Raising the Ladder for Improving Operational Effectiveness

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Certification Statement

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

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Abstract

The purpose of this Applied Research Project (ARP) was to identify factors that influenced Kingsport Fire Department's (KFD) ladder truck capabilities from being utilized and incorporated effectively during normal, training and emergency operations. This ARP used a Descriptive Research Method to identify ways KFD could improve utilization of ladder truck capabilities and consider implementing by addressing the following questions: a) What are the primary and secondary functions ladder truck companies typically perform? b) How should ladder truck personnel be assigned or deployed to improve operational effectiveness? c) What risk or safety issues should be considered in relation to ladder truck operations? d) What training should be incorporated to improve ladder truck operational effectiveness? Sample groups consisting of same size departments, KFD personnel, and departments with one person assigned to aerial apparatus were selected. The research showed that fire departments with sufficient staffing, training, and standardized truck company procedures tend to understand and utilize truck company capabilities more safely, effectively and efficiently. Recommendations included development of department standard operating guidelines, truck company-specific training program, cross-staffing truck companies with engine company personnel, evaluation of four-person truck companies versus three-person engine and one person truck companies, and strategic plan for increasing truck company personnel to meet current minimum staffing standards should be top considerations to improve the safety, effectiveness, and efficiency of KFD's truck company operations.

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Introduction

Since the fire service's infancy, there has been a continuous evolution of equipment, techniques, training, and science in an attempt to make the job safer while improving the effectiveness and efficiency of the services provided. A significant element of this process has been the incorporation of truck company operations. These specialized units are "primarily staffed and equipped to perform multiple specialized fire ground operations…that are necessary to ensure water reaches the seat of a fire in a timely manner, and the safety of attack personnel is maximized" (Mittendorf, 2011, p. 2). Richman (2008) says that personnel “must be proficient in the basic objectives of ladder company work” (p. 4). It has been said “engine companies extinguish fires, but truck companies determine *how* a fire will be extinguished” (Mittendorf, 2011, p. 2). The problem is during normal, training, and emergency operations the Kingsport Fire Department (KFD) does not effectively incorporate and utilize its ladder truck capabilities.

The purpose of this Applied Research Project (ARP) was to identify factors that influence KFD’s ladder truck capabilities from being utilized and incorporated effectively during normal, training, and emergency operations. This ARP used a Descriptive Research Method to identify ways KFD could improve utilization of ladder truck capabilities and consider implementing by addressing the following questions: a) What are the primary and secondary functions ladder truck companies typically perform? b) How should ladder truck personnel be assigned or deployed to improve operational effectiveness? c) What risk or safety issues should be considered in relation to ladder truck operations? d) What training should be incorporated to improve ladder truck operational effectiveness?

Background and Significance

Kingsport is part of the Greater Tri-Cities region of the Upper Northeast Region of Tennessee bordered by Virginia and North Carolina. Kingsport shares the Tri-Cities designation with sister cities Bristol and Johnson City. Although each municipality operates under their own separate governing bodies, the region shares in the economic impact of industries such as Eastman Chemical Company, Ballad Health, Bristol Motor Speedway, East Tennessee State University, as well as, significant retailers to include Bass Pro Shops and Cabela's. Located in the heart of the Appalachian Mountains range, the Tri-Cities area offers numerous outdoor activities that attract many visitors throughout the year.

The Kingsport Fire Department (KFD) was established in 1916 as a self-supporting all-volunteer organization consisting of 48 personnel distributed into four companies. At that time KFD staffed four hand-drawn hose reels and one hand-drawn hook and ladder apparatus. KFD quickly transitioned into a combination department when Kingsport received its designation as an incorporated city in 1917. Through its State of Tennessee Charter, the City of Kingsport (KPT) also assumed the financial responsibility of providing fire service to its residents. KFD began with one station and a 1917 American La France Fire Apparatus that remains on display today. Until 1930, KFD responded to incidents with one paid driver relying on volunteer firefighters for additional personnel. In 1930, KFD added a second engine with a paid driver and hired four paid firefighters. In 1941, KFD expanded its operations by opening fire station two and purchasing its first ladder truck. The ladder truck was assigned one paid driver and continued to rely on volunteers for additional ladder truck personnel. In 1950, KFD phased out the last of the volunteers and became an all-career fire service. Although engine companies had assigned firefighters, the ladder truck was assigned a single driver. By the end of 1960's, KFD responded

to the city's growth and expanded to four stations. With the opening of each station, additional engines and personnel were assigned, but the ladder truck remained with one operator. In 1974, the original ladder truck was replaced with a 105' articulating boom platform fire apparatus, and the 1941 ladder truck was placed in reserve status. The decision to purchase the articulating boom platform was based on a theory that the apparatus was to be used as an elevated waterway or master stream (C. Caldwell, personal communication, August 21, 2017).

Until 1990, KFD operations continued to function in this capacity operating five engines companies, one ladder truck, and one shift commander with 26 personnel assigned to the three shifts. A report from a KFD member showed the department maintained adequate staff in 1990 to average 4.2 personnel per front line apparatus including the ladder truck (Nunley, 2000). However, KFD kept the assignment of one person on the ladder truck. It was considered a waste of manpower to staff the ladder truck with additional personnel due to the fact its mission was singular in providing an elevated master stream. In fact, during periods of minimal leave request, the department would assign up to 6 personnel per engine leaving a lone ladder truck operator.

During the 90's decade, KFD experienced a rapid and progressive evolution with the opening of two stations, implementation of technician level trained Hazardous Materials and Technical Rescue teams, completed the Commission on Fire Accreditation International (CFAI) accreditation process, increased personnel in the Fire Prevention Division, added a second secretary, created a Training Division, hired a Public Education Officer and transitioned from First Responders to providing Advanced Life Support (ALS) Engines. In the past, KFD had maintained the practice of hiring twelve personnel when an additional apparatus was placed in service. This practice continued the average of four personnel per shift on the apparatus, however, with the opening of stations five and six, the city decided to move away from this

approach and hired nine for each station leaving three personnel per apparatus on each shift. This growth and the creation of new positions resulted in the reallocation of operations personnel without the hiring of additional personnel to fill the vacancies. In 2002, operations experienced another reallocation of personnel when the Assistant Chief position was created. Additionally, during this period, KFD established minimum staffing levels of three personnel per apparatus but neglected to address the ladder truck staffing maintaining a level of one person assigned to the apparatus.

During the 2008-09 economic downturn, Kingsport experienced another period of growth and expansion through annexation of communities on the fringe of city borders, revitalization of blighted areas in the downtown district, and investment in the quality of life and aesthetic amenities. In response to this growth, KFD added two stations in 2010 and 2012 along with additional equipment and personnel to cover the expanded response areas. Again, KFD was approved to hire nine personnel to staff each of the additional apparatus. In response to the city's growth, an additional ladder truck was placed in service in 2016, but only three personnel were hired (one per shift) to staff the apparatus.

The overall operations personnel reduction has not gone unnoticed. The Kingsport Firefighters Association Local 2270 (KFA) has addressed overall staffing levels with KFD, City of Kingsport Administration, and elected officials. The KFA produced three reports outlining concerns with KFD’s staffing levels utilizing data provided by National Fire Protection Association (NFPA) standards, Insurance Services Office (ISO), Commission of Fire Accreditation International (CFAI), Occupational Safety and Health Administration (OSHA), International Association of Fire Fighters (IAFF), and International Association of Fire Chiefs (IAFC) focusing the safety of the whole community during emergency incidents. (Kingsport

Firefighters Association 2003, Kingsport Firefighters Association 2007, and Kingsport Firefighters Association 2008). Although these reports provided in-depth and detailed assessments addressing critical concerns, they did not result in addressing the overall staffing considerations. Additionally, the ladder truck operations were discussed only from a staffing level perspective.

One hundred and one years later, the KFD has evolved into a 122-member career fire service organization providing an all-hazard response protecting a population just over 53,000 within its 53 square miles with nine engine companies and two ladder trucks. Despite KFDs growth and expansion, the department has failed to effectively utilize the ladder truck's capabilities and still considers it as an elevated waterway or master stream. Although the past 28 years have presented staffing challenges organizationally, KFD underutilizes the ladder truck capabilities. The department's policies and guidelines do not incorporate ladder truck specific operations. The department does not perform ladder truck company-specific training or maintain truck company training materials within the training library, has no standard operation guidelines (S.O.G.) for ladder truck companies, sets up in staging to prevent denying scene access to essential resources, and rarely performs duties other than elevated master stream applications. Although S.O.G.'s require additional personnel for safely backing a fire apparatus, the ladder truck is exempt and has a backup camera. Personnel with aspirations to promote from firefighter to fire engineer must obtain a Pumper Driver/Operator certification but are not required to obtain an Aerial Apparatus Driver Operator certification.

Kingsport's history reflects a mindset that does not fully realize the importance and capabilities of ladder truck company during emergency operations. When available personnel was not a challenge, KFD did not consider using additional personnel to perform ladder truck

company operations and incorporate its capabilities during the mitigation of fire incidents. Although many of these challenges can be addressed through the creation of department guidelines, implementing training programs, and establishing new policies the real issue may be the longstanding mindset that presents an adaptive challenge.

One of the National Fire Academy's (NFA) Executive Fire Officer Program (EFOP) Executive Leadership Course Objectives as outlined in the R0125 Syllabus (2017) is for students to "examine the systems within which the adaptive challenge exists, using purposeful collection of data to help clarify and define what occurs within these systems" (p. 3). This research problem encompasses this objective by attempting to identify best practices for utilizing ladder truck capabilities that "may require people to alter their assumptions, use different methods than they normally use, and develop new tools and behaviors" (Executive Leadership, 2015, p. SM 2-5). The hope is to adequately analyze the problem, identify innovative solutions, and recommend changes to KFD's resource deployment, training, and operations that take advantage of ladder truck capabilities.

The intent of this research project aligns with the United States Fire Administration's (2014-2018) strategic plan by attempting to "reduce fire and life safety risk through preparedness, prevention, and mitigation" (p. 10). This research will seek to identify best practices that contribute to KFD's capability to safely, efficiently and effectively deploy and utilize ladder truck company capabilities to support response, mitigation, and recovery from emergency incidents. Although valid attempts have been made to address the overall apparatus staffing issues, more extensive efforts need to be made in relation to exploring innovative solutions that prepare personnel to effectively incorporate ladder truck capabilities during the mitigation of emergency incidents.

Literature Review

The literature review began while preparing, participating, and performing various activities for the Executive Leadership (EL) class at the NFA. Prior to attending in the EL class and conducting the research for this project, the researcher has been involved in attempting to address the overall operational staffing deficiencies at KFD by trying to educate and lobby city leaders on NFPA standards, ICMA recommendations, and independent staffing studies that affect the safety, effectiveness, and efficiency of fire ground operations. During this process, it became apparent that KFD's most pressing staffing deficiency impacted ladder truck company operations. Although staffing would significantly improve operations capability, KFD does not have specific ladder truck company training materials or programs, standard operating guidelines on ladder truck company operations, and underutilizes a ladder trucks capabilities. The research proved to be an invaluable learning experience and significantly increased the researcher's knowledge of ladder truck company operations and capabilities. The research indicated an aerial apparatus is commonly referred to as a "Truck Company" not just for their elevated capabilities but for the specific nature of the work they perform. This research will utilize this common terminology from this point forward.

While on campus, the National Emergency Training Center (NETC) Library was visited to gather data on the subject by searching the library database. Additionally, the bulk of research utilized the google search engine focusing on information about a truck company’s primary and secondary responsibilities, personnel assignments, safety, and training. The research produced numerous APR’s found through the NETC Library; however, only two were considered recent according to APR criteria. The Google research did yield information on the subject found

mainly in professional magazine articles. The information gathered shared similar concepts that will be discussed while answering the four research questions.

Since KFD does not perform specific truck company operations, it was essential to gain an understanding of truck company responsibilities which led to the first research question, "what are the primary and secondary functions ladder truck companies typically perform?". NFPA 1710 defines truck company work as "forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work" (National Fire Protection Association, 2016, p. 9). Richman (2008) agrees truck companies are specifically designed and equipped to carry out the functions defined by NFPA 1710 and states property conversation and laddering the building as additional functions. In a FireRescue magazine article, McCormack (2010) provides an acronym (LOVERS_U) that describes truck companies basic functions as "**L**adders, **O**verhaul, **V**entilation, **E**ntry, **R**escue (and Search), **S**alvage and **U**tilities" (p. 2). Although these references provide an overview of truck company responsibilities, they do not divide these functions into primary and secondary functions. Reeder (2014) also refers to the LOVERS_U as "a helpful way of outlining the task of a truck company (p. 2). He goes on to say that the acronym is not a sequential order task but a "shopping list" to choose from and task are completed base on incident priorities. He also adds common truck company priorities include "Vent, Enter, Search (VES)" (p. 3) but updates the acronym to include "Isolate" (p. 3). In today's modern fire-ground VEIS is crucial to control the flow paths preventing the spread of fire throughout the structure improving the safety of interior operations and survivability of occupants trapped inside.

In an Applied Research Paper (APR), Hanson (2017) found that most fire service organizations consider "ventilation, search and rescue, forcible entry, salvage and overhaul,

elevated streams, elevated rescue, ladder deployment, and utility control" (p. 16) as traditional responsibilities for truck company operations. The research further indicated that "ventilation, forcible entry, search and rescue, and ladder deployment" (p.16) are considered primary truck company responsibilities, "while activities such as salvage and overhaul, utility control, and elevated streams are secondary functions" (p. 16). The International Fire Service Training Association (IFSTA) list rescue, ventilation, and elevated master streams as immediate functions to be performed by truck companies on structural incidents (2015). McCormack (2014) discusses modern day fires, the challenges they present, and how they impact truck company operations. He lists forcible entry, search, laddering, and ventilation as primary truck company functions while indicating other truck company responsibilities as secondary. Mittendorf (2011) states "a truck company needs to quickly size up the incident and prioritize fire-ground concerns as necessary" (p. 8). Although priorities are determined and vary with each incident, Mittendorf (2011) says truck company operations can be separated into primary and secondary responsibilities. He states that primary functions are the highest priority and include "forcible entry-forcible exit, ventilation, search, and ladders (aerial and portable)" (p. 8), while secondary functions are "utilities, salvage, overhaul, and master streams" (p. 8). The research up to this point has focused on truck company responsibilities on the fire-ground; however, truck company capabilities may be useful in other capacities.

Truck company operations are traditionally focused on structural fire incidents but IFSTA (2015) provides situations truck company capabilities may be beneficial. These include performing technical rescue incidents to include bridge operations and swift water rescues, hazardous material incidents, and aircraft incidents. In a FireRescue article, Frassetto (2014) discusses utilizing a truck company to "enhance a common hazmat team operation" (p. 1). He

emphasizes improving the safety and efficiency of working off an aerial platform to perform tanker offloading operations which will be discussed in more detail in research question number three.

Research question one indicates that truck companies have specific functions that must be performed on the fire scene and can be utilized in other fire department operations. Mittendorf (2011) states “a truck company is primarily staffed and equipped to perform multiple specialized fire-ground operations” (p. 2). The importance of truck company operations leads to the second research question, “how should ladder truck personnel be assigned or deployed to improve operational effectiveness?”. NFPA 1710 (2016) states that truck companies “shall be staffed with a minimum of four-on-duty personnel” (p. 9). Additionally, it addresses Quint Apparatus that are designed “to operate as either an engine company or a ladder company, shall be staffed as specified in 5.2.3.” (p. 9) which is “a minimum of four on-duty personnel” (p. 9). NFPA 1710 goes on to state in section 5.2.3.4.2 that Quint Apparatus “expected to perform multiple roles simultaneously, additional staffing, above the levels specified in 5.2.3 shall be provided to ensure that those operations can be performed as required” (p. 9). Mittendorf (2011) says "the assignment of personnel to a truck company is a key consideration that affects company operational effectiveness" (p.4) but realizes "monetary constraints normally have the most impact on the number of personnel assigned to a truck company" (p. 7). However, Mittendorf (2011) agrees with the NFPA 1710 standard of a minimum staffing level of four personnel should be assigned “with an optimal staffing level consisting of six members” (p. 7). He also addresses the Quint Company concept indicating that the minimum staffing level should consist of six assigned personnel with eight personnel being optimal. Hanson’s (2017) research revealed that of the 76 respondents indicated that 14.5% assigned two or less personnel to a truck

company, 59.2% have dedicated on duty truck company staffing levels of three personnel assigned, and 15.8% complied with the standard of a four-person minimum. Although respondents were asked indicate the size of their departments, the research did not directly correlate the size of the department to the amount of personnel assigned to a truck company. Jelinek (2012) had similar results when researching the effectiveness of quint operations "that 9 of 83 respondents (10.8%) staff with one or two, 41 (49.4%) staff with three, 33 (39.8%) provide four-person staffing" (p. 22). Roche (2017) provided a 2016 National Run Survey in which 248 organizations responded representing departments from across the United States, District of Columbia, and four Canadian provinces. The results from this survey revealed that only two departments assigned one person to a truck company, 29 assigned two personnel, six departments assigned five or more personnel and the remainder assigned three to four personnel per truck company. 17 departments did not provide truck company staffing levels.

Both Richman (2008) and Mittendorf (2011) indicate that truck company functions are directly related to task assignments. They offer suggestions based on truck company personnel assignments ranging from three personnel up to six personnel. These assignments include the tools, task, and personnel necessary to perform operations in a safe and effective manner. They vary in relation to the specifics of each assignment but emphasize the importance of predetermining the task that needs to be performed, who should perform them, and the tools necessary to efficiently carry out the assignment. Richman (2008) adds to the importance of personnel and task by emphasizing:

> The number of personnel available determines how much can be done safely and effectively at one time. Five or six firefighters might simultaneously conduct the primary search, force entry, and ventilate. A three-member crew might find it difficult to move

through an area trying to perform three different tasks, all of which were needed to accomplish their objective, rescue, in a timely manner.

Despite truck company personnel assignments, truck company skills must be performed on the fire-ground. Richman (2008) states "the task performed by a ladder company is required at every fire, regardless of who carries them out" (p.3). When departments do not have designated truck companies, Richman (2008) suggest utilizing mutual or automatic aid agreements, or "task be assigned to particular personnel" (p. 5) that may arrive on an engine, rescue or Emergency Medical Service (EMS) units.

Jelinek's (2012) research indicated that 93.1% of the 121 respondents "cross-train their personnel to perform both engine and truck work" (p. 23). The results of this research indicated that cross-training had advantages and disadvantages. The benefits included a better understanding of the fire-ground task, improved fire-ground flexibility, and improved utilization of personnel. Disadvantages showed a need for additional time to learn and maintain truck company skill proficiency, skills degradation, role confusion, and decreased competence in truck company skills. Of the respondents, 39% indicated various merging options to include engine/EMS crews, engine/specialized apparatus, and one respondent's department merged an engine/truck company configuration.

Additionally, Jelinek's (2012) department conducted a three-month internal study to "evaluate the efficacy [*sic*] of a four-person staffed quint versus a three-person plus one staffed ladder truck" (p. 1) in relation to merging companies to perform the task or having established four personnel companies. Department members indicated the three-month trial improved truck company functions, crew flexibility, and efficiency while operating as a four-person quint

company. Personnel stated an improved familiarity with truck company operations, specialized equipment, focused truck skill training, and appropriate apparatus placement on the fire-ground as advantages of four personnel assignments. One firefighter stated that returning to a three-person engine company and one person truck company would result in the truck "once again be underutilized, and become an afterthought" (p. 37).

It's imperative that truck company task must be performed, and these task can be accomplished utilizing different approaches based on a departments resources. The research indicates various advantages and disadvantages of different methods, but all fire service operations should consider the safety of the community and firefighters as their top priority. The third research question, “what risk or safety issues should be considered in relation to ladder truck operations?" will attempt to gather data related explicitly to truck company operational safety.

Operating vast apparatus requires unique skills, training, practice, and established safety procedures to prevent accidents. In fact, "approximately 30% of fire service vehicular accidents occur while moving backward" (Mittendorf, 2011, p. 35). These backing accidents are avoidable and can occur while backing into the station, during emergency responses, and positioning apparatus on an emergency scene (IFSTA, 2015; Mittendorf, 2011; Richman, 2008). IFSTA (2015) goes onto say “backing accidents generally account for a significant percentage of all damage repair cost” (p. 86). Anytime a truck must back up, a minimum of one spotter, with radio, should be used and the truck driver should not rely solely on backup cameras, backup alarms, warning devices, or mirrors (IFSTA, 2015; Mittendorf, 2011).

Backing situations are not the only time spotters are essential. It is equally important to ensure on-scene hazards are avoided while positioning and operating sizeable aerial apparatus during emergency incidents. Spotters should be utilized to avert overhead electrical wires, trees, falling debris, vehicles, pedestrians, and unstable surface areas while setting stabilizers and conducting aerial operations (IFSTA, 2015; Mittendorf, 2011). IFSTA (2015) also states “always have a second person present when working on, around, or under apparatus” (p. 119).

In an all-encompassing statement, Richman (2008) states "ladder companies should be staffed, equipped, and trained to perform necessary duties quickly and efficiently, as their performance can affect the safety and performance of other responding companies” (p. 12). Mittendorf (n.d.) authored a training course that emphasizes maximizing firefighter safety through effective truck company operation on the fire-ground. He breaks fire-ground operations into fire attack, which falls under engine company responsibilities, and logistical operations that are the responsibility of the truck company. Mittendorf (n.d.) says truck company functions are “designed to ensure that ladders, forcible entry, forcible exit, and ventilation operations allow an attack company to put the wet stuff on the red stuff in a safe and timely manner” (p. 3). These functions will improve visibility, reduce interior temperatures, minimize flashover conditions, remove harmful gases, provide secondary means of egress for firefighters and rescuing of victims, and quickly gaining access to perform suppression and victim rescue efforts (McCormack, 2010; Mittendorf, 2011; Richman, 2008). Mittendorf (n.d.) adds “it should be easy to see that three of the top five initial priorities (forcible entry-exit, ladders, and ventilation) are designed to maximize the safety of fire-ground personnel committed to interior operations” (p.8).

The latter part of Richmond’s (2008) statement “ladder companies should be…trained to perform necessary duties quickly and efficiently, as their performance can affect the safety and

performance of other responding companies" (p. 12) implies fire-ground operations are a coordinated effort of complex and specialized operations that requires a proficient level of training to perform safely. The final research question, "what training should be incorporated to improve ladder truck operational effectiveness?" hopes to identify essential training for improved truck company operations.

Mittendorf (2011) says "of all the attributes that collectively combine to develop an effective truck company, training (along with attitude) is one of the most essential elements" (p. 5). He goes on to emphasize "that training is the most important non-emergency function in the fire service" (p. 5). He also asks "is adequate time devoted to the basics, such as proper ladder placement, forcible entry techniques, familiarity with search operations, under challenging circumstances, the proper use of a power saw, efficient use of SCBA bottle on your back, and so on?" (p.6). McCormack (2014) reiterates these points concerning skills by saying "the only way to remain proficient at them is to practice them over and over…that's what makes training and practice so important" (p. 3). In a three month evaluation of quint operations with four on-duty personnel assigned to the apparatus, Jelinek (2012) found some of the advantages included "familiarity with truck company operations, focused truck company training, and appropriate spotting of the quint" (p. 33). Additionally, the research indicated members had "better awareness/utilization of the truck and the specialized equipment it carries during incidents" (p. 33). The literature indicates the importance of specific truck company skills and task while eluding to the types of training and skills that need to be performed.

McCormack (2014) says based on "research studies and fire-ground tactics" (p. 3), that truck size-up, truck assignments, forcible entry, search, laddering, and ventilation are all vital for truck company fire-ground operations. Reeder (2014) says that due to modern-day fires burning

faster and hotter, truck companies need a “keen awareness of flow path and the importance of cooling the atmosphere prior to entry” (p. 2) and "synchronizing your engine and truck company operations is paramount" (p.2). Not only do truck companies need to be proficient at their specific functions they need to work closely with engine company operations to prevent acceleration and expansion of the fire by not controlling the flow path and introducing oxygen-rich air into the fire (McCormack, 2014; Reeder, 2014),

Richman (2008) and Mittendorf (2011) provide extensive training guidelines on the primary and secondary functions of truck company fire-ground operations. They both emphasize that truck company operations are essential to fire-ground success and members must be thoroughly trained, effectively integrated, and proficiently trained no matter what assignment configuration a department may use to execute these vital task. McCormack (2010) reemphasizes that “it really doesn’t matter what your department’s approach to truck work is (although you may wish it was different), but what does matter is that the department members can perform the skills when the time comes” (p.2). No matter the size of the department, truck operations need to be defined, designated, and performed focusing on the primary functions of "forcible entry, laddering, search, ventilation, overhaul, and more" (McCormack, 2010, p. 2). These skills must be the primary focus of any truck company training program.

Mittendorf (2011) says that if fire department members are expected to perform engine and truck company operations "cross-training becomes essential for company effectiveness" (p. 7). However, he emphasizes the advantage of having separate designated companies “is the tendency of those companies to specialize in their particular responsibility” (p.7). Cross training members may be necessary for departments based on the fiscal constraints placed on their respective organizations, but without designated and specialized companies Mittendorf (2011)

says “you will most likely see your engine company’s proficiency remain the same, and truck company expertise slowly diminish” (p. 7). Up to this point training has focused on primary truck company functions, maintaining skill proficiency, and cross-training members, however, truck company placement has yet to be explored.

Due to the versatility a truck company can provide, there are multiple training considerations when it comes to positioning the apparatus on the emergency scene. IFSTA (2015) points out the fact that during most fire-ground incidents, engine companies arrive on scene prior to the arrival of the first truck company. Many times once engine company fire attack lines and water supply lines are placed blocking access for truck companies. IFSTA (2015) suggest engine company “operators must seek a position of best advantage for their apparatus while keeping in mind the needs of aerial apparatus that have yet to arrive” (p. 140). Lack of consideration for truck company placement “can seriously jeopardize the outcome of the incident” (IFSTA, 2015, p. 140). Due to the limited reach of a truck companies aerial device and the fact engine companies have more flexibility with the ability to extend attack line through various hose configurations, IFSTA (2015) suggest incorporating an "inside/outside" (p. 140) method into fire-ground operation training. The concept is simple, for buildings that are five stories or more, the truck company can be positioned inside the engine company. For buildings less than five stories, the truck company can be placed outside the engine company. Implementing this concept into training can provide for more effective and efficient fire-ground operations by maximizing the capabilities of on-scene resources. Richman (2008) states there are many factors to consider when positioning truck companies. He says structural stability of the fire building, proximity of exposures, and fire extension “will determine the position of the truck” (p. 139). The truck company position can also be influenced by inclines/declines, space

for setting stabilizers, overhead obstructions, and operations to be performed by the truck company (Richman, 2008). There are numerous variables that impact truck company positioning. The important point to ensure truck company members are “thoroughly trained in the operation of the equipment. They must be competent to drive, position, stabilize the aerial apparatus, and be proficient in the operations of the aerial device" (p. 150). Additionally, it is crucial that engine companies, as well as, incident commanders are trained to consider truck company access and placement during fire-ground operations (IFSTA, 2015; Richman, 2008). Richman (2008) also states that “standard operating guidelines (SOG) will dictate how the apparatus is to be positioned and, based on command's assignment of that company, what duties they are to perform given the particular fire situation" (p. 16). He also suggests standards that determine truck company response procedures and predetermined truck company "personnel positioning and tool assignments" (p.19). Mittendorf (2011) also suggest implementing “standardized procedures” (p. 9) in relation to personnel positions and predetermined duties for truck company personnel. They both suggest SOG's provide a base and starting point for truck company operational training (Mittendorf, 2011; Richman, 2008).

The literature review provides a clear vision of the importance of truck company operations not only on the fire-ground. Truck companies provide logistical support to improve the effectiveness and efficiency of fire-ground operations by performing their primary and secondary functions based on incident priorities. Truck company operations must be completed no matter the staffing configuration, but designated on-duty personnel that specialize in truck company operations appear to be the most effective. The essential truck company functions significantly improve the safety of fire-ground operations for responders and improve the survivability of occupants needing rescue by performing vital operations. Due to a truck

company's versatility and complexity a comprehensive training program must be developed to enhance the specialization of the skills needed to complete the task in a safe, effective and efficient manner. A critical aspect of this training is the implementation of fire department SOG"s that address truck company operations.

Procedures

The research conducted by the author for this Applied Research Project (ARP) was influenced by the information and concepts gathered during the literature review. The bulk of the data collected from the literature review utilized internet Google searches, purchase of applicable training text, review of KFD's copy of NFPA standards, and use of NETC's on-line database. The specific questions asked of other fire departments and KFD personnel where designed to address the four original research questions. A combination of questionnaires, surveys, and interviews was used with the intent of gathering reliable and accurate data that could be used not only for this project but also for promoting positive change with the KFD.

Since the purpose is to identify factors that influence the effective use of truck company operations, a descriptive research approach was utilized to obtain research information. A sample group of comparable fire departments was initially developed by Hayes (2015) and used to inquire if same size departments are performing primary and secondary truck company functions, best personnel assignment configurations for effective truck company operations, truck company safety issues, and the type of training truck companies perform to maintain skill proficiency.

A questionnaire was developed using the Survey Monkey website consisting of 18 close-ended questions focused on deriving answers to the specific research questions. A test of the

questionnaire was conducted in-house with a small test group of three KFD personnel to determine if the survey accurately solicited the appropriate research information. During this process, minor deficiencies were identified and the questionnaire modified before being distributed to the sample group of comparable fire departments. The questionnaire was conducted anonymously and did not identify each respondent's participation or answers. The sample group was contacted by email with a hyperlink to the questionnaire with instructions for the completion and submission process. The email introduced the researcher, explained the purpose of the study, assured respondent's anonymity, and established the two-week window for the survey completion. A follow-up email was distributed seven days after the original email reiterating the information provided in the first email, providing a quick overview of the results obtained thus far, soliciting participation, and expressing the willingness to share the research results with the sample group.

The process of selecting a sample group of comparable departments began with the USFA National Fire Department Census (2015) that consists of 27,140 registered fire departments or 90% of the fire service. A review of all 27,140 departments was conducted selecting those that were all-career, had 3 to 12 fire stations, and employed 50 to 250 active personnel. This criterion was initially used to ensure an adequate sample size was obtained; however, it was not narrow enough to truly represent fire departments comparable to KFD. A second review was conducted of the selected departments identifying departments with 7 to 9 fire stations and employing 75-150 active personnel. This selection process produced a sample group of 106 fire departments, from 31 states, and represents departments closely related to the same size as KFD. Each of the 106 departments was contacted by phone to obtain a contact name and email of a department representative. This information was added to the census spreadsheet

and was used to develop a sample group consisting of 79 departments (Hayes, 2015). After the initial email for a 2015 research project, the sample group was reduced to 74 due to unsuccessful delivery to five recipients. This sample group was utilized again in a 2017 and for this research project. After additional undeliverable notices, the sample group of comparable departments for this project was finalized at 66 recipients.

During the background and significance, the researcher theorized that KFD had a long historical culture of utilizing truck companies for the single purpose of elevated master streams. A survey was developed to test this theory, as well as, gather data on the mindset of KFD personnel in relation to truck company operations. The survey was designed utilizing SurveyMonkey consisting of 16 questions mirroring the questionnaire for comparable fire departments, but modified to elicit information specific to KFD. An email with a hyperlink to the survey was distributed using the city email system. Additionally, a reminder notification was sent through CrewSense further soliciting participation. Supervisors on each shift also asked members to participate in the survey. A follow-up email was distributed with the attached SurveyMonkey hyperlink encouraging survey participation. The KFD survey sample group was limited to 108 personnel consisting of the operations and training divisions due to their direct involvement with truck company operations. The administration and fire marshal's divisions were not included in the sample group.

During the literature review, the researcher discovered a FireHouse (2017) run survey that identified two fire departments out of 248 that assigned one person to their truck company. Both of these departments were contacted by phone from the privacy of the researcher's residence, and an interview was conducted. The interviews (Appendix C) consisted of eight questions designed to gather demographical information about their department and 15 opened

ended questions designed to solicit answers in relation to the four original research questions. These questions also mirrored the initial questionnaire for comparable fire departments but were intended to gather data from these two departments that shared the uniqueness of KFD with one person assigned to a truck company.

The research questionnaire developed for the sample of comparable fire departments was limited by the inability to collect contact names and emails for all 106 departments. Three of the departments had the wrong number listed in the census, or there was no answer. Twenty-seven of the attempts produced a voicemail with only three departments responding to the return message. The original email list was reduced to 74 because of errors with the email delivery system creating additional limitations. The sample group was further reduced to a total of 66 addressees after additional email errors. An attempt to follow up with the unreachable respondents may have overcome the limitations, but a follow up was not conducted. Despite the initial and follow up emails, the sample size of 66 produced a total of 36 responses to the survey limiting the amount of data collected and lowering the accurate representation of departments comparable to KFD. Further, the low response rate limited the reliability of data collected. Furthermore, despite the in-house test group on the survey draft and modifications, all questions did not provide the totality of results desired.

The research survey designed for KFD personnel was somewhat limited due to four of the 108 addresses were participating in a regional recruit school and did not check their email. An additional 13 personnel were on leave, and six personnel were on Family Medical Leave Act (FMLA) due to injuries during the survey period. This atypical staffing situation reduced potential participants to 85.

The research interview developed for departments with one person assigned to a truck company was limited by the hesitation of respondents to elaborate. Respondent exhibited a reluctance to expand on the open-ended questions and provided only brief responses. The information collected was limited in providing the in-depth insight anticipated.

Results

The research questions were designed to address specific issues associated with KFD's truck company operations. The intent was to identify best practices for deployment, training, and utilization of truck company capabilities during the mitigation of structure fires while identifying additional capabilities that may be incorporated into overall operational objectives. Although the four research questions were broad-based, data to answer these questions was collected using a combination of questionnaires, surveys, and interviews. These research methods were designed to gather more detailed information specific to KFD and expand on the material provided in the literature review. Of the 66 sample departments (Appendix A) ask to complete a questionnaire, 36 responded representing a 54.5 % response ratio. Of the 85 KFD personnel surveyed (Appendix B), 70 responded representing an 82.4% response ratio while both departments selected for the interview (Appendix C) participated.

The purpose of the first research questions, "what are the primary and secondary functions ladder truck companies typically perform?" was to identify how other departments are utilizing their truck companies compared to KFD. Additionally, the research intended to gather information concerning KFD member's expectations of truck company operations. During the literature review, several resources provided valuable insight on typical primary and secondary functions truck companies typically perform, as well as, alternative uses. When the sample

departments were asked about their primary functions, 34 of the 36 respondents stated the top four included ventilation (83.33%), laddering the building (80.56%), elevated master streams (80.56%), and search and rescue (69.44%) with forcible entry/exit (63.89%) rounding out the top five. Two of the 36 respondents selected “other” emphasizing a quint system that primarily functions as an engine company providing “defensive master streams and laddering 3+ story buildings”. When KFD personnel were asked the same question 63 of the 70 respondents selected elevated master streams (88.57%), laddering the building (77.14%), scene illumination (37.14%), protecting exposures (35.71%), and technical rescue incidents (25.74%) as the top five primary functions. Seven KFD members selected "other" stating task are accomplished by engine companies and truck company is not used for these functions without engine company personnel assistance. The interviewed departments stated “ventilation” or “not designated but assigned as needed” as primary functions.

A second question asked respondents to identify secondary functions performed by their respective truck companies. 35 of the sample departments answered this question with one choosing to skip. Of the 35, three selected the "other" option. The sample departments selected salvage/property conservation (54.29%), overhaul (48.57%), and scene illumination (34.29%) as the top three with utility control and protecting exposures equally receiving 28.57% selection. Of the 70 KFD personnel, 69 responded, and one skipped. Seven of the 69 respondents selected the “other” option. The top secondary functions included protecting exposures (42.03%) and scene illumination (39.13%) as the top two. Ventilation, technical rescue incidents, and laddering the building tied for third at 21.74%. Other selections receiving notable percentages included elevated master streams, salvage/property conservation, extrication, and overhaul. The “other” option included water supply, extra firefighter, and provide equipment as secondary functions.

The interview departments stated “secondary search” and “not designated but assigned as needed” as truck company secondary functions.

KFD's personnel survey was asked an additional question in relation to their expectations of primary and secondary functions truck companies should perform. All 70 KFD personnel responded to this inquiry. Eight of the 15 functions listed were selected by at least half of the respondents. They identified these functions as laddering the building (95.71%), ventilation (94.29%), elevated master streams (84.29%), protecting exposures (68.57%), forcible entry/exit (62.86%), search and rescue (61.43%), scene illumination (55.71%), and rapid intervention crew (50.00%).

The second research question, “how should ladder truck personnel be assigned or deployed to improve operational effectiveness?” was designed to gather information on personnel assignment options that KFD may explore or implement to increase the effectiveness of truck company operations. Sample departments were asked if they had aerial apparatus, the number of aerials assigned to front-line service, if the aerials were dedicated truck/ladder or quint companies, the number of the minimum on-duty personnel assigned to apparatus, and how they provide truck company operations if personnel is not assigned. Thirty-five or 97.22% of the departments stated they had aerial apparatus with one department indicating they did not have an aerial. Departments without a aerial apparatus were asked to skip the next three questions. Of the 35 sample departments with aerials in front-line service, 54.29% stated they had two, 31.43% had one, two departments had three, one with four, and two departments reported they had five or more. When asked about their department's minimum on-duty personnel assignments, 45.71% stated three personnel, 34.29% selected four personnel, 11.43% indicated two assigned, and one department assigned one operator. No departments assigned five or more and two departments

reported a form of cross-staffing apparatus depending on the type of incident or single versus multi-company stations. KFD personnel was asked to indicate what they thought appropriate minimum staff levels should be to perform truck company operations. All 70 respondents answered this questions resulting in 68.57% stating four personnel, 15.71 % stating five or more personnel and 15.71% felt three personnel would be sufficient. The two interviewed departments were not asked this question due to the fact they were selected based on their designation of assigning one person to the truck.

The final question under this research question asked if departments did not have designated truck companies with assigned personnel how did they provide truck company operations. This question intended to gather information on how departments accomplish truck company operational task. 34 sample departments responded with two respondents skipping this question. 82.35% selected non-applicable. Four departments stated they cross-staffed their truck company, one department assigns engine companies to perform truck operations, and one merged personnel or companies to accomplish truck task. None of the departments used mutual aid or specialized apparatus to complete truck operations. Given the current truck company staffing levels, KFD personnel were asked to select the “best way” to utilize truck companies. 41.43% felt KFD should fully evaluate the effectiveness of a four personnel truck company versus the current configuration of a one person truck and three-person engine company. 27.14% said KFD should cross-staff the truck company by assigning engine company personnel to truck companies upon scene arrival. Some respondents (20.00%) suggested merging various personnel, two respondents said they use engine companies to complete the task. Six "other" selections offered various options from using daytime personnel to adequately staffing truck companies as the only option. Of the two interviewed departments, one stated an operator drives

the apparatus to the scene, and off-duty personnel that are called back are assigned or in some cases mutual aid it utilized. The other department indicated that the truck company is cross-manned with engine or squad companies when needed. Additionally, the have the option of using mutual aid with three other districts.

The third research question, “what risk or safety issues should be considered in relation to ladder truck operations?” intended to identify safety considerations KFD should evaluate with assigning one person to a truck company and risk associated with the inefficient performance of truck company operations on the fire-ground. Sample departments were asked questions concerning utilization of spotters when aerial apparatus are backing, positioning, extending stabilizers or performing aerial operations, laddering of buildings with two or more stories, and coordination of ventilation operations with an interior attack. All 36 respondents answered these questions. 94.44% or 34 stated they use spotters when backing the apparatus with 5.56% or two saying they did not. 31 or 86.11% used spotter when performing apparatus positioning, extending stabilizers, and performing aerial operations while five or 13.89% indicated they did not use spotters when performing these functions. 25 departments stated they routinely ladder structures of two stories or more with the remaining 11 answering no. All respondents indicated they coordinate ventilation with interior operations.

To gage members’ impression concerning risk and safety issues with truck company task, KFD personnel were asked to select responses on a sliding scale if KFD routinely ladders structures of two or more stories, if ventilation is coordinated with interior operations, is vertical ventilation adequately utilized when needed, and if spotters are used when aerial apparatus are backing, positioning, extending stabilizers, and performing aerial operations. All 70 personnel answered these question with only two skipping the vertical ventilation question. When asked if

KFD routinely ladders structures of two or more stories, 35.71% disagreed, 34.29% agreed, 21.43% neither agreed nor disagreed, three personnel strongly agreed, two personnel strongly disagreed, and one stated rarely. 54.29% of personnel stated KFD usually coordinates interior operations with ventilation efforts, 18.57% said always, 15.74% said sometimes, and 11.43% felt KFD rarely coordinates these operations. KFD's adequate utilization of vertical ventilation resulted in 35.29%, or 24 of 68 personnel agreed, 33.82% or 23 personnel neither agreed or disagreed, 25.00% or 17 personnel disagreed, three personnel strongly agreed, and one member strongly disagreed. When asked if KFD assigns spotters to assist the truck company with backing, positioning, and operations, 40% said rarely, 30% said sometimes, 20% stated usually, five personnel said never, and two personnel responded always.

When the interviewed departments were asked the same line of questioning, both indicated they ladder buildings of two stories or more, they assign spotters during aerial movements and operations, and ventilation is coordinated with interior operations. One department stated they normally use vertical ventilation emphasizing synchronizing isolating the fire and controlling flow paths with suppression efforts. The other department said they use horizontal without expanding on other methods or coordination efforts.

The fourth and final question, “what training should be incorporated to improve ladder truck operational effectiveness?” sought to determine the type of specific truck company training that is performed by other departments, types of training aids used, and who receives the training. Based on the information gathered in the literature review the following questions were developed and presented to the sample departments. All 36 departments responded when asked if their organization had standard operating guidelines/procedures for truck company operations. 69.44% said they do and 30.56% indicated they lack standardized procedures. When asked if

they performed truck company-specific training, again 69.44% or 25 of 36 responded they perform this training and 30.56% stated they do not. A follow-up question asked who received this training and 35 of the 36 responded with one choosing to pass on answering. 51.53% said all personnel is cross-trained to perform truck operations, 22.86% stated no specific truck company training program exist, and 22.86% indicated only personnel assigned to truck companies receive this training. Other responses included members assigned to truck companies attend a truck academy, truck companies do specific training but multi-company drills are performed to integrate operations, and another said all personnel receive basic truck company training, but personnel assigned to truck companies spend more time developing truck specific skills. 35 of 36 respondents stated they use the following training props; forcible entry simulators (80.00%), multi-story facility (74.29%), smoke generators (74.29), live fire trainer (68.57), and 40.00% use ventilation simulators. Four respondents added they use multi-story public buildings, commercial props, and wrecked vehicles for extrication. One indicated the question was not applicable. When asked if their department prioritized aerial apparatus positioning and utilization on the fire-ground, 42.86% said always, 40.00% replied usually, 17.14% indicated sometimes with one stating rarely. Of the 36 sample departments, one skipped this question.

KFD personnel surveyed were presented questions in relation to aerial apparatus positioning and utilization, standard operating guidelines, specific truck company training, training props, and who should receive this training. All 70 personnel answered these questions and 51.43% said that aerial apparatus fire-ground positioning and utilization is a priority during fire-ground operations sometimes. 22.86% replied usually, 18.57% stated rarely, three personnel or 4.59% said never, and two individuals felt it was always a priority. 38.57% disagree that KFD has sufficient standard operating guidelines, 30.00% neither agreed or disagreed, 12.86%

strongly disagree, 12.86% agreed, and 7.14% indicated the department has adequate guidance or guidelines are not needed for current truck company configurations. When asked the level of specific truck company function/task training provided by KFD, 57.14% said a little, 20.00% felt a moderate amount, 20.00% stated none at all, and 2.86% or two respondent said a lot of training is provided. No respondents indicated the department provided a great deal of truck company-specific training. In relation to training aids, 91.43% said a multi-story facility is available and/or utilized by KFD. The respondent listed live fire trainer (85.71%), smoke generator (72.86%), ventilation simulator (37.14%), and forcible entry (28.57%) as other training props available. Three members selected other with one stating that all the training props are available but not utilized effectively. Overwhelmingly, 91.43% of KFD members felt all members should be cross-trained to perform specific truck company operations while 4.29% selected only personnel assigned to truck companies. 1.43% felt personnel should be trained on truck company skills but not on the integration of truck company operations or no truck company-specific training is needed. Three personnel indicated truck company personnel should be rapid intervention and rescue specialist, operators should be trained, and adequately staffed truck companies should receive the training.

The two interviewed departments were presented similar questions. Both indicated they have standard operating guidelines, perform specific truck company skill and operations training, and all personnel are cross-trained. One department said only experienced, and senior personnel are assigned to operate the aerial apparatus. The other department stated they have standardized procedures for aerial placement/position on structure fire operations. Both departments reported they have ventilation and forcible entry training props while one department added they have access to a multi-story facility.

Finally, two questions were presented to all three research sample groups in relation to truck company capabilities effective incorporation during normal, training, and emergency operations and what factor, if any, contribute to the ineffective use of truck company capabilities. The intention was to gather information on the perception the sample groups had concerning their overall truck company operations. Of the 36 sample departments, 35 responded with 62.86% agreeing that their organization effectively incorporates truck company capabilities, 22.86% strongly agreed, 8.57% disagreed, and 5.71% neither agreed or disagreed. All 70 of KFD personnel responded with 50.00% saying they disagreed that truck company capabilities are effectively incorporated. Others; 24.29% stated they agreed, 21.43% neither agreed or disagreed, and 4.29% strongly disagreed. Of the two interviewed departments one stated truck company capabilities are fully utilized when needed, and the other said truck capabilities are not incorporated because they are rarely required.

Of the 36 sample departments, 32 respondents indicated the ineffective use of truck company capabilities were not-applicable to their department. 25.00% stated a lack of staffing resources, 12.5% said lack of sufficient training program, 6.25% indicated a lack of adequate training props and 3.13% said they lacked sufficient equipment. Two respondents selected other with one stating they lack sufficient fire responses to be proficient and the other said a lack of command awareness devalued truck company operations. 94.20% of the 70 KFD personnel felt that lack of personnel resources was the most significant factor contributing to ineffective us of truck company capabilities. 55.07% indicated lack of sufficient training program, 33.33% stated a lack of operating guidelines and 26.09% said misappropriation of personnel was the contributing factor. The interviewed departments indicated increased staffing and experience with fire-ground operations would improve the ineffective use of truck company capabilities.

The original research provided valuable insight and varied data by utilizing multiple sample groups and research methods. The sample groups were supplied with "other" response options to elicit more detailed information. Some of the responses accomplished the research goal, but others were invalid and not included in the results. All data gathered will be incorporated during the discussion and recommendation portions of this project.

Discussion

The purpose of this research project was to identify factors that influence KFD's ladder truck capabilities from being utilized and incorporated effectively during normal, training, and emergency operations. The literature review provided an in-depth expansion of knowledge into the importance of truck company operations with the primary focus on fire-ground operations. Truck company experts agree that truck company task must be performed no matter what personnel assignments and apparatus deployment configurations a fire department employs (McCormack, 2010; Mittendorf, 2011; Richman, 2008).

Although KFD has provided an aerial apparatus since 1941, KFD has struggled to establish effective and efficient deployment procedures for truck company operations that would ensure utilization and incorporation of truck capabilities. The intent of the first research question, what are the primary and secondary functions ladder truck companies typically perform, was to establish industry standards and compare those with fire departments of similar size to KFD, perceptions of KFD personnel, and other departments designated as operating their aerial apparatus with one assigned member. The literature review revealed a common acronym used to determine truck company operations as "**L**adders, **O**verhaul, **V**entilation, **E**ntry, **R**escue (and Search), **S**alvage, and **U**tilities" (McCormack, 2010, p. 2). NFPA 1710 (2016) further

defines truck company operations by adding “aerial operations for water delivery and rescue” (p. 1710-8) and scene illumination. Other uses for truck companies included hazardous material responses, technical rescue incidents, extrication, and rapid intervention crews (Frassetto, 2014, Hanson, 2017; Richman, 2008). The literature review indicated that truck companies are specialized apparatus that have the capability to perform multiple functions. The review also indicated a consensus of primary truck responsibilities as ventilation, forcible entry/exit, search and rescue, and ladder operations (Mittenforf, 2011, McCormack, 2014) with all other operations identified as secondary possibilities depending on incident priorities.

The research showed that sample departments (comparable in size to KFD) reflect traditional standards and consider the top four priorities of truck company operations as ventilation (83.33%), laddering the building (80.56), elevated master streams (80.56%), and search and rescue (69.44%) with forcible entry a close fifth with 63.89% (Appendix A). Based on this information, it’s clear that sample departments have a better understanding of the primary responsibilities of truck company operations when compared to the expert consensus. Additionally, the research supports the original hypothesis that KFD considers the primary function of a truck company as an elevated master stream. KFD personnel (Appendix B) selected the top primary role of truck companies as elevated master streams with 88.57 % or 62 out of 70 personnel. The second primary function was laddering the building with 77.14% response rate. Scene illumination and protecting exposures finished out the top four with 37.14% and 35.71% respectively. Interestingly, ventilation was selected by 20.00% of personnel with search and rescue (7.14%), and forcible entry/exit (2.86%) finishing very low in primary truck functions. Although the two departments that also assigned one person to a truck company did not provide extensive information, the interviews did indicate that their truck company operations do not

align with accepted standard primary truck operations. The two interviewed departments (Appendix C) stated ventilation as the primary responsibility or primary responsibilities are not designated but assigned as needed.

The research showed truck company secondary functions varied greatly and indicated that several factors might influence these functions. Sample departments did agree that salvage/property conservation (54.29%) and overhaul (48.57%) as their top two secondary functions. Again, the sample departments showed a better understanding of truck company functions while KFD personnel chose protecting exposures (42.03%) and scene illumination (39.13%) as their top two secondary truck company functions. Although these may be secondary functions trucks may perform, they are not part of the widely accepted acronym LOVERS_U. Also, interviewed departments did not show a clear understanding of secondary functions by responding with secondary search and assigned as needed as their operational procedures.

The second research question focused on ladder truck personnel assignments and deployment procedures that improve operational effectiveness. The standard minimum assignment for on-duty personnel is four for designated truck companies with additional personnel recommended for quint type apparatus (NFPA, 2016). Although four personnel is the standard, personnel assignments can be influenced by several factors based on the jurisdiction's needs and financial support. The literature review did provide truck company operations with minimum staffing levels ranging from three to six personnel (Mittendorf, 2011; Richaman, 2008). However, no discussion or recommendations for truck company operations with one or two personnel assignments was offered. The research showed that the majority of sample departments operate with two aerial apparatus (54.29%) and assign a minimum of three to four personnel to their truck companies (80.00%). Only one department operates with one person, and

four departments said they assign at least two personnel. Fourty-eight out of 70 (68.57%) KFD members agreed with the NFPA 1710 standard of four-person minimum staffing with the remainder equally selecting three or five minimum truck company staffing levels.

Although there are minimum staffing standards, monetary constraints may hinder a fire department's ability to achieve these standards. Richman (2008) suggest that departments may have to rely on alternate means of accomplishing the truck task by utilizing automatic or mutual aid agreements. Additionally, departments could consider merging members or assigning engine companies to complete the truck task. 82.35% of sample departments said they do not consider these options for accomplishing the truck task but perform these functions with appropriately staffed designated truck companies. Five of the sample departments did indicate they rely on cross-staffed aerial assignments or merging of personnel to complete truck company task. Interestingly, none of the respondents utilize mutual or automatic aid. In comparison, most KFD personnel (41.43%) felt that the department should fully evaluate a four-person truck company versus the current configuration of one person truck and three-person engine company. 27.14% felt the department should cross-staff the truck by assigning engine companies to work with the truck company once they arrive on scene. KFD agreed with comparable departments believing mutual/automatic aid is not a viable option. Although the interviewed departments did have mutual aid agreements, they stated these agreements were rarely used to accomplish truck company task on the fire-ground.

The third research question sought to determine what risk or safety issues should be considered in relation to ladder truck operations. It became clear given the complexity, size, cost, and multiple capabilities of aerial apparatus that truck operations should not be performed without adequate personnel. IFSTA (2015) recommends assigning additional personnel to assist

the operator when backing, positioning, extending stabilizers, and overall aerial operations are performed. Additionally, truck company primary functions are performed to improve the safety and reduce risk to responders, occupants, and bystanders at a fire incident (Mittendorf, 2011, McCormack, 2014; Reeder, 2014; Richman, 2008). Sample departments (69.44%) and 100% of interviewed departments stated they provide a secondary means of egress when conducting operations in structures of two or more stories. When KFD personnel were asked the same line of questioning, the results were split with 40.00% stating that KFD does not routinely provide a secondary means of egress with ladder placement and 38.58% said KFD does ladder these type of structures. The rest of the responding members did not have an opinion on the matter. On the topic of coordinating interior operations with ventilation efforts all sample departments and interviewed departments fell in line with standard operational practices stating they coordinate these operations. Surprisingly, KFD members contradicted the researcher's assumption with 72.86% responding KFD usually or always coordinates ventilation and interior operations.

Although KFD has backing policies for using additional personnel for spotters when backing apparatus, the truck apparatus is excluded and relies upon a backup camera for backing assistance. IFSTA (2015) states "the driver/operator must not rely solely on back up cameras to provide a full and accurate view of the scene. Spotters are still required" (p. 113). The majority of both sample departments (86.11%) and interviewed departments (100%) agreed with IFSTA stating they use spotters to assist with aerial apparatus movements compared to KFD personnel (70.00%) saying spotters are rarely or sometimes used.

The fourth and final research question focused on the type of training that should be incorporated to improve ladder truck operational effectiveness. In Mittendorf’s (2011) opinion “of all the attributes that collectively combine to develop an effective truck company, training is

one of the most essential elements" (p. 5). Richman (2008) states that it is imperative that members "must be proficient in the basic objective of ladder company work" (p. 4) and they "need to be educated so they will make the proper decision while working in a hostile environment" (p. 4). Mittendorf (n.d.) adds it important "to take the time to ensure that company members are grounded in the basics for logistical responsibilities such as ventilation, search, utilities, ladders, and so on" (p. 4). The leading authors on the subject agree that standard operating guidelines are an important aspect in establishing training and operational procedures (McCormack, 2014; Mittendorf, 2011; Richman, 2008). One could assume that most departments have standardized procedures and the research showed that 69.44% of sample departments have established guidelines with 100% of interviewed departments concurring. However, 51.43% of KFD personnel feel the department lacks sufficient standard operating guidelines for truck company operations with only 12.86% agreeing that KFD does provide sufficient guidelines. Although most fire service training programs cover basic truck company skills, the research focused on continuation of needed truck company-specific training to ensure fire department members proficiency in performing these skills. Again, 69.44% of sample departments provide truck company-specific training with 51.43% indicating all department members receive this training and 22.86% stating only personnel assigned to a truck company train on these specific skills. The same percentage of 22.83% stated their department does not provide a truck company-specific training program. All interviewed departments indicated they focus on truck company-specific training. In comparison, 77.14% of KFD personnel feels the department offers a little or no training related to truck company operations, but 91.43% think that all personnel should receive this training.

An important consideration during truck company training is apparatus positioning on a fire scene. IFSTA (2015) offers recommendations on prioritizing the truck apparatus positioning that is influenced by multiple factors to include structure height, available space, overhead hazards, collapse zones, and incline/decline of the terrain. Mittendorf (2011) and Richman (2008) emphasize that truck company positioning must be a top consideration during fire-ground operations and effective training programs are essential to ensure positioning is adequately accomplished. To evaluate the effectiveness of a departments training program in relation to truck company apparatus placement, the research asked if aerial apparatus positioning and utilization was a priority. Of the sample departments, 82.86% indicated they usually or always make positioning a priority while 74.29% of KFD personnel felt the department sometimes, rarely, or never considered the positioning of aerial apparatus a priority.

Based on the primary truck functions of ventilation, forcible entry/egress, search and rescue, and laddering the building, it was important to evaluate the availability and utilization of training facilities and props that are available to improve skill proficiency. The literature review focused more on the tools and techniques used to perform these skills, however, the research indicated overwhelmingly that all sample groups have sufficient access to appropriate training simulators to facilitate truck company-specific training. The only response that varied significantly between sample departments and KFD was forcible entry props. 80.00% of sample departments said they have access and use forcible entry training props compared to 28.57% of KFD respondents.

A final question was asked of all sample groups to determine if their respective organizations effectively incorporated truck company capabilities during normal, training, and emergency operations and what, if any, factors contributed to the ineffective use of truck

companies. This question focused on the overall objective of this research project and provided some insightful responses. 85.72% of the sample departments stated they felt truck operations were effective utilized by their organization. The interviewed departments said they fully utilized their truck companies but stated increased staffing or more fire responses would greatly improve effectiveness. In comparison, 54.29% of KFD personnel indicated the department does not effectively incorporate truck company capabilities, and they pointed to lack of personnel (94.20%) and lack of sufficient training programs (55.07%) as the top two reasons. It is interesting to note that based on national averages and standards most of the organizations in the sample departments (80.00%) indicated they had adequately staffed truck companies and 85.72% felt their organization effectively utilized truck company capabilities. These organizations also ranked the different aspects of specific truck company training high with only 12.50% stating lack of sufficient training program as a contributing factor to ineffective use. The interviewed departments did not share the same confidence in their truck company capabilities. One department stated that truck company capabilities are fully utilized when needed but emphasized an increase in truck company staffing would improve truck operations. The other department did not feel truck company capabilities are incorporated, but correlated the ineffectiveness with the lack of experience due to low fire incidents. 54.29% of KFD personnel felt the department does not effectively integrate truck company capabilities, and indicated that lack of personnel and training as the primary contributors. The data seems to suggest there is a strong correlation between adequate truck company staffing and training, and the effective use of truck company capabilities.

Recommendations

The Kingsport Fire Department has shown a commitment to the truck company concept with the purchase of its first aerial device in 1941. Despite the introduction of the quint concept, KFD has stayed steady on course committed to purchase and support a designated truck apparatus even expanding the front line fleet to two ladder trucks in 2016. However, KFD has not fallen in line with the national standards in relation to truck company staffing, training, and effective integration of truck company capabilities into its operations. The impeded progression has been heavily influenced by a culture that assumes the truck serves the singular purpose of providing elevated master streams. Even during times of adequate staffing levels, KFD truck company staffing remained at one person assignment. This research project set out explore KFD's culture hypothesis and to identify the factors that influence KFD's ineffective use of its truck capabilities resulting in the following recommendations.

First, the research has shown that KFD's understanding does not coincide with nationally accepted standards in relations to primary and secondary functions of a truck company. To address this issue, KFD should develop a comprehensive training program focused on specific truck company operations emphasizing the identified primary and secondary functions, development of truck company skills proficiency, and integration of truck company operations during emergency incidents. Given the current personnel resources, the training should be provided to all operations personnel. The training program should be based, at a minimum, on the functions represented by the acronym LOVERS_U. Further evaluation of truck company secondary functions should include consideration for responses to hazardous material incidents, technical rescue situations, motor vehicle accidents, emergency medical responses, and serving

in a rapid intervention crew capacity. Additionally, KFD should add to their training library books and materials related to truck company specific operations.

KFD recently built a commercial multi-story training facility that has more than sufficient training props to perform truck company operations and improve skill proficiency. However, as one member stated, "they are all available for use, but are never used or trained on as they should be" (Appendix B). While this may be an over-generalization of the facts, KFD does not fully utilize the available training facilities for truck company operations. The only shortfall identified was forcible entry training simulators. KFD should consider the purchase of additional training props that would facilitate improvement in forcible entry/egress skill proficiency. KFD should aggressively pursue future opportunities to use properties made available through Kingsport's Downtown revitalization and projected demolition efforts.

Currently, KFD's operations do not effectively and efficiently assign personnel to perform truck company functions during fire incidents. It is recommended that KFD fully evaluate the best way to provide these essential functions. Given the current staffing levels, KFD should assess the effectiveness of assigning engine companies to the truck companies once they arrive on scene in a cross staffed compacity. KFD should further evaluate the effectiveness of cross staffing truck companies with engine company personnel versus a dedicated truck company staffed with minimum personnel that meets national and NFPA standards. Since the addition of the second truck company in 2016, KFD must consider addressing both truck companies simultaneously. The evaluation should include consideration for call volume, anticipated growth, and population density under normal and special event activities. The research has shown that a lack of personnel resources does hamper the effectiveness of truck company operations. KFD needs to

address this issue by developing a compressive and logical strategic plan that should be presented to city administrators and elected officials that outlines steps to correct this deficiency.

Lastly, the research identified the lack of sufficient guidelines addressing truck company operations. Standardized procedures and guidelines should be developed not only to include truck company training, skill proficiency improvement, and operational integration but should also address cross staffing procedures, deployment, response, and truck company movements. KFD's procedures concerning backing, placement, positioning, extending stabilizers, and aerial operations do not conform to the recommended and normal practices provided in the research. It is recommended, KFD re-evaluate their current procedures with consideration for the safety and risk associated with current methods. KFD should revise and develop procedures to ensure the department is not exposed to avoidable risk and improve the safety of their truck operations.

The research strongly indicated the need for effective and efficient use of truck company capabilities during fire-ground operations and other emergency incidents included in typical fire department responses. Truck company operations are strongly rooted in nationally accepted standards and practices implemented by the majority of today’s fire service organizations. Despite these facts, KFD has struggled with a culture that contributes to the ineffective use of truck companies that is exacerbated by the lack of monetary support from city leaders when attempts have been made to address the shortfalls. However, KFD leaders must recognize and facilitate the changes needed to positively influence the department’s culture and develop a strategy to implement the needed changes while gaining the support of department members, community leaders, and city officials. The information provided in this research project should provide a solid foundation to build upon in making our community safer by incorporating the

effective and efficient truck company capabilities into normal, training, and emergency operations.

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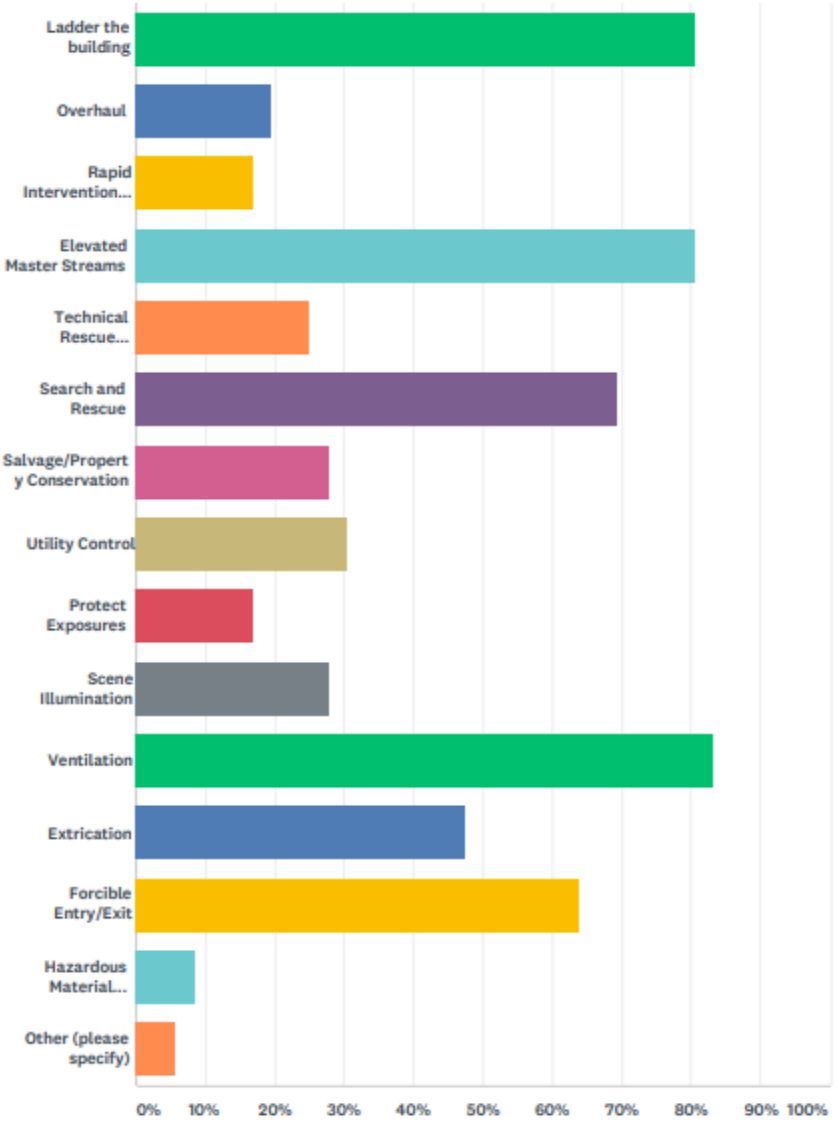
Appendix A

Q1 Please select the primary functions your department has identified as truck/ladder company responsibilities (Check all that apply).

Answered: 36 Skipped: 0



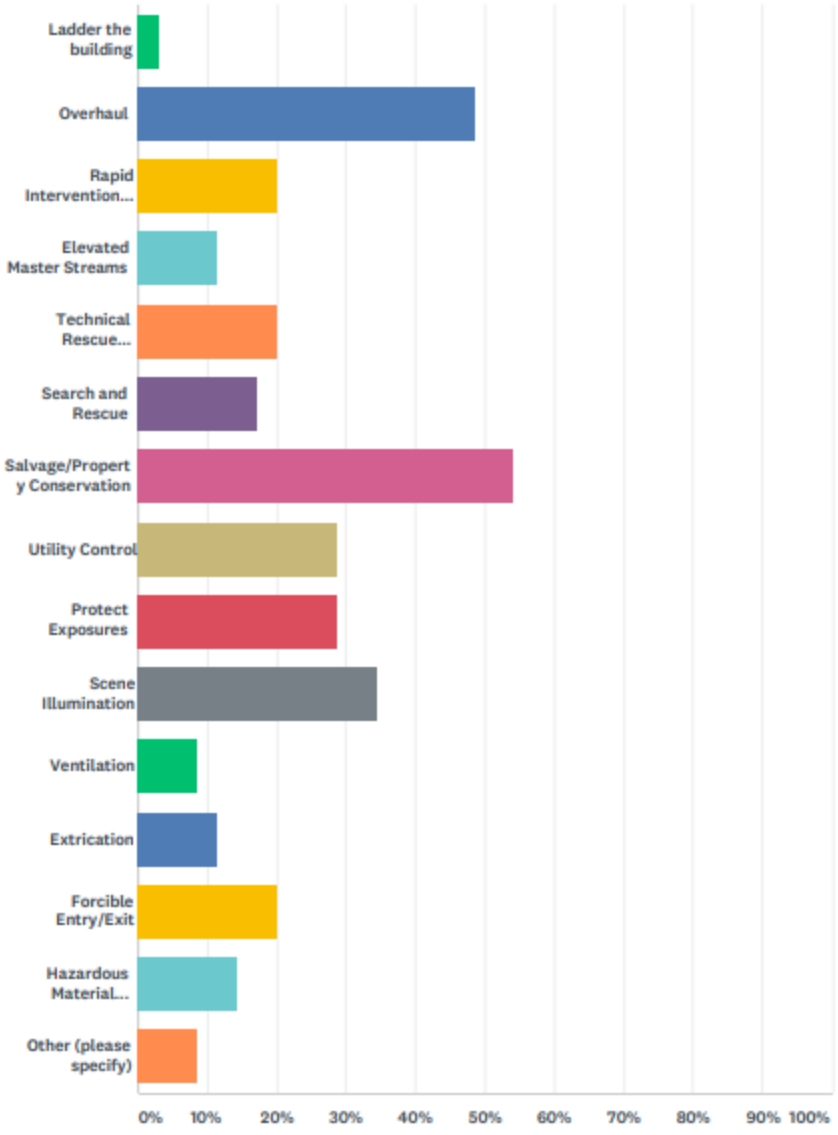
ANSWER CHOICES	RESPONSES	
Ladder the building	80.56%	29
Overhaul	19.44%	7

Truck Company Operations Questionnare		SurveyMonkey
Rapid Intervention Crew	16.67%	6
Elevated Master Streams	80.56%	29
Technical Rescue Incidents	25.00%	9
Search and Rescue	69.44%	25
Salvage/Property Conservation	27.78%	10
Utility Control	30.56%	11
Protect Exposures	16.67%	6
Scene Illumination	27.78%	10
Ventilation	83.33%	30
Extrication	47.22%	17
Forcible Entry/Exit	63.89%	23
Hazardous Material Incidents	8.33%	3
Other (please specify)	5.56%	2
Total Respondents: 36		

#	OTHER (PLEASE SPECIFY)	DATE
1	We run our ladder truck interchangeably as an engine. It does have extra extrication tools and obviously an aerial ladder, however our staff cycles through that vehicle without regard to it being a ladder truck.	NaN/NaN/0NaN NaN:NaN PM
2	Quints function as engine companies, other than providing defensive master streams and laddering 3+ story buildings.	NaN/NaN/0NaN NaN:NaN PM

Q2 Please select the secondary functions your department has identified as truck/ladder company responsibilities (Check all that apply).

Answered: 35 Skipped: 1



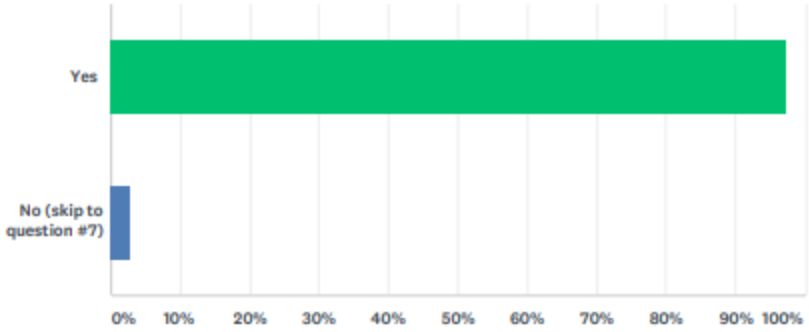
ANSWER CHOICES	RESPONSES	
Ladder the building	2.86%	1
Overhaul	48.57%	17

Truck Company Operations Questionnare		SurveyMonkey
Rapid Intervention Crew	20.00%	7
Elevated Master Streams	11.43%	4
Technical Rescue Incidents	20.00%	7
Search and Rescue	17.14%	6
Salvage/Property Conservation	54.29%	19
Utility Control	28.57%	10
Protect Exposures	28.57%	10
Scene Illumination	34.29%	12
Ventilation	8.57%	3
Extrication	11.43%	4
Forcible Entry/Exit	20.00%	7
Hazardous Material Incidents	14.29%	5
Other (please specify)	8.57%	3
Total Respondents: 35		

#	OTHER (PLEASE SPECIFY)	DATE
1	see above	NaN/NaN/0NaN NaN:NaN PM
2	this is secondary but supports the mission ---Assist getting the first line on the fire if they are struggling	NaN/NaN/0NaN NaN:NaN PM
3	Extinguishment	NaN/NaN/0NaN NaN:NaN PM

Q3 Does your department have aerial apparatus?

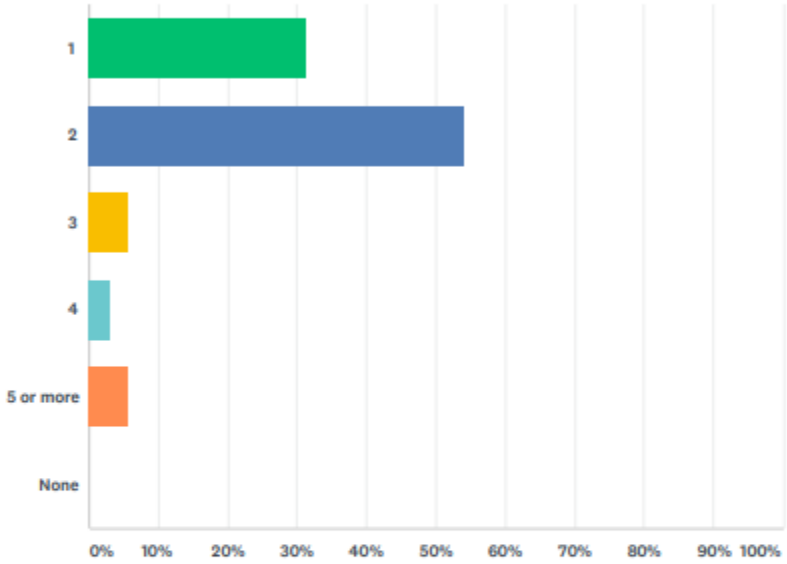
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	97.22%	35
No (skip to question #7)	2.78%	1
TOTAL		36

Q4 How many aerial apparatus are assigned to front line service?

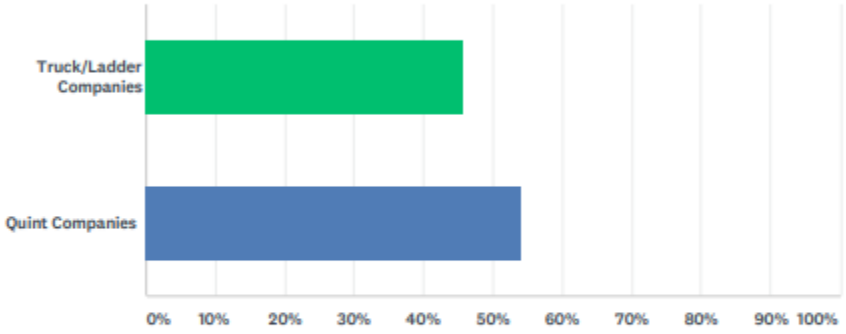
Answered: 35 Skipped: 1



ANSWER CHOICES	RESPONSES	
1	31.43%	11
2	54.29%	19
3	5.71%	2
4	2.86%	1
5 or more	5.71%	2
None	0.00%	0
TOTAL		35

Q5 Are aerial apparatus dedicated truck/ladder or quint companies?

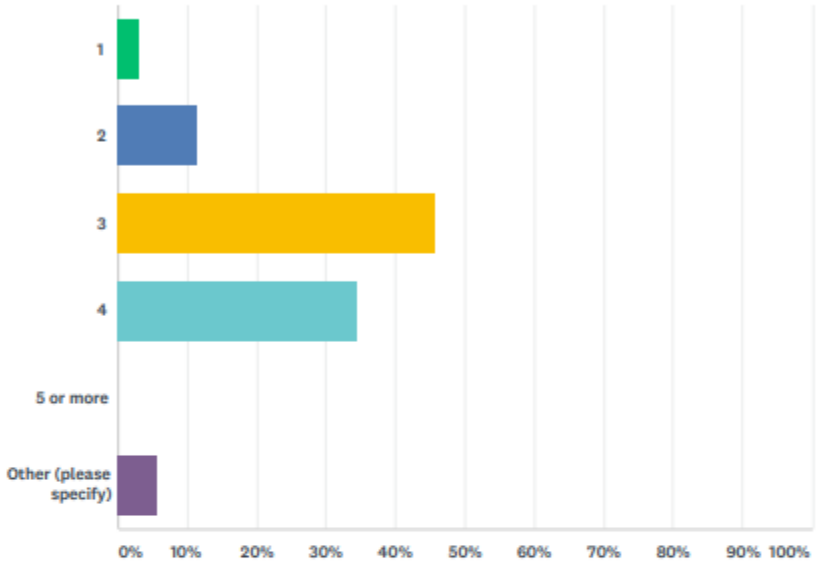
Answered: 35 Skipped: 1



ANSWER CHOICES	RESPONSES	
Truck/Ladder Companies	45.71%	16
Quint Companies	54.29%	19
TOTAL		35

Q6 What are the minimum on duty personnel assigned to your aerial apparatus?

Answered: 35 Skipped: 1

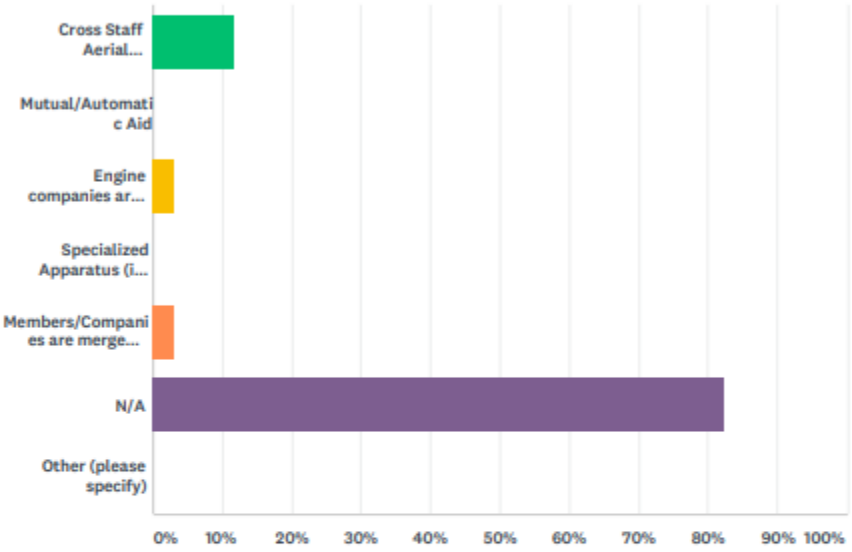


ANSWER CHOICES	RESPONSES	
1	2.86%	1
2	11.43%	4
3	45.71%	16
4	34.29%	12
5 or more	0.00%	0
Other (please specify)	5.71%	2
TOTAL		35

#	OTHER (PLEASE SPECIFY)	DATE
1	Aerial is housed in a station where personnel are assigned to multiple apparatus every shift. Staff choose the appropriate apparatus based on the call type or building type.	NaN/NaN/0NaN NaN:NaN PM
2	Single company station has min. of 4, double company has min. of 3	NaN/NaN/0NaN NaN:NaN PM

Q7 If your department does not have designated truck companies with assigned on duty personnel, how does you department provide truck company operations?

Answered: 34 Skipped: 2

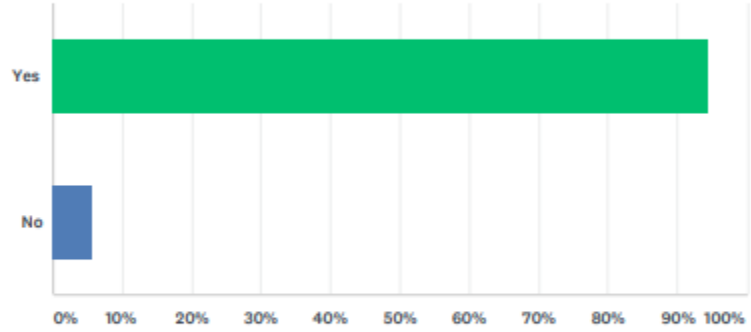


ANSWER CHOICES	RESPONSES	
Cross Staff Aerial Apparatus (Use personnel assigned to other apparatus)	11.76%	4
Mutual/Automatic Aid	0.00%	0
Engine companies are assigned perform truck company operations	2.94%	1
Specialized Apparatus (ie.; Rescue, Haz Mat, etc.)	0.00%	0
Members/Companies are merged to accomplish truck company task	2.94%	1
N/A	82.35%	28
Other (please specify)	0.00%	0
TOTAL		34

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q8 Does your department utilize "spotters" when backing aerial apparatus?

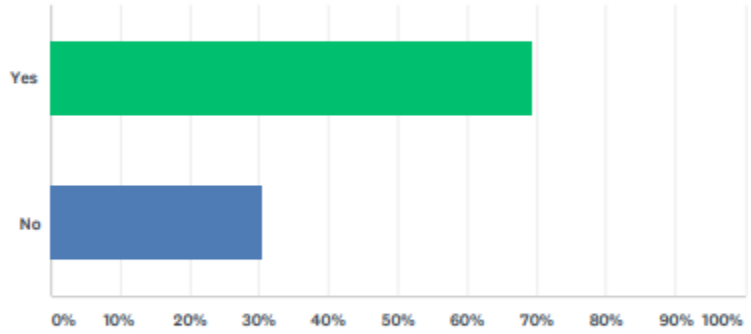
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	94.44%	34
No	5.56%	2
TOTAL		36

Q9 Does your department routinely ladder structures of 2 or more stories to provide for rescue or secondary egress during structure fire operations?

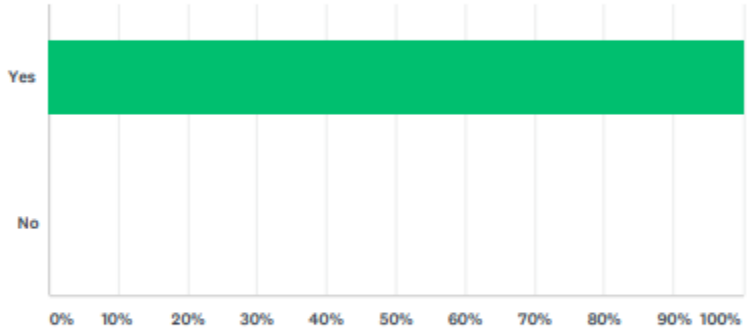
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	69.44%	25
No	30.56%	11
TOTAL		36

Q10 During structure fires, does your department coordinate interior operations with ventilation?

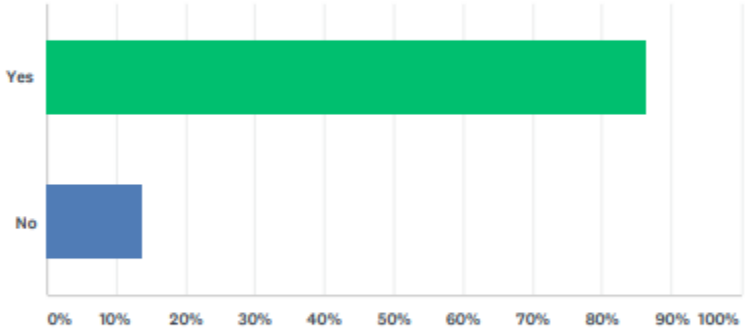
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	100.00%	36
No	0.00%	0
TOTAL		36

Q11 Does your department use "spotters" when aerial apparatus are positioning, re-positioning, extending stabilizers, and/or performing aerial operations?

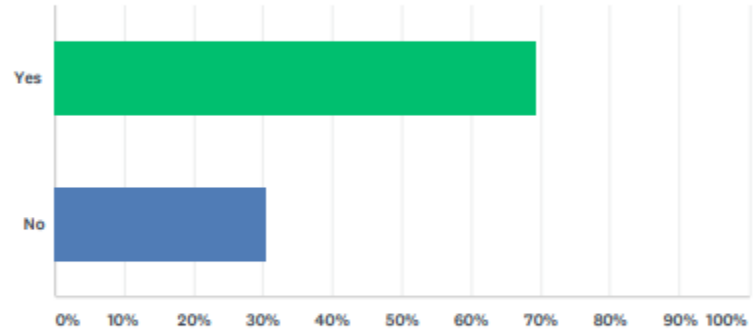
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	86.11%	31
No	13.89%	5
TOTAL		36

Q12 Does your department have Standard Operating Guidelines/Procedures for truck company operations?

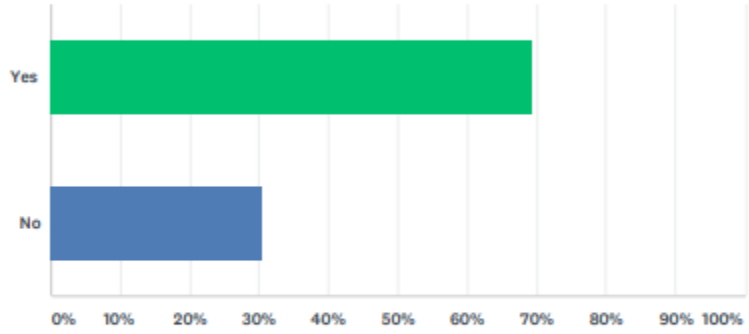
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	69.44%	25
No	30.56%	11
TOTAL		36

Q13 Is truck company specific training performed within your department?

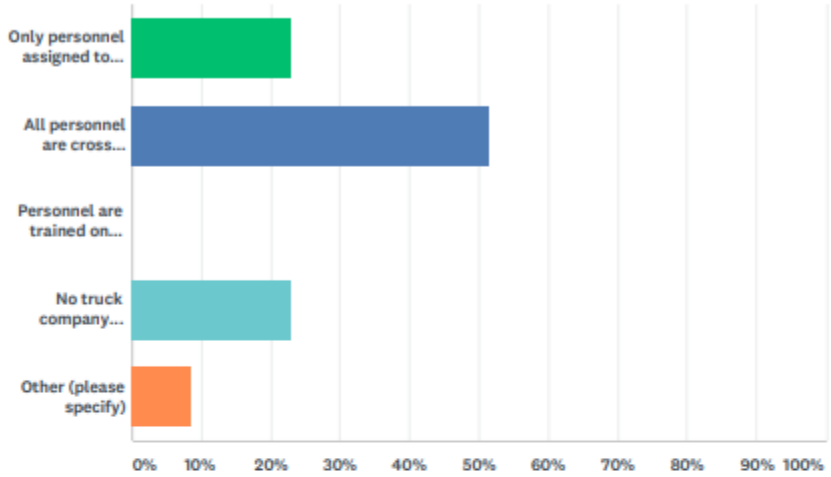
Answered: 36 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	69.44%	25
No	30.56%	11
TOTAL		36

Q14 If yes, who receives this training?

Answered: 35 Skipped: 1

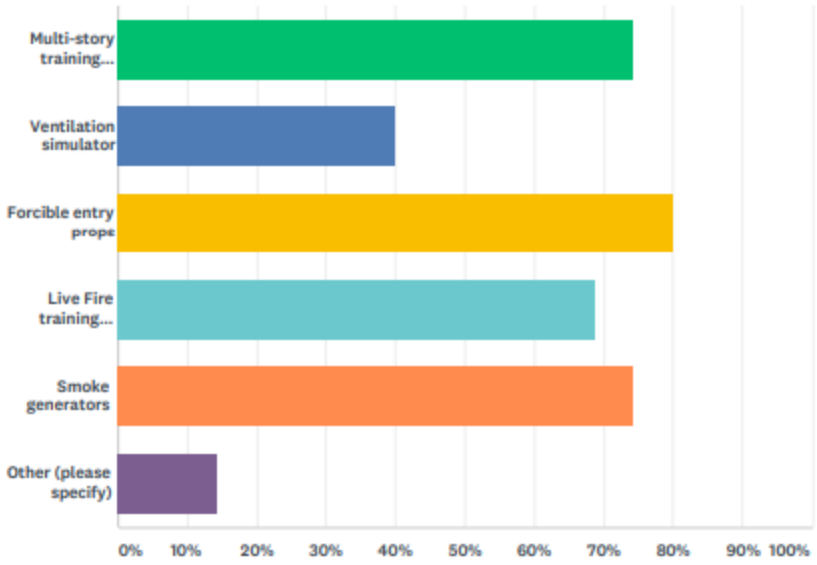


ANSWER CHOICES	RESPONSES	
Only personnel assigned to truck/ladder companies	22.86%	8
All personnel are cross trained to perform truck company operations	51.43%	18
Personnel are trained on truck company skills only, but not on integrating truck company operations on a fire scene	0.00%	0
No truck company specific training program	22.86%	8
Other (please specify)	8.57%	3
Total Respondents: 35		

#	OTHER (PLEASE SPECIFY)	DATE
1	Currently only members assigned to Truck companies are going through truck academies.	NaN/NaN/0NaN NaN:NaN PM
2	Ladder companies train on their functions, some multi-company drills are done to integrate ladder/engine ops	NaN/NaN/0NaN NaN:NaN PM
3	Our truck crews do spend more time developing their skills; but a a basic level all personnel cross staff and are trained	NaN/NaN/0NaN NaN:NaN PM

Q15 What truck company training props are available and/or utilized by your department?

Answered: 35 Skipped: 1

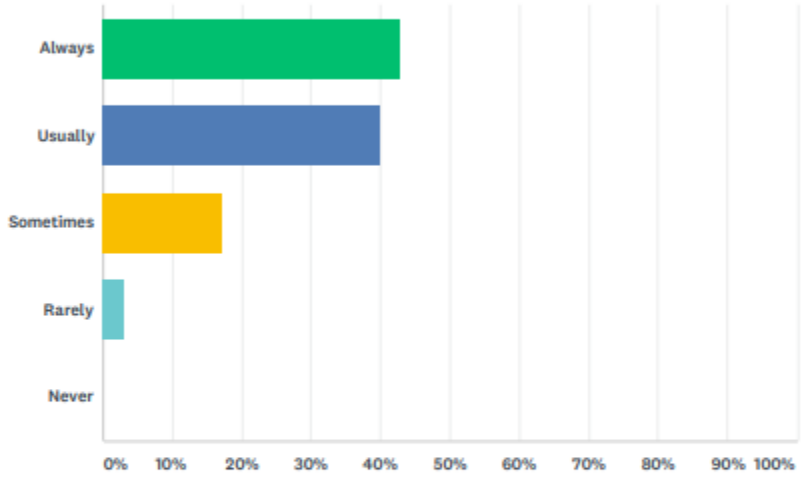


ANSWER CHOICES	RESPONSES	
Multi-story training facility	74.29%	26
Ventilation simulator	40.00%	14
Forcible entry props	80.00%	28
Live Fire training facility	68.57%	24
Smoke generators	74.29%	26
Other (please specify)	14.29%	5
Total Respondents: 35		

#	OTHER (PLEASE SPECIFY)	DATE
1	We use what ever we can to train on, mostly public buildings with high roof lines.	NaN/NaN/0NaN NaN:NaN PM
2	wrecking yards for extrication and other areas for swift water training	NaN/NaN/0NaN NaN:NaN PM
3	Panelized Commercial Prop	NaN/NaN/0NaN NaN:NaN PM
4	n/a	NaN/NaN/0NaN NaN:NaN PM
5	We cut lift and stablilize cars at out local metal recycling facility	NaN/NaN/0NaN NaN:NaN PM

Q16 Is aerial apparatus fire-ground positioning and utilization a priority for your department?

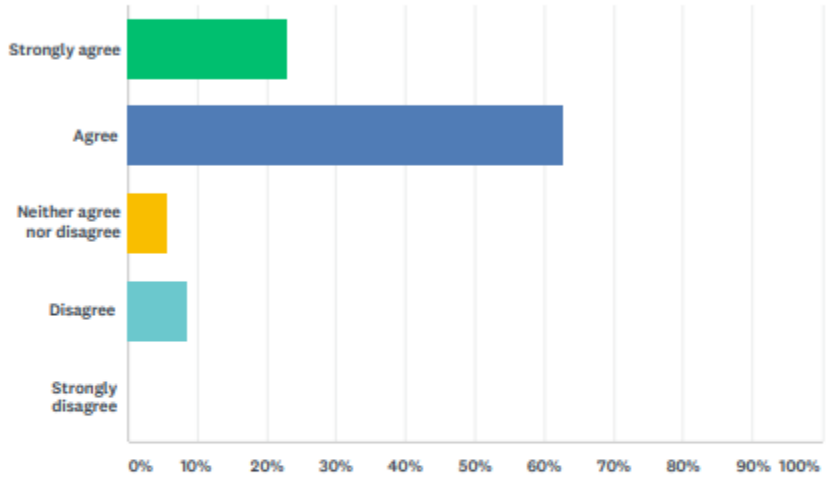
Answered: 35 Skipped: 1



ANSWER CHOICES	RESPONSES	
Always	42.86%	15
Usually	40.00%	14
Sometimes	17.14%	6
Rarely	2.86%	1
Never	0.00%	0
Total Respondents: 35		

Q17 Are truck company capabilities effectively incorporated during normal, training, and emergency operations?

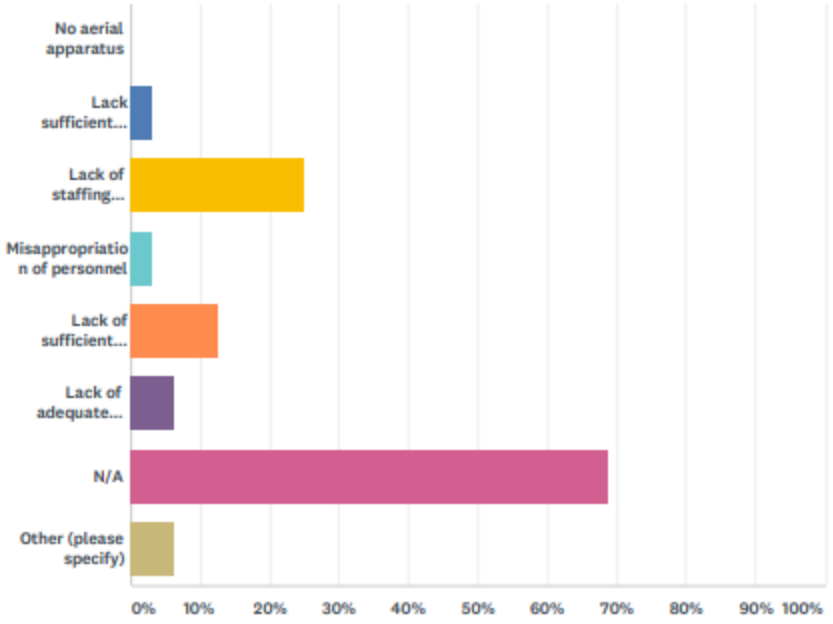
Answered: 35 Skipped: 1



ANSWER CHOICES	RESPONSES	
Strongly agree	22.86%	8
Agree	62.86%	22
Neither agree nor disagree	5.71%	2
Disagree	8.57%	3
Strongly disagree	0.00%	0
Total Respondents: 35		

Q18 If not, what factor(s) contribute to ineffective use of truck company capabilities?

Answered: 32 Skipped: 4



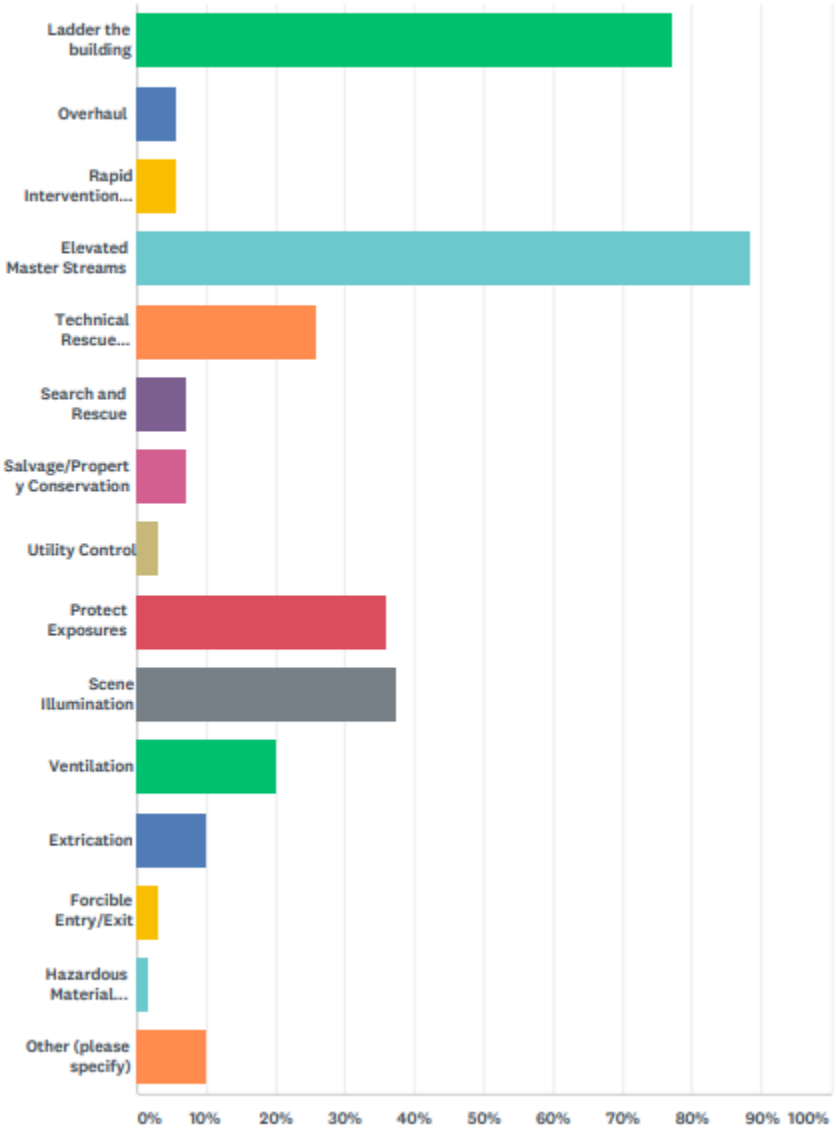
ANSWER CHOICES	RESPONSES	
No aerial apparatus	0.00%	0
Lack sufficient equipment	3.13%	1
Lack of staffing resources	25.00%	8
Misappropriation of personnel	3.13%	1
Lack of sufficient training program	12.50%	4
Lack of adequate training props	6.25%	2
N/A	68.75%	22
Other (please specify)	6.25%	2
Total Respondents: 32		

#	OTHER (PLEASE SPECIFY)	DATE
1	We just don't run enough working fires to be really good at truck work.	NaN/NaN/0NaN NaN:NaN PM
2	Lack of command awareness of the value of dedicated truck companies	NaN/NaN/0NaN NaN:NaN PM

Appendix B

Q1 Please select the primary functions KFD's truck/ladder company currently performs during normal, training, and emergency operations. (Check all that apply).

Answered: 70 Skipped: 0



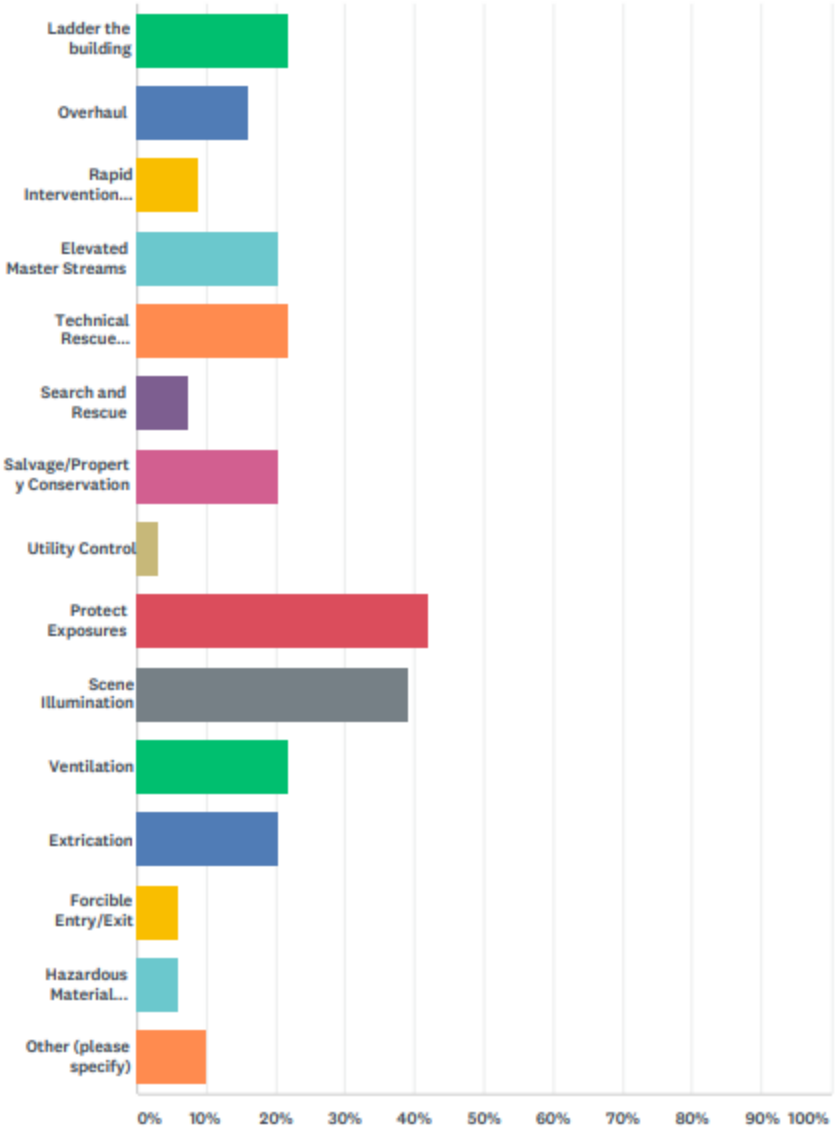
ANSWER CHOICES	RESPONSES	
Ladder the building	77.14%	54

KFD Truck Company Operations Survey		SurveyMonkey
Overhaul	5.71%	4
Rapid Intervention Crew	5.71%	4
Elevated Master Streams	88.57%	62
Technical Rescue Incidents	25.71%	18
Search and Rescue	7.14%	5
Salvage/Property Conservation	7.14%	5
Utility Control	2.86%	2
Protect Exposures	35.71%	25
Scene Illumination	37.14%	26
Ventilation	20.00%	14
Extrication	10.00%	7
Forcible Entry/Exit	2.86%	2
Hazardous Material Incidents	1.43%	1
Other (please specify)	10.00%	7
Total Respondents: 70		

#	OTHER (PLEASE SPECIFY)	DATE
1	ONLY STAFFED WITH ONE PERSONNEL	NaN/NaN/0NaN NaN:NaN PM
2	We do not have a true truck company, so all taks accomplished are accomplished by personnel from other engines!	NaN/NaN/0NaN NaN:NaN PM
3	this is done with help from a engine co.	NaN/NaN/0NaN NaN:NaN PM
4	With the one employee KFD staffs on their ladder I find it very hard for them to perform any of these duties other than the two listed above. WIthout the help of an engine company all other tasks would be unmanageable or would take to much time to complete.	NaN/NaN/0NaN NaN:NaN PM
5	Can't be Used's for other functions due to lack of personal.	NaN/NaN/0NaN NaN:NaN PM
6	KFD ladder company does not and will not function as any of the above because we only utilize a driver. He/she will have to be attached to a engine company to function on fireground.	NaN/NaN/0NaN NaN:NaN PM
7	KPD elevated photography	NaN/NaN/0NaN NaN:NaN PM

Q2 Please select the secondary functions KFD's truck/ladder company currently performs during normal, training, and emergency operations. (Check all that apply).

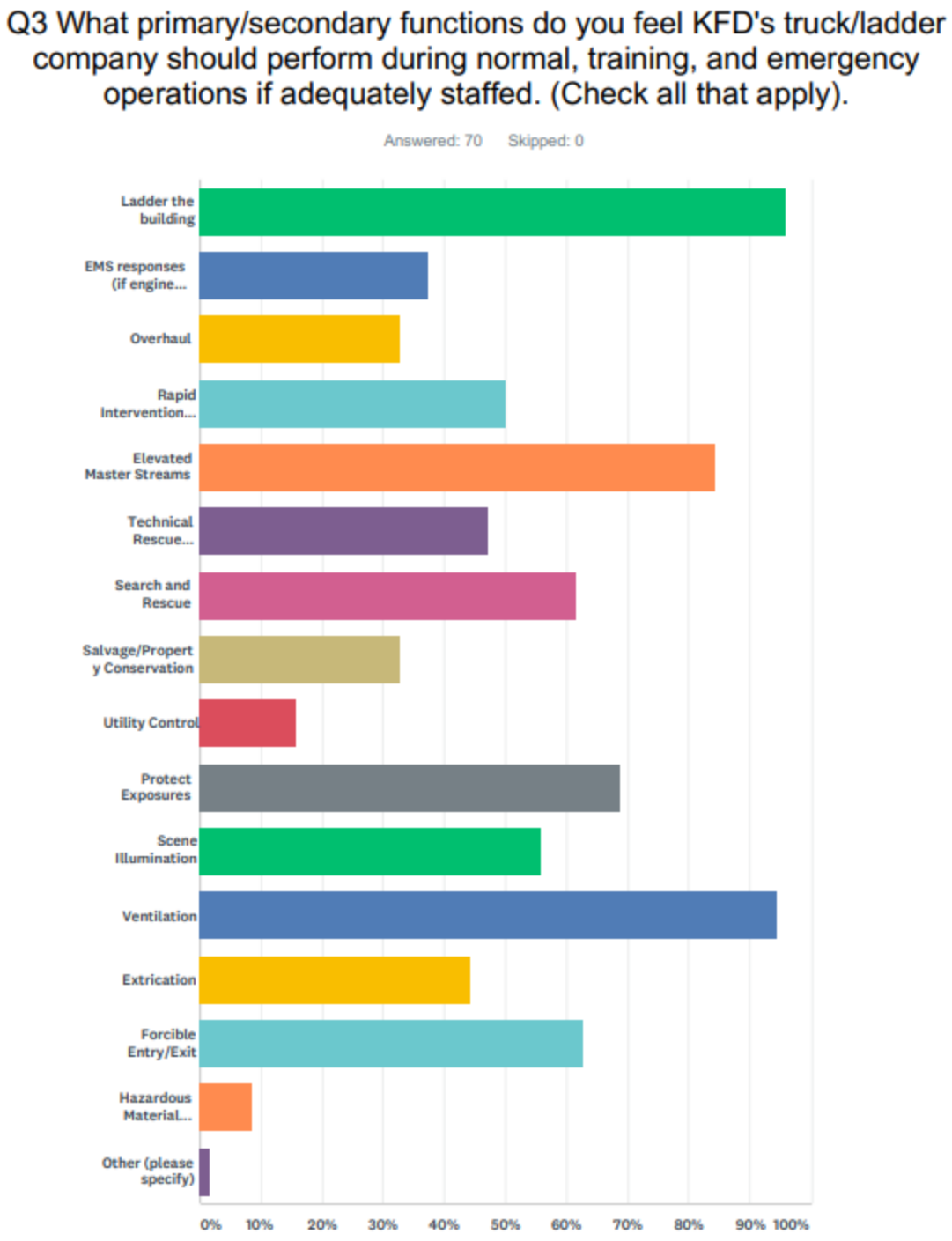
Answered: 69 Skipped: 1



ANSWER CHOICES	RESPONSES	
Ladder the building	21.74%	15

KFD Truck Company Operations Survey		SurveyMonkey
Overhaul	15.94%	11
Rapid Intervention Crew	8.70%	6
Elevated Master Streams	20.29%	14
Technical Rescue Incidents	21.74%	15
Search and Rescue	7.25%	5
Salvage/Property Conservation	20.29%	14
Utility Control	2.90%	2
Protect Exposures	42.03%	29
Scene Illumination	39.13%	27
Ventilation	21.74%	15
Extrication	20.29%	14
Forcible Entry/Exit	5.80%	4
Hazardous Material Incidents	5.80%	4
Other (please specify)	10.14%	7
Total Respondents: 69		

#	OTHER (PLEASE SPECIFY)	DATE
1	We do not have a true ladder company, one driver and maybe one FF!	NaN/NaN/0NaN NaN:NaN PM
2	done with help from an eng co	NaN/NaN/0NaN NaN:NaN PM
3	assisting with water supply	NaN/NaN/0NaN NaN:NaN PM
4	Extra firefighter	NaN/NaN/0NaN NaN:NaN PM
5	Same as above	NaN/NaN/0NaN NaN:NaN PM
6	Ladder driver will usually assist the engine company's driver.	NaN/NaN/0NaN NaN:NaN PM
7	Provide equipment.	NaN/NaN/0NaN NaN:NaN PM


Q3 What primary/secondary functions do you feel KFD's truck/ladder company should perform during normal, training, and emergency operations if adequately staffed. (Check all that apply).
Answered: 70 Skipped: 0
Ladder the building
EMS responses (if engine...
Overhaul
Rapid Intervention...
Elevated Master Streams
Technical Rescue...
Search and Rescue
Salvage/Property Conservation
Utility Control
Protect Exposures
Scene Illumination
Ventilation
Extrication
Forcible Entry/Exit
Hazardous Material...
Other (please specify)
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

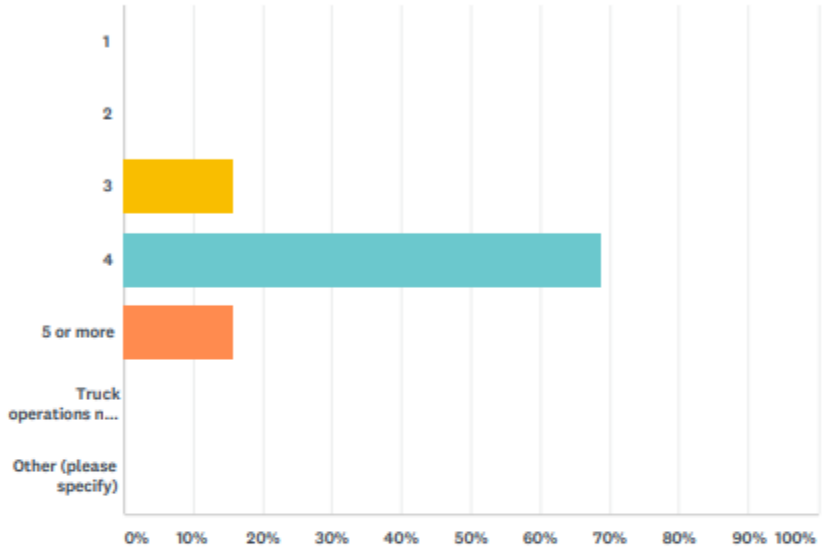
KFD Truck Company Operations Survey SurveyMonkey

ANSWER CHOICES	RESPONSES	
Ladder the building	95.71%	67
EMS responses (if engine company is unavailable)	37.14%	26
Overhaul	32.86%	23
Rapid Intervention Crew	50.00%	35
Elevated Master Streams	84.29%	59
Technical Rescue Incidents	47.14%	33
Search and Rescue	61.43%	43
Salvage/Property Conservation	32.86%	23
Utility Control	15.71%	11
Protect Exposures	68.57%	48
Scene Illumination	55.71%	39
Ventilation	94.29%	66
Extrication	44.29%	31
Forcible Entry/Exit	62.86%	44
Hazardous Material Incidents	8.57%	6
Other (please specify)	1.43%	1
Total Respondents: 70		

#	OTHER (PLEASE SPECIFY)	DATE
1	Secondary egress for residential fire when applicable	NaN/NaN/0NaN NaN:NaN PM

Q4 What is the appropriate minimum staffing levels needed to perform truck company operations in an safe, effective, and efficient manner?

Answered: 70 Skipped: 0

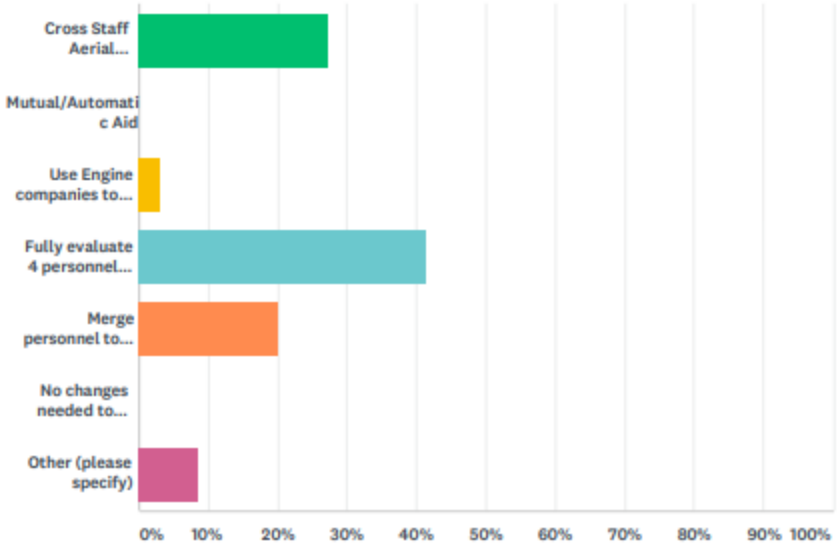


ANSWER CHOICES	RESPONSES	
1	0.00%	0
2	0.00%	0
3	15.71%	11
4	68.57%	48
5 or more	15.71%	11
Truck operations not needed	0.00%	0
Other (please specify)	0.00%	0
TOTAL		70

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q5 What is the best way to utilize truck company capabilities given the current staffing levels?

Answered: 70 Skipped: 0



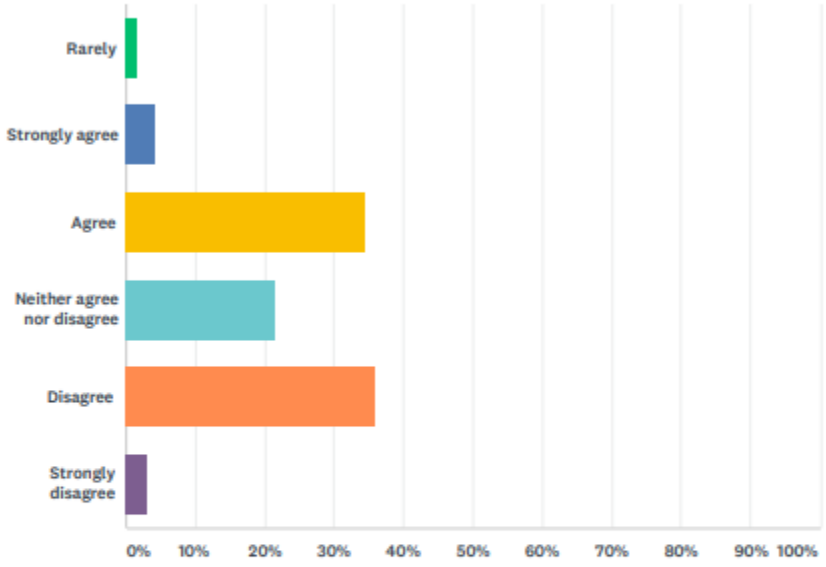
ANSWER CHOICES	RESPONSES	
Cross Staff Aerial Apparatus (assign an engine company to ladder truck upon on scene arrival)	27.14%	19
Mutual/Automatic Aid	0.00%	0
Use Engine companies to perform truck company task without utilizing ladder truck	2.86%	2
Fully evaluate 4 personnel truck company versus 3 person engine company/1 person truck company arrangement	41.43%	29
Merge personnel to accomplish truck company task as they arrive on scene	20.00%	14
No changes needed to current operations	0.00%	0
Other (please specify)	8.57%	6
TOTAL		70

#	OTHER (PLEASE SPECIFY)	DATE
1	In order to utilize truck company capabilities and provide citizens of Kingsport with greatest service possible, a full and complete evaluation and overhall of current truck company procedures needs to be done. Truck company is absolutely not utilized to greatest potential or even close, without a minimum of 4 personnel.	NaN/NaN/0NaN NaN:NaN PM
2	Current operations leave us without a truck company. The truck shows up as nothing more than an elevated master stream with the driver forming into engine company duties while engine company duties perform the work of the truck. The apparatus just sits there.	NaN/NaN/0NaN NaN:NaN PM
3	Put the inspectors on the truck. Boom...truck company. Not much, but that's all ya got. Ha	NaN/NaN/0NaN NaN:NaN PM

KFD Truck Company Operations Survey		SurveyMonkey
4	On scene staff help assist in truck ladder capabilities and tasks. They will help deploy the aerial, fans, and tools off of the ladder. If more responsibilities (ex. RIT) were delegated to the ladder truck more staffing would be required.	NaN/NaN/0NaN NaN:NaN PM
5	i dont think there is a good response using what we have. We just have minimum manning to handle structure fires, so taking personal from the engine jeapordizes engine priorities. So I feel that would put interior personal at a greater risk.	NaN/NaN/0NaN NaN:NaN PM
6	Staff the trucks with proper personnel without having to reassign arriving engines to truck company jobs	NaN/NaN/0NaN NaN:NaN PM

Q6 Does KFD routinely ladder structures of 2 or more stories to provide for rescue or secondary egress during structure fire operations?

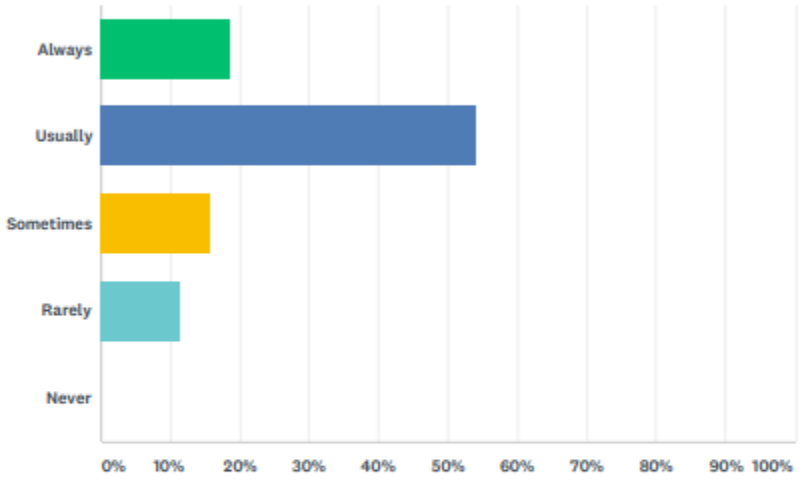
Answered: 70 Skipped: 0



ANSWER CHOICES	RESPONSES	
Rarely	1.43%	1
Strongly agree	4.29%	3
Agree	34.29%	24
Neither agree nor disagree	21.43%	15
Disagree	35.71%	25
Strongly disagree	2.86%	2
Total Respondents: 70		

Q7 During structure fires, does KFD routinely coordinate interior operations with ventilation efforts?

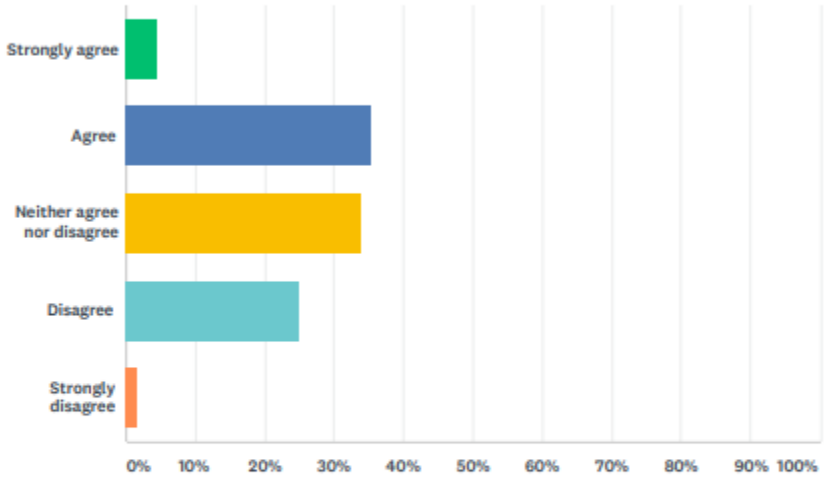
Answered: 70 Skipped: 0



ANSWER CHOICES	RESPONSES	
Always	18.57%	13
Usually	54.29%	38
Sometimes	15.71%	11
Rarely	11.43%	8
Never	0.00%	0
Total Respondents: 70		

Q8 Does KFD adequately utilize vertical ventilation tactics when appropriate?

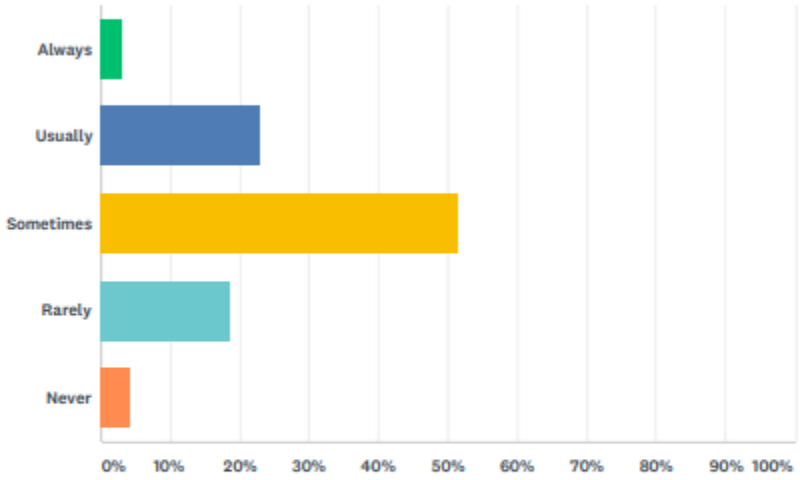
Answered: 68 Skipped: 2



ANSWER CHOICES	RESPONSES	
Strongly agree	4.41%	3
Agree	35.29%	24
Neither agree nor disagree	33.82%	23
Disagree	25.00%	17
Strongly disagree	1.47%	1
Total Respondents: 68		

Q9 Is aerial apparatus fire-ground positioning and utilization a priority during fire-ground operations?

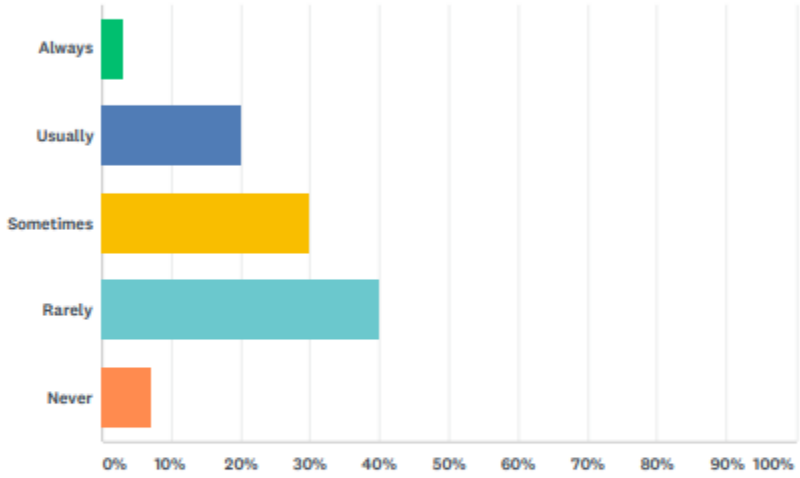
Answered: 70 Skipped: 0



ANSWER CHOICES	RESPONSES	
Always	2.86%	2
Usually	22.86%	16
Sometimes	51.43%	36
Rarely	18.57%	13
Never	4.29%	3
Total Respondents: 70		

Q10 Does KFD assign "spotters" when aerial apparatus are backing, positioning, re-positioning, extending stabilizers, and/or performing aerial operations?

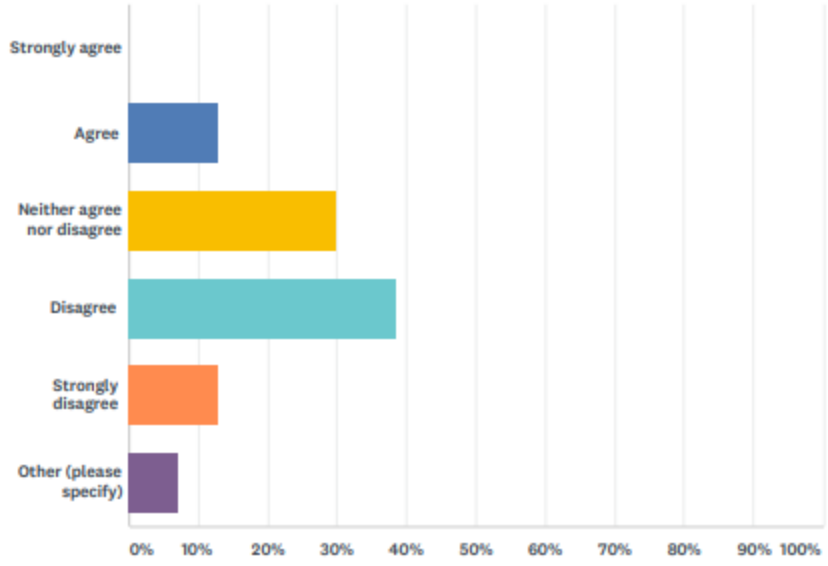
Answered: 70 Skipped: 0



ANSWER CHOICES	RESPONSES	
Always	2.86%	2
Usually	20.00%	14
Sometimes	30.00%	21
Rarely	40.00%	28
Never	7.14%	5
Total Respondents: 70		

Q11 Does KFD have sufficient Standard Operating Guidelines/Procedures for truck company operations?

Answered: 70 Skipped: 0

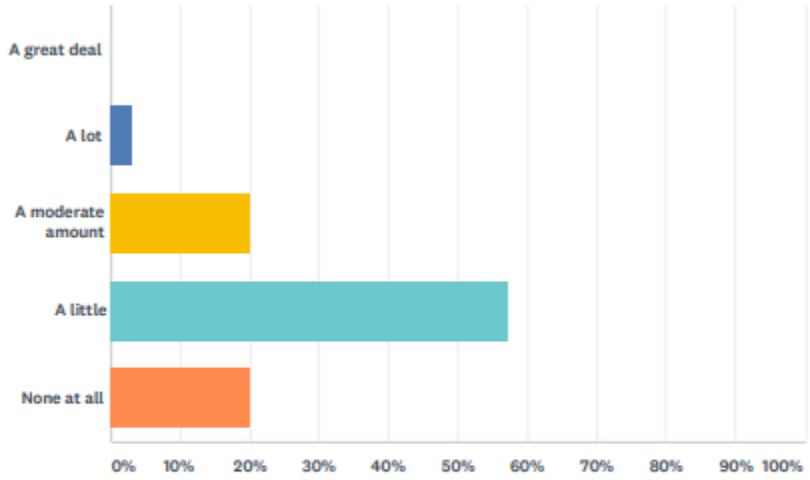


ANSWER CHOICES	RESPONSES	
Strongly agree	0.00%	0
Agree	12.86%	9
Neither agree nor disagree	30.00%	21
Disagree	38.57%	27
Strongly disagree	12.86%	9
Other (please specify)	7.14%	5
Total Respondents: 70		

#	OTHER (PLEASE SPECIFY)	DATE
1	For a single person truck yes.	NaN/NaN/0NaN NaN:NaN PM
2	Sufficient for current operations and staffing	NaN/NaN/0NaN NaN:NaN PM
3	Various SOPs are in place without the manpower requirements	NaN/NaN/0NaN NaN:NaN PM
4	Even with sufficient SOP manpower is the issue	NaN/NaN/0NaN NaN:NaN PM
5	unsure of the sog's for truck ops	NaN/NaN/0NaN NaN:NaN PM

Q12 What level of specific truck company function/task training does KFD provide?

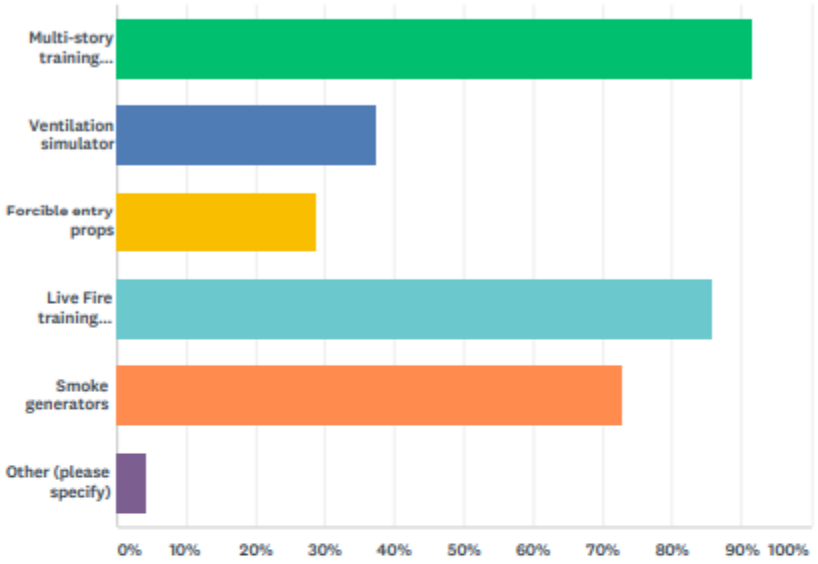
Answered: 70 Skipped: 0



ANSWER CHOICES	RESPONSES	
A great deal	0.00%	0
A lot	2.86%	2
A moderate amount	20.00%	14
A little	57.14%	40
None at all	20.00%	14
Total Respondents: 70		

Q13 What truck company training props are available and/or utilized by KFD?

Answered: 70 Skipped: 0

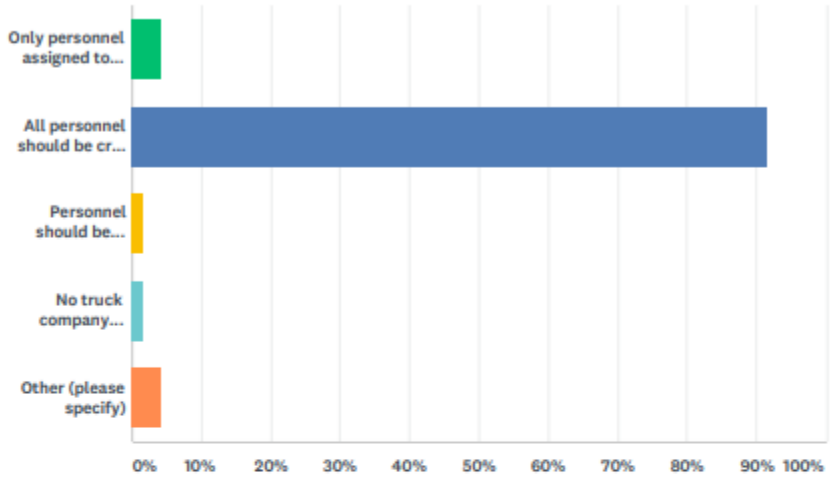


ANSWER CHOICES	RESPONSES	
Multi-story training facility	91.43%	64
Ventilation simulator	37.14%	26
Forcible entry props	28.57%	20
Live Fire training facility	85.71%	60
Smoke generators	72.86%	51
Other (please specify)	4.29%	3
Total Respondents: 70		

#	OTHER (PLEASE SPECIFY)	DATE
1	These are all available for our use, but are never used or trained on as they should be.	NaN/NaN/0NaN NaN:NaN PM
2	Pre plan of area and buildings	NaN/NaN/0NaN NaN:NaN PM
3	No specific Truck company training.	NaN/NaN/0NaN NaN:NaN PM

Q14 Who should receive specific truck company operations training?

Answered: 70 Skipped: 0

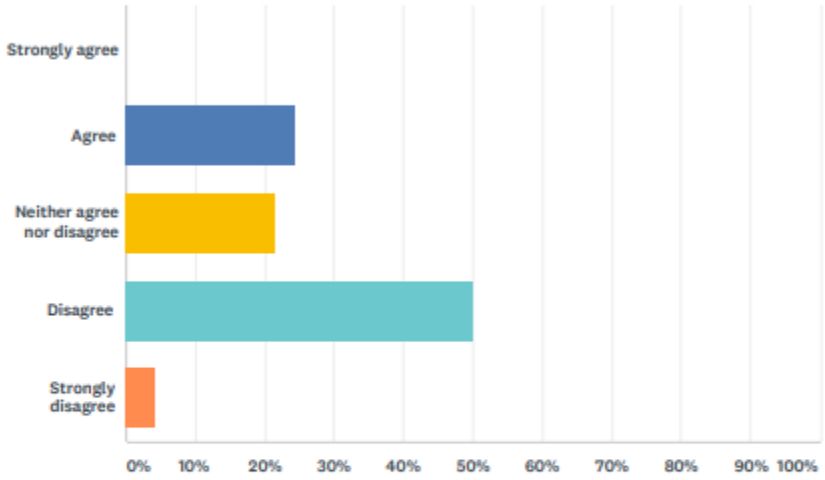


ANSWER CHOICES	RESPONSES	
Only personnel assigned to truck/ladder companies	4.29%	3
All personnel should be cross trained to perform truck company operations	91.43%	64
Personnel should be trained on truck company skills only, but not on integration of truck company operations at the fire scene	1.43%	1
No truck company specific training program is needed	1.43%	1
Other (please specify)	4.29%	3
Total Respondents: 70		

#	OTHER (PLEASE SPECIFY)	DATE
1	If we had proper staffing levels on truck comapines then specfic truck comapny tatics should be inculded for those on the truck. Cross training for everyone else of basic truck opertaions.	NaN/NaN/0NaN NaN:NaN PM
2	truck company should be specialist in ric and rescue	NaN/NaN/0NaN NaN:NaN PM
3	Especially operators of aerial apparatus	NaN/NaN/0NaN NaN:NaN PM

Q15 Are truck company capabilities effectively incorporated during normal, training, and emergency operations?

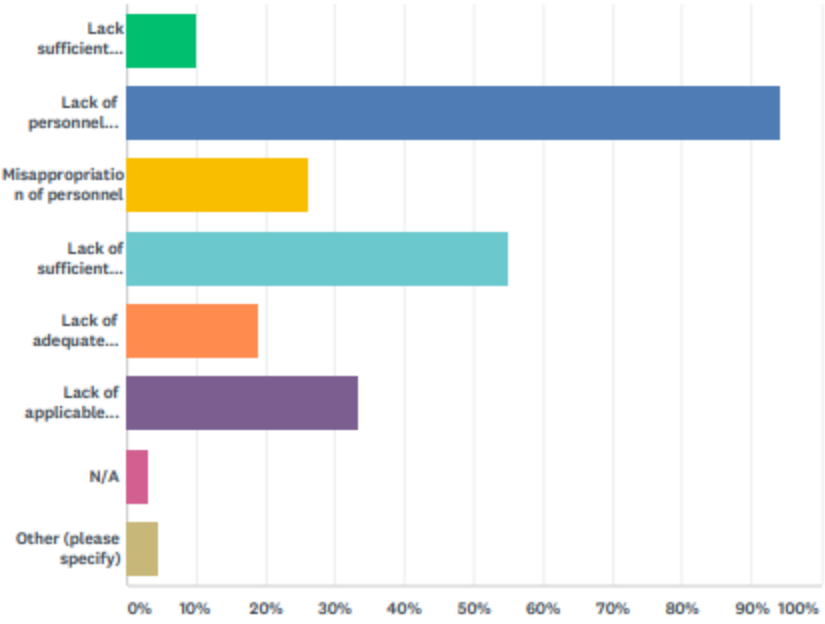
Answered: 70 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	0.00%	0
Agree	24.29%	17
Neither agree nor disagree	21.43%	15
Disagree	50.00%	35
Strongly disagree	4.29%	3
Total Respondents: 70		

Q16 If applicable, what factor(s) contribute to ineffective use of truck company capabilities?

Answered: 69 Skipped: 1



ANSWER CHOICES	RESPONSES	
Lack sufficient equipment	10.14%	7
Lack of personnel resources	94.20%	65
Misappropriation of personnel	26.09%	18
Lack of sufficient training program	55.07%	38
Lack of adequate training props	18.84%	13
Lack of applicable SOP/SOG's	33.33%	23
N/A	2.90%	2
Other (please specify)	4.35%	3
Total Respondents: 69		

#	OTHER (PLEASE SPECIFY)	DATE
1	The lack of manpower. We have the equipment.	NaN/NaN/0NaN NaN:NaN PM
2	One person truck company	NaN/NaN/0NaN NaN:NaN PM
3	Lack of staffing the apparatus.	NaN/NaN/0NaN NaN:NaN PM

Appendix C

Truck Company Operations Interview

Date: **4/2/18**

Sample Department: **Alpha**

Department is: **Career**

Population served: **14,000**

Square Miles served: **6**

Annual number of responses: **2,300**

Number of stations: **1**

Number of department personnel: **16**

Minimum staffing? **Yes**

What are the minimum staffing requirements? **4**

How many aerial apparatus does your department have in front line service? **1**

What type of aerial apparatus do you have? **100 ft Aerial Platform**

In a recent FireHouse run survey your department was listed as assigning your ladder crew with one person, is this correct? **Yes**

Is there a strategic plan in place to increase staffing on your aerial apparatus? If so, what is the plan?

Not at this time.

What are the primary functions performed by your truck company(ies)?

Ventilation

What are the secondary functions performed by your truck company(ies)?

Secondary Search

How are truck company task completed on the fire-ground?

Under normal operations, 1 apparatus operator drives aerial to the scene. All off duty personnel are called back on confirmed working structure fires and mutual aid is available. Personnel are assigned to truck company task as needed using the callback personnel and /or mutual aid if utilized

Does your department typically ladder buildings of 2 or more stories? **Yes**

What type of ventilation is normally used by your department and is it coordinated with suppression efforts? **Horizontal**

Does your department use "spotters when aerial apparatus are backing, positioning, extending stabilizers and/or performing aerial operations?

On duty/scene personnel assist as needed and per SOG's, first due engines leave space for aerial placement/positioning.

Does your department have Standard Operating Guidelines/Procedure for truck company operations? **Yes**

Does your department perform specific truck company skills and operations training?

Yes

Who receives this training? **All personnel are cross-trained to perform truck company task.**

What type of training props does your department have access to and/or utilize to teach and practice truck company skills?

Ventilation and forcible entry props

Is your truck company capabilities fully utilized by your department?

Truck Company capabilities are fully utilized when it is needed by assigning personnel as needed.

If not, what factors contribute to the ineffective use of truck company capabilities?

Increased staffing would benefit improving truck company operations but the small community does not have the resources to fund the additional staffing needs

Truck Company Operations Interview

Date: **4/2/18**

Sample Department: **Bravo**

Department is: **Career**

Population served: **25,000**

Square Miles served: 1**6**

Annual number of responses: **7,000**

Number of stations: **3**

Number of department personnel: **65**

Minimum staffing? **Yes**

What are the minimum staffing requirements? **12 per shift/ 4 shifts**

How many aerial apparatus does your department have in front line service? **1**

What type of aerial apparatus do you have? **A Quint designated as a Tower**

In a recent FireHouse run survey your department was listed as assigning your ladder crew with one person, is this correct?

Yes, but assigned additional personnel when on duty staffing levels exceeds minimum

Is there a strategic plan in place to increase staffing on your aerial apparatus? If so, what is the plan?

No, not currently

What are the primary functions performed by your truck company(ies)?

Not designated but assigned as needed

What are the secondary functions performed by your truck company(ies)?

Not designated but assigned as needed

How are truck company task completed on the fire-ground?

Tower responds with a squad or engine and personnel cross-man the aerial. Tower never responds alone. Additionally, city is divided into 4 districts with mutual aid response agreements.

Does your department typically ladder buildings of 2 or more stories? **Yes**

What type of ventilation is normally used by your department and is it coordinated with suppression efforts?

Vertical ventilation coordinated with suppression operations to isolate and control flow paths.

Does your department use "spotters when aerial apparatus are backing, positioning, extending stabilizers and/or performing aerial operations?

Yes with cross-staffed personnel

Does your department have Standard Operating Guidelines/Procedure for truck company operations? **Yes**

Does your department perform specific truck company skills and operations training?

Yes

Who receives this training?

All personnel are cross-trained to perform truck company task. However, only experience and senior personnel are assigned to operate or drive the aerial. Members who have not been trained are not allowed to drive the Tower.

What type of training props does your department have access to and/or utilize to teach and practice truck company skills?

Ventilation, Multi-story, and forcible entry props

Is your truck company capabilities fully utilized by your department?

Not really due to low fire call volume the Tower is rarely needed. Had one fire in the district last year

If not, what factors contribute to the ineffective use of truck company capabilities?

Lack of use due to low fire related incidents