CITYGATE ASSOCIATES, LLC
FOLSOM (SACRAMENTO), CA MANAGEMENT CONSULTANTS

STANDARDS OF RESPONSE COVER STUDY FOR THE CITY OF VALLEJO FIRE DEPARTMENT

Final Report

VOLUME 1 OF 3 – SOC REPORT

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CITYGATE ASSOCIATES, LLC
FIRE & EMERGENCY SERVICES

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EXECUTIVE SUMMARY

The City of Vallejo commissioned Citygate Associates, LLC to analyze several areas of fire services in Vallejo. These areas include: the overall staffing and deployment of fire services; the service needs of the Hiddenbrooke Development; the impact of fire station or crew reductions if necessary; the adequacy of the headquarters staffing; an analysis of the impacts of the current firefighter work schedule being tested; and finally, any policies or issues inordinately driving up the usage of overtime.

Citygate assigned its Fire and General Government Principals to study these issues. We interviewed key stakeholders and gathered written, mapping, response statistics, payroll and work schedule information from the Department and City finance. Citygate also facilitated one community listening session. The Citygate team then built data-driven models to deeply look at fire station deployment and to analyze the costs and policy drivers on the work schedule and overtime questions. Finally, Citygate took the study results and models to offer opinions on various service level reductions, should a severe fiscal situation make reductions necessary.

Our findings and recommendations in brief are:

A. DEPLOYMENT FINDINGS

Vallejo has a fire department with a deployment plan that is under challenge from several issues:

- First, the hilly geography and non-grid street network in many areas, as well as limited access under or over barriers such as freeways and waterways, creates a community that is difficult to serve with fewer fire stations;
- Second, the City is changing – development, increased traffic, and in-fill development are slowly occuring, but the revenue to enhance fire services is not yet increasing;
- The City needs to adopt realistic fire unit performance measures and use those to drive future development decisions;
- Even with these challenges, the current response system is well designed, located and performs well in the contiguous core of the City. It does not serve as well the fringe areas of Hiddenbrooke and the contract fire district;
- Additional fire stations are costly and not in the near-term City revenue picture.

While the current response times are a little longer than desirable to outlaying areas, Vallejo is achieving acceptable response times on most calls because many of the calls are clustered close to the higher-call-volume fire stations. Buildings fires are usually modest in size given the newer building construction in parts of the City less than twenty years old.

The current staffing per apparatus plan only provides the minimum number of firefighters for smaller fires and modest multiple-patient medical or rescue situations. Serious fires will draw in more units, placing serious demands and limitations in responding to other emergencies in a system that has two or more calls for service occurring 39 percent of the time. The City, as deployed, is doing an adequate job with modest emergencies and less severe, simultaneous calls

for service. When major incidents occur, the City must deploy all its resources and depend on mutual aid.

Thus, the City has a *distribution* problem, in that it does not have enough primary response units, in the fringe areas -- principally Hiddenbrooke -- as identified in the geographic mapping analysis. These findings leave the City in a difficult position; it is very expensive to add one or more fire stations to cover the edge areas of the City, and since the rest of the City really only has one fire station per neighborhood, there are no fire stations to relocate.

Given the appropriately wide area fire station spacing in the City, if severe budget reductions make closing one or more fire stations necessary, there will be meaningful service reductions. On the positive side, the existing fire station locations serve the core areas of the City well. Response times are acceptable in the core areas, and staffing and equipment meets the City's routine fire and emergency medical needs.

It must be noted that national response thinking is that a 4-minute fire apparatus travel time is the optimum for urban and higher-hazard suburban areas. However, today, most of the fire departments in the United States, outside of large metropolitan departments, cannot comply with a 4-minute travel time or 4 firefighters per crew due to economic realities and lower risk protection.

Given the moderate fire and medical risks in Vallejo, a 4-minute road travel time is an appropriate goal that Vallejo is close to achieving in the core areas of the City. Unlike in other communities, this is a very reachable goal in the core of the City, once dispatch and fire crew turnout times are improved. However, this goal cannot be met out to all the edges of the road network such as in the Hiddenbrooke area.

B. DEPLOYMENT RECOMMENDATIONS

1. After understanding the findings in this report, the City should adopt revised deployment time measures meeting the City's risk versus outcome needs:
    a. First-due unit: Arrival 90 percent of the time, within 7 minutes of the call being received at the police fire dispatch center.
    b. For serious building fires requiring 14+ firefighters and an Assistant Chief (First Alarm), all the firefighting units should arrive on-scene within 11 minutes, 90 percent of the time.
    c. The City needs to focus on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time, as well as lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent.
2. The City, as its fiscal situation allows, needs to discuss with the Hiddenbrooke community how they can partner together fiscally to improve the response times and level of service. Some options include:
    a. Retain the existing basic life support ambulance agreement.

b. Upgrade the ambulance agreement to include one paramedic per day and restrict the regional area the ambulance operates within to leave it more available for northeast Vallejo calls for service. This would come at an increased cost.

c. Create and staff a 2-person firefighter squad, with one member being a paramedic. This squad would handle medical calls, minor fires and, on serious fires, still be able to take an outside command and assessment function to set-up while the more distant units arrive.

d. Consider upgrading the back access road from Station #27's area to improve travel times and the ability to evacuate the community.

3. Given that Vallejo has an adequately equipped and staffed fire department, understand that there is no deployment "excess" capacity today to relocate stations to the underserved edge areas and if severe budget reductions are necessary, there will be meaningful service reductions.

4. The quantity of staffing for headquarters functions is at the lowest amount to continue current programs, and any additional reductions will reduce or halt the affected programs.

C. 48/96 Work Schedule Findings

The City agreed to change the work schedule for Fire Department line personnel to a "48/96" schedule that is a single 48-hour work shift followed by four days, or 96 hours off. This was a trial change, with the anticipation that there would be dollar savings in at least four measurable areas: sick leave usage, time off due to worker injuries, Fair Labor Standards Act required overtime payments, and "hold-over" overtime when on-duty personnel are held over until someone can be brought in on overtime to work a shift with an unexpected vacancy. After three years on the trial schedule, the short-term data does not support an argument that a "48/96" work schedule will overall save the City money in three of the four operational measures examined as compared to the former "3-4" schedule. The period of time for which data is available represents an insufficient sample to draw any long-term conclusions. Data is also not available from other agencies, most of whom have a similarly limited time-experience with the "48/96" schedule. The data does indicate savings in reduced FLSA Overtime costs, but given the cautionary note that Workers Compensations costs may be higher due to several reasons, those costs could easily offset the FLSA savings.

D. 48/96 Schedule Recommendation

5. In the context of the overall Fire Department budget, these expenses and savings are not significant; but a conservative approach would be to, at the very least, assume no better than a neutral fiscal outcome from the schedule change.

E. Overtime Usage Findings

Overtime Usage by the Fire Department has increased since 2002, even recognizing such factors as pay raises and increased workers compensation injury leaves. The significant factor driving overtime is the requirement in the current Memorandum of Understanding (MOU) with the IAFF Local 1186 that there be 28 line fire personnel on duty for each shift. This staffing number is

prudent given the Citygate deployment findings for the City. While the City has maintained surplus personnel assigned to each shift to fill in for absences due to vacation, illness, etc., this number has declined over the last four years, and has rarely been adequate to meet the 28-person minimum staffing requirement without calling people in on overtime. Approximately half of the absences that needed to be covered were filled with personnel working overtime during the past four years.

To increase the number of "surplus budgeted positions" in order to reduce the amount of paid overtime would cost the City over 20 percent more than filling the same vacancies with overtime, because the overtime pay rate does not include the cost of many of the benefits provided to full-time employees, the rate does not account for the training costs of the additional positions, and there would be days in which the number of surplus employees actually exceeds the number of vacancies that need to be filled. Based on the information from the Fire Department that there are only a small number of days with excess personnel on duty above the 28 constant staffing requirement, the present number of filled permanent positions is "about right" if the Department is not experiencing low morale and higher fatigue/injury rates due to the amount of overtime required of employees.

Nevertheless, MOU provisions provide that between 7 and 9 fire personnel can be off on any given day for schedule leave such as vacation and holiday time off. Other than this cap, there are no policies or procedures that attempt to balance the number of overstaffed or surplus positions available each day with the number of people seeking time off, resulting in some additional overtime costs.

In reviewing the remainder of the MOU provisions that affect "leave," Citygate did not find any that appeared unusual or would have a significant affect on overtime usage.

F. Overtime Usage Recommendation

6. If both the City and the IAFF Local 1186 are interested in reducing overtime usage on a long-term basis, then changes need to be made in the number of employees allowed off each day on scheduled leave and there need to be provisions regarding how that time is scheduled in order to provide a more even distribution of time off across all 12 months of the year, not just the popular ones.

STANDARDS OF RESPONSE COVERAGE DEPLOYMENT ANALYSIS

A. SYNOPSIS

This report outlines Citygate Associates' findings regarding fire service deployment in the City of Vallejo Fire Department. The study team engaged with the City and Department leadership to develop an in-depth Standards of Response Coverage assessment. This multifaceted approach to understanding fire crew deployment needs will serve to guide the City as it continues to evolve under the stress of service demands during uncertain economic times.

The findings and recommendations at the conclusion of this study show that while the City is deployed to cover its jurisdiction and its associated risks, it has response challenges in some areas during a time of economic constraints.

B. OVERALL DEPLOYMENT RECOMMENDATIONS

1. Given the response time information and the risks present in the City, this study recommends revised response time goals of:
   a. First-due unit: Arrival 90 percent of the time, within 7 minutes of the call being received at the police fire dispatch center.
   b. For serious building fires requiring 14+ firefighters and an Assistant Chief (First Alarm), all the firefighting units should arrive on-scene within 11 minutes, 90 percent of the time.
2. The City, as its fiscal situation allows, needs to discuss with the Hiddenbrooke community how they can partner together fiscally to improve the response times and level of service. Some options include:
   a. Retain the existing basic life support ambulance agreement.
   b. Upgrade the ambulance agreement to include one paramedic per day and restrict the regional area the ambulance operates within, to leave it more available for northeast Vallejo calls for service. This would come at an increased cost.
   c. Create and staff a 2-person firefighter squad, with one member being a paramedic. This squad would handle medical calls, minor fires and on serious fires still be able to take an outside command and assessment function to set-up while the more distant units arrive.
   d. Consider upgrading the back access road from Station #27's area to improve travel times and the ability to evacuate the community.
3. The City needs to focus on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time, as well as lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent.

C. NEXT STEPS AND RECOMMENDED PRIORITIES

1. After understanding the findings in this report, the City should adopt revised deployment time measures, as recommended above, meeting the City's risk vs. outcome needs.
2. The City needs to focus on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time, as well as lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent.
3. Discuss the options to improve service to Hiddenbrooke.
4. Given that Vallejo has an adequately equipped and staffed fire department, understand that there is no deployment "excess" capacity today to relocate stations to the underserved edge areas and if severe budget reductions are necessary, there will be meaningful service reductions.
5. Prioritize service reductions if the City budget is not projected to be able to sustain the present level of fire service expenditures.

D. BACKGROUND

The Commission on Fire Accreditation International recommends a systems approach known as "Standards of Response Coverage" to evaluate deployment as part of the self-assessment process of a fire agency. This approach uses risk and community expectations on outcomes to assist elected officials in making informed decisions on fire and EMS deployment levels. This study uses this methodology as a comprehensive tool to evaluate fire station location. Depending on the needs of the study, the depth of the components may vary.

Such a systems approach to deployment, rather than a one-size-fits-all prescriptive formula, allows for local determination. In this comprehensive approach, each agency can match local need (risks and expectations) with the costs of various levels of service. In an informed public policy debate, a city council or fire department governing board "purchases" the fire and EMS service levels (insurance) the community needs and can afford.

While working with multiple components to conduct a deployment analysis is admittedly more work, it yields a much better result than any singular component can. If we only look to travel time for instance, and not look at the frequency of multiple calls, the analysis could miss over-worked companies. If we do not use risk assessment for deployment, and just base deployment on travel time, a community could under-deploy to incidents.

The Standards of Response Coverage process consists of eight parts:

1. Existing Deployment – each agency has something in place today.
2. Community Outcome Expectations – what is expected of the response agency?
3. Community Risk Assessment – what assets are at risk in the community?
4. Critical Task Time Study – what must be done over what timeframe to achieve the stated outcome expectation?
5. Distribution Study – the locating of first-due resources (typically engines).
6. Concentration Study – First Alarm assignment or the effective response force.

7. Reliability and Historical Response Effectiveness Studies – using prior response statistics to determine what percent of compliance the existing system delivers.
8. Overall Evaluation – proposed standard of cover statements by risk type.

Fire department deployment, simply stated, is about the ***speed*** and ***weight*** of the attack. Speed calls for first-due, all risk intervention units (engines, trucks and or rescue companies) strategically located across a department. These units are tasked with controlling everyday moderate emergencies without the incident escalating to second alarm or greater size, which then unnecessarily depletes the department resources as multiple requests for service occur. Weight is about multiple-unit response for serious emergencies like a room and contents structure fire, a multiple-patient incident, a vehicle accident with extrication required, or a heavy rescue incident. In these situations, enough firefighters must be assembled in a reasonable time frame in order to control the emergency safely without it escalating to greater alarms.

Thus, small fires and medical emergencies require a single or two-unit response (engine and specialty unit) with a quick response time. Larger incidents require more crews. In either case, if the crews arrive too late or the total personnel sent to the emergency are too few for the emergency type, they are drawn into a losing and more dangerous battle. The art of fire crew deployment is to spread crews out across a community for quick response to keep emergencies small with positive outcomes, without spreading the stations so far apart that they cannot mass together quickly enough to be effective in major emergencies.

Given the need for crews to be stationed throughout a community for prompt response instead of all crews responding from a central fire station, areas such as the City are faced with neighborhood equity of response issues. When one or more areas grow beyond the reasonable travel distance of the nearest fire station, the choices available to the elected officials are limited: add more neighborhood fire stations; or tell certain segments of the community that they have longer response times, even if the type of fire risk found is the same as other areas.

E. VALLEJO FINDINGS

Existing Deployment Situation – What Vallejo has in Place Currently

The service area of the City is served by eight fire stations from which it provides firefighting, advanced and basic emergency medical services plus technical rescue responses. The City participates in a regional hazardous materials response team. As the City's service area has grown to its current resident population of approximately 121,000 and 30 square miles of land (another 23 square miles of water), the eight fire station locations and nine (9) fire companies can be challenged by demand for service and traffic congestion to provide adequate response times where the goal is to generate positive outcomes for the victims of fires, emergency medical, rescue or hazardous materials events. The City also serves under an agreement an unincorporated section of the County in the East Vallejo Fire Protection District just east of the City. A later section in this study will look in-depth at the Hiddenbrooke area of the City.

To analyze recent response time performance, this study will review in-depth City data for 20,870 incidents dated for the 24-month period from 04/01/2004 through 3/31/2006. Apparatus response data was included for 24,679 individual apparatus responses, as some incidents require more than one apparatus to respond.

Currently, the City and Department have not adopted fire unit response time performance goals. When the City entered into the first responder paramedic program, it did agree to Solano County Emergency Medical System response time goals of fielding a paramedic on-scene within 7 minutes from the time of fire crew notification, 90 percent of the time, averaged citywide. For this commitment, the County EMS System pays the City $144,000 per year for its additional costs to deploy paramedic firefighters. The Department loses compensation if they do not perform. In the last two years, due to occasional long response times and or the impact of multiple calls for service, the Department has lost approximately $2,000 per year in EMS payments. Thus, the actual contract compliance "fines" have been fairly small.

It is considered a best practice today for a fire department to have adopted meaningful and descriptive performance measures based on *local* risk and desired outcomes. Over the last fifteen years, fire service deployment measures have become more meaningful and specific. There are two private national organizations that publish guidelines to assist local communities in designing fire service deployment. This country does not issue Federal or State regulations on fire service deployment measures. These two organizations are the Commission on Fire Accreditation International (CFAI) and the National Fire Protection Association (NFPA).

The most recent guidance from the NFPA and CFAI is to use percent of completion measures, and to also define the time measure start point, the outcome desired, and how many units (and how those units are staffed) need to deploy for each measure. These issues need to be understood locally and each community needs to deploy fire services to meet its risks and desired outcomes, within its ability to pay for a given level of fire services.

For this study, given that Vallejo does not have adopted response time measures, measures had to be designed to study the City's performance.

Both sets of fire service deployment guidelines arrive at the same conclusion: that a 4-minute travel spacing between fire stations will provide appropriate outcomes in serious, time-critical emergencies. When 4 minutes of road travel are added to 1 minute for dispatch performance and 2 minutes for the fire crew to hear the alarm, don safety clothing and get the apparatus moving, then 4+1+2 minutes equals a total response time of 7 minutes. The national thinking is that if a 7-minute measure is accomplished 90 percent of the time, then most of the community will receive appropriate service from the first-due unit.

While the national response thinking is that a 4-minute fire apparatus travel time is the optimum for urban and higher-hazard suburban areas, today, however, most of the fire departments in the United States, outside of large metropolitan departments, cannot comply with a 4-minute travel time or 4 firefighters per crew due to economic realities and lower risk protection.

Given the moderate fire and medical risks in Vallejo, a 4-minute road travel time is an appropriate goal that Vallejo is close to achieving in the core areas of the City. Unlike in other communities, this is a very reachable goal in the core of the City, once dispatch and fire crew turnout times are improved. However, this goal cannot be met out to all the edges of the road network such as in the Hiddenbrooke area.

The best national thinking is that for serious emergencies that require multiple units, the first alarm units should all arrive at critical emergencies within 8 minutes travel time. When 8 minutes is added to 1 minute for dispatch and 2 minutes for crew turnout, then the first alarm total response measure totals 11 minutes, 90 percent of the time. Critical emergencies are those

immediately threatening to life or likely to cause severe property damage from fire. Crew turnout time is longer in critical emergencies because more protective clothing must be donned before the fire apparatus can respond. Thus, older national best practice total response time recommendations include:

- 60 seconds or less dispatcher processing time, when pre-arrival medical directions are not given to the caller;
- 60 seconds or less fire crew turnout time;
- 4 or 8 minutes road travel time.

Given the current safety clothing a firefighter must don before responding, studies since the NFPA guidelines have been published and the findings of many Standards of Response Coverage studies in fire departments have found that a one-minute crew turnout measure is unrealistic. However, there is ample data from many departments, that a crew turnout measure of 2 minutes, 90 percent of the time is a sustainable goal.

Therefore in this study, the ***first-due*** deployment measure used will be:

- 60 seconds or less dispatcher processing time, when pre-arrival medical directions are not given to the caller
- 2 minutes or less fire crew turnout time
- 4 or 8 minutes road travel time
- This totals a first-due unit time of 7 minutes, 90 percent of the time.

For a First Alarm response:

- 1 minute for dispatch
- 2 minutes for crew turnout
- 8 minutes travel time for the last due unit
- This totals an overall response time of 11 minutes, 90 percent of the time.

Once the current deployment system is measured against this benchmark, the City can adopt different deployment measures more specific to the risk and emergency outcome needs in Vallejo, if the performance measures above do not meet the City's outcome needs.

The Department does have automatic and mutual aid response agreements with its neighbors and it participates in the Regional EMS System. Some partner agency stations are too far away to be "first responders" in lieu of a city crew and they best help with second-due, second alarm, freeway incidents or specialty incidents when multiple units over a longer period of time are needed. In 2006, the daily staffing per unit for the City was:

Per Unit			**Extended**
8 Engines @	3	Firefighters/day	24
1 Ladder truck/Quint	4	Firefighters/day	4
		Subtotal *firefighters:*	*28*
1 Assistant Chief @	1	per day for command	1
		Total 24/hr Personnel:	***29***

This daily staffing is usually adequate for the moderate type of fire risk presented in the City, as will be discussed later in the risk section of this report. However, due to terrain challenges and remote subdivision areas in the City and Fire District contract area, this staffing is not completely distributed for equitable first-due unit coverage to all the edge area neighborhoods. Additionally, for this staffing statement to be accurate for a building fire, the assumption is that the closest crews are available and not already operating on another emergency medical call or fire, which can and does happen.

Community Outcome Expectations and Existing Response Performance Measures – What is Expected of the Vallejo Fire Department?

The next step in the Standards of Response Coverage process is to review existing fire and emergency medical outcome expectations. This can be restated as follows: for what purpose does the response system exist? Has the governing body adopted any response performance measures? If so, the time measures used need to be understood and good data collected.

The residents of Vallejo, like most suburban communities that adjoin a major metropolitan area, probably expect excellent fire and emergency medical operations from their fire department. They probably do not expect a rural level of service. The Department has been reporting <u>average</u> response times for the arrival of the first unit, given most fire service records systems still use the traditional average measure.

Current best practice nationally is to measure percent completion of a goal (i.e. 90 percent of responses) instead of an average measure. This is because the measure of average just identifies the central or middle point of response time performance for all calls for service in the data set. From an average statement it is impossible to know how many incidents had response times that were way over the average or just over. For example, if a department had an average response time of 5 minutes for 5,000 calls for service, it cannot be determined how many calls past the average point of 5 minutes were answered in the 6th minute or way out at 10 minutes. This is a significant issue if hundreds or thousands of calls are answered way beyond the average point.

The performance goal used in this study (providing the first-due unit is at the scene of a critical emergency within the City limits in 7 minutes from fire dispatch receipt, 90 percent of the time) can deliver acceptable outcomes, ***if*** all parts of the system perform as designed and are available to respond. When one minute is subtracted from the 7 minutes for dispatch center processing, and, 2 minutes is subtracted for the crew to get dressed in protective clothing and get the unit rolling, then the study response goal equates to a 4-minute <u>*travel*</u> time.

A 4-minute <u>*travel*</u> time goal for the first-due unit is appropriate for built-up, traffic-congested suburban areas. For the best possible coverage, 4 minutes travel time is the goal recommended in national fire service guidelines. However, much of the older winding road network in Vallejo's hills does not easily support 4-minute travel times. To actually design the Vallejo fire service delivery system to support this 4-minute goal could significantly increase the number of fire stations. However, the risk levels and calls for service volumes do not support adding additional stations. This issue will be discussed in more detail below.

The Insurance Services Office (ISO) Fire Department Grading Schedule would like to see fire stations spaced 1.5 miles apart, which given travel speeds on surface streets, is a 3 to 4-minute travel time. The newer NFPA guidelines and the CFAI Standard of Response Coverage process,

as already discussed on page 3, both suggest a 4-minute travel time for the initial fire apparatus response and 8 minutes travel time maximum for the follow-on units.

More importantly, within the Standards of Response Coverage process, positive outcomes are the goal and from that crew size and response time can be calculated to allow efficient fire station spacing. Emergency medical incidents have situations with the most severe time constraint. In a heart attack that stops the heart, a trauma that causes severe blood loss, or in a respiratory emergency, the brain can only live 8 to 10 minutes maximum without oxygen. Not only heart attacks, but also other events can cause oxygen deprivation to the brain. Heart attacks make up a small percentage; drowning, choking, trauma constrictions or other similar events have the same affect. In a building fire, a small incipient fire can grow to involve the entire room in an 8 to 10-minute time frame. If fire service response is to achieve positive outcomes in severe EMS situations and incipient fire situations, ***all*** the crews must arrive, size-up the situation and deploy effective measures before brain death occurs or the fire leaves the room of origin.

Given that the emergency started before or as it was noticed and continues to escalate through the steps of calling 911, dispatch notification of the crews, their response and equipment set-up once on scene, there are three "clocks" that fire and emergency medical crews must work against to achieve successful outcomes:

1. The time it takes an incipient room fire to fully engulf a room, thus substantially damaging the building and most probably injuring or killing occupants, if they are unable to evacuate on their own.
2. When the heart stops in a heart attack, the brain starts to die from lack of oxygen in 4 to 6 minutes and brain damage becomes irreversible at about the 10-minute point.
3. In a trauma patient, severe blood loss and organ damage becomes so great after the first hour that survival is difficult if not impossible. The goal of trauma medicine is to stabilize the patient in the field and get them to the trauma surgeon inside of one hour.

Somewhat coincidently, in all three situations above, the first responder emergency crew must arrive on-scene within 5 to 8 minutes of the 911 call to have a chance at a successful resolution. Further, the follow-on (additional) crews for serious emergencies must arrive within the 10 to 11-minute point.

The three event timelines above start with the emergency happening. It is important to note the fire or medical emergency continues to deteriorate from the time of inception, not the time the fire engine actually starts to drive the response route. It is hoped that the emergency is noticed immediately and the 911 system is activated. This step of awareness – calling 911 and giving the dispatcher accurate information – takes, in the best of circumstances, 1 minute. Then crew notification and travel take additional minutes. Even if the crew arrives within 7 minutes of the call to 911, the crew must still walk to the patient or emergency, size-up the problem, and deploy their skills and tools. Even in easy to access situations, this step can take 2 or more minutes. This takes considerably longer in rural homes up long driveways, garden apartment buildings with limited street access, multi-storied office complexes or shopping center buildings such as those found in parts of the City.

Thus, from the time of 911 receiving the call, an effective deployment system is ***beginning*** to manage the problem within 7 to 8 minutes total reflex time. This is right at the point that brain death is becoming irreversible and the fire has grown to the point to leave the room of origin and

become very serious. Thus, the first-due response goal in this study is within the range to give the situation hope for a positive outcome, as does the goal for the balance of a multiple-unit firefighting force. Yes, sometimes the emergency is too severe even before the Fire Department is called in for the responding crew to reverse; however, given an appropriate response time policy and a well-designed system, then only issues like bad weather, poor traffic conditions or multiple emergencies will slow the response system down. Consequently, a properly designed system will give the citizen the hope of a positive outcome for their tax dollar expenditure.

For this report, response time is "total reflex time," which is the sum of the fire dispatch, crew turnout and road travel time steps. This is consistent with the recommendations of NFPA and the CFAI.

Over the 24-month data period the Vallejo Fire Department responded to an average of 28.59 incidents per day of all types, broken down as: 21.90 EMS incidents per day, 1.51 fire incidents per day, and 5.18 other incidents per day. For the 24-month time period, 5.28 percent of incident responses were to fire, 76.60 percent to EMS, and 18.12 percent were to other types of incidents.

In the last **12** months of data, the *average* response time was 5:32 minutes. Presented below is a fractile analysis of the total calls for service response time in the most recent 12-month data set.

In order to perform total response time calculations, fire dispatch "Time of Call" data was imported and merged into incident data. To eliminate unusual incidents, only incidents with response times less than or equal to 15 minutes were included. Only incidents occurring inside a station area were used for the following measurements. 9,176 incidents matched these criteria.

1st Apparatus On Scene <= 03:00 6.4%
1st Apparatus On Scene <= 04:00 18.9%
1st Apparatus On Scene <= 05:00 41.5%
1st Apparatus On Scene <= 06:00 65.2%
1st Apparatus On Scene <= **07:00 82.5%** (7,569 calls) – *Desirable Goal Point (2-min turnout)*
1st Apparatus On Scene <= **08:00 90.7%** (8,314) – actual performance

If the prior 12-month incident data set is reduced to fire and EMS incidents, the following fractile performance results are observed:

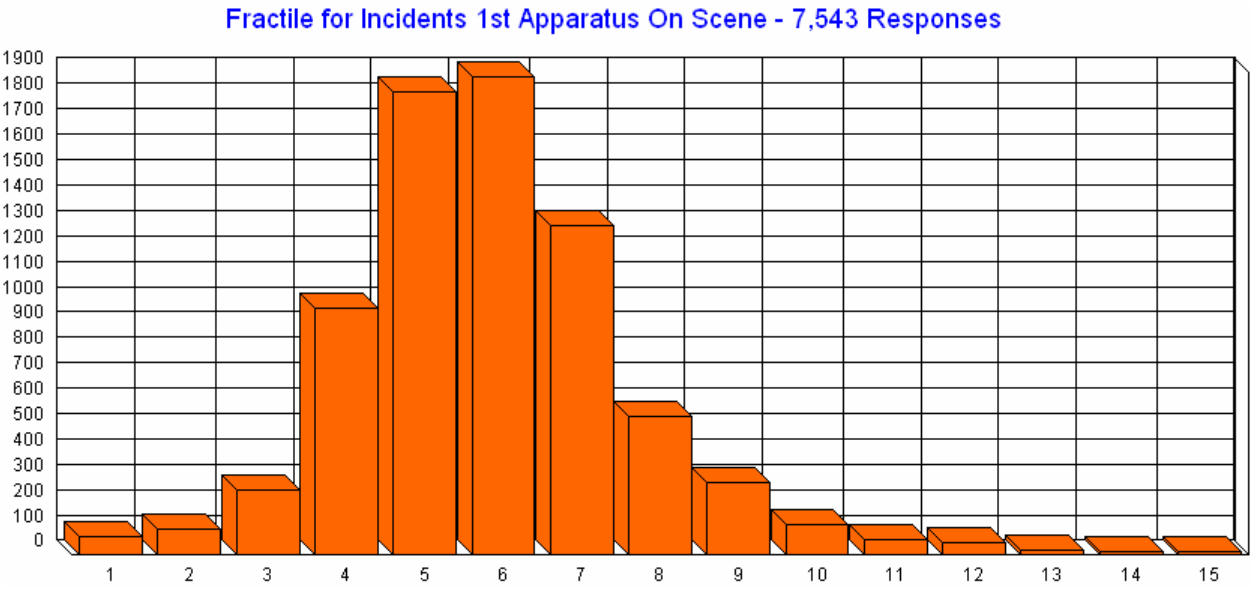
There are 7,543 Incident records being analyzed:

1st Apparatus On Scene <= 03:00 5.8%
1st Apparatus On Scene <= 04:00 18.7%
1st Apparatus On Scene <= 05:00 42.9%
1st Apparatus On Scene <= 06:00 68.0%
1st Apparatus On Scene <= **07:00 85.2%** – *Desirable Goal Point (2-min turnout)*
1st Apparatus On Scene <= **07:30 89.6%** (6,756 calls) – actual performance

Here is a breakdown when incidents are narrowed down for structure fires in the last 12 months: There are 161 Incident records being analyzed:

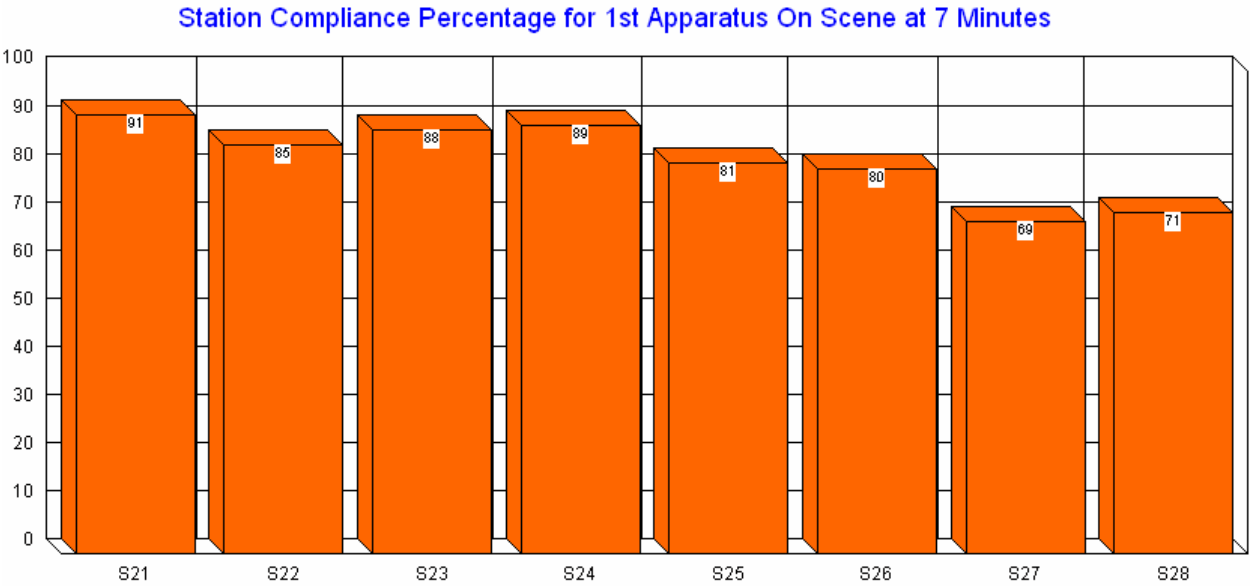
1st Apparatus On Scene <= 03:00 5.0%
1st Apparatus On Scene <= 04:00
1st Apparatus On Scene <= 05:00 34.2%
1st Apparatus On Scene <= **07:00 78.9%** – *Desirable Goal Point (2-min turnout)*
1st Apparatus On Scene <= **08:15 89.4%** (144 calls) – actual performance

Fractile response times can also be viewed graphically. Here is a graph illustrating the number of incidents by response time minute for fire and EMS incidents. Incidents with a zero response time were eliminated from the graph.



Notice the minute with the most 1st arriving apparatus is minute 6; however, minute 5 has nearly an equal number of arriving responses. This graph illustrates there are more responses to the left of 6 minutes (shorter than 6 minutes) than to the right of 6 minutes (longer than 6 minutes). This "left-shifting" of the graph indicates a setting where most responses are to locations near a fire station. Comparatively few responses are to remote locations.

The graph below compares the overall 7-minute response time compliance percentage for the first apparatus to arrive on the scene by station in the last 12 months of the data set. Notice incidents occurring within the Station #21 and Station #24 response areas have the greatest percentage of compliance. Station #27 lags far behind.



Given the citywide performance of 7:00 minutes at 85.2 percent, the City *just* does not meet the response goals recommended by national organizations and Citygate Associates that 90 percent of the incidents be responded to within 7 minutes. Here is how the fractile performance looks by first-due Station Area at the 7th minute in the most recent 12-month fire and EMS incident data set. Only fire and EMS incidents with response times greater than zero and less than 15 are represented:

Station Areas	*Actual Minute @ 90%*	*Compliance Level @ 7 minutes**
21	**7:00**	**90.8%**
22	**7:30**	**85.2%**
23	**7:15**	**88.4%**
24	**7:10**	**88.9%**
25	**8:15**	**80.9%**
26	**8:20**	**79.8%**
27	**9:30**	**68.8%**
28	**8:45**	**71.1%**

**Desirable Goal point using 2 minutes for turnout*

The question the above table does not answer is, of the 1,715 incidents fire and EMS incidents not responded to within 7 minutes in the most recent data set, in what response minute did those incidents receive a unit?

In fact, the performance in the next 45 seconds is improved substantially. By total reflex minute 7:30, when the on-scene situation is becoming critical, another 331 citywide fire and EMS incidents are covered, raising compliance to 90 percent first-due unit performance.

The next question is, of the calls not covered by 7:30, how many are there and in what minute is the 100 percent point achieved? There are still 779 fire and EMS calls for service that receive a response time above the 90 percent point of 7:30. The 100 percent point is finally reached at minute 15:00. While significant to the citizens on the calls receiving longer response times, these calls represent just 10 percent of the total fire and medical calls, including service out to the County areas and hard to reach freeway calls. Many suburban departments would be very happy with only 10 percent of the calls for service laying outside the desired performance goal. Given the strong performance in Vallejo close to minute 7, that is why the Department's reported average response times are very good at 5:32 minutes/seconds and with many incidents close to the core stations, the average does not reflect true performance out to Hiddenbrooke, which will be reviewed separately.

Why not a 100 percent measure? No department is expected or designed to cover all incidents. It is an acceptable practice to leave 10 percent for responses to fringe areas, or for the occasional periods when the City is short of resources given multiple calls for service during peak hours. For this review, we are modeling the City's prior performance and comparing the data results to a recommended 7-minute total response time. Later, this study will integrate all the SOC study elements to propose refined deployment measures that best meet the risk and expectations found in the City.

Call Processing Time

Call Handling Time for all fires and EMS responses in the last 12 months can be broken down as follows. There are 9,154 Incident records being analyzed.

Call Processing <= 01:00 57.9%
Call Processing <= **02:00 91.4**%

NFPA recommendations are that 90 percent of critical calls be dispatched in 1:00 minute or less. The City's communications center generally takes longer than this; and so dispatch should receive additional scrutiny to see if time performance can be improved, because this "longer dispatch time" contributes to the ability of the stations to be "on scene" 90 percent of the time within the 7-minute standard. If 90 percent of the calls received can be dispatched within the 1-minute goal, then the total response time compliance for 90 percent of the calls within the City falls to 6:30. This is ***faster*** than the 7-minute standard and excellent performance on 90 percent of the calls. The City needs to focus on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time.

Crew Turnout Time

Crew turnout time is a variable of the total response time that is completely within the Fire Department's control. The NFPA suggests that an ideal turnout time goal is to have the apparatus moving within 1 minute of the crew being alerted 90 percent of the time. However, until recently, the fire service has not really measured this time. In the departments that have, a more realistic turnout time measure reflecting station design and donning protective clothing is 2 minutes at 90 percent.

Here is a breakdown of turnout time for all apparatus arriving first on the scene in the last 12 months of data. Only the apparatus to reach each fire and EMS scene was included.

There are 8,364 Apparatus records being analyzed.

Turnout <= 00:01:00 78.7%
Turnout <= 00:**01:30 91.9%**

For a department that has not been measuring turnout time, this is good performance; with focus it can be better. The Department needs to focus on lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent.

Travel Time

The traditional method of reporting time in the fire service was travel time. Here is a summary of travel time for fire and EMS incidents in the most recent 12-month data set for the City. There are 8,165 incidents analyzed.

Travel <= 00:03:00 32.8%
Travel <= 00:04:00 61.3% – Desired Goal Point
Travel <= 00:05:00 82.2%
Travel <= 00:**05:45 90.0%** – actual performance

While the travel time performance is not at the national ideal of 4 minutes, given the non-grid road network in the City and the hilly terrain, 90 percent by the 5:45 (minutes: seconds) point is very good performance given the terrain, and is within norms for acceptable outcomes. This measure, along with total response time performance being only slightly longer than the desired 7 minutes at 90 percent, means there is very little wrong with the station location system from a response statistics perspective. Geographic mapping and further statistical inquiry will follow below to complete the analysis. The above three time segment measures cannot be added to one total, as there are different call counts involved. The overall measure of 07:30, 89.6 percent for fire and EMS incidents reflects that on some calls, one or more of the above time segments is actually accomplished very quickly, thus lowering the aggregate measure Department-wide.

Analysis

The point of this brief overview of response time performance is that the City station spacing is not very challenged meeting a 90 percent performance goal in most sections of the City. As will be identified in a later chapter, this is not true of the Hiddenbrooke area, or the County contract area. Further, when adopting performance measures, the City leadership must understand and define what type of coverage is to be designed for and measured. NFPA guidelines ask that 90 percent of the historical incidents Department-wide be covered. There are two flaws to this NFPA approach:

1. The Department is allowed to average unit performance across an 8-station system. Thus, the higher performing units with many calls close to their fire stations generate a high percent of completion measures, typically above 90 percent. When such high performing stations are averaged with low-call-volume stations that may only be performing at 75 percent, the Department-wide measure will not reveal the lower performing fire station areas. This is seen in the table on page 9, where Station #27 performs substantially weaker than the other stations.

2. Second, measuring performance based on prior calls Department-wide does not guarantee **equity** of opportunity to receive adequate service, if and when a call occurs. What a department should do is design a response system to cover 90 percent of the ***geography*** and of the actual calls. This is the approach taken in the Standards of Response Coverage process as published by the Commission on Fire Accreditation.

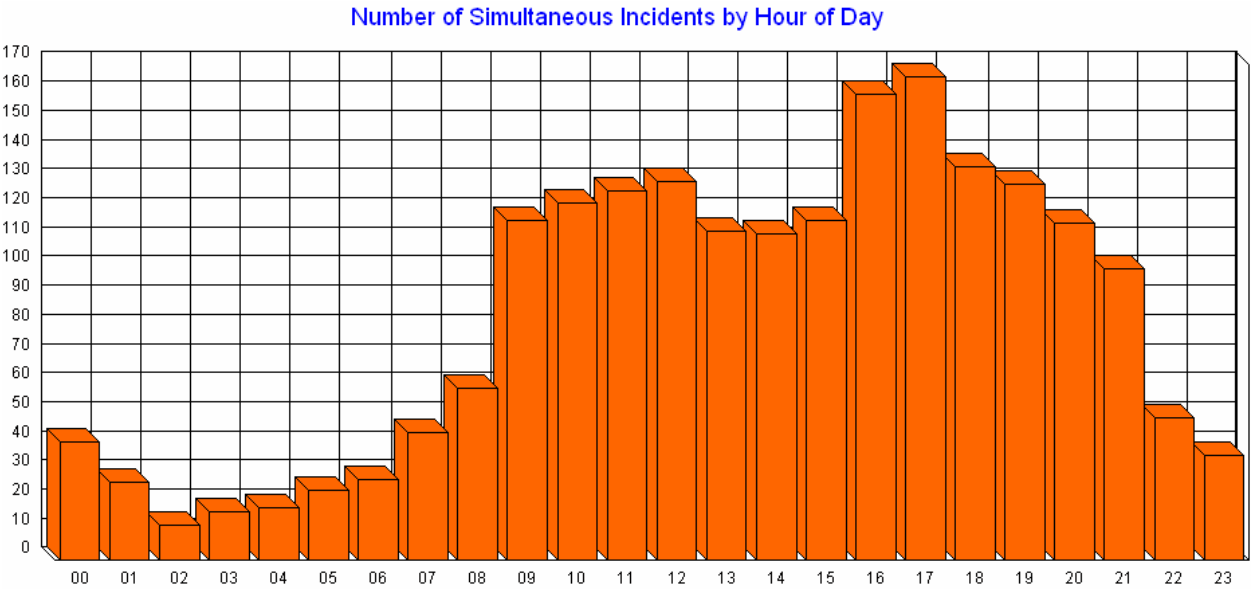
The above, brief recap of the data from the statistical appendix to this report paints a picture of *slightly slow* dispatch center performance and crew turnout time. The travel times and total response times *averaged citywide* are very close to national recommendations. Again, if dispatch reflex time and crew turnout time were both improved, the fire station spacing system **would** perform to the 7-minute, 90 percent goal point.

Another issue making some responses slow is a simultaneous call for service rate of **39** percent. This is a moderate to slightly high percentage in Citygate's experience indicating a significant demand for services within the City at peak hours of the day. Obviously, incidents that occur at the same time tax fire department resources more than those occurring when there is no other fire department response activity.

Here is the breakdown by number of simultaneous incidents in the 24-month data set:

At least 2 Incidents occurring at the same time	39.04%
At least 3 Incidents occurring at the same time	9.58%
At least 4 Incidents occurring at the same time	1.88%
At least 5 Incidents occurring at the same time	0.33%

The graph below illustrates the hourly distribution of 3 or more (9.58 percent) simultaneous incidents. This graph roughly follows the distribution frequency of incidents in general, although there is a noticeable spike in simultaneous activity during the evening rush hour. However, the percentage of simultaneous incidents remains relatively constant during a 24-hour day.



39 percent of the time, having two incidents working challenges an 8-station location system. When the unit closest to an emergency is on a call, and another call for service occurs in its area, then a "cover" unit must respond over a greater distance with a resultant longer travel time. These measures need to be kept in mind as the City looks at risk in the community and uses map models to look at travel time performance of the 8 stations.

Risk Assessment for Building Fires in Vallejo – What Assets Are at Risk in the Community?

City residents, if asked, would probably expect that fires be confined to the room or nearby area of fire origin and those medical patients salvageable upon arrival have their injuries stabilized and be transported to the appropriate final care location. Thus, the challenge faced by the City is to maintain an equitable level of fire service deployment across the entire City area, without adding significantly more resources as demand for services grows and traffic congestion increases, slowing response times.

Vallejo is an older community as compared to newer suburban areas of California. It is comprised of areas of open space, with pockets of light to high density residential. Most of the community is residential. There are typical retail and commercial centers.

The low density of building development and positive socio-economic factors in Vallejo account for a fairly small fire loss history for the prior three years:

2004-05	2005-06
125 Building fires - $2,507,700 loss	188 Building fires - $2,961,302 loss

This level of fire loss is very modest when compared to the assessed valuation for developed property in the City in the billions of dollars. The modest level of loss is a result of newer buildings built under better codes, with good fire prevention, as well as an early fire attack that prevented more loss. Most building fires in the City recently have started small, and allowed the First Alarm on-duty force to catch them. As the critical task measures and response time performance components of this study will show, the City is staffed with enough dedicated firefighters to contain a fire that is very serious and threatening lives when it is reported, if it occurs in the areas of the City where first-due travel times are adequate, or when multiple EMS calls are not consuming resources.

Patient medical outcomes were not part of this study. However, staff feels that the paramedic program meets the Emergency Medical System clinical requirements and that patient outcomes are good, with most patients that are salvageable on arrival surviving to the hospital.

In order to understand the importance of response time in achieving satisfactory outcomes, the deployment of resources must be based upon assessment of the values at risk. There are actually many different *types* of values at risk depending upon the nature of the emergency. At a very basic level, a fire in a structure is among the most frequent event with a measurable outcome. A medical aid is a different event, and while it is the most frequent, it is not as threatening to life and property as the structure fire.

From a hazard, risk and value perspective, the number of structural fires is usually linked to the distribution and concentration of different building types in the community. As is expected in a suburban area, communities have a very specific growth and development pattern consistent with past decisions or land use. As would be anticipated, there are pockets of various densities of housing stock ranging from low-cost, high-density housing to high-cost, low-density neighborhoods. There is widespread distribution of neighborhood retail and commercial facilities. Along the main transit routes are typical commercial, mixed and public uses. Then, of course, there are areas of high concentration of values in areas that exist in the traditional "downtown" areas. There are areas in which many job provider and sales tax businesses are located.

The incident reporting system indicates a wide variety of events that can result in a call for service, but it is a reported fire in a building that is the essence of a fire department's deployment plan. This same reporting system is often the only statistically significant evidence of the frequency and consequence regarding the values at risk in any community.

For this study, Citygate has reviewed the Department response performance information, its operational plans and community zoning. Citygate also interviewed Fire Department members and team members drove through some of the community. As is expected in a suburban area, much of the City consists of low and medium-density residential housing. There are some pockets of higher density residential housing and newer commercial development. Housing areas are, of course, complimented by retail/commercial/industrial development zones. In addition, the downtown core areas contain some multi-story, older buildings. The entire City contains most of the risks present in any developing suburban area adjoining a metropolitan area in the United States today.

Building Fire Risk

In a Standards of Response Coverage study, building fire risk is studied to identify key issues about buildings in the community such as size, construction type, fire flow, and occupant safety factors. Based on those factors, the fire station deployment system can be designed to place firefighters where the risk is the greatest.

As are many suburban communities, Vallejo is comprised principally of low-density housing. This type of building is considered a moderate or "typical" fire risk, both to occupants and firefighters. If a community were only comprised of one building type, then the response system could be uniform throughout the community. However, some buildings present a more significant risk to occupants if they catch fire, and fires in these buildings also require more firefighters, in fewer minutes, with specialized tools to control.

In order to assess building fire risk in other than low-density housing structures, this study reviewed the building assessment data collected by the Insurance Services Office (ISO) for underwriting purposes. The ISO sends specialists into the field to evaluate higher risk properties for underwriting purposes. The current data file for the City of Vallejo has entries for 537 buildings. One of the underwriting factors is to calculate the fire flow that is the firefighting water needed in gallons per minute that a major fire in the building would require for the fire to be controlled. From fire flow, the number of hose lines, appliances, firefighters and pumpers can be calculated. ISO Fire Flow calculations range from 500 to 8,000 gallons per minute. Of the 537 evaluated buildings in Vallejo, 83 have a calculated fire flow in excess of 3,000 gpm. In

Citygate's experience, this is a large number for a suburban community of Vallejo's size and reflects the age and commercial building diversity in this historic community. This quantity of more significant risk buildings also indicates the need for a timely firefighting force that is more significant than that needed just for low-density housing stock.

Study map #2 plots the locations of the evaluated ISO sites. While there are some in all the station areas of the City, it can be seen that the highest concentration of these sites is in Station Areas 1, 3 and 4, where there is the largest quantity of higher-density residential, commercial and industrial zoning.

Another way to assess above average building fire risk and the resultant impacts on the fire deployment system is to assess the quantity of higher multi-story buildings, especially those with limited or no fire sprinklers and those that are residential properties. In order to be prepared for emergencies in these properties, the Vallejo Fire Department has cataloged them. These taller buildings and "target hazard" sites are presented in this table:

High Rise/High Risk Structures	Address	Stories	Fire Sprinklers
General Mills (Sperry Mills)	800 Derr	10	Yes**
Marriott Courtyard (formerly Holiday Inn)	1000 Fairgrounds Drive	5	Yes
Masonic Building	707 Marin Street	5	Yes
Georgia Street Plaza	301 Georgia Street	3	Yes
Commercial	329 Georgia Street	3+	No
Redman's Hall	332 Georgia Street	3+	No
I.O.O.F. Building	350 Georgia Street	3+	No
Commercial/Residential	419 Georgia Street	2+	No
Commercial/Residential	428 Georgia Street	3+	No
Commercial	431 Georgia Street	3+	No
Commercial	433 Georgia Street	3+	No
Commercial	436 Georgia Street	3+	Yes
Residential (apartments)	520 Georgia Street	3+	Yes
Residential (apartments)	545 Georgia Street	3+	No
Residential (apartments)	546 Georgia Street	3+	No
Sutter Cancer Center **(new center)**	100 Hospital Drive	3	Yes
Sutter Solano Medical Center	300 Hospital Drive	5	Yes
Marina Towers & Annex	601 & 575 Sacramento Street	13	Yes*
Kaiser Permanente	975 Sereno Drive	7	Yes
Casa de Vallejo (Senior Residence)	1825 Sonoma Blvd.	6	No ^
City Hall	555 Santa Clara Street	4+	Yes
JFK Library	505 Santa Clara Street	3+	Yes
Commercial	326 Virginia Street	3+	No
Empress Theatre	328 Virginia Street	3+	No

Target Hazards	Address	Stories	Fire Sprinklers
Residential (apartments)	316 Virginia Street	3+	No
Church	500 Virginia Street	3+	No
Museum	734 Marin Street	3+	No
Old Federal Building	823 Marin Street	3+	Yes
St. Vicnents School	400 Florida Street	3+	No
St. Vincents Church	420 Florida Street	3+	No
USA Classics Auto Museum	1525 Sonoma Blvd.	2+	No***
Commercial	1926 Sonoma Blvd.	2+	No
Church	2025 Sonoma Blvd.	3+	Yes^^
Veteran's Building	444 Alabama Street	3+	No
Church	900 Tennessee Street	3+	No
California State Maritime Academy	200 Maritime Academy Rd.	3+	Yes ^^^
Church	448 Carolina Street	3+	No
Vallejo Adult School	1140 Capitol Street	4+	No
7-Up Bottling Plant	425 Chestnut	2+	Yes
Solano County Health Department	355 Tuolumne Street	5+	Yes
Solano County Court House	321 Tuolumne Street	2+	Yes
Senior Housing	445 Redwood Street	3+	Yes
Senior Housing	400 Redwood Street	3+	Yes
Senior Housing	40 Valle Vista Avenue	3+	Yes
U. S. Forest Service	1323 Club Drive	5+	Yes
Touro University	83 De Toro Way	3+	Yes
Austin Creek Apartments	55 Valle Vista Avenue	2+	Yes
Senior Housing	2261 Tuolumne Street	3+	Yes
Senior Housing	350 Locust Drive	3+	Yes
Sereno Village (low-income apartments)	750 Sereno Drive	3+	Yes
Broadstone Village Senior Apartments	88 Valle Vista Avenue	2+	Yes
*** Marina Towers (14 stories) is currently being sprinklered**			
**** Vacated - going to be demolished and replaced with housing**			
+ = Actual roof/attic area is higher			
^ Common areas only			
^^ Common areas and undercroft			
^^^ Only certain buildings and areas are sprinklered			

Two of the high-rise buildings above are not covered with fire sprinklers. Eleven of the buildings above are 3 stories or taller. There are three buildings that are 3-story residential buildings that are not sprinklered.

Why be concerned about taller buildings and those that are not fully covered with fire sprinklers? They present a serious challenge if the fire is serious and blocking the exit ways. When this happens it takes more firefighters to evacuate the occupants and place hose lines into action. Additionally, and as importantly, it may take a ladder truck to either evacuate some of the occupants, or place firefighters above the fire level to search for victims, or to control the smoke and heat by ventilating the building. All these are typical tasks of truck (ladder) company crews. In some cases, direct fire attack cannot even be accomplished without the ventilation crew opening up the building to release the heat so the fire hose attack crew can get into the main fire area.

Given the 11 multi-story buildings in Vallejo, the age of some of these buildings, the fact that some are residential and not sprinklered, all lead to the finding that the Vallejo Fire Department needs the timely response of a ladder truck and crew, which Vallejo does have today. The City needs to recognize in its fire deployment planning where significant life hazard, tax and employer generators are located and continue to ensure an effective response force can arrive quickly enough at these higher risk sites.

Special Hazard Risks

The City has many businesses that use or re-sell hazardous materials. Examples range from gasoline stations to dry cleaners to industrial fabrication processes. These businesses are highly regulated by the building, fire and environmental codes. They are supervised and inspected by various agencies. While calls for service for hazardous materials incidents are low due to high regulations and good safety practices, the City still provides adequate deployment to these sites via its multi-agency response team from fire departments around the County, in addition to City resources.

Wildland Fire Risk

The City has pockets of grass and native trees in between developed areas and on the outskirts of the City. As is much of the Bay Area, the climate is dry most of the year, leading to grass fire potential. The Vallejo area of the region is also prone to steady wind at times of the day. Fortunately, the wildland fire model is mostly grass and not heavy brush and trees. Given this, the wildland fire risk is less than other areas and can be more easily controlled by preventive weed abatement measures. Additionally, the Department deploys specialized wildland fire apparatus.

Critical Tasks Time Measures - What Must be Done Over What Timeframe to Achieve the Stated Outcome Expectation?

Fires and complex medical emergencies require a timely, coordinated effort in order to stop the escalation of the emergency. In this phase of the Standards of Response Cover process, time studies must be performed to determine how many personnel are required over what timeframe to achieve the stated outcome expectation. Once the tasks and time to accomplish them to deliver a desired outcome are set, from that travel time station spacing can be calculated to deliver the requisite number of firefighters over an appropriate timeframe.

Offensive vs. Defensive Strategies in Structure Fires Based on Risk Presented

Most fire departments use a strategy that places emphasis upon the distinction between offensive or defensive methods. These strategies can be summarized as follows:

> *"It is important to have an understanding of the duties required at a structural fire to meet the strategic goals and tactical objectives of the Fire Department response, and fireground operations fall in one of two strategies –* ***offensive or defensive.***
>
> - *We may risk our lives a lot to protect* ***savable*** *lives*
> - *We may risk our lives* ***a little*** *to protect* ***savable*** *property*
> - ***We will not risk our lives at all to save what is already lost****.*
>
> *Considering the level of risk, the Incident Commander will choose the proper strategy to be used at the fire scene. The Incident Commander must take into consideration the available resources (including firefighters) when determining the appropriate strategy to address any incident. The strategy can also change with conditions or because certain benchmarks (i.e., "all clear") are achieved or not achieved.*
>
> *Once it has been determined that the structure is safe to enter, an* ***offensive*** *fire attack is centered on life safety. When it is safe to do so, departments will initiate offensive operations at the scene of a structure fire. Initial attack efforts will be directed at supporting a primary search – the first attack line will go between the victims and the fire to protect avenues of rescue and escape.*
>
> *The decision to operate in a* ***defensive*** *strategy indicates that the offensive attack strategy, or the potential for one, has been abandoned for reasons of personnel safety, and the involved structure has been conceded as lost (the Incident Commander makes a conscious decision to write the structure off). The announcement of a change to a defensive strategy means all personnel will withdraw from the structure and maintain a safe distance from the building. Captains will account for their crews. Interior lines will be withdrawn and repositioned. Exposed properties will be identified and protected."*

Many fire department deployment studies using the Standards of Response Coverage process, as well as NFPA guidelines, arrive at the same fact – that a moderate risk structure fire needs a minimum of 13-15 firefighters, plus one commander. The NFPA recommendation (modified for 2 minutes turnout time) used as an initial reference point in this report, is that the first unit should be on-scene within 7 minutes of call receipt (1-minute dispatch, 2-minute crew turnout and 4-minute travel), 90 percent of the time. The balance of the units should arrive within 11 minutes of call receipt (8-minute travel), 90 percent of the time, if they hope to keep the fire from substantially destroying the building.

For an extreme example, to confine a fire to one room in a high-rise building requires many more firefighters than in a single-story family home in a suburban zone. The amount of staffing needed can be derived from the desired outcome and risk class. If the City desires to confine a one-room fire in a residence to the room or area of origin, that effort will require three engines, one ladder truck and a Assistant Chief providing a minimum of 14 personnel. This number is the

minimum needed to safely conduct the simultaneous operations of rescue, fire attack, and ventilation plus providing for firefighter accountability *in a low to moderate risk, one attack line fire*. A serious fire in a two-story residential building or a one-story commercial or multi-story building would require, at a minimum, an additional 2-3 engines, an additional Truck and Assistant Chief, for upwards of 12+ additional personnel. A typical auto accident requiring patient extrication or other specialty rescue incidents will require a minimum of 7 firefighters plus the Assistant Chief for accountability and control.

Given the firefighter safety accountability regulations in place today, it would not be uncommon that even a serious house fire is drawing in one or two additional City or automatic aid units to raise fireground staffing to a minimum of 16. When this occurs, the City's remaining units and automatic aid units must cover any secondary calls for service that occur. Examining the incident data in this study showed 39 percent of the incidents occurred when the Department was already engaged in another response activity. In the study team's experience, this is on the higher side of typical for a suburban department.

This factor must be taken into account when planning the overlap between fire stations, so that second-due units can effectively cover into other station areas. The fact that calls for service occur during times of peak human activity, means that even two medical calls occurring at once remove from service two engines and possibly the Assistant Chief if one call is a rescue call. From a total on-duty firefighter count of 28, if 7 of the personnel are committed, this still leaves 21 firefighters and no Assistant Chief, which would be an adequate attack force on a typical building fire. However, a building fire and two medical calls at once will stress the City's resources.

In order to understand the time it takes to complete all the needed tasks on a residential moderate to high risk fire and a modest emergency medical rescue, the City conducted several timed trials using their standard operating procedures to demonstrate how much time the entire operations take. The following tables start with the time of fire crew notification and finish with the outcome achieved. There are several important themes contained in the charts below:

1. It is noticeable how much time it takes after arrival or after the event is ordered by command to actually accomplish key tasks to arrive at the actual outcome. This is because it takes firefighters to carry out the ordered tasks. The fewer the firefighters, the longer some task completion times will be. *Critical steps* are highlighted in ***grey*** in the table.
2. The time for task completion is usually a function of how many personnel are ***simultaneously*** available.
3. Some tasks have to be assigned to a minimum of two firefighters to comply with safety regulations. An example would be searching a smoke filled room for a victim.

The following table of individual duties is required at a First Alarm fire scene in a moderate risk building. This set of duties is taken from the City operational procedures and is entirely consistent with the usual and customary findings of other agencies using the Standards of Response Coverage process and that found in NFPA #1710.

Time starts at wheel stop of first arriving unit. The scenario represents a two-story, single-family dwelling fire, with approximately 500 square feet of fire involvement. No condition existed to override the OSHA 2-in-2-out safety requirement.

Scenario: A simulated bedroom fire in a first-floor apartment of a two-story wood apartment building. Two apartments per floor and limited access – one entry point served all four apartments. Responding companies were provided the following information: "you are responding to a reported structure fire on the first floor of a two-story apartment building with two apartments on each floor. We have reports of people trapped on the second floor. Black smoke is coming from the first floor windows at the "C" – "D" corner. Primary access to the building is on the "A" side, any other access will be by ladder."

Significant task completion times are noted in grey:

The task times were combined with real times for dispatch, turnout and travel times for a "typical" building fire response in the core of the City.

Time Line and Critical Measured Events	Elapsed Time	Task Completion
911 Call	00:00	
Call Handling Interval	01:45	01:45
Turnout Time Interval	02:45	01:00
Engine #26 Arrived on Scene	04:07	01:22
Report on Conditions/Assignments made	04:18	01:11
Assistant #21 Arrived on Scene	04:53	02:08
A/C obtains briefing from Eng. #26	05:25	00:32
A/C provides size-up and report	05:35	00:03
Second Alarm assignment requested	05:39	00:04
Truck @21 Arrived on Scene	05:42	02:58
Engine #23 Arrived on Scene/Acknowledged assignment	05:45	03:00
Truck #21 received and acknowledged assignment	06:09	01:30
Engine #27 Arrived on Scene	06:23	03:38
Attack Line (1 ¾") at door	06:45	02:38
Eng. #27 acknowledged as Rapid Intervention Team	07:00	00:37
Supply line dropped at hydrant	07:05	01:20
RIT equipment obtained from Truck #21 by Eng. #27	07:33	00:23
Primary search began by Truck #21	07:46	01:37
Water supplied to Eng. #26 by Eng. #23	08:10	01:05
Back Up hose line in place	08:20	01:05
Primary search completed	09:08	01:22
Utilities secured by Eng. #27	09:41	02:41
Secondary Search completed	09:46	
RIT hose line in place by Eng. #27	10:05	03:05
Horizontal ventilation started by Truck #21	10:48	04:39
Second floor window laddered by Eng. #27	12:37	04:37
RIT in place and ready for assignment	14:27	06:27
Scenario Ended	14:48	

The above duties grouped together to form an *effective response force or First Alarm Assignment*. Remember that the above discrete tasks must be performed simultaneously and effectively to achieve the desired outcome. Just arriving on-scene does not stop the escalation of

the emergency. Firefighters accomplishing the above tasks do, but as they are being performed, the clock is still running, and has been, since the emergency first started. However, due to having only 13 firefighters and one chief on the problem, it still took well past the room of fire origin flashover point to control the fire and remove the victims to safety.

For comparison purposes, the critical task table below reviews the tasks needed on a typical auto accident rescue call that requires two units using 6 firefighters total:

Scenario: Two vehicles were overturned, one flat on its roof with the driver still in the seat/restraints. The second vehicle was partially on top of the first, on the right side, with no one in it. Some motor fluids were leaking from the second vehicle. Responding companies were provided the following information: "you are responding to a vehicle roll over, there will be one patient and extrication will be required. The patient must receive full cervical spine precautions and at least one door must be removed to facilitate the extrication. Please perform any other actions you must take to maintain a safe and effective operation."

Time Line and Critical Measured Events	Elapsed Time	On Task
911 Call	00:00	
Call Handling Interval	01:15	
Turnout Time Interval	02:15	01:00
Engine #21 arrived on scene	05:00	02:45
Scene Survey/Walk Around	05:45	00:45
Report on Condition/Assignments Made	05:50	00:05
Patient Contact by Paramedic Assessment begins	06:00	01:23
Truck Company arrived on scene	06:36	
Assistant Chief on Scene	06:44	
Truck Capt. Received brief from Eng, Capt.	06:50	00:14
A/C assumed and named Command	07:04	00:20
Begin C-Spine packaging	07:23	
Charged hose line in place/staffed	07:57	01:57
Vehicle stabilized	08:43	02:07
Extrication equipment set up	09:57	03:21
Patient protected during extrication	10:58	
Door removed	11:16	01:19
Patient removed from vehicle	12:20	01:04
Cervical Spine packaging completed, ready for transport:	14:39	02:19

Critical Task Measures Evaluation

What does a deployment study derive from a response time and crew task time analysis? The total completion times above to stop the escalation of the emergency have to be compared to outcomes. We know from nationally published fire service "time vs. temperature" tables that after about 8 minutes of free burning a room fire will grow to the point of flashover where the entire room is engulfed, the structure becomes threatened and human survival near or in the fire room becomes impossible. We know that brain death occurs within 6 to 10 minutes of the heart having stopped. Thus, the effective response force must arrive in time to stop these catastrophic events from occurring.

The response and task completion times discussed above show that the citizens of Vallejo are able to expect good outcomes and have a better than even chance of survival in a *modest* fire or medical emergency, when the closest responding units ***are*** available ***and*** can arrive by minute 7 first-due and 11 minutes for the First Alarm. It was noted earlier in this report that 89.6 percent of the calls for fire and EMS service were arrived at by minute 07:30. Therefore, the current Vallejo deployment model works well in areas closer to available stations. In outlying areas, or when the first-due station is not available, a serious fire could grow to dangerous proportions.

In EMS incidents, the patient is initially being assessed within 6:00 minutes total reflex time and is able to be transported within 15 minutes. These times are good for trauma patients, when all the needed units can arrive by minute 7-8, which is not always possible at the outer edges of the City, or when multiple calls for service occur.

However, each of these incidents, while only being moderate in size, required 7-13 personnel, or at 13 personnel, 46 percent of the entire on-duty force. When this occurs, the City cannot field another First Alarm force without automatic aid. Thus, the total on-duty force can handle one or two serious emergencies at once, plus two routine medical calls.

Fires and complex medical incidents require that the other needed units arrive in time to complete an effective intervention. Time is one factor that comes from great station placement. Good performance also comes from ***adequate staffing***. On the fire and rescue time measures above, Vallejo can do a good job, in terms of time, on small fires and routine medical calls. This is typical of suburban departments that staff 3-person crews for average, routine emergencies. However, serious fires and medical emergencies, where the closest unit is not available to respond, ***will*** challenge the City response system to deliver good outcomes. This factor **must** be taken into account when we look at fire station locations.

Previous critical task studies conducted by members of the study team, the Standard of Response Cover documents reviewed from accredited fire departments, and NFPA recommendations all arrive at the need for 15+ firefighters arriving within 11 minutes (from the time of call) at a room and contents structure fire to be able to ***simultaneously and effectively*** perform the tasks of rescue, fire attack and ventilation.

With the staffing of the engines at 3, and the truck at 4, three outcomes will occur. First, only 13 firefighters (using the current 3-engine, 1-truck response model) will arrive on the initial effective response force. **If** this minimum sized force is not immediately available, the task completion times listed above will be even longer, because the tasks that need to be done by two firefighters for safety will be done in a linear order, not in parallel as is possible when a four-person crew or multiple crews can be split into two teams. Third, the moderate to large working fires and serious rescues will consume more engines to obtain the needed personnel. At peak demand times of the day, this approach to staffing becomes self-defeating as the additional units being dispatched leave deployment gaps, which then create longer response times for other incidents.

If fewer firefighters arrive, what from the list of tasks mentioned will not be done? Most likely, the search team will be delayed as will ventilation. The attack lines only have two firefighters, which does not allow for rapid movement above the first floor deployment. Rescue is done with only two person teams, thus, when rescue is essential; other tasks are not done in a simultaneous, timely manner. Remember what this report stated in the beginning – effective deployment is about the **speed** *(travel time)* and the **weight** *(firefighters)* of the attack.

Yes, 13 initial firefighters can handle a low to moderate risk house fire (especially on the first floor), but only if they do not need, at the same time, to perform rescue, fire attack and ventilation. An effective response force of even 14 (13+1 AC) will be seriously slowed if the fire is in a low-rise apartment building or commercial/industrial building.

Given the Vallejo response times and staffing levels, compared with mostly moderate building fire risk, the current structure fire response system meets the community's needs for *low to moderate risk one room fire on the first or second floor without challenging rescue, ventilation or exposure problems*. Obviously, in bad traffic or weather, even a properly designed system will have delays.

Thus, today, the City has enough on-duty personnel to handle a low to moderate one to two room building fire in a one to two-story building or a few medical incidents occurring at the same time. The Department would be seriously challenged to handle a working building or grass fire at the same time as two EMS incidents. The Department has served well within its existing staffing, equipment capabilities and training. When the on-duty staffing is stretched thin, the Department can and does bring in automatic or mutual aid equipment, but from a distance.

Distribution and Concentration Studies – The Locating of First-Due and First Alarm Resources

In brief, there are two geographic perspectives to fire station deployment:

- **Distribution** – the spreading out or spacing of first-due fire units to stop routine emergencies.
- **Concentration** – the clustering of fire stations close enough together so that building fires can receive enough resources from multiple fire stations quickly enough. This is known as the **Effective Response Force** or commonly the "First Alarm Assignment" **–** the collection of a sufficient number of firefighter's on-scene delivered within the concentration time goal to stop the escalation of the problem.

To analyze first-due fire unit travel time coverage for this study, this study used a geographic mapping tool that can measure travel time over the street network. For this next portion of the study, the study team used the basemap and street travel speeds programmed to simulate real world fire truck travel times. Using these tools, the study team ran several deployment studies and measured their impact on various parts of the community. The time measure used was 4 minutes travel over the road network, which is consistent with a recommended goal of 7 minutes total reflex time (1+2+4) for a first-due unit and 11 minutes total reflex time (1+2+8) for the First Alarm using a realistic 2-minute turnout time.

Map #1 – Station Locations

This view shows the existing Vallejo fire station locations, with City land areas in light beige. Also shown are the streets to the east of the City in the Fire District that Vallejo Fire also protects. This is a reference map view for the other map displays that follow.

Map #2 – Insurance Service Office (ISO) Evaluated Buildings

Map #2 displays the locations of the buildings evaluated by the ISO for underwriting. The size of the dot corresponds to the quantity of calculated fire flow that a major fire in that building would require. While there are some buildings in all of the fire station areas, it is obvious that the majority of the higher fire flow buildings are in the western core of the City, near Stations #21, #23 and #24 and the ladder truck located at Station #21.

Map #2a – City Target Hazard and Taller Buildings

Displayed here are the locations of the previously identified higher risk and taller buildings in the City. As with the higher fire flow buildings, there are more of these properties in the western core of the City in Station Districts #21, #23 and #24. Given these locations and the ISO higher fire flow building locations, the ladder truck located at Station #21 is necessary and properly located.

Map #3 – First-Due Unit Distribution

This map shows in green the street segments and the *distribution* or first-due *travel* time for each station per a response goal of 4 minutes travel time (7 minutes total reflex). Thus, the computer shows how far each company travels within 7 minutes fire department response time from the time of the communications center receiving the call. Therefore, the limit of color per station area is the time an engine could reach, ***assuming*** they are in-station and encounter no unusual traffic delays. The computer uses travel speeds calculated from actual apparatus travel times from the Department's incident report data system and posted speed limits per roadway type. Thus, the projection is as "actual world" as possible.

While no department can be expected to serve every road segment out to the edge of their jurisdiction, in 4 or even 6 travel minutes, these maps show the edge areas of the City's streets and much of the eastern Fire District contract area are not covered in 4 travel minutes. Given the lack of gaps in all but the edge areas, Vallejo is adequately covered by first-due fire stations except for the Hiddenbrooke Development, some of the southern water front areas and the south end of Mare Island. The findings of this map are correlated by the strong response time findings in the green covered areas. The Hiddenbrooke distances are separately measured in Maps #3a, #5a and #20a and will be described in the separate Hiddenbrooke chapter later in this report.

The purpose of computer response mapping is to determine and balance station locations. This geo-mapping design is then checked in the study against actual dispatch time data, which reflects the real world. There also should be some overlap between station areas so that a second-due unit can have a chance of an adequate response time when they cover a call in another department. Overlap areas will be measured in a later map series.

Map #4 - ISO Coverage Areas – Engine Companies

This map exhibit displays the Insurance Service Office (ISO) requirement that stations cover a 1.5-mile distance response area, but without the 4-minute travel streets turned on. This makes it easier to see where the traditional 1.5-mile measure does not cover. Depending on the road network in a department, the 1.5-mile measure usually equates to a 3 to 4-minute travel time. However, a 1.5-mile measure is a reasonable indicator of station spacing and serves to check if the travel-speed-based Map #3 is too optimistic or not.

In Vallejo's case, this map shows there is adequate primary 1.5-mile coverage in the core areas of the City. While the 1.5-mile distance measure is more restrictive, the speed-based map is not much faster, and thus is to be believed over the hilly terrain found in Vallejo.

Map #5 – Concentration Coverage for ALL First Alarm Units

This map exhibit shows the *concentration* or massing of fire crews for serious fire or rescue calls. Building fires in particular require 12+ firefighters arriving within a reasonable time frame to work together and effectively to stop the escalation of the emergency. Otherwise, if too few firefighters arrive, or arrive too late in the fire's progress, the result is a greater alarm fire, which is more dangerous to the public and the firefighters.

The concentration map exhibits look at the Department's ability to deploy three of its stations, the one Truck Company, and Assistant Chief both located at Station #21 to building fires within 8 minutes travel time (11 minutes total Fire Department response time). This measure ensures that a minimum of 13 (3-engine/4-truck staffing) firefighters and one Assistant Chief deployed can arrive on-scene to work ***simultaneously*** and effectively to stop the spread of a modest fire.

The colors in the map show the area in **green** color where the Vallejo fire deployment system delivers the initial effective response force. Streets without the green highlights are less than 4-unit coverage.

Map set #5 shows, as did the first-due Map #3, that there is strong coverage by the First Alarm force in all but the same edge areas of the City. Again, the largest edge area under served is the Hiddenbrooke Development and will be discussed in detail in a later section of this study.

Map #6 – Engine Concentration

Displayed here is a subset of Map #5 above - First Alarm Concentration. Map #6 only measures the area covered by 3 Stations (engines) in 8 travel minutes. As shown here, the 3-engine coverage area is *larger* than in Map #5 because the ladder truck and Assistant Chief only respond from Station #21. This map clearly shows much better coverage in the eastern contract Fire District area and a little better coverage on the access road to Hiddenbrooke and in the eastern neighborhoods east of Station #24. Getting three engines to this much of the City in 8 travel minutes shows a very good station placement for all but the Hiddenbrooke area.

Map #7 – Ladder Truck Coverage

Displayed here is another subset of Map #5 above - First Alarm Concentration. This map displays the 8-minute travel time coverage for the ladder truck from Station #21. There is good coverage especially to the commercial and industrial higher risk areas of the City. The ladder truck is properly located.

Map #8 – Assistant Chief Coverage

Displayed here is another subset of Map #5 above - First Alarm Concentration. This map shows the 8-minute travel time coverage for the Assistant Chief from Station #21. As with the ladder truck, the Assistant Chief coverage is excellent in the core areas of the City, and falls off in the Fire District contract area and in Hiddenbrooke.

Map #9 – Engine Concentration Density

Map #5 showed the concentration coverage for 3 engines, 1 Truck, and 1 A/C as one color. Here, using color bands, the areas receiving the least to most multiple-*engine* coverage are shown. The important finding in this map is that the higher-risk, western core areas of the City, where the target-hazard buildings, the majority of the ISO-evaluated buildings, and the taller buildings exist, can receive upwards of eight (8) engines in 8 minutes travel time. This is equivalent to a second alarm in the higher risk areas. This is the result of good station placement and the fact that when stations are placed out into the outer "quadrants" they can come to the center quickly where the greater risk buildings are located. Furthermore, much of the City core receives coverage from five (5) stations in 8-minutes travel, which means good second or third-due unit support when the primary unit is already busy on a call, when another incident occurs.

Map #10 – Engine Staffing Density

Engines do not put out fires, the firefighters do. This map is a variant of Map #9 and shows how many firefighters are deployed to a given area within 8-minutes travel time. This map clearly shows the bulk of the on-duty staffing is available to the older, higher risk core areas of the City. This means that a fire in a high-risk building does not have to wait for distant mutual aid staffing to arrive, but rather the Vallejo Fire Department can and does field a significant on-duty force in the higher risk areas.

Map #11a and 11b – ISO 1.5 Mile Station Overlap Areas

Pertinent questions are: what is the overlap of the stations; was the travel time map measure too generous; and, could a station be closed?

In order to use a conservative measure, this map uses the desired ISO 1.5 driving distance measure, instead of road speeds. Map #11a plots the boundary of each station area in a different color and then in green tones the overlap. Basically, except for the core of Vallejo, each neighborhood is only covered by one station.

Map #11b shows what causes the overlap by removing Station #21. Now, most of the overlap is reduced. However, some overlap is necessary for First Alarm concentration and for simultaneous calls for service in high call volume areas.

Station #21 has the highest call for service workload in the department, followed closely by its neighbor stations:

Station #21	4,311	*St Vincent Hill*
Station #23	4,025	Redwood/Sonoma Area
Station #24	3,842	Springstowne Area

Furthermore, Station #21 responds to approximately 220 calls per year to principally three other Districts - #22, #23 and #24. Given this high workload due to the call for service in the older part of the City, if Engine #21 was closed and all the work transferred to Stations #23 and #24 principally, then response times would suffer in most of the City. Response times would be longer into downtown and the simultaneous calls in the other districts would not have timely back-up. Thus, the positive effect of this station is to not only provide good first-due times in the western core, but supports Districts #22, #23 and #24. Closing this engine would significantly

lengthen response times and multiple-unit responses (First Alarm coverage) across the western two thirds of Vallejo.

The ladder truck also responds to more than serious building fires. It can cover simultaneous calls for service in the western city, as well as being properly located in the older, higher-fire-risk western core of the City. The ladder truck handles approximately 387 calls per year, basically one per day to Districts #21, #22, #23, #24, #25, and #27. Simultaneous calls in District #26 are usually handled by Stations #22 and #24.

Map #12 – All Incident Locations

Plotted here are the locations of all calls for service for one year. Most neighborhoods experience at least some calls for service in one year. The newer and less-developed areas as well as the Fire District contract area have fewer calls in a year's time. This is a function mostly of population density – given that two-thirds of the calls for service are medical, people drive calls for service.

Map #13 - EMS Incident Locations

This map set further breaks out only the emergency medical and rescue call locations. Again, with the majority of the calls for service being emergency medical, almost all areas need Fire Department services over a year's time.

Map #14 – All Fire Type Locations

This map set identifies the location of all fires in the City. All fires include any type of fire call from auto to dumpster to building. There are obviously fewer fires than medical or rescue calls. Even given this, it is evident that all first-due engine areas experience fires.

Map #15 – Structure Fire Locations

This map is similar to the previous map, but only displays *structure* fires for the most recent 12-month data set. While the structure fire count is a smaller subset of the total fire count, there are two meaningful findings to this map. There are still structure fires in every first-due fire station area. However, there are more fires in Station #21's area, right in or near the significant risk buildings and the commercial zoning. These areas and buildings are of significant fire and life loss risk to the City. Fires in the more complicated building types must be controlled quickly or the losses will be very large. As Map #5 showed, the First Alarm coverage in this area is very good and this is one reason why there are not devastating fire losses currently in the City. Even when a serious fire occurs in an older building, the "weight" of the attack is timely, both in terms of time and total staffing, so the fires are controlled closer to the fire crews arrival.

Map #16 – All Incident Location Hot Spots

This map set examines, by clustering into "Density Spots," small areas where the density of calls for service is the highest. This type of map makes the location of *frequent* workload more meaningful than just mapping the dots of all locations as done in Map #12.

Why is this perspective important? Overlap of units and ensuring the delivery of a good concentration for the effective response force. When we compare this type of map with the concentration map, we want the best concentration to be where the greatest density of calls for service occurs. As Map #15 noted, many of the structure fire locations occur in Station Area

#21, where the significant risk areas and commercial zoning exists. Also important, this map shows why Engine #21's workload is so high. Given the high workload in the western city, a "double crew" station is of real benefit. Where a community needs a ladder truck, it should be located near the higher risk buildings and the highest density of calls for service, so that it can cover simultaneous calls that the primary engine cannot.

Map #17 – EMS Incident Location Densities

This map set is similar to Map #16, but only the medical and rescue hot spots of activity are plotted. The clusters of activity look very similar to the all-incident set in Map #16 because medical calls are such a large part of the total.

Map #18 – All Fire Location Densities

This map sets shows the hot spot activity for all fires. Again, the call densities are highest in Station Area #21's area, where there is high workload and simultaneous calls for service.

Map #19 – Structure Fire Densities

This map only shows the building fire workload by density. Here, once more, the activity cluster is in Station Area #21's area.

Map #20 – Hiddenbrooke Area Travel Times

This map zooms in on Hiddenbrooke to show the coverage from Station #27. As the citywide 4-minute coverage maps displayed, the 4-minute times end just east of the freeway interchange. From 4 to 8 minutes, about 50 percent of the development is covered from Station #27. The balance of the area would experience travel times from 8-12 minutes out to the very ends.

Map #21a to #21g – Coverage without One of the Fire Stations

This map uses subtraction to show the effect of closing a fire station one by one. Map #11 showed the overlaps all at once. In this series, in Station Number order, each fire station is turned off. The travel coverage measure used is the ISO 1.5-mile driving distance, as it is not subject to the variances of using computer-modeled speeds over the street network.

Map #21a shows the effect of not having Station #21. While most, but not all of the area is covered by the other stations, the "seams" between Stations #22, #23 and #24 are readily apparent. Thus, there is no overlap, which is not desirable given the high call for service rate in District #21, the higher risk properties in the older core of the City, and the citywide 39 percent simultaneous call for service rate.

The balance of this map series shows the effect of each station closure in order. Every other closure uncovers a significant neighborhood area. This perspective also shows how, in other than the case of Station #21, there is very little overlap between the station areas, as station density Map #11 also displayed. Thus, the stations are properly spaced out across the City, with the exception of coverage to the Hiddenbrooke area. This is especially true given the hilly terrain and non-grid street network in much of Vallejo.

Given the higher building fire risk and high calls for service in Station #21's area, it does not make sense to transfer a crew, either engine or ladder out to a 9th station for the lower population density and call for service rate in Hiddenbrooke. Other solutions must be found for this area.

As for the case of the low call volume and population density of Station #28, which is very similar to Hiddenbrooke, the fiscal situation is very different for Station #28. The Mare Island re-use area established a benefit fee assessment district to pay for the complete costs of Station #28 and its staffing. This was necessary to replace the Navy firefighters that had previously covered Mare Island. Since this station and staffing is paid for separately from the General Fund of the City, this engine crew cannot be transferred to protect the Hiddenbrooke northeast area. While the need for this engine is low today, as the re-use area grows, so will the calls for service. This is different from the largely built-out Hiddenbrooke area.

Another factor driving the need for a Mare Island fire station is the lack of access (as is true also in Hiddenbrooke). This lack is not just the two access points only from the east to the island, but the fact that one of them is a causeway that can be raised for boating access and this road also supports rail traffic to the island. When either the causeway is up, or the rail line is in use, then the only access to the island is from the northern bridge, which is a long way around to the southern island areas (where the housing is starting) from Station #21.

Response Historical Effectiveness and Reliability – What Statistics Say About Existing System Performance

In this section of the Standards of Response Coverage process, prior response statistics are used to determine what percent of compliance the existing system delivers. In other words, if the geographic map measures say the system will respond with a given travel time, does it actually deliver to expectations?

The Distribution and Concentration sections of this report used geographic mapping tools to estimate travel time over the street network. Thus, the maps show what *should* occur from the station placements. However, in the real world, traffic, weather, and units being out of quarters on other business such as training or fire prevention duties, affect response times. Further, if a station area has calls for service at the same time, the cover engine must travel much further. Thus, a complete Standards of Response Coverage study looks at the actual response time performance of the system from incident records. Only when combined with map measures, can the system fully be understood.

As a review of actual performance occurs, there are two perspectives to keep in mind. First, NFPA guidelines only require that a Department-wide performance measure of 90 percent of the historical incidents (not geography) be maintained. As discussed earlier in this report, this allows the possibility that a few high performing stations can "mask" the performance of stations with poorer travel times. In the CFAI Standards of Response Coverage approach, it is recommended that the performance of each station area also be determined to ensure equity of coverage. However, even this approach is not perfect – a station area may well have under 90 percent performance, but be low risk or under developed, thus not yet have an economic justification for better performance. In addition, the study must discuss exactly what is measured within the under-performing statistic. For example, a station area with a first-due performance of 88 percent with only 50 calls in the 88th to 90th percentile is far different from an area with 500 calls for service in that 88th to 90th percentile.

All measures then must be understood in the complete context of geography, risk, and actual numbers of calls for service "under-performed on." The Department's response time performance must be compared to outcomes such as fire loss or medical cases and be contrasted

to the community's outcome expectations. A community could be well deployed and have poor outcomes or the reverse. A balanced system will avoid such extremes and strive for equity of service within each category of risk.

Data for this section of the study was extracted from the dispatch system and the Department's incident records management system. Response time is measured from the time of fire dispatch receiving the call to the unit being on-scene. In concert with national guidelines for good outcomes, Citygate recommends a 4-minute travel time with 2 minutes added for turnout time and 1 minute for dispatch processing, resulting in a 7-minute total reflex (customer) measure. For multiple-unit calls, the outer measurement is 8 travel minutes, plus 2 minutes for turnout and one minute for dispatch, which is an 11-minute total reflex measure. Data was "cleaned" to eliminate records without enough time stamps or records with impossible times such as a 23-hour response. The data was modeled in a new fire service analysis tool called NFIRS 5 Alive.

Statistical Overview

For the Fire Department Management Team's use, there is an in-depth statistical appendix attached to this report (Volume 3 of 3). Earlier in this report, the response time statistics were summarized. Below is a summary of other findings from the response statistics study.

Over the 24-month data period the Vallejo Fire Department responded to an average of 28.59 incidents per day, 21.90 EMS incidents per day, 1.51 fire incidents per day and 5.18 other incidents per day. For the 24-month time period 5.28 percent of incident responses were to fire, 76.60 percent to EMS and 18.12 percent were to other types of incidents.

The two-years of available data break down as follows:

	4/2004 – 3/2005	**4/2005 – 3/2006**	**Total**
Incidents	10,444	10,426	20,870
Fire & EMS	8,541	8,548	17,089
Fire	556	546	1,102
Structure Fire	125	188	313
EMS	7,985	8,002	15,987

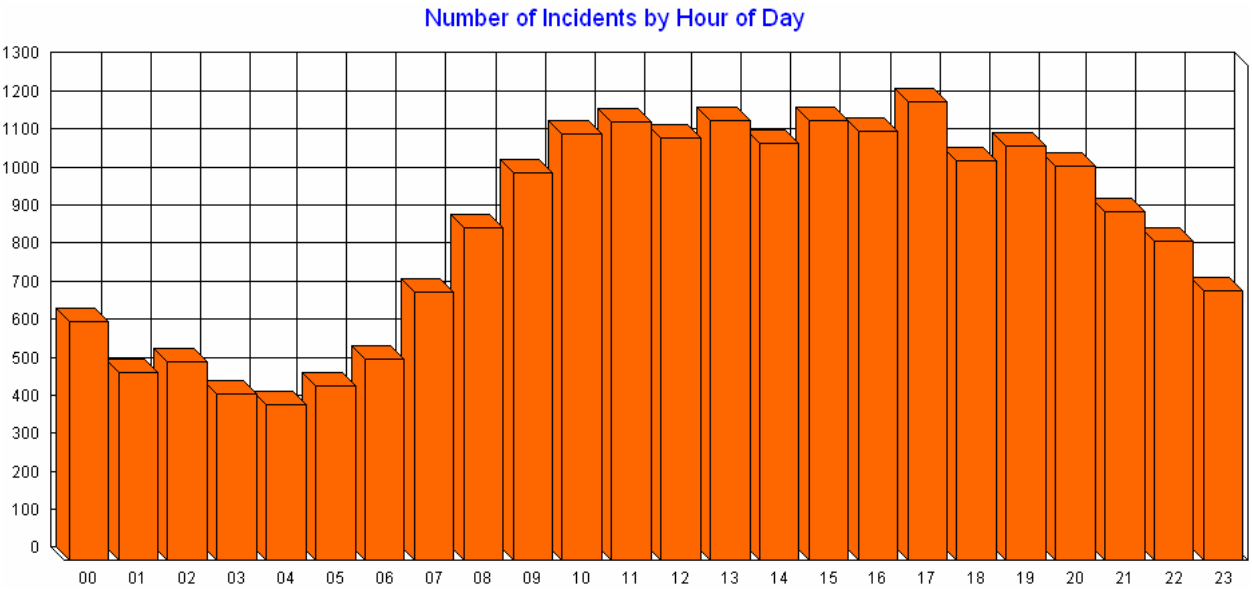
This trend shows little difference from year-to-year with the exception of Structure Fires. This single category rose 20 percent in 12-months.

Below is a list of the top incident types for the 24-month period.

Incident Type	Count
EMS call, excluding vehicle accident with injury	9,303
Medical assist, assist EMS crew	5,280
Vehicle accident with injuries	751
Dispatched & canceled en route	549
False alarm or false call, other	529
Rescue, emergency medical call (EMS) call, other	431
Good intent call, other	311
Building fire	291
Service Call, other	249
Passenger vehicle fire	207
Smoke or odor removal	153
Hazardous condition, other	142
Person in distress, other	139
Unintentional transmission of alarm, other	139
Assist invalid	136
Smoke detector activation, no fire - unintentional	130
Fire, other	99
Grass fire	86

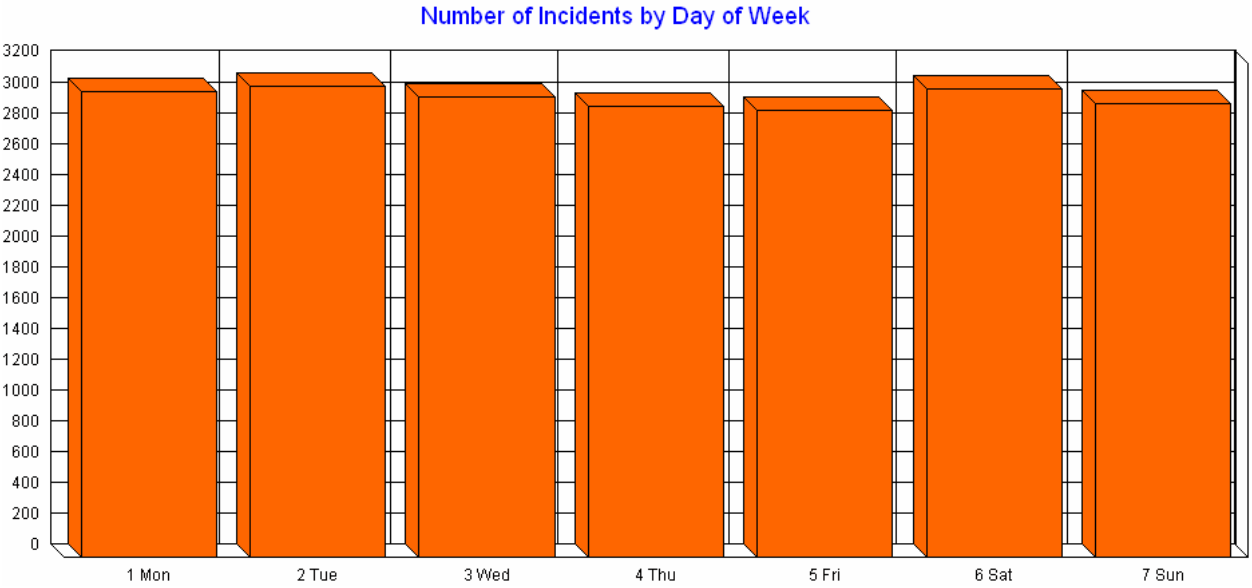
Chronological Distributions

The following graph illustrates the number of incidents by hour of the day:



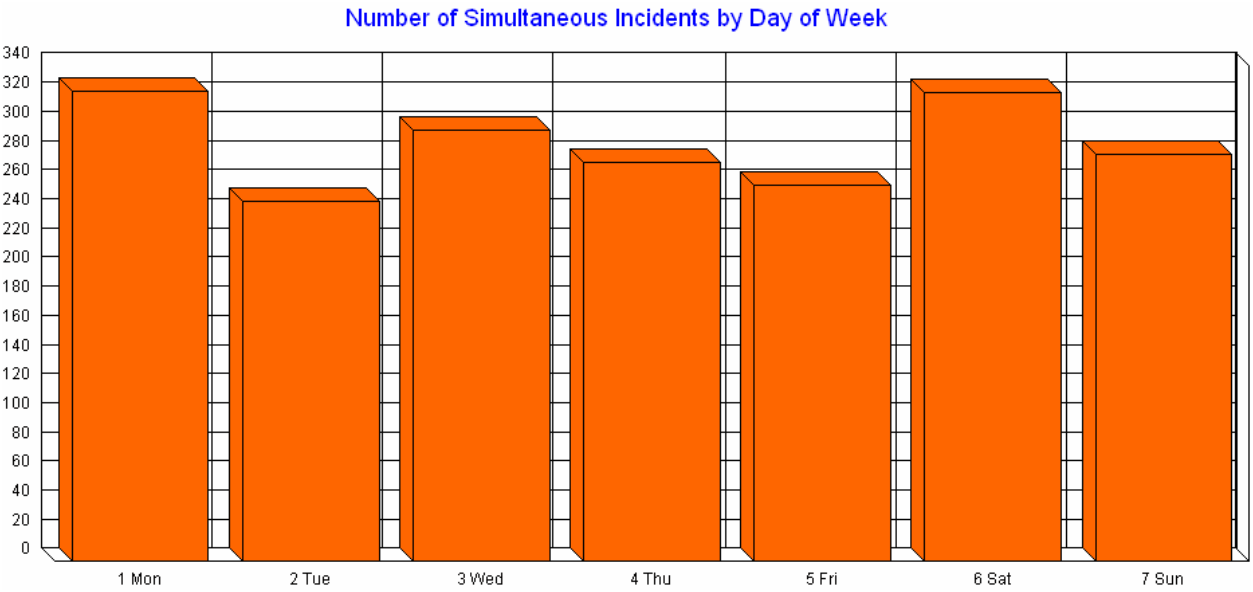
Given that medical calls for service are the bulk of the responses graphed above, those calls drive this graph. Serious fires occur anytime, but more typically at night when they go undiscovered longer.

The number of incidents tends to remain relatively constant by day of week with a very slight decline in incident activity on Thursday and Friday. This trend is illustrated in the following graph.



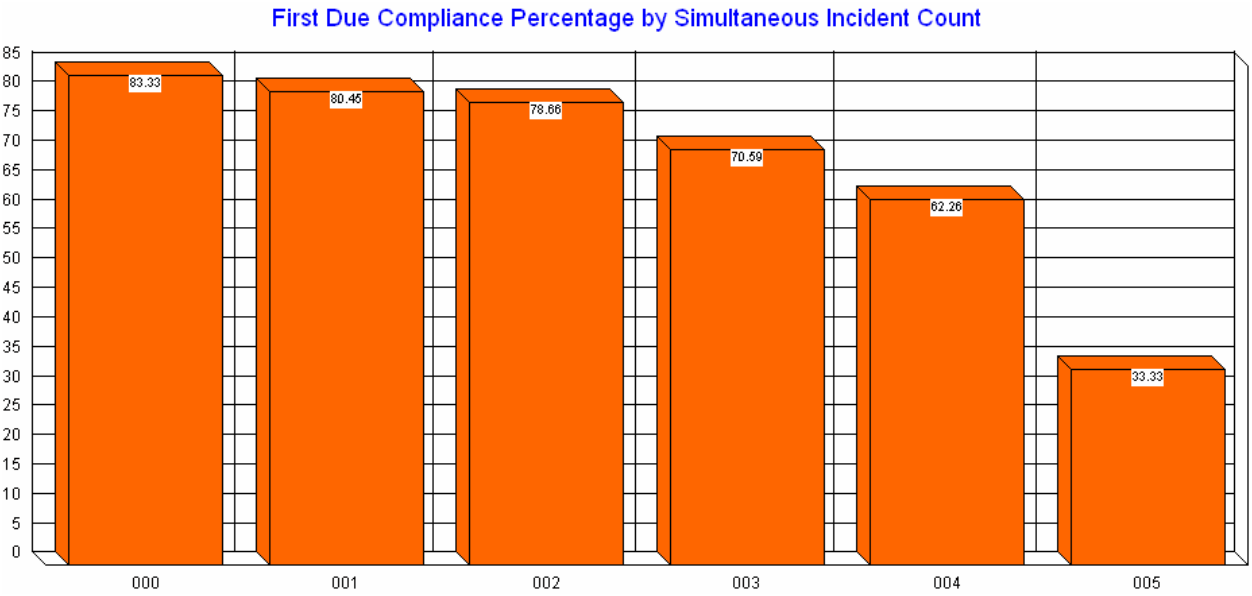
Simultaneous Incident Demand

Earlier in the report, the rate of simultaneous incidents was discussed by total frequency and hour of the day. Here is the pattern by day-of-the-week:



The chance of simultaneous incidents seems to increase on Monday and Saturday with minimum simultaneous activity on Tuesday. There is no easy explanation for this, as Monday may be commuter auto accident influenced and Saturday influenced by recreation activities.

The City needs to understand and measure how simultaneous incidents affect performance. The following chart illustrates the number of incidents by simultaneous count. Notice with no simultaneous incidents, citywide response time compliance is 83 percent. However, as the number of simultaneous incidents increases, response time compliance decreases.



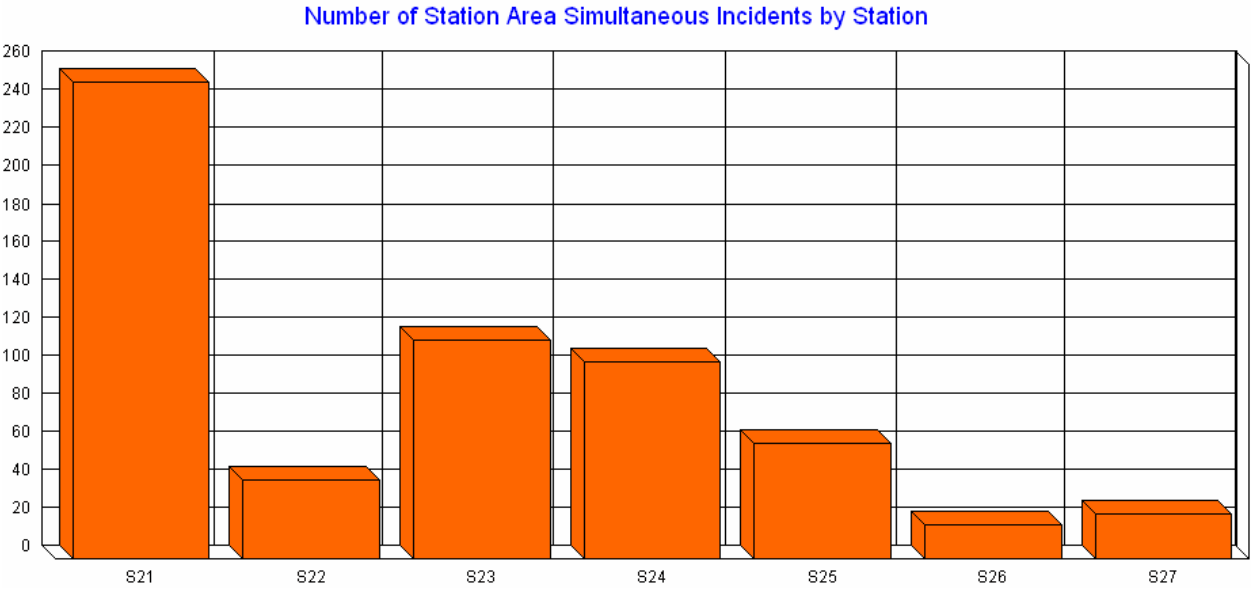
The simultaneous incident count of 39 percent only reflects all such calls. Not every simultaneous call occurs in a station area already busy on another call. This is why in the chart above, response times really do not decay until more than two calls are occurring.

Simultaneous calls across a department affect its ability to field a timely, effective First Alarm assignment for serious fires, while also handling other medical and more minor calls for service.

A positive indication in Vallejo is that of the 39 percent simultaneous call rate, such double calls in the same station area only occur 2.94 percent of the time. This means that while multiple calls affect the ability to field a first alarm to building fires, the occurrence of such fires in Vallejo is low, and with only 3 percent of the simultaneous calls occurring in the same station area, two or three simultaneous calls do not typically affect response times.

Of this 2.94 percent of simultaneous incidents within the same station area, 40.81 percent occur within Station #21's territory. This is why the truck company and the relative closeness of the other stations to Station #21 are important, as Station #21's area is the call workload center of the Department.

The next graph displays how the simultaneous incidents occur within one station area:



Deployment Compliance

Another method to isolate performance is to measure compliance as a percentage of responses meeting a minute goal for both first-due and First Alarm units.

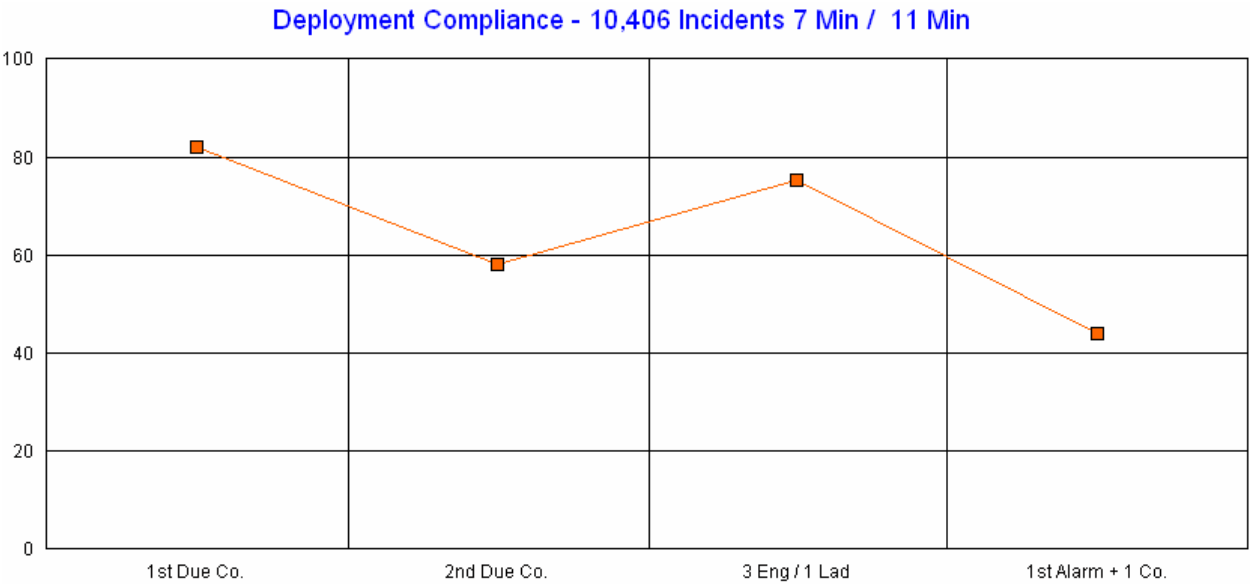
The response concepts of the "speed" and "weight" of the deployment plan can be seen in the Deployment Compliance graphs. The first and third plots illustrate speed. The second and fourth plots illustrate the "weight capacity" of the response. A flat line indicates the response area has great additional capacity to handle the simultaneous number of responses. This can occur for two reasons: first, there is not a simultaneous call for service problem in this area; and second, when simultaneous calls do occur, the second-due unit is close by to cover.

Deployment Compliance is a type of compliance report that measures the percentage of time a preset goal is realized. Again, the percentage range can run from 0 to 100 percent. For example, a goal could be set to measure compliance with having at least one company on the scene of an emergency within 7 minutes of a call and having a First Alarm assignment on the scene within 11 minutes.

The following Deployment Compliance graph plots *citywide* compliance for the First-Due Company (first plot) as well as a 3 Engine / 1 Ladder First Alarm assignment (third plot). The second and fourth plots illustrate compliance level for additional resources, the second company at 7 minutes and an augmented First Alarm assignment at 11 minutes. The additional resources column is simply 3 engines and 1 ladder ***plus*** one additional engine, showing how far away another unit is when the first alarm cannot handle the incident. This graph does not include engines and ladders responding from outside agencies for aid.

The following charts may not exactly match the response time text above. This is because first-due is calculated only for incidents where both a first-due and second-due company responded. Also, this chart only measures engine and ladder companies that recorded an On-Scene time in CAD or RMS.

In the graph below, notice the first-due company response is better than 80 percent at 7 minutes; however, the second due companies arrive within the 7-minute criteria about 58 percent of the time. Having a 3/1 First Alarm assignment arrive within 11 minutes occurs about 77 percent of the time, while an augmented First Alarm response (response of one additional engine or ladder) is in place after 11 minutes just over 43 percent of the time:



The compliance graphs for each individual station area are found in the statistical appendix. Due to the little to no overlap between station areas, only Station Area #21 had reasonable performance given its size and close-by back-up units. The rest of the station areas only have fair performance for multiple-unit response.

There are two significant lessons from this type of measure. First, the overall Department graph above shows that both first-due and First Alarm fractile compliance fall short of 90 percent at the national ideals for the best possible outcomes. Second, the compliance graphs by company area show that all but one of the station areas is too large for effective First Alarm compliance times. This is an additional finding that Vallejo is **not** covered with too many fire stations.

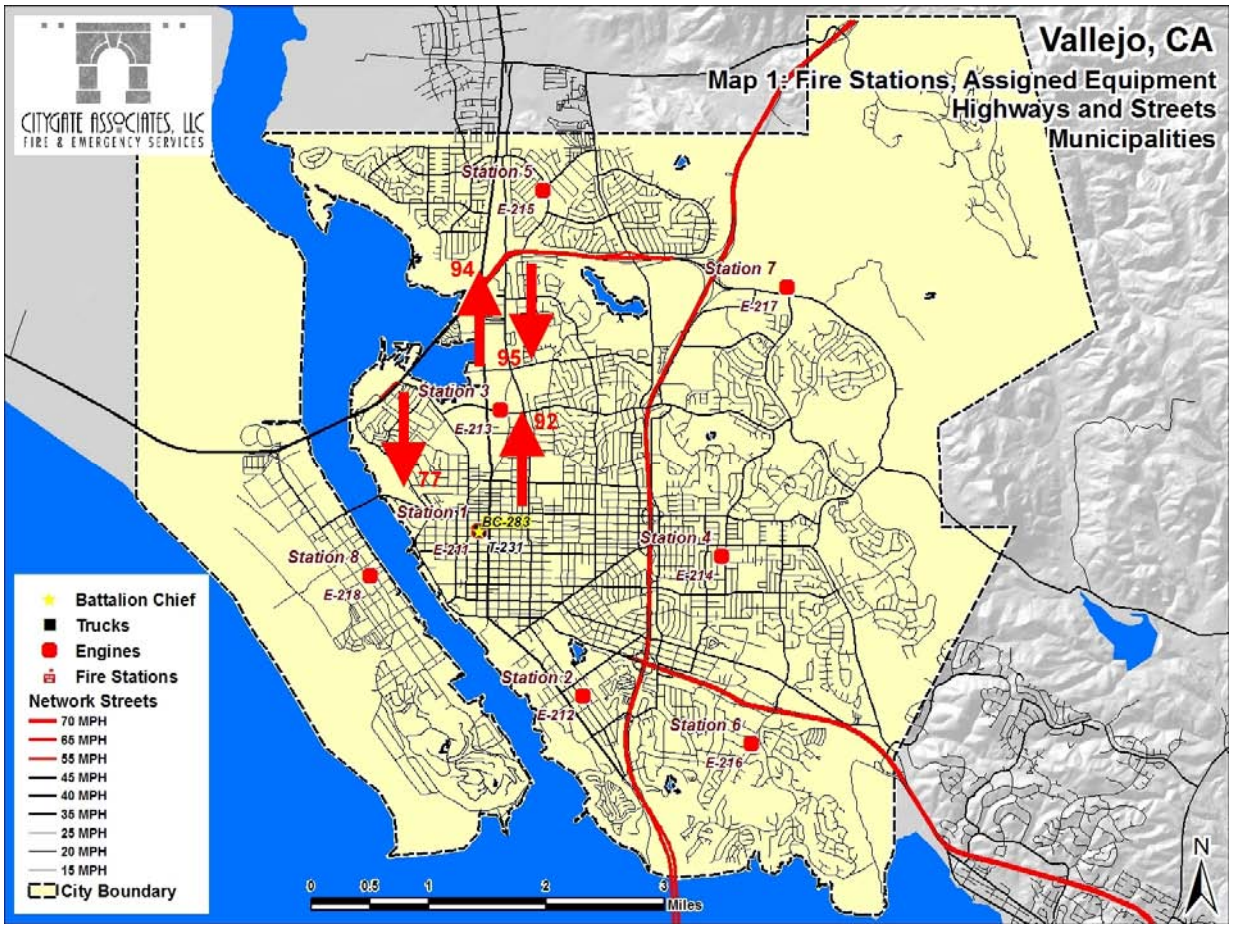
Response Patterns – Station to Station Area

Another way to display workload is to show it as the quantity of responses into other first-due areas in a data table, or on a map instead of a graph. When done this way, it is easier to see the impact of larger station areas, or station areas without close by back-up units. One of the issues to understanding simultaneous incident workload is to see how it impacts movement of fire crews from one station area to another.

The following data matrix illustrates the inter-station area responses of engine companies in the last 12 months. The *vertical* "total" row represents the total number of inter-station responses INTO the area. The *horizontal* "total" row shows the total number of GIVEN inter-station responses broken-down by stations in each column. Normally, engine companies would be expected to make more responses within their assigned station area than any other station area. Out of district responses less than 50 in the past 12 months do not appear on the chart below.

	S21	S22	S23	S24	S25	S26	S27	S28	Total
T21	(92)	64	113	76	67		67		387
E25			95						95
E23	77				94				171
E21		76	92	52					220
E22	70								70
E27					59				59
Total	147	140	300	128	220		67		

The biggest "receiving" station area is Station #23. The largest "giving" station area is Station #21. This measure is another indication of how important Station #21 is to the rest of the system. Here are the major movements between the stations presented on a map:



This map shows the interplay between Stations #21, #23 and #25. They have to support each other during periods of simultaneous call activity; they are in effect "chasing" each other's calls. This map shows, in a different way, the importance of Station #21 to support western core workload and to maintain reasonable response times across a 4-station area.

Statistical Conclusions

Several observations can be made from this overview of historical, actual response time performance:

1. Vallejo's *citywide* performance of **82.5 percent** by total reflex time minute 07:00 is close to a desirable goal of 90 percent.
2. The individual performance by station area is also close to the goal, except for Stations #27 and #28, due to their size and distances covered. If these weaker performing station areas were subtracted from the citywide average, the core of the City would probably perform close to 90 percent.
3. The City needs to focus on improving the police communication center response time performance to lower it from 2-minutes to 1-minute, 90 percent of the time, as well as lowering firefighter turnout time by 30-seconds from 2:30 to 2:00 minutes at 90 percent.
4. The individual station area response reliability performance graphs in the statistical appendix, beginning on page 43, correlate with the mapping findings, in that the stations are spread out as far as possible, with the exception of Station #21 that covers the higher call volume and higher risk older core of the City. These graphs show that when the closest unit is busy or absent, the overlap between stations is so slight to non-existent that the response time performance really falls when the second or third-due unit to an area has to respond.
5. Thus, the system is well designed for the core of the City, in that the stations are spread out and the only overlap (Station #21) is placed exactly where it is needed and cost effective. There is not waste in the station location system.
6. However, due to the challenging geography of Vallejo, the station system does not perform at the goal of 90 percent anywhere except barely in Station #21's area, and it cannot give desirable first-due or First Alarm goal performance to the Hiddenbrooke and Mare Island areas. This issue will be discussed in detail next.
7. The station system would perform at or better than 7 minutes at 90 percent in the core areas of the City, **if** the dispatch processing and turnout time measures are improved.

F. THE HIDDENBROOKE AND MARE ISLAND AREAS

As was stated previously, the Mare Island station is part of a Community Assessment District, so that development in the re-use area helps pay its own way instead of the City's General Fund. While the re-development projects have gotten off the ground slowly, there is now a modest increased pace, especially with housing, so there is an emerging 24-hour population -- not just a modest jobs base. When the base was active, the Navy fielded 2-3 fire crews on the island, which also left to support fires in the City. So today the fire crews in the City area are still less, even

with one crew on Mare Island, than during the period the Federal Government operated the island. Given the size and build-out development plans, plus the limited access, there is a long-term need for a City fire station on the island. Given the way the re-use area agreements were constructed, there was a way to provide long-term fiscal support for island fire services.

The situation in the Hiddenbrooke area is more complex and problematic for many reasons. The development of homes outside an urban-suburban area is always difficult for residents and elected officials. There may not be enough additional property tax revenue from the project for a strong public safety staffing level. Yet the residents do not feel as if they have moved to the "country" and well beyond typical suburban levels of police, fire and emergency medical services. Ideally, given the property tax structure in California, this issue could have been dealt with at the time of development. Some California communities require an additional assessment district at the time of subdivision approval to pay for the "services gap" the development creates.

However, even if that were done in Hiddenbrooke's situation, with a total of approximately 1,206 residential parcels, and 3,000 to 3,500 residents, all, or a portion of the estimated $2,400,000 per year to operate a fire station with a 3-person engine company would be a significant cost for the Hiddenbrooke properties. If all of the costs were borne by only the residential parcels in the Hiddenbrooke development, this would represent an average of $1,990 per year for each residential parcel or about $685 to $800 per capita. A few additional parcels are commercial and so this would reduce the cost per residential parcel a small amount. Even sharing half of the cost of operating a fire station in Hiddenbrooke would be nearly a $1,000 per year assessment on average for each residential parcel.

Clearly, the development is beyond the desirable reach of a fire station to provide response times comparable to urban-suburban levels of service. The driving distance from Vallejo Fire Station #27 is 3.1 miles to the ***east side of the interchange***, as compared to the Insurance Service Office recommendation of 1.5 miles. The driving distance from Vallejo Fire Station #25 is 3.6 miles to the same point, which is not only farther than a primary coverage goal of 1.5 miles, but exceeds the 2.5 mile ISO recommendation for ladder trucks or follow-on units.

It has been suggested that the American Canyon Fire Department is closer and should also respond. The street address of the closest American Canyon fire station is 911 Donaldson Way where a new station is being built. The driving distance from this station to the east edge of the Hiddenbrooke interchange is 3.6 miles. Given this distance, and the fact that a 911 call from Vallejo would have to be transferred to American Canyon, which takes upwards of an additional minute, the American Canyon station is not a better solution than a Vallejo City response **if** Station #27 is available. What American Canyon does offer under automatic aid is support to Vallejo when the City units are tied up. American Canyon will operate a Quint ladder truck from the new fire station and is open to re-working its automatic aid agreement with Vallejo to have this ladder truck respond to Hiddenbrooke instead of the more distant Vallejo ladder truck at Station #21.

Another travel distance question is: what about the rural back road that serves Hiddenbrooke as a secondary evacuation route? The entry of this road begins near Station #27 and winds through a rural ranch area and terminates near a water reservoir at the southwest corner of the development. The road is narrow in spots, full of curves and low trees in some segments. The total length of this road as shown in Map #20a is 2.32 miles and at an average speed of 20 mph, it would take 6.12 minutes to traverse. Map #3a shows how the first-due unit from Station #27

just makes the edge of the development, no different than from the freeway side. Map #5a shows how even with using this road, the full First Alarm assignment coverage is not improved into the development.

This back road is needed and serves a useful purpose as a secondary route when the freeway is closed or for evacuation of residents when the one street to the freeway would be too congested. Otherwise, this road in its current alignment is not short enough or fast enough to become the primary access method from Station #27.

Here is what response statistics say about actual response times into Hiddenbrooke:

Since Vallejo uses a "District" value to represent geographic subdivisions in its fire records system, it was determined that incidents with a district assignment of "3" or "03" fall within the Hiddenbrooke geographic area. In the two-year dataset, 137 (or just above ½ of 1 percent of incidents -- .65 percent) occurred within this geographic area.

The following chart illustrates the number of calls by incident type for the two-year dataset:

Incident Type	**Count**
321 EMS call, excluding vehicle accident with injury	62
311 Medical assist, assist EMS crew	32
Subtotal EMS and Medical assistance calls	94
322 Vehicle accident with injuries	4
600 Good intent call, other	4
611 Dispatched & canceled en route	4
160 Special outside fire, other	3
700 False alarm or false call, other	3
740 Unintentional transmission of alarm, other	3
521 Water evacuation	2
730 System malfunction, other	2
733 Smoke detector activation due to malfunction	2
744 Detector activation, no fire - unintentional	2
100 Fire, other	1
111 Building fire	1
131 Passenger vehicle fire	1
412 Gas leak (natural gas or LPG)	1
500 Service Call, other	1
511 Lock-out	1
520 Water problem, other	1
522 Water or steam leak	1
531 Smoke or odor removal	1
561 Unauthorized burning	1
621 Wrong location	1
713 Telephone, malicious false alarm	1
735 Alarm system sounded due to malfunction	1
745 Alarm system sounded, no fire - unintentional	1
Subtotal all other calls	43

Here is a table indicating the number of incidents by first arriving company:

1st Arriving Company	Count
E27	120
E25	6
BAT21	4
E23	2
21TR1	1
B27	1
E21	1
E24	1
T21	1

Response times ranged from a high of 16.8 minutes to a Vehicle Accident with Injuries at 1120 Songwood Road to a low of 0.82 minutes for an EMS Call to 4112 Summergate Avenue. Here is a table illustrating first arriving company response times:

1st Arriving	Count	Min	Max	Average
E27	120	.82	16.50	9.99
E25	6	.87	16.83	8.99
BAT21	4	1.32	10.63	7.26
E23	2	6.57	9.13	7.85
21TR1	1	10.72	10.72	10.72
B27	1	13.67	13.67	13.67
E21	1			
E24	1	5.23	5.23	5.23
T21	1	5.38	5.38	5.38

There was only one building fire in the two-year dataset. The First Alarm assignment arrived on the scene at 1095 Hiddenbrooke Parkway in 6.57 minutes for 2-E/1-T.

E-25 @ 6.57
T-21 @ 6.57
B-21 @ 6.58
E-23 @ 6.57

These times are not complete as the first unit arriving found no working fire and all units were "cleared" before arriving on scene. Thus, in the two-year period there is not one complete structure fire time record.

Here is the breakdown of 1st Arriving Apparatus by minute:

There are 137 Incident records being analyzed. Time starts with receipt of phone call. One record was ignored because of a zero time value.

1st Apparatus On Scene <= 00:01:00 1.5% (2)
1st Apparatus On Scene <= 00:02:00 2.2% (3)
1st Apparatus On Scene <= 00:03:00 2.2% (3)
1st Apparatus On Scene <= 00:04:00 3.7% (5)
1st Apparatus On Scene <= 00:05:00 3.7% (5)
1st Apparatus On Scene <= 00:06:00 8.1% (11)
1st Apparatus On Scene <= 00:07:00 11.0% (15)
1st Apparatus On Scene <= 00:08:00 14.0% (19)
1st Apparatus On Scene <= 00:09:00 31.6% (43)
1st Apparatus On Scene <= 00:10:00 51.5% (70)
1st Apparatus On Scene <= 00:11:00 72.8% (99)
1st Apparatus On Scene <= 00:12:00 86.8% (118)
1st Apparatus On Scene <= 00:12:30 90.4% (123)
1st Apparatus On Scene <= 00:13:00 91.9% (125)
1st Apparatus On Scene <= 00:14:00 94.9% (129)
1st Apparatus On Scene <= 00:15:00 95.6% (130)
1st Apparatus On Scene <= 00:16:00 96.3% (131)
1st Apparatus On Scene <= 00:17:00 100.0% (136)
1st Apparatus On Scene <= 00:18:00 100.0% (136)
1st Apparatus On Scene <= 00:19:00 100.0% (136)
1st Apparatus On Scene <= 00:20:00 100.0% (136)

Median 1st Apparatus On Scene 00:09:51 (9.85 minutes)
Average 1st Apparatus On Scene 00:09:48 (9.79 minutes)

The reason for some very short response times is that occasionally a fire unit is already out near the area on other duties or has just cleared from a prior response. However, clearly most of the calls are arrived at or beyond the 9-minute point.

Apparatus Responses

167 Apparatus records were located with responses to the Hiddenbrooke Districts “3” and “03.” Here is the statistical breakdown:

Company	Count	Min	Max	Average
E27	124	.82	16.72	9.95
BAT21	13	1.32	29.65	8.75
E25	11	.87	16.83	8.79
T21	8	1.58	29.60	11.82
E23	6	1.37	13.27	8.04
B27	2	13.67	29.62	21.65
E24	1	5.23	5.23	5.23
E21	1			
21TR1	1	10.72	10.72	10.72

Given the above distance measures from existing fire stations, and actual response times over the last two years, the subdivision is being responded to, but arrival is past the suburban goal point of best outcomes for serious fires and *immediately* life threatening medical problems. The response system does take care of small fires and medical emergencies. It just cannot get there in time for the very few, critical events that can and do happen. As seen above, most of the calls for service are medical in nature. As a stop gap, the City has worked with a private ambulance company to station a basic life support ambulance at the entrance to the subdivision where it can respond to calls in the eastern part of Vallejo as well as Hiddenbrooke. While this is not paramedic-level care, it is a good immediate response and the medical technicians can still apply an automatic defibrillator in a cardiac arrest so when the paramedic arrives at minute 9 or later, the paramedic can proceed with drug therapy.

Since, in the United States, there are not minimum response requirements on local government fire services, the Commission on Fire Accreditation has developed a matrix of issues to guide the discussion of when to add fire stations. Research in this area has noted that most communities do not add fire stations until there is a compelling combination of factors that make it effective to do so. These factors as expressed in the table are distance, response time, call for service quantity and types of buildings at risk for fire:

CHOICES	DISTANCE	RESPONSE TIME	PERCENT OF CALLS	BLDG INVENTORY
Maintain status quo	All Risks WITHIN 1.5 miles	First-due Co. is within 4 minutes total reflex time, 90 percent of the time	100 percent in City	Existing inventory and infill
Temporary facilities and minimal staffing	Risks 1.5 to 3.0 miles from existing station	First-due Co. exceeds 4 minutes travel time 10 percent of the time, but never exceeds 8 minutes	More than 10 percent of calls are in adjacent area	New area has 25 percent of same risk distribution as initial area
Permanent station needed	Risk locations exceeding four miles from the station	First-due Co. exceeds 4 minutes travel time, 20-25 percent of the time; some calls less than 8 minutes	More than 20-25 percent of calls are in outlying area	New area has 35 percent of same risk distribution as in initial area of coverage
Permanent station essential	Outlying risk locations exceeding five miles from the first station	First-due Co. exceeds 4 minutes travel time 30 percent of the time. Some calls less than 10 minutes	More than 30 percent of calls are in outlying area	New area has 50 percent of same risk distribution as in initial area

Source: *CREATING AND EVALUATING STANDARDS OF RESPONSE COVERAGE FOR FIRE DEPARTMENTS©*, 4th Edition, Commission on Fire Accreditation International, Inc.

This matrix can be used by the City to evaluate when to add new 24/7/365 fire stations. No single factor can and should drive an additional crew for an underserved area. It takes 2-4 of the above factors to be unmet, before it is cost-effective to add another crew. For example, having a long travel time to a very low density developed area, generating a call for service per week, is not the same as having thousands of people, generating one or more calls per day, with a fire station too far away, combined with the problem that the nearest station is busy backing up another station's dropped workload.

If we apply the criteria from the table to Hiddenbrooke, we find that the distance and resultant travel times are too long, but the building and population densities, and thus the call for service demand, are very low. Given this dilemma, many communities would not staff an expensive fire station for such a small quantity of risk. What they typically would do is to either not allow development outside the contiguous suburban area, condition the project with an expensive property tax supplemental levy for public safety, or clearly tell the developer ***and*** residents that such a pocket of development will never have the same highly effective response times as the contiguous areas of the core community. Across California, all three of these options have been done.

Hiddenbrooke does have a fire response, and it will arrive to stop the few serious fires from spreading to adjoining buildings and medical patients will be treated. What cannot occur is a short enough response to keep small fires from becoming large, or to likely save a patient that is already critical or in cardiac arrest from the time 911 is being called.

Thus, this response time currently falls past that of an effective suburban response ***to time critical*** emergencies, but the response is definitely better than a rural level of effort. The mapping and statistical series showed that there is a first-due unit into the development typically in the 8-12 minute range from the time of call. There also are multiple units available as the 3-engine map #6 showed the 8-minute travel time for three units to be well inside the western area of the subdivision. These three units could likely penetrate to the far end of the subdivision by minute 10-12. Staffed as Vallejo is, with three career firefighters per engine, and four on the truck, a response of 13 firefighters by total response minute twelve (12) is better than much of small town California has today but not at the level of the NFPA 1710 goal of 14-15 personnel by total response minute eleven (11).

The City and its residents have some choices to improve services to Hiddenbrooke, and these options will be presented below along with others for the entire City.

G. Overall Deployment Evaluation

Vallejo is a well-trained and equipped fire department with a deployment plan that is under challenge from several issues:

- First, the hilly geography and non-grid street network in many areas, as well as limited access under or over barriers such as freeways and waterways, creates a difficult to serve community with fewer fire stations;
- Second, the City is changing – development, increased traffic, in-fill development, but not yet the revenue to enhance fire services;

- The City needs to adopt realistic fire unit performance measures and use those to drive future development decisions;
- The call processing time in the police department and the fire crew turnout times need to be improved. If accomplished, then the goal of 7 minutes at 90 percent in the core of the City is attainable with the existing stations and number of crews.
- Even with these challenges, the current response system is well designed, located, and performs well in the contiguous core of the City. It does not serve as well the fringe areas of Hiddenbrooke and the contract fire district;
- Additional fire stations are costly and not in the near-term City revenue picture.

While the current response times are a little longer than desirable, Vallejo is getting acceptable outcomes on most calls because many of the calls are clustered close to the higher call volume fire stations and buildings fires are modest given the newer building construction in parts of the City less than ten years old.

The current staffing per apparatus plan only provides the minimum number of firefighters for smaller fires and modest multiple patients medical or rescue situations. Serious fires will draw in more units, placing serious demands and limitations in responding to other emergencies in a system that has two or more calls for service occurring 39 percent of the time. The City, as deployed, is doing an adequate job with modest emergencies and less severe, simultaneous calls for service. When major incidents occur, the City must deploy all its resources and depend on mutual aid.

Thus, the City has a *distribution* problem, in that it does not have enough primary response units, especially in the fringe areas, principally Hiddenbrooke, as identified in the geographic mapping analysis.

The City needs to maintain its focus on measuring all of the segments of total response time, not just the travel time of fire stations. This focus should be on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time, as well as lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent. The emphasis is necessary or total performance will continue to be longer than desirable from the current fire station locations for good outcomes in serious emergencies

The City needs to adopt a set of response time policies that reflect the ***moderate*** fire and medical risks in the community and the very difficult to serve street network. In considering establishing a new set of response time policies, consideration should be given to the fact that the older, national expectation of 1 minute for crew turnout time have been found to be unrealistic everywhere in the country when measured, due to today's modern safety equipment that must be donned before the unit can respond. It is possible to achieve crew turnout times of 2 minutes at the 90 percent point.

It must be noted that national response thinking is that a 4-minute fire apparatus travel time is the optimum for urban and higher-hazard suburban areas. However, today, most of the fire departments in the United States, outside of large metropolitan departments, cannot comply with a 4-minute travel time or 4 firefighters per crew due to economic realities and lower risk protection.

Given the moderate fire and medical risks in Vallejo, a 4-minute road travel time is an appropriate goal that Vallejo is close to achieving in the core areas of the City. Unlike in other communities, this is a very reachable goal in the core of the City, once dispatch and fire crew turnout times are improved. However, this goal cannot be met out to all the edges of the road network. Thus, total response time goals could look like:

1. 1 minute for Dispatch + 2 minutes for crew turnout + 4 minutes road travel time = 7 minutes at 90 percent total response time for the first-due unit, and for emergencies requiring a single engine and or ambulance response. Such a response is designed to mitigate and terminate the emergency without requiring additional resources. These are typically single patient EMS incidents and small fires.
2. For the firefighting effective response force (First Alarm) the moderate risk building fires in Vallejo an 8-minute road travel time for the additional responding units that can arrive after the first-due unit. Thus:

   1 minute for Dispatch + 2 minutes for crew turnout + 8 minutes road travel time = 11 minutes at 90 percent total response time for an effective response force that is sized to stop the escalation of the emergency where found upon the arrival of the last due unit.

Without additional fire stations serving the City and, the only response time improvement that could be expected would be to trim 1 minute from the current dispatch time segment and 30 seconds from crew turnout time. Otherwise, Vallejo is adequately deployed to the core areas, and given the terrain, there is no other solution to improve response times. Additionally, **any** reduction in fire crews on the street will have a negative effect on response times.

H. DEPLOYMENT OVERALL RECOMMENDATIONS

1. Given the response time information and the risks present in the City, this study recommends revised response time goals of:
   a. First-due unit: Arrival 90 percent of the time, within 7 minutes of the call being received at the police fire dispatch center.
   b. For serious building fires requiring 14+ firefighters and an Assistant Chief (First Alarm), all the firefighting units should arrive on-scene within 11 minutes, 90 percent of the time.
   c. The City needs to focus on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time, as well as lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent.
2. The City, as its fiscal situation allows, needs to discuss with the Hiddenbrooke community how they can partner together fiscally to improve the response times and level of service. Some options include:
   a. Retain the existing basic life support ambulance agreement.
   b. Upgrade the ambulance agreement to include one paramedic per day and restrict the regional area the ambulance operates within, to leave it more available for northeast Vallejo calls for service. This would come at an increased cost.

c. Create and staff a 2-person firefighter squad, with one member being a paramedic. This squad would handle medical calls, minor fires and on serious fires still be able to take an outside command and assessment function to set-up while the more distant units arrive.

d. Consider upgrading the back access road from Station #27's area to improve travel times and the ability to evacuate the community.

FIRE CREW DEPLOYMENT SERVICE REDUCTION STRATEGIES

While analyzing City revenue sources was not a part of this study's scope, Citygate does understand the City is under fiscal pressure to even continue its obligations, much less increase safety services. Given the deployment information above, Citygate was asked to offer its opinion as to where the least painful service reductions could be considered.

The deployment study has found the current station, apparatus, and staffing plan meets the City's needs except for the fringe and Hiddenbrooke areas. Thus, any reduction will have a negative impact on the City's fire and paramedic services. The following reductions could be taken; they are not in priority order as each has different implications for the council and community to consider:

1. Close or reduce staffing on the ladder truck. This unit is needed, more so in Vallejo than other nearby communities. Having stated this, the truck is used the least and does not serve a primary medical response area. Since it needs a front and rear operator (tiller operator) and is currently served by a crew of four, reducing this unit to just one operator is not possible. The crew size per day could be reduced to two or three, a savings of three to six positions total (one or two per shift). A two-person crew could still respond the ladder truck to fires. To make up for the short staffing once the ladder truck was on-scene, an additional engine would have to be dispatched on all structure fires, which would mean that four of the City's eight engines plus the truck would be committed to any one building fire.

   Closing the truck *staffing* reduces four positions per day or twelve total. The engine crew at Station #21 can still respond the truck to building fires **if** they are in quarters. Otherwise, the truck will not be available and there is not a close by mutual aid ladder truck to the core part of the City.

   a. Drawbacks: No ladder truck crew or tall ladder coverage on building fires. As noted in this study, Vallejo does have taller, unsprinklered buildings, some being residential in nature. This reduction places this population at risk when a serious fire occurs. However, the frequency of such fires is low in the City. This option reduces the total staffing available per day and thus for serious fires and simultaneous calls. When simultaneous calls occur and a primary engine is not available, response times will get worse as the ladder truck cannot cover the call.

   b. Compared to other impacts: This option still leaves in service a primary engine with a paramedic in each station area.

2. Reduce staffing by one per day on one to three engines. This reduces the same number of personnel, but does so by reducing a primary engine to two personnel, thus making the crew a "squad" for medical responses only. This option is difficult to implement as it takes a certified operator to drive the engine and usually a supervisor to manage the crew and station functions. However, the paramedic on the crew is a firefighter and usually not qualified to supervise. Even if this can be overcome, many medical calls take three firefighters minimum, plus the ambulance crew to treat and move a patient. When more personnel are needed, under this option, the squad will have to call for a full engine crew, and now two stations are busy for what would have been a single station call. This has a negative domino effect at peak hours when simultaneous calls occur.

a. Drawbacks: The primary engine is short a person, and cannot initiate any firefighting until the second unit arrives. While under the OSHA "2-in/2-out" rule a 3-person crew cannot do interior firefighting until a 4th firefighter arrives, they can enter the burning building IF there is a known life at risk. Thus, only operating EMS squads in station areas also reduces firefighting and rescue options. With a 2-person crew, it would be grossly unsafe to the firefighter to ask one to enter a dangerous situation with only one back-up firefighter outside.

b. Compared to other Impacts: This option still leaves in service a primary EMS unit, IF the paramedic staffing can be worked out.

3. Rolling Brownouts of One Station per Day. This option also reduces up to three positions per day, but completely closes a fire station. Many communities, in order to not make the slowest call volume neighborhood, fully take the reduction on behalf of all citizens; rotate the closure among the slower station areas.

   a. Drawbacks: Total daily staffing will be reduced for serious emergencies and simultaneous calls for service. One area per day will see significant response time delays. In the closed station area, there will not be paramedic coverage and the City could lose revenue in EMS system response time contract penalties.

   b. Compared to other Impacts: This option delivers the most serious response time reductions, although to different neighborhoods over the rotation cycle.

HEADQUARTERS STAFFING

As budget reductions have occurred over the past few years, several headquarters positions have already been reduced away. These include three clerical positions, one Disaster Preparedness position, and a Fire Inspector position that has been moved from suppression to prevention and then back to suppression. Currently, the Fire Marshal position is vacant. The Department has reduced all overtime for training and public education, leaving overtime only for essential fire crew back filling. The Department is currently *budgeted*[1] with the following positions:

- 1 Fire Chief
- 1 Deputy Chief
- 4 Assistant Chiefs, 3 on a fire crew 24-hour schedule to provide Incident Command
- 2 Captains (40-hour) assigned to the Training Division
- 1 Paramedic Program Coordinator
- 1 Administrative Analyst
- 4 Office Support/Clerical positions
- 3 Fire Inspectors
- 1 Non-Sworn Senior Code Enforcement Officer.

Citygate considers the Fire Chief and 3-shift Assistant Chief positions as essential. There is hardly any clerical capacity left for a fire department of this size and removing one more position does not produce serious savings.

Thus, the few and painful options left for headquarters cost reductions could be:

1. Require one of the Assistant Chiefs to assume the Fire Marshal duties in close cooperation with the City's Building Official.
2. Reduce one more fire inspector and only handle a few essential new construction activities. There would not be a proactive existing building inspection enforcement program at this point. Fire crews could handle some of the less technical inspections, but they need to be trained by someone and need a 40-hour inspector position to follow-up on difficult issues.
    a. Or, consider over time converting Fire Inspection positions to non-sworn Building and Fire Inspectors.
3. Reduce the Paramedic Coordinator position to a half-time, no-benefits contractor assignment. There are personnel in the Bay area that could perform essential duties for the Department in this area on a part-time basis.

[1] The Department has filled 1 Deputy Chief position that is not budgeted and also has a vacant unbudgeted Fire Prevention Assistant Chief. Both positions could be deleted if necessitated by the City's budget situation.

4. Eliminate the dedicated code enforcement position and have the Code Enforcement Division in the Community Department handle these complaints using existing staff.

This is all that is really left and any of the above reductions will take any of the affected program areas to below the minimums the City really needs.

48/96 WORK SCHEDULE AND OVERTIME USAGE: COST IMPLICATIONS

A. 48/96 WORK SCHEDULE

Background

In 2003, the City agreed to change the work schedule on a trial basis for line fire personnel from the "3-4" schedule involving a 9-day rotation with three, 24-hour work shifts and an average workweek of 56.3 hours to a "48/96" schedule with a 6-day rotation that would include two, 24-hour work shifts and an average work week of 56.3 hours. The 48/96 schedule is best described as a single 48-hour work period followed by four days, which is 96 hours off.

The union proposal to the City projected annual cost savings from an estimated 20 percent reduction in sick leave, reduced Fair Labor Standards Act (FLSA) overtime (hours over the federal firefighter work week of 53-hours) and a 50 percent reduction in "hold-over" related overtime ("holding" employees over a minimum of four hours to cover for employees who have not reported to work due to unexpected illness, injury or other cause). Sick leave and "hold-over" reductions were an estimate, while the FLSA overtime savings could be fairly closely estimated, since it is a derivative of the change in rotation period from nine down to six days.

The only related published study at the time was from the City of Minneapolis, which found sick leave usage actually higher over the short study period as well as higher work-related injuries. At the time of the Minneapolis study and the decision of the City of Vallejo to test the affect of a 48/96 schedule, there were relatively few fire departments in the country using the schedule and no reported data-based studies of the impact. Even now, in 2006, with more agencies having made the change to a 48/96 work schedule, there are no reported long-term data-based studies of either single agencies or a collection of agencies to determine the cost implications of the change. Many of the agencies that have changed agreed to do so for a one-year trial and Citygate knows of only one small agency in California to have reported that they have abandoned the 48/96 schedule. The majority of the California agencies that adopted the 48/96 schedule are in extremely high cost housing areas and made the change to lessen employee commutes; since the employees for the most part were living one to three hours away each commute direction. But the one-year trial period is far too short to establish whether or not the schedule has an impact on costs, because many complex factors can affect overtime and work injuries to cause short-term anomalous increases or decreases.

In 2004, one year after the City of Vallejo implemented the 48/96 schedule change, the City Council was given a report that described the anticipated reduction in FLSA overtime hours. There was a very slight 9.7 percent reduction in "hold-over" related overtime and a 13.3 percent reduction in sick leave from the prior year. The City is now seeking a further evaluation of the cost impact of the Fire Department work schedule change.

Analysis of Cost Implications

A number of cost-related potential benefits have been cited by various agencies in deciding to change to a 48/96 work schedule. These include:

- Sick leave reduction
- Worker compensation/injury cost reduction
- Lower FLSA overtime
- Lower incidents of "holding" employees over a minimum of four hours to cover for employees who have not reported to work due to unexpected illness, injury or other cause
- More productive time as there is less time spent on tasks necessary when a "new shift" takes over
- Better continuity of training
- More opportunity to "follow up" on citizen concerns
- Improved station and equipment maintenance due to improved morale and "ownership" of the station and equipment
- More timely completion of projects.

Unfortunately, neither the City of Vallejo nor any other agency appears to have measured the impact of any more than the first four items: sick leave, workers compensation, "hold-over" and FLSA overtime. With the exception of the Minneapolis study and data gathered by the City of Vallejo, the analysis by other agencies is either not published or is largely anecdotal. For the most part, agencies have entered a trial one-year experiment and then, those reporting, indicate they decided to continue the 48/96 shift largely because it is popular with the line personnel.

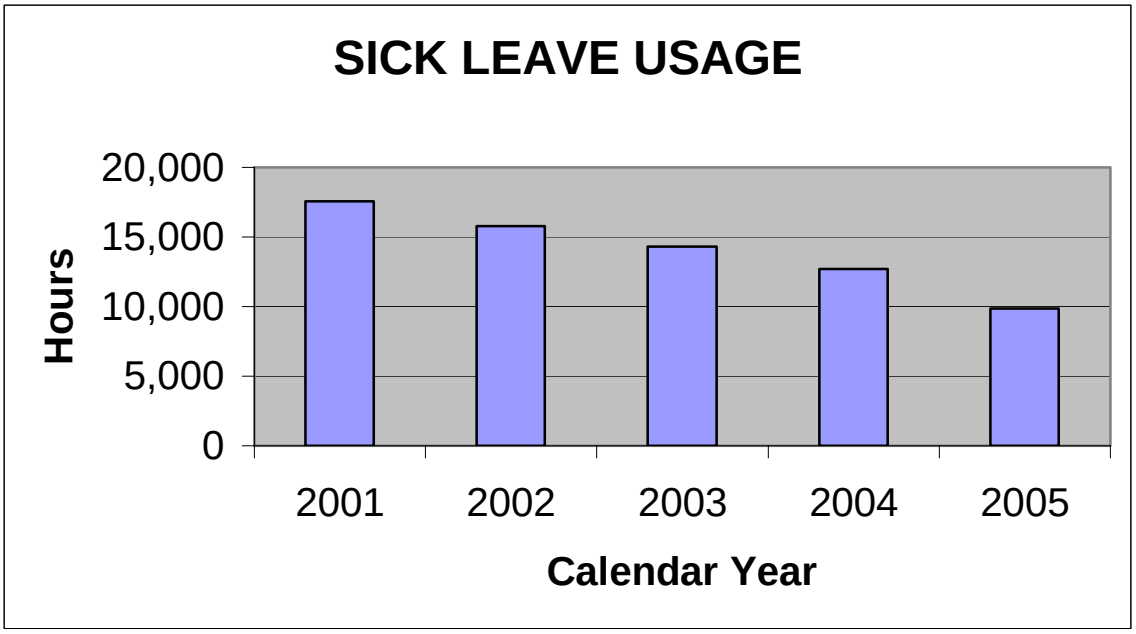
In order to evaluate the cost impact of the 48/96 schedule in Vallejo, Citygate examined the four measures for which data was available: *sick leave, workers compensation injury time off, "hold-over," and FLSA overtime costs.* The City Finance Department was able to provide detailed information for all line fire employees for Calendar Years 2002 through 2005 for sick leave usage, workers compensation time off and FLSA overtime. The Fire Department provided "hold-over" data for 2001 through 2003 and also for 2005 that was hand extracted from Department records; data for 2004 was not available.

The shortcoming of the Citygate analysis below is that all four "measures of cost impact" are subject each year to a high degree of variability based upon unusual circumstances that skew the data in an agency as small as Vallejo. For example, several major illnesses could add as many as 6,000 hours to either the sick leave or workers compensation usage, increasing the annual total as much as 20-25 percent over the prior year. The next year could see a comparable decrease if there is not a recurrence of this unusual set of events. An epidemic of the flu or some similar illness would not only impact sick leave but also "hold-over" costs as last minute replacement of employees becomes necessary. As a result, any effective analysis of "measures of cost impact" really should look at closer to 10 years of data both preceding and following implementation of the new schedule in order to draw conclusions with some confidence. Not only does Vallejo not have this lengthy period under the new schedule, but also neither do other large agencies.

The analysis, then, has to be done with the limited data available. Below is a summary of Citygate's conclusions, followed by the data illustrating these observations.

Sick Leave Usage

Sick leave usage has *decreased* in absolute numbers of hours used, but also the number of employees has fallen by almost 12 percent since 2002. Adjusted for this reduction in employees, there has been about a 19 percent decrease in usage over an average of the last three years compared to 2002. However, the City has reportedly been more aggressive in discouraging inappropriate use of sick leave and in the short-term there easily can be a natural variability of sick leave usage from year to year. This natural variability is reflected in the decrease in sick leave usage from 2001 to 2002, with both years under the prior schedule and so the decrease cannot be attributed to a schedule change. As a result, the available data does not support a conclusion that the 48/96 schedule has reduced sick leave usage in Vallejo and the City should not in its budget planning, therefore, reasonably count on having significant cost savings from reduced sick leave usage. This is a conservative fiscal approach in light of the fact that only consistent management oversight of sick leave usage and long-term data will support whether sick leave usage is affected at all by the change in work schedule alone.

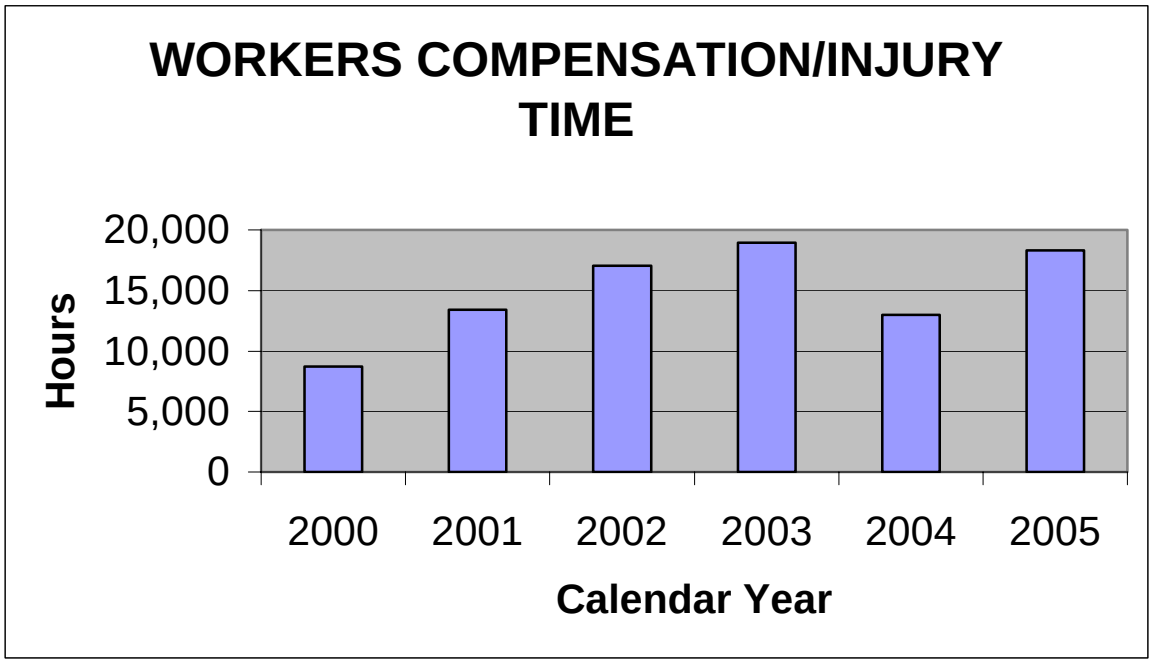


Workers Compensation Injury Time Off

Workers Compensation usage has *increased* over the pre-48/96 schedule year, with the exception of 2004 that reflects a sharp drop in work-related injury time off. It cannot be concluded from this data that fatigue associated with 48-hour shifts results in greater work related injuries, although with the limited data available, it would appear as if the trend is toward greater injuries since the usage has increased during this test period of the 48/96 schedule, and the number of employees has decreased about 12 percent. It is possible that some of the injury increases have

occurred as the remaining employees work too much overtime and occasionally tired employees get hurt. But in light of the limited data, the increase may also simply be due to bad luck.

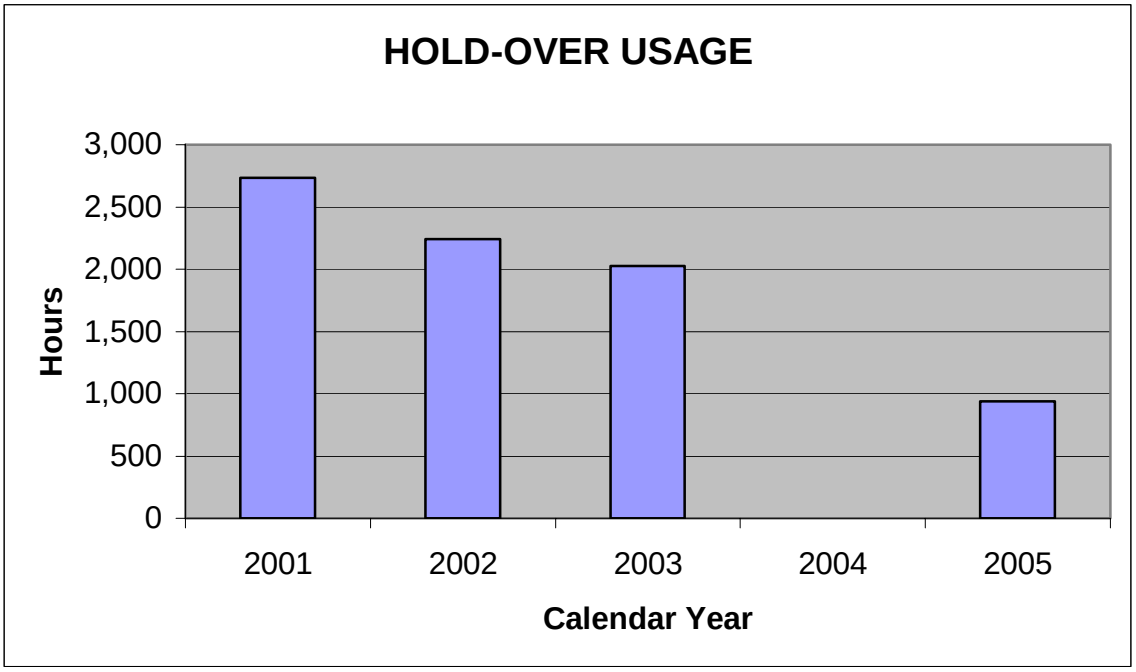
Having stated that the causal effects cannot be diagnosed, there still is a 21 percent increase in workers compensation leave hours from 2002 to 2005. This is an added overtime cost of $176,000 per year if all of this time must be covered by bringing an employee in on overtime to fill the vacancy. While this is not always the case, since there is "overstaffing" available some days to compensate for some sick and injury related absences, for budget planning purposes, the City should continue to anticipate worker compensation cost increases associated with this data trend. These costs may not only include added overtime payments, but also medical costs associated with any injuries. As noted earlier, a long-term analysis of data over the coming five or more future years will assist in establishing whether the short-term data truly represents a trend toward higher workers compensation costs for the City as a result of the 48/96 schedule or other factors such as that long-term data can identify.



"Hold-over"

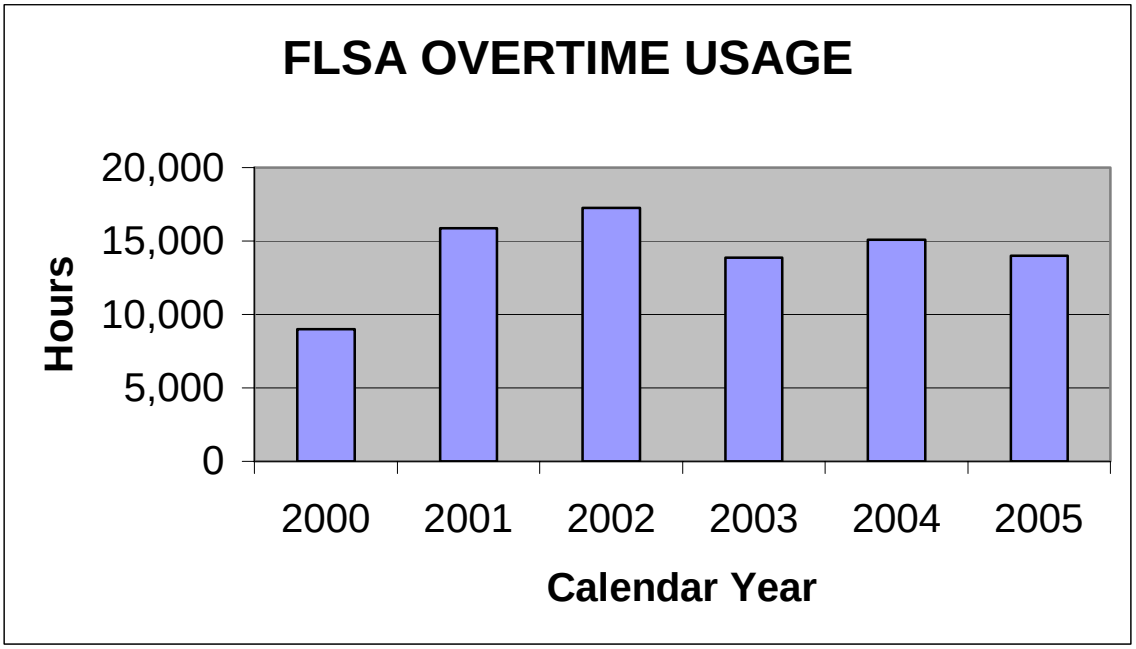
For this particular measure data is available for 2001 through 2003 and also again for 2005. It reflects a steady decline, until 2005, which reflects a rate less than half that experienced in 2002. While this measure also may be subject to natural variability based largely on unexpected illnesses, the change in schedule creates fewer opportunities for the need to hold an employee over for a minimum of four hours because his/her replacement has failed to report for work. It would be reasonably anticipated that the 48/96 schedule would reflect a long-term drop in "Hold-over" costs for the City. Indeed, there is a slight reduction from 2002 to 2003, but there is also a larger reduction from 2001 to 2002 and there was no schedule change between these years. Then, in 2005, there is very large reduction. This erratic data again reflects the difficulty is actually attributing savings to just a change to the 48/96 schedule without having considerably more years of data to compare.

With the natural variability of sick leave and worker injury that may be the principle reason for having to "hold" an employee over until someone can come in to work overtime in place of an ill or injured worker, it would not be reasonable for the City to anticipate significant savings from reduced "Hold-over" related overtime with the 48/96 schedule.



FLSA Overtime

Changing to a 6-day work period under the 48/96 schedule reduces the amount of FLSA caused overtime for regular hours worked in excess of 53 hours per week. This is reflected in a 17 percent decrease in FLSA paid overtime based on an average of the three years from 2003 through 2005 compared to FLSA overtime hours paid in 2002 under the prior work schedule. This represents an annual savings based on actual usage of about $50,000 for the City when adjusted for the 12 percent reduction in the number of employees since 2002, although the Fire Department and union both estimated that the savings would be about $16,000 to $17,000 per year.



Conclusions

The short-term data does not support an argument that a "48/96" work schedule will overall save the City money in the three of the four operational measures examined as compared to the former "3-4" schedule. The period of time for which data is available represents an insufficient sample to draw any long-term conclusions. The data does indicate savings in reduced FLSA Overtime costs, but given the cautionary note that Workers Compensations costs may be higher due to several reasons, those costs could easily offset the FLSA savings.

In the context of the overall Fire Department budget, these expenses and savings are not significant; but a conservative approach would be to at the very least assume no better than a neutral fiscal outcome from the schedule change with regard to sick leave usage, and assume that FLSA Overtime will only partially offset the possibility of higher Worker Compensation costs caused by any factor, not just the work schedule.

The additional arguments in favor of a 48/96 schedule, listed earlier in this section of the report, are not subject to measurement. Instead, issues such as difficulties or improvements in scheduling training, any differences in supervisory oversight, timely completion of projects and the quality of station and equipment maintenance should be evaluated by Fire Department Management, who is in the best position to advise the City Council regarding the impact of the 48/96 schedule on areas not readily subject to clear measurement by available data. These are areas that relate to the quality and consistency of service and will have minimal, if any, clearly measurable impact on costs incurred by the City.

B. OVERTIME USAGE

Background

Overtime usage by the Fire Department has increased from $1,188,643 in Calendar Year 2002 to $1,752,515 in 2005. At the same time the number of filled fire department positions has declined from 101 in 2002 to 89 in 2005. The City has asked for a review of overtime usage to determine the cause(s) of the increase and an analysis of whether this usage can be reduced without a corresponding cost increase to the City in other expense categories.

Section 7a of the City Memorandum of Understanding with the IAFF Local 1186 establishes a minimum staffing of 28 fire suppression personnel per day below the classification of Assistant Chief. This provides staffing of 3 personnel for each of 8 Engine Companies and a staffing of 4 personnel for the Truck Company. Over the past four years, the City has budgeted an average of 5 additional positions for each shift (15 total for the three shifts) to insure that personnel are available to fill in when there is a vacancy due to illness, injury, resignation, retirement, jury duty, or vacation/holiday/other earned time off. Presently, the MOU allows up to 9 people off on a shift for various "scheduled reasons such as vacations, compensated time and holidays. Any time the number of people off on a shift for any reason, including department vacancies, exceeds the available overstaffing, personnel will need to be called in to work overtime in order to meet the 28 firefighter minimum daily staffing provision rather than operate an Engine Company with fewer than 3 personnel or idle an Engine Company. In 2005, the actual number of filled positions averaged only 89, meaning that overstaffing to handle vacancies and avoid overtime was actually only 1 or 2 positions on each shift. What this means operationally, is that on most days some personnel will need to be hired on overtime to meet the minimum staffing requirement.

In examining the cause(s) of the overtime increase over the past four years, there are two important questions to be addressed. Is it less expensive to hire overtime to meet the minimum staffing requirement than to have the additional personnel on payroll to fill in for the vacancies? Additionally, do any of the MOU rules regarding time off "significantly" affect the potential number of vacancies each day and therefore the amount of overtime required.

Analysis of Overtime Costs

Overtime vs. Overstaffing to Meet Constant Staffing Requirements

The basic principle is that overtime is less expensive to use in filling vacancies if the overtime hourly rate is less than the hourly rate of a fully benefited employee. For Vallejo, the weighted average hourly rate for a fully benefited employee (Captain, Engineer, and Firefighter) is $64.84 for FY 2005-06, while the comparable Overtime hourly rate is $53.62. The reason for the difference is that overtime is not calculated on total compensation received by an employee. Instead, benefit costs such as retirement and medical are excluded, which results in an overtime rate that is lower than the fully benefited hourly rate. What is not also expensed in this overtime vs. fully benefited employee cost per hour equation is the initial and on-going cost to train, equip, and have workers compensation injury cost exposure for each "over staff" employee. If these costs could be captured on a cost per hour basis, then it is even more cost effective to pay overtime – to a point. That point is where the remaining employees are working too much

overtime and are not getting enough off-duty rest. Thus, there needs to be a balance point in departments the size of Vallejo and larger.

From the perspective of comparative hourly rates, it would seem that the least expensive approach for the City would be to have only 84 positions filled, which is the number required to provide the 28 firefighters per shift needed for constant staffing. The City could then fill any absences due to vacation, sick leave etc. with overtime, rather than overstaffing so that permanent personnel are available to fill these absences.

The greatest shortcoming of this approach is that over the past four years there has been an average of 6.6 absences on each 24-hour shift caused by sick leave, injuries, annual leave and compensated time off, which would require about 12 percent of the employees not currently working that shift to come back or hold over to work the overtime. This is almost double the actual overtime used during the past four years, because the City had some overstaffing to fill in for the absences.

Due to the additional impact of temporary vacancies caused by an estimated 5 percent annual turnover due to resignations and retirements, an average of about 8 vacancies would need to be filled per shift on average. When you factor this in, an average of 15 percent of the off duty workforce would be required to work overtime every day, if there were no overstaffing. Long-term, many employees are not willing to work that much overtime year after year and it can result in fatigue, injuries and morale problems. The result is that many agencies with constant staffing requirements (not all agencies have this requirement) overstaff to some degree to handle some of the vacancies and use overtime for the remainder. This has been the appropriate and best practice policy followed by the City of Vallejo.

Even with the budgeted overstaffing of an average of 5 positions per shift over the past four years, the City has only been able to cover half of the 233,000 hours of leave of all types taken by the full time employees. Adding more overstaff positions would cost the City, on average, about 20 percent more than filling these vacancies with overtime.

We qualify this statement by saying “on average,” because some days there will be fewer personnel off on leave than on others. The Fire Department reports that there are at least a small number of days in which they have more over-staffed positions on duty than there are vacancies, and so in this regard there are occasions in which the City is paying for unnecessary staffing. What this argues is that if the City wants to maximize the economic value of overstaffed positions, then it should reduce that number to the minimum necessary to insure that the overstaffing number each day never exceeds the actual number of firefighters on leave. While the City would still be paying more for the overstaffed positions that fill vacancies than they would if they filled them all with overtime, there are good policy reasons, as mentioned above, to insure that the amount of overtime required does not result in fatigue and low morale among employees.

Conclusion: Based on the information from the Fire Department that there are only a small number of days with excess personnel on duty above the 28 constant staffing requirement, the present number of filled permanent positions is “about right” if the Department is not experiencing low morale and higher fatigue/injury rates due to the amount of overtime required of employees.

Impact of MOU Provisions on Daily Vacancies

Citygate has reviewed the MOU Agreement between the City and IAFF Local 1186, with particular attention to provisions that might cause a significant increase in the number of daily vacancies that have to be filled in order to meet the 28-person constant staffing requirement. An important overall measure is that over the past 4 calendar years, employees on average were on leave of all types about 24 percent of their compensated 2,912 hours per year. Put somewhat differently, of the 121 "24-hour" shifts each employee is compensated for, an employee works 92 shifts on average per year or slightly less than 8 of the normally scheduled 10 "24 hour days" per month. Obviously the actual amount per employee will differ based on their longevity and associated annual vacation benefit, the amount of sick leave they use and time off for worker injuries. But it is this time on leave that creates the necessity to fill in the vacancy with either an overstaffed position or calling someone in to work overtime.

Sick leave and worker injury are largely unplanned absences, but time off for vacations, holidays and compensated time off earned in lieu of paid overtime can be scheduled. And it is the provisions in the MOU and Management Policy that determine whether vacancies created by this leave are bunched together, creating a greater need for overtime.

In 2005 there was an average of about 6 employees off each day on some type of leave. About 2.5 of these were off on scheduled leave, with the remainder being due to illness and injury. Obviously, if all scheduled leave could only be taken at the convenience of the City and without regard to the needs of the employee, then the 5 or 6 overstaffed positions the City has budgeted on each shift over the past four years would be nearly adequate to handle most of the vacancies created by various leave situations. But this type of "one-sided" administration of an employee-earned leave benefit is not very good personnel policy in an organization concerned about morale and partnerships with employees whose quality of work helps determine the quality of service delivered to the public. Citygate is not aware of any Fire Department where there are not some MOU provision that provides for scheduled leave that accommodates at least some of the needs and desires of the employees.

These MOU provisions vary widely. It is fairly common to limit the number of people who can be "off" on scheduled leave each day, and also to minimize the opportunity to take time "off" in single-shift increments, but instead to require employees to take time off in 2 or more consecutive shifts and even to require scheduling weeks or months in advance using seniority rights. These scheduling provisions help the Fire Department Management reduce the need for overtime created by having too many vacancies on any one day.

In Vallejo, the MOU provides that no more than 4 employees can be off each day on vacation leave, no more than 2 can be off each day taking "compensated time off days earned in lieu of paid overtime," no more than 2 can be off per day on "holiday leave" and two personnel can also be off for labor relations business. This is a total of 10 out of the 28 assigned personnel per shift who could be off on scheduled leave per day. While the MOU does address the question of how far in advance an employee must schedule leave and generally requires vacation to be taken in one or two increments during the year, it also does allow employees to take off as little as 12 hours at a time if they have leave accumulated from prior years, are requesting this at least 30 days in advance and it does not result in more than 4 employees taking vacation leave off on that day. The practical affect of these limitations is to permit employees, and not fire management, to determine the number of employees off on each day within the "daily caps" set out in the MOU.

Fire Management does not have an opportunity to further balance the number of leaves each day other than the maximum allowed in the MOU. While the cap could be changed or other limitations set based on time of the year, to more evenly spread leaves taken, any of these changes would require Meeting and Conferring under the law with the Union. However, this is not a perfect science as with 80 plus employees wanting to use earned leave, the cap cannot be set so low, that vacations cannot practically be scheduled.

While in a mathematically perfect world, only 2.5 employees might be off on any single day for scheduled leave, the MOU provisions a maximum of 10 to be off. If both the City and the IAFF Local 1186 are interested in reducing overtime usage on a long-term basis, then changes need to be made in the number of employees allowed off each day on scheduled leave and there need to be provisions regarding how that time is scheduled in order to provide a more even distribution of time off across all 12-months of the year, not just the popular ones.

In reviewing the remainder of the MOU provisions that affect "leave," Citygate did not find any that appeared unusual or would have a significant affect on overtime usage.

COMBINED NEXT STEPS AND RECOMMENDED PRIORITIES

A. *DEPLOYMENT*

1. After understanding the findings in this report, the City should adopt revised deployment time measures meeting the City's risk versus outcome needs:
   a. First-due unit: Arrival 90 percent of the time, within 7 minutes of the call being received at the police fire dispatch center.
   b. For serious building fires requiring 14+ firefighters and an Assistant Chief (First Alarm), all the firefighting units should arrive on-scene within 11 minutes, 90 percent of the time.
   c. The City needs to focus on improving the police communication center response time performance to lower it from 2 minutes to 1 minute, 90 percent of the time, as well as lowering firefighter turnout time by 30 seconds from 2:30 to 2:00 minutes at 90 percent.
2. The City, as its fiscal situation allows, needs to discuss with the Hiddenbrooke community how they can partner together fiscally to improve the response times and level of service. Some options include:
   a. Retain the existing basic life support ambulance agreement.
   b. Upgrade the ambulance agreement to include one paramedic per day and restrict the regional area the ambulance operates within to leave it more available for northeast Vallejo calls for service. This would come at an increased cost.
   c. Create and staff a 2-person firefighter squad, with one member being a paramedic. This squad would handle medical calls, minor fires and, on serious fires, still be able to take an outside command and assessment function to set-up while the more distant units arrive.
   d. Consider upgrading the back access road from Station #27's area to improve travel times and the ability to evacuate the community.
3. Given that Vallejo has an adequately equipped and staffed fire department, understand that there is no deployment "excess" capacity today to relocate stations to the underserved edge areas and if severe budget reductions are necessary, there will be meaningful service reductions.
4. The quantity of staffing for headquarters functions is at the lowest amount to continue current programs, and any additional reductions will reduce or halt the affected programs.

B. *48/96 WORK SCHEDULE*

5. The short-term data does not support an argument that a "48/96" work schedule will overall save the City money in the three of the four operational measures examined as compared to the former "3-4" schedule. The period of time for which data is available represents an insufficient sample to draw any long-term conclusions. The data does

indicate savings in reduced FLSA Overtime costs, but given the cautionary note that Workers Compensations costs may be higher due to several reasons, those costs could easily offset the FLSA savings.

6. In the context of the overall Fire Department budget, these expenses and savings are not significant; but a conservative approach would be to, at the very least, assume no better than a neutral fiscal outcome from the schedule change.

C. OVERTIME USAGE

7. Based on the information from the Fire Department that there are only a small number of days with excess personnel on duty above the 28 constant staffing requirement, the present number of filled permanent positions is "about right" if the Department is not experiencing low morale and higher fatigue/injury rates due to the amount of overtime required of employees.
8. In reviewing the remainder of the MOU provisions that affect "leave," Citygate did not find any that appeared unusual or would have a significant affect on overtime usage.
9. If both the City and the IAFF Local 1186 are interested in reducing overtime usage on a long-term basis, then changes need to be made in the number of employees allowed off each day on scheduled leave and there need to be provisions regarding how that time is scheduled in order to provide a more even distribution of time off across all 12 months of the year, not just the popular ones.