THE UNIVERSITY of TENNESSEE

MUNICIPAL TECHNICAL ADVISORY SERVICE

MORRISTOWN, TENNESSEE

Fire Services Study

September 2012

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Introduction and Scope of Work

MTAS conducted this study at the request of Morristown City Manager Tony Cox. Morristown participates in the Tennessee Municipal Benchmarking Project (TMBP), and upon review of the FY12 TMBP report, the city manager wanted to know if the city was providing fire services proportionate to the risk in the community at a reasonable cost. MTAS Management Consultant Pat Hardy and Fire Consultant Dennis Wolf met with Tony Cox to discuss the scope of the study.

The purpose of this study is to evaluate the entire fire department and make recommendations related to fire department management, operations, resources, and enhanced level of services. The scope of this study included review of the present ISO rating, meeting OSHA and NFPA requirements, and best practice management of the fire department. Best practices are acceptable performance standards in the fire service that are recognized and used to improve operations and safety. The recommendations provided in this report include consideration of local criteria including the size of the community, land usage, existing and potential use of resources, public perception of services, and geographical features of the community.

The level of fire services provided in any community is a local policy decision made by the elected governing body through the annual budget. The decision is unique to every community and includes factors such as desired response times, growth, increased life risk (schools, daycares, hotels, assisted care facilities, etc.), increased commercial and industrial risk, and the desire to maintain the ISO rating. A fire department is an investment in the community. The Insurance Services Office (ISO) states that, "A community's investment in fire mitigation is a proven and reliable predictor of future fire losses." Morristown has made a significant investment in community fire mitigation through the fire department as reflected in the favorable Class 3 ISO Rating.

The study provides a comprehensive overview of the delivery of fire services and addresses city administration's concerns that Morristown is above average in costs and had the highest per capita cost for a fire call in all of the cities in the Tennessee Municipal Benchmarking Project (TMBP) study. A written request from the city authorized MTAS to conduct an official study.

Background

The City of Morristown is located in, and is the county seat of, Hamblen County in East Tennessee, approximately 48 miles east of Knoxville, with a population of 29,137. The fire department service area covers 27.9 square miles. Morristown is the principal city of the Morristown, Tennessee Metropolitan Statistical Area, which encompasses all of Grainger, Hamblen, and Jefferson counties, and has a large industrial presence. A Mayor-Council form of government governs the city. The seven-member council, which includes the mayor, sets policy and evaluates the management of the city. The city administrator oversees all operational activities.

Fire protection and staffing is a local policy issue, and a community must balance local resources against acceptable risk. The City of Morristown provides fire services to 29,137 residents through a municipal fire department organized under Section 7-301 of the city charter. The fire chief is a city department head and serves at the will and pleasure of the Mayor and Council, and coordinates fire department activities through the city administrator. The Morristown Fire Department is a career fire department recognized by the State of Tennessee under TCA 68-102-108 and funded by the city. The fire department operates six engine companies, a truck company, and a battalion chief from six fire stations (Table 1). All Morristown engines have a minimum staffing level of at least three personnel and minimum staffing on the truck is two personnel.

Apparatus	Year Built	Type	Pump Capacity (gpm)	Aerial Ladder Length	Minimum Daily Staffing	Maximum Daily Staffing
Engine 1	2003	Quint	1,500	61’	3	4
Engine 2	2005	Quint	1,500	61’	3	4
Engine 3	1995	Engine	1,250	n/a	3	4
Engine 4	1989	Engine	1,250	n/a	3	3
Engine 5	2001	Quint	1,500	55’	3	4
Engine 6	2000	Quint	1,500	55’	3	3
Truck 1	1989	Aerial	1,500	92’	2	3
Brush Truck	1984	Brush Truck	n/a	n/a	0	0
Rescue/ Medical Truck	2005	Rescue/ EMS	n/a	n/a	0	0
Supply van	1984	Support	n/a	n/a	0	0
Reserve 1	1980	Engine	1,000	n/a	n/a	n/a
Reserve 2	1983	Engine	1,250	n/a	n/a	n/a
Truck 2	1962	Ladder	n/a	85’	n/a	n/a

Table 1 – Morristown Fire Department Apparatus

The Importance of the ISO Rating

This information will assist city leaders in their understanding of the complexities of providing fire protection, assist in the prioritization of community needs, and assist in the decision-making process.

The Insurance Services Office, Inc., also known as ISO, is a for-profit corporation that works for insurance companies to evaluate the capability of a community to suppress fires. ISO rates a community on a scale of 1 through 10. An ISO rating of 1 is the best (only 0.13% of the fire departments in the county have a Class 1 rating). An ISO rating of 10 is equivalent to not having any fire protection. Morristown has a Class 3 rating. ISO rates a community based upon three major categories: communication (10% of the rating), fire department (50% of the rating), and water supply (40% of the rating).

The Class 3 rating, received in 2004, is excellent. Less than four percent of all fire departments in Tennessee have a Class 3 ISO rating, and just five fire departments out of over 732 have a better ISO rating (see Figures 1 and 2). The Class 3 rating means the city is doing the right things to provide excellent service, and because of this Morristown residents pay very competitive rates for property insurance.

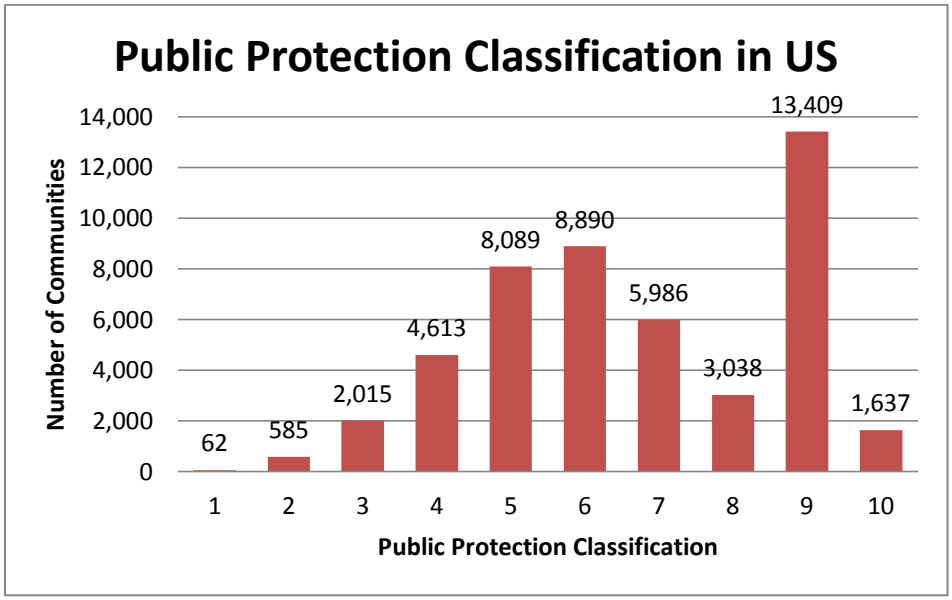


Figure 1 – Public Protection Classification (ISO Rating) in the US

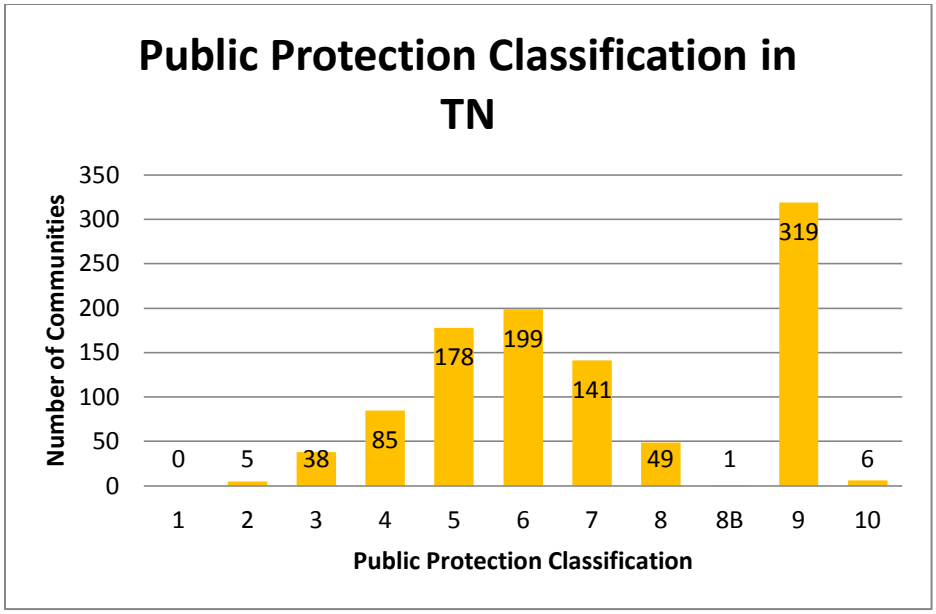


Figure 2 – Public Protection Classification (ISO Rating) in Tennessee

Fire Department Overview

The fire department is well managed with a mission statement that reflects the needs of the community. The city has an ordinance that establishes the Morristown Fire Department, places the fire chief in charge of the department, and delineates the duties and responsibilities of the fire chief. The mayor and council appoint the fire chief, who coordinates operations through the city administrator. The department has adequate job descriptions for all positions. The fire department has a table of organization that defines the chain of command. The fire chief serves as the Assistant to the Commissioner of Commerce and Insurance for the city as required by state law.

The city has an ordinance that adopts the 2006 edition of the National Fire Protection Association Fire Prevention Code. TCA 68-120-101(B)(5)(A) requires that a municipality adopt an edition of a code that is within seven years of the most current published edition of the model code. For NFPA 1, the most current edition is the 2012 edition. Morristown should begin planning to adopt a more recent version of the model code in 2013. The department maintains fire incident reporting records, training records, and pre-fire planning records and uses a comprehensive computer based records management system.

The fire department participates in the Tennessee Fire Incident Reporting System (TFIRS) and incident reporting is current. The department has response time data, but does not report individual components of response time. The department's average response time is approximately four minutes. Response time includes just turnout and travel time, and does not include call-processing time. The fire department collects data, reports to TFIRS, and uses the data in performance measures to assist in management and decision-making. The fire department participates in the TMBP.

The City of Morristown funds the fire department. The operating budget for FY13 is $6,133,570 ($210.51 per capita). The estimated budget for FY12 is $6,090,194 ($209.20 per capita). The FY11 budget was $5,834,128 ($200.23 per capita), and for FY10 was $5,910,187 ($202.84 per capita). The TMBP average per capita cost is $185.75. The fire department divides the budget into the five sub-categories of fire supervision, fire prevention and inspection, fire stations (facilities), firefighting, and fire medical response. This level of detail provides tighter budget control and enables better estimates of costs for particular services. The city provides all purchasing and payroll for the department following generally accepted accounting principles. The city has a formal capital improvement program for the replacement of fire apparatus and other capital items.

The department has eighty-four full-time career firefighters. The Morristown Fire Department is the only fire department in Hamblen County with full-time firefighters. Fire department personnel work 24-hour shifts on a three-shift system. Each shift has twenty-six personnel assigned, and minimum daily staffing for each shift is twenty-one fire personnel. The department responds with four engines, the truck, and a battalion chief on structure fires. If possible, the department staffs four of the engines with four

personnel, and staffs the remaining two engines and the ladder truck with three personnel. The department has six fire stations. A seventh station, located in the Lowland area, has been discussed, but is dependent upon further commercial/industrial development in the area.

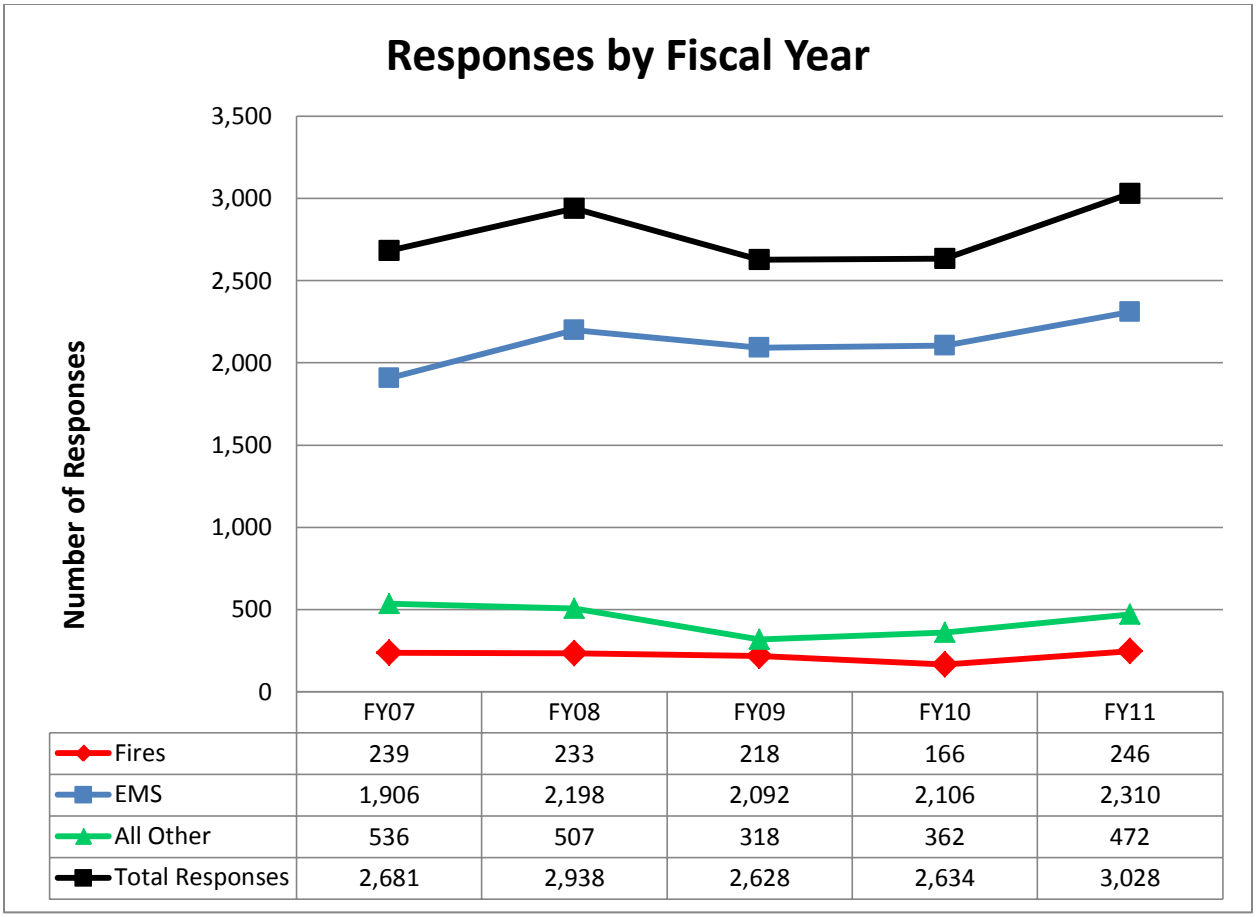
In addition to fire suppression, the fire department provides these essential services:

- Pre-fire planning
- Public fire education programs
- Fire cause investigation and determination
- Arson investigation
- First responder (EMS) assistance
- Vehicle extrication with state certified technicians
- Hazardous materials (Hazmat) response, both local and regional
- Structural collapse rescue
- Fire safety inspections
- Fire code enforcement
- Smoke alarm distribution and installation
- Special event participation details
- CPR instruction
- Child-restraint safety seat inspection

On a five-year fiscal year average, the department responds to approximately 2,782 calls per year. Approximately 220 calls (7.92%) are fire related, and of those approximately 67 are structure fires. Over 76% of the department's responses are emergency medical first responder calls. Table 2 shows the breakdown of response by type for the past five fiscal years.

Type Incident	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**
Structure fires	73	58	71	60	72
Vehicle fires	50	51	32	30	37
Other fires	116	124	115	76	137
Ruptures, Explosions	25	13	11	8	13
EMS calls	1,906	2,198	2,092	2,106	2,310
Hazardous condition	44	35	10	9	21
Service calls	58	35	18	8	34
Good Intent	68	53	12	7	37
Special/Weather/Unkn.	6	13	4	9	21
False Alarms	335	358	263	321	346
Total Responses	**2,681**	**2,938**	**2,628**	**2,634**	**3,028**

Table 2 – 5-Year Response History by Fiscal Year



	FY07	FY08	FY09	FY10	FY11
Fires	239	233	218	166	246
EMS	1,906	2,198	2,092	2,106	2,310
All Other	536	507	318	362	472
Total Responses	2,681	2,938	2,628	2,634	3,028

Figure 3 – Responses by Fiscal Year

The chart in Figure 3 shows the five-year response history with separate lines for total fire related responses, EMS related responses, and all other responses. The level of fire and other calls remains consistent over the five-year period, with requests for emergency medical services driving the increase in call volume.

Table 3 shows the annual property loss for the past five years. For the past five years, the city has averaged an annual property loss of approximately $1,860,822. This seems high when compared to the July 2012 Morristown mean housing price of $105,000 for a detached, single-family home since this amount represents the comparative value loss of approximately eighteen homes per year. The average loss per million of appraised value is $681.66, which is above the TMBP average of $561.07 per million of appraised value. The annual loss represents a property loss of 0.0682% of the total property value at risk, which is over $2.7 billion. The department investigates just 17.5% of fires to determine cause. At 59%, the department's rate for determining the cause of fires is below the average of 75.37% in the TMBP. Improvement in the fire cause determination rate could be useful in creating fire prevention programs to reduce the incidence of fire and the annual fire loss rate.

The true investigation rate is actually higher than the figure reported in the TMBP. In examining the fire cause determination rate, the fire department attempts to determine the cause of every fire, which is a 100% investigation rate. The officer on the first arriving company begins the initial investigation. If the company officer is able to determine cause, the officer enters the cause on the fire report. If not, the officer enters the cause on the fire report as "undetermined" and sends a report to the fire marshal's office for follow up. Until the fire marshal completes his investigation, the cause remains listed as undetermined. Because of the workload in the fire marshal's office and the need to wait occasionally for test results or insurance investigators, it may be weeks or months before a final determination is made. MTAS found that with the passage of time, the subsequent investigation is not catching up to the fire report, and the cause remains listed as undetermined even though the follow up investigation determined a cause. The assistant fire marshal position remains vacant, which is a contributing factor. The fire department should develop a checklist or other system to update the cause on fire reports once the investigation is complete and attempt to fill the vacant assistant fire marshal position.

Year	Dollar Loss
FY07	$1,529,725
FY08	$798,335
FY09	$1,516,340
FY10	$2,741,010
FY11	$2,718,700
Five-year Total Dollar Loss	$9,304,110
Average Loss Per Year	$1,860,822

Table 3 – Annual Property Loss

The ability of the fire department to respond quickly with adequate resources and personnel directly affects property loss. The fire department's reported average response time is quick, averaging just over four minutes, but the response time measures only turnout time and travel time. Total response time includes ring time, call processing time, turnout time, and travel time. Since the department does not track ring time and call processing time, the total response time is greater than four minutes. The apparatus resources are adequate in number, as the department responds four engines and an aerial ladder on structure fires.

Providing minimum adequate staffing is critical for firefighter safety and for aggressive interior fire attack capability. OSHA 1910.134(g)(4), commonly called the "2-in/2-out rule," requires that a minimum of two properly trained and equipped firefighters be outside of the IDLH (Immediately Dangerous to Life and Health) atmosphere, which is what the smoke filled interior of a structure fire is, before two firefighters can make entry into an IDLH atmosphere. This is a minimum requirement, as effective and safe (as possible) firefighting requires considerably more than four firefighters.

The average number of firefighters responding to structure fires over the last three years is slightly under the number recommended as adequate by NFPA. Morristown averaged 15.57 firefighters on the scene for the past three years (see Table 4) and 14.50 firefighters on the scene for the most recent twenty structure fires. NFPA recommends a minimum response of sixteen personnel (see Table 6) to a residential structure fire, with even more firefighters as the size of the structure, and associated risk (life, high hazard occupancies, etc.), increases. ISO looks for a minimum response of nineteen personnel to a structure fire. These agencies know that it takes firefighters to put out fires. An insufficient number of firefighters on the scene impede the department's ability to make an aggressive interior attack and perform needed firefighting tasks quickly and efficiently, which affects property loss rates. The rate for fires contained to the room or area of origin is 34%, which is below the median of 45% in the TMBP. The faster firefighters can put water on the fire, the less property damage there is. Improvement in the rate of fire confined to the room or area of origin will reduce annual property loss and the associated risk to people.

YEAR	AVERAGE NUMBER OF SUPPRESSION PERSONNEL	AVERAGE NUMBER OF ENGINES	AVERAGE NUMBER OF AERIAL TRUCKS
2011	15.75	4.00	0.33
2010	15.85	3.85	0.23
2009	15.08	3.67	0.17
Average	15.57	3.84	0.24

Table 4 – 3-Year Average Personnel and Apparatus Response for Structure Fires

The fire department is aware of the requirements of NFPA Standard 1500, Standard of Fire Department Occupational Safety and Health and NFPA Standard 1501, Standard for Fire Department Safety Officer and has a dedicated safety officer. The fire department has an employee safety policy in place for personal protective equipment (PPE). The fire stations have sufficient space for maintenance, repair, and storage of equipment, spare hose, and other supplies. Every firefighter has a personal alert safety system (PASS) device. Every firefighter entering a hazardous area has a portable radio. Each fire engine has a thermal imaging camera to assist firefighters in locating victims, hidden fire, and to maneuver inside a burning structure. The department has and enforces a two-in/two-out rule that complies with OSHA 1910.134(g)(4) and uses Rapid Intervention Teams (RIT). The department has a blood borne pathogen plan that complies with OSHA 1910.1030. The department has a respiratory protection plan that complies with OSHA 1910.134 and uses the qualitative fit test protocol. The department has had a minimum number of exposures to infectious diseases in the last three years, and investigates exposure incidents to prevent future occurrences. The department maintains medical surveillance and exposure records in accordance with OSHA 1910.120.

The department provides to all personnel turnout gear/personal protective equipment (PPE) that meets NFPA and OSHA requirements. The department has and enforces policies requiring the wearing of all PPE. The department inspects PPE monthly for wear and tear and repairs or replaces any damaged or defective equipment, and has a PPE replacement program. The department provides self-contained breathing apparatus (SCBA) to all personnel. The department has a breathing air compressor to refill the empty SCBA air cylinders and the tests the quality of the air quarterly as required by NFPA Standard 1989.

The fire department has good written job descriptions for all positions. The city conducts background checks on new firefighters. The hiring and promotional processes follow civil service procedures. Firefighters are required to complete the state fire school and achieve Firefighter I and II certification. Officers are required to achieve Fire Officer I certification. The department maintains personnel records, keeps personal medical information separate as required by law. The city verifies that all personnel who drive fire department or city vehicles have a valid driver license. Personnel must be at least 21 years of age to drive fire apparatus. Personnel driving a fire department vehicle involved in an accident must take an immediate drug screen. There has been an average of about four accidents per year involving fire department vehicles over the last three years.

The department maintains inventory records on apparatus and equipment. Firefighters inventory hand tools and equipment carried on fire apparatus daily using a check-off sheet and inspect the equipment for excessive wear or damage. The department repairs or replaces damaged equipment. The first out and reserve apparatus carry all of the equipment listed on the ISO equipment inventory sheet. The department performs an annual pump test meeting NFPA Standard 1911 requirements on all apparatus equipped with a rated fire pump and has test records dating back at least three years. The department performs an annual hose test meeting NFPA Standard 1962 requirements on fire hose and has test records dating back at least three years. The department tests the aerial ladder devices annually following NFPA 1911 standards.

Training

The department has a dedicated training officer, maintains detailed training records on all personnel, and fire personnel train regularly. In 2011, the department conducted ten training drills of at least 3-hours duration, which is more than the eight drills ISO requires. ISO places emphasis on drills, and requires at least eight drills per year, two of which must be at night, and four drills per year with other fire departments that provide mutual aid. The department has a training library, and audio-visual equipment. The department has a fire hydrant cut-a-way but does not have a pump cut-a-way to use for training. The department should acquire a large pump cut-a-way poster, which will receive the same training credit as an actual pump cut-a-way. Last year the department conducted all ISO required hazardous materials training, officer training, driver training, and new driver training. The recruit training program for new firefighters meets the ISO requirement of a minimum of 240 hours of training. All firefighters

averaged over 29 hours of training each month, which exceeds the ISO minimum requirement of 20 hours per month. All personnel have first responder training.

The department performs annual pre-fire planning inspections on all commercial properties in Morristown, and achieved a 90% inspection rate last year. All personnel participate in the pre-fire planning inspections or train on each occupancy using the pre-fire plans created by the fire department, and all personnel reviewed their respective portion of pre-fire plans in their assigned district at least once during the past year, which is an excellent participation rate.

Training is a major portion of the fire department score in the ISO rating, and the fire department is doing an excellent job with training. Of the 100 points available to a community for its ISO rating, the fire department's portion accounts for fifty of those points. Training is worth nine points (18%) of the fire department's fifty points. Ten points separate each ISO classification, so the nine training points represent almost one complete grade in the ISO classification schedule. The fire department received 6.69 out of the nine points available (74.33%), which is an excellent score compared to other Class 3 fire departments, but the lack of a local training facility hampers the fire department's training efforts. The department uses fire training facilities in Knoxville, Kingsport, Greeneville, Johnson City, and Eastman. Since the city requires an aerial ladder, the department needs access to a four-story drill tower, and the closest towers are in Knoxville and Johnson City. The travel time and distance involved complicates training, and even though the fire department can use these facilities, ISO does not give credit for them, so the fire department's score for a drill tower and burn building was zero. If the department had both a drill tower and burn building, the training points awarded would have been 8.83. The overall score would have moved from 77.03 to 77.89. This report acknowledges that Morristown is not seeking a Class 2 ISO rating, but the city is a very high Class 3, so needed improvements in the training program will help the city remain a high Class 3 fire department, and it is possible that an additional benefit of improvements would be a Class 2 ISO rating. Regardless, providing a drill tower and burn building should be a high priority for the city.

Facilities

Fire stations represent a major capital investment in the community. Morristown has six fire stations as identified in Table 5 and located as shown on the map in Figure 5. The building code classifies a fire station as a storage facility, but people live in them, which makes them unique structures. Fire stations are in use 24/7, contain the mixed-use functions of storage of motorized apparatus, storage of hazardous chemicals, and use as a business office, contain cooking operations, and overnight accommodations for on-duty crews. Since 2007, the state expects new and existing fire stations to be gender friendly to accommodate men and women working in the same station. Fire stations are part of the community's critical infrastructure and station security should be part of the community's homeland security plan. Fire stations should be capable of continuous operation during disasters. As a rule of thumb, fire stations have a useful designed life of approximately fifty years.

Station	Address	Year Built	Age	Bays	Bay Length	Door Height	Gender Friendly
1	625 S. Jackson Street	1996	16	1 2	63’ 10” 67’ 10”	13’ 10”	Y
2	1801 Buffalo Trail	1996	16	2	57’ 4”	14’ 1”	Y
3	3205 E. Andrew Johnson Hwy	1967	45	2	52’ 9”	11’	N
4	3835 W. Andrew Johnson Hwy	1967	45	2	39’	11’ 3”	N
5	5700 Air Park Blvd	2004	8	1 2	48’ 42’ 9”	14’	Y
6	5020 Davy Crockett Hwy	2006	6	1 2	48’ 2” 42’ 5”	14’	Y

Table 5 – Morristown Fire Stations

Modern fire apparatus is larger and heavier than apparatus designed twenty years ago. Innovations including high side compartments, mechanical/hydraulic ladder racks, topside storage compartments, elevated waterways, aerial ladders, platforms, and on-board foam systems have resulted in larger, wider, and taller apparatus. The use of polyethylene water tanks has increased the amount of water that a fire truck can carry, which in turn increases the weight, which means bay floors must be capable of supporting heavier fire trucks. The maximum height of a fire truck is 13’ 6”, but not all fire trucks are that tall. Depending upon the amount of storage space desired and the amount of water carried, most fire pumpers are at least twenty-four feet long, with lengths of thirty-two feet being common. Aerial ladder trucks and platforms are longer. Aerial ladder trucks have lengths starting around thirty-nine feet, and platforms have lengths starting around forty-seven feet.

All fire stations have a vehicle exhaust system in place, and the department has carbon monoxide warning signs in the stations as required by OSHA 1910.145. Stations 1, 2, 5 and 6 are well designed, modern and adequate. Station 5 is equipped for use as a backup dispatch center and as an emergency operations center (EOC). Firehouse Magazine recognized Fire Station 5 for its design and features. Stations 3 and 4 are the oldest fire stations in the city. These two stations have the shortest bays and lowest overhead door clearance heights, which limits the number and type of apparatus that can be placed there. Both stations are forty-five years old, so they are not gender friendly. Environmentally, these two stations lack the level of energy efficient design in newer buildings and do not have an oil separator for floor drains. Stations 3 and 4 do not have emergency generators. Morristown should consider either a replacement program where Stations 3 and 4 are replaced with a new building, as this is a better alternative than a major renovation to update the station to modern standards.

How Many Fire Stations Does Morristown Need?

The answer to this question is based upon the size of the city, the basic fire flow, and desired level of fire response. The map in Figure 4 shows the current city limits, designated by the black line. Morristown has conducted some "finger" annexations that have extend the city limits along major roadways, creating pocket areas separate from the main portion of the city.

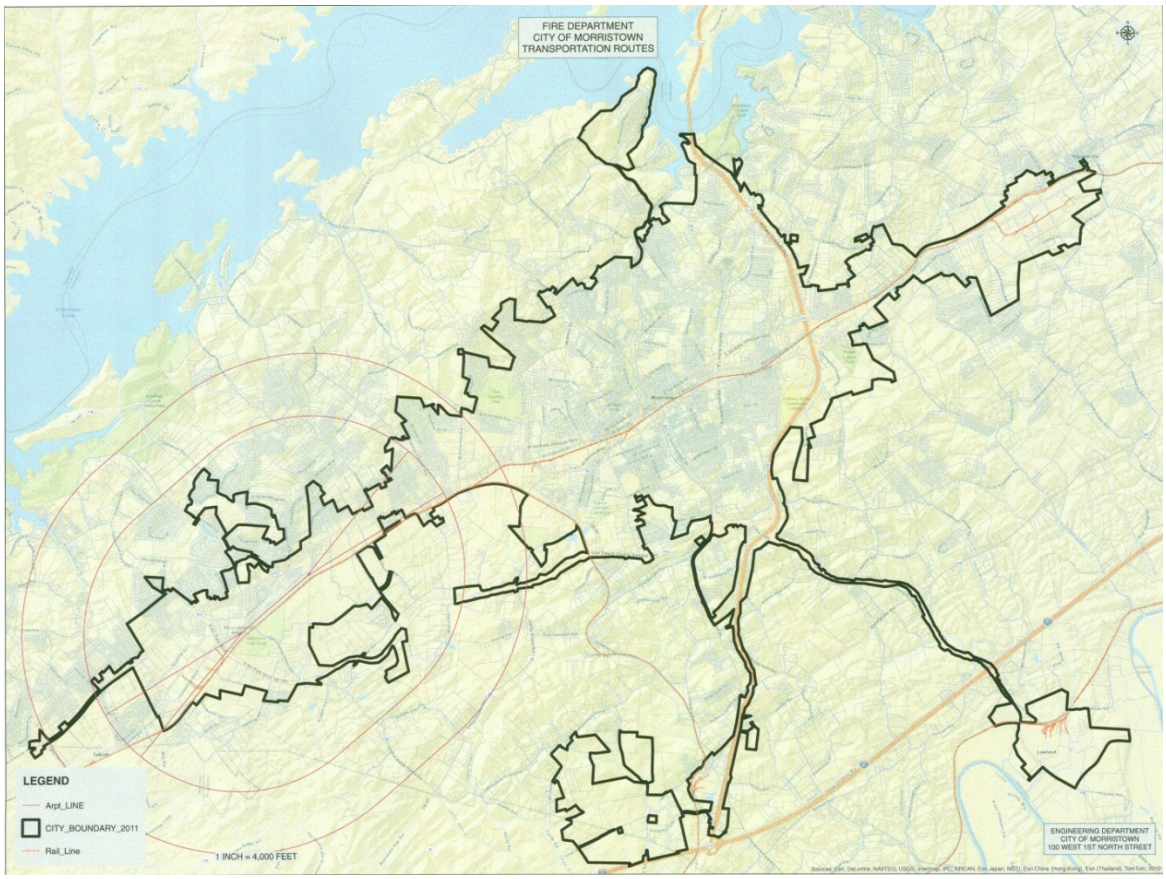


Figure 4 – Morristown City Limits

To begin to answer the question of how many fire stations Morristown needs now, one can look at several sources for guidance. The first is the Insurance Services Office (ISO) Fire Suppression Rating Schedule. Section 560 of the schedule covers distribution of companies and states: "The built-upon area of the city should have a first-due engine company within 1½-miles and a ladder-service company within 2½-miles." Morristown's six fire stations are located as shown on the map in Figure 5. The colored lines indicate the 1.5-mile response area for each fire station.

It is interesting to note that there is minimal overlap of the 1.5-mile response zones, meaning the fire stations are well located for maximum benefit and minimal "waste" of coverage. There are some gaps, which is why ISO gave the city 58.75% credit (2.35 points out of a possible 4 points) for distribution. Distribution is credit ISO awards for

the number and placement of fire stations to provide adequate coverage. The Norfolk Southern Railroad tracks bisect the city east-to-west, which means the fire department must have sufficient stations on both sides of the tracks for optimal coverage and response.

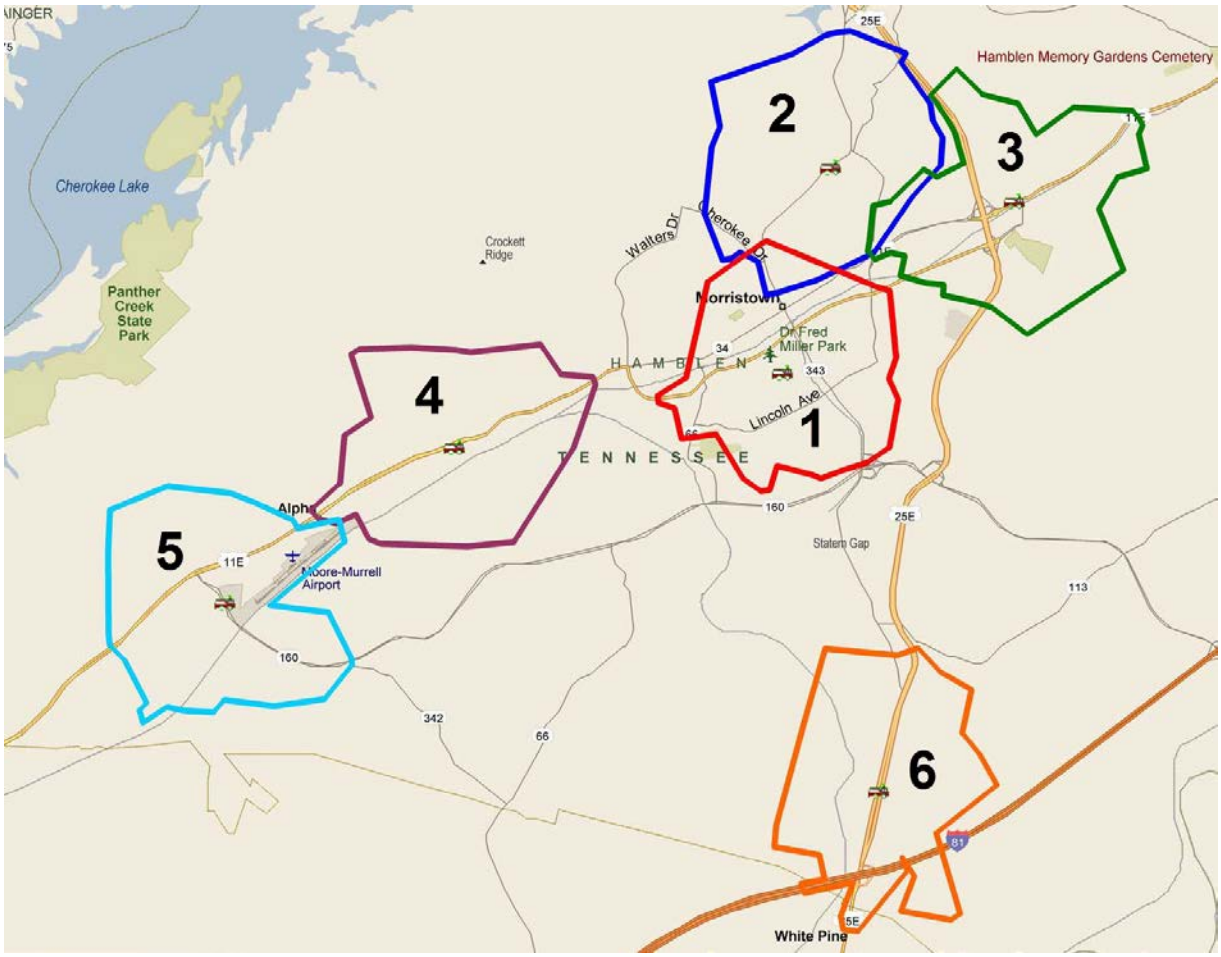


Figure 5 – Fire Stations with 1.5-Mile Response Areas

Using an "as the crow flies" radius of 1.5-miles to draw a circle does not adequately represent the geographical area that a single fire station can cover. Studies have shown that a polygon better represents the ISO required response area, and that the average size of the polygon is 4.5 square miles. Two caveats: the polygon model assumes the even distribution of resources throughout the area, which is generally not the case, and the formula does not allow for geographical barriers, such as rivers and railroads, but the formula is useful as a reference. Based upon the 27.9 square miles within the town limits, a travel distance of 1.5-miles, and assuming all engine companies are evenly distributed throughout the service area (which they are not) Morristown needs 6.60 fire stations right now for adequate coverage.

One can use the polygon model to determine the number of needed ladder trucks or service companies based upon ISO's maximum travel distance of 2.5-miles for a ladder or service company. The average size of a polygon for a ladder or service company is

12.3 square miles. Based upon a 27.9 square mile service area, a travel distance of 2.5-miles, and assuming all ladder or service companies are evenly distributed throughout the service area (which they are not) Morristown needs 2.41 ladder companies right now.

The second resource is the National Fire Protection Association (NFPA). NFPA addresses the number of fire stations needed in an indirect way based on minimum response times. NFPA Standard 1710 Section 5.2.4.1.1 allows a 240 second (4 minute) travel time for the first arriving engine company. Using an empirical model called the piece-wise linear travel time function, based upon studies done by the Rand Institute estimating the average response speed of fire apparatus at 35 mph, one can determine that the distance a fire engine can travel in 4 minutes is approximately 1.97 miles. A polygon based on a 1.97 mile travel distance covers on average 7.3 square miles. Based upon a 27.9 square mile service area, a travel-time-calculated travel distance of 1.97 miles, and assuming all engine companies are evenly distributed throughout the service area (which they are not) Morristown needs 4.07 fire stations right now. However, the town is not evenly distributed, and strip annexation has extended the corporate limits far beyond what the core fire stations can cover adequately.

The previous two examples are based upon time and distance to be covered. A third resource is the ISO Fire Suppression Rating Schedule's determination of needed engine companies based upon the community's basic (needed) fire flow. Section 510 of the schedule requires one engine company for a basic fire flow of 500 to 1,000 gpm, two engine companies for a basic fire flow of 1,250 to 2,500 gpm, and three engine companies for a basic fire flow of 3,000 to 3,500 gpm. Basic fire flow is calculated by determining the needed fire flow for all non-sprinklered properties in the community, and then the fifth highest is considered the basic fire flow for the community. For Morristown, that is 3,500 gallons-per-minute. For full ISO credit, the city needs to have enough fire engines on the scene to provide a total pump capacity of at least 3,500 gpm, and the fire department meets this requirement. A strong commercial and residential sprinkler ordinance can limit significantly community risk, as ISO does not consider properties protected by automatic sprinkler systems when determining the basic fire flow, and sprinklered properties reduce the fire risk in the community. Morristown has adopted model codes that require fire sprinklers in commercial occupancies, and Morristown should consider adopting a residential sprinkler ordinance for one and two-family homes to reduce fire risk to the community.

Finally, city leaders must consider the phenomenon known as flashover. As a fire grows in size, it gives off temperatures that heat other objects near the fire. At some point in the time-temperature curve, all of the objects in the fire room reach their ignition temperature and ignite. The entire room bursts into flames, and the temperature rises to a point where no person can survive, including firefighters. This is flashover. The NFPA Fire Protection Handbook states: "During flashover, however, the temperature rises very sharply to such a level that survival of persons still in the room at that stage becomes unlikely. Thus the time interval between the start of the fire and the

occurrence of flashover is a major factor in the time that is available for safe evacuation of the fire area." The development of fire conditions to reach the point of flashover is a function of temperature rise over time. Therefore, a sufficient number of fire stations strategically located to provide quick response times could reduce the incidence of flashover, thus saving lives and property. As shown in the graph in Figure 6, flashover can occur within 9 to 11 minutes of the start of a fire. Locating fire stations to provide a total response time of six to seven minutes is advantageous, as firefighters need time after arrival to setup, lay fire hose, and gain access to the seat of the fire before they can actually begin to search for trapped occupants or extinguish the fire. This is where having enough fire stations strategically located and apparatus staffed with a sufficient number of firefighters proves to be advantageous.

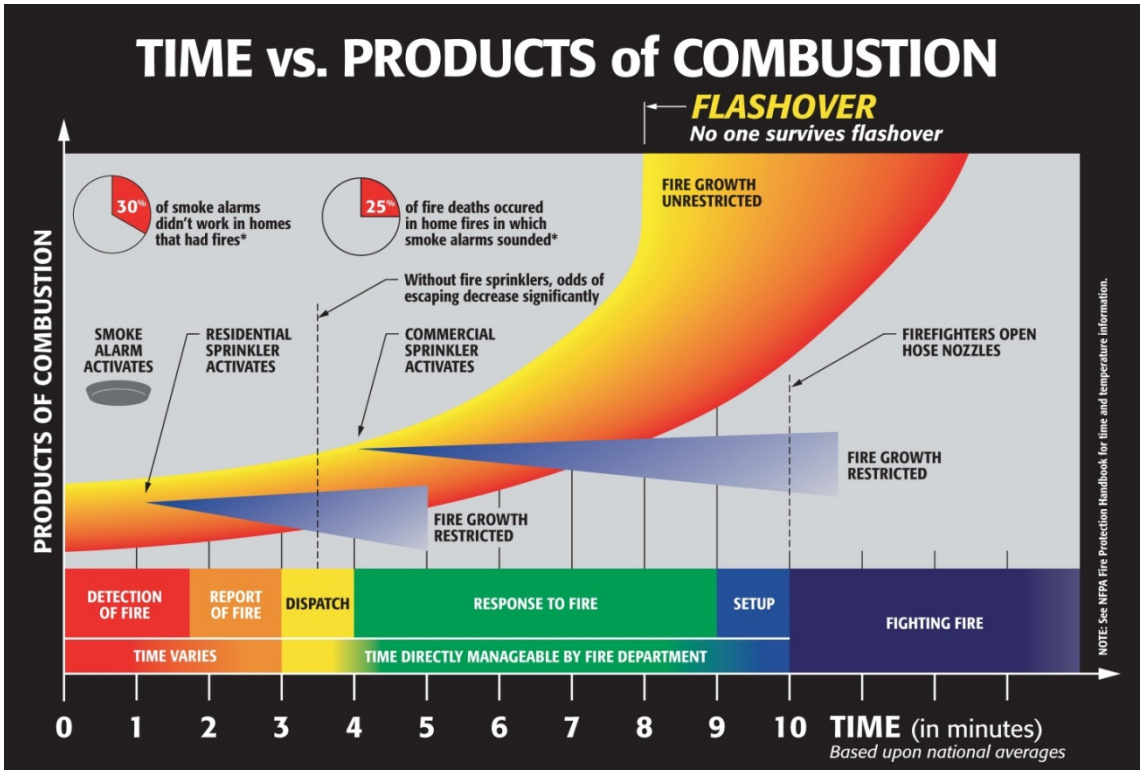


Figure 6 – Time versus Products of Combustion

Morristown's current six fire stations are well located, but inadequate in number. Morristown needs to add a seventh station to cover the area out Enka Highway indicated as Lowland on the city limits map in Figure 4.

How Many Ladder or Service Companies Does Morristown Need?

A community needs a ladder company when it has at least five buildings that are three stories or more than thirty-five feet in height, or five or more buildings with a needed fire flow greater than 3,500 gpm, or a combination of five buildings meeting these criteria. Morristown has enough buildings to require a ladder truck under ISO requirements. ISO

states that if a ladder company is not needed, a service company is then required. A service company carries the same tools and equipment as a ladder company, but does not have the aerial ladder. Based on ISO's requirements for distribution, Morristown needs one ladder company, and the fire department has one ladder company at Station 1. The fire department uses quints, which helps by providing aerial ladder capability and partial credit for an aerial ladder. A quint is a fire apparatus that carries a pump, water tank, required fire hose load, carries extension ladders, and has an aerial ladder device. Provided the apparatus carries all the required tools and equipment, and has all of the required annual tests, ISO gives quint apparatus up to full credit for an engine company and up to half credit for a ladder company. Quints are located in Fire Stations 1, 2, 5, and 6. The map in Figure 7 shows the 2.5-mile coverage area for Truck 1, as indicated by the streets outlined in red.

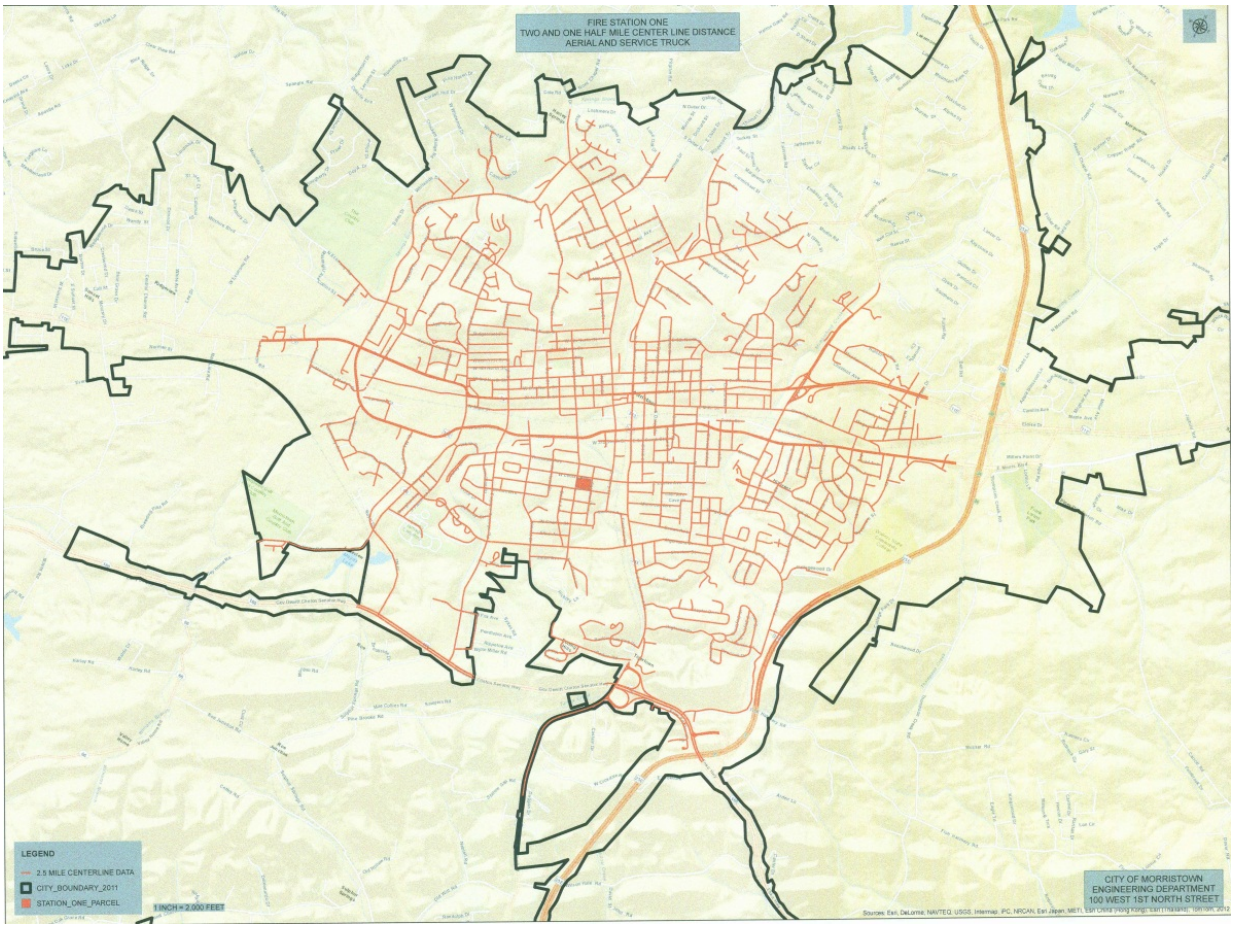


Figure 7 – 2.5-Mile Response Area for Truck 1

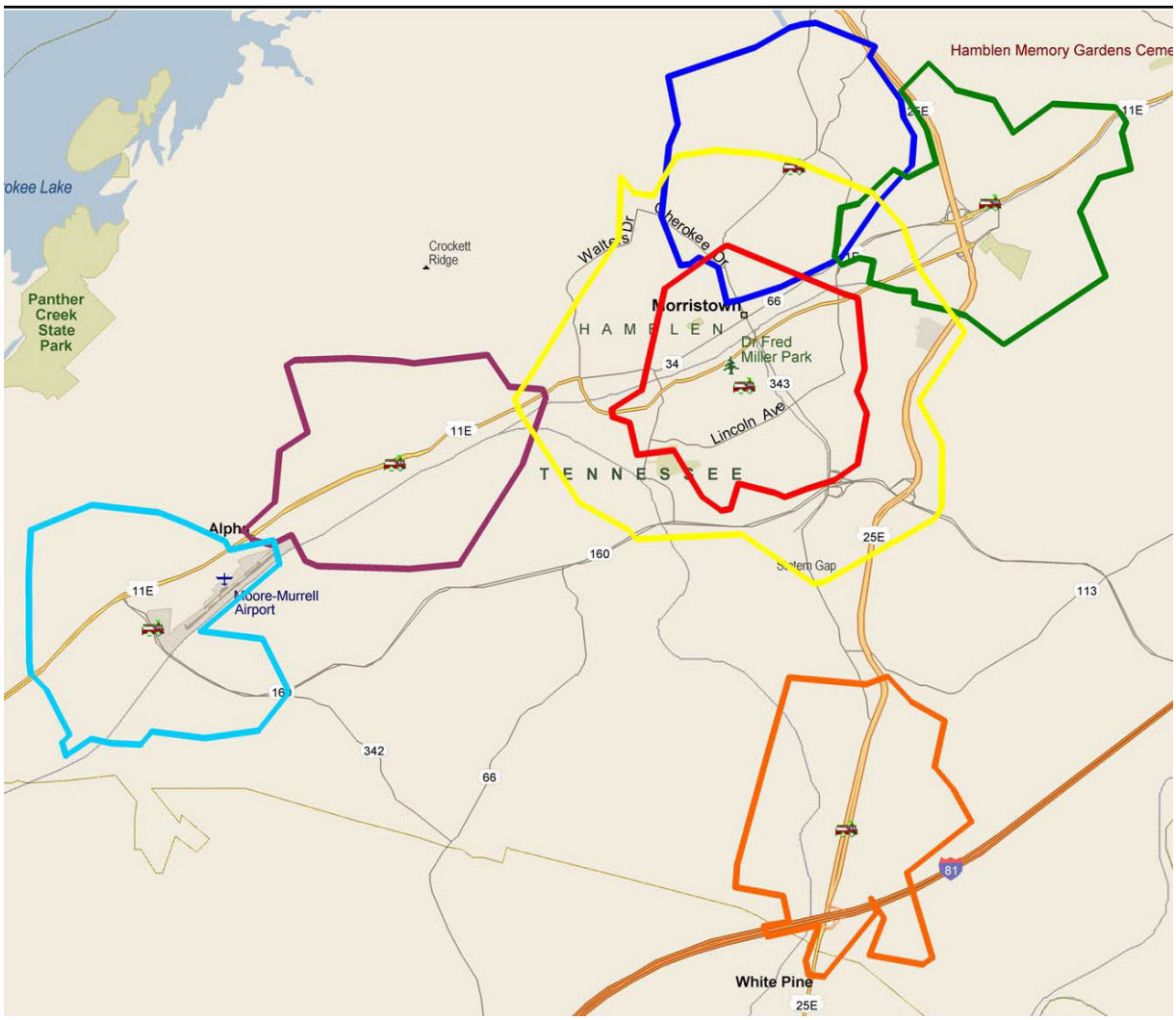


Figure 8 – 2.5-Mile Response Area of Truck 1 and All Fire Stations

The map in Figure 8 shows the response area of Truck 1 and the response areas of all six engine companies. It is evident that a large portion of the city is not within the 2.5-mile response area of Truck 1. The quints help by providing partial credit for a truck company in the other areas of the city. Morristown has a significant industrial and commercial presence, and the city should consider adding a second truck company for this risk and for the size of the area served.

Minimum Firefighter Response for a Low-Risk Structure Fire

Firefighting is a dangerous and labor-intensive operation, and the discussion on the number of firefighters needed to fight a fire continues, but there are guidelines one can use to make an informed decision on the number of firefighters needed to fight a structure fire. Back in 1966, NFPA Standard 197, A Training Standard on Initial Fire Attack, stated, "*The desirable number of men normally required to respond with the*

apparatus to give this level of performance with properly manned hose streams and equipment would be approximately fifteen plus the chief." NFPA Standard 1410 replaced NFPA Standard 197 in 1979, but the idea of a minimum of fifteen firefighters plus an incident commander as a valid minimum number of personnel for the initial alarm has withstood the test of time. Since then, various agencies have conducted many studies over the years regarding the number of firefighters needed to extinguish a fire, and there is consensus among NFPA, ISO, and the International City Management Association (ICMA) that a low-risk structure fire requires between sixteen to nineteen firefighters for effective operations. A single-family dwelling is an example of a low-risk structure fire. For example, ISO gives full staffing credit for a response of nineteen personnel. NFPA recommends a minimum of sixteen firefighters as shown in Table 6.

Initial full-alarm structure fire assignment per NFPA 1710, § 5.2.4.2.2		
Sub-section	Function	Minimum Number
(1)	Incident command	1
(2)	Water supply & attack pumper operators	2
(3)	Two hand lines with 2 firefighters each	4
(4)	Hand line support, 1 for each hand line	2
(5)	Search and rescue	2
(6)	Ventilation	2
(7)	Aerial device operator (only if aerial used)	1
(8)	Rapid Intervention Team (RIT)	2
	Total	16

Table 6 – NFPA Recommended Minimum Response for House Fire

The response level described above is for a residential structure fire of a house of about 2,000 square feet with no basement or exposures. NFPA 1710 Section 5.2.4.2.3 says that higher risk occupancies (schools, hospitals, apartments, commercial properties, etc.) require more resources, which means more apparatus and personnel. Local leaders must decide on a level of fire protection for their community, balancing the cost of providing the service against the lives and property at risk. To make this decision, it is important for the leaders to understand minimum response recommendations. This report acknowledges that Morristown does not have the financial resources to hire enough paid personnel to provide that level of response to a structure fire. The use of automatic aid and mutual aid can provide a sufficient number of trained firefighters but this method takes more time to assemble an effective firefighting team of sixteen personnel.

Apparatus

Morristown has seven first-out apparatus, meaning the apparatus is staffed and equipped for immediate response. The fire department has three reserve, or backup, apparatus. ISO requires that a community have at least one reserve engine and ladder truck for every eight, or fraction thereof, required engines or ladder trucks, and the fire

department complies with this requirement. NFPA Standard 1901 recommends that properly maintained fire apparatus that is fifteen years or older be placed in reserve service, and apparatus more than twenty-five years old not be used for emergency response. Older apparatus lacks the safety features and operational capabilities found on newer apparatus, such as enclosed seating areas (Engine 4 and both reserve engines have open cabs), auxiliary braking systems, reflective striping, improved warning light requirements, and increased tip load requirements for aerial devices.

Apparatus	Year Built	Age	Type	Move To Reserve Service	Retire from Emergency Service	Estimated Replacement Cost
Engine 1	2003	9	Quint	2018	2028	$800,000
Engine 2	2005	7	Quint	2020	2030	$800,000
Engine 3	1995	17	Engine	2010	2020	$550,000
Engine 4	1989	23	Engine	2004	2014	$400,000
Engine 5	2001	11	Quint	2016	2026	$800,000
Engine 6	2000	12	Quint	2015	2025	$800,000
Truck 1	1989	23	Aerial	2004	2014	$1,400,000
Reserve 1	1980	32	Engine	1995	2005	$550,000
Reserve 2	1983	29	Engine	1998	2008	$550,000
Truck 2	1962	50	Ladder	1977	1987	$1,400,000

Table 7 – Age of Fire Apparatus

The city performs maintenance and repair on the fire apparatus and maintains maintenance records. Morristown has two first out pumpers that are more than fifteen years old, and the aerial truck is twenty-three years old. All reserve apparatus exceeds the recommended maximum age for the apparatus to be used for emergency service (see Table 7). The city should implement program to replace apparatus on a fifteen year/twenty-five year cycle so that the city can budget for this capital expense and fire department can develop specifications in a timely manner. The city should retain properly maintained and serviceable apparatus that reaches the age of fifteen years as reserve apparatus. Once apparatus reaches the age of twenty-five years, the city should retire the apparatus from service. The city may consider retaining apparatus with possible historical value, such as the 1962 ladder truck, for public relations, parades, or other non-emergency service. For liability reasons, if the city elects to dispose of older apparatus, the city should make sure that it does not sell the apparatus to another fire department for use in emergency service.

The Cost of Fire Service in Morristown

One of the concerns of city leaders is whether the cost of providing fire services in Morristown is cost effective. In other words, is the community getting a good return on its investment? Determining the level of fire protection for a community is a complex process. Factors that affect this decision are many, and conditions are dynamic. Some of the factors to be considered include the following.

Aging Housing, Population, and Infrastructure – Older homes and buildings represent an increased risk to the community. The electrical systems in older homes may be overtaxed, lack the modern overcurrent protection provided by circuit breakers, and require the use of extension cords. Firewalls and fire stops may have been penetrated to run telephone, cable TV, and computer lines, which compromises their reliability. Wood frame construction may lack fire stopping found in newer homes. An aging population uses the EMS system more frequently, contributing to an increase in call volume. Older buildings may lack sprinkler or alarms systems, which can contribute to increased fire growth before detection. Older water mains for fire protection may be undersized or tuberculation in the mains may reduce available fire flows.

Community Growth – The need for emergency services is constant, but the demand for emergency services grows. More residents, more visitors, more homes, and more businesses increase the demand for emergency services. Morristown has reserve area for annexation and undeveloped areas for infill, so the community will grow, but growth may not start until the economy improves.

In looking at Table 2, the call volume (demand) increased by 12.9% in the last five years. The number of structure fires has remained steady at approximately 67 per year. The largest increase in service demand was for emergency medical calls, which increased by 21.2%. As the population ages, Morristown must plan for an increase in the number of EMS responses.

Community Expectations – Growth will mean that people will move *to* Morristown *from* other places. Knoxville is the largest city nearby, and people who move from Knoxville or other areas where they have been receiving urban level emergency services expect the same level of emergency services in Morristown. The larger the community, the higher the level of service people expect.

Missed Calls – The current demand for services is within the capabilities of the fire department, but there will come a time when the fire department will not be able to respond to a call in a timely manner. The city should monitor indicators such as response time, the number of firefighters responding, the number of fire apparatus responding, and the number of minutes it takes to assemble an effective firefighting force (at least sixteen firefighters, the required pump capacity on the scene, the ability to generate adequate fire flow, etc.) to help determine if the fire department is meeting desired community services.

Excessive Response Times –Seconds saved are minutes earned, and response time is a critical factor for positive outcomes on fires and for decreased morbidity and mortality on medical emergencies. Excessive response time endangers the community. The city should monitor response time two ways. First, monitor the total response time from the time the phone rings in the dispatch office until the first unit arrives on the scene. This is the response time for the initial arriving apparatus. Second, monitor the time from when the phone rings in the dispatch office until all first alarm units are on the scene. This is the response time of the first alarm assignment. Recommended benchmarks are six minutes, thirty-five seconds (6:35) for the initial arriving company and ten minutes, thirty-five seconds (10:35) for the full first alarm assignment. Use these as performance indicators and trigger points for adding stations or companies if these response times become excessive.

Reduced Firefighter Response – The Morristown Fire Department is a career department, so staffing levels do not fluctuate. Recruitment, retention, and turnover are continuing issues for every fire department. Apparatus responding with fewer than the required number of firefighters needed compromises the safety of citizens and the firefighters. The city should maintain a minimum staffing level of four personnel on all apparatus.

Ability to Provide Non-Emergency Services – In addition to fire and emergency medical response services, the fire department provides many value added services mentioned in this report. Monitor the ability to continue to provide these services and for any decreases in the use of the service or the quality of the service as a result of pressures on the fire department that interfere with the provision of these value-added services.

Value of Services Received – The Morristown Fire Department provides very good fire and emergency service for the city at a reasonable cost. As with any business, the cost of supplies, utilities, insurance, and other items increases, which means the business (the fire department) must "charge," i.e. budget, more for its services. As long as the quality of the service is high, and the service benefits the community, the return on investment is positive. Benchmarks will help the city determine if the service is worth the expense. The fire department should monitor customer satisfaction through a user survey.

Summary

The Morristown Fire Department is a well-organized, well-managed fire department. The department is using many industry best practices in daily management. The department is above average in Tennessee in the areas of firefighter training and commercial inspections. The department's efforts to staff engines with four personnel are also above average, and no doubt contributes to the higher cost-per-call figure in the TMBP.

As shown in Appendix B, which is a list of major disaster events over the last ten years, Morristown is at risk for a variety of manmade and natural disasters. A fire department is usually the "Ghostbusters" organization for a city, as residents call the fire department "*when there's something weird in the neighborhood*" and they do not know whom to call, or there is an unusual situation or major emergency. To fill this role, the fire department uses an "all-hazards" approach and is prepared to respond to these situations and disasters, as the fire department is the first-line emergency response organization for the community. Equipping the department and training personnel takes time and money, and the benefit is the immediate response of well-trained and equipped personnel to help the community recover quickly.

At $248 per capita, with the average being $186 per capita, Morristown's cost per capita for providing fire service was the highest in the TMBP, and Morristown is concerned about this. The department's full-time equivalent rate per thousand population is 2.99, which is higher that the TMBP average of 2.11. Personnel are the most expensive component of any fire department budget, and the higher staffing service level Morristown offers contributes to the higher fire costs per capita. Morristown's overtime to salary ratio is 5.36% and the TMBP average is 2.33%. The fire department's overtime budget is $210,000 per year. Approximately $145,000 of this amount is not true overtime and is paid to the shift firefighters as part of a labor agreement that has been in effect for a number of years. The cost for true overtime is approximately $65,000 per year, which makes the overtime to salary ratio 1.75%, and thus less than the TMBP average. In the future, the fire department should report the labor agreement overtime to the TMBP as part of wages, or add a note to the report to reflect the labor agreement.

Also contributing to the cost is the higher number of calls for service per thousand population. Morristown's rate is 104 calls per thousand population and the TMBP average is 87. Compared to the TMBP, Morristown's fire rate per thousand population is higher, 8.4 versus 6.7, and the structure fire rate is slightly higher, 2.5 versus 1.7. The EMS call rate per thousand is much higher than the TMBP average, 79.28 versus 50.41. These high service demand rates contribute to the cost for service.

Morristown has the highest full-time equivalent (FTE) rate of any city in the TMBP, which contributes to the cost for service. Morristown is an industrial based community, which requires a strong level of fire protection to protect these major employers, and Morristown tries to maintain four personnel on four of the six engine companies, while most other cities maintain three. The city and fire department face the challenge of continuing to provide quality service in a poor economy while dealing with aging infrastructure and apparatus, so it is natural to look for ways to reduce operating costs. The fire department's budget is in line with the services provided for the level of risk in the community.

The fire department has several immediate challenges and desired service improvements. Stations 3 and 4 are almost 50 years old and need to be replaced. The apparatus fleet is aging, as two first line engines and the truck should be moved to

reserve service now. In less than two years, an engine and the truck should be retired from emergency service. All current reserve apparatus should be retired from service. A mechanic with emergency vehicle technician (EVT) certification to repair and maintain apparatus would benefit the maintenance of fire apparatus.

The fire department needs a training center with classrooms, office space, a burn building, and a four-story drill tower.

The department is doing a good job on commercial inspections and pre-fire planning, but the fire marshal's office could improve service with the ability to maintain a two-person staffing level. The layout of the fire marshal's office is not optimal, and renovating the space would improve working conditions.

The fire department never goes below three personnel on a fire engine, or two personnel on the truck, and tries to maintain four personnel on Engines 1, 2, 3 and 5, and three personnel on Truck 1. Research has shown that four-person crews are the most effective in fire suppression operations, and the fire department desires to increase staffing to maintain four personnel on Engines 1, 2, 3, 5, 6 and Truck 1.

All of these items requiring planning and funding. The best way to examine and prioritize these needs is through a comprehensive strategic plan. The fire department should develop a strategic plan with short and long-range goals and objectives tied to the level of risk present in the community and the level of fire protection desired. The plan will serve as a roadmap for the city in planning for a budgeting for maintaining and improving service levels.

Recommendations

1. Prepare to adopt a new fire code in 2014. The version of the model code adopted should be within seven years of the most recent edition of the model code, which is the 2012 edition of NFPA 1.
2. Adopt a response time standard for the initial arriving company that includes all components of response time. Morristown is a perpetual organization that will outlast current leaders, and this study looks towards eventual build out, which is many years in the future. Once adopted, the response time standard will serve as a planning guide for future leaders. This study recommends a response time standard of 6:35 (six minutes, 35 seconds) for 90% of all responses, which is based upon recommendations found in NFPA Standard 1710, Standard for the Organization and Deployment of Fire Suppression Operations. The 6:35 breaks down as follows: ring time – 15 seconds, call processing time – 60 seconds, firefighter turnout time – 80 seconds, travel time – 240 seconds. Using this standard, planners would look for fire station locations to maintain a 4 minute travel time to as much of the area to be protected as possible. Track and report response time monthly.
3. Adopt a response time standard for the full first alarm assignment that includes all components of response time. This study recommends a first alarm response time standard of 10:35 (ten minutes, 35 seconds) for 90% of all responses, which is based upon recommendations found in NFPA Standard 1710, Standard for the Organization and Deployment of Fire Suppression Operations. The 10:35 breaks down as follows: ring time – 15 seconds, call processing time – 60 seconds, firefighter turnout time – 80 seconds, travel time – 480 seconds. Monitoring this benchmark will help community leaders determine if the fire department is meeting the desired service level for the community. Track and report this time monthly.
4. Increase the rate of investigation of fire to determine cause.
5. Place Engines 3, 4 and Truck 1 in reserve service as soon as possible and replace them with fire apparatus meeting the current requirements of NFPA Standard 1901. Consider replacing Truck 1 with a 100' platform. Replace all current reserve apparatus with apparatus that is less than 25 years old.
6. Plan for and construct a training facility with a burn building and drill tower.
7. Develop plans to replace Fire Stations 3 and 4, identify funding sources, and replace the fire stations.
8. Develop a strategic plan for fire services. The plan should state the desired service level for the community, identify goals and objectives to achieve the desired level of service, identify desired performance measures to monitor progress, include a time line, and identify key individuals responsible for specific goals and objectives.

Appendix A – Estimated Travel Times and Total Response Time in Minutes

Distance To Travel in Miles	Estimated Travel Time	Ring Time	Call Processing Time	Fire Dept. Turnout Time	Total Response Time
0.25	1.08	0.25	1.00	1.33	3.66
0.38	1.30	0.25	1.00	1.33	3.88
0.50	1.50	0.25	1.00	1.33	4.08
0.75	1.93	0.25	1.00	1.33	4.51
1.00	2.35	0.25	1.00	1.33	4.93
1.25	2.78	0.25	1.00	1.33	5.36
1.50	3.20	0.25	1.00	1.33	5.78
1.75	3.63	0.25	1.00	1.33	6.21
2.00	4.05	0.25	1.00	1.33	6.63
2.25	4.48	0.25	1.00	1.33	7.06
2.50	4.90	0.25	1.00	1.33	7.48
2.75	5.33	0.25	1.00	1.33	7.91
3.00	5.75	0.25	1.00	1.33	8.33
3.25	6.18	0.25	1.00	1.33	8.76
3.50	6.60	0.25	1.00	1.33	9.18
3.75	7.03	0.25	1.00	1.33	9.61
4.00	7.45	0.25	1.00	1.33	10.03
4.25	7.88	0.25	1.00	1.33	10.46
4.50	8.30	0.25	1.00	1.33	10.88
4.75	8.73	0.25	1.00	1.33	11.31
5.00	9.15	0.25	1.00	1.33	11.73
5.25	9.58	0.25	1.00	1.33	12.16
5.50	10.00	0.25	1.00	1.33	12.58
5.75	10.43	0.25	1.00	1.33	13.01
6.00	10.85	0.25	1.00	1.33	13.43
6.25	11.28	0.25	1.00	1.33	13.86
6.50	11.70	0.25	1.00	1.33	14.28
6.75	12.13	0.25	1.00	1.33	14.71
7.00	12.55	0.25	1.00	1.33	15.13

Notes:

- Travel time was calculated using the Rand formula of T = 1.7(D) to estimate travel time, where T is time and D is the distance to be covered expressed in miles.
- The 15-second ring time, 60-second call processing time, and 80-second turnout time are based on recommendations found in NFPA Standard 1710.
- Minutes expressed as decimal minutes: to compute seconds, multiply the decimal number by 60. For example, 3.66 decimal minutes equals 3:40 (three minutes, forty seconds).

Appendix B – Disasters in Hamblen County from 2001 Through 2011

DATE	HAZARD TYPE	PROPERTY DAMAGE	PROPERTY DAMAGE ADJUSTED TO 2011 DOLLARS
5/6/2001	Severe Storm/Thunder Storm - Wind	$0	$0
5/21/2001	Severe Storm/Thunder Storm - Wind	$10,000	$12,840
7/4/2001	Severe Storm/Thunder Storm - Wind	$0	$0
8/11/2001	Severe Storm/Thunder Storm - Wind	$0	$0
10/24/2001	Severe Storm/Thunder Storm - Wind	$0	$0
1/24/2002	Severe Storm/Thunder Storm - Wind	$2,000	$2,506
3/17/2002	Flooding	$166,667	$208,835
4/28/2002	Hail	$5,000	$6,265
4/28/2002	Hail	$5,000	$6,265
5/13/2002	Severe Storm/Thunder Storm - Wind	$20,000	$25,060
7/2/2002	Severe Storm/Thunder Storm - Wind	$10,000	$12,530
2/3/2003	Wind	$1,269	$1,571
2/14/2003	Flooding	$548,485	$679,076
2/14/2003	Flooding	$330,303	$408,947
5/2/2003	Severe Storm/Thunder Storm - Wind	$6,000	$7,429
5/11/2003	Severe Storm/Thunder Storm - Wind	$8,000	$9,905
5/17/2003	Severe Storm/Thunder Storm - Wind	$15,000	$18,571
6/11/2003	Severe Storm/Thunder Storm - Wind	$15,000	$18,571
6/11/2003	Severe Storm/Thunder Storm - Wind	$15,000	$18,571
5/26/2004	Severe Storm/Thunder Storm - Wind	$3,000	$3,586
5/26/2004	Severe Storm/Thunder Storm - Wind	$2,000	$2,391
5/26/2004	Severe Storm/Thunder Storm - Wind	$2,000	$2,391
5/31/2004	Severe Storm/Thunder Storm - Wind	$20,000	$23,908
7/13/2004	Severe Storm/Thunder Storm - Wind	$2,000	$2,391
7/13/2004	Severe Storm/Thunder Storm - Wind	$2,000	$2,391
7/25/2004	Severe Storm/Thunder Storm - Wind	$40,000	$47,816
7/26/2004	Severe Storm/Thunder Storm - Wind	$2,000	$2,391
9/17/2004	Tropical Depression	$12,000	$14,345
4/22/2005	Thunderstorm Wind	$25,000	$28,889
4/22/2005	Thunderstorm Wind	$5,000	$5,778
6/6/2005	Thunderstorm Wind	$15,000	$17,333
7/1/2005	Thunderstorm Wind	$20,000	$23,111
4/2/2006	Thunderstorm Wind (G60)	$5,000	$5,652
4/8/2006	Thunderstorm Wind (G60)	$12,000	$13,565
6/24/2006	Thunderstorm Wind (G40)	$5,000	$5,652
7/28/2006	Thunderstorm Wind (G60)	$25,000	$28,261
8/8/2006	Thunderstorm Wind (G60)	$10,000	$11,304
8/10/2006	Thunderstorm Wind (G60)	$25,000	$28,261
8/10/2006	Lightning	$20,000	$22,609
9/28/2006	Thunderstorm Wind (G60)	$3,000	$3,391
9/28/2006	Thunderstorm Wind (G60)	$3,000	$3,391

12/1/2006	High Wind (G67)	$27,750	$31,370
4/3/2007	Thunderstorm Wind (50EG)	$30,000	$32,842
6/8/2007	Thunderstorm Wind (60EG)	$15,000	$16,421
6/24/2007	Thunderstorm Wind (55EG)	$12,000	$13,137
6/25/2007	Thunderstorm Wind (55EG)	$10,000	$10,947
6/26/2007	Thunderstorm Wind (55EG)	$15,000	$16,421
4/11/2008	Thunderstorm Wind (45EG)	$2,000	$2,101
6/28/2008	Thunderstorm Wind (55EG)	$8,000	$8,404
6/28/2008	Thunderstorm Wind (52EG)	$5,000	$5,253
2/11/2009	Thunderstorm wind (60EG)	$20,000	$21,224
6/16/2009	Thunderstorm Wind (60EG)	$20,000	$21,224
6/16/2009	Thunderstorm Wind (60EG)	$15,000	$15,918
8/4/2009	Thunderstorm Wind (60EG)	$30,000	$31,837
9/7/2009	Thunderstorm Wind (50EG)	$5,000	$5,306
8/5/2010	Severe Storm/Thunder Storm - Wind	$2,000	$2,080
8/5/2010	Severe Storm/Thunder Storm - Wind	$1,000	$1,040
	TOTALS	**$1,633,474**	**$1,971,277**
		PROPERTY DAMAGE	**PROPERTY DAMAGE ADJUSTED TO 2011 DOLLARS**

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