Development of a Future Fire Station Placement Model for the Dearborn Fire Department

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Certification Statement

I hereby certify that this paper constitutes my own produce, that where the language of others is set forth, quotations marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

Signed: ____________________________
Abstract

In 2015 the Dearborn Fire Department began the process of studying the impact of increased calls and call distribution patterns on the response times of the Dearborn Fire Department. After it became apparent that distance from current fire stations locations contributed to higher response times the need for research was identified in order to identify the need for a sixth fire station and the location where that station would be most operationally effective while still maintaining cost efficiency. The purpose of this study was to identify the effectiveness of the current fire stations within the Dearborn Fire Department coverage area and to identify methods for the determination of the most effective fire station placement model for potential future fire stations. The descriptive model research method was utilized throughout this project in order to best describe the factors contributing to a research based placement model. The research indicated that the Dearborn Fire Department should in fact seek to build a secondary station on the West End of Dearborn in order to facilitate more rapid response and allow for a full structure fire response within its eleven mile coverage area. The research further found that there is a need for re-location of the existing fire station one from an easterly location to a more centralized location. Finally the research found a need to relocated fire station two on the West End further north to more appropriately divide the West End fire district. Further research is required to develop staffing models, to determine the types of companies to be housed at these locations and to determine most cost effective methods of land acquisition where applicable. The researcher recommends formation of a committee of community participants and municipal representatives to determine how the recommended stations can be built in a fiscally responsible manner.
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Introduction

A problem exists within the Dearborn Fire Department. Currently the Dearborn Fire Department lacks a formal process for identifying effective locations of future fire stations. Current station placement may not be the most effective due to development of the City, service consolidations and changing demographics. The purpose of this project is to identify the effectiveness of current fire station locations and to determine best practice for new station(s) placement.

The author addressed the following research questions:

1. What is the efficiency of current fire stations (response times, call distribution, population served etc.)?
2. What methods are available to determine most efficient fire station placement?
3. What factors are important when considering fire station placement according to nationally recognized fire service organizations.
4. What factors specific to the Dearborn Fire Department should be considered when identifying fire station locations and placement
5. What impact would potential fire station sites have on the City of Dearborn’s fire and EMS service delivery?

This study follows the descriptive research model that often is used to determine and/or report on the present status of the operational impact fire station locations. The purpose of descriptive research is to clarify and report the way things are at a specific point in time. The author reported the status of fire and EMS service delivery as affected by current locations of fire stations throughout the Dearborn Fire Department service area. The author conducted a
comprehensive literature review to determine current industry standards and impacts of fire station placement dependent on a number of variables including distance, call volume, call distribution and changing populations and demographics. The method that was used to collect and analyze the data needed to address the research questions that were presented.

**Background and Significance**

The Dearborn Fire Department covers 28 square miles which includes the City of Dearborn, MI and the City of Melvindale, MI. The City of Dearborn is ring suburb community to the City of Detroit and located within Wayne County in Southeastern Michigan. According to the 2010 US Census, the current population of Dearborn is 98,153 people. Dearborn is well known for its population’s diversity which includes multiple cultures, ethnicities, and religions. Dearborn is well known throughout the nation as the home of Henry Ford and the Ford Motor Company. Dearborn is a well-known as a manufacturing hub, which houses many large industrial and commercial properties in addition to its 37,851 households (U.S. Census Bureau, 2010).

Dearborn’s current borders were drawn in 1928 with the consolidation of the City of Fordson, Dearborn Township and the old City of Dearborn. The consolidation was part of an effort by citizens to bring growth to the community and reduce taxes through diversification of industrial, commercial and residential properties. After being endorsed and supported by Henry Ford the consolidation officially took place on January 9, 1929 (Hutchinson & Rising, 2003).

Given Dearborn’s long history of auto manufacturing and its’ presence of a significant sized labor force. Dearborn is well known as one of the birth places of the American Labor Movement and specifically for the historic “Battle of the Overpass” in 1937 which eventually played a major role in the unionization of the Ford Motor Company in 1941 (Hutchinson & Rising, 2003).
Dearborn has diverse zoning which consequently translates into a diverse tax base. Currently Dearborn’s zoned areas include seventeen percent (17%) commercial parcels, twenty-seven percent (27%) industrial parcels and fifty-five percent (55%) residential parcels. (Ciavaglia, 2013) Many large industrial complexes such as the historic Ford Rouge Plant and AK Steel as well as numerous commercial entities such as the Ford Motor Company World Headquarters call Dearborn home. Dearborn is also home to many other large institutions and organizations, including two hospitals, a large shopping mall, three colleges, and multiple historic sites, and museums. The Henry Ford Museum and Greenfield Village regularly attracts over one million people annually to Dearborn.

Dearborn has a diverse population. Dearborn is well known for its large Arab-American population which is estimated at 30,000 citizens. (De La Cruz & Brittingham, 2003). Although estimated at approximately 30,000 citizens of Arab-American decent, exact numbers are difficult to come by as the US Census Bureau does not count Arab-Americans as a separate ethnicity and instead counts the community in within the general Caucasian population. Dearborn’s population has diverse religious backgrounds as well, and Dearborn is home to many Christian Churches and Mosques including two of the largest mosques in found in North America.

The City of Dearborn is served by a full service career fire department with 128 sworn personnel and one Executive Coordinator clerical support person. The Dearborn Fire Department is considered an “all hazard department” and is the agency tasked with all responses for fires, hazardous materials, rescue, and emergency medical incidents, as well as the coordination of disaster mitigation and recovery within City limits. The Dearborn Fire Department is a licensed advanced life support agency and transports citizens in need of
treatment to local emergency rooms both within and outside of City limits as dictated by County protocol.

In August 2013, the Dearborn Fire Department successfully consolidated fire departments with the neighboring City of Melvindale. As part of the agreement, the City of Dearborn hired all former Melvindale Firefighters to provide contracted fire and emergency medical services to the residents of the City of Melvindale for an annual fee. As a result of the consolidation, the Melvindale Fire Department no longer exists and all of the existing equipment and resources have now become the property of the Dearborn Fire Department along with one centrally located fire station within the City of Melvindale’s borders.

The City of Melvindale is a smaller inner ring suburban community with a population of 10,715 and is approximately 2.76 square miles in size. With the addition of the City of Melvindale, the Dearborn Fire Department’s total coverage area is 27.26 square miles with a resident population of 108,868. Estimated day time population of the combined community is approximately 200,000. Melvindale is just to the south of Dearborn and also borders the City of Detroit to the east.

Call volume for Dearborn Fire Department has grown substantially over the past 30 years; however staffing increases have increased. The Dearborn Fire Department resources are busier today and provide more services now than they have at any other point in its 107-year history. As the run volume continues to escalate the Dearborn Fire Department has now witnessed a correlation between increase demand for service and increases in response times. Further complicating the increased call volume has been a schedule change to a 50.4 hour work week in 2008 as part of labor negotiations. The schedule agreement lowered the amount of hours that line firefighters work, from a 54 hour workweek to a 50.4-hour. The result of this leaves the Dearborn Fire Department with four less firefighters on duty per day. Ultimately less
staff available equates to less apparatus in service which limits availability and thus increases response times.

Following the 2007 housing market collapse and reduction of State revenue sharing the City of Dearborn has faced challenging economic times (O’Connor, 2014). To combat these challenges, the City of Dearborn reduced its workforce city-wide from 911 general employees (non-police or fire) in 2001 to 691 general workers in 2015. The Fire Department was largely exempted from these reductions due to a City Charter (2001) clause which attributes firefighter staffing to the population of Dearborn as determined by the most recent U. S. Census Bureau population report, the economic challenges have still been felt. The fire department did lose three administrative support positions during this time. Although the economy of Dearborn and Southeastern Michigan has shown some improvement over the past few quarters, the City of Dearborn continues to be challenged with difficult economic times for the foreseeable future. While taxable values in 2014 were estimated to increase from $3.42 to $3.46 billion, representing a 1.28% increase, six years of decline has represented a 26% or $1.2 billion decline in taxable values on Dearborn properties (Personal communication O’Connor, April 15, 2014). The Dearborn Fire Department is largely funded on property tax revenue which is unfortunately for the City predictably slow to return even with an improving housing market due in part to the provisions of Proposal A of 1994 which limited the increase in taxable value to no more than 5% a year. This growth rate is not predicted to keep pace with current inflationary increases which in some areas of Dearborn have increased over 15% within the last 12 months.

Given the continued challenging economic times the Dearborn Fire Department and coupled with the continued increases in demand for fire/EMS services the City of Dearborn has decided to look at the impact of current fire station locations and the impact of a potential future fire station placement model. As discussed earlier continued increases in call volume are
now directly having an effect on response times. Further the increased demand for services and its relation to the availability of apparatus, instances of out of district responses and the lower availability of on duty firefighters due to schedule changes have further complicated this issue. Challenging economic times require that the City of Dearborn explore all potential efficiencies could potentially have positive on response times while keeping costs as low as possible.

Dearborn is a somewhat unique in that due in part to the Ford Motor Company the city has a green belt that separates the East and West sides of the City. Separated by the greenbelt and the Southfield Freeway both part of the City have their own unique qualities, cultures and downtowns, yet still manage to integrate enough to form one very community based City.

The current fire stations within the Dearborn Fire Department service area were built between the 1930’s and the 1970’s and were constructed for a number of reasons including political, population density, expected growth, and available land opportunities (Lenaghan, 2011). Currently the five fire stations are not geographically distributed evenly across the fire service area. Three fire stations are located east of Southfield Freeway, one fire station is located in the City of Melvindale (also east of Southfield Freeway) and one fire station is located west of Southfield Freeway and covers a large 11 square mile district.

Fire Station One is the most central fire station although it is significantly more east (1.25 miles) then Southfield Freeway. Fire Station One is located at 3750 Greenfield and is also headquarters to the Fire Department Administration. Fire Station One houses Engine 1, Rescue 1 (ambulance) and F2 (Battalion Chief). The current station was built in 1973 and was constructed on land donated to the City by the Ford Motor Company due in part to a land development project a subsidiary called Ford Land was developing in the area. Initially in 1973 then Mayor had anticipated this fire station as a volunteer fire station to work in conjunction
with the full time career firefighters at the other stations. Hubbard would be prohibited from using volunteers in a 1972 Arbitration Award brought upon by a grievance form the Dearborn Fire Fighters Association L412. After the disbanding of the volunteer program, Fire Station One was manned with career firefighters. Station One currently houses eight full-time firefighters per shift to man its apparatus, although when the department has numerous staff off on leave the Station One manning will go down to seven and the battalion chief will lose his aid.

Fire Station Two is located at 19800 Outer Drive and was built in 1968. Fire Station Two is the further west station and located almost 2.5 miles west of the Southfield Freeway. The station was built on land that was originally owned the Dearborn Public School System, and the City was able to trade land with the schools for the location (Lenaghan, 2011). Fire Station Two is the largest fire station and staffs the most firefighters in part due to its large service district and the distance from the other Dearborn Fire Stations. Station Two houses: Engine 2, Engine 12, Ladder 2, and Rescue 2. Station Two houses twelve firefighters per shift but that number is reduced dependent on leave usages. Dependent on daily staffing, Station Two may take an Engine or Ladder out of service due to lack of staff. Station Two protects a fire district of approximately 11 square miles.

Fire Station Three is located at 3630 Wyoming in a heavily industrialized area in the most southeastern part of the City of Dearborn. Fire Station Three was built in 1939 as a public service project by the Work Projects Administration (WPA) which provided jobs for unemployed Americans as part of Franklin Roosevelt’s New Deal Policy for Depression Era America. The City was built on existing City owned land which had previously served as the City dump. Fire Station Three is located 3.25 miles east of Southfield Freeway and is within a mile from the historic Ford Rouge Plant. At one time the Ford Rouge Plant was almost a City onto itself hosting a plant which built automobiles from raw materials all the way to the finished project. At one point the
Ford Rouge Plant maintained its own Fire Department within the plant with over 130 firefighters. With the development of the Ford Rouge Plant neighborhoods quickly sprung up in Dearborn’s South End in the 1920s and 1930s, numerous apartments and multi-family structures were also built at that time to house many immigrants that would travel to Dearborn often by themselves to work at the Rouge Plant, eventually bringing family members over. Throughout the years, technology and improved safety regulations have altered the workforce at the Rouge Plant. Today the working population within the Rouge Plant is much smaller and the Rouge Fire Department has been essentially disbanded leaving Station Three as its primary fire service provider. Much of the residential area has been condensed in the South End as well beginning with an urban renewal plan in the 1960s. A rash of arsons in the 1970s further ushered a decrease in the amount of residential structures. Today many formally residential areas have been rezoned for industrial uses; consequently the population of this area has greatly decreased from what it was in 1939. Fire Station Three is always staffed with five firefighters.

Fire Station Four is located at 6501 Schaefer and it was built in 1958. Station Four is located two miles east of the Southfield Freeway. Fire Station Four was built on land that had to be purchased from private owners (Lenaghan, 2011). Fire Station Four was built in a highly densely populated area of Dearborn both in 1958 and today. According to Lenaghan (2011) the station was built in its current location due in part to pressure from residents of the affluent Aviation Subdivision who wanted a fire station near their properties. Fire Station Four is currently the busiest of the five fire stations responding to over 3500 calls per year. Fire Station Four houses Engine 4, Ladder 4 and Rescue 4. Fire Station Four also is home to the Dearborn Fire Department’s Apparatus Bureau. Fire Station Four is staffed with nine firefighters but may go down to seven firefighters dependent on daily leave and manpower.
Fire Station Five is located at 3501 Oakwood Boulevard within the City of Melvindale. This fire station while owned by the City of Melvindale has been under the operational control of the Dearborn Fire Department since August 8, 2013, when the City of Melvindale Fire Department was absorbed by the Dearborn Fire Department. The Dearborn Fire Department now operates Station Five and provides services to both Melvindale and Dearborn out of the station. Fire Station Five was built in 1974 and is located in the center of the 2.5 square mile community on a main street which essentially divides Melvindale in half and leads into Dearborn on its west side. Station Five houses Engine 5 and Rescue 5 it is always staffed with five firefighters. Station Five is also home to the Fire Marshal's Bureau of the Dearborn Fire Department.

The current locations of the Dearborn Fire Stations were built for various reasons and opportunities. One predominant theme in all but one of the fire stations was that the land dedicated to the construction was essentially without cost to the City of Dearborn. Fire station placement may have also been impacted by political influences such as the recruitment of land development into an area or pressure from an affluent neighborhood association. Despite the reasons for the previous location determination of existing fire stations, one that that is certain is that populations, call volumes and services provided have changed dramatically since the constructions of all of the existing stations. Standardization of fire department responses as outlined in National Fire Protection Association Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public Career Departments (NFPA, 2004) has set a pre-determined industry standard for fire departments and the influence of this standard must be taken into account as the Dearborn Fire Department seeks to develop a model for future fire station locations.
This study has significant linkage to the course goals of the Executive Fire Officer Program second year course entitled “Executive Analysis of Community Risk Reduction”. As stated in the Executive Analysis of Community Risk Reduction Manual (2014), the course goals of the Executive Analysis of Community Risk Reduction Program are to improve the executive’s abilities to:

1. Identify the role of the Executive Fire Officer in Community Risk Reduction
2. Develop risk-reduction objectives and methods utilizing all-hazard risk analysis.

As a leader within the Dearborn Fire Department, the researcher recognizes the importance of the Executive Fire Officer in assessing community risk and developing techniques and strategies for meeting the fire service expectations of the citizens of Dearborn and Melvindale, as well as the firefighters within the Dearborn Fire Department. This study has been undertaken to apply validated research to an organizational question. The question of the what is the most impactful methodology to determine future fire station locations must be examined mined to provide the citizens and elected officials accurate information to ensure potential fire station placement is: effective, efficient, safe, and in compliance with best practices. According to Kouzes and Posner (2012), leaders understand that implementation of change and achieving change may result in a slow, steady, and consistent process. Leaders must know the value of progress for modeling the way (Kouzes & Posner, 2012). Understanding the impact of the current call volume trends, response times, staffing, hazardous occupancy locations, and current station placement will aid the Executive Fire Officer in construction a risk reduction plan by development of a fire station location plan which can improve coverage thus reducing vulnerability to the community. The information gained from this research project can provide validated information to the Dearborn Fire Department to assist in leadership decisions moving forward. Kouzes and Posner (2012) stated that employees gauge their leader’s dedication to
organizational processes by both hearing and vision. Employees want to see action by their leaders that shows a direct relationship between words and deeds, only then will a leader be judged credible (Kouzes & Posner, 2012). As the impact of current fire station placement has been a subject of debate for many years within the Dearborn Fire Department, and the recent addition of Fire Station Five has again brought up this issue, it is appropriate for the researcher, as fire chief, to explore this problem to promote consistent progress and build commitment by modeling the way for those under his command. Through the understanding of the impact of fire station placement, the researcher can use the information collected to establish his vision for the Dearborn Fire Department.

As stated in the Executive Development Manual (2013), the goals of the United States Fire Administration (USFA) are as follows:

1. Reduce risk at the local level through prevention and mitigation.
2. Improve local planning and preparedness.
3. Improve the fire and emergency services’ capability for response to and recovery from all hazards.
4. Improve the fire and emergency services’ professional status.
5. Lead the Nation's fire and emergency services by establishing and sustaining USFA as a dynamic organization.

This research project has direct or indirect linkage to all of the USFA’s objectives. The linkages include:

1. Reduce risk at the local level through prevention and mitigation.

An understanding of the impact of the current and potential future fire station locations can lead to alternate strategic practices and deployment of resources.
These practices can have a direct linkage to the ability to mitigate an emergency most effectively and efficiently.

2. Improve local planning and preparedness.

An understanding of capabilities of the current and potential future fire station locations can assist Dearborn Fire Department leaders in the planning and preparedness for low, medium and high hazard areas as described by NFPA 1710 (2010).

3. Improve the fire and emergency services’ capability for response to and recovery from all hazards.

With the results of this study, the Dearborn Fire Department will be able to take steps to ensure the best use of resources through proper geographic determination or will be able to make the appropriate arguments that would more properly ensure adequate fire protection and emergency medical service delivery based on potential fire station placement.

4. Improve the fire and emergency services’ professional status.

This study has an indirect linkage to the fourth goal of the USFA by adding to the database of applied research within the National Fire Academy. Through continued scholarly research and applied scientific practices, the fire service will continue to improve its standing amongst the public safety professions.

5. Lead the Nation’s fire and emergency services by establishing and sustaining USFA as a dynamic organization.

This study has an indirect impact contributing to the USFA’s desire to create a sustainable dynamic organization by adding to the database of applied research studies. The USFA through programs such as the National Fire Academy’s Executive
Fire Officer Programs forces its students to take on existing challenges within the fire service and develop strategies to overcome these challenges through their applied research projects. As challenges continue to be mitigated though scholarly research the USFA will continue to enhance its reputation as a sustainable dynamic organization.

**Literature Review**

The search for literature on fire department methodology for fire station location determination and its relevance to community risk reduction varied across the use of various databases. Through utilization of EBSCO databases, thousands of results were obtained on fire stations, but few of the articles pertained directly to the fire station location methodology. After the initial search of various databases, key words consisting of *fire departments, fire stations,* and *deployment fire service resources* were used to obtain more specific and focused scholarly articles on scheduling issues related to deployment of fire service resources from fixed positions. Much of the literature was recent (i.e. post 2006); however some material was dated. After careful consideration, these dated sources were used because they were applicable to this study. As part of the literature review, the author further examined applicable Federal and State Regulations, the National Fire Protection Association (NFPA) standards, and specific professional texts related to the fire service.

**Industry Standards for Fire Station Locations and Deployment**

Perhaps more than any other contributing factor, fire station location can have the greatest influence in response time due to its travel distance to likely calls for service. The proximity of a fire station to the location of a call for service can be the difference between confining a fire to a room and its contents, or the spread of the fire throughout an entire structure. In terms of EMS the travel time to a call for a heart attack may mean the difference
between complete recoveries or significant cardiac deviances post cardiac catheterization. It is important for the Executive Fire Officer to have an understanding what the current industry standards and expectations are of the fire service’s leading agencies.

**NFPA 1710 Standard**


NFPA 1710 (2010) also sets the standard for fire apparatus response times to the scene of an emergency. NFPA 1710 (2010) recommended that the first pumper company at the scene of a fire should arrive within a travel time of 240 seconds from the time of dispatch of crews to 90% of their incidents. Within 480 seconds of travel time, the fire department should have the ability to deploy a first alarm assignment to 90% of service calls. NFPA 1710 (2010) further stated that a fire department should have the capability to deploy additional assignments that could provide additional command staff, personnel, and additional services beyond the capability of the initial full alarm assignment.

In regard to emergency medical service (EMS) response, NFPA 1710 (2010) recommended a staffing level that consists of at least the “minimum personnel” necessary to provide emergency medical care relative to the level of care offered by the fire department. In terms of incidents requiring Advanced Life Support (ALS), the NFPA 1710 Standard (2010) required a minimum response of at least two paramedics and two emergency medical technician-basic level employees on scene within 480 seconds of travel time. This requirement is prefaced by an additional requirement that first responder unit or basic life support (BLS) ambulances make the initial contact with the patient within 240 seconds.
Both of the previous requirements come with a minimum compliance rate of ninety percent (90%). The NFPA 1710 model follows Figure 1 below:

Figure 1.  

*NFPA 1710 Response Time Timeline.*

![NFPA 1710 Response Time Timeline](image)


While NFPA 1710 has become the de-facto industry standard in recent years, it is not without its critics. Morrison (2001) states that full compliance with NFPA 1710 is not realistic for many communities, especially those with limited financial resources. Morrison (2001) goes on to state that he believes the NFPA 1710 standard was politically influenced by the International Association of Fire Fighters who reportedly paid for more than 2500 NFPA memberships for its union members to vote on NFPA 1710. Bruno (2001) further cites opposition from the National League of Cities who claim that NFPA 1710 sets a standard that is unachievable without providing for any funding source. The National League of Cities Director Donald Borot goes on
to state that each community should have the ability to provide the level of fire protection in which it feels is appropriate (Bruno, 2001).

**Insurance Services Office Standards**

The Insurance Services Office’s (ISO) Public Protection Classification (PPC) is another industry standard often referenced when delivery of fire protection services is discussed. The ISO requires that a fire station must be within five miles of a structure in order to be rated as “fire protected” (ISO, 1998). This distance requirement is based off of formulas related to travel distance and assumed travel time for within a five mile distance. The ISO method however seems to rely on an assumption that a responding vehicle can always drive the shortest distance between two points. Fire apparatus typically have to maneuver many turns and intersections in order to reach a location. Simply assuming a five mile circle around a center point may not be the most accurate method for determining station location. The ISO has been criticized as only applying the use of response models to standard travel time to all areas regardless of their various characteristics which can considerably vary response times of the arriving apparatus.

**The Commission of Fire Accreditation International Standards**

The Commission on Fire Accreditation International (CFAI) in another organization which has been referenced more and more by fire departments when determining fire station locations. The CFAI outlines specific criteria of determining fire station location determination within their *Standards of Cover Process* (2008). According the CFAI the standard of coverage of any community’s fire service must take into account a community assessment which included evaluation of: the risks and hazards of the community, the defining benchmarks of emergency response standards, potential future fire stations, and support for the strategic plan (CFAI, 2008). According to the recommendations of the CFAI an identified acceptable standard of response coverage must be identified by the community in order to properly assess resource
distribution and deployment (2008). The CFAI describes response time as a culmination of a three elements: pre-response elements, response elements, and post-response elements. Pre-response elements within the CFAI standard of coverage recommendations include:

1. Event Initiation: The event initiation is defined as the act or condition which begins the initiation of a response process.
2. The Emergency Event: The emergency event is the emergency itself that has taken place.
3. The Alarm: The alarm is defined as the recognition of a need for fire department assistance.
4. Notification: The notification is the actual reporting of an event, typically done through a call to 911.

Response elements included in the CFAI standards of coverage guide include:

1. Alarm Processing: Alarm processing includes providing information to the dispatcher which has answered the 911 call for help.
2. Turnout Time: Turnout time is the time needed to don fire protective clothing.
3. Travel Time: Travel time is defined as the time it takes a fire vehicle to arrive at the requested location from its point of departure.

Post-response elements of the CFAI standards of coverage include:

1. Initiation of Actions: The initiation of action occurs once the fire company has arrived on scene and begins mitigation of the incident.
2. The Termination of Event: The termination of the event includes the conclusion of mitigation activities.

As the City of Dearborn seeks to begin the CFAI Accreditation process in 2015 it is important that the recommended response times of the CFAI can be met and that resources are
properly deployed in order to ensure most effective response. The current benchmarks according to the CFAI are fifty (50) seconds for processing time, sixty (60) seconds for turnout time. The remaining portions of the total response time should be adopted by the fire department in accordance with the community’s defined response time standards (CFAI Accreditation Manual 2008). The current response time standard for the Dearborn Fire Department is five minutes from time of notification to initiation of actions on the scene by the first arriving company and an eight minute arrival time for arrival of the first alarm (City of Dearborn Fire Department, 2015). In comparison to NFPA 1710, the CFAI allows communities more independent assessment of need. This is an important aspect to response time benchmarking as the availability of resources is often linked to the willingness of the community to pay for the costs of those resources. There are a number of variables which may impact a fire department’s ability to meet response time standards, almost all of these variables are dependent on the availability of funding by the citizens of the community through tax funding.

Effects of Response Times on Mitigation of Fire Department Incidents

Fire Department’s today respond to a wide variety of incidents including: fires, emergency medical emergencies, hazardous material releases, technical rescue, and general calls for assistance. The Dearborn Fire Department today is an all service fire department and the determination of how response times affect its ability to most efficiently mitigate an emergency is an important aspect when considering deployment of resources and fire station placement. According the National Fire Protection Handbook, Seventeenth Edition: the ability of a victim to survive a fire is largely based on time (NFPA, 2008). The standard time and temperature curve (Figure 2.) shows the rapid escalation of fire from the development stage to flashover. Without rapid intervention fire can become extremely dangerous if not fatal within a short amount of time.
Clark (1991) identifies the time period between the incipient stages of a structure fire until the flashover of the entire area as the most critical time for intervention in order to facilitate survival of a victim. In many cases even prior to flashover the conditions of a structure will not allow survivability of occupants due in part to superheated gases, smoke and the release of gaseous toxins. Once flashover does occur however firefighting activities are increasing complicated and survivability of occupants is not likely. Fire departments must recognize the need to arrive at a fire as early as possible in order to prevent the continued growth of a fire to the flashover stage.

EMS runs also require a rapid arrival time of fire departments. There are many medical conditions in which rapid intervention by either EMS or hospital staff is essential in order to prevent serious complications or death. Rapid defibrillation of cardiac arrest patients has the most significant impact on the possibility of resuscitation and should not be delayed. (Norma et
al, 2006). Jauch et al. (2013) through work with the American Heart Association/American Stroke Association has recently promoted the development of EMS Stroke Protocols to allow for rapid treatment and transport decisions based on symptomology and the need to rapidly combat embolism in stroke patients. The American College of Surgeons’ Committee on Trauma (1998) states that the rapid triage and intervention of the trauma patient can be paramount to survivability. The Dearborn Fire Department and its governing medical control authority utilizes emergency medical protocols based on industry standards drawn from many of the above mentioned source agencies such as the American Heart Association, the American College of Surgeons, and American Stroke Association.

**Capabilities**

Having the available resources and capabilities to fight a fire safely and properly is a necessity. The NFPA (2008) in its *Fire Protection Handbook* has identified a number of initial response capabilities for low, medium and high hazard occupancies. Table 1 demonstrates recommended resources for initial fire attack response according to occupancy type.

<table>
<thead>
<tr>
<th>Occupancy Type</th>
<th>High Hazard Occupancy</th>
<th>Medium Hazard Occupancy</th>
<th>Low Hazard Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial resources required according to NFPA Fire Protection Handbook 20th ed. (2008).</td>
<td>• 4 pumpers</td>
<td>• 3 pumpers</td>
<td>• 2 pumpers</td>
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<td></td>
<td>• 2 ladder trucks</td>
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<tr>
<td></td>
<td>• Not less than 24 firefighters</td>
<td>• Not less than 16 firefighters</td>
<td>• Not less than 12 firefighters.</td>
</tr>
<tr>
<td></td>
<td>• 1 safety officer</td>
<td>• 1 safety officer</td>
<td>• 1 safety officer</td>
</tr>
<tr>
<td></td>
<td>• RIT Team</td>
<td>• RIT Team</td>
<td>• RIT Team</td>
</tr>
</tbody>
</table>
Workload

Workload is an important factor to consider when evaluating a fire station location and then determining if a communities’ response times can be achieved (TriData, 2007). The concept of work is not only the amount of calls that a particular apparatus or station makes per day, but rather the amount of time an apparatus or fire station is operating in a fashion that keeps it unavailable for additional calls. Evaluating workload can also be important when looking at overlapping coverage districts and in determining if station placement or assigned resources are in the best possible location for most efficient response (TriData, 2007). TriData (2007) has further recommended the amount of redundancies in service that should be available within a fire department given the call volume per year.

Table 2.

<table>
<thead>
<tr>
<th>Workload</th>
<th>Annual Calls</th>
<th>Simultaneous Calls</th>
<th>Recommended Distance between Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low Workload</td>
<td>Less than 500</td>
<td>Infrequent</td>
<td>Maximum</td>
</tr>
<tr>
<td>Low Workload</td>
<td>500-999</td>
<td>Few</td>
<td>Maximum</td>
</tr>
<tr>
<td>Moderate Workload</td>
<td>1000-1999</td>
<td>Some (usually at peak demands periods)</td>
<td>Marginal overlap</td>
</tr>
<tr>
<td>High Workload</td>
<td>2,000-2,999</td>
<td>Likely overlap</td>
<td>Significant overlap</td>
</tr>
<tr>
<td>Very High Workload</td>
<td>3,000-3,999</td>
<td>Daily overlap usually during peak times</td>
<td>Significant overlap</td>
</tr>
<tr>
<td>Extremely High Work Load</td>
<td>More than 4000</td>
<td>Hourly regardless of time of day</td>
<td>Requires total redundancy</td>
</tr>
</tbody>
</table>

Once a particular apparatus has “a very high workload” they should be considered busy and monitored for workload effects on response times (TriData, 2007). As units become busier, response times can increase due in part to chances for simultaneous calls within the same running district. As units become busier, more reliance may be put on units from farther
distances (TriData, 2007). This factor may have an impact on the need for additional fire stations or alternative locations for fire station placement.

A second method for evaluating the workloads of particular units within a fire department is by calculating their “unit hour utilization” (UHU). In this formula a “unit hour” is defined as equal to one hour of service by an ambulance for dispatch or performing tasks on a call for service. The term “utilization” is a measure of productivity that compares the available resources (i.e. unit hours) with actual amount of time those units are being utilized for patient treatment, transport, or other productive activity (J.R. Henry Consulting, 2011). The formula for calculating a UHU is as follows:

\[
    \text{UHU} = \frac{(\text{number of calls}) \times (\text{average call duration in hours})}{8,760 \text{ hours per year}}
\]

(TriData, 2007).

While many communities strive for a UHU of 15 to 20% to ensure quality response times. Other communities prefer to keep their UHU’s between 35 and 45% for maximum efficiency, although the risk of simultaneous calls for service and delayed response times is increased (TriData, 2007). To ensure proper fire station placement and deployment of resources within the community, it is essential that the Fire Chief understands the UHU of his resources (TriData, 2007).

**Procedures**

The procedures that will be used to collect and analyze the data needed to address the research questions and associated hypotheses are presented in this section. A descriptive research design will be used in this project. This type of design is appropriate when the independent variables are not manipulated. Research methods utilized in this paper include data analysis from a number of sources including: literature review, archival data from past fire department records and examinations of municipal plans, real estate availability and
geographical analysis of the City of Dearborn. Research for this paper began at the Learning Resource Center of the National Fire Academy (NFA) located in Emmitsburg, Maryland in January of 2015. Multiple periodicals, texts, and peer reviewed journals concerning the location determination of fire stations were reviewed. Upon initial review of this material, five research questions and hypotheses have been developed for this study:

1. What is the efficiency of current fire stations?
   
   \( H_1 \): The current locations of fire stations have impacted fire department efficiency within the City of Dearborn.

2. What are the methods available to the City of Dearborn in evaluating future fire station location?
   
   \( H_2 \): The City of Dearborn can utilize various independent methods or a combination of methods to assist in a fire station location identification model.

3. What factors are important when considering fire station placement according to nationally recognized fire service organizations?
   
   \( H_3 \): Nationally recognized fire service organization standards are applicable to the City of Dearborn service expectations.

4. What factors specific to the Dearborn Fire Department should be considered when identifying fire station location and placement?
   
   \( H_4 \): The City of Dearborn has unique considerations and limitations when considering fire station location and placement.

5. What impact would a proposed fire station site have on the City of Dearborn’s fire and EMS service delivery model?
H0: An additional fire station would have an impact on service delivery of fire and EMS services within the City of Dearborn?

**Efficiency of Current Fire Station Locations**

In order to determine the current efficiency of the Dearborn Fire Department’s five current fire station locations, a review of applicable data was conducted in 2015 to determine current response time data over the past five years. The data set utilized included calendar years 2011 to 2014. Historical run data information was retrieved from the Dearborn Fire Department’s record management system which utilized the Xerox FireHouse software system.

In order to further process the data the total number of fire and EMS calls for service was tabulated for each of the current fire stations. All non-emergency calls for service were removed from consideration as they are not responded to in an urgent matter and may be tiered. Once data sets were acquired the data was further divided into sets for each of the existing Dearborn fire stations and their primary response districts. An assessment of call volume, work load distribution and response time was conducted on each of the fire station districts to understand current utilization and efficiencies. The data collected from this archival data search was utilized in comparison with current standards of the NFPA, CFAI, ISO and the AHA to determine the efficacy of the current stations. The City of Dearborn Geographic Information Services (GIS) Department was contacted for assistance in utilization of acquired data within a mapping system. Maps were created to determine likely response times considering travel obstructions, time of day and traffic patterns from each of the five fire stations in comparison with actual response times. Next calls for service were mapped out by district in order to assess the workload capacity of each of the five existing fire districts. Once data was obtained regarding current efficiencies of the existing fire stations, it was important to understand future shifts in population or demand for resources within the City of Dearborn. The
City of Dearborn Economic and Community Development Department was contacted in regard to the City’s Master Plan and expected changes to the City which may produce changes in demand for fire department resources. As the City of Dearborn is an older and established community within Southeastern Michigan the City itself is almost entirely developed, minus the green space which has been historically preserved in the center of the community. Although some re-zoning of the City is planned the overall impact on demand for service from the fire department is low and the determination would be to not include it within the scope of this research project. The data related to response times and call for service will be utilized based of strictly historical data sets in order to understand a new stations impact on existing City layout, and demand for resources. Minimal change is expected in terms of travel distances or obstructions within the foreseeable future. Although there are no current plans to relocate existing fire stations, it is important for the Dearborn Fire Department to understand the efficiency of the current station location for long term planning of fire department resource distribution.

Fire Station Placement Factors

The determination of fire station location planning is effected by numerous factors. Effective deployment of fire department resources is the most important factors but other factors often have influence or impact on decisions regarding fire station location. Politics, availability of land, construction costs, neighborhood groups, finances and changing demographics all may all impact the location of a fire station and must be considered as planning begin. In a fire station location study conducted by Tulsa, Oklahoma the process began with an assessment of historical station placement and then moved on to evaluation of high hazard areas and response times (Kuehnert, 1999). A similar evaluation was completed by the researcher utilizing Dearborn data. The CFAI (2008) recommends utilizing community
assessments, fire and non-fire risks, definition of service expectations, work load, utilization of apparatus and potential for further fire station locations. The researcher evaluated data related to the CFAI (2008) recommendations in order to obtain knowledge of the current state of service delivery and the potential for a future fire station location.

Results

Research Questions and Hypotheses

Five research questions and associated hypotheses were developed for this study.

1. What are the methods available to the City of Dearborn in evaluating future fire station location?

   $H_2$: The City of Dearborn can utilize various independent methods or a combination of methods to assist in a fire station location identification model.

The traditional methodology utilized for fire station location planning prior to the increased utilization of geographic information systems in cities with gridiron street layout would be to measure distance from fire stations to hazardous areas in travel-miles (American Society of Planning Officials, 1957). This method requires plotting fire stations out in diamond shapes with limited overlaps. Other studies utilized the drawing of outlined circles of three-quarters, one and a half, or three miles in radius based on jurisdictional standards. Drawing circles however is less realistic than measuring travel-miles (American Society of Planning Officials, 1957). Today more fire departments utilize geographic informational systems (GIS) to determine ideal locations of fire station placement based on traffic patterns, distance, obstructions, and call volume. Through the utilization of GIS reports fire departments can perform an incident analysis which can map out incident type, cause, dates and times, likely
responding units and arrival times (ERSI, 2007). Travel time modeling can also assist the fire
department in assessing resulting response times due to irregular shapes districts.

2. What factors are important when considering fire station placement according to
nationally recognized fire service organizations?

H3: Nationally recognized fire service organization standards are applicable to the
City of Dearborn service expectations.

The most important factor for determining fire station location needs to be a
determination of response time expectations and standards by the community (ESRI, 2007).

Upon the determination of the response time expectation it must be divided into the various
components of the total response time, those are: reflex time, dispatch time, turnout time,
travel time, access time, and setup tome (ESRI, 2007). According to NFPA 1710 (2010) the total
response time of a fire department to a house fire should be six minutes and twenty seconds.
This expectation is divided into the following categories and associated time expectations in
Table 3.

**NFPA 1710 Time expectations and responsible organizations for activities.**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Expectation</th>
<th>Responsible Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm handling time.</td>
<td>60 seconds</td>
<td>Dispatch</td>
</tr>
<tr>
<td>Turnout time.</td>
<td>80 seconds</td>
<td>Fire Department</td>
</tr>
<tr>
<td>Travel Time</td>
<td>240 seconds</td>
<td>Fire Department</td>
</tr>
<tr>
<td>Full Assignment</td>
<td>480 seconds</td>
<td>Fire Department</td>
</tr>
</tbody>
</table>

Work load is another important factor when determining fire station location. In order to
realize the most efficiency out of a fire station a station needs to be utilized and not simply
placed in order to make rapid response times in low call volume areas. The utilization of the
UHU evaluation of utilization and the TriData (2007) recommendations are an effective away to
understand the demand on a fire station location. According to Tri-Data (2007) fire based EMS
should maintain a UHU level of thirty-five to forty-five percent. Maintaining a UHU within this range will ensure that the ambulances are efficiently being utilize but not in such demand that they are unavailable for other calls or utilization at fires or other emergencies.

The ISO Fire Suppression Rating Schedule requires urban areas to have an engine company within 1.5 miles and a truck company within 2.5 miles of a structure fire. Structures outside of a five mile distance according to ISO are not considered to be fire protected (ISO, 2012).

3. What is the efficiency of current fire stations?

\[ H_1: \] The current locations of fire stations have impacted fire department efficiency within the City of Dearborn.

The number of runs and the response times for the years from 2004 through 2014 were obtained from the fire department records. Figures 1 and 2 provide graphical representations of this data.

Figure 3.

*Call Volume Growth of the Dearborn Fire Department*

Calls for service increases at such large magnitudes can have a negative impact on response times and has in the case of the Dearborn Fire Department. Figure 4 shows the increased
response times related to the increased call volume and limited availability of Dearborn
apparatus.

Figure 4.

Response Time Increases within the Dearborn Fire Department Service Area (in minutes).

The number of runs increased from 9432 in 2004 to 13099 in 2014 for an increase of
39%. The response times increased from 3.88 minutes in 2008 to 4.65 minutes in 2014 for a 19%
change in response time. While the relationship between run volume and response time could
not be tested statistically, it appears that as run volume increases, so does response time. This is
an important factor in the determination of fire station travel times and the type/amount of
resources that will be housed at the location.

When compared to the Tri-Data (2007) report, the workload of the various companies
of the Dearborn Fire Department reflected a multitude of workloads. Based on the number of
calls for each of the companies and/or types of apparatus, the workload does not appear to be
equitable. While workload is not equalized each fire station location is instrumental in making
the City’s desired standard of a less than five minute response time. See Table 4 for the division
of work.
Table 4.

*Division of Workload by Apparatus*

<table>
<thead>
<tr>
<th>Apparatus</th>
<th>Workload</th>
<th>Annual Calls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine 1</td>
<td>Moderate</td>
<td>1789</td>
</tr>
<tr>
<td>Engine 2</td>
<td>Moderate</td>
<td>1017</td>
</tr>
<tr>
<td>Engine 12</td>
<td>Moderate</td>
<td>1353</td>
</tr>
<tr>
<td>Engine 4</td>
<td>High</td>
<td>2017</td>
</tr>
<tr>
<td>Engine 5</td>
<td>Low</td>
<td>991</td>
</tr>
<tr>
<td>Quint 3</td>
<td>Low</td>
<td>557</td>
</tr>
<tr>
<td>Bat Chief</td>
<td>Low</td>
<td>487</td>
</tr>
<tr>
<td>Rescue 1</td>
<td>High</td>
<td>2924</td>
</tr>
<tr>
<td>Rescue 2</td>
<td>High</td>
<td>2762</td>
</tr>
<tr>
<td>Rescue 3</td>
<td>Low</td>
<td>955</td>
</tr>
<tr>
<td>Rescue 4</td>
<td>High</td>
<td>2982</td>
</tr>
<tr>
<td>Rescue 5</td>
<td>Moderate</td>
<td>1813</td>
</tr>
<tr>
<td>Ladder 2</td>
<td>Low</td>
<td>239</td>
</tr>
<tr>
<td>Ladder 4</td>
<td>Low</td>
<td>543</td>
</tr>
</tbody>
</table>

TriData (2007) recommended a unit hour utilization (UHU) of 35% to 40% for EMS Units in order to meet demands. In a report entitled *Calculating Your EMS Service’s Average Cost of Service and Unit Hour Utilization*, J. R. Henry, Consulting (2011) believed ambulances should strive for a UHU of 50% to 55% for optimal performance. The unit hour utilization (UHU) formula can be used to determine the percentage of utilization.

**Utilizing the Unit Hour Utilization Formula**

\[
UHU = \frac{(\text{number of calls}) \times (\text{average call duration in hours})}{8,760 \text{ hours per year}}
\]

Table 5 presents the UHU for the five Dearborn Fire Department ambulances.
Table 5.

Unit Hour Utilization Rates for Ambulances (Annual Basis)

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Number of Calls</th>
<th>Average Duration</th>
<th>UHU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rescue 1</td>
<td>2924</td>
<td>1.36</td>
<td>45.3%</td>
</tr>
<tr>
<td>Rescue 2</td>
<td>2762</td>
<td>1.37</td>
<td>43.1%</td>
</tr>
<tr>
<td>Rescue 3</td>
<td>955</td>
<td>1.22</td>
<td>13.3%</td>
</tr>
<tr>
<td>Rescue 4</td>
<td>2982</td>
<td>1.52</td>
<td>51.7%</td>
</tr>
<tr>
<td>Rescue 5</td>
<td>1813</td>
<td>1.32</td>
<td>27.3%</td>
</tr>
</tbody>
</table>

The number of calls varied from 955 for Rescue 3 to 2,982 for Rescue 4. The average duration of the calls also varied with Rescue 3 (1.22) having the shortest average duration to Rescue 4 (1.52) having the longest average duration. The utilization rates provided additional support that Rescue 3 (13.3%) was under-utilized, while Rescue units 1, 2, and 4 were over-utilized. It is important to note that Rescue 3 is at times taken out of service due to low manpower resulting from Kelly days, vacation days, sick time usage and military leave.

4. What factors specific to the Dearborn Fire Department should be considered when identifying fire station location and placement?

Hₐ: The City of Dearborn has unique considerations and limitations when considering fire station location and placement.

Upon review a number of factors were identified which must be considered specifically related to the Dearborn Fire Department’s station location placement methodology. The City of Dearborn is a primarily fully developed community having been incorporated in 1925. The only areas of the City of Dearborn not fully developed are a green belt located in the center of the City going north and south to the borders. This area separates the East and West ends of the City and because of the low residential population has no fire stations within the area. Current
response times to this “Southfield Corridor” are the department’s longest, although the impact on the total response time of the department is minimal due in part to the low volume. This area however does have a significant number of high hazard buildings which will continue to need re-assessment with any further development. The project further identified numerous geographic barriers that require attention when determining fire station location. Large plots of land consumed by many commercial, educational, and industrial locations can cause significant response time concerns due to the inability to rapidly navigate around them. Identified geographic areas which should be considered include: the Fairlane Center Mall, the Ford Motor Company Research and Engineering Center, the Ford Motor Company Rouge Center Complex, the Ford Motor Company World and North American Headquarters, the University of Michigan-Dearborn Campus and the Henry Ford College Campus. All of these sites must be factored into fire station placement. One example of this is the placement of current Fire Station 3. Although the run volume of this station is significantly lower than the others, due to the Rouge Complex without the station or an alternatively placed station in the area, the fire department would be extremely challenged to make any nationally recognized response times in the South end of Dearborn.

5. What impact would a proposed fire station site have on the City of Dearborn’s fire and EMS service delivery model?

H₅: An additional fire station would have an impact on service delivery of fire and EMS services within the City of Dearborn?

Given the current fire station locations and the limited number of resources on the West End of town there is a significant need to reduce service area size, reduce response times, and provide for a more comprehensive and efficient work force west of the Southfield Freeway.
Utilizing Southfield Freeway as the dividing line Table 6 demonstrates the current unevenness of resource distribution that currently exists in Dearborn.

Table 6.

*Resources on East and West Sides of Southfield Freeway.*

<table>
<thead>
<tr>
<th>West of Southfield Freeway</th>
<th>Apparatus</th>
<th>East of Southfield Freeway</th>
<th>Apparatus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station Two 19800 Outer Drive</td>
<td>Ladder 2</td>
<td>Station One 3750 Greenfield Rd.</td>
<td>Battalion Chief Engine 1 Rescue 1</td>
</tr>
<tr>
<td></td>
<td>Engine 2 Engine 12 Rescue 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station Three 3630 Wyoming</td>
<td>Quint 3 Rescue 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station Four 6501 Schafer</td>
<td>Ladder 4 Engine 4 Rescue 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Station Five 3501 Oakwood Blvd (Melvindale)</td>
<td>Engine 5 Rescue 5</td>
</tr>
<tr>
<td>Total Staff Assigned</td>
<td>10</td>
<td>Total Staff Assigned</td>
<td>22</td>
</tr>
<tr>
<td>Sq. Miles of Coverage</td>
<td>11</td>
<td>Sq. Miles of Coverage</td>
<td>17</td>
</tr>
<tr>
<td>Calls for Service</td>
<td></td>
<td>Calls for Service</td>
<td></td>
</tr>
</tbody>
</table>

As demonstrated in Table 6, the West End of town does not have enough staff to complete a first alarm assignment for a structure fire without the assistance of one of the East End Stations. When compared to the coverage areas and the calls for service it is evident that the resource allocation on the West End of Dearborn is far inferior to the East End.

A secondary problem identified within the current station locations is the overlap of districts on the East End due in part to the inappropriate location of fire station one. Fire station one is currently located to close to neighboring fire districts on the East End. This problem was further complicated with the addition of the City of Melvindale which added a third fire station and district closer than would be optimum for fire station one. Fire station one as pointed out in
the 1985 City Master Plan, should have been placed more centralized. A closer placement to Southfield Freeway would allow responding units to arrive on the City’s current longest response time areas much more rapidly and serve as a resource to both East and West End fire stations during large events and assistance with simultaneous run volume.

In order to address the two primary problems with the City of Dearborn’s current fire station distribution multiple GIS tests were conducted taking into consideration current travel time distances from existing stations and the improvement that could be gained from potential future locations. In order to ensure economic efficiency the research assumed the maintenance of at least three of the current five fire stations serving the City of Dearborn. City owned land and or facilities that could be converted were also utilized as a factor in areas in which a fire station benefit was found. After twenty tests it is was found that movement of station one to a more centralized location, re-converting an existing former library in the southwest section of Dearborn into a fire station, and movement of current fire station two further north would be the structure that would provide Dearborn with the best coverage in terms of travel time and distribution of resources. With the conversion of the library into a fire station rather than building new the City of Dearborn could expect to save 1.5 million dollars from building new (Peterson, 2015). This number does not include land cost should the City have to purchase land for a new station in southwest Dearborn. Appendix A shows the addition of a secondary West End station and Appendix B demonstrates the proposed locations of all fire stations using a combination of existing and new sites.

Discussions and Implications

The results of the research conducted for this project demonstrated both similarities and differences to information obtained from of the literature review. The level of need and the
adequacy of fire department resources always has been a contentious issue within the United States. There are varying opinions throughout the fire service as to how determination should be made as to the right number of and location of fire stations within a particular community. Based on the results of this study, it appears that the City of Dearborn could benefit with the addition of a second fire station in the West End and re-location of two existing fire stations.

When comparing the Dearborn Fire Department availability of apparatus, companies, and staffing at a fire scene, the researcher found that the Dearborn Fire Department complies with NFPA recommendations in many areas, while deficient in others. For example, NFPA 1710 recommends a minimum staffing of 13 firefighters on scene at initial fire alarms. The Dearborn Fire Department meets this recommendation on almost every fire alarm. However, the Dearborn Fire Department is forced to meet this recommendation on its West End by deploying apparatus and companies from the East End of Dearborn which delays response time and efficiency.

It is also important to understand the impact of workload on the West End specifically when it comes to ambulance call volume. All eleven miles of the West End is serviced by one ambulance when compared to four that service the seventeen miles of the East End. Rescue two currently has a “high workload” according to identified standards by Tri-Data (2007). In some cases, the West End ambulance is more than doubling call volume of some of the East End ambulances. Once a unit has “a very high workload,” they should be considered busy and monitored for workload effects on response times (TriData, 2007). As units become busier, response times can increase due in part to chances for simultaneous calls within the same running district. As units become busier, more reliance may be put on units from farther distances (TriData, 2007). A second ambulance unit is needed in the West End to distribute workload and decrease EMS response times.
Regarding the fire scene, the inability to meet NFPA recommended fire scene staffing utilizing only West End resources leaves the Department vulnerable. The more pieces of apparatus that are required to be deployed to meet a scene’s staffing requirements, the less apparatus and staff are available for other unrelated calls throughout the community.

Results of this study provide evidence that an additional fire station would have a benefit to the West End, however an opening of an additional station would be dependent on the ability of the City to afford such a project given the current challenging economic times and the ability to increase daily minimum staffing to support operations. A recent change from a fifty-four hour work week to a fifty hour work week for firefighters has led to decreased daily staffing. Changes in the work schedule and/or hiring of additional firefighters would be required for a future fire station to have the intended effect on service delivery. Call volume continues to rise and will continue to have a negative effect on the response times of the Dearborn Fire Department unless travel times can be reduced through properly located stations and the availability of staff and apparatus continuous to grow.

**Recommendations**

The researcher conducted in this study determined the need and potential location for an additional fire station to the Dearborn Fire Station’s current five fire station locations; however additional research still needs to be done to determine the best way a new facility can be obtained and assigned resources to provide for the most efficient service delivery. The Dearborn Fire Department should form an internal committee to review and reflect upon the operational effects of an additional fire station located in the southwest portion of the City of Dearborn. Response times are a complex issue with many variables that need to be further explored to present City Hall with the true effects of a new fire station. Further study is needed to predict the impact of staffing within the fire station and the apparatus type which should be
housed within the fire station. An important area for additional fire station location research included forecasted call volume changes and upcoming community development projects within the City of Dearborn. While the City of Dearborn does not anticipated major shifts in these two areas in the near future, it is essential to assess long term possibilities as the expected life of a fire station can well exceed over forty years. The impacts on service delivery should be reviewed and a cost-benefit analysis should be completed. Development of plans for re-development of existing structures should be reviewed in order to determine of the anticipated benefit can be met in an altered facility rather than a newly constructed facility.
References


Appendix A

Proposed DFD with Secondary West End Fire Station
Appendix B

Proposed DFD with secondary West End station, relocated Station Two, and relocated Station One.