Table of Contents

Orange County Fire Authority
Standards of Cover

The development of a Standards of Cover for the Orange County Fire Authority (OCFA) is the culmination of an extensive process of analysis, stakeholder input from many sources, and expert assessment and evaluation. The OCFA has utilized a systematic 10-phase approach to bring this project to completion. The concept of Standards of Cover is not new to the fire service or OCFA. In the past this concept has been referred to simply as fire station location. The current application of this methodology has escalated as a result of the advocacy of the Commission on Fire Accreditation International (CFAI) for a more systematic means of developing fire agency performance, based on data. The SOC methodology, as provided by CFAI, is recognized as the only means of achieving equivalency for the development of response coverage other than outright adoption of other standards that are not based upon local considerations.

The CFAI accreditation process places a strong emphasis on self-assessment with the general premise that the best assessment is a local assessment. The CFAI process outlines a comprehensive and orderly approach to this process. One of the core concepts is the development of a Standards of Cover (SOC) document.

"Standards of Cover" is defined as "those adopted written policies and procedures that determine the distribution, concentration and reliability of fixed and mobile response forces for fire, emergency medical services, hazardous materials and other technical responses."

The purpose of this Standards of Cover document is to provide OCFA a tool for:

- Assessing community fire and non-fire risk
- Defining baseline emergency response performance standards
- Planning future station locations
- Determining apparatus and staffing patterns
- Evaluating workload and ideal unit utilization
- Measuring service delivery performance
- Assisting in the Strategic planning and policy development process relative to resource procurement and allocation

The key elements in this Standards of Cover document include:

1. A determination of levels of service to be provided throughout the OCFA jurisdiction
2. A community risk assessment that identifies the fire and non-fire risks common and/or unique to OCFA
3. An analysis of the OCFA's current response capability in terms of time, equipment, and on-scene performance

4. A set of Standards of Cover statements that describes how OCFA resources will be allocated and deployed to maximize emergency response effectiveness throughout the OCFA service delivery area

This document describes the procedures, decisions, and outcomes of the SOC process for OCFA. Detailed analysis and justifications are provided in Reference Materials Sections, attachments and exhibits.

A Community Based Risk Assessment is an analytical process of identifying and quantifying key factors within the community, that when combined, define risk in a way that can be compared to OCFA's response capability. These key factors include historical incident analysis, identification of general and specific hazards, identification of community values and their relationship to departmental expectations, potential severity, consequence, and frequency of certain events. It is this comparison that provides a valuable strategic planning and resources deployment tool for the OCFA.

Community Expectations

A wide range of stakeholder interviews have been conducted in order to clearly understand the community's expectations. Stakeholders include all 23 member agencies, California Department of Forestry and Fire Protection, John Wayne Airport, and six automatic and mutual aid agencies. When asked to describe the overall level of service provided by OCFA the vast majority indicated it was "excellent."[1]

Citizen input has also been obtained starting in 1998 with an on-going Customer Satisfaction Survey[2], a series of facilitated discussion forums, and through direct distribution of survey forms at shopping malls and other community locations.

The community expectations identified throughout the process are summarized to include:

- Quick response
- Trained personnel
- State of the art equipment
- Good community relations

[1] See Section 3, "Community Expectations" for additional stakeholder comments and discussion.
[2] Survey results are on file at OCFA.

Services Provided

The OCFA provides a full range of emergency services that are categorized into four areas:

Medical	Rescue
Medical Aids	Trapped or at risk victims
Multi-victim incidents	Specialty/Technical Rescue
Mass Casualty Disaster Rescue	
Fire	**Special Hazards**
Structures/Fixed Property	Hazardous Materials
Mobile Property	Airport Rescue Fire Fighting
	Wildland Fire Suppression

These services are provided from a network of 61 fire stations. The OCFA is organized into four departments: Business Services, Support Services, Fire Prevention, and Operations.[3]

Levels of Service

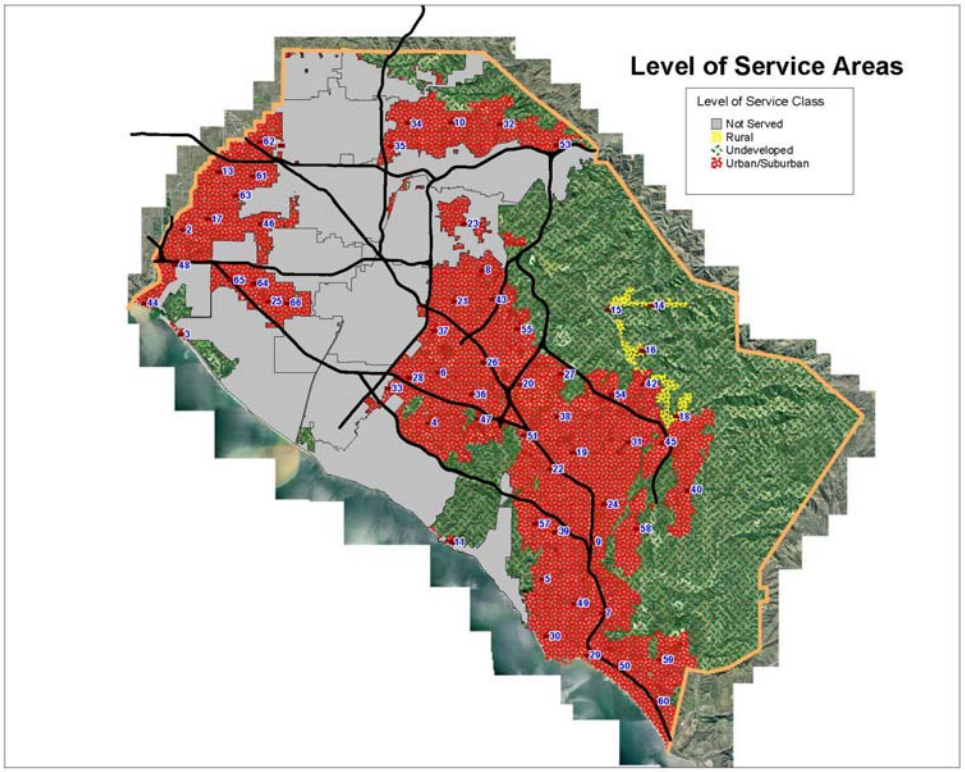
OCFA serves 1.3 million residents covering an area of 553 square miles. The physical terrain and development varies greatly ranging from wilderness to dense urban areas with high-rise buildings. The services provided to each of these areas can be significantly different. This difference is based on infrastructure, resources availability, frequency of emergencies and revenues derived from each area.[4]

The geographic area is divided into four categories:

1. Urban
2. Suburban
3. Rural
4. Undeveloped/Wilderness

[3] See Section 4, "Services Provided" for additional discussion.
[4] See Section 2, "Community Served" for additional discussion. Section 5, "Community Risk Analysis" contains a discussion of global risk assessment factors that also points out significant differences.

Note that the Urban and Suburban service areas are combined on the map. The two uses are intermixed in such a manner that it is not reasonable to identify them separately. The risk differences between urban and suburban development are addressed in the risk categorization process.



Refer to Attachment A for a larger version of this map

Risk Determination and Categories

A critical step in the SOC process is to identify and categorize the types of risk that may occur within the area served. Once risk categories are identified, resources can be deployed to match the risk in the best possible manner. The goal is to ensure sufficient resources are distributed throughout the community in such a manner as to provide adequate response without over committing valuable resources that could be used elsewhere.

OCFA has identified the following risk categories:[5]

Fire Risk:		
	Low	Areas with mobile property, outbuildings, structures with less than 1,000 gpm needed fire flow, and/or a BAR (building area ratio – amount of land covered by building) of less than 10%.
	Moderate	Areas with single occupancy structures with a needed fire flow requirement from 1,000 to 2,500 gpm and/or a BAR greater than 10% and less than 75%.
	High	Areas with multi-occupancy structures with a needed fire flow above 2,500 gpm, structures over three stories in height and/or a BAR greater than 75%.
	Special	Areas with high-rise buildings, target hazards and/or specific building construction/use that require additional resources.
Rescue Risk:		
	Low	Areas with a history or potential for rescue situations that require only the tools and knowledge set available on first due apparatus. Examples include: persons needing assistance up or down an elevation difference where simple solutions such as a rope or ladder will complete the rescue.
	Moderate	Areas with a history or potential for rescue situations requiring the use of specialty equipment carried on all OCFA truck companies. Examples include: traffic accidents with persons trapped, persons needing to be moved up or down an elevation while unable to walk or help themselves.
	High	Areas with a history or potential for rescue calls requiring specialized equipment and training. Examples include: technical rescues of persons trapped by equipment, buildings or earth that will require extended and complex rescue solutions.
	Special	Disaster responses to earthquakes, floods, landslides, hurricanes or tornados and other situations where large numbers of people are at risk.

[5] See Section 5, "Community Risk Analysis" for a discussion on risk categories.

Medical Risk:		
	Low	Areas with a history or potential for emergency incidents where predominately a Basic Life Support level of care is provided routinely. Calls requiring basic first aid/EMT-1 skills. These areas would normally have low population densities and/or limited residential or commercial development.
	Moderate	Areas with a history or potential for emergency incidents where Paramedic or Advance Life Support level of care is provided routinely. Calls requiring the full scope and depth of the Emergency Medical System.
	High	Areas with a history or potential for needing multiple Paramedic Level responses simultaneously. These areas would normally have high population densities and/or large numbers of "at risk" populations.
	Special	Disasters, Mass Casualty Incidents.
Special Hazards Risk:		
Hazardous Materials		
	Low	Areas with hazards that would require Level D entry. Incidents that require only the tools and knowledge set available on first due apparatus. This risk would include incidents related to common chemicals such as those used in the home or business.
	Moderate	Areas with hazards that would require Level B or C entry. Incidents that require specialized tools and knowledge to deal with hazardous materials that are normally liquids or solids without acute hazards. This risk would include incidents related to chemicals used in light industry, larger amounts hazardous materials in transport or storage.
	High	Areas with hazards that would require Level A entry. Incidents involving "Acutely Hazardous" materials that require encapsulation of the workers and multiple specialized teams with a level of decontamination that is potentially hazardous.
	Special	Weapons of Mass Destruction or terrorist acts.

Airport Rescue Fire Fighting		The protection provided at Orange County Airport is provided under the federal regulations and FAA requirements per our contract with the airport. OCFA will continue to use the current risk categories indicated in Section 5. These are: Category I, Category II, and Category III.
Wildland		Wildland/Undeveloped Areas and National Forest Land – The weight and speed of initial attack for wildland fires is dependent on location, weather, topography and fuels. OCFA will continue to use the regionally accepted response levels indicated in Section 5. These are: Low, Medium, High and Red Flag. Risk areas are further identified as urban/suburban interface, rural interface and undeveloped or wilderness. Urban/suburban and rural areas are those with an interface between the wildland and the developed areas. Undeveloped/wilderness areas are those without direct risk to inhabitable structures.
Swiftwater		
	Moderate	Areas with standing water such as lakes where victims do not tend to move large distances from the area of the original emergency.
	High	Areas with moving water such as streams, flood control channels or the ocean where victim can move large distances in a short period of time.

Measurements of System Performance

Once the service area is subdivided into Level of Service areas and risk categories are established for the anticipated types of incidents, the next step is to define a method of measurement to assess delivery capability.

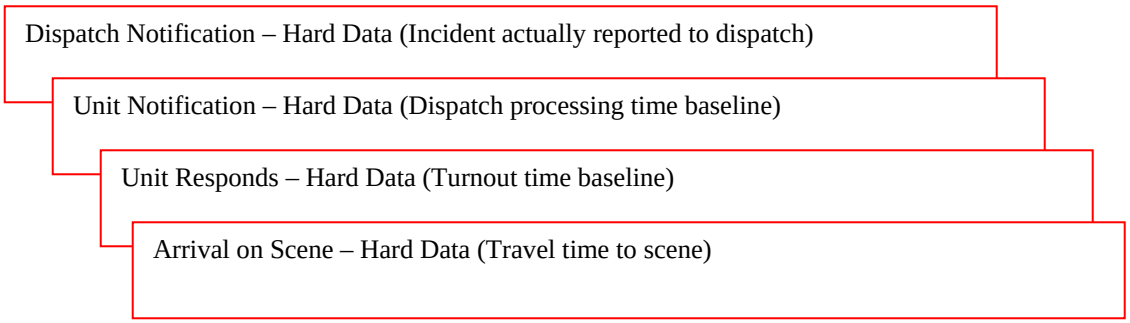
Three concepts are used to measure system performance:

1. Distribution (what and where)
2. Concentration (how much)
3. Reliability (how well)

The combinations of these three concepts provide a method to quantify delivery capability and give policymakers detailed and useful information for the establishment of response goals. [6]

The concept of "Core Emergencies" is used in these analyses. Not all calls for service should have an impact on locating stations or the deployment of apparatus and personnel. Core Emergencies are the calls that best represent the values and citizens at risk within the service area.[7]

Any discussion of response time centers on these four key time stamps:



Performance reliability (normally measured in minutes and seconds) is a very good indication of the system's ability to provide service in the real world. One aspect of reliability can be to quantify the measurement of the percentage of times the system performs within its stated objective. The first two measurements that affect all emergencies are:

> Dispatch Time: The time interval between Dispatch Notification and Unit Notification. Core Emergency calls are currently dispatched within one minute 83% of the time (2004 data).
>
> Turnout Time: The time interval between Unit Notification and Unit Response. The first unit is currently getting out the door only 35% of the time within one minute. The average in 2004 was 1:22 and the 80th percentile was 1:48.

[6] Distribution, Concentration, and Response Reliability are all discussed in Section 6, "Measurement of System Performance."

[7] An exact definition and listing of "Core Emergencies" is provided in Section 6. Note: Advance Life Support, rescues and structure fires form the basis for core emergencies.

Incident location does not impact either of these measurements. There are many variables that do.

Dispatch Time	Turnout Time
Dispatcher workload	Time of day
Nature of complaint	Location of Firefighters
Multiple incidents	Nature of incident
Language/communication difficulties	Activity of Firefighters at time of notification
Accuracy of information	

Performance Measurement Concept #1: Distribution

Distribution refers to the network of fire stations from which service is delivered. OCFA has determined that a successful distribution of resources means that the system is capable of responding a sufficient number of personnel with the correct apparatus and equipment to accomplish the following objectives:

1. Assess the situation
2. Establish a plan of action capable of mitigating the emergency
3. Request additional resources as appropriate
4. Stop/impede the escalation of the emergency

The first arriving company generally accomplishes these initial tasks. The distribution network of the OCFA can be described by stating the percentage of incidents in which the first due company arrives on scene within a specific time interval. A review of the 2004 data reveals that collectively, first due companies arrive on the scene within:

6:00 minutes total response time 55% of the time
7:00 minutes total response time 75% of the time
7:22 minutes total response time 80% of the time
8:30 minutes total response time 90% of the time

Performance Measurement Concept #2: Concentration

OCFA defines a successful concentration network as one in which the system is capable of responding a sufficient number of personnel with the correct apparatus and equipment to accomplish the following objectives:

1. Stopping the emergency from continued escalation
2. Providing for the safety and security of citizens and emergency responders
3. Completing all critical tasks in a timely manner[8]
4. Providing for effective incident management

[8] Note: Critical task are those activities that must be conducted in a timely manner in order to control a fire prior to flashover or to treat a patient. See Section 7, "Critical Task Analysis" for further discussion.

These objectives go beyond the capability of a single engine company. Concentration deals with the ability to place additional resources on scene within a time frame that permits effective intervention.

The following table illustrates the OCFA's ability to get additional units on scene of structure fires for the year 2004. An "Initial Attack Force" of two engines and one truck arrived on scene within 10:00 minutes 63% of the time. All units in an "Effective Response Force" (3E/1T/1M) arrived on scene within 12:00 minutes 76% of the time. The average arrival times for the second and third engines were 8:41 and 9:59 indicating the longer travel distances for these additional resources.

The last two columns provide the response time for the 80th and 90th percentile. For example, note that the 80th percentile for the arrival of an Effective Response Force is only 15 seconds longer than the 12-minute target response time.

Criteria	**Measure**	**Performance 2004**	**Average 2004**	**80th**	**90th**
Second Engine	8:00	47%	8:41	9:55	11:15
Initial Attack Force (2E/1T)	10:00	63%	9:43	11:45	13:30
Third Engine	12:00	84%	9:59	11:25	12:50
Effective Response Force (3E/1T/1M)	12:00	76%	10:29	12:15	13:40

Performance Measurement Concept #3: Performance Reliability

Performance reliability is further evaluated using two additional measurements; ability to meet distribution and concentration measures by the initial response resources and availability of resources to meet demand.

Response Time

Response time is the time interval between Dispatch Notification and Arrival on Scene. It includes Dispatch time, Turnout time, and Travel time.[9] Response time goals are established through OCFA policy. Response time performance is generally measured for the first unit on scene (Distribution) and for an Effective Response Force (Concentration). Incident response times are impacted by many variables including availability of first due units, travel distance, traffic, geography, weather, and street networks.

[9] Note: The definition of response time varies between agencies. OCFA includes dispatch time in its definition while other agencies only include Turnout time and Travel time. The distinction is important when making comparisons between agencies and establishing goals.

First Due Analysis

Each station has a first due area. Reliability of the deployment system can be evaluated by analyzing if the resources devoted to the area are adequate to handle the volume and timing of calls within that area. The basic premise is that as the number of calls in an area increase or concentrate into specific time periods, the percent of time that the first due unit is available for another call will decrease. If the distribution network is weak, response times will increase as calls will have to be covered by units from neighboring service areas. Availability of initial first due units is one important measurement of performance.[10]

The following table evaluates the OCFA's distribution network performance by first due companies or station area using a seven minute and twenty seconds response time target. Thirty percent of the first due/station areas are available at the 80th percentile, but 75% of the stations were able to attain the seven minute and twenty seconds response time target for their first due areas.

Measure of Performance	**Performance at 7 minutes 20 seconds**		**Availability**	
	% of Total Stations	**# of Stations**	**% of Total Stations**	**# of Stations**
80th Percentile	75%	43	30%	17
70th Percentile	14%	8	37%	21
Below 70th Percentile	11%	6	33%	19
Stations w/First Dues		57		57

It should be noted that units with less than 80% availability in the first due areas with only one unit in that station could result in substandard performance. Forty stations (70%) have less than 80% availability. All stations with performance under 80% have availability under 80%, and stations with performance under 70% have availability under 70%. It should also be noted that while 33% of the stations have availability under 70%, only 11% of stations have performance under 70% (6 stations). This is due to good system status management (move up and cover) by our dispatch center. This analysis shows a direct relationship between availability and performance.

Critical Task Analysis

Following a formal risk assessment and historical performance analysis, a critical task analysis was conducted to identify the relationship of resource distribution and staffing patterns.

The first 15 minutes is the most crucial period in the suppression of a fire. How effectively and efficiently firefighters perform during this period has a significant impact

[10] See Section 6, "Measurements of System Performance" for a further discussion on First Due unit analysis and other factors that impact performance and availability.

on the overall outcome of the event. This general concept is applicable to fire, rescue, and medical situations.

Critical tasks must be conducted in a timely manner in order to control a fire or to treat a patient. OCFA conducted a critical task analysis to quantify and evaluate performance during this critical time period. Three scenarios commonly encountered were identified; a medium risk structure fire, a traffic collision with a trapped victim, and a cardiac arrest. Each scenario was conducted using standard operating procedures and realistic response times based on actual system performance. Each scenario was run multiple times with a variety of fire companies to validate and verify observations and times.

To further validate the analysis process, the results were compared with records from actual working fires and similar incidents from the previous years. The overall results were reviewed to determine if the actions taken within the early minutes of an incident resulted in a stop loss or not and if additional resources were required. This critical task analysis process demonstrated that the current deployment plan resulted in stopping loss a very high percentage of time within the initial critical time goals.

The critical task analysis demonstrated some important differences based on apparatus configuration and staffing in the ability to enter a building on a working structure fire when it comes to executing the "two-in two-out" rule and fire ground operations. Specifically in the staffing of truck companies, qualitative analysis showed that four person truck companies provided a greater level of dependability and performance. The various configurations used for dealing with cut and rescue traffic collisions and cardiac arrest (ALS) did not result in a significant variance in performance.[11]

Comparability

Comparability is a process of comparing one system to another to identify best practices and assess performance compared to like organizations. Although many fire service agencies do not have set SOC performance measures, 14 comparable departments within California and another 14 departments outside California were found with adopted standards. The standards and methods of measurement identified by the various agencies vary widely. One observation is that each agency must establish standards and methods of measurement that are appropriate and effective for its local area.

The 28 agencies in this survey do not all measure response time in the same method used by OCFA (dispatch time, turnout time, travel time). Of the 16 that do, response time standards varied from 5 minutes to 9 minutes 20 seconds, with the average being 6 minutes 24 seconds.

The performance levels and percentages of compliance differ as well. One agency measured compliance at 100%, two agencies measured it at the 95th percentile, 17 at the 90th percentile, four at the 80th, one at the 75th percentile, one stated averages, and two agencies did not state a level of compliance at all.

[11] See Section 7, "Critical Task Analysis" for a full description along with extensive charts and graphs.

Only 10 agencies measured total response time for an Effective Response Force (as defined by their agency) with an overall average time was 12 minutes 12 seconds.[12]

Performance Measures/Standards

The entire Standards of Cover analysis process (community risk assessment, historical performance analysis, comparisons, and critical task analysis) results in a series of system performance measurements. These measurements range from the initial receipt of call at the dispatch center to the on-scene performance of fire fighting personnel. The measurements are used to document current levels of performance and establish response time goals and service level objectives.

Multiple Levels of Risk Results in Multiple Standards

It is important to recognize that the complex nature of the OCFA service area (topography, geography, economic conditions and multiple risk factors) makes it very difficult to fit everything into a "one size fits all" scenario. Because the service demands are based upon a combination of risk factors, the concentration and distribution needs vary between urban/suburban, rural and wilderness areas.[13]

Recommended Standards

The overall goal of OCFA is:

> *Limit the risks to the community and its people from fire, injury, death and property damage associated with fire, accidents, illness, explosions, hazardous materials incidents, and other natural or manmade emergencies through prevention and response.*

The OCFA Standards of Cover Performance Objectives are:

Fire

> *For all fire incidents, OCFA shall arrive in a timely manner with sufficient resources to stop the escalation of the fire and keep the fire to the area of involvement upon arrival. Initial response resources shall be capable of containing the fire, rescuing at-risk victims and performing salvage operations, while providing for the safety of the responders and general public.*

EMS

> *For all emergency medical incidents, OCFA shall arrive in a timely manner with sufficiently trained and equipped personnel to provide medical services that will*

[12] Comparability Survey results are included in Section 8, "Comparability."
[13] Section 9, "Performance Measures"

stabilize the situation, provide care and support to the victim and reduce, reverse or eliminate the conditions that have caused the emergency while providing for the safety of the responders. Timely transportation of victim to appropriate medical facilities shall be accomplished in an effective and efficient manner when warranted.

Rescue

For all incidents where rescue of victims is required, OCFA shall arrive in a timely manner with sufficient resources to stabilize the situation and extricate the victim(s) from the emergency situation or location without causing further harm to the victim, responders, public or the environment.

Special Hazards

For all special hazards such as Hazardous Materials, Wildland, Swiftwater and Aircraft Firefighting, OCFA shall arrive in a timely manner with sufficient resources to stabilize the situation, stop the escalation of the incident, contain the hazard where applicable and establish an action plan for the successful conclusion of the incident while providing for the safety and security of the responders, public and the environment.

The Distribution and Concentration performance measures provide the foundation for the management and assessment of the system. The OCFA Standards of Cover performance measures are:

Distribution Performance Measure

For 80% of all core incidents, the first unit shall arrive within 7 minutes and 20 seconds of total response time in Urban/Suburban areas, 12 minutes in Rural areas, and as soon as possible in wilderness areas.

The first unit should be capable of advancing a 1- 3/4" attack line for fire control or initiate a rescue when a life hazard is present, or providing basic life support for airway breathing and circulation for medical incidents.

Concentration Performance Measure

For 80% of all core incidents in all risk areas, an effective response force shall arrive within the total response time indicated in the SOC Matrix (Attachment B) by level of service, service provided and risk level providing the minimum equipment and manpower required.

Compliance Methodology

Once performance standards have been established, they must be monitored to insure that they are being met or that progress is being made towards the established standards. To accomplish this task a compliance methodology has been developed that will provide monthly, quarterly and annual feedback.[14]

Overall Evaluation

Overall System Performance when measured by the draft SOC performance measures shows compliance in all categories. All critical measures at within the 80th percentile as required. Many are at or above the 90th percentile.

The results of the analysis show the following:

- First Unit Performance — First Unit Performance, when measured at 7:20, is at the 80th percentile system-wide
- Truck Company Coverage — Truck Performance, when measured at 12:00, is at the 86th percentile system-wide.
- Effective Response Force — Effective Response Force Performance, when measured at 12:00, is at the 80th percentile system-wide.
- Initial Attack Force — Three areas exist where the "2in/2out gap" is greater than the four minutes. These include:
    - Coto De Caza
    - Portola Hills and Canyon areas
    - Yorba Linda (eastern portion)
- Paramedic Unit Coverage — Paramedic Unit Performance, when measured at 10:00, is at the 91st percentile system-wide.

Areas for improvement have been divided into two sections:

Adjustments to the Existing Delivery System
This section includes actions that are designed to decrease the amount of time needed for crews to begin responding to an emergency; to decrease the amount of time needed to travel to an emergency and to increase the amount of time units are available to respond to emergencies.

Adding Resources to the Delivery System
This section includes adding resources that will have a direct impact on current service delivery and/or the safety of OCFA personnel; that will build capacity, refine the delivery of services, and increase system reliability; and issues that should be studied in the future Strategic Planning Processes

[14] See Section 10, "Compliance Methodology" for a complete description of proposed monitoring system.

Future Performance Goals and Objectives

After the completion of the analysis of the current delivery system in accordance with the Draft SOC Standards, it has been determined that additional progress may be able to be made on the standards. The current First Unit Performance of 7:20 at 80% should be able to be reduced to 6:58 at 80% by implementing the Priority 1 and Priority 2 recommendations detailed in the Reference Section of this report. In addition, the EMS Low and Rescue Low Effective Response Force should be able to be lowered to 6:58 as well. Rural First Unit Performance should be able to be reduced to 11:30 at the 80th percentile.

For future performance, after achieving the 6:58 performance goal, additional improvement may be possible on the percent of compliance. Analysis shows that it may be possible to increase the overall system performance by as much as five percent if the call loading and call generation projections are correct and the measures included in this study are implemented. While there is diminishing return and point where improvement is more costly than the benefit derived, it is believed that percent of compliance performance can be maintained and/or slightly improved over the next five years. This performance should be monitored routinely to insure that projected performance is matching actual performance in both service delivery and in the service environment (location, nature and frequency of calls). Modeling should be adjusted to the new data and assumptions each year to validate that these projections are continuing in the same manner.

The following goals/objectives are recommended:

Goal 1 – Improve First Unit Performance

Objective 1-A Reduce the First Unit Performance in Urban/Suburban to 6:58 while maintaining a system reliability of 80 percent or greater.

Objective 1-B Reduce the First Unit Performance in Rural to 11:30 while maintain a system reliability of 80 percent or greater.

Goal 2 – Improve Effective Response Force Performance

Objective 2-A Reduce ERF Performance for EMS Low Risk Urban/Suburban to 6:58 while maintaining a system reliability of 80 percent or greater.

Objective 2-B Reduce ERF Performance for Rescue Low Risk Urban/Suburban to 6:58 while maintaining a system reliability of 80 percent or greater.

Objective 2-C Reduce ERF Performance for EMS Low Risk Rural to 11:30 while maintaining a system reliability of 80 percent or greater.

Objective 2-D Reduce ERF Performance for Rescue Low Risk Rural to 11:30 while maintaining a system reliability of 80 percent or greater.

Goal 3 – Improve overall performance in all areas

Objective 3-A Increase overall performance for first unit arrival by one percent over the next five years

Objective 3-B Increase overall performance for Effective Response Force by one percent over the next five years.

Conclusion

The Orange County Fire Authority delivers a high quality service to the citizens it serves. The vast protection area extends from the mountains to the ocean. The OCFA encounters most every risk encountered by fire departments across the nation. Overall, the current delivery system provides for the timely arrival of the appropriate resources for all types of emergencies. The quality of service is evident in that the OCFA has a fire death rate that is only 31% of the national level, and fire loss that is only 41% of the national rate in spite of the higher housing market. Based on surveys over the past six years, customer satisfaction is 97%.

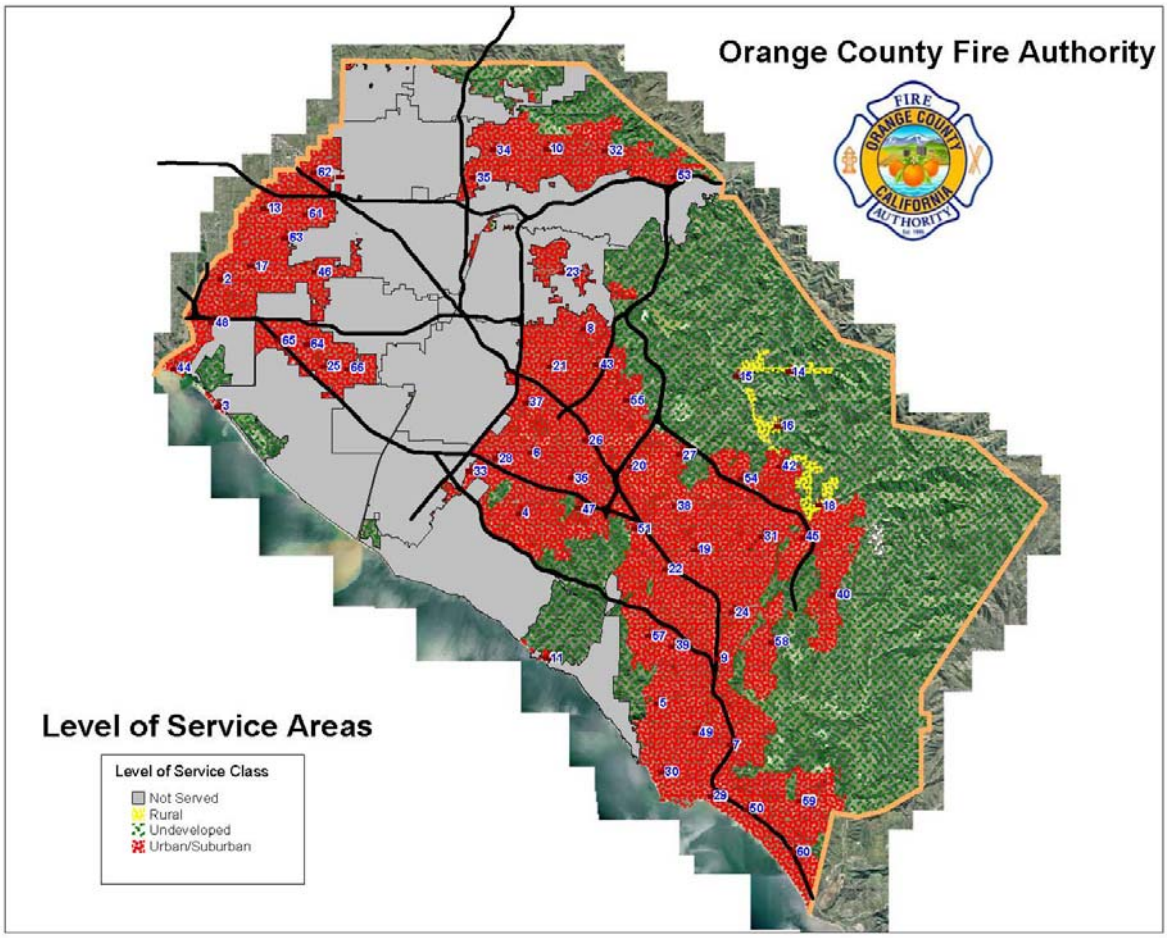
The work products in the Reference Materials sections, attachments, and exhibits clearly illustrate that most of the previous choices made by decision makers were sound. The current delivery system is based on an analytical risk assessment. Resource allocation is tailored to the identified risk. The current system, while effective, is capable of being improved. Although the systems functions at a high level in almost every area, the analysis shows that there are opportunities for improvement and that isolated areas of inconsistent service delivery that can be addressed.

This Standards of Cover document has been designed to formalize and standardize the deployment methodology for OCFA. The "Performance Measures/Standards" provided in this document have be used to analyze the delivery system and make recommendations for improvement. The performance measures listed in Attachment B are well within the national averages for "metro" fire departments and represent the service levels that have been provided by OCFA for many years (five years are documented in this process).

Based on the findings documented in this study, it is recommended that the "Performance Measures/Standards" provided in this documents be adopted for the OCFA for the purposes of advanced/strategic planning and for the use in the accreditation process.

Attachment A: Level of Service Map

Exhibit A



Attachment B: Standards of Cover Matrix

OCFA Standards of Coverage Standards

Attachment B

Distribution		Minimum Required	Urban/Suburban		Rural		Undeveloped
All Risks		First Unit	0:07:20	80%	0:12:00	80%	As soon as is Possible
Concentration							
Fire	High	6 engines, 2 trucks, 1 medic, 2 BC's 29 personnel	0:15:00	80%	0:30:00	80%	Does not Apply
	Mod	3 engines, 1 truck, 1 BC, 1 medic 15 personnel	0:12:00	80%	0:20:00	80%	As soon as is Possible
	Low	2 engines 6 personnel	0:10:00	80%	0:15:00	80%	As soon as is Possible
EMS	High	2 engines, two medics 8 personnel (4 Paramedics)	0:12:00	80%	0:20:00	80%	As soon as is Possible
	Mod	1 medic eng/trk or medic van with 1 unit 4 personnel (2 Paramedic)	0:10:00	80%	0:15:00	80%	As soon as is Possible
	Low	1 unit 2 personnel (2 EMT)	0:07:20	80%	0:12:00	80%	As soon as is Possible
Rescue	High	3 eng, 1 trk, 1 USAR trk, 1 medic 15 personnel (3 USAR, 2 Paramedic)	0:20:00	80%	0:30:00	80%	As soon as is Possible
	Mod	1 engine, 1 truck, 1 medic 8 personnel (2 paramedic)	0:12:00	80%	0:15:00	80%	As soon as is Possible
	Low	1 engine or truck 3 personnel	0:07:20	80%	0:12:00	80%	As soon as is Possible

SOC Matrix Attachment B.xls Page 1 3/8/2006

OCFA Standards of Coverage Standards

Attachment B

Concentration - Special Hazards

		Minimum Required	Urban/Suburban		Rural		Undeveloped
HazMat	High	6 eng, 2 trk, 2 HazMat, 1 medic, 2 BC 39 personnel (10 Hazmat, 2 paramedic)	0:45:00	80%	0:45:00	80%	As soon as is Possible
	Mod	3 eng, 1 trk, 1 HazMat, 1 medic, 1 BC 20 personnel (5 HazMat)	0:30:00	80%	0:30:00	80%	As soon as is Possible
	Low	1 engine or truck 3 personnel	0:10:00	80%	0:15:00	80%	As soon as is Possible
		Interface Areas:					
Wildland	High	6 eng, 2 BC, 1 medic 21 personnel*	0:15:00	80%	0:20:00	80%	As soon as is Possible
	Mod	6 eng, 1 BC, 1 medic 20 personnel*	0:15:00	80%	0:20:00	80%	As soon as is Possible
	Low	2 eng, 1 BC 7 personnel	0:10:00	80%	0:15:00	80%	As soon as is Possible
		* Additional resources dispatched are not measured: patrols,					
Swiftwater	High	4 eng, 2 chiefs,1 helo, 1 swift water, 1 patrol 22 personnel	0:15:00	80%	0:30:00	80%	As soon as is Possible
	Mod	2 eng, 1 chiefs,1 helo, 1 swift water, 1 patrol 15 personnel	0:15:00	80%	0:30:00	80%	As soon as is Possible

Reference Materials Section

Section 1. Purpose

The Commission on Fire Accreditation International (CFAI) defines "Standards of Response Coverage" as being those adopted, written policies and procedures that determine the distribution, concentration and reliability of fixed and mobile response forces for fire, emergency medical services, hazardous materials, and other technical response.

The purpose of a Standards of Coverage document is to provide:

- A tool to assess community fire and non-fire risk
- A tool that defines baseline emergency response performance standards
- A tool for planning future station locations
- A tool for determining apparatus and staffing patterns
- A tool for evaluating workload and ideal unit utilization
- A tool for measuring service delivery performance
- A tool that supports strategic planning and policy development relative to resource procurement and allocation

The key elements in the development of a Standards of Coverage document include:

- A determination of levels of service to be provided within the area served
- A community risk assessment that identifies the fire and non-fire risk common and/or unique to Orange County Fire Authority (OCFA)
- An analysis of the OCFA's current response capability in terms of time and on-scene performance for personnel and equipment
- Development of a standards of coverage statement that describes how the OCFA resources will be allocated and deployed to maximize emergency response effectiveness throughout the OCFA

Section 2. Community Served

Orange County is the second most populous county in California just behind Los Angeles and just ahead of San Diego. It is the fifth most populous county in the nation. Orange County has more residents than 21 states. Orange County ranked eighth in the nation for population growth amongst counties between 2002 and 2003.

Orange County, as a whole, is very diverse. No single racial or ethnic group has more than 50% of the population. The average age in Orange County is 35. Orange County housing stock is over 1,024,300 housing units of which 50% are single-family detached dwellings. Sixty percent (60%) of these units are owner occupied. Housing covers 28% of the landmass in Orange County. Open space or uncommitted land accounts for another 46% of the land with only 12% being used for commercial/industrial uses. Only 4% of the land is still in agricultural use. The remaining 10% of the land mass is used for transportation.[15]

The OCFA currently serves an area of 553 square miles within the 798 square miles of the county, about 69.37% of the land area. This includes over 200,000 acres of State Responsibility Area (SRA) and the Cleveland National Forest.

Of the 3,017,289 Orange County residents, the OCFA protects 1,308,813 or about 43.4% of the population. In addition to the areas within Orange County, the Fire Authority provides service to portions of San Diego and Riverside Counties through contractual agreements. Orange County remains a CDF Contract County and the Fire Authority continues to protect all State Responsibility Area (SRA) wildland areas within Orange County.[16]

The service area for the Fire Authority is vast and complex. It ranges from wilderness areas to dense urban areas with high-rise buildings. The overall service area is divided into four categories:

1) Urban
2) Suburban
3) Rural
4) Undeveloped/Wilderness.

The services provided in each of these areas vary significantly. The differences are based on infrastructure, resources availability, frequency of emergencies and revenues derived from each area.

For the purpose of this process and CFAI accreditation process, the Standards of Coverage established herein apply to all areas within the OCFA legal jurisdiction including Aliso Viejo, Buena Park, County of Orange, Cypress, Dana Point, Irvine, La

[15] Exhibit 2A; 2005 County Profile and Exhibit 2B, 2005 Land Use Efficiency.
[16] Exhibit 2C; Protection Area Map.

Palma, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, Los Alamitos, Mission Viejo, Placentia, Rancho Santa Margarita, San Clemente, San Juan Capistrano, Seal Beach, Stanton, Tustin, Villa Park, Westminster, and Yorba Linda.

Exhibits

2A 2005 County Profile
2B 2005 Land Use Efficiency
2C OCFA Protection Area Map

Section 3. Community Expectations

Introduction

Obtaining and understanding the desires and expectations of community stakeholders is an important first step. The OCFA is committed to incorporating the needs and expectations of residents and policy makers in the service delivery planning process.

It will become increasingly important to emphasize public process and inter-agency communication as the demand for service increases throughout the community. The input received will help guide OCFA vision, planning efforts, policy decisions, and service delivery.

Stakeholders

The range of stakeholders involved in this process is extensive, including the California Department of Forestry, John Wayne Airport, automatic and mutual aid agencies, and member agencies. OCFA member agencies include:

Aliso Viejo
Buena Park
County of Orange
Cypress
Dana Point
Irvine
La Palma
Laguna Hills
Laguna Niguel
Laguna Woods
Lake Forest
Los Alamitos
Mission Viejo
Placentia
Rancho Santa Margarita
San Clemente
San Juan Capistrano
Seal Beach
Stanton
Tustin
Villa Park
Westminster
Yorba Linda

Automatic and Mutual Aid agencies involved in this deployment planning process include:

Newport Beach
Laguna Beach
Orange
Santa Ana
Long Beach
Anaheim

Interviews were conducted with each of these agencies. Topics discussed during the interviews included:

- Balancing of resources
- Diversion of medical resources to other than closest hospital
- Communication system enhancements
- Wildland response

- Possible modifications to response protocols
- Utilization of USAR resources
- Expansion of planning efforts to include entire region

The resultant information provided an important input in the deployment planning process.

Stakeholder Expectations

The various City and County stakeholders hold the Fire Authority in high regard. The vast majority of stakeholders indicated service levels were "excellent" when asked to describe the overall level of service provided by OCFA. Several other comments documented during the 2005 stakeholder interviews conducted by ESCi staff were constructive and consistent with this general assessment. They included:

- Continue or maintain current response performance
- Balance available financial and physical resources to manage growth without jeopardizing service to any one city or stakeholder group
- Be fiscally prudent and maintain affordability
- Provide risk management support in planning and preparation for major emergencies
- Continue placing emphasis on customer service and orientation to communities and citizens
- Develop ownership in each community including participation at staff, policy and community levels
- Prepare agency to provide service to an aging population
- Be visionary/innovative in service delivery
- Provide leadership in health care at all levels of episodic care from first response to ambulance transport

Community Processes

In November of 1998 the OCFA initiated an ongoing "Customer Satisfaction Survey Program" to determine the degree of customer satisfaction with services rendered by the members of the Operations Department during emergencies. The information compiled from these surveys is useful in documenting the degree of customer satisfaction, as well as addressing perceived and/or real skill levels and professionalism of OCFA emergency responders. The data obtained from these surveys is summarized in a report to the Fire Chief.[17] Since the inception of the program, the rate of survey return has been over 30% with an overall satisfaction rating of over 97%.

Beginning in 2000 the OCFA took specific action to involve the community in its planning processes. Two approaches were taken to solicit and receive input. The first involved a series of facilitated discussion forums. The second involved OCFA personnel

[17] Survey results are on file at OCFA.

directly by distributed surveys to shoppers at shopping malls and other community sites using an ESCi designed survey tool.

The community survey participants were asked to prioritize services offered by the fire department, list expectations, express any concerns they had regarding service or service levels provided, provide feedback regarding the fire department, and list any miscellaneous comments they would like to share. These two efforts resulted in 309 surveys being collected. The information was utilized in the strategic planning process.[18]

Other Community Stakeholders

In addition, other stakeholder groups were asked to participate in a similar process. This group included representatives of the building industry association, John Wayne Airport, neighboring fire departments, neighboring police departments, and EMS agencies.

Community Expectations

The community survey process identified four key expectations including:

- Quick response
- Trained and capable personnel
- State of the art equipment and tools
- Good community relations

Stakeholder Participation Level

Numerous internal and external stakeholders were involved in a variety of way beyond simply providing input including project planning, interviewing and evaluation, critical task planning, process review, and approval.[19]

Exhibits

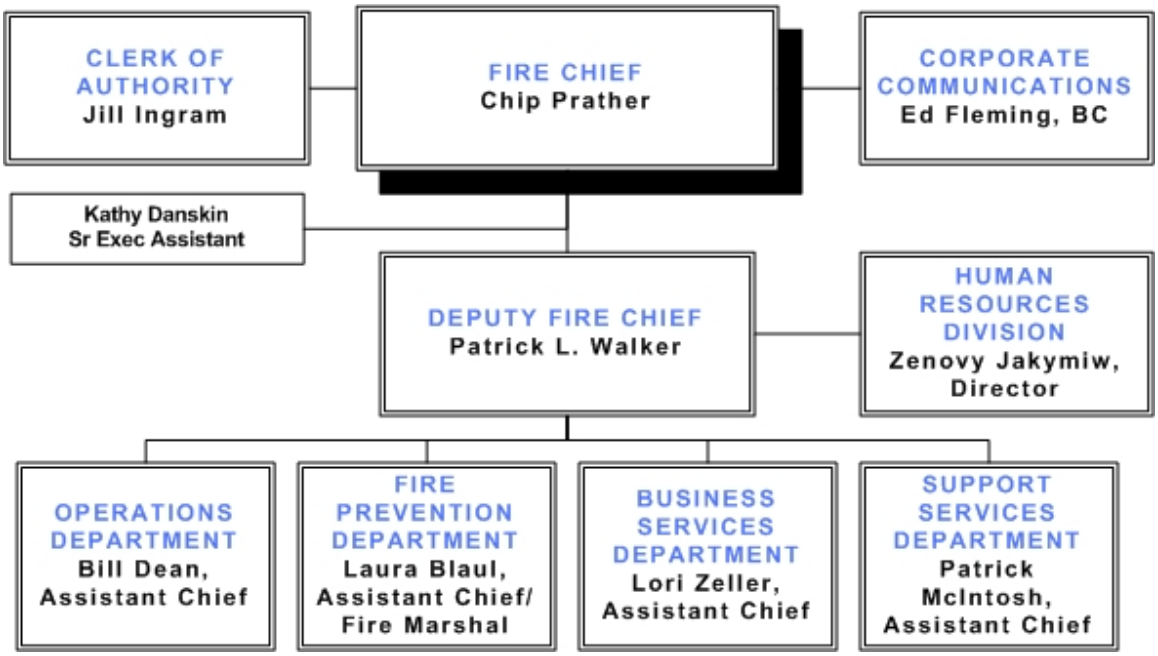
3A Stakeholder Involvement Matrix

[18] Survey results are on file with ESCi in Wilsonville, Oregon. A summary report is included in the 2000 OCFA Strategic Planning document.
[19] Exhibit 3A; Stakeholder Involvement Matrix.

Section 4. Services Provided

The Orange County Fire Authority operates out of 61 fire stations serving 1.3 million residents in 22 incorporated cities and the unincorporated areas of Orange County.[20] On duty staffing consists of 259 on duty personnel. At least 85 of these personnel are certified paramedics.[21] These personnel staff 55 career and combination fire stations, four reserve (stand-alone) stations and two support stations (crews/equipment and air operations). Reserves staff five engines, sixteen patrols/squads, four air utilities and four water tenders. The Fire Authority staffs one ambulance in the City of San Clemente and manages two additional ambulances in the City of Westminster.

The ranks of the OCFA consist of 807 career firefighters, 357 reserve firefighters, and 302 administrative and support personnel. There are four departments: Business Services, Support Services, Fire Prevention, and Operations.



Within the Operations Department, there are five field divisions, with eight battalions, and one support division.[22] Orange County Fire Authority is one of the largest regional fire service organizations in California with a service area that includes urban, suburban, and rural and wilderness areas.

Front line apparatus (those units staffed for immediate response) includes 57[23] fire engines, 10 paramedic vans, and 13 trucks, of which 30 are paramedic advanced life support units, 26 are paramedic assessment units and 24 are basic life support units. The

[20] Exhibit 4D; OCFA First Due Service Areas.
[21] Exhibit 4C; Staffing Matrix OCFA.
[22] Exhibit 4A; Map of Battalions Boundaries and Station Locations.
[23] Five of these are reserve engines.

Fire Authority emergency response fleet also includes helicopters, a hazardous materials response unit, airport crash rescue units at John Wayne Airport, dozers, swift water rescue capabilities, and a federally sponsored urban search and rescue task force.[24]

OCFA provides a full range of services including:

Medical Assistance:
- Medical Aids
- Multi victim incidents
- Mass casualties

Fire Suppression:
- Fixed Property – Structures, dwelling, high-rise
- Mobile Property - vehicles, trains, boats

Rescue Services:
- Trapped or at risk victims
- Urban Search and Rescue (confined space, trench, building collapse)
- Swift Water Rescue

Special Hazards Response:
- Hazardous Materials
- ARFF (Airport Rescue Fire Fighting)
- Wildland

Cooperating Agencies

In addition to the OCFA, there are 12 other municipal fire departments and the two military fire departments at Seal Beach Naval Weapons Station and the Joint Powers Training Center/Los Alamitos in Orange County. Most of these departments participate in mutual/auto aid agreements with the OCFA and some provide services to county islands under contract with the OCFA. The OCFA also maintains mutual and/or automatic aid agreements with Los Angeles, Riverside, San Bernardino, and San Diego Counties, Camp Pendleton Fire Department, and the U.S. Forest Service.

Reserve Personnel

Reserve personnel are utilized for specific needs. Their training is based upon their assigned duties and unit type. The fire and medical first responders assigned to engines are fully trained. Squads are trained in medical first responder and structure fire support. Patrols are trained both in medical first responder and wildland fire fighting. Reserve hand crews and helicopter support crews are trained on their specified task as well as basic life support.

[24] Exhibit 4B; ECC Resource Worksheet by Division.

Administrative and Support Services

OCFA provides its own support and administrative services that other cities and counties generally provide their fire departments. Civilian personnel staff the following functions: Human Resources, Risk Management, Employee Benefits, Payroll, Purchasing, Accounts Payable/Receivable, Treasury, Automotive, Planning and Development, Building and Hazardous Materials Inspections, Service Center/Warehouse, Public Information, Audio Visual, Legislative Analysis, Property Management-including maintenance and construction of new stations, Clerical and Dispatch. These services to the community are in addition to Fire Suppression and Emergency Medical Services. The services these important sections provide are not fully reviewed in this deployment study.

Exhibits

4A Battalions Boundaries and Station Locations Map
4B ECC Resource Worksheet by Division
4C Staffing Matrix OCFA
4D OCFA First Due Service Areas

Section 5. Community Risk Analysis

Community Risk Assessment is a critical step in the process of developing a Standards of Cover. Risk analysis should identify, define, and describe the types of problems that dictate the overall deployment of OCFA resources. The protection area of the Fire Authority has a wide range of risk including some very unique challenges.

Risk Assessment is the process of examining the events that may occur within a jurisdiction and projecting the potential impacts of those events on the community. It is the goal of the SOC process to match the deployment of resources with the identified risk in the most effective manner possible. The steps in this effort include:

- An examination of the nature of the hazard(s) that exist
- Identification of the values and property at risk
- Evaluation of the impact and consequence of an event
- Consideration of the potential frequency of an event

The OCFA responds to a variety of risks and each type of risk may have different resource needs. In the SOC process, deployment is analyzed from the basis of risk. Some risks require a greater deployment of resources than others to achieve an acceptable outcome. The OCFA deployment strategy is based on the goal of providing the needed resources to handle the risk. It is quantified by considering how many people must arrive within a specific time frame with the appropriate equipment in order to achieve the desired outcome. The entire system comes down to a calculation of the speed and weight of initial attack resources needed to control the emergency at hand.

The relationship between probability and consequences is one of the principles used in risk analysis. This concept is critical to the eventual establishment of risk levels for each area served. As either factor increases, it will impact the overall risk. The probability and consequence establishes the overall risk factor for any given situation.[25]

Risk Expectations

Each community must identify an accepted level of service. Accepted Risk is a relative term that is determined by considering expected and desired outcomes, availability of resources, and cost. The process of establishing what is "right" for the community is a policy decision. It is important to capture the expectations of the community at the start of the process in order to build the appropriate criteria.[26]

The first step in this examination of risk is to look at the mission and goals established by the organization. The second is to establish performance objectives for each service that is provided. The final step is to develop specific performance measures for each service provided in each risk category.

[25] Exhibit 5A; Risk Categories; Probability Consequence Risk Chart.
[26] See Section 3, "Community Expectations."

Mission and Goals

The general mission of most fire departments is similar in that it relates to what the fire department does.

> Limit the risks to the community and its people from fire, injury, death and property damage associated with fire, accidents, illness, explosions, hazardous materials incidents, and other natural or manmade emergencies through mitigation.

OCFA has taken this general idea and expanded its mission statement to reinforce the purpose of the organization and the values it will carry into the community.

> *We proudly serve the changing needs of our communities by providing the highest quality regional emergency, safety, and support services with:*
>
> • *Professionalism*
> • *Enthusiasm*
> • *Organizational Integrity*
> • *Pride*
> • *Leadership*
> • *Effectiveness*
>
> *Our people pledge a commitment to preserving the quality of life. We protect lives, property, and the environment with compassion, vigilance, and dedication to excellence.*

Performance Objectives

The OCFA has developed objectives for each of the major services it provides; fire suppression, emergency medical services (EMS), rescue, and special hazards. These performance objectives further define the quality and quantity of service to be provided.

> Fire
>
> *For all fire incidents, OCFA shall arrive in a timely manner with sufficient resources to stop the escalation of the fire and keep the fire to the area of involvement upon arrival. Initial response resources shall be capable of containing the fire, rescuing at-risk victims and performing salvage operations, while providing for the safety of the responders and general public.*

EMS

For all emergency medical incidents, OCFA shall arrive in a timely manner with sufficient trained and equipped personnel to provide medical services that will stabilize the situation, provide care and support to the victim and reduce, reverse or eliminate the conditions that have caused the emergency while providing for the safety of the responders. When warranted, timely transportation of victim(s) to appropriate medical facilities shall be accomplished in an effective and efficient manner.

Rescue

For all incidents where rescue of victims is required, OCFA shall arrive in a timely manner with sufficient resources to stabilize the situation and extricate the victim(s) from the emergency situation or location without causing further harm to the victim, responders, public and the environment.

Special Hazards

For all special hazards such as Hazardous Materials, Wildland, Swiftwater and Aircraft Firefighting, OCFA shall arrive in a timely manner with sufficient resources to stabilize the situation, stop the escalation of the incident, contain the hazard where applicable and establish an action plan for the successful conclusion of the incident while providing for the safety and security of the responders, public and the environment.

Global Risk Assessment

Local and Regional Data affecting all calls for service

Changing Demographics

A review of the census data and other regional sources of data show that density (population per square mile) is not a significant issue in most areas. Currently, some pockets of higher density exist, but the majority of the protection area is not densely populated and is suburban in nature.[27]

A review of the Southern California Association of Governments (SCAG) data on population growth indicates that Orange County will increase by 26% to nearly 3.7 million people by 2050. Population has a direct correlation on risk. OCFA has a correlation of .9899 for emergency calls for service shown in relationship to population served.[28] This means that the historical data shows that population affects incident responses with a relationship of 99% accuracy. High-density population areas, including

[27] Exhibit 5B; Population Per Square Mile-Density Map.
[28] Exhibit 5C; Correlation between Population and Calls for Service.

high-rise residential dwellings, increase the risk associated with that service area. The more people in a given service area, the more incidents, or calls, are generated. Density is increasing throughout Orange County, and higher concentrations of population are appearing in areas that historically have not had population centers. Examples include the infill development in the Irvine industrial area and the older commercial areas such as Buena Park and Lake Forest.

The population growth history of Orange County over the past five years shows an increase of 5.23%, while the areas protected by the OCFA increased by 7.00%. In fact, with annexations, some member agencies experienced increases of 20-30%, while the unincorporated areas dropped by 32.92%. The past five years has seen an increase of 33,780 dwelling units within the OCFA service area. This increase (7%) is equal to the rise in population. Based on the correlation between population and incidents this population increase would mean a 7% increase in call volume. The actual increase was 8%.

The population makeup in Orange County is changing as well. When the same data is examined for the age of the population served, several areas of elderly population are evident and tend to be the areas of increased call loading. According to the 2003 American Community Survey of Orange County, the average age is 34.5 and comprised of 49.9% men and 51.1% women.[29]

Persons aged 65 years or older make up 9.9% of our current population. Using age 60, rather than 65, the percentage jumps to 13.31% of the overall population. This is important because of the aging of our society (baby-boomers getting older) and the rate at which the elderly population use OCFA emergency services. The analysis clearly shows that the current population over 60 years of age will increase by 240% (27.1% of the overall population) by the year 2050.[30] The majority of this increase will occur by 2030. This is noteworthy because call history in Orange County show that the elderly population segment uses OCFA services at a rate three and one half times greater than the average age population.[31] The doubling effect will have a significant impact on service delivery distribution, workloads, and the reliability of the system.

In Orange County, 42.1% of the population speaks a language other than, or in addition to, English. Trend analysis of census data shows that this percentage is likely to increase in the future. The number of calls where responders may encounter language barriers will increase. It may also affect the time it takes to dispatch a call when decisions need to be made, or the length of time on a call to obtain report information and history.

In Orange County, 96.4% of all housing units are owner occupied. Only 7.4% of families live below the poverty level. Approximately one-third (33.5%) of those living in Orange County who are 25 or older have a four year degree or higher. These factors create a base population that is generally easier to serve due to lower risk factors associated with affluence and education.

[29] Exhibit 5D; Average Age by Census Block Group.
[30] Exhibit 5E; Orange County Demographic Analysis 2000 to 2050.
[31] Exhibit 5F; Call Generation by land Use Type.

Infrastructure

Infrastructure includes streets, water, utilities, stations, housing, and commercial buildings. The age and quality of the infrastructure have a direct correlation on risk and must be considered in the deployment of resources. The age works both ways; older materials burn faster and were not designed to protect the structure from fire or earthquakes in the same manner as those used today. Newer streets are no longer wide and straight, resulting in longer routes and slower driving speeds. Structures are built with higher density resulting in greater exposures and calls to an area. Utilities are being moved underground causing above and below ground safety issues.

The two most significant infrastructure issues for the fire department are water and roads. Access to the scene of an emergency and water supply to fight fires are essential to providing service. In the developed areas, a great deal of effort is made to insure that both are provided during construction and after occupancy.

Streets/Traffic Networks

The street network is the backbone of an emergency response system. The network must be both efficient and effective in order to maximize emergency response. The best-case scenario is a network with direct routes and multiple points of entry. Orange County has a mix of good and bad areas with respect to overall traffic circulation but the street network generally works well.[32] Lack of efficient circulation within a project, community or region can seriously degrade the ability of the Fire Authority to provide effective and rapid response. One of the biggest problems is the planning of a delivery system based on anticipated infrastructure that is not completed. A missing street at a critical point can completely change the service delivery area of a station and the effectiveness of the overall response. For example, Station 58 is one of the most recent stations built by OCFA, and is located near the intersection of Crown Valley Parkway and Antonio Parkway. If the extension of Crown Valley Parkway to the planned 241 Freeway extension were not completed as included in the Master Plan, the Station would only serve a 180 degree area instead of the 360 degree service area it was designed to serve. The majority of the circulation issues, however, are in the hillside or canyon communities.

Increases in traffic can become a significant negative factor that directly effects deployment. Traffic issues continue to increase in Orange County. Impacts are directly related to growth and demographic changes. Increased traffic presents both distribution (initial response time) and concentration (multiple resource response) problems. If response times lengthen, the effective response area for each station is reduced. If multiple resources from multiple stations cannot arrive in an acceptable time frame, then more resources will be needed within the system.

[32] Exhibit 5G; Orange County Master Plan of Arterial Highways.

Some traffic improvement options may actually reduce response times while others simply slow the negative impacts. Increased traffic decreases response performance and increases the potential for accidents. In some traffic situations, with raised center medians, units must simply turn off emergency lights and wait for the traffic to clear before proceeding.

Solutions to this issue are available but may have significant cost. Technology solutions such as Emergency Vehicle Preemption (EVP) are very cost-effective when done in conjunction with other work or when the signal is first installed. Center median breaks, drive-over or crawl-over sections in median or simply leaving painted medians rather than raised medians have positive impacts on responding units.

Rail/Air/and Waterway Networks

Rail lines are an inherent risk due to the nature and volume or materials transported. Literally all materials that are used in our society travel by rail. Large amounts of chemicals, flammables, toxics and people are transported daily on rail networks. While the number of incidents may be small, the consequences of a rail incident can be significant. This has been the case in Orange County with both freight and passenger rail incidents. The Orange County rail line network is illustrated in Exhibit 5H.[33]

Airports also have a low incident frequency but an even greater consequence when an incident occurs. OCFA protects the Orange County/John Wayne Airport (JWA) and the majority of the area surrounding the airport and flight path. The risk associated with the airport extends far beyond the actual airport boundaries. According to statistics observed over a ten-year period (1995 to 2004) over half of the aircraft accidents occur during the final approach and landing while 38% occur during the takeoff, climb and descent phase. Only 5% of accidents occur during the cruising phase of air travel. The result is that accidents will likely occur near, but not necessarily on, airport property.[34]

In Orange County, the issue of waterways is not so much about the transportation of goods or people on the waterways as it is the impact of the waterways on the other transportation systems, namely the street network. The waterway features (rivers, bays, lakes, and ocean) are impediments to response in many cases. With limited points to cross these features, they cause inefficiencies that greatly impact the ability of emergency resources to service areas that would otherwise be accessible in terms of time and distance from fire stations.

Population Centers

Population centers are areas with population densities in excess of the majority of the protection area. They are important because there is a direct relationship between population, risk and the impact on workload. Population centers typically exist in the older communities. This is changing, however, with new developments specifically

[33] Exhibit 5H; Orange County Rail Lines.
[34] Exhibit 5I; Aircraft Accidents - Locations and Timing.

focused on increasing densities to 50 or more dwelling units per acre. While most density issues revolve around housing units, "job centers" that produce daytime occupancy rates in excess of the housing limits also exist. These "job centers" bring workers and customers into an area, which doubles or triples the transient populations during normal business hours. The structures in these are often higher occupancy mid-rise (four and five story) and high-rise (six or more stories/over 55 feet) buildings with large workforces. Several high-density job center properties exist within the OCFA protection area.[35]

Areas of Significant Change

There is a great deal of development still to be completed within the boundaries of OCFA. These proposed major projects will produce over 50,000 new homes and millions of square footage of commercial property over the next thirty years. Large projects such as the Northern Sphere in Irvine or the "Ranch Plan" in south Orange County will produce the largest impacts, but other projects such as the redevelopment of the Irvine Business Complex (IBC) will also change the resources needed to service these areas. In the case of the IBC, thousands of residential units in mid and high-rise buildings will be introduced to an area that dose not currently have a significant number of dwelling units. These changes will require a change in resource deployment.

Specific Areas of Impact

Irvine Build-out - The City of Irvine is the largest growing city within the OCFA protection area. In the next 10 to 15 years the city will add over 20,000 dwelling units and millions of square feet of commercial/industrial/retail space. Three specific areas will have deployment issues:

> Irvine Business Complex – The IBC will significantly change the area land use. In the past this area had little residential development. Over 5,000 dwelling units have been or are being constructed with another 10,000 units in various stages of planning. This area could ultimately see even more residential units. All of the residential is high density in mid-rise or high-rise structures. These changes will require additional resources. While the IBC has many high-rise buildings today, it does not have high-rise dwelling units. This change will introduce risks not currently present in this protection area (For example, non-ambulatory residents, sleeping occupants, and cooking activities). Each of these risk factors increases the probability of an incident as well as the potential consequence. It should also be noted that the Irvine General Plan will allow a traffic level of service "E" in the IBC whereas the balance of the city will have level "D" or better.[36]
>
> Great Park – The Great Park development is intended to be the "jewel of the city." It will attract visitors from throughout the region. This creates two important deployment issues. The first is the size and nature of the sports and event center(s). Current planning parameters forecast up to 30,000 visitors in the park

[35] Exhibit 5J; OCFA High Rise Building Inventory 2004.
[36] Exhibit 5G, Orange County Master Plan of Arterial Highways, page 2.

complex during major events. The 1,347 acre Orange County Great Park will be a major metropolitan park and the focal point of redevelopment of the larger 4,700 acre area that was formerly the Marine Corps Air Station El Toro. The Great Park will include extensive natural areas in addition to recreational and cultural uses. The remaining 3,700 acres will be developed by the Lennar Corporation and will include residential, educational, commercial, and retail uses as well and supporting facilities. The second issue is the design and layout of the Great Park. The park itself, with a lack of through streets or even drivable surfaces for emergency vehicles, could become an impediment. Consideration during the planning processes is being given to providing "Green Vehicles" for emergency responses into the Great Park.

Spectrum - Irvine Spectrum is a large mixed-use development with mostly office, commercial, and retail uses. Currently under construction is a 3,000 unit residential complex with at least one additional large residential complex planned. The density of development, coupled with the large shopping and entertainment facilities located at the convergence of I-5 and I-405, makes the area a deployment challenge. The surrounding area has the Irvine Meadows amphitheater and large numbers of car dealerships. Infill projects in this area, along with the phase four expansion of the shopping and entertainment center will continue to increase call loading and traffic. High-rise residential has also been suggested for this area.

Ranch Plan - This project includes 14,000 new residences and approximately 5,000,000 square feet of commercial and retail uses. Modeling projections for the Ranch Plan indicate that 3 to 4 new fire stations (including Station 56 already partially funded from the Ladera project) will be required. Of specific concern is the inclusion of 6,000 senior citizen dwelling units in the plan. The senior community will be comparable to the Leisure World community in Laguna Woods. As indicated earlier, this type of community uses services at a rate three and one half times greater than the average community.

Tustin Legacy; The reuse of the Marine Corps Air Station - Tustin is well underway. This project will add 4,601 dwelling units, and 11,400,000 square feet of commercial, institutional and recreational uses. There will be over 100 acres of park space. Fire Station 37 will be relocated onto this project when the infrastructure and financing is available to do so. This project is immediately adjacent to the IBC and will have impacts on call loading and traffic impediments.

Limitations to Growth

Construction limits

Orange County is rapidly approaching a time of build-out as all of the raw land is developed. The final large-scale development plans are underway. Once the current building projects are completed, the built-upon areas of the county will be surrounded by

the Pacific Ocean, Cleveland National Forest, and State/dedicated open space lands. No large area of developable land or even agricultural land will be left in Orange County. This will have an effect on land values and will increase the pressure on the redevelopment of existing developed areas. Increased density and intensification of uses are expected.

Infrastructure limitations

Three infrastructure issues will have the greatest limitation on future growth include traffic, water and sewer capabilities. Traffic trip counts are one of the most limiting factors in growth and development in Orange County today and will continue to be so in the future. Water and its byproduct (sewage) have shaped the southern California landscape for over a hundred years. The lack of water or sewer capacity to support development is a major issue in many of the communities served by OCFA. The water issue is why new developments must provide "will serve" documents detailing how the commodities will be provided before develop is allowed to proceed. These three issues will continue to drive development parameters. Traffic and water are key and have direct impacts on the ability of the OCFA to provide service. As traffic service levels decrease, response times increase proportionally. Without adequate water OCFA cannot protect the new developments. Safeguards are in place to monitor the water issues, but the traffic issues are not within the control of the OCFA.

Many of the communities that OCFA protects are currently adopting land use plans that utilize the "New Urbanism" concepts. This new orientation to higher densities, transit orientated development, mixed use complexes and the move to a more vertical orientation will have impacts on the resources needed to serve the newly development areas.

Environmental Risks

Topography/Soils

Several issues related to topography and soil conditions cause both potential risk and actual incidents. The most common risk is hillside instability or landslides. Areas of instability have caused many incidents where homes have fallen down the hillside. Most of the slides have been slow moving events that have not resulted in rescue situations; however some have been rapid moving incidents, such as the mudslides in Laguna Canyon and the landslides in Bluebird Canyon, which resulted in major rescue efforts.[37] The same slope features also impact the spread of wildland fires.

The second topographic risk is liquefaction zones and is more theoretical as it has not caused problems in recent history. Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. Liquefaction and related phenomena have been responsible for tremendous amounts of damage in historical earthquakes around the world. This potential risk impacts major

[37] Exhibit 5K; Orange County Hazard Map Landslide/Liquefaction Zones.

portions of central and west Orange County. Additionally, areas in the floodplain of most of the major waterways/drainages in Orange County are subject to liquefaction.

The third topographic risk is access. Access issues fall into two categories; access in developed areas and access to wildland fires. The hillside and canyon areas have circulation issues with respect to emergency response. In many cases, it is not possible to access adjacent properties quickly due to the geographic features that have been preserved in the development. Topographic response barriers are prevalent in many areas served by OCFA. Elevation changes and large open space impact the ability of emergency resources to reach the scene of an emergency in a timely manner. In some hillside communities, it is possible to see directly across a natural area to other homes or business, but actually driving time to them may take several minutes on narrow winding roads. These can be significant impediments to response.

Riparian areas and roadless areas may also play a significant role in the ability of the fire department to access fires quickly. These same access issues are also factors in remote rescues situations.

Flood

Orange County has a significant flood history. The first recorded flood in Orange County was in 1810. Floods have occurred in the county on a 20-30 year cycle since 1825.[38] Floods and flood control have had a major impact on the development of Orange County. Significant incidents led to the formation of the Orange County Swift Water Rescue team and the consolidation of the swift water function with USAR trucks.

Fire Risk Assessment

The assessment of fire risk requires an understanding of fire flow demand and capability, probability of emergency incidents, consequences to life safety, and economic impact to the community served.

Common fire and life safety factors, such as fire flow and code compliance for life safety, are used to determine risk classification. Risk classifications range from Low, Moderate, High and finally to Special/Maximum. Single family dwellings, considered typical or Moderate risk, comprise the majority of most communities.

Building Stock

Structure fire risk assessment is performed on the community's building stock. According to 2000 Census data, Orange County Fire Authority has 456,429 dwelling units with an average age of 28 years. Only 2.5 percent of the total housing units were built before 1940 and half of the housing stock was built in the 1960's and 1970's. The actual inventory of building stock within the Fire Authority ranges from historical adobe homes

[38] Exhibit 5L; FEMA Flood Map.

to high-rise buildings of up to 20 stories.[39] The majority of large commercial structures are protected with fire sprinkler systems. Residential dwellings in some areas are protected with residential sprinkler systems, however, most are not.

The Insurance Services Office (ISO) provides ratings for cities/regions and for specific buildings based on a rating schedule. Buildings are rated primarily on fire flow requirements. Buildings with higher fire flow requirements are considered the higher risk. The higher the risk, the more emergency units are needed for response. Overall risk is assigned a property protection class. The majority of OCFA protection area is ISO Class 3 or 3/9. The canyon areas and Cleveland National Forest are Class 4/9. Split classifications are assigned to mixed areas. The first number is the risk classification for structures within five miles of a fire station and 1000 feet of a fire hydrant. The second is for structures in excess of five miles from a station or 1000 feet. A class 9 rated occupancy generally will not be able to purchase fire/hazard insurance.[40]

The size or area of a building is a key factor in assessing risk for fires. Generally speaking, larger more complex structures carry a larger risk due to the time it takes to complete suppression activities within them. They tend to require longer hose lays, more ladders and may require equipment staging areas within the building for working crews. One basic concept used to show the size and density of structures is the Building Area Ratio (BAR). The BAR is the percentage of the square footage (total) of the building divided by the square footage of the parcel it is built upon. A BAR that is greater than 75% is considered high density.

The height of buildings is also a factor in assessing risk for fires. While the BAR captures some of this risk, the nature of the configuration is not totally understood without knowing the building height. There is a direct relationship between height and the equipment needed to protect the building. For example, the roof of most three-story buildings cannot be accessed with a 24-foot ladder standard on many OCFA engine companies. A 24-foot ladder can be placed with only one person while a 35-foot ladder requires two personnel. Buildings four or more stories require an aerial ladder to access the upper floors and roof area.[41]

Processes being preformed within a structure can increase the risk factors significantly. If a standard commercial concrete tilt-up building is used as an office or warehouse, the risk is not significant, but if the same building is used as a woodworking shop or printing shop, an explosion potential exists. The same building using large quantities of flammable liquids or gases would change the risk factors again. Finally, changing the use by adding a large number of people such as in a church or restaurant changes the life hazard and the risk factors of the structure. What is happening in the structure is every bit as important to the overall risk assessment as the size, location and construction of the building.

[39] Exhibit 5M; Building Stock Age by Census Track.
[40] Exhibit 5N; ISO Rating Map and Exhibit 5O, Fire Flow in ISO Rated Occupancies.
[41] Exhibit 5J; OCFA High Rise Building Inventory 2004.

Built-in fire protection (fire sprinklers, standpipes, etc) is a major issue with larger structures. Built-in fire protection negates many of the concerns regarding large structures or hazardous processes. In many communities, developers and builders are given "credit" for built-in protection by allowing narrower streets, longer cul-de-sacs, larger buildings and/or smaller water mains. This results in the balancing of risk and cost. While built-in fire protection should significantly reduce the spread of fire, it may not extinguish the fire. Firefighters still need to complete the extinguishment and perform ventilation, overhaul and salvage operations.

Changes in type of development are happening in Orange County. Land values have risen to a point where developers are beginning to use housing/building configurations in Orange County that have not been used to any real extent previously. Examples include:

1. The "wrap" which is a parking structure with living or work areas on three or more sides of the parking structure
2. "Podium" style construction with parking areas below the living or work areas
3. The "Row House" which is a continuous structure for major portions of a block where there is no access from front to back without going through or around the structure
4. Mid-rise and high-rise residential structures

Each of these new configurations has specific issues related to access, height and complexity that require additional or different resources to protect.

The OCFA, in assessing all of the factors, has determined that the following levels should be established to identify the fire risk in each geographic area:

Low - Areas with mobile property, outbuildings, structures with less than 1,000 gpm needed fire flow, and/or a BAR (building area to amount of land covered by building ratio) of less than 10%.

Moderate - Areas with single occupancy structures with needed fire flow requirement from 1,000 to 2,500 gpm and/or a BAR greater than 10% and less than 75%.

High - Areas with multi-occupancy structures with needed fire flow above 2,500 gpm, structures over three stories in height and/or a BAR greater than 75%.

Special - Areas with high-rise buildings, target hazards and/or specific building construction or use that require additional resources.

Medical Risk Assessment

OCFA responded to over 79,000 incidents in 2004. Almost 70% are medical calls for service. Even more calls have a medical component (traffic accident is a rescue but will

likely have injured victims). The high percentage of medical calls makes the medical risk a high probability for occurrence throughout the service area.

OCFA is slightly higher in the percent of medical calls than the national average but lower in fire calls. The types of calls OCFA responds to directly correlates to the leading causes of death nationally. The number one leading cause of death is heart disease and OCFA responds, on average, to 7.6 calls per day to heart related events. OCFA responds to traffic collisions with injuries more than any other daily event (14 times a day). Accidents are the fifth leading cause of deaths nationwide. This issue is discussed in more detail in the Section 7, Comparability.

The OCFA, in assessing all of the factors, has determined that the following levels should be established to identify the medical risk in each geographic area:

> Low - Areas with a history or potential for emergency incidents for predominately Basic Life Support level of care was provided. Calls requiring basic first aid/ EMT-1 level skills. These areas normally have low population densities and/or limited residential or commercial development.
>
> Moderate - Areas with a history or potential for emergency incidents where Paramedic or Advance Life Support level of care was routinely provided. Call locations that require the full scope and depth of the Emergency Medical System. This is the majority of the protection area.
>
> High - Areas with a history or potential for needing multiple Paramedic Level responses simultaneously. These areas would normally have high population densities and/or large numbers of “at risk” populations.
>
> Special - Disasters, Mass Casualty Incidents.

Rescue Risk Assessment

OCFA protects a large area with many freeways, rail lines, waterways and commercial/industrial areas. The need for rescue services is great. In addition to the risk associated with transportation accidents, industrial accidents and construction accidents, Orange County still has large areas of open space that generate remote rescue situations. As noted in the environmental risks discussion, the majority of the OCFA protection area has issues with land movement and earthquakes. The rescue risk from these two issues is significant in terms of consequence. In terms of frequency it is low for liquefaction and moderate for landslides.

The OCFA, in assessing all of the factors, has determined that the following levels should be established in determining the risk for rescue emergencies in each geographic area:

> Low - Areas with a history or potential for rescue situations that require only the tools and knowledge set available on first due apparatus. Examples include:

persons needing assistance up or down an elevation difference where simple solutions such as a rope or ladder will complete the rescue. These areas might include parks, open space, large event centers or schools.

Moderate - Areas with a history or potential for rescue situations requiring the use of specialty equipment available on all OCFA truck companies. Examples include: traffic accidents with persons trapped, persons needing to be moved up or down an elevation while unable to walk or help themselves.

High - Areas with a history or potential for rescue calls requiring specialized equipment and training. Examples include: technical rescues of persons trapped by equipment, buildings or earth that will require extended and complex rescue solutions.

Special - Disaster responses to earthquakes, floods, landslides, hurricanes or tornados and other situations where large numbers of people are at risk.

Special Hazards Risk Assessment

Hazardous Materials

A hazardous material is any substance or material capable of posing an unreasonable risk to health, safety and property. Multiple factors determine if a material is considered hazardous, including quantity, concentration, and physical or chemical characteristics. A hazardous material becomes a hazardous waste when it can no longer be used for the purpose it was originally intended.

Hazardous materials are present throughout Orange County. Chemicals are used in process, in transit, in storage, and in some cases disposed of illegally. OCFA issues permits for hazardous materials in almost every part of the protection area.[42] These hazardous materials come in all sizes and risks from household hazardous waste to acutely hazardous materials. Businesses use, transport or sell thousands of different types of hazardous materials. Many processors mix materials changing the chemical properties and increasing the potential risk. Over 5,000 occupancies within the Fire Authority have or use hazardous materials in their place of business. About 3,200 have “reportable levels” (quantities of material that require disclosure of the location, amount and nature of the risk) of hazardous materials. Forty-one users qualify for the CalARP (California Accidental Release Prevention) program and 15 users are in the federal RMP (Risk Management Program). Additionally, all types and quantities of hazardous materials travel through Orange County by rail, air and truck. The hazardous materials risk is significant enough to require OCFA to have a hazardous materials response team capable of Level A entry.

[42] Exhibit 5P; OCFA Hazardous Materials Permits October 2004.

Nuclear (Unique Risk)

The San Onofre Nuclear Generating Station (SONGS) is located next to San Onofre State Beach, which adjoins the Camp Pendleton U.S. Marine Corps Base in northern San Diego County just south of Orange County. Large portions of South Orange County are within the identified Emergency Planning Zone for the plant. The plant contains three nuclear reactors. Unit 1 was retired in 1992 after 25 years of service and is currently being decommissioned. Units 2 and 3 are currently in use and are capable of producing enough power to serve the needs of 2.75 million households which is 2,254 megawatts of power. When both SONGS units are operating, they have the potential of saving the equivalent of 188 billion cubic feet of natural gas per year. The Fire Authority participates in annual exercises for potential emergencies at the power plant. The Fire Authority has a mutual aid agreement with the plant. The Fire Authority provides radiological monitoring teams for offsite assessment in the event of a problem at the facility. One other nuclear reactor (research only) is located at the University of California; Irvine.

The OCFA, in assessing all of the factors, has determined that the following levels should be established in determining the risk for hazardous materials emergencies in each geographic area:

> Low - Areas with hazards that would require Level D entry. Incidents that require only the tools and knowledge set available on first due apparatus. This risk includes incidents related to common chemicals such as those used in the home or business.
>
> Moderate - Areas with hazards that would require Level B or C entry. Incidents that require specialized tools and knowledge to deal with hazardous materials that are normally liquids or solids without acute hazards. This risk includes incidents related to chemicals used in light industry, larger amounts hazardous materials in transport or storage.
>
> High - Areas with hazards that would require Level A entry. “Acutely Hazardous” materials incidents that require encapsulation of the workers and multiple specialized teams with a level of decontamination that is potentially hazardous.
>
> Special - Weapons of Mass Destruction or terrorist acts.

Aircraft Rescue and Fire Fighting (ARFF)

John Wayne Airport (JWA) - The Fire Authority provides ARFF services to the Orange County Airport (John Wayne Airport/JWA) on a contractual basis under the federal regulations and FAA requirements. A record 9.6 million passengers chose JWA in 2005 for either business or vacation travel. On May 27, 2005, the JWA recorded its busiest day ever with more than 35,181 passengers. JWA is now home to 11 commercial, three commuter and two cargo airlines with approximately 261 daily arrivals or departures to

23 non-stop U.S. destinations. JWA was ranked 27th in the nation for takeoffs and landings. In addition to commercial activity, John Wayne Airport has the tenth largest general aviation operation in the United States and is home base to 573 private and corporate aircraft. General aviation activity at JWA accounted for approximately 71 percent of the Airport's 249,000 total takeoffs and landings in 2004. More than 20,000 tons of cargo was shipped in and out of the county through JWA. The United States Postal Service, with facilities adjacent to the Airport, ships approximately 20,000 pounds of first-class mail daily via eight commercial carriers. Plans are currently underway to expand the airport by adding an additional six permanent gates (from 14 current to 20 proposed) and capacity for another 2.4 million annual passengers. The size of the terminal will increase by 300,000 square feet from 440,000 square feet to 740,000 total square feet.

OCFA will continue to use the current ARFF risk categories, Categories I, II and III.[43]

Wildland

Orange County has a long history of significant wildland fires. Vegetation often called "chaparral" located in close proximity to development increases the risk. When a fire occurs, the weather, topography, type/nature of vegetation, access and water supply have a significant impact on severity and outcome. Large catastrophic wildland fires in Southern California are usually driven by Santa Ana winds. These winds can blow at 60 to 100 mph and last for days. Houses that interface with the wildland areas are at risk from burning vegetation. The Laguna Beach Fire (1993) and the San Clemente -Trafalgar Canyon Fire (2001) underscore the inherent risks in these interface areas.

The weight and speed of initial attack for wildland fires is dependent on location, weather, topography and fuels. Risk areas are identified as:

Urban/suburban interface - Areas between the wildland and the developed areas

Rural interface - Areas between the wildland and the developed area with larger wildland areas adjacent

Wildland/Undeveloped Areas and Forestry Land – Areas without direct risk to inhabitable structures

OCFA will continue to use the regionally accepted wildland response levels; Low watershed, Medium watershed, High watershed and Red Flag. Risk will be based on proximity to the wildland and the amount of defensible space that exists. The nature of the interface changes with rainfall and maintenance efforts or the lack thereof. The State of California has identified areas of high risk and designated them as Very High Fire Severity Zones.[44] OCFA will maintain the capability of responding a High watershed dispatch to these areas.

[43] Exhibit 5R; OCFA SOP 209.02, "Aircraft Incident Operations at John Wayne Airport," page 2.
[44] Exhibit 5Q; Very High Fire Hazard Severity Zones.

Swiftwater

Orange County has many miles of streams, flood channels, ocean beaches and lakeshores. Many of the streams do not flow year round, but when they do, they flow fast and dangerous. Because they do not flow all the time, people do not always take the potential of flooding into consideration. Rapid runoff in areas remote from the streambed can cause the situation in the main drainage to change rapidly, trapping victims in a matter of minutes.

The OCFA, in assessing all of the factors, has determined that the following levels should be established in determining the risks related to swift water emergencies in each geographic area:

> Moderate - Areas with standing water such as lakes where victims do not tend to move long distances from the area of the original emergency
>
> High - Areas with moving water such as streams, flood control channels or the ocean where victim may move long distances in a short period of time

Exhibits

5A Risk Categories; Probability Consequences Chart
5B Population Per Square Mile-Density Map
5C Correlation between Population and Calls
5D Average Age by Census Block Group
5E Orange County Demographic Analysis 2000 to 2050
5F Call Generation by Land Use Type
5G Master Plan of Arterial Highways
5H Rail lines
5I Aircraft Accidents - Locations and Timing
5J Mid-rise/High-rise Building Locations
5K Hazard Map Landslide/Liquefaction Zones
5L FEMA Flood Map
5M Building Stock Age by Census Track
5N ISO Rating Map
5O Fire Flow in ISO Rated Occupancies Map
5P OCFA Hazardous Materials Permits October 2004
5Q Very High Fire Hazard Severity Zones
5R OCFA SOP 209.02, “Aircraft Incident Operations at John Wayne Airport

Section 6. Measurement of System Performance

Deployment is generally measured using three concepts: Distribution (what and where), Concentration (how much) and Reliability (how well). These concepts will be used in the creation of performance objectives, performance measures for response times, and the determination of the agency's ability to provide an effective response force for each risk category for each service provided.

Distribution

Distribution is defined as the systematic locating of geographically distributed first due resources (stations, apparatus and personnel) for all-risk initial intervention. Distribution locations, also known as "points of service delivery" are established to ensure the rapid deployment of resources to intervene in routine emergencies and bring them to a successful conclusion. For the most part, this is time and distance analysis.

The OCFA distribution system is set up to provide the appropriate emergency response to the variety of risks identified in the previous Section. The OCFA uses an "all-risk" concept in that each first due station is equipped and staffed to provide an effective base line response.

The effectiveness of a distribution system is normally measured by the percentage of the jurisdiction covered by the first due units within adopted public policy response times. Specific performance objectives have been established for each service provided. For examples; keeping the fire to the area of involvement upon arrival, or on EMS incidents, to provide care and support to the victim to reduce, reverse or eliminate the conditions that caused the emergency.

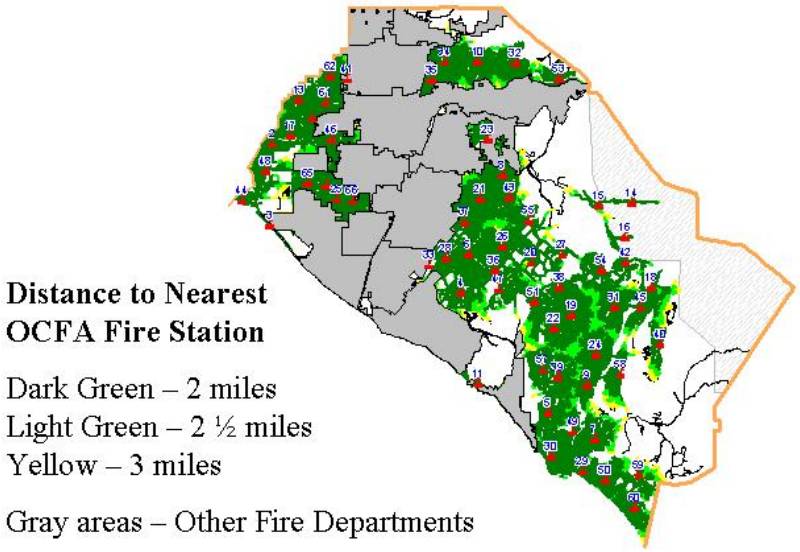
A distribution network is considered successful when it is capable of providing a resource to the scene of an emergency with the correct apparatus, equipment, and staffing to complete the following:

1. Assessment of the situation
2. Establishment of a plan of action capable of mitigating the emergency
3. Request for appropriate resources
4. Intervention to stop/impede the escalation of the emergency

The current distribution of resources for the OCFA can be traced to a number of events throughout its history. The location and spacing of stations has been dependent on funding, land availability and infrastructure. The impacts of such events as Proposition 13, the Orange County Bankruptcy, and extreme growth in short periods of time and the closure of two military bases in Orange County have had an impact of the place and number of resources in the current delivery system.

The distribution of stations tends to be farther apart or less dense in the central and south portion of the protection area and denser in the older areas. The current distribution is shown below.[45]

Basic Distribution – OCFA Protection Areas



Source: OCFA GIS Layer – ESRI Network Analyst

Distribution Performance Measurement

CadAnalyst is a DECCAN software product that analyzes real OCFA performance. OCFA has used this software since 1998. Data is updated quarterly. For purposes of this study, Year 2004 core emergencies are evaluated. Core emergencies are those incidents that have a direct impact on the placement of fire stations and the resources in the stations. Advanced Life Support (ALS) and rescue incidents and structure fires are classified as Core Emergencies.[46] Other types of fires are not modeled as they do not overly effect deployment, but are a sub-set of the total workload. In addition, response times may be skewed due to delays in reaching fires in off-road or backcountry areas. Incidents in these areas are not used for analysis.

Measuring the distribution system is normally accomplished using Travel Time or total Response Time of first due company resources. Travel Time is the interval of time from the point the emergency unit begins responding to its arrival at the scene of the emergency. Total Response Time begins when the request for emergency services is received at the dispatch center and extends to the arrival of the first emergency unit at the scene of the emergency.

[45] Exhibit 6A; Basic Distribution Map.
[46] Exhibit 6B; Core Emergencies.

Response Times

The rapid deployment of resources to emergencies is another distribution factor to consider. A review of Year 2004 data (57,957 core emergencies incidents) reveals that collectively, first due companies arrive on the scene within:

6:00 minutes total response time 55% of the time
7:00 minutes total response time 75% of the time
7:22 minutes total response time 80% of the time
8:30 minutes total response time 90% of the time

Average total response time was 6:07 minutes

Travel Time Analysis

In 2004, 57% of the calls in OCFA protection areas were covered within a four minute or less travel time by the first unit to arrive. The average travel time to all core emergencies was 4:03 and 80% of all core emergencies have a unit arriving in 5:12 for travel time.[47]

Criteria	Average 2004	80th	90th
First Unit Travel	4:03	5:12	6:15
First Engine Travel	4:06	5:15	6:15
First Truck Travel	5:42	7:55	9:25
First Medic Travel	4:53	6:25	7:45

Another method of analysis for travel time in areas without historical data or to validate historical data is by mileage or distance. The Insurance Services Office (ISO) uses a calculation that assumes that fire apparatus travel at 35 mph on average. ISO calculates the travel time according to the formula:

$$T = 0.65 + 1.7D$$

Where T = the travel time in minutes

D = the distance in miles

It should be noted that ISO uses slower speeds for underpowered apparatus, terrain impacts or apparatus laying hose lines. OCFA has determined through detailed analysis that 30 mph is a more accurate average speed for its service area.[48] The 6-D chart depicts travel time based on distance and speed. To arrive at the times shown, incidents were plotted, or geocoded, to the location of the call, and then ArcGIS Network Analyst and

[47] Exhibit 6C; Performance Measurements from CADAnalyst
[48] Exhibit 6D; Engine Travel Time Validation – Distance Interval.

MapInfo mapping software were used to calculate the distance to each call. Based on the distance to the call, and the travel time, the average MPH was calculated. (Outliers were removed – less than 10 mph and greater than 55 mph). Plotting the speeds based on distance from the fire stations shows OCFA performance, averages and comparisons to the ISO calculations.

Based on 30 mph and travel times of 4 minutes (2 miles), 5 minutes (2 ½ miles) and 6 minutes (3 miles), OCFA has mapped the overall distribution coverage of stations within the protection area.[49]

Response time can be measured from the time in route to the scene or from the time the call is received to the scene. Using travel time, statistics show that OCFA placed the first unit on scene within 4 minutes only 57% of the time. The first unit response time at the 80th percentile was 6:15 minutes.[50]

The distribution of stations in the older communities in the north end of the county has a higher distribution density.[51] Crystal Cove State Park, the large red area off the coast below Newport Beach, is measured as a single area instead of by grid.

The Basic Distribution Map, Exhibit 6A, shows the road miles covered from stations at 2 miles, 2 ½ miles, and 3 miles. The gray/black streets show areas that are further than 3 miles from a station. Exhibit 6F shows the areas further than 3 miles from a station as red polygons. These maps do not consider automatic or mutual aid units in the calculation. Table 6F details the number of calls OCFA responded to in these areas in 2002 through 2004.[52]

System-wide Total Response Time performance is very similar to First Unit Travel Time performance. The correlation can be seen by comparing the Total Response Time grid map with the First Unit Response Time grid map.[53]

Balance of Distribution

The measures of area served, miles of streets in an area, and calls per week are standard deployment measures. Exhibit 6H, First Due by Population, shows the population served in each first due area. Exhibit 6I, First Due by Street Miles, shows the miles of streets in each first due area. These maps show each fire station's overall share of the protection area and protection risk.

Exhibit 6J, Area Served/Miles of Streets/Calls per Week by First Due, overlays several different factors for comparison purposes. Note that the high points for calls per week occur in Station 22 and Station 48 first due areas and are attributed to the age of population.

[49] Exhibit 6A; Basic Distribution Map.
[50] Exhibit 6C; Performance Measures 2004, Criteria C.
[51] Exhibit 6E; First Unit Travel Time Map.
[52] Table 6F is included with Exhibit 6F.
[53] Exhibit 6G; Total Response Time Grid Map.

Distribution implies that there are certain risks that will require resources beyond that available on initial attack. The next phase of a standards of cover study includes an analysis of whether sufficient resources are available within acceptable time frames to amass staffing, equipment and apparatus to deal with identified risk levels.

Concentration

Concentration is defined as the number and spacing of resources needed to achieve an "effective response force" that can be assembled at the scene of an emergency within a defined time frame for each given risk and level of service. An effective response force is the accumulation of resources necessary to stop the escalation of the emergency and bring it to conclusion. In other words, concentration is the ability to place enough resources on a specific call to keep the event from becoming a major emergency. Concentration considers risk versus cost. Both factors are variables, thus:

Increased Risk = Increased Concentration

Concentration can be measured in several ways. The most common approach is to measure the percentage of the community covered by an effective response force within adopted time frames. A first-alarm assignment is considered an effective response force for fire incidents.

As stated in the CFAI handbook *Creating And Evaluating Standards Of Response Coverage For Fire Departments* on developing SOC's, "Concentration pushes and pulls distribution, and there is no one perfect mathematical solution. Each agency, after risk assessment and critical task analysis, must be able to quantify and articulate why its resource allocation methodology meets the governing body's adopted policies for initial effective intervention on both a first-due and multiple-unit basis."

In arriving at a concentration level for any community, the challenge is to strike a balance on how much overlap there should be between station response areas. Some overlap is necessary to maintain response times and to provide backup for distribution when first-due units are committed.

A successful concentration network means that the system is capable of providing the correct equipment, apparatus and staffing to the scene of an emergency to complete the following:

1. Stop the emergency from continuing to escalate
2. Provide for the safety and security of citizens and emergency workers
3. Complete all critical tasks in a timely manner
4. Provide for incident management

Most of the areas now served started out with limited development and very little risk. As time passed and development continued, both the population base and risk increased. The

location and spacing of resources has been dependent on funding, land availability and infrastructure.

Measuring the current concentration is accomplished using calls for service and the system performance of the company resources.

Calls for Service

Call volume affects the amount of time a company is available to respond to emergencies within its respective first due area. Under optimal conditions when stations are properly located, the call volume distribution should be evenly divided. The impacts of call queuing and commit times are discussed later in this section under the Reliability heading. This discussion on concentration focuses on basic workload issues. Incident locations are spread relatively even throughout the developed area of the OCFA jurisdiction.[54]

Some populations use emergency services more than others. By looking at the relationship of population to calls for service in those areas, it is possible to see which areas are generating call loading that is above or below the average. Exhibit 6L, Calls per Week vs. Population per 1000, illustrates that the two stations with the highest concentrations of senior citizens have calls to population ratios over three times that of most other stations. This is consistent with the data derived from the Land Use analysis discussed in Section 5, Risk Assessment.

Performance Indicators

Specialty Units

The Orange County Fire Authority has 30 paramedic units, 26 paramedic assessment units and 13 truck companies in the 61 stations. The concentration of truck companies is less dense in the central and south portion of the protection area than in the older northern areas. The concentration of medic units is generally balanced, although there are deficiencies in some areas.[55]

System Performance

The following table illustrates the OCFA's ability to get additional units on scene of structure fires in 2004. An "Initial Attack Force" of two engines and one truck arrived on scene within 10:00 minutes 63% of the time. All units in a full "Effective Response Force" arrived on scene within 12:00 minutes 76% of the time. Note that the 80th percentile for an Effective Response Force is only 15 seconds longer.[56]

[54] Exhibit 6K; Incident Locations 2000-2004.
[55] Exhibit 6M; Truck Coverage, and Exhibit 6N; Medic Coverage.
[56] Source Data includes OCFA Incident Data Base as analyzed in Exhibit 6C; CADAnalyst Performance Measures.

Criteria	Average 2004	80th	90th
Second Engine	8:41	9:55	11:15
Initial Attack Force (2E/1T)	9:43	11:45	13:30
Third Engine	9:59	11:25	12:50
Effective Response Force (3E/1T/1M)	10:29	12:15	13:40

Unit Workload

The most important workload indicator is the number of responses per unit. Five engines account for almost 20% of all calls for service. The top ten busiest engines account for approximately 35% of the total call load.[57] The amount of time units are unavailable is a key factor in analyzing Concentration and Reliability.

One final workload issue is the number of calls that a unit services within its own first due area versus the number it responds to outside of its first due area. There are three reasons for responses outside of the first due area; 1) Concurrent calls in adjoining areas, 2) Calls requiring multiple units, and 3) Specialty unit capabilities that take the unit out of its primary first due to provide services to the larger area. It should be noted that fire, rescue and paramedic calls routinely require adjacent units. This will be discussed further in this section under Reliability.

Commit Times/ Unit Utilization

Commit times are a factor of reliability. Commit time is the time when the unit is actually on an emergency incident. It starts when the unit is dispatched and ends when the unit is available to respond to another incident. Commit times are important because they can be used in modeling availability. The average commit time for OCFA units is about 30 minutes.[58]

Unit utilization is an important factor when evaluating concentration capability. The amount of time the unit is committed on emergencies is the unit utilization measurement. In a single resource fire station, if the unit is busy more than 20% of the time it may not be able to perform at the 80% level without additional resources being made available or other resources moving up to provide secondary service. In stations with two or more resources, the unit utilization of the first unit can easily go up to 50% without response issues (not counting fatigue or re-supply issues) as long as the secondary unit(s) does not exceed the 20% unit utilization.

[57] Exhibit 6O; 2004 Incidents by Unit.
[58] Exhibit 6P; Commit Times by Unit.

The following formula is used to calculate the unit utilization measure:

$$\frac{\text{Commit time } x \text{ calls per day}}{\text{Time in service}} = \% \text{ of day unavailable or unit utilization}$$

If a unit has an average commit time of 30 minutes, the unit will be able to run about 3,500 calls per year before it consumes 20% of the 24-hour day. In a fire station with only one unit, 20% is the threshold where additional resources should be considered. It does not mean that a second unit is required, but that overall performance needs to be examined to see if the "move and cover" procedures and adjacent resources are capable of dealing with the additional call load in an adequate manner.

Units are out of service for incidents, meetings, mandatory training and repairs. Engine 2 for example, is committed an average of 25 minutes per call and is out of service for reasons other than incidents (training, mechanical, medical) an average of 45 minutes a day.[59]

Effective Response Force

Small fires do not have much impact on the resource allocation of most fire departments. Major fires have a significant impact on all fire departments. The dilemma is how to staff for routine emergencies while being prepared for a significant impact fire. Balancing distribution vs. concentration of resource and staffing is an issue all fire agencies deal with constantly.

The following table is a representative matrix depicting an agency's baseline fire flow goals by number of companies:

Fire Risk Type	**Criteria**	**Engines**	**Trucks**	**Medics**	**BC**
High	5,000 + gpm	6	2	1	*2*
Moderate	1,500 to 2,500 gpm	3	1	1	1
Low	Less than 1,500 gpm	1 or 2	0	0	0

Deployment of resources is based on typical risk and historical calls from within the service areas. Agencies must analyze everything from single-family dwellings to occupancies that demand heavy fire flows and multiple-company response. Mutual aid units can be used in the calculation of the total response need, but an agency must have a baseline level of service it can provide in the event mutual aid units are committed with their own primary agency.

Based on 2004 performance, OCFA achieved the following concentration performance levels for each fire risk level:

[59] Exhibit 6Q; Out of Service Time, Engine 2.

Fire	Risk	Resources	Time	Performance
	High	6 engines, 2 trucks, 1 medic, 2 BC's 29 personnel	0:15:00	80%
	Moderate	3 engines, 1 truck, 1 BC, 1 medic 15 personnel	0:12:15	80%
	Low	2 engines 6 personnel	0:10:00	81%

Overall system concentration is good, but numbers and locations of truck companies have regional impacts on effective response forces. OCFA may be deficient but additional actual analysis is necessary.

Response Reliability

Response reliability deals with the delivery system's ability to meet stated or desired performance objectives, response time goals, and performance measures. Historical performance and system reliability are the two key components of this measurement. A key indicator in the analysis of performance is the ability of first due companies to service their own first due area.

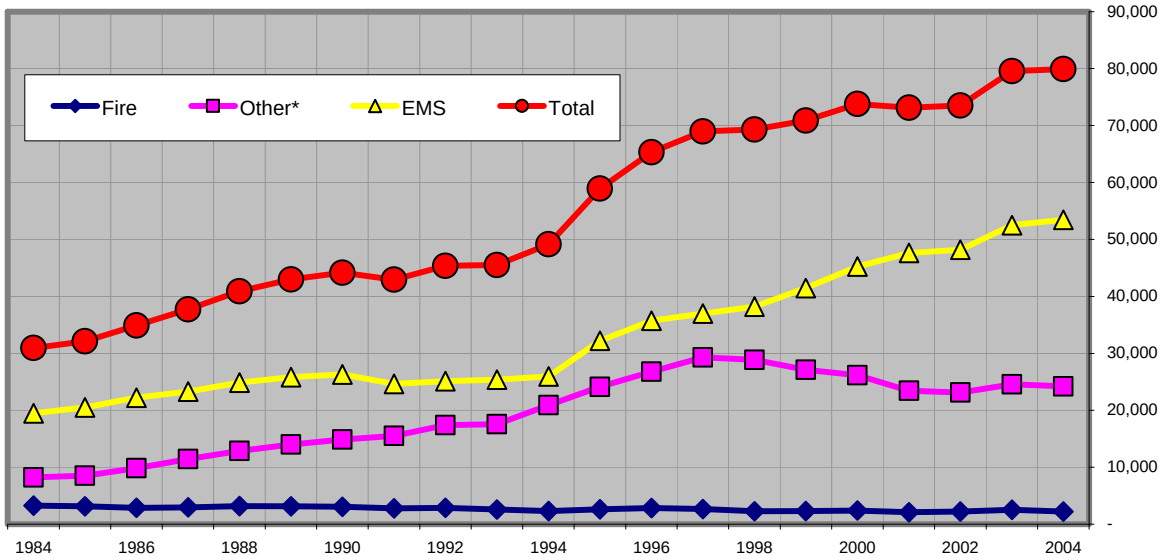
Historical Response Effectiveness

The first step in reviewing response effectiveness is to determine the level of performance in the existing delivery system. If the current deployment is supposed to answer calls within x minutes, y percent of the time, does it? If not, why? There can be several reasons for performance that is below expectations. Call stacking or queuing is one of the most common. Other problems may include traffic, street design, dispatch times, turnout times, etc. All these issues affect performance and need to be measured and analyzed. If, for example, the service areas have trouble with rush-hour traffic, complicated by raised center medians and/or blind intersections, traffic signal pre-emption could be a solution.

While unit workload was discussed earlier, it is also necessary to look at system workloads to get an understanding of the impacts on the service delivery. Call workload tends to be distributed evenly on a system wide basis with pockets of greater intensity.[60] The trend follows the population density for the most part, particularly considering the age risk factors discussed earlier in Section 5.

The following chart illustrates the 20-year historical call volume for the OCFA. Fire incidents are trending slightly down, but total incidents are steadily increasing. Calls by type of incident and the relationship of calls to the total workload are illustrated in Exhibits 6T and 6U.

[60] Exhibit 6R; 2004 Total Workloads.



When call volume is examined by the time of day, it shows call volume increases rapidly in the morning and remains high until the late evening with little variation.[61] There is some relief in call volume on weekends but not significant at the system level.[62] Finally, when viewed by month of year, little variance exists.[63] In conclusion, system demand is relatively constant with higher demand between 0700 to 1900 hours. The lowest system demand point occurs at 0500.

Performance Issues

Performance that Affects All Incidents

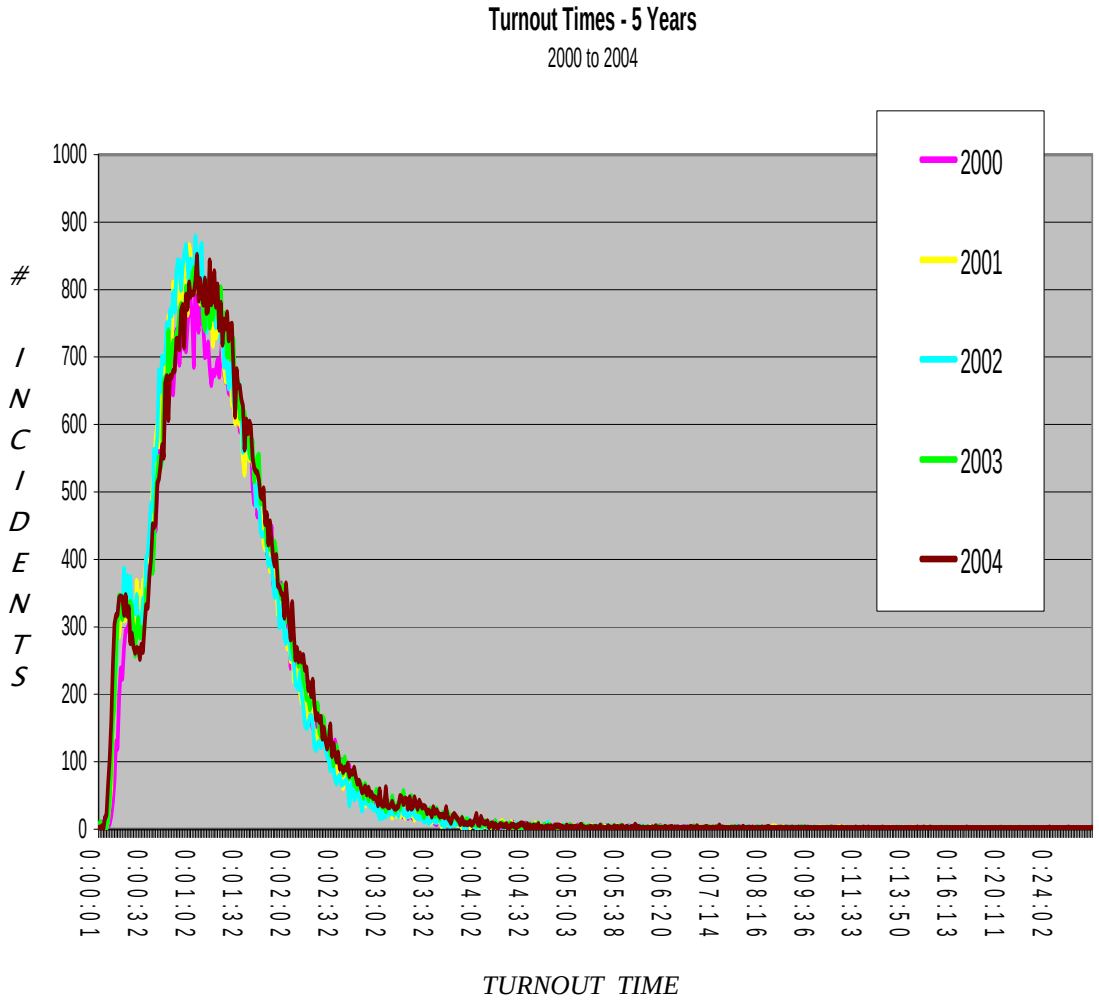
Two aspects that have an impact on overall performance regardless of type or location include dispatch time and turnout time. Dispatch time is the interval between receipt of the call and notification of responding units. Turnout time is the interval between unit notification and the actual response of the units.

Dispatch time performance is not an issue in the current system. Core Emergency calls (Medical Aids and Structure Fires) are dispatched within one minute 83% of the time and within 1:12 minutes 90% of the time.[64] This is significantly faster than many metro departments.

Turnout time analysis indicates that the OCFA met its turnout time performance goal of one minute only 35% of the time. The average turnout time is 1:22 and at the 80th percentile it is 1:48. The following graph shows turnout times over the past five years.

[61] Exhibit 6V; Time of Day Analysis.
[62] Exhibit 6W; Calls by Hour/Day of Week.
[63] Exhibit 6X; Fire Calls by Month.
[64] Exhibit 6C; OCFA Incident Data Base – CADAnalyst Performance Measures.

Turnout time performance has not changed significantly over the past five years. From a practical point, 30 seconds of time equates to ¼ mile of distance.



The busiest units tend to have the lowest turnout times. Conversely, some of the least busy stations have the longer times.[65] Some of this may be station design but is more likely related to the individual performance at these stations.

Call Stacking /Queuing

Experience indicates that units are busiest when normal social activity is at its peak. Call-stacking problems are not confined to urban areas. Call-stacking must be reviewed on both a department-wide and a first-due unit basis.

The use of queuing theory to add overflow or part-time crews to help at peak times is a viable option to avoid simultaneous call periods.[66] The ambulance industry has used these

[65] Exhibit 6Z; Engine Turnout Times.

tools for years in operating system status management models. The analysis gets complicated, as the effect of multiple simultaneous incidents ripples across service areas at peak hours of the day.

While at times difficult, analyzing call-stacking can produce important results. Individual travel times may appear acceptable on a distribution map but actual system performance may be unacceptable due to simultaneous calls for services.

Response Performance

First Due Analysis

Each station has a first due area. Reliability of the deployment system can be evaluated by seeing if the resources devoted to the area are adequate to handle the volume and timing of calls within its area. The basic premise is that as the number of calls in an area increase or concentrate into specific time periods, the percent of time that the first due unit(s) is available for another call will decrease. If the distribution network is weak, response times will increase, as calls have to be covered by units from neighboring service areas.

The following table evaluates the OCFA's distribution network performance by first due companies or station area using a seven minute and twenty seconds response time target. Thirty percent of the first due/station areas are available at the 80th percentile, but 75% of the stations were able to attain the seven minute and twenty seconds response time target for their first due areas.

Measure of Performance	**Performance at 7 minutes 20 seconds**		**Availability**	
	% of Total Stations	**# of Stations**	**% of Total Stations**	**# of Stations**
80th Percentile	75%	43	30%	17
70th Percentile	14%	8	37%	21
Below 70th Percentile	11%	6	33%	19
Stations w/First Dues		57		57

It should be noted that units with less than 80% availability in the first due areas with only one unit in that station could result in substandard performance. Forty stations (70%) have less than 80% availability. All stations with performance under 80% have availability under 80%, and stations with performance under 70% have availability under 70%. It should also be noted that while 33% of the stations have availability under 70%, only 11% of stations have performance under 70% (6 stations). This is due to good

[66] Queuing theory is the mathematical study of waiting lines. There are several related processes, arriving at the back of the queue, waiting in the queue (essentially a storage process), and being served by the server at the front of the queue. It is applicable in transportation and communications.

system status management (move up and cover) by our dispatch center.[67] This analysis shows a direct relationship between availability and performance.

Each first due area can be examined as a subsystem of the total system. For example, in 2004 the performance for Station 21 with Engine 21 and Medic 21 was as follows:

Total calls for each unit in all areas served: Engine 21; 2613 calls
Medic 21; 3654 calls

Total calls dispatched in first due for all Station 21 units: 2509

Total calls in first due where a unit gets on scene: 2337

Percent of total calls that were in first due area for Engine 21: 67.9%

Primary units dispatched in first due area: Engine 21; 1774 calls
(70.7% of first due calls)
Medic 21; 1570 calls
(67.2% of first due calls)

Percent of time that any Station 21 unit arrived first: 82.4%; 1926 calls

First due unit (E21) in less than 6 minutes (100% available): 74.5%

Any unit (other than Station 21 unit) arrived in
less than 6 minutes (0% available): 37.8%

Any unit less than 6 minutes (first due performance): 70.7%

First Due Units Available: 83.5%

From the data collected and derived from each first due area, a calculation of the remaining capacity can be made. Some units are already below the performance threshold and should be addressed in the next phase of the deployment study.[68]

Mutual Aid/Automatic Aid

Historically, fire protection was provided from a single resource, a fire station or apparatus, located in the center of a newly formed population center. These population centers (towns) were located some distance from one another. With time, as communities grew closer together and built new stations to protect their individual areas, expensive duplication and/or overlap of resources developed. In some cases, competition for funding developed to the point of actually reducing cooperative efforts.

[67] Exhibit 6-AA; First Due Performance.
[68] Exhibit 6BB; Calculation of Remaining Capacity.

In the contemporary fire service, the concepts of automatic and mutual aid, in which boundaries are dropped through contractual agreements, have reduced much of the negative impact of competition. The scope of automatic and mutual aid between agencies is a local policy decision.

Automatic Aid vs. Mutual Aid

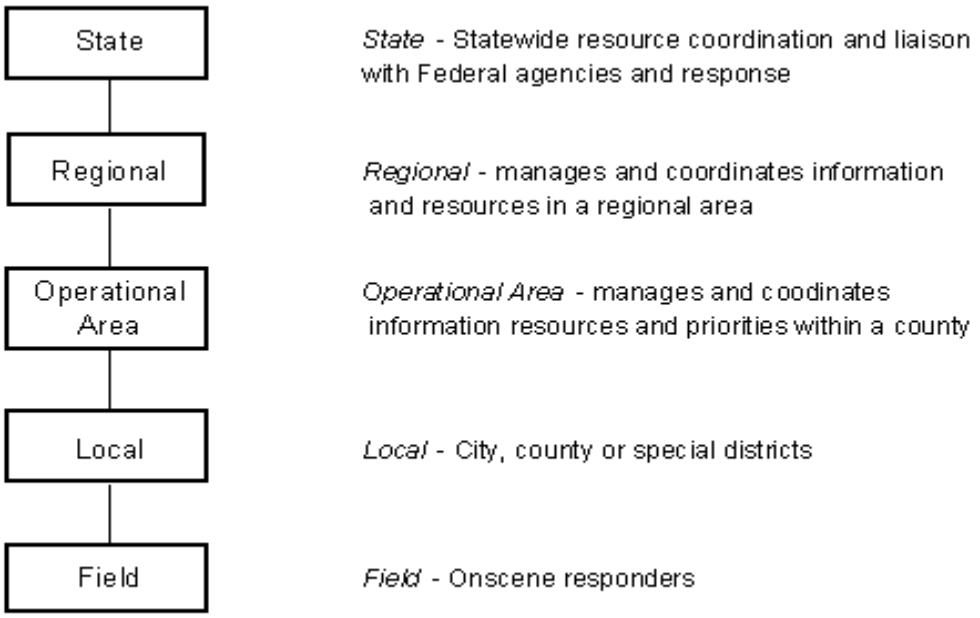
The terms "Automatic Aid" and "Mutual Aid", while sometimes used interchangeably, are actually different types of agreements. Automatic Aid, often called AutoAid, is established through legal agreements between agencies to send specified resources to areas within the other agency's services area. This practice of sending the closest resource regardless of jurisdiction is sometimes referred to as "boundary drops." The overriding concept in automatic aid is that both agencies agree in advance to send resources without additional discussion or approvals by the respective agencies.

Mutual Aid is based on the concept that if an agency uses all of its resources and needs assistance, adjacent agencies will come to their aid. Because the system is designed to be mutual, requests under mutual aid is for "like resources."

The State of California mutual aid system for fires is built primarily on engine company response. The system is standardized in the California Emergency Plan. Requests for assistance are made through pre-identified coordination and control points to insure assistance is provided in a manner that will get the resources to the emergency quickly without duplication or exhausting all the resources in any one geographic area.

Agencies are not generally reimbursed for sending Mutual Aid resources for the first twelve hours of an incident. Under other systems of assistance such as the "Five Party Agreement"(pre-negotiated costs with state and federal agencies), agencies are reimbursed based on agreed upon rates. Resources may also be obtained on an "Assistance for Hire" basis, for which the ordering agency pays all costs. The important point is that not all assistance is free.

California uses the Standardized Emergency Management System or SEMS. This system uses five organizational levels that are activated as needed. As each level exhausts its available resources, additional resources are activated from the next level.



Mutual/Auto Aid Received

The OCFA has established automatic aid, mutual aid and contract aid with all other fire agencies in Orange County, and with adjacent counties. The aid is typically for emergency incidents only, and is not for investigations, inspections, or other service related calls. Exhibit 6F shows the areas outside of the 3-minute service areas and if aid is considered and provided in the deployment process.

OCFA is linked to the Metro Net (Anaheim, Garden Grove, Orange, Fullerton, Huntington Beach, Fountain Valley, and Newport Beach) dispatch system CAD to CAD. This means there is no dispatch delay between agencies, and automatic aid results in a timely manner. Mutual aid requests outside the OCFA/Metro Net link are delayed while a phone call is placed and requests are entered manually by the other dispatch center. OCFA calculates a 3-minute delay for units that are not in Metro Net.

OCFA is not dependent on mutual or automatic aid, but is dependent on contract aid. Contract aid (paid service) occurs in areas that are “unincorporated island communities” within or adjacent to another jurisdictions response area. For example, the small island adjacent to Fountain Valley at Edinger Ave and Harbor Blvd is contracted to Fountain Valley Fire Department for emergency services. OCFA does not have units within timely response of this island. All OCFA contract areas have response times greater than six minutes.

While OCFA does not rely on mutual and automatic aid for initial response in most areas, there are areas that would have limited depth of coverage without the assistance of mutual and/or automatic aid resources. For example, OCFA Battalion 2 in northeast Orange County has only one truck company and is surrounded by other jurisdictions. For

multiple calls or second alarm incidents, OCFA depends on Anaheim or Fullerton for fill-in coverage. The same applies to medic coverage. OCFA can send a truck or medic unit from another battalion, but the length of response would exceed average response times.

OCFA performance measures are analyzed using all units that respond regardless of agency. OCFA does not measure first due performance for service areas outside of its own jurisdiction. For example, the islands that are contracted to Anaheim above Stanton are considered Station 46's first due area, but the performance measurements for that area is based on whichever unit(s) responds. It could be Anaheim Engine 4 or OCFA Engine/Truck 46.

Mutual/Auto *Aid Provided*

OCFA provides automatic and mutual aid for other Orange County fire protection jurisdictions. Since La Habra is not adjacent to the OCFA, mutual aid is infrequent.

OCFA also participates in mutual aid under the California Master Mutual Aid Agreement. OCFA provides automatic aid to Long Beach, Corona, Los Angeles County, Riverside County San Bernardino County, and the Camp Pendleton Fire Department in San Diego County. OCFA participates in an agreement with Cleveland National Forest (USFS) and contracts with California Department of Forestry and Fire Protection for wildland fire incidents. OCFA provides EMS services to San Diego County in the area south of San Clemente through a contractual arrangement.

OCFA is the local area coordinator for all Orange County state and federal mutual aid requests, as well as the alternate regional coordinator for the State Office of Emergency Services Region 1 (Los Angeles, Orange, Ventura, Santa Barbara and San Luis Obispo counties). OCFA is not dependent on out-of-county resources for service, but benefits from joint agreements by sharing resources and providing closest specialized services across jurisdictional lines.

Special Staffing

Reserve Units

The fire service has a long history with volunteerism. Today, across the nation in rural and less dense suburban areas, the majority of fire departments are volunteer organizations. The fire service in Orange County started as a joint volunteer-paid staff operation. With time, volunteers started to receive a stipend for their time in response to state and federal mandates and training. OCFA has now replaced the original volunteers established in the 1930's with a Reserve Program. The current Reserve Program fulfils the needs of OCFA by providing first responder coverage to four communities and support services throughout the service area. These services are discussed in Section 4.

Reliability is an issue with some reserve unit staffing. Most employers do not offer the time off for reserve members to respond to calls. Maintaining qualified and trained staff

for each reserve station is a challenge. Reserve units are not staffed full time. When reserve units are staffed, turnout times are well within target times and provide excellent response time performance. However, since reserve personnel rely on paging systems for notification and must first drive from home to the station, the response times are well outside target response time goals. Reserve engines serving as a first due units are included in the response criteria, but other reserve units are not counted due to lack of reliability. The reserve system is analyzed separately.

Seasonal Activity Units

Seasonal conditions such as wind, rain or extreme temperatures can cause demands for additional staffing. Alternate staffing may take many forms including increasing the number of personnel per unit, adding personnel to cross-staffed units,[69] or staffing extra units configured as strike teams. Relief unit staffing also occurs when regular first due units are dispatched out of the county through mutual aid or contract aid systems. Since staffing on these units is seasonal, hours of operation vary. OCFA does not include special staffing or additional temporary resources in its reliability analysis of deployment.

Differential Staffing Patterns

Staffing on OCFA trucks vary due to different contractual agreements with partner cities. Three contract cities have three person truck companies. New truck companies will be established at four-person truck companies by agreement with the firefighter union. Three person truck companies will be considered for conversion to four person truck companies throughout the system when practical.

Engine companies are staffed by three personnel unless it is a paramedic engine, in which case it is staffed with four personnel. The impact of staffing levels is discussed further in Section 7, Critical Task Analysis.

The use of differential staffing by time of day (peak staffing) is another practice that has benefited many agencies. For example, if there is a high need in a business district for medic service, the agency could staff the first due engine with an additional paramedic from 8:00 a.m. to 5:00 p.m. and then return to a three-person paramedic assessment engine for the rest of the shift.

In addition to upstaffing units to increase capability, “peak activity units” can be used to relieve limited reliability coverage (too many calls at the same time). For example, in the case of Station 22 where call loading is consistent throughout the day, a short-term call loading in an adjacent service area could take the Station 22 resources out of its area. Utilizing a peak activity unit could be one solution to address this type of potential negative response reliability factor.

Peak activity units are not currently used in OCFA.

[69] Cross-staffed: Where a station has 1 crew and 2 units. The crew takes the unit appropriate to the type of call such as Structure Engine or Brush Engine.

Move-up and Cover

The OCFA has a move-up and cover policy that addresses backfill issues during an emergency.[70] This policy allows for the dispatch center to routinely move units from a double covered or less impacted station to a first due area that has been left uncovered by activity. The Move-Up and Cover system provides more reliable coverage. Move-up and cover is reflected in the analysis of the first due area analysis discussed above.

Exhibits

6A Basic Distribution Map
6B Core Emergencies
6C Performance Measurements from CADAnalyst
6D Engine Travel Time Validation – Distance Interval
6E First Unit Travel Time
6F Areas Outside of 3 Minutes, Map & Table
6G First Unit Response Time
6H Population by First Due Area
6I Street Miles by First Due Area
6J Area Served/Miles of Streets/Calls per Week by First Due
6K Location of Calls Map
6L Calls per Week vs. Population per 1000
6M Location/Coverage of Truck Companies
6N Location/Coverage of Medic Units
6O Incidents by Unit (2004)
6P Commit Times by Unit (six years)
6Q Out of Service Time E2
6R Total Workloads
6S Call History 20 years
6T Calls by Type 2000-2004
6U Call Distribution
6V Time of Day Analysis
6W Calls by Hour/Day of Week
6X Fire Calls by Month
6Y Turnout Times – 5 Years
6Z Engine Turnout Times (Average) 2004
6AA First Due Performance
6BB Calculation of Remaining Capacity (All) Six Minute Total Response Time
6CC SOP Move-Up and Cover

[70] Exhibit 6CC; Standard Operating Procedure; Move-Up and Cover.

Section 7: Critical Task Analysis

Introduction to Critical Task Analysis Process

The fire department responds to a wide variety of emergency scenarios. The variables can be extensive requiring the fire department to be highly adaptive. This complex combination of variables is why the fire department has various evolutions (methods), tools and techniques to do its job. As noted in previous sections, the primary reason fire department apparatus is distributed and concentrated in a certain manner is to carry out the specific mitigation measures necessary to prevent an emergency incident from escalating.

Although the Fire Authority responds to a wide range of emergency and non-emergency incidents this section deals specifically with those scenarios that are truly emergencies and require immediate intervention to prevent loss of life and property.

A Critical Task Analysis is a requirement of any Standards of Cover document that is developed to meet the Commission on Fire Accreditation International's requirements in self-assessment. It is also a key performance indicator for future use in the accreditation process.

This process leads to two concepts in the context of a Standards of Cover:

1. The identification of an Effective Response Force
2. The analysis of critical tasking by the fire forces upon arrival at an emergency

Since no fire department can reduce fire and life safety risks to zero, a Standards of Cover study is designed to find a balance between distribution, concentration and reliability that will yield the maximum saving of life and property with available resources.

Identifying the Effective Response Force

An Effective Response Force is defined as *the minimum amount of staffing and equipment that must reach a specific risk location within the departments stated response time goal.*

Critical tasks are defined as *the activities and actions to be taken by the effective response force in dealing with the assigned emergency*. In creating a Standards of Cover, the capability of arriving companies and the required number of firefighters to achieve these tasks must be adequately assessed.

Critical tasking should be developed for each risk category, and in some cases, for special operations. A basic assumption in critical tasking is that firefighter safety will be emphasized and that the critical tasking incorporates compliance with local, state and federal rules and regulations.

Critical Task Analysis (CTA)

Critical tasks are those actions and activities that must be conducted in a timely manner by personnel on emergency incidents in order to control the escalation of the event. In the case of fire, it is aimed at attack prior to flashover. In the case of emergency medical situations it involves the treatment and stabilization of the patient.

The first fifteen minutes after a fire company arrives is the most crucial in controlling the event. Therefore a CTA evaluates this time period. When conducting validation exercises, the CTA commences when a vehicle stops at the scene and ends when all tasks are completed or in approximately fifteen minutes if all tasks are not finished.

In performing the Standards of Cover research for the OCFA the critical task process and evaluation of the effective response force was thoroughly researched and documented to determine the baseline of current department operations. Previous sections outlined how the baseline for service in the OCFA was developed. This section focuses entirely on the baseline of operations after the units arrived on scene.

There are seven steps to creating a critical task analysis document:

1. Identifying the scenarios to be evaluated
2. Identifying the number and types of tasks to be accomplished
3. Utilization of the current or proposed staffing configuration
4. Conducting time trials to validate performance
5. Analyzing that performance
6. Comparing critical tasking to fire ground performance
7. An ongoing evaluation

Scenarios

Three specific scenarios were developed for use in the critical task analysis process:

- a moderate or typical risk structural fire where an IDLH environment exists (requiring compliance with the two-in two-out rule);
- a witnessed cardiac arrest which assumes that the event is survivable by the patient; and
- a single vehicle traffic collision in which the patient cannot be removed or treated for injuries effectively without the use of extrication equipment (cut and rescue).

The rationale for selecting these three scenarios is based upon a combination of reviewing the actual workload reflected in the response data and an evaluation of a true life threatening circumstance in which response mitigation will likely make a difference.

Basic critical task lists were developed for each scenario.[71]

[71] Exhibits 7A.1, 2, & 3; Critical tasks lists descriptions for each scenario.

Utilizing the department's current staffing and deployment plan, a matrix was developed of the various configurations that are currently required for response to these scenarios. Response data from the previous three years was used to establish on scene times for the various components. A chart was developed for the average response time and the 80th and the 90th percentile performance levels.[72]

Evaluation Scenarios

Structural Fire

The single occupancy structure fire task analysis evaluates the OCFA Multi Company Drill Evolution 1 (MCD). Definitions and evaluation time measurements conformed to the standard evolution rules and regulations. The "prop" was the single story strip mall areas of the OCFA/RFOTC drill grounds. Smoke was generated, but no heat or fire was used due to the reset time limitations of the prop, and the rehab time for crews. A flare was placed 70' inside the structure to simulate a fire.

Cardiac Arrest

The cardiac arrest task analysis evaluates the OCFA's advanced life support. Protocols and time measurements were in conformance with EMSA guidelines, the prop that was utilized incorporated the ability to evaluate the effectiveness of airway, breathing and circulation strategies. Evaluators who were selected for this process were trained at the ALS level.

Traffic Collision Cut and Rescue

The OCFA traffic collision cut and rescue evaluates the standard operating procedures involving a single vehicle accident with trapped victims. The "prop" was a single vehicle in the upright position that required door removal, victim stabilization and placing the patient in position to initiate transport. All safety requirements were required to protect fire crews during the operation.

Time Trials

A series of time trials to validate the findings was conducted at the OCFA Training Center. A total of twenty-four separate fire crews participated. Participants were notified that they were not being evaluated as individuals but rather as teams. Crews were asked to treat the scenarios as realistically as possible and to not take any shortcuts or to perform unrealistic acts. Furthermore, all crews received the following instructions:

1. Crews were told over the radio of the time interval to be on-scene based upon department's actual response data.

[72] Exhibit 7B; Critical Task Analysis – Unit Time Intervals.

2. First-in units utilized the fast attack mode as per departmental procedures. The second-in unit took command.
3. The exposure on the structure fire was located at the rear of the building.
4. Utility shut off was simulated.
5. Crewmembers were instructed to wait for direction from their officers before performing their assignment.
6. Observers and timekeepers were not allowed to answer questions.

The fire crews that were selected came from all areas of the county. There was no attempt to alter the level of training or education and experience of the individuals of the fire companies to assure that the performance was relatively consistent with the day-to-day operations. The time trials were observed by OCFA training staff as well as by members of ESCi to assure that the time trial protocols were adhered to in all cases.

Upon completion of the time trials a matrix was developed that identified the time elements of critical tasking for all three scenarios. This information was compiled to document three components. The left hand axis of this chart laid out time intervals. The tasks accomplished on the "Y" axis and the different configurations were plotted on the chart to illustrate relationships.[73]

Outcomes

The desired outcome in each of the scenarios is to demonstrate, given the nature and inherent risks, that the effective response force can deal with the identified critical tasks within a specific time frame. Based on the Department's performance in the past using existing Standard Operating Procedures and apparatus configurations the time frame for evaluation is 12 minutes.

All time trials started with the arrival of the first due unit on-scene. Several important observations were made.

A. The results were obtained under the best of circumstances, during daylight hours with optimum arrival of units.
B. The total firefighter count varied for each scenario.
C. The completion time for the various tasks was a function of both the number of personnel available and the configuration of the equipment.
D. There was a difference in the time interval to accomplish actual entry to a building depending on the number of personnel on the first due company. The critical variable was compliance with the two-in two-out rule. Companies with fewer personnel had to wait for additional backup.

[73] Exhibits 7C, 7C.1, 2, 3, & 4; OCFA Field Validation Table & Charts.

Results of Time Trials

As discussed in previous sections, the criterion for distribution is based upon getting a unit to the scene within a specified time period. Concentration is based upon getting a sufficient number of multiple units on the scene to mitigate the emergency.

The purpose of this section is to provide objective information on the tasks that can be performed by arriving fire companies and how much time it takes to deal with certain emergency events. The CTA demonstrated that the capacity of the OCFA to perform is affected by a variety of variables including:

- Arrival time of first in units
- Arrival time of secondary units
- Apparatus configuration
- Standard operating procedures
- Command and control activity by supervising officers

Findings

The results of these evaluations indicate that the OCFA has the capacity to keep a fire to the room of origin, restore airway breathing and circulation to a witnessed cardiac arrest and can stabilize and remove a trapped victim within the first twelve minutes of a significant number of its emergencies. Due to the depth of preparation, analysis and variety of involved resources, this Critical Task Analysis is quite possibly the most comprehensive time trial validation ever completed for a contemporary fire agency.

This CTA also indicates that monitoring actual performance and maintaining the current level of service cannot be taken for granted. The results clearly indicate that delaying the arrival of a second due company or reducing staffing levels on first due companies can result in degradation of performance. Outward growth on the edge of developed areas, or additional high risk development in infill areas will continue to place pressure on the OCFA's ability to perform. Travel times may lengthen as a result of congestion and other factors resulting in reduced time in which a fire crew will have to actually mitigate the emergency.

Lengthening Travel Times

Lengthening travel time by sixty seconds reduces the time for effective mitigation by an estimated 25 percent. The rationale for this observation is that it takes a certain amount of time upon arrival to initiate operations. As one can observe on the time trial results matrix, moving each initial action to the right by sixty seconds increases the opportunity for the event to escalate potentially resulting in greater losses. Adding two minutes to the travel time could reduce effectiveness by up to 50 percent. These potential consequences have not actually been evaluated in field tests. This is the very reason that the SOC process requires constant monitoring and periodic analysis to assure that the deterioration of level of service does not occur.

Training and Education

Data from the time trials provides insight into the relationship between the department's training and education program and effectiveness on the fire ground. Moreover, there is a subtle but measurable difference in how well the department can execute basic tasks depending upon staffing levels and the actions and activities of company officers.

Differences in Staffing and Equipment Configurations

There was approximately a sixty-second difference between a three-person engine and a four-person engine in the time interval between arrival and point of entry on structure fires. There is also a significant difference in the performance of truck companies depending upon how the equipment is carried on the particular apparatus, and upon the assertion of command and control of truck officers. Both of these time trial components require further analysis.

The critical task analysis demonstrates that with the variation in staffing there are some differences in the ability to enter the building during a working structure fire. This may, however, be offset by variations in the sequence of events depending upon apparatus configuration and staffing patterns.

The various configurations used for dealing with traffic collisions (cut and rescue) and cardiac arrest (ALS) do not have a significant variance in performance.

Additional Risk Levels

This data also pointed out that the level of risk is a component of determining critical tasks. These exercises did not take into consideration the time elements of accessing multiple floors in high-rise occupancies. It is anticipated that subsequent studies will involve these components.

Summary

The purpose of this section was to validate through critical task analysis the research into an effective response force's ability to perform on the fire ground. A systematic approach was taken to evaluate three specific scenarios that occur frequently in Orange County. These are the type of incidents where intervention can make a difference. The three general categories of events selected include a structural fire, cardiac arrest, and traffic collision. Utilizing historical data from OCFA's Management Information System the level of service and current response time performance were used to create a series of time trials. The time trials were used to evaluate the performance of fire companies. The fire companies who performed this work were selected based on availability and were representative of performance that could be expected on a day-to-day basis in the field.

The evolutions were conducted multiple times and observed by multiple evaluators to verify the data. To further validate the conclusions of this study, a review was conducted

of the records of all working structure fires handled by the department from the previous year. It was determined, based on the performance of the fire companies, that the current deployment plan and recommended response time goal provides a level of service that is effective in stopping loss a very high percentage of time.

Exhibits

7A Matrix of Performance Factors
7A.1 Single Occupancy Structure Fire Task List
7A.2 Vehicle Extrication Task List
7A.3 Cardiac EMS Task List
7B Critical Task Analysis – Unit Time Intervals
7C Field Validation – Standards of Response Coverage
7C.1 OCFA Field Validation – Structure Fire
7C.2 OCFA Field Validation – Structure Fire (First Four Tasks 8 minutes)
7C.3 Field Validation Raw Data

Section 8. Comparability

OCFA Comparison to Like Agencies

Comparability of performance was conducted by surveying 28 agencies that have completed a Standards of Cover or goal-setting process. Not all agencies that have a standard are necessarily comparable since they measure response times differently than OCFA. Some measured response time starting with turnout time. OCFA measures response time starting with the dispatch time. Fourteen comparable departments within California and 14 comparable outside of California were found that have adopted standards. Of the 16 that measure response from dispatch time to on scene time, the same as OCFA does, the response standards ranged from 5 minutes to 9 minutes 20 seconds, with the average being 6 minutes 24 seconds.

The performance level or percentage of compliance differed as well. The performance levels were measured by one agency at 100% compliance, two agencies used the 95th percentile, 17 agencies used the 90th percentile, four used the 80th, one used the 75th percentile, one used averages, and two agencies did not state a level of compliance. Ten of the agencies measure total response time for an Effective Response Force (as defined by their agency). The average time was 12 minutes 12 seconds.[74]

OCFA Comparison to Commission on Fire Accreditation International Accredited Agencies

An additional 55 agencies that have completed the accreditation process and have adopted standards of coverage were also identified. There are differences in the definition of response time, and a variety of different standards based on dispatch zones, areas or type of call. Some agencies have multiple standards within a category such as 1st unit on scene within 6 minutes 90% of the time or within 8 minutes 99% of the time.

The following table combines both surveys and reports the average benchmark totals compared to OCFA.[75]

	Perform Level	Total Response Time	ERF Response time STR	# Stations	Pop	Sq Miles	Sq Mi per Station	Pop Per Station Area
Average	85%	0:06:29	0:11:11	9.7	195,907	89.3	10.0	15,325
Agencies Responding	75	57	16	46	45	45	45	45
OCFA-Proposed	80%	0:07:20	0:12:00	*58	1,308,000	551	9.50	22,552

*61 minus 3 (FS33, FS41 and FS52 who do not have a first due eng/truck)

[74] Exhibit 8A; SOC OCFA Comparables
[75] Exhibit 8B; Agencies with SOC's in Place

Requirements and Industry Practices

The CFAI requires agencies to conduct a Standards of Coverage process, but does not require the standards to be more restrictive than the agency's current performance level. An SOC document should list goals, objectives, and performance measurements. Staffing, size of each response area, and/or population served is required. Current and future needs are identified through risk analysis and an evaluation of community expectations.

The ability to meet stated goals and objectives is determined by measuring actual performance. Performance is generally measured as a percent of compliance with the stated standard. The department is expected to meet or exceed its stated performance level to remain accredited, or to adopt a strategic plan that will improve performance up to the stated target level. Only one of the agencies surveyed stated its adopted plan specified improvement performance goals. All the others used current performance levels for their stated goals.

Exhibits

8A SOC OCFA Comparables.
8B Agencies with SOC's in Place.

Section 9. Performance Measures

The following Performance Measures are recommended for adoption by the Orange County Fire Authority Board of Directors:

Distribution Performance Measure

For all incidents, the first due unit should arrive within 7 minutes and 20 seconds of total response time in the suburban/urban areas of Orange County Fire Authority jurisdiction and within 12 minutes of total response time for the rural areas, 80% of the time.

All responses into wilderness/undeveloped areas should be as soon as possible.

Concentration Performance Measures

Fires:

In low risk areas, an effective response force of two engines (6 personnel) should arrive within 10 minutes of total response time in the urban/suburban areas and within 15 minutes of total responses time in the rural areas, 80% of the time.

In moderate risk areas, an effective response force of three engines, one truck, one chief officer and a medic unit (15 personnel) should arrive within 12 minutes of total response time in the urban/suburban areas and within 20 minutes of total responses time in the rural areas, 80% of the time.

In high risk areas, an effective response force of six engines, two trucks, two chief officers and a medic unit (29 personnel) should arrive within 15 minutes of total response time in the urban/suburban areas and within 30 minutes of total responses time in the rural areas, 80% of the time.

EMS:

In low risk areas, an effective response force of one unit (2 personnel) should arrive within 7 minutes and 20 seconds of total response time in the urban/suburban areas and within 12 minutes of total responses time in the rural areas, 80% of the time.

In moderate risk areas, an effective response force of one engine or truck and a medic unit (4 personnel - 2 of which are paramedics) should arrive within 10 minutes of total response time in the urban/suburban areas and within 15 minutes of total response time in the rural areas, 80% of the time.

In high risk areas, an effective response force of two engines and two medic units (8 personnel - 4 of which are paramedics) should arrive within 12 minutes of total response time in the urban/suburban areas and within 20 minutes of total response time in the rural areas, 80% of the time.

Rescue:

In low risk areas, an effective response force of one engine or truck (3 personnel) should arrive within 7 minutes and 20 seconds of total response time in the urban/suburban areas and within 12 minutes of total response time in the rural areas, 80% of the time.

In moderate risk areas, an effective response force of one engine, one truck and a medic unit (8 personnel - 2 of which are paramedics - 3 of which are USAR qualified) should arrive within 12 minutes of total response time in the urban/suburban areas and within 15 minutes of total response time in the rural areas, 80% of the time.

In high risk areas, an effective response force of three engines, one truck, one USAR truck and one medic unit (15 personnel - 2 of which are paramedics) should arrive within 20 minutes of total response time in the urban/suburban areas and within 30 minutes of total response time in the rural areas, 80% of the time.

Special Hazards

Hazardous Materials:

In low risk areas, an effective response force of one engine or truck (3 personnel) should arrive within 10 minutes of total response time in the urban/suburban areas and within 15 minutes of total response time in the rural areas, 80% of the time.

In moderate risk areas, an effective response force of three engines, one truck, one HAZMAT team, one chief officer and a medic unit (20 personnel - 2 of which are paramedics and 5 are hazmat qualified) should arrive within 30 minutes of total response time in all areas, 80% of the time.

In high risk areas, an effective response force of six engines, two trucks, two hazmat teams, two chief officers and one medic unit (39 personnel - 2 of which are paramedics and 10 hazmat qualified) should arrive within 45 minutes of total response time in all areas, 80% of the time.

Wildland Fire:

In low risk areas, an effective response force of two engines and one chief officer (7 personnel) should arrive within 10 minutes of total response time in the developed interface areas and within 15 minutes of total response time in the rural interface areas, 80% of the time.

In moderate risk areas, an effective response force of six engines, one chief officer and one medic unit (20 personnel) should arrive within 15 minutes of total response time in the developed interface areas and within 20 minutes of total response time in the rural interface areas, 80% of the time.

In high risk areas, an effective response force of six engines, two chief officers and one medic unit (21 personnel) should arrive within 15 minutes of total response time in the developed interface areas and within 20 minutes of total response time in the rural interface areas, 80% of the time.

Swiftwater:

In moderate risk areas, an effective response force of two engines, one chief officer, one swiftwater unit, one patrol, and one helicopter (15 personnel) should arrive within 15 minutes of total response time in the developed interface areas and within 30 minutes of total response time in the rural interface areas, 80% of the time.

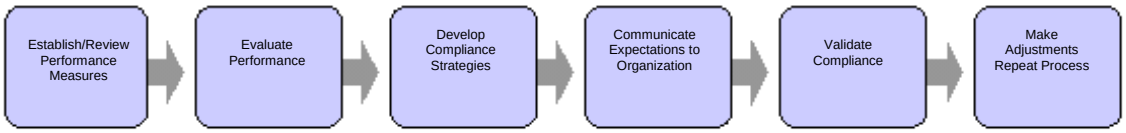
In high risk areas, an effective response force of four engines, two chief officers, one swiftwater unit, one patrol and one helicopter (22 personnel) should arrive within 15 minutes of total response time in the developed interface areas and within 30 minutes of total response time in the rural interface areas, 80% of the time.

Section 10. Compliance Methodology

Compliance Methodology/Maintenance of Effort requires that performance objectives and performance measures are evaluated and efforts are made to reach or maintain the established levels. Best put, "That which gets measured gets done."

Compliance Model

Compliance is best achieved through a systematic approach. The OCFA has identified the following six-step compliance model.



Phase 1. Establish/Review Performance Measures

Complete the initial SOC process. Conduct a full review of the performance measures every five years.

Process is risk based:

- Services Provide identified
- Levels of Service defined
- Levels of Risk categorized
- Performance Objective and Measures developed:
  - Distribution Measures
  - Concentration Measures

Phase 2. Evaluate Performance

Performance Measures are applied to actual service provided:

System level
Regional level
First Due Area level
Unit level

Phase 3. Develop Compliance Strategies

Determine Issues and Opportunities:

- Determine what needs to be done to close the gaps
- Determine if resources can be/should be reallocated
- Seek alternative methods to provide service at desired level
- Develop budget estimates as necessary
- Seek additional funding commitment as necessary

Phase 4. Communicate Expectations to Organization

Communicate Expectations:

- Explain method of measuring compliance to personnel who are expected to perform the services
- Provide feedback mechanisms
- Define consequences of noncompliance

Train Personnel:

- Provide appropriate levels of training/direction for all affected personnel
- Communicate consequences of noncompliance
- Modify (remediate) business processes, business application systems, and technical infrastructure as necessary to comply

Phase 5. Validate Compliance

Develop and deploy verification tools and/or techniques that can be used by sub-sections of the organization on an on going basis to verify that they are meeting the requirements:

- Monthly evaluation:
  - Performance by Unit
  - Overall Performance
  - Review of performance by Division/Section Management

- Quarterly evaluation:
  - Performance by Unit
  - Performance by First Due
  - Overall Performance
  - Review of performance by Executive Management

Determine whether independent validation and verification techniques will be used to measure the performance.

Solicit external assistance as necessary.

Phase 6 Make Adjustments/Repeat Process

Review changes to insure that service levels have been maintained or improved.

Develop and implement a review program to ensure ongoing compliance:

- Annual Review and Evaluation
  - Performance by Unit
  - Performance by First Due
  - Overall Performance
  - Review of performance by Governing Body
  - Adjustment of performance standards by Governing Body as necessary

- Five Year Update of Standards
  - Performance by Unit
  - Performance by First Due
  - Overall Performance
  - Adoption of performance measures by Governing Body

Establish management processes to deal with future changes in the OCFA service area.

Section 11. Overall Evaluation

Overall Evaluation

Overall System Performance when measured against the draft SOC performance measures shows compliance in all categories. All critical measures are within the 80th percentile and many are at or above the 90th percentile. Opportunities for system improvement do exist. They fall into two categories.

1. The implementation of policy, procedures and technology that will improve performance within the existing resource structure

2. The addition of new resources to the delivery system

Opportunities for improvement within the Existing Deployment System

The analysis indicates the potential for improvement in the following areas:

- First Unit Performance
- Truck Company Coverage
- Effective Response Force
- Hospital follow-up
- Paramedic Unit Coverage
- Initial Attack Force
- Call Volume and Call Queuing

First Unit Performance

First Unit Performance, when measured at 7:20, is at the 80th percentile system-wide. Several small pockets exist where service (response time) is greater than the 7:20 performance measure.[76]

- Coto De Caza (northern and southern portion) and Wagon Wheel
- El Toro Road at SR73 and the area adjacent to the Leisure World towers
- Irvine in new development areas (PA1, PA6 and PA40/Great Park)
- Irvine/Tustin border near Jamboree South of I-5
- Irvine Shady Canyon/Turtle Ridge
- Ladera (southern portion) and San Juan Capistrano (eastern portion)
- Mission Viejo (areas between FS36/39/24)
- Rancho Santa Margarita (northeast and southern portion down to Las Flores)
- San Clemente (Forester Ranch/Talega/Southern portion)
- System-wide areas at the tops of hillsides and long dead end streets

Paramedic Unit Coverage

Paramedic Unit Performance, when measured at 10:00, is at the 91st percentile system-wide. Several small pockets exist where service (response time) is greater than the 10:00 performance measure.[77]

[76] Exhibit 11-A; First Unit Performance

- Aliso Viejo (West and South of FS57)
- Coto De Caza (southern portion)
- Irvine in new development areas (PA1, PA6 and PA40/Great Park)
- Irvine Shady Canyon
- Ladera (southern portion)
- Lake Forest (Foothill Ranch/Portola Hills)
- San Clemente (Forester Ranch)
- Silverado Canyon
- Yorba Linda (eastern portion)

Truck Company Coverage

Truck Performance, when measured at 12:00, is at the 86th percentile system-wide. Several small pockets exist where service (response time) is greater than the 12:00 performance measure.[78]

- Aliso Viejo (West and South of FS57)/Laguna Niguel (South of FS57)
- Capistrano Beach
- Coto De Caza (southern portion) and Wagon Wheel
- Irvine in new development areas (PA6 and PA40/Great Park)
- Irvine Shady Canyon
- Ladera (southern portion) and San Juan Capistrano (eastern portion)
- Lake Forest (Foothill Ranch/Portola Hills)
- San Clemente (southern portion)
- Seal Beach
- Silverado Canyon
- Yorba Linda (eastern portion)

Initial Attack Force

Initial Attack Performance is the assemblage of four personnel with the appropriate equipment in order to enter the IDLH (Immediately Dangerous to Life or Health) environment to suppress a fire. An exception to this four person safety standard is permitted for the purposes of rescuing "at risk" victims. This performance is measured by the amount of time (2in/2out gap) between the arrival of the first unit and the assemblage of at least four personnel on scene. Through the field validation of fire ground operations, it has been determined that a three person crew needs 3 to 4 minutes of time to prepare for entry into a structure to initiate firefighting operations. This means that a "2in/2out gap" only exists where the arrival of the second unit is greater than three minutes. Three pockets exist where the "2in/2out gap" is four minutes or greater.[79]

- Coto De Caza
- Portola Hills and Canyon areas
- Yorba Linda (eastern portion)

---

[77] Exhibit 11-B; Paramedic Unit Coverage
[78] Exhibit 11-C; Truck Company Coverage
[79] Exhibit 11-D; Two In/Two Out Gap Analysis Note: Call volume in each of these areas is low.

Effective Response Force

Effective Response Force Performance, when measured at 12:00, is at the 90th percentile system-wide. Several small pockets exist where service (response time) is greater than the 12:00 performance measure. These areas include all the areas with Truck Performance issues listed above plus the additional three areas listed below.[80]

- Irvine PA1
- Rancho Santa Margarita (northeast and southern portion down to Las Flores)
- San Clemente (Forester Ranch/Talega/downtown)

Areas Affected by Call Volume and Call Queuing

In addition to distribution issues, four areas have concentration issues with respect to total call volume and the frequency of concurrent calls for service.[81]

- Most of the Saddleback Valley
- San Clemente (downtown)
- Tustin (FS21/37 areas)
- Irvine (IBC – trending up and projected to be an issue)

Areas Affected by Hospital follow-up

Several areas have commit time issues (extended time out of service) with respect to the location/distance of the hospital and the ability of the unit to return to service in its own first due in a timely manner.[82]

- Coto De Caza and Wagon Wheel
- Rancho Santa Margarita
- San Clemente (southern portion and Talega)
- Yorba Linda (eastern portion)
- Issues are projected to occur in:
  - Irvine PA1 and PA6
  - Rancho Mission Viejo Company Project "The Ranch"

New Service/Increased Performance *– Issues that have a direct impact on current service delivery and/or the safety of OCFA personnel*

Several opportunities exist to improve performance within the current delivery system including:

A-1. Implement programs designed to decrease the time needed to get resources on the road following notification of an emergency. An improvement in "Turnout Time" could be accomplished with several integrated processes such as:

[80] Exhibit 11-E; Effective Response Force
[81] Exhibit 11-F; Call Volume/Call Queuing
[82] Exhibit 11-G; Hospital Locations

a. Installation of timers in fire stations to keep personnel apprised of the time it takes to get out of the fire station.
b. Tracking/Publishing performance for each unit as they compare to benchmark performance measures and peer performance.
c. Use of new procedures such as a "pre-announcement" which allows personnel to begin moving to apparatus even before they know all of the call details.
d. Education of operations personnel regarding the importance of turnout time.

A-2. Implement programs designed to decrease the time needed for resources to travel to the scene of an emergency. An improvement in "Travel Time" could be accomplished with several integrated processes such as:

a. Increased use of Traffic Signal Preemption (EVP) wherever possible.
b. Working with member agencies on traffic circulation and access issues to improve the fire department's ability to get to the emergencies efficiently.
c. Sending the closest unit by use of Automatic Vehicle Locating (AVL) systems.
d. Aggressive use of "System Status Management" in the Communications Center to manage assets as efficiently as possible using computer programs to calculate performance projections based on current assets, historical workload and call type and location.

A-3. Implement programs designed to increase Unit Availability by using alternative methods of returning paramedics from the hospital when only one paramedic is needed. Medic Engine Companies should be able to return to service as a PAU until the paramedic returns from the hospital.

A-4. Redeploy M38 (Irvine East Industrial) to FS19 (Lake Forest) and the Medic Engine at FS19 to FS38 (swap configurations). FS19 has a high number of concurrent calls within its first due area. Adjacent units service many of these while the Medic Engine is on follow-up to the hospital. This action will allow E19 to remain available for concurrent calls during these time frame. This action to occur after the opening of FS27.

A-5. Increased use of "Tiered" dispatch to reduce the number of units assigned to each call to the minimum needed keeping units within their own first due areas more often resulting in increased availability.

A-6. Staff new FS27 (Irvine – Portola Springs) with an Engine and Medic Van until the opening of the permanent FS20 (Irvine – Great Park) when the medic van would redeploy to FS20. Leave FS27 as a PAU Engine.

A-7. Temporarily staff FS20 with a PAU Engine until the permanent station opens.

A-8. Redeploy the Medic Van from FS27 and add a Truck Company as risk dictates. This action eliminates the First Unit, First Medic, First Truck, IAF and ERF issues in this services area

A-9. Staff FS56 (Ortega Highway/Antonio Parkway) with a PAU Engine.

A-10. Prepare report on truck company deployment to include optimal locations, minimum staffing (4) and impacts to member agencies. The Critical Task Analysis revealed that four person truck companies increased company efficiency (allow the unit to split into two two-person teams to completed tasks) and increased the safety margin for the team members.

A-11. Provide "Peak Load" staffing units to system for limited hours per day on variable days. This action will increase system performance overall. It is possibly the best use of resources available in the system with respect to overall performance improvement. Initial "trial period" to be develop with labor group to address issues, expectations, outcomes and methods of evaluation of program impacts – i.e. Medic Vans for trial period.

Increased System Reliability *- Issues that will build capacity, refine the delivery of services, and increase system reliability.*

B-1. Develop a mechanism for timely assessment of resource needs in stations impacted by call volume or other changes in first due area. This action will allow for the continual monitoring and periodic analysis of the delivery system to insure performance measures are addressed.

B-2. Relocate M26 (Irvine – Valencia) to FS55 (Irvine – Northwood) when the permanent fire station is completed. This action will eliminate the First Medic issues in PA1 without reducing service to other areas currently served.

B-3. Develop procedures (SOP's) for maintaining adequate medical response coverage during major wildland incidents.

B-4. Relocate the HazMat team function to FS06 (Irvine – City Hall). This action will free up station personnel at FS04 to focus on UCI (increased student population and construction).

B-5. Relocate USAR truck from FS06 to FS20 when permanent station 20 is completed. This action also places the USAR assets at the Great Park (central locations) and at the intersection of three freeways.

B-6. Add a medic van to FS57 (Aliso Viejo). This eliminates First Medic and First Unit issues for this service area while reducing the workload on adjacent medic units (E22, E222 and E24 – all Medic Engines) to increase availability within their respective first due areas.

B-7. Add Paramedic Vans to FS24 (Mission Viejo) and FS45 (Rancho Santa Margarita). Medic Engine 24 is currently spending 1/3 of its time outside of its first due area. Placing the paramedics on a van will allow E24 to be available in its own first due area more often. It also allows for hospital follow-up without leaving the first due area uncovered

Future Planning Issues *- Issues that should be studied in future Strategic Planning Processes.*

C-1. Conduct non-emergency activities in low service demand periods.

C-2. Incorporate SOC concepts into recruit and career training activities to develop understanding and knowledge of the issues and opportunities involved.

C-3. Standardize the engine fleet (Type 2/3 engines).

C-4. Evaluate paramedic coverage after the impacts of proposed changes, implementation of Tier Medical Dispatch and Peak Activity Units are known.

C-5. Evaluate areas of opportunity identified in the study for improvement in first unit and effective response force performance measures.

C-6. Evaluate the impact of 2in/2out at identified stations FS15 (Silverado Canyon), FS40 (Coto de Caza) and FS53 (Yorba Linda – East).

Section 12. Goals and Objectives

Goals and Objectives

The analysis of the current delivery system indicates that additional improvement can be made on the standards. The current First Unit Performance of 7:20 at 80% may be able to be reduced to 6:58 at 80% by implementing the recommendations detailed above. The EMS Low and Rescue Low Effective Response Force may be lowered to 6:58 as well. The Rural First Unit Performance could be reduced to 11:30 at the 80th percentile.

Analysis shows that it may be possible to further improve the overall system performance by as much as five percent if the call loading and call generation projections are correct. While there is diminishing point of return where improvement is more costly than the benefit derived, it is believed that performance improvement can be made above the 80th percentile before this point is reached. This performance should be monitored routinely to insure that projected performance is matching actual performance in service delivery and the location, nature and frequency of calls. Modeling should be adjusted to the new data and assumptions each year to validate that these projections are continuing in the same manner.

The following goals and objectives are recommended in order to achieve these performance improvements:

Goal 1 *– Improve First Unit Performance*

Objective 1-A Reduce the First Unit Performance in Urban/Suburban to 6:58 while maintaining a system reliability of 80 percent or greater.

Objective 1-B Reduce the First Unit Performance in Rural to 11:30 while maintaining a system reliability of 80 percent or greater.

Goal 2 *– Improve Effective Response Force Performance*

Objective 2-A Reduce ERF Performance for EMS Low Risk Urban/Suburban to 6:58 while maintaining a system reliability of 80 percent or greater.

Objective 2-B Reduce ERF Performance for Rescue Low Risk Urban/Suburban to 6:58 while maintaining a system reliability of 80 percent or greater.

Objective 2-C Reduce ERF Performance for EMS Low Risk Rural to 11:30 while maintaining a system reliability of 80 percent or greater.

Objective 2-D Reduce ERF Performance for Rescue Low Risk Rural to 11:30 while maintaining a system reliability of 80 percent or greater.

Goal 3 *– Improve overall performance in all areas*

Objective 3-A Increase overall performance for first unit arrival by one percent over the next five years.

Objective 3-B Increase overall performance for Effective Response Force by one percent over the next five years.

Table of Exhibits

Table of Exhibits (continued)

OCFA Standards of Coverage Standards

Attachment B

		Minimum Required	Urban/Suburban		Rural		Undeveloped
Distribution							
All Risks		First Unit	0:07:20	80%	0:12:00	80%	As soon as is Possible
Concentration							
Fire	High	6 engines, 2 trucks, 1 medic, 2 BC's 29 personnel	0:15:00	80%	0:30:00	80%	Does not Apply
	Mod	3 engines, 1 truck, 1 BC, 1 medic 15 personnel	0:12:00	80%	0:20:00	80%	As soon as is Possible
	Low	2 engines 6 personnel	0:10:00	80%	0:15:00	80%	As soon as is Possible
EMS	High	2 engines, two medics 8 personnel (4 Paramedics)	0:12:00	80%	0:20:00	80%	As soon as is Possible
	Mod	1 medic eng/trk or medic van with 1 unit 4 personnel (2 Paramedic)	0:10:00	80%	0:15:00	80%	As soon as is Possible
	Low	1 unit 2 personnel (2 EMT)	0:07:20	80%	0:12:00	80%	As soon as is Possible
Rescue	High	3 eng, 1 trk, 1 USAR trk, 1 medic 15 personnel (3 USAR, 2 Paramedic)	0:20:00	80%	0:30:00	80%	As soon as is Possible
	Mod	1 engine, 1 truck, 1 medic 8 personnel (2 paramedic)	0:12:00	80%	0:15:00	80%	As soon as is Possible
	Low	1 engine or truck 3 personnel	0:07:20	80%	0:12:00	80%	As soon as is Possible

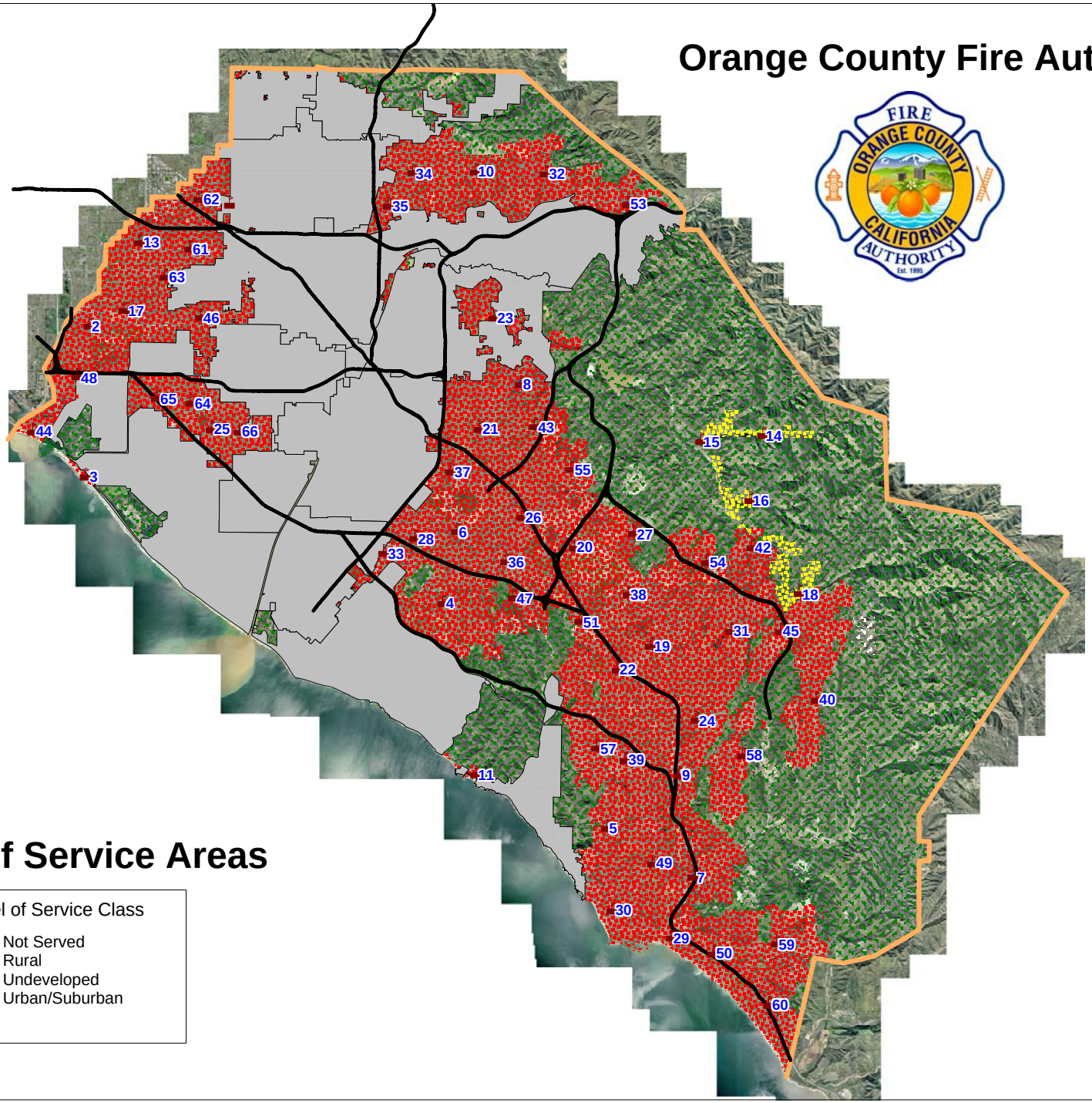
OCFA Standards of Coverage Standards

Attachment B

Concentration - Special Hazards

		Minimum Required	Urban/Suburban		Rural		Undeveloped
HazMat	High	6 eng, 2 trk, 2 HazMat, 1 medic, 2 BC 39 personnel (10 Hazmat, 2 paramedic)	0:45:00	80%	0:45:00	80%	As soon as is Possible
	Mod	3 eng, 1 trk, 1 HazMat, 1 medic, 1 BC 20 personnel (5 HazMat)	0:30:00	80%	0:30:00	80%	As soon as is Possible
	Low	1 engine or truck 3 personnel	0:10:00	80%	0:15:00	80%	As soon as is Possible
			Interface Areas:				
Wildland	High	6 eng, 2 BC, 1 medic 21 personnel*	0:15:00	80%	0:20:00	80%	As soon as is Possible
	Mod	6 eng, 1 BC, 1 medic 20 personnel*	0:15:00	80%	0:20:00	80%	As soon as is Possible
	Low	2 eng, 1 BC 7 personnel	0:10:00	80%	0:15:00	80%	As soon as is Possible
		* Additional resources dispatched are not measured: patrols,					
Swiftwater	High	4 eng, 2 chiefs,1 helo, 1 swift water, 1 patrol 22 personnel	0:15:00	80%	0:30:00	80%	As soon as is Possible
	Mod	2 eng, 1 chiefs,1 helo, 1 swift water, 1 patrol 15 personnel	0:15:00	80%	0:30:00	80%	As soon as is Possible

Orange County Fire Authority



Level of Service Areas

Level of Service Class

- Not Served
- Rural
- Undeveloped
- Urban/Suburban