Fire and Emergency Medical Services Operations and Data Analysis Flint, Michigan

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Center for Public Safety Management

CPSM
Center for Public Safety Management, LLC

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Exclusive Provider of Public Safety Technical Assistance for the
International City/County Management Association

ICMA
Leaders at the Core of Better Communities

General Information

About ICMA

The International City/County Management Association (ICMA) is a 100-year-old, nonprofit professional association of local government administrators and managers, with approximately 9,000 members located in 32 countries.

Since its inception in 1914, ICMA has been dedicated to assisting local governments in providing services to its citizens in an efficient and effective manner. Its work spans all of the activities of local government—parks, libraries, recreation, public works, economic development, code enforcement, brownfields, public safety, etc.

ICMA advances the knowledge of local government best practices across a wide range of platforms including publications, research, training, and technical assistance. ICMA's work includes both domestic and international activities in partnership with local, state, and federal governments as well as private foundations. For example, it is involved in a major library research project funded by the Bill &Melinda Gates Foundation and it is providing community policing training in Panama working with the U.S. State Department. It worked in Afghanistan assisting with building wastewater treatment plants and has teams in Central America working with SOUTHCOM to provide training in disaster relief.

Center for Public Safety Management LLC

The **ICMA *Center for Public Safety Management (*ICMA/CPSM*)*** is one of four Centers within the Information and Assistance Division of ICMA providing support to local governments in the areas of police, fire, EMS, emergency management, and homeland security. In addition to providing technical assistance in these areas we also represent local governments at the federal level and are involved in numerous projects with the Department of Justice and the Department of Homeland Security. In each of these Centers, ICMA has selected to partner with nationally recognized individuals or companies to provide services that ICMA has previously provided directly. Doing so will provide a higher level of services, greater flexibility, and reduced costs in meeting member's needs as we will be expanding the services that ICMA can offer to local government is expanding. For example, The Center for Productivity Management (CPM) is now working exclusively with SAS, one of the world's leaders in data management and analysis. And the Center for Strategic Management (CSM) is now partnering with nationally recognized experts and academics in local government management and finance.

The Center for Public Safety Management, LLC (CPSM) is the exclusive provider of public safety technical assistance for ICMA and continues to provide training and research for the association's members and represents ICMA in its transactions with the federal government and other public safety professional associations.

CPSM's local government technical assistance experience includes workload and deployment analysis, using our unique methodology and subject matter experts to examine department organizational structure and culture, identify workload and staffing needs as well as industry best

practices. We have conducted over 175 such studies in 35 states and 135 communities ranging in size from 8,000 population, in Boone, Iowa, to 800,000 population, in Indianapolis, Ind.

Thomas Wieczorek is the Director of the Center for Public Safety Management. Leonard Matarese serves as the Director of Research & Program Development. Dr. Dov Chelst is the Director of Quantitative Analysis. Joseph Pozzo is the Senior Manager for Fire/EMS.

Methodology

The Center for Public Safety Management team follows a standardized approach to conducting analyses of police, fire, and other departments involved in providing public safety services to the public. We have developed this standardized approach by combining the experience sets of dozens of subject matter experts in the areas of police, fire, and EMS. Our collective team has more than one hundred years of conducting research in these areas for cities in and beyond the United States.

The reports generated by the operations and data analysis team are based upon key performance indicators that have been identified in standards and safety regulations and by special interest groups such as the International Association of Chiefs of Police (IACP), International Police Association, the International Association of Fire Chiefs (IAFC), the International Associations of Fire Fighters (IAFF), and the Association of Public Safety Communication Officials International, and through the Center for Performance Measurement of ICMA. These performance measures have developed following decades of research and are applicable in all communities. For that reason, comparison of reports will reveal similar reporting formats, but each community's data are analyzed on an individual basis by the CPSM specialists and represent the unique information for that community.

The CPSM public safety management team begins most projects by extracting calls for service and raw data from a public safety agency's computer-aided dispatch system. The data are sorted and analyzed for comparison to nationally developed performance indicators. These performance indicators (e.g., response times, workload by time, multiple-unit dispatching) are valuable measures of agency performance regardless of departmental size. The findings are shown in tables and graphs organized in a logistical format. Despite the size and complexity of the documents, a consistent approach to structuring the findings allows for simple, clean reporting. The categories for the performance indicators and the overall structure of the data and documents follow a standard format, but the data and recommendations are unique to the organization under scrutiny.

The team conducts an operational review in conjunction with the data analysis. The performance indicators serve as the basis for the operational review. The review process follows a standardized approach comparable to that of national accreditation agencies. Prior to the arrival of an on-site team, agencies are asked to provide the team with key operational documents (e.g., policies and procedures, asset lists, etc.). The team visits each locality on-site to interview agency management and supervisory personnel, rank-and-file officers, and local government staff.

The information collected during the site visits and through data analysis results in a set of observations and recommendations that highlight strengths, weaknesses, opportunities, and threats of the organizations and operations under review. To generate recommendations, the team

reviews operational documents; interviews key stakeholders and observes physical facilities; and reviews relevant literature, statutes and regulations, industry standards, and other information and/or materials specifically included in a project's scope of work.

The standardized approach ensures that the Center for Public Safety Management measures and observes all of the critical components of an agency, which in turn provides substance to benchmark against localities with similar profiles. Although agencies may vary in size, priorities, and challenges, there are basic commonalities that enable comparison. The approach also enables the team to identify best practices and innovative approaches.

In general, the standardized approach adopts the principles of the scientific method: We ask questions and request documentation upon project start up; confirm accuracy of information received; deploy operations and data analysis teams to research each unique environment; perform data modeling; share preliminary findings with the jurisdiction; assess inconsistencies reported by client jurisdictions; follow up on areas of concern; and communicate our results in a formal, written report.

CPSM Project Contributors

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City of Flint, Michigan

The city of Flint, Michigan is the county seat of Genesee County and is located approximately sixty miles northwest of Detroit. Flint has a land area of approximately 33 square miles. It has been ranked the 7th largest city in Michigan. In 2013, the city's estimated population was 99,763.[1] Flint is close to major airports, numerous highway systems, and rail service. It has state-of-the-art healthcare providers, as it is served by Hurley Medical Center, McLaren Regional Medical Center, and Genesys Regional Medical Center, to name a few.[2]

Flint was the birthplace of General Motors and the United Auto Workers. Flint is home to a variety of industries, including manufacturing, retail, healthcare, and wholesalers, to name a few. Flint has gradually developed into a "college town" with the presence of Kettering University, University of Michigan-Flint, Mott Community College, and Baker College.[3]

The city offers well-maintained parks, green spaces, and waterways, and it has a wide array of recreational opportunities such as skateboarding, golf, bicycling, and hiking. The city is located within thirty miles of state and recreational game areas.[4] There is also an emphasis on arts and culture.

Part I, Article III, Section 3-101 of the charter of the city of Flint establishes that the city council is the legislative body of the government. The city is run via a strong mayor-council form of government, and is divided into nine wards. Section 3-102 of the charter provides that each council member elected from his/her district will serve a four-year term.[5] The city council elects a president from its membership to serve as presiding officer and a vice president to serve in the absence of the president. Section 4-101 of the charter provides that the mayor will serve as the chief executive officer of the city, and pursuant to Section 4-201, with

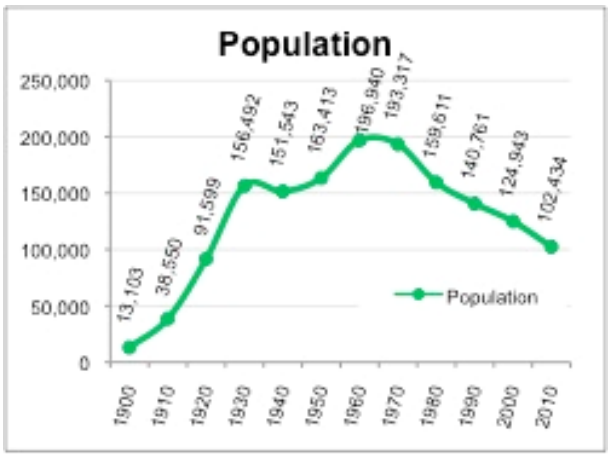
[1] http://quickfacts.census.gov/qfd/states/26/2629000.html
[2] http://www.flintandgenesee.org/community/communities-at-a-glance/#flint
[3] http://www.flintandgenesee.org/community/communities-at-a-glance/#flint
[4] http://www.cityofflint.com/parks/pdf/RecPlanUpdate%20.pdf
[5] Charter, City of Flint Michigan.

approval of the council, shall appoint a chief administrative officer. The chief administrative officer (city administrator) directs and supervises the day-to-day management of city government.

At the time of this operational analysis, the city was, pursuant to Public Act 436 of 2012, the Local Financial Stability and Choice Act, operating under an emergency manager. This Act was designed to safeguard and assure the financial accountability of local units of government and school districts.[6] Flint has been placed into state-level financial receivership and is one of seventeen municipalities and/or school districts in Michigan operating under this state legislation.

As previously mentioned, the city of Flint has an estimated 2013 population of 99,763. According to the 2010 U.S. Census, the city's population that year was 102,400, with a demographic make-up as follows: 37.4 percent white; 56.6 percent African-American; 0.5 percent American Indian and Alaskan Native; and 0.5 percent Asian. Of the population that is white, 3.9 percent is Hispanic or Latino. Of the 2010 population, 8 percent were under the age of 5 and 10.7 percent were above the age of 65. [7]

The median household income in Flint in 2008-2012 was $26,339, with 39.7 percent of the population living below the poverty level in the same data period. There were 41,045 households for this period with the average owner-occupied housing unit valued at $50,500. There were 51,321 total housing units.[8] Lastly, there are 2.46 persons per household.



The city's population peaked at roughly 200,000 in the 1960s, before a decline in industry began to plague Flint and the surrounding area. The 2013 U.S. Census Bureau-estimated current population (99,763) is down from 102,434 in 2010 and 124,987 in 2000. This amounts to a population decrease of 20.2 percent between 2000 and 2013.

The population loss followed the loss of major employers. The decline of General Motors dealt a particularly devastating blow. In the late 1970s, GM had some 80,000 local employees; by 2010, large GM divisions in the city — including Buick, Fisher Body, and AC Delco Sparkplugs — had closed their doors, leaving fewer than 8,000 local GM employees. The massive layoffs had a ripple effect on other industries, leaving almost no sector of the economy untouched while putting thousands of additional residents out of work. By 2010, the unemployment rate in Flint had reached almost 20 percent. Many residents left to seek employment opportunities elsewhere, leaving entire neighborhoods nearly vacant.

[6] http://www.michigan.gov/treasury/0,1607,7-121-1751_51556-201116--,00.html
[7] U.S. Census Bureau, State & County QuickFacts, Flint, Michigan.
http://quickfacts.census.gov/qfd/states/26/2629000.html
[8] Ibid.

The vacant Buick City remains a brownfield — the largest brownfield in the United States. People have fled the city; their abandoned homes, businesses, and properties have fallen into disrepair. This once-thriving city known as the capital of the auto industry has now become known better for its crime, rising to the top of *Business Insider's* list of the most dangerous cities in America.[9]

Flint's economic troubles continue to plague the community. According to the Bureau of Labor Statistics, Flint's unemployment rate in July 2014 was 9.3 percent, well above both the state (7.7 percent) and national average (6.2 percent). Perhaps even more telling is the fact that 39.7 percent of Flint's residents live below the poverty level.[10]

The economic woes have naturally had a devastating impact on the city's operations, and Flint continues to face significant financial challenges. Plummeting property and income tax revenues, coupled with significant increases in legacy costs (especially pension and retiree health care); have resulted in a gap between revenues and expenses. The city has been in state receivership since December 2011, and the city's five-year financial plan paints a dire picture for the future: "Unfortunately, the financial forecast for the next several years beyond FY16 shows a continuing gap between projected revenues and expenses. Within the next few years, without significant means to identify and collect additional revenues, or to further reduce the cost basis, the city of Flint will be extremely challenged to provide even the most basic of city services."[11]

The city has been struggling to turn around its finances, and there has been some success. The deficit at the end of FY12 was $19.1 million; at the end of FY13, the city had succeeded in reducing the deficit to $12.9 million. In addition, the city's cash position had improved, and the city put in place an appropriately balanced budget that was expected to further reduce the deficit. As shown in Figures 1 and 2, the FY15 revenues are projected to be $165.1 million and expenditures $162.2 million, and the FY16 revenues are projected to be $169.5 million and expenditures $166.6 million.

[9] See: Christina Sterbenz and Erin Fuchs, "How Flint, Michigan, Became the Most Dangerous City in America," June 16, 2013. http://www.businessinsider.com/why-is-flint-michigan-dangerous-2013-6.
[10] U.S. Census Bureau, State & County QuickFacts, Flint, Michigan. http://quickfacts.census.gov/qfd/states/26/2629000.html
[11] City of Flint 5-Year Financial Plan, page 2. http://www.cityofflint.com/FinancialMgr/images/FY15 FY16 Adopted Budget Document.PDF.

Figure 1: City of Flint FY 15 and FY 16 Revenue–All Funds

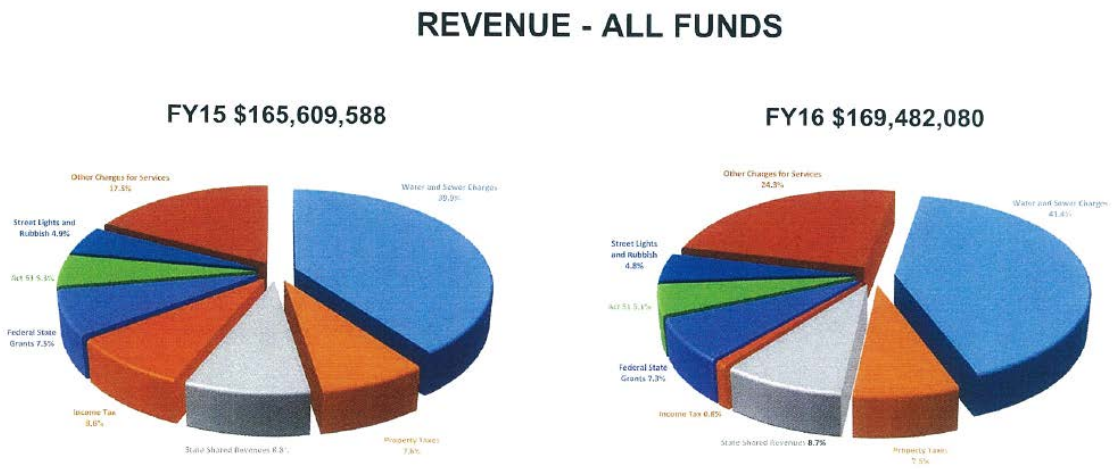
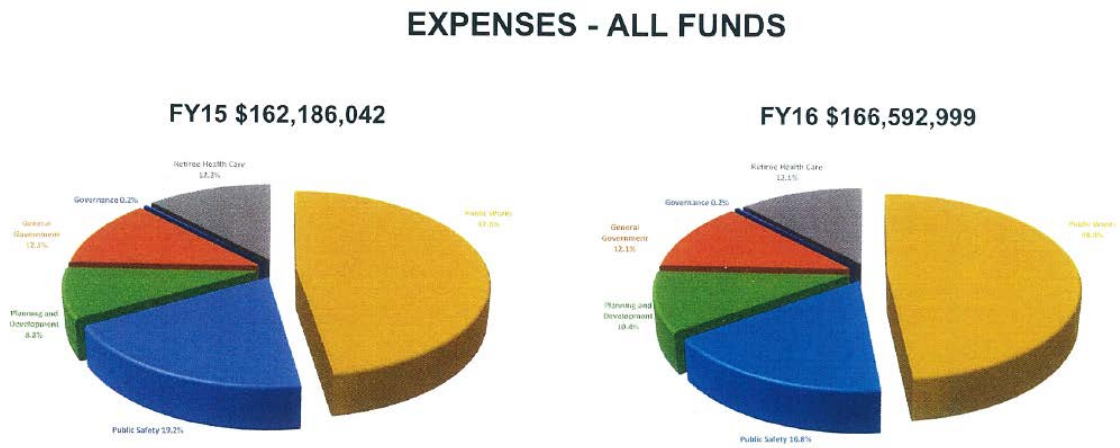


Figure 2: City of Flint FY 15 and FY 16 Expenses–All Funds

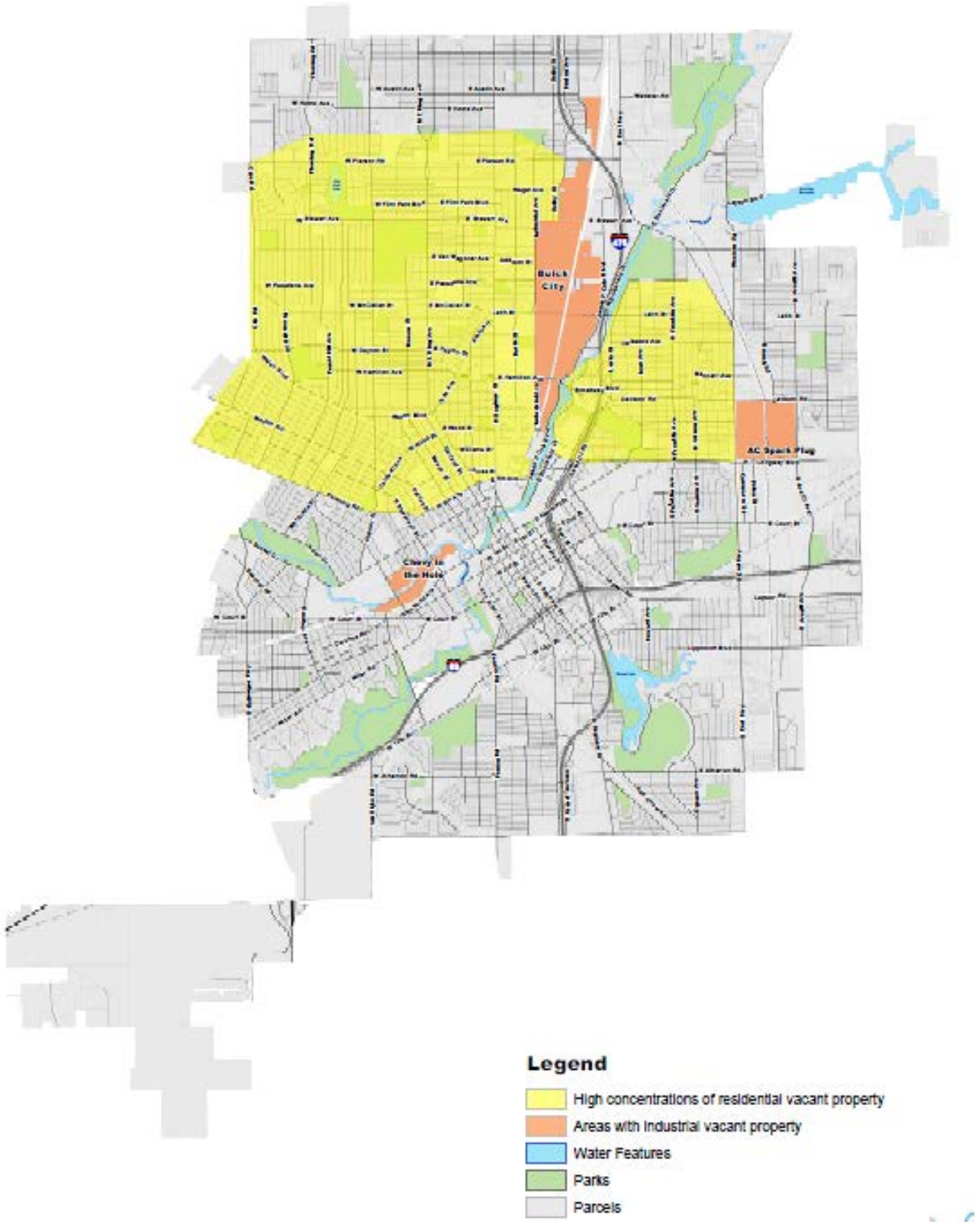


Reaching these financial goals has not been easy. There has been a significant reduction in city staffing and, as a result, in services for citizens. The city has also led efforts to diversify the economy and attract new industry. Local foundations have funded renovation projects along downtown's Saginaw Street. In addition, 2014 has seen a drop in violent crime.

Like Detroit and other cities coping with widespread urban blight, Flint has undertaken an effort plan to tear down abandoned homes and other structures and return the land to nature — an effort that is intended to reduce crime and to concentrate the dwindling population in a smaller service area.[12] To date, federal grant funding has been used to demolish about 1,500 properties, but there remain roughly 3,000 vacant residential structures. The remaining vacant structures create impacts on public safety services that range from incendiary fires to havens for criminal activities. Figure 3 illustrates the concentration of vacant structures throughout the city.

[12] See Tom Leonard, "US Cities May Have to be Bulldozed in Order to Survive," *The Telegraph*, June 12, 2009.

Figure 3: Concentration of Vacant Property



Executive Summary

The Center for Public Safety Management, LLC (CPSM) was retained by the city of Flint to complete a comprehensive analysis of the city's fire department. This analysis is designed to provide the city with a thorough and unbiased review of services provided by the Flint Fire Department (FFD). As well, the report provides information for how the city, based on funding and the management of staffing and deployment of resources, can better provide fire and EMS first response services from current fire stations. The report further provides a benchmark of the city's existing service delivery performance as analyzed in the accompanying comprehensive data analysis, which was performed utilizing information provided by the FFD. *This data analysis in itself provides significant value to the city as the city now has a workload analysis from which to move forward with future planning efforts.* Also included in this report is the use of geographic information systems (GIS) data mapping to support the operational discussion and recommendations.

During the study, CPSM analyzed performance data provided by the FFD and also examined firsthand the department's operations. Fire departments tend to deploy resources utilizing traditional approaches, which are rarely reviewed. To begin the review, project staff asked the city for certain documents, data, and information. The project staff used this information/data to familiarize themselves with the department's structure, assets, and operations. The provided information was also used in conjunction with the raw performance data collected to determine the existing performance of the department, and to compare that performance to national benchmarks. These benchmarks have been developed by organizations such as the National Fire Protection Association (NFPA), Center for Public Safety Excellence, Inc., (CPSE), and the ICMA Center for Performance Measurement. FFD staff was also provided an electronic shared information folder to upload information for analysis and use by the CPSM project management staff.

Project staff conducted a site visit on August 13 and 14, 2014, for the purpose of observing fire department and agency-connected supportive operations, interviewing key department staff, and reviewing preliminary data and operations. Telephone conference calls were conducted as were e-mail exchanges between CPSM project management staff and the city so that CPSM staff could affirm the project scope, and elicit further discussion regarding this operational analysis.

Recommendations and considerations for continuous improvement of services are presented next and in the order in which they appear in the report. CPSM recognizes there may be recommendations and considerations offered that have to be bargained, budgeted for, or for which processes have to be developed prior to implementation.

Recommendations and Considerations

- While discussing the organization with the fire chief and staff during the CPSM on-site visit, the fire chief discussed a reorganization of positions. This plan would include reallocating the EMS supervisor position back to field operations and the renaming of the primary caption position to district commander. CPSM recommends an even closer look at the organizational structure. As currently structured and proposed by the fire chief there are two levels of first-line supervision at the company level. ***CPSM recommends the FFD have***

only one level of first-line supervision and further recommends, due to the limited number of available staffed companies, that this be at the lieutenant level and be assigned to each apparatus. As well, CPSM does not recommend the continuance of the apparatus operator II position classifications. Instead, as an efficiency measure, CPSM recommends additional compensation for FF/EMTs only when they move up to temporarily fill in an apparatus operator position. Further, whether the middle management level is titled primary captain or district commander, it is important that this level remain in place, especially with limited and available administrative staff and command positions, considering the day-to-day responsibilities to manage and lead the operational component of the agency. Lastly ***CPSM recommends the sergeant/fire inspector position be re-designated as a hazards mitigation officer to perform and maintain a risk analysis and vulnerability study of the community (discussed later in this report), work with the appropriate agencies to assist with the continued mitigation of the vacant housing issues confronting the city, and focus on target hazards and pre-fire planning efforts in conjunction with other fire prevention-related activities. A recommended organizational chart for the FFD is presented as Figure 6.***

- Efficiencies that may be realized through a public safety administrative model include consolidating all administrative, financial, and technical services and support for core public safety functions under the umbrella of one director. A true efficiency in this model is the elimination of one or more senior staff positions in one or both of the public safety agencies. It is inefficient to keep both the police and fire chief and hire an additional public safety director, unless funding is available to sustain that model. This is not the case in Flint. ***CPSM recommends that prior to moving to this model both agencies must have in place a senior-level position, or must preserve a senior level position in the case of a retirement, to ensure both agencies have a leadership component and proven subject matter expert to serve as a division director. The public safety director would be an existing and funded senior level position to lead the entire public safety agency.***
- In a review of the recent quarterly report on the citywide strategic plan, it was found that the FFD reported on its fourteen key objectives, with seven listed as incomplete, three as not started, and four as completed. For those listed as completed, however, there is no listing of activities or discussion of the effectiveness or efficiency with which the objectives were completed, although there may exist individual reports or information transmitted verifying the completion. As an example, one key objective is "turnaround time for Fire Inspections to be five days or less." A true measure of this will list the number of inspections and the actual days or average days this occurred, so that it is clear the objective is satisfied***. It is recommended that reporting on each FFD key objective be expanded to include the true measurement of the objective and the outcomes associated with each so the objective can be transparently communicated to the public.*** This communication is important if the public is asked for funding to support the FFD through additional taxing so that fire protection services can be sustained.

- Community risk and vulnerability assessments are essential elements in a fire department's planning process. The FFD has not completed a comprehensive community risk and vulnerability assessment. This is an extremely important process to complete, given the number of vacant structures in the city, and the risk and threat they pose. ***It is strongly recommended the FFD complete a fire and community risk assessment as a component of future department and city planning. This assessment should be done in conjunction with the fire and EMS calls for service demand analysis provided in this report. CPSM further recommends the department develop and implement an internal risk management plan beyond that of a vacant structure guideline and which follows the standards of NFPA 1500, Standard for a Fire Department Occupational Safety and Health Program.***
- The city of Flint's last Insurance Services Office (ISO) Community Grading Schedule evaluation was completed in 2010, when it received a community rating of 5/10. Since then, several changes have been made in the ISO evaluation criteria. ISO began using its new Community Grading Schedule at the end of 2012. A review of the new schedule and the deficiencies found in the 2010 report, many of which have not been addressed, should provide considerable assistance to the city to improve its current grade. ***As improvement can be made in the next ISO evaluation, CPSM recommends the fire department review the new ISO rating schedule and its 2010 rating to identify areas of improvement, with a focus on enhancing the overall ISO PPC rating, which translates to improved service delivery.***
- CPSM found that the fire prevention unit still uses a paper-based system to track and record its inspections, violations and corrective actions; this creates inefficiency and ineffectiveness. ***It is recommended the fire prevention unit transition to an efficient, automated records management system for fire prevention and code enforcement activities.***
- The current FFD schedule is inefficient and diminishes the effectiveness of service delivery, in that fire operational employees can be scheduled off for an additional twelve hours a month (that is, they receive a 24-hour Kelly day instead of a 12-hour Kelly day). This has a negative effect on overall available staffing and drives up overtime. The additional twelve-hours per employee per 28-day cycle adds approximately 10,764 hours of additional time off per year (69 operational staff x 12 hours x thirteen 28 day cycles = 10,764 hours) that then needs to be covered by other personnel. According to staff, not all of this time can be covered by extra staffing or overtime, which leads to stations being put out of service. ***CPSM recommends that, in accordance with 29 USC §207(k), the city of Flint and the FFD discuss and bargain (if required and or necessary) a 53-hour a week schedule (212 hours in a 28-day cycle), which will reduce the Kelly day to 12-hours per employee in a 28-day cycle. CPSM further recommends that premium pay be paid only after the scheduled 212 hours have been reached, and that productive (actual scheduled hours worked) and nonproductive time (leave/vacation of all types) be calculated in accordance with 29 USC §207(k) to maximize efficiencies regarding overtime.***

- ***Utilizing the staffing factor formula presented in this report, the FFD can better determine a more accurate staffing and overtime budget, or for developing future budgetary alternatives for "overstaffing" to reduce overtime costs. Further utilizing a staffing factor, the FFD can potentially — barring numerous long-term vacancies — staff more than three stations on a more regular basis.***

- In the short term, and dependent on available daily staffing, one staffing alternative is to staff three stations around the clock and one station (one unit) during a 12-hour peak demand time. Peak demand time in Flint runs from 10:00 a.m. to midnight, with peak load between the hours of 2:00 p.m. and 10:00 p.m. The best utilization of staffing and deployment in this scenario is to staff the fourth station between the hours of noon and midnight. Deployment of apparatus in this staffing model would include: two Quints and one engine apparatus around the clock (minimum staffing of three each): two squads around the clock (minimum staffing of two each); one district commander around the clock (minimum staffing of one); and one peak-load engine from noon to midnight (minimum staffing of three). This model requires fourteen personnel around the clock and three personnel *if staffing allows* during a 12-hour peak load time, for a total of seventeen personnel per shift.

- In the long term, and once staffing is managed so that assigned personnel are available for duty, and a staffing factor has been further evaluated and implemented, a second alternative is to staff and deploy from a minimum of four stations around the clock. Travel times depicted in this report and actual demand for service are the drivers for this consideration. Deployment of apparatus in this staffing model would include: two Quints and two engine apparatus around the clock (minimum staffing of three each): two squads around the clock (minimum staffing of two each); and one district commander around the clock (minimum staffing of one. This model requires seventeen personnel around the clock. Utilizing the staffing factor of 1.39 as discussed above, this requires 23.63 personnel per shift per day, which is slightly above the parameter of the twenty-three staff per shift as currently assigned and funded. This does not mean that there will be no overtime needed, as additional vacancies may occur due to unplanned short- and long-term issues. Utilizing a staffing factor, however, enables the department to better plan and prepare for what staffing is needed to staff a given deployment model as well as what additional overtime may be needed to sustain the model.

- Regarding response times, at the 90th percentile there is a marked increase in time and a gap between the NFPA 1710 benchmark and what is actually occurring in Flint. Of particular significance are the average dispatch times and the dispatch turnout times at the 90th percentile. Management has the most control over these two components of response time. Dispatch time in Flint at the 90th percentile is from three to four minutes greater than the national benchmarks (NFPA, CPSE), while turnout time at the 90th percentile is almost two minutes greater than the NFPA benchmark. Reducing dispatch and turnout time will reduce overall response time. ***It is strongly recommended that the FFD develop and implement a comprehensive performance-based management strategy for all elements***

of response time, with a focus on dispatch and turnout times, as these are most controllable from a human perspective.

- EMS transport in the city of Flint is handled by a myriad of a private ambulance services. These include Mobile Medical Response, Pro Med, Regional EMS, Universal Ambulance, STAT EMS, Swartz Ambulance, and Patriot Ambulance Service. When a transport is needed, the emergency communications center notifies the next available service through means of a call-down list. There is inefficiency in the notification and response of EMS transport units since the communications center does not know the location of available transport units and therefore may not be contacting the closest unit/agency for response. ***CPSM recommends the city enter into performance-based contractual agreements with one or more private EMS agencies for the delivery of EMS and EMS transport services in the city of Flint. CPSM further recommends a competitive, closed-bid process be established so that the city may realize the best economic and performance advantage. The request for proposal process for EMS and EMS transport services should establish expectations for clinical excellence and system performance. It may be in the city's best interest to seek outside assistance in the development of a high-performance performance-based solicitation and contract. In other words, the city should establish service levels commensurate with community expectations. Finally, if the city is desirous of this alternative, the city is encouraged to discuss with neighboring jurisdictions the potential advantages of a countywide or regional approach to ambulance services.***
- In its review of the Flint Fire Department, the Insurance Services Office found the department's training facilities to be deficient because it lacks a training drill tower and a fire building (smoke room), and also does not have a sufficient library of training materials and student manuals. Multimedia capabilities and other visual demonstration tools such as pump and hydrant cutaways were also found to be lacking by the ISO review. CPSM has found that none of the fire training facility limitations from the 2010 ISO report has been resolved, although some could be easily remedied by contracting with a neighboring community for the use of its training facilities. ***CPSM strongly recommends the FFD enter into an agreement with a neighboring jurisdiction for the use of its training facilities so as to eliminate point deductions ISO would make, and more importantly, to enhance fire suppression training.***
- In contrast to EMS training record-keeping, the department lacks documentation or individual training records for firefighting tactical competencies, incident command, specialized rescue, and other technical training. ***CPSM recommends that for effective and consistent recording of all staff training, the FFD procure a records management software system for documenting all FFD staff training.***
- In our studies, CPSM has found that many fire department training officers prepare a full-year training schedule that is then approved by the fire chief. The Flint training officer prepares a training schedule twice a year and holds regularly scheduled training programs for each shift as part of the training plan. ***To improve the effectiveness of staff education and training, CPSM recommends the implementation of an annual training plan review process that establishes fire training goals and that is approved by the fire chief.***

- The FFD's standard operating guidelines require that each guideline is to be reviewed at least once every 24 months or when a change in policy is made or a new technical, tactical, or strategy element is introduced into the department. A new guideline must be incorporated into the document within six to twelve months of an element's introduction. However, these review requirements have not been followed. Most of the department's SOGs have neither been reviewed nor updated for more than a decade and some were last reviewed in the 1990s. This lack of review could be the cause of a serious and potentially dangerous liability. ***To improve the fire training plan as well as continued situational awareness and core improvement of staff, CPSM recommends linking the annual training plan to department SOGs, establishing a schedule for reviewing each guideline, and adhering to this schedule.***

Organizational Analysis

Part I, Article VI, Section 4-203 of the city charter created the executive departments of the city to include public safety. Chapter 19, Article II, Section 19-21 of the city code provides that the fire chief shall be the head of the fire department and is responsible for overseeing the operations of the department to include direction of all fire suppression and prevention activities; training, planning, and development of programs for public protection; and enforcement of regulations essential to the fire protection and safety of life and property. In addition to providing fire protection services, the agency provides hazardous material response services. The department currently operates out of five stations, which are strategically sited throughout the community to provide an effective response time to constituents.

Organization and Structure

The FFD has a traditional organizational structure that includes a fire chief as the head of the agency and various staff officers. The fire chief also serves as the emergency management coordinator. Currently, the department is budgeted for seventy-five positions. The positions are dispersed as follows: seven assigned to administration and 68 assigned to field operations.

Administrative personnel include five uniformed positions and two non-uniformed positions (a support tech and an administrative clerk). Uniformed positions include the fire chief, two personnel assigned to fire prevention, one assigned as an EMS supervisor, and one assigned to the fire safety/training officer position. All personnel assigned to administration are officers, with the exception of the EMS supervisor position. Figure 4 illustrates the current organizational chart.

Operations staff works a 24-hour shift and have a schedule wherein they work 24 hours on and are off 48 hours. Operational positions include a middle-management position (primary captain) that oversees the day-to-day shift operations and responds to incidents as the incident commander for command and control of the scene. A lieutenant or sergeant is assigned to each apparatus as a company officer and serves as the first-line supervisor. CPSM found little consistency as to which company by shift has a sergeant or lieutenant as the officer. This is largely due to legacy positions the department has maintained. Some shifts have more lieutenants than others and some have more sergeants. Other positions include apparatus operators who serve as the primary operators of responding apparatus, and apparatus officer IIs who serve as back-up operators when the primary officer is off duty. Lastly, operational staffing is completed with firefighters/EMTs, which represent the largest cadre of organizational staff.

While discussing the organization with the fire chief and staff during the CPSM on-site visit, the fire chief discussed a reorganization of positions. This would include reallocating the EMS supervisor position back to field operations and the retitling of the primary caption position to district commander. Figure 5 illustrates this proposed reorganization.

Figure 4: Current FFD Organizational Chart

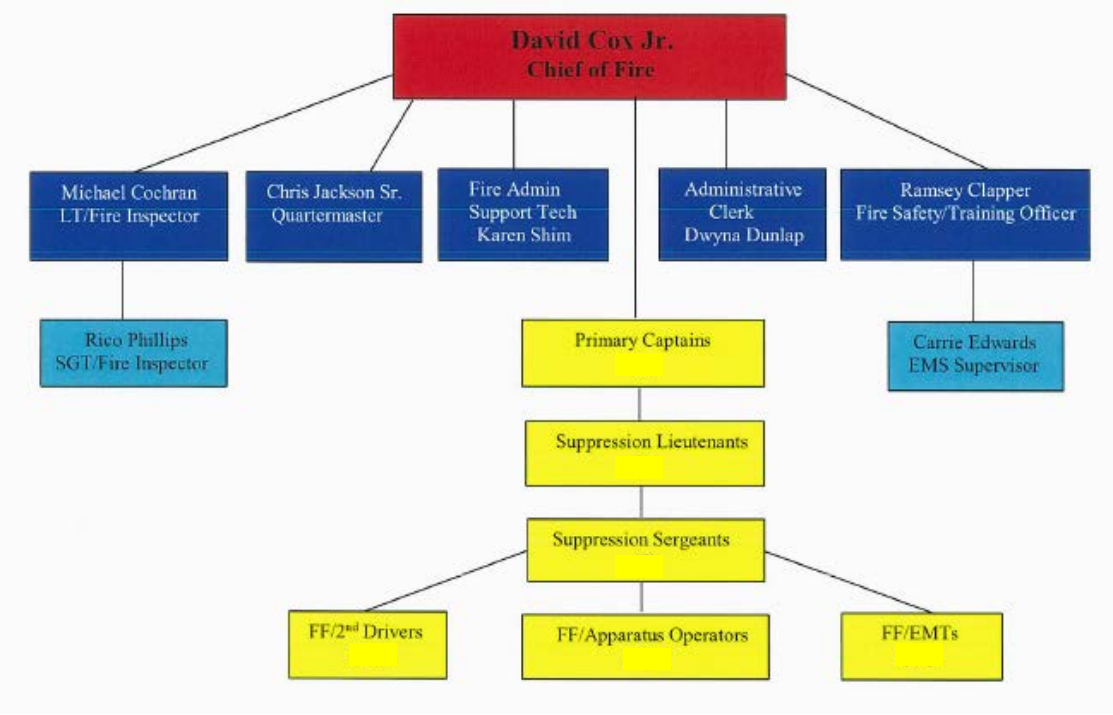
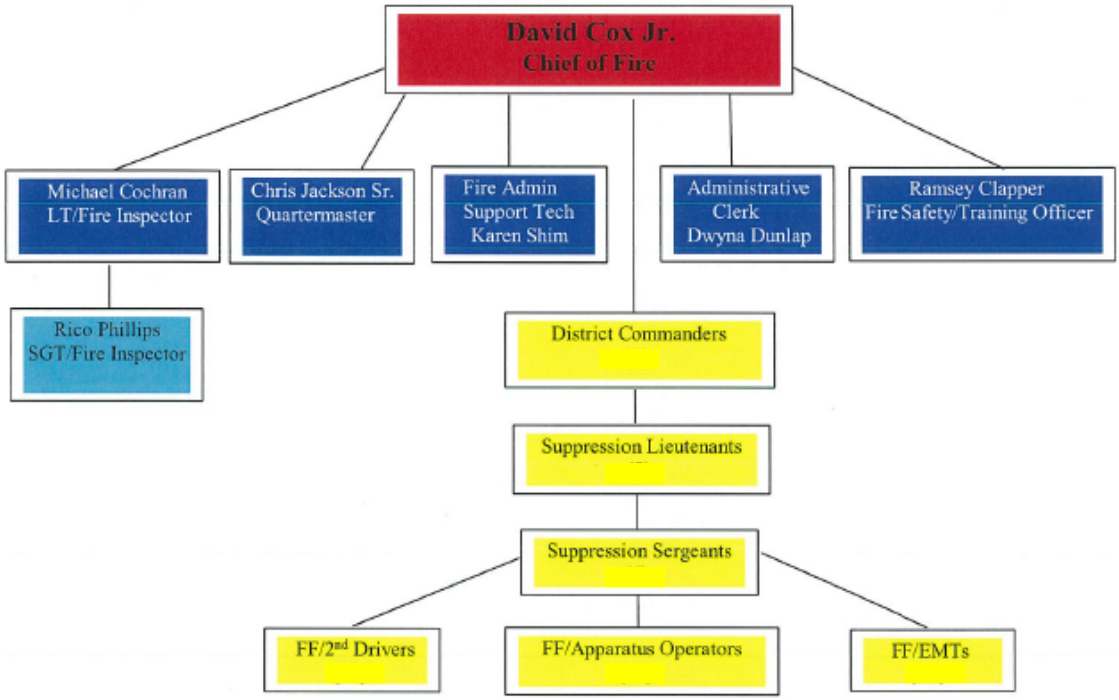
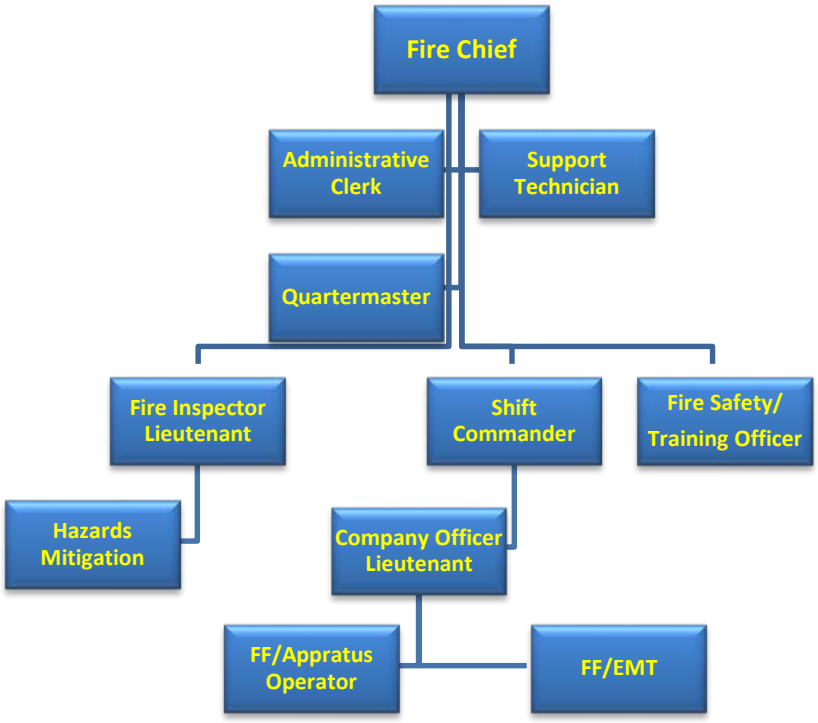


Figure 5: Proposed FFD Organizational Chart



CPSM recommends even a closer look at the organizational structure. As currently structured and proposed by the fire chief, there are two levels of first-line supervision at the company level. ***CPSM recommends the FFD have only one level of first-line supervision and further recommends, due to the limited number of available staffed companies, this be at the lieutenant level and assigned to each apparatus. As well, CPSM does not recommend the continuance of the apparatus operator II position classifications. Instead, as an efficiency measure, CPSM recommends additional compensation for FF/EMTs only when they move up to temporarily fill in an apparatus operator position. Further, whether the middle management level is titled primary captain or district commander, it is important that this level remain in place, especially with the limited and available administrative staff and command positions, and considering the day-to-day responsibilities to manage and lead the operational component of the agency. Lastly, CPSM recommends the sergeant/fire inspector position be re-designated as a hazards mitigation officer to perform and maintain a risk analysis and vulnerability study of the community (discussed later in this report), work with the appropriate agencies to assist with the continued mitigation of the vacant housing issues confronting the city, and focus on target hazards and pre-fire planning efforts in conjunction with other fire prevention related activities.*** Figure 6 illustrates a recommended organizational chart.

Figure 6: CPSM Recommended FFD Organizational Chart



Public Safety Administrative Model

Another alternative is to consolidate fire and police agencies and create a public safety director model. In this model, both agencies come together under the umbrella of a single public safety director. The public safety director would hold the title of Police and Fire Chief in order to clarify that this individual is responsible for all public safety activities. One person should be designated as the fire administrator responsible for ensuring that all areas related to fire suppression and prevention are properly managed. This position could hold the rank of commander or deputy chief. A similar position should be established for law enforcement functions. However, neither of these positions should be designated as police chief or fire chief. Doing so undermines the authority of the public safety director.

Efficiencies that may be realized through a public safety administrative model include consolidating all administrative, financial, and technical services and support for core public safety functions under the umbrella of one director. A true efficiency in this model is the elimination of one or more senior staff positions in one or both of the public safety agencies. It is inefficient to keep both the police and fire chief and hire an additional public safety director, unless funding is available to sustain that model. This is not the case in Flint. ***CPSM recommends that prior to moving to this model both agencies must have in place a senior-level position, or must preserve a senior level position in the case of a retirement, to ensure both agencies have a leadership component and proven subject matter expert to serve as a division director. The public safety director would be an existing and funded senior level position to lead the entire public safety agency.***

Figure 7 illustrates a proposed organizational chart for a Public Safety Department.

Figure 7: Public Safety Department Organizational Chart

Internal Planning

Organizing and managing a contemporary fire and emergency medical services agency requires results-oriented and well-thought-out and achievable goals and objectives. In addition, to determine how well an organization or program is doing requires that these goals be measurable and that they are measured against desired results. Included in a fire organization's key internal planning components should be a formal strategic plan, community risk and vulnerability assessment and plan, performance measures, and a succession plan.

As a part of the overall city of Flint 2014-2019 strategic plan, the FFD has established fourteen strategic planning points. Included in the strategic planning process were the establishment of key objectives, the division to which each objective is assigned, and a scorecard system that monitors the status of each key objective. One weakness noted in the fourteen key objectives provided to CPSM staff is that several are unmeasurable and/or have a project date as ongoing, which in itself builds in the inability to measure effective outcomes or efficiencies.

In a review of the recent quarterly report on the citywide strategic plan, the FFD reported on its fourteen key objectives, with seven listed as incomplete, three as not started, and four as completed. For those listed as completed, however, there is no listing of activities or discussion of the effectiveness or efficiency with which the objectives were completed, although there may exist individual reports or information transmitted verifying the completion. As an example, one key objective is "turnaround time for Fire Inspections to be five days or less." A true measure of this will list the number of inspections and the actual days or average days this turnaround took, so that it is clear the objective is satisfied***. It is recommended that reporting on each FFD key objective be expanded to include the true measurement of the objective and the outcomes associated with each so the objective can be transparently communicated to the public.*** This communication is important if the public is asked for funding to support the FFD through additional taxing so that fire protection services can be sustained.

One area of internal planning that is a critical component to determining the proper staffing and deployment model for a fire department is the completion of a *Community Fire Risk Assessment*. What's involved in a fire risk analysis? A fire department collects and organizes risk evaluation information about individual properties, and on the basis of the rated factors then derives a "fire risk score" for each property. This is done by assessing the needed fire flow, probability, consequences, and occupancy risk, and then establishing fire management zones. The score is then used to categorize the property as one of low-, moderate-, or high/maximum-risk. To assist in this endeavor, there are retail software products currently available that rate a property based on the information that is inputted.

Plotting the rated properties on a map provides a better understanding of how fire stations, response run cards, and staffing patterns can be used to provide a higher concentration of resources for worse-case scenarios or, conversely, fewer resources for lower levels of risk.[13] The community fire risk assessment may also include determining and defining the differences in fire

[13] *Fire and Emergency Service Self-Assessment Manual, Eighth Edition*, (Chantilly, VA: Center for Public Safety Excellence, 2009), 49.

risk between various categories of buildings — a detached single-family dwelling, a multifamily dwelling, an industrial building, and a high-rise building — by placing each in separate category. Further, an overall community risk profile can be linked to historical response time data and demand, which is discussed later in this report. This analysis can then be used to informatively establish response time baselines and benchmarks.

Community risk and vulnerability assessment are essential elements in a fire department's planning process. ***The FFD has not completed a comprehensive community risk and vulnerability assessment.*** This is an extremely important process to complete given the number of vacant structures in the city and the risk and threat they pose.

According to a National Fire Protection Association (NFPA) paper on assessing community vulnerability, fire department operational performance is a function of three considerations: resource availability/reliability, department capability, and operational effectiveness.[14] These elements can be further defined as:

> **Resource availability/reliability:** The degree to which the resources are ready and available to respond.
>
> **Department capability:** The ability of the resources deployed to manage an incident.
>
> **Operational effectiveness:** The product of availability and capability. It is the outcome achieved by the deployed resources or a measure of the ability to match resources deployed to the risk level to which they are responding.[15]

The community risk and vulnerability assessment evaluates the community as a whole, and with regard to property, measures all property and the risk associated with that property and then segregates the property as either a high-, medium-, or low-hazard depending on factors such as the life and building content hazard, and the potential fire flow and staffing required to mitigate an emergency in the specific property. According to the NFPA *Fire Protection Handbook*, these hazards are defined as:

> **High-hazard occupancies:** Schools, hospitals, nursing homes, explosives plants, refineries, high-rise buildings, and other high life-hazard or large fire-potential occupancies.
>
> **Medium-hazard occupancies:** Apartments, offices, and mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces.
>
> **Low-hazard occupancies:** One-, two-, or three-family dwellings and scattered small business and industrial occupancies.[16]

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[14] Fire Service Deployment, Assessing Community Vulnerability, National Fire Protection Association, from http://www.nfpa.org/assets/files/pdf/urbanfirevulnerability.pdf.
[15] National Fire Service Data Summit Proceedings, U.S. Department of Commerce, NIST Tech Note 1698, May 2011.
[16] Cote, Grant, Hall & Solomon, eds., *Fire Protection Handbook* (Quincy, MA: National Fire Protection Association, 2008), 12.

Figures 8 and 9 illustrate the critical tasks and resource deployment required for certain categories of risk, which traditionally in the fire service are determined by the size of the building, fire flow required, life hazard, and corresponding tasks required to mitigate the emergency. Other risks such as hazardous materials, the likelihood of a high angle rescue, and wild land/urban interface represent fire department response risk as well.

The examples illustrated here include low-risk incidents (small, detached unoccupied building) and moderate-risk incidents such as dwelling fires, which represent the most common risks in the community. High risk/high hazard incidents require resources and critical tasking that either stretch or exceed the capabilities of departments the size of the FFD. These communities typically depend on mutual aid to assist in mitigating these emergencies.

Figure 8: Low-Risk Fire Response

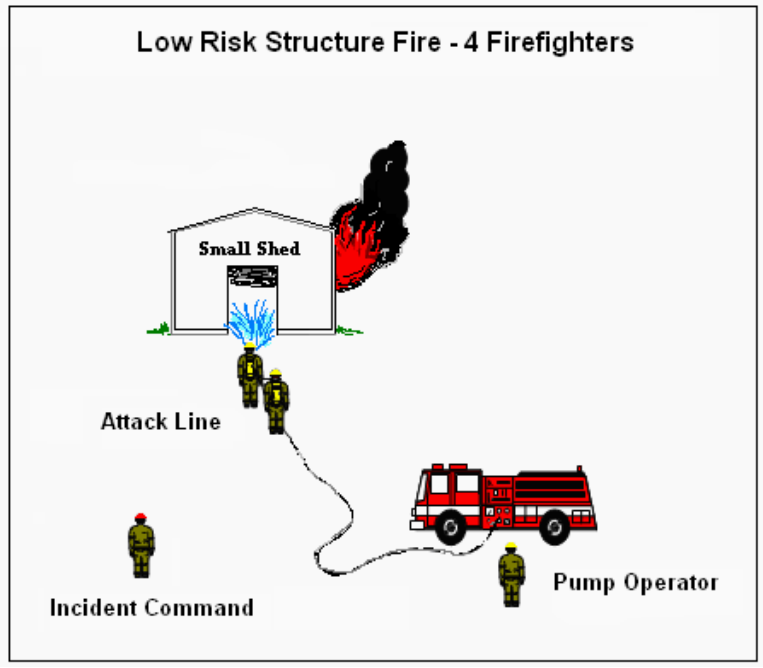
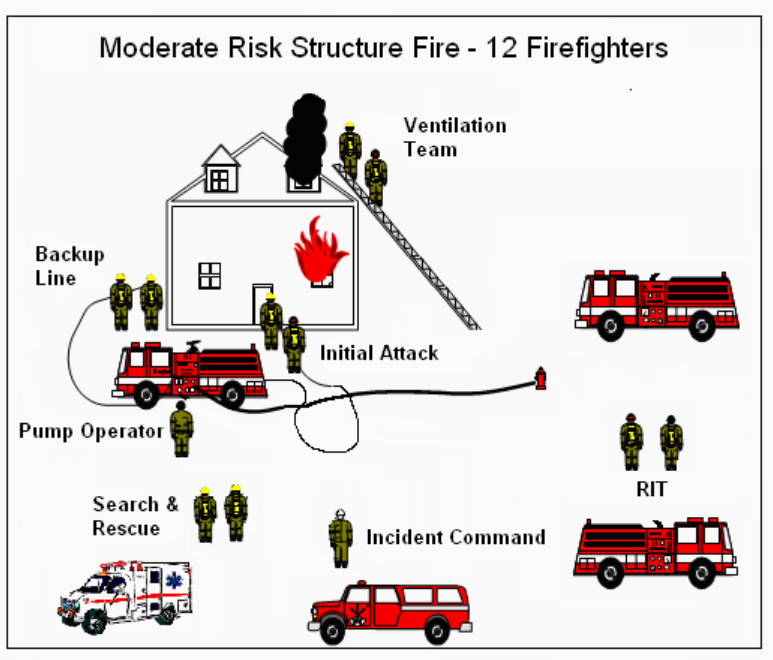


Figure 9 represents critical task elements for a moderate-risk structure fire. Some jurisdictions add additional response resources to meet and in some cases exceed the specifics of national benchmarking, such as National Fire Protection Association (NFPA) 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments,* 2010 Edition.

Figure 9: Moderate-Risk Fire Response



It is strongly recommended the FFD complete a fire and community risk assessment as a component of future department and city planning. This assessment should be done in conjunction with the fire and EMS calls for service demand analysis provided in this report.

FFD Fiscal Perspective

Through its many difficulties, Flint has maintained its commitment to protect public safety. However, the high number of abandoned buildings, the city's socioeconomic factors, and limited financial resources are considerable obstacles to maintaining the level of public safety that citizens may expect.

Over the past fifteen years, the department has experienced significant downsizing. In 1998 there were 368 employees and nine fire stations covering the city. In 2014, there are sixty-eight sustainable full-time operational positions that deploy out of three stations most of the time and seven administrative positions. The fire department's EMS response is limited to basic life support (BLS) Tier 1, or the more critical calls.

As in any career department, personnel costs account for the largest expenditure of the department. The International Association of Fire Fighters (IAFF) estimates that personnel costs account for roughly 85 percent of most fire department budgets.[17] In Flint, personnel costs are $9,617,299, or roughly 84 percent of the budget. These figures are dramatically skewed, however, by the fact that these personnel costs include legacy costs such as pensions and retiree health care costs that makes up almost 41 percent ($4,648,826) of the total budget.

The city has worked to increase revenues and has sought grant funding to maintain adequate staffing for fire operations. The city now charges fees for services that were once covered by property taxes. In addition, earlier this year, the city passed a special 6 mill tax, with the funds targeted exclusively for public safety. The mill tax has an expiration date of 2017; without this additional revenue, projections show that the department will lose 20 positions. The expiration of the city's SAFER grants has put an additional strain on the fire service. The SAFER grants amounted to $3,466,660 and $3,252,213 in FY2013 and FY2014, respectively.

The amended FY2015 budget for the Flint Fire Department consists of $351,700 in revenues and $11,408,195 in expenditures, netting an overall expenditure of $11,056,495. With the SAFER grant, the department's revenues in FY2013 and FY2014 were $3,611,560 and $3,482,101, respectively. The department had expenditures of $15,006,679 and $15,952,009 in FY2013 and FY2014, respectively, for a net expenditure of $11,395,119 in FY2013 and $11,304,209 in FY2014. Comparing these figures shows that the department succeeded in reducing its expenditures to accommodate the loss of the SAFER grants by reducing personnel and browning out fire stations.

[17] IAFF FireFighters, "Economic Decline Threatens Staffing, Benefits." http://www.iaff.org/about/GP/jf03.html.

Fire Risk Perspective

Demand for Service

Demand for fire and EMS response is a key component in the staffing and deployment decision-making process. Staffing to meet demand, either by geography or by peak demand periods, is an important consideration. It is essential this component be monitored and reviewed on a regular basis to ensure staffing and deployment of resources are adequately meeting demand, and the most appropriate resources are being deployed.

Figure 10 illustrates the time of day that calls are occurring in Flint while Table 1 depicts call types. Figures 12 and 13 illustrate demand and the distribution of fire and FFD first response EMS incidents occurring during the study period. Fire demand is most concentrated in the central, south central and northwestern areas of the city.

Overall, the FFD responded to 4,271 total calls for service during the study period (July 1, 2013-June 30, 2014). Of these, 1,092 or 25.6 percent were EMS responses and 2,549, or 59.7 percent, were fire responses. Call rates were highest during the day between 10:00 a.m. and midnight and peak between 2:00 p.m. and 10:00 p.m.

Figure 10: Call Distribution by Hour of Day

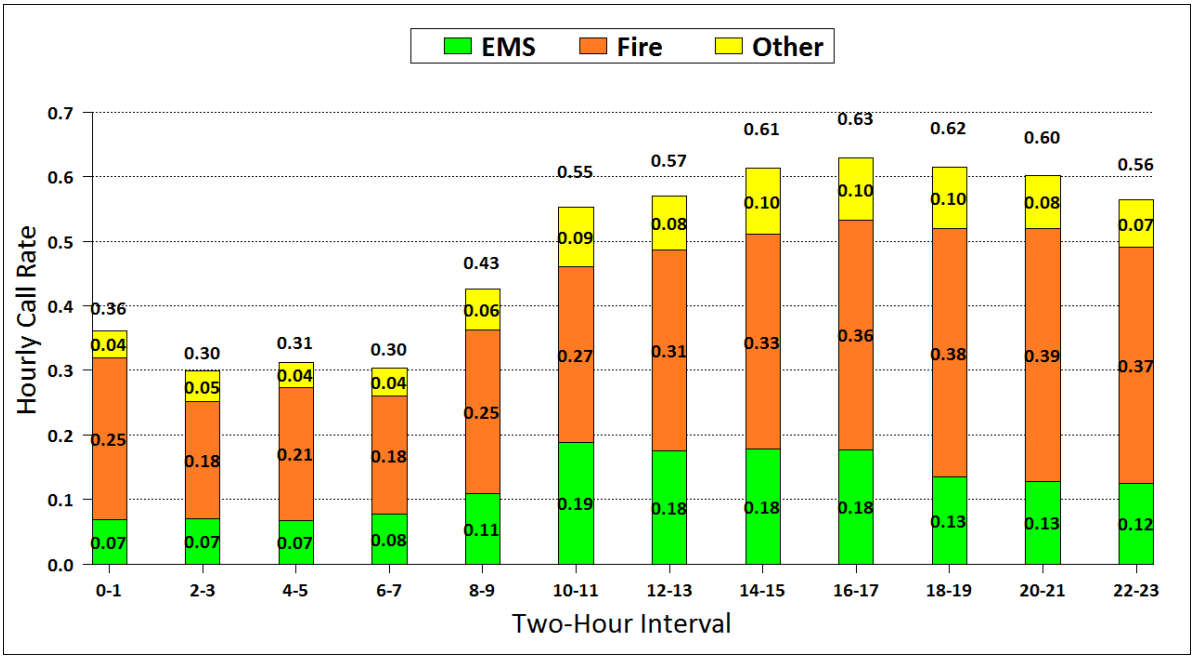


Table 1: Call Types

Call Type	Number of Calls	Calls per Day	Call Percentage
ALS	270	0.7	6.3
MVA	29	0.1	0.7
Fall and injury	154	0.4	3.6
Illness and other	224	0.6	5.2
EMS transport	415	1.1	9.7
EMS Total	**1,092**	**3.0**	**25.6**
Structure fire	537	1.5	12.6
Outside fire	246	0.7	5.8
Hazard	426	1.2	10.0
False alarm	356	1.0	8.3
Good intent	322	0.9	7.5
Public service	662	1.8	15.5
Fire Total	**2,549**	**7.0**	**59.7**
Mutual aid	5	0.0	0.1
Canceled	625	1.7	14.6
Total	**4,271**	**11.7**	**100.0**

Figure 11: Call Types by Percentage

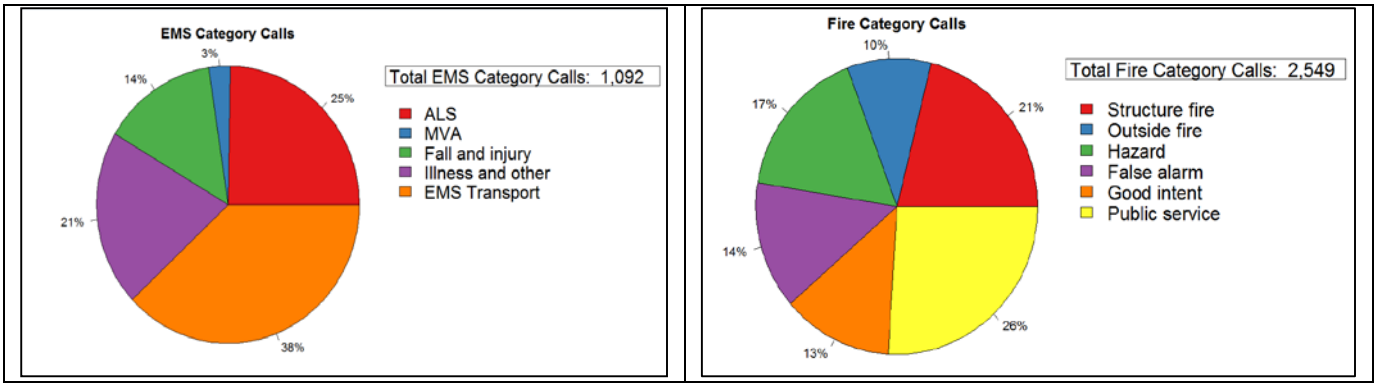
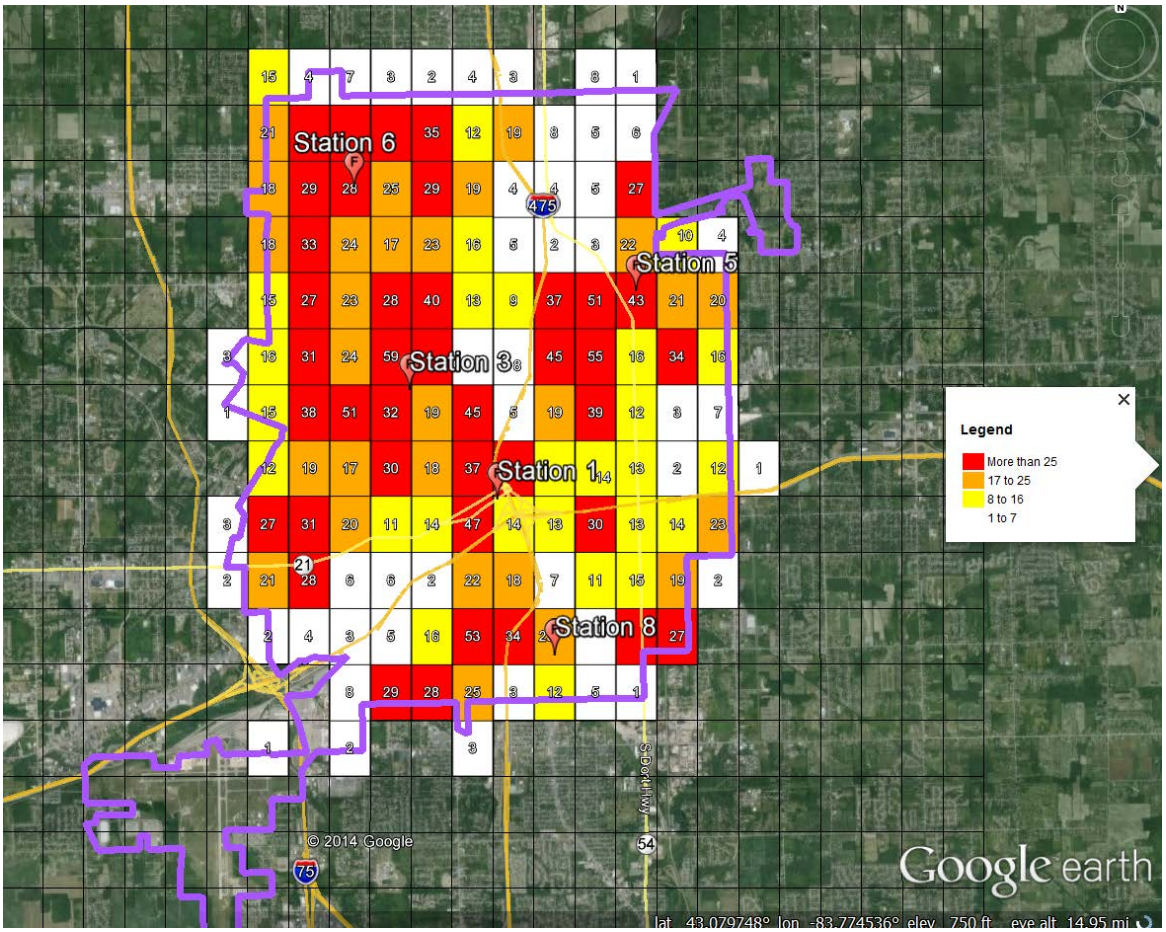


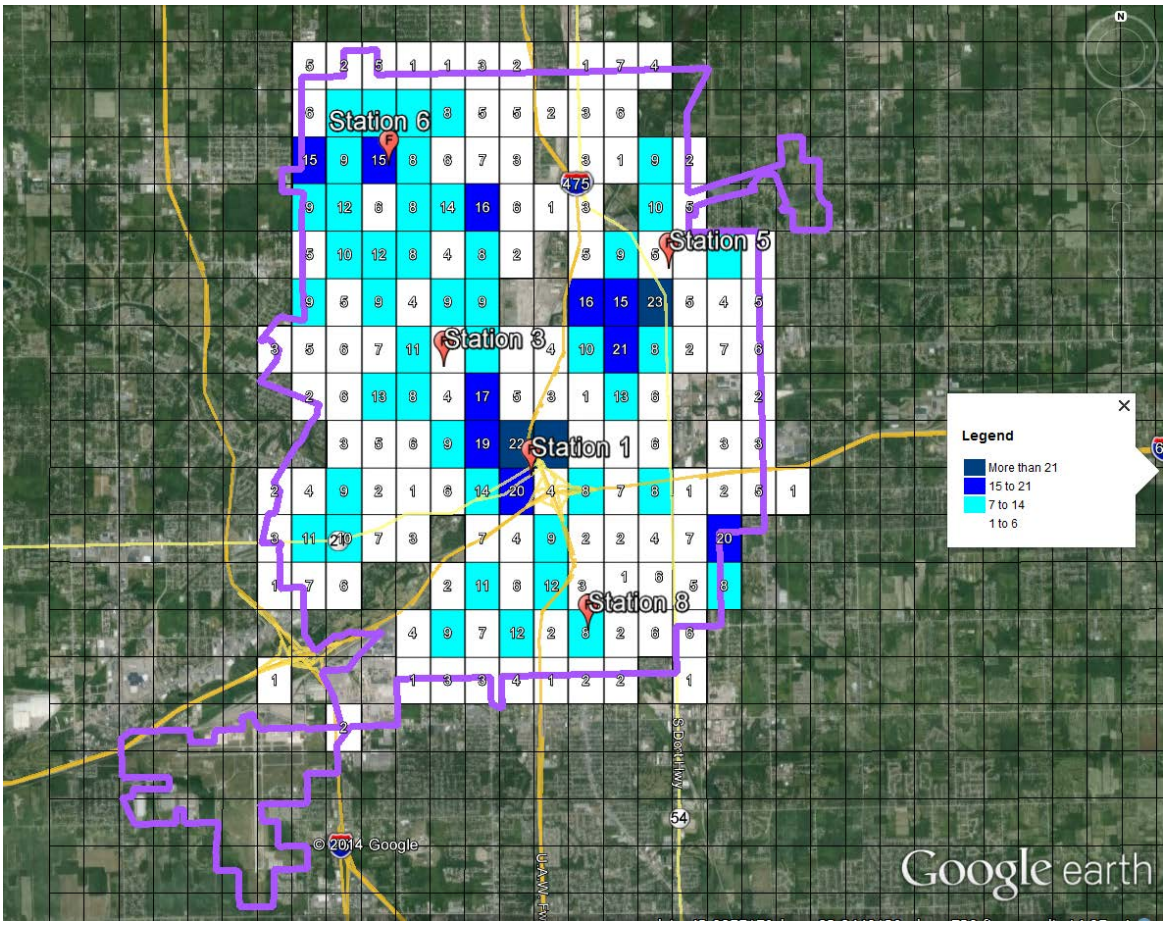
Figure 12: Fire Demand



In this map the darker the color (orange to red) the higher the concentration of calls. From Table 1 the calls are tabulated as:

Structure fire	537
Outside fire	246
Hazard	426
False alarm	356
Good intent	322
Public service	662

Figure 13: EMS Demand



In this map the darker the color (teal to blue) the higher the concentration of calls. From Table 1 the calls are tabulated as:

ALS	270
MVA	29
Fall and injury	154
Illness and other	224
EMS transport	415

City of Flint Risk and Assessing Risk

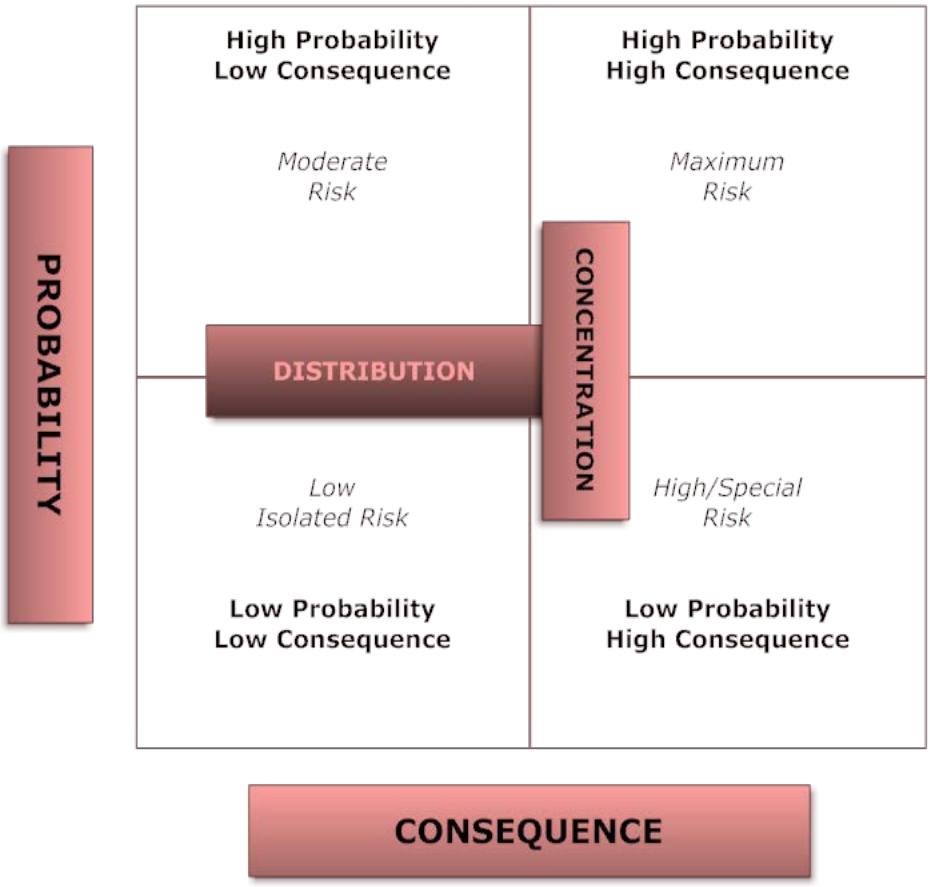
The cost of providing fire protection and EMS to a community continues to escalate; it is therefore paramount to examine the planning processes involved in providing services. Each jurisdiction needs to decide what degree of risk (such as the risk of fire) is acceptable, based on criteria that have been developed to define levels of risk in all sections of the community. To this end, a

comprehensive planning approach that includes a fire risk assessment, hazard analysis, and fire department risk management plan is essential in determining local needs.

A fire risk analysis requires several steps. As noted earlier, a fire department collects and organizes risk evaluation information about individual properties and on the basis of the rated factors can derive a "fire risk score" for each property. This is done by assessing the needed fire flow, probability, consequences, and occupancy risk. The score is then used to categorize the property as one of low-, moderate-, or high/maximum-risk. *Included in this assessment should be both a structural and non-structural (weather, wild land urban interface, transportation routes etc.) analysis.*

Again, it is essential to plot rated properties on a map as this provides a better understanding of how fire response and deployment of assets can be used to provide a higher concentration of resources for worse-case scenarios or, conversely, fewer resources for lower levels of risk (as shown in Figure 14).[18]

Figure 14: Levels of Risk



[18] *Fire and Emergency Service Self-Assessment Manual,* 49.

The following three maps illustrate a variety of different types of fire risks found in the city of Flint. The past year's fire calls are arrayed by individual fire calls and are grouped in clusters in Figure 16.

The first of the three maps (Figure 15) was developed by the city of Flint's planning department. In it, the locations of large businesses, multistory apartment buildings, schools, and private and public institutions that have been categorized as high hazards are shown. These may require pre-fire planning, evacuation planning, or a specialized fire response.

Figure 15: High-Hazard Structures

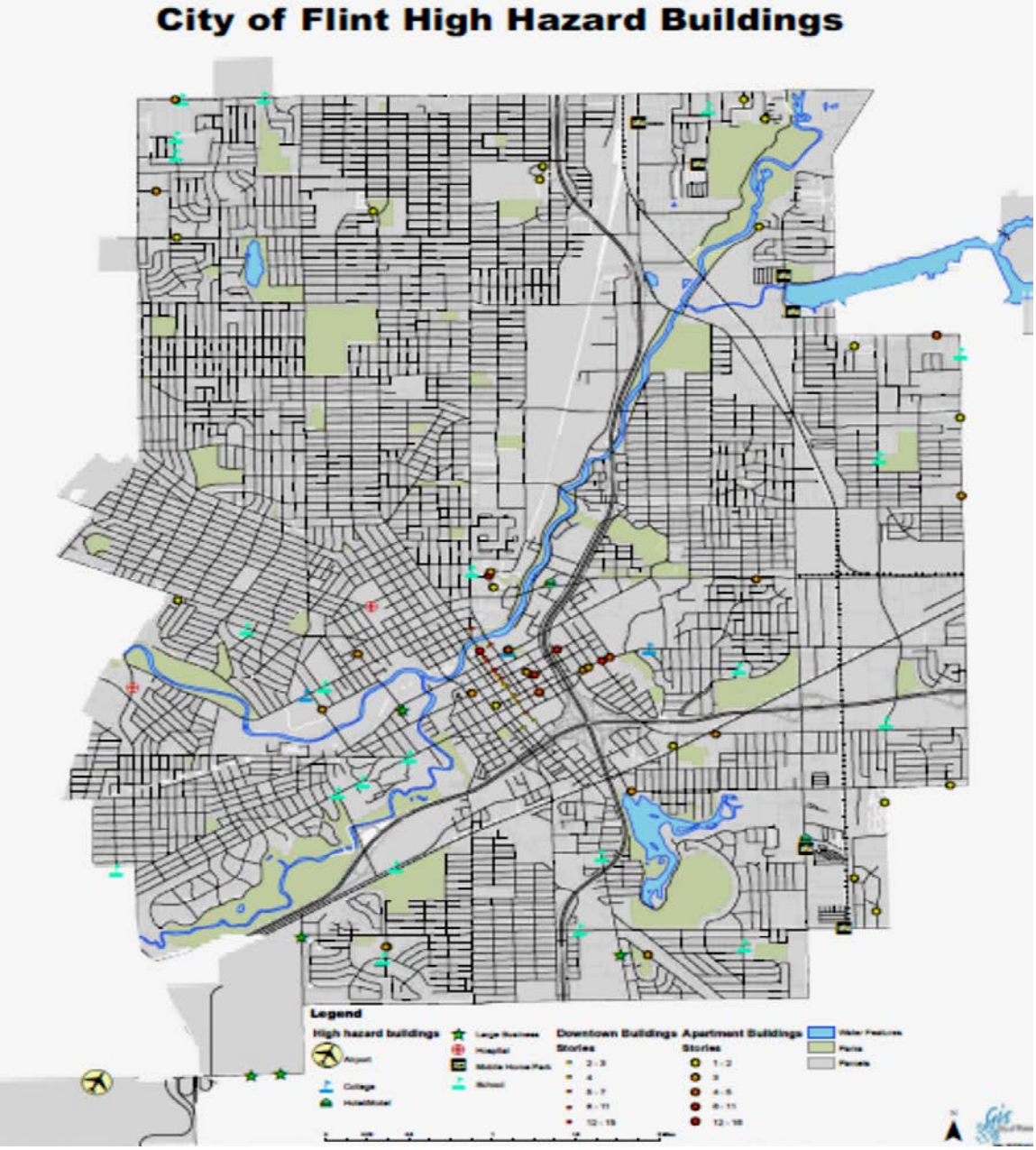


Figure 16 illustrates the three fire stations that are staffed the most (Stations 1, 5, and 6) and the individual fire calls to which the fire department has responded over the past year. Of particular note is the fact that there is a cluster of calls near each of the active stations. The underlying yellow and orange layers indicate high concentrations of vacant properties.

Figure 16: Flint Fire Calls and Active Station Locations

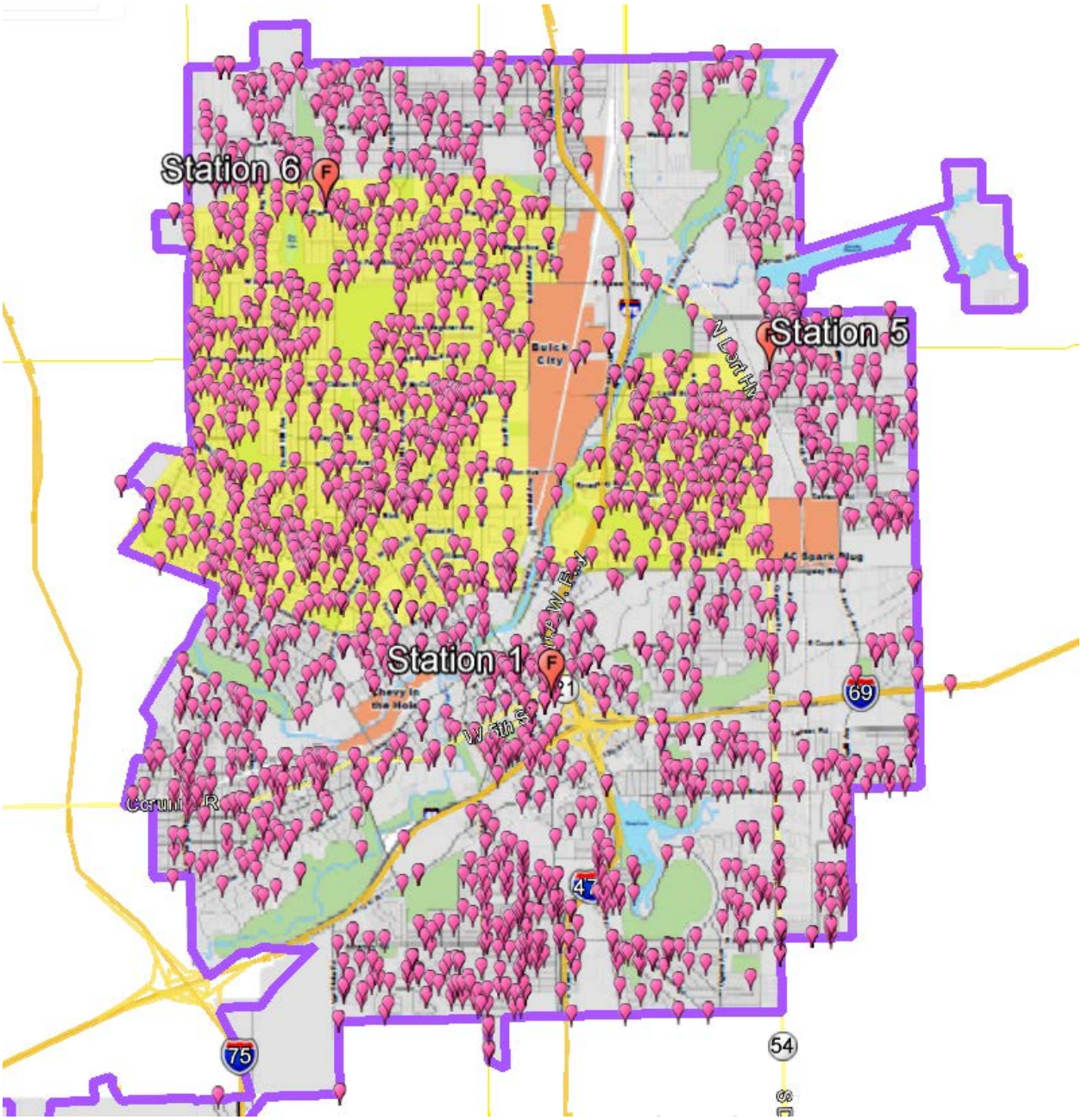
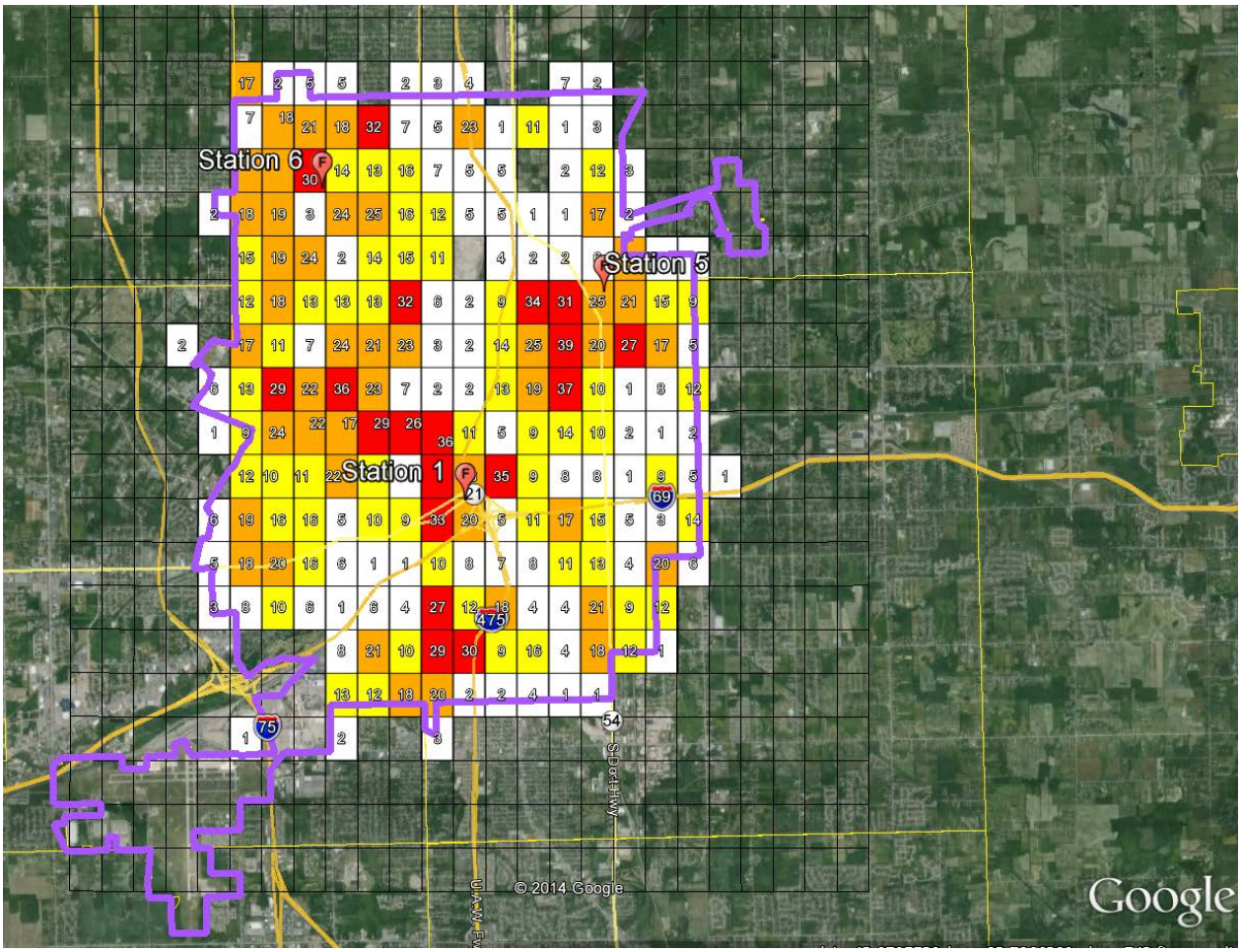


Figure 17 presents the city as a series of square blocks and displays the number of fire calls in each block. This makes the fire call clusters illustrated in Figure 16 somewhat clearer. Again, only the three stations that are open the majority of the time are plotted. It should be noted that there are a high number of calls near the southern portion of I-475. This response area is normally allotted to the almost always browned-out Station 8.

Figure 17: Flint Fire Calls by Cluster Blocks



In addition to examining risks faced by the community at large, the FFD needs to examine internal risks as part of an ongoing effort to protect all assets, including personnel, resources, and property. The National Fire Protection Association annually produces a report on firefighter injuries due to variety of causes such as fire ground injuries and fire vehicle accidents.[19] The cost of these injuries to first responders is a major burden for communities across the United States.

The concept of identify and mitigating risk is not new to the fire service and can be an excellent tool for strengthening existing health and safety guidelines. The National Fire Protection Association's *Standard for a Fire Department Occupational Safety and Health Program* (NFPA 1500) requires the

[19] Michael J. Karter, Jr. and Joseph L. Molis, U.S. Firefighter Injuries 2013, National Fire Protection Association, November 2014, http://www.nfpa.org/~/media/Files/Research/NFPA%20reports/Fire%20service%20statistics/osffinjuries.pdf.

development of a separate risk management plan for fire departments; that is, separate from those incorporated in a local government plan.[20]

The risk management plan establishes a standard of safety for the daily operations of the department. This standard of safety establishes the parameters within which the department should conduct all activities during emergency and nonemergency operations. The intent is for all members of the department to operate within this standard or plan of safety. The following framework provides a broad outline of an internal risk management plan, as shown in Figure 18.

Risk identification: Actual or potential hazards.

Risk evaluation: The potential of occurrence of a given hazard and the severity of its consequences.

Prioritizing risk: The degree of a hazard based upon the frequency and severity of occurrence.

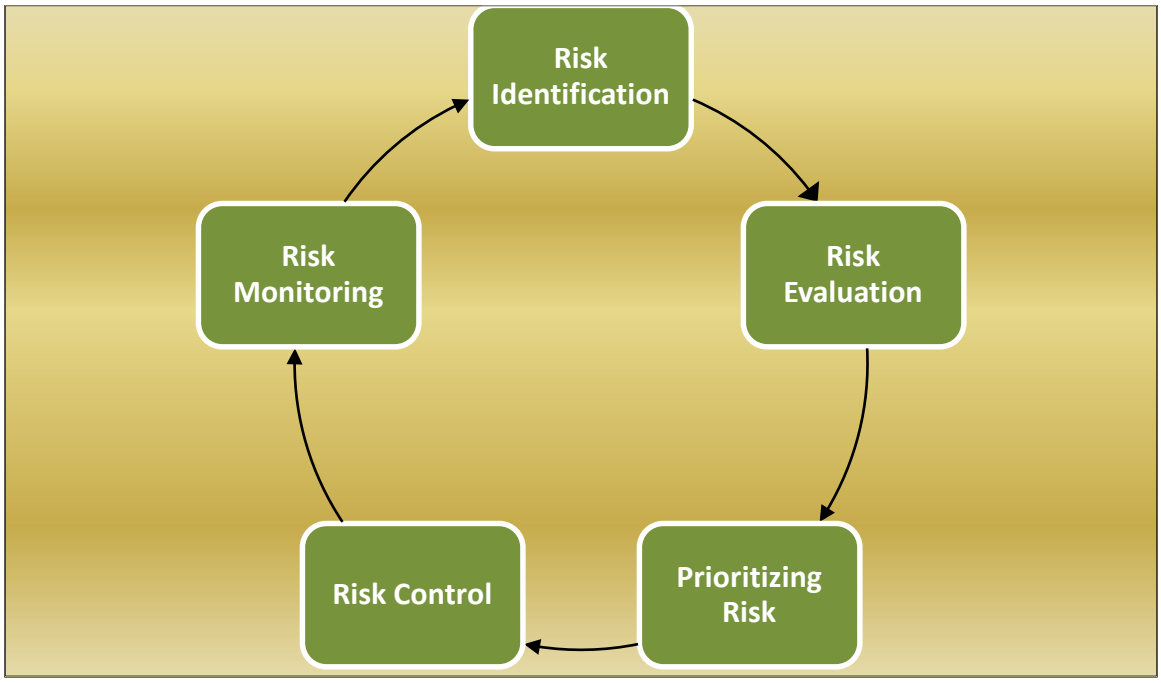
Risk control: Solutions for eliminating or reducing real or potential hazards by implementing an effective control measure.

Risk monitoring: An evaluation of the effectiveness of risk control measures.[21]

As illustrated by Figure 18, risk management planning is an ongoing process in which monitoring informs the identification of new risks or changes in the levels of risk.

[20] Robert C. Barr and John M. Eversole, eds., *The Fire Chief's Handbook*, Sixth Edition (Tulsa, OK: PennWell Books, 2003), 270.
[21] NFPA 1500 (2007). *Standard for a Fire Department Occupational Safety and Health Program, Annex D*.

Figure 18: Steps of an Internal Risk Management Plan



The Flint Fire Department has not completed an internal risk assessment nor does it have a written internal risk management plan other than that which deals with vacant structures. In addition, the department has not reviewed in over a decade its Standard Operating Guidelines, which prescribe specific tactical fire ground operations. As already documented CPSM recommends the FFD complete a fire risk assessment. This should be a priority activity. This assessment should be done in conjunction with an effort to identify, plot, and analyze each high-hazard risk in the city. CPSM further recommends the department develop and implement an internal risk management plan beyond that of a vacant structure guideline and which follows the standards of NFPA 1500, Standard for a Fire Department Occupational Safety and Health Program.

The Insurance Services Office Community Grading Schedule

A community's Insurance Services Office (ISO) Public Protection Classification (PPC) is an important economic development tool. Along with the quality of schools, demographics of the population, and other criteria, the community PPC is often an important criterion used by companies and organizations looking to relocate or expand to a new community.

The PPC is a community classification, and not a classification of the fire department. However, the fire department plays an important role in this score. A large percentage (40 percent) of the classification is based on a community's water supply. When water is not accessible or when it cannot be delivered to an area within five road miles of the nearest fire station, the second ISO classification is usually a 9 or 10 (a 10 is the worst classification a community can receive). As this is a contributing factor in Flint's ISO score, the city planning and fire departments need to identify

location(s) where these problems exists (water distribution) and look for ways to ameliorate or eliminate the risk through the redeployment of resources or a contractual arrangement or mutual aid agreement with a neighboring jurisdiction.

The city of Flint's last Insurance Services Office (ISO) Community Grading Schedule evaluation was completed in 2010, when the city received a community rating of 5/10. Since then, several changes have been made in the ISO evaluation criteria. ISO began using its new Community Grading Schedule at the end of 2012. A review of the new schedule and the deficiencies found in the 2010 report, many of which have not been addressed, should provide considerable assistance to the city to improve its current grade.

Some significant changes made recently to the ISO grading schedule focus attention on areas that have been proven effective in fire suppression, as well as on fire prevention, public fire education, and fire investigation. The grading schedule also has been revised to align the schedule's requirements to nationally accepted standards. The revised grading schedule makes increased reference to the national consensus standards of the National Fire Protection Association (NFPA), American Water Works Association (AWWA), and Association of Public-Safety Communications Officials International (APCO).The new schedule recognizes proactive efforts to reduce fire risk and frequency.

The ISO schedule continues to evaluate three major categories of fire suppression: fire department, emergency communications, and water supply. In addition, it includes a new community risk reduction section that recognizes community efforts to reduce losses through fire prevention. The addition of the new risk reduction section represents a major shift in emphasis in the grading schedule, giving incentives to communities that strive to reduce fire severity proactively through a structured program of fire prevention activities. Examples of fire prevention programs include wildland-urban interface ordinances, certificate of occupancy inspections, and inspections of fire prevention equipment.

The fire department section, which carries a 50+ weight in the schedule's grading, now recognizes fire departments that use various methods to solve the critical issues of economic constraints and firefighter recruitment and retention. The schedule provides additional credit for automatic-aid personnel and equipment, including an increase in the automatic-aid factor for fire departments that operate with common fireground procedures. In addition, the schedule offers credit to fire departments that develop and use standard operating procedures and incident management systems.

The schedule considers a fire department's deployment analysis, based on NFPA 1710, as a potential alternative to the ISO's traditional road-mile distribution. This criterion establishes optimal distances for standard response districts around each fire station of 1.5 road miles for an engine company and 2.5 road miles for a ladder service company. The new ISO schedule shifts the emphasis away from the number of apparatus and equipment carried to the proper deployment of those resources.

The ISO uses a fire risk analysis based on the ability of a fire department to bring a certain volume of water (fire flow) to a structural fire within a certain time frame that is presumed by an optimal

distance (road-mile distribution). In the 2010 Flint ISO report, this risk analysis is based on five listed structures located in the city. As the fire department reviews its deficiencies in order to improve its next grading it should evaluate the fire flow needs of these structures in correlation with its current resource deployment.

The ISO has modified the apparatus equipment list to include only items specified in NFPA 1901. This change better aligns the schedule with consensus standards and allows additional flexibility to revise the equipment lists if there are significant changes to NFPA 1901.

While the total credit points for the existing major categories remain unchanged, there have been changes that increase or decrease the point weights for some sections.

The total credit points remain as they were prior to the 2012 changes, namely:

- Fire Department: 50+ points
- Emergency Communications: 10 points
- Water Supply: 40 points.

The community risk reduction section has a weight of 5.5 points, resulting in a revised 105.5+ available points. The inclusion of the new section with its extra points allows recognition of communities that include effective fire prevention practices.

As improvement can be made in the next ISO evaluation, CPSM recommends the fire department review the new ISO rating schedule and its 2010 rating to identify areas of weakness and where improvement can be made, with a focus on enhancing the overall ISO PPC rating, which also translates to improved service delivery.

Target Hazards and Vacant Structures

The many abandoned buildings in Flint pose a threat to responders. NFPA statistics show that vacant buildings account for a high percentage of firefighter injuries. In 2007 the FFD assessed the risk of vacant and abandoned buildings to fire personnel and found that such structures represent the largest source of injuries to Flint firefighters. The report concluded that vacant structure fires represented 40 percent of the department's structure fire volume; that the department's injury rate at fires exceeds the national average; and that 62 percent of the department's fire ground injuries occurred at vacant structure fires. Moreover, 93 percent of the cost of injuries at fires in vacant structures occurred in buildings that were unsecured when firefighters arrived.[22] The overwhelming numbers of abandoned buildings that receive offensive attacks are vacant, have been condemned, and/or are scheduled for demolition. The hazards include poor structural integrity, advanced fire conditions due to the use of accelerants, large amounts of trash and debris, entanglement and entrapment hazards, discarded drug paraphernalia, vermin, and many other

[22] Andy Graves, "Vacant Structure Fires and Firefighter Injuries in the City of Flint, April 2006–April 2007," City of Flint Fire Department, June 2007, page 1. (http://www.cityofflint.com/fire/pdf/FFD%20Injuries%20at%20Vacant%20Structure%20Fires.pdf).

challenges.[23] "Flint firefighters have most often been injured during offensive attacks in abandoned structures that were unsecured upon their arrival," concludes the 2007 report.[24]

Based on these findings, the department clarified its policy regarding fires at abandoned and vacant buildings. The policy defined an abandoned building as "a property that has no legal occupants and is neglected with no efforts made to preserve its value or condition." A vacant building was defined as "a property that has an owner but no permanent occupants, with reasonable efforts being made to preserve its value and condition." The department's policy emphasizes that no level of firefighter risk is acceptable when there is no chance of saving lives or property. "When there is no ability to save lives or a salvageable property, there is no justification to expose fire department members to any avoidable risk and defensive fire suppression efforts are the appropriate strategy," confirms the 2007 report.[25] The department advocates rapid interior attacks only in situations of acceptable risk to firefighters.

In 2012, a follow-up study was undertaken to assess the effectiveness of Flint's abandoned building policy. In keeping with the policy, offensive attacks at vacant and abandoned buildings decreased, while defensive and transitional operations increased. The results of the study, which compared the injury rates before and after the new policy was put in place, illustrate the effectiveness of the new risk management policy. Although there was no significant difference in the number of injuries before and after the policy was implemented (76 in the five years before the policy; 79 after), there was a significant change in the frequency and severity of these injuries. According to the follow-up report, the 76 injuries before the 2007 policy cost a total of $236,905; the total cost of the 79 injuries after the policy was $137,367. In an article reviewing results, the study concludes, "The drastic reduction in the cost of complete work restriction time while structure fire volume dramatically increased illustrates the effectiveness of the policy."[26]

[23] Graves, "Vacant Structure Fires and Firefighter Injuries in the City of Flint, April 2006–April 2007," page 2.
[24] Richard Dicks, Memorandum, August 28, 2007. http://www.cityofflint.com/fire/pdf/FFD%20Abandoned%20Building%20Policy.pdf.
[25] Dicks, Memorandum.
[26] Andrew Graves, "Abandoned Building Policy: Five Years Later," *Fire Engineering* (June 23, 2014). http://www.fireengineering.com/articles/print/volume-167/issue-6/features/abandoned-building-policy-five-years-later.html.

Fire Prevention/Investigation

Fire suppression and response, although necessary to protect property, have little impact on preventing fire deaths. Rather, public fire education, fire prevention, and built-in fire protection systems are essential elements in protecting citizens from death and injury due to fire, smoke inhalation, and carbon monoxide poisoning. The new 2012 edition of the Insurance Services Office (ISO) Community Grading Schedule now gives a fire department credit for fire prevention, public fire and life safety education, and code enforcement.

Fire prevention, public fire safety education, and fire investigation services in the city of Flint are managed as part of the fire department's seven-person administration section. These services are conducted by two fire prevention personnel. Until April 2014, when the previous fire marshal retired, a fire marshal with the assistance of a lieutenant was responsible for fire prevention, public education, and fire investigations. Since then the lieutenant, who previously reported to the fire marshal, has been in charge of fire prevention, assisted by of a recently appointed sergeant. The lieutenant reports directly to the fire chief.

The lieutenant is fully qualified to lead fire prevention. In addition to his fire prevention experience, he has qualifications as a state certified fire inspector. He also has state certifications as a fire investigator I, with training in fire cause and origin, and fire investigator II, with training in advanced investigative techniques such as arc mapping and in providing expert courtroom testimony. The sergeant who reports to the lieutenant has some previous volunteer experience in fire public education, and is currently being trained by the lieutenant in fire prevention and code enforcement. A recommendation on additional and more focused work for this position was discussed previously in the section of this report on recommended FFD reorganization.

The FFD fire prevention unit has the responsibility for fire inspections, public fire and life safety education, and fire investigations for the city. The Flint City Council recently adopted the new 2015 edition of the International Fire Code. The bureau's inspection responsibilities include reviewing fire code adoption and compliance; issuing permits for fire protection systems; SARA Title III inspections; conducting plan reviews for new construction and building renovations; and conducting license renewal inspections and inspections for fire work displays and special events.

In 2014, the fire prevention unit conducted 198 license renewal inspections, including five to fifteen liquor license inspections per year. There were approximately 200 additional inspections conducted at businesses or occupancies that did not require an annual city license inspection. In 2013, the fire prevention unit began annual inspections of municipal and state properties within the city. These inspections included the 67th and 68th district courts, the Michigan Department of Social Services, Michigan Health Department, and the Flint Housing Commission. In addition, the bureau completes an average of about 25 plan reviews per year. ***CPSM found that the fire prevention unit still uses a paper-based system to track and record its inspections, violations, and corrective actions; this creates inefficiency and ineffectiveness. It is recommended the fire prevention unit transition to an efficient, automated records management system for fire prevention and code enforcement activities.***

Public safety education has always been a priority of the fire prevention unit. During the 2013-2014 school year the bureau personnel taught fire safety education classes to more than 10,000 elementary-age students. Most of these students were enrolled in Flint community schools and were taught with the use of the FPB Fire Safety House. In addition, the fire prevention unit holds annual Fire Prevention Week activities that reach an additional 800 children and 100 adults. The students interact with department's firefighters, receive basic first aid training, learn how to escape a house fire in the Fire Safety House, or are taught fire safety lessons in a classroom setting.

Fire safety is also taught to more than 1,300 high school students at community outreach programs such as summer safety fairs, back-to-school rallies, job/career fairs, and speaking engagements. During the summer months approximately 8,000 additional citizens are reached annually at various public events including approximately 500 citizens during a safety fair held at the University of Michigan-Flint. Finally, fire prevention unit personnel taught fire safety classes and held fire drills at three to four senior living community apartments. The average attendance at each of these classes is 35 to 40 senior citizens.

Smoke alarms are a critical factor in saving thousands of lives from fires nationally every year. Without properly installed and working smoke alarms, fire victims usually die of smoke inhalation before structural fires are reported to fire departments or before first responders are able to arrive on the scene.

The FFD and the fire prevention unit received approximately 500 smoke alarms during the 2014 Fire Prevention Week from the National Hockey League's Detroit Red Wings hockey organization. The team, in partnership with Comerica Bank, annually supplies the city of Flint with the smoke alarms. Each year, FPB representatives, along with personnel from other fire departments from around the state of Michigan, travel to Detroit, meet with members of the Red Wings organization, and receive the donated smoke alarms to be taken back to their respective cities.

The fire prevention unit also investigated 110 arson fires in 2013. The fire prevention unit provides cause and origin determinations on all structural fires and when arson is suspected the bureau works closely with the Flint police department to resolve the investigations. The bureau also works cooperatively with Hurley Medical Center on a juvenile fire setter program.

Operational Analysis

Operational Staffing and Deployment

Current Staffing and Deployment

The FFD operational staffing personnel work 24 hours on duty and are off for 48 hours. With this staffing configuration there are three shifts or platoons. As discussed, the FFD has sixty-eight personnel assigned to fire operations; with a sixty-ninth added under the proposed new organizational chart (CPSM supports this addition to fire operations). Under the sixty-nine person operational staffing model, this distributes twenty-three personnel equally to each shift.

The FFD operates out of five stations (stations 1, 3, 5, 6, and 8). In reality and due to budget constraints, the FFD predominantly operates out of three stations (1, 5, and 6). Station 8 is unmanned generally every day according to staff, while station 3 is browned out almost every day. Typically then, the following units are available to respond:

- Station 1: Truck 15 (75-foot Quint)[27] – **Staffing of 3**.
  - Squad 1 (no fire pump or hose; carries technical equipment) – **Staffing of 2**.
  - District Commander – **Staffing of 1**.
- Station 5: Engine 51 – **Staffing of 3**.
- Station 6: Engine 61 **Staffing of 3**.
  - Squad 2 when station 3 is closed (no fire pump or hose-carries technical equipment) – **Staffing of 2**.

Total committed staffing when three stations are open: 14.

If station 3 is open, the following apparatus is added:

- Station 3: Truck 35 (75-foot Quint) – **Staffing of 3.**

Total committed staffing when four stations are open: 17.

As there are twenty-three personnel assigned to each shift, the question then must be raised "Why are there typically only three stations open?" During the on-site visit CPSM learned there were nine personnel assigned to fire operations who were off the front-line for disciplinary reasons and various workers' compensation injuries or illnesses — or an average of three per shift (the equivalent of one engine company). In addition to this, each person assigned to fire operations receives a twenty-four hour shift off (known as a Kelly day) in a 28-day rotational cycle.

[27] A Quint is a firefighting apparatus that carries hose, water, a fire pump, ground ladders, and a hydraulic aerial ladder that delivers an elevated master stream.

More specifically, the FFD operates on a 28-day work cycle under the Fair Labor Standards Act (FLSA)-29 USC §207(k). Under the FFD's schedule and work cycle, the average workweek is 56 hours, or 224 hours in a 28-day cycle [56 hours a week x 4 weeks (28 days)]. The maximum number of hours under 29 USC §207(k) a firefighter can be scheduled is 212 hours in a 28-day cycle [53 hours a week x 4 weeks (28 days)]. Any time worked over 212 hours by a nonexempt fire employee is mandated under 29 USC §207(k) to be paid at premium pay rate, or 1-1/2 times the hourly rate.

Under the current schedule deployed by the FFD, nonexempt fire operational personnel average 50.4 hours of work per week [(224-24=200/4=50)(Flint averages 50.4 hours; 200.77 hours in a 28-day cycle; 2,616 hours per year)-*For presentation purposes CPSM rounds to even numbers*)] . Additionally, any time worked over the average workweek or in excess of 200 hours in a 28-day cycle by a nonexempt fire operational person is paid at 1-1/2 times the hourly rate. As hours worked in excess of the average 50 hours/week and between 200 and 212 hours in a 28-day cycle are paid at the premium hourly rate, the city of Flint is in excess of what can be implemented and managed under 29 USC §207(k). Generally, fire departments that deploy a schedule similar to Flint's implement a Kelly day to cover only those hours required to reduce scheduled hours below the mandated threshold (in this case 212 hours, or an average 53-hour workweek).

The current FFD schedule is inefficient and diminishes the effectiveness of service delivery, in that fire operational employees can be scheduled off for an additional twelve hours a month (that is, they receive a 24-hour Kelly day instead of a 12-hour Kelly day). This has a negative effect on overall available staffing and drives up overtime. The additional twelve-hours per employee per 28-day cycle adds approximately 10,764 hours of additional time off per year (69 operational staff x 12 hours x thirteen 28 day cycles = 10,764 hours) that then needs to be covered by other personnel. According to staff, not all of this time can be covered by extra staffing or overtime, which leads to stations being put out of service. ***CPSM recommends that, in accordance with 29 USC §207(k), the city of Flint and the FFD discuss and bargain (if required and or necessary) a 53-hour a week schedule (212 hours in a 28-day cycle), which will reduce the Kelly day to 12-hours per employee in a 28-day cycle. CPSM further recommends that premium pay be paid only after the scheduled 212 hours have been reached, and that productive (actual scheduled hours worked) and nonproductive time (leave/vacation of all types) be calculated in accordance with 29 USC §207(k) to maximize efficiencies regarding overtime.***

Staffing Factor

According to the FFD, it employs sixty-nine full time firefighters who are assigned to one of three platoons and are scheduled on a 24-hour shift. Each platoon works approximately ten shifts per month. The standard rotation is one shift on and two days off. While there are additional or "overstaff" positions rostered to maintain some minimum staffing and reduce overtime (three or two, depending on the apparatus), due to employee absences resulting from scheduled or unscheduled leave, or other causes such as workers' compensation leave and discipline-driven vacancies, the additional staff are not always available. This results in browning out of stations. The FFD operates then with a "constant staffing" methodology. This staffing method requires overtime to staff vacant full-time positions to maintain minimum staffing.

Through the development of a staffing factor, the FFD can better plan the fiscal impacts of maintaining minimum staffing by maximizing current staff, calculating overtime, or developing alternative staffing methodologies to fill minimum staffing vacancies.

The staffing factor calculation is: $\textbf{staffing factor} = \frac{\textbf{hours per year of operation}}{\boldsymbol{E}}$

and where $E = P - A$, with

E = the number of effective hours per employee per year or hours actually worked.
P = the number of paid hours per employee per year.
A = the average number of hours of paid absences per year per employee.

As noted, there are sixty-nine full time career positions assigned to shift operations. For a one year period (July 1, 2013 to June 30, 2014) the number of paid hours scheduled/worked per operational employee for this period was 2,616 hours. This totals 180,504 hours for all operational employees. During this same time period, all operational employees (84 total) aggregately utilized 73,495 hours of all categories leave (personal, vacation, sick, Kelly day, workers' comp, light duty, etc.),[28] which created staffing vacancies. Utilizing the staffing factor formula above,[29] we can then calculate:

P = 2,616
A = 875 [average 73,495/84=875; avg. 73,495-13,125 (15 less employees)=60,370/69=875]
P – A = 1,741
E = 1,741

$$\textbf{Staffing factor} = \frac{2{,}616}{1{,}741} = \textbf{1.50}$$

Therefore, it requires the equivalent of one full-time and 0.50 of a full-time employee, or an equivalent combination of full-time and overtime staff/funding, to fill each position per twenty-four hour shift, or aggregately 21 personnel utilizing a three-station deployment model (14 total staff x 1.50), or 25.5 personnel utilizing a four-station model (17 total staff x 1.50). ***Utilizing this staffing factor formula, the FFD can better determine a more accurate staffing and overtime budget, or for developing future budgetary alternatives for "overstaffing" to reduce overtime costs.***

By reducing the Kelly day by twelve hours as discussed above, 10,764 hours can be subtracted from the aggregate leave hours number (60,370 - 10,764=49,606), which would give an employee leave-taken average of 719 hours (49,606/69). Thus, the staffing factor is reduced to:

P = 2,616
A = 719
P – A = 1,897
E = 1,897

$$\textbf{Staffing factor} = \frac{2{,}616}{1{,}897} = \textbf{1.38}$$

[28] FFD-provided information.
[29] David Ammons, *Tools for Decision Making,2nd edition,* (Washington, DC: CQ Press, 2009), 229-230.

Utilizing these averages, it would then require the equivalent of one full-time and 0.38 of a full-time employee, or a combination of full-time and overtime staff, to fill each position per 24-hour shift, or aggregately 19.32 personnel utilizing a three-station deployment model (14 total staff x 1.38), or 23.46 personnel utilizing a four-station model (17 total staff x 1.38). ***Utilizing this staffing factor formula, the FFD can potentially — barring numerous long-term vacancies — staff more than three stations on a more regular basis.***

Staffing Alternatives

To ensure adequate staffing, to the department must first ensure that staffing is properly managed. As discussed above, staffing shortfalls are exacerbated by the current 24-hour Kelly day system. A second factor is the number of staff assigned to light duty or who are off the operational line due to service-connected injuries or illness. At the time of the CPSM on-site visit there were nine employees (13 percent of the fire operational workforce), or an average of three per shift (the equivalent of one engine company), assigned to workers' comp leave. Further broken down, of the 73,495 hours of leave taken in the one-year period in records provided to CPSM by the FFD, 15,184 hours (21 percent) were utilized for sick leave; 22,490 hours (31 percent) were used for vacation; 6,016 hours (8 percent) were utilized for workers' comp leave; 3,500 hours (5 percent) were utilized for light duty; and 22,024 hours (30 percent) were utilized for Kelly day leave.

In the short term, and dependent on available daily staffing, one staffing alternative is to staff three stations around the clock and one station (one unit) during a 12-hour peak demand time. Peak demand time in Flint runs from 10:00 a.m. to midnight, with peak load between the hours of 2:00 p.m. and 10:00 p.m. The best utilization of staffing and deployment in this scenario is to staff the fourth station between the hours of noon and midnight. Deployment of apparatus in this staffing model would include: two Quints and one engine apparatus around the clock (minimum staffing of three each): two squads around the clock (minimum staffing of two each); one district commander around the clock (minimum staffing of one); and one peak-load engine from noon to midnight (minimum staffing of three). This model requires fourteen personnel around the clock and three personnel *if staffing allows* during a 12-hour peak load time, for a total of seventeen personnel per shift.

In the long term, and once staffing is managed so that assigned personnel are available for duty, and a staffing factor has been further evaluated and implemented, a second alternative is to staff and deploy from a minimum of four stations around the clock. Travel times depicted in this report and actual demand for service are the drivers for this consideration. Deployment of apparatus in this staffing model would include: two Quints and two engine apparatus around the clock (minimum staffing of three each): two squads around the clock (minimum staffing of two each); and one district commander around the clock (minimum staffing of one). This model requires seventeen personnel around the clock. Utilizing the staffing factor of 1.38 as discussed above, this requires 23.46 personnel per shift per day, which is slightly above the parameter of the twenty-three staff per shift as currently assigned and funded. This does not mean that there will be no overtime needed, as additional vacancies may occur due to unplanned short- and long-term issues. Utilizing a staffing factor, however, enables the department to better plan and prepare for what staffing is needed to staff a given deployment model as well as what additional overtime may be needed to sustain the model.

Current Station and Response Time Analysis

This section discusses response time from current stations, which will assist in the overall discussion of what stations should be staffed with the available staffing each day. Response time and travel time from each station, when coupled with demand for service, are the appropriate drivers for making deployment decisions.

Dispatch time is the time interval that begins when an alarm is received at the communication center and ends when the response information begins to be transmitted via voice or electronic means to the emergency response facility or emergency response units in the field. *Turnout time* is the time interval that begins when the notification process to emergency response facilities and emergency response units begins by an audible alarm or visual announcement or both and ends at the beginning point of travel time. ***The fire department has the greatest control over these segments of the total response time.*** *Travel time* is the time interval that initiates when the unit is enroute to the call and ends when the unit arrives at the scene. Response time (or total response time) is the time interval that begins when the call is received by the primary dispatch center and ends when the dispatched unit arrives on the scene to initiate action.

According to NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments, 2010 Edition*, where the primary public safety answering point is the communications center the alarm processing time or dispatch time should be less than or equal to 60 seconds 90 percent of the time.[30] This standard also states that the turnout time should be less than or equal to 80 seconds for fire and special operations 90 percent of the time, and travel time shall be less than or equal to 240 seconds for the first arriving engine company 90 percent of the time. The standard further states the initial first alarm assignment should be assembled on scene in 480 seconds 90 percent of the time. NFPA 1710 response time criterion is utilized by CPSM as a benchmark for service delivery and in the overall staffing and deployment of fire departments, and is not a CPSM recommendation, which is discussed further in this report.

A more conservative and stricter measure of total response time is the 90th percentile measurement. Simply explained, for 90 percent of calls, the first unit arrives within a specified time, and if measured, the second and third unit. Table 2 depicts average dispatch, turnout, travel, and total response times of first arriving FFD units for fire and EMS category calls. Table 3 depicts the 90th percentile response time (NFPA 1710 benchmark).

Empirical research has found that there is no clinical distinction between response times under eight minutes and those over eight minutes until the response time was less than four minutes for EMS services.[31] Similarly, research has found that there are improved patient survival rates for a

[30] NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments*, 2010 Edition, (Quincy, MA: National Fire Protection Association), 7.
[31] P.T. Pons, et. al. (2005). Paramedic response time: does it affect patient survival? *Academic Emergency Medicine,* 12(7), 594-600.

response time of less than five minutes but no statistical distinction in patient survival rates for response times greater than five minutes, and in this study, up to 10:59, 90 percent of the time.[32]

Research into the response times for the EMS role in trauma supportive care revealed similar results. In one study, the efficacy of the eight-minute response standard was researched and it was found that exceeding the eight-minute recommendation did not have a statistically significant impact on patient survival after traumatic injury.[33] In other words, whether units responded in less than or greater than eight minutes, patient survivability due to trauma did not change. Similarly, a study examined the EMS role in the "golden hour" for traumatic care; the study looked at 146 EMS agencies transporting to 51 Level 1 and Level 2 trauma centers across North America. Results found that there was no association between EMS intervals and mortality among injured patients with physiologic abnormality in the field.[34]

Currently, there is no empirical evidence recommending an optimal response time for fire suppression efforts. In addition, there is no empirical evidence linking response times to specific outcomes. Scientifically, it is known that fire grows rapidly and thus, designers of fire department systems attempt to maintain a geographic distribution of fire stations that limit the travel distance between stations. This general design is still evaluated by agencies such as ISO. For example, ISO recommends that there be a fire engine every 1.5 miles and a ladder truck every 2.5 miles.[35]

In general, fire suppression system design strategies have not changed in upward of 100 years. However, recent research by UL's Fire Research Division has found that today's fires may grow very rapidly and reach untenable levels in as little as four minutes.[36] In homes and home furnishings of the past, this time is reported to be upward of twenty minutes. Few municipalities will be in a position to fund labor-intensive deployment models that will meet the demands of the modern fire ground or the recommendations of NFPA 1710. Therefore, CPSM recommends a risk-based integrated risk management plan (IRMP) that utilizes a system of efforts to reduce the community's risk; for example, the impact from fire. An IRMP provides a greater return on investment and improves long-term sustainability.

In summary, setting *reasonable* standards for response times should be a local policy decision that incorporates elements of risk, the community's willingness to pay for services, the community's *acceptable* level of risk it is willing to assume, and the community's expectations for service.

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[32] T.H. Blackwell and J.S. Kaufman. (2002). Response time effectiveness: Comparison of response time and survival in an urban emergency medical services system. *Academic Emergency Medicine,* 9(4), 288-295.
[33] P.T. Pons and V. J. Markovchick. (2002). Eight minutes or less: Does the ambulance response time guideline impact trauma patient outcome? *Journal of Emergency Medicine,* 23(1), 43-48.
[34] C.D. Newgard, et. al. (2010). Emergency medical services intervals and survival in trauma: Assessment of the golden hour in a North American prospective cohort. *Annal of Emergency Medicine*, 55(3), 235-246.
[35] ISO. (2012). *Fire suppression rating schedule.* Jersey City, NJ: ISO.
[36] S. Kerber. (2010). *Impact of Ventilation on Fire Behavior in Legacy and Contemporary Residential Construction* (Chicago, IL: UL).

Table 2: Average Response Time Components of First Arriving Unit

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
ALS	3.2	1.0	5.1	9.4	166
MVA	4.0	1.2	4.6	9.9	15
Fall and injury	3.9	1.1	4.3	9.3	72
Illness and other	3.3	1.0	4.9	9.1	106
EMS transport	3.4	1.0	4.8	9.2	247
EMS Total	**3.4**	**1.0**	**4.8**	**9.2**	**606**
Structure fire	3.4	1.4	4.4	9.2	397
Outside fire	3.1	1.3	5.4	9.9	85
Hazard	4.1	2.0	6.0	12.1	62
False alarm	3.1	1.8	4.9	9.8	42
Good intent	3.7	1.9	5.4	10.9	66
Public service	3.5	1.4	4.8	9.7	79
Fire Total	**3.4**	**1.5**	**4.8**	**9.8**	**731**
Total	**3.4**	**1.3**	**4.8**	**9.5**	**1,337**

Table 3: 90th Percentile Response Time Components of First Arriving Unit

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
ALS	4.9	2.8	7.9	12.2	166
MVA	5.6	3.2	7.1	14.3	15
Fall and injury	5.9	2.5	6.8	12.3	72
Illness and other	5.4	2.6	7.5	12.2	106
EMS transport	5.4	2.3	8.2	13.4	247
EMS Total	**5.2**	**2.6**	**7.8**	**12.7**	**606**
Structure fire	5.0	2.8	6.8	11.5	397
Outside fire	4.9	3.8	9.1	14.0	85
Hazard	6.4	5.1	10.3	17.6	62
False alarm	4.6	4.7	6.8	13.1	42
Good intent	5.9	5.1	8.4	17.3	66
Public service	5.5	3.6	7.2	13.0	79
Fire Total	**5.2**	**3.4**	**7.5**	**13.0**	**731**
Total	**5.2**	**3.0**	**7.6**	**12.9**	**1,337**

When comparing average response time components with the 90th percentile components, the following is observed:

- The average dispatch time was 3.4 minutes.
  - The 90th percentile dispatch time was 5.2 minutes.
- The average turnout time was 1.5 minutes.
  - The 90th percentile turnout time was 3.4 minutes.
- The average travel time was 4.8 minutes.
  - The 90th percentile travel time was 7.5 minutes.
- The average response time for EMS calls was 9.2 minutes.
  - The 90th percentile response time for EMS calls was 12.7 minutes.
- The average response time for fire category calls was 9.8 minutes.
  - The 90th percentile response time for fire category calls was 13.0 minutes.
- The average response time for structure fire calls was 9.2 minutes.
  - The 90th percentile response time for structure fire calls was 11.5 minutes.
- The average response time for outside fire calls was 9.9 minutes.
  - The 90th percentile response time for outside fire calls was 14.0 minutes.

According to NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments, 2010 Edition*, and as a benchmark, where the primary public safety answering point is the communications center, the alarm processing time or dispatch time should be less than or equal to 60 seconds 90 percent of the time.[37] This standard also states that the turnout time should be less than or equal to 60 seconds for emergency medical services 90 percent of the time, and travel time shall be less than or equal to 240 seconds for the first responder basic life support (BLS) 90 percent of the time. Fire responses are afforded an additional 20 seconds (80 seconds) for turnout time due to the impact of donning personal protective gear prior to beginning the travel segment while maintaining the same dispatch and travel requirements as the BLS EMS recommendations. Further, the benchmark recommendation for turnout time by the Center for Public Safety Excellence (CPSE) is that the dispatch time should be completed within 60 seconds 90 percent of the time.[38] While CPSE supports this benchmark it also affords a baseline (minimum acceptable performance) of 90 seconds 90 percent of the time.[39]

Regarding response times, in each category above at the 90th percentile, there is a marked increase in time and a gap between the NFPA 1710 benchmark and what is actually occurring in Flint. ***Of particular significance are the average dispatch times and the dispatch turnout times at the***

[37] NFPA 1710, 7.
[38] Ibid.
[39] *Fire and Emergency Service Self-assessment Manual,* p. 70.

90th percentile. Management has the most control over these two components of response time. Dispatch time at the 90th percentile in Flint is from three to four minutes greater than the national benchmarks (NFPA, CPSE), while turnout time at the 90th percentile is almost two minutes greater than the NFPA benchmark. Reducing dispatch and turnout time will reduce overall response time. It is strongly recommended that the FFD develop and implement a comprehensive performance-based management strategy for all elements of response time, with a focus on dispatch and turnout times, as these are most controllable from a human perspective.

Travel time at the 90th percentile is 3.5 minutes greater than the NFPA 1710 benchmark; however, this is due to a reduction in the number of stations that are regularly staffed. While it is not specifically commensurate with the benchmark provided by NFPA 1710, it is a reasonable service level, understanding that the standard is unattainable by most communities in the United States. It is for this reason that the CPSE has provided a baseline recommendation of five minutes and twelve seconds in an urban population density of more than 2,000 people per square mile, as is found in Flint.[40]

Travel time is analyzed further through geographic information system (GIS) mapping, as illustrated in the next set of figures. Figures 19, 20, 21, and 22 use GIS mapping to illustrate response time probabilities, showing 240-second, 360-second, and 480-second travel time bleed comparisons, respectively. These comparisons are made by the road network from each FFD fire station. Figure 19 illustrates the current five-station model of stations 1, 3, 5, 6, and 8. Figure 20 illustrates what are the most frequently staffed stations under the current staffing and budget constraints, namely stations 1, 5, and 6. Figure 21 illustrates a four-station model utilizing stations 1, 3, 5, and 6. Lastly, Figure 22 illustrates an alternative four-station model utilizing stations 1, 5, 6, and 8.

The location of responding units is one important factor in response time; reducing response times, which is one of the key performance measures in determining the efficiency of department operations, is often dependent on this factor. A community with a network of several responding fire stations seeks to optimize coverage with short travel distances while giving special attention to natural and manmade barriers and response routes that can create response-time problems.[41]

[40] Ibid.
[41] NFPA 1710, 122.

Figure 19: Travel Time Bleeds – Stations 1, 3, 5, 6, 8

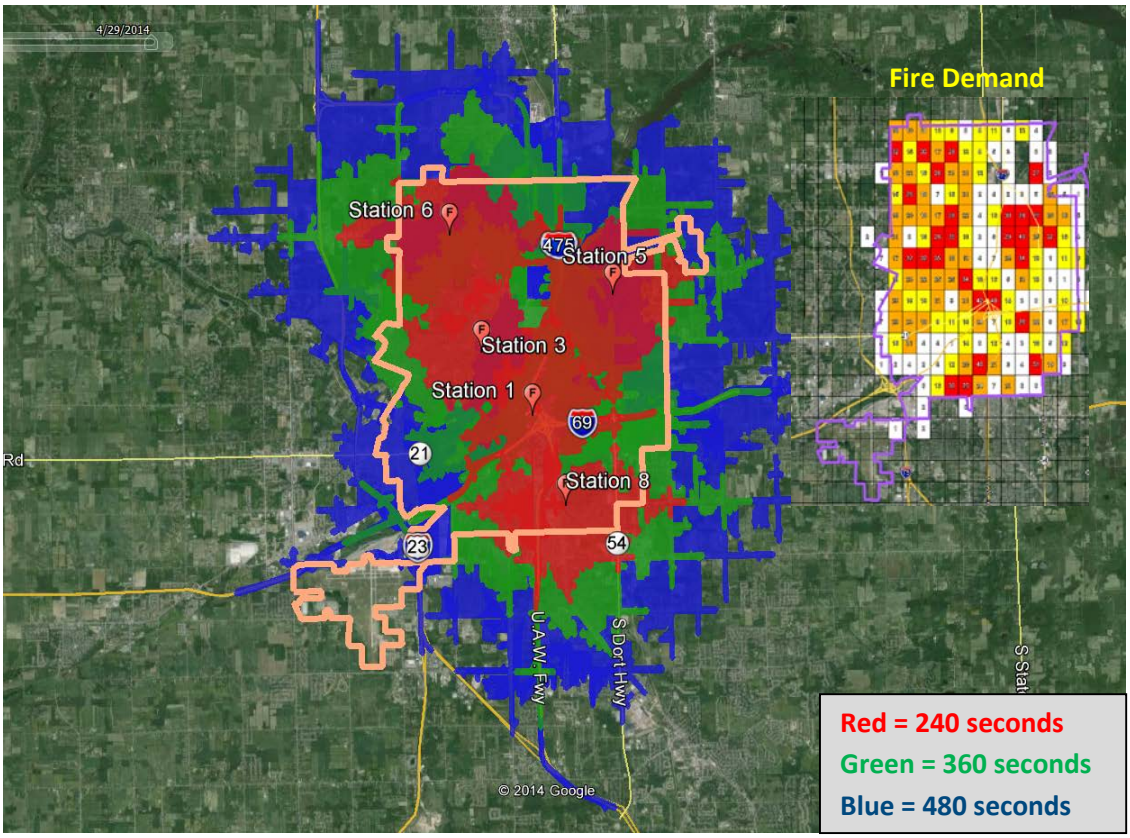


Figure 20: Travel Time Bleeds – Stations 1, 5, 6

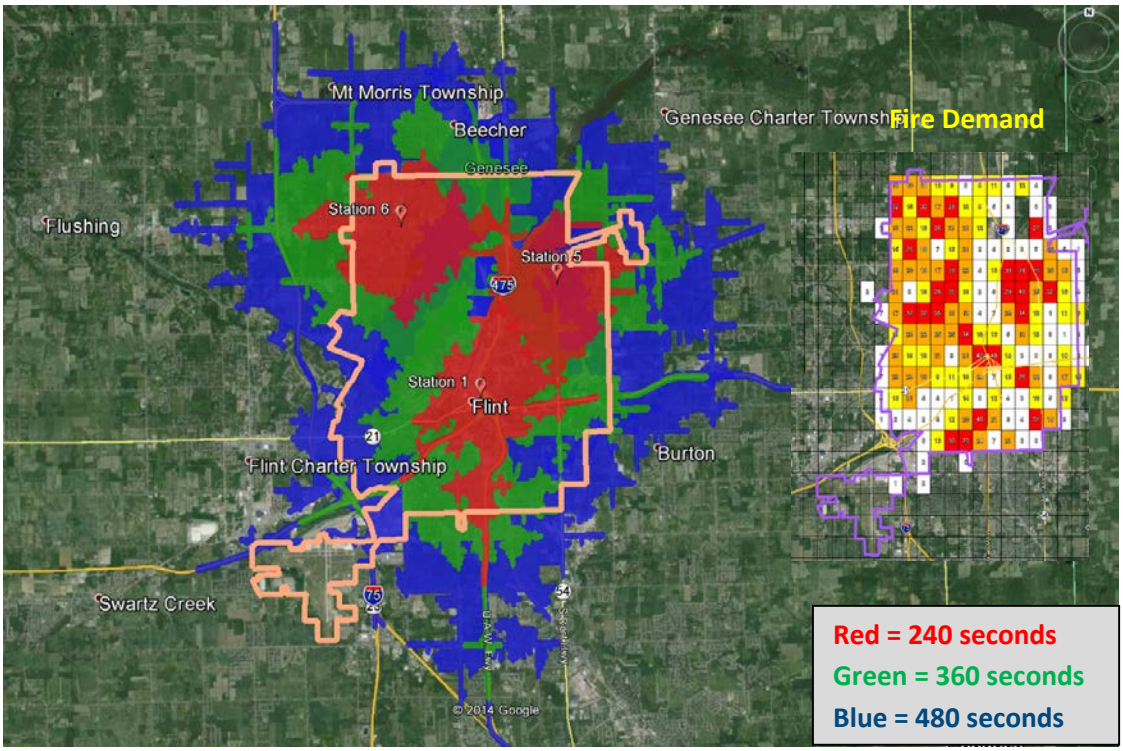


Figure 21: Travel Time Bleeds – Stations 1, 3, 5, 6

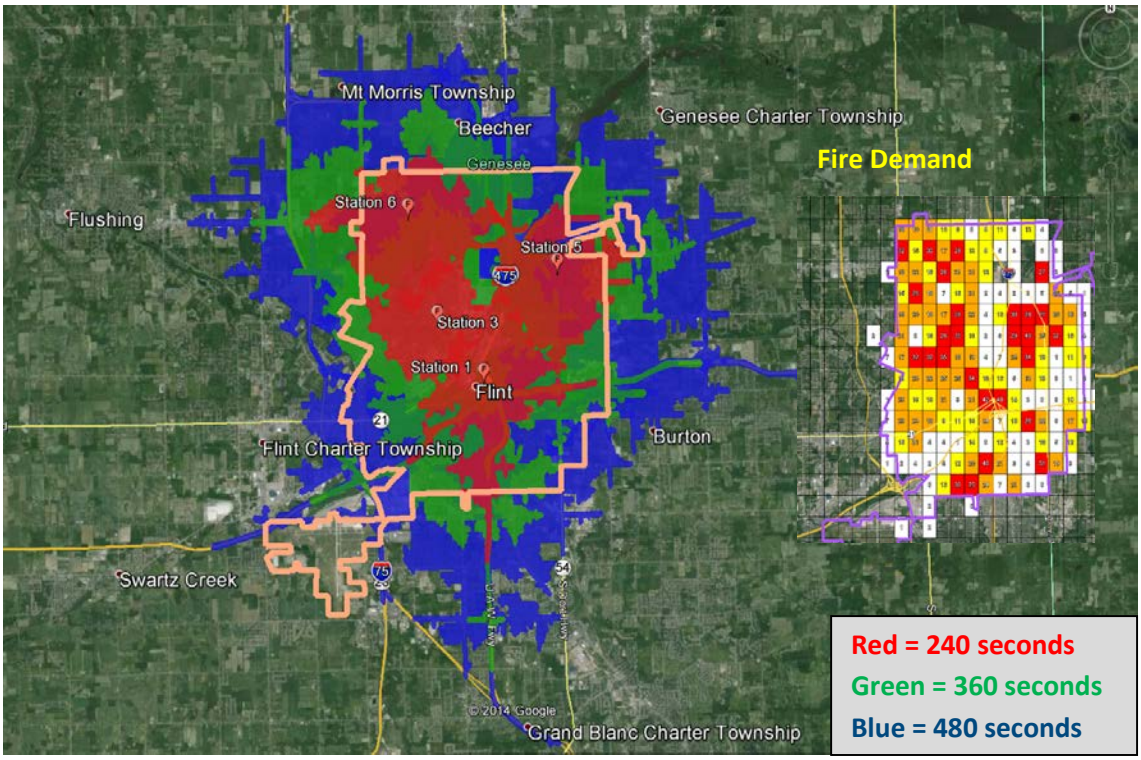
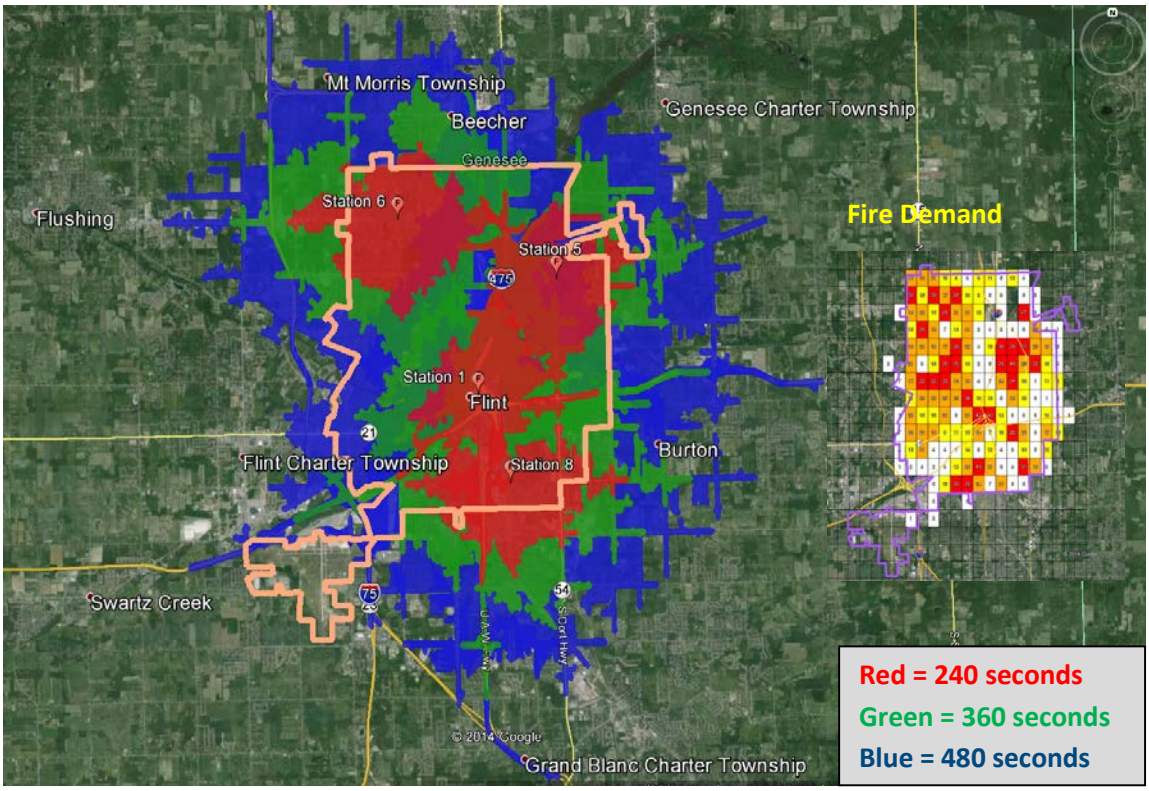


Figure 22: Travel Time Bleeds – Stations 1, 5, 6, 8



When considering staffing and deployment alternatives, the optimum from a travel time perspective is the five-station model as illustrated in Figure 19. In this model the city is nearly 100 percent covered at the 240- and 360-second benchmark and is 100 percent covered at the 480-second benchmark.

With regard to the most-used deployment model (three-station model utilizing stations 1, 5, and 6); Figure 20 illustrates a significant gap in the 240-second benchmark in the central-western, high-demand area of the city. There are also gaps in the 240-second benchmark in the southeast and southwest portions of the city. However, there is nearly 100 percent coverage at the 360-second benchmark coverage and there is 100 percent coverage at the 480-second benchmark in these areas.

When considering the redeployment of a fourth station either during peak-load times or around the clock, CPSM recommends staffing stations 1, 3, 5, and 6. This is illustrated in Figure 21. In this deployment model the higher demand areas are covered the most when using the 240- and 360-second benchmarks. Although there is demand in the southern portion of the city, the southeast and southwest portions of the city, which are outside of the 240-second benchmark and some of the 360-second benchmark, the higher demand in the southern portion of the city (south central) is adequately served from station 1 within the 240- and 360-second benchmarks.

Emergency Medical Services

The FFD responds to Tier 1 EMS calls for service only. Tier 1 responses are classified as the most critical of EMS calls. The FFD provides basic life support (BLS) services. Fire operations personnel are trained to the medical first responder level. All fire operations apparatus carry automated external defibrillators (AEDs), as well as basic first aid and splinting equipment. The FFD operates under the Genesee County medical control system and has an agreement with Dr. Peter Stoyanoff to serve as the FFD's medical director.

EMS transport in the city of Flint is handled by a myriad of a private ambulance services. These include Mobile Medical Response, Pro Med, Regional EMS, Universal Ambulance, STAT EMS, Swartz Ambulance, and Patriot Ambulance Service. When a transport is needed, the emergency communications center notifies the next available service through means of a call-down list. ***There is inefficiency in the notification and response of EMS transport units since the communications center does not know the location of available transport units and therefore may not be contacting the closest unit/agency for response.*** The Genesee County Sheriff's Department has mobile paramedic units that are dynamically deployed and respond to high-priority/life-threatening EMS calls. There is a county millage tax to support EMS, which Flint does not directly receive in the form of funding.

Alternative EMS Service Delivery Models

The provision of emergency medical services is generally a responsibility of local government. However, the utilization of private providers for ambulance services is a well-established practice in the city of Flint. As mentioned above, there are several private ambulance providers currently operating in and around the city. Because there are no ambulances positioned by agreement or contract in the city, there is no performance guarantee an ambulance will arrive for treatment and transport in a reasonable or agreed upon time. This is an ineffective and uncertain delivery of a critical community service. The FFD is attempting to establish a fixed base for private ambulances in the city through an agreement to utilize current fire stations as posting locations. As of the CPSM staff on-site visit, there were no agreements in place to implement this program.

CPSM recommends the city enter into performance-based contractual agreements with one or more private EMS agencies for the delivery of EMS and EMS transport services in the city of Flint. CPSM further recommends a competitive, closed-bid process be established so that the city may realize the best economic and performance advantage. The request for proposal process for EMS and EMS transport services should establish expectations for clinical excellence and system performance. It may be in the city's best interest to seek outside assistance in the development of a high-performance performance-based solicitation and contract. In other words, the city should establish service levels commensurate with community expectations. Finally, if the city is desirous of this alternative, the city is encouraged to discuss with neighboring jurisdictions the potential advantages of a countywide or regional approach to ambulance services.

Training and Preparation

A lieutenant serves as both the training officer and safety officer for the FFD. He is a part of the seven-member administration staff who report directly to fire chief. This lieutenant is fully qualified to be the training and fire safety officer. He is certified as a Fire Service Instructor by the Michigan Fire Fighters Training Council and has received state certifications as a Fire Officer I, II, and III. In addition, the lieutenant has received enhanced training at a variety of fire academies and institutions, including FEMA's Emergency Management Institute, FEMA's National Fire Academy, the Michigan Department of Community Health, Michigan State University, Kellogg Community College, and Texas A&M Emergency Extension Service. He is thoroughly qualified to teach on a wide range of topics that include supervisory practices, fire tactical operations, fire-ground decision making, ICS, NIMS, rescue operations, hazardous materials, and many others. The lieutenant is well-qualified also to serve as the department's health and safety officer and has appropriate credentials from FEMA's National Fire Academy.

The department's training facilities are limited to a classroom on the second floor of station 1 and the use of the Flint Central High School parking lot for state-mandated annual emergency driving training. In its review of the Flint Fire Department, the Insurance Services Office found the department's training facilities to be deficient because it lacks a training drill tower and a fire building (smoke room), and also does not have a sufficient library of training materials and student manuals. Multimedia capabilities and other visual demonstration tools such as pump and hydrant

cutaways were also found to be lacking by the ISO review.[42] ***CPSM has found that none of the fire training facility limitations from the 2010 ISO report has been resolved, although some could be easily remedied by contracting with a neighboring community for the use of its training facilities. CPSM strongly recommends the FFD enter into an agreement with a neighboring jurisdiction for the use of its training facilities to eliminate point deductions ISO would make due to training deficiencies, and, more importantly, to enhance fire suppression training.***

The 2010 ISO report also made mention of the department's lack of training records. In CPSM's review, the continuing education EMS training records were well documented. The records clearly delineated individual training and met the requirements of the Genesee County Medical Control Authority core competencies in airway management, cardiac arrest management, MEGA code, baseline vitals/sample history, IV therapy/medication administration, and trauma management for Michigan Fire and Rescue Agencies. The training records show that the department has adequate training as well in terms of the length and type of class instruction and multiyear recertification requirements for CPR and EMS licenses. Michigan OSHA annual training requirements on handling blood-borne pathogens and emergency driver training are also well documented. ***In contrast to EMS training record-keeping, the department lacks documentation or individual training records for firefighting tactical competencies, incident command, specialized rescue, and other technical training. CPSM recommends that for effective and consistent recording of all staff training, the FFD procure a records management software system for documenting all FFD staff training.***

All Flint fire suppression personnel must have the state certifications as a Firefighter I and II prior to beginning their service in the department. After one year of service they must also earn a state license as an Emergency Medical Technician-Basic (EMT-B). To be promoted to fire officer (sergeant and above), a FFD firefighter must have a combination of the following: Fire Officer I and II (state certification as a Company Officer), Fire Officer III, and fifteen college credits.

In our studies, CPSM has found that many fire department training officers prepare a full-year training schedule that is then approved by the fire chief. The Flint training officer prepares a training schedule twice a year and holds regularly scheduled training programs for each shift as part of the training plan. ***To improve the effectiveness of staff education and training, CPSM recommends the implementation of an annual training plan review process that establishes fire training goals and is approved by the fire chief.***

A fire department's standard operating guidelines (SOGs) are often used as the basis for establishing a training plan in that the SOGs prescribe the strategic and tactical procedures to be used by the fire company and stipulate a multiplicity of fire department health and safety regulations as well as any mandated fire personnel procedures. The FFD's standard operating guidelines require that each guideline is to be reviewed at least once every 24 months or when a change in policy is made or a new technical, tactical, or strategy element is introduced into the department. A new guideline must be incorporated into the document within six to twelve months of an element's introduction. However, these review requirements have not been followed. Most of the department's SOGs have been neither reviewed nor updated for more than a decade and some

[42] Public Protection Summary Report, Insurance Services Office, Inc. August 20, 2010, pp 24-28.

were last reviewed in the 1990s. This lack of review could be the cause of a serious and potentially dangerous liability. ***To improve the fire training plan as well as continued situational awareness and core improvement of staff, CPSM recommends linking the annual training plan to department SOGs, establishing a schedule for reviewing each guideline, and adhering to this schedule.***

Appendix I: Data and Workload Analysis

Introduction

This data analysis was prepared as a key component of the operational study of the Flint Fire Department (FFD). This analysis examines all calls for service between July 1, 2013, and June 30, 2014, as recorded in the communications center.

This analysis is divided into four sections: the first section focuses on call types and dispatches; the second section explores time spent and workload of individual units; the third section presents analysis of the busiest hours in a year; and the fourth section provides a response time analysis of FFD units.

During the period covered by this study, the department operated out of five stations. However the department frequently browned out one or two stations daily. Particularly, station 8 is closed on a more frequent basis due to the city's fiscal situation, which limits the daily staffing of stations on a continual basis. The department has utilized five engines, two quints, one grass truck, two squad units, and one battalion chief's car. During special events/occasions, a second battalion chief's car is deployed.

During the study period, the department responded to 4,271 calls, including 625 canceled calls. FFD recorded a total of 415 EMS transport calls with NFIRS incident type of 661 (EMS call, party transported by non-fire agency). We would like to note that FFD units responded to those EMS calls and private EMS transport service transported patients. The total combined yearly workload (deployed time) for all FFD units was 4,272 hours. The average estimated dispatch time of the first arriving FFD unit was 3.4 minutes and the average response time of the first arriving FFD unit was 9.5 minutes. The 90th percentile dispatch time was 5.2 minutes and the 90th percentile response time was 12.9 minutes, which means that FFD units had a response time of less than 12.9 minutes for 90 percent of calls.

Methodology

In this report, we analyzed calls and runs. A call is an emergency service request or incident. A run is a dispatch of a unit. Thus, a call might include multiple runs.

We received CAD and National Fire Incident Reporting System (NFIRS) data for the Flint Fire Department. We first validated CAD and NFIRS data and found that a significant number of CAD calls did not have NFIRS reports. Then, we removed 18 duplicated CAD canceled calls from the analysis.

We classified the calls in a series of steps. For CAD calls that were missing NFIRS reports, we used the CAD call nature code to assign a call type. For CAD calls with NFIRS reports, we first used the NFIRS mutual aid field to accurately identify mutual aid calls from the FFD perspective. Secondly, we identified canceled calls using the canceled call flag in CAD or NFIRS incident types of 611, 621, and 622. Then we used NFIRS incident type to assign EMS, EMS transport, MVA, and fire category call types. Lastly, we used CAD call nature to further break down NFIRS EMS calls into ALS, MVA,

fall and injury, or illness and other. The classification between NFIRS incident type and call type is documented in Attachment IV.

The Flint Fire department did not track unit level manpower schedule for the study period, meaning there was no standard recording of unit level staffing. In this report, we collected handwritten manpower schedules recorded at the station level from January 2014 through June 2014, and counted the number of days in service for the five stations. We assumed that the five stations were in service for the same proportion of time in 2013 and estimated the number of days in service of the five stations for the study year. We assumed that units in the same station had an identical number of days in service and we then developed daily workload statistics (runs per day, deployed time per day) accordingly.

A total of three incidents to which support units (fire chief, assistant fire chief, fire marshal, and safety/training officer's car) were the sole responders are not included in the analysis sections of the report. Nevertheless, the workload of support units is documented in Appendix I. In this report, mutual aid and canceled calls are not included in the analysis of call duration and response time analysis.

In our data validation process, we have noticed **serious data issues** and would like to recommend the agency to address them in future operations.

- We found out that a significant number of incidents did not have NFIRS reports. We recommend the fire department implement a quality assurance process to cross validate its NFIRS and CAD records regularly to ensure NFIRS reports are being completed.
- If the fire department plans to maintain the current schedule, we recommend the department implement a system whereby the manpower schedules at the station and unit level are recorded in electronic format.
- The unit level time stamps recorded in NFIRS are different than the time stamps in CAD. For example, alarm time in NFIRS is later than the call received time recorded in CAD. Thus, a response time analysis using NFIRS data might not be accurate.
- We recommend the communication center begin to track EMS transport calls.

Aggregate Call Totals and Dispatches

In this report, each citizen-initiated emergency service request is a call. During the year studied, FFD responded to 4,271 calls. Of these, 537 were structure fire calls and 246 were outside fire calls within FFD's jurisdiction. Each dispatched unit is a separate "run." As multiple units are dispatched to a call, there are more runs than calls. The department's total runs and workload are reported in the second section of this data analysis.

Table D-1: Call Types

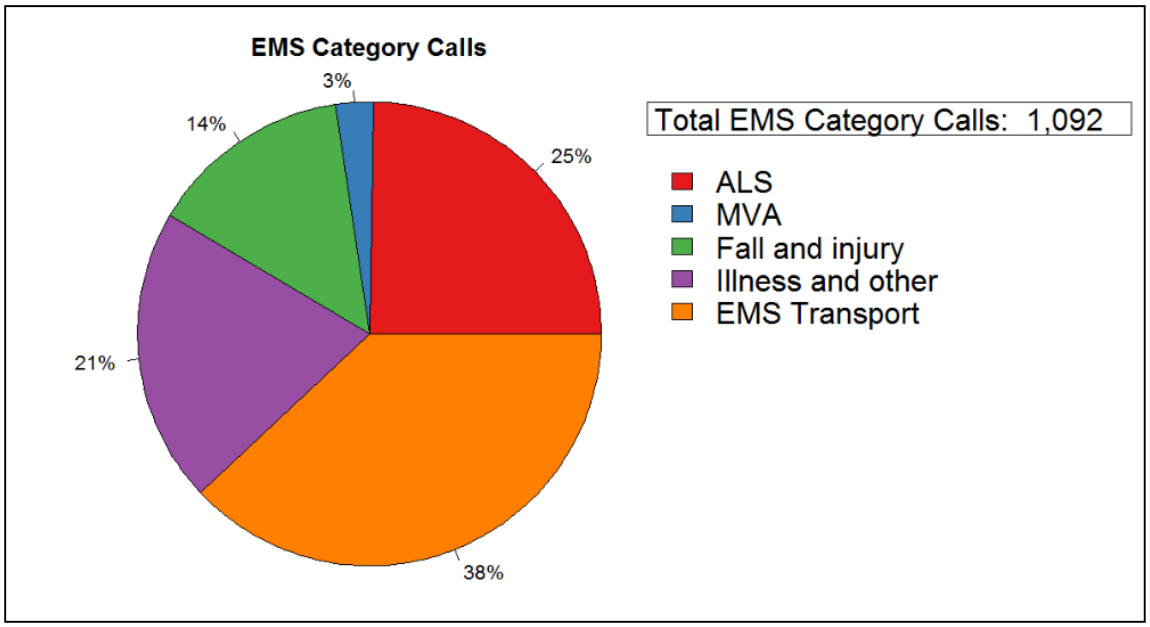
Call Type	Number of Calls	Calls per Day	Call Percentage
ALS	270	0.7	6.3
MVA	29	0.1	0.7
Fall and injury	154	0.4	3.6
Illness and other	224	0.6	5.2
EMS transport	415	1.1	9.7
EMS Total	**1,092**	**3.0**	**25.6**
Structure fire	537	1.5	12.6
Outside fire	246	0.7	5.8
Hazard	426	1.2	10.0
False alarm	356	1.0	8.3
Good intent	322	0.9	7.5
Public service	662	1.8	15.5
Fire Total	**2,549**	**7.0**	**59.7**
Mutual aid	5	0.0	0.1
Canceled	625	1.7	14.6
Total	**4,271**	**11.7**	**100.0**

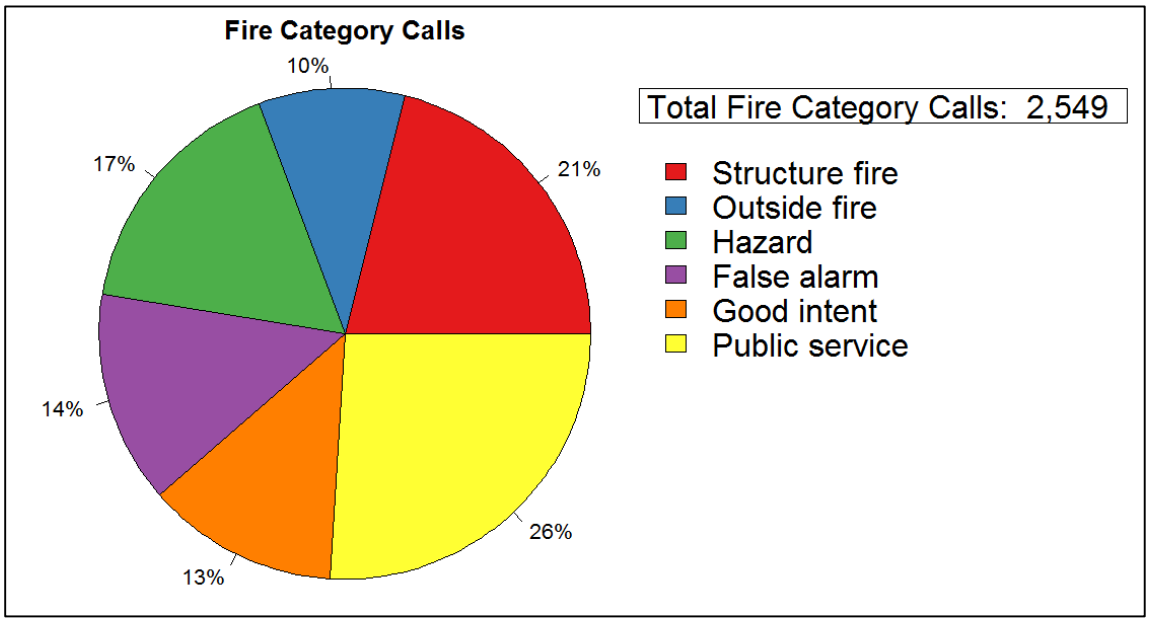
Note: EMS transport calls were transported by a private EMS transport agency.

Observations:

- The department responded to 4,271 calls in a year, averaging 11.7 calls per day.
- EMS calls for the year totaled 1,092 (26 percent of all calls), averaging 3.0 per day.
- Fire calls for the year totaled 2,549 (60 percent of all calls), averaging 7.0 per day.
- Structure fire calls for the year totaled 537 (13 percent of all calls), averaging 1.5 per day.
- Outside fire calls for the year totaled 246 (6 percent of all calls), averaging 0.7 per day.
- Canceled calls totaled 625 (15 percent of all calls), averaging 1.7 per day.

FigureD-1: EMS and Fire Calls by Type



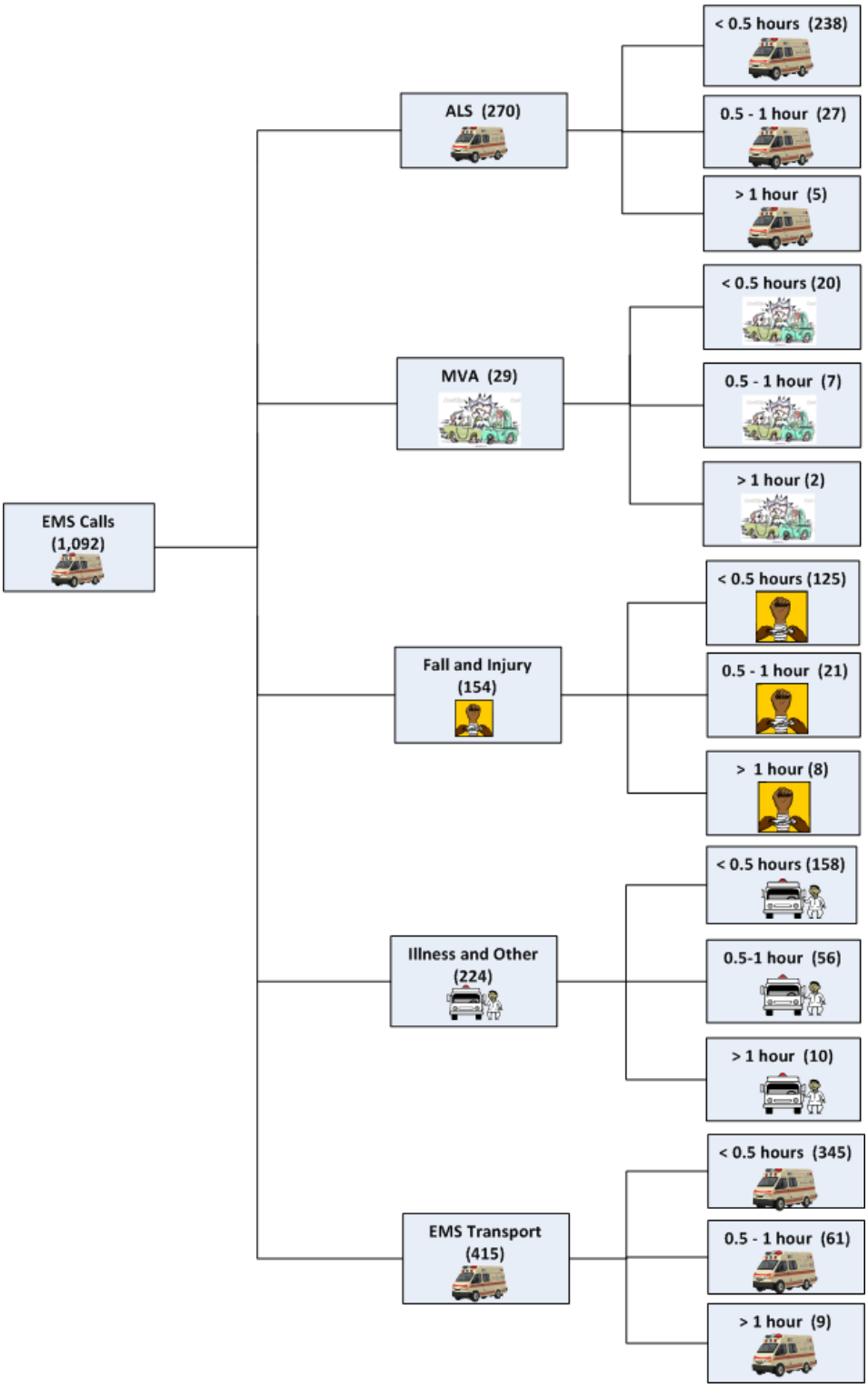


Observations:

- A total of 537 structure fire calls accounted for 21 percent of the fire category total.
- A total of 246 outside fire calls accounted for 10 percent of the fire category total.
- Public service calls were the largest fire call category, making up 26 percent of the fire category total.
- False alarm calls were 14 percent of the fire category total.

- EMS transport calls were responded to by Flint Fire Department units, but patients were transported by a private EMS transport agency. EMS transport was the largest EMS call category and accounted for 38 percent of the EMS category total.
- Motor vehicle accidents calls accounted for 3 percent of the EMS category total.

Figure D-2: EMS Calls by Type and Duration

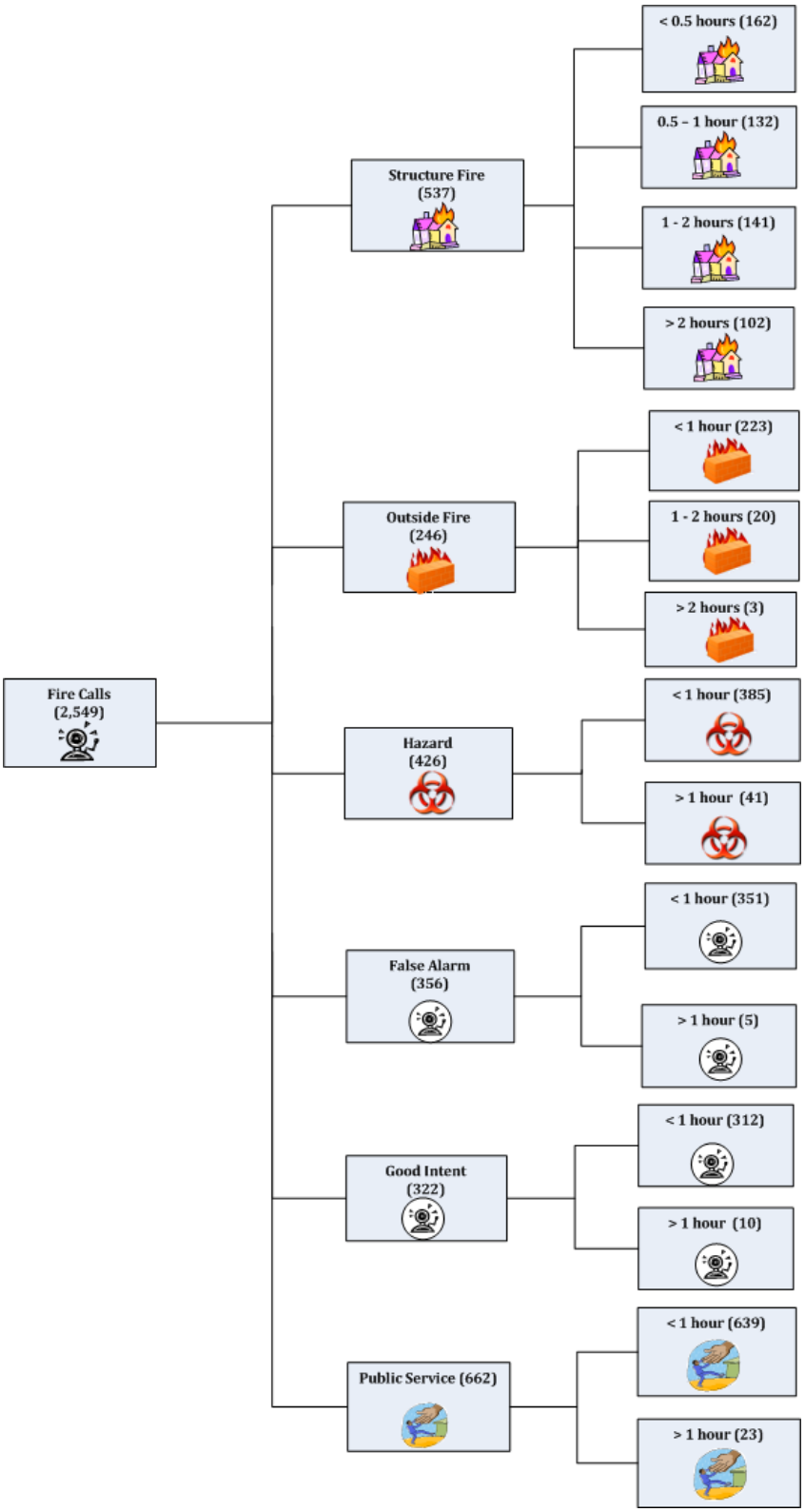


Note: Duration of a call is defined as the longest deployed time of any of the FFD units responding to the same call.

Observations:

- A total of 886 EMS category calls (81 percent) lasted less than half an hour, 172 EMS category calls (16 percent) lasted between half an hour and one hour, and 34 EMS category calls (3 percent) lasted more than one hour.
- A total of 238 ALS calls (88 percent) lasted less than half an hour, 27 ALS calls (10 percent) lasted between half an hour and one hour, and 5 ALS calls (2 percent) lasted more than one hour.
- A total of 345 EMS transport calls (83 percent) lasted less than half an hour, 61 EMS transport calls (15 percent) lasted between half an hour and one hour, and 9 EMS transport calls (2 percent) lasted more than one hour.

Figure D-3: Fire Calls by Type and Duration

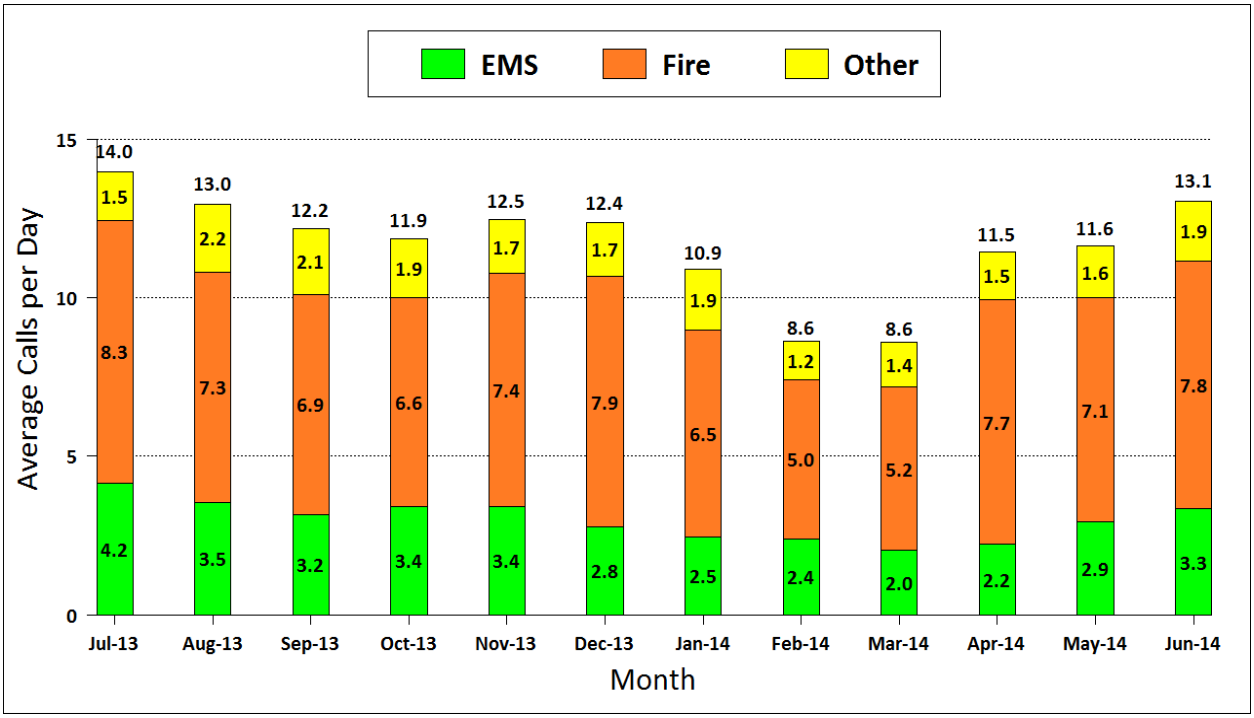


Note: Duration of a call is defined as the longest deployed time of any of the FFD units responding to the same call.

Observations:

- A total of 2,204 fire category calls (86 percent) lasted less than one hour, 219 fire category calls (9 percent) lasted between one and two hours, and 126 fire category calls (5 percent) lasted more than two hours. On average, there were 0.9 fire category calls per day that lasted more than one hour.
- A total of 162 structure fire calls (30 percent) lasted less than half an hour, 132 structure fires calls (25 percent) lasted between half an hour and one hour, 141 structure fire calls (26 percent) lasted between one and two hours, and 102 structure fire calls (19 percent) lasted more than two hours.
- A total of 223 outside fire calls (91 percent) lasted less than one hour, 20 outside fire calls (8 percent) lasted between one and two hours, and 3 outside fire calls (1 percent) lasted more than two hours.
- A total of 351 false alarm calls (99 percent) lasted less than one hour, and 5 false alarm calls (1 percent) lasted more than an hour.

Figure D-4: Average Calls per Day, by Month



Observations:

- Average calls per day ranged from a low of 8.6 calls per day in February and March 2014 to a high of 14.0 calls per day in July 2013. The highest monthly average was 62 percent greater than the lowest monthly average.
- Averages EMS calls per day ranged from a low of 2.0 calls per day in March 2014 to a high of 4.2 calls per day in July 2013. The highest monthly average was more than double the lowest monthly average.
- Averages fire calls per day ranged from a low of 5.0 calls per day in February 2014 to a high of 8.3 calls per day in July 2013. The highest monthly average was 65 percent greater than the lowest monthly average.
- The most calls responded to by FFD in a single day were 47. That occurred on December 22, 2013. Those 47 calls included two EMS calls, three structure fire calls, two outside fire calls, 26 hazard calls, one false alarm, four good intent calls, two public service calls, and seven canceled calls. The second highest number of calls responded to by FFD in a day was 32 calls; that occurred on December 23, 2013.

Figure D-5: Calls by Hour of Day

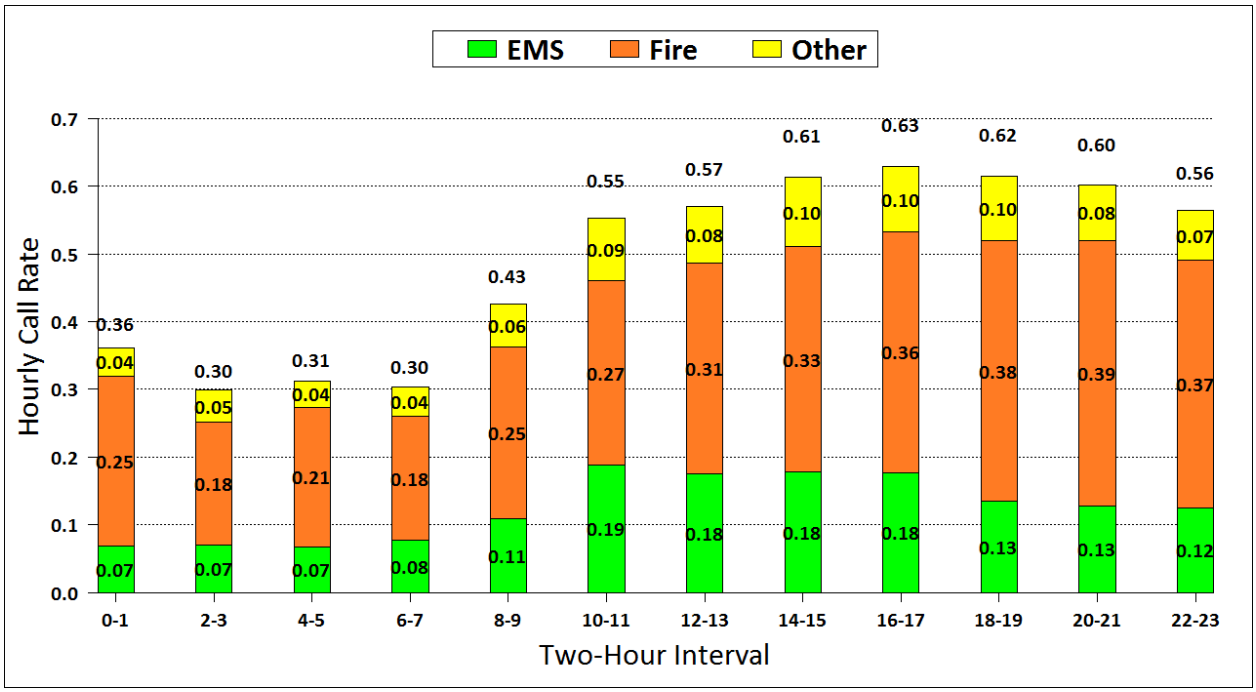


Table D-2: Calls by Hour of Day

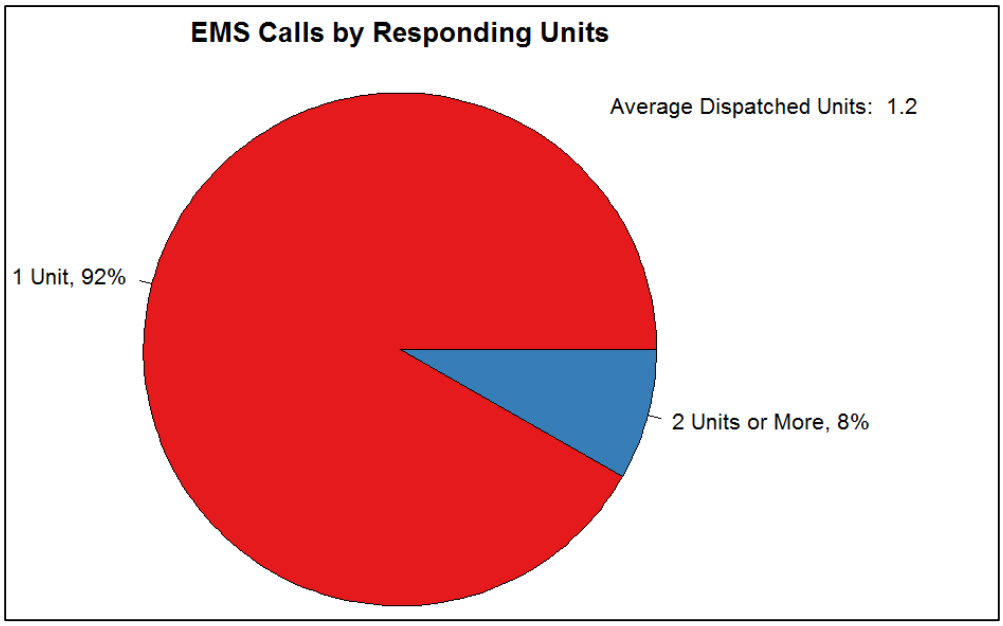
Two-Hour Interval	Hourly Call Rate			
	EMS	Fire	Other	Total
0-1	0.07	0.25	0.04	0.36
2-3	0.07	0.18	0.05	0.30
4-5	0.07	0.21	0.04	0.31
6-7	0.08	0.18	0.04	0.30
8-9	0.11	0.25	0.06	0.43
10-11	0.19	0.27	0.09	0.55
12-13	0.18	0.31	0.08	0.57
14-15	0.18	0.33	0.10	0.61
16-17	0.18	0.36	0.10	0.63
18-19	0.13	0.38	0.10	0.62
20-21	0.13	0.39	0.08	0.60
22-23	0.12	0.37	0.07	0.56
Calls per Day	**2.99**	**6.98**	**1.73**	**11.70**

Note: Average calls per day shown are the sum of each column multiplied by two, since each cell represents two hours.

Observations:

- Hourly call rates averaged between 0.30 calls and 0.63 calls per hour.
- Call rates were highest during the day between 10:00 a.m. and midnight, averaging between 0.55 and 0.63 calls per hour.
- Call rates were lowest between midnight and 8:00 a.m., averaging between 0.30 and 0.36 calls per hour.

Figure D-6: Number of Flint Fire Department Units Dispatched to Calls



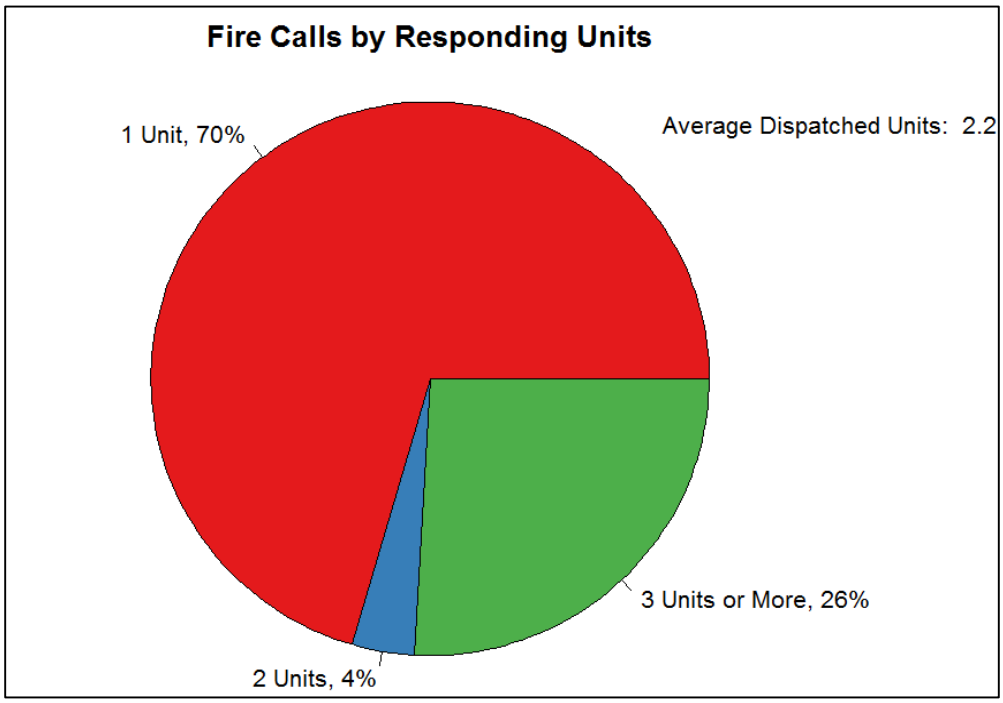


Table D-3: Number of Flint Fire Department Units Dispatched to Calls

Call Type	Number of Flint Fire Department Units							
	One	Two	Three	Four	Five	Six	Seven	Total
ALS	263	7	0	0	0	0	0	270
MVA	19	0	5	5	0	0	0	29
Fall and injury	114	3	18	18	1	0	0	154
Illness and other	209	9	0	2	2	2	0	224
EMS transport	397	11	4	0	0	3	0	415
EMS Total	**1,002**	**30**	**27**	**25**	**3**	**5**	**0**	**1,092**
Structure fire	63	12	7	14	141	251	49	537
Outside fire	199	8	3	1	11	21	3	246
Hazard	372	19	3	6	9	13	4	426
False alarm	319	12	0	0	7	16	2	356
Good intent	256	16	7	1	13	24	5	322
Public service	587	25	4	5	12	29	0	662
Fire Total	**1,796**	**92**	**24**	**27**	**193**	**354**	**63**	**2,549**
Mutual aid	3	0	0	0	1	1	0	5
Canceled	573	16	10	1	6	17	2	625
Total	**3,374**	**138**	**61**	**53**	**203**	**377**	**65**	**4,271**
Percentage	**79.0**	**3.2**	**1.4**	**1.2**	**4.8**	**8.8**	**1.5**	**100.0**

Observations:

- On average, 2.2 units were dispatched per fire category call.
- For fire category calls, one unit was dispatched 70 percent of the time, two units were dispatched 4 percent of the time, and three or more units were dispatched 26 percent of the time.
- For structure fire calls, one unit was dispatched 12 percent of the time; two, three, or four units were dispatched 6 percent of the time; five units were dispatched 26 percent of the time; six units were dispatched 47 percent of the time; and seven units were dispatched 9 percent of the time.
- For outside fire calls, one unit was dispatched 81 percent of the time, two units were dispatched 3 percent of the time, and three or more units were dispatched 16 percent of the time.
- On average, 1.2 units were dispatched per EMS category call.
- For EMS category calls, one unit was dispatched 92 percent of the time, two units were dispatched 3 percent of the time, and three or more units were dispatched 5 percent of the time.

Table D-4: Annual Deployed Time by Call Type

Call Type	Average Deployed Minutes per Run	Annual Hours	Percent of Total Hours	Deployed Hours per Day	Annual Number of Runs	Runs per Day
ALS	18.2	84	2.0	0.2	277	0.8
MVA	22.6	20	0.5	0.1	54	0.1
Fall and injury	26.9	113	2.6	0.3	251	0.7
Illness and other	23.9	103	2.4	0.3	257	0.7
EMS transport	22.9	171	4.0	0.5	449	1.2
EMS Total	**22.9**	**491**	**11.5**	**1.3**	**1,288**	**3.5**
Structure fire	56.7	2,569	60.1	7.0	2,718	7.4
Outside fire	28.5	204	4.8	0.6	430	1.2
Hazard	26.2	260	6.1	0.7	594	1.6
False alarm	16.0	130	3.0	0.4	488	1.3
Good intent	16.7	155	3.6	0.4	557	1.5
Public service	21.6	325	7.6	0.9	903	2.5
Fire Total	**38.4**	**3,643**	**85.3**	**10.0**	**5,690**	**15.6**
Mutual aid	65.6	15	0.4	0.0	14	0.0
Canceled	9.4	123	2.9	0.3	785	2.2
Total	**33.0**	**4,272**	**100**	**11.7**	**7,777**	**21.3**

Note: Each dispatched unit is a separate "run." As multiple units are dispatched to a call, there are more runs than calls. Therefore, the department responded to 11.7 calls per day and had 21.3 runs per day.

Observations:

- Total deployed time for the year, or deployed hours, was 4,272 hours. This is the total deployment time of all the units deployed on all type of calls, including 15 hours spent on mutual aid and 123 hours on canceled calls. The deployed hours for all units combined averaged approximately 11.7 hours per day.
- There were 7,777 runs, including 785 runs dispatched for canceled calls. The daily average was 21.3 runs for all units combined.
- Fire category calls accounted for 85.3 percent of the total workload.
- There were 3,148 runs for structure and outside fire calls, with a total workload of 2,773 hours. This accounted for 64.9 percent of the total workload. The average deployed time for structure fire calls was 56.7 minutes, and the average deployed time for outside fire calls was 28.5 minutes.
- EMS calls accounted for 11.5 percent of the total workload. The average deployed time for EMS calls was 22.9 minutes. The deployed hours for all units dispatched to EMS calls averaged 1.3 hours per day.

Workload by Individual Unit—Calls and Total Time Spent

In this section, the actual time spent by each unit on calls is reported in two types of statistics: workload and runs. A dispatch of a unit is defined as a run; thus one call might include multiple runs. The deployed time of a run is from the time a unit is dispatched through the time a unit is cleared. The Flint Fire Department did not have all stations open every day. We collected handwritten manpower schedules from January 2014 through June 2014 and estimated number of days in service for the five stations and developed daily workload statistics accordingly.

Table D-5: Call Workload by Unit

Station	Unit Type	Unit ID	Number of Days in Service	Average Deployed Minutes per Run	Annual Number of Runs	Annual Hours	Runs per Day	Deployed Hours per Day
1	Battalion Chief	BC	363	40.4	783	527.5	2.2	1.5
	Rescue Boats Trailer	BOAT	NA	10.5	10	1.7	NA	NA
	Engine	EN11	363	28.9	445	214.5	1.2	0.6
	Grass Truck	GRASS	NA	36.3	2	1.2	NA	NA
	Squad	SQ1	363	41.4	746	515.3	2.1	1.4
	Quint	Truck15	363	28.7	1,629	779.6	4.5	2.1
3	Battalion Chief	BC2	NA	21.2	5	1.8	NA	NA
	Engine	EN31	NA	29.6	15	7.4	NA	NA
	Squad	SQ2	318	42.2	710	499.1	2.2	1.6
	Quint	Truck35	318	33.8	527	296.8	1.7	0.9
5	Engine	EN51	365	31.7	1,264	667.9	3.5	1.8
6	Engine	EN61	365	27.6	1,581	727.8	4.3	2.0
8	Engine	EN81	31	31.0	60	31.0	1.9	1.0

Note: Runs per day are calculated using total number of runs divided by number of days in service. Deployed hours per day are calculated using annual hours divided by number of days in service.

Observations:

- Truck15 made the most runs, averaging 4.5 runs and 2.1 hours of deployed time per day.
- Of the five engines, EN61 made the most runs, averaging 4.3 runs and 2.0 hours of deployed time per day. Engine EN51 averaged 3.5 runs and 1.8 hours of deployed time per day.
- Battalion chief unit BC averaged 2.2 runs and 1.5 deployed hours per day.
- Two squads had similar utilization. They averaged 2.1 and 2.2 runs per day, and 1.4 and 1.6 deployed hours per day, respectively.

Figure D-7: Deployed Minutes by Hour of Day

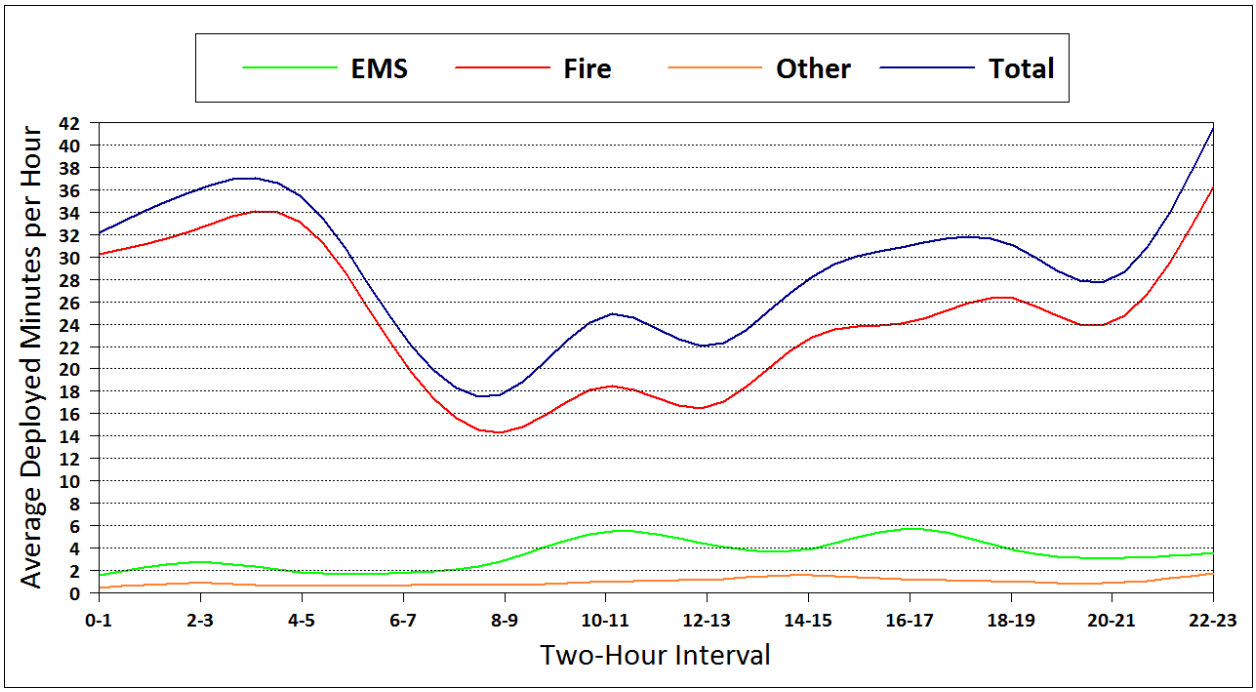


Table D-6: Deployed Minutes by Hour of Day

Two-Hour Interval	EMS	Fire	Other	Total
0-1	1.5	30.2	0.4	32.2
2-3	2.7	32.6	0.8	36.1
4-5	1.8	33.0	0.6	35.4
6-7	1.7	20.7	0.6	23.0
8-9	2.9	14.3	0.7	17.8
10-11	5.4	18.5	0.9	24.8
12-13	4.3	16.6	1.2	22.0
14-15	3.9	22.6	1.5	28.0
16-17	5.7	24.2	1.2	31.0
18-19	3.9	26.3	0.9	31.1
20-21	3.1	24.1	0.8	28.0
22-23	3.5	36.3	1.7	41.5
Total	**80.7**	**598.8**	**22.7**	**702.2**

Note: Daily totals shown equal the sum of each column multiplied by two, since each cell represents two hours.

Observations:

- Hourly deployed minutes were highest during the day between 10:00 p.m. and 6:00 a.m., averaging from 32.2 minutes to 41.5 minutes per hour. Average deployed minutes peaked between 10:00 p.m. and midnight, averaging about 41.5 minutes per hour.
- Hourly deployed minutes were the lowest between 6:00 a.m. and 2:00 p.m., averaging between 17.8 minutes and 24.8 minutes per hour.

Table D-7: Total Annual and Daily Average Number of Runs by Call Type and Unit

Station	Unit Type	Unit	EMS	**Structure Fire**	**Outside Fire**	Hazard	False Alarm	Good Intent	Public Service	Mutual aid	Can-celed	**Total**	**Number of Days in Service**	**Runs per Day**
1	Battalion Chief	BC	73	**460**	**41**	41	25	50	54	2	37	**783**	**363**	**2.2**
	Rescue Boats Trailer	BOAT	5	**2**	**1**	0	0	0	0	0	2	**10**	**NA**	**NA**
	Engine	EN11	88	**72**	**24**	64	39	41	54	0	63	**445**	**363**	**1.2**
	Grass Truck	GRASS	0	**0**	**1**	0	0	0	1	0	0	**2**	**NA**	**NA**
	Squad	SQ1	58	**448**	**38**	38	25	44	58	2	35	**746**	**363**	**2.1**
	Quint	Truck15	342	**311**	**93**	116	134	110	261	5	257	**1,629**	**363**	**4.5**
3	Battalion Chief	BC2	0	**5**	**0**	0	0	0	0	0	0	**5**	**NA**	**NA**
	Engine	EN31	3	**6**	**0**	0	2	1	2	0	1	**15**	**NA**	**NA**
	Squad	SQ2	44	**436**	**38**	34	27	48	53	2	28	**710**	**318**	**2.2**
	Quint	Truck35	83	**196**	**34**	43	47	26	43	0	55	**527**	**318**	**1.7**
5	Engine	EN51	251	**380**	**60**	105	63	104	187	1	113	**1,264**	**365**	**3.5**
6	Engine	EN61	328	**386**	**96**	146	122	130	184	2	187	**1,581**	**365**	**4.3**
8	Engine	EN81	13	**16**	**4**	7	4	3	6	0	7	**60**	**31**	**1.9**

Note: Runs per day are calculated using total number of runs divided by number of days in service. Number of days in service by unit is listed in Table 5.

Observations:

- Truck15 had the most runs during the year and it averaged 4.5 runs per day. EMS responses totaled 342 runs. Structure and outside fire calls totaled 404 runs (25 percent) during the year.
- Of the five engines, EN61 had the most runs during the year and it averaged 4.3 runs per day. Structure and outside fire calls totaled 482 runs (30 percent of its runs) during the year.
- Battalion chief unit made 783 runs, with 501 runs (64 percent) made to structure and outside fire calls.

Table D-8: Daily Average Deployed Minutes by Call Type and Unit

Station	Unit Type	Unit	EMS	**Structure Fire**	**Outside Fire**	Hazard	False Alarm	Good Intent	Public Service	Mutual aid	Canceled	**Total**	**Fire Category Calls Percentage**
1	Battalion Chief	BC	4.5	**68.8**	**3.0**	2.2	1.3	2.5	3.5	0.4	1.0	**87.2**	**94.8**
	Rescue Boats Trailer	BOAT	0.2	**0.0**	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**	**19.6**
	Engine	EN11	5.4	**13.8**	**2.1**	5.6	1.5	2.0	3.4	0.0	1.8	**35.5**	**84.9**
	Grass Truck	GRASS	0.0	**0.0**	**0.1**	0.0	0.0	0.0	0.1	0.0	0.0	**0.2**	**100.0**
	Squad	SQ1	4.7	**68.8**	**2.4**	2.1	1.3	1.5	3.2	0.4	0.7	**85.2**	**94.5**
	Quint	Truck15	22.0	**52.6**	**8.3**	9.4	6.3	6.0	16.2	0.9	7.2	**128.9**	**82.9**
3	Battalion Chief	BC2	0.0	**0.3**	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**	**100.0**
	Engine	EN31	0.2	**1.1**	**0.0**	0.0	0.0	0.0	0.1	0.0	0.0	**1.4**	**87.2**
	Squad	SQ2	4.3	**77.1**	**3.0**	1.6	1.8	1.9	3.4	0.3	0.7	**94.2**	**95.5**
	Quint	Truck35	5.2	**36.9**	**3.7**	3.5	1.6	1.0	2.6	0.0	1.5	**56.0**	**90.7**
5	Engine	EN51	16.1	**60.4**	**4.5**	7.9	2.6	4.5	10.7	0.3	2.6	**109.8**	**85.3**
6	Engine	EN61	18.8	**55.8**	**7.0**	10.8	5.1	6.3	10.7	0.4	4.7	**119.6**	**84.3**
8	Engine	EN81	9.5	**31.7**	**2.9**	4.2	3.0	1.6	5.6	0.0	1.5	**60.1**	**84.2**

Note: Daily average deployed minutes are calculated using yearly deployed minutes divided by number of days in service. Number of days in service by unit is listed in Table 5.

Observations:

- On average, Truck15 was deployed 129 minutes (2 hours and 9 minutes) per day. Of its total workload, 83 percent was responding to fire category calls.
- On average, Engine EN61 was deployed 120 minutes (2 hours) per day. Fire category calls accounted for 84 percent of its workload.

On average, battalion chief unit BC was deployed 87 minutes (1 hour and 27 minutes) per day.

Analysis of Busiest Hours

There is significant variability in the number of calls from hour to hour. One special concern relates to the fire and EMS resources available for hours with the heaviest workload. We tabulated the data for each of the 8,760 hours in the year. Approximately once every 12.2 days, the Flint Fire Department responded to four or five calls in an hour. This occurred in 0.3 percent of the total number of hours in the year studied. We report the top ten hours with the most calls received and discuss the two hours with the most calls received or most runs made.

Table D-9: Frequency Distribution of the Number of Calls in an Hour

Number of Calls in an Hour	Frequency	Percentage
0	5,486	62.63
1	2,479	28.30
2	625	7.13
3	140	1.60
4	28	0.32
5	2	0.02

Observations:

- During 30 hours (0.34 percent of all hours), four or five calls occurred; in other words, the FFD responded to four or five calls in an hour roughly once every 12.2 days.
- Three calls occurred during 140 hours of the year; this means that FFD responded to three calls in an hour roughly once every 2.6 days.

Table D-10: Top 10 Hours with the Most Calls Received

Hour	Number of Calls	Number of Runs	Total Deployed Hours
12/22/2013, 6 a.m. to 7 a.m.	5	7	1.5
11/17/2013, 5 p.m. to 6 p.m.	5	6	5.3
12/22/2013, 7 a.m. to 8 a.m.	4	12	10.9
9/25/2013, 8 a.m. to 9 a.m.	4	11	2.8
11/17/2013, 10 p.m. to 11 p.m.	4	10	4.7
12/24/2013, 1 p.m. to 2 p.m.	4	10	2.1
12/21/2013, 10 p.m. to 11 p.m.	4	9	4.5
6/7/2014, 9 p.m. to 10 p.m.	4	9	4.8
9/28/2013, 5 p.m. to 6 p.m.	4	8	8.5
12/22/2013, 9 a.m. to 10 a.m.	4	7	2.0

Note: The combined workload is the total deployed minutes spent responding to calls received in the hour, and which may extend into the next hour or hours. Number of runs only includes dispatches from FFD units.

Observations:

- The hour with the most calls received was 6:00 a.m. to 7:00 a.m. on December 22, 2013. The five calls involved seven individual dispatches. These five calls included four hazardous conditions calls and one canceled call. The combined workload was 1.5 hours. The longest call lasted 30 minutes, and it was a power line down call. Each of the four hazardous conditions calls was responded to by one FFD unit; the canceled call lasted 11 minutes and was responded to by three units.
- The hour with the most runs made by FFD was 7:00 a.m. to 8:00 a.m. on December 22, 2013. The four calls involved 12 individual dispatches. These four calls included two structure fire calls and two hazardous condition calls. One structure fire call was responded to by six FFD units, and lasted four hours. Both hazardous conditions calls were related to arcing, shorted electrical equipment.

Dispatch Time and Response Time

This section presents dispatch and response time statistics for different call types and units. The main focus is the dispatch and response time of the first arriving FFD units for calls responded with lights and sirens. However, for structure fire calls, we also analyze the response time of the second, third, and fourth arriving units.

Different terms are used to describe the components of response time: Dispatch time is the difference between the unit dispatch time and call received time of the first arriving unit. Turnout time is the difference between the unit time enroute and the unit dispatch time. Travel time is the difference between the unit on-scene arrival time and the time enroute. Response time is the difference between the on-scene arrival time and call received time.

In this section, we focus on calls that were responded to with lights and sirens. Of 3,641 EMS and fire category calls, 2,038 calls (56 percent) were responded to by the FFD with lights and sirens. A total of 1,337 calls (66 percent of 2,038) were used in the analysis. The average dispatch time was 3.4 minutes. The average turnout time was 1.3 minutes. The average travel time was 4.8 minutes. The average response time for EMS calls was 9.2 minutes. The average response time for fire category calls was 9.8 minutes. The average response time for structure fire calls was 9.2 minutes. The average response time for outside fire calls was 9.9 minutes. The 90th percentile dispatch time was 5.2 minutes, and the 90th percentile response time was 12.9 minutes.

Table D-11: Average Dispatch, Turnout, Travel, and Response Times of First Arriving Unit, by Call Type

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
ALS	3.2	1.0	5.1	9.4	166
MVA	4.0	1.2	4.6	9.9	15
Fall and injury	3.9	1.1	4.3	9.3	72
Illness and other	3.3	1.0	4.9	9.1	106
EMS transport	3.4	1.0	4.8	9.2	247
EMS Total	**3.4**	**1.0**	**4.8**	**9.2**	**606**
Structure fire	3.4	1.4	4.4	9.2	397
Outside fire	3.1	1.3	5.4	9.9	85
Hazard	4.1	2.0	6.0	12.1	62
False alarm	3.1	1.8	4.9	9.8	42
Good intent	3.7	1.9	5.4	10.9	66
Public service	3.5	1.4	4.8	9.7	79
Fire Total	**3.4**	**1.5**	**4.8**	**9.8**	**731**
Total	**3.4**	**1.3**	**4.8**	**9.5**	**1,337**

Figure D-8: Average Dispatch, Turnout, and Travel Times of First Arriving Unit, by EMS Call Type

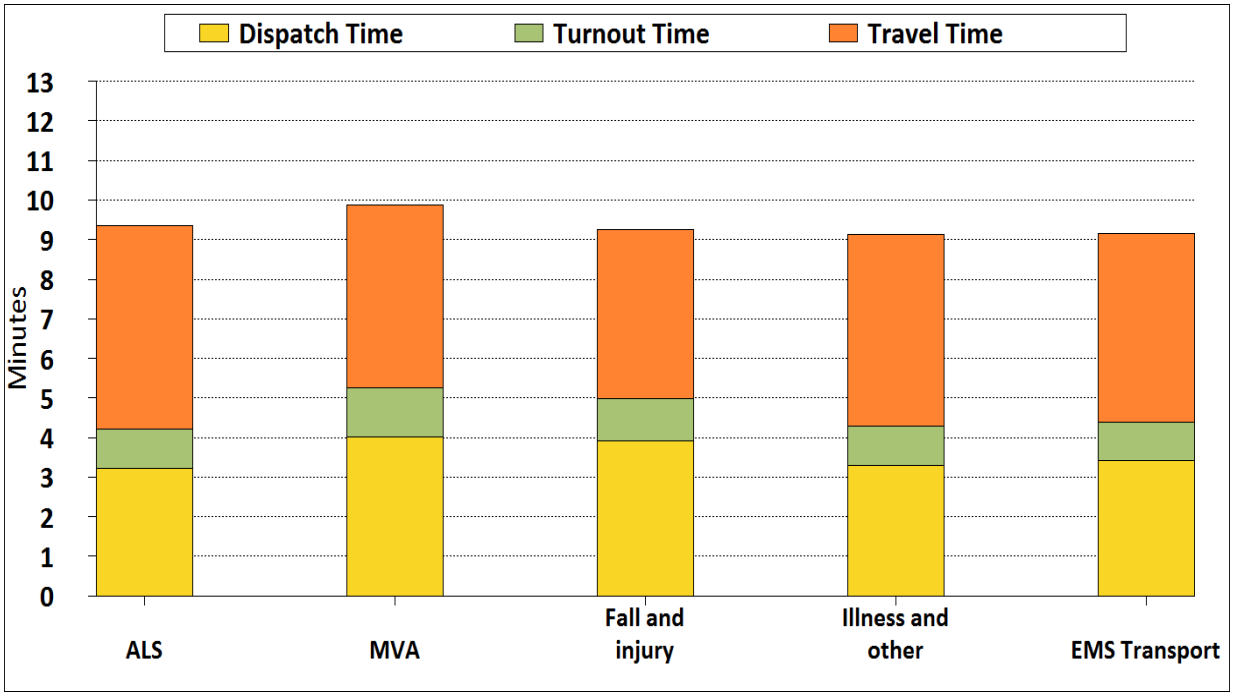
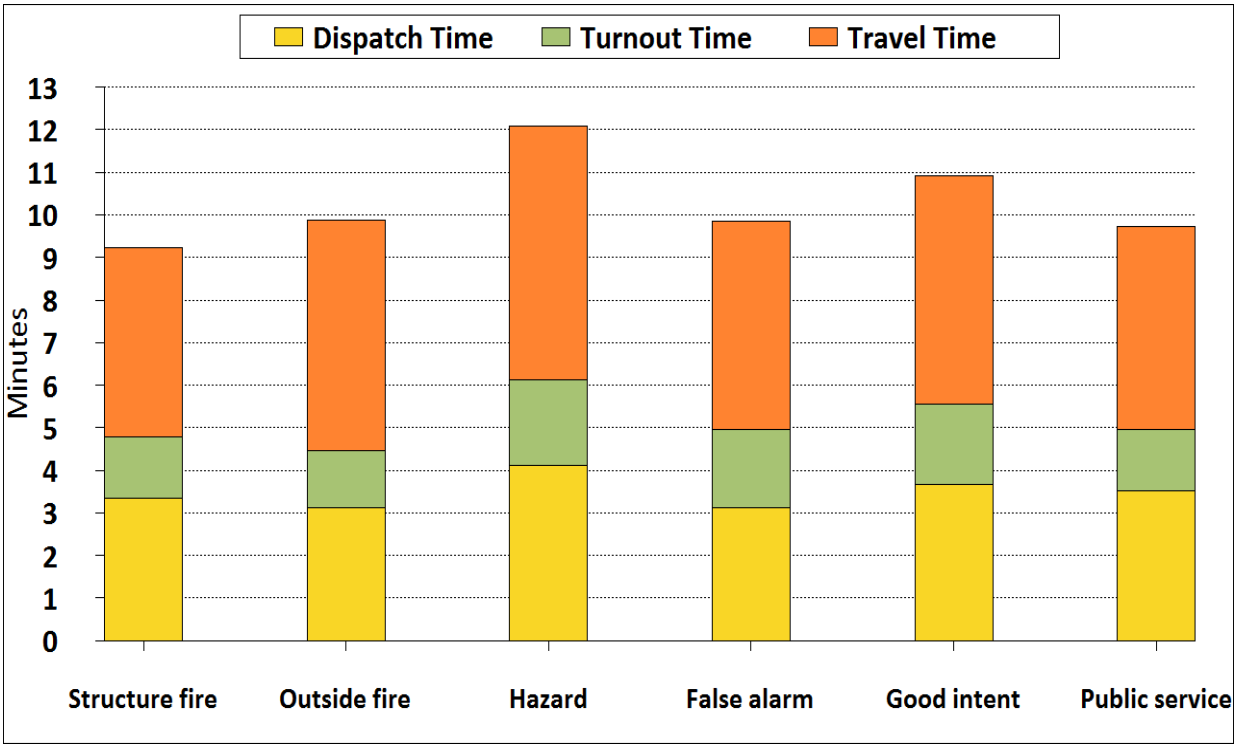


Figure D-9: Average Dispatch, Turnout, and Travel Times of First Arriving Unit by Fire Call Type



Observations:

- The average dispatch time was 3.4 minutes.
- The average turnout time was 1.3 minutes.
- The average travel time was 4.8 minutes.
- The average response time for EMS calls was 9.2 minutes.
- The average response time for fire category calls was 9.8 minutes.
- The average response time for structure fire calls was 9.2 minutes.
- The average response time for outside fire calls was 9.9 minutes.

Table D-12: 90th Percentile Dispatch, Turnout, Travel, and Response Times of First Arriving Unit, by Call Type

Call Type	Dispatch Time	Turnout Time	Travel Time	Response Time	Sample Size
ALS	4.9	2.8	7.9	12.2	166
MVA	5.6	3.2	7.1	14.3	15
Fall and injury	5.9	2.5	6.8	12.3	72
Illness and other	5.4	2.6	7.5	12.2	106
EMS transport	5.4	2.3	8.2	13.4	247
EMS Total	**5.2**	**2.6**	**7.8**	**12.7**	**606**
Structure fire	5.0	2.8	6.8	11.5	397
Outside fire	4.9	3.8	9.1	14.0	85
Hazard	6.4	5.1	10.3	17.6	62
False alarm	4.6	4.7	6.8	13.1	42
Good intent	5.9	5.1	8.4	17.3	66
Public service	5.5	3.6	7.2	13.0	79
Fire Total	**5.2**	**3.4**	**7.5**	**13.0**	**731**
Total	**5.2**	**3.0**	**7.6**	**12.9**	**1,337**

Note: A 90th percentile value of 12.9 indicates that the total response time was less than 12.9 minutes for 90 percent of all calls. Unlike averages, the 90th percentile response time is not equal to the sum of the 90th percentile of dispatch time, turnout time, and travel time.

Observations:

- The 90th percentile dispatch time was 5.2 minutes.
- The 90th percentile turnout time was 3.0 minutes.
- The 90th percentile travel time was 7.6 minutes.
- The 90th percentile response time for EMS calls was 12.7 minutes.
- The 90th percentile response time for fire category calls was 13.0 minutes.
- The 90th percentile response time for structure fire calls was 11.5 minutes.
- The 90th percentile response time for outside fire calls was 14.0 minutes.

Figure D-10: Average Dispatch, Turnout, Travel, and Response Time of First Arriving Unit, by Hour of Day

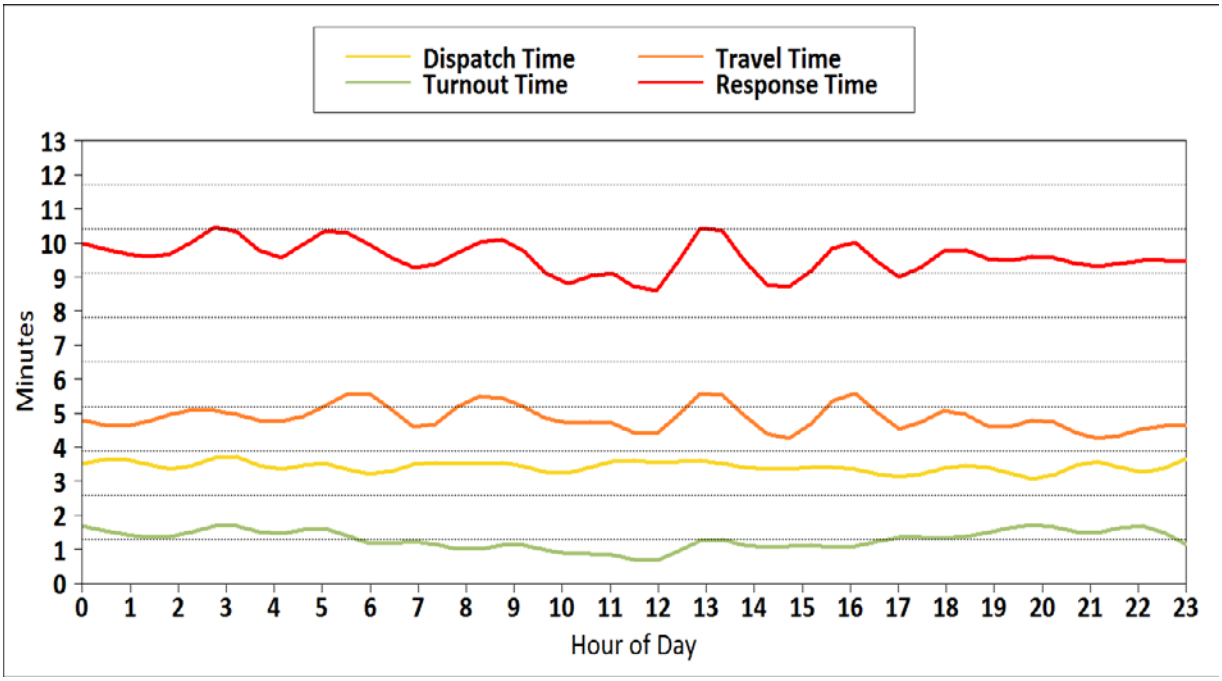


Table D-13: Average Dispatch, Turnout, Travel, and Response Times of First Arriving Unit, by Hour of Day

Hour	Dispatch Time	Turnout Time	Travel Time	Response Time	90th Percentile Response Time	Sample Size
0	3.5	1.7	4.8	10.0	12.4	50
1	3.6	1.4	4.6	9.7	13.0	46
2	3.3	1.4	5.0	9.8	11.8	59
3	3.8	1.7	5.0	10.5	13.9	27
4	3.4	1.5	4.7	9.6	12.0	54
5	3.5	1.6	5.2	10.3	13.5	42
6	3.2	1.2	5.6	10.0	14.0	35
7	3.5	1.2	4.5	9.3	11.9	39
8	3.5	1.0	5.3	9.8	15.4	34
9	3.5	1.2	5.3	10.0	15.3	48
10	3.2	0.9	4.7	8.8	12.0	52
11	3.6	0.8	4.7	9.1	12.1	65
12	3.5	0.7	4.4	8.7	11.9	50
13	3.6	1.3	5.7	10.5	18.9	59
14	3.4	1.1	4.7	9.1	13.1	69
15	3.4	1.1	4.4	8.9	12.5	66
16	3.4	1.1	5.6	10.1	14.3	61
17	3.1	1.4	4.5	9.0	11.5	69
18	3.4	1.3	5.1	9.8	13.3	65
19	3.4	1.5	4.6	9.5	12.4	67
20	3.1	1.7	4.8	9.6	13.5	63
21	3.6	1.5	4.3	9.3	12.3	71
22	3.3	1.7	4.5	9.5	12.1	78
23	3.7	1.1	4.6	9.4	12.5	68

Observations:

- Average dispatch time was between 3.1 and 3.8 minutes.
- Average turnout time was between 0.7 and 1.7 minutes. It peaked between midnight and 6:00 a.m., averaging between 1.4 and 1.7 minutes.
- Average travel time was between 4.3 and 5.7 minutes.
- Average response time was between 8.7 and 10.5 minutes.
- Average 90th percentile response time was between 11.5 and 18.9 minutes.

Figure D-11: Number of Total Calls by First Arriving Units

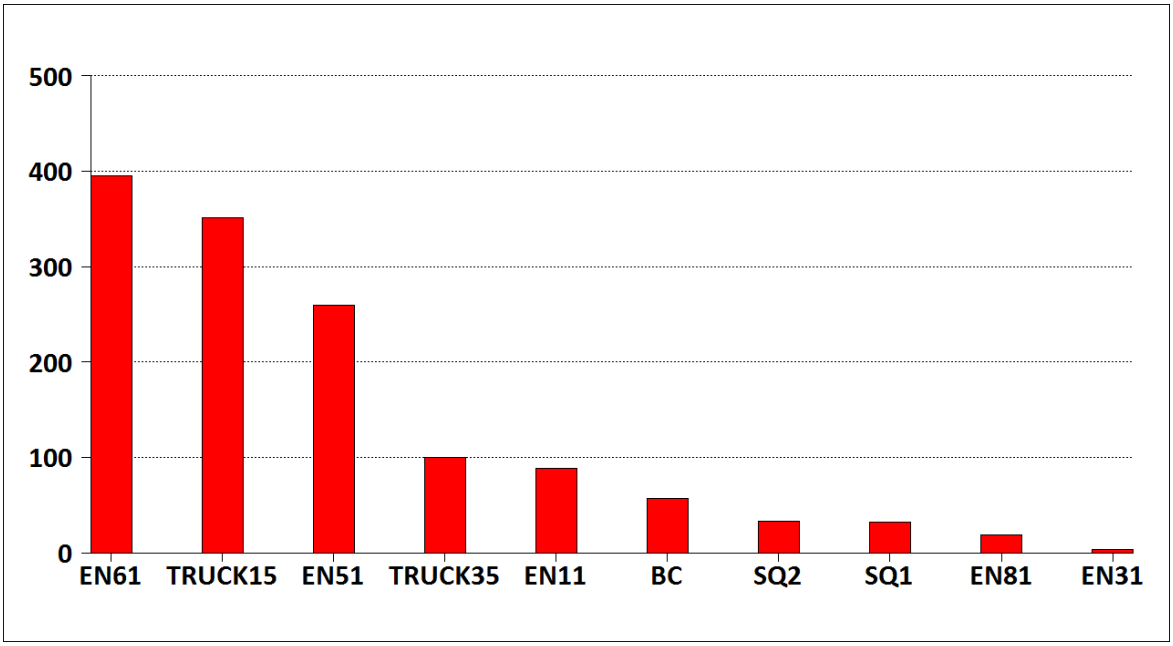


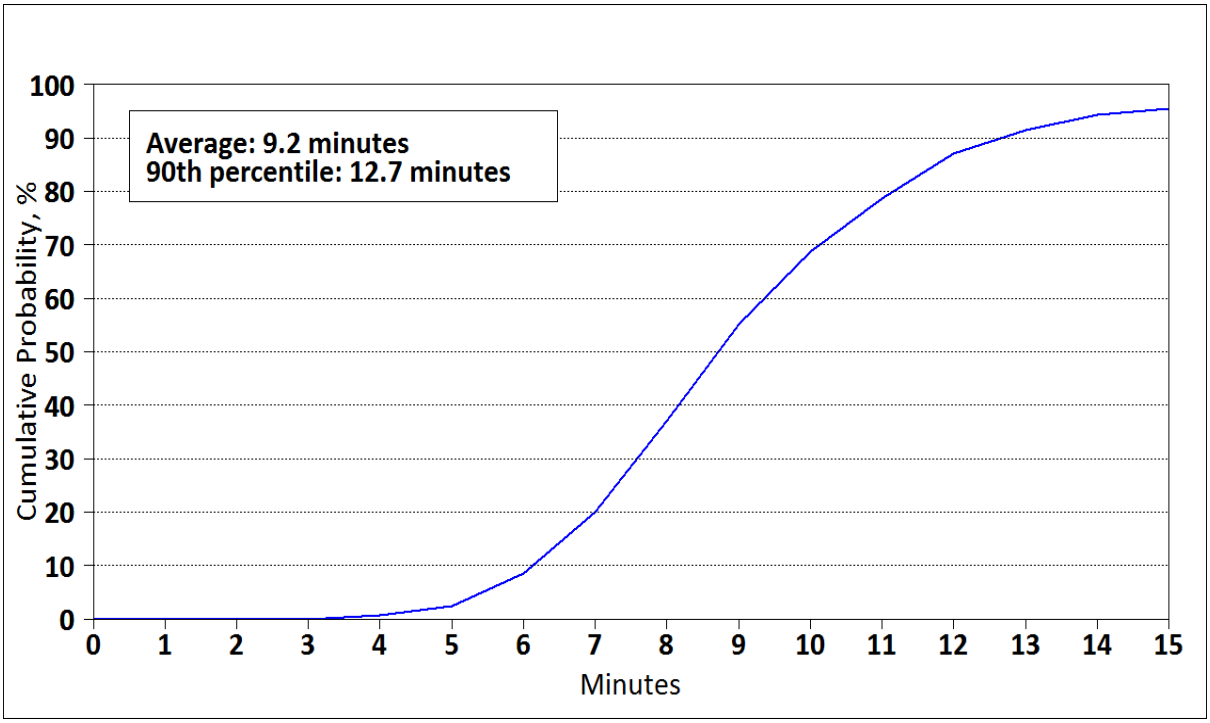
Table D-14: Number of Total Calls by First Arriving Units

Unit	EMS	Structure and Outside Fire	Other Fire	Total	Percentage	Cumulative Percentage
EN61	183	146	66	395	29.5	29.5
Truck15	182	93	76	351	26.3	55.8
EN51	132	84	43	259	19.4	75.2
Truck35	47	40	13	100	7.5	82.6
EN11	38	26	24	88	6.6	89.2
BC	2	45	10	57	4.3	93.5
SQ2	3	22	8	33	2.5	96.0
SQ1	7	18	7	32	2.4	98.4
EN81	10	7	2	19	1.4	99.8
EN31	2	1	0	3	0.2	100.0

Observations:

- Engine 61 arrived first on scene most often, followed by Truck15 and EN51. Those three units accounted for 75 percent of the first arrivals at calls.
- For structure and outside fire calls, EN61 and Truck15 arrived first on scene most often.

Figure D-12: Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for EMS calls



Reading the CDF Chart: The vertical axis is the probability or percentage of calls. The horizontal axis is response time. For example, with regard to EMS calls, the 0.9 probability line intersects the graph at the time mark at about 12.7 minutes for first arriving FFD unit. This means that FFD units had a response time of less than 12.7 minutes for 90 percent of EMS calls.

Figure D-13: Frequency Distribution Chart of Response Time of First Arriving Unit for EMS Calls

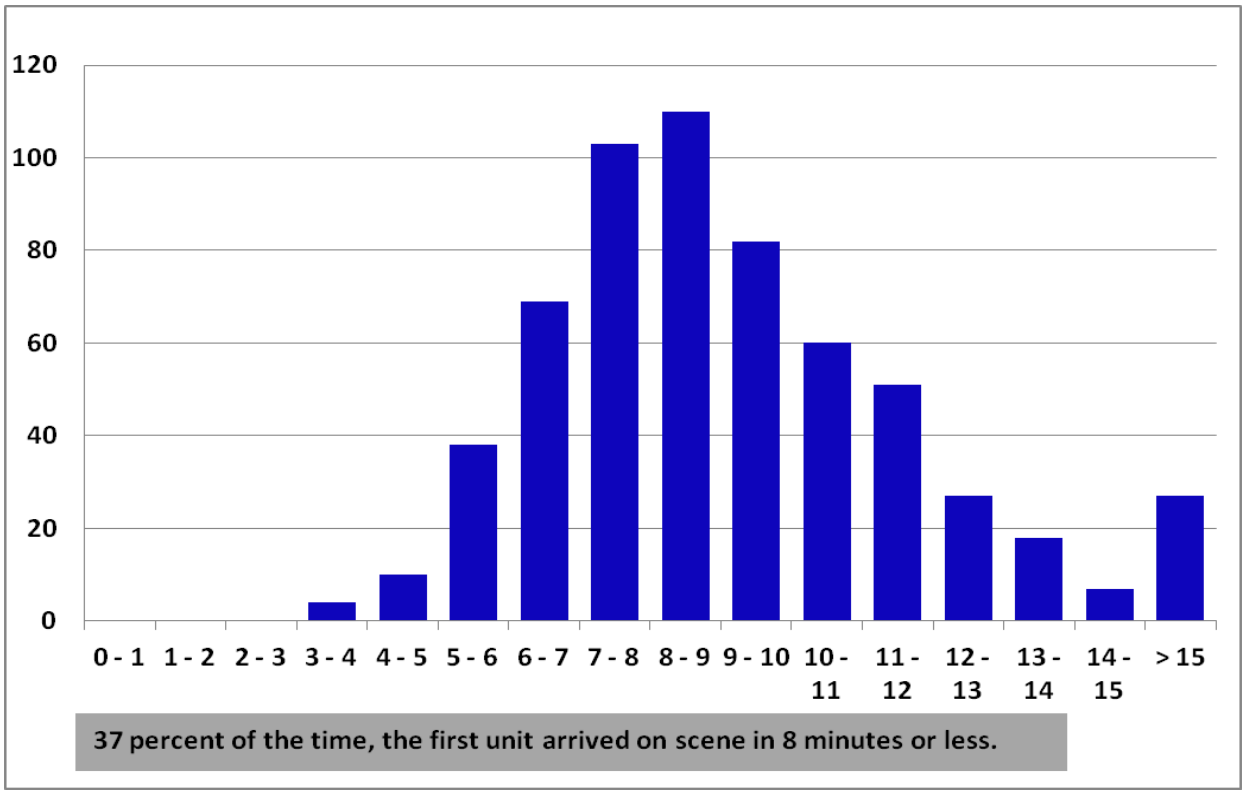


Table D-15: Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for EMS Calls

Response Time (minute)	Frequency	Cumulative Percentage
3 - 4	4	0.7
4 - 5	10	2.3
5 - 6	38	8.6
6 - 7	69	20.0
7 - 8	103	37.0
8 - 9	110	55.1
9 - 10	82	68.6
10 - 11	60	78.5
11 - 12	51	87.0
12 - 13	27	91.4
13 - 14	18	94.4
14 - 15	7	95.5
> 15	27	100.0

Observations:

- The average response time of the first arriving FFD unit for EMS calls was 9.2 minutes.
- For 37 percent of EMS calls, the response time of the first arriving FFD unit was less than or equal to 8 minutes.
- For 90 percent of EMS calls, the response time of the first arriving FFD was less than 12.7 minutes.

Table D-16: Average Response Time for Structure and Outside Fire Calls by First Arriving Unit

Unit Type	First Arriving Unit	Outside Fire		Structure Fire		Total	
		Response Time	Number of Calls	Response Time	Number of Calls	Response Time	Number of Calls
Battalion Chief's car	BC	8.9	2	9.1	43	9.1	45
Engine	EN11	11.1	6	9.2	20	9.7	26
Engine	EN31	NA	0	13.1	1	13.1	1
Engine	EN51	10.1	16	9.1	68	9.3	84
Engine	EN61	9.2	28	9.0	118	9.0	146
Engine	EN81	11.0	1	10.1	6	10.3	7
Quint	Truck15	10.2	21	10.1	72	10.1	93
Quint	Truck35	9.8	9	8.5	31	8.8	40
Squad	SQ1	16.3	1	9.5	17	9.9	18
Squad	SQ2	7.9	1	8.8	21	8.7	22
Total		**9.9**	**85**	**9.2**	**397**	**9.3**	**482**

Observations:

- For outside fire calls, the average response time of the first arriving unit was 9.9 minutes.
- For outside fire calls, Engine 61 was the first unit on scene most often and had an average response time of 9.2 minutes.
- For structure fire calls, the average response time of the first arriving unit was 9.2 minutes.
- For structure fire calls, Engine 61 was the first unit on scene most often and had an average response time of 9.0 minutes.

Table D-17: Average Response Time for Structure and Outside Fire Calls by Second Arriving Unit

Unit Type	Second Arriving Unit	Outside Fire		Structure Fire		Total	
		Response Time	Number of Calls	Response Time	Number of Calls	Response Time	Number of Calls
Battalion Chief's car	BC	11.5	6	10.5	68	10.6	74
Engine	EN11	NA	0	11.1	10	11.1	10
Engine	EN31	NA	0	10.7	1	10.7	1
Engine	EN51	8.9	2	11.3	27	11.1	29
Engine	EN61	9.8	2	10.1	34	10.1	36
Engine	EN81	NA	0	8.8	1	8.8	1
Quint	Truck15	NA	0	10.1	45	10.1	45
Quint	Truck35	13.2	4	10.6	42	10.8	46
Squad	SQ1	11.5	6	10.6	66	10.7	72
Squad	SQ2	10.4	5	10.0	73	10.0	78
Total		**11.2**	**25**	**10.4**	**367**	**10.5**	**392**

Observations:

- For outside fire calls, the average response time of the second arriving unit was 11.2 minutes, which was 1.3 minutes longer than the first arriving unit.
- For structure fire calls, the average response time of the second arriving unit was 10.4 minutes, which was 1.2 minutes longer than the first arriving unit.

Figure D-14: Cumulative Distribution Function (CDF) of Response Time of First Four Arriving Units for Structure Fire Calls

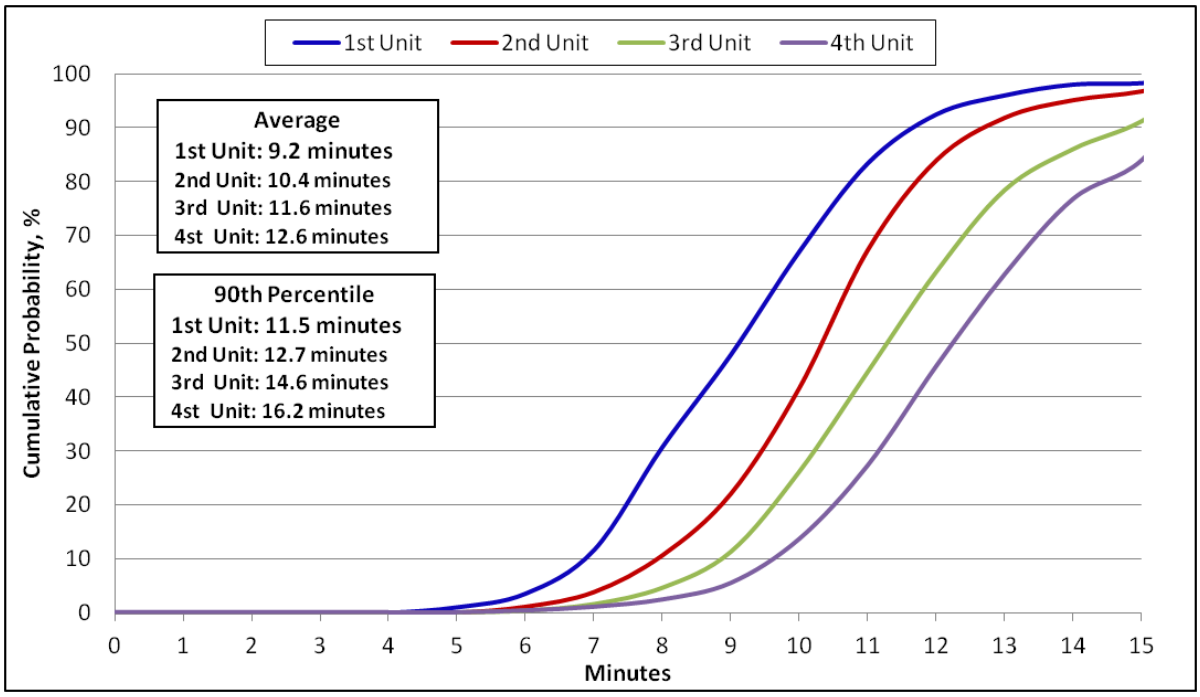


Figure D-15: Frequency Distribution Chart of Response Time of First Arriving Unit for Structure Fire Calls

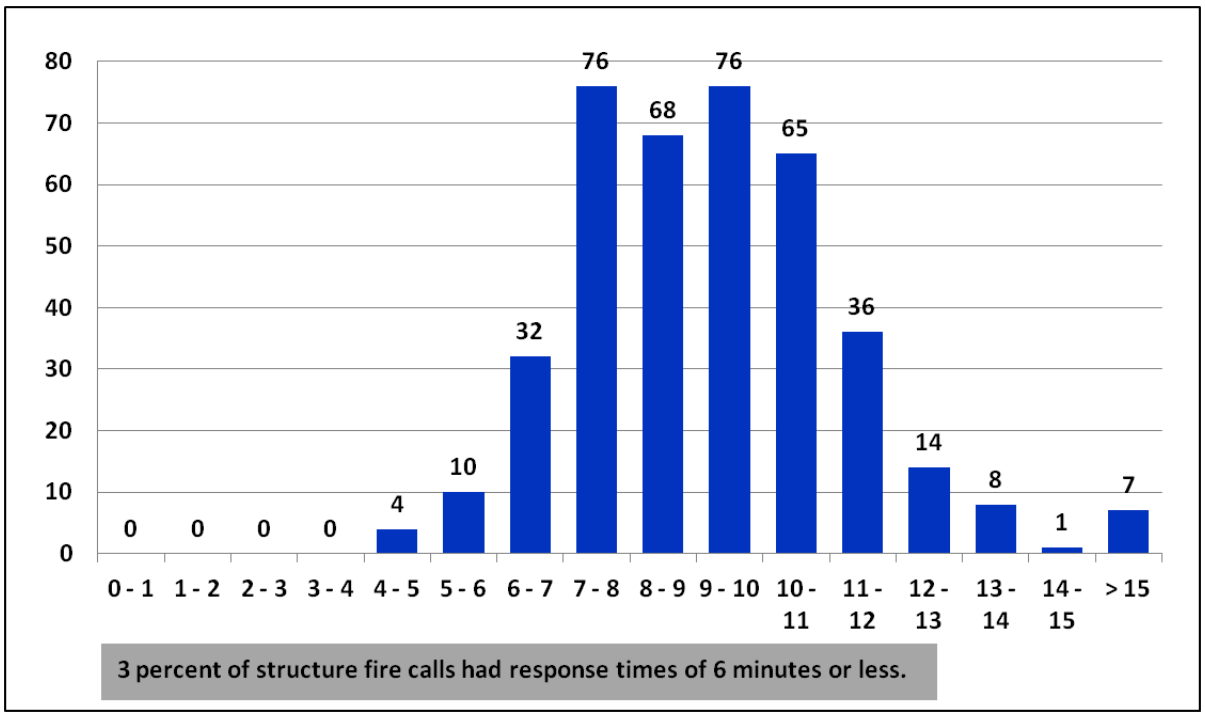


Table D-18: Cumulative Distribution Function (CDF) of Response Time of First Four Arriving Units for Structure Fire Calls

Response Time (minute)	1st Unit		2nd Unit		3rd Unit		4th Unit	
	Frequency	Cumulative Percent	Frequency	Cumulative Percent	Frequency	Cumulative Percent	Frequency	Cumulative Percent
0 - 1	0	0.0	0	0.0	0	0.0	0	0.0
1 - 2	0	0.0	0	0.0	0	0.0	0	0.0
2 - 3	0	0.0	0	0.0	0	0.0	0	0.0
3 - 4	0	0.0	0	0.0	0	0.0	0	0.0
4 - 5	4	1.0	0	0.0	0	0.0	0	0.0
5 - 6	10	3.5	4	1.1	1	0.3	1	0.3
6 - 7	32	11.6	10	3.8	4	1.5	2	1.0
7 - 8	76	30.7	25	10.6	10	4.6	4	2.4
8 - 9	68	47.9	42	22.1	22	11.2	9	5.5
9 - 10	76	67.0	72	41.7	49	26.1	24	13.7
10 - 11	65	83.4	94	67.3	61	44.7	40	27.3
11 - 12	36	92.4	61	83.9	61	63.2	54	45.7
12 - 13	14	96.0	29	91.8	50	78.4	50	62.8
13 - 14	8	98.0	12	95.1	25	86.0	41	76.8
14 - 15	1	98.2	6	96.7	17	91.2	21	84.0
> 15	7	100.0	12	100.0	29	100.0	47	100.0

Observations:

- For structure fire calls, the average response time of the first arriving unit was 9.2 minutes.
- For 3.5 percent of the time, the first arriving unit's response time for structure fire calls was less than 6.0 minutes.
- Ninety percent of the time, the first arriving unit's response time for structure fire calls was less than 11.5 minutes.
- For structure fire calls, the average response times of the second, third, and fourth arriving units were10.4, 11.6, and 12.6 minutes, respectively.
- For structure fire calls, the 90th percentile response times of the second, third, and fourth arriving units were 12.7, 14.6, and 16.2 minutes, respectively.

Figure D-16: Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for Outside Fire Calls

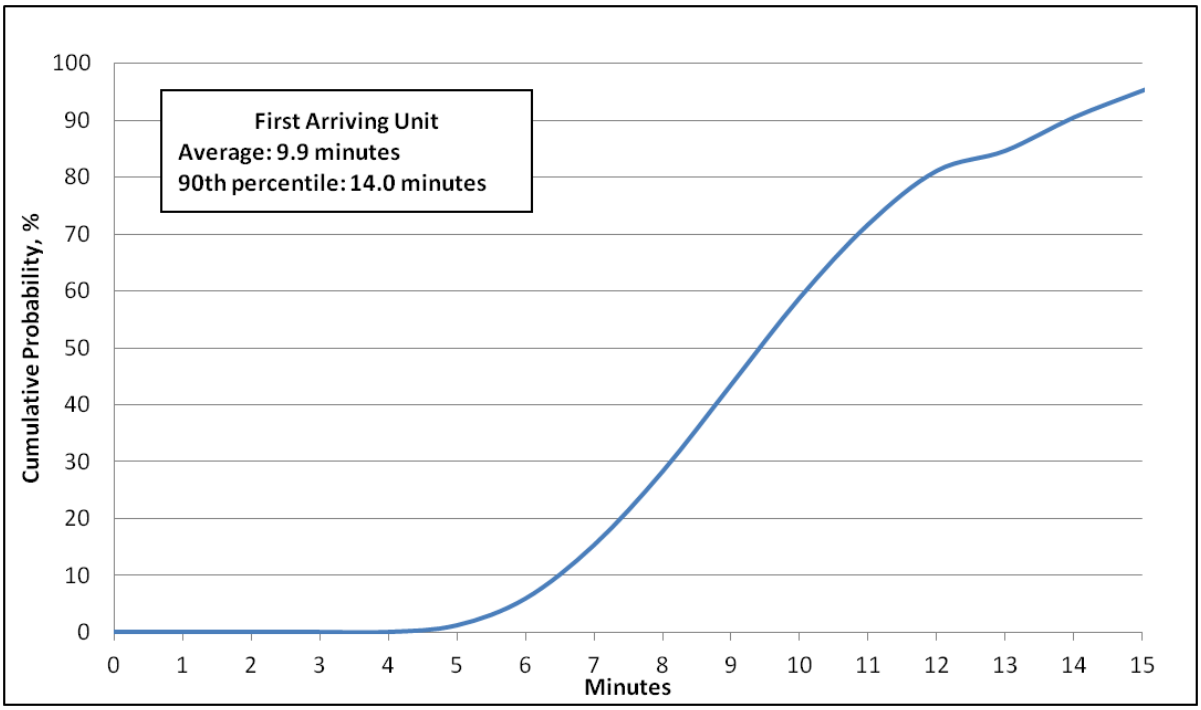


Figure D-17: Frequency Distribution Chart of Response Time of First Arriving Unit for Outside Fire Calls

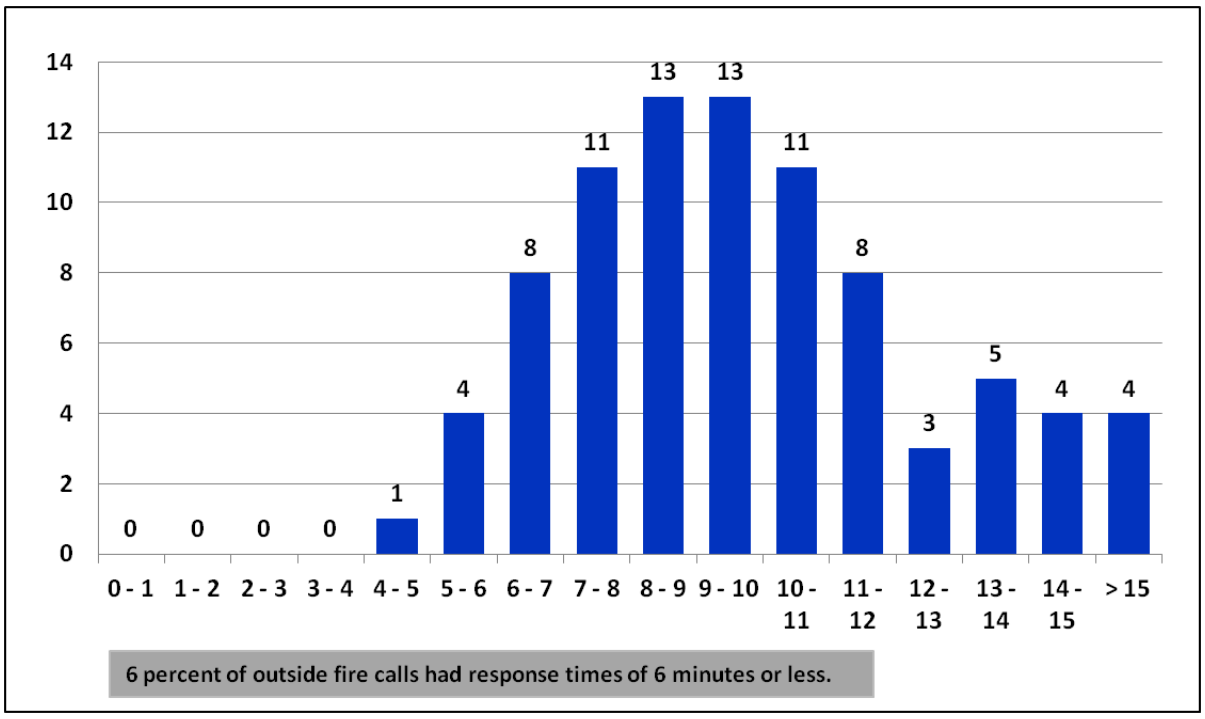


Table D-19: Cumulative Distribution Function (CDF) of Response Time of First Arriving Unit for Outside Fire Calls

Response Time (minute)	Frequency	Cumulative Percent
0 - 1	0	0.0
1 - 2	0	0.0
2 - 3	0	0.0
3 - 4	0	0.0
4 - 5	1	1.2
5 - 6	4	5.9
6 - 7	8	15.3
7 - 8	11	28.2
8 - 9	13	43.5
9 - 10	13	58.8
10 - 11	11	71.8
11 - 12	8	81.2
12 - 13	3	84.7
13 - 14	5	90.6
14 - 15	4	95.3
> 15	4	100.0

Observations:

- For outside fire calls, the average response time of the first arriving unit was 9.9 minutes.
- For 5.9 percent of the time, the first arriving unit's response time was less than 6.0 minutes for outside fire calls.
- Ninety percent of the time, the first arriving unit's response time was less than 14.0 minutes for outside fire calls.

Attachment I: Workload of Support Units

Unit Description	Number of Runs	Annual Hours
Bike Team	2	10.4
Gator	8	50.6
Support	1	10.0

Attachment II: Property and Content Loss Analysis for Structure and Outside Fire Calls

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Structure fire	$4,716,617	367	$1,086,368	259
Outside fire	$337,256	71	$69,793	42
Total	$5,053,873	438	$1,156,161	301

Note: This analysis only includes structure and outside fire calls with property loss or content loss greater than 0.

Observations:

- Out of 537 structure fire calls, 367 calls (68 percent) had recorded property loss, with total recorded loss value of $4,716,617. A total of 259 calls (48 percent) had recorded content loss, with total recorded loss value of $1,086,368. The largest recorded property loss was $400,000, which occurred at 2906 Kleinpell St. on February 5, 2014.
- Out of 246 outside fire calls, 71 had recorded property loss and 41 had recorded content loss.

Attachment III: Actions Taken Analysis for Structure and Outside Fire Calls

Action Taken	Number of Calls	
	Structure fire	Outside fire
Fire control or extinguishment, other	5	0
Extinguishment by fire service personnel	402	200
Salvage & overhaul	4	0
Remove hazard	1	0
Ventilate	29	2
Establish safe area	1	0
Restore sprinkler or fire protection system	1	0
Assistance, other	**3**	**0**
Information, investigation & enforcement, other	2	0
Investigate	19	14
Action taken, other	2	0
Missing	68	30
Total	**537**	**246**

Observations:

- A total of 407 structure fire calls were controlled or extinguished, which accounted for 76 percent of structure fires in the FFD's jurisdiction.
- A total of 200 outside fire calls were controlled or extinguished, which accounted for 81 percent of outside fires in the FFD's jurisdiction.

Attachment IV: Correspondence between NFIRS Incident Type and Call Type

NFIRS Incident Type	Incident Description	Call Type
100	Fire, other	Outside fire
111	Building fire	Structure fire
112	Fires in structure other than in a building	Structure fire
113	Cooking fire, confined to container	Structure fire
116	Fuel burner/boiler malfunction, fire confined	Structure fire
118	Trash or rubbish fire, contained	Structure fire
121	Fire in mobile home used as fixed residence	Structure fire
130	Mobile property (vehicle) fire, other	Outside fire
131	Passenger vehicle fire	Outside fire
140	Natural vegetation fire, other	Outside fire
141	Forest, woods or wildland fire	Outside fire
142	Brush or brush-and-grass mixture fire	Outside fire
143	Grass fire	Outside fire
150	Outside rubbish fire, other	Outside fire
151	Outside rubbish, trash or waste fire	Outside fire
154	Dumpster or other outside trash receptacle fire	Outside fire
160	Special outside fire, other	Outside fire
162	Outside equipment fire	Outside fire
251	Excessive heat, scorch burns with no ignition	Hazard
300	Rescue, EMS incident, other	EMS
311	Medical assist, assist EMS crew	EMS
320	Emergency medical service, other (conversion only)	EMS
321	EMS call, excluding vehicle accident with injury	EMS
322	Motor vehicle accident with injuries	MVA
323	Motor vehicle/pedestrian accident (MV Ped)	MVA
324	Motor vehicle accident with no injuries.	MVA
350	Extrication, rescue, other	EMS
351	Extrication of victim(s) from building/structure	EMS
352	Extrication of victim(s) from vehicle	EMS
353	Removal of victim(s) from stalled elevator	EMS
357	Extrication of victim(s) from machinery	EMS
360	Water & ice-related rescue, other	EMS
361	Swimming/recreational water areas rescue	EMS
372	Trapped by power lines	EMS

NFIRS Incident Type	Incident Description	Call Type
381	Rescue or EMS standby	EMS
400	Hazardous condition, other	Hazard
411	Gasoline or other flammable liquid spill	Hazard
412	Gas leak (natural gas or LPG)	Hazard
413	Oil or other combustible liquid spill	Hazard
422	Chemical spill or leak	Hazard
424	Carbon monoxide incident	Hazard
440	Electrical wiring/equipment problem, other	Hazard
441	Heat from short circuit (wiring), defective/worn	Hazard
442	Overheated motor	Hazard
444	Power line down	Hazard
445	Arcing, shorted electrical equipment	Hazard
460	Accident, potential accident, other	Hazard
461	Building or structure weakened or collapsed	Hazard
463	Vehicle accident, general cleanup	Hazard
480	Attempted burning, illegal action, other	Hazard
481	Attempt to burn	Hazard
482	Threat to burn	Hazard
500	Service Call, other	Public service
511	Lock-out	Public service
512	Ring or jewelry removal	Public service
520	Water problem, other	Public service
521	Water evacuation	Public service
522	Water or steam leak	Public service
531	Smoke or odor removal	Public service
550	Public service assistance, other	Public service
551	Assist police or other governmental agency	Public service
552	Police matter	Public service
553	Public service	Public service
554	Assist invalid	Public service
561	Unauthorized burning	Public service
600	Good intent call, other	Good intent
611	Dispatched & canceled en route	Canceled
621	Wrong location	Canceled
622	No incident found on arrival at dispatch address	Canceled
650	Steam, other gas mistaken for smoke, other	Good intent
651	Smoke scare, odor of smoke	Good intent

NFIRS Incident Type	Incident Description	Call Type
652	Steam, vapor, fog or dust thought to be smoke	Good intent
653	Smoke from barbecue, tar kettle	Good intent
661	EMS call, party transported by non-fire agency	EMS transport
700	False alarm or false call, other	False alarm
710	Malicious, mischievous false call, other	False alarm
713	Telephone, malicious false alarm	False alarm
715	Local alarm system, malicious false alarm	False alarm
731	Sprinkler activation due to malfunction	False alarm
732	Extinguishing system activation due to malfunction	False alarm
733	Smoke detector activation due to malfunction	False alarm
735	Alarm system sounded due to malfunction	False alarm
736	CO detector activation due to malfunction	False alarm
740	Unintentional transmission of alarm, other	False alarm
743	Smoke detector activation, no fire - unintentional	False alarm
744	Detector activation, no fire - unintentional	False alarm
745	Alarm system activation, no fire - unintentional	False alarm
746	Carbon monoxide detector activation, no CO	False alarm
814	Lightning strike (no fire)	Public service