CITYGATE ASSOCIATES, LLC

FOLSOM (SACRAMENTO), CA MANAGEMENT CONSULTANTS

STANDARDS OF COVER ASSESSMENT

LAKESIDE FIRE PROTECTION DISTRICT

VOLUME 2 OF 3 – TECHNICAL REPORT

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CITYGATE ASSOCIATES, LLC
FIRE & EMERGENCY SERVICES

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VOLUME 2—TECHNICAL REPORT

SECTION 1—STANDARDS OF COVERAGE INTRODUCTION AND LAKESIDE FPD OVERVIEW

1.1 OVERVIEW OF STUDY AND ORGANIZATION OF REPORT

Citygate Associates, LLC's detailed work product for the Standards of Response Cover (SOC) planning analysis (fire crew deployment study) for the Lakeside Fire Protection District (the District) is presented in this volume. Citygate's scope of work and corresponding Work Plan was developed consistent with Citygate's Project Team members' experience in fire administration. Citygate utilizes various National Fire Protection Association (NFPA) publications as best practice guidelines, along with the self-assessment criteria of the Commission on Fire Accreditation International (CFAI) and the Insurance Services Office (ISO).

1.1.1 SOC Study Questions

To deeply analyze the District's existing Standards of Response Coverage, Citygate reviewed computer data, performed our own independent response time analysis, and used geographic mapping to visualize predicted coverage from fire stations. As a result, this study addresses the following questions:

1. Is the type and quantity of apparatus adequate for the District's deployment to emergencies?
2. What are the recommended re-deployment strategies for both the District and a possible annexation of County Service Area (CSA) #115?

The baseline or "as is" deployment workload portion of the study consists of ***Sections 1-4*** and reviews the adequacy of the existing deployment system from the current fire station locations and the impacts, if any, from the District's mutual aid partners.

Given the annexation question, Citygate was also tasked with investigating a relocation of Station #1 to an area that could also serve CSA #115. This review is contained in ***Section 5***.

1.1.2 Standard of Response Cover Review Components

To address the scope of work for this deployment project, Citygate performed the following:

- Reviewed the existing District fire crew and fire station deployment plan as of FY 2013/14.

- Modeled the need and effects of the current fire station locations. Although this is not a study of fire departments adjacent to the District, Citygate considered the impacts of the District's existing automatic and mutual aid agreements on the District's needs.
- Proposed performance goals that are consistent with national guidelines from the NFPA, CFAI, and ISO.
- Used a geo-mapping software program for the updated mapping analysis of this project to analyze current fire station locations based on driving time.
- Used an incident response time analysis program called StatsFD™ (formerly NFIRS 5 Alive) to review the statistics of prior historical performance for the last 5 fiscal years.

1.1.3 SOC Study Processes

The core methodology used by Citygate in the scope of its deployment analysis work is the "Standards of Response Coverage" 5th Edition, which is a systems approach to fire department deployment, as published by the CFAI. This is a systems-based approach using local risk and demographics to determine the level of protection best fitting the District's needs.

The Standards of Response Coverage method evaluates deployment as part of the self-assessment process of a fire agency. This approach uses risk and community expectations on outcomes to assist elected officials in making informed decisions on fire and EMS deployment levels. Citygate has adopted this methodology as a comprehensive tool to evaluate fire station locations. Depending on the needs of the study, the depth of the components may vary.

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

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

The Standard of Response Cover process consists of the following eight elements. For ease of reference, we have highlighted these elements in grey boxes throughout the report to show their exact location.

Table 1— Standard of Response Cover Process Elements

Element	Meaning
1. Existing Deployment Policies	Reviewing the deployment goals the agency has in place today.
2. Community Outcome Expectations	Reviewing the expectations of the community for response to emergencies.
3. Community Risk Assessment	Reviewing the assets at risk in the community.
4. Critical Task Time Study	Reviewing the tasks that must be performed and the time required to achieve the tasks to deliver the stated outcome expectation for the Effective Response Force.
5. Distribution Study	Reviewing the spacing of first-due resources (typically engines) to control routine emergencies.
6. Concentration Study	Reviewing the spacing of fire stations so that building fires can receive sufficient resources in a timely manner (First Alarm assignment or the Effective Response Force).
7. Reliability and Historical Response Effectiveness Studies	Using prior response statistics to determine what percent of compliance the existing system delivers.
8. Overall Evaluation	Proposing Standard of Cover statements by risk type as necessary.

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

This deployment design paradigm is reiterated in the table below:

Table 2—Fire Department Deployment Simplified

	Meaning	Purpose
***Speed** of Attack*	Travel time of first-due, all-risk intervention units strategically located across a department	Controlling moderate emergencies without the incident escalating to second alarm or greater size
***Weight** of Attack*	Number of firefighters in a multiple-unit response for serious emergencies	Assembling enough firefighters within a reasonable time frame to safely control the emergency

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

1.2 LAKESIDE FPD OVERVIEW

1.2.1 Lakeside FPD General Description

An independent Board of Directors, elected by its constituents, governs the Fire District under California law. The Fire Chief oversees the general operations of the Fire Department under District Board policy direction.

In FY 2013/14, the Fire Department employed 57 personnel, in all program areas. The District maintains four (4) fire stations and a fleet maintenance center strategically located throughout the District and an administrative office as part of Fire Station #2. The Department staffs four fire engines, two paramedic ambulances, one Tele Squirt (smaller aerial ladder) ladder truck (crossed staffed by an engine crew, and specialty units for wildland fires, technical rescue and an Office of Emergency Services (OES) fire engine for mutual aid response.

The San Diego County Sheriff's Department is the District's Public Safety Answering Point (PSAP) for all 9-1-1 emergency calls. A request from a caller for the Fire Department is forwarded to a fire dispatcher at the Heartland Communications Facility Authority, a Joint Powers Authority (JPA) for dispatch of the Fire Department's resources.

The District's service area encompasses approximately 45.11 square miles. Within the boundaries of the District are expansive wildland areas, single-family homes and multi-family residential complexes, and small- to middle-sized commercial businesses. Historically, the

District as an unincorporated area of San Diego County is zoned as a bedroom community to the larger urban area.

The District sites astride a major east/west freeway (Interstate 8) and a regional north/south county highway (Highway 67), both of which create considerable traffic to the mountain communities north and east of the District. The District also contains mid- to high-density housing complexes, an aging housing stock, mobile home parks and a wildland fire interface threat throughout the entire north and east sides of the area. Precise population estimates for the District are not available given its unincorporated status. Based on several census categories in 2010, the District's population was estimated at about 51,000 residents.

As in other areas of San Diego County, the District has suffered severe losses from wildland fires, most notably during the early hours of the Cedar Fire in 2003, where before dawn the fire killed 12 people living in Wildcat Canyon and Muth Valley areas of the District who had little or no warning that the wildfire was approaching.

Table 3—Lakeside FPD at a Glance

District Element	Information
Governance	Board of Directors
Day-to-Day Oversight	Fire Chief
Personnel	57 (as of FY 13/14)
Stations	4
Apparatus	4 Fire Engines 2 Paramedic Ambulances 1 Tele Squirt Ladder Truck Specialty Units
9-1-1 Public Safety Answering Point (PSAP)	San Diego County Sheriff's Department
Fire Dispatcher	Heartland Communications Facility Authority
Population	57,000 (based on 2010 Census)
Service Area	45.11 square miles
Significant Building Types	Expansive wildland areas Single-family homes Multi-family residential complexes Small- to middle-sized commercial businesses Mobile home parks

1.2.2 Legal Basis for Agency

Lakeside is a Fire Protection District established under the laws of the State of California with a locally-elected Board of Directors.

1.2.3 Topography and Climate

Topography

The District lies northeast of the City of San Diego where the metropolitan area starts to become more suburban and rural. The District changes from a somewhat flat valley floor in the southwest to hills and mountains in the north and eastern areas.

Climate

As much of the rest of Southern California, the District features a Mediterranean climate with cool winters and hot, dry summers. The seasonal Santa Ana winds are felt strongly in the District's area as warm and dry air is channeled through the foothill passes at times during the autumn months. This phenomenon markedly increases the wildfire danger in the foothills, canyon, and mountain areas that contain a very combustible wildland fuel type similar to the rest of San Diego County.

Section 2—Outcome Goals – Risk Assessment and Existing Deployment Staffing Plan

2.1 Why Does the Department Exist and How Does it Deliver the Existing Fire Crew Deployment Services?

2.1.1 Existing Response Time Policies or Goals – Why Does the Agency Exist?

SOC Element 1 of 8*
Existing Deployment Policies
**Note: This is an overview of Element 1. The detail is provided on page 19.*

A review of the District's fire station and crew deployment system begins by understanding what fire department response time policies have been adopted, if any. Historically, the District has not used a strategic plan, master plan, or Standards of Response Cover process to adopt performance measures and response time policies tied to desired emergency incident outcomes.

In budget documents, the District has not identified any response time or outcome-driven policies for its fire services to meet. Due to the paramedic program, the Fire Department strives to meet the County of San Diego Emergency Medical Services Agency response time requirement of responding to 90 percent of the emergency medical incidents within 10:00 minutes.

The lack of response goals tied to specific outcomes by type of emergency contained in District documents and the annual budget is not congruent with best practices for emergency response time tracking. Nationally-recognized standards and best practices call for a time line with several important time measurements.

The District has not identified response goals for emergency medical incidents versus fires, technical rescue, and hazardous material responses; all are required to meet the Standards of Coverage model for the Commission on Fire Accreditation International (CFAI). In this SOC update, Citygate will recommend response time goals to include all risks including fire, EMS, hazardous materials, and technical rescue responses. The goals will be consistent with the CFAI systems approach to response.

2.1.2 Existing Outcome Expectations

SOC Element 2 of 8
Community Outcome Expectations

The Standards of Response Coverage Process begins by reviewing existing emergency services outcome expectations. This can be restated as follows: for what purpose does the response system exist? Has the governing body adopted any response performance measures? If so, the time measures used need to be understood and good data collected.

Current best practice nationally is to measure percent completion of a goal (e.g., 90% of responses) instead of an average measure. Mathematically this is called a "fractile" measure.[1] This is because the measure of average only identifies the central or middle point of response time performance for all calls for service in the data set. Using an average makes it impossible to know how many incidents had response times that were way over the average or just over. For example, if a department had an average response time of 5 minutes for 5,000 calls for service, it cannot be determined how many calls past the average point of 5 minutes were answered in the 6th minute or way out at 10 minutes. This is a significant issue if hundreds or thousands of calls are answered far beyond the average point. Fractile measures will identify the number of incidents per minute reached up to 100%.

Lakeside FPD has data from its computer aided dispatch (CAD) system and its Records Management System (RMS) to make these measurements possible. Upon completion of this study, the District should consider adopting the performance goals recommended for its emergency response systems.

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

Thus, from the time of 9-1-1 receiving the call, an effective deployment system is ***beginning*** to manage the problem within seven to eight minutes total response time. This is right at the point that brain death is becoming irreversible and the fire has grown to the point to leave the room of origin and become very serious. Thus, the District needs a first-due response goal that is within the range to give the situation hope for a positive outcome.

It is important to note the fire or medical emergency continues to deteriorate from the time of inception, not the time the fire engine actually starts to drive the response route. Ideally, the emergency is noticed immediately and the 9-1-1 system is activated promptly. This step of awareness—calling 9-1-1 and giving the dispatcher accurate information—takes, in the best of

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[1] A *fractile* is that point below which a stated fraction of the values lie. The fraction is often given in percent; the term percentile may then be used.

circumstances, one minute. Then crew notification and travel time take additional minutes. Once arrived, the crew must walk to the patient or emergency, size-up the situation, and deploy its skills and tools. Even in easy-to-access situations, this step can take two or more minutes. This time frame may be increased considerably due to long driveways, apartment buildings with limited access, multi-storied apartments or office complexes, or shopping center buildings such as those found in parts of the District.

Unfortunately, there are times that the emergency has become too severe even before the 9-1-1 notification and/or Fire Department response for the responding crew to reverse; however, when an appropriate response time policy is combined with a well-designed system, then only issues like bad weather, poor traffic conditions, or multiple emergencies will slow the response system down. Consequently, a properly designed system will give citizens the hope of a positive outcome for their tax dollar expenditure.

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

Finding #1: The District lacks published response time goals tied to specific outcomes by type of emergency. This is not congruent with best practices for emergency response time tracking. Updated deployment measures are needed that include specialty response measures for all-risk emergency responses that includes the beginning time measure from the point of fire dispatch receiving the 9-1-1 phone call, and a goal statement tied to risks and outcome expectations. The deployment measure should have a second measurement statement to define multiple-unit response coverage for serious emergencies. Making these deployment goal changes will meet the best practice recommendations of the Commission on Fire Accreditation International.

2.2 COMMUNITY RISK ASSESSMENT

SOC ELEMENT 3 OF 8

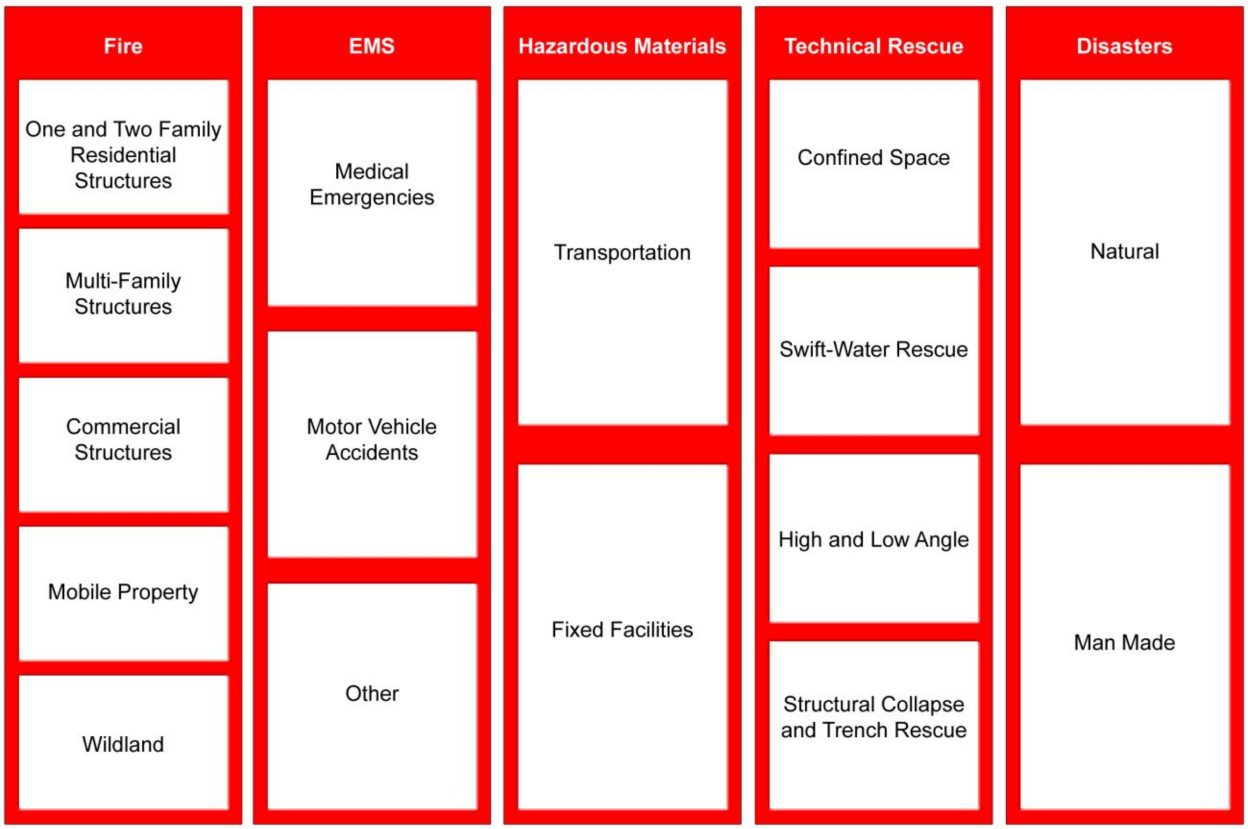
COMMUNITY RISK ASSESSMENT

Risk assessment is a major component of developing a Standards of Cover (SOC) document. A risk assessment identifies the type of incidents a fire department will respond to and what resources and staffing it will need to mitigate the situation.

To better understand risk it is necessary to define the types and levels of risk a community can encounter. For risk assessment in an SOC study, it is typical to consider low, moderate, high/special, and maximum risk occupancies. Risk also can be classified by probability and consequences. Probability is defined as the likelihood of a fire occurring in an occupancy type. Consequences are defined as the effects of the fire on the property and community. These classifications will be discussed later in this section.

The figure below identifies the risks that Citygate studied to develop this Standards of Cover report. Since the District is an "all-risk" response agency, each of the types of incidents was studied.

Figure 1—Risk Types Studied



The District has some demographic data available from the U.S. Census Bureau and San Diego County agencies to understand the risks to be protected and how to deploy emergency response or prevention resources to these risks to lessen or prevent the seriousness of an emergency. The data sets are:

1. Population and socioeconomic data from City planning and U.S. Census Bureau data sets.
2. Wildfire hazard severity zones, as initially identified by CAL FIRE and refined by San Diego County.
3. Building fire flow and type of construction data as collected by the Insurance Service Office (ISO).

4. The County's General Plan Safety Element.

5. The history of fire and special hazard incidents in the District.

2.2.1 Fire Assessment

Building Fire Risk

The response area for each fire station is identified as a station district. When a request for service is received through the 9-1-1 system, the Heartland Communications Facility Authority verifies the call location and uses the computer-aided dispatch (CAD) system to identify the required resources to send. The CAD system takes into consideration the type of occupancy and associated risk. Once the call type has been identified, the correct type of predetermined response is dispatched. This utility allows the dispatcher to dispatch a predetermined fire alarm assignment quickly to the emergency.

The District staff has identified risk hazards for each type of occupancy within the District. Fire service deployment risks are divided into the following four classifications defined below:

- Maximum-Risk Occupancies
- High/Special-Risk Occupancies
- Moderate-Risk Occupancies
- Low-Risk Occupancies.

Maximum-Risk Occupancies: These types of occupancies are usually found in the nation's largest cities and require significant responses, personnel, and resources. The maximum risks in the District are the wildfire zone with a history of devastating fires, and the freeway and highway that transport hazardous materials via cargo trucks.

High/Special-Risk Occupancies: Schools, apartments, small nursing homes, low-rise buildings, commercial structures, dwellings in water-deficient areas, and other high life hazard or large fire potential occupancies. The District contains all of these types of risks.

Moderate-Risk Occupancies: One-, two-, or three-family dwellings and small commercial and industrial occupancies. Most of the occupancies within the District, typical of most suburban San Diego County communities with low-rise housing, fall into the moderate-risk category including the single-family residences.

Low-Risk Occupancies: Small non-commercial structures that are remote from other buildings, such as detached residential garages and out buildings. Many parts of the District contain these occupancies with more rural housing size parcels.

Risk Probability and Consequences

The table below illustrates the probability and consequences for each of the four fire risk types. As indicated earlier, probability is defined as the likelihood of fire occurring in an occupancy type; consequences are defined as the effects that the fire will have on the property and community. Both probability and consequences are reviewed by the fire department to assure proper distribution (location) of fire stations and concentration (the number of units needed to suppress the fire and limit the consequences).

Table 4—Probability and Consequence Matrix

	Low Consequence	High Consequence
High Probability	**Moderate Risk** (High Probability) (Low Consequence)	**Maximum Risk** (High Probability) (High Consequence)
Low Probability	**Low Isolated Risk** (Low Probability) (Low Consequence)	**High/Special Risk** (Low Probability) (High Consequence)

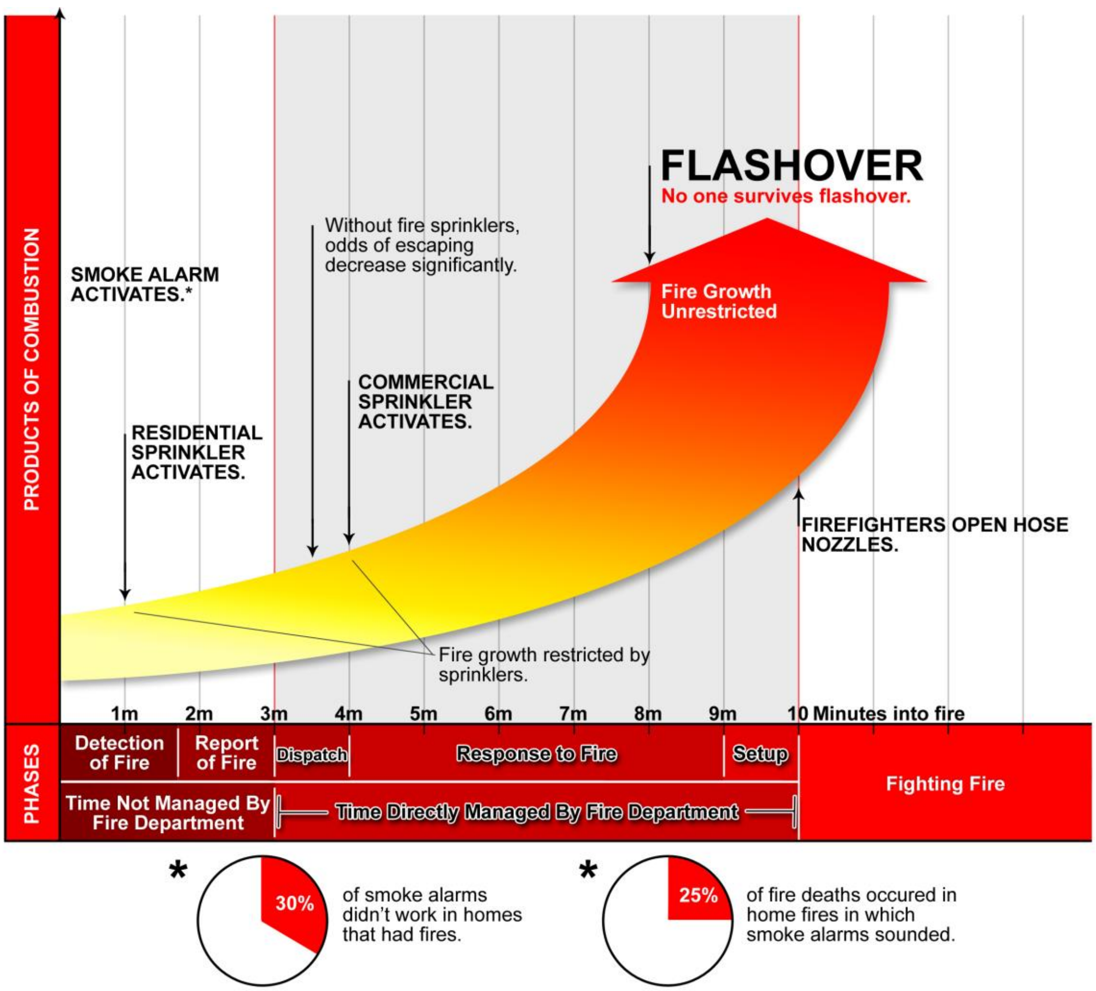
For building fire risk, to determine the appropriate response mix of fire units and staffing, the Department uses an extensive data file from the ISO of local properties the ISO reviewed on-site for underwriting purposes. In total, there were 2,600 buildings listed in the file. One of the measures the ISO collects is called "fire flow," which is the amount of water that would need to be applied if the building were seriously involved in fire. The measure of fire flow is expressed in gallons per minute (gpm). The ISO data set for the Lakeside, California area contains information on 425 commercial buildings. Of these, 229 buildings have required fire flows of 1,000 gpm or higher. There are a total of 16 buildings with fire flows in excess of 3,000 gpm, and three buildings greater than 5,000 gpm.

Fire flows above 1,000 is a significant amount of firefighting water to deploy, and a major fire at any one of these buildings would require the entire on-duty District firefighting force *plus* mutual aid units. Using the generally accepted figure of 50 gallons per minute per firefighter on large building fires, a fire in a building requiring 1,000 gallons per minute would require 20 firefighters. Minimum daily staff for the District is 16 personnel plus one Battalion Chief. Fortunately for the District, all of the larger fire flow buildings are big box retail and thus are fully covered with automatic fire sprinklers.

The District has an automatic aid or "borderless" closest unit response plan with all of the nearby fire departments, where the closet unit is dispatched regardless of jurisdiction. This is very efficient as all of the area's fire departments are dispatched by a single communications center, the Heartland Communications Facility Authority.

Deployment resources and response time are two critical components necessary for a good outcome. As indicated in the chart below, a total response time of 7 minutes from answering the 9-1-1 call is typically needed to stop the fire before flashover. Flashover is the point at which the entire room erupts into fire after all objects in that room have reached their ignition temperature. If a person is in a room at flashover, survivability becomes all but impossible.

<u>Figure 2—Products of Combustion per Minute</u>



Source: http://www.firesprinklerassoc.org

Wildland Fire Risk

The Lakeside region has a severe wildland urban interface; foothill to mountain alignment and proximity of development. Wildland fires due to the steep terrain and highly flammable chaparral vegetation of the foothills easily occur in high wind periods that correspond with seasonal dry periods. The direction of the hilly terrain range exacerbates the Santa Ana winds, increasing their severity. The convergence of topography, vegetation fuel, wind and dry Mediterranean climate conditions create a high probability that large uncontrollable fires on a recurring basis are inevitable. Major fires have burned inside and near the District on numerous occasions causing extensive damage, as noted previously in this report.

The number of structures and encroachment of new development in the hillside areas increase the danger from wildland fires in foothill locations. Specific concerns partially addressed by San Diego County's state-of-the-art wildfire construction ordinances include the density of development, spacing of structures, brush clearance, building materials, access to buildings by fire equipment, adequacy of evacuation routes, property maintenance, and water availability.

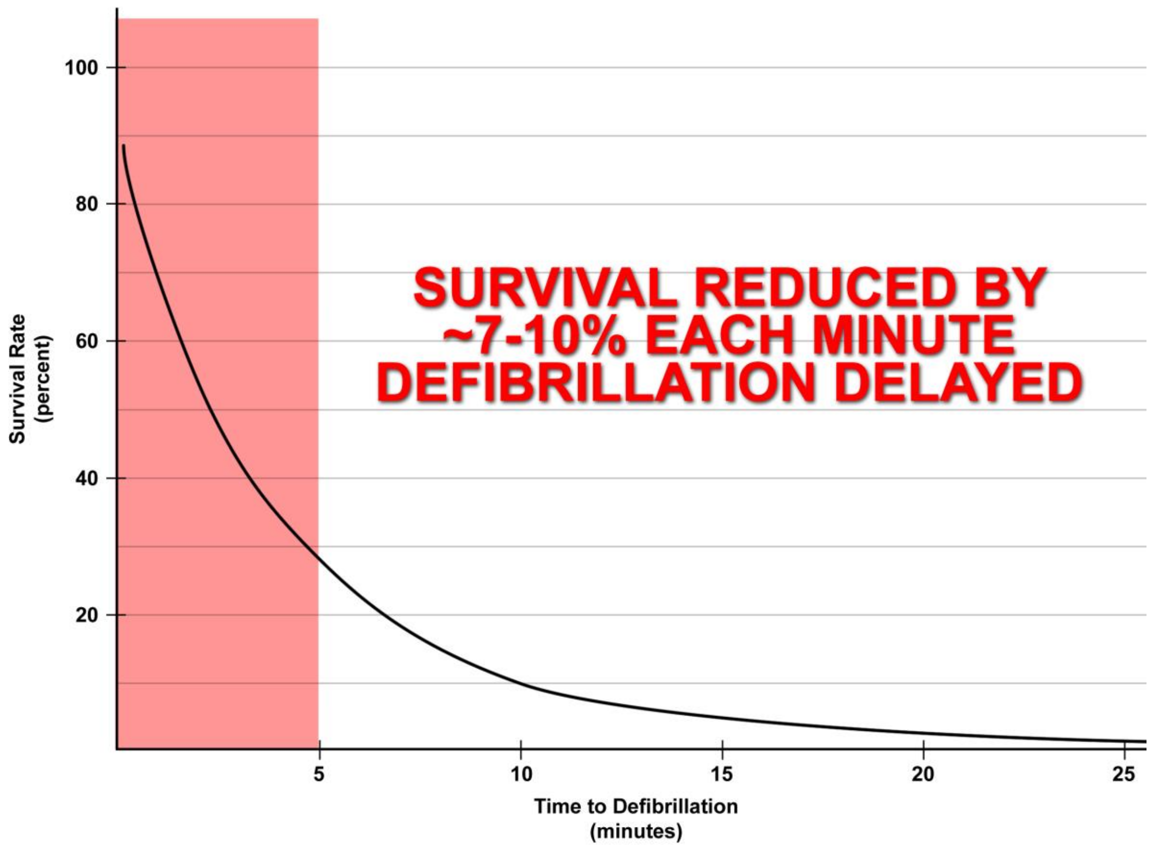
Citygate obtained and mapped the wildfire threat zones as identified by CAL FIRE and San Diego County. These areas, based on fuel type, density, and percent of slope, range from moderate to high to very high. Many of these areas abut buildings. As such, the District's response plan is designed to deliver a mix of structural and wildland fire apparatus to emerging wildfire incidents.

2.2.2 Emergency Medical Services System Assessment

The emergency medical system provided by the Department consists of four engine companies and two rescue-ambulance companies staffed with Advanced Life Support Paramedics (EMT-P). These units are equipped to meet the standards set forth by the San Diego County Department of Health Services, Local Emergency Medical Services Agency. The Department's EMS system provides a 24-hour "first response" emergency paramedic via the engine in each neighborhood fire station district and then the District's ambulances provide transport to a hospital as necessary. The District's ambulances serve (via a contract) a larger County Service Area in cooperation with the City of Santee Fire Department.

The most serious medical emergency would likely be a heart attack or some other emergency where there was an interruption or blockage of oxygen to the body. The figure below indicates survivability rate of a heart attack victim. There are other factors that can influence survivability as well, such as early CPR, early defibrillation, and early ALS intervention.

Figure 3—Survival Rate vs. Time of Defibrillation



Source: www.suddencardiacarrest.org

2.2.3 Hazardous Materials Risk Assessment

Hazardous materials risk assessment is for fixed facilities that store, use, and produce hazardous chemicals. Additionally, with the road transportation infrastructure in the Lakeside region, the risk assessment also includes those threats and hazards.

The state of California EPA and the California Building, Fire, and Environmental Codes regulate hazardous materials storage and use. San Diego County Environmental Health services, along with the County's fire and building inspectors, manage and inspect facilities under the Certified Unified Program Agency (CUPA).

2.2.4 Technical Rescue Risk Assessment

It is difficult to predict and locate where technical rescue requests for service will occur in an urban city. The potential types of technical rescues that might occur in the District range from trench collapses due to water pipe installations, high angle rescue of window washers, structural collapse after an earthquake, confined space rescues from tanks and underground vaults, and swift water rescues from flooded urban streams. Technical rescues can also come from industry. Personnel trapped in machinery, transportation accidents, aircraft crashes, and motor vehicle accidents account for many technical rescues.

The District's firefighters have prepared and trained for these events and the District has established a response matrix with the Heartland Communications Facility Authority to send the appropriate number of personnel and equipment to mitigate the situation.

2.2.5 Natural and Man-made Disasters

An area's fire department is also expected to respond to natural disasters. Some of these can cause fires or disrupt the water supply needed to fight fires. Other disasters can place a burden on the fire department for medical and technical rescue incidents.

The County's General Plan Safety Element describes several risks associated with public safety. Specific hazards of concern to the San Diego region include earthquakes, landslides and mudflows, dam or reservoir failure, and contamination of soil and groundwater resources. These hazards can impact the District's residents, workers, and visitors, and can cause the disruption of critical facilities (hospital, schools, fire stations) and essential facilities (water, gas, sewage, electricity, communications). The Fire Department and County regionally need to be prepared to respond to these emergencies; a risk assessment will help them identify the hazards, locations, and impact in the event of a natural emergency.

Earthquakes and Seismic Hazards

Earthquake-induced ground shaking is what causes the damage to structures and infrastructure like roads and bridges. The District has some older building stock, which is more susceptible to damage from an earthquake.

The San Diego region is crisscrossed by numerous earthquake faults. Consequently, the potential for fault rupture, strong ground shaking, landslides, and liquefaction is high. These geologic and seismic hazards can affect the structural integrity of buildings and utilities, and, in turn, cause severe property damage and potential loss of life. The County's policies and programs for geologic/seismic hazards are intended to reduce death, injuries, damage to property, and economic and social dislocation due to seismic events, as well as to enhance preparedness to survive, respond to, and recover from a major earthquake or geologic disaster. Effective implementation of seismic policies requires a continuing awareness of the seismic hazards affecting the District; strong, enforceable seismic standards for the siting, design, and review of proposed development. Citywide programs for disaster preparedness and recovery planning are also needed.

Geologic Hazards

Site-specific investigation of geologic and soils conditions are a community's primary means of hazard evaluation and an important basis for developing effective mitigation of individual development projects through planning and design. Standardized reporting procedures are necessary to assure consistency of hazard evaluation in the planning area. Data collected for an individual development site does not necessarily provide a complete picture of the regional geologic hazards affecting the site. A broader database of geologic and soils information, derived from a variety of research, development, and excavation projects, would provide a broader perspective and significant insights on potential development hazards that can be utilized on a regional scale for risk assessment.

Hills and mountains surround the District edges and are also located within the District. Slope failure does not need to be initiated by an earthquake. Intense rainstorms can penetrate the underlying soils and make them slip or slide off the slope, causing catastrophic consequences at the bottom of the hill. Slopes exposed to heavy rain, especially after a wildland fire, will usually result in a mudslide causing a great deal of damage at the bottom of the hill.

Flood Hazards

Flooding represents a potential hazard in the District, especially at the base of the mountains and foothills. For flood evacuation planning the 100-year floodplain within the Lakeside area of San Diego County is currently defined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate maps. FEMA periodically updates these maps. The 100-year floodplain is confined to storm channels, debris basins, and between levees with a few minor exceptions.

Storm drains and flood control facilities within the District include: channels, storm drains, street waterways, natural drainage courses, dams, basins, and levees. Flows carried within the street right-of-way may cause localized flooding during storms, possibly making some roads impassable during the storm event.

Dam Inundation

Flood inundation resulting from the failure of the San Vicente and/or El Capitan Dams is a potential hazard for the Lakeside region.

Wind Hazards

The District is subject to extremely high winds, which have resulted in significant property damage. For example, portions of roofs and block walls have been broken and blown away and public utility structures, such as power lines and traffic signals, have been damaged. The most significant wind problems occur at the canyon mouths and valleys extending downslope from the Mountains. The highest velocities are associated with downslope canyon and Santa Ana winds. The Santa Ana wind conditions are a reversal of the prevailing westerly Pacific Ocean onshore winds and usually occur on a region-wide basis during late summer and early fall. Santa Ana's winds are dry and warm and flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of the canyons and dissipate as they spread across the valley floor. High winds exacerbate brush fire conditions.

Of the major fires in the Lakeside region of San Diego County, all have occurred during periods of high winds. New development in the foothill areas and valleys will expose buildings and population to significant wind hazards.

2.3 Risk Assessment Impact

Upon review of the risk assessment data, the Lakeside Fire Protection District contains:

- Urban, suburban and rural population densities
- Building stock ranging from single-family detached homes to large businesses
- Typical suburban area commercial and institutional uses schools, health care, and large retail sales properties
- Many residential areas that are bordered by steep slopes containing high quantities of wildland fire fuel types mixed in with significant housing
- Transportation risks from the highway and freeway routes.

Based on the these factors, the District has staffed and designed its response system to field an "Effective Response Force" to reported serious fires in buildings and wildland areas, and operates paramedics via fire engines and ambulances for emergency medical responses.

The most recent California Building Code now requires automatic fire sprinklers in residential as well as commercial buildings. For the foreseeable future, the District will need both first-due firefighting unit and Effective Response Force (First Alarm) coverage in all parts of the District, consistent with national best practices. There are just not enough fire-sprinklered buildings or properties that can be defended against wildfire without a strong fire department response.

The District's multi-unit force (First Alarm) is designed to stop the escalation of the emergency and keep it from spreading to greater alarms. This "informal" goal will be the foundation of updated deployment measures as part of this Standard of Response Cover process.

2.4 EXISTING LAKESIDE FPD DEPLOYMENT STAFFING AND UNIT COUNT

2.4.1 Existing Deployment Situation—How Does the District Provide Services Currently and What Resources Does it Utilize?

SOC ELEMENT 1 OF 8*

EXISTING DEPLOYMENT POLICIES

**Note: Continued from page 7.*

For this study, given that the District Board of Directors has not adopted a response time policy, the response time benchmarks used by Citygate are those recommended by the National Fire Protection Association (NFPA) and the Commission for Fire Accreditation International (CFAI). Citygate also proposes performance benchmarks for the District to use for future planning and reporting to its residents. The performance marks are more consistent with actual data and achievable results.

The proposed benchmarks for the District are that an all-risk initial intervention unit (engine company or ladder truck company) will arrive at the scene of a critical emergency in 8 minutes or less from the time of call receipt in the Heartland Communications Facility Authority, 90% of the time. All the companies that make up the Effective Response Force (First Alarm) should arrive at critical emergencies within 11 minutes, again from call receipt. In these two measures, the travel time is 5 minutes for the first unit and 8 minutes for the Effective Response Force units in urban and suburban population areas. These response times are not possible in the rural, hilly regions of the District. Benchmarks are defined as what the community would like to see as an optimal response time.

Critical emergencies are those immediately threatening to life or likely to cause severe property damage from fire. Crew turnout time is longer in critical emergencies because more protective clothing must be donned before the fire apparatus can respond. Thus, the CFAI-recommended total response time includes:

1. Sixty (60) seconds or less dispatcher processing time, when pre-arrival medical directions are not given to the caller
2. Sixty (60) seconds or less fire crew turnout time to medical incidents; 80 seconds for fire incidents
3. A travel (driving) time reflective of the District's risk and Citygate will recommend 5 minutes for the first-due unit and 8 minutes for multiple units to severe emergencies.

The Department's current daily staffing plan is:

Table 5—2014 Daily Minimum Staffing per Unit

Per Unit	Minimum		Extended Minimum
4 Engines @	3	Firefighters/day	12
2 Ambulances @	2	Firefighters-Paramedics/day	4
Subtotal Firefighters:			***16***
Battalion Chief	1	Per day for command	1
		Total:	**17**

This daily staffing is adequate for the immediate response fire risk needs presented in the more built-up urban areas of the District. However, for this staffing statement to be accurate for a building fire, the assumption is that the closest crews are available and not already operating on another emergency medical call or fire, which happens as the incident statistics section of this study will show (Section 4). For example, if one engine is committed to an EMS call, then an adjacent engine company must respond.

The Department has solid automatic and mutual aid partnerships with the surrounding fire departments that will send their closest units if the District's units are committed to other emergencies.

2.4.2 District Services Provided

The District's fire services are "all-risk" by providing the people it protects with services that include structure fire, paramedic first response, technical rescue, and first-responder hazardous materials response as well as other services.

Given these risks, the District uses a tiered approach of dispatching different types of apparatus to each incident category. The dispatch center's computer-aided-dispatch (CAD) system, which selects the closest and most appropriate resource types, handles this function. In all, the dispatching system uses multiple unique resource-dispatching groups. As an example, here are the resources dispatched to common risk types:

Table 6—Resources Sent to Common Risk Types

Risk Type	Type of Resources Sent	Total Firefighters Sent
1-Patient EMS	1 Engine and 1 Ambulance	3 FF + 2 on Ambulance
Auto Fire	1 Engine	3 FF
Building Fire	4 Engines, 1 Ladder Truck, 1 Ambulance, 1 Battalion Chief	18 FF
Wildland Fire	2 Engines, 1 Wildland Engine, 1 Ambulance, 1 Battalion Chief	12 FF
Technical Rescue	1 Engine, 1 Rescue Truck, 1 Ambulance, 1 Battalion Chief	9 FF

Other Specialty Responses

The District, via its own resources and mutual aid agreements, has access to these specialty units for unique incident types:

- Urban Search & Rescue unit(s)
- Hazardous Materials unit(s)
- Air/Light Utility unit(s)
- Water Tender unit(s)
- Type III Brush Engines.

Finding #2: The District has a standard response dispatching plan that considers the risk of different types of emergencies and pre-plans the response. Each type of call for service receives the combination of engine companies, truck companies, ambulances, and command officers customarily needed to handle that type of incident based on fire department experience.

2.5 CRITICAL TIME TASK MEASURES—WHAT MUST BE DONE OVER WHAT TIME FRAME TO ACHIEVE THE STATED OUTCOME EXPECTATION?

SOC ELEMENT 4 OF 8
CRITICAL TASK TIME STUDY

In order to understand the time it takes to complete all of the needed tasks on a moderate residential fire and a modest emergency medical rescue, Citygate references national best practices and time-task information using standard operating procedures.

Given the complexity of getting four District crews to the training center for critical task time measure drills, this study did not require the Department to take personnel off-line to conduct their own critical task time trials. Therefore, the following time-task evolutions are based on aggregate Citygate client data for similar California fire departments to demonstrate how much time the operations take. The following tables start with the time of fire dispatch notification and finish with the outcome achieved. There are several important themes contained in these tables:

- The evolution results were obtained under best conditions, in that the day was sunny and moderate in temperature. The structure fire response times are from actual events, showing how units arrive at staggered intervals.
- It is noticeable how much time it takes after arrival or after the event is ordered by command to actually accomplish key tasks to arrive at the actual outcome. This is because it requires firefighters to carry out the ordered tasks. The fewer the firefighters, the longer some task completion times will be. *Critical steps* are highlighted in ***grey*** in the table.
- The time for task completion is usually a function of how many personnel are ***simultaneously*** available so that firefighters can complete some tasks simultaneously.
- Some tasks have to be assigned to a minimum of two firefighters to comply with safety regulations. An example is that two firefighters would be required for searching a smoke-filled room for a victim.

The following tables of unit and individual duties are required at a First Alarm fire scene for a typical single-family dwelling fire. This set of duties is taken from standard operational procedures, which is entirely consistent with the usual and customary findings of other agencies using the Standards of Response Cover process. No conditions existed to override the OSHA 2-in/2-out safety policy.

Shown below are the critical task times for a typical District response to structure fires in built-up suburban areas with four engines, one ladder truck, one ambulance and a battalion chief for a total of **18** personnel.

Scenario: *This was a simulated one-story residential structure fire with no rescue situation. Responding companies received dispatch information as typical for a witnessed fire. Upon arrival they were told approximately 1,000 square feet of the home was involved in fire.*

Table 7—First Alarm Structure Fire – 18 Firefighters

Task Description	Task Clock Time	Elapsed Time from 9-1-1
Time of call	00:00	00:00
Dispatch	01:20	
Crew turnout	02:26	
Travel to scene	08:01	11:47
First-due engine on scene		11:47
Forcible entry	01:14	
Attack team entry pre-connect	01:40	
2nd engine & ambulance on scene / water supply	01:45	
First unit walk around size-up	01:46	
3rd engine on scene / primary search	02:21	14:08
Ladder truck on scene	02:55	
Battalion Chief on scene / command	03:20	
Attack line advanced to interior	03:23	15:10
Ladder truck on scene / ventilation	04:43	
4th engine on scene rapid intervention crew	04:55	
Water Supply to attack pumper	05:04	
Back-up fire attack line	06:12	
Ladder to roof	07:46	
Positive pressure ventilation set-up	08:04	
Primary search completed, no victims	09:26	21:13
Secure utilities	11:03	
Vertical ventilation complete in roof	12:20	
Fire under control	12:25	
Total Time to Control:	***12:25***	**24:12**
Total Personnel:	18	

The above duties grouped together to form an *Effective Response Force or First Alarm assignment*. Remember that the above discrete tasks must be performed simultaneously and effectively to achieve the desired outcome; arriving on-scene does not stop the escalation of the emergency. While firefighters accomplish the above tasks, the clock keeps running, and has been since the emergency first started.

Fire spread in a structure can double in size during its free burn period. Many studies have shown that a small fire can spread to engulf the entire room in less than four to five minutes after free burning has started. Once the room is completely superheated and involved in fire (known as flashover), the fire will spread quickly throughout the structure and into the attic and walls. For this reason, it is imperative that fire attack and search commence before the flashover point occurs, if the outcome goal is to keep the fire damage in or near the room of origin. In addition, flashover presents a serious danger to both firefighters and any occupants of the building.

For comparison purposes, the critical task table below reviews the tasks needed on a typical automobile accident rescue.

Scenario: *This was a simulated two-vehicle accident, with two patients, one of whom was trapped. Extrication required total removal of the driver's door. A standard response of one engine, one ambulance, one rescue truck, and one battalion chief responded with a total of 9 personnel.*

Table 8—Multi-Casualty Traffic Collision – 9 Personnel

Task Description	Task Clock Time	Elapsed Time from 9-1-1
Pre-arrival response time		11:47
First-due engine on scene	00:00	
Size up, 360-degree survey	00:54	
Patient #1 contact	01:15	13:02
1st truck on scene	01:39	
Protection hose line in place	01:56	
Battalion Chief on scene / command	02:12	
Patient #2 contact	02:21	14:08
Patient(s) stabilization	03:39	
Patient #2 removal	03:39	15:26
Heavy rescue on scene / extrication of trapped patient	03:47	
Extrication need determined and assigned to ladder truck	02:30	
Vehicle stabilized	04:16	
Patient care assigned to ambulance crew	05:29	
Extrication team with tools ready to begin	05:24	
Door removed	07:38	
Patient #1 removed and in full c-spine	09:13	
Total Time to Begin Transport:	***09:13***	**21:00**
Total Personnel:	9	

2.5.1 Critical Task Analysis and Effective Response Force Size

What does a deployment study derive from a response time and company task time analysis? The total task completion times (shown above) to stop the escalation of the emergency have to be compared to outcomes. We know from nationally-published fire service "time vs. temperature" tables that after about four to five minutes of free burning, a room fire will grow to the point of flashover. At this point, the entire room is engulfed, the structure becomes threatened and human survival near or in the fire room becomes impossible. Additionally, we know that brain death begins to occur within four to six minutes of the heart having stopped. Thus, the Effective Response Force must arrive in time to stop these catastrophic events from worsening.

The response and task completion times discussed above show that the residents of the District are able to expect positive outcomes and have a chance of survival in a *serious* fire or medical emergency—if enough units are available to immediately respond.

The point of the tables above is that mitigating an emergency event is a team effort once the units have arrived. This refers back to the "weight" of response analogy. If too few personnel arrive too slowly, then the emergency will worsen instead of improve. Control of the structure fire incident still took 12:25 minutes after the time of the first unit's arrival, or 24:12 minutes from fire dispatch notification.

In the District, the quantity of staffing and the time frame it arrives in can be critical in a serious fire. Fires in older and/or multi-story buildings could well require the initial firefighters to rescue trapped or immobile occupants. If a lightly-staffed force arrives, it cannot simultaneously conduct rescue and firefighting operations.

Fires and complex medical incidents require that the other needed units arrive in time to complete an effective intervention. Time is one factor that comes from ***proper station placement***. Good performance also comes from ***adequate staffing*** and training. However, major fires and medical emergencies where the closest unit is not available to respond will challenge the District's response system to deliver good outcomes. This factor **must** be taken into account when fire station locations are considered.

Best practices suggest the need for 15+ firefighters to arrive within 11 minutes (from the time of call) at a room-and-contents common house fire to be able to ***simultaneously and effectively*** perform the tasks of rescue, fire attack, and ventilation. This is supported by previous critical task studies conducted by Citygate, the Standard of Response Cover documents reviewed from accredited fire departments, and NFPA 1710 recommendations. Given that the Department sends 18 personnel to an incident involving a working First Alarm building fire, the District and its leaders understand that firefighting crews arriving closely together are needed to deliver a positive outcome that protects lives and property by stopping the escalation of the emergency as found by the arriving force.

However, if fewer firefighters arrive, it is important to understand *which* tasks mentioned above would not be done. Most likely, the search team would be delayed, as would ventilation. The attack lines would only have two firefighters, which does not allow for rapid movement above the first-floor deployment. Rescue is done with only two-person teams per Cal/OSHA safety regulations; thus, when rescue is essential, other tasks are not done in a simultaneous, timely manner. Remember what this report stated in the beginning: effective deployment is about the **speed** *(travel time)* and the **weight** *(firefighters)* of the attack.

The District staffs each fire crew with 3 personnel, which is not consistent with the NFPA 1710 recommended staffing, as well as being compliant at the first unit arrival with the OSHA 2-in/2-out requirement. In April 2010, the National Institute of Standards and Technology (NIST) published a fire crew staffing study titled "Report on Residential Fireground Field Experiments."

The first-of-its-kind NIST study used multiple standardized actual fire scenarios to measure the effectiveness of different fire crew per apparatus sizes. The NIST study found in summary:

> "*The four-person crews operating on a low-hazard structure fire completed all the tasks on the fireground (on average) seven minutes faster—nearly 30%—than the two-person crews. The four-person crews completed the same number of fireground tasks (on average) 5.1 minutes faster—nearly 25%—than the three-person crews.*"

Eighteen initial firefighters (4 engines, 1 ladder truck, 1 ambulance, and 1 battalion chief) should be able to handle a serious risk house fire; however, even an Effective Response Force of 18 will be seriously slowed if the fire is above the first floor, in a low-rise apartment building, or commercial/industrial building. A severe wildfire also requires an immediate and heavy staffing response to control the fire to the first few acres. This is also where the capability to add alarms (more staffing) to the standard response becomes important. *However, this response provides more firefighters than the District has on-duty each day on its fire engines (12) due to automatic aid from adjoining fire departments*.

The current District First Alarm (Effective Response Force) of 18 personnel to a building fire reflects the District's goal to confine serious building fires to or near the room of origin and to prevent the spread of fire to adjoining buildings. This is a typical desired outcome in built-out areas and requires more firefighters to respond more quickly than the typical rural outcome of keeping the fire to the building of origin, as opposed to the room of origin.

Given the District's current response to building fires, it is, in effect, the District's de-facto deployment measure to built-up urban areas. Thus, this becomes the baseline policy for the deployment of firefighters.

2.5.2 District Emergency Unit Staffing

The four engine companies and two ambulance units are staffed on a daily basis with a minimum staffing of three or two firefighters, respectively. The daily minimum shift staffing count is 16 firefighters plus one battalion chief for incident command and safety officer functions. Per NFPA 1710, a minimum of 15 firefighters plus a command chief are required for a typical room-and-contents fire in a home in a suburban area. For a single-patient EMS event, one fire company plus an ambulance is needed. Given that, the daily staffing depth of the District is only adequate to handle a single modest house fire and another medical emergency by relying on mutual aid.

Large, busy fire departments—such as San Diego, Los Angeles, Oakland, San Jose, and San Francisco—staff apparatus with four personnel each. As Citygate will explain after our geographic and incident demand analysis sections, the District is deploying the staffing it can afford and this force has the ability to control typical, day-to-day small emergencies.

SECTION 3—GEO-MAPPING ANALYSIS

3.1 DISTRIBUTION AND CONCENTRATION STUDIES—THE IMPACT OF FIRST-DUE AND FIRST ALARM RESOURCE LOCATIONS ON DELIVERING THE DESIRED OUTCOMES

SOC ELEMENT 5 OF 8
DISTRIBUTION STUDY

SOC ELEMENT 6 OF 8
CONCENTRATION STUDY

The District today is served today by four fire stations. As part of this deployment study, it is appropriate to understand the existing station coverage limits, coverage gaps that may need one or more stations, and possible steps to eliminate coverage gaps. Given the age of some of its oldest fire stations with resultant repair needs, it is necessary for the District to consider the appropriate number of fire stations and their ideal location, given the 50-year investment cycle that drives fire station replacement.

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

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

To analyze first-due fire unit travel time coverage for this study, Citygate used a geographic mapping tool called *FireView*™ that can measure theoretical travel time over the street network. For this next portion of the study, Citygate used the base map and street travel speeds calibrated to actual fire company travel times from previous responses to simulate real-world coverage. Using these tools, Citygate measured the impact of several deployment scenarios on various parts of the District. The travel time measure used was 4 and 5 minutes over the road network, which is consistent with the "benchmark" recommendations and desirable outcomes in critical emergencies. When a minute is added for dispatch time and 2 minutes for crew turnout times, then the maps effectively show the area covered within 8 minutes for first-due and 11 minutes for a First Alarm assignment.

3.1.1 Community Deployment Baselines

Map #1 – General Geography and Station Locations

This view shows the existing District fire station locations (in red) within the District boundaries. This is a reference map view for the other map displays that follow. Also displayed are nearby fire stations inside and outside the District that are part of the District's automatic aid response system (in green).

This base map also shows a possible relocation site for Fire Station #1 (in blue), to be used in a later map analysis.

Map #2 – Risk Assessment – Wildfire Hazards, ISO-Surveyed Buildings and Population

Risk assessment is an effort by a fire department to classify properties by potential impact on service demand levels. In this study, commercial building fire risk was examined by understanding the locations of the higher fire flow buildings as calculated by the Insurance Service Office (ISO) as a measure of the impact of zoning on the location of the educational, commercial, and industrial properties in the City. These higher fire flow sites (≥2,000 gpm) are shown on the map and must receive a timely and effective First Alarm force to serious fires, thus requiring more firefighters in fewer minutes to handle possible emerging serious fires. Most of these higher fire flow buildings are located along the major road corridors and central core of the District in the flatter elevation areas.

This map also displays the wildland fire high hazard along the entire northern and eastern edge of the District.

Map #3a, b, & c – First-Due Unit Distribution 4-Minute Engine Travel

Map **3a** shows, in green colored street segments, the *distribution* or first-due response time for each District station per a response goal of 4 minutes *travel* time which is the NFPA 1710 best practice recommendation for career fire departments in urban areas. Therefore, the limit of color per station area is the time an engine could reach within this time, ***assuming*** it is in-station and encounters no unusual traffic delays. In addition, the computer uses mean fire company speed limits per roadway type. Thus, the projection is optimal or "perfect-world."

Map **3b** shows the 4-minute travel coverage with the CAL FIRE station turned on. Due to its location it only assists the District slightly with the under-served 4-minute coverage.

Real dispatch data to be discussed in the next section *shows* response times to be slower in most all areas. This is due to the effects of simultaneous incidents, the non-grid street design layout, and the upslope hilly areas. The purpose of computer response mapping is to determine and balance station locations. This geo-mapping design is then checked in the study against actual dispatch time data, which reflects the real world. There also should be some overlap between station areas so that a second-due unit can have a chance of an adequate response time when it covers a call in another fire company's first-due area.

It is not possible to serve every road segment out to the edge of the District's urban/suburban areas in 4 travel minutes. This is understandable since most of the District is not of an urban population density and its street network serves a very challenging topography.

Map **3c** shows the 4-minute drive time coverage from the existing District stations and its automatic aid partner fire departments.

Finding #3:	Using the current four fire station locations, not all of the urban density developed areas are within 4 minutes travel time of a fire station. Stations #1 and #2 are located too close together. Coverage would be improved if Station #1 was moved to the south.

Map #3d & e – First-Due Unit Distribution 5-Minute Engine Travel

Map **3d** and Map **3e** measure the 5-minute travel time from the existing station sites. As can be seen, on a "non-grid" street network like the District's, a 5-minute travel time coverage measure is substantially more effective for only one more minute of added travel time. Even with up to three minutes added for dispatch and crew turnout times, a 5-minute travel measure still allows the first unit to arrive at the emergency within 8 minutes from fire dispatch notification, which is faster than the San Diego County EMS 10-minute goal for a paramedic unit.

Map #4a, b, & c – ISO Coverage Areas from Existing Fire Stations

Map **4a** and Map **4b** display the ISO requirement that stations cover a 1.5-mile travel distance, from first the existing District Stations and then second, with the CAL FIRE station turned on. Depending on the road network in a department, the 1.5-mile measure usually equates to a 3.5- to 4-minute travel time. However, a 1.5-mile measure is a reasonable indicator of station spacing and overlap. As can be seen, the ISO coverage is similar but less forgiving than the 4-minute travel time measure. This is due to the fact that a "distance" based measure cannot account for higher speeds on freeways and primary arterial streets that feed out into the neighborhoods.

Map **4c** measures the 1.5-mile driving distance from the District and automatic aid partner fire stations.

Viewed from this 1.5-mile driving *distance* measurement, the District's most populated area in its southwest corner is not completely covered south of existing Station #1.

Maps #5 – Concentration (First Alarm) Multiple-Unit Coverage

This map exhibit shows the *concentration* or massing of fire crews for serious fire or rescue calls. Building fires, in particular, require 15+ firefighters (per NFPA 1710) arriving within a reasonable time frame to work together and effectively to stop the escalation of the emergency. Otherwise, if too few firefighters arrive, or arrive too late in the fire's progress, the result is a greater alarm fire, which is more dangerous to the public and the firefighters.

The concentration map exhibits look at the District's ability to deploy three of its engine companies, one automatic aid engine company, one automatic aid truck company, one ambulance, and one chief officer to building fires within 8 minutes travel time (11 minutes total Fire Department response time from 9-1-1 answer). This measure ensures that a minimum of 18 firefighters (three firefighters per engine, two firefighter/paramedics on one ambulance, three firefighters per ladder truck, and one chief for incident command) can arrive on-scene to work ***simultaneously*** and effectively to stop the spread of a modest fire.

The area in **green** shows where the District's current fire deployment system should deliver the initial Effective Response Force.

As can be seen, the more populated southwest area of the District is within 8 minutes of the entire Effective Response Force. This is excellent as this is where the bulk of the larger buildings and populations exist and need the best response possible for serious building fires.

Finding #4:	The coverage of the Effective Response Force (First Alarm) to serious fires is adequate in the most populated southwest area of the District.

The next series of maps will "take apart" the First Alarm unit coverage by apparatus type to see what unit locations do or do not limit the full First Alarm coverage.

Map #6 – Engines Only at 8-Minute Travel

This map shows a different view of concentration by only showing the 8-minute coverage of 4 engine companies. Here, the green color shows the areas receiving four engines in 8 minutes travel time. This coverage is better than in Map 5 because the single ladder truck cannot cover all of the more populated areas within 8 minutes travel. This coverage provides the populated areas with four engines, or 12 firefighters, within 8 minutes travel.

Map #7 – Battalion Chief Travel at 8 Minutes

This map displays the battalion chief coverage from Station #2. At 8 minutes travel time, it is not possible to cover the outer areas of the District. However, since Station #2 is the most central fire station in the District, and given serious fires are time-sensitive for the arrival of the Incident Commander and Safety Officer, much of the District is adequately covered from this location.

Map #8 – Single Ladder Truck Coverage

This map displays the 8-minute travel time coverage from either of two ladder trucks located outside of the District. Given the southwest location of these units, they cannot cover all of the more populated areas of the District at 8 minutes travel.

Finding #5: Improving ladder truck coverage to the outer areas of the District would require the addition of one ladder truck at Station #3 or the use of quints (engine and aerial ladder combined apparatus) instead of engines in Stations #3 or #26.

Map #9 – District Ambulance Coverage

Measured in this map is the 8-minute driving time coverage for the District's ambulances. The four locations are excellent and provide the best coverage possible to all but the most rural areas of the District.

Map #10 – All Incident Locations

This map is an overlay of the exact location for all incident types using a 3-year data set. It is apparent that there is a need for Fire Department services on almost every street segment of the District. The greatest concentration of calls is also where the greatest concentration of Fire Department resources is available. Given the District's mutual and automatic aid partnerships, also shown are the locations outside the District where its units responded.

Map #11 – EMS and Rescue Incident Locations

This map further breaks out only the emergency medical and rescue call locations. Again, with the majority of the calls for service being emergency medical, virtually all areas of the District need emergency medical services, with the greatest need being where population densities are the highest.

Map #12 – All Fire Type Locations

This map identifies the location of all fires in the District over the previous 3 years. All fires include any type of fire call, from auto to dumpster to building. There are obviously fewer fires than medical or rescue calls. Even given this, it is evident that all first-due engine districts experience fires; the fires are more concentrated where the District's resources are more concentrated.

Map #13 – Structure Fire Locations

This map is similar to the previous map, but only displays structure fires for the 3-year data set. While the structure fire count is a smaller subset of the total fire count, there are two meaningful findings from this map. First, there are still structure fires in every first-due fire company district. Second, the location of many of the building fires parallels the higher risk buildings in commercial areas, along with the higher density housing sections of the District. These areas and buildings are of significant fire and life loss risk to the District. Fires in the more complicated building types must be controlled quickly or the losses will be very large. Fortunately, concentration (First Alarm) coverage is adequate in these areas of the District.

Map #14 – EMS and Rescue Incident Location Densities

Using the 3-year data set, this map examines by mathematical density where clusters of incident activity occurred. In this set, the darker density color plots represent the highest concentration of all EMS incidents. This type of map makes the location of frequent workload more meaningful than just mapping the dots of all locations as done in Map 10.

Map #15 – All Fire Location Densities

This map shows the hot spot activity for all fires. In this case, the call for service density is slightly more scattered, reflecting small fires, such as auto fires in areas where the population density is the highest.

Map #16 – Structure Fire Densities

This map shows only the building fire workload by density. The density is less scattered than the EMS density that follows the highest population per square mile. These building fire densities indicate a structure fire workload primarily in the southwest area of the District.

Map Series #17 & 18 – Station #1 Relocation Coverage Maps

The remaining series of maps will be used in Section 5 where an analysis is conducted on relocating Station #1.

SECTION 4—STATISTICAL ANALYSIS AND OVERALL DEPLOYMENT RECOMMENDATION

4.1 HISTORICAL EFFECTIVENESS AND RELIABILITY OF RESPONSE—WHAT STATISTICS SAY ABOUT EXISTING SYSTEM PERFORMANCE

SOC ELEMENT 7 OF 8
RELIABILITY & HISTORICAL RESPONSE EFFECTIVENESS STUDIES

The map sets described in Section 3 show the ideal situation for response times and how responses might look under perfect conditions with no competing calls, light traffic conditions, units all in place, and no simultaneous calls for service. Examination of the actual response time data in this section will provide a picture of how response times are in the "real" world of simultaneous calls, rush hour traffic conditions, units out of position, and delayed travel time for hazards such as those caused by severe weather.

4.1.1 Data Set Identification

The Lakeside Fire Protection District provided National Fire Incident Reporting System (NFIRS version 5) incident data, and more comprehensive computer-aided-dispatch (CAD) apparatus response data, for the time period 1/1/2011 – 12/31/2013.

When the CAD data was combined with incidents, the District logged 21,667 distinct incidents for the 3-year period with a total of 38,208 individual apparatus records.

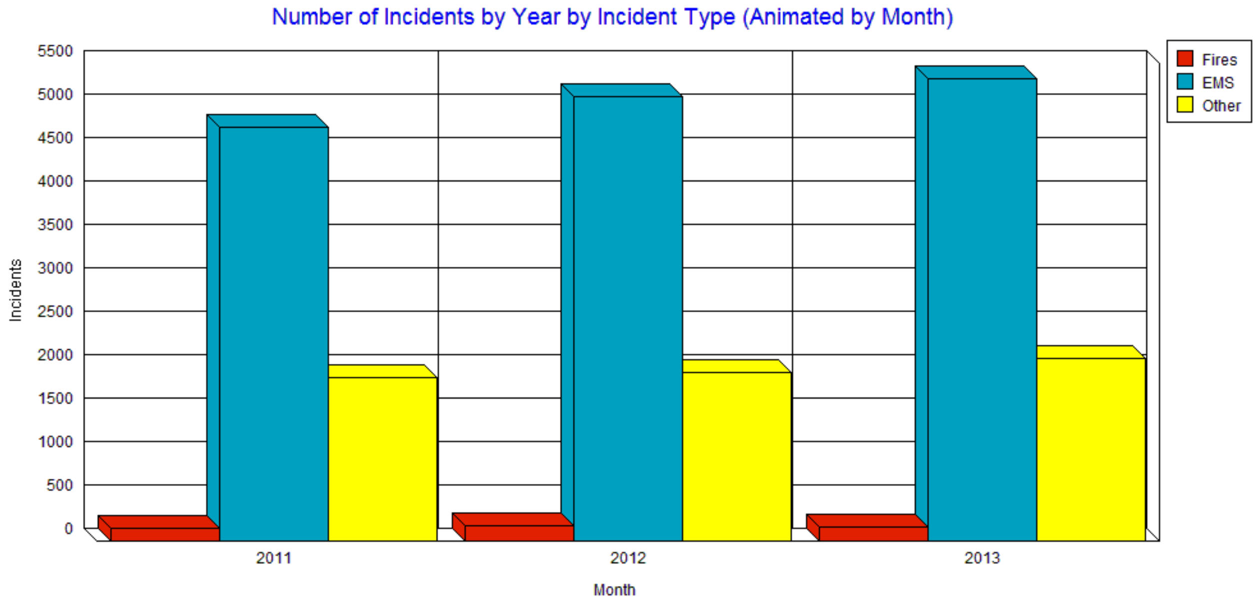
4.1.2 Analysis Period

Unless otherwise noted, *response time performance* measurements in the sections to follow were based on the latest 2013 data.

4.1.3 Service Demand

In 2013, the District responded to 7,608 incidents for an average of 20.84 incidents per day (2.15% of incident responses were to fire; 70.01% were to EMS; and 27.84% were to other incidents).

Figure 4—EMS Incidents by Year



4.1.3 Breakdown by Incident Type

Below is a list of the incident types occurring in the District in the past 3 years. Notice the heavy representation of EMS incidents. In this list "111 Building Fires" ranks 14th by incident count.

Table 9—Incidents: Count – Year by Incident Type – ≥95 Total

Incident Type	2011	2012	2013	Totals
321 EMS call, excluding vehicle accident with injury	4,432	4,724	4,922	14,078
611 Dispatched & canceled en route	1,140	1,296	1,321	3,757
322 Vehicle accident with injuries	205	203	198	606
554 Assist invalid	120	88	128	336
324 Motor vehicle accident no injuries	91	111	123	325
600 Good intent call, other	74	63	77	214
622 No incident found on arrival of incident address	49	45	50	144
561 Unauthorized burning	60	33	51	144
700 False alarm or false call, other	57	35	39	131
510 Person in distress, other	43	28	39	110
651 Smoke scare, odor of smoke	27	40	38	105
541 Animal problem	27	34	37	98
320 Emergency medical service, other (conversion only)		44	53	97
111 Building fire	30	42	23	95

4.1.4 Breakdown by Property Type

The following table illustrates the count for property types receiving services from the Lakeside Fire Protection District. Family residences top the list.

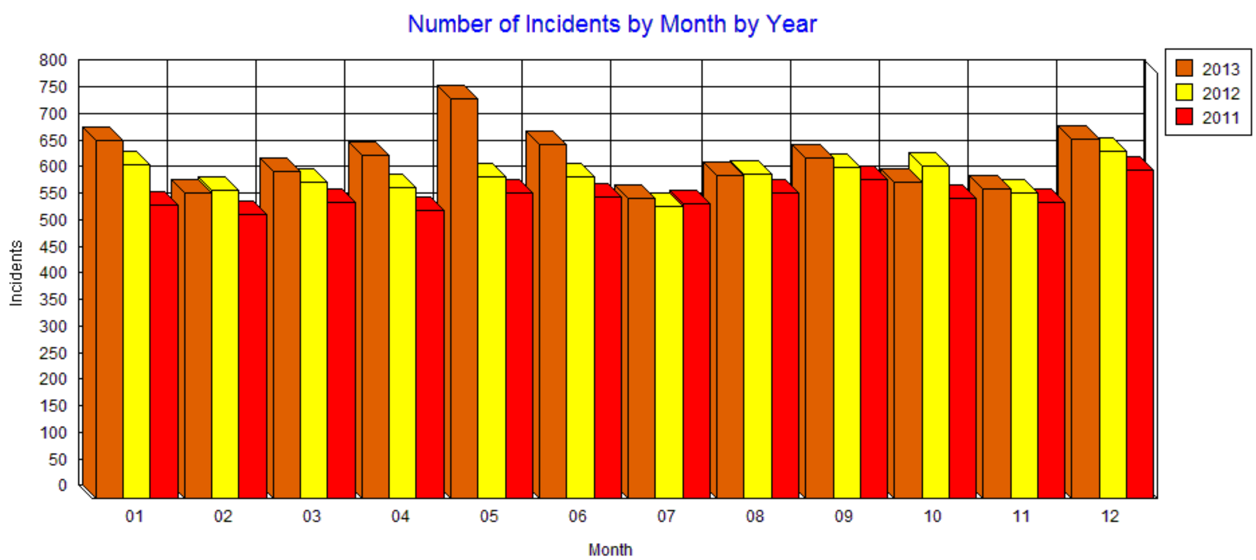
Table 10— Incidents: Count – Year by Property Use – >100 Total

Property Use	2011	2012	2013	Totals
419 1 or 2 family dwelling	2,452	2,600	2,694	7,746
-Blank-	1,668	1,851	1,969	5,488
429 Multifamily dwellings	964	1,019	1,093	3,076
962 Residential street, road or residential driveway	245	224	212	681
961 Highway or divided highway	133	217	183	533
963 Street or road in commercial area	128	141	104	373
960 Street, other	152	84	125	361
142 Clubhouse	143	89	98	330
311 24-hour care Nursing homes, 4 or more persons	77	96	108	281
400 Residential, other	100	71	107	278
965 Vehicle parking area	99	97	72	268
888 Fire station	65	60	65	190
519 Food and beverage sales, grocery store	44	48	69	161
931 Open land or field	44	50	60	154
511 Convenience store	40	47	55	142
215 High school/junior high school/middle school	37	47	44	128
161 Restaurant or cafeteria	12	47	58	117

4.1.5 Breakdown of Incident Demand Over Time

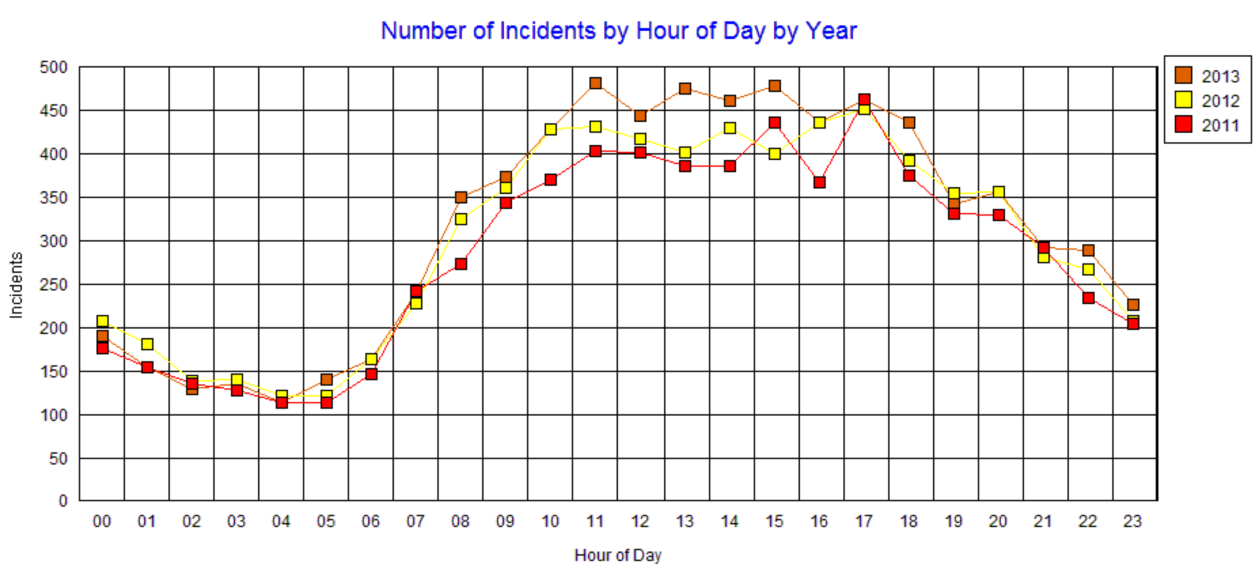
The chart below illustrates the number of incidents by month. The graph illustrates the trending for each month is fairly consistent.

Figure 5—Number of Incidents by Month



This graph compares incident activity by hour of day. The graph follows traditional fire department activity hours. Notice year-to-year activity increases tend to be greater in late morning through early evening hours.

Figure 6—Number of Incidents by Hour of Day by Year

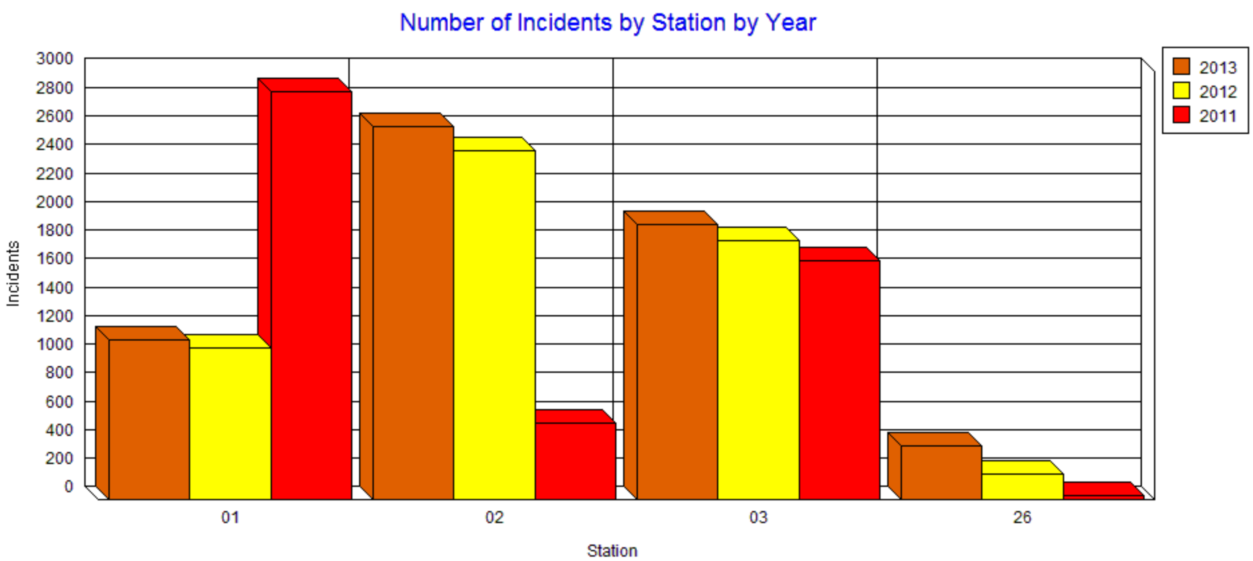


4.1.6 Breakdown of Incident Demand by Station Area

Normally incidents are broken down by the station area in which the incident occurs. This is not possible in the District because available data does not identify the geographic station area of incidents.

As a substitute for geographic designation, stations below were identified by the first arriving apparatus. While this is not ideal, it nevertheless allows for some quantitative comparisons of station demand.

Figure 7—Number of Incidents by Station by Year



Finding #6:	The District's time of day, day of week, and month of year calls for service demands are very consistent. This means the District needs to operate a fairly consistent 24/7/365 response system.

4.1.7 Unit Utilization

The utilization percentage for apparatus is calculated by the number of responses and duration of responses. The following is a 2013 Unit Utilization Summary for the District apparatus.

Table 11—Unit Utilization – 2013

Vehicle	Overall	Responses
M2	32.63%	3,231
M3	26.73%	2,539
E2	9.57%	2,031
E3	7.42%	1,515
E1	7.02%	1,595
E26	3.33%	618

4.1.8 Simultaneous Analysis

Simultaneous incidents occur when other incidents are underway at the same time that a new incident occurs. In the District during 2013, 45.68% of incidents occurred while one or more other incidents were underway.

The following is the percentage of simultaneous incidents broken-down by number of simultaneous incidents:

Table 12—Simultaneous Incidents – Percentage by Number of Incidents

# of Simultaneous Incidents	Percentage
1 or more	45.68%
2 or more	13.31%
3 or more	02.68%
4 or more	00.64%

4.1.9 Aid Activity with Other Jurisdictions

The table below shows aid activity from 2011 to 2013. Aid, whether given or received, accounts for 41.72% of incident activity. The District has an extremely high level of aid. This aid is more likely to be given to other agencies than received from other agencies. The ratio of aid given to aid received is 60/40.

The following is a breakdown by aid type by year:

Table 13—Incidents: Count – Year by Aid Type

Aid Type	2011	2012	2013	Totals
1 Received	48	28	73	149
2 Automatic Aid Received	1,201	1,184	1,148	3,533
3 Given	196	244	269	709
4 Automatic Aid Given	1,435	1,564	1,630	4,629
5 Other Aid Given	11	5	4	20
N None	3,921	4,222	4,484	12,627
Totals	**6,812**	**7,247**	**7,608**	**21,667**

4.2 Response Time Analysis

Once the types of incidents and locations are quantified, incident analysis shifts to the time required to respond to those incidents. Fractile breakdowns track the percentage (and count the number) of incidents meeting defined criteria, such as the first apparatus to reach the scene within progressive time segments.

As a reminder, there is no current District response time goal. As such, Citygate will benchmark the existing response time performance to the best practice expectations of NFPA 1710 for career fire departments in urban areas, as well as those of the Commission on Fire Accreditation International.

Fire department response time should be measured as the amount of time it takes to reach 90% compliance with three component tasks: (1) Call Handling; (2) Turnout; and (3) Travel. These three components can be combined into a "Call to Arrival" measurement. The total response time does not include the "dismount" time to leave the engine or ambulance and walk to the patient, which, in a large complex or multi-story building, can take more than a minute.

Table 14—Three Component Tasks of Total Response Time (Call to Arrival)

Component Task	Measurement	National Recommendation
Call Handling Time	The time from the initial request for assistance until the apparatus is "toned-out" (or dispatched).	60 seconds for 90% of emergency incidents.
Turnout Time	The performance of a company from the time the company is notified of the emergency until the company begins "wheels-turning" to the scene.	60-80 seconds for 90% of emergency incidents. However, fire departments adopt goals from 60-120 seconds since crews must don mandated protective clothing and many older station designs do not allow fast turnout times.
Travel Time	The performance of a company from the time it begins to move toward the incident until the company arrives on the scene of the incident.	4 minutes (240 seconds) first company arrival to 90% of emergency incidents in urban and suburban settings.

Note: 90% compliance is not the same as an average. It is possible to have an average of 90 seconds for a particular task while it may be well over 3 minutes for the task to be accomplished for 90% of emergency incidents. What causes a divergence between average and 90% compliance is consistency. For example:

If 1,000 incidents have a Call Handling Time between 85 and 90 seconds the Call Handling operation can be characterized as "consistent." In this case the Call Handling average and 90% compliance can be similar. However, if Call Handling Time varies from 25 seconds to 240 seconds then the average may still be near 90 seconds while 90% compliance takes over 180 seconds (3 minutes). Consistency is a key element of contemporary performance measurements.

To summarize the table above, **Total Response Time** (Call to Arrival) is 7 minutes (or 420 seconds), made up of three component parts:

Call Handling Time:	1 minute
Turnout Time:	2 minutes (Most agencies can meet this, based on our experience)
Travel Time:	4 minutes (240 seconds)

All measurements in the sections to follow have been based on fire and EMS responses as much as possible, to eliminate non-emergency incidents.

4.2.1 Call Handling Time – Department Wide

Call Handling Time performance in the District is reasonable with the 60-second national standard being difficult to support in most agencies.

Table 15—Call Handling Time

Year	Time
2012	01:18
2013	01:20

4.2.2 Turnout Time

Turnout performance in the District is slower than a very-achievable 2-minute turnout time measure for 90% of the fire and EMS incidents.

Table 16—Turnout Time

Year	Time
Overall	02:15
2012	02:25
2013	02:26

Turnout times miss the mark for most all of the apparatus

Table 17—Turnout Time by Apparatus

Vehicle ID	2011	2012	2013
E1	02:30	02:10	02:18
E2	02:16	02:31	02:28
E26	02:26	02:07	02:33
E26S	02:21	02:32	
E3	02:23	02:31	02:29
M1	02:27	01:53	
M2		02:19	02:19
M3	02:14	02:27	02:36
R3	03:14	03:13	03:02

4.2.3 Travel Time

Travel Time performance in the District is below a desired national recommendation of 04:00 in urban areas, with more of a grid type street network:

Table 18—Travel Time – Department Wide

Year	Time
2012	07:44
2013	08:01

The following is a travel time breakdown by 1st arriving apparatus at fire and EMS incidents.

Table 19—Travel Time Performance – Apparatus to 90% of Fire & EMS Incidents

Vehicle ID	2011	2012	2013
E1	06:21	06:20	06:21
E2	07:49	07:18	06:46
E26	09:21	07:40	07:05
E26S	07:12	07:25	
E3	06:24	06:25	05:58
M1	08:25	05:41	
M2		08:46	08:55
M3	09:12	09:08	09:09
R3	07:00	06:57	08:03

4.2.4 Call to Arrival Performance

A Call to Arrival performance of 90% compliance in 7 to 8 minutes is considered adequate for a primary response. Additional time is expected when a fire department serves more rural and remote areas. In the District, Call to Arrival performance is consistent with a fire department making suburban to rural and remote responses.

Table 20—Call to Arrival Performance – Department-Wide for Fire & EMS Incidents

Year	Time
2011	09:37
2012	10:03
2013	10:25

In-District Call to Arrival performance is decreasing year-to-year.

Table 21—Call to Arrival Performance – Apparatus to 90% of Fire & EMS Incidents

Vehicle ID	2011	2012	2013
E1	08:41	08:40	08:39
E2	10:23	09:43	09:32
E26	12:08	09:34	09:37
E26S	09:34	09:49	
E3	08:53	09:01	08:43
M1	10:53	08:05	
M2		11:06	11:22
M3	11:39	11:18	11:37
R3	09:54	10:54	11:13

4.2.5 Medic Ambulance Travel Time Analysis

The District has two ambulances (M1 and M2). The following table tracks M1 first arrival travel time performance in 2011 and compares it to M2's first arrival travel time performance in 2012 and 2013 to all responses, in and out of the District. Notice that while the number of first arrivals remained relatively steady from 2011 – 2012, travel time performance decreased. Without a station change, M2's first arrival travel time performance decreased again in 2013.

Table 22—Travel Time Performance – Medic Ambulances to 90% of Incidents Inside and Outside the District

First Company	2011	2012	2013
M1	09:14		
M2		09:40	10:20

Now the selection of first arrivals by M1 and M2 is decreased to only those within the District. All aid responses were eliminated. Here we see better first arrival travel performance, but the same trend of decreasing first arrival travel time performance year to year.

Table 23—Travel Time Performance – Medic Ambulances to 90% of Incidents Within District Only

First Company	2011	2012	2013
M1	07:52		
M2		08:32	08:44

4.2.6 Effective Response Force (First Alarm)

As we have described earlier in this report, Effective Response Force (ERF) is defined as a team of engine, rescue, and chief vehicles arriving at the scene of a building fire. It can also be defined by the number of firefighting personnel arriving at the scene. The time is stamped when either the last vehicle or the last firefighter arrives on the scene to complete the Effective Response Force team.

In the District, the ERF team is 4 engines, 1 ladder, 1 medic ambulance, and one chief officer. This translates to approximately 18 firefighters (3 firefighters on each engine and ladder, two firefighter-paramedics on the medic ambulance, plus one chief officer). A nationally-recommended goal in urban areas is for all of the units assigned to arrive within 8 minutes travel time.

Over the 3 years of available data, the District responded to 110 building fires. Seventy-one (71) of those building fires were within the District boundaries. Of those building fires within the District, only 4 had the arrival of 3 engines, 1 ladder, and 1 firefighter/paramedic ambulance. For those 4 incidents, 75% ERF travel time compliance was reached at 07:00 with 100% compliance being reached at 07:30.

If ERF was calculated by the arrival of 14 firefighters (only *all four District* engines and the ambulance) then there were 10 qualifying building fires within the District response area. For these 10 incidents, 90% ERF travel time compliance was reached in 07:30.

While the volume of in-District ERF building fires is low, it seems compliance either by apparatus or by firefighter arrival is similar at 07:30 for both ERF definitions.

4.2.7 Incident Statistics Findings

Based on Citygate's review of the three years of recent incident statistics, we find the following:

Finding #7:	Crew turnout times are too long to 90% of the fire and EMS incidents. Management focus is needed to bring them into alignment with best practice goals.
Finding #8:	Long travel times for the District's fire units are due to topography, simultaneous incidents, and Station #1 not being placed in the best location.

Section 5—Relocation of Station One Analysis

5.1 Station One Relocation Overall Opinion

As part of our deployment analysis, Citygate was asked to determine if there was a better fit site for Station #1 to not only serve the southwest portion of the District, but also the CSA 115 area of annexed land.

5.2 Station One Relocation Coverage Analysis

Citygate used the geographic coverage model to predict travel time coverage from several possible fire station sites that District staff identified. After all the testing, the best-fit site was found to be near Winter Gardens Blvd. and Royal Road.

Map #17a – 4-Minute Travel Coverage for All Stations with a Relocated Station #1

With Station #1 relocated to a more central area on the road network, the coverage at the more aggressive 4 minutes touches Station #2's coverage on the north and extends beyond the District limits on the south, well into CSA 115. Due to lack of streets to cross-connect some areas, this site cannot reach some pockets to the west and east.

Map #17b – 5-Minute Travel Coverage for All Stations with a Relocated Station #1

At 5 minutes travel, the relocated Station #1 can cover the entire southwest portion of the District; its coverage touches Stations #2 and #3 and extends to the District's boundaries and all of CSA 115.

Map #17c – 5-Minute Travel Coverage from Only Relocated Station #1

This view shows the relocated Station #1 coverage without the overlap of the other two stations.

Map #17d – 5-Minute Travel Coverage from Relocated Station #1 and Automatic Aid Stations

Finally measured on this map is the 5-minute coverage from all of the District and partner department stations, along with a relocation of Station #1.

Map #18 – ISO Coverage Areas from Only Relocated Station #1

Map **18** measures the 1.5-mile driving distance from the District stations using a relocated Station #1. As can be seen using this measure, the Southwest District and part of CSA 115 is covered while a small gap north of the new station site is opened up due to the non-grid road network being difficult for one site to serve completely.

Finding #9: A relocation of Station #1 to near the intersection of Winter Gardens Blvd. and Royal Road substantially improves coverage at both the 4th and 5th minute of travel and allows 5-minute coverage into all of CSA 115.

SECTION 6—OVERALL DEPLOYMENT EVALUATION RECOMMENDATIONS

SOC ELEMENT 8 OF 8
OVERALL EVALUATION

The Lakeside Fire Protection District serves a very diverse population, set of risks, and land use types in a geographically-challenging area. Population drives emergency service demand and development brings more risks to be protected against fire. Most of the outer District areas with slower response times also have the lowest population densities.

For the foreseeable future, to suppress fires when they occur, the District will need the existing number of stations for both first-due firefighting unit and Effective Response Force (First Alarm) coverage in the most populated areas of the District, consistent with current best practices.

Older Fire Station #1 is no longer in a good response time location and needs to be moved to the south.

Based on our deployment analysis above, Citygate offers these near-term recommendations:

6.1 RECOMMENDED RESPONSE TIME BENCHMARK GOALS

Recommendation #1:	**Adopt Updated Deployment Measures**: The District should adopt updated performance measures for the major types of emergencies to direct fire crew planning and to monitor the operation of the Department. The measures should take into account a realistic company turnout time of 2 minutes and be designed to deliver outcomes that will save patients medically salvageable upon arrival, and to keep small, but serious, fires from becoming greater alarm fires. Citygate recommends these measures be:
1.1	Distribution of Fire Stations: To treat medical patients and control small fires, the first-due unit should arrive within 8 minutes, 90% of the time from the receipt of the 9-1-1 call in the fire dispatch center. This equates to 1 minute call handling time, 2 minutes company turnout time, and 5 minutes travel time in the most populated areas.

1.2 Multiple-Unit Effective Response Force for Serious Emergencies: To confine fires near the room of origin, to stop wildland fires to under three acres when noticed promptly, and to treat up to five medical patients at once, a multiple-unit response of at least 18 personnel should arrive within 11 minutes from the time of 9-1-1 call receipt in fire dispatch, 90% of the time. This equates to 1 minute call handling time, 2 minutes company turnout time, and 8 minutes travel time spacing for multiple units in the most populated areas.

1.3 Hazardous Materials Response: Provide hazardous materials response designed to protect the community from the hazards associated with uncontrolled release of hazardous and toxic materials. The fundamental mission of the Fire Department response is to minimize or halt the release of a hazardous substance so it has minimal impact on the community. This is done by achieving a travel time in urban to suburban areas for the first company capable of investigating a HazMat release at the operations level within 5 minutes travel time, or less than 90% of the time. After size-up and scene evaluation is completed, a determination will be made whether to request additional resources from the District's multi-agency hazardous materials response partnership.

1.4 Technical Rescue: Respond to technical rescue emergencies as efficiently and effectively as possible with enough trained personnel to facilitate a successful rescue. Achieve a travel time for the first company in urban to suburban areas for size-up of the rescue within 5 minutes travel time or less, 90% of the time. Assemble additional resources for technical rescue capable of initiating a rescue within a total response time of 11 minutes, 90% of the time. Safely complete rescue/extrication to ensure delivery of patient to a definitive care facility.

Recommendation #2:	**<u>Fire Station #1 Location</u>**: Station #1 should be relocated as soon as funding allows to the south near Winter Gardens Blvd. and Royal Road.