Complying with ISO Response Time Criteria

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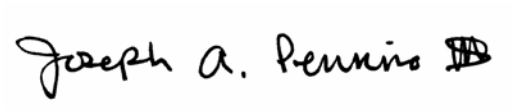

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Abstract

The problem was Largo Fire Rescue had not identified causes for its decrease in compliance with the Insurance Services Office's (ISO) response time standards to working fires from 2013 to 2014. The purpose of this applied research project was to use the historical research method to identify possible causes for Largo Fire Rescue's decrease in compliance with these response time standards. Succeeding a wide-ranging literature review, an in-depth data analysis was conducted which included using National Fire Incident Reporting System (NFIRS) and Computer Aided Dispatch (CAD) data to research historical departmental response data. Furthermore, CAD notes were scrutinized, apparatus Global Positioning System (GPS) data was collected, and unit availability was determined in an attempt to answer the following research questions: a) What are the possible causes of the increase in response times? (b) In what ways have each of these causes affected overall response times? The results of the study indicated two main reasons for the increase in response times. One of the causes involved a dramatic increase in overall calls for service resulting in a correlating decrease in unit availability. The second contributing factor was the inability of Largo Fire Rescue's only aerial platform to meet ISO's requisite response times to all locations within the fire district from where it is currently housed. One recommendation included placing rescue units in service during the busiest parts of the day to share the call load, increasing the availability of suppression apparatus. In the case of the aerial platform, its response area could be divided with another truck already operated by Largo Fire Rescue. Additional recommendations include assessing Pinellas County's emergency dispatch procedures for compatibility with an automatic vehicle location (AVL) system and ensuring that continuous, ongoing monitoring of response times to working fires takes place.

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Complying with ISO Response Time Criteria

Each year, fires cause an estimated $11.5 billion in property loss, 15,925 civilian injuries, and 3,240 civilian fatalities in the United States (Karter, 2014). It can take less than ten minutes from the time a single object in a room is ignited until the entire room and all of its contents are aflame, an occurrence identified as "flashover" (Thiel, 2012). The ability for fire departments to respond quickly to these fires facilitates rapid extinguishment and decreases property damage and civilian morbidity. For this and other reasons, the Insurance Services Office (ISO) utilizes the National Fire Protection Association's (NFPA) standards for fire department response times as part of its Fire Suppression Rating Schedule (FSRS).

From 2013 to 2014, Largo Fire Rescue experienced a decrease in compliance with ISO response time standards to working fires. The problem was Largo Fire Rescue had not identified causes for this decrease in compliance. Without determining the cause for the increase in response times, Largo Fire Rescue was incapable of improving its response times and increasing its compliance with ISO response time standards. The purpose of the research was to use the historical research method to identify causes for Largo Fire Rescue's decrease in compliance with ISO response time standards. The research questions were: (a) What are the possible causes of the increase in response times? (b) In what ways have each of these causes affected overall response times?

Background and Significance

The City of Largo is the fourth largest city in the Tampa Bay Area and is home to approximately 80,000 people and 7,000 businesses. It is centrally located on Florida's West Coast in Pinellas County, which is the most densely populated county in the state. Largo Fire Rescue has an ISO rating of one and employs 132 sworn firefighters and 8 civilian employees.

The department provides fire protection, emergency medical services, hazardous materials response, technical rescue operations, fire prevention, community education, and disaster planning services for more than 100,000 residents in a service area of approximately 30.5 square miles that includes unincorporated portions of Pinellas County, the City of Belleair Bluffs, and the Town of Belleair (Figure 1).

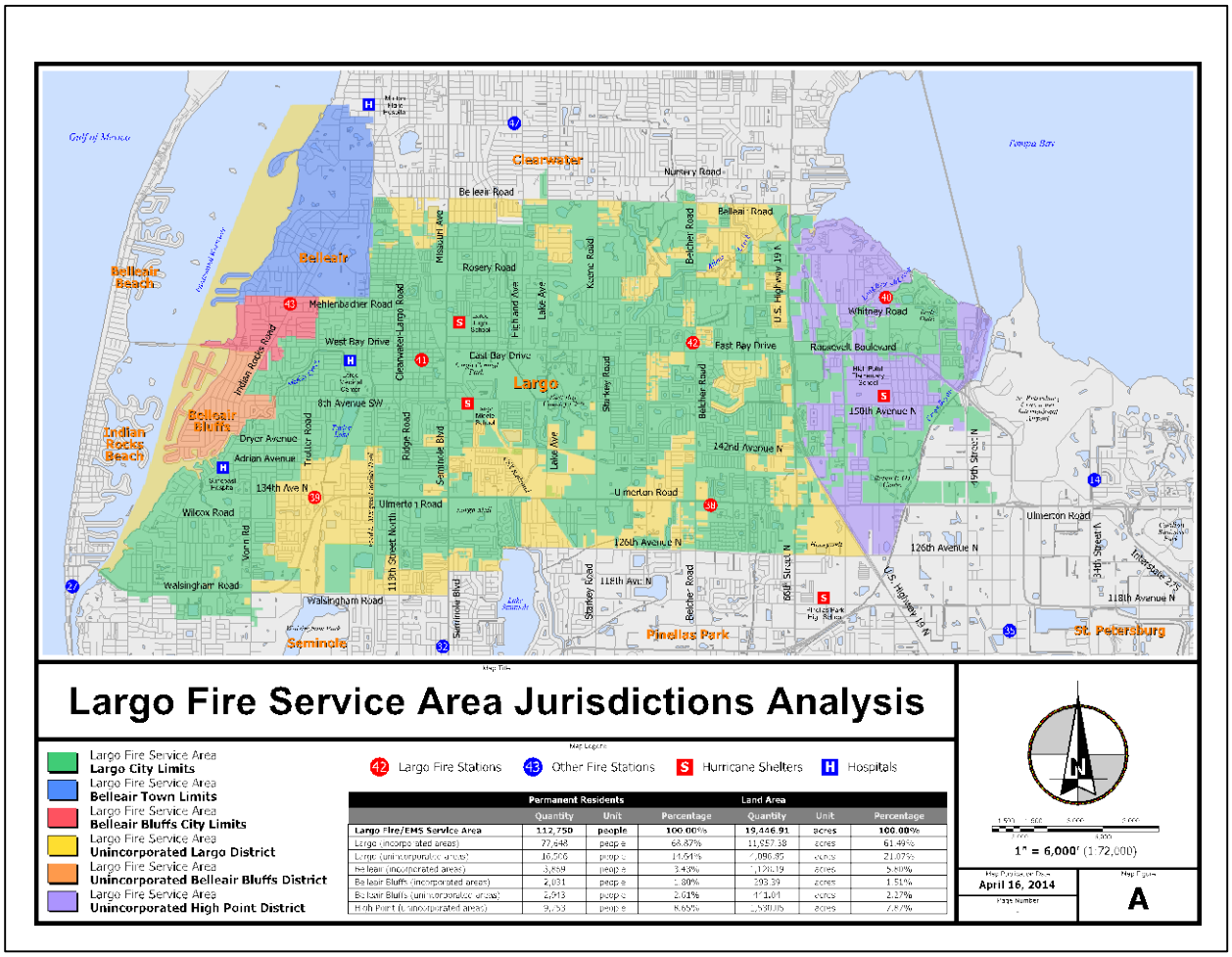

Figure 1. Largo Fire Rescue Service Area Jurisdiction.

The Department uses five advanced life support (ALS) engines, one ALS truck, two ALS squads, two ALS rescues, and one basic life support (BLS) aerial platform, which respond out of six stations to approximately 25,000 calls for service each year. These numbers represent more

than 65 calls for service each day. The department is part of an all-hazards automatic aid program that includes all Pinellas County fire departments. Largo Fire Rescue is also an integral part of the County's regional response approach to hazardous materials and technical rescue incidents.

As part of their overall deployment analysis, ISO uses a systemic evaluation that analyzes CAD history to confirm that, using its current deployment of companies, the fire department meets the time limitations for the initial arriving engine and full-alarm assignment (Insurance Services Office, 2014). ISO considers the full-alarm assignment a ladder truck and enough engines to meet the needed fire-flow. For the Largo Fire District, this means one ladder truck and three fire engines. ISO sets its response time requirement in accordance with the general criteria outlined in NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*.

The National Fire Protection Association (NFPA) is a nonprofit organization that provides research, training, education, codes, and standards for the fire service. NFPA 1710 describes levels of service, deployment capabilities, and staffing levels for career fire departments. Concerning turnout times, this standard allows 80-seconds for fire incidents, which is the time interval between when firefighters are notified of the incident to when travel time begins. The standard outlines 240-seconds as the maximum travel time for the first arriving engine company and 480-seconds as the maximum travel time for the remainder of the first alarm. In summary, NFPA 1710 advocates that the first arriving engine should arrive on scene within 320-seconds (turnout time plus travel time) and the remainder of the first alarm should arrive on scene within 560-seconds of being dispatched.

In 2013, Largo Fire Rescue managed to meet this standard with the first arriving engine approximately 74% of the time and with the remainder of the first alarm units approximately 64% of the time. In 2014 however, the department was only able to meet this standard with the first arriving engine approximately 70% of the time and with the remainder of the first alarm units approximately 50% of the time. This translates to a 5.7% decrease in compliance for the first arriving engine and a 28% decrease in compliance for the remainder of the first alarm units.

This decrease in compliance with ISO response time criteria is a significant problem for Largo Fire Rescue. The mission of Largo Fire Rescue is to "protect and enhance the quality of life within the community by providing a range of public services for the health, safety, and welfare of our citizens" (Largo Fire Rescue, 2015). The ability of Largo Fire Rescue crews to rapidly respond in order to protect the community from the threat of fire is at the heart of its mission. However, many do not see the ISO/NFPA standards as feasible or attainable. For instance, Wall Street Journal author Carl Bialik writes that NFPA standard 1710, which governs response times, "is not widely being met at this point, because of financial difficulties and because of how much resources are needed to comply" (Bialik, 2012). Opinions aside, hostile fire can grow with tremendous speed; therefore, increased response times can increase property damage and civilian morbidity (Thiel, 2012). Furthermore, longer response times can potentially have an adverse affect on the department's ISO rating and lead to higher insurance costs to residents and business owners alike. This is especially true in the case of Largo Fire Rescue, where the cause of the increased response times was not identified and, therefore, could not be corrected.

The United States Fire Administration lists five operational goals in its strategic plan. These goals include:

1. Reduce risk at the local level through prevention and mitigation
2. Improve local planning and preparedness
3. Improve the fire and emergency services' capability for response to and recovery from all hazards
4. Improve the fire and emergency services' professional status
5. Lead the Nation's fire and emergency services by establishing and sustaining USFA as a dynamic organization (United States Fire Administration, 2010 p. 13)

This applied research project is designed specifically to accomplish the United States Fire Administration goals one, two, and three. Furthermore, this research is directly related to the National Fire Academy's Executive Development course. One of the main topics of the Executive Development course is dedicated to service quality. Particularly, how to "improve constantly and forever the system of production and service, [and] to improve quality and productivity" (United States Fire Administration, 2013, p. SM 11-3).

Literature Review

A broad literature review was conducted to abridge the body of knowledge that is presently available on relevant subjects relating to fire department response times. This review included timely and pertinent trade journals, applied research projects, NFPA standards, books, peer-reviewed articles, and various other applicable publications. Care was taken to expand the research outside of the emergency services profession and into other industries that may provide alternate perspectives on the subject. Several topics where outlined in the literature review that could have an affect on response times. Some of these factors include fire station design, apparatus design, the number of units available to respond to incidents, the available road network, training, quantity of fire stations, the time of day incidents occur, and fire station

location (Thiel, 2012). The literature review provided an understanding as to which of these elements would apply to the response time problem that was threatening Largo Fire Rescue.

It would be impossible to gauge the different factors that may affect response times without first ensuring that alarm times, turnout times, and overall response times have been accurately documented. In an article published in the Wall Street Journal, author Carl Bialik observes the lack of consistency and transparency in the way U.S. city fire departments measure their response times to fire emergencies (Bialik, 2012). It is impossible to ensure response time standards are being met if proper data collection is not taking place. Once a viable method of data collection is decided upon, regular reporting of alarm processing, turnout time, travel time, and total response time should be conducted (Walls, 2013). According to Buckman (2006), the emergency response calls can then be analyzed and displayed by type, time of call, location, agency, and other criteria.

Perhaps the utmost immobile element affecting response time is the location of fire stations. Not surprisingly, Taylor (2015) found that in places where there are higher concentrations of fire stations, fires are likely to be attended to more rapidly. Placing a fire station in the proper location is difficult, however. Thiel (2012) compares determining the location of a fire station is like “playing chess without a board” and goes on to mention that there are “no perfect sites” (p. 107). Though fire stations cannot be easily moved, the case has been argued for dynamically moving emergency vehicles to meet service demands. Pinellas County’s emergency medical services (EMS) provider (Sunstar) is using a geographic information system (GIS) to locate ambulances in areas that optimize their response capabilities (Figure 2).

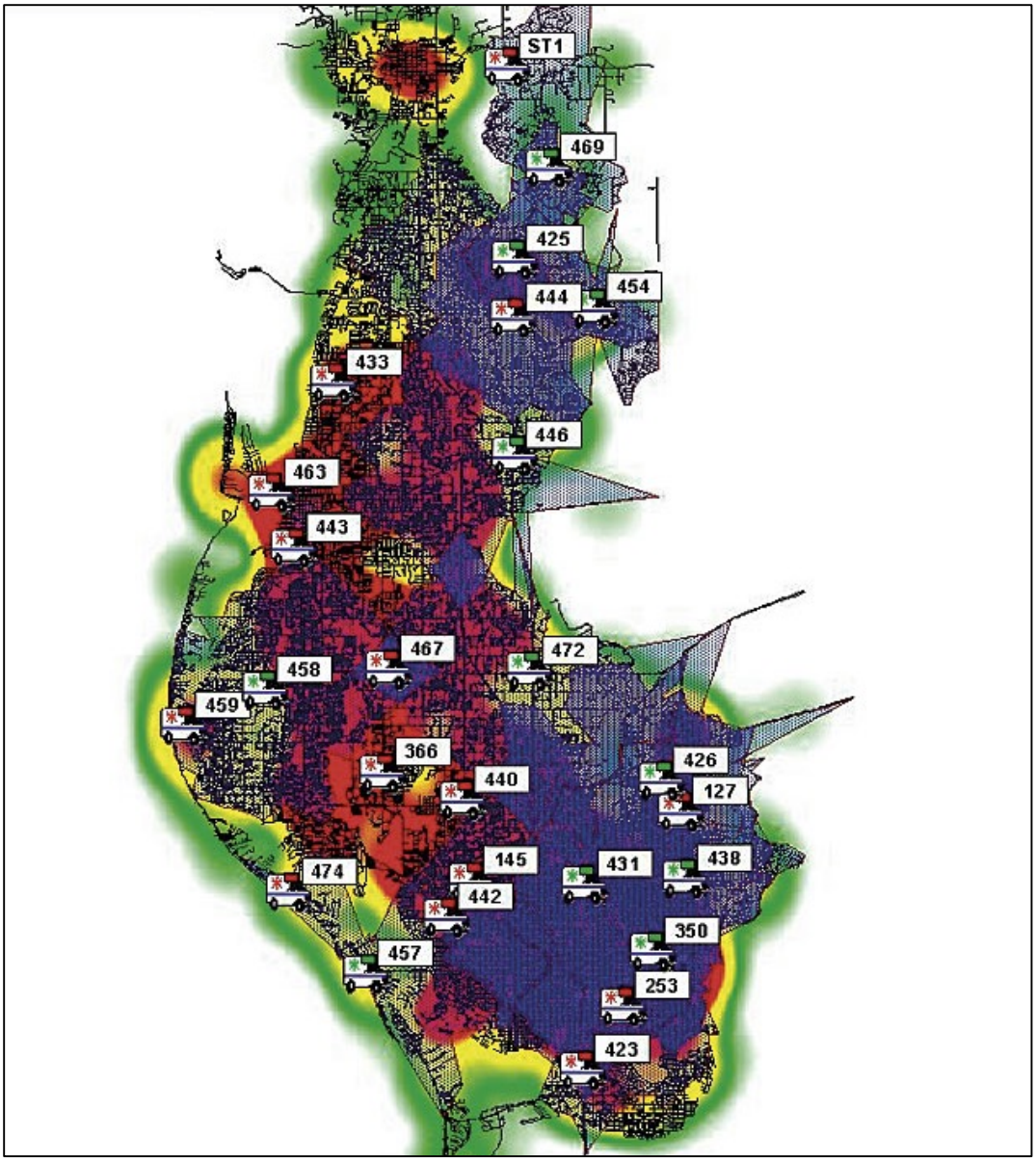

Figure 2. Mobile Area Routing and Vehicle Location Information System (MARVLIS) used to track and deploy ambulances in Pinellas County, retrieved from http://www.esri.com/news/arcnews/winter0607articles/maximizing-time.html. Copyright 2015 by Esri.

Jim Pennington, director of Information Technology for Sunstar Emergency Medical Services, discusses how using GIS can assist the company in ensuring the appropriate number of

ambulances are in service at any given time and that they are placed in the correct geographic location (“Maximizing Time”, 2007).

Studies seem to indicate another factor that can influence turnout times and overall response times is the time of day when the incidents occur. Taylor (2015) suggests that it is reasonable to assume that the time of day does in fact influence response time due to factors like traffic congestion. There is technology such as traffic preemption devices that can ease the negative impact vehicular traffic can have on response times. These systems have been used successfully in industries such as public transportation. The City of Calgary in Alberta, Canada has many transmitter-equipped buses in service. Each of which saves 2,000 gallons of fuel and nearly 50,000 pounds of carbon dioxide emissions per year (Bruner, 2008). However, the emitters do not only conserve fuel and reduce emissions, they also save time. Bruner goes on to say (2008) “Even when the Canadian city’s broad avenues are filled with traffic, Calgary Transit’s buses run nearly as fast as they do when the roads are empty.” The devices have also had a significant impact on both urban and suburban fire departments. As mentioned, Largo Fire Rescue operates in the most populated county in the State of Florida. All of the Department’s emergency response vehicles possess Opticom emitters, which have corresponding detectors at most major intersections.

Another factor that fluctuates depending on the time of day is the demand placed on the fire service. The United States Fire Administration (2007) reports that the demand for fire department fire-related services is at its lowest in the early morning, gradually increases until peak demand is reached in the late afternoon, and slowly tapers off through the evening and nighttime. Service demand however, does not appear to tell the whole story. For instance, Taylor’s study of the London Fire Brigade’s response times to reported dwelling fires found that

between 0300 and 0700 and between 1100 and 1800 services take longer than usual to arrive on the scene (Taylor, 2015).

Turnout time can have a significant impact on overall response times as well. As previously noted, NFPA 1710 allots 80-seconds for turnout time for fire incidents, which is the time interval between when firefighters are notified of the incident to when travel time begins. Research conducted by Upson and Notarianni (2010) found that turnout times can vary significantly depending on time of day. Data collected from a group of large fire departments demonstrated a noteworthy difference in turnout times between daytime and nighttime hours, which is an element not currently acknowledged in NFPA 1710. In their 2010 study, Upson and Notarianni compared turnout times of several large fire departments from 0600 to 1800, when crews are likely at their highest readiness; and from 0000 to 0600, when they are likely at their lowest readiness. During the nighttime calls, turnout time was completed in the required 80-seconds only 21% of the time. "The time required for turnout of 90% of the nighttime calls was 158-seconds for fire (just under two times the standard)" (Upson & Notarianni, 2010, p. 74).

Data collected from the National Fire Incident Reporting System (NFIRS) between 2001 and 2002 appears to reveal similar trends:

> More fires have a 4-minute range response time between 6 p.m. and midnight (17%) than any other time of day. Between midnight and 6 a.m., only 14% of fires had a response time in the 4-minute range. These results were expected because firefighters—both career and volunteer—tend to be asleep between midnight and 6 a.m. In addition, it is more difficult to see at night and just after awakening, which results in driving more slowly. Fires have a better chance of having a response time of less than 5 minutes

> between noon and 6 p.m. (49%). Only 40% had a response time of less than 5 minutes between midnight and 6 a.m. (United States Fire Administration, 2006).

One suggestion to motivate firefighters to reduce their turnout time is to place a countdown clock in the apparatus bay that counts down from 60-seconds when the tones activate (Rhoades, 2012). Largo Fire Rescue Standard Operating Procedure 602 *Response, Placement, and Company Functions* (Appendix A) surpasses the NFPA standard and states, "Units responding from quarters should clear the station within 30-seconds from 0700 to 1900 and within 60-seconds from 1900 to 0700" (p. 1).

Identifying and taking the correct route from the fire station to the incident location is another element that can affect response time. Largo Fire Rescue SOP 602 stipulates, "Apparatus shall follow the route affording them the quickest total travel time but shall not exceed safe speed considering conditions and posted speed limit when in emergency status" (p. 1). Fortunately, the technology of emergency communications is evolving rapidly and mobile data computers (MDC's) can give firefighters (including those at Largo Fire Rescue) the information they need including GPS mapping and route information (Thiel, 2012). In addition, advanced vehicle location (AVL) systems are now being utilized in the fire service to report a response vehicles current location. This system uses GPS data, which allows dispatchers to send the closest units to an emergency, thus reducing travel times (Rhoades, 2012). Utilizing the correct route is nothing new to the private sector. The United Parcel Service (UPS) is currently using route optimization software called Orion, which finds the swiftest route. UPS CEO David Abney expects the software to save the company $300 million to $400 million each year by 2017 (Rosenbush, 2015).

The literature was helpful in narrowing the scope of the research. For instance, while it was helpful to understand the affect fire station location may have on response times, it did not explain why Largo Fire Rescue's response times increased from 2013 to 2014 since the Department did not change the location of its fire stations during that time period. The same could be said for the dynamic relocation and deployment of Pinellas County ambulances using GIS. Following the literature review, it became apparent as to which factors affecting response times had implications on Largo Fire Rescue and warranted further research.

Procedure

Preliminary research for the literature review was conducted at the National Fire Academy during the February 2015 Executive Development course. Discussions with fire service colleagues took place on campus and the campus library was utilized to identify pertinent texts and research on topics relevant to this project. Additionally, historical figures such as Largo Fire Rescue CAD data was gathered which included incident times, response times, turnout times, unit availability, incident notes, and GPS data. The procedures were concentrated on satisfying the following two research questions: (a) What are the possible causes of the increase in response times? (b) In what ways have each of these causes affected overall response times?

NFIRS data for 2013 and 2014 was collected and a comprehensive list of the "working fires" that took place in the Largo Fire Rescue response district was comprised. According to Largo Fire Rescue Standard Operating Procedure 601 *Incident Command* (Appendix B), a "working fire" or "working incident" is defined as "any fire beyond its incipient stage requiring the deployment of at least one attack line and/or commitment of three or more companies to control" (p. 11). When a "working fire" is declared by the incident commander the incident is

coded as such by dispatch and will then appear in the NFIRS search results for "working fires." To maintain consistency with ISO, "non-working" incidents were excluded from the scope of this study. The data for each working incident was then studied more thoroughly, focusing in-depth on particulars such as dispatch time, turnout time, travel time, incident location, route taken, etc. All of the fire departments located in Pinellas County are dispatched by the Pinellas County Regional Communications Center. Therefore, all municipalities have access to statistics such as call received time, dispatch time, responding time, on-scene time, etc. (Figure 3).

Incident 4 Date 08/22/2014 Nature 69M-STRUCTURE FIRE MOA 1

Location 7360 ULMERTON RD, LOT A Received 16:43:43 Map

Dispatched 00:00:45 Grid 406A

Dispatch Code M69 Complainant Callback 727

Hospital

Unit	Type	Dispatch	Respond	On-Scene	Transport	At Hospital	Available
E38	E	16:44:28	16:45:36	16:46:41			18:49:56
T42	E	16:44:28	16:45:18	16:48:54			18:49:23
38FD	ST	16:44:28					16:45:48
E39	E	16:44:28	16:45:30	16:53:57			18:54:38
T41	T	16:44:28	16:45:56	16:53:34			18:50:09
S38	S	16:44:28	16:45:03	16:51:29			18:48:17
R34	R	16:44:28	16:45:05	16:52:44			17:52:42
LAOPP	ST	16:44:28					16:45:48
D38	D	16:44:28	16:45:29	16:47:40			18:51:41
D41	D	16:44:28	16:46:00	16:53:29			18:51:28
LA301	CO	16:46:45	16:46:45	16:52:24			17:55:17
DE2	DE	16:48:29	16:49:16	17:02:23			18:54:58
PD3	PD	16:48:31	16:49:16	17:02:23			18:54:58
E34	E	16:48:51	16:49:04	16:58:36			18:15:17
D35	D	16:48:53	16:49:51	16:59:05			17:08:13
432	A	16:49:23	16:49:36	16:53:35			18:40:15
S39	R	16:49:47	16:49:51	17:07:42			18:54:10
LA600	CO	16:52:17	16:52:26	16:58:42			17:46:47

Figure 3. Example of data gathered from NFIRS report.

In order to maintain the reliability of the research, all working fire incidents that progressed from something other than a structure fire (e.g., a fire alarm, vehicle fire, etc.) were excluded from the author's analysis. This is because the initial dispatch would not have comprised the proper amount of units for a structure fire response, causing the subsequent units to have a delayed response. Furthermore, incidents where crews were initially dispatched to the

wrong address, or for whom the address was later changed en route, were also excluded from the research. All attempts were made to identify aberrant variables and eliminate them from the study.

Incident times where gathered and compared in order to determine if there was causality between the time of day and response time and/or turnout time. Other factors that were studied were unit availability (e.g., if a piece of apparatus was out of service) and call concurrency (e.g., if a unit was already committed to another incident). Furthermore, GPS data was utilized to examine the routes crews chose and call notes were scrutinized in hopes of gleaning any additional insight that may have been available.

The procedures listed were appropriate to determine the possible causes of Largo Fire Rescue's increase in response times and in which ways each of these causes affected overall response times. The limitations of the study included the amount of data that could be collected for each incident or regarding each individual responding crew. Some incidents occurred more than two years ago and it is not possible to determine why a unit may have had incomplete or aberrant GPS data, why an incident was classified a certain way by central dispatch, or why a specific unit was not dispatched to a particular incident, etc. These anomalies forced the author to exclude various incidents from the research and narrow the scope of the study. Additionally, turnout time officially ends when a firefighter manually acknowledges a "responding" prompt on the mobile data computer. This does not necessarily mean the vehicle has begun to leave the station. Likewise, the travel time officially ends when a firefighter manually indicates the unit is on scene via the MDC. In reality, the vehicle could still be responding. In some cases, GPS data could be utilized to determine where the vehicle was when the "responding" and "on scene" declarations were made.

Results

In 2013, there were 31 working fires that could be included in the study in contrast to 24 working fires in 2014. These were calls that contained significant data and an absence of uncontrolled variables such as progressing from something other than a structure fire response, crews being initially dispatched to the wrong address, etc. The locations of these incidents are mapped in Figures 1 and 2 below and shown in relation to the six fire stations operated by Largo Fire Rescue. The first question this applied research project was intended to answer was: What are the possible causes of the increase in response times between 2013 and 2014? Several possible causes of the increase in response times were identified, the first of which is time of day. In 2013, 81% of the incidents occurred between 2300 & 0600 compared to 87.5% in 2014.

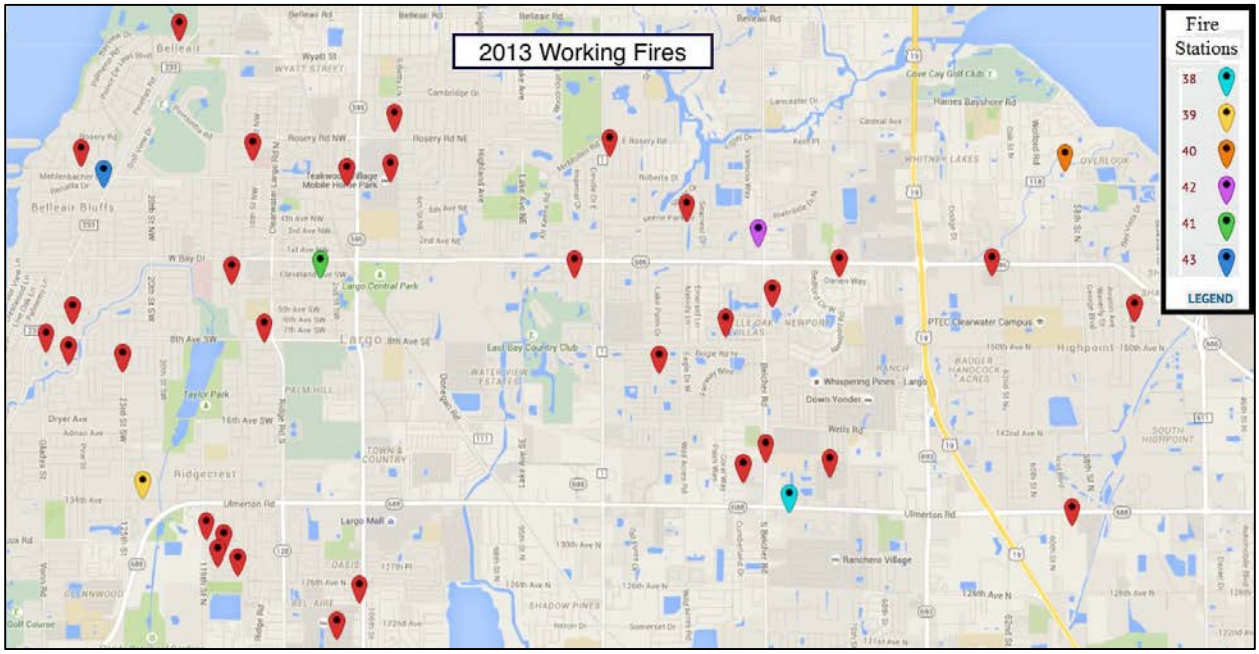

Figure 4. Locations of working fires in 2013 in relation to Largo fire stations.

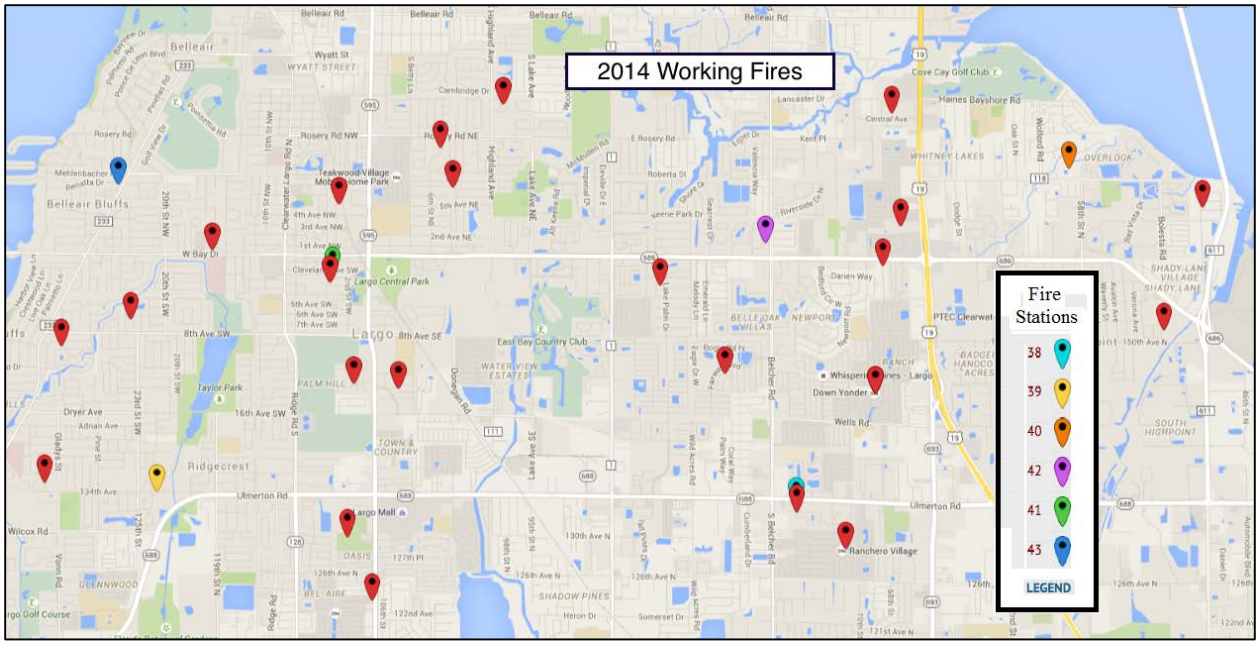

Figure 5. Locations of working fires in 2014 in relation to Largo fire stations.

The second possible cause of increased response times that was identified was distance. While the six fire stations Largo Fire Rescue operates are spread evenly across its jurisdiction, the apparatus are not. This is especially true in the case of Largo Fire Rescue's 100 foot aerial platform (Truck 41) since it responds on nearly every working fire in the city but is housed in fire station 41, on the west side of the City's fire district (see Figure 1). In 2013, Truck 41 had four long responses (greater than 4.5 miles) with one of them being longer than six miles. In 2014, Truck 41 had six long responses with three of them being six miles or more.

The third possible cause for increased response times that was identified was whether or not the closest suppression unit to the incident location (usually an engine) was available. This unit could have been delayed for a multitude of reasons including training, administrative duties, going to get fuel, being assigned to a different incident, etc. In 2013, the closest suppression unit was unavailable to respond in four out of the 31 working fires examined. In 2014, the closest suppression unit was unavailable to respond in five out of the 24 working fires studied. Yet,

another possible cause for increased response time is turnout time. In 2013, crews achieved the NFPA recommended 80-second turnout time 48% as compared to 66% of the time in 2014.

Several other causes were identified while reviewing the data that appeared to be more isolated in nature. In 2013, one incident occurred where units responded from the location of a previous call instead of their respective fire stations. During three other incidents that year, crews appeared to take a longer route than what was available. In contrast, in 2014, one incident occurred where crews took a slower route than what was available. There was another instance where crews altered their route due to road construction, and at least one incident where further units were dispatched.

The second question this applied research project was designed to answer was: In what ways have each of these causes affected overall response times? In 2013, 81% of the incidents occurred between 2300 & 0600 compared to 87.5% in 2014. This could have had either a positive or a negative affect on response times. Firefighters are likely sleeping during this time, which translates to an increase in turnout time. Contrastingly, service demand is at its lowest during the overnight hours and traffic is at its lightest. These factors can translate into a decrease in travel time.

The distance the vehicles have to travel to the incident can have significant implications for response time. As mentioned, between 2013 and 2014, Truck 41 had ten long responses (greater than 4.5 miles), all of which were outside of the ISO response time parameters. Of the working fires responded to by Truck 41 in 2013, 13% of them required long responses. In 2014, the percentage of long responses for Truck 41 grew to 25% (see Figure 4). The response data collected from 2013 and 2014, in many cases, showed a direct correlation between distance traveled and response time.

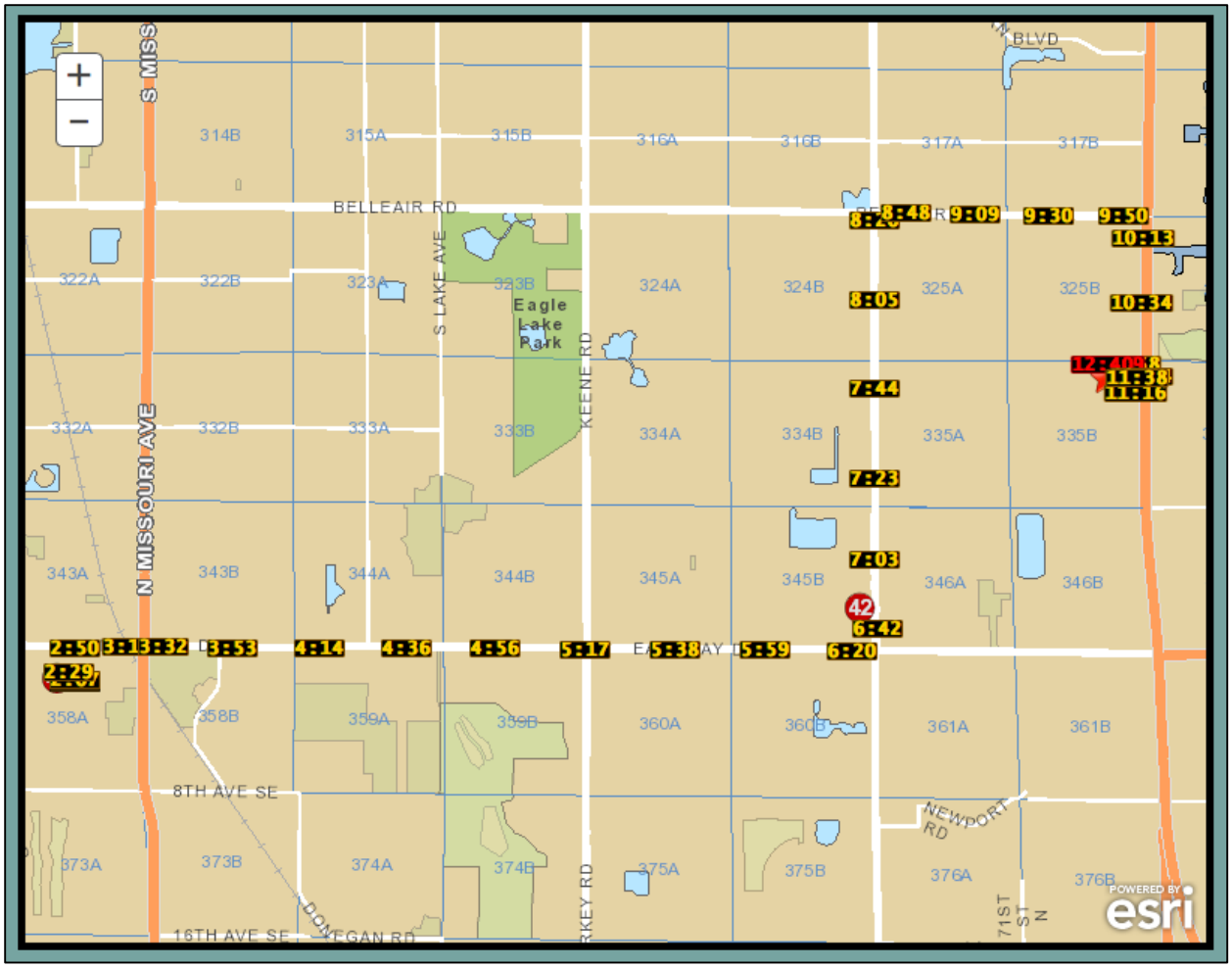

Figure 6. GPS trail of a long response by Truck 41 to a working fire in 2014.

The third possible cause for increased response times that was identified was whether or not the closest suppression unit to the incident location (usually an engine) was available. In 2013, the closest suppression unit was unavailable to respond in four out of the 31 or 13% of the working fires examined. In 2014, the closest suppression unit was unavailable to respond in five out of the 24 or 21% of the working fires studied. When the closest suppression unit is unavailable, a chain reaction occurs that increases the response times for all of the engines dispatched.

The majority of the time that this occurred in 2013 and 2014, the first-arriving and third-arriving engine fell outside of the ISO response time constraints. This was because the first-responding engine (which would normally be the second-responding engine) was responding from further away but was still required to meet ISO's 320-second response time constraint established for the first-arriving engine company. The same rationale applies to the third-arriving engine, which would normally be the fourth engine dispatched and exempt from the 560-second response time required for the remainder of the alarm.

Yet, another possible cause for the increased response times is turnout time. In 2013, crews achieved the NFPA recommended 80-second turnout time 48% as compared to 66% of the time in 2014. It is interesting that, while 6.5% more calls occurred between 2300 & 0600 compared to 2014, turnout time actually improved in 2014. Since turnout time makes up a portion of the overall response time, this increase in compliance with NFPA's recommended 80-second turnout should have had an overall positive affect on response times in 2014.

Several other causes were identified while reviewing the data that appeared to be more isolated in nature. In 2013, one incident occurred where units responded from the location of a previous call instead of their respective fire stations. During three other incidents that year, crews appeared to take longer routes than what was available, an anomaly which occurred only once in 2014. There was also an instance in 2014 where crews altered their route due to road construction (see Figure 5) and one incident where further units were inadvertently dispatched. While these incidents had an affect on individual responses, they were so infrequent and sporadic in nature that they were not considered as significant contributors to the overall increase in response times in 2014.

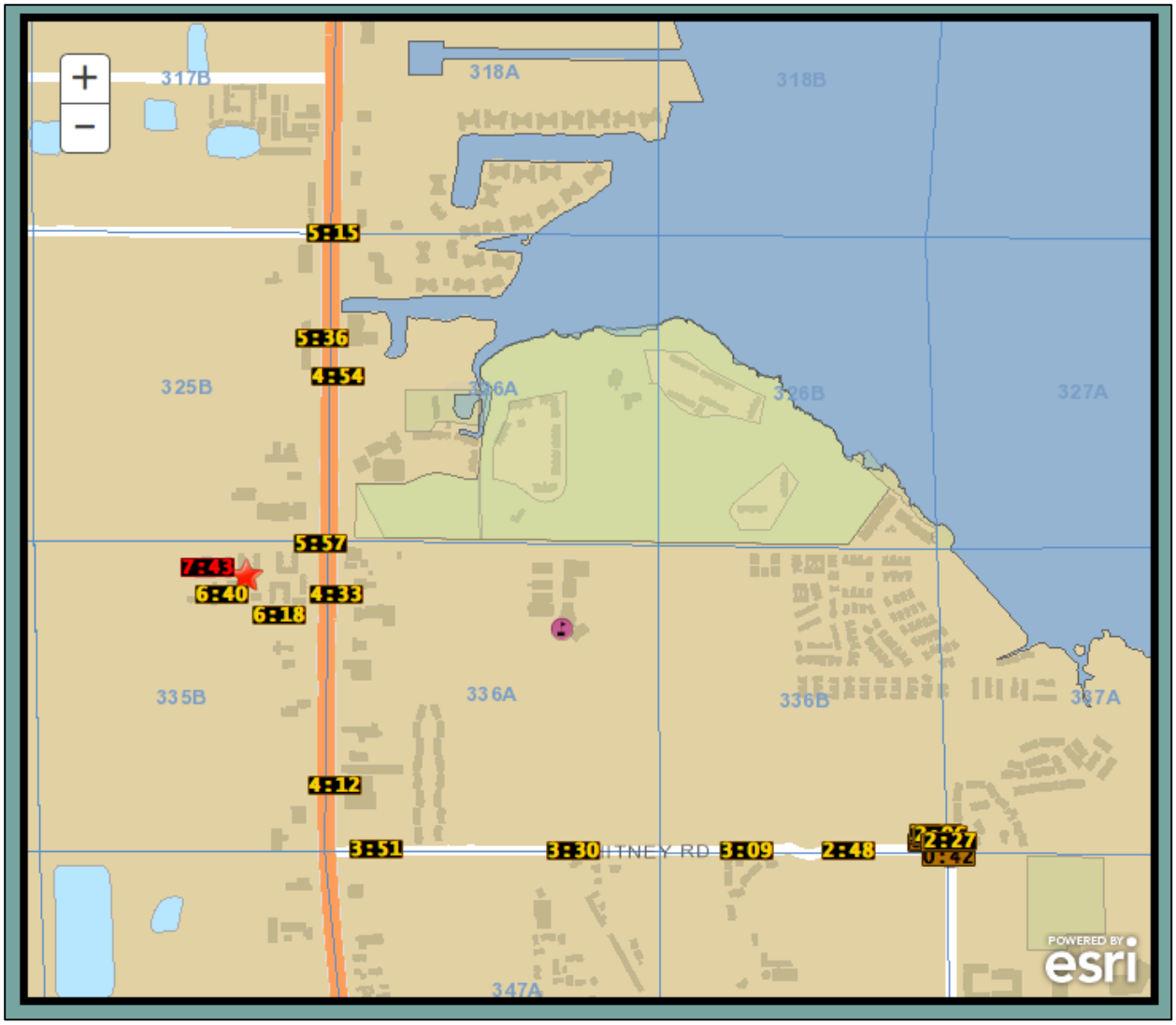

Figure 7. Engine 40 forced to take a longer route due to road construction.

Discussion

The purpose of this study was to determine why Largo Fire Rescue saw a decrease in compliance with ISO response time standards between 2013 and 2014. The ultimate goal was to determine the causes of these increased response times so they could then be corrected. However, with the almost limitless amount of factors that can affect response time, pinpointing one specific cause is next to impossible. The relationship between the study results and the specific findings of other authors, which were discussed in the literature review, were mixed.

Taylor (2015) suggested that it is reasonable to assume that the time of day influences response times due to factors like traffic congestion and the local demand on the fire service. Furthermore, the United States Fire Administration (2007) reports that the demand for fire department fire-related services slowly tapers off through the evening and nighttime hours. Research conducted by Upson and Notarianni (2010) found that turnout times can vary significantly depending on time of day. Data collected from a group of large fire departments demonstrated a noteworthy difference in turnout times between daytime and nighttime hours. Largo Fire Rescue has recognized that it takes longer to get dressed and leave the station during the nighttime hours and therefore determines an acceptable turnout time to be 60-seconds at night, in contrast to 30-seconds during the day. The research conducted pertaining to Largo Fire Rescue, however, did not indicate a notable difference in response times regarding time of day. One possible cause for this is the tradeoff between shorter response times and longer turnout times. While turnout times are typically longer during the overnight hours, traffic is at its lightest and more apparatus are likely to be available. In fact, Largo Fire Rescue's overall response times rose in 2014 while turnout times went down.

Ensuring the correct route is being taken to the incident is imperative when trying to meet response time requirements. According to Thiel (2012), mobile data computers can give firefighters the information they need including GPS mapping and route information. All of Largo Fire Rescue's emergency response apparatus have had these capabilities for many years. Furthermore, GPS data was retrieved from responding units and did not show noteworthy routing errors or discrepancies. Therefore, it was determined that routing errors were not the reason for the increased response times in 2014.

In 2013, the closest suppression unit was unavailable to respond in 13% of the working fires examined. In 2014, this percentage rose to 21%. The impetus behind this increase is likely the upsurge in the calls for service Largo Fire Rescue encountered between 2013 and 2014. Largo Fire Rescue responded to 22,890 incidents in 2013 and 25,078 incidents in 2014. This represents an almost 10% increase in call volume in 2014 (Figure 6). The resulting decrease in availability of the closest suppression units has had a very real impact on response times. If this trend continues, Largo Fire Rescue will need to add additional units to contend with the increased call volume or suffer from persistently increasing response times.

The distance the apparatus have to travel to an incident can also have remarkable consequences on response time. As mentioned, between 2013 and 2014, Truck 41 had ten long responses (greater than 4.5 miles) to working fires, all of which were outside of the ISO response time parameters. These long responses have increased from 13% in 2013 to 25% in 2014. The fact that Truck 41 had more long responses in 2014 than in 2013 certainly attributed to Largo Fire Rescue's decrease in compliance with ISO response time requirements. This statistic is not likely to improve in the future unless changes are made.

The results of the research exposed several concerns relating to the trend of increasing response times and the future implications this will have on Largo Fire Rescue. Calls for service have steadily increased over the past several years, a trend that is likely to continue in the immediate future. Furthermore, Truck 41 cannot meet ISO response time requirements on the east side of Largo Fire Rescue's fire district. This means, if changes are not made, future compliance with ISO response times may come down to the geographical location of the incident (east or west side of district) and whether or not the closest unit is available.

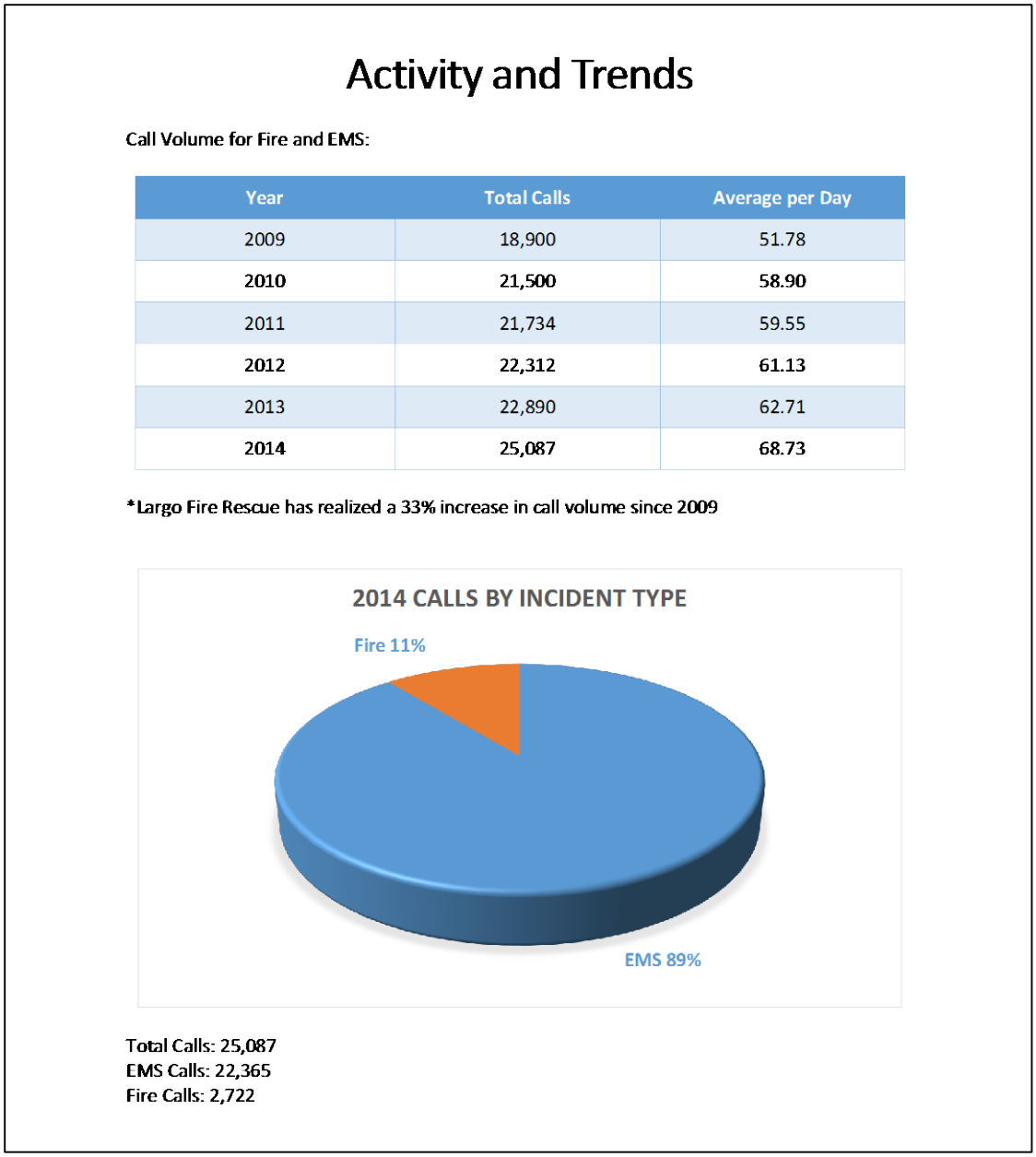

Figure 8. Largo Fire Rescue calls for service by year and type.

Recommendations

Based on the research conducted, several recommendations can be made to help prevent and reverse the trend of increasing response times suffered by Largo Fire Rescue. The fist recommendation involves the increase in calls for service Largo Fire Rescue is experiencing. As

calls for service increase, the amount of time crews are dedicated to calls also increases proportionately. This results in fewer units being available to respond to structure fire calls at any given time. Several options exist to remedy this conundrum, all of which require further study and financing. One option may be to supplement Largo Fire Rescue's response capabilities during the busiest parts of the day. Additional rescue units could be placed in service to detract from the call load the suppression units are managing, ensuring they are available for fire related calls a greater percentage of the time. As previously mentioned, Pinellas County's ambulance contractor is already doing this. They have acted on what the United States Fire Administration recognized in their 2007 report. The demand for public safety is not static throughout the day. Services are typically higher during the daytime hours and taper off at night. However, adding supplementary resources comes with a price, therefore additional funding would be required to utilize this option.

The second recommendation is to change the response area for Truck 41. Dispatching one aerial platform, from a station that is not centrally located, to fires throughout the jurisdiction is having a significant negative affect on response times. Largo Fire Rescue currently operates an ALS 75-foot aerial (Truck 42) out of fire station 42, which is a more centralized location than station 41. This particular piece of equipment possesses a water pump and is typically deployed as a suppression unit. Nevertheless, it could be utilized as a truck on the east side of town, which would dramatically reduce the amount of time it would take to get the first truck on scene. This recommendation would require further research and training of department members on standard apparatus response procedures and company functions. Pinellas County has a GIS department that could potentially assist Largo Fire Rescue in projecting response times to different areas of its jurisdiction by both Truck 41 and Truck 42 to confirm that this is a viable option. This

recommendation has little to no fiscal implications other than the staff time required to conduct the training and implement the change. Truck 42 would not give the department full credit in accordance with ISO's rating schedule, however. The City of Largo has several 10-story buildings on the east side of the Department's response district that Truck 42 could not fully access because of the limited reach of its shorter aerial. It would benefit from approximately 75% credit for arriving within ISO's response time parameters, which is far better than not receiving any credit. In Figure 4, fire station 42 and the positive impact that Truck 42 could have on response times on the east side of the City's district can be visualized.

A recommendation for future research would encompass Pinellas County's emergency dispatch procedures. Currently, the closest apparatus is dispatched based on the location of the fire station where it is assigned. A crew could be at the store grocery shopping, on a special assignment, or somewhere other than the fire station but it would have no bearing on dispatch procedures. The vast majority of the response apparatus in the county have mobile data computers with integrated GPS. Furthermore, all 18 municipalities in Pinellas County work within a consensual automatic aid agreement. The utilization of automatic vehicle location (AVL) would allow units to be dispatched based on their actual current location rather than the assumption that they are at their assigned fire station. The positive impact on response times for Largo Fire Rescue and the rest of the municipalities in Pinellas County would likely be significant.

The final recommendation involves the continuous and ongoing monitoring of response times to working fires. Currently, there is no process in place to identify excessive response times. The process could be as simple as filling out a form after each working fire with the turnout times and response times of each unit assigned to the call. This real-time monitoring is

the best opportunity to identify issues affecting response times. The causes for extended response times can be discussed with the crews involved and action can be taken immediately to address them.

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Appendix A

Largo Fire Rescue Standard Operating Procedure 602

LARGO FIRE RESCUE
STANDARD OPERATING PROCEDURES
602 RESPONSE, PLACEMENT AND COMPANY FUNCTIONS PAGE 1 OF 5

This S.O.P. provides guidance for units as they respond and position for operations at emergency scenes.

RESPONSE

Units shall respond in "emergency status" (emergency lights, sirens and opticom if equipped) to all dispatches unless advised to do otherwise or as established by S.O.P. Units responding from quarters should clear the station within 30 seconds from 0700 to 1900 and within 60 seconds from 1900 to 0700. The incident commander should be aware of the staffing needed to resolve an incident. Whenever an engine, truck, or pumper responds to an incident or a mutual aid assignment, it will notify the responding district chief of the number of personnel responding if less than *minimum staffing*. Apparatus shall follow the route affording them the quickest total travel time but shall not exceed safe speed considering conditions and posted speed limit when in emergency status. All personnel shall remain seated and wear provided safety restraints. Drivers must use the utmost care and pay extra attention to safety when traveling. All emergency units shall conform to Florida Statutes, Chapter 316.072 for response safety regulations. Responding units shall maintain radio contact on the appropriate channel with Dispatch and advise when on-scene. **Units shall not contact command while enroute to request assignment. Arriving first alarm units shall follow standard placement assignments (level 1 staging) unless advised by command to do otherwise.** Second and greater alarm units shall stage at a remote site from the scene (level II staging) and notify the staging officer (if established) or command of location and status. All level II staged units should be at the same location. Personnel shall stay with their respective units in staged status until given an assignment through the command system. Units not used in function positions (pump, ladder, lighting, etc.) shall be positioned out of the way.

1. Standard Placement (Level I Staging)

Upon arrival at the scene, units shall position their vehicles based on standard practice, maximum effectiveness and safety. Placement of units at situations other than fire alarms, structure fires and smoke investigation are covered in other incident-specific S.O.P.'s.

- **First arriving Engine Company**
  This unit should be placed at the front of the fire structure, slightly to one side (to allow truck placement) or in best position based upon size-up factors to begin suppression or investigation activities.

- **First arriving truck company**
  Unit should be placed at front of structure or positioned based upon size-up factors with the capability of reaching the roof for ventilation or rescue.

  1. **Exception #1:** Multi-story occupied structure with smoke or fire showing, placement shall be to enable rescue from upper floors.
  2. **Exception #2:** Large volume fire showing (already vented) and/or threatening exposures, placement shall be to enable establishment of aerial fire stream.
  3. **Exception #3:** Mobile home parks or small structures (under 1,400 square feet), placement *may* be 250 feet from fire structure out of the way of engines laying lines but accessible for equipment or defensive operations.
  4. **Exception #4:** If truck company is first due, it will follow first arriving engine functions.

- **Second arriving engine company**
  Position to establish water supply and prepare to lay line upon direction of either command or initial size up of smoke and/or flames showing. Command may cancel this assignment, after inital attack or investigation, if conditions are not warranted.

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Appendix B

Largo Fire Rescue Standard Operating Procedure 601

suppression efforts must continue to support the rescue operation as safely as possible.

5. The IC shall immediately call for additional resources. Initially this will typically be an additional alarm and the appropriate number of EMS units, However the IC should consider even additional alarms, air transport resources, or a Technical Rescue response in the case of a structural collapse.
6. If a second chief officer is on-scene, the IC shall make the decision to maintain "Command" or assume "Rescue Group or Branch". While the terminology may seem confusing, a "Group" should be used if on the same channel as the IC. If a separate channel is established, it should be considered a "Branch."
7. The "Rescue Group Supervisor" or "Branch Director", and all units assigned to the RIT/Rescue operation shall remain on the originally assigned tactical channel.
8. In the event of a MAYDAY, the IC should take his or her command communications to another tactical channel, and all units on the call **not** directly involved in the RIT/Rescue operation or assigned to the "Rescue Group or Branch" shall operate on this second channel. The second channel may be requested by the IC, or if a 2nd alarm has been dispatched, a "staging channel" will be designated by dispatch. This "staging channel" could be used for this purpose. This will leave the person and or unit with the MAYDAY on the original tactical channel. Again all units involved in the rescue or suppression efforts supporting the rescue shall remain on this original channel.
9. If available, two Command equipped vehicles should be placed in close proximity of each other, so that both the "IC" and the "Rescue Branch" may have a functioning command vehicle, command board, radio, and the ability to separately track resources while maintaining verbal communications with one another.

GENERAL RULES OF THE INCIDENT COMMAND SYSTEM

1. Freelancing will not be tolerated. All chiefs, officers, companies and personnel shall adhere to this SOP and the Incident Action Plan.
2. Orders from the IC take precedence and shall be carried out without delay, unless immediate danger to citizens and/or personnel would result. Delay in carrying out orders, and the reason for the delay, shall be reported to the IC as soon as possible.
3. All personnel at an incident have a responsibility and obligation to communicate changing conditions or hazardous situations, up through the chain of command.
4. Communication discipline at an incident must be maintained in order to achieve a safe and effective operation. All non-essential communications shall be kept to a minimum.
5. All other applicable SOPs should be followed to ensure standardized operations. Command shall communicate to dispatch and all units on-scene the following progress marks, based on progress reports from Staff Positions and following the Incident Action Plan.

INCIDENT COMMAND RADIO BENCHMARKS AND KEY OBJECTIVES

1. **Command established with a declaration of mode of operation**.
2. **Working fire or working incident declared**, if applicable. *(Working fire is defined as any fire beyond its incipient stage requiring the deployment of at least one attack line and/or commitment of three or more companies to control)*
3. **Water supply established.** *(Upon completion of an uninterrupted water supply from a hydrant).*
4. **Primary search complete**. *(area searched and unit that completed the search)*