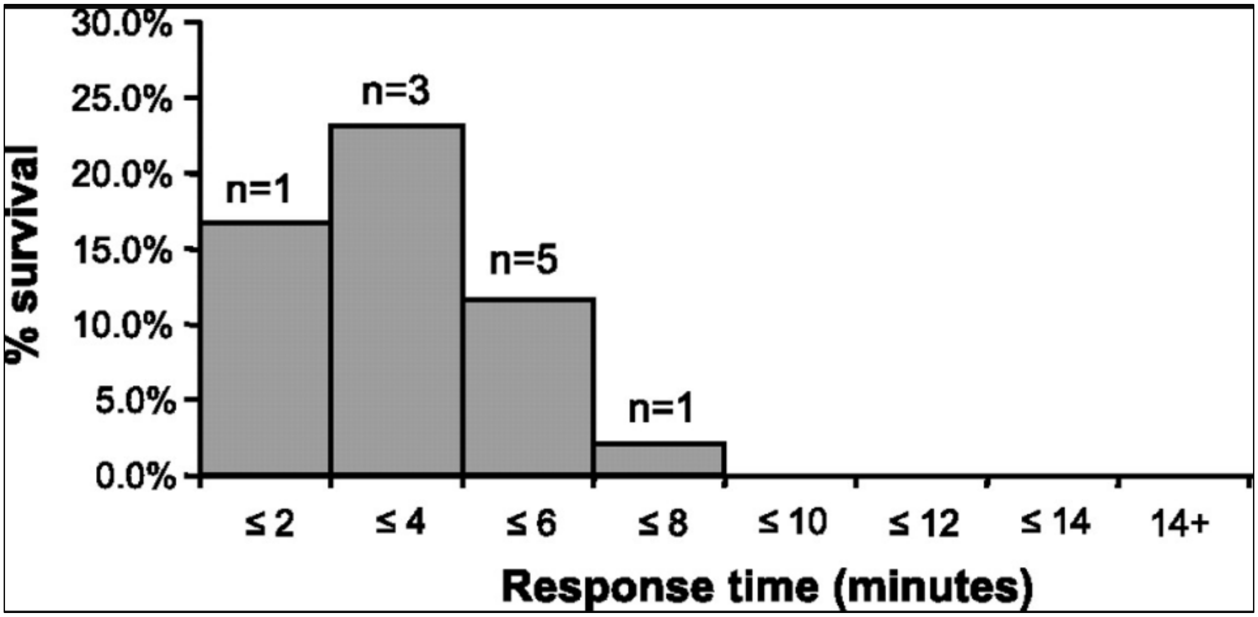
Figure 25: Typical Cardiac Arrest Timeline



This graph illustrates that the chances of survival of cardiac arrest diminish approximately 10% for each minute that passes before the initiation of CPR and/or defibrillation. These dynamics are the result of extensive studies of the survivability of patients suffering from cardiac arrest. While the demand for services in EMS is wide ranging, the survival rates for full-arrests are often utilized as benchmarks for response time standards as they are more readily evaluated because of the ease in defining patient outcomes (a patient either survives or does not). This research results in the recommended objective of provision of basic life support within 4-minutes of notification and the provision of advanced life support within 8 minutes of notification. The goal is to provide BLS within 6 minutes of the onset of the incident (including detection, dispatch and travel time) and ALS within 10 minutes. This is often used as the foundation for a two-tier system where fire resources function as first responders with additional (ALS) assistance provided by responding ambulance units and personnel.

With cardiac arrest – and opioid overdose has a similar timeline – rapidity of initial treatment (CPR, AED, drugs) can have a significant impact on patient survival outcomes:

Figure 26: Cardiac Arrest Survival Rate vs. Timeline



Additional research shows the impact and efficacy of rapid deployment of automatic defibrillators to cardiac arrests. This research – conducted in King County (WA), Houston (TX) and as part of the OPALS study in Ontario, Canada – shows that the AED can be the largest single contributor to the successful outcome of a cardiac arrest – particularly when accompanied by early delivery of CPR. It is also important to note that these medical research efforts have been focused on a small fraction of the emergency responses handled by typical EMS systems – non-cardiac events make up the large majority of EMS and total system responses and this research does not attempt to address the need for such rapid (and expensive) intervention on these events.

The results of these research efforts have been utilized by communities and first responders, often on their own with no single reference, to develop local response time and other performance objectives. However, there are now three major sources of information to which responders and local policy makers can refer when determining the most appropriate response objectives for their community:

- The Insurance Services Office (ISO) provides basic information regarding distances between fire stations. However, this "objective" does little to recognize the unique nature of every community's road network, population, calls for service, call density, etc.

- The National Fire Protection Association (NFPA) promulgated a documented entitled: "NFPA 1710: Objective for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments." This document (NFPA 1710) was first published in 2001 and updated in every several years – has and generated a great deal of dialogue and debate – which is still on going. This document is not a requirement for communities to follow – local authorities can and must determine for themselves an appropriate service level – but it is an important starting point for most service level discussions.
- The Commission on Fire Accreditation International (CFAI) in its "Objectives of Coverage" manual places the responsibility for identifying "appropriate" response objectives on the locality. These objectives should be developed following a comprehensive exercise in which the risks and hazards in the community are compared to the likelihood of their occurrence.