Designing an Effective Emergency Communications Center For the City of Dearborn, MI

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Certification Statement

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Abstract

In 2016 under the direction of Fire Chief Joseph Murray the Dearborn Fire Department conducted an extensive review of the current emergency operations center (EOC) of the City of Dearborn. Upon completion of this assessment a recommendation was made that a complete overhaul including significant technological upgrades was required. After consultation with the Mayor's Office and Chief of Police the Fire Chief began the process of determining best practice to determine design of the EOC. The problem facing the Dearborn Fire Department is that the City of Dearborn has no formalized process for the planning and design of a modern emergency operations center (EOC). The descriptive research method was utilized in this paper. Research methods included: interviews with city officials who have a significant role in the EOC, a review of budgetary constraints and projections, review of the Wayne County Hazard Mitigation plan and review of highly functional EOC plans and designs from comparable communities within the region. Input was sought out from the Dearborn Mayor, Chief of Police, Department of Public Works Director and the Director of Information Services as well as external experts and project managers of similar EOC design projects. Five research questions were developed as part of this research project which included: Who will be the likely users of the EOC?. What are the mandatory requirements or recommendations of an EOC by governmental agencies responsible for emergency management? What are the industry best practice standards currently being utilized in highly functioning EOCs. What are the potential threats and factors specific to Dearborn's which must be addressed for an effective EOC? What technological and material upgrades are required to maximize functionality in an The research has indicated a need for an upgraded facility with plans developed based upon identified industry best practice, community needs and budgetary limitations.

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Introduction

A problem exists within the City of Dearborn Fire Department. The City of Dearborn currently has no formalized process for the planning and design of a modern emergency operations center (EOC). Dearborn's current EOC is approaching a pre-planned upgrade and a formal planning and design process is required to ensure the development of a highly functional new EOC.

The purpose of this project is to determine current industry best practices for EOC planning and design and implementation to be utilized in the Dearborn EOC design. In order to meet the objectives of this project the following five research questions were addressed by the researcher:

1. Who will be the likely users of the EOC?
2. What are the mandatory requirements or recommendations of an EOC by governmental agencies responsible for emergency management?
3. What are the industry best practice standards currently being utilized in high functioning EOCs?
4. What are the potential threats and factors specific to Dearborn's which must be addressed for an effective EOC?
5. What technological and material upgrades are required to maximize functionality in an EOC?

This study follows the descriptive research model. 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 the current plans and development efforts of a new higher functioning EOC. The

author conducted a comprehensive literature review to determine current industry standards and impacts of an effective EOC on operations and recovery efforts following a disaster or other large scale event. The methods that were used to collect and analyze the data needed to address the research questions are presented.

Background and Significance

The City of Dearborn is a mid-sized urban community located in Southeastern Michigan. Dearborn is located in Wayne County and is one of several border communities to the City of Detroit. According to the 2010 US Census, the current population is 98,153 people which include people of multiple cultures, ethnicities, and religions. As was the history of many communities in the Detroit Metro Area, Dearborn was originally settled as an agriculture farm community. In 1833 the Federal Government chose land in what is now considered the City of Dearborn to build a military arsenal. The arsenal spurred formation of a town and a subsequent roadway connecting that post to Chicago and Detroit via Chicago Road and from then on, Dearborn quickly developed. Dearborn is well known today as the home of Henry Ford and the Ford Motor Company. Henry Ford and Dearborn are so closely tied together that Dearborn's City Seal reads "Hometown of Henry Ford". Dearborn is widely known as a manufacturing hub, hosting 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 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. The movement to consolidate was encouraged and endorsed by Henry Ford who feared annexation of his Ford Rouge Plant into the City of Detroit. Consolidation of Fordson and Old Dearborn officially took place on January 9, 1929 (Hutchinson

& Rising, 2003). With Dearborn's long history of industrial and manufacturing is the presence of a strong labor unions including many skilled trades, the Teamsters and the United Auto Workers labor force. Dearborn is well known 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 a diverse occupancy and tax base which has led to a relatively stable source of municipal revenue throughout the years. Some of the larger industrial complexes within the City of Dearborn include: the historic Ford Rouge Plant, AK Steel, Double Eagle Steel, and Kenwal Steel Corporation. Dearborn also hosts numerous commercial entities such as the Ford Motor Company World Headquarters, Ford Motor Company North American Headquarters, Carhartt World Headquarters, Beaumont Hospital and Medical Center and Ford Motor Company Research and Engineering Complex. According to the 2010 US Census Dearborn is also home to 37,851 residential properties are located in Dearborn. Dearborn is home to many other specialty institutions, including two hospitals, a large shopping mall, two colleges, multiple churches, two of the largest mosques in North America and multiple historic sites, and museums.

Dearborn is well known as a culturally diverse community. Although the ethnic majority continues to be people of European decent, Dearborn currently is home to the largest percentage of Arab Americans within the United States. Although the US Census does not separate "Arab American" as a separate ethnicity in its current survey, many experts believe that as many as 30,000 Arab Americans currently call Dearborn home (De La Cruz & Brittingham, 2003).

In August of 2013, the Dearborn Fire Department successfully consolidated fire departments as well as emergency management services with the neighboring City of

Melvindale. As a result of this agreement, the City of Dearborn hired all former Melvindale firefighters into the Dearborn Fire Department. The City of Dearborn now provides contracted fire suppression, fire prevention, emergency management and emergency medical services to the residents of the City of Melvindale. The City of Melvindale is a small 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. As part of the consolidation, management of disasters within the City of Melvindale is also a concern of this project. The day time population of the combined community is estimated at approximately 200,000.

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 from 911 non-public safety workers in 2001 to 691 non-public safety workers in 2014. Public safety to include emergency management personnel were largely exempted from reductions due in part to a City Charter (2001) mandates that sets minimum staffing levels based on the number of residents as determined by the U. S. Census Bureau. The Fire Department did however lose three civilian positions in the overall attempt of the City to reduce costs in relation to lost revenue. Even with the significant reduction of the workforce, the City of Dearborn continues to be challenged with difficult economic times, although property values are beginning to rise throughout both Dearborn and Melvindale.

The City of Dearborn has had a long history of placing emphasis on Emergency Management. In 1942 under then Mayor Orville Hubbard, the City of Dearborn established its own Civil Defense Department. The Dearborn Civil Defense Department was separate from the Police Department. The services provided to the City by the Civil Defense department included

the preparation of public resources, the preparation of civilians from potential disaster whether related to fears of war-related attack or natural disaster. The Civil Defense Department duties would later be absorbed within the Police and Fire Departments.

In 2006 the lead role was transferred to the Dearborn Fire Department. Under the Fire Chief's supervision the Emergency Management role was assigned to staff members from within the Dearborn Fire Department. The position of Emergency Management Coordinator was later introduced and subsequently filled with Fire Department personnel.

The current EOC of the City of Dearborn was established in 2006 and is located in the basement of an existing City-owned building. The current location of the EOC is centrally located within the City of Dearborn. The existing EOC is approximately one thousand square feet and is set up with twenty-two work stations however this number can be expanded or detracted dependent on the need of the emergency. While functional the existing EOC was not designed nor constructed for the purpose of becoming and EOC.

In December of 2014 the Dearborn Fire Department applied for a State of Michigan Grant to explore the potential of a consolidated dispatch program with the Cities and Melvindale and Dearborn Heights (immediate neighbors). Included in this project was the upgrade of Dearborn to the 800mhz radio system, and a re-design and re-development of the existing EOC. The City of Dearborn was awarded 3.5 million dollars though the State of Michigan to conduct this project. An external private project manager was hired by the City of Dearborn in 2015 to assist in facilitating the dispatch components; however the development, protocols and policies of the EOC development remains with the Dearborn Fire Department.

With multiple options available to the Dearborn Fire Department it was important to research applicable regulations, standards and regulations in order to design a new EOC which will increase safety to occupants, increase efficacy and ensure resources are available for the

various types of applicable emergencies as defined in the City of Dearborn's Hazard and Vulnerability Analysis (HVA).

This study has significant linkage to the course goals of the Executive Fire Officer Program third year course entitled "Executive Analysis of Fire Service Operations in Emergency Management". As stated in the Executive Analysis for Fire Service Operations in Emergency Management Manual (2013), the course goals of the Executive Analysis of Fire Service Operations in Emergency Management Program are to improve the executive's abilities to:

1. Lead effectively and efficiently within a dynamic and complex organization by enhancing the development of teams and the application of research.
2. Develop and integrate management and leadership techniques necessary in complex organizations.(p. ix)

As the Fire Chief and the responsible party for emergency management for the City of Dearborn and the City of Melvindale, the researcher recognizes the importance of developing techniques and strategies for meeting the emergency management service expectations of the citizens of Dearborn and Melvindale, as well as for the firefighters within the Dearborn Fire Department. This study has been undertaken to apply validated research to an organizational question. The question of how to best design and plan for a highly functional EOC in order to effectively mitigate large scale emergencies demands focused research in order for the researcher to make informed decisions for his organization.

The Executive Development Manual (USFA, 2013), states the goals of the United States Fire Administration (USFA) are as followed:

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 operational impact of a properly designed EOC can lead to additional strategic planning and practices related to logistics, resource allocation and effective operational management. These practices can have a direct linkage to the ability to prepare for and mitigate an emergency most effectively and efficiently.
2. Improve local planning and preparedness.

   An understanding of current capabilities or the existing Dearborn Fire Department EOC and how it may be improved on in comparison to the City of Dearborn Hazard Vulnerability Analysis and available financial resources..
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 make recommendations as to the design, location, construction and the equipping of a modern EOC. A properly equipped and designed EOC will assist the Dearborn Fire Department in controlling the response and recovery of a large scale emergency.
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 confront 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 dynamic organization.

Literature Review

The search for literature on the design, construction and equipping of emergency operations centers varied across the use of multiple databases. Through utilization of EBSCO databases, thousands of results were obtained on emergency management, but few of the articles pertained directly to the design of an emergency operations center. After the initial search of various databases, key words consisting of *emergency operations center, EOC designs*, *hardening targets, and EOC equipment*, were used to obtain more specific and focused scholarly articles on EOC design as related to the scope of this project. Much of the literature was recent (i.e. post 2007); 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 other professional texts and literary resources related to the emergency management and the fire service.

The Emergency Operations Center's Application

Alexander (2002) defined and Emergency Operations Center (EOC) as the "nerve center" of disaster-relief housing in a room or rooms, an apartment or a building located outside the main disaster area, but usually not at a great distance from it. The EOC is where the emergency operations are directed (Alexander, 2002). The EOC must have good communications channels to hospitals, centers of government, and the field-operations posts or directly to operations in the field (Alexander, 2002). The EOC can consist of a single chamber or it can have two or more rooms. The may include a conference room for determining strategy, a situation room for accumulating and analyzing information, a communications room for transmitting and receiving information, a media briefing room and a room for resting and recuperating in. Generally, small jurisdictions have only one-or two-room EOCs, perhaps consisting of a conference room and a general operations room (Alexander, 2002).

Alexander (2002) described an illustration of information flow from a localized disaster. Alexander (2002) described the EOC as the location some distance away from the site of the disaster which receives information from the Incident Command Post (ICP) and from other sources such as central government. The EOC outputs instructions to the ICP which sends them as commands to workers at the disaster site, thus a system approach enables one to focus attention on the character and quality of information flows and to assess how they cross the boundaries between subsystems (Alexander, 2002).

Regulations and Industry Standards

After extensive research the researcher has determined that there exists no mandatory regulatory requirement of how a municipality EOC must be designed, constructed or equipped. While there are multiple federal guidelines no actual mandate or requirement could be found. Federal and State grant funding can be heavily tied into the emergency management program of the City however, so the recommendations of State and Federal resources was researched.

In 2010, the American Society of Civil Engineers (ASCE) developed a Standard Guide for Emergency Operations Center Development (2010). In this ASCE standard the ASCE recognizes that there is no "one-size" approach to EOC development which will fit all jurisdictions (ASCE, 2010). The standard guide developed by the ASCE (2010) addresses process and procedures for the development of a new EOC facility or the modification of an existing facility. A critical part of the development of an emergency management capability is establishing and preparing to operate an EOC (ASCE, 2010). An important part of this preparation is identifying the hazard and threats to the community serviced and development of a risk analysis (ASCE, 2010). Vulnerability of the location of the EOC also needs to be considered when developing plans for a new EOC. The location and its associated risk (i.e. flooding, wild fire, wind, accessibility) all needs to be taken into account prior to full development (ASCE, 2010). The ASCE (2010) states that EOCs need to be developed a maintained based on the risks, vulnerabilities, capabilities and the needs of an individual jurisdiction (ASCE, 2010).

The ASCE (2010) goes further however, to describe some common functional elements such as communications and work space that every EOC requires. Important components of an EOC according to the ASCE (2010) include space for external and non-jurisdictional agencies along with the internal users. Many private sectors agencies are rapidly grow partners in the activities the authority having jurisdiction (AHJ) and there should be space allocated to these

partners. Space for the public information office/joint information center (PIO/JIC) is critical during an incident however it may not be advisable to have it located within the EOC. When available it can be better to place the PIO/JIC in an area designated close by where media activity will not interfere with emergency management operations (ASCE, 2010). Space for meetings are another important component for an EOC according to the ASCE (2010). EOC space should be utilized in a manner to support both day to day activities and activation activities. In many cases the EOC may be a joint facility with other non-emergency operations. Alternate plans for accessory use must be created in the event of activation (ASCE, 2010). Break areas and recreational space are required to provide EOC personnel with adequate space for relaxation to foster staff alertness and efficiency and avoid early burnout (ASCE, 2010). Space is also required for the survivability needs of the EOC to include the need for protected air, water and fuel systems. The EOC should be isolated from other non-related uses by a minimum of a two hour fire separation wall (ASCE, 2010). An EOC should also be designed in compliance with the requirements of the American with Disabilities Act (ADA) in order to ensure that EOC personnel with disabilities can adequately access and utilize the EOC during times of emergency (ASCE, 2010). Heating, ventilation and air conditioning (HVAC) systems should be separated from the other components of a shared building in order to protect occupants in the event of an attack on the main building systems (ASCE, 2010). Security systems and security personnel are also a crucial consideration for EOC design creation (ASCE, 2010). Space shall be allocated to provide for security personnel and required equipment. An EOC should also have ample room for potential medical needs and a cache of supplies should be stored within the facilities (ASCE, 2010). A defibrillator and first aid kit should be provided for in an EOC at a minimum (ASCE, 2010). Personal hygiene and showering facilities should also be located in a facility which houses the EOC. Shower space for both men and women should be provided. (ASCE, 2010). Sleep areas

some incidents may require staff to remain on duty for long periods of time. Sleep areas can be in the EOC itself or in a nearby sleeping area in existing rooms designed for other purposes. (ASCE, 2010). Space should be provided for supplies for continual operations of the EOC for up to 30 days. Supplies should include food, water, and preparation equipment. Freezers, microwaves, and stoves will all be required for preparing nourishment for a sustainable operation for up to 30 days (ASCE, 2010).

The role of communications is an essential part of the emergency operations center (EOC) and considerable attention is required during the design process of an EOC (ASCE, 2010). The need for communication to area hospitals, field command units, field personnel, and other governmental agencies is essential (Alexander, 2002). Amateur radio capabilities should also exist within the EOC to supplement communications to external parties should a catastrophic communications failure take place (ASCE, 2010). The location of antennas, cables and power supplies required for amateur radio operations within the EOC must be considered during the initial design phase (ASCE, 2010).

Finally, the consideration of mobility is key in regard to the planning of the emergency operations center. Should the EOC not be functional related to a disaster alternative sites should be designated if possible. Mobile sites should also be identified and pre-planned to ensure the continuance of services provided by the EOC in an off-site venue (ASCE, 2010).

Potential Threats in the Dearborn Area

Review of a jurisdiction's hazard and threat identification and assessment is an important part of designing an EOC. The hazard and threat identification process reflects a comprehensive analysis of the types of hazards associated with incidents in that a jurisdiction might need to manage. It reflects not only the most likely events but would have significant consequences if they occurred (ASCE, 2010). When developing plans for the design and function

of an EOC it is also important to review a jurisdiction's risk analysis and vulnerability assessment (ASCE, 2010). A jurisdictions risk analysis is a rating of the significance of the consequence should an event occur, this can be a numeric rating or qualitative rating (ASCE, 2010). The vulnerability assessment of a municipality establishes which types of potential incidents should be considered when establishing an EOC (ASCE, 2010). A city would not want to place their EOC near a river where there is a vulnerability of flooding.

Users of the Emergency Operations Center

Although most emergency operations center (EOC) activations will have select key individual present such as the mayor, emergency –plan coordinator or chief of staff. It is important that designers of the EOC take into account that the EOC should be developed with a plan to support groups and organizations which according to Alexander (2002) should be classified in the following categories: bureaucratic and legislative structures, coordinating agencies, scientific bodies, normal emergency services, parasternal organizations, teams and task forces, other types of organizations to include media, and survivor associations, adapting organizations, and expanding organizations. The users of an EOC should be people who have the ability and authority to facilitate resources and support to the various organizations and groups as listed above. Other trained volunteers for example members of the American Red Cross (ARC), Community Emergency Response Teams (CERT) and Medical Reserve Corp (MRC) may be integral to the municipal response and may require EOC designees to be present (ASCE, 2010).

Technological and Material Needs of an Emergency Operations Center

The use of technology can be a significant asset during an activation of the emergency operations center (EOC) and should be considered and important part of the design of an EOC

(ASCE, 2010). According to the ASCE (2010), technology trends are toward miniaturization and software based applications. Technology will likely continue to require more space in the EOC's of the future and this need for expansion should be considered in the design of an EOC. A communications analysis should be conducted during the design phase of an EOC to ensure the space's communications will comply with all applicable laws, ordinances and standard (ASCE, 2010). The exchange of information is extremely important during the activation of an EOC as such information needs to flow both horizontally and vertically. Information management needs to include not only formal but also informal communications (ASCE, 2010). Municipalities should ensure that communications are both interoperable and integrated with all likely affected entities and responder organizations (ASCE, 2010). Redundancy of the communication equipment should also be considered in the case of a failed or damaged antenna or other vital communication hardware (ASCE, 2010). Certain requirements such as the need to have a direct line to a State Governors' Office or a nuclear plant also need to be examined and pre-planned into the EOC design (ASCE, 2010). According to Davis (1999) two-way communication equipment and multiple means of communication such as telephone, cellular phone, facsimile, internet and radio are integral to the EOC. Activation hardware for the use of warning systems should installed into the EOC for warning of residents of a potential disaster (ASCE, 2010). The ASCE (2010) suggests that technology support vendors should also be identified during the planning phase of an EOC and contracts should be undertaken to ensure the necessary maintenance issues related to equipment calibration, maintenance, repair and replacement.

Computer-based software systems such as Web-EOC can also be integrated into the design of an EOC to aid in the display and management of data (Sibley, 1999). Software systems utilized should offer the EOC the ability to send communications as well as print and distribute hard copies of information (Sibley, 1999). Software systems can fail and technologies can be

made void of usefulness so it is essential that EOC's have two systems of operating and communicating one based on technology and the second based on more traditional methods (Harris, 2007).

The incorporation of "virtual EOCs" has recently been implemented in many communities nationwide. Virtual EOCs (vEOC) can assist the authority having jurisdiction (AHJ) with community continuity in the face of disaster by incorporating both on-site and off-site facilitators into the operations (Becerra-Fernandez et. al, 2008). The ability to interconnect key personnel during an emergency where it is prohibitive to assemble is an important ability in coordination of emergency operations (Smith, 2016).

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 and no intervention or treatment is provided to the participants. Data will include information obtained from interviews of Dearborn and Melvindale city officials, interviews of Dearborn and Melvindale public safety officials including the police and fire chiefs followed by a review of budgetary and spatial restrictions and finally a comprehensive review and of the existing hazard and vulnerability assessment of the Cities of Dearborn and Melvindale. The data collected as part of this research will answer the following questions:

1. Who are the likely users (participants) of the EOC during activation?

   H_1: Likely participants of the EOC must be identified in order to properly equip and design a functional EOC.

2. What are the mandatory requirements and industrial standards of EOC design for use by local government agencies?

   H_2: Mandatory requirements will have an impact on EOC design and functionality.

3. What are the current industry best practice standards utilized in existing highly functioning EOCs?

   H_3: Industry best practice standards will have an impact on the design of the Dearborn EOC.

4. What are the potential threats and factors specific to the City of Dearborn and Melvindale which must be accounted for in the development of the EOC?

   H_4: Potential threats and hazards will have an impact on the design and functionality of the Dearborn EOC.

5. What technological and material upgrades are required to maximize functionality in the Dearborn EOC?

   H_5: Technological and material upgrades will impact the design and functionality of the Dearborn EOC?

Users of the EOC

In order to determine the likely users of a Dearborn emergency operations center (EOC) a review of the roles and requirements of EOC's was conducted after review of activations of EOCs within the region and review of recommendations from federal , state and local authorities who share in responsibility during times of disaster. The research further attempted to discern impact of the National Incident Management System (NIMS) on the development of the EOC and State of Michigan disaster activation protocols in order to ensure that the users identified would include those necessary to ensure integration with other governmental agencies. Research into the roles and responsibilities of top administrators within the City of

Dearborn was also conducted through the review of existing emergency plans and through the review of job descriptions, and formalized roles and responsibilities which were provided by the City of Dearborn Human Resource Department. Top administrators once identified as having some level of responsibility during EOC activation were then interviewed to determine their particular needs for data and information during activation and asked to identify the staff that would likely need to be included. Once identified the participants were then compared to industry recommended staffing charts to determine assignment.

Mandatory Regulations

The research performed a comprehensive literature review of all applicable federal, state and local laws and ordinances which have an impact on the design of an EOC. Documents reviewed included the Code of Federal Regulations: CPG 1-3 Federal Assistance Handbook, Emergency Management, Direction and Control Programs, and CPG 1-32 Financial Assistance Guidelines in order to ensure that in the absence of mandated regulation that the availability of grant funding would be available due to compliance with federal recommendations. Also reviewed was the State of Michigan Public Act 390 on Emergency Management. A review of the requirements of the State of Michigan was conducted to ensure compliance with all applicable state law and to ensure the availability of inter-operability with the State of Michigan in the event of a disaster.

Current Industry Best Practice

To determine the current industry best practice standards for the design of EOCs the researcher conducted a comprehensive review of standards from industry leading agencies such as the National Fire Protection Association and the American Society of Engineers. The researcher further conducted three separate on-site inspections of acclaimed EOCs within the State of Michigan which included interviews of the staff and management of each. Common

themes and trends found in the majority of the identified industrial standard and during the inspections of the three external EOCs aided the researcher in identifying important aspects of the functionality of an EOC which could be utilized within the City of Dearborn. The researcher finally conducted an interview with subject matter experts and public safety consultant Ms. Spring Tremaine to determine the most recent trends in EOC design and development.

Potential Threats and Vulnerabilities

To determine the current threats and vulnerabilities facing the City of Dearborn the researcher obtained a copy of the Wayne County Hazard and Vulnerability Assessment which includes annexes for the City of Dearborn. An interview was also conducted with Captain Bradley Smith the Emergency Operations Coordinator of the City of Dearborn to determine the most likely disaster events to face the City of Dearborn as well as to obtain information related to specific threats related to the demographic, geographic and infrastructure impacts of the community. Capt. Brad Smith is currently a certified Professional Emergency Manager (PEM) in the State of Michigan and is involved in many emergency management planning teams on both the local and state levels.

Technological and Material Needs of the EOC

To determine the technological and material needs of the Dearborn EOC the research conducted a review of current standards of industry leading organizations in the field of emergency management including the National Fire Protection Association (NFPA) and the American Society of Civil Engineers (ASCE) in order collect data on current trends and best practice in the equipping and of a highly functional EOC. The researcher continued his investigation of technological and material needs by visiting three highly successful EOCs within the State of Michigan and again consulting with subject matter expert Ms. Spring Tremaine a public safety consultant in the metro-Detroit region.

Results

Research Questions and Hypotheses

Five research questions and hypotheses were developed, reviewed and researched as part of this project. The results and findings of these questions and hypotheses can be found below:

1. Who are the likely users (participants) of the EOC during an activation?

   H_1: Likely participants of the EOC must be identified in order to properly equip and design a functional EOC.

The participants in the EOC were identified through job descriptions and primary responsibilities assigned to key City employees within the Dearborn Emergency Operations Plan. Participants include: elected officials, department heads, administrative support and various staff members including information systems management personnel.

2. What are the mandatory requirements and industrial standards of EOC design for use by local government agencies?

   H_2: Mandatory requirements will have an impact on EOC design and functionality.

The research conducted has determined that there are no mandatory requirements by federal, state or local entities regarding the requirement for an EOC, nor the components of an EOC. Federal, state and local grant funding however can be impacted by the presence of an EOC and its components. The research conducted has determined that particular attention should be attributed to FEMA regulations found under Title 44 of the code of Federal Regulations: CPG 1-3 Federal Assistance Handbook, Emergency Management. If a municipality should not anticipate the need for external funding for the operation of the EOC then the federal guidelines can be considered supplemental. The State of Michigan's Public Act 390 on Emergency Management Wayne County also discusses a number of plans for activations of state and federal aid but is silent on the requirement for individual communities to maintain EOCs.

The City of Dearborn is currently not under any particular federal, state or county mandates to obtain and equip an EOC however grant funding for financial support and equipment is dependent on Dearborn's voluntary compliance with many of the federal and state recommendations as to: the presence of a center, the associated equipment, and operation of an EOC.

3. What is the current industry best practice standards utilized in existing highly functioning EOCs?

   H_3: Industry best practice standards will have an impact on the design of the Dearborn EOC.

The research was conducted through review of current best practice standards of various independent leading organizations within the emergency management specialty as well as interview of recognized experts within the region in relation to EOC operations and design. The results of the research and interviews indicated the need to design an EOC which meets five main objectives: flexibility, sustainability, security, survivability and interoperability. Flexibility is required to ensure the appropriate space, equipment, furniture, supplies, and information systems to satisfy multiple types of missions. The ability to be self-sustaining is also a need for EOC's according to the research. Due to the nature of the role of the EOC to operate during times of extreme high risk it is essential that the EOC be able to sustain itself and its participants twenty four hours a day and seven days a week. A quality security plan was also identified as best practice in the design of an EOC. The facility should be hardened to prevent catastrophic failure. Cyber security is also a significant requirement in order to ensure the successful operation of all required informational systems. Alternate plans not dependent on information systems should be developed in order to ensure continuity of work despite failure of computer systems. Survivability of the EOC is another industry standard. The design of the EOC should be

such that if a disaster were to hit the EOC would be least likely to be adversely effected by the event. Finally, interoperability is a key standard for best practice EOC design. The ability to share common principles of operations and exchange routine information with other EOC or operations personnel is important when working towards the mitigation of a disaster.

4. What are the potential threats and factors specific to the City of Dearborn which must be accounted for in the development of the EOC?

   H_4: Potential threats and hazards will have an impact on the design and functionality of the Dearborn EOC.

The research indicates that Dearborn has the most significant risk of hazard in the following areas: flooding, hazard materials incidents, public health emergencies, infrastructure failure of communications, infrastructure failure of water systems and severe weather both heat emergencies in the summer and cold temperatures in the winter months (Wayne County, 2016). The research has found that there are identified flood zones within the City of Dearborn which follow the path of the Rouge River which extends through the length of the City. The EOC should also be located away from primary public health destinations to avoid potential of contamination or unanticipated transmission of citizens seeking assistance. The likelihood of severe weather is a significant threat and as such an EOC location should be adequately prepared to adverse weather conditions.

In an effort to understand the potential threats to a Dearborn EOC the Wayne County Hazard Mitigation Plan was reviewed. The Wayne County Department of Homeland Security and Emergency Management Committee consists of representatives from each municipality within Wayne County. Identified and ranking of threats are commonplace throughout all communities. The following table indicates the most likely hazards to be encountered by the City of Dearborn of which EOC activation would likely occur as determined though the Wayne

County Department of Homeland Security by after correlating the responses from the individual communities:

Table 1.

Summary of Hazard Rankings

Hazard	Number of Responses	Priority Rank
Severe Weather Winter	24	1
Hazmat Incidents - Fixed	21	2
Infrastructure Failure – Communications & Electrical	20	3
Thunderstorms	20	3
Hazmat Incidents - Transportation	19	5
Flooding (Urban)	18	6
Tornadoes	15	7
Fires (Structural)	15	7
Transportation Accidents - Rail	14	9
Pipeline Accidents	12	10
Severe Weather Summer	10	11
Criminal Acts (Vandalism/Arson/Un-specified)	10	11
Transportation Accidents - Highway	8	13
Civil Disturbance	7	14
Criminal Acts (Mass Shootings)	7	14
Public Health Emergencies	7	14
Nuclear Power Plants	6	17
Infrastructure Failure – Sewer System	5	18
Infrastructure Failure – Storm System	5	18
Transportation Accidents (Un-specified)	5	18
Terrorism	4	21
Transportation Accidents - Air	4	21
Infrastructure Failure – Water System	4	21
Transportation Accidents – Rail/Highway Crossing	3	24
Drought	1	25
Earthquakes	1	25
Erosion - Shoreline	1	25
Fires (Natural)	1	25
Oil & Gas Well Accidents	1	25
Fires (Scrap Tire)	0	30
Gas/Oil Shortages or Supply Disruptions	0	30
Information Technology Intrusion	0	30
Subsidence (Mining & Tech)	0	30
Weapons of Mass Destruction	0	30

Source: Wayne County Department of Homeland Security and Emergency Management (2013) Hazard mitigation plan. Brighton, MI: ASTI Environmental.

Table 2 shows the risk assessments related to identified hazards within the communities of Wayne County to include the City of Dearborn.

Table 2.

Risk Assessment of Wayne County Potential Hazards

Hazard Event	Likelihood Sum	Consequence Sum	Risk Sum	Hazard Risk Rank
Flooding - Urban	22	25	550	2
Hazmat Incidents - Fixed	19	26.5	503.5	6
Public Health Emergency	22	24	528	5
Infrastructure Failure – Communication & Electrical	21	23.5	493.5	7
Infrastructure Failure – Water Systems	21	27	567	1
Severe Weather Summer	22	24.5	539	4
Severe Weather Winter	22	25	550	2

Source: Wayne County Department of Homeland Security and Emergency Management (2013) Hazard mitigation plan. Brighton, MI:ASTI Environmental.

5. What technological and material upgrades are required to maximize functionality in the Dearborn EOC?

   H_5: Technological and material upgrades will impact the design and functionality of the Dearborn EOC?

The research has indicated that technological and material needs are an important aspect of design of a comprehensive plan for an EOC. Particular attention must be paid to the ability to effectively maneuver and establish communications. Phone lines, computers and other systems have historically been recognized as an important need for proper communication and operations. Noise levels are another concern of EOC's and a plan to mitigate noise should be developed. Carpeting the EOC and angling of walls can contribute to a noise reduction. The design of work stations must have the ability to be flexible but should

incorporate ergonomic designs in order to facilitate a potential for long hours worked by EOC participants. The effective use of the most current audio, video and data available is a significant need identified for an EOC. The use of fully integrated operating systems which incorporate reliable technology can improve communications and ensure all involved are aware of changing circumstances (Fulton, 2010).

The use of virtual EOCs is rapidly becoming more commonplace within the United States. Integration of Crisis Information Management Systems (CIMS) is now almost standard for communities comparable to the City of Dearborn. CIMS can streamline many functions of the EOC and allow for off-site personnel to participate in EOC operations more fully if not able to physically be present in the EOC. CIMS programs have to be evaluated based on the type of product offered to ensure adequate usability and to ensure it meets the anticipated needs of the community it serves (Fulton, 2010).

With the rapidly changing pace of technology in today's age. EOCs must continue to re-evaluate the functionality of their technological and material systems within the EOC. A significant challenge reported through interviews is the presence of technology within the EOC , without the ability to integrate all aspects. EOC designers must to anticipate future technological needs in the EOC and build infrastructure to support those needs when possible.

Discussions and Implications

The results of the research conducted for this project demonstrated the current industry standards, practices, similarities and the differences in planning and design utilized by various communities and was obtained through literature review, on-site observations, interviews and surveys. The research was conducted in a coordinated manner in order to determine information required to answer the five research questions. The research question required

that the researcher seek out best practice to determine the likely users of the EOC during times of activation. Upon research of historical incidents within the local area and reviewing job descriptions of the City of Dearborn, and finally the Dearborn Emergency Operations Plan it was determined that the EOC during full activation would likely require the presence of twenty-seven members of the City staff. Likely Dearborn EOC participants would include the Mayor, the Mayor's Chief of Staff, City of Dearborn department heads, administrative support, information systems/audio-visual support, and other key staffers who have integral roles to ongoing operational coordination. The researcher than interviewed the identified EOC participants in order to determine their particular needs for technological, material or personnel support. The data collected as part of the interviews were similar to identified industry standards and comparable to other communities of the similar size in the immediate area.

The research conducted verified that there are no federal, state or local mandates which require an EOC or what materials, personnel or technologies are integrated into the EOC. Although there are no current mandates on the design of an EOC there are a number of recommendations and standards identified by both federal and state agencies including the Federal Emergency Management Agency (FEMA) and the Michigan State Police Emergency Management Division. Often grant funding and revenue sharing for emergency management projects or equipment is dependent on meeting the identified standards of these agencies and as such it is important for the City of Dearborn to comply to the greatest extent possible. The third research question required a study of current industry best practice and an evaluation of similar communities' EOCs. The design and planning of an EOC depends on many variables including budget, spatial requirements, infrastructure, hazard analysis and functionality. Despite the many variables amongst EOC throughout the United States, the research has identified five main areas that should be addressed during the design and planning process for

the development of an EOC. These five areas include: flexibility, sustainability, security, survivability and interoperability (Michigan State Police, 2003). Floor plans and designs can range from single rooms to larger areas with multiple rooms (Department of Defense, 2004). The research has indicated the ability to utilize an EOC for other functions can assist in the justification of funds, however it can also lead to security issues (Harris, 2007). The location of the EOC is important and it is important to ensure the EOC is built in a location that will minimize the effects of any local hazards (Michigan State Police, 2003). Due to the likelihood of flooding, the Dearborn EOC should be away from flood zones and elevated above ground level. The size of the EOC is also an important aspect of the EOC and fifty to eight square feet has been identified as the industry standard when planning for an EOC site plan. Dearborn's expected EOC participants in a full activation would be twenty-seven so an EOC should be built to approximately 2200 square feet. The facility itself should be constructed up to code and in compliance with the American Disabilities Act (ADA) requirements. An EOC built within the borders of Dearborn is also obligated to meet the requirements of the Michigan Building Code and local building ordinances. Although case studies have ranged in a community the size of Dearborn it is advisable to utilize a multi-room model of an EOC. Space should be allocated to account for the day to day activities of the emergency management coordinator, a conference room, communications rooms, kitchen area, storage areas, and an operations room. According to the research the operations room must include at a minimum the following features: telephone lines and logs, status displays, computers with internet networking, and adequate mechanics (Michigan State Police, 2003).

The research finally addressed the need for enhanced technologies and material improvements from the City of Dearborn's current EOC. Industry trends have identified a priority placed on improvements in technological and material aspects of the EOC. Proper

communications are essential and an EOC should have a sufficient number of telephone lines, computer lines, facsimile machines, local area network (LAN) access, access to emergency alerting systems, electromagnetic protection for the facility, a communications room (with added noise reduction), a set of radios for to communicate with operational personnel, adequate radio tower coverage and the ability to transfer to emergency power (Michigan State Police, 2003). The integration of Critical Incident Management Systems (CIMS) was identified as a significant requirement of EOC planning. The City of Dearborn currently operates a CIMS and it is utilized by multiple agencies in the region as well. The current system has been identified as very functional and interacts well with other local and county agencies. The research has also indicated the rapid expansion of virtual EOCs (vEOCs). Virtual EOCs with a fully integrated CIMS program can aid the information sharing of both present and non-present participants who require involvement in the case of an EOC activation (Fulton, 2010). Virtual EOCs with integration with CIMS programs should be properly vetted to ensure ease of usability, and to determine ongoing training needs for likely users of the system. Without regular training sessions the vEOC and CIMS systems may not be fully functional and leave participants without a full understanding of all available information.

Recommendations

The research conducted in this study determined that the City of Dearborn should review the following recommendations in order to properly design and plan for a new EOC with updated technological, material and communication equipment. The recommendations listed below are based on industry best practice, availability of resources , identified hazards, geography and budgeted funds:

1. The City of Dearborn should institute an EOC design and planning committee to include likely participants of EOC activation. Further study will need to be

completed to ensure proper resources are available for all likely participants so as much inclusion of likely participants is strongly recommended.

2. The EOC should be located in an area with adequate space for up to twenty seven participants. At eighty square feet per participant the EOC should be built out to approximately 2200 square feet. The EOC should also be built in an area which is not likely to be subject to the likely hazards identified in the Wayne County Hazard Mitigation Report (2013). The avoidance of areas near to the Rouge River is recommended due to the potential for flooding.
3. Available vacant space in the Dearborn Administrative Center should be considered as a possible location for the City of Dearborn EOC. The space offers ample space, is in close proximity to the office and hub of the information technologies area and also within close proximity to the new dispatch center. Efficiencies may be found by integrating these three areas. The Dearborn Administrative Center also allows for a rapid separation and secure atmosphere for the EOC should it be required. The Dearborn Administrative Center already has a number of resources identified as EOC design best practice to include: access to showers and locker rooms, ample conference space for break out needs, emergency power and it is away from flood zones and the available space is on the second floor of the building. One possible design has been attached in Appendix A. This recommendation will also require further study to include architectural input, costs of converting the space and the ability to meet any additional demands determined from the first recommendation.
4. Even as a new EOC is being designed and planned the committee members should consider future needs and upgrades to the location. As upgrades to

technology continue to rapidly take place it is important to anticipate potential future needs to minimize the cost impact and to ensure continued usability of equipment and information systems. It is further recommended that a separate technology replacement fund be instituted to ensure a constant funding source for technological improvements and updates. The EOC will likely only be as functional as usability of the equipment.

5. The final recommendation is that the City of Dearborn also identifies a backup site for and EOC in the case of a catastrophic failure of the primary EOC. Potential sites include the existing EOC, the Fire Department Training Academy, or available space at the Henry Ford Community and Performing Arts Center. Further study is also indicated regarding the need of a supplemental mobile EOC in the event a disaster requires mobility away from the main EOC.

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Appendix A: EOC Design

Proposed Dearborn Emergency Operations Center Design