Analyzing Growth and Demand to Determine Response Times to Justify Additional Fire Stations in West Chester Township.

By: Rick L. Prinz
Captain
West Chester Fire Department
9119 Cincinnati Dayton Road
West Chester, Ohio 45069

A research project submitted to the Ohio Fire Executive Program

29 January 2007

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.

Signed: _____

Printed Name: _____

ABSTRACT

The West Chester Fire Department continues to deal with rapid commercial and residential development causing an increase in traffic density and travel distances that would result in longer response times to fire and emergency medical calls. Additionally, more calls for service were being answered on a daily basis causing a strain on emergency units to clear a call in order to respond to another. As West Chester Township continues to grow, Fire and Township officials had been concerned about future response times in undeveloped and newly developed areas, as well as the overall response times in West Chester.

The purpose of the research was to analyze the West Chester Fire Department response times and evaluate if the West Chester Fire Department was meeting the national and community standards for emergency response, and at what point the West Chester Fire Department may have to consider adding another fire station to meet community and national standards to reduce response times?

The following questions were answered by evaluative research:

1. What are the current service demands and are they being met?
2. What is the anticipated increase in demand for residential / commercial development?
3. How often are West Chester fire resources unavailable for service, and when is the heaviest demand for service?
4. When will West Chester need to build additional fire stations?

The initial research began by analyzing data in the West Chester Fire Department records management system known as Fire RMS. These data were used to determine the current service demands for the fire department and how current service delivery compares to the cited standards. Fire RMS data were also analyzed to determine response times. Data from Southwest Ohio Fire Benchmarking was used to compare West Chester to other similar communities in Southwest Ohio.

The research showed that West Chester continues to grow, which is increasing the demand for Fire and EMS service, and increasing response times. The data also shows that West Chester emergency responses are slower than other comparable communities.

Recommendations from this study are: to give consideration to adding additional fire and EMS units to be housed at stations with heavier demands for service. To consider locating a fire station in the Northwest portion of the township to comply with the Insurance Service Office (ISO) and NFPA 1710 standards; to consider adopting a fire sprinkler resolution for residential occupancies; and to work internally on reducing firefighter turnout times.

TABLE OF CONTENTS

INTRODUCTION

Statement of the Problem

This study examined the service demands experienced on a daily basis by the West Chester Fire Department. By examining the level of service demand, it was possible to determine if current service demands were being met and at what point in the future the demand will exceed the current fire department resources. This study examined the demand placed on the West Chester fire service and identified the peak hours for service, the most frequent calls for services, how often units are unavailable for service and the response times for responding emergency apparatus. *The problem this study investigated was how will the West Chester Fire Department continue to respond to fire and emergency medical calls in a timely manner and meet the current and expected demands for service.* This study used local Fire/EMS data to describe the current response scenario to determine the best course of action that will enable fire and EMS units to respond to emergencies in a timely manner.

Over the past several years, West Chester Township has experienced a tremendous amount of residential and commercial growth. To keep up with this development and provide an effective service to the citizens and business community of West Chester the Fire Department added two additional fire stations, one in the Northeast and one in the West central portions of the township. The department had remodeled and rebuilt three existing stations to provide for a 24-hour operation. The Fire Department has switched gears from a predominately volunteer / part time department to a combination department consisting of career and part time members

staffed at all stations around the clock. While the addition of the two new stations in 1999 is providing fire and emergency medical services to the residents and business community, it is becoming apparent that additional growth, traffic congestion, and run volume are increasing response times. Commercial and residential development expanding to the townships west and north perimeters suggest that it may be necessary to consider additional alternatives to provide for swift fire and EMS response.

The future of West Chester Township suggests a continued growth pattern with similar development trends. Although, the local economy will determine the speed of future development, existing and future projects such as a community hospital and destination based shopping centers, coupled with major businesses locating in West Chester, all point to continued economic development. All that considered, the predicted build out is to occur around 2015. With that in mind, the fire department must continue to look for ways to provide and improve upon services and provide them in a timely manner. Without continued growth and expansion of fire department services, the public will suffer with increased response times. In the event of an emergency, time is of the essence whether responding to suppress a fire or responding to treat a heart attack victim. The results of this study identified the key components needed to develop and maintain effective emergency services in a timely manner.

Purpose of the Study

The purpose of this study was to provide a multitude of facts regarding service demand, anticipated demand due to development and response times, and identify the key factors so township and fire administration can make an informed decision on how to meet the service demands in a timely manner today and in the future to better serve the interests of West Chester Township.

Research Questions

The following questions were answered through evaluative research:

1. What are the current service demands and are they being met?
2. What is the anticipated increase in demand for residential / commercial development?
3. How often are West Chester fire resources unavailable for service, and when is the heaviest demand for service?
4. When will West Chester need to build additional fire stations?

BACKGROUND AND SIGNIFICANCE

How many times has the fire service been asked by the customer when responding to an emergency, "what took you so long?" Too often firefighters are faced with confronting a customer who is dissatisfied with the service based upon how long it took for the emergency services to reach his/her emergency. When responding to an emergency, every minute counts, which is why so many advances in early notification were developed to help reduce response times with fire alarm systems that auto dial dispatch centers and enhanced 911 systems.

Distance, call volume, railroads, traffic congestion, and the availability of the closest emergency unit are all factors that dictate response times. In fact, response times have been such a concerning and controversial issue that the National Fire Protection Association (NFPA) has formed and adopted a standard, NFPA 1710, that addresses the response time issue and sets a standard for departments to follow. In addition, the Insurance Service Office (ISO) has also written standards outlining station placement and response times.

Over the past two decades the West Chester community has experienced a tremendous amount of residential and commercial growth. West Chester Economic Development Claritas Reports (2003). In 1997, the Union Centre Boulevard interchange off of Interstate 75 was constructed, and opened 3,000 acres of land for commercial and residential development. It was estimated the interchange would bring 21,000 new jobs to the area.

However, since the opening of the interchange, West Chester has seen the development of more than 34 million square feet of space; the creation or retention of more than 21,000 jobs; 6,400 new residents; several major shopping complexes; new businesses; office development; construction of several hotels, conference centers and restaurants; and significant road improvements that added an additional 35 miles of Township roads. The development that started in 1997 has since resulted in over 64,000 square feet for restaurants; 9,991,135 for retail office space; 390,000 square foot of hotel space; 6,944,860 in industrial space; and 85,000 square feet for bank offices. For details see appendix 1. Another way to express the growth is to track new property valuations. See table 1.

Table 1.
WEST CHESTER NEW CONSTRUCTION VALUATIONS

YEAR	NEW COMMERCIAL SQUARE FEET	COMMERCIAL VALUATION	NEW HOUSING VALUATION	TOTAL VALUATION
2005	6,207,841	152,517,025	82,693,740	235,210,765
2004	3,535,708	127,206,508	75,358,745	202,565,253
2003	1,414,403	223,163,881	55,145,121	278,309,002
2002	1,201,957	122,020,122	24,687,452	146,707,574
2001	2,347,005	115,998,274	32,969,895	148,968,169
2000	2,737,404	96,700,000	20,326,653	117,026,653
1999	2,900,000	134,755,161	34,228,124	168,983,285
TOTAL:	**20,344,318**	**972,360,971**	**325,409,730**	**1,297,770,701**

Source Butler County Building Dept 2006

West Chester Township is 35 square miles with a great variety of residential, commercial, industrial, and retail developments. It is situated between the greater Cincinnati and Dayton metropolitan area on the I-75 corridor, with close proximity to major interstates, airports and railroad lines. Most of West Chester Township‘s residential development is on the North and East side and its commercial and industrial on the southwest side with a mix of retail throughout. Currently West Chester is experiencing residential growth to our extreme Northwestern border and a significant amount of land remains on our Northwestern side. The location makes West Chester an appealing site for residents and businesses to locate and expand. According to the West Chester Department of Planning and Zoning (2005), if past trends continue West Chester looks forward to build out some time around 2015. The expected population could top out over 70,000 with a daytime population of 98,826 people. Claritas Reports 2006 issued a report from the United States Census Bureau to West Chester Township detailing current and projected population per census tract. This report, in the form of a map, see appendix 2. shows population data from 1990 and 2010 projections.

As West Chester continues to grow and expand to its borders the fire department can expect additional buildings, increased traffic loads and congestion, increased day and night time populations, and an increased run volume, all of which contribute to increased response times. The potential impact this study could have on the West Chester Fire Department is to provide the administrative staff sufficient data to make an informed decision about how to continue providing emergency services in a timely and efficient manner.

LITERATURE REVIEW

National Fire Protection Association (NFPA) standard 1710 for the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career fire departments 2004 edition, this standard contains minimum requirements relating to the deployment of fire suppression and emergency medical operations to the public by career fire departments. NFPA 1710 4.1.2.1 establishes the following criteria for career departments.

1. One minute (60 seconds) for turnout time.
2. Four Minutes (240 seconds) or less for the arrival of the first arriving engine company at a fire suppression incident and eight minutes (480seconds) or less for the deployment of a full first alarm assignment at a fire suppression incident.
3. Four minutes (240seconds) or less for the arrival of a unit with first responder or higher-level capability at an emergency medical incident.
4. Eight minutes (480 seconds) or less for the arrival of an advanced life support unit at an emergency medical incident.

NFPA 4.1.2.2 stipulates that the fire department shall establish a performance objective of not less than 90 percent for the achievement of each response time objective listed in 4.1.2.1. The NFPA and its panel of fire chiefs all urge career departments to adopt this standard of a one minute for dispatch time, one minute for turnout time, and four minutes for drive time. Although NFPA 1710 is not a requirement, it is still nationally recognized by most fire departments and

private fire service agencies as a standard or goal to meet. West Chester Township and fire administration have also recognized the standard and consider it a worthy goal for the community.

The Insurance Service Office (ISO) 2005 has issued criteria for the distribution of engine companies. ISO 560 states that the built upon area of the jurisdiction should have a first due engine company within one and one-half miles and a ladder service company within two and one-half miles. This criterion produces an expected response time of 3.2 minutes for an engine company and 4.9 minutes for a ladder service company. See Appendix 3 for West Chester ISO coverage.

The ISO criteria has also been recognized by the township and fire administration as necessary since the township has realized a ISO score from five to three, which has had a significant impact on reducing homeowner and commercial insurance rates, which in turn has had an impact on the growth and development of the township.

Meng (2005) article, in Fire Chief Magazine, details the extensive response times experienced by the Hillsborough County, Florida, fire department and the trouble they encountered in attempting to gain support from the elected officials to build more stations and hire personnel to reduce response times. Eventually, through data analysis of response times they were able to convince the elected officials to provide the necessary funding to expand the department twenty-five percent over five years.

Dedman of the Boston Globe has studied response times for the Boston area fire departments and has written several articles and provided interesting facts from the National Fire Incident Reporting System (NFIRS.) Dedman (2005) reports that many communities across the United States, especially the suburbs, are at risk for long response times. In fact, data from NFIRS 1986-2002 indicates that West Chester only had a 51.1% on-time rating; a far stretch from the NFPA 1710 recommended 90%. However looking at the overall response time picture as seen in appendix 4. it is apparent that about 750 of the responses are in the five minute mark however, the majority of are calls are in the six to seven minute range. Another report generated from Fire RMS and seen in appendix 5. is the average response time by time of day report. It is interesting to note that the majority of the calls that are in the six minute mark all fall in the hours of 07:00-18:00 hours. The calls in the seven minute mark are from 00:00-05:00 hours and 18:00-23:00 hours.

Allen, a statistics professor from Boston College hired by the Boston Globe, found a significant increase in the percentage of fires with a fatality as response times increased. She found that as for every one minutes the response time increases the probability of a death increases by half a percent. She also found that the property damage is tied to response time. As response times increase, the average property damage in a house fire steps up quickly. When firefighters arrive within three 3 minutes or less the average loss is $27,000; at five minutes $34,000; at seven minutes $41,000; and at nine minutes or longer $61,000. The Boston Globe

estimates that if the six minute standard had been reached; about $1 billion a year in losses from house fires nationally could have been prevented.

In 1970 the National Institute of Standards and Technology (NIST) found that after a fire breaks out people have about 17 minutes to escape before being overcome by heat and smoke. Today the estimate is three minutes, which is why every minute counts; a swift response is more critical than ever before for avoiding a fire tragedy. This fact outlined by NIST is directly attributed to the introduction of synthetic furnishings. Furnishings in the past were natural carbon based materials that burned at a slower rate and produced products of combustion less lethal than today's synthetic furnishings that burn much faster and produce highly toxic smoke.

Gromersall (2003) completed a study called Access to the Public Services Fire Department Response Times in Cincinnati Fire Department. She found the following: Response time is dependant upon distance and is affected by the type of streets, street conditions, and speed limits set by the jurisdiction. She noted the type of call could influence the attitude of first responders and the timeliness of their response. For example, a firefighter is more likely to respond in a swift manner to a reported fire call rather than to an alarm drop where they have responded to several times before on the previous shift. The time of day also is a factor to consider in response times. She found that daytime response is much faster than a night response when firefighters are summoned from their beds. She also discovered that response time is dependant upon the number of turns in a journey. The more turns a vehicle has to make the slower the response.

Snyder (2005) suggests in his study (Facility Location Under Uncertainty) that a study of the jurisdiction to determine if a shift in location of the population is occurring from one side of the community to the other, may determine where to staff emergency service operations during a specific time period to meet the demands of the population and then relocate the emergency service to accommodate the location shift of the population.

Society for Academic Emergency Medicine (2005) completed an investigation called Paramedic Response Time: Does it Affect Patient Survival? Their study focused on an urban 911-based paramedic ambulance service that transported to a single urban county teaching hospital. Data collected included patient demographics, paramedic response, scene and transport times, nature of medical complaint, and whether the patient survived to hospital discharge. Their conclusion was that a definite survival benefit was identified for response times less than four 4 minutes. However, it also concluded that paramedic response times within eight 8 minutes was not associated with improved survival to hospital discharge.

NFPA Journal (2005). According to NFPA member Ben Klaene, fire department response time is a misunderstood term. He explains that alarm time is the time from ignition to discovery and dispatch time is the time between the call to dispatcher until the fire department responds and is usually one minute. Turnout time and response times are both addressed in NFPA 1710, which addresses the time it takes firefighters to don protective equipment and travel to the scene. In this journal it is pointed out that in a sprinkled building a fire is being suppressed

at step one (ignition), and fire department response times are not so critical because the fire is being suppressed.

National Research Council of Canada (2005) recently studied five new residential developments with a FIRECAM model to assess whether occupants in an apartment building with sprinkler protection, but longer fire department response times, were as safe as those in a building without sprinkler protection, but a faster fire department response time. Their study concluded that sprinkler protection and existing fire department response times provide a better level of fire safety than no sprinkler protection and a shorter fire department response time.

NFPA Fire and Analysis Research (2005). Researcher John R. Hall indicates that there is evidence that a higher fire department response time correlated with higher property damage rates per fire. He also indicates that the critical time for resident survival is before the fastest, best fire departments can typically respond. His research has found that adding fire sprinklers would save fifty to sixty percent of lives lost.

United States Fire Administration (2006) Deputy Fire Administrator announced the study "Structure Fire Response Times" is based on data from 2001 and 2002 NFIRS information. That information indicates that local fire department response times to structure fires are less than five minutes nearly fifty percent of the time, and less than eight minutes about seventy-five percent of the time. Nationally, average response times were generally less than eight minutes. Other findings reported were that regardless of region, season, or time of day, (1) structure fire response times are generally less than five minutes half the time; (2) the nationwide 90th

percentile response time to structure fires is less than eleven minutes; (3) structure fires in the Northeast have the lowest response times while those in the West have the highest, and (4) average structure fire response times show a relationship between flame spread and longer response times, after flames have spread beyond the room of origin.

Federal Highway Administration (2006) conducted a study called "Traffic Signal Preemption for Emergency Vehicles." This study points out that one remarkable benefit in signal preemption is the reduction of response times. Signal preemption is designed to give responding emergency vehicles a green light upon approach of an intersection while providing a red light to conflicting approaches. This study analyzed the Denver Fire Department for ninety days at seventy-five signalized intersections. The data shows the Denver Fire Department reduced the response times by fourteen to twenty-three percent, with savings of approximately seventy 70 seconds per response on a route with three to six signalized intersections.

To compare how West Chester stacked up among other communities, the Southwest Ohio Fire Benchmarking report was consulted. This benchmarking report began in 2000 with thirteen communities participating and was facilitated by Management Partners. The goal of the project is to track statistics among the participating jurisdictions including fire prevention, fire suppression, EMS, response times and administration. Now in its fifth year there are sixteen participating jurisdictions. The West Chester response times compared to other communities in the benchmarking study show that West Chester has continually had longer response times for

fire and EMS responses. The following data in appendix 6, 7, and 8 is a summary of the 2004 benchmarking study showing how West Chester compares with two other similar communities.

The realization that a swift response can reduce property damage and save lives coupled with the fact that West Chester is deficient in two national standards in regards to response times and distances prompted this researcher to explore solutions to reduce response times and travel distances within the jurisdiction.

PROCEDURES

The initial research began by analyzing data in the West Chester Fire Department record management system known as Fire RMS. These data were used to find what the current service demands are for the fire department and how the department compares to the cited standards as listed in the literature review.

A district run analysis report for 2005 was generated and that data was broken down to determine how many calls were made per apparatus into each district, and indicates amount of fire, EMS and false calls received per unit, as well as mutual aid received per district. Additionally, data was broken down to indicate how many calls were averaged per apparatus per day, and how many hours per day the apparatus is in service and unavailable to make additional calls.

Data from the district run analysis was then used to calculate the amount of calls made outside first due area responses per apparatus, and averaged responses per unit to district per month. For example, looking at table 2, pg. 28, district one left to right, one can see that E-11 responded into its own district 679 times, E-12 responded into district one 80 times and so on. An outside district response time report calculated response times for each apparatus responding to another district.

For a comparison of fire and EMS responses the Southwest Ohio Fire Benchmarking report was reviewed to compare West Chester's demographics and times to other similar communities.

Comparisons were made of population, fires, and fire responses, EMS responses and EMS response times, and number of stations operated.

Data from Fire RMS was also used to determine the average response time for each fire and EMS unit and additionally list response times for second due units as well.

A township map was used to indicate station locations and then circles were drawn in to indicate a 1.5-mile radius for engine responses and 2.5-mile radius for ladder truck responses. Also indicated on the Northwest portion of the map are four Emergency Service Zones currently outside of the district 4 ISO service areas where long response times are experienced.

Additionally, queries were run to determine the call volume for each emergency service zone (ESZ) outside of the district four ISO radius. These emergency service zones are shown as 401, 402, 403, and 404 respectively.

Another report was generated to show fire and EMS calls per ESZ and the response times from 2001-2005. These numbers were then broken down to determine where the highest demand for service was occurring and what district had the longest response times.

A map from the United States Census bureau detailing West Chester with population data from 1990 and 2010 projections was acquired to show population per census tract.

Much of the information collected for the literature review was collected from the West Chester library and the World Wide Web.

Definition of Terms

NFPA: National Fire Protection Agency.

ISO: Insurance Service Office.

Fire RMS: West Chester Township Record Management System

Dispatch Time: The point of receipt of the emergency alarm at the public safety answering point to the point where sufficient information is known to the dispatcher to deploy applicable units to the emergency.

Response Time: The travel time that begins when units are en route to the emergency incident and ends when units arrive at the scene.

Turnout Time: The time beginning when units acknowledge notification of the emergency to the beginning point of the response time.

.Limitations of the Study

Limitations that may have an affect on this research:

Data entered into Fire RMS is assumed to be accurate and factual information and data.

Data collected from Southwest Ohio Fire Benchmarking is assumed to be accurate and factual information.

RESULTS

The results of the research project come from a critical review of the data from Fire RMS, other published research, journal articles, and a benchmarking study.

Research Question One: What are the current service demands and are they being met?

According to the information gathered from multiple sources within Fire RMS and put together onto a spreadsheet per Table 2. these data indicate that the current department wide demand for emergency services is 26.2 calls a day, which totaled 9,597 calls in 2005 requiring mutual aid services 89 times and kept units in service and unavailable an average of 2.24 hours per vehicle a day (See appendix 9). When responding to an emergency call often times it is necessary for other apparatus to respond out of their districts to assist on the call. The data showed that West Chester apparatus respond outside of their district to assist other units an average of 318 times per month or 10.2 times a day. When apparatus are out of their districts assisting on another call they essentially leave their districts unprotected, which requires yet another district to respond or rely on mutual aid from another community, which in turn creates long response times. (See appendix 10). Furthermore, ISO standards dictate that an engine company be situated to have a 1.5-mile radius response area and a ladder truck company 2.5-mile radius response area. The area within district four outside of the ISO radius is depicted by

Emergency Service Zones (ESZ). A query was generated to determine the demand for service outside of the ISO radius (See appendix 3). Call volume for the outer radius totals 294 call for service in 2005, 96 more calls as compared to 2001. Per the literature review one suggestion was to move units dictated by population and demand shifts within the community. This method would be unadvisable due to the physical obstructions caused by the railroads blocking major roads causing major delays in response. In addition the politics involved and difficulty explaining to a resident or business owner that a delay occurred because the station around the block was empty due to units being shifted to another location to meet peek demands in another area.

Additionally, a report was generated to calculate the amount of calls, fire and EMS per ESZ and the response time. In order to eliminate confusion each ESZ was not placed on the map, but was accounted for in the calculation and is summed into the district total. Details of the report show the heaviest demands for fire service are in districts 3 and 5 and the longer response times are in districts 2 and 5. EMS demands are in districts 2 and 5 and the longest response times are in districts 3 and 5 (See appendix 11 and 12 for details).

Research Question Two: What is the anticipated increase in demand for residential / commercial development?

Based on the information from West Chester Department of Planning and Zoning (2005), if past trends continue West Chester Township can anticipate build out by 2015. Research has shown that the past ten-year trend with all of the development caused a 45 percent increase in emergency responses, which is about three percent per year see appendix 13. If the past is a predictor, in the next nine years looking toward 2015, the department can anticipate another 30 percent increase in run volume, totaling an estimated 6,600 calls for service (See appendix 1 for past development).

Research Question Three: How often are West Chester fire resources unavailable for service, and when is the heaviest demand for service?

The data retrieved from Fire RMS, revealed that West Chester Fire Department responded to 3, 529 EMS calls for service and 1,604 fire calls totaling 5,133 calls for emergency services in 2005. When referencing appendix 9 Fire and EMS numbers are much larger due to counting actual number of units responding versus the actual run count. West Chester emergency units are most frequently requested for emergency services on Thursday, Friday, and Saturday between the hours of 10:00-14:00 hours. They spend an average of 00:55:01 for fire responses, and an average of 00:49:07 for emergency medical responses. As shown in Table 2., each apparatus is broken down to HRS/DAY that the unit is unavailable for service. There is a

total of 20.19 hours per day or an average of 2.24 hours per day per vehicle that apparatus is in service and unavailable for additional calls.

Table 2.

Apparatus responses and average in service time per day

	E-11	E-12	E/Q13	E-14	E/Q15	S-91	S-92	S-94	R-41	TOTAL
TOTAL	**1233**	**1043**	**844**	**1007**	**1300**	**1203**	**1520**	**1221**	**128**	***9499***
AVG-DAY	***3.37***	***2.85***	***2.31***	***2.75***	***3.56***	***3.29***	***4.16***	***3.34***	***0.35***	***25.98***
HRS/DAY	**3.08**	**2.61**	**2.11**	**2.52**	**3.76**	**2.68**	**3.39**	**2.72**	**0.32**	***20.19***

Research Question Four: When will West Chester need to build additional fire stations?

Based upon the research and the data provided above it has been determined that the longer response times and demand are not located within district 4 outer ISO area. West Chester administration should consider adding and or relocating additional fire and EMS apparatus at existing stations in the high demand districts. Because the Northwest area in question does not have a significant demand and response times are lower than the other compared areas the need for an additional station in the Northwest quadrant is not apparent at this time. However; it should be noted that construction continues in that area and call volume is on the rise each year.

DISCUSSION

Information detailed in a professional publication provided by Steve Meng (2005), a member of the Hillsborough County, Florida Fire Department, explained that extensive record keeping and analysis of response time data was critical in influencing the decisions of the council to approve expenditures to expand the department. This researcher finds Meng's information to be relative and pertinent as any request for additional funding cannot be made by request alone, but must be backed up by current facts showing trends to justify the request.

Dedman (2005) indicated that the suburbs are at risk for longer response times. West Chester is a suburb of Northern Cincinnati and according to Dedman's report and information gathered from the National Fire Incident Reporting System, from 1986-2002 West Chester had a 51.1% on-time rating. According to NFPA 1710, the committee has suggested a goal of 90%. While the NFPA has suggested this goal of 90% it is realized that the goal is a guideline and not a mandatory requirement. However, it is felt within the department's administration that it is a worthy goal to seek.

NFPA 1710 also suggest that career fire departments set a goal to limit turnout time of one 1 minute or less and have a four 4 minute response time for the first arriving engine and eight minutes for the first alarm assignment, and in addition a four minute response time for the arrival of EMS units. The typical response time for a fire and EMS response West Chester is at least three minutes above the recommended response time for first due engine and two and one-half minutes over for the EMS response. However, the second due first alarm assignment is on

time. (See appendix 14 to see average response times per incident). This is a frequent reoccurring phenomenon with West Chester rescue responding units as it can only be surmised that the second due is arriving on time due to station locations and traffic patterns. Reaction times per NFPA 1710 are set at one minute; West Chester reaction times are over the one minute mark there has been effort made by the West Chester fire administration to decrease the reaction time by broadcasting a pre alert tone to the responding companies before the dispatch so responders can start to make their way to the apparatus. However, reaction times are still consistently over the one minute mark. This researcher's hypothesis to this problem includes a lack of understanding and training among the responders and the general attitude of the responders to not make a swift response. It is further believed by this researcher that it is much faster to respond during rush hour traffic than it is to respond late in the night when responders are awaken from sleeping such as Gromersall (2003) (See appendix 5) for a break down of response times by time of day.

The Insurance Service Office (ISO) 2005 has issued criteria for the distribution of engine companies. ISO 560 states that the built upon area of the jurisdiction should have a first due engine company within one and one-half (1-1/2) miles and a ladder service company within two and one-half (2-1/2) miles. This criterion produces an expected response time of 3.2 minutes for an engine company and 4.9 minutes for a ladder service company (See Appendix 3 for West Chester ISO coverage). When looking at the ISO map it is clear to see that district 4 has a large area outside of the ISO radius. District four made 1,052 out of district runs in 2005, if district

four apparatus is not available to respond within its own district, other units from further districts, or mutual aid must be called. So in an effort to eliminate long response times from other districts there should be some consideration of placing an additional emergency apparatus in the existing station to cover when primary units are unavailable.

Klaene (2005) indicated that too much attention is being spent on response times. He suggests that rather than adding stations to reduce time, more effort should be concentrated on requiring sprinklers to be installed in all buildings as sprinklers are proven to respond and quickly extinguish or control a fire before the local fire service can start to respond. As profound as that statement is, this researcher strongly agrees with Klaene because sprinklers are proven to operate quickly and efficiently to reduce fire and property damage and increase chances of surviving a fire incident. However that is only one part of the equation. Emergency Medical services still need to be strategically located within the jurisdiction so they can quickly respond to emergency medical situations. And fires are not the only threat facing the citizens, so overall fire and emergency services must have the capability to respond in a timely manner.

The Federal Highway Safety Administration conducted a study called "Traffic Signal Preemption for Emergency Vehicles" and it has shown that providing emergency vehicles with a green light at intersections and giving all opposing traffic a red signal greatly improves the safety of emergency responders and reduces response times. It is the researcher's opinion that additional research needs to be done in this area to determine if signal preemption is an alternative to additional fire stations within a jurisdiction.

An interesting aspect of the research was the comparison between similar departments from a benchmarking study. The data in appendix 6, 7, and 8 from Southwest Ohio Fire Benchmarking has shown that West Chester, as compared to two other similar communities, is almost three minutes longer for fire response and about two minutes longer responding to emergency medical calls. What was interesting is that although the two other communities had faster response times they still did not meet the standard set forth in NFPA 1710. This researcher concludes that the NFPA standard 1710 may be an unrealistic expectation for suburban fire departments and additional research is needed to determine what reasonable response times are for suburban fire departments.

The implications of the study results for the West Chester Fire Department are that additional funds will need to be secured to purchase, staff, and equip additional emergency apparatus. First, the fire department must get approval from the township to place an issue on the levy so the citizens can ultimately decide the level of their service. Additionally, the fire department will have to add personnel, purchase fire apparatus for the stations, provide supervision / management, and endure the added cost of fuel and maintenance, salaries and benefits.

RECOMMENDATIONS

As the literature review and results have shown, West Chester is a growing community that is continuing to experience an increased run volume with long response times. It was further shown that West Chester does not currently meet the NFPA 1710 standard, ISO standard, or compare well with other similar community's response times.

To lower response times within all districts not just the outer ISO loop of district 4, it is recommended that West Chester adds additional first responder equipment such as a mini pumper with medic equipment; and or relocate EMS apparatus into districts with a heavy demand to respond when primary units are unavailable.

It is recommended that West Chester begin the process to secure public approval and further evaluate and study the need for a new station to be operational in the Northwest portion of the township to meet ISO and NFPA 1710 standards.

It is further recommended that future research be conducted to determine the impact of traffic signal preemption and response times versus constructing additional fire stations and that future research be conducted to determine if the NFPA 1710 standard is a fair and adequate measure for suburban departments to meet.

And finally, it is recommended that the West Chester Fire Department find a way to reduce the department's reaction times for all stations.

REFERENCES

Allen, E. (2005). Boston Globe response time and death correlations. Retrieved June 20, 2005, from boston.com news. (pp.15) Boston, Massachusetts.

Butler County Transportation Development [BCTID]. (2005). Union Centre interchange.

Butler County Building and Zoning (2005). Square footage and valuations.

Claritas (2004). U.S. census bureau West Chester population per census tract. San Diego, CA.

Dedman, B. Boston Globe (2005) deadly delays: the decline of fire response. Boston Globe. Boston Massachusetts.

Federal Emergency Management Association [FEMA]. (2002). National Fire Incident Reporting System Ohio fire department response times. Retrieved June 10, 2005, from FEMA.gov. (pp.15)

Federal Highway Administration [FHA]. (2006). Traffic signal preemption for emergency vehicles. Retrieved March, 26, 2006 from Federal Highway Administration.com.

Gomersall, C. (2003). Access to Public Services: an analysis of fire department response times in Cincinnati. University of Cincinnati. (pp.16, 30)

Hall, J.R. NFPA Fire and Analysis Research (2005). Response times and fire loss. (pp.18) Quincy, Massachusetts: NFPA

Insurance Service Office [ISO]. (2005). Criteria for distribution of companies 560. Retrieved June 13, 2005, from ISO http://www.iso.com mitigation online.

Klaene, B. (2005). Sprinklers and response time. NFPA Journal. Quincy, Massachusetts: NFPA.

Meng, S. (2005). Fire chief magazine statistical modeling to improve response times. (pp.14, 29)

National Research Council of Canada 2005 fire cam modeling. NFPA Journal July/August 2005. (pp.18) Quincy, Massachusetts: NFPA

National Fire Protection Association [NFPA]. (2004). NFPA 1710 Standard for the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career fire departments. Quincy, Massachusetts: NFPA

Snyder, L.V. (2005). Facility location under uncertainty. Taylor & Francis publishing Lehigh University Bethlehem, PA

Southwest Ohio Fire Benchmarking (2004). Comparison of communities.

Societies for Academic Emergency Medicine volume 12 (2005). Paramedic response time does it affect patient survival.

United States Fire Administration Deputy Fire Administrator [USFA]. (2006). Structure fire response times. Washington, DC.

West Chester Economic Development Claritas Reports (2003). Union Centre Boulevard Development.

West Chester Fire Department fire records management system retrieved 2006.

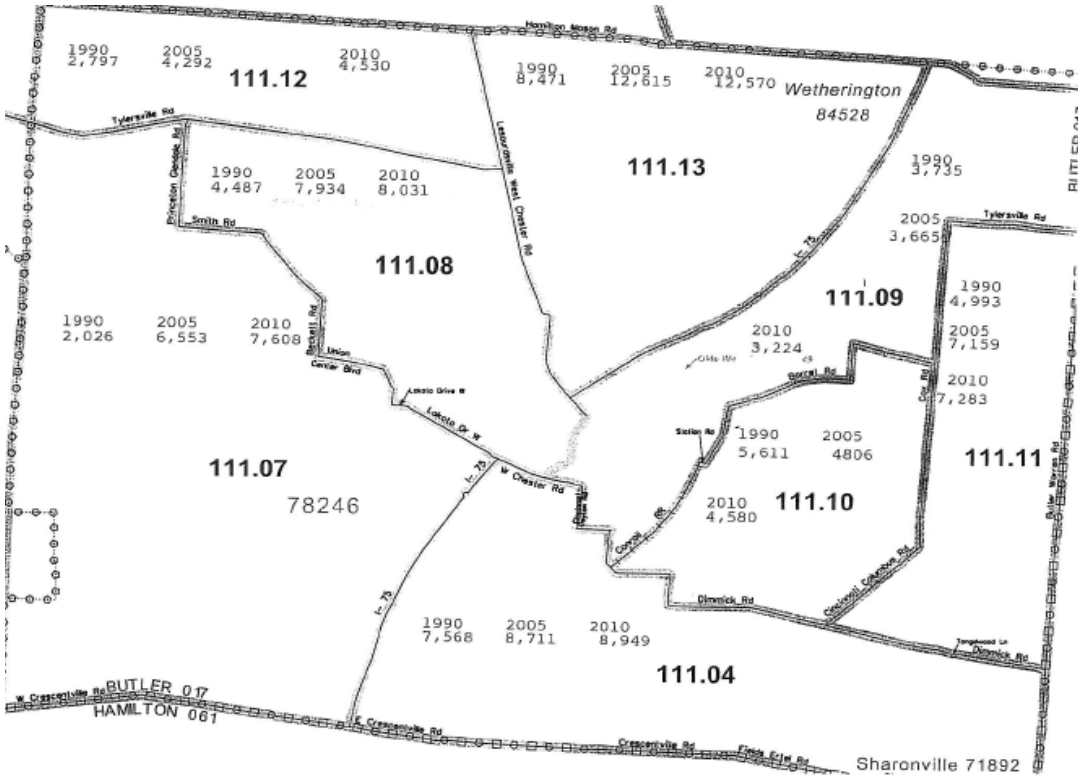
West Chester Planning and Zoning (2005). Expected build out and population.

APPENDIX 1 – UCB DEVELOPMENT 1997-2005

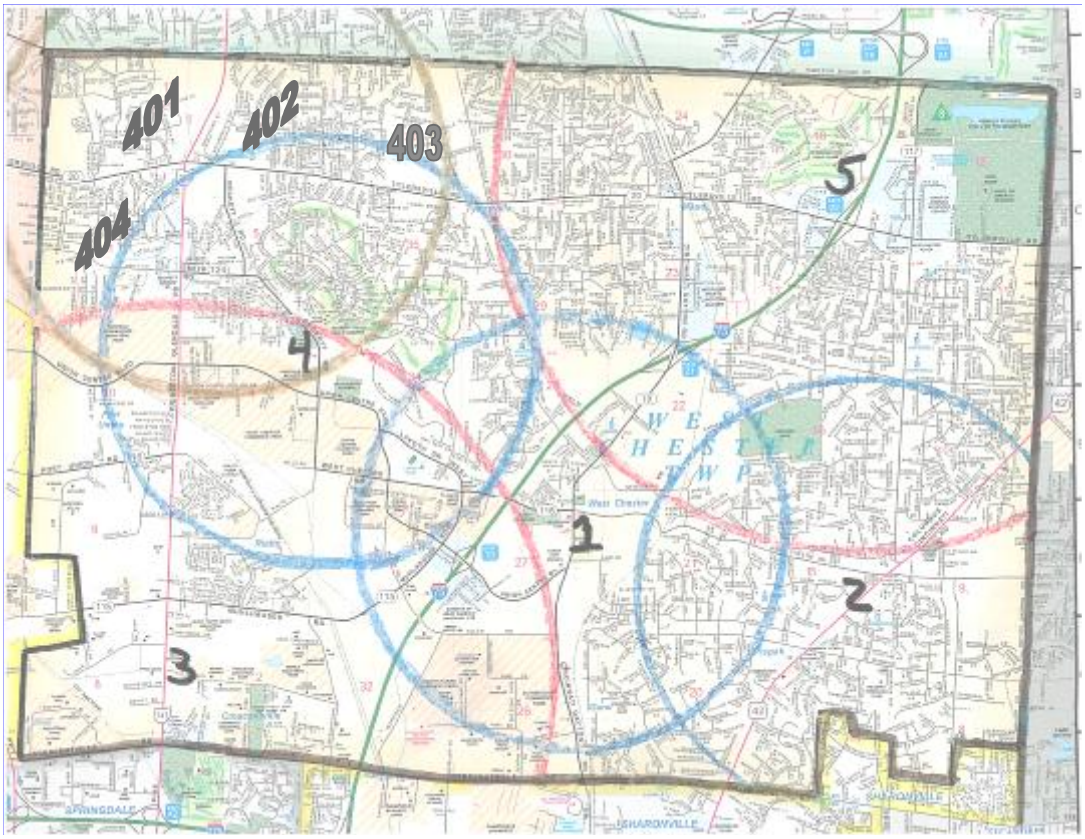
UCB Development		
1997-2005		
Company/Development	**Square Footage**	**# of Jobs**
Restaurant District		
Applebee's	5,000	50
Burger King	1,000	50
Wendy's	1,000	50
Rafferty's	7,000	50
Busken Bakery	7,000	50
Max & Irma's	5,000	50
Bob Evans	4,000	50
Roadhouse	4,000	50
Uno's Pizzeria	5,000	50
Buffalo Wild Wings	5,000	50
Starbucks	4,000	25
Don Pablo's	7,000	50
Pussers	9,000	60
TOTAL	**64,000**	**635**
Retail/Office		
Streets of West Chester (Phase 1)	425,000	200
Centre Pointe Office Park (Buildings 1-4)	490,000	2,500
Union Centre Pavilion (Biggs & center)	146,000	150
Walgreens	11,000	30
Indiana Wesleyan	30,000	12
Mercedes-Benz	61,000	55
West Chester Billiards Centre	20,000	50
Schumacher Retail Centre	66,000	100
Huff Realty building	10,000	100
West Chester Towne Centre	182,000	300
Office/Medical buildings (Wunnenberg Way)	9,680	90
Banks	8,540,455	1,000
TOTAL	**9,991,135**	**4,587**
Hotels		
Hampton Inn	57,914	15
Marriott	200,000	120
Sleep Inn	45,000	30
Staybridge Inn	80,000	30
Courtyard Marriott	8,000.00	30
TOTAL	**390,914**	**225**
UCB Development		

1997-2005		
Company/Development	**Square Footage**	**# of Jobs**
Industrial		
Bakery Crafts	250,000	126
Cornerstone Consolidated	865,000	1160
Lakota Professional Buildings I & II	36,000	
World Park at Union Centre	306,000	
West Chester Commerce Center	306,800	
JP Flooring	100,000	41
Chappell Crossing (Building 1)	20,000	30
Port Union at Union Centre (Buildings D & E		
8950 Global Way	81,000	
Jack of All Games (original location)	206,000	
Jack of All Games	400,000	160
Proctor & Gamble	550,600	750
Rite Track	61,000	136
University Moving & Storage	63,000	50
Liz Clairborne	675,000	330
General Motors	352,000	185
Penco	39,434	151
Dell	427,026	800
Cummins Interstate Power	40,000	54
General Electric	60,000	200
San-Mar	800,000	300
KAO Brands	750,000	300
Duke 10	400,000	
Amylin	156,000	300
TOTAL	**6,944,860**	**5073**
Banks		
Northside Bank	2,800	50
Fifth Third		35
PNC	3,495	30
People's	18,160	45
First Financial	27,000	20
US Bank Centre	34,000	29
TOTAL	**85,455**	**209**
TOTALS	**34,867,273**	**21249**

APPENDIX 2 WEST CHESTER CENSUS MAP 1990-2010



APPENDIX 3 WEST CHESTER ISO AND ESZ MAP

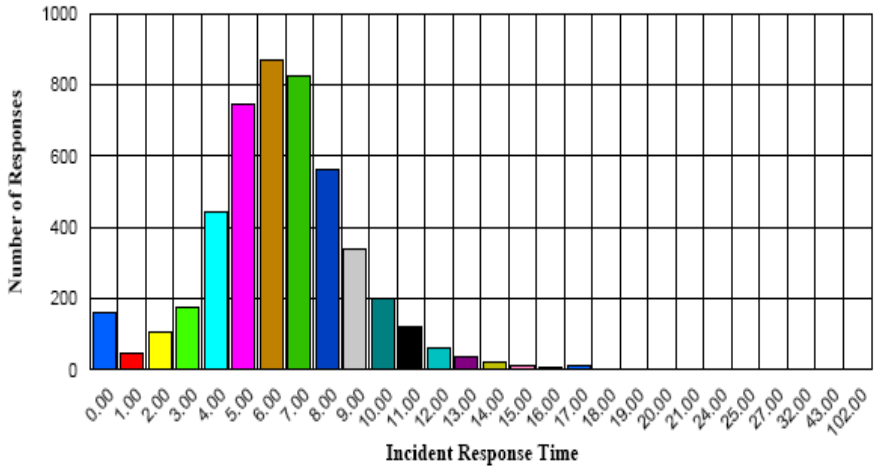


- Each district and station is represented by single digit numeral.
- Emergency Service zones (ESZ) are represented by three digit numerals.
- Red circles indicate 2.5 miles radius from station.
- Blue circles indicate 1.5 miles radius from station.
- Top left brown circle indicates area not within ISO criteria for engine or ladder response.

APPENDIX 4 INCIDENT RESPONSE TIMES

Response Time Recap

Date Range: From 1/1/2005 To 12/31/2005



APPENDIX 5 RESPONSE TIMES BY TIME OF DAY

Average Response Time by Time of Day

Report Period: From 1/1/2005 To 12/31/2005

Time	Count	Count in Average	Average Response Time HHMMSS
00:00:00 to 00:59:59	136	124	00:07:36
01:00:00 to 01:59:59	147	136	00:07:55
02:00:00 to 02:59:59	137	129	00:08:20
03:00:00 to 03:59:59	100	93	00:08:01
04:00:00 to 04:59:59	98	92	00:08:24
05:00:00 to 05:59:59	93	88	00:07:49
06:00:00 to 06:59:59	121	110	00:07:29
07:00:00 to 07:59:59	156	145	00:06:55
08:00:00 to 08:59:59	219	207	00:06:46
09:00:00 to 09:59:59	231	213	00:07:08
10:00:00 to 10:59:59	278	260	00:07:08
11:00:00 to 11:59:59	294	267	00:06:21
12:00:00 to 12:59:59	296	277	00:06:13
13:00:00 to 13:59:59	298	276	00:06:18
14:00:00 to 14:59:59	315	292	00:06:43
15:00:00 to 15:59:59	278	255	00:06:16
16:00:00 to 16:59:59	262	242	00:06:37
17:00:00 to 17:59:59	291	267	00:06:39
18:00:00 to 18:59:59	273	258	00:07:02
19:00:00 to 19:59:59	254	239	00:07:08
20:00:00 to 20:59:59	248	237	00:06:48
21:00:00 to 21:59:59	210	192	00:06:39
22:00:00 to 22:59:59	228	216	00:06:28
23:00:00 to 23:59:59	170	159	00:07:20
Totals:	**5,133**	**4,774**	

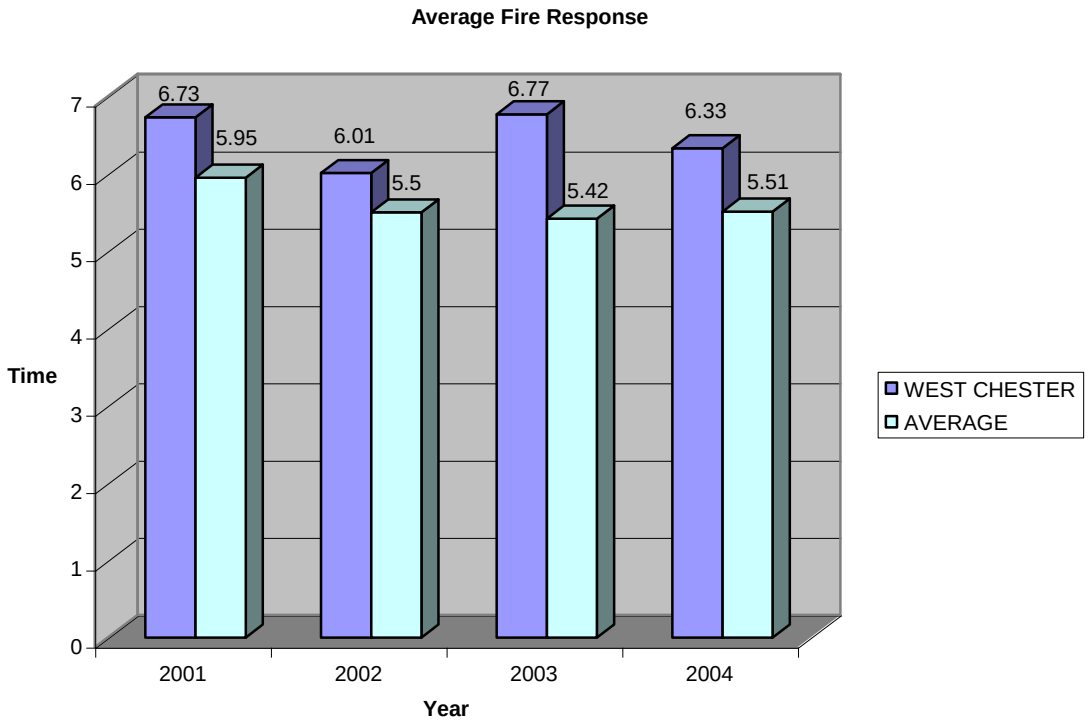
APPENDIX 6 BENCHMARKING STUDY

SOUTHWEST OHIO FIRE BENCHMARKING

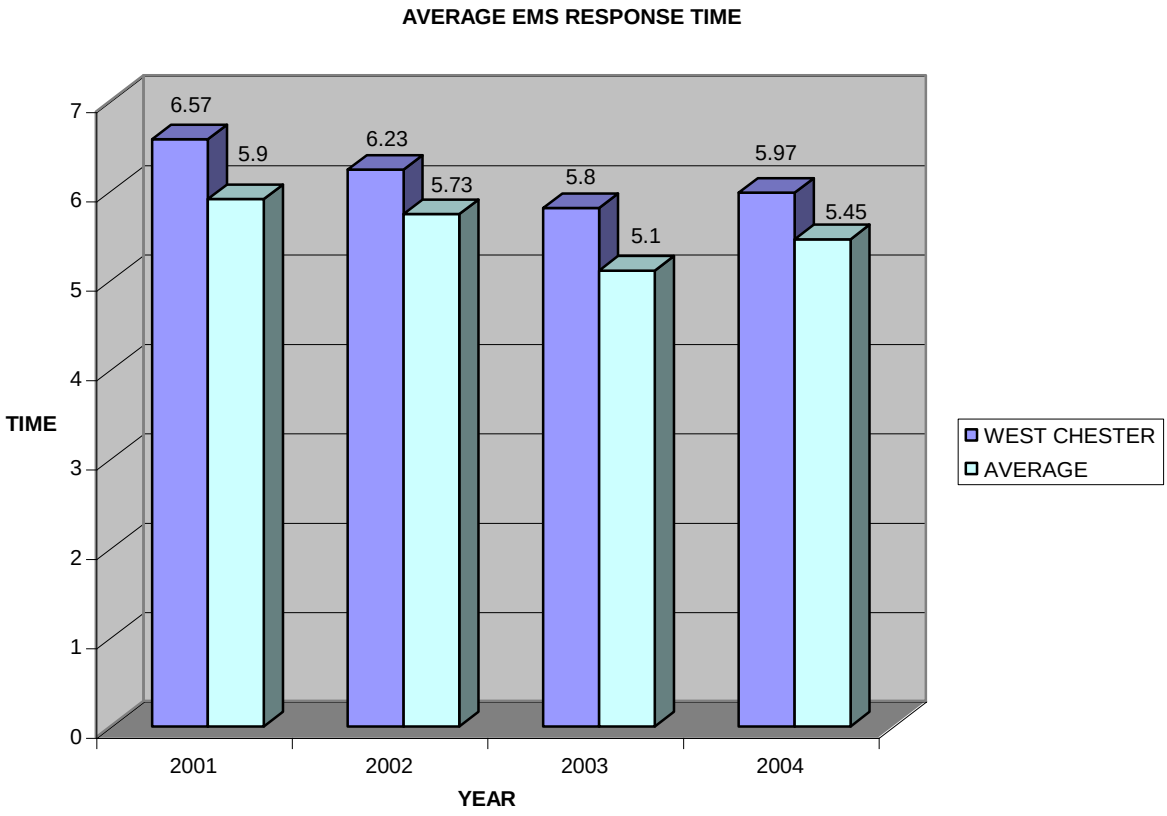
	COLERAIN	GREEN	WEST CHESTER
POPULATION	60,144	55,660	54,895
FIRES	93	32	32
FIRE RESPONSES	1,421	1,605	2,028
EMS RESPONSES	5,755	3,905	3,192
FIRE RESPONSE TIME	4.68	5	7.85
EMS RESPONSE TIME	5.38	5	5.97
STATIONS OPERATED	5	4	5

Source: SW Ohio Benchmarking 2004

APPENDIX 7 – SW OHIO BENCHMARKING COMPARISON FIRE RESPONSE TIME



APPENDIX 8 – SW OHIO BENCHMARKING COMPARISON EMS RESPONSE TIME



APPENDIX 9 DISTRICT RUN ANALYSIS

DISTRICT RUN ANALYSIS

					DISTRICT 1				***Dist***	***Demand***	***0.19%***
E-11	**E-12**	**E/Q-13**	**E-14**	**E/Q-15**	**MUT AID**	**S-91**	**S-92**	**S-94**	**R-41**	**HM42**	
679	80	84	142	113	12	590	48	85	21	0	**1854**
					DISTRICT 2				***Dist***	***Demand***	***0.18%***
87	729	2	16	66	18	119	686	23	26	1	**1773**
					DISTRICT 3				***Dist***	***Demand***	***0.17%***
150	9	626	199	42	15	79	14	502	23	6	**1665**
					DISTRICT 4				***Dist***	***Demand***	***0.16%***
134	10	118	623	33	19	79	25	553	22	0	**1616**
					DISTRICT 5				***Dist***	***Demand***	***0.28%***
183	215	14	27	1046	25	336	747	58	36	2	**2689**
					TOTAL						
1233	**1043**	**844**	**1007**	**1300**	**89**	**1203**	**1520**	**1221**	**128**	**9**	***9597***
					AVG-DAY						
3.37	***2.85***	***2.31***	***2.75***	***3.56***	***0.24***	***3.29***	***4.16***	***3.34***	***0.35***	***0.02***	***26.2***
					HRS/DAY						
3.08	**2.61**	**2.11**	**2.52**	**3.76**	**0.19**	**2.68**	**3.39**	**2.72**	**0.32**	**0.01**	**23.39**
					FIRE						
105	76	63	87	87	2	27	16	26	**489**		
					EMS						
437	558	377	387	700	87	1054	1394	1104	**6098**		
					FALSE						
382	190	223	287	243		43	15	26	**1409**		

APPENDIX 10 APPARATUS RESPONSE TIMES OUTSIDE FIRST DUE AREA

APPARATUS RESPONSES OUTSIDE FIRST DUE AREA 2005

APPARATUS RESPONDING TO DISTRICT ONE						
UNIT	**COUNT**	**AVERAGE RESPONSE TIME**	**AVG/MONTH**			
E-12	80	0:08:48	6.6			
Q / E 13	84	0:06:55	7			
E-14	142	0:06:01	11.8			
Q / E 15	113	0:07:25	9.4			
S-92	48	0:08:54	4			
S-94	85	0:06:14	7			
APPARATUS RESPONDING TO DISTRICT TWO						
E-11	87	0:08:15	7.25			
Q / E 13	2	0:09:48	0.16			
E-14	16	0:11:50	1.33			
Q / E 15	66	0:07:58	5.5			
S-91	119	0:07:14	9.9			
S-94	23	0:11:04	1.9			
APPARATUS RESPONDING TO DISTRICT THREE						
E-11	150	0:09:05	12.5			
E-12	9	0:08:49	0.75			
E-14	199	0:08:29	16.5			
Q / E 15	42	0:12:14	3.5			
S-91	79	0:07:11	6.5			
S-92	14	0:11:07	1.1			
S-94	502	0:07:41	41.8			
APPARATUS RESPONDING TO DISTRICT FOUR						
E-11	134	0:07:54	11.1			
E-12	10	0:12:38	0.83			
Q / E 13	118	0:07:51	9.8			
Q / E 15	33	0:10:11	2.75			
S-91	79	0:07:56	6.58			
S-92	25	0:11:46	2.08			
APPARATUS RESPONDING TO DISTRICT FIVE					**TOTAL O.O.D. RUNS**	
E-11	183	0:07:32	15.2		**E-11**	554
E-12	215	0:08:13	17.9		**E-12**	314
E-14	27	0:08:27	2.25		**Q /E-13**	218
Q / E 13	14	0:08:14	1.16		**E-14**	384
S-91	336	0:07:27	28		**Q / E-15**	254
S-92	747	0:08:07	62		**S-91**	613
S-94	58	0:10:54	4.8		**S-92**	834
					S-94	668
TOTAL:	**3,839**		**318.94**		**TOTAL:**	**3839**

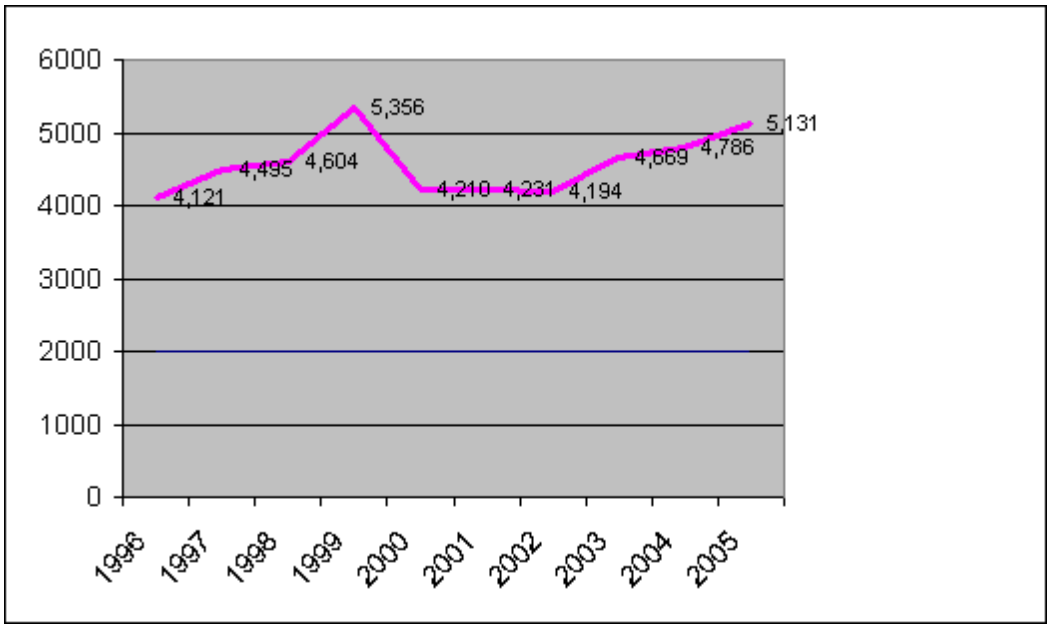
APPENDIX 11 FIRE CALLS PER ESZ AND RESPONSE TIMES

FIRE CALLS PER ESZ AND RESPONSE TIME									
2001					**DISTRICT CALLS**				
DISTRICT	CALLS	RESPONSE TIME			**2001**	**2002**	**2003**	**2004**	**2005**
1	185	6.53			185	173	205	214	232
2	252	7.06			252	215	253	191	222
3	290	6.24			290	245	274	305	252
4	239	6.72			239	252	250	269	257
5	257	7.59			257	252	238	315	331
2002					**RESPONSE TIME**				
DISTRICT	CALLS	RESPONSE TIME			**2001**	**2002**	**2003**	**2004**	**2005**
1	173	6.71			6.53	6.71	6.39	6.16	6.26
2	215	7.24			7.06	7.24	6.7	7.01	6.28
3	245	6.23			6.24	6.23	6.53	6.44	6.68
4	252	6.97			6.72	6.97	6.71	6.46	6.79
5	252	7.24			7.59	7.24	7.31	7.17	7.3
2003									
DISTRICT	CALLS	RESPONSE TIME							
1	205	6.39							
2	253	6.7							
3	274	6.53							
4	250	6.71							
5	238	7.31							
2004									
DISTRICT	CALLS	RESPONSE TIME							
1	214	6.16							
2	191	7.01							
3	305	6.44							
4	269	6.46							
5	315	7.17							
2005									
DISTRICT	CALLS	RESPONSE TIME							
1	232	6.26							
2	222	6.28							
3	252	6.68							
4	257	6.79							
5	331	7.3							

APPENDIX 12 EMS CALLS PER ESZ AND RESPONSE TIMES

EMS CALLS PER ESZ AND RESPONSE TIMES									
2001									
DISTRICT	CALLS	RESPONSE TIME							
1	434	7.75							
2	636	6.97							
3	463	7.04							
4	419	6.6							
5	570	8.15							
2002				**DISTRICT CALLS**					
DISTRICT	CALLS	RESPONSE TIME		**2001**	**2002**	**2003**	**2004**	**2005**	**TOTAL**
1	433	7.01		434	433	441	425	502	2235
2	667	7.44		636	667	683	715	756	3457
3	441	7.28		463	441	526	526	505	2461
4	435	6.68		419	435	520	548	600	2522
5	595	8.31		570	595	743	804	991	3703
2003				**RESPONSE TIME**					
DISTRICT	CALLS	RESPONSE TIME		**2001**	**2002**	**2003**	**2004**	**2005**	**TOTAL**
1	441	6.23		7.75	7.01	6.23	5.97	5.91	32.87
2	683	6.6		6.97	7.44	6.6	6.45	6.69	34.15
3	526	7.21		7.04	7.28	7.21	7.22	7.33	36.08
4	520	6.77		6.6	6.68	6.77	6.53	6.63	33.21
5	743	7.57		8.15	8.31	7.57	7.52	7.41	38.96
2004									
DISTRICT	CALLS	RESPONSE TIME							
1	425	5.97							
2	715	6.45							
3	526	7.22							
4	548	6.53							
5	804	7.52							
2005									
DISTRICT	CALLS	RESPONSE TIME							
1	502	5.91							
2	756	6.69							
3	505	7.33							
4	600	6.63							
5	991	7.41							

APPENDIX 13 TEN YEAR RUN COMPARRISON



APPENDIX 14 AVERAGE RESPONSES BY INCIDENT

STATION RESPONSE BY INCIDENT 2005		
	AVERAGE RESPONSE TIME	SECOND DUE 1ST ALARM
FIRE		
11	6:14	7:13
12	6:33	8:01
13	6:12	8:01
14	6:58	8:41
15	8:53	8:03
TOTAL AVG	**7:00**	**8:00**
EMS		
91	6:06	
92	6:39	
94	6:42	
TOTAL AVG	**6:54**	