

Evaluating the Efficacy of a Four-Person Staffed Quint

Running Head: EVALUATING THE EFFICACY OF A FOUR-PERSON STAFFED QUINT

Evaluating the Efficacy of a Four-Person Staffed Quint Versus a Three-Person Staffed
Engine Plus One-Person Staffed Ladder Truck

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Evaluating the Efficacy of a Four-Person Staffed Quint

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, expressions, or writings of another.

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ABSTRACT

In today's economic climate, departments are struggling to find ways to provide efficient and effective service with existing or diminishing resources. The problem was Humboldt Bay Fire (HBF) did not know which staffing model was more effective, a one-person staffed truck plus a three-person staffed engine or a four-person staffed quint, which resulted in an inefficient apparatus staffing configuration at the headquarters station. The purpose was to identify which of these staffing models provided the most effective and efficient service delivery. Using evaluative research the author answered the following questions: (a) What are the advantages of staffed quints when compared to separate engine and truck companies? (b) What are the disadvantages of staffed quints when compared to separate engine and truck companies? (c) Does a four-person staffed quint provide more efficient service delivery as compared to a three-person staffed engine and one-person staffed truck? (d) How does the quint staffing model affect fireground operations? (e) What is the effect of quint staffing on emergency response times? In addition to personal observations the author utilized both external and internal (within HBF) questionnaires to answer the research questions. Evaluation of the research revealed that a four-person staffed quint offers a more effective way utilize personnel at structural fires and other emergencies. Recommendations included staffing a four-person quint instead of a one-person truck and three-person engine, revising the HBF Structure Fire Response Guideline to give the first arriving truck officer flexibility and discretion to initiate either engine or truck work, placement of more experienced officers on the quint, and refocusing the training program to emphasize truck spotting and early tactical prioritization of either engine or truck work when the quint is first due.

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INTRODUCTION

In today's economic climate, with increased community pressures to deliver both cost efficient and effective service, it has become a ubiquitous fire service challenge to maintain high quality emergency response capability with existing or diminishing resources. Unfortunately, public expectations remain high, and there is an unwritten belief that a community's firefighters will solve whatever challenge they are faced, regardless of their department's staffing capabilities. Fire service leaders are expected to balance these expectations with their department's actual ability to deliver services, all the while maintaining firefighter and public safety. As a result, many organizations are evaluating alternative staffing models and ways of distributing emergency response assets throughout their communities.

This Applied Research Project (ARP) serves to evaluate one such method, specifically the efficacy of a four-person staffed quint as compared to a three-person engine company and one-person staffed truck company, both of which responded from the Humboldt Bay Fire headquarters (HQ) fire station. Specifically, the problem was Humboldt Bay Fire (HBF) did not know which of these staffing models was more efficient and effective which resulted in a potentially inefficient apparatus staffing configuration at the headquarters station. The research's purpose was to identify which of these staffing models provided the most effective and efficient service delivery. This project utilized the evaluative research method to answer the following questions: (a) What are the advantages of staffed quints when compared to separate engine and truck companies? (b) What are the disadvantages of staffed quints when compared to separate engine and truck companies? (c) Does a four-person staffed quint provide more efficient service delivery as compared to a three-person staffed engine and one-person staffed truck? (d) How

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does the quint staffing model affect fire ground operations? (e) What is the effect of quint staffing on emergency response times?

Additionally, this ARP is significant in that HBF is currently researching purchase of a new aerial device, and this ARP's staffing model recommendation will influence the type of aerial device HBF purchases.

BACKGROUND AND SIGNIFICANCE

The City of Eureka resides approximately 300 miles north of San Francisco on the Northern California coast. It has a day-time population of approximately 50,000 and is the largest city within the County of Humboldt. EFD covers approximately seven square miles and is surrounded by mountains and lush redwood forests to the east, and Humboldt Bay to the west. The Humboldt #1 Fire Protection District (HFD) serves the greater Eureka area and protects communities adjacent to the City of Eureka. The next closest city, Arcata (population 15,000), is located approximately 8 miles north, and more rural communities are located along the Highway 101 corridor to the south. Eureka contains most of the infrastructure related to county government and has a large retail district in its downtown core. Eureka is a beautiful city that is frequently referred to in tourism advertisements as a "Victorian Seaport."

In spite of its beauty, Eureka has a substantial crime problem, with crime statistics comparable to some larger metropolitan communities. EFD and HFD serve a diverse socioeconomic population with a substantial number of residents living below the poverty line. Residential structures within the two jurisdictions range from modern lightweight construction to older Victorian-style single- and multi-family residences, with the predominant construction type being balloon-frame. Target hazards within the community include hospitals, a shopping mall, a bulk-fuel storage facility, a natural-gas-fired power plant, dozens of mid-rise apartments and

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commercial buildings, one high-rise (the seven-story Humboldt County Correctional Facility), and multiple docks supporting both pleasure craft and a commercial fishing fleet. Unfortunately, the hazards associated with the communities' older structures, combined with above average crime and poverty rates translate into an above-average per capita structure fire response rates for both agencies.

EFD and HFD have operated under an automatic aid agreement for the past 17 years. This agreement includes a boundary drop and each agency routinely responds resources to the other agency for a variety of incident types. The two departments share a number of policies and procedures relative to structural firefighting. Additionally, both are dispatched from the City of Eureka Communications Center and utilize the same command and tactical radio channels. Significantly, the two agencies are in the initial formative stages of consolidation, and currently share contractual services for one fire chief and also a training officer (the author). It is estimated formal consolidation will occur within the next 12 to 18 months. Recently an internal committee, consisting of EFD and HFD members, selected the name of Humboldt Bay Fire for the successor agency. Within this ARP, the two agencies will be collectively referred to as Humboldt Bay Fire (HBF).

In November of 2010 City of Eureka voters approved Measure O, a local sales tax ballot initiative, which enacted a one-half of one percent (0.5%) increase to the sales tax rate. This tax, which has a five year sunset clause, raises the sales tax rate from eight and one-half percent (8.5%) to nine percent (9%) and is expected to generate approximately \$3.2 million per year. The ballot measure stated that the tax would be used to fund essential services such as police, fire, medical response, street maintenance, environmental programs, the City zoo, and parks and recreation (League of women voters of california education fund, 2011). It is hoped that this

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additional revenue will be used to either maintain or enhance public safety funding levels, thus limiting the impact of California's state-wide financial crisis.

EFD is a combination fire department with daily staffing of 11 career personnel, providing service via three 3-person engine companies, a one-person truck company, and a duty officer each shift. Who staffs the ladder truck varies from day to day depending on engine company vacancies but could be either an engineer (driver-operator) or the shift Captain II (battalion chief equivalent responsibilities). The department's executive staff, consisting of two assistant chiefs and the fire chief share duty officer responsibilities on a rotational basis. HFD staffs two 3-person engine companies plus a duty officer for total daily staffing of seven career personnel. A typical first-alarm structure fire response within EFD's jurisdiction would be four engines, the ladder truck, and two chief officers (one from each agency) for a total of 15 personnel. A typical response within the HFD would include four engines and two chief officers, for a total of 14 personnel. Additionally, effective January 1, 2012 EFD and HFD merged their separate volunteer programs into one, with a combined volunteer force of 24 members. Volunteer firefighter response to structure fires varies from approximately two to eight personnel on any given incident.

The ability to effectively control structure fires involves a sequence of events that begins well before apparatus arrival to an emergency scene. These events, beginning with fire discovery, include alarm time (time of dispatch notification and processing), dispatch time (time of dispatch notification to dispatch of emergency units), turnout time (time measured from emergency unit notification to response), and response time (travel time to an emergency scene) (NFPA 1710, 2010). Analysis of these tasks to find areas where an emergency response system could be more efficient involves a complex analysis that falls outside the scope of this ARP.

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Additionally, decisions about resource deployment locations, though important, are excluded from this ARP as it focuses solely on evaluating how resources are organized within an existing station pre-arrival to an emergency scene. It is also important to note that ladder truck services are a necessity for structural fire operations within the City of Eureka. This fact was highlighted in a document titled “City of Eureka Fire Department Standards of Response Coverage Report” (SORC). This report stated, “The City needs (three-person) staffing on the ladder truck, given the unusual quantity of older, higher risk buildings, which are atypical for a suburban city in this part of the state” (Citygate Associates, 2007). This same report recommended four-person staffing on all EFD engine companies.

Unfortunately HBF much like the entire nation, are experiencing serious budget challenges. Although the 2007 SORC supported increased truck and engine company staffing, our current reality is that we will not see this level of staffing increases in the foreseeable future. Thus the short-term, real world question is not, “How can we increase staffing?”, but instead, “What is the most effective way to use the personnel we currently have?”

A possible solution is to relocate personnel on existing apparatus. With this in mind, staffing of a quint fire apparatus was explored a possible solution. Beginning on October 1, 2011 HBF embarked on a three-month trial of an alternative staffing model which down-staffed the headquarters engine company and staffed the ladder truck with four personnel. The shift Captain II was moved off of the ladder truck and placed in a car to function as the shift battalion chief. This research project serves to evaluate the efficacy of the quint staffing model as compared to the preexisting staffing pattern. NFPA 1901, Standard for Automotive Fire Apparatus, defines a quint as a fire apparatus with a permanently mounted fire pump (minimum rated capacity of 1000 gallons per minute), a minimum of a 300 gallon water tank, 30 cubic feet of hose storage area, 85 feet of ground ladders, and an aerial ladder or elevated platform with a permanently

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mounted waterway (2009). However, due to a smaller than recommended water tank on EFD's ladder truck (200 gallons) this ARP defines a quint as a, "Fire department emergency vehicle with a permanently mounted fire pump, a water tank, a hose storage area, an aerial device with a permanently mounted waterway, and a complement of ground ladders."

Finally, this ARP relates to the United States Fire Administration strategic goal of improving the fire and emergency services' capability for response to and recovery from all hazards via its attempt to plan and implement the most effective emergency response delivery system possible within local budgetary and political constraints (USFA, 2011). In addition, this ARP relates to the course content of *Executive Leadership* (R125) through its efforts to resolve a problem which is both technical and adaptive in nature. Accepting the proposed staffing reconfiguration requires not only a rewrite of structural fire response guidelines, but also a major cultural shift in the way personnel incorporate truck company functions into fire suppression.

LITERATURE REVIEW

Several studies have been conducted evaluating the efficacy of engine and truck companies of varying staffing levels relative to their efficiency in completion of fireground tasks. To begin, National Fire Protection Association (NFPA) 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency medical Operations, and Special Operations to the Public by Career Departments recommends four on-duty personnel for fire companies whose primary functions are to pump and deliver water and perform basic firefighting at fires, including search and rescue, as well as four personnel for companies whose primary functions are to perform truck company functions, such as forcible entry, ventilation, search and rescue, aerial operations for water delivery and rescue, utility control, illumination, overhaul, and salvage work (2010).

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Two recent studies demonstrate strong correlations between crew size and task efficiency. A 2010 study conducted by the National Institute of Standards and Technology (NIST) titled “NIST Fireground Field Experiments” demonstrated that four-person crews were 25% more effective than three-person crews in completion of the critical fireground tasks, and 30% more efficient than two-person crews (Averill, et al.). A second study titled “Initial Attack Effectiveness: Wildfire Staffing Study” further demonstrated how increased crew staffing improves task efficiency. This study compared the efficacy of two, three, four, and five-person crews in completing wildland progressive hose lays. The author found that increasing staffing from two firefighters to three (those who are actively working on the hose lay) improved task efficiency by 31%, and when increasing staffing to four firefighters time-task efficiency improved by 49% (Rahn, 2010). No significant increases were noted for five-person crews as compared to crews of four.

These results are consistent with those of a study conducted by the Dallas Fire Department in 1984. This study evaluated the efficacy of three, four, or five-person companies in 91 structure fire scenarios in an apartment, single family dwelling, or a high-rise structure. This study found a direct correlation between apparatus staffing levels and performance quality during completion of critical tasks such as fire attack and search and rescue, with five person crews demonstrating the most coordinated completion of tasks and four or three person crews performing less efficiently. This study also noted both increased physiological stress and increased firefighter risk to firefighters of lower staffed crews (McManis Associates & John T. O'Hagan and Associates).

As this research evaluates the efficacy of four personnel arriving on either one apparatus (four-person staffed quint) or two (three-person staffed engine company plus a one-person

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staffed truck) it is important to note that NFPA 1710 does permit flexibility in resource deployment methods. The standard defines a company as,

A group of members: (1) Under the direct supervision of an officer; (2) Trained and equipped to perform assigned tasks; (3) Usually organized and identified as engine companies, ladder companies, rescue companies, squad companies, or multifunctional companies; (4) Operating with one piece of fire apparatus (engine, ladder truck, elevating platform, quint, rescue, squad, ambulance) except where multiple apparatus are assigned that are dispatched and arrive together, continuously operate together, and are managed by a single company officer; (5) Arriving at the incident scene on fire apparatus.

Based upon this definition, as long as units are dispatched and arrive at the same time and are managed by one company officer, an engine or truck company complement may arrive on different pieces of apparatus.

The advantages and disadvantages of staffed quints (as compared to separately staffed engines and trucks) have been identified through decades of experience by numerous departments around the Country. For example, Langston (1998) in an Executive Fire Officer Program ARP titled *The Modified Quint Concept* identified the following advantages to a staffed quint: Carries equipment of both an engine and truck company, truck company rescue capabilities, politically easier to justify staffing of one vehicle instead of two, decreased incident scene congestion (one less apparatus), ability to perform exposure protection while remainder of crew initiates interior attack, and Insurance Service Office (ISO) may give both truck and pump credit during department evaluations.

Conversely Langston noted quints' disadvantages including that they are large, heavy and can be difficult to maneuver, high maintenance costs, loss of both engine and truck capability

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when a unit is taken out of service, wear and tear due to response to medical and service calls, and limited hose compartment space.

Additionally, VanSolkema, in an Executive Fire Officer Program ARP titled, *Traditional Aerial Truck Versus a Quint: Where Do We Go from Here?* summarized a quint's advantages as follows: They are multi-purposed units that are capable of performing both engine and truck work, they carry equipment for both engine and truck functions, have capability to handle small fires without engine company assistance, and provide improved aerial coverage (assuming multiple quints in use). Disadvantages included reduced compartment space and ground ladder capabilities, additional weight being added to an already heavy apparatus, poor maneuverability, increased maintenance costs, requirement for additional training and new standard operating guidelines, and an increased potential for labor problems due to staffing reductions from two apparatus to one (2000).

Mittendorf (2010) also comments on a quint's limitations. In his opinion the major limiting factors are staffing, i.e. trying to perform too many functions with a short-staffed crew, training, and a lack of specialization. In his opinion, quints limit their companies' ability to specialize in a functional area of responsibility, such as engine or truck work. As such he believes it is important to equally train a quint crew in both engine- and truck-company operations to ensure equal proficiency in both areas. With these considerations in mind, he states a critical factor in determining the success or failure of a quint company is whether or not it has a strong and knowledgeable officer running the crew. Mittendorf states,

The last place to assign a new or inexperienced fireground officer is to a quint. A quint demands an officer who is able to size-up the many and varied fireground needs, prioritizes those needs, and then is capable of utilizing limited personnel...to accomplish

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those priorities in an effective sequence. That takes fireground experience, and experience in engine and truck company operations.

Quint companies are anecdotally described as being “jack of all trades, master of none.”

Using this analogy, several authors criticized the quint concept. In an article titled, “Quint Apparatus” numerous commentators offered their opinions as to the efficacy of quints (Fire Engineering , 2009). Phoenix Fire Department Assistant Chief Steve Kreis describes his opposition to quint apparatus in urban departments, primarily due to their lack of specialization in either engine or truck duties. “There is an ‘art’ to being a good engine or ladder crew member or officer” offers Kreis. Peters (2010) offers another poignant opinion, questioning the ability of firefighters on quints to perform all engine and truck functions:

The fire service leader who thinks that he will be able to perform all of the functions of a pumper and an aerial at the same time with the same apparatus is fooling himself....Unless the rig is staffed with about 10 people and is strategically placed in the perfect location, some of these duties will not be accomplished.

Dallas Fire Department Assistant Chief Larry Anderson agrees. He said that truck functions such as rescue, forcible entry, ventilation, and primary search require a level of experience and training above what is required to be on an engine company (Fire Engineering , 2009).

Rick Lasky, fire chief of Lewisville Fire Department offered that adequate staffing is the key ingredient to a quint company’s success. He states, “You need enough people to pump the pump, attack the fire, perform search and rescue, and ventilate. If you do the math, you will end up short on personnel” (Fire Engineering , 2009). Mittendorf (2010) believes that if a quint is to be appropriately used at a structure fire minimum staffing should be six personnel. This, in his opinion, allows three teams of two to perform engine and truck operations simultaneously.

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Broadly speaking, national emergency apparatus response times generally average less than five minutes 50% of the time (United States Fire Administration/ National Fire Data Center, 2006). Benchmarks for acceptable apparatus response times can be located in a few different references. To begin, NFPA 1710 (2010) recommends that the first company arrive at the scene of a structure fire within five minutes or less from dispatch, 90% of the time. The standard also establishes that an apparatus respond with four personnel. The standard gives companies an additional 80 seconds for turnout time (time of alarm receipt to time of response).

For comparison, the City of Eureka SORC recommended a first arriving apparatus response time goal of seven minutes – one minute for dispatch, two minutes for crew turnout, and four minutes for road travel time. The study also recommends an 11 minute response time for the remainder of a first alarm assignment (Citygate Associates, 2007).

Finally, in research similar to the authors, Griffin (2007) compared response times of quints to engines. His study compared the response times of four engines and four quints located in different stations within the City of Monroe, North Carolina. This research concluded their quints were slightly faster. Their quints had an average response speed of 25.60 miles per hour as compared to their engines, which averaged 24.25 miles per hour.

PROCEDURES

This ARP utilized evaluative research methodology to identify the most efficient and effective delivery of truck company services for Humboldt Bay Fire. The process involved analysis of information contained within the literature review and two separate questionnaires.

To begin, the author utilized resources contained within the National Fire Academy Learning Resource Center and “Google” (an online search engine) to conduct internet searches

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and access industry periodical website in order to perform a comprehensive review of current and relevant literature. Second, two questionnaires were designed and distributed. The first, an external questionnaire titled, "Quint Staffing Model Questionnaire" was distributed using an established email network of current Executive Fire Officer students to assess how other agencies have utilized quint staffing models within their jurisdictions. The questionnaire was developed using "Survey Monkey," an online service which enables subscribers to construct a questionnaire and then automatically collect and analyze the data. There were a total of 132 respondents. Ten questions were asked to establish the groundwork for analysis:

1. How many aerial apparatus (tiller, platform, straight, or quint) does your department staff?
2. How many of your department's aerial apparatus are of the "quint" type?
3. How many personnel typically staff your department's quint(s)?
4. Are your department's personnel cross-trained to perform both engine and truck work?
5. What advantages or disadvantages have you observed relative to cross training of personnel?
6. Does your department merge companies which respond separately (i.e. two piece companies) to perform emergency scene functions? If yes, please explain.
7. On a 1-5 scale, with 1 being low and 5 being high, how would you rate your department's experience with its use of quints?
8. What benchmarks or SOGs does your department use to determine if the quint's company performs engine work or truck work at structural fires?

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9. Has your agency observed any benefits during fireground operations due to quint staffing? Please explain.
10. Has your agency observed any negative effects of quint staffing during fireground operations? Please explain.

In addition, an internal questionnaire titled, “Humboldt Bay Fire Truck Staffing Questionnaire” was distributed to current HBF employees. This questionnaire had a total of 24 respondents out of 50 that were distributed. The following questions were asked to provide understanding of the departments’ perspective on our use of a staffed quint:

1. What advantages did you observe to the truck/ HQ engine staffing modification during the three month quint trial?
2. What disadvantages did you observe to the truck/ HQ engine staffing modification during the three month quint trial?
3. Which of the following is the most appropriate benchmark for determining whether Truck 8181 (4-0 staffed) should perform engine or truck work when arriving on scene? Why?
4. Were you assigned to Truck 8181 during the truck trial?
5. In your opinion, did a 4-0 staffed truck provide more or less effective service delivery as compared to a 3-0 staffed engine and one-person staffed truck? Please explain.
6. Has 4-0 truck staffing improved our effectiveness in performing truck company functions, specifically ventilation and search & rescue? Please explain.
7. One of the early identified advantages of 4-0 truck staffing was our ability to split into two 2-person crews. If we were to return to our previous staffing model (staff E

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8115 3-0 and T 8181 with one person) could we effectively merge the two pieces and split to perform two separate fireground assignments?

8. On a 1-5 scale, with 1 being low and 5 being high, how would you rate our experience with the truck staffing model?

Finally, to answer the research question “What is the effect of quint staffing on emergency response times?” data from Eureka Fire Department’s incident documentation software program, Firehouse Software, was evaluated to determine if there was a difference in response times between the staffed quint during the truck trial, and the previously staffed headquarters engine. Response times were measured from when the alarm was received by the headquarters station to arrival on scene. A limitation in analyzing this data set is that the times are subject to measurement errors when units either prematurely or belatedly report their response or arrival times. Additionally, as part of the HBF truck trial the response boundaries of Truck 8181 were modified so that the truck did not respond to the more rural addresses contained within Humboldt Fire District. Thus longer (typically multi-engine) responses did not occur for Truck 8181 as they did for Engine 8115 during the comparable time frame of October 1 to December 31 in 2010.

RESULTS

The three-month quint staffing trial evaluated a previously untested staffing configuration for Humboldt Bay Fire. The purpose of this research was to provide information to either sustain or discontinue this alternative staffing model. It is hoped that the research contained within this ARP will provide sufficient evidence to support this decision.

The two questionnaires - Quint staffing model questionnaire (referred to herein as external questionnaire) and the Humboldt Bay Fire Truck Staffing Questionnaire (referred to

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herein as internal questionnaire) were used to provide answers to the research questions. External questionnaire questions one through three (listed below) were intended to provide demographic information about a responders' agency. All remaining internal and external questionnaire questions were intended to directly answer research questions one through four.

Question one: "How many aerial apparatus (tiller, platform, straight, or quint) does your department staff?" revealed that of the 131 respondents, six (4.6%) staffed zero, 51 (38.9%) staff one, 24 (18.3%) staff two, 13 (9.9%) staff three, and 37 (28.2%) staff four or more. For clarity, refer to Figure 1.

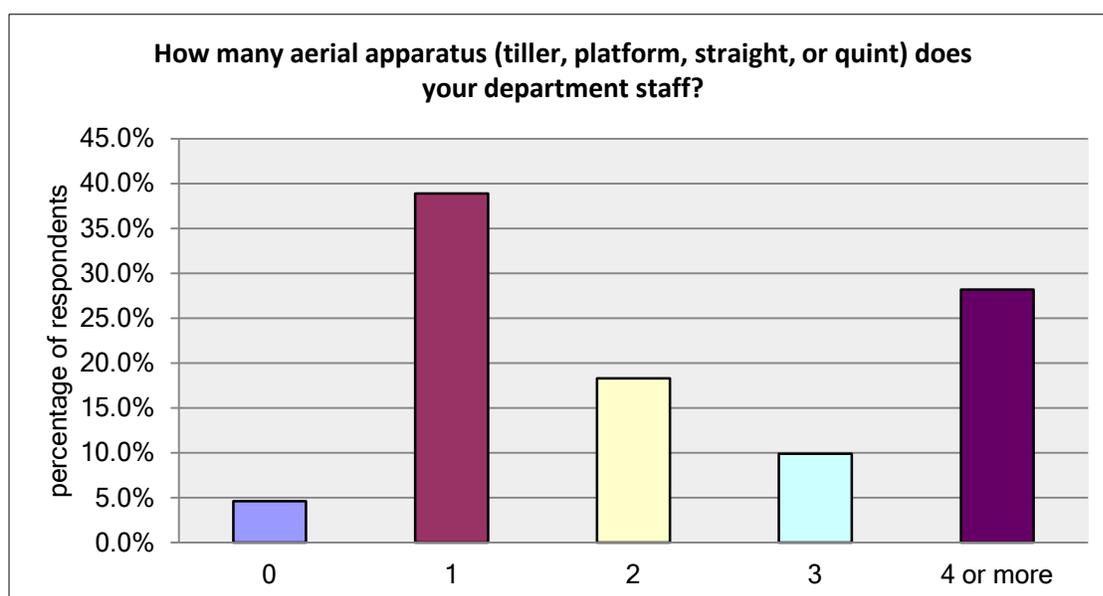


Figure 1. External questionnaire – Total number of aerial apparatus

Question two, "How many of your department's aerial apparatus are of the 'quint' type" identified that 28 (23.1%) have zero, 47 (38.8%) have one, 22 (18.2%) have two, 11 (9.1%) have three, and 13 (10.7%) have four or more quint type aerial apparatus (Figure 2).

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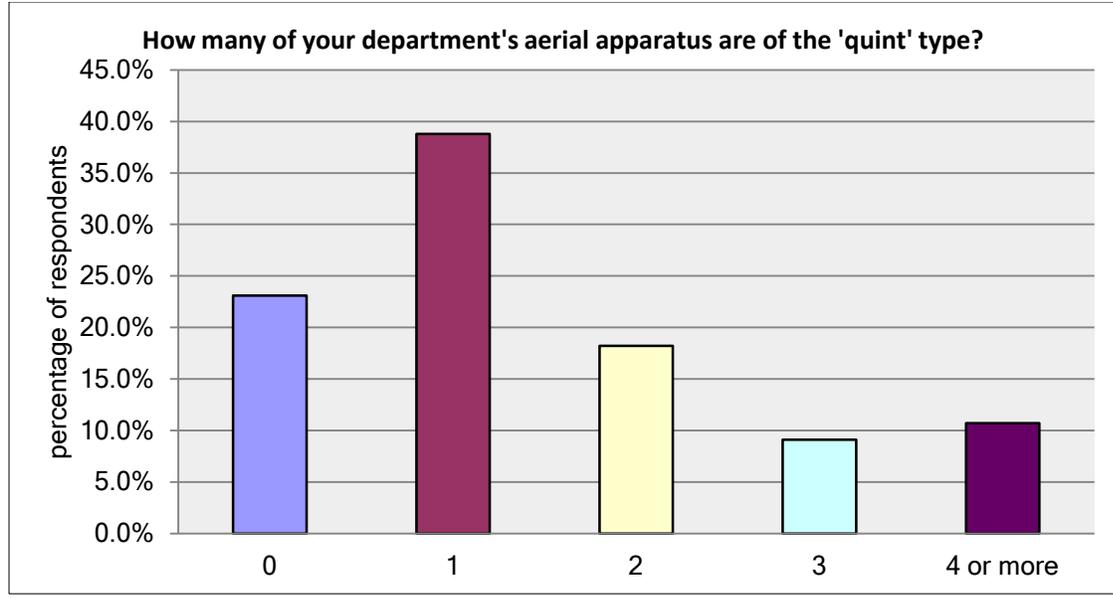


Figure 2. External questionnaire – Total number quint type aerial apparatus

Question three asked, “How many personnel typically staff your department's quint(s)?” Results illustrated 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, and none of the respondents are staffing their quints with five or more personnel (Figure 3).



Figure 3. External questionnaire – Number of personnel staffing department's quint(s)

Research questions

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Research question one: What are the advantages of staffed quints when compared to separate engine and truck companies?

Research question two: What are the disadvantages of staffed quints when compared to separate engine and truck companies?

External questionnaire questions four and five supported analysis of these questions.

Question four asked, “Are your department’s personnel cross-trained to perform both engine and truck work?” One hundred and thirty respondents answered this question. Of those, 121 (93.1%) cross train their personnel to perform both engine and truck work, where as nine (6.9%) do not.

External questionnaire question five asks its takers, “What advantages or disadvantages have you observed relative to cross-training of personnel?” There were 107 respondents to this question. Answers were tabulated and the advantages and disadvantages are broadly categorized as follows: Advantages included better understanding of tasks (eight respondents), fireground flexibility (23 respondents), and staffing considerations (24 respondents). Disadvantages included time necessary for truck company skills maintenance (four respondents), truck company skills degradation (four respondents), and decreased proficiency in truck company skills (21 respondents). One respondent described a trend of crews delaying engine company operations to perform truck company operations, particularly if an engine company is delayed getting on scene. A second respondent reported problems with role confusion (engine versus truck functions) when quint companies arrived on scene.

Research question three: Does a four-person staffed quint provide more efficient service delivery as compared to a three-person staffed engine and one-person staffed truck?

External questionnaire questions seven and nine and internal questionnaire question four provide answers to this question. External questionnaire question nine asked, “Does your

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department merge companies which respond separately (i.e. two-piece companies) to perform emergency scene functions? If yes, please explain.” 30 respondents (39%) stated yes, and 47 (61%) said no. Responses indicated that crews who merged companies would combine either an engine crew plus ambulance crew (four respondents), or combine a quint/truck crew with an ambulance crew (five respondents). Two other respondents described combination of specialized apparatus, such as a rescue or haz mat company with other apparatus to perform fireground functions. Only one respondent described merging of a one-person truck company with a three-person engine company.

Internal questionnaire question four queried, “In your opinion, did a 4-0 staffed truck provide more or less effective service delivery as compared to a 3-0 staffed engine and one-person staffed truck? Please explain.” 24 respondents answered this question. 23 (95.8%) answered “yes”, and one respondent answered “no difference.” The majority of respondents described the quint staffing model as delivering safer, more efficient and effective truck company operations, particularly the ability to split into two 2-person crews. For example, one member stated his opinion this way:

1 (person) staffed truck=no truck [*sic*]. Performing in both configurations the truck was seldom used and truck tasks were late with one-person staffing, and so much more is possible with four. As an IC the 4-0 truck gives me a much more versatile resource and facilitates task prioritizing.

By contrast the one respondent who answered “no difference” stated, “The customer service contact with the customer is not driven by the vehicle we show up on.”

External questionnaire question seven asked, “On a 1-5 scale, with 1 being low and 5 being high, how would you rate your department's experience with its use of quints?” Eighty-

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three respondents answered this question with an overall rating average of 3.72. Seven respondents rated their experience as a 1 (poor), three rated their experience as a 2, 20 rated their experience as a 3, 29 as a 4, and 24 as a 5 (great). Refer to Table 1.

Table 1

Satisfaction Rating for Department's Use of Quints

| Satisfaction Rating | Respondents |
|---------------------|-------------|
| 1 (poor) | 7 |
| 2 | 3 |
| 3 | 20 |
| 4 | 29 |
| 5 (great) | 24 |

For comparison, the comments below have been grouped by whether respondents rated their satisfaction as a 1 or 2, 3, or a 4 or 5.

To begin, external questionnaire respondents who rated their satisfaction as either a 1 or 2 offered the following comments: “(We) do not commit enough personnel to be successful.” “Historically we have used our quints as truck companies only. We just recently (within the past year) began utilizing one quint as such.” “If we are to use the quint concept all our aerials would have to be quints.” “We do not operate our quints as quints at this time.” “We typical [*sic*] operate strictly as a truck company doing support functions.”

Respondents posting a rating of 3 described the challenges they faced in using this style of apparatus: “Quints are just used as another apparatus,” offered one respondent. “Middle of

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the road ...” offered another. “(Crews) are not always sure of their duties, engine or truck company.” Another described an unanticipated problem:

When we first ordered the quint it seemed the right way to go but quickly found out that it was too big to respond to some rural calls as we had to use it as both engine and ladder for a while. We will most likely go with a ladder with platform next time with no quint concept.

Another respondent posting a 3 expressed both frustration and disappointment with their use of the quint model:

We have failed miserably to adopt a SOG/SOP for initial fire ground operations. This is a reflection of a weak training division and management resistance and/or incompetence. Our Chief told our officers that, “No matter what decision you make, you can't be wrong.” ...Therefore we have officers that believe they are a ‘truck’ company all the time regardless of conditions on arrival...

Listed below are examples of respondents who rated their satisfaction as either a 4 or 5. One respondent offered the following: “The quint is basically a glorified engine on our department. They are not on assignments as a truck company.” A second offered, “We have seen some maintenance issues, but these appear to be in line with other agencies. With limited staffing, we can't afford to run a ‘truck’ company, so the quint works very well for us.” A third stated, “(A quint) offers good ability to provide a truck to a district as a first in. Otherwise it would be harder to justify a truck alone.” Yet another respondent describes a successful outcome for using a quint to address station staffing issues:

With decreased staffing and station brownouts, if we did not have a quint, we would have to choose an engine over a truck and rely on mutual aid for a truck. We use a pump on

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apparatus many more times than we would use the aerial. Combining the engine and truck functions has helped our department complete our mission more efficiently.

Finally, two respondents describe how a quint apparatus is a good fit for the typical building construction challenges faced by their municipalities:

We feel that a quint offers us greater flexibility on the fireground which works well with the typical construction and occupancies within the town. We are currently in the process of replacing our current quint with a new one. The quint is assigned to my station. I like the fact that it can be used as a front line engine, or used for aerial/truck operation; it provides flexibility for operations on the fireground.

The other respondent commented,

(It) works really well as we have a very mixed suburban, commercial, and interstate area. We need an aerial device for the large homes in our districts as well as the 5 story hotels and commercial but the quint allows that company to fight the dumpster, car fire and single family dwelling fires where a pump is a necessity. Obviously the other issue is staffing and the most that company will have unless a volunteer comes up to ride with us is four.

Internal respondents, when asked, “On a 1-5 scale, with 1 being low and 5 being high, how would you rate our experience with the truck staffing model?” provided an overall rating average of 4.58. Of the 24 respondents answering this question one answered with a rating of 2, one marked a 3, five respondents answered with a 4 and 17 rated their experience as a 5. Generally speaking, respondents indicated improvements in performance of truck functions, crew flexibility and efficiency as the reasons for their high ratings. If responses were narrowed

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to only personnel assigned to Truck 8181 during the trial period, 12 of the 13 respondents rated our department's experience as a 5, with an overall rating average of 4.92.

Research question four: How does the quint staffing model affect fireground operations?

External questionnaire questions eight and nine, and internal questionnaire questions one through five assisted the author in answering the research question. External questionnaire question eight asked, "What benchmarks or SOGs does your department use to determine if the quint's company performs engine work or truck work at structural fires?" There were 73 respondents to this question. Seven (9.6%) reported their quints perform engine work if first due, 20 (27.4%) responded it is either incident commander or quint officer discretion, 13 (17.8%) stated it was dependent upon apparatus sequence of arrival, eight reported their quints perform truck work only, and 13 (18%) said they had no benchmark or standard operating guideline (SOG) in place. The remaining nine respondents made mention of an existing SOG but did not describe how it is implemented (Figure 4).

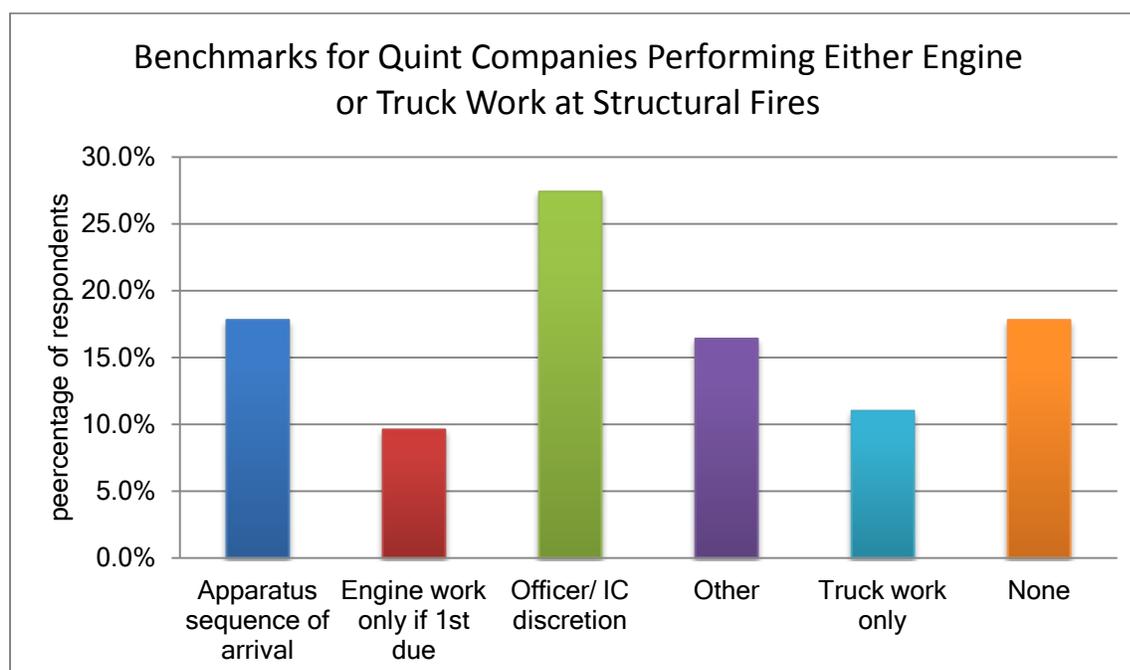


Figure 4. External questionnaire – Benchmarks used to determine if the quint's company performs engine work or truck work at structural fires

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Internal questionnaire question three inquired, “Which of the following is the most appropriate benchmark for determining whether Truck 8181 (4-0 staffed) should perform engine or truck work when arriving on scene? Why?” Twenty-four HBF members answered this question. One respondent stated apparatus sequence of arrival, one stated the quint should only perform engine work if first due, 15 (62.5%) stated it should be either the quint company officer or incident commander’s discretion, two (8.3%) said a time benchmark (e.g. two, three, or four minutes) of first arriving engine should drive the decision, four (16.7%) said the truck should never perform engine work, and one said it should vary with occupancy type, i.e. engine work for residential, truck work for commercial building fires (Figure 5).

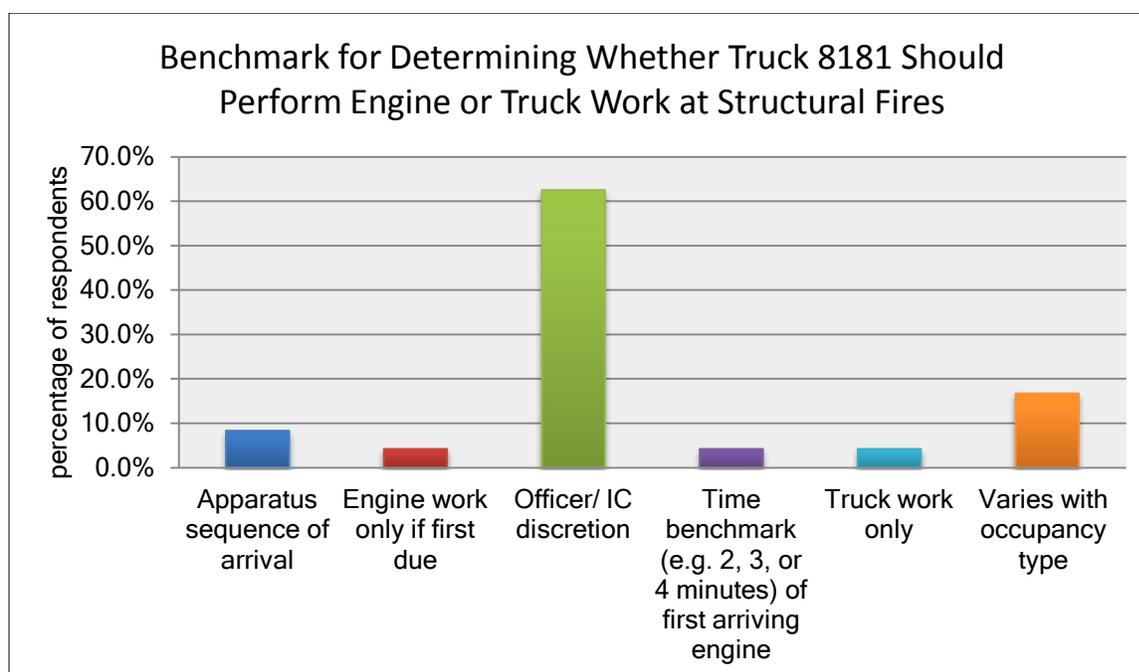


Figure 5. Internal questionnaire– Preferred benchmark for determining whether Truck 8181 should perform engine or truck work when arriving on scene

Notable respondent comments included the following:

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It (the truck company) should only be doing engine work if it is first on scene and can make an immediate difference like to save a life. Otherwise it should start doing truck work if the next arriving engine is only a few minutes out.

(The) truck crew can force doors, perform rescues, searches, prepare for ventilation, break shit [*sic*] all while the engine companies lay and stretch lines. Outcome is rescues get done, ventilation happens early (novel concept) and the fire gets put out. The truck is not an engine. It is not great at laying lines and if it is forced to do engine work then it is not available for aerial work. The reason I chose (officer) discretion is because of the unknown number of engines and the time to scene. On a limited basis the truck may be forced to work as an engine.

I think it needs to be the officer's decision. The fire on Summer Street was a perfect example of the truck using their 200 gallons and darkening down most, if not all of the fire. In most cases I feel the truck needs to be used as a truck. I try and spot the truck every time to be able to set it up and fly it if needed. I can also stretch more hose, I can't stretch the ladder. Leaving the decision for the officers keeps us flexible on the fireground. It is hard to say something on the fireground will "always" be this way when it comes to tactical decisions. Many factors make up an officer's decision process.

We need to remain flexible and allow our officers to make quick decisions on the fireground. The priority of fireground tactics should be vent and search for the truck and fire attack and RIC for the engines. We should also be thinking about the second in

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engine taking command instead of the truck in the event the Battalion is not at scene. By doing this, the truck has the flexibility to split the crew and accomplish high priority fireground ops [*sic*]. The third in engine (usually on scene) can create two-out and then RIC once the Battalion arrives on scene. The truck should be used as a truck and every measure should be taken to ensure that. We have three other engines available to do engine work and in this very small city, they aren't far behind.

Question nine of the external questionnaire asked its takers, “Has your agency observed any benefits during fireground operations due to quint staffing?” Seventy-one respondents answered this question and their responses are generally categorized as follows: Five respondents (7%) replied that it provided them with a four-person staffed company, five (7%) stated it brought needed truck company equipment to the scene, four (5.6%) said the quint could perform engine functions, two (2.8%) said it provides improved truck operations, 11 (15.4%) replied it offers improved flexibility in making fireground assignments, four (5.6%) said it improved operational efficiency, and 17 (24%) stated, “None.” Additional advantages described by respondents included, “Reduces our need for engine move ups for coverage”, “Best practices when fighting [*sic*] multiple story structures”, and “The benefit is for ISO rating only.” Additionally, one author noted a benefit specific to the building types faced in their first due response area:

The quint is vital when it comes to our large homes (5-15,000 square feet and I am not exaggerating) and commercial buildings ...so we have the opportunity to have an aerial stream if needed; an aerial device to support rescue when needed; the pumping capability and finally due to our staffing, it is nice to have the quint to support all the functions needed on the fireground with the minimal staffing (Table 2).

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Table 2

Observed Benefits of Quint Staffing During Fireground Operations

| Benchmark | Respondents |
|--------------------------------------|-------------|
| Brings more equipment to the scene | 5 |
| Can act as engine | 4 |
| Financial considerations | 2 |
| Fireground flexibility | 11 |
| Four-person company | 5 |
| Improved operational efficiency | 4 |
| Improved truck operations | 3 |
| ISO only | 1 |
| Other | 5 |
| Provides an additional truck company | 1 |
| Provides truck functions | 2 |
| Reduced engine move ups | 1 |
| Vital for large residences | 1 |
| None | 17 |

Internal questionnaire question one posed a similar inquiry to Humboldt Bay Fire personnel, specifically, “What advantages did you observe to the truck/ HQ engine staffing modification during the three month quint trial?” Twenty-two respondents answered this question; their responses can be broadly categorized as follows: Six described the benefits of four-person staffing as compared to three. For example, one respondent stated:

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The first advantage I saw was having the truck staffed with four personnel. During the trial period I responded to four confirmed fires, and every time the crew was split to give us two functional groups. With this configuration it makes us more efficient at what we do It is obvious how it helps on fires, but for medicals, vehicle accidents, service calls, etc. having the extra person made calls run more smoothly. We had two codes while on the trial period. One code was a 3 y/o boy on Christmas Eve [*sic*]. Two members of the crew were able to ride in the ambulance to assist the paramedic. The 3 y/o [*sic*] survived, and I believe it was because of the extra help from the truck company...

Eight additional HBF members described crew efficiency as an advantage. “The (four-person) staffing on T-8181 not only made emergency operations more effective and safe but also made for efficient routine in-house activities allowing more time for training” wrote one respondent. Additional respondents offered the following advantages: Familiarity with truck company operations, focused truck operations training, and appropriate spotting of the quint. Two of the more notable comments posted were, “The biggest advantage to me was that the trial started a physical discussion and philosophical change in how we utilize our truck and staffing. Four people to plug in were huge on incidents scenes” and “The ability to split crews has helped to accomplish more tasks with the same number of people on scene. Better awareness/ utilization of the truck and the specialized equipment it carries during incidents [*sic*]. Apparatus spotting on incidents, personnel are more aware of placement on scene and leaving an effective place for the truck to spot and work.”

External questionnaire question 10 posed, “Has your agency observed any negative effects of quint staffing during fireground operations? Please explain.” Sixty-nine respondents

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answered this question. Their responses are generally categorized as follows: Three respondents acknowledged poor truck (quint) placement, eight described the need for increased quint staffing (five of which stated the need to go from three-person staffing to four), four respondents stated role confusion (need to perform either engine or truck work), and 41 did not describe any negative effects (Table 3).

Table 3

Observed Negative Effects of Quint Staffing During Fireground Operations

| Benchmark | Respondents |
|--|-------------|
| Decreased coordination of engine & truck functions | 1 |
| Decrease in crews performing truck company functions | 2 |
| Delay in engine company functions | 1 |
| Delay in truck company functions | 1 |
| Inability to pre-assign tasks | 1 |
| Need increased quint staffing | 8 |
| Poor quint placement | 3 |
| Quint too large (100' platform) | 1 |
| Quint used only as engine | 1 |
| Role confusion (perform engine or truck work) | 4 |
| None | 41 |

Internal questionnaire question two asked, “What disadvantages did you observe to the truck/ HQ engine staffing modification during the three month quint trial?” HBF members described the following shortcomings: Three members described wear and tear on an aging vehicle as a concern. Four additional members expressed concern about slower response times.

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“The only disadvantage I noticed was that the response times were a little slower to medical calls due to the truck being a larger, heavier, slower vehicle.” Three additional respondents described frustration due to a lack of consistency between the three platoons. One respondent commented,

During any trial period there are going to be bumps in the road. The most challenging for me was having the three platoons not on the same page on some issues. In the beginning placement of equipment was constantly changing. Which crew you were on would change how business was being done...

Additional observed disadvantages included an on-scene conflict between engine and truck tactics when the truck is first due, adjusting to new tactics, lack of a dedicated headquarters engine company, and use of the quint for fire attack. For example, one respondent noted,

Not having a staffed pumping engine in HQ's first-in is a disadvantage. The four-person truck does come at the sacrifice of a staffed engine from HQ. For fires in HQ's first due, the truck sometimes needs to default to truck work due to the pumping limitations of the truck even if initial actions by a pumping engine would be more tactfully [*sic*] effective.

Additionally, a second member stated opposition to the quint being used for initial fire attack. This respondent said, “If the truck was first on scene it should be preparing for ventilation or search and rescue based on what the company officer sees as a priority.”

The HBF truck trial also committed the shift battalion chief to a car instead of moving to provide ladder truck coverage on minimum staffing days. Because of this change an additional overtime burden was created. Two individuals acknowledged this overtime liability as a significant concern. Another respondent described the challenges of cross-staffing an engine to

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respond to rural fires. Finally, five members stated they saw no disadvantages to the truck staffing model (Table 4).

Table 4

| <i>Observed Disadvantages to Quint Staffing Model During Truck Trial</i> | |
|--|-------------|
| Disadvantage | Respondents |
| Cross staffing engine to respond to rural fires | 1 |
| Increased overtime costs | 2 |
| Lack of consistency between 3 crews | 3 |
| Lack of staffed pumping engine in HQ's first in | 1 |
| Lose ability to split when need to take command | 1 |
| Personnel adjusting to truck tactics | 1 |
| Role confusion (perform either engine or truck work) | 1 |
| Slower apparatus, need to modify response boundaries | 4 |
| Wear and tear on truck | 3 |
| None | 5 |

Internal questionnaire question five asked, “Has 4-0 truck staffing improved our effectiveness in performing truck company functions, specifically ventilation and search & rescue? Please explain.” This question was designed to gauge member’s perceptions of the new staffing model’s effectiveness. Twenty-two respondents answered this question, all of whom answered “yes.” A sampling of comments for the question include, “There is more of an assumed role of vent/search when the truck is 4-0 staffed. Engine work is now assumed to go to engine companies unless specifically assigned otherwise.” Another firefighter offered, “The work can be started immediately and not take an engine out of service (which) will greatly

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improve our effectiveness and help save a life or property which is our main objective.” Yet another member echoed these sentiments with the following comment:

We now, for the first time in basically forever, have a truck company. The truck is able to focus, train, and implement truck stuff day in and day out. Previously, everyone had to wear multiple hats (jack of all, master of none). Also, instead of a merged crew with no clear, concise plan, we have a tight group with a solid game plan.

Internal questionnaire question six asked, “One of the early identified advantages of 4-0 truck staffing was our ability to split into two 2-person crews. If we were to return to our previous staffing model (staff Engine 8115 3-0 and Truck 8181 with one person) could we effectively merge the two pieces and split to perform two separate fireground assignments? Results of this question clearly indicated most respondents feel this is not a viable option, with an overall rating average of 1.71 on a 1-5 scale. Eleven respondents marked this as a 1 (ineffective), 10 respondents rated this strategy as a 2, two members ranked it a 3, one respondent responded with a 4, and no one ranked it as a five (very effective). Table 5 highlights these findings. Respondents had rather strong opinions on this topic. The following comments illustrate the negative sentiments described by many: “(A) one person truck is silly. Merging is a paper tiger and is neither effective nor efficient.” Another firefighter offered,

Old habits die hard. If we return to a 3-0 engine, and 1-0 truck downtown the truck will be deprioritised [*sic*] on scene. Incident IC's will place a higher priority on putting the engine co.s [*sic*]to work and the 1-0 truck will once again be underutilized, and become an afterthought. The potential solution for this is to preplan the merge between the engine and the truck on scene but in my mind that becomes a waste of resources.

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Conversely, some respondents thought this was a plausible scenario but most expressed reservations. One wrote, “We would make it happen, just not as efficiently.” Another offered, “Now that we are more used to the idea of splitting crews into two and two, I think this would translate pretty easily if the staffing configuration went back to 3-0 staffing and 1-0 on the truck.” A third grudgingly acknowledged this as a plausible (though not ideal) option:

I think this option would be marginal at best. It would require two units, parked in different locations to find each other, decide who was splitting, and go to work. The reality is that the two resources likely will not have trained as consistently on the merge and split as a dedicated truck crew would. I see this as being cumbersome at best.

Table 5

Effectiveness of Merging and Then Splitting a Three-Person Engine and a One-Person Truck to form Two 2-Person Crews

| Rating | Respondents |
|--------------------|-------------|
| 1 (ineffective) | 11 |
| 2 | 10 |
| 3 | 2 |
| 4 | 1 |
| 5 (very effective) | 0 |

Research question five: What is the effect of quint staffing on emergency response times?

To answer this question, response times were compared for the downtown engine company (Engine 8115) from October 1 to December 31 2010 and Truck 8181 from October 1 to December 31 2011. The data set illustrates mean response times for all response types (code two and code three responses) and code three responses from the downtown (headquarters) station

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between the two apparatus during the second quarter of fiscal year 2010 and 2011. Additional analysis evaluated the difference in mean percentage each apparatus arrived on scene in less than three or four minutes. Results indicated that Truck 8181 had an average response time for all incident types of two minutes and twenty-five seconds (2:25) as compared to two minutes and twenty-four seconds (2:24) for Engine 8115, a difference of one second. When comparing only emergency (code three) responses Truck 8181 responded to incidents on average in two minutes and eighteen seconds (2:18) as compared to two minutes and four seconds (2:04) for Engine 8115. This is a difference of 14 seconds, or a 10.2% increase in average code three response times for Truck 8181. The data was also evaluated to determine fractile percentages of responses in which apparatus arrived in less than three or four minutes. It was found that Engine 8115 achieved the three minute standard for 89.4% of code three responses, whereas Truck 8181 achieved the benchmark for 88.6% of code three responses, a difference of 0.8%. When comparing the same data set for response times of less than four minutes Engine 8115 met the standard for 93.2% of code responses, whereas Truck 8181 met the standard 96.5% of the time (Table 6).

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Table 6

Response Time Comparison: Engine 8115 versus Truck 8181

| Dates | Unit/ Response type | Mean (minutes) | % Responses < 3 minutes | % Responses < 4 minutes |
|---------------------------------|----------------------------------|-------------------|----------------------------|----------------------------|
| October 1 – December 31 2011 | Truck 8181: All incidents | 2:25 | - | - |
| | Truck 8181: Code 3 responses | 2:18 | 88.6% | 96.5% |
| October 1 – December 31 2010 | Engine 8115: All incidents | 2:24 | - | - |
| | Engine 8115: Code 3 responses | 2:04 | 89.4% | 93.2% |

Note. Dashes indicate data was not applicable.

DISCUSSION

Generally speaking, internal questionnaire respondents were more satisfied with the quint staffing model than external respondents. On a 1-5 scale, external questionnaire respondents provided an overall satisfaction rating of 3.72. HBF personnel on the other hand, gave an overall rating of 4.58, with 17 of 24 respondents rating HBF's experiences as a 5. Internal respondents were equally unified in their dissatisfaction with merging a three-person engine with a one-person truck, giving an overall rating of 1.71 on a 1-5 scale. In the author's opinion, both ratings are not necessarily a qualified judgment of quint staffing as they are a referendum on the ineffectiveness of the previous staffing model. As one respondent noted, the new staffing configuration represented a philosophical change in how the truck is utilized, sparking enthusiasm in HBF personnel. This enthusiasm was contagious, and personnel were motivated

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to learn how to use quint personnel in the most efficient way. However, as the trial was only three months long it is possible HBF's personnel have not identified all of the potential issues with the quint staffing model.

In this research numerous advantages and disadvantages to staffing quints as compared to separately staffing engines and trucks were noted. Authors Langston (1998) and VanSolkema (2000) noted the following advantages to staffed quints.

- Carries equipment of both an engine and truck company
- Multi-purpose units that are capable of performing both engine and truck work
- Truck company rescue capabilities
- Capability to handle small fires without assistance from an engine
- Ability to perform exposure protection while remainder of crew initiates interior attack
- Decreased incident scene congestion (one less apparatus)
- ISO may give both truck and pump credit during department evaluations
- Politically easier to justify staffing of one vehicle instead of two
- Improved aerial coverage (assuming multiple quints in use)

Conversely authors Langston, Van Solkema, noted the following disadvantages:

- Quints are large and heavy apparatus as compared to engines
- High maintenance costs
- Loss of both engine and truck capability when a unit is taken out of service
- Increased wear and tear on apparatus due to response to medical and service calls
- Limited hose compartment space
- Reduced ground ladder capabilities

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- Limited overall compartment space
- Poor maneuverability
- Requirement for additional training and new standard operating guidelines
- Potential for labor problems due to staffing reductions from two apparatus to one

Additionally, Kreis, Peterson, and Anderson all expressed concern about the inability for quint crews to specialize, i.e. the ability to focus on a more narrow skill set of either engine or truck work. Finally, Lasky and Mittendorf both refer to the importance of adequate staffing for efficient quint operations. Mittendorf said minimum acceptable staffing should be six, whereas Lasky appears to criticize the quint as a staffing solution, offering that using a quint company to simultaneously perform multiple engine and truck functions will likely make you short staffed, with some tasks ultimately suffering.

The author's external questionnaire displayed similar results. It is notable that many respondents also noted improved operational efficiency and fireground flexibility as advantages. In fact, three respondents commented that improved truck company operations were an advantage. Additionally, numerous respondents noted a crew's flexibility to perform either engine or truck work and that a quint brings additional equipment to the scene. Also consistent were the observations of a quint's potential ISO rating benefits and financial benefits due to decreased staffing and equipment costs. Interestingly, five respondents mentioned the increased efficiency of a four-person company. This is consistent with the findings in the author's internal questionnaire, with the majority of respondents noting the improved operational efficiency of four-person staffing. Internal respondents also observed an improvement in performance of truck company functions and apparatus spotting.

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One of the most difficult questions to answer was how to establish a benchmark for whether a quint company should perform engine or truck work when arriving first on scene. External questionnaire respondents preferred a variety of criteria, with officer/ IC discretion being the most frequent response. The majority of internal respondents (62.5%) also preferred this option. However, in reading the respondent's comments it becomes apparent that although they favor both flexibility and officer discretion, many leaned towards accomplishing truck work first, preferring the HBF quint perform engine work as an exception rather than as a general rule. With this in mind, Mittendorf's comment about the need to place an experienced officer on a quint company becomes even more important. An officer who is experienced in both engine and truck work, i.e. one who has observed how early tactical decisions drive an incident's success or failure will more likely be an effective quint company leader.

In the external survey, the overwhelming majority of respondents (93.1%) stated their agencies cross-trained personnel to perform both engine and truck company functions. A variety of explanations were provided, but they could be broadly categorized as providing either fireground or staffing flexibility. If questionnaire data is narrowed to respondents with only one in-service truck functioning as a quint (35 respondents) 94.3% cross train their personnel, with the majority of these respondents describing cross training as a necessity in smaller departments. One respondent captured the general consensus by stating, "It helps us bridge the gap for not having enough staffing that can specialize in engine and truck company operations." It appears that when faced with real-world staffing constraints the general notion of firefighters performing as "specialists", i.e. those who focus exclusively on either engine or truck company operations, is not a practical staffing solution. Perhaps comparing the efficacy of departments whose members do not cross staff apparatus to those which routinely do could be the subject of future research.

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One of the author's personal observations is that many members preference for conducting truck operations may cause problems in the quints first due response area. During training occurring throughout the HBF truck trial and in classroom-based simulations immediately following it the author observed that some members strongly advocate that the HBF truck company should exclusively perform truck company functions. For example, an engineer recently commented that our engine response times to the downtown core are so short that we do not need the truck to perform fire attack, as engines can perform this task more effectively. This member offered, "There is plenty of truck work to do before the first engine arrives on scene." In fact, this observation directly connects to comments made by external respondents. For example, one external respondent warned of problems with personnel delaying engine company operations to perform truck work, resulting in problems if an engine company is delayed getting on scene. Another respondent's opinion illustrates the point:

I feel that 99 times out of a 100, the initial best action, that will save the most lives, protect the most property, with an acceptable level of assumed risk is to STRETCH A HOSELINE [*sic*], of the correct diameter and length, and to place the properly operating nozzle flowing 180 gpm at the correct place. Once every hundred fires, the correct action for the first arriving apparatus, will be to act as a truck (i.e. go for rescue without the protection of a hose line).

On the contrary, some external respondents described how truck work suffered because of the engine mindset from the all of their firefighters. Although the responsibility of determining the most appropriate action of a HBF quint company ultimately resides with the first arriving officer, guidance can be provided in a well written standard operating guideline for

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structural fire operations. This in turn should be supported by classroom and field-based training which emphasizes the importance of good decision making by first arriving officers.

Does a four-person staffed quint provide more efficient service delivery as compared to a three-person staffed engine and one-person staffed truck? External questionnaire respondents indicated that departments who combined companies typically merged either an engine and ambulance crew or a quint/truck with an ambulance crew. Only one respondent described the merging of a one-person truck with a three-person engine company, indicating this is an atypical staffing configuration. Internally, personnel overwhelmingly indicated this was not an effective way to staff apparatus, with 95.8% of respondents stating a four-person staffed truck provides more effective, efficient, and safer service delivery as compared to merging of a three-person engine and one-person truck. Some respondents described poor truck positioning as a major limitation. Others felt that the one person staffing the truck only drove a “toolbox” to scene, and a merging and then splitting of personnel from two apparatus is not a practical. Respondents indicated that a four-person truck, on the other hand, created a seamless transition from arriving apparatus to fire ground assignment. “The truck pulls up on scene, crews split if needed and everyone goes to work, instead of having the two units (engine and truck) having to find each other on the fire ground and then figure things out like in the past” offered on respondent. The crew’s effectiveness was also observed on other call types such as medical aids, where two field saves were in part credited to the work performed by the added firefighter. This was an unexpected finding, and provided an additional argument for staffing Truck 8181 with four personnel.

What is the effect of quint staffing on emergency response times? Truck 8181, a 100 foot rear mounted aerial platform responded on average 14 seconds slower than Engine 8115 during

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comparable time periods in 2010 and 2011. It should be noted that response times for both units are very good, responding to over 93% of responses in four minutes or less, and respond in less than three minutes approximately 90% of the time. For response times of four minutes or less the data revealed that Truck 8181 matched this benchmark 96.5% of the time, whereas Engine 8115 met this benchmark less frequently at 93.2%. It would be expected that the smaller and newer apparatus (Engine 8115) would meet this criteria a higher percentage of the time. However, it is important to note that as part of the HBF truck trial the truck response boundaries were modified to exclude Humboldt Fire District response areas. Thus responses to a small number of multi-apparatus responses, where the truck would have been last due were eliminated. These responses can range from five to ten minutes depending on location.

In either case, average response times are well below the NFPA 1710 recommendation of engines arriving within five minutes or less 90% of the time. This is also within the parameters established by the 2007 City of Eureka Standards of Response Coverage report which recommended two minutes for crew turnout plus four minutes of road travel time for a total of six minutes for the first arriving apparatus, 90% of the time.

RECOMMENDATIONS

After careful analysis of the research, the author makes the following recommendations to solve the problems presented within this project. Listed below are those recommendations.

1. There are clear operational advantages to permanently staffing a quint instead of a one-person truck and three-person engine. The author recommends maintaining four-person staffing on Truck 8181 and down staffing Engine 8115, as funding permits. This configuration has the added benefit of reducing fleet size by one, thus creating a long-term

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savings by not needing to replace Engine 8115. The findings of this research can be used to influence policy makers when engaged in either staffing or budgeting discussions.

2. Revise the HBF Structure Fire Response Guideline to reflect first arriving truck officer flexibility and discretion in performing engine or truck work, with inclusion of specific examples of when engine work would be more appropriate. Within this same guideline, clearly state that the first arriving apparatus operator should give the truck company priority placement.
3. In order to ensure good early decision making when the truck arrives first to a structure fire, only non-probationary captains should be assigned as the officer on Truck 8181, with preference given to more senior captains interested in the assignment.
4. During the trial, awareness and performance of truck company functions improved significantly. However this improvement may come at the cost of early engine work in Truck 8181's first due response area. For this reason the training program needs to emphasize early decision making on when to prioritize either engine or truck work when the quint is first due. Within this training there needs to be a particular focus on adjusting some members' traditional truck company mindset, encouraging them to remain flexible as to when it is appropriate to focus initial efforts on fire attack. Examples of appropriate conditions for the HBF quint to stretch hose rather than perform truck work include: Ability to reduce fire spread to multiple floors or surrounding exposures, ability to control a small fire with one attack line, and arrival delay of first due engine. This training should also include a refresher on truck spotting considerations.

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In an ideal world, Humboldt Bay Fire would be able to adopt the 2007 Standards of Cover recommendations to staff all engines with four personnel, and provide four personnel on an aerial device. Unfortunately, in these tough economic times finding ways to maximize the effectiveness of existing personnel is our best hope for providing quality service to the citizens we serve. This research serves as a tool to ensure we are able to deliver these services in an efficient and cost effective way.

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REFERENCES

Averill, J. D., Moore-Merrell, L., Barowy, A., Santos, R., Peacock, R., Notarianni, K. A., et al. (2010). *NIST technical note 1661: A report on residential fireground field experiments*. Washington DC: National Institute of Standards and Technology.

Citygate Associates. (2007). *Standards of response cover study for the city of eureka fire department*. Folsom, CA: Citygate Associates.

Fire Engineering . (2009). *Quint apparatus*. Retrieved January 21, 2012, from Fire Engineering: <http://www.fireengineering.com/articles/print/volume-156/issue-3/departments/roundtable/shquint-apparatus.html>

Griffin, D. C. (2007). *The quint concept, evaluated within the Monroe Fire Department*. Emmitsburg: MD: National Fire Academy.

Langston, T. (1998). *The modified quint concept*. Emmitsburg:MD: National Fire Academy Executive Fire Officer Program.

League of women voters of california education fund. (2011, January 6). *Measure O - Eureka sales tax increase for public services*. Retrieved November 20, 2011, from Smart voter: <http://www.smartvoter.org/2010/11/02/ca/hm/meas/O/>

McManis Associates & John T. O'Hagan and Associates. (1984). *Dallas fire department staffing level study*. Dallas, TX: Dallas Fire Department.

Evaluating the Efficacy of a Four-Person Staffed Quint

Mittendorf, J. (2010, June 21). *Los Angeles firemen's credit union - The LACFU blog*. Retrieved January 21, 2012, from Quints part 2: <http://mylafirecu.org/2010/06/21/quints-part-2/>

National Fire Protection Association [NFPA]. (2010). *NFPA 1710: standard for the organization and deployment of fire suppression operations, emergency medical operations, and special operations to the public by career fire departments*. Quincy: MA: NFPA.

National Fire Protection Association [NFPA]. (2009). *NFPA 1901: Standard for automotive fire apparatus*. Quincy, MA: NFPA.

Peters, W. C. (2010, June). Serious decisions are necessary when specifying aerial apparatus. *Fire Engineering (Apparatus supplement)* , pp. 23-32.

Rahn, M. (2010). *Initial attack effectiveness: wildfire staffing study*. San Diego: University of San Diego.

United States Fire Administration [USFA]. (2011). *Executive fire officer program: Operational policies and procedures - applied research guidelines*. Retrieved January 28, 2012, from http://www.usfa.fema.gov/downloads/pdf/efop_guidelines.pdf

United States Fire Administration/ National Fire Data Center. (2006). *Structure fire response times: Topical fire research series v* . Emmitsburg: MD: U.S. Department of Homeland Security.

VanSolkema, R. (2000). *Traditional aerial truck versus a quint: Where do we go from here?* Emmitsburg:MD: National Fire Academy.