On Duty Staffing Level Evaluation
For the City of Twinsburg

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A research project submitted to the Ohio Fire Executive Program

31 May 2005

CERTIFICATION STATEMENT

I hereby certify that the following statements are true:

1. This paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

2. I have affirmed the use of proper spelling and grammar in this document by using the spell and grammar check functions of a word processing software program and correcting the errors as suggested by the program.

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ABSTRACT

This study addressed if the current shift staffing level adequately meets the needs of emergency fire/EMS responses with the existing run volume, multiple occurrence rates today and for future service demands.

This study assessed the current staffing system of the Twinsburg Fire Department for adequacy and reviewed if continuing to utilize both fulltime and part time employees would be efficient/cost effective for the community once the additional station was built.

Using evaluative research sought to answer:

1. How does current staffing levels compare to NFPA 1710?
2. What's the staffing level for fire departments contained within Northeast Ohio?
3. What's considered adequate staffing to accomplish today's and future needs once a second fire station is constructed?

A literary search established current standards utilized by the Fire Service for staffing. Reviewing data from this department determined if mutual aid usage and/or personnel callbacks was affected by staffing levels and/or multiple run occurrence rates. Using a survey, comparisons of staffing to other departments of similar type operation, population and run volumes were made. A review of budgetary costs for various staffing schemes was conducted.

The results found that while the Twinsburg Fire Department doesn't meet current national standards for apparatus staffing for first alarm structure fire response, it's currently staffed adequately to handle today's run volume. Due to anticipated community growth as projected by the City's Comprehensive Plan, this will not remain true much longer.

The recommendations indicates creating a response policy that meets the intent of Section 1.3 Equivalency, (NFPA 2001, p1710-4) and increase staffing by one during weekday peak hours. When a second fire station is built, increase personnel to eleven to staff two stations. By doing so, a safe work environment for the fighters at structure fires is maintained while providing optimum EMS coverage of the areas covered.

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INTRODUCTION

The Twinsburg Fire Department is accountable for the fire and EMS protection of an area that covers two political entities, the city and township of Twinsburg, herein referred to as the District of Twinsburg. The City of Twinsburg owns and operates the fire department and funds it through the city's general fund account. The greater part of the income to this general fund is obtained through the city's 2% income tax rate. The Township of Twinsburg contracts for that service by negotiating a three year contract with the city. Due to the rapid residential, commercial and industrial growth of the past 14 years in this District along with the increased demand for current and potential future services, it was not certain the current staffing level for adequacy to maintain the expected level of service quality would continue to be met.

Currently the Twinsburg Fire Department consists of one main fire station, staffed by nine fulltime firefighter – paramedics per shift on the 24 hour/7 day workweek system, herein referred to as the suppression forces. The suppression force is responsible for emergency and non-emergency fire protection and EMS responses. Each of the three shifts' consists of one captain, one lieutenant and seven firefighter - paramedics. This requires a fulltime workforce of 28 employees. A 29th person supporting the three shifts is a float captain, who fills in for the six other officers whenever one is off on their FLSA day, or Kelly Day as it is referred to in Twinsburg. A part time workforce of 25 firefighter – paramedics supports the shifts in maintaining full strength levels.

In addition there are six more fulltime employees that support both the fire prevention bureau functions and administrative duties of the fire department operations. The administrative level consists of a fire chief, assistant fire chief and an administrative

assistant. Staffing the fire prevention bureau is, one captain with two fire safety inspectors for a fulltime department total of 35 employees. Adding in the part time staff of 25 employees the total of all employees comes to 60.

The City of Twinsburg is currently in the beginning process of building a second fire station, a satellite station in the northeast section of the City, with a projected completion time frame of late in the year 2006. A third satellite fire station is also being considered at some future time for the southern portion of the coverage area, possibly by the year 2010.

The problem this study addressed was threefold. The first part of this problem my staff and I had was the conviction that the response quality with the current on duty staffing level of nine that can drop to a minimum level of seven, is inadequate to meet the current needs of our emergency fire and EMS response area as recommended by certain NFPA, OSHA, NIOSH and AHA Standards. The second part of this problem was a belief that the current staffing level with our existing run volume, multiple occurrence run rate and potential future service demands are deficient and would like to improve that quality by adding three additional personnel per shift once the second station is completed, for an on duty maximum level of twelve. The third part of the problem we have continued to experience is maintaining the authorized on duty full strength level of nine firefighter/medics on each shift for one apparent reason. This appears to be due to the high number of hours required of part time personnel to cover one fulltime position exclusively, on top of covering hours whenever the fulltime personnel take days off for a variety of reasons.

That third part of the problem was documented with the following information. From January 01, 2002 through August 31, 2004, the 9th on duty fire-medic position on each shift was only staffed by part time personnel. The overall on duty attendance records for the years

2002, 2003 and 2004 indicates that a full strength level of nine firefighters occurred only 56.85% in 2002, with a slight increase to 60.96% in 2003 and a slight decrease to 60.91% by the end of 2004. This was far below the expected goal of 85% of the time, noted in Figure 1.

(figure not available)

Figure 1.
Percent of time at full strength from 2002 through 2004

That data is reflected by the hours required/covered by the part time staff. The needed coverage was approximately 24,000 hours in 2002 while the part time staff only covered 19,654.50 hours or 81.89% of that workload. For 2003 that number was increased to 26,000 hours required while the part time staff only worked 20,498.25 hours or 78.83% of that workload. For 2004, of the required 25,000 hours, the part time staff covered only 16,951 hours or 67.80%. This is noted in Figure 2.

(figure not available)

Figure 2.
Hours required vs. worked for the years 2002 through 2004

The purpose of this research project was to assess the current staffing system of the Twinsburg Fire Department and investigate ways to improve staffing if justified. Determine if once the additional station is built, would continuing to utilize both fulltime and part time employees be both efficient and cost effective for our community. The results will be provided for a review by the City Administration, consisting of the Mayor and seven City Council members.

This project used evaluative research to answer the following questions:

1. How does the current staffing level of the Twinsburg Fire Department compare to suggested national staffing standards, NFPA 1710?

2. To assist the City Administrators review what is the current staffing level for both fulltime and combination fire departments of all communities contained within the area of the North East Fire Chief's Association of similar population and geographical size in relationship to the City of Twinsburg.
3. What is the adequate staffing level of firefighter – paramedics needed to accomplish the staffing needs of the Twinsburg Fire Department for today and to meet the future needs by 2006 once the second fire station is constructed?

BACKGROUND and SIGNIFICANCE

The potential impact this study could have on the Twinsburg Fire Department is improved emergency run handling capacity, less dependence on mutual aid, improved fireground tactics due to more tasks being performed simultaneously and a safer work environment to the shift response personnel.

The first issue for the fire department administration to deal with was the belief that the current on duty staffing level was inadequate per the recommendations of the National Fire Protection Association (NFPA), National Institute for Occupational Safety and Health (NIOSH), American Heart Association (AHA), and certain Occupational Safety and Health Administration (OSHA) standards as they apply to the Fire Service and our current run volume. For example, a number of fire service organizations, the NFPA the most notable, which in the *Fire Protection Handbook, Nineteenth Edition* and in conjunction with *NFPA 1710*, recommend fourteen to fifteen firefighters respond to a typical residential structure fire. Twinsburg's current on duty maximum staffing level is nine firefighters, or five to six firefighters under the national recommendations, requiring Twinsburg to depend heavily on a mutual aid box alarm system (MABAS) to make up the first alarm response assignment. The

department also provides a paramedic EMS transport service. The department maintains three ALS Squads, staffing each with a three person paramedic crew. However with the increased volume of EMS runs coupled with the increased simultaneous occurrence rate of these runs, the incidence of the station being minimally manned to unmanned has gone up proportionally.

A second issue for the Twinsburg Fire Department administration was to provide accurate data for the members of the City of Twinsburg Council, if the soon to be built second fire station can be staffed appropriately through a combination of dividing the current on duty staffing level of nine between the two facilities as some Council members have suggested. And/or if by utilizing part time firefighter – paramedics to exclusively staff some new positions generally filled by fulltime employees, a system that was previously utilized from 1996 through October of 2004, would be effective. That system had proven to not work effectively from its inception, due to the high volume of hours needed to cover those positions.

The third and final issue for the fire department administration to resolve was the difficulty in maintaining adequate numbers of part time personnel to fill fulltime positions exclusively along with openings created by fulltime personnel on their days off.

The Twinsburg Fire Department is responsible for providing fire prevention/protection and Emergency Medical Services to a 21 square mile response area that comprises the political entities of the City and Township of Twinsburg, Ohio. The City is located in the NE corner of Summit County approximately 25 miles SE of Cleveland and approximately 20 miles NE of Akron. The City is approximately 13 square miles in size with a 2000 Census of 17,006 residents, a 77% increase in population from the 1990 Census of 9,606 residents. At

the end of 2004, the City population was estimated by the Mayor and Planning Commissioner of Twinsburg to be approximately 18,500. The Township on the southern and southeastern border of the city which consists of approximately 8 square miles, had a 2000 census of 2,153 residents, a 13.6% increase in population from the 1990 Census of 1,896 residents. At the end of 2004, the Township population was estimated by the Trustees to be approximately 2,500. Figure 3 reflects this change. City and Township officials expect the total population of both communities to level off at approximately 25,000 by the year 2010.

(figure not available)

Figure 3.

Population Census data for 1990, 2000 and 2004

The runs for service over that same period of time went from 813 runs in 1990 to 2,010 runs in 2000, a 147% increase. Currently the run average is 6 per 24 hour period, with 70.35% EMS, 24.18% fire related and 5.47% motor vehicle accidents. The run volume has grown at an average rate of 6.61%, with the 2004 total at 2,192 runs, as noted in Figure 4.

(figure not available)

Figure 4.

Run Volume totals from 1990 through 2004

In addition to this residential base, the community also is home to a large industrial and commercial area that employs over 15,000 workers during daytime hours, with the largest employer being the Chrysler Stamping plant with approximately 2,200 employees. There is also three very heavily traveled roadway systems, State Route 91, State Route 82 and State

Route 480, which cut centrally through the community as we are a major north/south line of travel for many suburbanites commuting to and from the Cleveland and Akron areas.

To meet Twinsburg's growing service demands, the Twinsburg Fire Department is using mutual aid assistance, Table 1, from many of Twinsburg's surrounding neighboring fire departments at a rapidly escalating rate each year, which is affecting those neighboring departments somewhat negatively, as in most cases, those communities staffing levels, Table 2, are less than that of Twinsburg's.

Table 1

Mutual Aid Received vs. Given from 2000 through 2004

Year	Given[a]	Received[b]	% Required[c]	Ratio[d]
2000	26	90	4.47	3.46
2001	44	119	5.50	2.7
2002	44	128	6.15	2.9
2003	59	154	6.96	2.6
2004	42	153	6.97	3.6

[a]Number of times Twinsburg gave mutual aid assistance to other communities

[b]Number of times Twinsburg received mutual aid assistance from other communities

[c]Percentage of times mutual aid assistance required by Twinsburg

[d]Ratio mutual aid assistance required by Twinsburg vs. given by Twinsburg to other communities

Table 2

Staffing Levels of Area Fire Departments

Department	Aurora	Hudson EMS	Hudson Fire	Macedonia	Oakwood Village	Solon	Streetsboro	Twinsburg
Maximum[a]	7	3	3	4	4	17	5	9

[a]Number of on duty personnel

The number of runs the department is responding to at this time has increased to a level where the fire administration no longer feels confident that the nine on duty is adequate to meet the current service demands let alone when dropping to the minimum manning level of seven. Also the incidences of concurrent runs, mostly EMS, has grown to a point where there is approximately a 23% chance there will be another run before the first run is completed.

That information comes from the department's Microsoft Access ™ database on service runs for each year. In 1997 a new data field was added to that database to track this statistic. The data field, labeled Another Call, is enabled whenever a run occurs while a previous run is still in process. This is corroborated by the Firehouse database report titled, Overlapping Incidents, which has been in use since September of 2001.

The current Twinsburg Firefighter Bargaining Unit Local 3630 has a clause in its contract indicating the minimum manning level can drop to four firefighters, not counting the chief officers. This minimum staffing level is an unrealistic number today, due to the growing service needs. To offset that contractual minimum, in 1998 the department minimum manning level was increased to six by the current fire chief, using part time personnel to maintain that minimum and using fulltime members on overtime whenever the part time staff was unable to meet that minimum.

As service demands continued to rise, on May 1st of 2004, the minimum level was increased to seven. At the present time, the Twinsburg Fire Department cannot add any more personnel; fulltime or part time, to the on duty shifts as there is no more physical room. However with a new satellite station about to be constructed in the next two years, the goal will be to increase the two station staffing level to twelve per shift and if the third projected

satellite station is built by the year 2010, the level will be raised to fifteen fire-medics per shift.

It was believed that once the second station is built, by increasing the staffing level to twelve fulltime firefighter - paramedics, the Twinsburg Fire Department will become less dependant on mutual aid and will be in a stronger position to respond to and transport up to three simultaneous emergency related patients and still have minimal personnel left to respond to additional rescue situations as first responders and/or send at least one minimally staffed fire unit to any fire related run. This system would continue to depend on part time personnel to cover the open fulltime positions as typically three to four firefighter – paramedics are off due to Kelly days, vacations, holidays, comp. time, sick leave or injury leaves on any given day.

LITERATURE REVIEW

For my literature review the local library, the internet, along with some previous study's/reports were reviewed on staffing issues as they relate to fire and EMS services. A Masterplan study on the fire department needs of Twinsburg that was conducted by Architectural Resources Corporation of Dayton, Ohio, Gary L. Snyder, AIA, President, January 1999 was my first study reviewed for input. The Nineteenth Edition of the NFPA's Fire Protection Handbook, the Insurance Services Office rating criteria, the National Institute for Occupational Safety, the Occupational Safety and Health Administration, the International Association of Fire Fighters (IAFF), the Fire Chief's Handbook, 5th Edition, the American Heart Association (AHA), sections of the Ohio Revised Code as it pertains to staffing issues for EMS, the Revised Ohio Administrative Code, section 4121:1-21-01 on

firefighting and National Fire Protection Association (NFPA) Standards 1410, 1500, and 1710, were reviewed and also used for my research.

In the Fire Chief's Handbook, 5th Edition in the section on Fire Company Operations, sub section Staffing Tests, it states; "….we find the not-so-startling conclusion that the more firefighters performing a prescribed job, the less time it will take". (p. 621). In sub section, Determining Needs, it states; "What then, is adequate company strength? It depends upon need. The need in a district of well-spaced, one-story homes is not the same as an area covered with six-story combustible tenements, each occupied by more than 100 people." (p. 621). Under sub section, Initial Response, it states; "The reasoning that it is the group total that really matters raises the question of what that total should be. Recommended minimums for initial response range from 12 to 16; but in actual practice vary from 4 to 35. Here again the correct number depends upon the character of the area to be protected". (p. 623).

The Insurance Services Office (ISO), a company that rates fire departments nationwide on their ability and resources to fight fires, including the City of Twinsburg which currently has an ISO rating of 5, provided more information. Here are some of the criteria evaluated in any departments review for the response to building fires per ISO. In their Fire Suppression Rating Schedule handbook it stated, "The Grading Schedule considers four factors in determining the number of needed Engine Companies for first alarm to structure fires in a given city. These four factors are:

- Needed Engine Companies based on the city Basic Fire Flow.
- Needed Engine Companies based on first-due response distance, and companies needed for distribution throughout the city.

- Needed Engine Companies based on response of companies on the first alarm of fire to buildings.
- Number of Needed Engine Companies by Basic Fire Flow." (p.75-76)

The ISO review last performed in Twinsburg in 1996, indicates a Needed Fire Flow of 3,500 GPM. Again the Fire Suppression Rating Schedule indicates that "…a city having a Basic Fire Flow of 3,500 GPM, then the Number of Needed Engine Companies to be three". (p.76). Further on in their Fire Suppression Rating Schedule handbook it stated, "…that two Engine Companies and one Ladder Company or Service Company be dispatched on all first alarms for building fires" (p. 84). Continuing on it is noted, "The number of aerial ladder or aerial platform trucks needed for a city depends on the distribution of Ladder Companies based on two primary factors:

1. Building heights.
2. Buildings with needed fire flows greater than 3,500 GPM." (p. 110-111)

"The specific criteria for evaluating needed Ladder Company service are:

- Response areas with five buildings that are three stories high or 35 feet or more in height

Or

- Response areas with five buildings that have Needed Fire Flow greater than 3,500 GPM

Or

- Any combination of five buildings that meet the height and fire flow requirements given above.

When a given city satisfies the height and/or fire flow requirement, a minimum of one Ladder Company is needed." (p. 111). Twinsburg has all of the above and currently is able to staff and respond one Engine Company and/or one Ladder Company or a second Engine Company. Continuing on with equipment locations it states, "Distribution of Companies: The built-upon area of the city should have a first due Engine Company within 1.5 miles and a Ladder-Service Company within 2.5 miles." (p. 140) Twinsburg has one centrally located station to cover 21 square miles. The ISO criteria for evaluating staffing in regards to building fires states; "A standard operation under the Grading Schedule is two Engine Companies and one Ladder-Service Company to first alarm building fires. Based on the number of needed personnel to earn full credit, the first alarm assignment should have 18 firefighters. This number is consistent with research findings in the early 1980's on controlling a developing fire with a first alarm assignment." (p. 146). Twinsburg has a maximum on duty level of nine and a minimum staffing level of seven.

The Masterplan study conducted by Architectural Resources Corp. of Dayton, Ohio, Gary L. Snyder, AIA, President, January 1999, on behalf of the City of Twinsburg was utilized as it relates to manning levels and response time performance. In that study submitted to the City of Twinsburg by Gary L. Snyder, AIA, President of Architectural Resources Corp. on January 18, 1999, under the heading of Personnel, Snyder indicates, "Personnel requirements are determined primarily by the size of the fire and physical characteristics of the building, i.e., it takes from 3 to 10 times the personnel to fight a fire in a multi-storied commercial building as the same fire in a one story single family residence." Snyder goes on with, "Current regulations are also redefining the minimum crew size for various emergencies. These have increased manpower needs in many communities." (p. 6).

In regards to how many units should respond to a structure fire, in the Nineteenth Edition of the NFPA's Fire Protection Handbook, "It does seem reasonable to say that not less than two fire suppression vehicles and a command officer should respond to any structure fire and the number of personnel responding should be sufficient to carry out the tasks indicated above, and whatever else is typically necessary in local operations, in a timely fashion. Normative data are available from some cities. Although that number is dependent on numerous factors, it is relevant to note that, in the broad spectrum of environments protected by 41 of the fire departments making up a portion of the Metropolitan Chiefs section of the International Association of Fire Chiefs, no department in the mid-1990s dispatched fewer than 13 firefighters (including a command officer) to a reported fire in a single-family detached dwelling. The average number dispatched was 18.6, and this did not include a rapid intervention team." (p. 7-36)

A new expression popped into firefighting terminology in the early 90's in regards to what became known as the 2 In/2 Out rule. On May 1, 1995, Department of Labor Deputy Assistant Secretary, James W. Stanley, issued a memo titled, Response to IDLH or Potential IDLH Atmospheres (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21788). This was issued as a result of numerous questions posed, with, "The specific question posed is whether OSHA regulations mandate the minimum number of workers required to be involved in operations under IDLH or potential IDLH conditions". At the end of this memo is a two page summary. This memo refers to NFPA 1500, which addresses the need for four persons to assemble before interior firefighting operations can begin in IDLH atmospheres.

This 2 In/2 Out issue became controversial as many Fire Chiefs and Unions wanted to justify using that interpretation for increasing additional staffing levels. What occurred as a result was that the OSHA respiratory protection standard, Respiratory Protection Standards 29 CFR 1910.134, was revised on January 8, 1998. Those changes became effective on April 8, 1998. Section (g)(4) specifically addresses the two in/two out question which soon became known as the two in/two out rule. On August 3, 1998, OSHA published a document called Questions and Answers on the Respiratory Protection Standard. It is noteworthy as pointed out in CPL 2-0.120 - Inspection procedures for the Respiratory Protection Standard, dated September 28, 1998, (http://www.osha.gov/OshDoc/Directive_pdf/CPL_2-0_120.pdf) that, "The "two-in/two-out" rule is a worker safety practice requirement, not a staffing requirement."

The 2 In/2 Out issue continued to be discussed making it into a number of Fire Service profession magazines. As noted in an April 1, 1999 Fire Chief article by Ronnie J. Coleman (http://firechief.com/ar/firefighting_heroism_not_endangered/), "The two-in/two-out ruling is not an opinion - it's a regulation. It's intended to create a workplace in which fewer and fewer firefighters suffer the consequences of inappropriate fireground management. It's going to be frustrating for some fire agencies as they sort out the set of circumstances under which the two-in/two-out rule affects discretionary decision-making, but it's a logical rule."

The State of Ohio has also addressed staffing levels. Under the Revised Ohio Administrative Code, chapter 4121:1-21-01 Scope and definitions, (A) Scope it states, "The purpose of Chapter 4121:1-21-01 of the Administrative Code (hereinafter "this chapter") is to provide reasonable safety for life, limb, and health of employees." Firefighting staffing is addressed under Chapter 4121:1-21-07 Fire department occupational safety and health,

“(C) Operating at emergency incidents.

(1) The employer shall provide an adequate number of personnel to safely conduct emergency scene operations. Operations shall be limited to those that can be safely performed by the employees available at the scene. No employee or employees shall commence or perform any fire fighting function **or** evolution that is not within the established risk management principles as specified in paragraphs (A)(2)(a)(b)(c) of this rule.”

(2) Employees operating in hazardous environments at emergency incidents shall operate in teams of two or more.

(a) Team members operating in hazardous environments shall be in communication with each other through visual, audible, or physical means, in order to coordinate their activities. Team members shall be in close proximity to each other to provide assistance in case of an emergency.

(3) At working structural fires a minimum of four employees shall be required, consisting of two employees working as a team in the hazardous atmosphere, who shall remain in voice or visual contact with each other: and two members who are located outside the hazardous atmosphere, who shall be responsible for maintaining a constant awareness of the number and identity of those operating in the hazardous atmosphere and be prepared to perform rescue of those members if required.

(4) Initial attack operations shall be organized to ensure that, if upon arrival at the emergency scene, the initial attack employees find an imminent life-threatening situation where immediate action could prevent the loss of life or serious injury,

such action shall be permitted with less than 4 employees. No exception shall be permitted when there is no possibility to save lives. Any such actions taken shall be thoroughly investigated by the employer." (p. 103-104).

In the 2000 edition of the National Fire Protection Association standard 1410, Training for Initial Emergency Scene Operations, Chapter 1-2, Purpose states, "This document is a training standard designed to provide fire departments with an objective method of measuring performance for initial fire suppression and rescue procedures using available personnel and equipment." (NFPA 2000, p. 1410-4). The Twinsburg Fire Department has been testing its personnel using this format four times per year since 1996.

In the 2002 edition of the National Fire Protection Association standard 1500, Fire Department Occupational Safety and Health Program, Chapter 8.4, Members Operating at Emergency Incidents (NFPA 2002, p. 1500-22) provides a number of safety guidelines. It states at 8.4.4: "Members operating in hazardous areas shall operate in crews of two or more." Paragraph 8.4.7. (NFPA 2002, p. 1500-22) notes, "In the initial stages of an incident where only one crew is operating in the hazardous area at a working structural fire, a minimum of four individuals shall be required, consisting of two individuals working as a crew in the hazard area and two individuals present outside this hazard area available for assistance or rescue at emergency operations where entry into the hazard area is required."

In 2001, the National Fire Protection Association approved a new standard, Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, known as NFPA 1710, on August 2 of that year. The stated purpose of this standard as noted in Chapter 1 Administration, Section 1.2 Purpose, (NFPA 2001, p1710-4) is, "…to specify the minimum

criteria addressing the effectiveness and efficiency of the career public fire suppression operations, emergency medical service, and special operations delivery in protecting the citizens of the jurisdiction and the occupational safety and health of fire department employees." Although Section 1.3 Equivalency, (NFPA 2001, p1710-4) allows a community to create a program that meets the intent of 1710 as noted, "Nothing in this standard is intended to prohibit the use of systems, methods, or approaches of equivalent or superior performance to those prescribed in this standard. Technical documentation shall be submitted to the Authority Having Jurisdiction to demonstrate equivalency." The section 4.1.2.1 and sub section 4.1.2.1.1, (NFPA 2001, p1710-6), establishes time objectives to be met for both fire and EMS responses. These time objectives are to be met 90% of the time. The sub section 5.2.2.1.1, (NFPA 2001, p1710-8) in reference to firefighting responses states, "These companies shall be staffed with a minimum of four on duty personnel." The sub section 5.2.3.2.2, (NFPA 2001, p1710-8) also in reference to firefighting responses indicates a total of 14 to 15 personnel to respond to the initial full alarm assignment. Under the section of EMS System Functions 5.3.3, is subsection 5.3.3.3 Staffing (NFPA 2001, p1710-9) in 5.3.3.3.2 it notes, "EMS staffing requirements shall be based on the minimum levels needed to provide patient care and member safety."

At the website for the National Institute of Occupational Safety and Health, www.cdc.gov/niosh/homepage.html a search of their link labeled, Search NIOSHTIC-2, for fire fighter staffing, provides 27 case studies of fire fighter fatalities investigated by NIOSH from August of 1998 through November of 2004. One common recommendation is for each department involved in this investigation to; "Provide adequate firefighter staffing to ensure safe operating conditions."

Most of the research I found was leading in the direction of staffing levels for fire and EMS based systems was from previous studies that included the 1991 Phoenix Arizona Fire Department, "Fire Department Evaluation System (FIREDAP)" study, the 1984 "Dallas Fire Department Staffing Level Study" and the 1993 Office of the Fire Marshal of Ontario, "Fire Ground Staffing and Delivery Systems Within a Comprehensive Fire Safety Effectiveness Model." These same studies were assessed by Bruce J. Moeller, Ph.D., MIFireE, Fire Chief of the Sunrise Fire-Rescue Department of Sunrise, FL, in a 2002 paper called, "Research in the Development of Deployment Standards: Why Can't We Answer 'Big Questions' in the Fire Service?" These papers were reviewed by Chief Moeller in regards to their reference in the development of NFPA 1710. Chief Moeller also added the 1993 IAFF's, "Safe Fire Fighting Staffing: Critical Considerations". Chief Moeller wanted to evaluate if the criteria stated by the committee that developed NFPA 1710 was valid. "To perform a systematic review of these four studies, a critique derived from methodologies applied elsewhere was used here.[6] The four studies were evaluated to see if they 1) employed original data; 2) provided a comparison to other systems; 3) provided sufficient information to replicate the study and 4) if appropriate statistical analysis was used. The review of a study's appropriateness also assessed if any methodological problems were identified. Employing this approach, the following studies were reviewed." (Moeller, 2002). His conclusion, "There are several conclusions that can be drawn from the foregoing discussion. Of secondary importance is that there is no data, one way or the other, to support any position on precise staffing or response time requirements as outlined in NFPA 1710. There is simply no good research to provide the necessary support. This is not a criticism of NFPA 1710 as much as it is a criticism of the fire service. The primary conclusion that should be drawn from this paper

is that we have failed to provide a mechanism to answer the Big Questions in our field. In the vacuum that remains, pseudo-science has been inserted to justify recently adopted standards." (Moeller, 2002).

In another article questioning the recommendations of NFPA 1710 titled, Setting Community Standards of Response Coverage for Fire Services by Fire Chief Stewart Gary of the Livermore-Pleasanton, CA, from the Western City magazine, (October 2001) for the International City/County Management Association, Chief Gary reports on a national coalition of local government agencies that had taken a prominent role in opposing the NFPA 1710 standard related to minimum staffing requirements and response times for fire companies. "The coalition consists of all 476 California cities, 44 municipal leagues (including the League of California Cities) and a number of statewide and national organizations. The coalition's concerns focus both on the process by which the standard was developed, and the "one size fits all" approach reflected in the standard. (For more information, visit the League's website at www.cacities.org .)

This approach is also referred to as Standards of Response Coverage (SORC).The SORC process supports firefighter safety. It's not just about the number of firefighters per company. The League believes there are better ways to go about the process of determining appropriate staffing levels and response times for fire agencies. One way is already used as part of a fire agency's accreditation by the Commission on Fire Accreditation International (CFAI). CFAI evaluates deployment (where firefighting companies are strategically placed) with a systems approach that uses risk assessment and community expectations to help elected officials make decisions about appropriate deployment of fire and emergency medical services."

The author notes that a Standards of Response Coverage, SORC, uses an eight step process to address specific issues. “This helps policymakers at all levels understand community needs and respond appropriately.”

In 1995, the International Association of Fire Fighters put together a manual, Safe Fire Fighter Staffing, Critical Considerations. In the Introduction it states; “This manual identifies those benchmarks by which safe and effective minimum fire suppression services should be assessed.”(p. 1). Further on in this manual it is noted; “The conclusion reached in the Dallas Study have recently been confirmed for small fire departments by the Westerville, Ohio Fire Deparmtent[4]. Using standard firefighting tactics, the results of the Westerville Fire Department study showed that 4 firefighters could perform rescue of potential fire victims 80% faster than a 3 firefighter crew.” (p. 5). The Westerville Fire Department study was conducted for a National Fire Academy Executive Fire Officer paper titled Manning Levels for engine and ladders companies in small fire departments, by then fire chief, Richard C. Morrison, 1990. In addressing the minimum staffing for EMS, the IAFF manual notes; “Early ACLS provided by paramedics at the scene is another critical link in the management of cardiac arrest. EMS systems should have sufficient staffing to provide a minimum of two rescuers trained in ACLS to respond to the emergency. However, because of the difficulties in treating cardiac arrest in the field, additional responders should be present. In systems that have attained survival rates higher than 20% for patients with ventricular fibrillation, the response teams have a minimum of two ACLS providers plus a minimum of two BLS personnel at the scene. Most experts agree that four responders (at least two trained in ACLS and two trained in BLS) are the minimum required to provide ACLS to cardiac arrest victims…”. (p. 35-36).

Richard C. Morrison (1990), fire chief of the Westerville, Ohio Fire Department, prepared a research paper for the National Fire Academy titled Manning Levels for Engine and Ladder Companies in Small Fire Departments. The purpose of this study was to establish how efficient a three person engine company and three person ladder company was when performing the same tasks a four person engine company or four person ladder company performed. The test was conducted in a three story wood frame house before they would eventually be conducting a live fire training event in. The four tasks for the engine company test were placing a hoseline in service to the basement, 1st floor, 2nd floor and 3rd floor of the structure. When the 4th person was added to the task effort the time was reduced by 19.5% to 48.5%. The three tasks for the ladder company test was to set up ladders to effect a rescue of a trapped person on the 2nd and 3rd floors, while test #3 was to simulate cutting a ventilation hole in the peak of a roof on a shed. When the 4th person was added to the task effort the time was reduced by 29.5% to 43.0%. (p. 12).

In a joint effort in 1997, the International City/County Management Association (ICMA) and the International Association of Fire Chiefs (IAFC) formed the Commission on Fire Accreditation International, Inc. (CFAI). The CFAI's mission is to provide a means for a fire department to seek accreditation. "This process uses a systems approach to deployment rather than a one-size-fits-all prescriptive formula. (Creating and Validating Standards of Response Coverage for Fire Departments, 4th Edition". (p. 4). This process looks at the entire function a fire department provides to its community, not just the firefighting aspect. "Some medical emergencies such as multiple car collisions or industrial accident rescues require speedy arrival of multiple crews to control the scene, perform rescue operations, and provide medical care." (Introduction, p. 1).

In today's fire service, providing EMS service is a larger portion of the task than actual firefighting demands. According to research information from the National Center for Early Defibrillation, in sudden cardiac arrest situations, to increase the odds of survival, two studies recently published in The New England Journal of Medicine found support to the value of early defibrillation with automatic external defibrillators (AED's). According to an editorial by Rose Marie Robertson, MD, of Vanderbilt University Medical Center, "Taken together, these studies provide strong evidence that trained personnel can intervene effectively when witnessed cardiac arrest is due to ventricular fibrillation." (National Center for Early Defibrillation, 2000). From the Emergency Cardiovascular Care handbook for Healthcare Providers from the American Heart Association, 2000, in cases of myocardial infarction, about 50% of all pre hospital deaths occur within the first hour after onset of the event. The community should, "Train and equip first responders for arrival within 5 minutes and rapid defibrillation." (p. 30). The AHA also notes that "there is a 10% decrease for survival for every minute of delay." (Chapter 4: Defibrillation, 1994).

The Boston Globe conducted a special report titled Deadly Delays: The Decline of Fire Response in January of 2005. The intent of the report was to address staffing levels and response times in responding to fires as compared to national standards. While the report is for the state of Massachusetts, the series shows the issues to be the same as my research is looking for in Ohio. In an article titled Slower arrival at fires in US is costing lives (By Bill Dedman, Globe Correspondent) it addresses the consequence of reduced staffing levels, "In fact, it is a daily event somewhere in America. Once a day on average in this country, someone dies when firefighters arrive too late, an investigation of fire response times by the Globe has found. America's fire departments are giving fires a longer head start, arriving later each

year, especially in the suburbs around Boston, Atlanta and other cities, where growth is brisk but fire staffing has been cut". In regards to staffing and response times; ""Fire protection in America is a myth," said Vincent Dunn, a retired New York City deputy fire chief and author of books on fire safety, who reviewed the Globe's findings. "These two subjects are the dirty little secrets of the fire service: The response times outside the center cities are too great, and the personnel responding, inside and outside the center cities, are too few. No one wants to talk about that."". Several related links can be obtained from the series at www.boston.com/news/specials/fires/ too numerous to list here.

A number of other documents were reviewed for this project not listed here but the results were often the same. The consensus of the articles is that the manning requirements should be at least four personnel on the fire scene to form a working company. Other studies show a three person crew versus a four and five person crew, but I found none involving two person crews. This indicates that to function effectively and safely on the fire ground more than a two person crew is necessary. After reviewing all of this literature I felt that enough information and data was available to meet the goal for this research paper.

PROCEDURES

In order to answer the questions posed in the introduction section of this project a literary search was considered necessary to establish what standards are currently utilized by the Fire Service in regards to adequate staffing levels to provide optimum EMS and fire protection to a community. The first place for information was our fire department library of National Fire Protection Association standards and handbooks. This led me to also research information my department had from the Insurance Standards Offices from our last audit in 1996. Upon review of that material I became aware there was a more recent Fire Suppression Rating

Schedule Handbook (1995) that sent me to our local library to obtain, however that one was not as informative as the one I ultimately used from 1993. Most of the remaining resource material I obtained was from a search of the internet. Here I obtained material from the National Fire Academy, the American Heart Association, the New England Journal of Medicine, the Ohio Administrative Code, the Ohio Bureau of Workers Comp, the Occupational Safety and Health Administration, the National Center for Early Defibrillation, the National Institute of Occupational Safety and Health, the International City/County Management Association and the Commission on Fire Accreditation International. The information gathered here was researched for personnel required to perform the tasks of firefighting and advanced life support care in a safe and effective manner.

A second step was to review all available data from the Twinsburg Fire Department to determine if the incidences of using mutual aid and/or personnel call backs to assist this fire department respond to runs was affected by staffing levels and/or multiple run occurrence rates.

A third step was to compare our staffing levels to other fire departments of similar type operation, population and run volumes. A survey (**Appendix A**) was developed and sent out to forty four of the eighty eight member departments in the North East Ohio Fire Chief Association domain, this includes twelve counties in northeast Ohio. The surveys were sent out via the internet e-mail system and by regular postal mail for those departments that an e-mail address was unavailable. These departments were picked as they are more familiar to the local publicly elected officials in my community for the comparisons to be made in regards to population, run volume and community business types. Thirty one surveys were

returned via e-mail or Fax, for a 68.89% return rate. The survey information was then placed into an Excel spreadsheet for review and comparisons (**Appendix B-1 and B-2**).

A fourth step was to review budgetary costs for various staffing schemes to be considered. This included meeting with the finance director for possible options for generating revenue including a direct use of EMS billing revenues to fund any increase in staffing levels. A review of the City's Comprehensive plan, a look forward for a five period performed every five years was reviewed for any projected impact on the anticipated growth of the City and how it might impact this Fire Departments' service ability.

The fifth and final step was to analyze staffing recommendations of national standards and research material obtained.

Definition of Terms

Advanced Cardiac Life Support (ACLS or ALS). A detailed medical protocol for the provision of lifesaving cardiac care in settings ranging from the pre-hospital environment to the hospital setting. Retrieved March 2005, from http://www.free-definition.com/ACLS.html .

Basic Life Support (BLS). A specific level of prehospital medical care provided by trained responders, including emergency medical technicians, in the absence of advanced medical care. Retrieved March 2005, from http://www.free-definition.com/Basic-life-support.html.

Combination Fire Department. A mix of fulltime, part time and/or volunteer members that make up the fire organization for a community. More often this is for a department that uses fulltime and volunteer members, although many area departments that use part time employees consider themselves a combination department.

EMS. Emergency Medical Service.

Emergency Medical Technician (EMT). An emergency responder trained to provide emergency medical services (EMS) to the critically ill and injured. Retrieved March 2005, from http://www.free-definition.com/EMT.html.

Fire Engine. One of many specialized fire supression apparatuses. A Fire Engine is designed to pump water using an engine and onboard water supply, which can be replenished via a fire hydrant, water tender or any other available water source. Engines are also known as pumpers as they are used to pump water onto fires. Their primary purpose is for direct fire suppresion, and carry many tools including ladders, pike poles, and ventilating equipment. Engines are normally staffed with at least 3 (Captain, Engineer, Firefighter), preferably 4 (second Firefighter), to be able to effectively and safely attack a fire. Retrieved March 2005, from http://www.free-definition.com/Fire-engine.html.

Firefighter. Sometimes called a fireman, is a person who is trained and equipped to put out fires, rescue people and in some areas provide emergency medical services. The fire service, is one of the emergency services. Retrieved March 2005, from http://www.free-definition.com/Firefighter.html.

Fulltime Firefighter – paramedic. An employee with an annual salary and benefits hired to repsond to EMS and fire runs that works 2,496 hours per year on a 24 hour duty cycle every three days.

IDLH. An environment that is Immediately Dangerous to Life or Health, often requiring respiratory protection for those working under that condition.

Mutual Aid. In emergency services, mutual aid is a formal agreement among emergency responders to lend assistance across jurisdictional boundaries when required; either by an emergency that exceeds local resources or a disaster. Retrieved March 2005, from http://www.free-definition.com/Mutual-aid.html.

Mutual Aid Box Alarm System. Similar to mutual aid, but goes one step further as it is a pre determined aid system for large scale incidents.

Paramedic. A trained and licensed or certified medical professional. Most commonly, paramedics are those who respond to medical emergencies out in the field for the purpose of stabilizing the victim's condition so she/he can be transported to medical facilities. The paramedic is a type of emergency medical technician (EMT). Retrieved March 2005, from http://www.free-definition.com/Paramedic.html.

Part Time Firefighter – paramedic. An employee with an hourly rate and few benefits hired to repsond to EMS and fire runs working less than 159 hours every 21 days.

Suppression Force. Firefighters engaged in the activity of extinguishment of fires.

Squad. An emergency vehicle used to transport ill or injured patients.

RESULTS

The results of the literature review indicated to me the following. The NFPA and IAFF maintain that four firefighters should be the minimum staffing on fire apparatus. The Fire Chiefs' handbook recommends that twelve to sixteen firefighters be the initial response for a structure fire. The ISO recommends that two Engine Companies and one Ladder company with eighteen firefighters be the initial alarm response. The 19th Edition of the NFPA Fire Protection Handbook recommends not fewer than twelve firefighters and one chief officer, plus a safety officer and a rapid intervention team, respond initially to a structure fire.

Standard NFPA 1500 indicates the need for four persons to assemble before interior firefighting operations can begin in IDLH atmospheres. Per the Revised Ohio Administrative Code, at working structural fires, a minimum of four employees shall be required, consisting of two employees working as a team in the hazardous atmosphere. Standard NFPA 1710 in reference to firefighting responses states, companies shall be staffed with a minimum of four on duty personnel. The Ohio Revised Code requires that at least two certified EMT's staff any ambulance involved in patient emergency transports. The research (1990) conducted by the Westerville, Ohio fire department provided data showing the improvement in task performance when using four firefighters as compared to three firefighters. Two opposing views found to the four person minimum were from Bruce J. Moeller, Ph.D., MIFireE, Fire Chief of the Sunrise Fire-Rescue Department of Sunrise, FL, and Fire Chief Stewart Gary of the Livermore-Pleasanton, CA. Bruce J. Moeller concluded that there is no data, one way or the other, to support any position on precise staffing or response time requirements as outlined in NFPA 1710. While Fire Chief Stewart Gary of the Livermore-Pleasanton, CA, indicates that it's not just about the number of firefighters per company and recommends the Commission on Fire Accreditation International (CFAI) process be used. The CFAI process evaluates deployment, where firefighting companies are strategically placed. The majority of the literature review information read indicates that a four person Engine crew, four person Ladder crew are the most effective for fire response and a four person Ambulance crew is most productive for cardiac type runs. Table 3 gives a summary of those results.

Table 3

Staffing Recommendations by various Research Sources Used

SOURCE	RECOMMENDATION
1995 I.A.F.F. Study	4 per fire unit
A.H.A.'s Emergency Cardiovascular Care handbook	2 EMT's & 2 Medics Cardiac Arrest
ARC Study	Awareness of minimum levels
Boston Globe January 2005 :Deadly Delays: The Decline of Fire Response	Recommends NFPA guidelines
Bruce J. Moeller, Ph.D., MIFireE	Minimums up to community
Commission on Fire Accreditation International, Inc. (CFAI)	Based on protection area/needs
Fire Chief Handbook 5th Ed.	Based on protection area/needs
Fire Chief Stewart Gary	Based on protection area/needs
ISO's FSRS Handbook	18 to 20 1st alarm assignment
N.F.P.A. 1410	2 Eng. Co & 1 Ladder Co.
N.F.P.A. 1500	4 per fire unit
N.F.P.A. 1710	4 per fire unit
N.I.O.S.H.	Follow NFPA 1500
NFPA Fire Protection Handbook 19th Ed.	14 to 16 1st alarm assignment
O.S.H.A.	Follow NFPA 1500
Ohio Administrative Code	Groups of 4
Richard C. Morrison (1990), fire chief, Westerville, Ohio, paper	4 per fire unit
Ronnie Coleman, Fire Chief (1999)	4 per fire unit

To answer the question of how often was the authorized full strength level of nine attained, a review of data collected from the Twinsburg Fire Department files shows that the average on duty staffing level for the three year period of 2002 through 2004 only reached a full strength of nine on duty 75% of the time during three of the months for the 36 month period examined. Those months were January 2002 at 75.81%, January of 2004 at 75.81% and February 2004 at 77.59%. Tables 4, 5 and 6 show the duty levels per month and year.

Since a part time workforce is a part of maintaining the staffing levels and coupled with the fact that those members work 12 hour shifts, some numbers are reflected as 0.5 (12 hour) increments.

Table 4

2002	9 On Duty	8 On Duty	7 On Duty	6 On Duty	Tour Totals	Percent At Authorized Strength	Percent At 8	Percent At 7	Percent At 6
Jan	23.5	6	1	0.5	31	75.81%	19.35%	3.23%	1.61%
Feb	17.5	8	2	0.5	28	62.50%	28.57%	7.14%	1.79%
Mar	18.5	8	3.5	1	31	59.68%	25.81%	11.29%	3.23%
Apr	17	10	2.5	0.5	30	56.67%	33.33%	8.33%	1.67%
May	21	7.5	2	0.5	31	67.74%	24.19%	6.45%	1.61%
Jun	15	8.5	3	3.5	30	50.00%	28.33%	10.00%	11.67%
Jul	10	9	7.5	4.5	31	32.26%	29.03%	24.19%	14.52%
Aug	15.5	6.5	7	2	31	50.00%	20.97%	22.58%	6.45%
Sep	20	8.5	1	0.5	30	66.67%	28.33%	3.33%	1.67%
Oct	17	8.5	2	3.5	31	54.84%	27.42%	6.45%	11.29%
Nov	17.5	10.5	1.5	0.5	30	58.33%	35.00%	5.00%	1.67%
Dec	15	8.5	6	1.5	31	48.39%	27.42%	19.35%	4.84%
TOTALS	207.5	99.5	39	19	365	56.85%	27.26%	10.68%	5.21%
TOTALS	56.85%	27.26%	10.68%	5.21%	100.00%				

Table 5

2003	9 On Duty	8 On Duty	7 On Duty	6 On Duty	Tour Totals	Percent At Authorized Strength	Percent At 8	Percent At 7	Percent At 6
Jan	23	7	0.5	0.5	31	74.19%	22.58%	1.61%	1.61%
Feb	20.5	3.5	3	1	28	73.21%	12.50%	10.71%	3.57%
Mar	20	9	2	0	31	64.52%	29.03%	6.45%	0.00%
Apr	21	7	2	0	30	70.00%	23.33%	6.67%	0.00%
May	21	6.5	2.5	1	31	67.74%	20.97%	8.06%	3.23%
Jun	13	12	4.5	0.5	30	43.33%	40.00%	15.00%	1.67%
Jul	17.5	9.5	3	1	31	56.45%	30.65%	9.68%	3.23%
Aug	20.5	6.5	2	2	31	66.13%	20.97%	6.45%	6.45%
Sep	21	4.5	3	1.5	30	70.00%	15.00%	10.00%	5.00%
Oct	17.5	7	4	2.5	31	56.45%	22.58%	12.90%	8.06%
Nov	17	5.5	5	2.5	30	56.67%	18.33%	16.67%	8.33%
Dec	10.5	8.5	6.5	5.5	31	33.87%	27.42%	20.97%	17.74%
TOTALS	222.5	86.5	38	18	365	60.96%	23.70%	10.41%	4.93%
TOTALS	60.96%	23.70%	10.41%	4.93%	100.00%				

Table 6

2004	9 On Duty	8 On Duty	7 On Duty	6 On Duty	Tour Totals	Percent At Authorized Strength	Percent At 8	Percent At 7	Percent At 6
Jan	23.5	6.5	1	0	31	75.81%	20.97%	3.23%	0.00%
Feb	22.5	6	0.5	0	29	77.59%	20.69%	1.72%	0.00%
Mar	18	8.5	3.5	1	31	58.06%	27.42%	11.29%	3.23%
Apr	18.5	7.5	3	1	30	61.67%	25.00%	10.00%	3.33%
May	19	7.5	3.5	0	30	63.33%	25.00%	11.67%	0.00%
Jun	14	9	7	0	30	46.67%	30.00%	23.33%	0.00%
Jul	11	9.5	10.5	0	31	35.48%	30.65%	33.87%	0.00%
Aug	17.5	8	5.5	0	31	56.45%	25.81%	17.74%	0.00%
Sep	12.5	11.5	6	0	30	41.67%	38.33%	20.00%	0.00%
Oct	23	4.5	3.5	0	31	74.19%	14.52%	11.29%	0.00%
Nov	21.5	6	2.5	0	30	71.67%	20.00%	8.33%	0.00%
Dec	21.5	8	1.5	0	31	69.35%	25.81%	4.84%	0.00%
TOTALS	222.5	92.5	48	2	365	60.96%	25.34%	13.15%	0.55%
TOTALS	60.96%	25.34%	13.15%	0.55%	100.00%				

To answer the question of what are the multiple run occurrence rates, a review of data collected from the Twinsburg Fire Department files provides the next table, 7. Table 7 tracks emergency runs only and overlapping occurrence rates for each year from 1997 through the end of 2004. Starting with 1997, when there were 178 overlapping occurrences out of 1,332 runs for a 13.36% occurrence rate, through the end of 2004, where there were 431 overlapping occurrences out of 1,829 runs for a 23.56% occurrence rate are noted in Table 7.

Table 7

Annual Overlapping Occurrence Rates per Emergency Runs

Year[a]	1997	1998	1999	2000	2001	2002	2003	2004
Runs[b]	1,332	1,451	1,629	1,637	1,746	1,755	1,955	1,829
Occurrences[c]	178	230	290	323	406	438	481	431
%[d]	13.36	15.85	17.80	19.73	23.25	24.96	24.60	23.56

[a]Calendar year

[b]Emergency runs only

[c]Number of times concurrent runs occurred

[d]Percent of time concurrent runs occur

The data from Table 8 can be further broken down to show that during 2004 the overlapping occurrence rates were mostly for double runs at 84.78% as noted in Table 8.

Table 8

Overlapping Occurrence Types for the year 2004

Month[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	%[b]
2 at time	23	32	19	17	32	33	25	39	21	25	21	36	84.78%
3 at a time	6	1	4	3	5	8	5	7	3	5	2	4	13.91%
4 at a time	0	0	0	1	0	0	0	0	0	1	2	0	1.05%
5 at a time	0	0	0	0	0	0	1	0	0	0	0	0	0.26%

[a]Calendar year

[b]Rate percent

The impact of the overlapping occurrence rates and various staffing levels affect the more labor intensive incidents, which are motor vehicle accidents (MVA's) and firefighting. A review of data provided the following information on MVA runs for 2004. There were 109 MVA's which accounted for 4.97% of the total where the following was revealed. During three of those 109 runs no personnel were available to respond from the station. During 23 of those 109 runs the shift was already out on another run for 21.10% of the time, slightly lower than our overlapping occurrence rate of 23%. During 17 (73.91%) of those 23 times, the needed Engine was understaffed 9 (39.13%) times and 8 times (34.78%) the Engine did not respond as any personnel were available to staff it. During 49 of those 109 runs the shift was at a level of less than nine for 44.95% of the time. During 18 of those 49 times the needed Engine was understaffed for 36.73%. This is depicted in Figure 5.

109 Motor Vehicle Accidents		
Staff Level On Duty	How Often Occurred	Percent
9	60	55.05%
8	36	33.03%
7	11	10.09%
6	2	1.83%
TOTALS	**109**	**100.00%**
Shift on Another Run		Percent
	23	21.10%
Station Unmanned		Percent
	3	2.75%
Engine Needed		Percent
	80	73.39%
Engine Understaffed		Percent
	49	61.25%

Figure 5.

The impact of the overlapping occurrence rates and various staffing levels affect on motor vehicle accidents (MVA's) during 2004.

Also during 2004 there were 31 runs that meet TFD's criteria for an apparent working structure fire. While that only accounted for 5.84% of the total 530 Fire runs the following was discovered. During 10 of those 31 fire runs the shift was at a level of less than nine for 32.35% of the time. During 4 of those 10 times the needed first Fire Engine was understaffed for 40.0% of the time. All 10 times the needed Aerial unit was understaffed for 100.0% of the time. During 8 of the 31 times the shift was already out on another run for 25.8% of the time, slightly higher than our overlapping occurrence rate of 23%. During 3 of the 8 times the needed first Fire Engine was understaffed for 37.50% of the time. During 4 of the 8 times the needed Aerial Unit was understaffed and the other 4 times it was unavailable to respond at all. More importantly of the 31 runs that met TFD's criteria for an apparent working structure

fire, 14 (45.16%) actually were a working structure fire and the following was revealed. During 5 of those 14 times the shift was at a level of less than nine for 35.71% of the time. As a result during 4 of the 5 times the needed Aerial unit was understaffed for 80.0% of the time. During 4 of those 14 times the shift was already out on another run for 28.57% of the time, slightly higher than our overlapping occurrence rate of 23%. As a result during 2 of those 4 times the needed first Fire Engine was understaffed for 50.0% of the time. During 2 of those 4 times the needed Aerial Unit was understaffed and the other 2 times it was unavailable to respond at all. As a result, safety to the responding personnel and the safety of the potential victims are possibly reduced as important fireground tasks take longer to complete if at all due to the understaffed units and the availability of mutual aid response units. This is depicted in Figure 6.

31 Fire Runs Sounding Real		
Staff Level On Duty	How Often Occurred	Percent
9	21	67.74%
8	4	12.90%
7	6	19.35%
6	0	0.00%
TOTALS	**31**	**100.00%**
Shift on Another Run		Percent
8		25.81%
Station Unmanned		Percent
0		0.00%
Engine Understaffed		Percent
4		12.90%
Aerial Understaffed		Percent
16		51.61%

14 Actual Structure Fires		
Staff Level On Duty	How Often Occurred	Percent
9	9	64.29%
8	1	7.14%
7	4	28.57%
6	0	0.00%
TOTALS	**14**	**100.00%**
Shift on Another Run		Percent
4		28.57%
Station Unmanned		Percent
0		0.00%
Engine Understaffed		Percent
2		14.29%
Aerial Understaffed		Percent
8		57.14%

Figure 6.

The impact of the overlapping occurrence rates and various staffing levels affect on motor vehicle accidents (MVA's) during 2004.

To answer the question of was the incidences of using mutual aid and/or the call back of off duty personnel to assist this fire department respond to runs required due to manning levels. A review of data collected from the Twinsburg Fire Department files shows that mutual aid was required 154 times or 7.02% of the total 2004 run volume of 2,192 runs. During 2004, the run average was six per day, with 70.35% for EMS, 24.18% being Fire's and 5.47% being MVA's. Data shows the majority of the run volume can be covered when the On Duty level is at nine; however this is true when the runs are EMS only. An MVA or Fire run in this mix negates the ability to answer further runs effectively or at all until that MVA or Fire run is completed. A Staffing level of nine occurred on 222 days for 60.65% during 2004, while a staffing level of eight and/or seven occurred 143 times for 39.35% of the time. Furthermore it is becoming more difficult to cover the run volume when it is over six per day, even with nine firefighter – paramedics On Duty. During 2004, 144 days had more than 6 runs per day for 39.34% of the runs. It was also discovered the bulk of the run volume occurs between the hours of 8 AM and 9 PM, all week, for 73.40% of the time as noted in Figure 7.

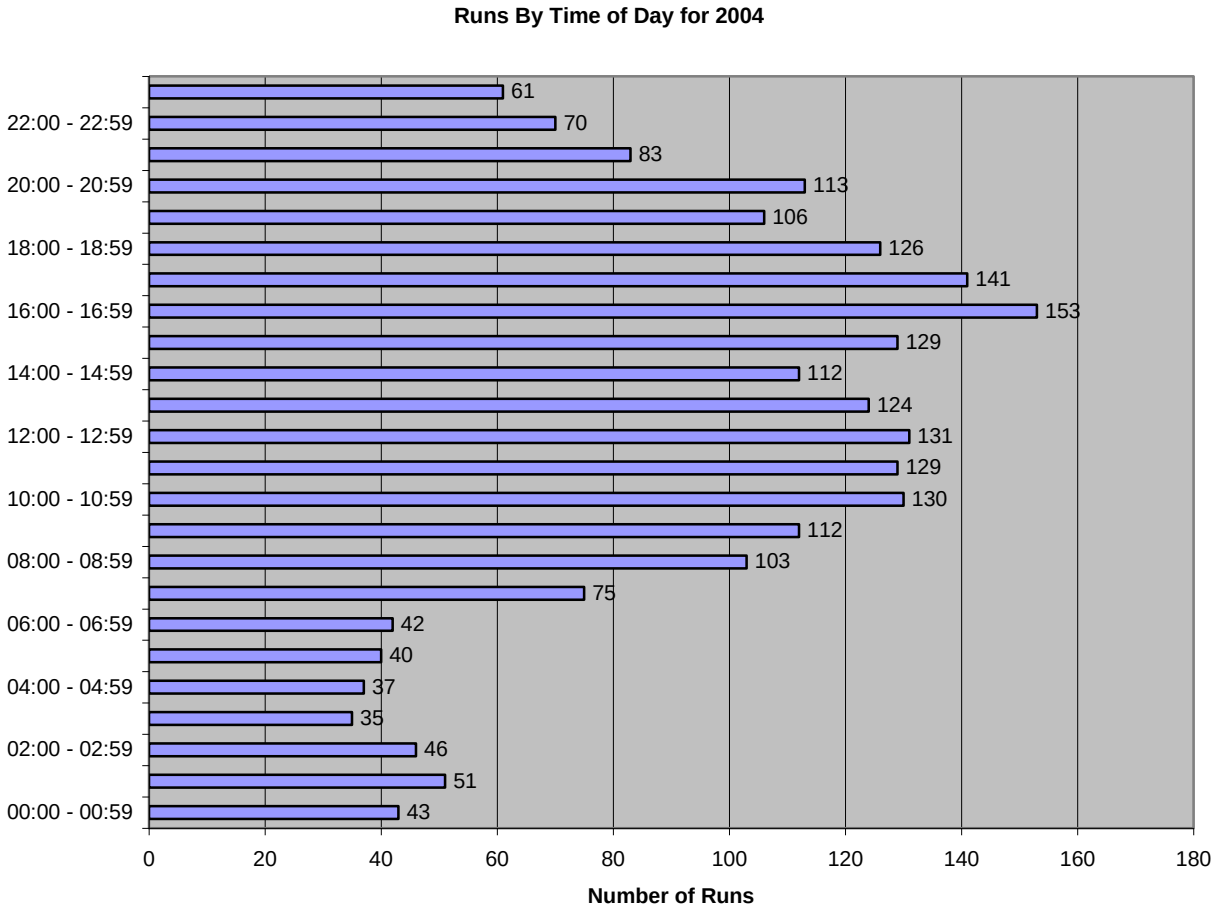

Figure 7.

Runs by time of day during 2004

To answer the question of how does Twinsburg staffing levels compare to other fire departments of similar type operation, population and run volumes, using the population data obtained from **Appendix B-1,** four groups were created (See **Appendix C1 & C2**). That grouping was as follows; Group A contains twelve departments that range in population from approximately 13,000 to 14,999, Group B contains six departments that range in population from approximately 15,000 to 19,999, Group C contains seven departments that range in

population from approximately 20,000 to 24,999 and Group D contains four departments that range in population from approximately 25,000 to 34,000. Twinsburg has a population that is comparable to the seven other departments in Group C of **Appendix C-2**. The survey showed that communities with a similar population as ours had on average a maximum staffing level of twelve while ours is nine and that on average the minimum staffing level is eight while ours is seven. Comparing the seven communities of similar population size as Twinsburg's reveals that only one, Willoughby City utilizes Part Time fire-medics. We are below average by one for total fulltime personnel. The average size of the seven communities is 8.7 square miles, although Solon is the largest at 22.0 square miles. The square mileage of Twinsburg is 21.2 or on average 12.5 square miles larger. Our population average is slightly lower by 330 and our run volume is also below average by 527.

Currently the Twinsburg Fire Department utilizes a workforce of 25 part time employees to cover open shifts created whenever a fulltime employee is off. A review of the total hours part time members need to cover each year is completed during the annual budgetary process. There are typically 365 days in a calendar year. With 24 hours to each day multiplied by 365 days of the year, the hour total comes to 8,760 hours of coverage. There are three shifts of nine firefighter-medics. To provide round the clock coverage, each shift is responsible to provide 2,920 hours of coverage. The Twinsburg fulltime shift personnel work the 24/48 hour system, with a pay week of 48 hours or 2,496 hours per year. This leaves 424 hours not covered, which equals 17.6 twenty-four hour shifts to either cover with overtime, part time personnel or let go uncovered. (U*sing part time employees to cover one fulltime position we find this is a ratio of five part time employees for one fulltime position using the numbers noted previously.*) The City of Twinsburg has chosen to utilize part time employees

to minimize the impact of fulltime overtime while attempting to maintain maximum staffing levels. The Twinsburg part time firefighter-medic is required to work a minimum of 48 hours per month. Each part time firefighter-medic is responsible to cover a minimum total of 576 hours per year. (*From 1996 through 2002 the minimum was 60 hours per month. Due to the higher monthly requirement, the turnover rate for part time increased. Many of the part time members are actually fulltime firefighters in other communities.*) Using that data one can determine the number of part time firefighter-medics required to cover one fulltime firefighter-medic position. By dividing the number of minimum hours the part time employee is required to work in one year into the number of hours of coverage for one shift. The number arrived at indicates that Twinsburg requires 45 part time employees to cover the 27 fulltime shift personnel. As a result it must be determined how many hours of coverage will be created by each fulltime employee during any calendar year to budget for this part time staff. Currently the Twinsburg Fire Department only has enough physical room to employ 25 part time firefighter-medics. For the year 2005, the potential hours the 25 part time personnel need to cover is 20,121 hours. The information in **Appendix D** gives a more detailed breakdown accounting those hours of need.

To answer the question of what are the budgetary costs for various staffing schemes to be considered, a review of the cost for a fulltime employee versus a part time employee were compared. To raise the current staffing level from nine to ten per shift using part time employees will require hiring five as explained above with the five to one ratio between part time and fulltime employees. The first year cost to hire five part time employees is approximately $75,592.51 as noted in **Appendix E**. To raise the current staffing level from nine to ten per shift using a fulltime employee, the first year cost is approximately

$75,816.30 as noted in **Appendix F**. While the city will save approximately $223.79, by using part time employees, uniforms and gear for five people must be purchased rather than one if using a fulltime employee. Another significant issue to deal with is the space it takes to accommodate the extra four employees.

Currently the fire department is funded through the city's general fund which obtains its revenues through a 2% payroll income tax. A portion of the fulltime fire pension is obtained through a 0.3 mil internal levy against the property tax rate. This raises approximately $201,871 a year. The 2004 Fire Pension contribution cost the city $444,455.18. The remaining $242,584.28 came from the General Fund. During 2004 the EMS Billing system collected approximately $424,927.20, which goes into the city's general fund from which all city departments including the fire department are funded. After consulting with the city finance director the following was obtained. If the City Income Tax is raised by ¼% an additional $817,023 would be added to the General Fund collection. If the city raised the City Income Tax by ½% an additional $1,634,046 would be added to the General Fund collection.

Currently the Comprehensive Plan of the city is under its five year review. The need for potential additional fire stations are considered as noted in the Plan where it states, "However, as the City nears total development an evaluation should be made of the adequacy of response times from the single central fire station. If warranted, it may be advisable to replace the existing central fire station with two new fire stations strategically sited to provide optimum response times." (p. 32). This would most likely affect the staffing levels under review here.

DISCUSSIONS/IMPLICATIONS

The study conducted of literature on this topic revealed a number of interpretations on staffing. While most of the information found is on fire runs, most fire departments today in our area are responsible for EMS, which in most cases is the larger portion of the service provided. The recommendations of NFPA 1710 are not just about adequate staffing but also in meeting a desired response time 90% of the time for the emergency runs responding to. At this time with a maximum staffing level of nine firefighter – paramedics Twinsburg does not currently have the ability to meet NFPA 1710 in its entirety. It must be noted that NFPA 1710 is not entirely all about staffing. A review of the title *Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* should remind the reader that this is an ORGANIZATION and DEPLOYMENT standard. Not all researchers agrees with the staffing portion of NFPA 1710, "Of secondary importance is that there is no data, one way or the other, to support any position on precise staffing or response time requirements as outlined in NFPA 1710. There is simply no good research to provide the necessary support." (Moeller B.J., 2002). Others have looked at a number of the referenced study's noted in NFPA 1710 and have tested the data and noted that crew size does matter. The Twinsburg Fire Department has on a number of occasions responded with less than the normal compliment of nine due to overlapping incidents that has reduced the efficiency of fireground task completion as noted by, "Using standard firefighting tactics, the results of the Westerville Fire Department study showed that 4 firefighters could perform rescue of potential fire victims 80% faster than a 3 firefighter crew." (IAFF, Safe Fire Fighter Staffing - Critical Considerations, 1995).

During this study a review of the motor vehicle accidents and structure fires were examined from the year 2004, as they are more labor intensive, i.e., use more manpower. Motor vehicle accidents were studied because in Twinsburg the engine company also responds to assist in extrications of patients if needed and/or to suppress any potential fire hazards. It was established that of the 109 motor vehicle accidents 49 of them, approximately 45%, the shift level was less than nine. It was established that of the 31 fire runs that started out sounding like an actual structure fire, where 14 actually were actual structure fires, and a similar trend of understaffing was noted. While these runs make up a small overall percentage of the total runs; "….we find the not-so-startling conclusion that the more firefighters performing a prescribed job, the less time it will take". (Bachtler, J., & Brennan, B.) (1995). (p. 621). Of the 31 fire runs that started out sounding real it was noted that for 10 of them, approximately 32%, the shift level was less than nine. Of 14 fire runs that ended up actually being structure fires, 5 of them, approximately 35%, the shift level was less than nine. In addition to NFPA 1710 requirement of 4 firefighters be assembled prior to structural interior firefighting, NFPA 1500, the Fire Protection Handbook, ISO and the Ohio Revised Code, calls for the same staffing level. At a recent structure fire in November of 2004, those requirements of having 4 man companies and 15 firefighters respond to a structure fire were put to the test. Prior to the fire run coming in, the department was at a level of nine for the day when a squad run occurred taking three firefighter – medics to respond to that EMS incident. Approximately 15 minutes later a call for a working structure fire was received. Upon arrival to the address, a working fire was already in progress. The arriving OIC was faced with a fire pushing out of the roof line at 10 AM in the morning with two cars in the garage. This crew of six now had to change tactics to establish a search team for the potential

occupants. As entry was being forced, confirmation was received that the occupants were in fact out of town. Had there been occupants, the outcome of having only four firefighters available to start a search and rescue, the results could have been tragic. Unfortunately for this family the two family dogs were home and one did not survive due to the smoky conditions. There were 27 case studies of fire fighter fatalities investigated by NIOSH from August of 1998 through November of 2004. One common recommendation is for each department involved in this investigation to; "Provide adequate firefighter staffing to ensure safe operating conditions.". In an effort to provide this additional staffing, the Twinsburg Fire department uses a mutual aid box alarm system (MABAS) to provide additional manpower for all fire runs. Unfortunately there is no guarantee that those mutual aid companies will be available when called. This meets the intent of the NFPA 1710 Implementation Guide for the criteria of a fire crew of four can be met with mutual aid, automatic aid, or by vehicles responding to the same location and combining personnel to establish work crews of four. Taking this concept one step further for a normal staffing response to a structure fire, "……not fewer than twelve fire fighters and one chief officer, plus a safety officer and a rapid intervention team, respond initially to a structure fire." (Cote, A. (Ed.). (2003). (1(2), 7-35-7-37).

The second area that NFPA 1710 takes a stand on is that the response time for the events are reached within the specified times 90% of the time. A review of the 90% data that the Twinsburg Fire Department has provided for the years of 2001 through 2004, indicates that those times are not reached within the 90% goal as noted in Figure 8.

Calendar Year	1st Engine Arrives 4 Min.	1st Assignment Arrives 8 Min.
2001	39.32%	33.33%
2002	33.68%	23.52%
2003	47.79%	39.58%
2004	74.27%	47.83%

Calendar Year	BLS Arrives 4 Min.	ALS Arrives 8 Min.
2001	42.60%	40.37%
2002	52.75%	44.97%
2003	53.60%	47.18%
2004	58.99%	56.46%

Figure 8.

4 Year Response Time Data
Fire and EMS 90% Goals

After reviewing all of this information my evaluation is that for most suburban departments reviewed in my study to try and meet the staffing recommendations of NFPA 1710, would be financially difficult if not impossible utilizing all fulltime employees. A very similar situation arises when using part time personnel as it takes almost a ratio of 5:1 to cover the required hours. The savings in benefits is offset by the amount of extra gear and physical space needed to accommodate a large part time force. After a review of the questionnaire sent out only six of the responding departments indicate they are meeting the intent of NFPA 1710. Another 20 of the responding departments indicate they are attempting to meet the intent of 1710 but 9 are not even trying. This trend appears to support the difficulty in adding additional personnel to any department. The average minimum manning level of the 31 responding departments is 6.43 with a maximum level of 8.84. However when the departments are categorized by population size, the numbers change proportionally with the population. It appears that except for a few of these suburban fire departments the vast majority staff to primarily handle the EMS run volume.

Based on the results of this study it is my interpretation that the Twinsburg Fire Department is currently staffed adequately to handle the current EMS run volume and minimally meets the structure fire response through the use of the MABAS system. This will not remain the condition for much longer however as the anticipated community growth should continue to increase as projected by the Comprehensive Plan. Current data indicates that a tenth position should be added to cover the peak run volume times of 8 AM through 8 PM which accounted for 73% of the runs in 2004. Once a second fire station is built, increasing the staffing level should be considered to maintain a safe work environment for the fighters at structure fires. The total staffing level should be maintained to leave at least enough personnel to respond as first responders as the run volume exceeds the current average of six per day.

RECOMMENDATIONS

The purpose of this research project was to assess the current staffing system of the Twinsburg Fire Department and investigate ways to improve staffing if justified. Determine once the additional station is built, would continuing to utilize both fulltime and part time employees be both efficient and cost effective for our community. During the review of the various standards and studies examined many different and occasionally opposing views were encountered.

Most of the literature studied took into account all of the issues facing the community of Twinsburg. Issues such as potential commercial/residential growth, response times, run volume, travel distance, and risk, both to the community and the firefighters, were noted throughout the reference material.

While response times are affected by travel times, the city is working on alleviating that issue by the recent approval at the 03/22/05 Council Meeting of a $1.2 Million satellite fire station for the NE area of the City of Twinsburg with a completion date of late 2006. Also city and township officials are reviewing the potential of a third satellite fire station in the southernmost area of Twinsburg, located in the township to address response/travel time issue at that end of the district.

The potential commercial/residential growth issue that directly affects the run volume is certainly two issues that will continue to impact the quality of service that the Twinsburg Fire Department will be challenged to maintain. This is because both the city and township have a combined total of 1,800 plus acres of undeveloped land that once developed has the potential to increase up to 4,000 more residents into the community by the year 2010.

The first recommendation is to provide the City Administration with a response policy that meets the intent of Section 1.3 Equivalency, (NFPA 2001, p1710-4) which allows a community to create a program that meets the intent of 1710. In January of 2005 the department took the first steps to address this process by registering and starting the accreditation process through the Commission on Fire Accreditation International, Inc. In the interim and based on the evaluative research, analysis of data collected from the Twinsburg Fire Department databases and the literature review, a recommendation to create one additional position per shift is made to cover the peak run volume period of the weekday. The analysis of the Twinsburg Fire Department data from the year 2004 indicates that the period is a thirteen hour time frame that starts at 08:00 hours and ends at 21:00 hours. A thirteen hour shift would be difficult to cover so initially the recommendation is to have the coverage time run from 07:00 hours to 19:00 hours. The part time staff already works those

hours and as a result scheduling would require no changes. The position should be covered by hiring one new fulltime employee, supported by two part time employees, further analysis would be needed to determine if the present compliment of 25 part time employees can handle the additional 1,040 hours thereby eliminating the need to add two more part time employees. The cost to hire one additional fulltime firefighter – paramedic is $75,816.30 versus the cost to hire the equivalent five part time employees at $75,592.15. An analysis of the EMS Billing collection shows a two year average collection of $363,893 after the 7% collection fee is paid. If directly earmarked to support hiring of personnel for the fire department rather than continuing to go directly into the General Fund it would cover the cost with no trouble. Another idea that could generate additional funding would be to consider increasing the City 2% Income Tax by 0.125%, where an additional $408,511 could be generated.

The addition of a tenth person to the weekday coverage would allow for the shift OIC to remain on station during overlapping EMS runs, provide an additional person during fire runs as three of Twinsburg's six initial mutual aid department respond with only a three man engine company. The minimum staffing level during these hours of weekday prime time response need will be raised to eight. During EMS runs, a utility vehicle will respond non emergency to the scene and if patient care is determined to be at the BLS level, the 3rd medic on the squad will be returned to the station allowing a staff of eight to be available with a 4 man engine company and a 3 man ladder company should any fire runs come in. Currently when in this situation, a 4 man engine company and a 2 man ladder company is responding.

A second recommendation for the future is to add enough additional personnel to allow for a two station staffing level of at least eleven, where the new station would have four and

the main station would be staffed at seven. As noted in **Appendix C-2** the seven communities that Twinsburg is most similar to, the maximum on duty average is 12, however the average run total is 2,719. A staffing level of eleven would solve two problems, first a satellite station with a crew of four to respond as a four man ladder company and a total department level prepared to deal with the anticipated average run rate of 7.27 (based on the annual increase rate of 6.61%) by the year 2007, the first year of the new station availability. The best solution would be to hire all fulltime employees as they can cover more hours than part time employees can but the practice of a part time work force should be kept as maintaining full strength levels are more economical this way as overtime is not incurred, which adds to the fulltime pension contribution costs for the city.

As this was my first attempt to create a research project on any subject a few recommendations can be made for anyone that may in the future attempt to research staffing levels. If you use a survey questionnaire try to anticipate some answers to your initial questions that you may receive that may require more follow up questions to support the answers you receive to the initial question. For example, in asking if the departments were trying to utilize or live up to NFPA 1710 and/or 1720 as applicable, tabulating the answers it became obvious to me that I did not establish why or how the respondents were using NFPA 1710/1720. In asking a question on EMS and transporting, I neglected to ask how many personnel a squad was staffed with. If you are not tracking your run data it will be very difficult to analyze your staffing problem adequately against the information collected in the literature review. The National Fire Academy has a wealth of research papers on this issue but go there early in the process as it takes 3-4 business days to obtain this material from

them through your local public library and you will need to read a considerable amount of information to find departments or communities similar in size to your own.

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Appendix A

Questionnaire

1. What is the actual geographical size area that your fire department covers (round to nearest ½ square mile)? _____

2. What is the population of the coverage area your fire department is responsible for (use 2000 Census figure or latest known County or District Census data, list year used if not using 2000 Census data)? _____

3. How many total Calls for Service did your fire department respond to for the year 2004 (include non emergency run totals)? _____

4. How many stations do you have? _____

5. What hours is your fire department staffed (check only one)?

   - ❑ 24/7
   - ❑ On Call
   - ❑ Other, describe _____
     _____
     _____

6. What are the personnel classification type(s) used on your fire department (check all that apply and list quantity)?

   - ❑ Fulltime Quantity _____
   - ❑ Part Time Quantity _____
   - ❑ Paid On Call Quantity _____
   - ❑ Volunteer, i.e., Not Paid _____

7. If your fire station(s) is/are staffed, what is your authorized **maximum** on duty shift level (include all shift personnel available for responding)? _____

   7.1. Do your part time or volunteer members assist in maintaining the authorized on duty full strength levels?

   - ❑ Yes
   - ❑ No

8. If your fire stations are staffed, what is your authorized **minimum** on duty shift level (include all shift personnel available for responding)? _____

8.1. Do you maintain this minimum level with (check all that apply),

- ❑ Fulltime members on overtime
- ❑ Part Time members
- ❑ Volunteer members

9. What is the work week schedule your fulltime shift firefighters work?

- ❑ 24 hour on some type of 48 to 56 workweek and list _____
- ❑ Other _____

10. Do your part time or volunteer members have a monthly minimum of hours to work?

- ❑ Yes and list _____
- ❑ No

11. How many fulltime employees are assigned to a fire prevention bureau as their primary function? _____

12. How is your fire department funded? (check all that applies)

- ❑ Income Tax/General Fund
- ❑ Levy
- ❑ Other, describe _____
  _____

13. Does your fire department follow the recommendations for NFPA 1710 or 1720 as applicable to your staffing/response needs (check only one)?

- ❑ NFPA 1710
- ❑ Attempting to follow NFPA 1710
- ❑ NFPA 1720
- ❑ Attempting to follow NFPA 1720
- ❑ None of the above

14. Does your fire department provide EMS service (if answer is No, skip to #16)?

- ❑ Yes
- ❑ ALS
- ❑ BLS
- ❑ 1st Responder Only
- ❑ No

15. Does your fire department provide EMS transport?

- ❑ Yes
- ❑ No
- ❑ N/A

16. What was your Operating Budget (do not include Capital items) for the year 2004?

_____

Name of Department : _____

Survey Participant : _____

Phone # : _____

E-mail address (optional): _____

Appendix B-1

Department	Size	Population	Runs	Station(s)	Hrs Staffed?			FT	PT	POC	Vol.	Total	Shift Min.	Shift Max.
					24/7	P.O.C.	Other							
Ashtabula	7.5	21,000	1,535	1	x			26				26	6	10
Conneaut	26.5	13,000	2,700	3	x	x		12	12	50		74	3	4
Bedford	5.0	14,214	2,044	1	x			29				29	6	8
Bedford Heights	4.5	11,375	1,610	1	x			27				27	5	9
Berea	6.0	18,970	1,649	1	x			23				23	5	7
Brecksville	19.5	13,382	1,342	1	x			15	22			37	4	5
Brooklyn City	5.0	11,500	2,215	1	x			30	8			38	7	9
Garfield Heights	7.5	31,000	3,550	2	x			47				47	8	14
Lyndhurst	4.0	14,950	1,997	1	x			26				26	6	8
Mayfield Heights	5.0	20,000	3,321	1	x			33				33	7	10
Middleburg Heights	7.5	15,585	2,355	1	x								4	8
Parma Heights	4.5	21,000	2,701	1	x			30				30	6	9
Rocky River	4.5	20,500	2,407	1	x			29				29	6	9
Shaker Heights	6.2	29,800	3,444	2	x			67				67	16	18
Solon	22.0	23,000	2,267	3	x			54				54	14	18
University Heights	2.0	15,000	1,400	1	x			29				29	7	9
Eastlake	7.0	21,195	2,340	1	x			30				30	7	9
Painesville City	7.5	17,503	2,828	1	x			26				26	5	8
Wickliffe	4.0	13,500	1,974	1	x			20	17			37	6	8
Willoughby City	10.5	22,621	4,461	2	x			39	36			75	11	16
Willowick City	2.0	14,361	1,525	2	x			1	56			57	6	6
Avon Lake	11.5	18,500	1,684	1	x			27	2			29	5	8
Wadsworth	25.0	23,500	1,996	2	x			13		50		63		2
Aurora	25.0	14,500	1,676	2	x			17	23			40	5	7
Kent	27.5	34,000	3,815	2	x			34	1			35	5	10
Mantua-Shalersville	54.0	13,000	1,299	1	x			7	30			37	4	5
Streetsboro	25.0	13,800	1,647	1	x			14	21			35	4	8
Coventry	12.0	12,000	1,505	1	x			14	3			17	3	4
Tallmadge	17.0	16,500	2,092	2	x			11	45			56	5	6
Twinsburg	21.5	21,000	2,194	1	x			35	25			60	7	9
Wooster City	15.5	26,000	4,100	2	x			42				42	10	13
	Size	Population	Runs	Station(s)	Hrs Staffed?			FT	PT	POC	Vol.	Total	Shift Min.	Shift Max.
					24/7	P.O.C.	Other							
												0		
TOTALS	402.2	576,256	69,406	44	31	1	0	807	301	100	0	1,208	193	274
Average	13.0	18,589	2,312	1.42				27	22	50	0	40	6.43	8.84

Appendix B-2

Department	Any FT In FPB	2004 Op Budget	How Are You Funded?			What Deployment Scheme Are You Using?					Provider EMS	Transport Service
			General Fund	Levy	Other	Meeting 1710	Trying To Meet 1710	Meeting 1720	Trying To Meet 1720	Neither		
Ashtabula	1	$1,800,000	x							x	x	
Conneaut	0	$1,080,000	x	x	x					x	x	x
Bedford	1	$2,550,000	x	x			x				x	x
Bedford Heights	1	$2,400,000	x	x			x				x	x
Berea	1	$1,615,029	x				x				x	x
Brecksville	0	$1,768,000			x				x		x	x
Brooklyn City	0	$2,646,343	x				x				x	x
Garfield Heights	3	$3,944,352	x			x					x	x
Lyndhurst	1	$2,480,000	x						x		x	x
Mayfield Heights	2	$3,136,765	x				x		x		x	x
Parma Heights	1	$2,500,000	x				x				x	x
Rocky River	1	$2,840,000	x				x				x	x
Shaker Heights	2	$6,800,000	x			x					x	x
Solon	4	$4,920,000	x			x					x	x
University Heights	1		x			x					x	x
Eastlake	1	$2,300,000	x	x	x					x	x	x
Painesville City	0	$2,924,505	x	x			x				x	x
Wickliffe	1	$2,100,000	x				x		x		x	x
Willoughby City	0	$5,067,601	x		x					x	x	x
Willowick City	0	$1,301,912	x	x	x		x		x		x	x
Avon Lake	1	$2,918,043	x	x			x				x	x
Wadsworth	2	$2,031,089	x	x						x	x	x
Aurora	1	$2,300,000	x	x						x	x	x
Kent	2	$3,235,354	x							x	x	x
Mantua-Shalersville	1	$1,150,000		x			x	x			x	x
Streetsboro	1	$1,524,000	x				x				x	x
Coventry	0	$1,100,000	x	x		x					x	x
Tallmadge	1	$1,850,000	x	x			x				x	x
Twinsburg	3	$3,400,000	x							x	x	x
Wooster City	2	$3,841,000	x				x				x	x

Department	Any FT In FPB	2004 Op Budget	How Are You Funded?			What Deployment Scheme Are You Using?					Provider EMS	Transport Service
			General Fund	Levy	Other	Meeting 1710	Trying To Meet 1710	Meeting 1720	Trying To Meet 1720	Neither		
										0		
TOTALS	35.0	$77,523,993	28	12	5	5	15	1	5	8	30	29
Average	1.2	$2,673,241										

Appendix C-1

GROUP A							
Department	**Population**	**Shift Max.**	**Shift Min.**	**Runs**	**No. FT**	**No. PT**	**No. POC**
Bedford Heights	11,375	9	5	2,044	27		
Brooklyn City	11,500	9	7	2,215	30	8	
Coventry	12,000	4	3	1,505	14	3	
Conneaut	13,000	4	3	2,700	12	12	50
Mantua-Shalersville	13,000	5	4	1,299	7	30	
Brecksville	13,382	5	4	1,342	15	22	
Wickliffe	13,500	8	6	1,974	20	17	
Streetsboro	13,800	8	4	1,647	14	21	
Bedford	14,214	8	6	2,044	29		
Willowick City	14,361	6	6	1,525	1	56	
Aurora	14,500	7	5	1,676	17	23	
Lyndhurst	14,950	8	6	1,997	26		
12	**13,299**	**7**	**5**	**1,831**	**18**	**21**	**50**

GROUP B							
Department	**Population**	**Shift Max.**	**Shift Min.**	**Runs**	**No. FT**	**No. PT**	**No. POC**
University Heights	15,000	9	7	1,400	29		
Middleburg Heights	15,585	8	4	2,355			
Tallmadge	16,500	6	5	2,092	11	45	
Painesville City	17,503	8	5	2,828	26		
Avon Lake	18,500	8	5	1,684	27	2	
Berea	18,970	7	5	1,649	23		
6	**17,010**	**8**	**5**	**2,001**	**23**	**24**	**0**

Appendix C-2

GROUP C							
Department	**Population**	**Shift Max.**	**Shift Min.**	**Runs**	**No. FT**	**No. PT**	**No. POC**
Mayfield Heights	20,000	10	7	3,321	33		
Rocky River	20,500	9	6	2,407	29		
Ashtabula	21,000	10	6	1,535	26		
Parma Heights	21,000	9	6	2,701	30		
Eastlake	21,195	9	7	2,340	30		
Willoughby City	22,621	16	11	4,461	39	36	
Solon	23,000	18	14	2,267	54		
7	**21,331**	**12**	**8**	**2,719**	**34**	**36**	**0**

GROUP D							
Department	**Population**	**Shift Max.**	**Shift Min.**	**Runs**	**No. FT**	**No. PT**	**No. POC**
Wooster City	26,000	13	10	4,100	42		
Shaker Heights	29,800	18	16	3,444	67		
Garfield Heights	31,000	14	8	3,550	47		
Kent	34,000	10	5	3,815	34	1	
4	**30,200**	**14**	**10**	**3,727**	**48**	**1**	**0**

Department	**Population**	**Shift Max.**	**Shift Min.**	**Runs**	**No. FT**	**No. PT**	**No. POC**
Twinsburg	**21,000**	**9**	**7**	**2,192**	**35**	**25**	

Appendix D

Number Of Kelly (FLSA) Tours Each FF Has	Number Of Shift FF Affected	Tours For PT To Cover	Number Of Hours This Equals
17	21	357	8,568

Number Of Holiday Tours Each FF Has	Number Of Shift FF Affected	Tours For PT To Cover	Number Of Hours This Equals
5	28	140	3,360

Number Of Vacation Tours All FF Have	Number Of Shift FF Affected	Tours For PT To Cover	Number Of Hours This Equals
220	28	220	5,280

Number Of Sick Hours All FF Used Thru 12/31/04	Tours For PT To Cover	Number Of Hours This Equals
2,326.00	97	2,326

Number Of Comp. Hours All FF Used Thru 12/31/04	Tours For PT To Cover	Number Of Hours This Equals
587.25	24	587.25

Total Tours For PT To Cover	Number Of Hours This Equals
838	**20,121**

Appendix E

Part Time Firefighter-Medic 1st Year Costs

Hours to cover 1 Shift	2,920
Ave. Hourly Wage	$17.89
Wage Cost	$52,238.80
Medicare @ 1.45%	$757.46
FICA @ 6.20%	$3,238.81
Worker's Comp @ 4%	$2,089.55
Total	$58,342.51
$200 Polygraph Exam x 5	$1,000.00
$500 Psychological Exam x 5	$2,500.00
$350 Physical Exam x 5	$1,750.00
$1,000 Uniforms x 5	$5,000.00
$1,400 Turnout Gear x 5	$7,000.00
Total	$17,250.00
Grand Total	$75,592.51

Appendix F

Fulltime Firefighter-Medic 1st year Costs

1st Year Shift Fire-Medic	$47,445.00
Pension	$11,386.80
Medicare @ 1.45%	$687.95
Worker's Comp @ 4%	$1,897.80
Hospitalization	$9,085.00
Vision	$162.25
Dental	$1,047.00
Employee Assistance Plan	$22.50
Life Insurance	$132.00
Total	$71,866.30
$200 Polygraph Exam	$200.00
$500 Psychological Exam	$500.00
$350 Physical Exam	$350.00
$1,500 Uniforms	$1,500.00
$1,400 Turnout Gear	$1,400.00
Total	$3,950.00
Grand Total	$75,816.30