

Chapter 6 – Principles of Fire Protection Service Delivery

General

This Municipal Service Review was not intended to be a comprehensive evaluation of all aspects of the Stanislaus County fire protection delivery system. Nonetheless, the guiding principle is that county fire agencies must work together more efficiently and effectively. Given the fact that fire agencies often respond outside of their jurisdiction boundaries, this review is aimed at achieving a more uniform and cost efficient balance or *economies of scale* throughout the County. It is appropriate to note that the *deployment platform* of almost all fire agencies is based on certain principles that are somewhat universal. These principles include standards of cover, levels of effort, levels of service, staffing configuration, elements of time, risk assessment, distribution of resources, concentration, response time goals, Insurance Services Office review, and mandates by state and federal government. This chapter will provide an assessment of these factors in relationship to the individual county fire agencies.

Limitations to this Study

The Municipal Service Review is not intended to be an in-depth study of standards of cover (SOC), but this process cannot ignore the implications of these principles. A more comprehensive discussion of SOC concept of thresholds and triggers is included in the Appendix to help the reader understand why fire agencies must grow in conjunction with the population and development or face response failure. For this review, ESCi's observations are going to focus on the following:

- Where are the fire stations now?
- What level of service are they currently providing?
- What is the potential for expanding that level of service in the short term?
- Can any efficiency be developed from strengthening the coordination and cooperation among the agencies?
- Can any efficiency be expected from redrawing district lines or engaging in consolidation or other cooperative behavior?

Standards of Cover

One of the fundamental principles for assessing fire service delivery is known as standards of cover (SOC). The concept is simply that fire protection resources need to be distributed in a community based on risks, hazards, and values; and furthermore, they should be able to respond in a timely fashion to prevent a small fire from becoming a larger one. This involves the ability to concentrate resources, especially staffing, to be able to perform the job in a safe and effective manner on significant events.

Level of Effort

Level of effort is defined as the *level of financial resources* devoted to providing a specific level of service. It is most often expressed in terms of a *per capita* expenditure, (as defined in Chapter 5) or as a given increment of a tax rate or contribution produced by a given amount of the population. Because the primary funding sources used to provide fire services in Stanislaus County are derived from property tax, the policy question regarding level of service is based on level of effort. Financial resources must match the level of service to be provided. The level of effort is, therefore, reflected in the revenues and expenditures of the reporting agencies. The surrogate for level of effort is called *per capita costs*. This is derived by dividing the budget by the population being served. In the case of the fire agencies reported on in this study, there are multiple per capita numbers. These numbers are derived by dividing the budgets of the respective entities by the population being protected – this gives a *per person* level of effort that is often used as a means of comparison.

Secondarily, decisions must be made that require a business approach to providing a level of service consistent with the revenue. This chapter looks at compliance with regulations, response time performance, and fiscal impact of providing that level of service.

The information provides justification and fundamental orientation of the deployment system.

Levels of Service

Level of service is the method by which most fire agencies are evaluated is their ability to provide adequate resources to mitigate events. In order to understand the effectiveness of a fire department, the delivery system needs to be defined in terms that can be measured. Level of service is primarily defined as the resources needed to meet an organization's stated service level objectives. Level of service is defined only in terms of what is provided, not in terms of effectiveness and efficiency in dealing with any specific emergency.

In general, the level of service provided is described by the characteristics of the agency providing service. This includes the idea that an adequate number of personnel are placed on an adequately designed and equipped piece of fire apparatus; and they are deployed to arrive at the scene of an emergency in a timely fashion to remove the hazards, reduce the danger, or stop the emergency from progressing any further. Using these attributes, the following level of service is recognized by the fire service:

- ✓ *No Service* – No response is available for the area.
- ✓ *Wildland Level of Service* – A fire company equipped to handle wildland events will arrive within 30 minutes of travel time to intervene. There is no limit on the number of total resources that will be ultimately deployed, nor is there an expectation of the time required to complete the deployment.
 - Generally, this is any rural area not readily accessible by public or private maintained road.
- ✓ *Frontier Level of Service* – A fire company equipped to handle basic all-risk emergencies will arrive within 15 minutes of travel time. There is no expectation that the deployment of these resources will result in confining fires to the area of origin,

but that the response will result in preventing the fire from spreading from the building of origin to exposures.

- ✓ *Rural Level of Service* – A fire company equipped to handle basic structural fires and other related emergencies will arrive within 15 minutes of travel time, accompanied with other vehicles to sustain a fire flow of 500 gpm (gallons per minute) for a minimum of one hour. There is an expectation that the deployment will result in confining the fire to the room of origin, if the fire has not gone to flashover prior to arrival of the response. This level of service is the basic reason the Insurance Services Office (ISO) created its ISO 8B category.
 - Generally this is an unincorporated or incorporated area with total population less than 10,000 people, or with a population density of less than 1,000 people per square mile.
- ✓ *Suburban Level of Service* – A fire company equipped to handle all risk emergencies will arrive within five to six minutes of travel time, 80 percent of the time, and be able to generate fire flow for 2,000 square foot occupancy for one hour. There is an expectation that the deployment will confine most fires to the room of origin.
 - Generally this is an incorporated or unincorporated area with a population of 10,000 to 29,999 or any area with a population density of 1,000 to 2,000 people per square mile.
- ✓ *Urban Level of Service* – A fire company equipped to handle all risk emergencies will arrive within five minutes of travel time, 90 percent of the time, and be able to generate adequate fire flow for the designated risk level in the area. There is an expectation that the response will confine most fires to the room of origin.
 - Generally this is an incorporated or unincorporated area with a population of over 30,000 people and a population density over 2,000 people per square mile.

Given the overall goal to control emergencies before they reach maximum intensity, communities must establish a level of service, in writing, that can be used to make deployment decisions. These are the day-to-day objectives of the responding units. That is the primary purpose behind this concept; to determine if the level of service meets the needs of the users of the system.

Level of service is measured by response time goals along with the types and the nature of the service being provided. For example, providing two firefighters to the scene of a medical emergency within 10 minutes with 90 percent reliability is one level of service. To provide four firefighters in five minutes with an 80 percent reliability is another. Levels of service can be modified up or down depending upon the availability of resources, deployment patterns, staffing, and other factors. This is normally called the *Standards of Cover*. (SOC)

Most of the fire agencies in this area do not have an adopted SOC document. The suburban fire station assets appear to have a de facto performance of somewhere between five and six minutes, 80 percent of the time. The accepted, albeit informal performance standard, for the rural units appears to be in the range of having a travel time of nine to ten minutes on average. Fractals are not available for review.

Based on the per capita expenditures and the area covered, each fire agency in this review has been given a definition of a *level of service*. Most of the fire districts being reviewed in this

process would be classified as rural areas; most of the cities will be considered borderline suburban/urban

Figure 26: Level of Service Provided

Department	Type of Service
CDF	Rural
Denair	Rural
Mountain View	Rural
Newman	Rural
Oakdale Rural	Rural
Patterson	Rural
Turlock Rural	Rural
Westport	Rural
Woodland	Rural
West Stanislaus	Rural/Suburban
Burbank-Paradise	Suburban
Salida	Suburban
Hughson	Suburban
Keyes	Suburban
Oakdale	Suburban
Industrial	Suburban
Ceres FPD	Suburban
Ceres	Urban
Modesto	Urban
Stanislaus Consolidated	Urban
Turlock City	Urban

*Source: LAFCO Survey

Staffing Configurations

There are several different staffing configurations available for a fire agency to deploy. They generally consist of three specific types of staffing resources:

Volunteers – A staffing configuration that is entirely dependent on the response of individuals that are properly equipped and trained to function as firefighters but receive no compensation for providing a level of service.

Full-Time – A staffing configuration that is dependent on individuals being on-duty, properly equipped, and trained to function as firefighters who are compensated for providing the level of service.

Part-Time – A staffing configuration that is dependent on individuals that are on-duty on the basis of working alternative work schedules other than being full-time. They are trained as firefighters, have the proper equipment, and function as firefighters but are only compensated for the hours they work in the station. They usually have an hourly wage rate.

Fire agencies, due to the amount of money that is available, often utilize a combination of ways and means of using these three types of personnel resources consisting of:

- *Totally volunteer agency* – No one is compensated
- *Combination agency* – Some are compensated, some are not. A mixture of volunteers, reserves, or part time personnel
- *Totally full-time agency* – All are compensated

A fire agency can only afford the level of service that money allows. Based on these definitions, each fire agency in this study has been given a staffing description which is shown as follows.

Figure 27: Type of Fire Department

Department	Total Staffing	Full-time	Volunteers	Type
Burbank Paradise FPD	30	0	30	Volunteer/Part Time
CDF	7	7	0	Variable
Ceres City	24	21	3	Mostly Paid
Ceres FPD	0	0	0	Under contract
Denair FPD	23	0	23	Volunteer
Hughson FPD	25	2	23	Mostly Volunteer
Industrial FPD	0	0	0	Under contract
Keyes FPD	29	1	28	Mostly Volunteer
Modesto	192	192	0	Entirely paid
Mountain View FPD	18	0	18	Mostly Volunteer
Newman	15	1	14	Mostly Volunteer
Oakdale	28	28	0	All paid
Oakdale Rural FPD	48	19	29	Combination Combination—part of another department
Patterson	5	5	0	
Salida FPD	37	11	26	Combination
Stanislaus Consolidated FPD	86	56	30	Mostly Paid
Turlock City	53	33	20	Combination
Turlock Rural FPD	30	0	30	Volunteer
West Stanislaus FPD	105	5	100	Mostly Volunteer
Westport FPD	17	0	17	Volunteer
Woodland Avenue FPD	26	0	26	Volunteer
County Fire Warden	*(4)	0	0	Paid Staff
Total	798	381	417	

* Non combat

Elements of Response Time

In conducting research for the Commission on Fire Accreditation International, Inc. (CFAI), members of the initial task force spent considerable effort toward examining the factors that make up the time required to be notified of and respond to a fire emergency. A thorough understanding of the relationship of time and the progression of an emergency was fundamental to defining optimum service levels. In the process of this work, the task force noted that many fire departments are collecting data on emergency response but are not necessarily using that data to measure performance.²⁵

Problems occur when fire departments use different timeframes in collecting and reporting response time statistics. For example, if a department does not include alarm processing or turnout time in its definition of response, the department's response statistics may be unfairly weighted because only travel time to the emergency is measured and reported. On the other hand, a department that does include alarm time and processing time in its collection of data may be compared unfavorably to a department that does not.

Fire emergency response times are well defined in the Stanislaus County because of the use of a single dispatch center. Definitions of the times to be measured are described in the *Cascade of Events*.

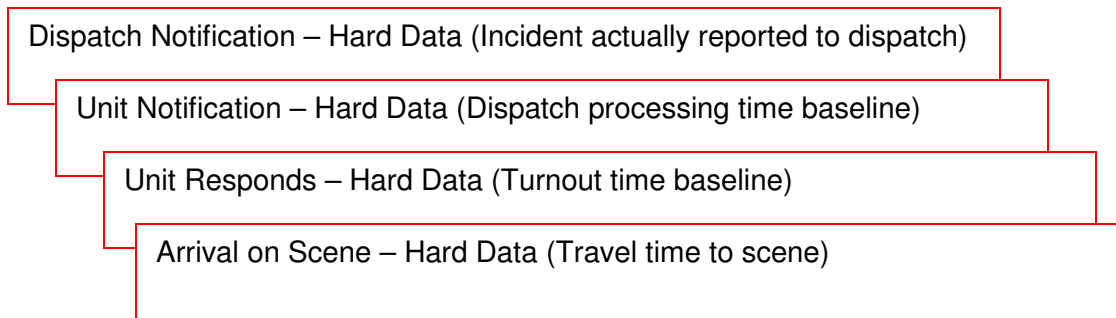
Cascade of Events

Response time elements are actually a cascade of events. This cascade is similar to that used by the medical community to describe the events leading up to the initiation, mitigation, and ultimate outcome of a cardiac arrest. It is imperative the reader keep in mind that certain intervals described can be directly influenced by the fire service (reflex interval and travel interval), while others can be influenced indirectly (through public education, engineering initiatives, and standards).

Careful definition of terminology is essential to any conversation about response performance standards. It becomes even more critical when an organization attempts to benchmark its performance against other providers. Reviewers should understand the standard response time intervals as outlined on the next page.

²⁵ *Creating & Evaluating Standards of Response Cover for Fire Departments*, Fourth edition, Chapter 2, Page 1, Commission on Fire Accreditation International, Inc, 2003, Chantilly, VA.

Figure 28: Cascade of Events



Time Points and the Cascade of Events

The response performance continuum is composed of the following time points and time intervals:

- **Event Initiation Point** - The point at which factors occur that may ultimately result in an activation of the emergency response system. Precipitating factors can occur seconds, minutes, hours, or even days before a point of awareness is reached. An example is the patient who ignores chest discomfort for days until it reaches a critical point at which he/she makes the decision to seek assistance (point of awareness). It is rarely possible to quantify the point at which event initiation occurs.
- **Emergency Event Awareness** - The point at which a human being or technologic sentinel (i.e., smoke detector, infrared heat detector, etc.) becomes aware of conditions requiring an activation of the emergency response system. This is considered the point of awareness.
- **Alarm** - The point at which awareness triggers an effort to notify the emergency response system. An example of this time point is the transmittal of a local or central alarm to a public safety answering point. Again, it is difficult to determine the time interval during which this process occurs with any degree of reliability.

A sub-interval which we shall call the alarm transmission interval lies between the awareness point and the alarm point. This interval can be significant, as when the alarm is transmitted to a distant commercial alarm monitoring organization, which then must retransmit the alarm to the local 9-1-1 and dispatch facility. When there is an automatic transmission of the signal, the fire department gains valuable time in controlling the event.

- **Notification** - The point at which an alarm is received by the public safety answering point (PSAP). This transmittal may take the form of electronic or mechanical notification received and answered by the PSAP.
- **Call Processing Interval** - The interval between the first ring of the 9-1-1 telephone at the dispatch center and the time the CAD operator activates station and/or company

alerting devices. This can, if necessary, be broken down into two additional parameters: *call taker interval* (the interval from the first ring of the 9-1-1 telephone until the call taker transfers the call to the fire department dispatcher) and *dispatcher interval* (the interval from the time when the call taker transfers the call to the dispatcher until the dispatcher [CAD operator] activates station and/or company alerting devices).

- **Dispatch Time** - The time when the dispatcher, having selected appropriate units for response, initiates the notification of response units.
- **Reflex or Turnout Interval** - The interval between the activation of station and/or company alerting devices and the time when the responding crew activates the *responding* button on the mobile computer terminal or notifies dispatch by voice that the company is responding. During the reflex interval, crews cease other activities, don appropriate protective clothing, determine the location of the call, and board and start the fire apparatus. It is expected that the responding signal will be given when personnel are aboard the apparatus and the apparatus is beginning to roll toward the call.
- **En-route Time** – The point at which the responding apparatus signals the dispatch center that they are responding to the alarm.
- **Travel (Interval)** – Begins at the termination of the reflex interval and ends when the responding unit notifies the dispatcher unit that it has arrived on scene (again, via voice or electronic notification).
- **On Scene Time** – The point at which the responding unit arrives on scene.
- **Initiation of Action** – The point at which operations to mitigate the event begin. This may include size-up, resource deployment, etc.
- **Termination of Incident** – The point at which the unit(s) has completed the assignment and is available to respond to another request for service.
- **Total Response Interval** – Alarm processing time + turnout time + travel time.
- **Operations Interval** – This time measurement is an indicator of the customer's perception of the performance of the emergency service system after they are on-scene. It includes those factors that, in the customer's perception, reflect the performance of the fire service whether or not the fire service directly controls those elements. This interval adds the call-processing interval to the response interval.

In general, what the public sees is:

- **Total Response Time** — The time required for response, measured as the time between when the emergency responder is notified of an incident by the dispatch agency and when the responder's vehicle comes to a complete stop at the scene (or staging area).

What fire agencies must plan for and keep track of is:

- **Turnout Time** — The time measured between when the emergency responder is first notified of an incident by the dispatch agency and when the responder's vehicle begins moving toward the incident.
- **Travel Time** — The time measured between when the emergency responder's vehicle begins moving toward the incident and when that the vehicle comes to a complete stop at the scene (or staging area).

Risk Assessment

The Standards of Cover incorporate the idea that the level of service being provided be compared to the level of risks, hazards, and values being exposed. This concept, while it is basic to the Standards of Cover concept, does not always apply itself well to issues of overlap and redundancy. It is clear from the Municipal Service Review that there is a desire to eliminate redundancy. However, before deciding whether something is actually a duplicate, one has to evaluate the underlying premise as to why a fire station is already in a general area to begin with.

This Municipal Service Review process does not specify an extensive risk assessment program. However, data was collected from several different points of view to take a look at recognized fire problems in the area relating to population and the concentration of buildings that have an economic impact on the community. Population has been mapped according to the 2000 Census data; and clearly shows that there are density concentrations in the cities and along the two transportation corridors, with large areas in the County currently undeveloped.

One data element reviewed was the Insurance Services Office's Needed Fire Flow (NFF) studies for Stanislaus County (see ISO information in this chapter). In spite of the fact that the County covers a very large amount of area, the ISO has very few buildings that have assigned needed fire flow requirements within this County. These ISO-rated buildings are identified in *Appendix E: Map Atlas* and are described as a density map of Needed Fire Flow locations. Specific addresses are available on request.

Distribution

Distribution is the attribute of a fire station being located so that personnel can respond to an event in a timely fashion based on the aforementioned *Cascade of Events*.

Standards of Cover principles incorporate this concept called *total response time* to measure distribution. In the most simplified terms, the closer fire stations are together, the quicker personnel can get to an emergency. The further apart they are, the longer it takes. While this may seem intuitive, it is not a well known factor to many stakeholders in the system.

For example, a person who lives in a well developed city may have an expectation that the fire service will be to the front door within a matter of only a few moments. A person moving out of that city into a residential area that is locally very densely populated area, may have the same expectation (in a tract development). Yet, the reality is that the levels of service provided by that city may be significantly different than the level of service provided by a department that is primarily serving a rural area around a newly developed tract.

For explanation the response time by all Stanislaus fire agencies must also be broken into three components - alarm processing time, turnout time, and travel time. The element of time for alarm processing is in the hands of the dispatch and communication system. The amount of time it takes to turnout a fire apparatus is different depending on whether or not the station is staffed by full-time, permanent personnel, or otherwise assigned personnel, or whether staffing is recalled (volunteer). Travel time is a function of speed and the availability of a road network to get to the scene of an emergency. This results in different levels of service being provided in different areas.

The *Map Atlas* (See Appendix E) illustrates each agency's response pattern from a perspective of travel time only. It should be recognized that the travel time polygons (areas) often go well beyond the boundaries of an agency. That is considered to be part of the relationship between adjacent engine companies. There will also be areas that are not covered by a travel time polygon. These represent areas that are currently underserved by fire suppression capability.

Concentration

Concentration is used in the Standards of Cover process to describe the ability of a fire agency to put enough personnel on the fireground to make a safe and effective attack upon a structural fire or other emergency. The term *concentration* is used in concert with the concept of an effective response force.

Effective Response Force

The term effective response force means that a fire department places a sufficient number of people on responding fire equipment to perform specific duties that would mitigate the emergency within a certain time frame. For structure fires, this equates to a first alarm assignment. An effective response force has three areas of application - emergency medical incidents, structural fires, and all other emergency responses.

In the simplest of terms, sending one person on a fire truck does not constitute an effective response force. By the same token, waiting until there are ten people on a fire truck does not constitute an effective response time if it takes 20 minutes. Generally accepted practices in the fire service are that it requires a minimum of two people on a vehicle to be able to treat effectively a minor emergency such as a medical aid; a traffic collision; or, for that matter, a fire of minimum consequence, such as a fire in a trash container or an insipient wildland fire. Contemporary fire service practices also indicate that it takes a minimum of three people on a vehicle to do an effective job of mounting an attack on a fire of any consequence, i.e. a beginning fire in a structure or a major fire in a vehicle. Four persons are preferred in urban areas.

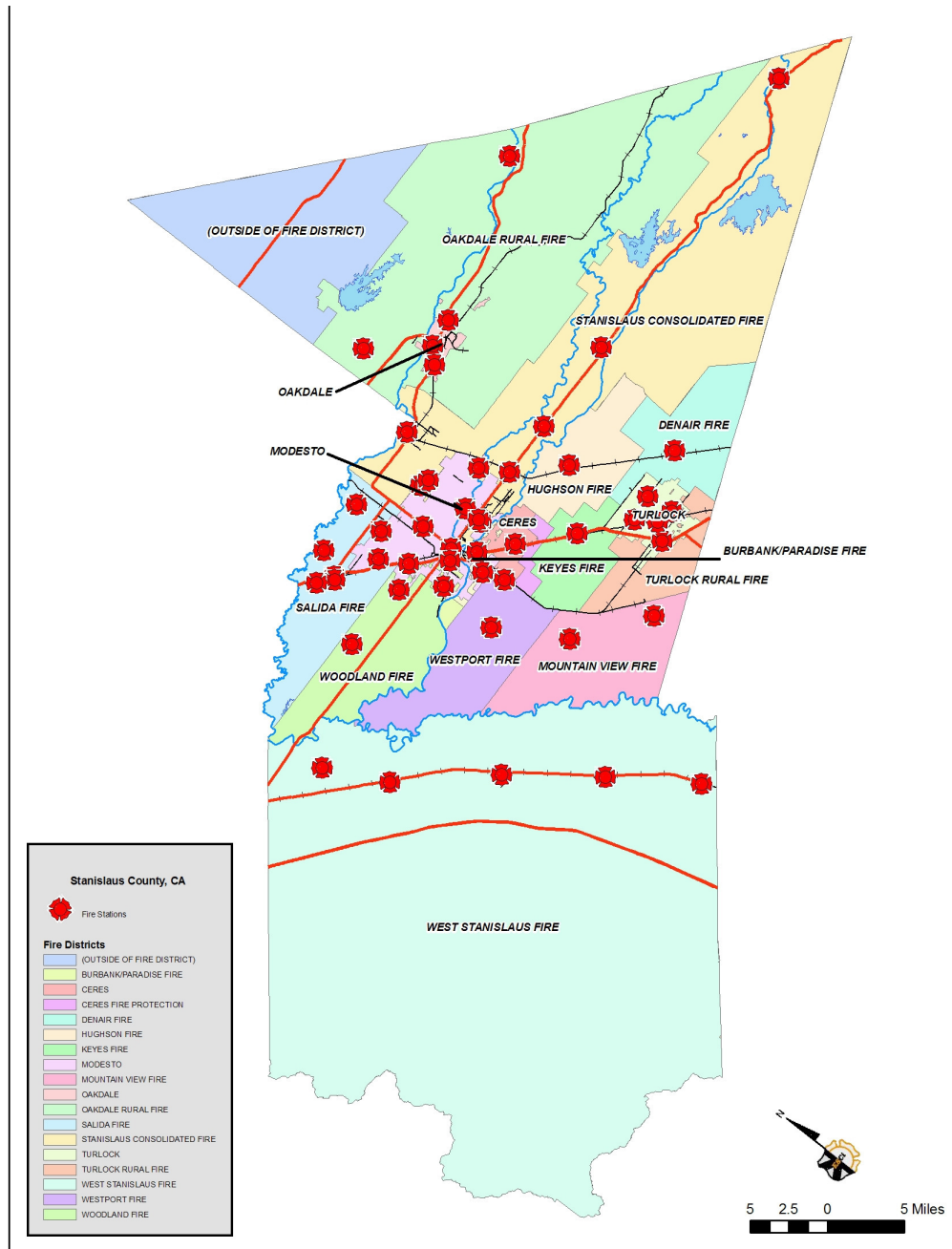
Federal law and national standards establish a firefighter safety requirement known as the *two in-two out* rule. This rule states that it takes four people to be on the fireground before anyone is authorized to enter a building unless there is a life being threatened.

In addition, the ISO has made a determination that unless six people are on the fireground within a reasonable timeframe, it is unlikely that the department will be able to do anything to reduce structural fire loss effectively.

The current delivery system utilizing volunteers, paid call, reserves, sleepers, or interns all create a similar type of deployment pattern. The major issue with all volunteer fire departments relates to the reliability of the volunteer fire force depending upon two different modalities - time of day or time of year.

There is a significant difference between the level of service that is provided to urban or suburban communities with respect to distribution and concentration criteria and those that are emerging in underserved areas or rural areas. The ability to mount an effective response force is also impacted by the lack of available personnel to staff equipment in a timely fashion.

Figure 29: Map of the Current Fire Station Locations in the County for Local Government



Structural fire protection is a function of providing a response to two risk factors - people and their property. People who are living or working in buildings that present fire hazards have emergencies. The more people there are, the more calls for service. The more buildings there are, the more the potential for loss. The following two charts provide an insight into the distribution and concentration of both people and density in this study area.

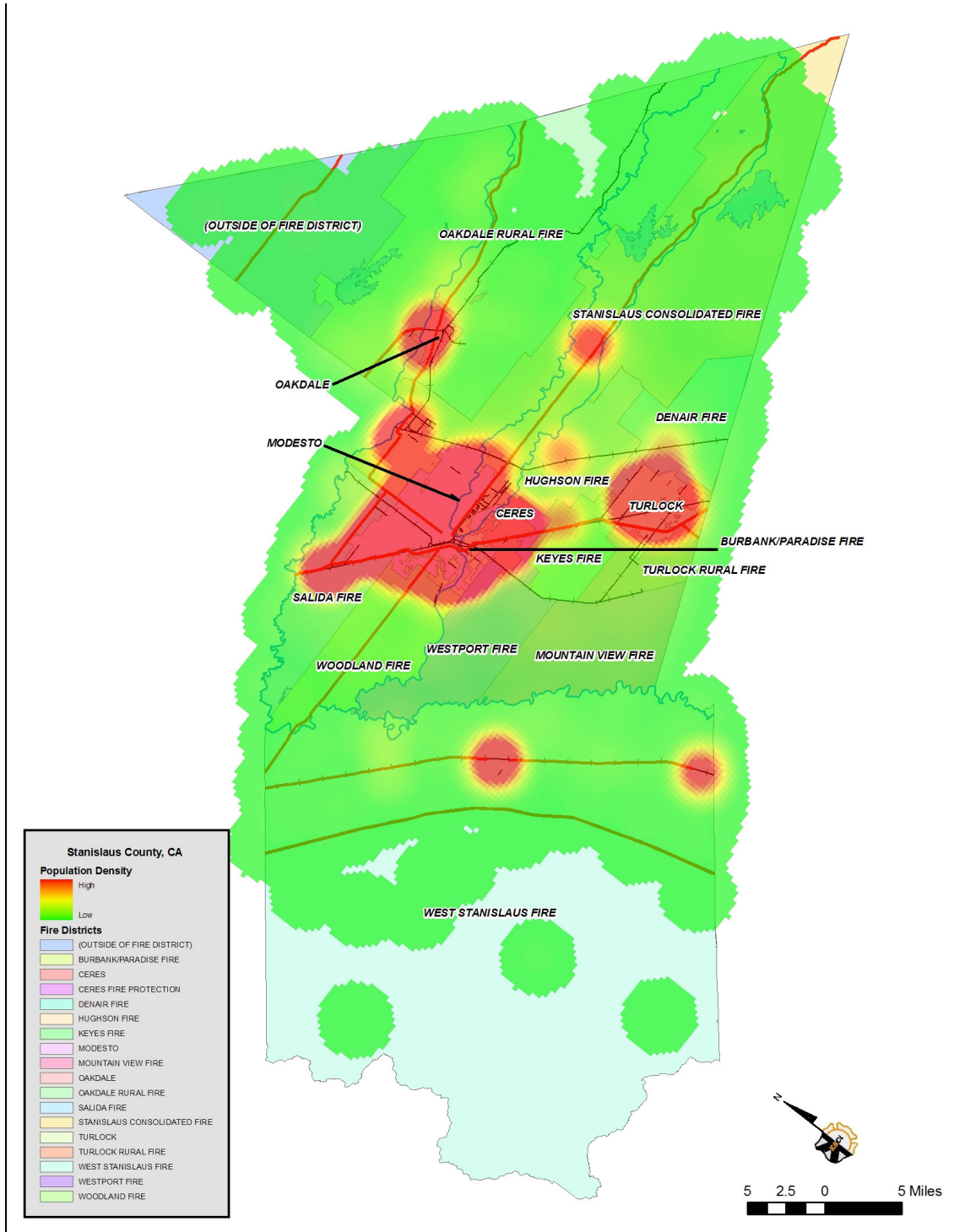
The following chart illustrates the relative rating of the population densities from high to low in the County.

Figure 30: Density Comparison

Department	Population	Density*
Ceres	38,813	5,505
Modesto	206,000	5,150
Turlock City	67,000	4,751
Patterson	17,000	4,250
Oakdale	17,500	3,181
Newman	10,000	2,500
Burbank -Paradise	7,000	1,572
Salida	18,100	430
Hughson	10,000	285
Stanislaus Consolidated	38,380	176
Keyes	4,700	174
Turlock Rural	4,000	148
Denair	5,200	123
Woodland	5,500	122
Westport	3,000	66
Mountain View	2,500	47
Oakdale Rural	11,000	47
West Stanislaus	9,800	15
CDF	N/A	N/A
Ceres FPD	N/A	N/A
Industrial	N/A	N/A

**People per square mile*

Figure 31: Map of Population Densities



Response Time Goals

As describe previously, response time must be broken down into three components - alarm processing time, turnout time, and travel time.

Alarm processing time is a function of how well organized the communications centers operate. In Stanislaus County, all of the fire districts are served by the same dispatch center. Data is available on alarm processing time.

There are significant differences in the turnout time among these districts because all have staffing patterns that rely on recalls. Travel distances reflected by the large amount of area to be served clearly demonstrates that response times are not the equivalent in urban and suburban areas.

Official Response Times to Deal with the Range of Risk

Most of the firefighting agencies examined in this Municipal Service Review do not have an officially adopted response time. Nor have they adopted a risk assessment model that addresses the range of fire flows indicated in this study. Notably, this MSR was not intended to be a deployment analysis. Nonetheless, one cannot look at service levels without having some assessment of response time and the types of risks involved. That is the primary performance measure by which a community determines whether a fire department is meeting its expectations or not.

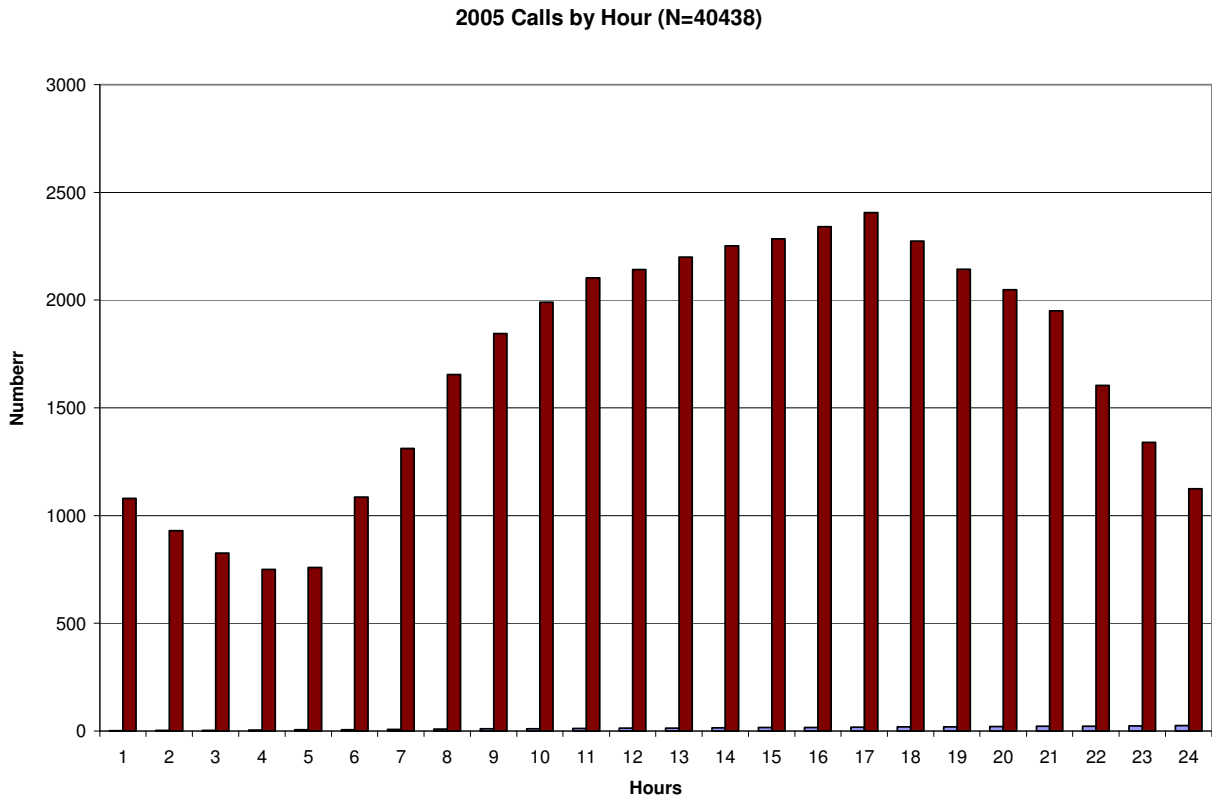
In assessing the response times in Stanislaus, there were three factors taken into consideration:

1. All of these organizations are dispatched by the same Regional Communications 9-1-1- Center (SR9-1-1) that is managed by the JPA in Modesto. It is estimated by the Regional Center that they may be performing between 90–120 seconds to initially dispatch a call. (This is called alarm processing time.)
2. Most of these organizations are predominately volunteer organizations and upon notification of an occurring event, there is a period of time in which the volunteer needs to go to the fire station. This could and likely will include such things as disengaging in personal or professional business, driving a private vehicle to the fire stations to staff the equipment, and availing themselves with protective clothing. It is estimated that the majority of the fire departments take 2.5 to 3 minutes to ready themselves for departure. (This is called turnout time.)
3. Once the vehicles depart, the operator must locate the scene of the emergency. Depending upon the nature of the roadbed that is available and the distance that must be covered, this results in what is commonly called travel time.

The combination of these three is often referred to in the vernacular as response time.

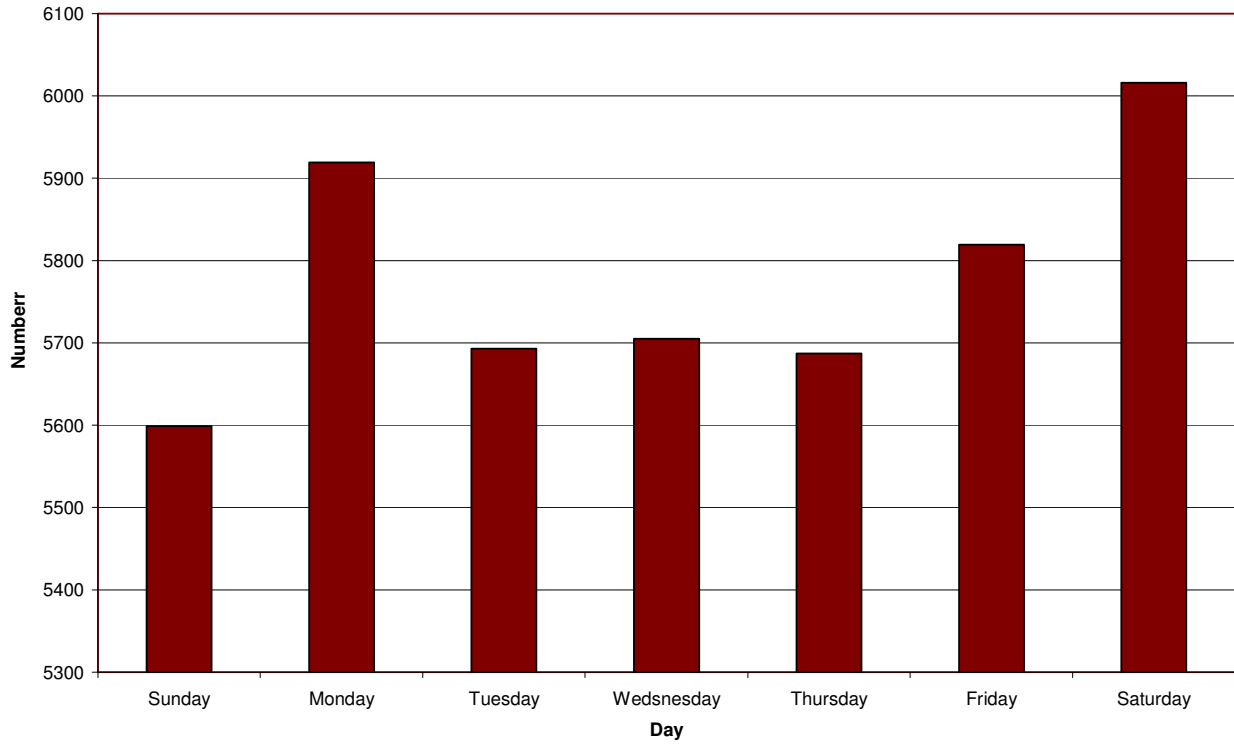
Assessment of Response Time Performance

The following four charts are based upon the 2005 data from the Stanislaus 9-1-1 Communications Center. These four charts reflect a normal distribution of response patterns for the fire service in California.



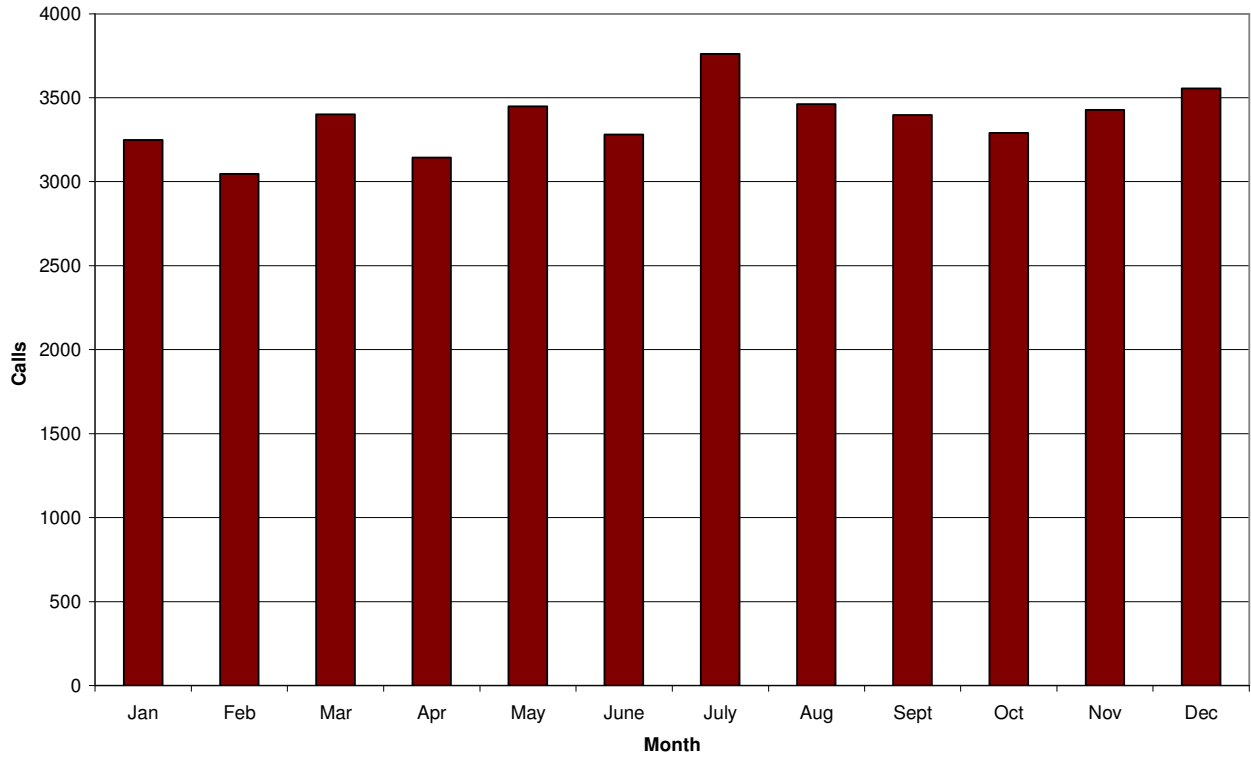
This is a typical pattern for fire and emergency service call distribution.

2005 Calls by Weekdays (N=40438)

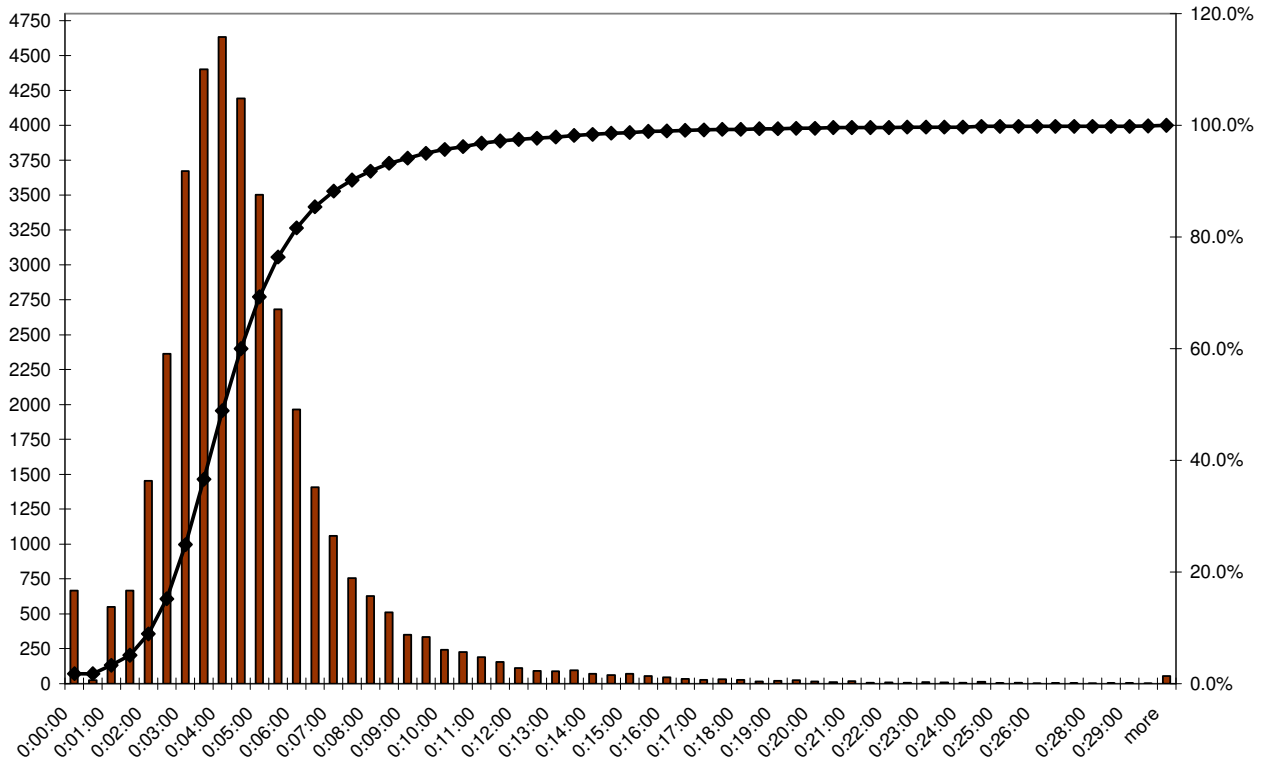


There is no explanation for the increased call load on Mondays evident in the data

2005 Calls by Month (N=40438)



2005 Response Times (N=37703)



This figure shows the overall system as having a five-minute travel time about 80 percent of the time. The data is for the overall system and reflects the heavier workload of Modesto and the other cities. Most of the fire districts are providing a response time that is essentially a combination of a suburban level of service in the densely populated areas and a rural level of service in the less dense areas. Data was reviewed from the emergency call center in an attempt to make a determination of the distribution of travel time statistics for each individual company, but a data dictionary was not provided. The general facts that can be observed in the chart are that the majority of the calls are being handled in a five-minute travel time. Intuitively, most of the more rural fire chiefs feel that their average travel time is between seven and eight minutes. This would likely mean a total elapsed time even for the rural areas is between seven and nine minutes for about 80 percent of the calls. This is because the chart illustrates that by 8.00 minutes the response curve hits the 90 percent level for all calls.

That same observation does not appear to be relevant to the city fire departments that are examined in this study. Most of the city fire departments cover a much more limited area (an average of less than six square miles). This places them within a different category of travel time. The cities are providing what could be classified as a suburban level of service.

In both cases, rural and city alarm time and turnout times are similar. What is essentially different is that the density of the population in cities is a response travel time of between five and six minutes.

This does not mean that rural fire departments are slower. Nor does it mean that city fire departments are faster. What it means is that the concentration of population and the size of the area being protected make a significant differentiation between rural fire protection and a suburban fire protection.

Criterion and Performance Indicators

The Commission on Fire Accreditation International, which publishes the Standards of Cover document, has also conducted research with the Insurance Services Office and fire departments that have conducted self-assessments. It has been determined that total response time is linked to the following attributes:

- The total area the company is responsible to protect
- The availability of the street and highway system on which to respond
- The total number of parcels in which development has occurred
- The density of population per square mile
- The density of housing units in a given square mile

Therefore, in assessing response times of the various organizations evaluated in this MSR, it is fair to state that a rural fire department has a wide range of travel times to negotiate the extremely large areas they are protecting. City fire departments have shorter travel distances, and, therefore, have a significantly lower total elapsed time. This is a function of a more compact response area.

Being a city or a district seems to make no significant difference in terms of performance. The factors that drive the performance are related to the attributes listed in the previous paragraph.

Those volunteer departments that maintain sleeper programs or student interns may actually have a foreshortened turnout time. Those departments that eventually will add full-time personnel to their staff will also have an impact on turnout time. However, one should not jump to the conclusion that merely putting a person in a fire station and allowing them to get on the apparatus and leave by themselves constitutes an effective fire force.

Distribution of Rural Fire Stations based on ISO Data

Contemporary literature based on a study of approximately 24,000 fire agencies by the Insurance Services Office, indicates that ***rural*** fire departments have an ***average*** of only 1.5 fire stations protecting an area on average of 68 square miles with a population density of 160 people per square mile with an average response time of 12 to 13 minutes.

The data collected on these study departments indicates that these attributes could also describe most of the rural Stanislaus agencies very closely.

Insurance Services Office Ratings

Government rarely evaluates levels of service provided by fire departments in terms of specific impacts on the economy. In the private sector, the Insurance Services Office (ISO) prepares reports on local fire defenses. ISO looks at the community's commitment to its fire suppression service for buildings. Once it has completed and filed the report, ISO sells this information to insurance underwriters who may use this rating to set premium rates.

The system uses ten different public fire protection classifications which define the various levels of public fire protection. Property insurance premiums are often based on the public fire protection (PPC) classification rate and the type of occupancy asking for insurance. Notably, life safety issues are not considered in this evaluation system, and the fire department evaluation does not include a review of fire prevention or public education activities.

Once completed, the ISO report puts a city into a specific class. A Class 1 is considered to be the best rating; Class 10 is considered to be the lowest rating. The ISO publishes the Fire Suppression Rating Schedule (FSRS), which provides a list of features that have a significant influence on minimizing damage once a fire has started. The elements evaluated include handling of fire alarm communications, the fire department's equipment, personnel and training, and the portion of water supply that is set aside for fire fighting purposes. A city can be penalized by divergence points.

ISO: Divergence

Even the best fire department will be less than fully effective if it has an inadequate water supply. Similarly, even a superior water supply will be less than fully effective if the fire department lacks the equipment or personnel to use the water.

Preliminary score is subject to modification by a divergence factor which recognizes any disparity in the effectiveness of the fire department or water supply. The divergence factor mathematically reduces the preliminary scores if the scores are out of line with each other.

Commonly, the community will have a different grading than the fire department because the overall score is only determined after evaluating the water system and measuring the difference in divergence between water and fire. The public fire protection class given to a city is based on the percentage of credits that the city earned in the evaluation process.

The following figure describes the categories:

Figure 32: ISO Grading Schedules

Classification	% of Points
1	90% or more
2	80% to 89.99%
3	70% to 79.99%
4	60% to 69.99%
5	50% to 59.99%
6	40% to 49.99%
7	30% to 39.99%
8	20% to 29.99%
9	10% to 19.99%
10	0% to 9.99%

Every fire agency that has been evaluated within the recent past has received an ISO classification detailed report. The document does not provide a list of recommendations with

respect to specific actions that would improve grading. However, a review of the points that were assessed would provide direction for improvement.

In view of the growth in this area and the actions needed to be taken by the districts to respond to this growth, it is likely that the ISO's next grading would focus attention upon the same factors. In the event that fire stations, staffing, training, water supply, communications, and other factors have not kept pace, agencies may not retain their class and would not likely improve to another insurance class.

It needs to be noted that there is very little incentive to improve beyond a Class 4 community with respect to homeowners' insurance. Industry practices result in very little differences in the rates of homeowners in communities that have lower classifications. The area that could provide significant impact is in large, non-sprinklered businesses or industries. The group of occupancies that would benefit the most from an improved ISO grading is older buildings, especially non-sprinklered ones. Notably, the ISO classification detail report indicates that the local grading classification system only applies to properties with a fire flow of less than 3,500 gpm.

In areas where there are buildings over the 3500 gpm fire flow, each receives a unique public fire protection classification number based on the combined fire department response and water supply availability to those high demand buildings.

Note: (1) This information is unedited and is provided exactly as it is given to ESCi by the ISO. These are actual records and cannot be altered by the consultant.

The following is a list of the current ISO ratings for the respective fire districts:

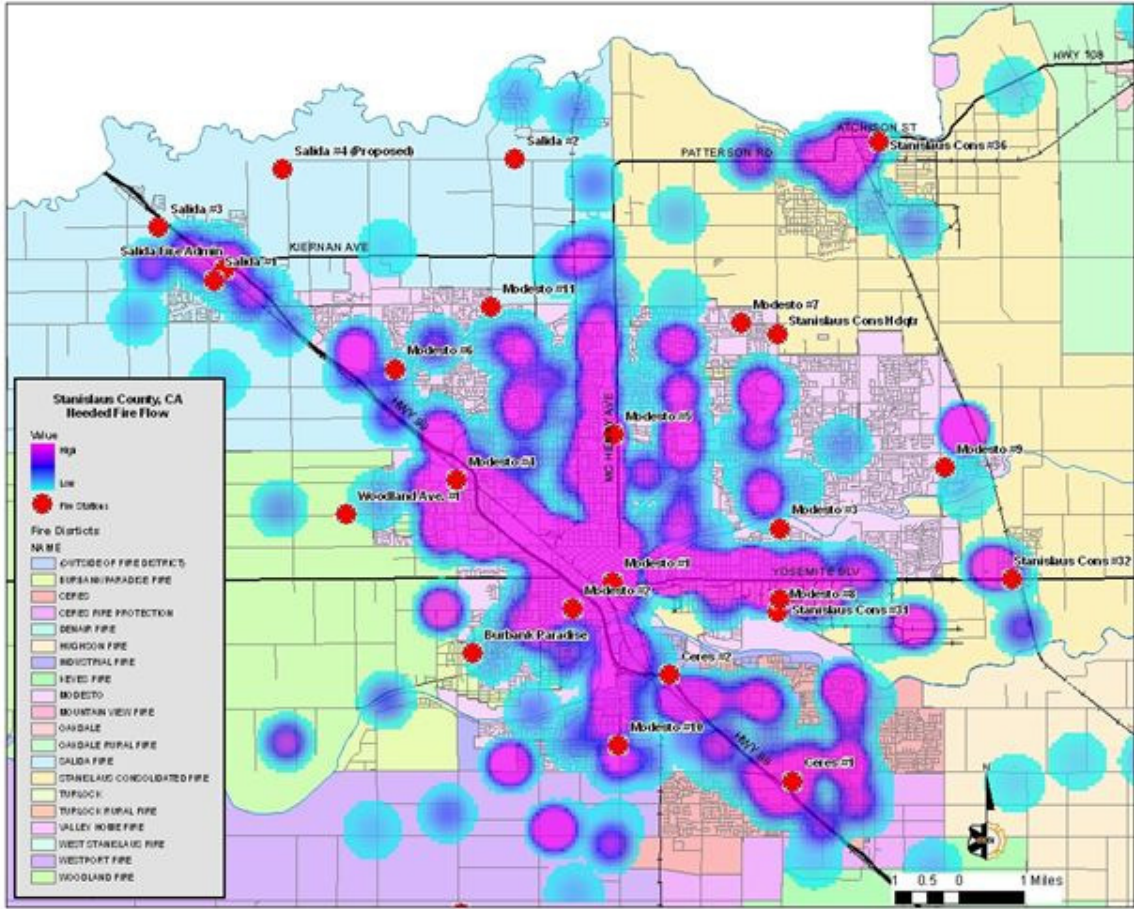
Figure 33: Stanislaus County Fire District ISO Grading Schedule Listings

Department	ISO Rating
Modesto	2
Ceres	3
Newman	3
Turlock City	3
Oakdale	4/6
Turlock Rural	4/8
Hughson	4/8B
Oakdale Rural	4/9
Salida	4/9
Stanislaus Consolidated	4/8/9
Patterson	5
Burbank Paradise	5/8
West Stanislaus	5/8/10
Denair	5/9
Keyes	5/9
Woodland	6/8
Westport	8
Ceres FPD	9
Mountain View	9
Industrial	3
CDF	Unknown

ISO: Database of Fire Flows

The ISO was contacted to find out how many buildings within Stanislaus County are class-rated buildings by the ISO coding system. The following figure shows geographical distribution and the range of fire flows designated by the ISO that could generate fire department response in the respective areas. A complete list of ISO Needed Fire Flows is available but not included in this report.

Figure 34: Map of Needed Fire Flow



ISO: Eligibility to Achieve Class 8B Rates

As noted, several of the departments in this MSR have Class 9 ratings. The ISO does have a class rating designated as Class 8B. It is intended to recognize jurisdictions that have a base Class of 6 or better, that are dispatched in a timely manner, and are able to effectively utilize limited water supplies for suppression of fires in structures in areas that otherwise would be classified as Class 9. Class 8B is applicable to jurisdictions meeting all of the established 8B criteria to at least 85 percent of the built-upon area in their jurisdiction within five all-weather-road miles of a recognized fire station.

Furthermore, the five-road miles can be created with the help from automatic aid fire departments. The criteria is that the first alarm assignment must be able to sustain 200 (gpm) for 20 minutes, beginning within five minutes of the first arriving engine company. Furthermore, 8B criteria require a minimum of six people on scene. In addition, the fire department needs to have a minimum of 24 hours of training per year in structural firefighting.

Mandates that Effect Structural Firefighting

State Mandates

Contemporary fire service management recognizes that each and every fire agency has to determine its policies and procedures based on local conditions. However, it should also be recognized that fire agencies are *mandated* to adhere to specific federal and state regulations under some specific conditions. Furthermore, the fire profession is one that has adopted a wide variety of technical standards that now must be utilized by all agencies, whether full-time, combination, or volunteer. However, these recognized professional standards are not consistently implemented or enforced from one agency to another. For example, a fire agency has to address Federal Occupational Safety and Health Administration (OSHA) requirements for compliance with protective clothing and fire attack practices. However, the manner in which the agency complies varies from community to community. In another instance, all cities must enforce the provisions of local and state fire codes. The manner in which they conduct that enforcement varies according to a wide variety of variables.

Federal Standards

In 1999, OSHA interpreted an existing federal standard regarding respiratory protection. The actual law and the interpretation are quite lengthy and subject to so many refinements that it would not be appropriate to reproduce it in this document. However, it is important to recognize the far-reaching implications of one of its provisions, the commonly called *two-in, two-out* rule. The expression refers to conditions where firefighters must enter an atmosphere that is *immediately dangerous to life and health* (IDLH). Two firefighters are required upon entry and two other firefighters must remain outside of the structure. This crew is designated as a rapid intervention team (RIT). This provision has profoundly influenced fireground operations for structural firefighting.

Time of Day

The time of day for responding to alarms is an important consideration with volunteer firefighters; it is not so important to full-time personnel. Most volunteer fire departments are staffed with individuals who either work or live within a reasonable driving distance to the fire station. A person cannot live or work 20 miles away from a fire station and expect to be a viable member of an effective response force. However, time of day does have a bearing upon the availability of individuals. If a person lives close to the firehouse but works elsewhere, it creates one set of circumstances. Conversely, if an individual works close to the firehouse but lives further away, that creates a different environment. It is not uncommon in volunteer fire departments for organizations to create staffing patterns based upon lifestyle.

The International Association of Fire Chiefs, through its Volunteer Combination Officers Section (VCOS), has published documents that clearly illustrate that dealing with time of day issues is a management and leadership issue within all volunteer organizations. This is one of the reasons why it is important for fire departments to keep attendance records on recalls. In the event a department has a very unreliable response force at any given time of day, how they recruit and retain volunteer firefighters is a major consideration.

Quality of Staffing Resources

Chapter 7 of this report includes information on recruiting and retaining staff members. In the context of this chapter the only thing that is important to understand is that the modality of time of day of a response creates concern in many volunteer fire departments.

There is also an element of time of day having to do with the type of call. It is not uncommon for volunteer firefighters to show up en-masse when there is a working structure fire but to only have one or two individuals show up if the nature of the call is to put someone back in bed that has merely fallen out. While it is difficult to explain this to the average citizen, the fact is that volunteer firefighters do choose the nature and type of call that they want to be committed to.

This particular phenomenon has a different consequence within the context of fully paid and staffed engines. In conducting studies of fire departments, it has been noted that even in paid fire forces, turnout and the travel times are statistically longer when paid personnel are dispatched to what are considered *undesirable* calls. In both cases, the phenomenon is the same. The type of call and the time of day do have a bearing on reliability.

Impact of Fire Season on Staffing

Seasonality is an entirely different issue. In conducting on-site reviews and discussing recruiting and retention of volunteers, it is clear that in the Stanislaus environment, there are fire departments availing themselves of personnel who are also seasonal firefighters. The net result is that in the winter time, the reliability factor for these personnel is higher. In the summer time, the reliability factor is lower.

One explanation for this is that many individuals who are seasonal firefighters are engaged in volunteer fire departments in the winter time in hopes of increasing their ability to be a candidate to be a full-time firefighter somewhere else.

The ISO draws no distinction in staffing patterns between the number of people on the fire ground in regard to paid staff and volunteers. However, it does draw a distinction between the numbers of people given credit on overall staffing. The ratio normally considered is that it takes four volunteers to equal one paid firefighter. That doesn't mean that it takes four volunteers to be the same as one paid firefighter; it is an estimate of reliability factor. If one looks at the total number of volunteers on any given organization and looks at the recall numbers, the ratio is usually about 25 percent. For example, if a fire department had 20 volunteers on board – referring to those that are adequately trained, adequately equipped, and are notified in accordance with policy – that for those 20 personnel it would be estimated that five of them would show up on a recall – 25 percent.

It will not always be the same individuals. In addition, the combination of qualifications and competencies are not always the same. It is common for this to relate back to the modality of time of day. Depending on whether volunteers are recruited and deployed between daylight hours, one might get fewer officers or more officers because of the mix of residency and places of business.

All of this is brought to bear at one point in time – the arrival of a piece of fire apparatus at the scene of an emergency. In the event that a sufficient number of personnel arrive at the scene to

be able to engage in appropriate mitigation, it is likely that the emergency will be remedied. In the case of an organization that cannot provide an effective response force on a reliable basis, the community's confidence that they have adequate fire protection will be eroded. To the degree that events result in tragic loss of life or property, the credibility of the fire department will be eroded.

Five Miles or Five Minutes

A map has been prepared by ESCi that shows a five-mile polygon around *each* of the fire stations operated by the agencies being studied. These maps are provided in the Departmental Description chapter and are also provided in a *Map Atlas* for larger scale viewing. Because the vast majority of the response is with volunteers, ESCi felt it was not appropriate to talk strictly about minutes of response but rather to emphasize what areas these departments can respond to in order to provide a minimum amount of service in a reasonable timeframe. The five-mile polygon is consistent with the ISO criteria for a suburban department. This map, if compared to the population density map, clearly illustrates that there is a correlation between population and demand for service levels. If you place any departmental map along side of the population density map, the basic pattern of coverage will easily be seen.

GIS Analysis of the Road Network

The method used to develop the maps that display the degree of coverage a fire station can provide on the road network is based upon Geographic Information Systems (GIS) software. The system used in this report was *ArcView*. ESCi utilizes both the 3.2 and 8.1 versions of this software. The analysis of the road network utilizes a commercial software package named *TeleAtlas*, or *Tiger data*, whichever is provided. Furthermore, in order to perform that analysis a special software extension called *Network Analyst* is employed. Both *ArcView* and *TeleAtlas* are considered industry standards in performing this type of analysis.

All maps in the *Map Atlas* were prepared using this software configuration. Travel speeds are based on reasonable and prudent road speeds as defined in contemporary traffic engineering standards. Coloring of the streets and the creation of polygons identify the area where the road network can be expected to provide access to an address on that network within a reasonable timeframe. There are many different models that can result in different polygons being created to answer various questions, such as what can happen when a road speed is increased or new roads are added to the network. Readers are encouraged to look at the polygons in the *Map Atlas* for each respective fire station. These polygons are not response zones that are based on jurisdictional boundary. They indicate capacity of individual stations utilizing Code 3 response to cover geographical areas within contemporary travel times. These polygons will change constantly depending on the design of the highway and traffic conditions. They are included to provide readers with an assessment of two things. The first is the area being covered by respective stations. The second is the area that is not covered by these polygons. These areas will be considered underserved.

It should be noted that these are theoretical travel times. The ability for a vehicle to traverse any given section of roadbed is dependent on many variables. These variables have been identified in another section of the report. The report provides *best estimate* response times polygon based upon the assumption that the apparatus is leaving the station and travels continuously at the posted speed limit for each section of travel.

Community Perception of Fire Service Delivery

During the on-site review, a series of questions were addressed by the respondents relating to how the community sees its organization. In an almost overwhelming response to this inquiry, the respondents believe that their community loves, respects, appreciates the firefighters; but, in almost every instance in which they offered that opinion there almost was a negative comment. The negative implication is that most communities simply do not know what kind of fire protection they currently have. As stated by many individuals, in spite of the fact that they have to do fund raising events to raise money, and the fact that they are always involved in recruiting volunteer firefighters, the majority of citizens in the community remain ignorant to what kind of fire department they have.

There may be an explanation for that phenomenon. In the case of individuals who lived in the area for a lengthy period of time, they may well know that the department is volunteer and take it for granted. In the case of individuals who recently moved into an area, especially those that emigrated from areas of more suburban orientation, they may assume that the fire department was something that it is not. According to the information collected, there is a significant number of retirees buying and moving into properties that are serviced by these volunteer fire departments that are not knowledgeable about what services are being provided.

The flight to the country life is not necessarily limited to Stanislaus County. It is being reflected in other rural counties all over the State of California. The dilemma created for the fire department is that retirees move to these areas to have the lowest possible living expenses and yet simultaneously place an increased level of impact on the emergency medical services system and usually don't want to pay for it. This could be classified as an operational *Catch 22*.

The answer to this dilemma is not simple. One end of the answer needs to be dealt with through the concept of community and public education, yet none of these fire departments have extensive public education resources or staff to develop a program. In the context of this discussion, several organizations indicated that they do door-to-door annual solicitations in which they attempt to explain to the public that they are a volunteer fire department and are relying upon community support to deal with their funding deficiencies. Even those departments admit that their points of contact are not always as comprehensive as desired, and none of them reported having an extensive public education instrument which they can provide to the public which differentiates between the types of services that they may have had in the past versus the type of services being provided by the volunteers.

One observation is that many of the fire departments do not have significant signage that clearly indicates that they are a volunteer fire department. They are identified as a fire protection district or some other form of organization or structure but the word 'volunteer' does not appear in the signage. While this may not be of great significance in altering public opinion, it is part of the fabric of underestimation of the role of volunteers within the system. The Volunteer and Combination Officers Section (VCOS), in conducting officer training programs for chiefs, has placed emphasis on the fact that signage is part of marketing of a fire department.

Response Reliability with Volunteers

Response reliability is a factor when staffing an organization with volunteers. In essence, the numbers of volunteers that are considered part of the table of organization are a reflection of the total number of volunteers that can be brought to bear on a major event. However, they are not a reflection of the numbers that will turn out for a normal event. The Insurance Services Office considers the ratio of volunteer personnel to paid personnel to be a 4-1 ratio. Therefore, an organization with 12 volunteers can be expected to field three individuals under most ordinary conditions. If they have 16, they will likely produce four. As one can tell by looking at Figure 27 (page 153) it is highly unlikely that any of these departments will be able to field an adequate number of people to staff and deploy all their apparatus without having to request additional recalls.

Summary

The level of service is a function of the level of effort. A fire agency with limited financial resources cannot provide a high level of service. A fire agency with adequate financial resources still has to be prudent with its expenditures. This chapter describes the current level of service as being a function of rural or urban economic scenarios. As an area evolves from low population to higher densities, the level of effort generated will likely result in the fire agency needing to make transition to higher levels of service.

The fire service agencies that protect the citizens of Stanislaus County are a combination of cities that are predominantly paid with a median range of per capita cost and rural areas that are predominantly volunteer organizations. The latter operates with relatively low per capita financial support. Both maintain a fairly high level of service. Fire facilities are located primarily with respect to historical response to community demand rather than any empirical study, yet they are relatively well located to cover the majority of emergency incidents that occur. This is primarily because the older stations were located at the crossroads of population centers.

The departments have increased demands from federal and state mandates, while concurrently maintaining a response level that has, so far, not resulted in severe loss of life or property or injury to firefighters. However, increasing population along with increasing demands for service will lead to the time where response failures can and probably will occur.

The real dilemma is when the service expectations are not supported by adequate financial support. This creates the operational gap that many fire agencies are struggling with today. This phenomena often results in a need to leverage all opportunities for containing costs and obtaining assistance by combined efforts that are explored in the next chapter.