CENTER FOR PUBLIC SAFETY MANAGEMENT, LLC

FIRE AND EMS OPERATIONAL AND ADMINISTRATIVE ANALYSIS

Petaluma Fire Department

Final Report-November 2022

CPSM®

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THE ASSOCIATION & THE COMPANY

The International City/County Management Association is a 108-year old, nonprofit professional association of local government administrators and managers, with approximately 13,000 members located in 32 countries.

Since its inception in 1914, ICMA has been dedicated to assisting local governments and their managers in providing services to its citizens in an efficient and effective manner. ICMA advances the knowledge of local government best practices with its website (www.icma.org), publications, research, professional development, and membership. The ICMA Center for Public Safety Management (ICMA/CPSM) was launched by ICMA to provide support to local governments in the areas of police, fire, and emergency medical services.

ICMA also represents local governments at the federal level and has been involved in numerous projects with the Department of Justice and the Department of Homeland Security.

In 2014, as part of a restructuring at ICMA, the Center for Public Safety Management (CPSM) was spun out as a separate company. It is now the exclusive provider of public safety technical assistance for ICMA. CPSM provides training and research for the Association's members and represents ICMA in its dealings with the federal government and other public safety professional associations such as CALEA, PERF, IACP, IFCA, IPMA-HR, DOJ, BJA, COPS, NFPA, and others.

The Center for Public Safety Management, LLC, maintains the same team of individuals performing the same level of service as when it was a component of ICMA. CPSM's local government technical assistance experience includes workload and deployment analysis using our unique methodology and subject matter experts to examine department organizational structure and culture, identify workload and staffing needs, and align department operations with industry best practices. We have conducted 400 such studies in 46 states and provinces and 300 communities ranging in population from 8,000 (Boone, Iowa) to 800,000 (Indianapolis, Ind.).

Thomas Wieczorek is the Director of the Center for Public Safety Management. Leonard Matarese serves as the Director of Research & Program Development. Dr. Dov Chelst is the Director of Quantitative Analysis.

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SECTION 1. INTRODUCTION

The Center for Public Safety Management LLC (CPSM) contracted with the City of Petaluma to complete an analysis of the city's Fire Department.

The service demands and challenges generated by the community are numerous for the department and include Advanced Life Support (ALS) EMS first response and ground transport, fire, technical rescue, hazardous materials, vertical density challenges, and transportation emergencies to include vehicle traffic, a mass transit system utilizing bus transportation and commuter rail, and other non-emergency responses typical of urban and suburban fire departments.

A significant component of this report is the completion of an All-Hazards Risk Assessment of the Community. The All-Hazards Risk Assessment of the Community contemplates many factors that cause, create, facilitate, extend, and enhance risk in and to a community. The All-Hazards Risk Assessment of the Community is an important component of this report as it links directly to staffing and deploying fire and EMS assets in the community.

The response time and staffing components discussion of this report are designed to examine the current level of service provided by PFD compared to national best practices. As well, these components provide incident data and relevant information to be utilized for future planning and self-review of service levels for continued improvement which is designed to meet community expectations and mitigate emergencies effectively and efficiently.

Other significant components of this report are an analysis of the current deployment of resources and the performance of these resources in terms of response times and the PFD fire management zones; a comprehensive review of the current ISO Public Protection Classification report; current staffing levels and patterns; department resiliency (ability to handle more than one incident); critical tasking elements for specific incident responses and assembling an effective response force; fire prevention and training; and the EMS ground transport system that includes an expanded EMS district external to city boundaries.

Based upon CPSM's detailed assessment of the PFD, it is our conclusion that the department, overall, provides quality EMS and fire services. The PFD staff are professional and dedicated to the mission of the department, were transparent during our discussions, and were quite focused on creating a positive future for the agency.

The comprehensive risk assessment and review of deployable assets which are critical aspects of a fire and EMS department's operation will first assist the PFD in quantifying the risks that it faces. Second, the PFD will be better equipped to determine if the current response resources are sufficiently staffed, equipped, trained, and positioned. The factors that drive the service needs are examined and then link directly to discussions regarding the assembling of an effective response force and when contemplating the response capabilities needed to adequately address the existing risks, which encompasses the component of critical tasking.

This report also contains a series of observations and planning objectives and recommendations provided by CPSM which are intended to help the PFD deliver services more efficiently and effectively. Recommendations and considerations for continuous improvement of services are presented here. CPSM recognizes there may be recommendations and considerations offered that first must be budgeted and/or bargained, or for which processes must be developed prior to implementation.

RECOMMENDATIONS

Community Risk Reduction

(See pp. 13-16.)

1. CPSM recommends the PFD address Community Risk Reduction staffing and adjust staffing to ensure current (and future) inspectable properties are receiving annualized (where required) inspections, and those not requiring annualized inspections receive timely inspections in accordance with applicable laws and standards, and as established by the Fire Marshal. Addressing this deficiency in Community Risk Reduction will require additional staffing to the extent possible with available funding.

Education and Training

(See pp. 16-20.)

2. CPSM recommends that due to the importance of training as outlined herein, the city consider funding a training officer at the Captain level to develop, coordinate, manage, and deliver consistent training and education programs for new hires and incumbent personnel of the PFD. This position will have primary responsibility to ensure PFD staff are proficiently trained to perform assigned tasks, maintain state and national standards, and that required certifications and annual coursework are current and properly documented.

ISO-PPC Rating

(See pp. 20-24.)

3. CPSM recommends the PFD review and address, to the extent possible, deficiencies in the current ISO Public Protection Classification report as outlined in this analysis. This includes, given the identified building risks in the city, ensuring company personnel conduct (and document for future ISO reviews) some level of commercial, industrial, institutional, and other similar type buildings (all buildings except one- to four-family dwellings) familiarization and pre-plan information gathering; developing an officer training program targeted at ensuring officers have opportunities for the various levels of officer certification and that they receive structured annualized officer training; working with Petaluma Water Service and Utility to ensure the fire hydrants are inspected and flow-tested on a more regular basis; and addressing public life safety education deficiencies through enhanced and sustainable programs.

Facilities

(See pp. 24-34.)

4. CPSM recommends the city, to the extent possible, and because PFD Stations 2 and 3 lack the personnel safety, hygiene, gender separation, storage, ergonomics, and infrastructure that contemporary fire facilities include, develop a funding plan to renovate Stations 2 and 3 over the course of a three- to five-year capital improvement planning period. CPSM does not recommend the two stations be renovated at the same time as each renovation will create some level of crew and/or apparatus displacement, which may not be workable or organizationally healthy if crews are displaced at the same time.

5. CPSM further recommends the city conduct two analyses for Station 1. The first analysis should include a feasibility cost analysis of a seismic renovation and a facility renovation that maintains fire administration, the current operational deployment assets, and the housing of the ladder truck.

   The second analysis should include a feasibility costs analysis of a seismic renovation and a facility renovation that maintains fire administration and creates space for the department logistics center at Station 1. This analysis should also include an analysis of the 307 Petaluma

Blvd. South parcel to include a facility scope and analysis of the site by an architectural firm to ensure the operational footprint, to include the PFD ladder truck can be met. If this site can accommodate the operational footprint for the PFD, CPSM recommends the city also conduct a costs analysis for the construction of a new Station 1. CPSM further recommends a midtown site be evaluated for a potential new fire station. A midtown site would be preferable for the ladder truck for cross town deployments, proximity to the freeway, Lakeville corridor with many mid-rise commercial and residential buildings, and the downtown area with its many multi-story buildings.

Fleet

(See pp. 34-37.)

6. CPSM recommends the PFD continue, to the extent possible and based on available funding, to maintain the current fleet replacement plan as outlined herein, which meets industry standards. The city should also implement a rolling 10-year capital replacement plan to assure adequate lead time to take delivery of fire apparatus and ambulances as current fleet approach recommended lifespan.

   CPSM further recommends:

   - The PFD maintain fleet and equipment components that are either fixed or portable and that require annual testing in accordance with manufacturer and industry specifications and standards and maintain proper records at the department and with the vendor.
   - The PFD explore external fleet maintenance solutions such as an external vendor specific to emergency apparatus (engine, ladder, ambulance apparatus) and which includes Emergency Vehicle Technician (EVT) certified staff and 24-hour service. CPSM also recommends the PFD explore funding for a fleet manager, who could also serve as a logistics manager who would be responsible for all PFD fleet, fleet maintenance, the fleet replacement program, as well as the logistical function and supply-chain management of the department.
   - As the city has wildland/urban interface and substantial wildland fire hazard areas within proximity to the city, CPSM recommends the PFD explore additional wildland apparatus resources such as a Type 3 or an additional Type 6 apparatus. A Type 3 brush/wildland engine is built on a commercial chassis designed for rugged terrain, typically has a water tank of 500 gallons, fire pump, bumper and top mounted fire nozzles, and assorted hose and hand tools.

Staffing and Deployment

(See pp. 67-79.)

7. CPSM recommends the PFD, to the extent possible and if practical depending on available automatic and mutual aid resources, work with regional Fire Chiefs to increase response resources to strip mall/commercial, apartment, and high-rise fire responses that align more closely with the NFPA 1710 standard.

8. CPSM further recommends that due to factors listed here, and to increase PFD resources to be able to assemble an Effective Response Force, the City of Petaluma develop a one to three-year funding plan to increase staffing and apparatus response by adding three personnel per day to Fire Station 2, thus providing full-time staffing of the Engine and Ladder Companies (maintain 4-person staffing on the ladder) and deploying both units from this station (for a total of seven personnel). CPSM further recommends that if Station 4 is constructed in midtown or if Station 1 is relocated to 307 Petaluma Blvd. South, the ladder

truck with staffing (four personnel/shift) be re-located to either one of these locations, whichever is constructed first, and the three person engine remain at Fire Station 2.

EMS Operations and Deployment

(See pp. 89-110.)

9. PFD should eliminate the 48-hour shift pattern for personnel assigned to primary ambulance duty, or at the very least, rotate personnel off ambulance assignment during a 48-hour shift to allow for adequate time for rest and recovery.
10. PFD and the other agencies that are part of the REDCOM JPA should work with the leadership at REDCOM and Sonoma County to take full clinical and safety advantage of using the Medical Priority Dispatch System (MPDS) system for EMS response prioritization, mode of response, and clinical level of response.
11. PFD leadership should evaluate the total fire and EMS emergency response system staffing value of PFD ambulances being dispatched on calls which are not primary medical responses, thereby enhancing the availability of ambulances for response to medical calls.
12. PFD should collaborate with its Medical Director and the LEMSA to develop and publish clinical dashboards to evaluate and improve key clinical measures for PFD. If these metrics are not able to be developed and published by the current clinical quality improvement processes available through the LEMSA, PFD should consider adding a quality improvement position to focus on quality improvement, including continuing medical education based on quality improvement findings.
13. The clinical leadership of PFD should conduct an analysis of ambulance on-scene times to determine if they feel this average on-scene duration of 11 minutes is consistent with EMS clinical protocol expectations.
14. To enhance efficiency and cost effectiveness of ambulance deployment, and due to financial losses derived for ambulance operations, the community and PFD should consider other options for ambulance service delivery such as single-role paramedics (paramedic-certified only) in lieu of dual role (fire and paramedic certified) personnel to reduce associated staffing and benefit costs for the dual role position on 1 to 2 or all ALS ambulances; the conversion of one ALS ambulance to a light duty Squad capable of EMS response to low-acuity EMS and fire incidents, as well as higher acuity fire response to bolster the Effective Response Force. Coupled with the Squad concept, elimination of the BLS transport unit, or a more effective approach of adjusting the hours of the BLS unit that matches higher demand times. *It is noted here that on a national level, private EMS agencies as well as local governments have greater success recruiting Emergency Medical Technician (EMT) certified staff than advanced EMT and/or Paramedic staff.*
15. PFD should initiate a process review to try and shorten the 90th percentile activation time for ambulance responses, such as by using a 'pre-alert' process to notify ambulance units of incoming calls in their district even before a final determination regarding the type or severity of the medical response.
16. PFD should expand their participation in the existing Specialized Assistance for Everyone (SAFE) program, a specialized response unit for behavioral health emergencies and work with its Medical Director, LEMSA, and the Coastal Valleys EMS Agency (CVEMSA) to determine additional roles that an expanded MIH/CP program could play in working with high utilizers and other patients within Petaluma who would benefit from this type of service model.

17. PFD should immediately initiate a process to replace at least two ambulances, with another two replaced within the next 18 months.
18. PFD should consider and implement a process to independently evaluate and publish patient experience scores as a key metric in evaluating overall service delivery quality.

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SECTION 2. ANALYSIS METHODOLOGY

Data Analysis

The CPSM Fire and EMS Team used numerous sources of data to support our conclusions and recommendations for the Petaluma Fire Department. Information was obtained from the ISO and Architects MA reports to the city, along with numerous sources of internal information garnered from a CPSM document/information request. Internal sources included data from the computer-aided dispatch (CAD) system for response time and workload information, and the department's National Incident Reporting System (NFIRS) records management system for calls for service.

Interviews

This study relied extensively on intensive interviews and interaction with city staff and department personnel. On-site and in-person interviews to include virtual meetings were conducted with all senior fire department staff regarding the administration and operations of the department.

Document Review

CPSM Fire and EMS Team consultants were furnished with numerous reports and summary documents by the Petaluma Fire Department. Information on department planning; staffing and deployment of resources; EMS ground transport; mutual and automatic aid; policies and procedures; community risk, fire code enforcement, public education; investigation records; fleet and facilities; training; and additional performance information were reviewed by fire project team staff. Follow-up phone calls, emails and virtual meetings were used to clarify information as needed.

Operational/Administrative Observations

Over the course of the evaluation period, numerous observations were conducted. These included observations of fire and EMS operations; community risk reduction; fleet schedules and overall facility usefulness in a contemporary fire department; administrative functions; deployment of apparatus from a coverage perspective as benchmarked against national standards; and operational staffing benchmarked against national standards as it relates to assembling an effective response force. The CPSM Fire and EMS Team engaged all facets of department operations from a ground floor perspective and as well from a management perspective.

Staffing Analysis

In virtually all CPSM Fire and EMS studies, we are asked to identify appropriate staffing and resource deployment levels. This is the case in this study as well. In this report we discuss operational workload; critical tasking; assembling an effective response force; operational deployment, station locations and the feasibility of relocating deployable assets to improve response coverage; and other factors to be considered in establishing appropriate staffing levels. Staffing recommendations are based upon our comprehensive evaluation of all relevant factors and are benchmarked against national standards such as the National Fire Protection Association (NFPA) 1710 Standard, ISO Public Protection Classification rating system, and the Center for Public Safety Excellence, Standards of Cover.

SECTION 3. AGENCY REVIEW AND CHARACTERISTICS

CITY OF PETALUMA

The City of Petaluma is located in southwest Sonoma County, Calif. The city covers 14.5 square miles, with only a small percentage of this being water (Petaluma River and tributaries). Petaluma is not contiguous to other cities in the county, only unincorporated communities of Sonoma County.

FIGURE 3-1: City of Petaluma

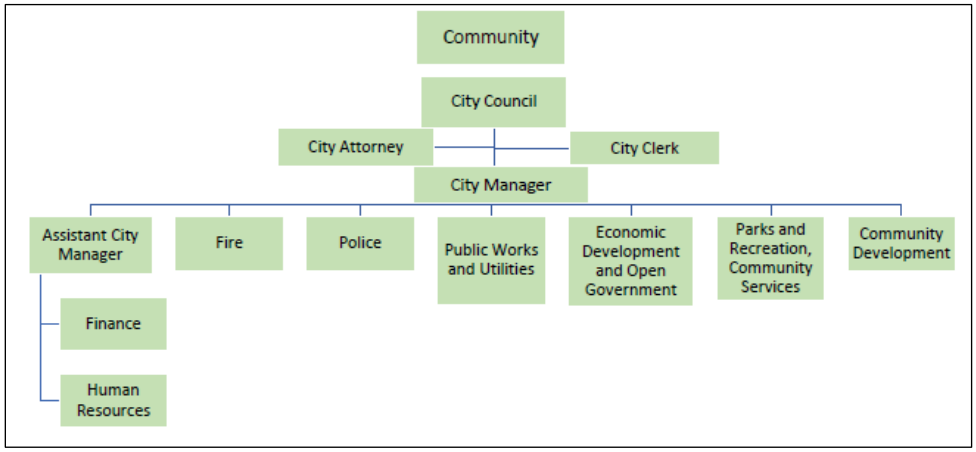
The city operates under the council-manager form of government. The City Council is the governing body of the municipality, and the City Manager is the administrative head of the municipal government and is responsible for the efficient administration of departments.[1]

Pursuant to Section 24 of the City Charter, the City Manager, with the consent of a majority of the council, appoints certain city officials to include the Fire Chief, who is a direct report to the City Manager.

The following figure illustrates the organizational chart of the city and where the fire department fits.

1. City of Petaluma, City Charter

FIGURE 3-2: City of Petaluma Organizational Chart



PETALUMA FIRE DEPARTMENT

The Petaluma Fire Department (PFD) is a career fire department that employs full-time administrative, community risk reduction, emergency management, support staff, and operational level officers and firefighters. When fully staffed, the PFD deploys three engine companies, one cross-staffed truck company, three advanced life support (ALS) emergency medical services (EMS) ground transport units, and one basic life support (BLS) EMS ground transport unit (40 hours/week). The PFD operational units operate on a 48/96 work schedule (48 hours on duty, then 96 hours off duty). There are three operational shifts or platoons (A, B, C shifts).

The PFD is led by a Fire Chief who has overall responsibility for the management and leadership of the department. The Fire Chief is assisted by one Assistant Fire Chief, a Fire Marshal, program managers, and civilian support staff.

The Assistant Fire Chief manages the three operational shifts as described above. This includes all operational components and staffing. Each of the three operational shift Battalion Chiefs report directly to the Assistant Fire Chief and have assigned ancillary duties in addition to their shift operational and administrative duties. The ancillary duties include community activities, technology, health and safety, support services such as fleet, facilities and equipment, emergency operations, and training.

The Fire Marshal is responsible for all fire prevention and technical services linked to community risk reduction and includes fire prevention code enforcement, fire, and life safety elements of building plans review, and hazardous materials-CUPA (Certified Unified Program Agency) program element permitting, inspection, and enforcement. The Fire Marshal is assisted by an Assistant Fire Marshal, code inspectors, and shift personnel (four) with origin and cause of fires.

The disaster preparedness and emergency management functions also operate under the fire department. The city has a comprehensive educational program regarding disaster preparedness. This includes the PFD-organized and managed Citizens Organized to Prepare for Emergencies (COPE) program, which takes a neighborhood approach to disaster and emergency preparedness. Other important components of the emergency management function include the know-your-zone evacuation planning (fire, flood, earthquake, power outage), community disaster planning information, and an emergency alert program that utilizes

various media such as smart phones to alert citizens when an emergency is imminent or occurring.

The key elements of the PFD include:

- Fire protective services.
- EMS first-tier response (ALS level) and ground transport at the ALS and BLS levels.
- Fire prevention, fire code enforcement, CUPA program management, and fire protection plans review.
- Fire cause and origin investigation.
- Emergency management operations and preparation.
- Technical rescue response and mitigation.
- Hazardous materials response and mitigation (leak and spill/operations response).
- Community outreach (COPE).
- Employee training and education.
- Fleet, facility, and logistical support and management.
- Special event support.

The next figure illustrates the PFD organizational chart.

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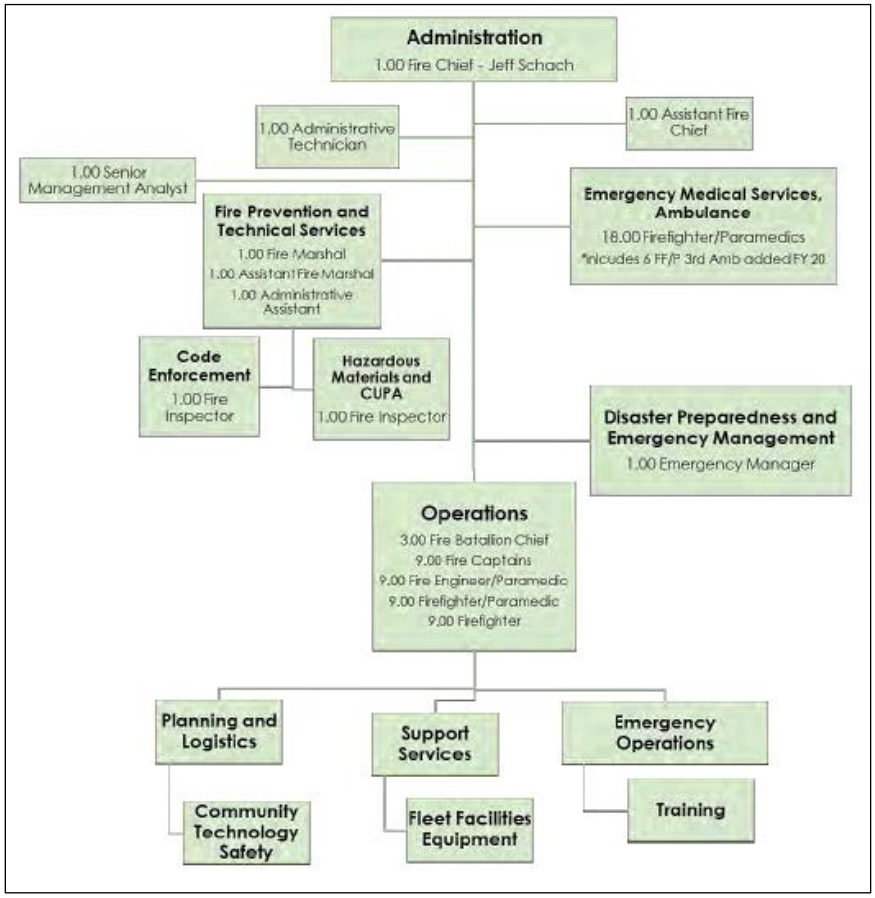
FIGURE 3-3: Petaluma Fire Department Organizational Chart



Fire and EMS operations are deployed from three fire stations located in the northwest, central west, and central east areas of the city. Fire and EMS operations are commanded by the Assistant Fire Chief. The division delivers field operations and emergency response services through a clearly defined division of labor that includes a middle manager (Battalion Chief), first-line operational supervisors (Captains), Engineers (apparatus driver/operators), and firefighters and firefighter/paramedics. The entire city is considered a single operational battalion and is commanded each day by the Battalion Chief who acts as the overall day-to-day shift commander managing daily shift scheduling, on-duty crews, employee relations, assigned administrative and logistical duties, and who serves as an incident commander on those incidents to which they respond.

The next figure illustrates the municipal boundaries, station locations, and primary assigned first-line response apparatus.

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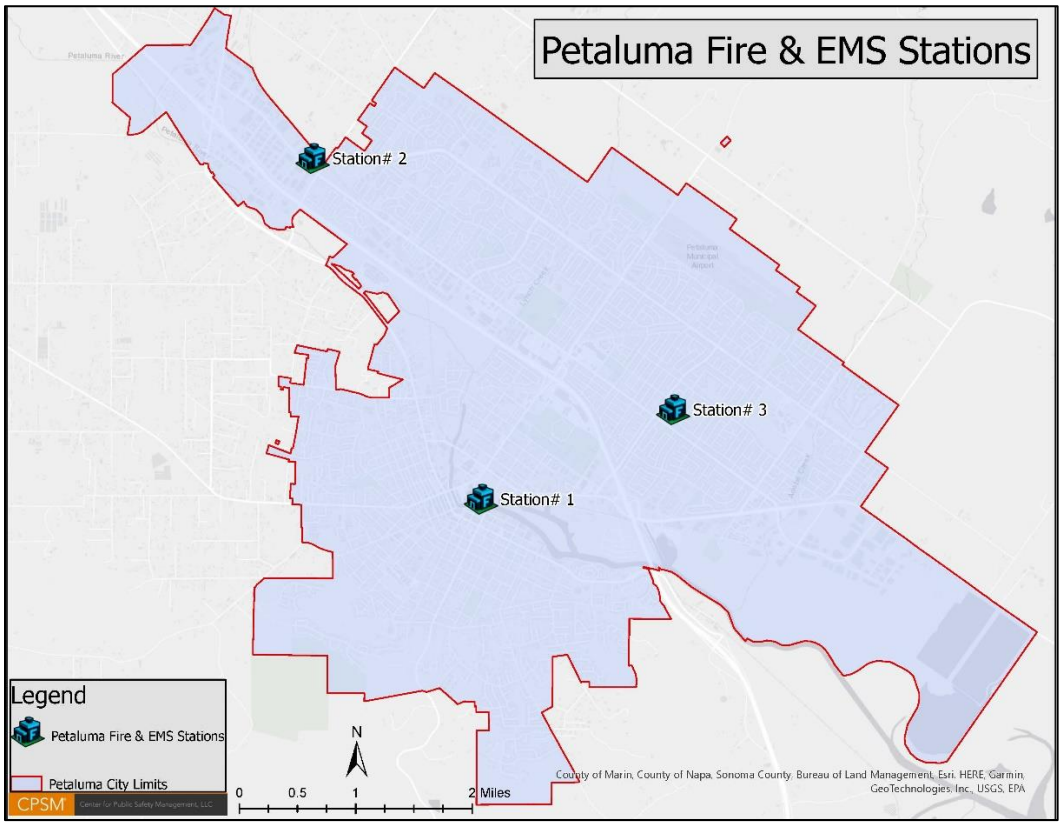
FIGURE 3-4: Petaluma Municipal Boundaries and PFD Stations



Station 1 (9301)

Battalion 9
1 staffing

Engine 9381
3 staffing

Medic 991
2 staffing

BLS 994
2 Staffing
10 hours day

Station 2 (9302)

Engine 9382
4 staffing

Truck 9351
Cross-Staff w/Engine

Medic 992
2 staffing

Station 3 (9303)

Engine 9383
3 staffing

Medic 993
2 staffing

17 Total Staffing 24/7/365

19 Total Staffing when BLS Ambulance Staffed

In addition to the frontline fire appratus, the PFD also has available to respond with on-duty crews the following response units:

- 1 State OES Type 1 Engine.
- 1 Type 6 Engine (for brush/wildland fire response).
- 1 boat for water emergency response and non-emergency water responses
- 1 technical rescue response trailer.
- 2 haz-mat response trailers.

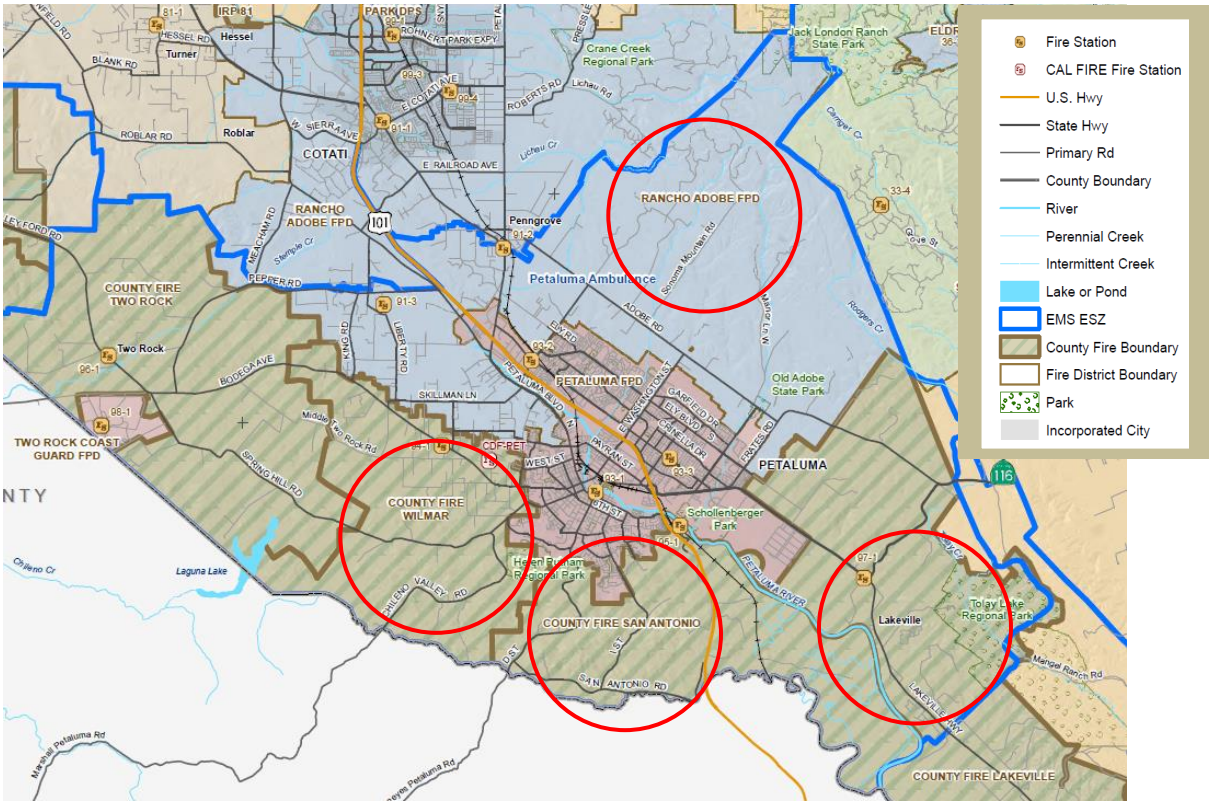
Automatic and Mutual Aid

The primary purpose of automatic and mutual aid is the response of primary units to calls for service they may be closer to, and multicompany response incidents regardless of jurisdiction, where another jurisdiction may be closer by location, and to supplement an initial alarm assignment, particularly to multi-unit responses, to ensure an effective response force is assembled to mitigate the incident. Petaluma has agreements for automatic and mutual aid with agencies as shown in the following table.

TABLE 3-1: Petaluma Automatic and Mutual Aid Agreements

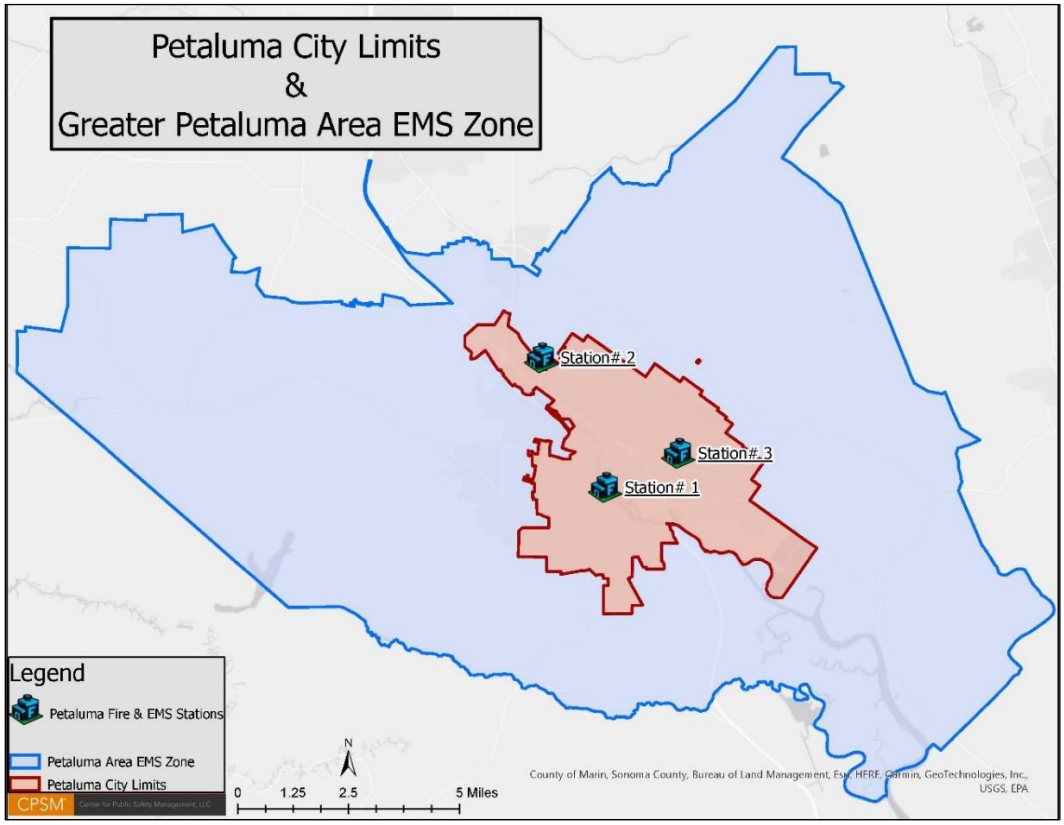
Agency	Agreement Date	Agreement Components
State of California	October 2022	Reciprocal Automatic Aid with County Service Area #40: Wilmar, San Antonio, Lakeville Volunteer Fire Districts.
State of California of Forestry and Fire Protection	July 2004	Establish operating procedures, define financial responsibilities, and ensure an automatic commitment of sufficient firefighting resources in the Petaluma Area Mutual Threat Zone (PAMTZ) for life and structure, and wildland fire perimeter control.
Rancho Adobe Fire Protection District	July 2002	Reciprocal Automatic Aid utilizing pre-determined response matrix. Automatic response based on availability of home department's resource availability.

FIGURE 3-5: Automatic Aid Districts and Stations



The PFD also has an expanded EMS district to which it provides EMS ground transport, as illustrtaed in the following figure. The expanded district lies outside of the municipal boundaries.

FIGURE 3-6: Expanded PFD EMS District



Automatic/mutual aid workload is described in the next two tables.

TABLE 3-2: Medical Response Calls by Type and District

District		Number of Calls				Percent Calls
		EMS	Fire	Canceled	Total	
Petaluma EMS	Inside Petaluma	4,079	638	343	5,060	79.8
	Outside Petaluma	557	44	119	720	11.4
	Total	**4,636**	**682**	**462**	**5,780**	**91.2**
Bells EMS		0	0	3	3	0.0
Bodega Bay EMS		0	0	1	1	0.0
Closest ALS		22	2	14	38	0.6
Sonoma Life Support		191	11	285	487	7.7
Sonoma Valley FRA		10	0	17	27	0.4
Verihealth South		1	0	0	1	0.0
Total		**4,860**	**695**	**782**	**6,337**	**100.0**

Note: All calls that occurred outside Petaluma EMS are aid given.
The PFD also responded 51 times in Marin County.

TABLE 3-3: Fire Calls by Type and District

District	Number of Calls				Percent Calls
	EMS	Fire	Canceled	Total	
Petaluma FD	3,978	1,426	470	5,874	91.8
Graton FPD	0	0	1	1	0.0
Lakeville VFC	20	5	20	45	0.7
North Sonoma Coast FPD	0	0	1	1	0.0
Rancho Adobe FPD	181	92	99	372	5.8
San Antonio VFC	41	8	22	71	1.1
Santa Rosa FD	1	0	1	2	0.0
Schell-Vista FPD	1	0	0	1	0.0
Sebastopol FD	0	0	2	2	0.0
Sonoma Life Support	0	0	2	2	0.0
Sonoma Valley FRA	0	1	1	2	0.0
Timber Cove FPD	0	0	1	1	0.0
Two Rock VFC	0	5	3	8	0.1
Wilmar VFC	7	3	3	13	0.2
Windsor FPD	0	0	2	2	0.0
XSN Team	0	2	1	3	0.0
Total	**4,229**	**1,542**	**629**	**6,400**	**100.0**

Note: All calls that occurred outside Petaluma FD's district are aid given.

Community Risk Reduction Programs

Community Risk Reduction activities are important undertakings of a modern-day fire department. A comprehensive fire protection system in every jurisdiction should include, at a minimum, the key functions of fire prevention, code enforcement, inspections, and public education. Preventing fires before they occur, and limiting the impact of those that do, should be priority objectives of every fire department. Fire investigation is a mission-important function of fire departments, as this function serves to determine how a fire started and why the fire behaved the way it did, providing information that plays a significant role in future fire prevention efforts. Educating the public about fire safety and teaching them appropriate behaviors on how to react should they be confronted with a fire is also an important life safety responsibility of the fire department.

Fire suppression and response, although necessary to protect property, have negligible impact on preventing fire. Rather, it is public fire education, fire prevention, and built-in fire protection systems that are essential elements in protecting citizens from death and injury due to fire, smoke inhalation, and carbon monoxide poisoning. The fire prevention mission is of utmost importance, as it is the only area of service delivery that dedicates 100 percent of its effort to the reduction of the incidence of fire.

Fire prevention should be approached in a systematic manner, and many community stakeholders have a personal stake and/or responsibility in these endeavors. It has been estimated that a significant percentage of all the requirements found in building/construction and related codes are related in some way to fire protection and safety. Various activities such as plan reviews, permits, and inspections are often spread among different departments in the municipal government and are often not coordinated nearly as effectively as they should be.

Every effort should be made to ensure these activities are managed effectively between departments.

The Fire Prevention Division in the PFD is commanded by the Fire Marshal. In addition to the Fire Marshal, the office is staffed with an Assistant Fire Marshal and two Fire Inspectors. Additional staff includes an administrative assistant and a part-time plans review specialist. One Fire Inspector is focused on fire code enforcement and one Fire Inspector is focused on hazardous materials inspections and the Certified Unified Program Agency (CUPA) program element permitting, inspection, and enforcement. Together these four positions administer the fire code inspection program and fire permitting functions, plan review, and weed abatement programs. The office also manages two important professional services agreements that provide services for fire plan review and fire inspection services. A second agreement is for weed abatement. Both contracts are for as-needed services.

At the time of this analysis the City of Petaluma and PFD were utilizing the following fire and building codes:

- California Fire Code 2019 edition, Petaluma Municipal Code.
- California Building Code 2019 edition, Petaluma Municipal Code.
- California Title 24
  - Part 1–California Administrative Code.
  - Part 2–California Building Code.
  - Part 2.5–California Residential Code.
  - Part 3–California Electrical Code.
  - Part 4–California Mechanical Code.
  - Part 5–California Plumbing Code.
  - Part 6–California Energy Code.
  - Part 8 California Historical Building Code.
  - Part 9–California Fire Code.
  - Part 10-California Existing Building Code.
  - Part 11–California Green Building Standards Code.
  - Part 12–California Referenced Standards Code.

There are 1,388 inspectable occupancies in the city. These are broken down as follows:

- Fire Code Program: 196, annual Inspections required.
- CUPA Program: 292 underground storage tanks in this program require annual inspection. All others in this program are triannual. The CUPA program is a state initiative managed by CalEPA and was implemented to protect citizens from hazardous waste and hazardous materials through local regulatory agencies (in this case, the PFD Fire Marshal's Office). The following describes the number of regulated components of this program in the city. The numbers do not equate to an aggregate as facilities and program components overlap.

Additionally, these facilities range from small business to those large businesses that are regulated under state statutes:

- 354 businesses and facilities.
- 338 Hazardous Materials Release Response Plan and Inventory (Business Plan) regulated businesses and facilities.
- 19 regulated underground storage tank facilities (total of 67 regulated underground storage tanks).
- 187 regulated hazardous waste generator facilities.
- 1 hazardous waste facility.
- 5 Resource Conservation and Recovery Act large quantity generator facilities.
- 1 California Accidental Release Prevention Program Facility.
- 25 Regulated Above-ground Petroleum Storage Act facilities.

- Engine Company Program: 650 of 900 properties require annual inspections. All others in this program are scheduled outside of an annualized schedule.

Regarding the Engine Company Inspection Program, a management decision was made two years ago to pause this program. This decision was made largely due to the high numbers of state-mandated inspections included in this program and to avoid potential COVID exposure. These inspections did occur, however. Additionally, these inspections are currently being completed by a consultant inspector as there is not time allocated in the full-time Fire Marshal's Office positions for these inspections. The Fire Marshal is developing a program for pre-fire plans that will be conducted by engine company personnel and which will engage them back with relevant buildings and facilities. According to the Fire Marshal, due to the large number of state-mandated inspections assigned to this program, it is likely these inspections cannot be reassigned to field operations.

For 2019, 2020, and 2021 the Fire Prevention Bureau conducted the inspections shown in the following table.

TABLE 3-4: PFD Completed Fire Inspections, 2019–2021

2019	2020	2021
1,243	203 (COVID)	194 (COVID)

The Fire Prevention Bureau also conducted the following number of fire pre-plans in the fiscal year 2020-2021 cycle.

- Building: 203 reviews.
- Planning: 54 reviews.
- Fire Prevention: 334 permits. These are reviews that are permitted through the Fire Code and go directly to the Fire Marshal, such as sprinkler systems and fire alarm systems.

It should be noted that many plan reviews, particularly those involving fire protection systems, site plan review, and fire department ingress and egress require final fire inspections, which are coordinated and conducted by the Fire Marshal's Office.

Public education is the area where the fire service can make the greatest impact on preventing fires and subsequently reducing the accompanying loss of life, injuries, and property damage through adjusting people's attitudes and behaviors regarding fires and fire safety. The PFD does not have a comprehensive public fire education program due to the current inspection workload; the effort they are able to commit is commendable and results in time and resources well spent. A substantial percentage of all fires, fire deaths, and injuries occur in the home, an area where code enforcement and inspection programs have little to no jurisdiction. The PFD provides the following programs for public education: Citizens Organized to Prepare for Emergencies (COPE); Fire Safety; coordinates Fire Prevention Week; school visits (3rd Grade and 7th Grade [CPR]); station visits for preschoolers.

The investigation of the cause and origin of fires is also an important part of a comprehensive fire prevention system. Determining the cause of fires can help with future prevention efforts. Battalion Chiefs and Captains initiate the fire origin and cause determination process. When possible, they can and should make the origin and cause determination. When needed, particularly when the on-scene officers cannot determine the origin and cause of the fire, or they believe a crime has been committed, there are four shift firefighters trained in cause and origin of fires, and as well the Fire Marshal and Assistant Fire Marshal respond for fire and arson investigation.

For 2019, 2020, and 2021 the PFD staff conducted the following number of fire investigations.

TABLE 3-5: PFD Fire Investigations, 2019–2021

2019	2020	2021
9	7	4

Recommendation:

- CPSM recommends the PFD address Community Risk Reduction staffing and adjust staffing to ensure current (and future) inspectable properties are receiving annualized (where required) inspections, and those not requiring annualized inspections receive timely inspections in accordance with applicable laws and standards, and as established by the Fire Marshal. Addressing this deficiency in Community Risk Reduction will require additional staffing to the extent possible with available funding. (Recommendation No. 1.)

Education and Training Programs

Training is, without question, one of the most essential functions that a fire department should be performing on a regular basis. One could even make a credible argument that training is, in some ways, as important as emergency responses because a department that is not well trained, prepared, and operationally ready will be unable to fulfill its emergency response obligations and mission. Education and training are vital at all levels of fire service operations to ensure that all necessary functions are completed correctly, safely, and effectively. A comprehensive, diverse, and ongoing training program is critical to the fire department's level of success.

An effective fire department training program must cover all the essential elements of that department's core missions and responsibilities. The level of training or education required for a set of tasks varies with the jobs to be performed. The program must include an appropriate combination of technical/classroom training, manipulative or hands-on/practical evolutions, and training assessment to gauge the effectiveness of these efforts. Much of the training, and

particularly the practical, standardized, hands-on training evolutions should be developed based upon the department's own operating procedures and operations while remaining cognizant of widely accepted practices and standards that could be used as a benchmark to judge the department's operations for any number of reasons.

The PFD has a documented training program for incumbent personnel. This includes company level "standards" training and performance evaluations and mandatory annual training. The next table outlines the subjects included in the standards training and performance evolutions and mandatory training. It is noted here that each company standard has multiple training and performance evolution standards.

TABLE 3-6: PFD Company Standards and Performance Evolutions

EMS Standards: 5 standards	Rescue System Standards: 4 standards
Engineer Standards: 20 standards	Truck and RIC Standards: 5 standards
FF Safety and SCBA Standards: 9 standards	Ventilation Standards: 4 standards
Hose Standards: 11 standards	Wildland Standards: 5 standards
Ladder Standards: 11 standards	--

The next table outlines PFD's annualized mandatory training, which covers an array of subjects in EMS, fire protection, water incidents, incident command, tools and equipment, and wild land.

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TABLE 3-7: PFD Company Standards and Performance Evolutions

Discipline	Firefighter	Apparatus Engineer	Captain	Battalion Chief	Staff	Governing Body
CPR/AED	X	X	X	X		
Haz-Mat FRO	X	X	X			OSHA
Confined Space	X	X	X			OSHA
HIPPA	X	X	X	X		
SCBA Fit Test	X	X	X	X		OSHA
SCBA Confidence	X	X	X			Petaluma Fire Dept.
Workplace/Sexual Harassment	X	X	X	X	X	OSHA/City HR
Company Evolutions	X	X	X			Petaluma Fire Dept.
River and Flood Rescue Operations	X	X	X	X		Petaluma Fire Dept.
Rescue Systems (LARRO)	X	X	X			
Ground Ladders	X	X	X			
Aerial Ladder Operations	X	X	X			
Multi-Casualty Incidents	X	X	X	X		Petaluma Fire Dept.
EMS (EMT & Paramedics)	X	X	X	X		Coastal Valley EMS
Auto Extrication Tools	X	X	X			Petaluma Fire Dept.
Highway/Freeway Safety	X	X	X	X		Petaluma Fire Dept.
Ventilation/Power Saws	X	X	X			Petaluma Fire Dept.
Thermal Imaging	X	X	X			Petaluma Fire Dept.
Firefighter Safety/Survival	X	X	X			Petaluma Fire Dept.
Dangerous Occupancy Operations	X	X	X			Petaluma Fire Dept.
Code 3 Driving	X	X	X	X		Petaluma Fire Dept.
Incident Command System (ICS)	X	X	X	X		Petaluma Fire Dept.
RT-130/RT-131 Refresher	X	X	X	X		CICCS
Wildland Task Book (red cards)	X	X	X			CICCS
Chainsaw Use in the Wildland	X	X				Petaluma Fire Dept.
Sonoma Co. Overhead Refresher	X	X	X	X		Sonoma Co. Fire Chiefs

Because so much depends upon the ability of the emergency responder to effectively deal with an emergency, education and training must have a prominent position within an emergency responder's schedule of activities when on duty. Education and training programs also help to create the character of a fire service organization. Agencies that place a real emphasis on their training tend to be more proficient in carrying out day-to-day duties. The prioritization of training also fosters an image of professionalism and instills pride in the organization. Overall, the PFD has an excellent robust and comprehensive training program and there exists a dedicated effort focused on a wide array of training activities as outlined in the tables above.

Training in the PFD occurs at many locations in the city. First, and most importantly, training occurs at each station on each shift. The station Captain leads this training. Fire Apparatus Engineers also lead training, particularly when the training is focused on fire the fire apparatus operations. Firefighters and Battalion Chiefs also participate in and lead certain training at the station level.

Station 2 serves as the center for more involved practical training as this location has a three-story training tower, and cargo containers that serve as training props for various exercises and evolutions. Other props as well are available here, as well as a large concrete training pad.

Rancho Adobe Fire District Station 2 has a burn building and drafting pit that are utilized by the PFD as well. An additional off-site training location is the Petaluma Community Center. This facility has classrooms available for didactic and lecture-style training sessions.

For recruit academies, a 56-hour/week employee is selected to coordinate and lead this training program. The recruit academy lead is assisted by other PFD members during certain practical training segments of the program, as well as on-duty engine companies.

The department hires only certified prospective employees. Candidates for firefighter-paramedic entry level positions must have:

- State Firefighter I certification.
- Current certification as a paramedic through the National Registry or State of California or be currently enrolled and attending an accredited California Paramedic Academy at the time of application. *Certification as a Paramedic as outlined here is required prior to final job offer*.
- Equivalent to graduation from high school, ambulance experience as a paramedic, and experience as a firefighter.
- Valid Class C driver license. *Must obtain a valid California Class C driver license with a Firefighter Endorsement or higher within 36 months of hire.*
- Must pass and maintain physical requirements as specified by the city and be able to wear self-contained breathing apparatus.
- Candidate Physical Agility Test (CPAT) required prior to conditional job offer.

The department also hires firefighters through a lateral program. This program is designed to hire firefighter-paramedics who are already employed at this level, or higher levels (minimum of one year) but are seeking employment opportunities with the PFD. This program hires candidates at Step 3 of the salary range, are provided 48 hours of vacation leave at time of hire, and who will complete a two-week PFD intensive training academy designed to acclimate the new employee with PFD equipment, tools, policies, and guidelines. These candidates have the CPAT requirement waived and must be state-certified as a Firefighter 1, or Firefighter 1 Academy

certified, and must possess current accreditation as a Paramedic in advanced life support, either through the National Registry or State of California.

Recommendation:

- CPSM recommends that due to the importance of training as outlined herein, the city consider funding a training officer at the Captain level to develop, coordinate, manage, and deliver consistent training and education programs for new hires and incumbent personnel of the PFD. This position will have primary responsibility to ensure PFD staff are proficiently trained to perform assigned tasks, maintain state and national standards, and that required certifications and annual coursework are current and properly documented. (Recommendation No. 2.)

ISO-PPC RATING

The ISO is a national, not-for-profit organization that collects and evaluates information from communities across the United States regarding their capabilities to combat building fires. ISO conducts field evaluations in an effort to rate communities and their relative ability to provide fire protection and mitigate fire risk. This evaluation allows ISO to determine and publish the Public Protection Classification (PPC). The data collected from a community is analyzed and applied to ISO's Fire Suppression Rating Schedule (FSRS) from which a Public Protection Classification (PPC) grade is assigned to a community (1 to 10). This is an analysis of the structural fire suppression delivery system in a community.

Class 1 (highest classification/lowest numerical score) represents an exemplary community fire suppression program that includes all of the components outlined below. A Class 10 indicates that the community's fire suppression program does not meet ISO's minimum criteria. It is important to understand the PPC is not just a fire department classification, but a compilation of community services that include the fire department, the emergency communications center, and the community's potable water supply system operator.[2]

A lower PPC score indicates a more favorable rating, which potentially may translate into lower insurance premiums for business owners and homeowners. This lower classification makes the community more attractive from an insurance risk perspective. How the PPC for each community affects business and homeowners can be complicated because each insurance underwriter is free to utilize the information as they deem appropriate. Overall, many factors feed into the compilation of an insurance premium, not just the PPC.

A community's PPC grade depends on:

- **Needed Fire Flows** (building locations used to determine the theoretical amount of water necessary for fire suppression purposes). The Petaluma needed fire flow is 3,500 gallons per minute. This is based on the fifth largest needed fire flow in the city.
- **Emergency Communications** (10 percent of the evaluation).
- **Fire Department** (50 percent of the evaluation).
- **Water Supply** (40 percent of the evaluation).

2. PFD ISO PPC update; Effective August 2020.

The City of Petaluma has an ISO rating of ***Class 02/2X, the second-highest rating achievable***. This rating was updated on August 1, 2020.

The following figures illustrate the PPC ratings across the United States and in California.

FIGURE 3-7: PPC Ratings in the United States[3]

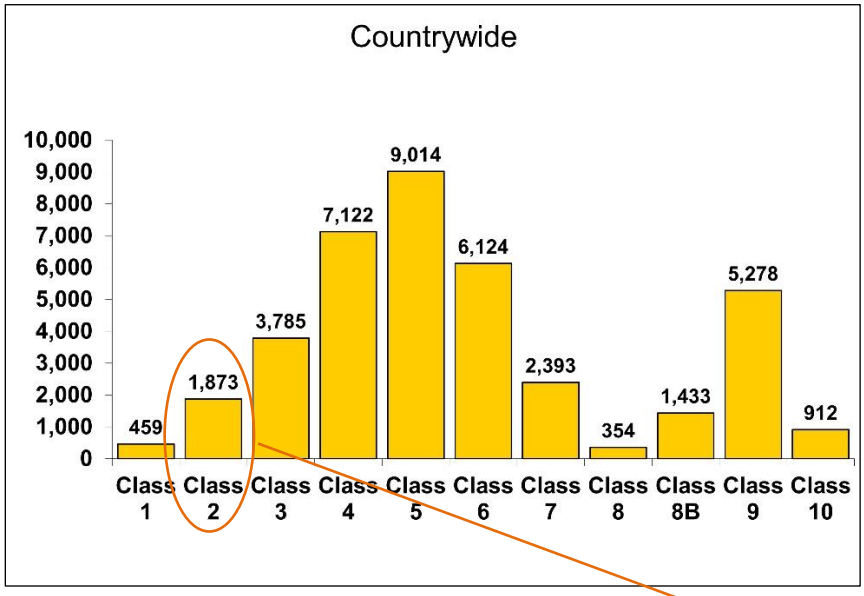
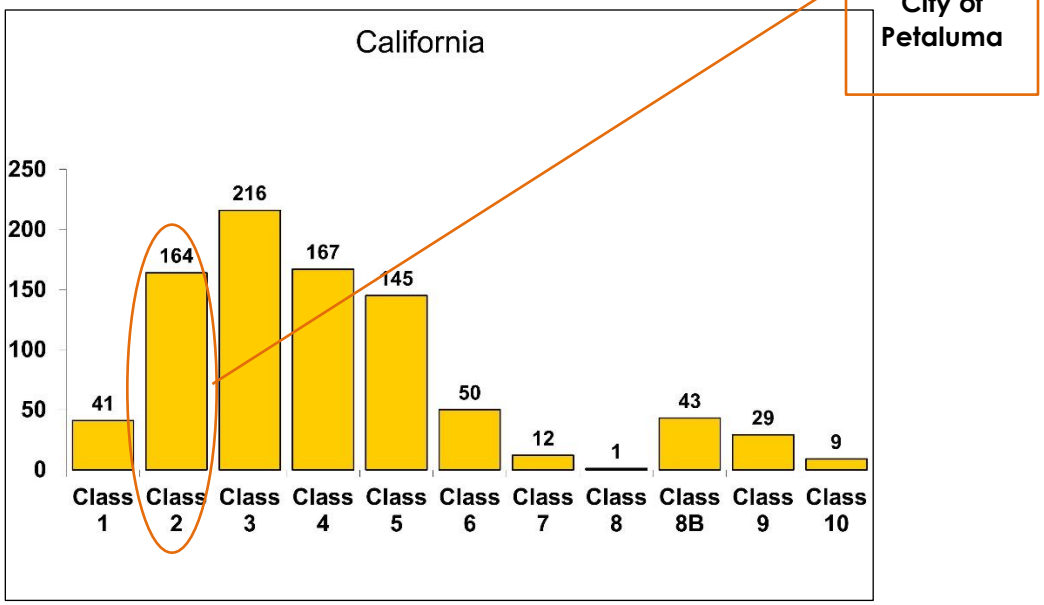


FIGURE XX: PPC Ratings in California[4]



3. https://www.isomitigation.com/ppc/program-works/facts-and-figures-about-ppc-codes-around-the-country/
4. Ibid.

The City of Petaluma's 2020 final rating report included the following credit by category:

- **Emergency Communications**: 9.55 earned credit points/10.00 credit points available.
- **Fire Department**: 38.40 earned credit points/50.00 credit points available.
- **Water Supply:** 36.93 earned credit points/40.00 credit points available.
- **Community Risk Reduction** (Fire Prevention/Inspection, Public Education, and Fire Investigation activities): 4.40 earned credit points/5.50 credit points available.

Overall, the community PPC rating yielded 86.22 earned credit points/105.50 credit points available. There was a -3.10 point diversion reduction assessed as well, which is automatically calculated based on the relative difference between the fire department and water supply scores. **80.00 points or more qualify a community for a rating of 2/2X.**

The next table outlines the scoring for the three Petaluma ISO-FSRS components.

TABLE 3-8: Petaluma ISO Earned Credit Overview

FSRS Component	Earned Credit	Credit Available
414. Credit for Emergency Reporting	2.55	3
422. Credit for Telecommunicators	4.00	4
4.32. Credit for Dispatch Circuits	3.00	3
440. Credit for Emergency Communications	**9.55**	**10**
513. Credit for Engine Companies	6.00	6
523. Credit for Reserve Pumpers	0.50	0.50
532. Credit for Pump Capacity	3.00	3
549. Credit for Ladder Service	2.17	4
553. Credit for Reserve Ladder and Service Trucks	0.19	0.50
561. Credit for Deployment Analysis	7.26	10
571. Credit for Company Personnel	9.32	15
581. Credit for Training	7.96	9
730. Credit for Operational Considerations	2.00	2
590. Credit for Fire Department	**36.62**	**50**
616. Credit for Supply System	30.00	30
621. Credit for Fire Hydrants	2.93	3
631. Credit for Inspection and Flow Testing	4.00	7
640. Credit for Water Supply	**36.93**	**40**
Divergence	**-3.10**	**-**
1050. Community Risk Reduction	**4.44**	**5.50**
Total Credit	**86.22**	**105.50**

Areas of scoring that should be reviewed further internally by the city and the PFD, and which can have the most impact on individual areas evaluated and scored that connect to total section scoring include:[5]

5. Public Protection Classification Summary Report, Petaluma, CA August 2020.

- Deployment analysis: #561 (7.26/10 credits).
  - This category contemplates the percentage of built-upon area that first due engines cover (1.5 miles) and first due ladders cover (2.5 miles).
  - In the Auguct 2020 ISO update letter, and through further clarification, the ISO only recognizes one fire apparatus in service at Station 2 (the crew at Station 2 cross-staffs the ladder and engine). Additionally, the ladder as discussed herein is in the northwest area of the city and away from the primary buildings where an increased fire flow and an elevated aerial device is needed. Overall ladder coverage in the city is deficient based on this benchmark due to its present location (Station 2).
- Training: #581 (B) Classes for Officers (6.00/12 credits).
  - For maximum credit each officer should be certified in accordance with the general criteria of NFPA 1021 standard. In addition to this benchmark, each officer should receive 12 hours of continuing education on- or off-site annually. *The recommendation for a Training Officer links to this deficiency.*
- Training: #581(H) Pre-Fire Planning Inspections (1.20/12 credits).
  - For maximum credit, company members should annually make pre-fire planning inspections of each commercial, industrial, institutional, and other similar type building (all buildings except one- to four-family dwellings). Pre-fire planning inspections are company level walk-throughs of commercial, industrial, institutional, hotels/motels, and larger footprint buildings to become familiar with floor plans, hose connections, means of egress, concentrations of population, hazardous materials storage, and the like. Typically fire departments have templates they fill in while conducting these pre-fire plan inspections that include pertinent owner/occupant information, sketched floor plans, hydrant locations, fire department connections, elevator locations, hazardous storage, or process locations in the building, etc. Another purpose of a pre-fire plan is its use when an actual incident is occurring at the target hazard site or building. In this case the incident commander has at his/her disposal vital information that he/she can reference when making incident decisions. A record of inspections is important as well to gain appropriate credits. *The recommendation for a Training Officer links to this deficiency.*
- Water Supply: #630, #631 Credit for Inspection and Flow Testing (4.00/7.00 credits). The 4.40 credits are for inspection.
  - This item contemplates fire hydrant inspection and testing frequency in the city, and the completeness of the inspections, to include documentation. This score indicates the hydrants have not been inspected or flow tested on a regular basis.
  - There was 0.00 credits for flow testing which indicates there is no record of this activity for at least 10 years.
- Public Safety Education: #1033 (15.00/30 credits).
  - This item contemplates programs for public safety education.

Recommendation:

- CPSM recommends the PFD review and address, to the extent possible, deficiencies in the current ISO Public Protection Classification report as outlined in this analysis. This includes, given the identified building risks in the city, ensuring company personnel conduct (and document

for future ISO reviews) some level of commercial, industrial, institutional, and other similar type buildings (all buildings except one- to four-family dwellings) familiarization and pre-plan information gathering; developing an officer training program targeted at ensuring officers have opportunities for the various levels of officer certification and that they receive structured annualized officer training; working with Petaluma Water Service and Utility to ensure the fire hydrants are inspected and flow-tested on a more regular basis; and addressing public life safety education deficiencies through enhanced and sustainable programs. (Recommendation No. 3.)

FACILITIES

Sound community fire-rescue protection requires the strategic distribution of an adequate number of station facilities to ensure that effective service area coverage is achieved, that predicted response travel times satisfy prevailing community goals and national best practices, and that the facilities are capable of supporting mission-critical personnel and vehicle-oriented requirements and needs.

Fire facilities must be designed and constructed to accommodate both current and forecast trends in fire service vehicle type and manufactured dimensions. A facility must have sufficiently sized bay doors, circulation space between garaged vehicles, and departure and return aprons of adequate length and turn geometry to ensure safe response.

Fire department facilities are exposed to some of the most intense and demanding uses of any public local government facility, as they are occupied 24 hours a day. Personnel-oriented needs in fire facilities must enable performance of daily duties in support of response operations. For personnel, fire facilities must have provisions for vehicle maintenance and repair; storage areas for essential equipment and supplies; and space and amenities for administrative work, training, physical fitness, laundering, meal preparation, and personal hygiene/comfort.

As discussed, the PFD responds from three facilities as outlined in the following table.

TABLE 3-9: Petaluma Fire Facilities

Station Number	Address	Year Built	Square Footage	# of Bays	Crew Size
1	198 D St., Petaluma	1938	7,920	6	6
2	1001 N. McDowell Blvd., Petaluma	1981	4,894	3	6
3	831 S. McDowell Blvd., Petaluma	1971	4,080	2	5

Additional information on all stations is as follows:

- Station 1 utilizes some bay space for storage and physical training space and equipment.
- All Bays at Station 1 are back-in bays.
- All bays at Station 2 are drive-through bays.
- All bays at Station 3 are back-in bays.

- All stations need to be retrofitted for gender separation. There currently are make-shift accommodations for this at each station.
- All stations have issues due to the age of the facilities, space for storage, mechanical system sustainment, and not having infection control and decontamination systems.
- Stations 2 and 3 have external storage areas for structural protective gear. Station 1 has no external area feasible for structural protective gear storage and stores the gear inside the station and adjacent to the living area.
- All stations need seismic retrofitting.
- All stations need adequate and separate areas for physical training and storage of personal protective gear.

The city and PFD had engaged an architectural firm regarding the renovation of Stations 2 and 3. This began in 2012 but was terminated by a former Fire Chief. Additionally, consideration to either renovate or rebuild Station 1 on an alternate site have been discussed. It is clear after our tour of these facilities, and due to their age and lack of contemporary fire facility amenities, the city should seriously plan for the renovation of these facilities. CPSM does not recommend these stations be relocated, as their existing locations serve the respective response districts well.

Included in the prior architectural analysis, the following renovation scheme for each station is as follows:[6]

Station 2

- Fire Station 2 preliminary design retains approximately 2,880 square feet of the three original apparatus bays.
- The remaining fire station footprint is replaced by a two-story building addition.
- All current 2019 California Building Code provisions and requirements still apply to the proposed design. No revision or update to the proposed design shall be required.
- The major planning issue associated with Fire Station 2 is the impact of the FIRM Flood Map. This flood map was in the final stages of adoption during design development. The footprint of Fire Station 2 is within the 500-year flood plain map whereas the balance of the site is within the 100-year flood plain map.
- Preliminary meetings between Civil Engineer Lafranchi and former City Engineer Bates were underway at the time of termination. Both parties had been working on resolving any flood plain map issues that are present.
- Proposed improvements at Fire Station 2 also included a 2,000-gallon above-ground fuel tank (500 gallons unleaded and 1,500 gallons diesel) to provide emergency response access to both police and fire at the north end of the City's UGB.
- Proposed improvements at Fire Station 2 also included a secondary site access directly from Corona Road to relieve congestion at the North McDowell and Corona Road intersection.
- This secondary access would require the design and construction of a bridge across a significant but unnamed drainage channel that parallels Corona Road.

6. Architects MA, Petaluma Fire Station 2 and 3 Project Summary, February 1, 2022

Station 3

- Fire Station 3 preliminary design retains almost all of the existing 4,080 square feet of the fire station including both apparatus bays.
- The existing fire station footprint is expanded in size to include a third apparatus bay. This station will also have a two-story building addition.
- All current 2019 California Building Code provisions and requirements still apply to the proposed design. No revision or update to the proposed design shall be required.
- There are no major planning issues associated with Fire Station 3.
- During the public design review process, it should be expected that neighboring residents will weigh in on the fire station's plans for expansion and remodel.

Consideration when moving forward on fire facility renovation projects should include:

- Personnel-oriented needs in fire facilities must permit performance of daily duties in support of response operations. For personnel, fire facilities must have provisions for vehicle maintenance and repair; storage areas for essential equipment and supplies; space and amenities for administrative work, training, physical fitness, laundering, meal preparation, and personal hygiene/comfort, and—where a fire department is committed to minimize "turnout time"—bunking facilities.
- A fire department facility may serve as a de facto "safe haven" during local community emergencies, and also serve as a likely command center for large-scale, protracted, campaign emergency incidents. Therefore, design details and construction materials and methods should embrace the goal of building a facility that can perform in an uninterrupted manner despite prevailing climatic conditions and/or disruption of utilities. Programmatic details, like the provision of an emergency generator connected to automatic transfer switching, even going as far as providing tertiary redundancy of power supply via a "piggyback" roll-up generator with manual transfer (should the primary generator fail), provide effective safeguards that permit the fire department to function fully during local emergencies when response activity predictably peaks.
- Personnel/occupant safety is a key element of effective station design. This begins with small details like the quality of finish on bay floors and nonslip treads on stairwell steps to decrease tripping/fall hazards, or use of hands-free plumbing fixtures and easily disinfected surfaces/countertops to promote infection control. It continues with installation of specialized equipment such as an exhaust recovery system to capture and remove cancer-causing byproducts of diesel fuel exhaust emissions. A design should thoughtfully incorporate best practices for achieving a safe and hygienic work environment.
- Ergonomic layout and corresponding space adjacencies in a fire station should seek to limit the travel distances between occupied crew areas to the apparatus bays. Likewise, it should carefully consider complementary adjacencies, such as lavatories/showers in proximity of bunk rooms, and desired segregations, like break rooms or fitness areas that are remote from sleeping quarters. Furnishings, fixtures, and equipment selections should provide thoughtful consideration of the around-the-clock occupancy inherit to fire facilities. Durability is essential, given the accelerated wear and life cycle of systems and goods in facilities that are constantly occupied and operational.
- National standards such as NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, outlines standards that transfer to facilities such as infection

control, personnel and equipment decontamination, cancer prevention, storage of protective clothing and employee fitness. NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Firefighting and Proximity Fire Fighting*, further delineates laundering standards for protective clothing and station wear. Laundry areas in fire facilities continue to evolve and are being separated from living areas to reduce contamination. Factors such as wastewater removal and air flow need to be considered in a facility design.

Station 1

Station 1 was not included in the 2012 renovation analysis along with Stations 2 and 3. Thus, no recent architectural or seismic analysis has been completed. The current facility was built in 1938 and is not seismically sound. The administrative offices of the PFD operate out of this facility; however, there is not enough room for the current administrative staff. Due to the lack of sufficient space, the department leases office space (1,000 square feet) in a commercial building adjacent to this station. This station also lacks sufficient apparatus and operational storage space and cannot accommodate the ladder truck, which should be positioned in this station as it is closer to the areas of the city where this apparatus will be most beneficial.

One alternative is to relocate the operational segment of Station 1 into a new facility and renovate the current Station 1 and utilize it as an administrative and logistical facility for the PFD. The city owns a vacant parcel at 307 Petaluma Blvd. South. A facility scope and analysis of the site would have to be conducted by an architectural firm to ensure the operational scope can be met. This is an alternative that should be considered but has two costs—a new fire facility that likely will need four bays (engine, ambulance, ladder, battalion chief) and the renovation (facility and seismic) of the existing facility to be utilized as fire headquarters.

Station 4

The department is having discussions with city administration about the potential for an additional fire facility in the central portion of the city (Fairgrounds property). This discussion includes combining this facility with police administration and operations, and as well a new emergency operations center (EOC), which also is needed. This new facility would essentially become a public safety facility housing fire administration and operational fire units, police administration and operational deployment assets, and a ready-to-go EOC that is equipped and set up to be activated at a moment's notice.

CPSM was advised there is an existing project (in the planning stages) to renovate the current police facility. This renovation is typical of police facility renovations in that current locker rooms need renovation and contemporary gender separation, renovation, and addition of administrative office space due to growth of the agency, training and muster areas need renovation and IT upgrades, as well as special operations, evidence, and community space need modernization and expansion.

Both departments (police and fire) have discussed the possibility of a combined public safety facility and recognize the mutual benefit of having a combined facility that includes a shared EOC. Benefits include enhanced facilitation of planning and collaboration between the two agencies, shared facility administrative space and maintenance costs, and the utility of a single location for police and fire.

Tangible benefits of combining the two agencies in one facility include:[7]

7. Manns Woodward Studios presentation on combined facilities, Baltimore, MD.

- Cost savings in facility cost, site development costs, and utility infrastructure. In Petaluma, the cost of renovating the current police facility, renovating the current PFD Station 1 to use as fire administration, and the construction of a new Station 1 for operations are in totality a costly endeavor. With separate projects there would likely be limited cost savings through economies of scale.
- Land acquisition issues are combined into one facility and one location, not two facilities in two different locations.
- Providing a centralized location for emergency operations optimizes preparedness and provides better services to the community.
- Project management costs are typically more cost effective when compared to separating out the builds.
- Elimination of duplicate spaces.
- Sharing equipment and systems such as security systems, access control, A/V devices, generators, UPS systems, etc. can yield significant project cost savings.
- There would be shared logistical and infrastructure support and costs such as janitorial and janitorial supplies, IT support, utility expenses.

For the PFD, the new facility would become the new headquarters and initially house the ladder truck, Basic Life Support (BLS) ambulance, on-duty shift Battalion Chief, fire administrative staff, the Fire Prevention Bureau, and it would have the capacity for increased operational and administrative staffing/equipment as needed.

Some items to consider should the city decide to move forward with a combined public safety facility include:

- Law enforcement facilities are inherently highly secure facilities for obvious reasons, and need adequate common areas for staff such as locker rooms/showers and break and fitness areas; conference and community rooms; visitor staff and agency vehicle parking; evidence processing and storage area; records processing and storage area; separate square footage for investigations, patrol, and specialty functions etc.; training area; logistics and equipment storage; decontamination room; and sally port/holding cells.
- As with a fire facility, a police facility must be designed and constructed to accommodate current and forecast needs, and as well it must be able to accommodate operation and constant use. This list is not all-inclusive and may differ from agency to agency depending on needs.
- When considering the construction of a combined fire and law enforcement facility, a thorough review of the literature should be conducted to include NFPA standards that reference fire station design (as noted herein) and the International Association of Chiefs of Police, *Police Facility Planning Guidelines* manual as starting points.
- Commonalities of needs between police and fire include such things as training space, fitness and well-being space, decontamination and uniform laundry space, community room space, conference room space, locker room/shower space, visitor parking, and closed, covered parking for equipment and vehicles to name a few. A combined public safety facility can accommodate joint use of these areas.

- Emergency management is central to both agencies' missions and in the case of Petaluma, including an EOC in a combined public safety facility is appropriate and effective.

When siting fire stations for the most efficient response, several factors must be considered. These include the road network the assigned apparatus will use to serve the response district the station is built to serve, which directly ties to response travel time. Travel time is key to understanding how fire and EMS station location influences a community's aggregate response time performance. NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments*, establishes benchmark travel times for first arriving fire units as:

- ≤ 240 seconds for the first arriving engine company to a fire suppression incident 90 percent of the time.
- ≤ 240 seconds for the first arriving engine company with automated external defibrillator (AED) or higher level capability.

Additionally, the ISO-FSRS considers current placement of fire facilities housing engine and ladder companies within 1.5 road miles (engine company) and 2.5 road miles (ladder company) of built-upon areas and other criteria.

The location of responding units is one key factor in response time; reducing response times, which is typically a key performance measure in determining the efficiency of department operations, often depends on this factor. The goal of placement of a single fire station or creating a network of responding fire stations in a single community is to optimize coverage with short travel distances, when possible, while giving special attention to natural and manufactured barriers and response routes that can create response-time problems.[8]

Finally, the current and potential for future demand for service is a consideration for the siting of fire facilities. Demand is the number and types of calls for services provided by the entire fire department. When demand is evaluated, it is important the number of incidents is not confused with the number of unit responses. An emergency call may require the response of more than one unit, but only one incident number is generated. This is a direct accelerator of demand. CPSM measures a call as a single event, which may be handled by a single unit, and a run as a response made by a unit to a call that involves more than one unit.

The next figure outlines the PFD's current stations as benchmarked against the NFPA 1710 standard for initial response to fire and EMS incidents (240 seconds of travel time) and the ISO's 1.5-mile standard for engine coverage and 2.5-mile standard for ladder coverage.

The red circles indicate gaps in the NFPA 1710 travel time standard of 240 seconds, and the orange circles indicate gaps in the ISO-FSRS standard for 1.5-mile engine company coverage and 2.5-mile ladder company coverage to built-upon areas.

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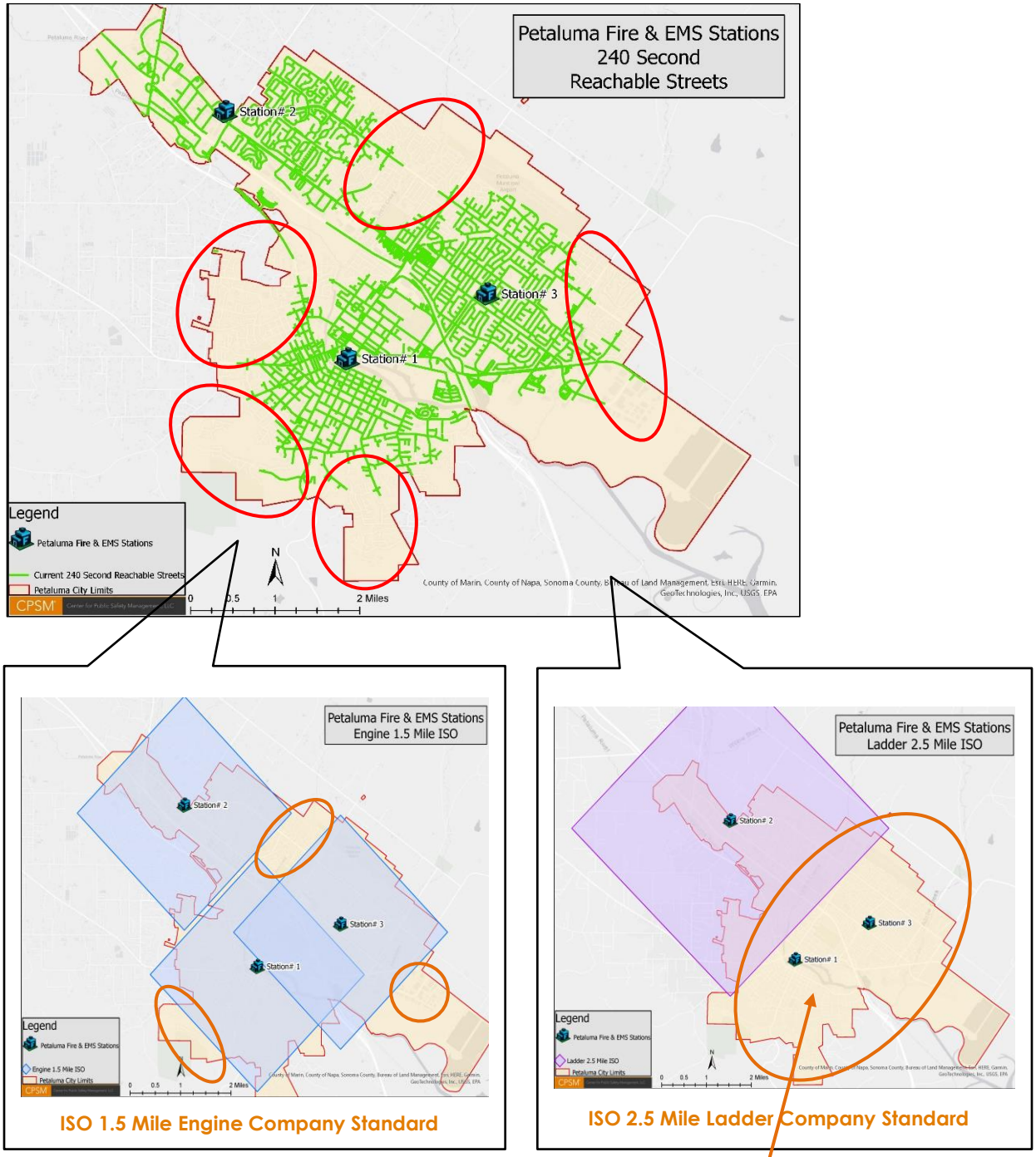
8. NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments*, 2020 Edition.

FIGURE 3-8: PFD Travel Time of 240 Seconds from Stations 1, 2, and 3



ISO 1.5 Mile Engine Company Standard

ISO 2.5 Mile Ladder Company Standard

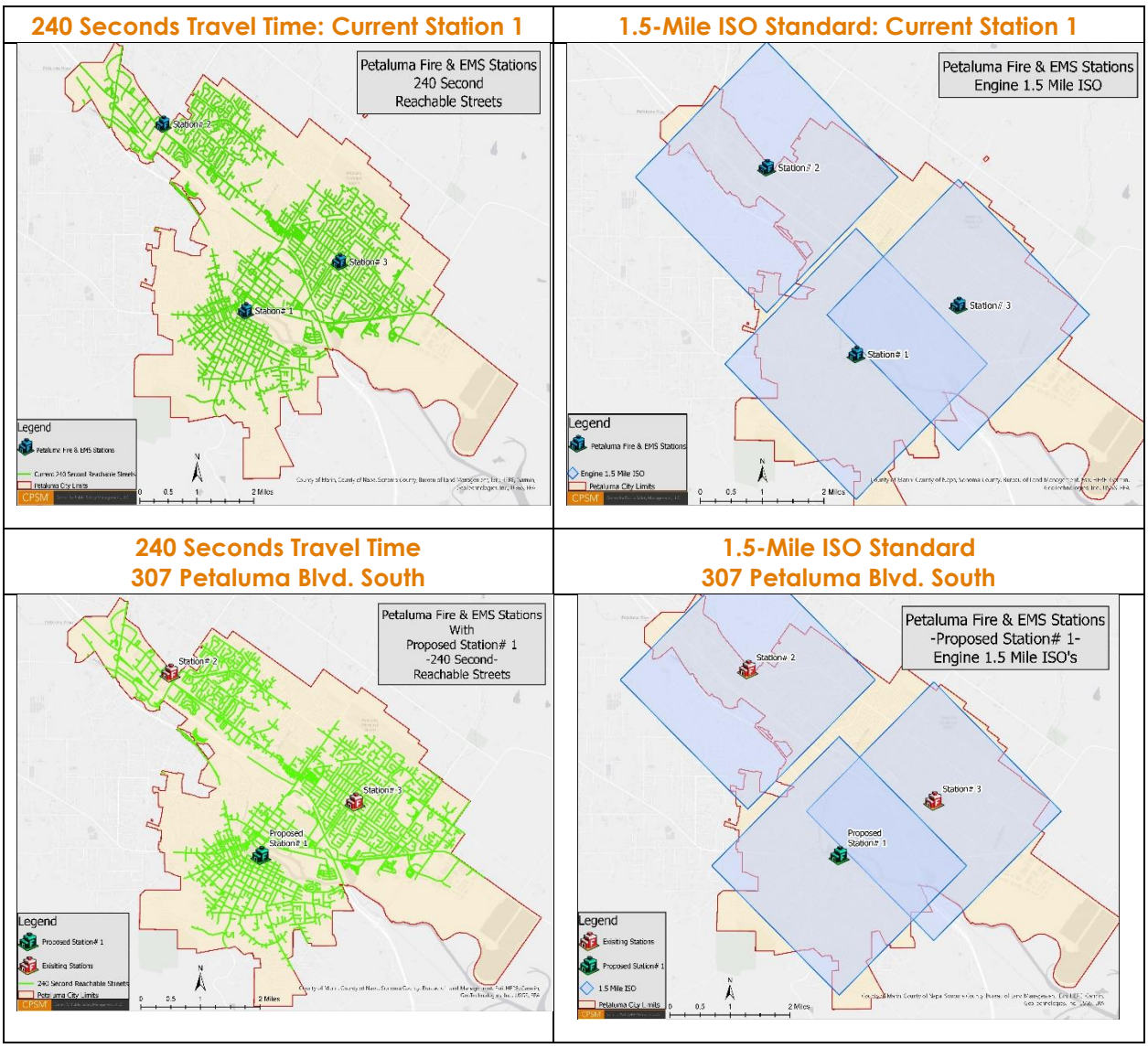
Downtown Area with Multi-Story Occupied Buildings

No Immediate Ladder Coverage

The next figure outlines the PFD's current stations as benchmarked against the NFPA 1710 standard for initial response to fire and EMS incidents (240 seconds travel time) and the ISO

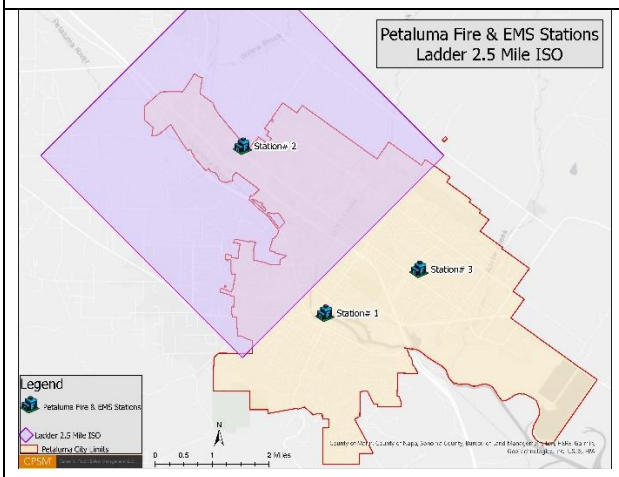
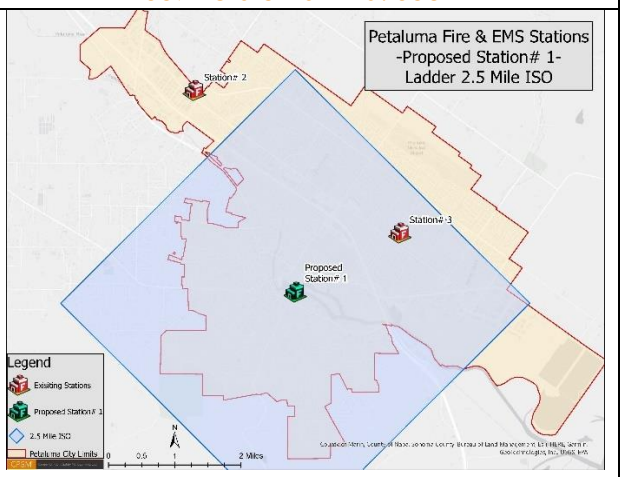
1.5-mile standard for engine and ladder coverage, respectively. This figure also illustrates how these benchmarks compare with Station 1 moved to 307 Petaluma Blvd. South one can see there is little change in engine company service.

FIGURE 3-9: 240 Seconds and ISO 1.5-Mile Benchmarks–Current Stations and Proposed Station 1 Located at 307 Petaluma Blvd. South



The next figure assesses PFD Station 2 as benchmarked against the ISO 2.5-mile standard for ladder coverage. This figure also illustrates how these benchmarks compare with the ladder placed at Station 1 if the station is moved to 307 Petaluma Blvd. South.

FIGURE 3-10: ISO 2.5-Mile Benchmark for Ladder Coverage–Current Station 1 and Proposed Station 1 Located at 307 Petaluma Blvd. South

2.5 Mile ISO Standard: Station 2	2.5 Mile ISO Standard 307 Petaluma Blvd. South
	

While there is little change in coverage in travel time at 240 seconds and the ISO 1.5-mile engine company standard, there is marked improvement in the 2.5-mile ladder company coverage standard, particularly in the Station 1 and 3 response zones where the heaviest fire incident demand is, and where the highest fire flows are required as well as an elevated aerial device.

The next figure outlines the PFD's current stations as benchmarked against the NFPA 1710 standard for initial response to fire and EMS incidents (240 seconds of travel time) and the ISO 1.5-mile standard for engine and ladder coverage, respectively.

An additional comparison involves travel time of 360 seconds, which is the NFPA 1710 standard for the next arriving fire suppression unit. It is likely the ladder at Station 4 would have a first due response area (a 240-seconds standard); however, it is also likely it will be the second arriving fire suppression unit on multi-unit incidents as well and citywide.

This figure also illustrates how these benchmarks compare with a new Station 4 at the fairground's location and locating the current ladder apparatus at this location for centralized response. In this scenario the city will have to contemplate staffing the engine at Station 2 full time.

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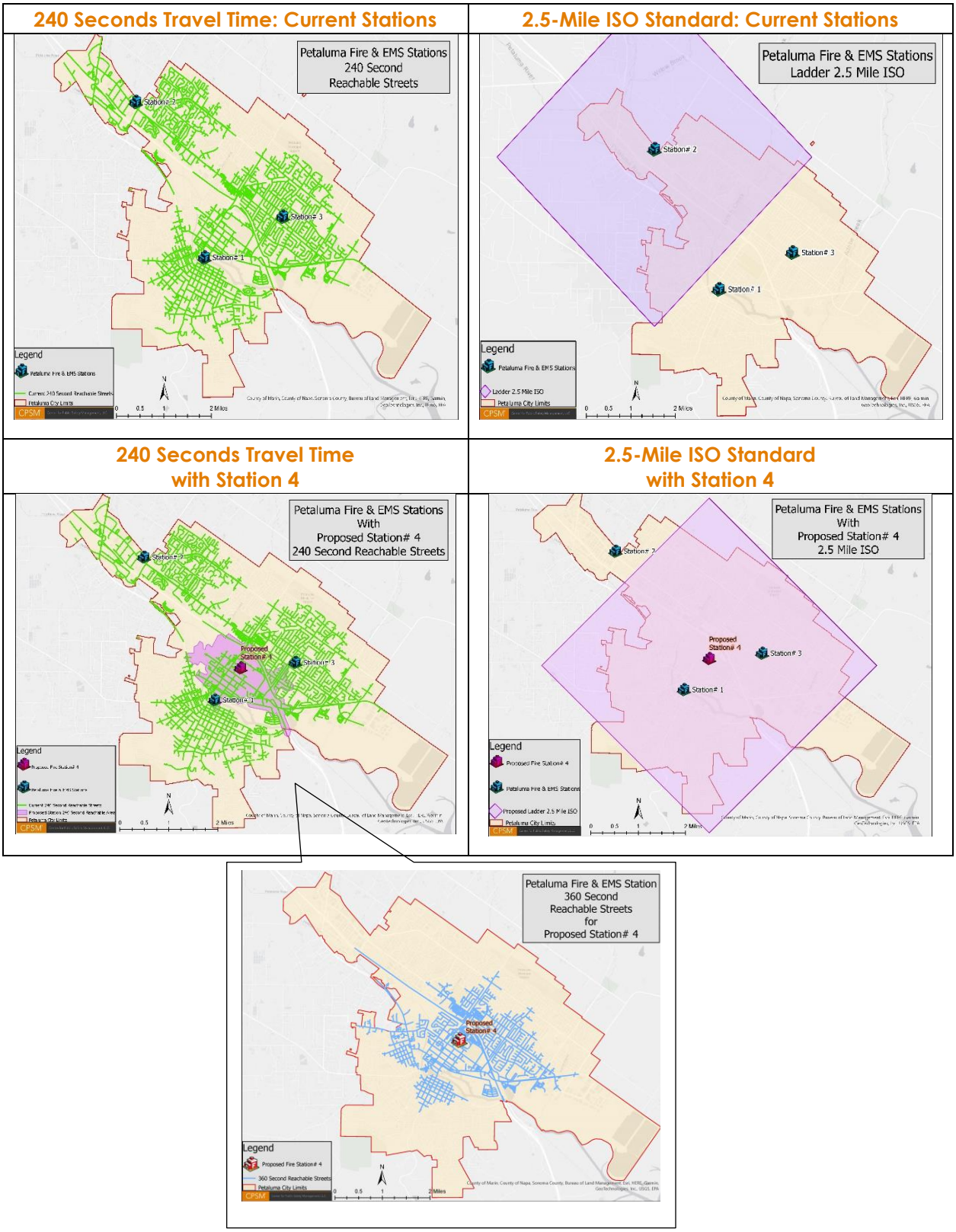
FIGURE 3-11: 240-Seconds and ISO 2.5-Mile Ladder Coverage Benchmarks– Current Stations and Proposed Station 4 at the Fairgrounds Location



These maps tell us there is marked improvement in the 2.5-mile ladder company coverage standard with the PFD ladder placed at a new Station 4, particularly in the Station 1 and 3 response zones where the heaviest fire incident demand is, and where the highest fire flows are required as well as an elevated aerial device.

Recommendations:

- CPSM recommends the city, to the extent possible, and because PFD Stations 2 and 3 lack the personnel safety, hygiene, gender separation, storage, ergonomics, and infrastructure that contemporary fire facilities include, develop a funding plan to renovate Stations 2 and 3 over the course of a three- to five-year capital improvement planning period. CPSM does not recommend the two stations be renovated at the same time as each renovation will create some level of crew and/or apparatus displacement, which may not be workable or organizationally healthy if crews are displaced at the same time. (Recommendation No. 4.)

- CPSM further recommends the city conduct two analyses for Station 1. The first analysis should include a feasibility cost analysis of a seismic renovation and a facility renovation that maintains fire administration and the current operational deployment assets.

  The second analysis should include a feasibility costs analysis of a seismic renovation and a facility renovation that maintains fire administration and creates space for the department logistics center at Station 1. This analysis should also include an analysis of the 307 Petaluma Blvd. South parcel to include a facility scope and analysis of the site by an architectural firm to ensure the operational footprint, to include the PFD ladder truck can be met. If this site can accommodate the operational footprint for the PFD, CPSM recommends the city also conduct a costs analysis for the construction of a new Station 1. CPSM further recommends a midtown site be evaluated for a potential new fire station. A midtown site would be preferable for the ladder truck for cross town deployments, proximity to the freeway, Lakeville corridor with many mid-rise commercial and residential buildings, and the downtown area with its many multi-story buildings. (Recommendation No. 5.)

An alternative to the Station 1 renovation that maintains fire administrative and operational assets at this site, or relocation of Station 1 operational assets to 307 Petaluma Blvd. South and maintaining the current Station 1 as fire headquarters and logistics center after renovation, is the design and build of a public safety center (PFD Station 4) on the Fairgrounds site. Such a facility would house fire administration and programs, a ladder company, the BLS ambulance, and the on-duty Battalion Chief; police administration, programs, and operational assets; and the Emergency Operations Center. CPSM recommends this facility be considered once the Station 1 analyses are completed by an architectural firm and after considering renovation costs for the current police facility.

FLEET

The procurement, maintenance, and eventual replacement of response vehicles is one of the largest expenses incurred in sustaining a community's fire-rescue department. While it is the personnel of the PFD who provide emergency services within the community, the department's fleet of response vehicles is essential to operational success. Modern, reliable vehicles are needed to deliver responders and the equipment/materials they deploy to the scene of dispatched emergencies within the city.

The PFD has a fleet of frontline and reserve heavy fire apparatus and ambulances. Additional fleet includes administrative and light response vehicles, a boat, and various other vehicle and trailers for specialty fire and EMS incidents.

PFD routine apparatus maintenance is performed through a contract with Petaluma Public Schools as the city does not have fire fleet maintenance capabilities. This arrangement does not involve the fire pump or aerial hydraulic system maintenance and repair, nor does it provide fleet management planning. Apparatus-specific work, aerial ladder testing, and annual preventive maintenance and required service is performed by a vendor who specializes in this type of fire apparatus work. This combination of maintenance and repair work is common practice across the country. The intricacies and scope of fire pumps and fire pump controls, aerial ladder hydraulic systems and controls, and apparatus electrical control systems (the main components outside of the motor, chassis, and drive train) are best left in the hands of specialists for diagnosis, maintenance, and repair.

As fleet maintenance, repair, planning, and overall program management is essential in a fire department because of the diverse apparatus, and is managed by a shift Battalion Chief who also has other assigned shift and operational duties, CPSM recommends the PFD explore funding for a fleet manager, who could also serve as a logistics manager who would be responsible for all PFD fleet, fleet maintenance, the fleet replacement program, as well as the logistical function and supply-chain management of the department.

The following table lists PFD frontline heavy apparatus.

TABLE 3-10: PFD Frontline and Reserve Heavy Apparatus

Unit Number	Year of Purchase	Unit Number	Year of Purchase
Fire Frontline		**EMS Frontline**	
Engine 9381 (Type 1)	2018	M991 (M9240)	2016
Engine 9382 (Type 1)	2006	B994 (M9569)	2015
Engine 9383 (Type 1)	2016	M992 (M9961)	2019
Truck 9351 (Type 1)	2018	M993 (M9582)	2018
Engine 9961 (Type 6)	2018	**EMS Reserve**	
Fire Reserve		M995 (M9111)	2013
Engine 9384 (Type 1)	2005	M996 (M9782)	2012

The PFD also has assigned to the city a 2018 Type 1 engine. This engine is assigned to the city by the State Office of Emergency Services and is available for use in the city as a reserve and is utilized for wildland responses outside of the city by PFD deployed personnel. Additionally, the PFD deploys a Type VI brush truck which is a brush apparatus built on 4x4 commercial chassis and are equipped with a 150 gallon tanks, low or high pressure pumps, pump and roll capability, and assorted wildland hose and hand tools. As the city has wildland/urban interface and substantial wildland fire hazard areas within proximity to the city, CPSM recommends the PFD explore additional wildland apparatus resources such as a Type 3 or an additional Type 6 apparatus. A Type 3 brush/wildland engine is built on a commercial chassis designed for rugged off-road terrain, typically has a water tank of 500 gallons, fire pump, bumper and top mounted fire nozzles, and assorted hose and hand tools.

NFPA 1901, *Standard for Automotive Fire Apparatus*, serves as a guide to the manufacturers that build fire apparatus and the fire departments that purchase them. This document is updated every five to eight years (or shorter time periods) using input from the public and industry

stakeholders through a formal review process. The committee membership is made up of representatives from the fire service, manufacturers, consultants, and special interest groups. The committee monitors various issues and problems that occur with fire apparatus and attempts to develop standards that address those issues. A primary interest of the committee over the past years has been improving firefighter safety and reducing fire apparatus crashes.

The PFD replacement plan for heavy response apparatus is:

- Engine: 10 years of frontline service.
- Ladder: 10 years of frontline service.
- Medic (ambulance): 5 years of frontline service.
- Reserve Engine: 5 years in reserve service.
- Reserve Medic: 3 years in reserve service.

The Annex Material in NFPA 1901 (2016) contains recommendations and work sheets to assist in decision making in vehicle purchasing. With respect to recommended vehicle service life, the following excerpt is noteworthy:

> *"It is recommended that apparatus greater than 15 years old that have been properly maintained and that are still in serviceable condition be placed in reserve status and upgraded in accordance with NFPA 1912, Standard for Fire Apparatus Refurbishing (2016), to incorporate as many features as possible of the current fire apparatus standard. This will ensure that, while the apparatus might not totally comply with the current edition of the automotive fire apparatus standards, many improvements and upgrades required by the recent versions of the standards are available to the firefighters who use the apparatus."*

The impetus for these recommended service life thresholds is the continual industry advances in vehicle and occupant safety. Despite good stewardship and maintenance of emergency vehicles in sound operating condition, there are many advances in occupant and vehicle component safety, such as fully enclosed cabs, enhanced rollover protection and air bags, three-point restraints, antilock brakes, increased visibility, cab noise abatement/hearing protection, a clean cab free from carbon products, and a host of other improvements as reflected in each revision of NFPA 1901. These improvements provide safer response vehicles for those providing emergency services within the community, as well those "sharing the road" with these responders.

Many departments use a 10-5 rule (10 years of frontline service, then 5 years of reserve service) when programming replacement of fire apparatus such as engines, ladders, water tenders, heavy rescues, and heavy squad type haz-mat vehicles. Annex D of the current NFPA 1912 edition states:

> *To maximize firefighter capabilities and minimize risk of injuries, it is important that fire apparatus be equipped with the latest safety features and operating capabilities. In the last 10 to 15 years, much progress has been made in upgrading functional capabilities and improving the safety features of fire apparatus. Apparatus more than 15 years old might include only a few of the safety upgrades required by the recent editions of the NFPA fire department apparatus standards or the equivalent Underwriters Laboratories of Canada (ULC) standards. Because the changes, upgrades, and fine tuning to NFPA 1901,*

Standard for Automotive Fire Apparatus have been truly significant, especially in the area of safety, fire departments should seriously consider the value (or risk) to firefighters of keeping fire apparatus more than 15 years old in first-line service.

It is recommended that apparatus more than 15 years old that have been properly maintained and that are still in serviceable condition be placed in reserve status, be upgraded in accordance with NFPA 1912, and incorporate as many features as possible of the current fire apparatus standard. This will ensure that, while the apparatus might not totally comply with the current editions of the automotive fire apparatus standards, many of the improvements and upgrades required by the current editions of the standards are available for firefighters who use the apparatus.

The NFPA 1901 standard states apparatus that was not manufactured to applicable NFPA fire apparatus standards or that is 25 years old should be replaced.

Given that NFPA 1901 targets specifications for only fire suppression vehicles, NFPA 1917, *Standard for Automotive Ambulances*, was published in 2013 (updated in 2019) to provide similar recommendations governing the design and construction of ambulances. The U.S. General Services Administration also promulgates ambulance standards under KKK-A-1822. Additionally, the Commission on Accreditation of Ambulance Services (CAAS) has established a Ground Vehicle Standard (2016). While NFPA 1917, KKK, and CAAS standards do not include recommended service-life replacement standards for EMS vehicles, industry standard is that primary ambulances should be retired from frontline service once the ambulance chassis reaches five years of age or 250,000 miles. PFD has four ambulances that are older than five years old, and one that is approaching its five-year mark this year. A replacement schedule depends on a number of variables, most notably vehicle mileage, escalation of annualized repair expenses, and frequency with which the subject vehicle is out of service. After replacement, serviceable vehicles may be retained in ready-reserve status for an additional two to four years. In light of the inherently shorter service life of ambulances, which is due to higher frequency of emergency responses handled than corresponding suppression vehicles, there are fewer legitimate concerns regarding "missing" essential improvements in occupant/operator safety standards.

Assuring a reliable ambulance fleet is essential to quality patient care and helps assure community and employee trust. Like fire and EMS facilities, maintenance of an attractive and reliable ambulance fleet can serve as an excellent recruitment and retention strategy.

PFD currently maintains a fleet of six ambulances. Industry standard practice is to maintain a 35 percent reserve ambulance fleet. For PFD, with a current staffing goal of four ambulances (three primary and one BLS unit), this would result in five ambulances on hand and available to be used on primary ambulance response. Currently, PFD has an adequate ambulance fleet.

The supply chain for ambulances is currently significantly impacted by vehicle microchip and production challenges. EMS industry fleet managers and ambulance manufacturers are advising ambulance agencies that vehicles ordered today will have at least a two-year delivery time. Consequently, if not done already, we recommend that PFD immediately initiate the process to order at least two ambulances, with another two ordered within the next 18 months.

Once the first two ordered ambulances have been placed in service, we recommend that ambulances **M9111** and **M9782** should be removed from reserve status and placed in surplus status, and ambulances **M9240** and **M9569** should be removed from primary status and placed

in reserve status. Within two years, ambulances **M9582** and **M9961** should also be placed in reserve status, with ambulances **M9240** and **M9569** removed from reserve to surplus status.

An emerging trend across the nation and certainly in the fire service is the electrification of fire apparatus. Distinct advantages of these apparatus include zero emissions, reduced noise, reduced fuel costs, and little compromise with power and functionality. One leading fire apparatus manufacturer includes a system that combines electric power with internal combustion power for extended operations inherent to fire operations.

Additional electrification considerations include the PFD light fleet to include administrative vehicles, other staff vehicles, and light pick-up truck type vehicles used for logistical and other PFD purposes. Advantages for these vehicles are similar to heavy fire apparatus and include zero emissions, reduced fuel costs, and reduced noise. When considering these vehicle types, the PFD should also be mindful of electrical charging station installation and maintenance costs, as well as vehicle and power (battery) maintenance costs that may differ from the traditional internal combustion fleet.

Recommendation:

- CPSM recommends the PFD continue, to the extent possible and based on available funding, to maintain the current replacement plan as outlined herein, which meets industry standards. The city should also implement a rolling 10-year capital replacement plan to assure adequate lead time to take delivery of fire apparatus and ambulances as current fleet approach recommended lifespan.

CPSM further recommends:

- The PFD maintain fleet and equipment components that are either fixed or portable and that require annual testing in accordance with manufacturer and industry specifications and standards and maintain proper records at the department and with the vendor.
- The PFD explore external fleet maintenance solutions such as an external vendor specific to emergency apparatus (engine, ladder, ambulance apparatus) and which includes Emergency Vehicle Technician (EVT) certified staff and 24-hour service. CPSM also recommends the PFD explore funding for a fleet manager, who could also serve as a logistics manager who would be responsible for all PFD fleet, fleet maintenance, the fleet replacement program, as well as the logistical function and supply-chain management of the department.
- As the city has wildland/urban interface and substantial wildland fire hazard areas within proximity to the city, CPSM recommends the PFD explore additional wildland apparatus resources such as a Type 3 engine or an additional Type 6 brush apparatus. A Type 3 brush/wildland engine is built on a commercial chassis designed for rugged off-road terrain, typically has a water tank of 500 gallons, fire pump, bumper and top mounted fire nozzles, and assorted hose and hand tools. (Recommendation No. 6.)

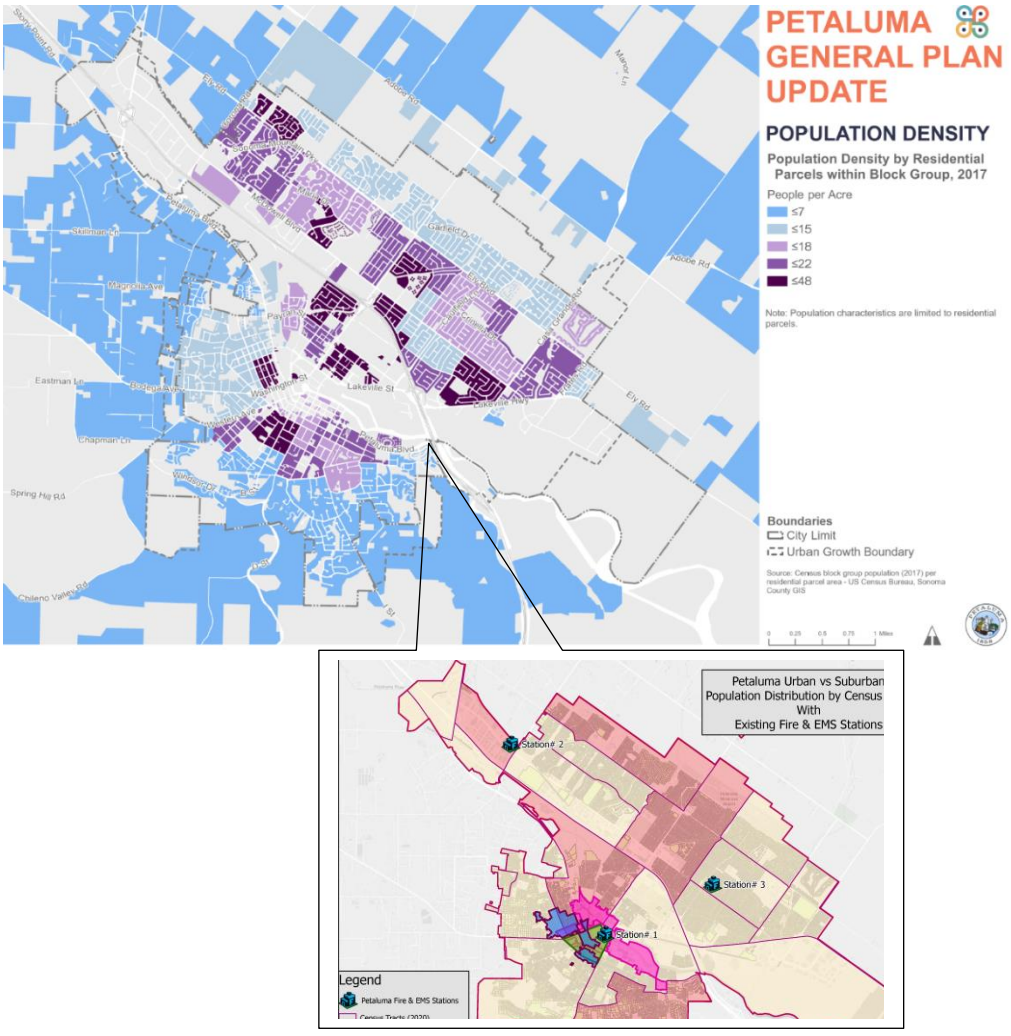
SECTION 4. ALL-HAZARDS RISK ASSESSMENT OF THE COMMUNITY

POPULATION AND COMMUNITY GROWTH

The U.S. Census Bureau indicates the population of Petaluma in 2020 was 59,403. This is a 3 percent increase in population since the 2010 Census of 57,941. The population density is 4,147 per square mile. This is an increase of 118 people per square mile over the 2010 census numbers.

The next figure illustrates population density in Petaluma (residential parcels), as recorded in the General Plan update (2017).

FIGURE 4-1: Petaluma Population Density



In terms of fire and EMS risk, the age and socio-economic profiles of a population can have an impact on the number of requests for fire and EMS services. Evaluation of the number of seniors and children by fire management zones can provide insight into trends in service delivery and quantitate the probability of future service requests. In a 2021 National Fire Protection Association (NFPA) report on residential fires, the following key findings were identified for the period 2015–2019:[9]

- Males were more likely to be killed or injured in home fires than females and accounted for larger percentages of victims (57 percent of the deaths and 55 percent of the injuries).
- The largest number of deaths (19 percent) in a single age group was among people ages 55 to 65.
- 59 percent of the victims of fatal home fires were between the ages of 39 and 74, and three of every five (62 percent) of the non-fatally injured were between the ages of 25 and 64.
- Slightly over one-third (36 percent) of the fatalities were age 65 or older; only 17 percent of the non-fatally injured were in that age group.
- Children under the age of 15 accounted for 11 percent of the home fire fatalities and 10 percent of the injuries. Children under the age of 5 accounted for 5 percent of the deaths and 4 percent of the injuries.
- Adults of all ages had higher rates of non-fatal fire injuries than children.
- Smoking materials were the leading cause of home fire deaths overall (23 percent) with cooking ranking a close second (20 percent).
- The highest percentage of fire fatalities occurred while the person was asleep or physically disabled and not in the area of fire origin, key factors to vulnerable populations.

In Petaluma, the following age and socioeconomic factors are considered herein when assessing and determining risk for fire and EMS preparedness and response:[10]

- Children under the age of five represent 4.5 percent of the population.
- Persons under the age of 18 represent 19.9 percent of the population.
- Persons over the age of 65 represent 18.4 percent of the population.
- Male persons represent 50.2 percent of the population.
- There are 2.64 persons per household in Petaluma.
- The median household income in 2020 dollars was $92,762.
- Persons living in poverty make up 6.6 percent of the population.

Black or African American alone represents 1.3 percent of the population. The remaining percentage of population by race includes White alone at 76.1 percent, American Indian or Alaska Native alone at 0.8 percent, Asian alone at 4.4 percent, two or more races at 7.0 percent, and Hispanic or Latino at 21.7 percent.

9. M. Ahrens, R. Maheshwari "Home Fire Victims by Age and Gender," Quincy, MA: NFPA, 2021.
10. U.S. Census Bureau QuickFacts: Petaluma, CA

There is a considerable number of current and planned development projects in Petaluma and these will increase population and demand for fire and EMS services, particulalry due to growth in vertical density. Projects include multistory apartment buildings, condominiums, multistory residential over commercial, as well as single-family dwellings.[11] Projects that have some level of city approval and/or have been issued permits to begin contruction are listed here.

Projects under construction (the project has received all planning approvals; final plans approved; building and other permits have been issued; may be under construction) include:

- Riverfront: Mixed use project consisting of single-family homes, townhomes, apartments, hotel, and office space.
- Quarry Heights: Single-family homes and townhomes.
- Body Ranch Subdivsion: Single-family homes and multistory condominiums.
- PEP Senior Housing: Multistory senior apartment building with 53 units.
- North River Apartments: Two multistory apartment buildings with a total of 184 units.
- Midpen Affordable Housing Project: Multistory building with 43 housing units.

Projects in the plan check process (the project has received all planning approvals; construction drawings have been submitted to the Building Division) include:

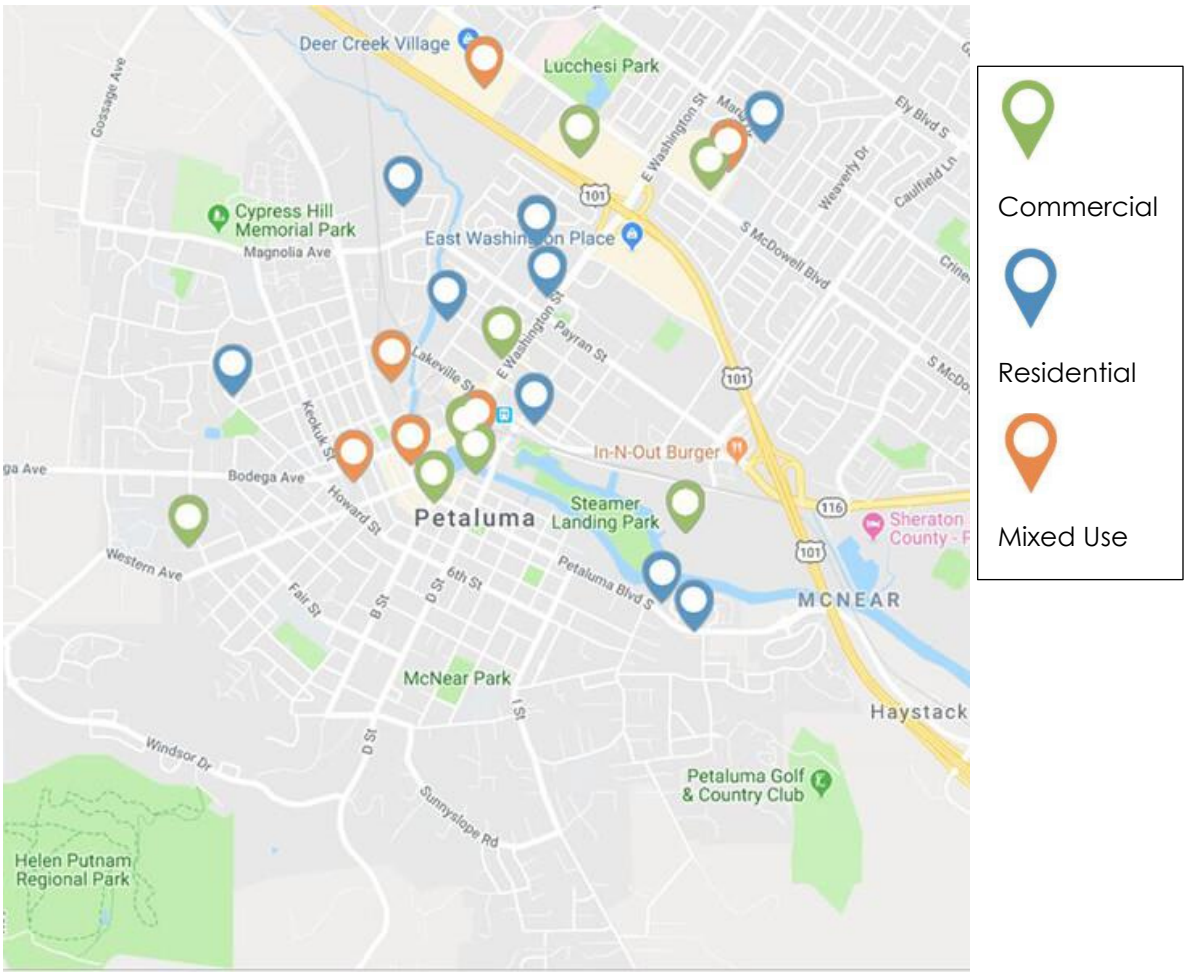
- Casa Grande: Single-family dwellings.
- Foley-Omahony Mixed Use Building: Multistory, multi-unit building with nine residential units and commercial area.
- Home 2 Suites: Multistory hotel building.
- Deer Creek-Residential: Five multistory buildings with 134 one- and two- bedroom units.

Projects that have received all planning approvals (the project has received all discretionary approvals from the city, with no appeals pending) include:

- Haystack Pacifica: Multistory building with 182 residential units over 24,855 square feet of ground floor commercial space.
- 890 PBN Co-op: Mutlistory mixed use building with residential over commercial space; seven residential units and 1 guest suite.
- Meridian at Corona Station: Multiple multistory buildings with a total of 164 housing units.
- Burbank Affordable Housing Project: Multistory building with 50 housing units.
- Riverbend: Single-family dwellings.
- Riverview Apartments: 27 multistory buildings with a total of 264 apartment units.

11. Proposed Major Development Projects In The City Of Petaluma

FIGURE 4-2: Major Development Projects Planned or Underway



ENVIRONMENTAL FACTORS

The City of Petaluma is prone to and will continue to be exposed to certain environmental hazards that may impact the community. The most common natural hazards prevelant to the region, according to the City of Petaluma Emergency Operations Plan threat assessment include:[12]

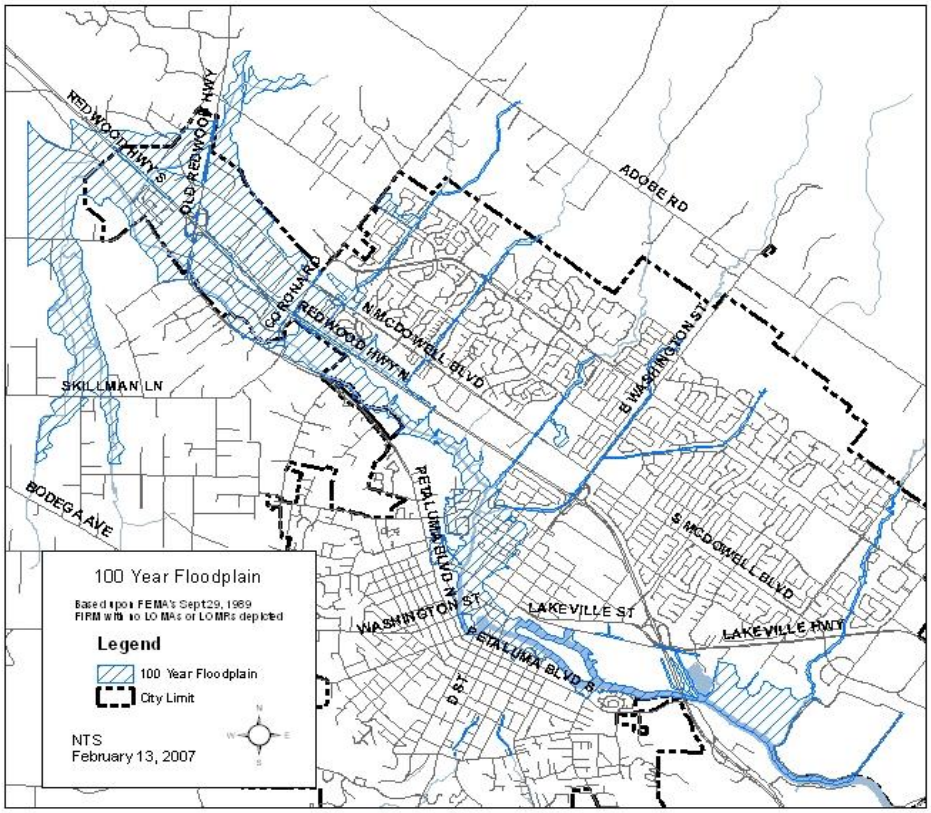
- Earthquake. The City of Petaluma is in the area of two major fault lines: San Andreas and Healdsburg/Ridgers Creek. Subsequent environmental risks due to an earthquake include:
  - Ground shaking and liquefaction, which is the loss of shear strength of soil.
  - Flood control damage.
  - Pumping station damage due to liquefaction.
  - Power distribution line damage, a potential fire risk.

12. City of Petaluma Emergency Operations Plan.

- Bridge failure.
- Road damage due to liquefaction.
- Water and natural gas transmission line damge and escape of product.

- Winter storms. Subsequent environmental risks of winter storms include:
  - Flash flooding.
  - Landslides/mudslides.
  - Stream and creek flooding.
  - High winds.
- Flooding. Subsequent environmental risks of flooding include:
  - Slow rise flooding from moderate to heavy rain over several hours to several days.
  - Flash flooding from heavy rain over a short period of time.

FIGURE 4-3: Flood Plain Map of Petaluma

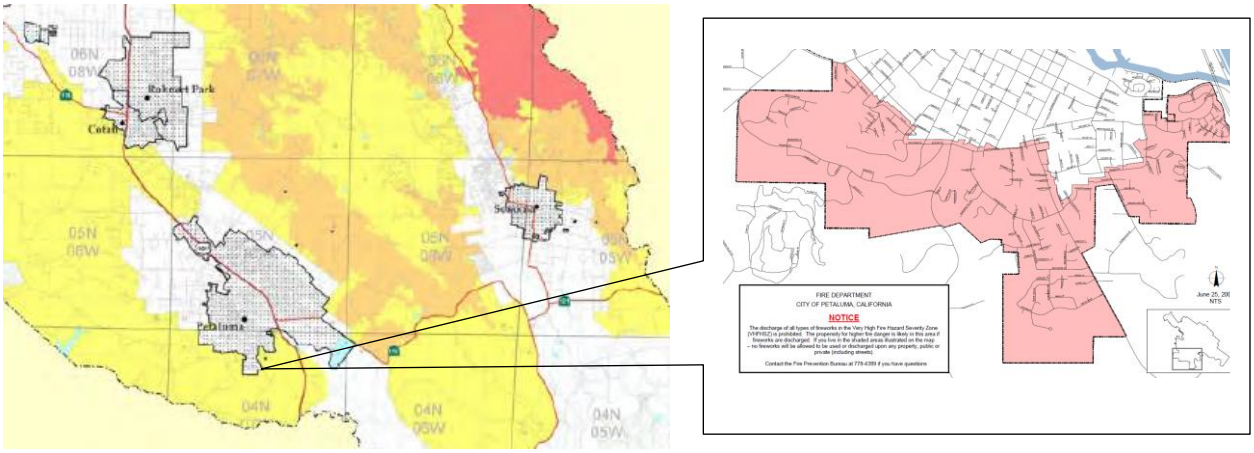


- Landslides.
  - Occuring with earthquakes or independently.
  - Includes soil or rock falling, sliding, or flowing.

- Wildland-urban interface fires.
  - Any area of the city where structures meet or intermingle with undeveloped wildland.

The next figure indicates the wildland severity risk for Petaluma. The yellow shade indicates a moderate risk, the orange a high risk, and the red a very high risk. The area contiguous to the southern city boundaries indicates a moderate risk. The area to the north, east and northeast are moderate with some high risk within reach of the city. The Petaluma General Plan classifies the area in the call-out as very high wildland hazard.

FIGURE 4-4: Wildland Fire Hazard Severity for Petaluma



- Dam failure with inundation of flowing and flood waters.
  - Warm Springs Dam–failure unlikely.
  - Coyote Dam–failure unlikely.
  - Smaller agricultural and strom water dams may impact specific areas of the city.
- Drought. Subsequent environmental risks inlude:
  - Increased wildland fire hazard.
  - Reduced water levels.

BUILDING AND TARGET HAZARDS

A community risk and vulnerability assessment will evaluate the community, and regarding buildings, it will review all buildings and the risks associated with each property and then classify the property as either a high, medium, or low hazard depending on factors such as the life and building content hazard and the potential fire flow and staffing required to mitigate an emergency in the specific property. According to the NFPA *Fire Protection Handbook*, these hazards are defined as:

High-hazard occupancies: Schools, hospitals, nursing homes, explosives plants, refineries, high-rise buildings, and other high life-hazard (vulnerable population) or large fire-potential occupancies.

Medium-hazard occupancies: Apartments (includes townhomes, condos, residential over commercial), offices, and mercantile and industrial occupancies not normally requiring extensive rescue by firefighting forces.

Low-hazard occupancies: One, two, or three-family dwellings and scattered small business and industrial occupancies.

Petaluma has the following building types.

- Single-family housing units (predominate building risk with 17,082 units).
- Townhomes/condos (varying number of vertical floors, 736 total units).
- Apartment building units (varying number of vertical floors, 308 total units).
- Residential over commercial housing units (varying number of vertical floors, 21 structures).
- Assisted living/nursing homes.
- Commercial/industrial structures, 1,606 structures.
- Strip malls, 9 locations.
- High rises: Currently there are no high-rise structures (vertical elevation of 75 feet or more from grade level).

In terms of identifying target hazards, consideration must be given to the activities that take place (public assembly, life safety vulnerability, manufacturing, processing, etc.), the number and types of occupants (elderly, youth, handicapped etc.), and other specific aspects related to the construction of the structure.

Petaluma has a variety of target hazards that are hazard class:

High Hazard

- Assisted living/nursing facilities.
- Educational facilities.
- Vertical buildings three or more floors that are residential with vulnerable population.

Medium Hazard

- Mulitfamily dwelling buildings (multistory townhomes and apartment buildings, multistory condominiums).
- Residential over commercial buildings, multistory.
- Commercial and industrial facilities and sites.

The greatest building risk by number of buildings in Petaluma are of a low-moderate hazard (single-family dwellings, predominately wood frame construction are low hazard). Those single-family dwellings in excess of 2,000 square feet and of lightweight wood construction should be considered moderate hazards. Petaluma does have high-risk/vulnerable population risks (nursing/assisted living facilities), schools and multifamily, mutlistory residential structures (apartments/condos), as well as multiple vertical residential projects under construction or approved and planned for near-to mid-term contruction. All of these buidling risks present the

PFD with life-safety concerns and challenges of direct access and density. The industrial and mercantile building risk, while a lower life safety risk, is gernerally a moderate to higher hazard risk and based on processes, storage, and overall occupancy type.

The following figure illustates parcel types and the various buidling risks as discussed in Petaluma. As noted, the majority of parcels are residential. An additional observation is that commercial parcels are generally clustered together with little comingling with residential other than downtown, which is largely made up of business and retail parcels.

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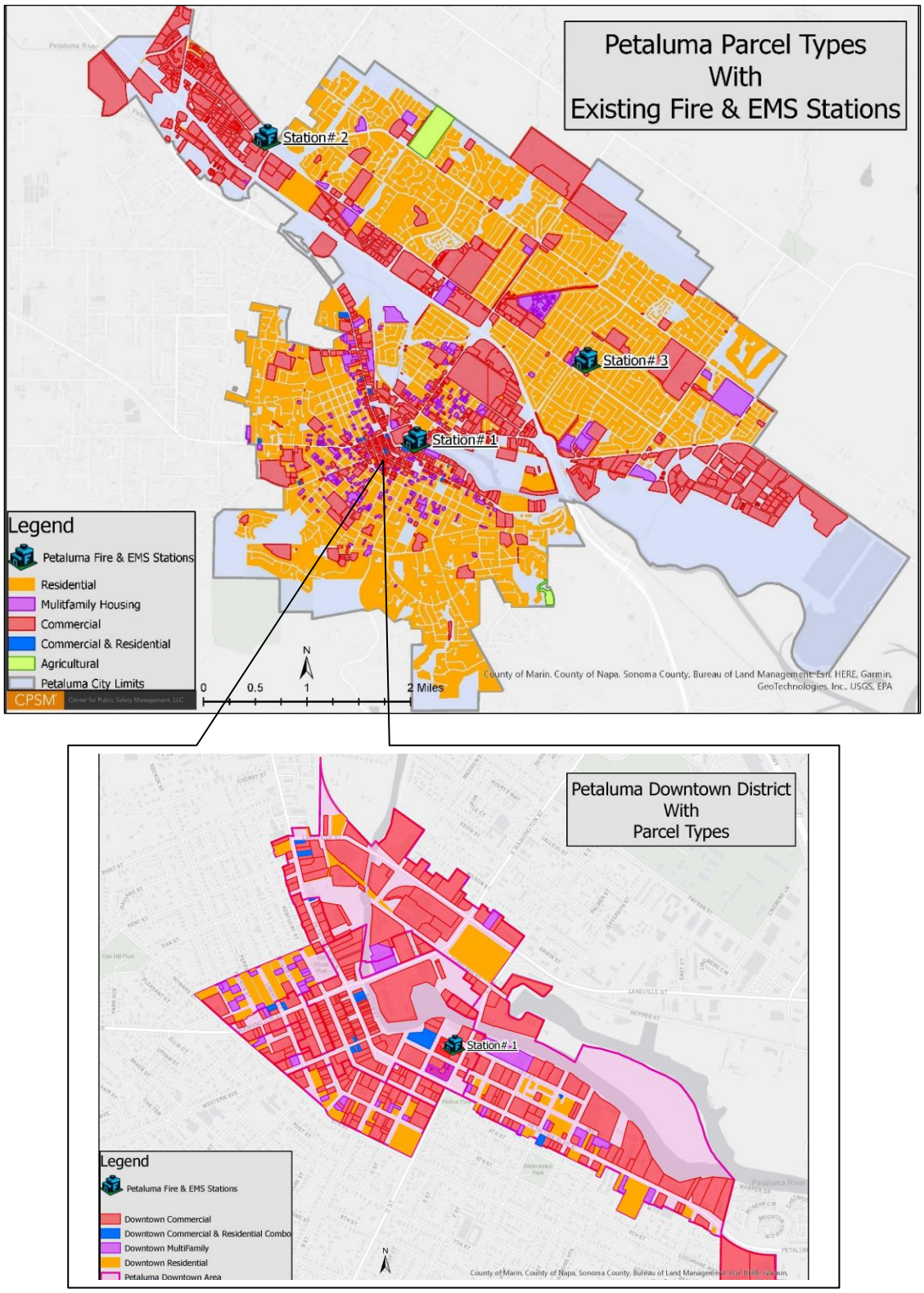
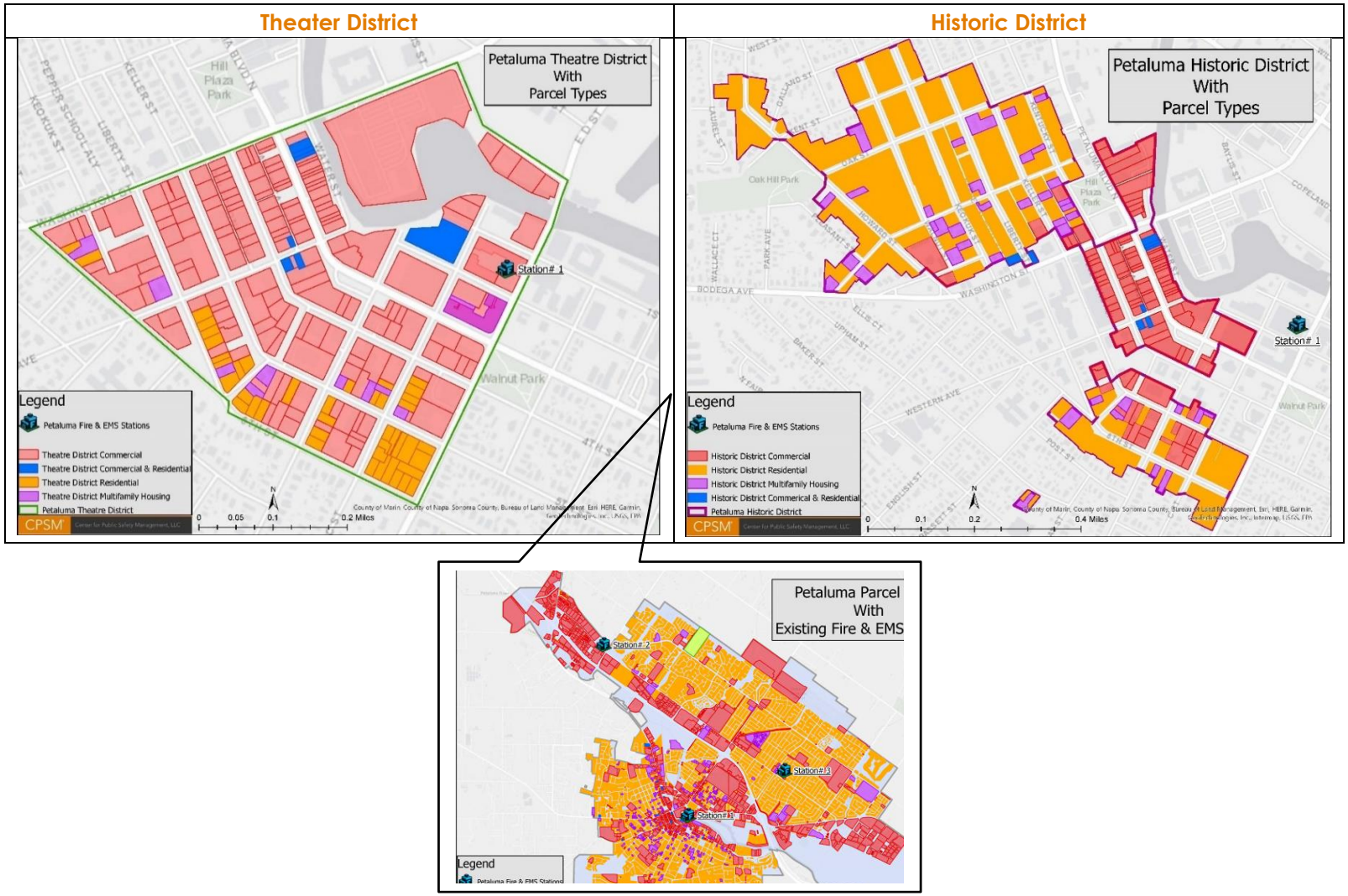
FIGURE 4-5: Petaluma Parcel Types



The next set of maps illustrate the theater and historic district parcels and types of buildings and building risks present.

FIGURE 4-6: Petaluma Theater and Historic District Parcel Types



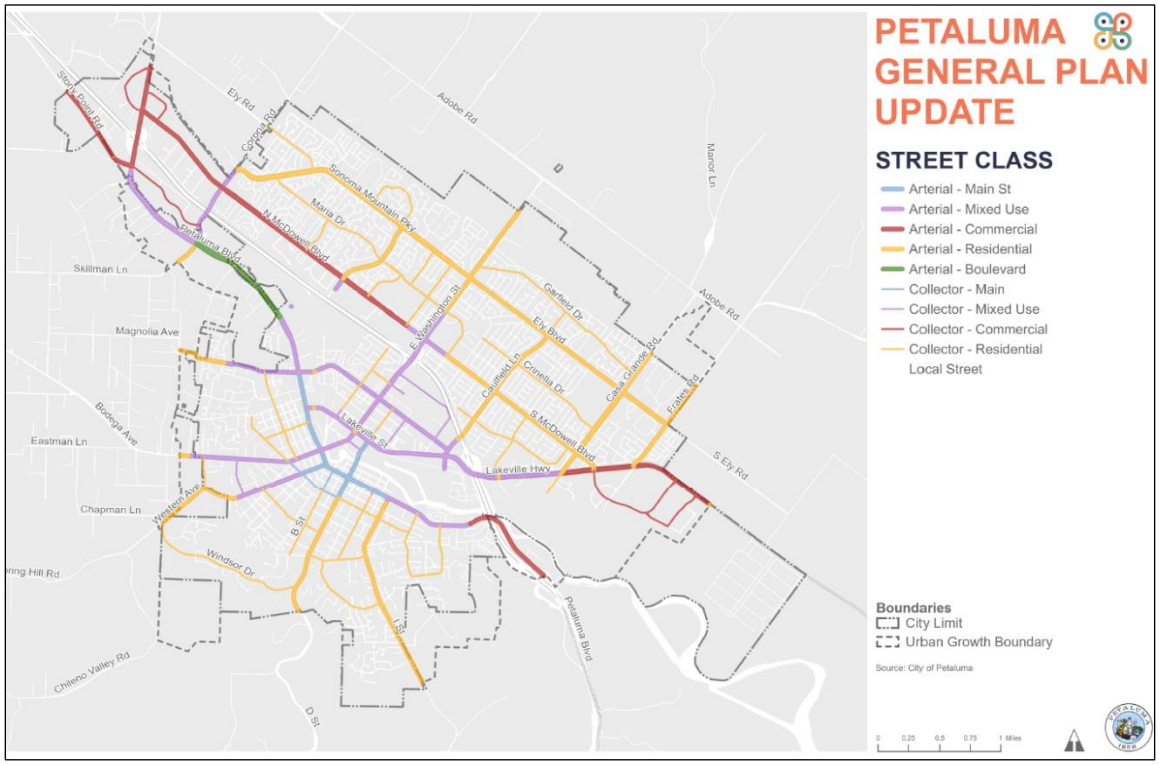
TRANSPORTATION FACTORS

The existing public street network within the city limits consists primarily of city-maintained roadways. According to the city's General Plan 2025, the street network totals approximately 160 roadway lane miles. The road network system also consists of sidewalks that take foot traffic to and across vehicular intersections. Roads by functional type in Petaluma include:[13]

- Arterial streets, which provide high-speed/high-capacity movement of traffic and are accessed from collector and local streets.
- Collector streets, which are medium-speed and volume roads and provide access within and between neighborhoods.
- Connector streets, which are low-speed/low-volume roads within and between neighborhoods and which have access to collector and arterial roads.
- Local streets, which are low-speed/low-volume roads that provide direct access to residential and commercial land uses.

The following figure illustrates the principal road network in Petaluma.

FIGURE 4-7: Petaluma Street Classifications



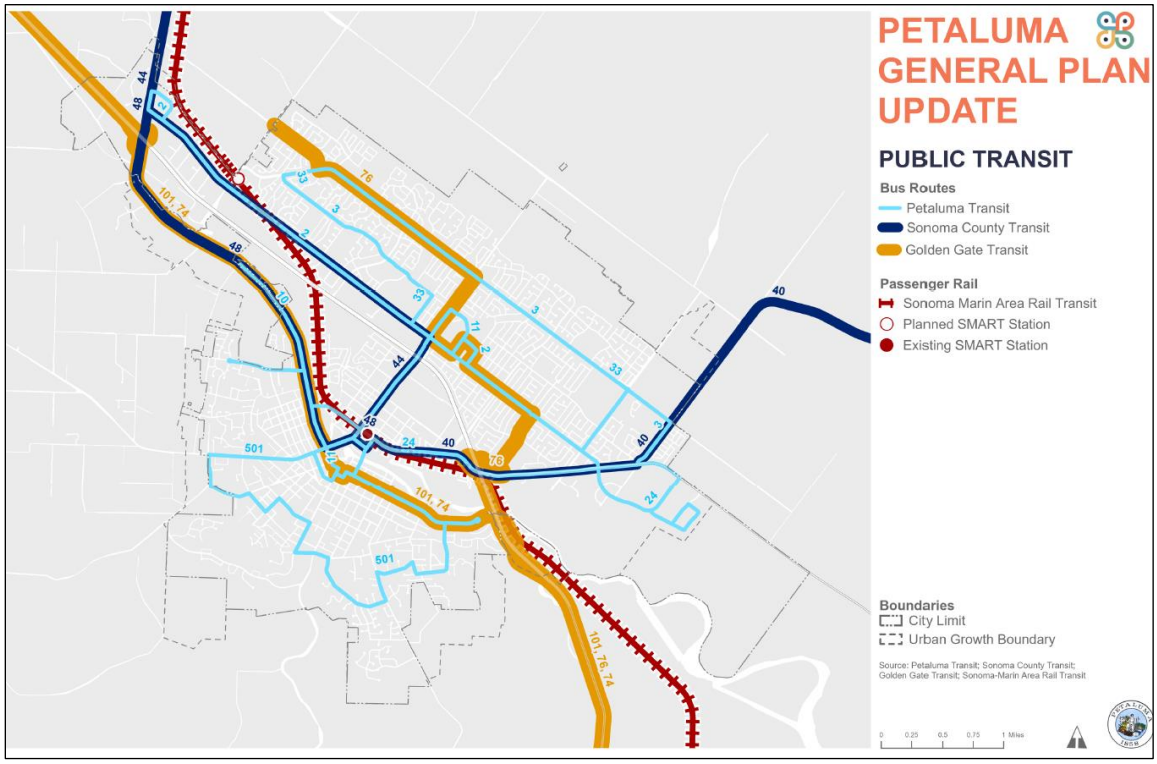
The residents of Petaluma are also served by several public transit modes that include bus and rail within the city limits. The existing bus service includes Petaluma Transit (Routes 2, 3, 10, 11, 24, and 33), Sonoma County Transit (Routes 40, 44, 48), and Golden Gate Transit (Routes 101, 172).

13. General Plan 2025, City of Petaluma, CA.

The city also has active commuter rail. At present, the Sonoma-Marin Area Rail Transit (SMART) has one stop in Petaluma (downtown near the Petaluma Transit Mall). A stop in Petaluma north is planned.

The next figure illustrates public transit routes in Petaluma.

FIGURE 4-8: Public Transit Routes in Petaluma



The road and transportation network described herein poses risks for a vehicular accident, some at medium to greater than medium speeds, as well as vehicular-versus-pedestrian-bicycle risks. There are additional transportation risks since tractor-trailer and other commercial vehicles traverse the roadways of Petaluma to deliver mixed commodities to business locations. Fires or releases of product involving these products can produce vapors, smoke, and other products of combustion that may be hazardous to health. Additionally, there is risk for a mass casualty incident involving mass-transit buses either on specific bus routes/roads in the city or utilizing the road network in the city for stops in jurisdictions external to Petaluma, or with the public rail transportation system.

FIRE, FIRE-RELATED, AND EMS RISK

An indication of the community's fire risk is the type and number of fire-related incidents the fire department responds to. CPSM conducted a data analysis for this project that analyzed PFD incident responses and workload.

The following table details the call types and call type totals for these types of fire-related risks between January 1, 2021, and December 31, 2021.

TABLE 4-1: Fire Call Types–In City

Call Type	Total Calls	Calls per Day
False alarm	265	0.7
Good intent	168	0.5
Hazard	142	0.4
Outside fire	93	0.3
Public service	710	1.9
Structure fire	39	0.1
Technical rescue	9	0.0
Fire Total	**1,426**	**3.9**

EMS Risk

As with fire risks, an indication of the community's pre-hospital emergency medical risk is the type and number of EMS calls to which the fire department responds. The following table outlines the call types and call type totals for these types of EMS risks between January 1, 2021, and December 31, 2021.

TABLE 4-2: EMS Call Types–In City

Call Type	Total Calls	Calls per Day
EMS response	3,770	10.3
MVA	208	0.6
EMS Total	**3,978**	**10.9**

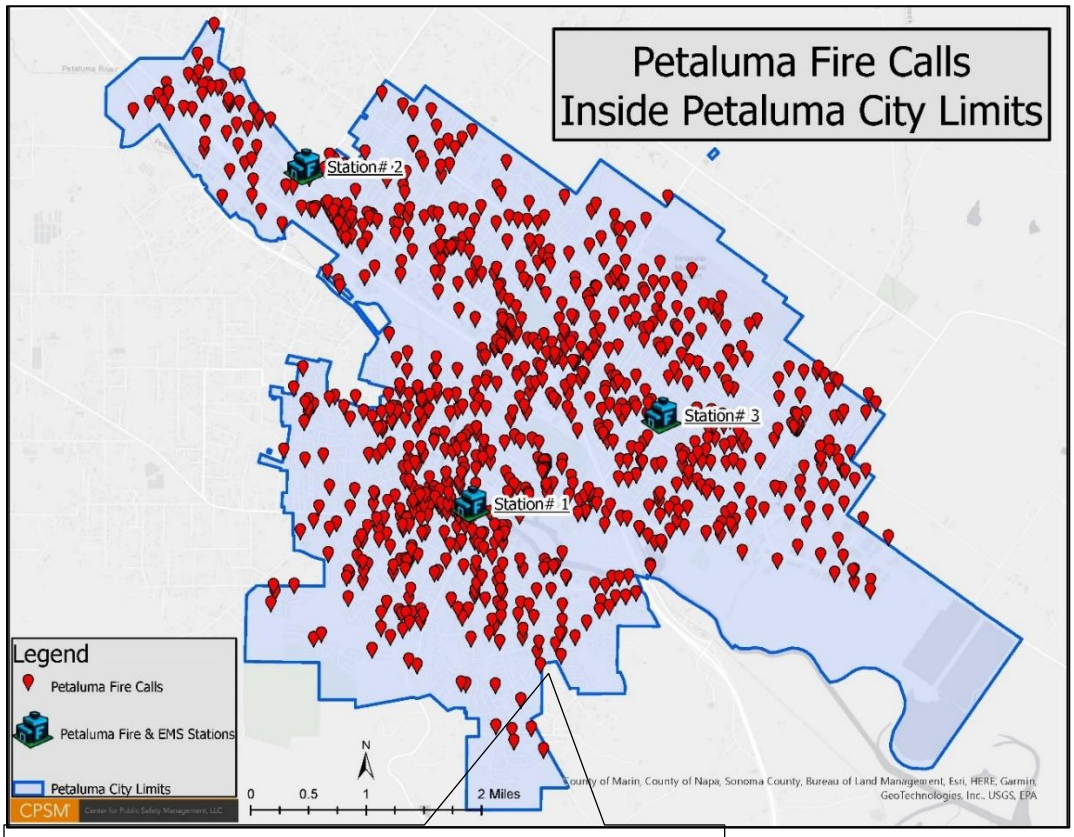
These tables tells us:

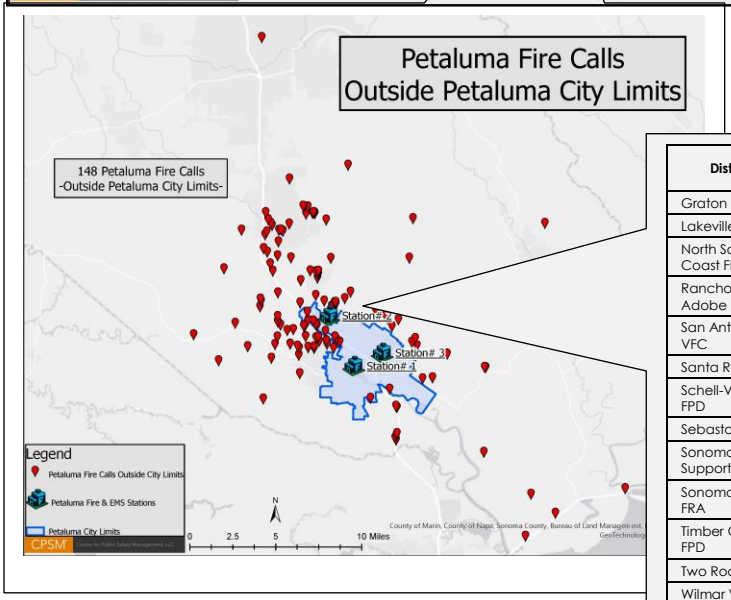
- Fire calls totaled 1,426 (22 percent of all calls), or an average of 3.9 calls per day.
  - False alarm calls made up four percent of total calls (19 percent of fire calls).
  - Structure and outside fire calls combined made up 2 percent of total calls (9 percent of fire calls), or an average of 0.4 calls per day, or about one call every three days.
- EMS calls totaled 3,978 (62 percent of all calls), an average of 10.9 calls per day.
  - Motor vehicle accidents (MVA) made up 3 percent of total calls (5 percent of EMS calls).
- Overall, PFD's fire response apparatus responded to an average of 17.5 calls per day, including 1.3 canceled (7 percent) calls and 1.4 mutual aid (8 percent) calls per day.

FIRE AND EMS INCIDENT DEMAND

Analyzing where the fire and EMS incidents occur, and the demand density of fire and EMS incidents, helps to determine adequate fire management zone resource assignment and deployment. The following figures illustrate fire and EMS demand inside and outside of Petaluma city limits.

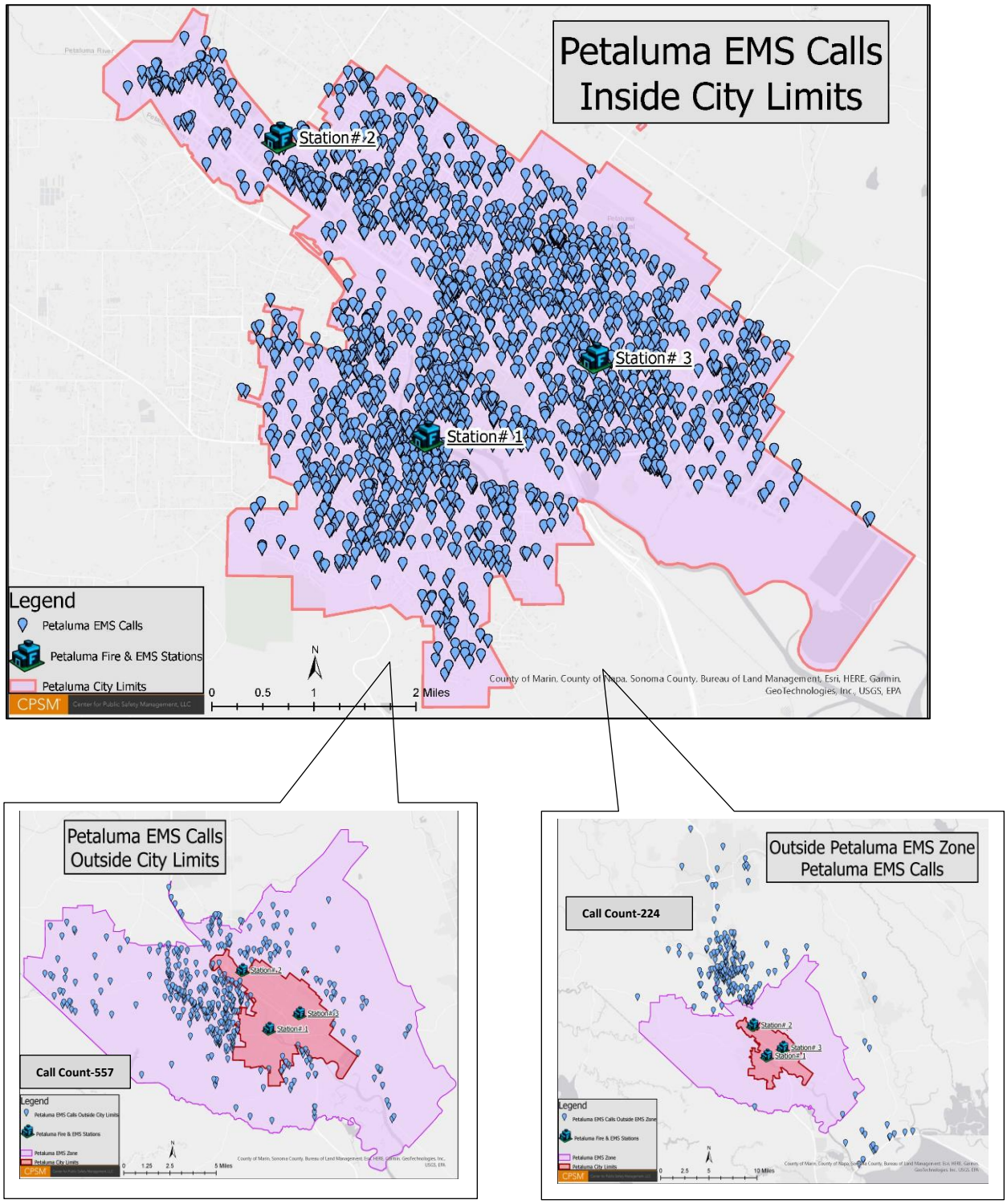
FIGURE 4-9: Fire Demand: Inside and Outside of Petaluma





District	Number of Calls			
	EMS	Fire	Canceled	Total
Graton FPD	0	0	1	1
Lakeville VFC	20	5	20	45
North Sonoma Coast FPD	0	0	1	1
Rancho Adobe FPD	181	92	99	372
San Antonio VFC	41	8	22	71
Santa Rosa FD	1	0	1	2
Schell-Vista FPD	1	0	0	1
Sebastopol FD	0	0	2	2
Sonoma Life Support	0	0	2	2
Sonoma Valley FRA	0	1	1	2
Timber Cove FPD	0	0	1	1
Two Rock VFC	0	5	3	8
Wilmar VFC	7	3	3	13
Windsor FPD	0	0	2	2
XSN Team	0	2	1	3

FIGURE 4-10: EMS Demand: Inside and Outside of Petaluma



Fire and EMS demand is most heavily concentrated in the Station 1 and 3 response zones. Demand is driven by population density, which is highest in these zones. The Station 1 response

area has the heaviest demand. Current and planned densification, particulalry vertical density, will continue to add to this demand for fire and EMS service.

Fire and EMS demand outside of the city is concentrated in the following areas by call type:

- Fire: Heaviest out-of-city responses in the unincorporated areas area to the west and north of the city.
- EMS: Outside of city but in the EMS response zone, to the west and northwest of the city.
- EMS: Outside of city and outside of EMS zone, to the north of the city and EMS zone.

These responses, although necessary and reciprocal to existing mutual aid agreements, do take PFD units outside of the city and due to the limited number of response assets and demand in the city may at times have an effect on overall resilliency and deployable assets for fire and EMS alarms in the city. The PFD also responded into Marin County 51 times for EMS calls for service.

COMMUNITY LOSS AND SAVE INFORMATION

Fire loss is an estimation of the total loss from a fire to the structure and contents in terms of replacement. Fire loss includes contents damaged by fire, smoke, water, and overhaul. Fire loss does not include indirect loss, such as business interruption.

In a 2021 report published by the National Fire Protection Association on trends and patterns of U.S. fire losses, it was determined that home fires still cause the majority of all civilian fire deaths, civilian injuries, and property loss due to fire. Key findings from this report include:[14]

- Public fire departments responded to 1,338,500 fires in 2020, a 7.5-percent increase from the previous year.
- 490,500 fires occurred in structures (37 percent). Of these fires, 379,500 occurred in residential structures and 86,000 occurred in apartments or multifamily structures.
- 2,230 civilian fire deaths occurred in residential fires, and 350 deaths occurred in apartments or multifamily structures.
- Home fires were responsible for 11,500 civilian injuries.
- An estimated $21.9 billion in direct property damage occurred as a result of fire in 2020 (includes fires in the California wildland-urban interface and a large loss naval ship fire in California).

The following table shows overall fire loss in Petaluma in terms of dollars for the years indicated. This information should be reviewed regularly and discussed in accordance with response times to actual fire incidents, company level training, effectiveness on the fireground, and effectiveness of incident command. In all years, one- and two-family dwellings and other types of buildings such as multifamily and mercantile were the leading content and property loss categories.

14. *Fire Loss in the United States During 2020*, National Fire Protection Association.

TABLE 4-3: Content and Property Loss, 2017–2021

2017	2018	2019	2020	2021
$1,719,520	$659,570	$1,079,000	$661,700	$1,414,425

Resiliency

Resiliency as defined by the Center for Public Safety Excellence (CPSE) in the Fire and Emergency Service Self-Assessment Manual (FESSAM), ninth edition, is: "an organization's ability to quickly recover from an incident or events, or to adjust easily to changing needs or requirements." Greater resiliency can be achieved by constant review and analysis of the response system and focuses on three key components:

- Resistance: The ability to deploy only resources necessary to control an incident and bring it to termination safely and effectively.
- Absorption: The ability of the agency to quickly add or duplicate resources necessary to maintain service levels during heavy call volume or incidents of high resource demand.
- Restoration: The agency's ability to quickly return to a state of normalcy.

Resistance is controlled by the PFD through staffing and response protocol, and with PFD resources dependent on the level of staffing and units available at the time of the alarm.

Absorption is accomplished through availability to respond by PFD units and through regional auto aid resources. This is aided through the computer-aided dispatch at the fire dispatch center.

Restoration is managed by PFD unit availability as simultaneous calls occur, the availability of regional auto aid resources, recall of staff to staff fire units during campaign events when warranted, and backfilling PFD stations when needed through the computer-aided dispatch at the fire dispatch center.

The following tables and figure analyze PFD resiliency. In this analysis, CPSM included all 5,648 calls that occurred inside and outside Petaluma in the data analysis study period. We did this because PFD is part of a regional auto/mutual aid system, so responses outside of the city impact resiliency of the department to respond to calls inside of the city.

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TABLE 4-4: Call Workload by Primary PFD Units

Station	Unit	Unit Type	Minutes per Run	Total Hours	Total Percent	Minutes per Day	Total Runs	Runs per Day
9301	9341	Type 6 Engine	11.3	0.2	0.0	0.0	1	0.0
	9342	Boat	8.5	0.4	0.0	0.1	3	0.0
	9357	Brush Truck	43.4	18.8	0.9	3.1	26	0.1
	9381	Type 1 Engine	15.8	680.4	34.3	111.9	2,585	7.1
	BC9	BC	15.1	112.0	5.6	18.4	444	1.2
	OES400	Type 1 Engine	14.7	1.5	0.1	0.2	6	0.0
	Total		**15.9**	**813.4**	**41.0**	**133.7**	**3,065**	**8.4**
9302	9351	Aerial Truck	14.3	319.7	16.1	52.6	1,341	3.7
	9382	Type 1 Engine	12.8	141.1	7.1	23.2	659	1.8
	Total		**13.8**	**460.8**	**23.2**	**75.8**	**2,000**	**5.5**
9303	9383	Type 1 Engine	16.3	709.1	35.8	116.6	2,617	7.2
Total			**15.5**	**1,983.2**	**100.0**	**326.0**	**7,682**	**21.0**

TABLE 4-5: Total Runs by Run Type and Ambulance

Station	Unit	EMS Response	MVA	Fire	Canceled	Mutual Aid	Total	Runs per Day
9301	MED991	1,769	132	278	225	66	2,470	6.8
9301	BLS994	580	46	65	37	10	738	2.0
	Total	**2,349**	**178**	**343**	**272**	**76**	**3,208**	**8.8**
9302	MED992	1,259	96	234	143	395	2,127	5.8
9303	MED993	1,727	123	326	138	128	2,442	6.7
	Total	**5,335**	**397**	**903**	**543**	**599**	**7,777**	**21.3**

This table examines each PFD station's availability to respond to calls within its first due area, focuses on calls where at least one fire response unit arrived.

TABLE 4-6: Station Availability to Respond to Calls

Station	Calls in Area	First Due Responded	First Due Arrived	First Due First	Percent Responded	Percent Arrived	Percent First
9301	2,060	1,889	1,859	1,847	91.7	90.2	89.7
9302	1,089	1,013	991	983	93.0	91.0	90.3
9303	2,059	1,865	1,834	1,815	90.6	89.1	88.1
Total	**5,208**	**4,767**	**4,684**	**4,645**	**91.5**	**89.9**	**89.2**

The next table examines the availability of each PFD station's ambulance to respond to calls within its first due area where at least one ambulance arrived.

TABLE 4-7: Station Availability to Respond to Medical Response Calls

Station	Calls in Area	First Due Responded	First Due Arrived	First Due First	Percent Responded	Percent Arrived	Percent First
9301	2,030	1,692	1,652	1,608	83.3	81.4	79.2
9302	1,321	1,159	1,131	1,100	87.7	85.6	83.3
9303	1,871	1,567	1,540	1,515	83.8	82.3	81.0
Total	**5,222**	**4,418**	**4,323**	**4,223**	**84.6**	**82.8**	**80.9**

FIGURE 4-11: Calls by Hour of Day

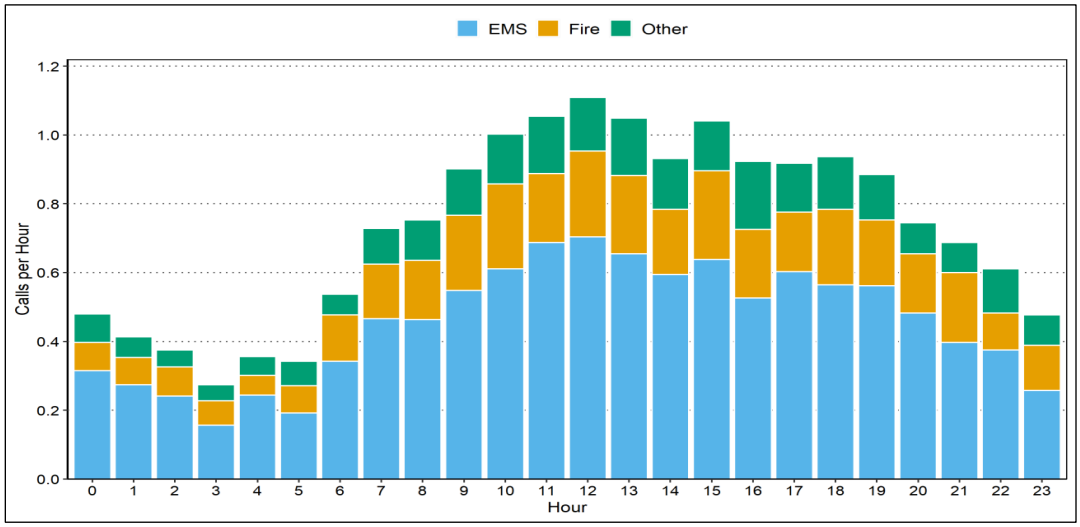

TABLE 4-8: Frequency of Overlapping Calls

Station	Scenario	Number of Calls	Percent of All Calls	Total Hours
9301	No overlapped call	2,188	93.3	610.2
	Overlapped with one call	150	6.4	20.4
	Overlapped with two calls	8	0.3	0.6
9302	No overlapped call	1,232	96.6	315.8
	Overlapped with one call	43	3.4	6.4
9303	No overlapped call	2,099	93.2	603.0
	Overlapped with one call	148	6.6	21.4
	Overlapped with two calls	6	0.3	0.3
Outside Petaluma	No overlapped call	516	98.1	153.9
	Overlapped with one call	10	1.9	1.2

TABLE 4-9: Frequency Distribution of the Number of Calls

Calls in an Hour	Frequency	Percentage
0	4,358	49.7
1	2,897	33.1
2	1,115	12.7
3	303	3.5
4	74	0.8
5+	13	0.1
Total	**8,760**	**100.0**

This analysis of the PFD's resiliency to respond to calls tells us:

- The overall peak call time is 7:00 a.m. to 10:00 p.m., with a concentrated peak time between the hours of 9:00 a.m. and 3:00 p.m.
- Engine 1 has the highest workload in terms of runs for fire units, followed by Engine 3, which corresponds with the demand analysis maps.
- Medic 991(Station 1) has the highest workload in terms of runs for EMS units, followed closed by Medic 993 (Station 3), which corresponds with the demand analysis maps.
- Overall, all primary fire and EMS units (including the BC and the BLS ambulance) averaged 42 runs per day.
- Aggregately, 14 percent of the time the Station 1 and Station 3 response zones have an overlapped call (7 percent for each station). The greatest percentage of the time the zone is overlapped with one call. This corresponds with the demand analysis maps.
- Two percent of the time an overlap call occurs within the city when a Petaluma unit is on a call outside of the city.
- There were 629 canceled calls PFD units responded to (almost 10 percent of all calls). Units were canceled either en route to the incident or after arrival on scene. While this is common nationally, it is important to note here that whether canceled en route or after arrival on scene, the unit(s) is/are still unavailable for another call in the city.
- Stations 1 and 3 fire units arrived on scene in their first due district under 90 percent of the time. This is due to the demand in these response districts, which puts units out of position more often. This links to response times and the NFPA 1710 benchmark. Overall, EMS transport units arrived first in their first due areas 81 percent of the time. This is due to workload and being out of position. Because the fire apparatus is staffed with paramedics, initial basic and advanced life support care can be given prior to the transport unit arriving.
- PFD made 367 fire calls and 781 EMS calls outside of the city on mutual aid incidents.

The PFD does have moderate resilliency issues as detailed above. Specifically, 51 percent of the time there is one or more calls in an hour. The workload of the engine companies tells us that aggregately each fire management zone has an overlapped call 10 percent of the time, and the ability for two stations (1 and 3) to arrive first in their specific fire management zone is just below 90 percent of the time. Affecting the resilliency is that Petaluma has three stations with three primary fire response units and three primary, 365/24/7 ambulances. When one or two fire

suppression or EMS units are tied up on an incident, whether in or out of the city, it is difficult for the PFD to absorb service level demand.

The PFD's ability to absorb multiple calls and restore response capabilites to a state of normacly can be challenging at certain times, which include multiple EMS calls that result in a transport, a single working structure fire or multi-unit fire call in the city that ties up both fire units for extended time periods, or lastly when a singlre fire unit and/or EMS unit is tied up for an extended period.

RISK CATEGORIZATION

A comprehensive risk assessment is a critical aspect of creating standards of cover and can assist the PFD in quantifying the risks that it faces. Once those risks are known, the department is better equipped to determine if the current response resources are sufficiently staffed, equipped, trained, and positioned.

In this component, the factors that drive the service needs are examined and then link directly to discussions regarding the assembling of an effective response force (ERF) and when contemplating the response capabilities needed to adequately address the existing risks, which encompasses the component of critical tasking.

The risks that the department faces can be natural or manufactured and may be affected by the changing demographics of the community served. With the information available from the CPSM data and operational analysis, the PFD, the city, and public research, the PFD can begin an analysis of the city's risks and can begin working towards recommendations and strategies to mitigate and minimize their effects. This section contains an analysis of the various risks considered within the PFD service area.

Risk is often categorized in three ways: consequence of the event on the community, the probability the event will occur in the community, and the impact on the fire department. The following three tables look at the probability of the event occurring, which ranges from unlikely to frequent; consequence to the community, which is categorized as ranging from insignificant to catastrophic; and the impact to the organization, which ranges from insignificant to catastrophic.

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TABLE 4-10: Event Probability Matrix

Probability	Chance of Occurrence	Description	Risk Score
Unlikely	2%-25%	Event may occur only in exceptional circumstances.	**2**
Possible	26%-50%	Event could occur at some time and/or no recorded incidents. Little opportunity, reason, or means to occur.	**4**
Probable	51%-75%	Event should occur at some time and/or few, infrequent, random recorded incidents, or little anecdotal evidence. Some opportunity, reason, or means to occur; may occur.	**6**
Highly Probable	76%-90%	Event will probably occur and/or regular recorded incidents and strong anecdotal evidence. Considerable opportunity, means, reason to occur.	**8**
Frequent	90%-100%	Event is expected to occur. High level of recorded incidents and/or very strong anecdotal evidence.	**10**

TABLE 4-11: Consequence to Community Matrix

Impact	Consequence Categories	Description	Risk Score
Insignificant	Life Safety	■ 1 or 2 people affected, minor injuries, minor property damage, and no environmental impact.	**2**
Minor	Life Safety Economic and Infrastructure Environmental	■ Small number of people affected, no fatalities, and small number of minor injuries with first aid treatment. Minor displacement of people for <6 hours and minor personal support required. ■ Minor localized disruption to community services or infrastructure for <6 hours. Minor impact on environment with no lasting effects.	**4**
Moderate	Life Safety Economic and Infrastructure Environmental	■ Limited number of people affected (11 to 25), no fatalities, but some hospitalization and medical treatment required. Localized displacement of small number of people for 6 to 24 hours. Personal support satisfied through local arrangements. Localized damage is rectified by routine arrangements. ■ Normal community functioning with some inconvenience. Some impact on environment with short-term effects or small impact on environment with long-term effects.	**6**
Significant	Life Safety Economic and Infrastructure Environmental	■ Significant number of people (>25) in affected area impacted with multiple fatalities, multiple serious or extensive injuries, and significant hospitalization. ■ Large number of people displaced for 6 to 24 hours or beyond. External resources required for personal support. Significant damage that requires external resources. Community only partially functioning, some services unavailable. Significant impact on environment with medium- to long-term effects.	**8**
Catastrophic	Life Safety Economic and Infrastructure Environmental	■ Very large number of people in affected area(s) impacted with significant numbers of fatalities, large number of people requiring hospitalization; serious injuries with long-term effects. General and wide-spread displacement for prolonged duration; extensive personal support required. Extensive damage to properties in affected area requiring major demolition. ■ Serious damage to infrastructure. Significant disruption to, or loss of, key services for prolonged period. ■ Community unable to function without significant support. ■ Significant long-term impact on environment and/or permanent damage.	**10**

TABLE 4-12: Impact on PFD Matrix

Impact	Impact Categories	Description	Risk Score
Insignificant	Personnel and Resources	One apparatus out of service for period not to exceed one hour.	**2**
Minor	Personnel and Resources	More than one but not more than two apparatus out of service for a period not to exceed one hour.	**4**
Moderate	Personnel and Resources	More than 50 percent of available resources committed to incident for over 30 minutes.	**6**
Significant	Personnel and Resources	More than 75 percent of available resources committed to an incident for over 30 minutes.	**8**
Catastrophic	Personnel, Resources, and Facilities	More than 90 percent of available resources committed to incident for more than two hours or event which limits the ability of resources to respond.	**10**

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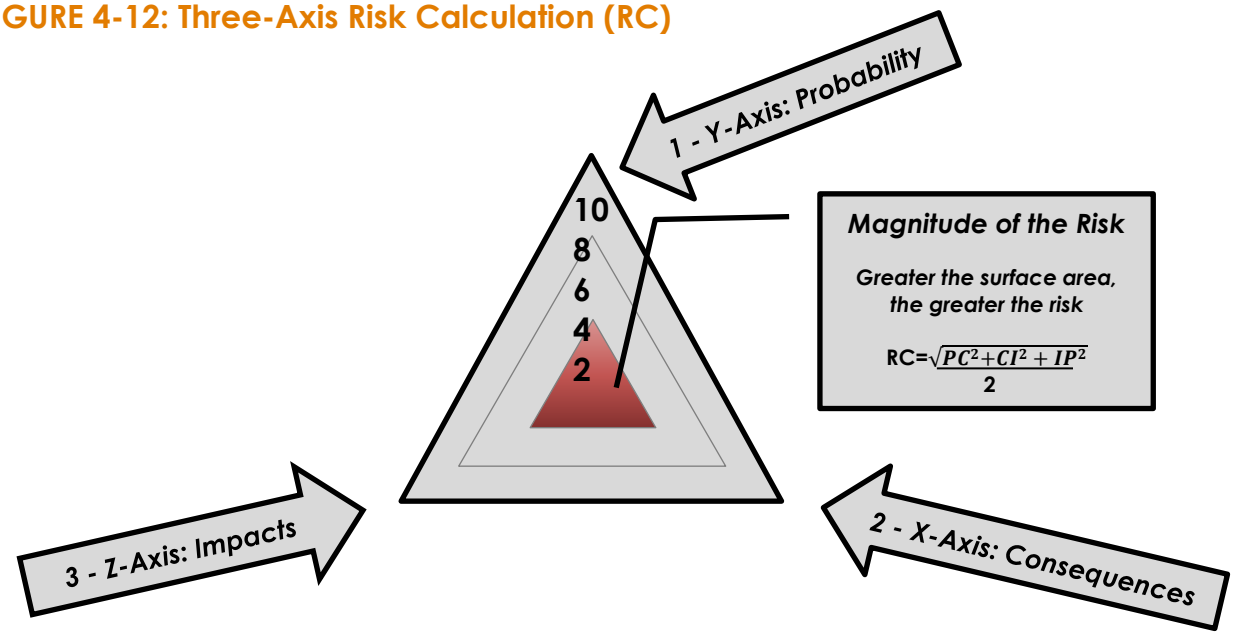
This section also contains an analysis of the various risks considered in the city. In this analysis, information presented and reviewed in this section (All-Hazards Risk Assessment of the Community) have been considered. Risk is categorized as Low, Moderate, High, or Special.

Prior risk analysis has only attempted to evaluate two factors of risk: probability and consequence. Contemporary risk analysis considers the impact of each risk to the organization, thus creating a three-axis approach to evaluating risk as depicted in the following figure. A contemporary risk analysis now includes probability, consequences to the community, and impact on the organization, in this case the PFD.

FIGURE 4-12: Three-Axis Risk Calculation (RC)



The following factors/hazards were identified and considered:

- **Demographic factors** such as age, socio-economic, vulnerability.
- **Environmental/natural hazards** such as flooding, wind events, wildland fires.
- **Manufactured hazards** such as rail lines, roads and intersections, target hazards.
- **Structural/building risks**.
- **Fire and EMS incident numbers and density**.
- **Resiliency.**

The assessment of each factor and hazard as listed below took into consideration the likelihood of the event, the impact on the city itself, and the impact on PFD's ability to deliver emergency services, which includes PFD resiliency and automatic aid capabilities as well. The list is not all inclusive but includes categories most common or that may present to the city and the PFD.

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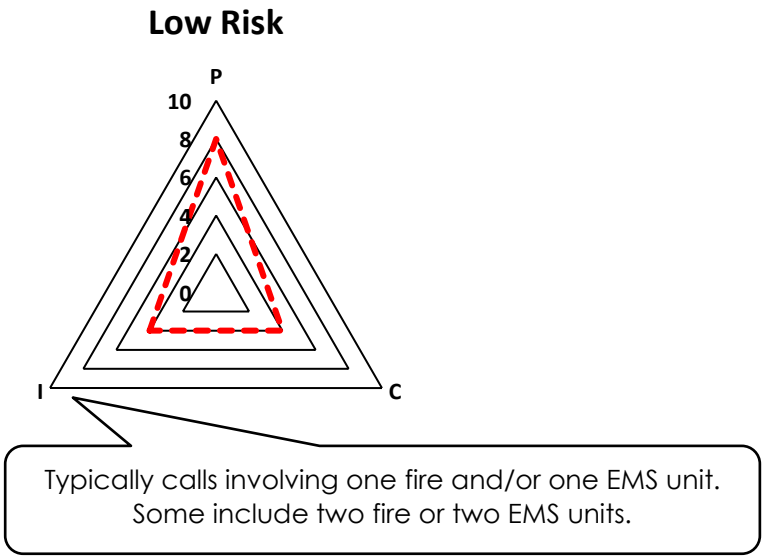
Low Risk

- Automatic fire/false alarms.
- Low-acuity BLS EMS Incidents.
- Low-risk environmental event.
- Motor vehicle accident (MVA); no entrapment or MCI.
- Good intent/hazard/public service fire incidents with no life-safety exposure.
- Outside fires such as grass, rubbish, dumpster, vehicle with no structural/life-safety exposure.

FIGURE 4-13: Low Risk



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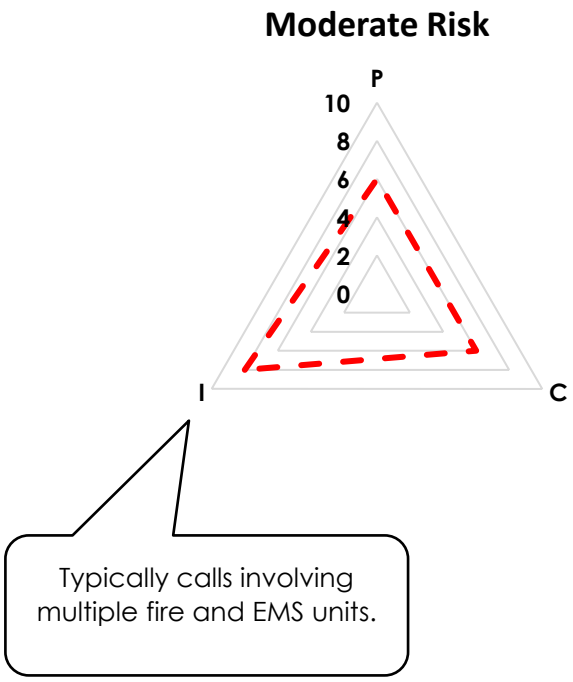
Moderate Risk

- Fire incident in a single-family dwelling where fire and smoke or smoke is visible, indicating a working fire.
- Suspicious substance investigation involving multiple fire companies and law enforcement agencies.
- ALS EMS incident.
- Environmental event with moderate conditions requiring fire and EMS mitigation.
- MVA with entrapment of passengers.
- Grass/brush fire with structural endangerment/exposure.
- Low-angle rescue involving ropes and rope rescue equipment and resources.
- Surface water rescue.
- Good intent/hazard/public service fire incidents with life-safety exposure.
- Rail event with no threat to life safety but requiring multiple transports of minor injuries.

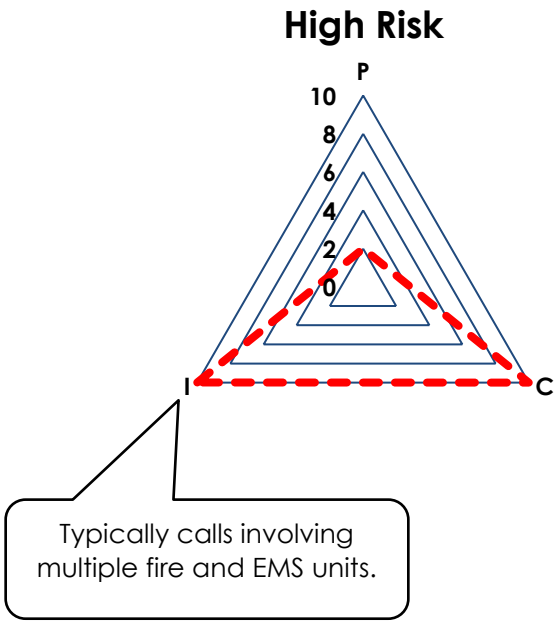
FIGURE 4-14: Moderate Risk



High Risk

- Working fire in a target hazard.
- Cardiac arrest.
- Mass casualty incident of more than 10 patients but fewer than 25 patients.
- Confined space rescue.
- Structural collapse involving life-safety exposure.
- High-angle rescue involving ropes and rope rescue equipment.
- Trench rescue.
- Suspicious substance incident with multiple injuries.
- Industrial leak of hazardous materials that causes exposure to persons or threatens life safety.
- Weather event that creates widespread flooding, heavy winds, building damage, mudslide, and/or life-safety exposure.

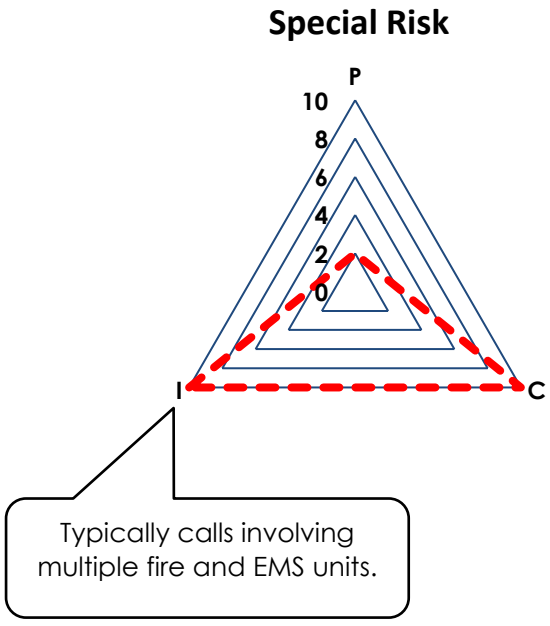
FIGURE 4-15: High Risk



Special Risk

- Working fire in a structure of more than three floors.
- Fire at an industrial building or complex with hazardous materials.
- Fire in an occupied targeted hazard with special life-safety risks such as age, medical condition, or other identified vulnerabilities.
- Wildland fire during a drought, high wind event encroaching more than one built upon area on several fronts.
- Mass casualty incident of more than 25 patients.
- Rail or transportation incident that causes life-safety exposure or threatens life safety through the release of hazardous smoke or materials and evacuation of residential and business occupancies.
- Explosion in a building that causes exposure to persons or threatens life safety or outside of a building that creates exposure to occupied buildings or threatens life safety.
- High-impact environmental event such as an earthquake, epidemic, or pandemic.
- Mass gathering with threat of fire and threat to life safety or other civil unrest, weapons of mass destruction release.

FIGURE 4-16: Special Risk



SECTION 5. FIRE OPERATIONS DEPLOYMENT AND PERFORMANCE

CURRENT STAFFING AND DEPLOYMENT OF FIRE RESOURCES

When exploring staffing and deployment of fire departments it is prudent to design an operational strategy around the actual circumstances that exist in the community and the fire and risk problems that are identified. The strategic and tactical challenges presented by the widely varied hazards that a department protects against need to be identified and planned for through a community risk analysis planning and management process as completed in this report. It is ultimately the responsibility of elected officials to decide the level of risk that is acceptable to their community. Once the acceptable level of risk has been decided, then operational service goals can be established. Whether looking at acceptable risk, or level of service goals, it would be imprudent, and probably very costly, to build a deployment strategy that is based solely on response times and emotion.

The staffing of fire and EMS companies is a never-ending focus of attention among fire service and governmental leadership. While NFPA 1710 and OSHA provide guidelines (and to some extent the law, specifically OSHA in OSHA states) as to the level of staffing and response of personnel, the adoption of these documents varies from state to state and department to department. NFPA 1710 addresses the recommended staffing in terms of specific types of occupancies and risks. The needed staffing to conduct the critical tasks for each specific occupancy and risk are determined to be the *Effective Response Force* (ERF). The ERF for each of these occupancies is detailed in NFPA 1710 (2020 edition), section 5.2.4, Deployment.

One of the factors that has helped the fire service in terms of staffing is technology. The fire service continues to benefit from technological advances that help firefighters extinguish fires more effectively. More advanced equipment in terms of nozzles, personal protective gear, thermal imaging systems, advancements in self-contained breathing apparatus, incident command strategies, drones with infrared cameras, and devices used to track personnel air supply are some of the technologies and techniques that help firefighters extinguish fires faster and manage the fireground more effectively and safely. While some of these technologies do not reduce the staffing or workforce needed, they can have an impact on firefighter safety, property loss, and crew fatigue.

Even with the many advances in technology and equipment, the fireground is an unforgiving and dynamic environment where firefighters must complete critical tasks simultaneously. Lightweight wood construction, truss roofs, dwellings and buildings with basements, increased setbacks making accessibility to the building difficult, and large footprint commercial buildings and estate homes are examples of the challenges that firefighting forces are met with when mitigating structural fires. Newly constructed homes are larger than much of the older home stock a community. These homes tend to incorporate open floor plans, with large spaces that contribute to rapid fire spread. The challenge of rapid fire spread is exacerbated by the use of lightweight roof trusses, vinyl siding, and combustible sheathing. The result is that more personnel are required to mitigate the incidents safely and effectively in these structures. Providing adequate staffing through an Effective Response Force for these environments depends on many factors.

While staffing and deployment of fire services is not an exact science, CPSM has developed metrics it follows and recommends that communities consider when making recommendations about staffing and deployment of fire resources. While there are many benchmarks that communities and management use in justifying certain staffing levels, there are certain considerations that are data driven and presented through national consensus that serve this purpose as well.

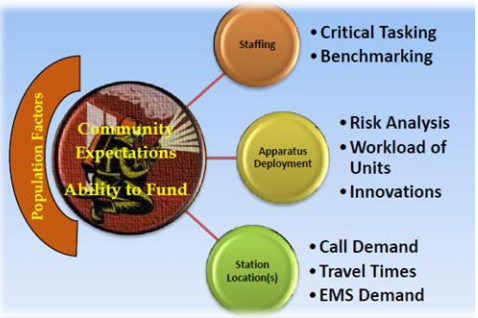
In addition to metrics, fire and EMS staffing is also linked to station location, what type of apparatus is responding, that is, the combination of engine, ladder, ambulance, or specialty apparatus. These joint factors help to determine what level of fire and EMS service is going to be delivered in terms of labor, response time, and resources.

Linked to these components of staffing and deployment are 11 critical factors that drive various levels and models from which fire and EMS departments staff and deploy. These factors are:

Fire Risk and Vulnerability of the Community: The community risk and vulnerability assessment are used to evaluate the community. With regard to individual property, the assessment is used to measure all property and the risk associated with that property and then segregate the property as either a high-, medium-, or low-hazard depending on factors such as the life and building content hazard and the potential fire flow and the staffing and apparatus types required to mitigate an emergency in the specific property. Factors such as fire protection systems are considered in each building evaluation. Included in this assessment should be both a structural and nonstructural (weather, wildland-urban interface, transportation routes, etc.) analysis.

Population, Demographics, and Socioeconomics of a Community: Population and population density drive calls for local government service, particularly public safety. The risk from fire is not the same for everyone, with studies telling us age, gender, race, economic factors, and what region in the country one might live all contribute to the risk of death from fire. Studies also tell us these same factors affect demand for EMS, particularly population increase and the use of hospital emergency departments. Many uninsured or underinsured patients rely on emergency departments for their primary and emergent care, utilizing pre-hospital EMS transport systems as their entry point.

Call Demand: Demand is made up of the types of calls to which units are responding and the location of the calls. This drives workload and station staffing considerations. *Higher population centers with increased demand require greater resources.*



Workload of Units: The types of calls to which units are responding and the workload of each unit in the deployment model. This tells us what resources are needed and where; it links to demand and station location, or in a dynamic deployed system, the area(s) in which to post units.

Travel Times from Fire Stations: Looks at the ability to cover the response area in a reasonable and acceptable travel time when measured against national benchmarks. Links to demand and risk assessment.

NFPA Standards, ISO, OSHA Requirements (and other national benchmarking). CPSM considers national benchmarks, standards, and applicable laws when making recommendations or alternatives regarding the staffing and deployment of fire and EMS resources.

EMS Demand: Community demand; demand on available units and crews; demand on non-EMS units responding to calls for service (fire/police units); availability of crews in departments that utilize cross-trained EMS staff to perform fire suppression.

Critical Tasking: The ability of a fire and EMS department to collect an effective response force as benchmarked against national standards when confronted with the need to perform required critical tasks on a fire or EMS incident scene defines its capability to provide adequate resources to mitigate each event. Department-developed and measured against national benchmarks. Links to risk and vulnerability analysis.

Innovations in Staffing and Deployable Apparatus: The fire department's ability and willingness to develop and deploy innovative apparatus. Compressed air foam systems, deploying quick response vehicles (light vehicles equipped with medical equipment and some light fire suppression capabilities) on those calls (typically the largest percentage) that do not require heavy fire apparatus.

Community Expectations: Measuring, understanding, and meeting community expectations.

Ability to Fund: The community's ability and willingness to fund all local government services and understanding how the revenues are divided up to meet the community's expectations.

While each component presents its own metrics of data, consensus opinion, and/or discussion points, aggregately they form the foundation for informed decision making geared toward the implementation of sustainable, data- and theory-supported, effective fire and EMS staffing and deployment models that fit the community's profile, risk, and expectations.

PFD responds with fire suppression apparatus and EMS transport units with crews from three fire station locations. PFD also relies to some extent on auto/mutual aid companies for fire and EMS service delivery, particularly to collect the appropriate effective response force for single family, multi-family, vertically dense, commercial, and other building types.

Emergency response units include:

Engine Companies, which are primarily designed for firefighting operations, the transport of crew members, hose (fire attack and larger supply), tank water, ground ladders, self-contained breathing apparatus, and storage of an assortment of hand tools used for a broad spectrum of fire operational tasks. As engines are often utilized as first response units on EMS calls, they also carry an assortment of EMS gear to treat patients and provide life-saving measures prior to the arrival of EMS transport units. The PFD engines are set up for this as well and are staffed with advanced emergency medical technicians. Staffing complements for engine apparatus are discussed below. PFD currently responds to emergencies with an inventory of one engine.

Ladder Company, which is also primarily designed for firefighting operations but differs from engines in that it also has a hydraulically operated aerial device designed to reach above grade floors to transport crew members, effect rescues, and provide an elevated water stream. Ladder trucks also transport crew members, ground ladders, self-contained breathing apparatus, various forcible entry tools, ventilation equipment, and hydraulic rescue tools as well as other equipment to deal with an assortment of fires and technical rescues. The PFD currently responds to emergencies with an inventory of one ladder truck. When needed, the unit responds with a crew capable of performing ladder company functions such as ventilation, utility control, above-grade firefighting tasks, and elevated master stream application.

EMS Ground Transport Units, which are primarily designed to respond to EMS calls for service with crew members and provide on-scene treatment and then transport while continuing care to the

hospital emergency department. Equipment includes both basic and advanced life support targeted at timely intervention and patient stabilization. PFD currently responds to emergencies with an inventory of three ambulances which are staffed with paramedics/advanced emergency medical technicians.

Command Vehicles, which are typically SUV-type vehicles with command centers built into the cargo compartment are designed to carry a command level officer to the scene and equipped with radio and command boards as well scene personnel-tracking equipment and associated gear. PFD has one command vehicle assigned to the Battalion Chief (shift commander), the Fire Chief and the Assistant Chief. These personnel are responsible for responding to fire and EMS incidents and establishing command and control of the incident.

PFD has three shifts, A, B, and C. All three shifts are staffed daily with a minimum of members. The following table details the positions for each shift.

TABLE 5-1: PFD Shift Matrix: Minimum Staffing

A Shift (24 on 48 off)	B Shift (24 on 48 off)	C Shift (24 on 48 off)
STATION 1 **Engine 9381** 1 Captain 1 Engineer/PM 1 Firefighter/PM **Medic 991** 2 Firefighter/PMs **Batt 9:** 1 Battalion Chief	**STATION 1** **Engine 9381** 1 Captain 1 Engineer/PM 1 Firefighter/PM **Medic 991** 2 Firefighter/PMs **Batt 9:** 1 Battalion Chief	**STATION 1** **Engine 9381** 1 Captain 1 Engineer/PM 1 Firefighter/PM **Medic 991** 2 Firefighter/PMs **Batt 9:** 1 Battalion Chief
Station 2 **Engine 9382** Cross-Staffed **Truck 9351** 1 Captain 1 Engineer/PM 2 Firefighter/PMs **MEDIC 992** 2 Firefighter/PMs	**Station 2** **Engine 9382** Cross-Staffed **Truck 9351** 1 Captain 1 Engineer/PM 2 Firefighter/PMs **MEDIC 992** 2 Firefighter/PMs	**Station 2** **Engine 9382** Cross-Staffed **Truck 9351** 1 Captain 1 Engineer/PM 2 Firefighter/PMs **MEDIC 992** 2 FF/PMs
Station 3 **Engine 9383** 1 Captain 1 Engineer/PM 1 Firefighter/PM **MEDIC 993** 2 Firefighter/PMs	**Station 3** **Engine 9383** 1 Captain 1 Engineer/PM 1 Firefighter/PM **MEDIC** 2 Firefighter/PMs	**Station 3** **Engine 9383** 1 Captain 1 Engineer/PM 1 Firefighter/PM **MEDIC** 2 Firefighter/PMs

NFPA 1710 AS A CONSENSUS STANDARD AND TWO-IN/TWO-OUT

NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Career Fire Departments, 2020 edition* (National Fire Protection Association, Quincy, MA) outlines organization and deployment of operations by career, and primarily career fire and rescue organizations.[15] It serves as a benchmark to measure staffing and deployment of resources to certain structures and emergencies. Further, NFPA standards are consensus standards and not the law. Many local governments and special fire districts strive to achieve these standards to the extent possible without having an adverse fiscal impact on the community.

Cities and communities must decide on the level of service and compliance they can deliver based on budgetary constraints and operational capabilities. Questions of legal responsibilities are often discussed in terms of compliance with NFPA Standards. NFPA 1710 was the first organized approach to defining levels of service, deployment capabilities, and staffing levels for substantially career departments. Research work and empirical studies in North America were used by the standard's committee for the basis for developing response times and resource capabilities for those services as identified by the fire department.[16]

NFPA 1710 details staffing levels for fire departments in terms of fire, EMS, and special operation incidents. According to NFPA 1710, fire departments should base their capabilities on a formal community risk assessment, as discussed in this report, and taking into consideration:[17]

- Life hazard to the population protected.
- Provisions for safe and effective firefighting performance conditions for the firefighters.
- Potential property loss.
- Nature, configuration, hazards, and internal protection of the properties involved.
- Types of fireground tactics and evolutions employed as standard procedure, type of apparatus used, and results expected to be obtained at the fire scene.

According to NFPA 1710, if a community follows this standard, engine and ladder companies shall be staffed with a minimum of four on-duty members.[18] Additional staffing parameters in this standard for engine and ladder companies is based on geographical isolation and tactical hazards, and increases each to five or six as a minimum.[19] This staffing configuration is designed to ensure a fire department can efficiently assemble an effective response force for each risk the department may encounter and complete the critical tasking necessary to combat building fires and other emergency incidents simultaneously to the extent possible.

The PFD response to structural fires is three engines, one ladder truck, three ambulances, and one Battalion Chief. The response typically includes PFD and Rancho Adobe Fire District units. PFD contributes, depending on unit availability, three engines, one ladder truck, one to three

15. NFPA 1710 is a nationally recognized standard, but it has not been adopted as a mandatory regulation by the federal government or the State of California. It is a valuable resource for establishing and measuring performance objectives for the City of Petaluma but should not be the only determining factor when making local decisions about the City's fire and EMS services.
16. NFPA 1710 Origin and Development of the NFPA 1710, 1710-1
17. NFPA 1710, 5.2.1.1, 5.2.2.2
18. NFPA 1710, 5.2.3.1.1; 5.2.3.2.1
19. NFPA 1710, 5.2.3.1.2, 5.2.3.1.2.1.,5.2.3.2.2.,5.3.2.3.2.2.1

ambulances, and one Battalion Chief. In total this response typically places 20 personnel on scene. Automatic aid companies from contiguous communities make up the balance of the working fire and greater alarm fires. ***NFPA 1710 permits fire departments to use established automatic aid and mutual aid agreements to comply with the assembling of on-scene personnel to complete critical tasks as outlined in the standard.***

Another consideration, and one that links to critical tasking and assembling an effective response force, is that of two-in/two-out regulations. Essentially, prior to starting any fire attack in an immediately dangerous to life and health (IDLH) environment [with no confirmed rescue in progress], the initial two-person entry team shall ensure that there are sufficient resources on-scene to establish a two-person initial rapid intervention team (IRIT) located outside of the building.

This critical tasking model has its genesis with the Occupational Safety and Health Administration, specifically 29 CFR 1910.134(g)(4). The California State Plan also applies to state and local government employers. Federal OSHA covers the issues not covered by the California State Plan.[25] The federal rule (29 CFR 1910.134(g)(4)) applies to the PFD.

CFR 1910.134: Procedures for interior structural firefighting. The employer shall ensure that:

(i) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times;

(ii) At least two employees are located outside the IDLH atmosphere; and

(iii) All employees engaged in interior structural firefighting use SCBAs.[20]

According to the standard, one of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

NFPA 1500, *Standard on Fire Department Occupational Health, Safety, and Wellness, 2021 Edition*, has similar language as CFR 1910.134(g)(4) to address the issue of two-in/two-out, stating the initial stages of the incident where only one crew is operating in the hazardous area of a working structural fire, a minimum of four individuals shall be required consisting of two members working as a crew in the hazardous area and two standby members present outside this hazard area available for assistance or rescue at emergency operations where entry into the danger area is required.[21]

NFPA 1500 also speaks to the utilization of the two-out personnel in the context of the health and safety of the firefighters working at the incident. *The assignment of any personnel including the incident commander, the safety officer, or operations of fire apparatus, shall not be permitted as standby personnel if by abandoning their critical task(s) to assist, or if necessary, perform rescue, this clearly jeopardizes the safety and health of any firefighter working at the incident*.[22]

In order to meet CFR 1910.134(g)(4), and NFPA 1500, the PFD must utilize two personnel to commit to interior fire attack while two firefighters remain out of the hazardous area or immediately dangerous to life and health (IDLH) area to form the Initial Rapid Intervention Team (IRIT), while attack lines are charged, and a continuous water supply is established.

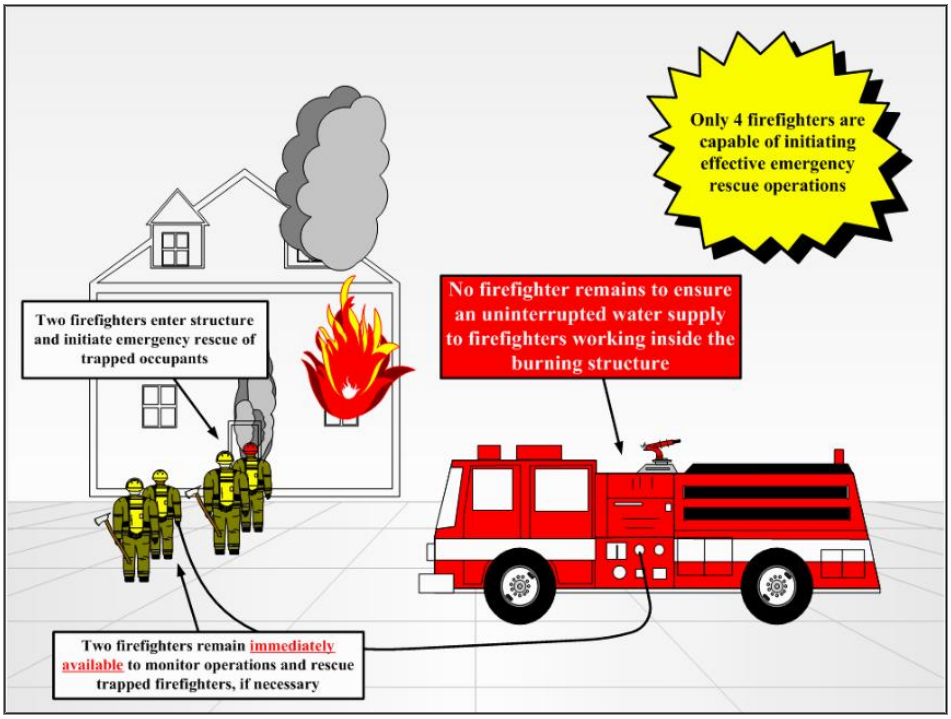
20. CFR 1910.134 (g) 4
21. NFPA 1500, 2021, 8.8.2.
22. NFPA 1500, 2021, 8.8.2.5.

However, NFPA 1500 allows for fewer than four personnel under specific circumstances. It states: *Initial attack operations shall be organized to ensure that if on arrival at the emergency scene, initial attack personnel find an imminent life-threatening situation where immediate action could prevent the loss of life or serious injury, such action shall be permitted with fewer than four personnel.*[23]

CFR 1910.134(g)(4) also states that nothing in section (g) is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled.[24]

It is also important to note that the OSHA standard (and NFPA 1710) specifically references "interior firefighting." Firefighting activities that are performed from the exterior of the building are not regulated by this portion of the OSHA standard. However, in the end, the ability to assemble adequate personnel, along with appropriate apparatus, on the scene of a structure fire, is critical to operational success and firefighter safety.

FIGURE 5-1: OSHA "Two-In/Two-Out"



EFFECTIVE RESPONSE FORCE AND CRITICAL TASKING

Critical tasks are those activities that must be conducted on time and preferably simultaneously by responders at emergency incidents to control the situation and minimize/stop loss (property and life-safety). Critical tasking for fire operations is the minimum number of personnel needed to perform the tasks needed to effectively control and mitigate a fire or other emergency. To be effective, critical tasking must assign enough personnel so that all identified functions can be performed simultaneously. However, it is important to note that initial response personnel may manage secondary support functions once they have completed their primary assignment.

23. NFPA 1500, 2021 8.8.2.10.
24. CFR 190.134, (g).

Thus, while an incident may end up requiring a greater commitment of resources or a specialized response, a properly executed critical tasking assignment will provide adequate resources to immediately begin bringing the incident under control.

The specific number of people required to perform all the critical tasks associated with an identified risk or incident type is referred to as an ***Effective Response Force*** (ERF). The goal is to deliver an ERF within a prescribed period. NFPA 1710 provides the benchmarks for effective response forces.

NFPA 1710 addresses standards for an ERF across different types of occupancies. An effective ERF is defined as the minimum number of firefighters and equipment that must reach a specific emergency incident location within a maximum prescribed travel [driving] time. The maximum prescribed travel time acts as one indicator of resource deployment efficiency.

NFPA 1710 provides a staffing deployment model and critical tasking guidelines for four specific occupancies. These occupancies are:

- Single-Family Dwelling.
- Open-Air Strip Mall/Commercial.
- Garden-Style Apartment.
- High-Rise Building.

The Center for Public Safety Excellence (CPSE) has also established benchmarks regarding staffing and deployment. CPSE sets standards for agencies desiring accreditation through the Commission on Fire Accreditation International (CFAI). CFAI uses standards set forth in the *Quality Improvement for the Fire and Emergency Services, Tenth Edition*, to provide guidance in staffing and deployment to agencies desiring accreditation through Core Competencies.

Core Competency 2C.4

> *A critical task analysis of each category and risk class has been conducted to determine the first due and effective response force capabilities, and a process is in place to validate and document the results.*

Core competency 2C.4 requires that the agency conduct a critical task analysis of each risk category and risk class to determine the first-due and effective response force capabilities, and to have a process in place to validate and document the results. The process considers the number of personnel needed to perform the necessary emergency scene operations. Completion of the process also helps to identify any gaps in the agency's emergency scene practices.

The following discussion and tables will outline how critical tasking and assembling an effective response force is first measured in NFPA 1710, and how the PFD is benchmarked against this standard for the building types existing in Petaluma. This discussion will cover single-family dwelling buildings, open-air strip mall/commercial buildings, apartment buildings, and high-rise buildings as outlined in the NFPA standard. As discussed above, for all multi-unit structural responses, the PFD relies on automatic aid to assemble an Effective Response Force.

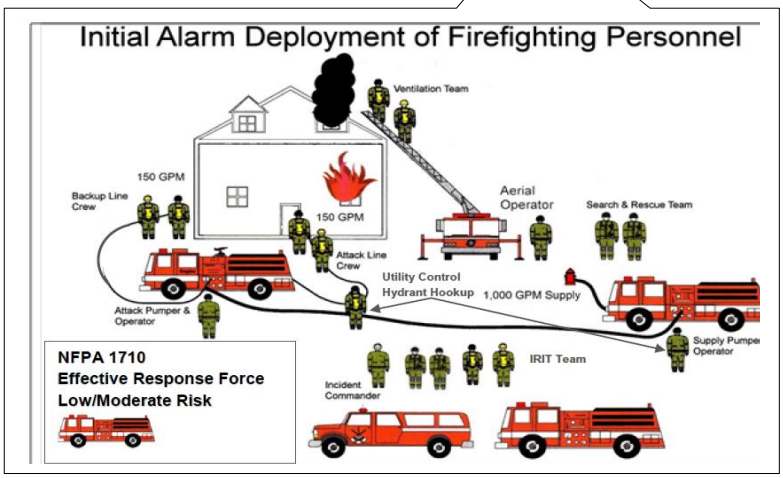
Single-Family Dwelling: NFPA 1710, 5.2.4.1

The initial full alarm assignment to a structural fire in a 2,000 square-foot, two-story, single-family dwelling without a basement and with no exposures must provide for a minimum of 16 members, (17 if an aerial device is used). The following table outlines the critical task matrix.

TABLE 5-2: NFPA 1710 Effective Response Force for Single-Family Dwelling Fire

Critical Tasks	Personnel
Incident Command	1
Continuous Water Supply	1
Fire Attack via Two Handlines	4
Hydrant Hook Up-Forcible Entry-Utilities	2
Primary Search and Rescue	2
Ground Ladders and Ventilation	2
Aerial Operator if Aerial is Used	1
Establishment of IRIC (Initial Rapid Intervention Crew	4
Total Effective Response Force	**16 (17) If Aerial is Used**

Note: Single-family dwellings in Petaluma greater than 2,000 square feet should be considered a more moderate risk, particularly if built with lightweight wood-frame construction.



The next table outlines how PFD is able to assemble an ERF for a single-family dwelling fire.

TABLE 5-3: PFD Effective Response Force for Single-Family Dwelling Fire

PFD Response Matrix	Personnel
PFD Chief Officer	1
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD Truck/Ladder	4
PFD Ambulance (1-3) Dependent on Availability	2-6
	Total ERF for PFD: 16 to 20 Members**

** PFD meets the minimum requirements of NFPA 1710 **since fire departments shall be permitted to use established automatic aid and mutual aid agreements to comply with section 5.2 of this standard**. (NFPA 1710.5.2.1.3)

Open-Air Strip Mall/Commercial Building, NFPA 1710 5.2.4.2

The initial full alarm assignment to a structural fire in a typical open-air strip mall/commercial building ranging from 13,000 square feet to 196,000 square feet in size must provide for a minimum of 27 members (28 if an aerial device is used). The next table outlines the critical tasking matrix for this type of building.

TABLE 5-4: NFPA 1710 Effective Response Force for Open-Air Strip Mall Fire

Critical Tasks	Personnel
Incident Command	2
Continuous Water Supply	2
Fire Attack via Two Handlines	6
Hydrant Hook Up-Forcible Entry-Utilities	3
Primary Search and Rescue	4
Ground Ladders and Ventilation	4
Aerial Operator if Aerial is Used	1
Establishment of IRIC (Initial Rapid Intervention Crew	4
Medical Care Team	2
Total Effective Response Force	**27 (28) If Aerial is Used**

The next table outlines how the PFD is able to assemble an ERF for an open air strip mall.

TABLE 5-5: PFD Effective Response Force for Open-Air Strip Mall fire

PFD Response Matrix	Personnel
PFD Chief Officer	1
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD Truck/Ladder	4
PFD Ambulance (1-3) Dependent on Availability	2-6

Total ERF for PFD: 24 Members**

** PFD **does not meet** the minimum requirements of NFPA 1710 for the Initial alarm assignment for Open-Air Strip Shopping Center based on the current response matrix.

Apartment Buildings, NFPA 1710 5.2.4.3

The initial full alarm assignment to a structural fire in a typical 1,200 square-foot apartment within a three-story, garden-style apartment building must provide for a minimum of 27 members (28 if an aerial device is used). The next table outlines the critical tasking matrix for this type of building fire.

TABLE 5-6: NFPA 1710 Effective Response Force for Apartment Building Fire

Critical Tasks	Personnel
Incident Command	2
Continuous Water Supply	2
Fire Attack via Two Handlines	6
Hydrant Hook Up-Forcible Entry-Utilities	3
Primary Search and Rescue	4
Ground Ladders and Ventilation	4
Aerial Operator if Aerial is Used	1
Establishment of IRIC (Initial Rapid Intervention Crew	4
Medical Care Team	2
Total Effective Response Force	**27 (28) If Aerial is Used**

The following table outlines the how the PFD is able to assemble an Effective Response Force for an apartment building fire.

TABLE 5-7: PFD Effective Response Force for Apartment Building Fire

PFD Response Matrix	Personnel
PFD Chief Officer	1
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD Truck/Ladder	4
PFD Ambulance (1-3) Dependent on Availability	2-6

Total ERF for PFD: 24 Members**

** PFD **does not meet** the minimum requirements of NFPA 1710 for the Initial alarm assignment for Open-Air Strip Shopping Center based on the current response matrix.

High-Rise, NFPA 5.2.4.4

The initial full alarm assignment to a fire in a building where the highest floor is greater than 75 feet above the lowest level of fire department vehicle access must provide for a minimum of 42 members (43 if the building is equipped with a fire pump). The next table outlines the critical tasking matrix for this type of building fire.

TABLE 5-8: NFPA 1710 Effective Response Force for Special Risk/High-Rise Fire

Critical Tasks	Personnel
Incident Command	2
Continuous Water Supply	1/1- 1 FF for continuous water. If fire pump exists an additional FF will be required for a total of 2
Fire Attack via Two Handlines	4
One Handline above the Fire Floor	2
Establishment of IRIC (Initial Rapid Intervention Crew	4
Primary Search and Rescue Teams	4
Entry Level Officer with Aide near Entry Point of Fire Floor	2
Entry Level Officer with Aide near the Entry Point above the Fire Floor	2
Two Evacuation Teams	4
Elevation Operations	1
Safety Officer	1
FF Two floors below Fire to Coordinate Staging	1
Rehabilitation Management	2
Officer and FFs to Manage Vertical Ventilation	4
Lobby Operations	1
Transportation of Equipment below Fire Floor	2
Officer to Manage Base Operations	1
Two ALS Medical Care Teams	4
Total Effective Response Force	**42 (43) If building is Equipped with Pump**

The next table outlines how the PFD is able to assemble an ERF for a high-rise building fire.

TABLE 5-9: PFD Effective Response Force for Special Risk/High-Rise Building Fire

PFD Response Matrix	Personnel
PFD Chief Officer	1
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD/RAD Engine	3
PFD Truck/Ladder	4
PFD Ambulance (1-3) Dependent on Availability	2-6

Total ERF for PFD: 29 Members**

** PFD **does not meet** the minimum requirements of NFPA 1710 for the Initial alarm assignment for Special Risk/High Rise based on the current response matrix.

In conclusion, PFD meets the Effective Response Force (ERF) for single-family dwellings *but does not meet, even with automatic and mutual aid*, the ERF for Open-Air Strip Shopping Center/Commercial Buildings, Apartments, and High-Rise Structures. Not meeting the ERF means that the tasks as outlined for these critical individual structures cannot be completed simultaneously and as outlined herein.

Recommendations:

- CPSM recommends the PFD, to the extent possible and if practical depending on available automatic and mutual aid resources, work with regional Fire Chiefs to increase response resources to strip mall/commercial, apartment, and high-rise fire responses that align more closely with the NFPA 1710 standard. (Recommendation No. 7.)
- CPSM further recommends that due to factors listed here, and to increase PFD resources to be able to assemble an Effective Response Force, the City of Petaluma develop a one to three-year funding plan to increase staffing and apparatus response by adding three personnel per day to Fire Station 2, thus providing full-time staffing of the Engine and Ladder Companies (maintain 4-person staffing on the ladder) and deploying both units from this station (for a total of seven personnel). CPSM further recommends that if Station 4 is constructed in midtown or if Station 1 is relocated to 307 Petaluma Blvd. South, the ladder truck with staffing (four personnel/shift) be re-located to either one of these locations, whichever is constructed first, and the three person engine remain at Fire Station 2. (Recommendation No. 8.)

Factors on which these recommendation are based are:

- Demand for service on the PFD.
- Population density that includes substantial current and projected vertical density structures, many involving assisted and/or senior living.
- Current and future residential-over-commercial buildings.
- Other building risks identified in this report, particularly in the Station 1 downtown response zone.
- The PFD cross-staffs the truck company with an engine and mutual and automatic aid response resources have extended response times due to the location of these assets.
- Response capability resiliency.

PFD RESPONSE TIMES

Response times are typically utilized as a primary measurement for evaluating fire and EMS services. Response times are used as a benchmark to determine how well a fire department is currently performing, to help identify response trends, and to predict future operational needs and station placement. Achieving the quickest and safest response times possible should be a fundamental goal of every fire department.

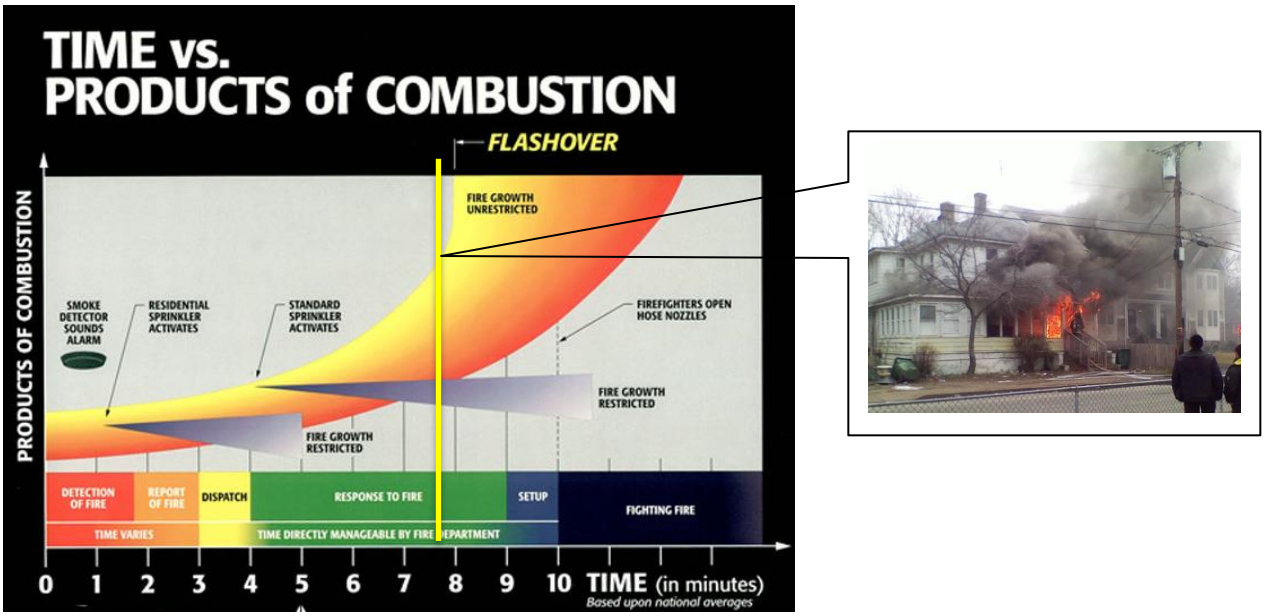
Fire incident response time criterion is linked to the concept of "flashover." This is the state at which super-heated gases from a fire are released rapidly, causing the fire to burn freely, and become so volatile that the fire reaches an explosive state (simultaneous ignition of all the combustible materials in a room). In this situation, usually after an extended period (often eight to twelve minutes after ignition but at times as quickly as five to seven minutes), and a

combination of the right conditions (fuel and oxygen), the fire expands rapidly and is much more difficult to contain. When the fire does reach this extremely hazardous state, initial firefighting forces are often overwhelmed, larger and more destructive fire occurs, the fire escapes the room and possibly even the building of origin, and significantly more resources are required to affect fire control and extinguishment.

Flashover occurs more quickly and more frequently today and is caused at least in part by the introduction of significant quantities of plastic and foam-based products into homes and businesses (e.g., furnishings, mattresses, bedding, plumbing and electrical components, home and business electronics, decorative materials, insulation, and structural components). These materials ignite and burn quickly and produce extreme heat and toxic smoke.

The next figure illustrates the time progression of a fire from inception (event initiation) through flashover. The time-versus-products-of-combustion curve shows activation times and effectiveness of residential sprinklers (approximately one minute), commercial sprinklers (four minutes), flashover (eight to ten minutes), and firefighters applying first water to the fire after notification, dispatch, response, and set up (ten minutes).

FIGURE 5-2: Fire Growth from Inception to Flashover[25]



As a benchmark, for an urban community and as described in the staffing analysis section above, NFPA 1710 recommends the entire initial response of between 17 and 28 personnel, depending on occupancy type and personnel tasks, be on scene within eight minutes of dispatch (610 seconds and 43 personnel for a high-rise incident). It is also important to keep in mind that once units arrive on scene there is a time lag before water reaches the fire as crews and companies have several tasks to complete in the initiating action period immediately after arrival at the scene. ***NFPA 1710 recommends that units be able to commence an initial attack within two minutes of arrival, 90 percent of the time.***

The ability to quickly deploy adequate fire staff prior to flashover thus limits the fire's extension beyond the room or area of origin. Regarding the risk of flashover, the authors of an IAFF report conclude: Clearly, an early aggressive and offensive initial interior attack on a working structural

25. Source: https://www.slideserve.com/tavon/the-international-society-of-fire-service-instructors

fire results in greatly reduced loss of life and property damage. Consequently, given that the progression of a structural fire to the point of "flashover" (the very rapid spreading of the fire due to super-heating of room contents and other combustibles) generally occurs in less than ten minutes, two of the most important elements in limiting fire spread are the quick arrival of sufficient numbers of personnel and equipment to attack and extinguish the fire as close to the point of its origin as possible.[26]

For the purpose of this analysis, ***response time*** is a product of three components: ***dispatch time***, ***turnout time***, and ***travel time***.

For this study, and unless otherwise indicated, response times and travel times measure the first arriving unit only. The primary focus of this section is the dispatch and response time of the first arriving units for calls responded to with lights and sirens.

Dispatch time is the difference between the time a call is received and the earliest time an agency is dispatched. Dispatch time includes call processing time, which is the time required to determine the nature of the emergency and the types of resources to dispatch.

The NFPA 1710 standard for this component of response times is the event is processed and dispatched in:

- ≤ 64 seconds 90 percent of the time.
- ≤ 106 seconds 95 percent of the time.
- Special call types:
  - ≤ 90 seconds 90 percent of the time.
  - ≤ 120 seconds 99 percent of the time.

The next component of response time is **turnout time**, an aspect of response which is controlled by the responding fire department. NFPA 1710 states that turnout time shall be:

- ≤ 80 seconds (1.33 minutes) for fire and special operations 90 percent of the time.
- ≤ 60 seconds (1.0 minute) for EMS responses.

The last component of response time is **travel time,** an aspect of response time that is affected by factors such as station location, road conditions, weather, and traffic control systems. NFPA 1710 states that travel time for the first arriving fire suppression unit to a fire incident shall be:

- ≤ 240 seconds for the first arriving engine company to a fire suppression incident 90 percent of the time.
- ≤ 360 seconds for the second company 90 percent of the time.
- ≤ 480 seconds to assemble the initial first alarm assignment on scene 90 percent of the time for low/medium hazards, and 610 seconds for high-rise fire incidents 90 percent of the time.

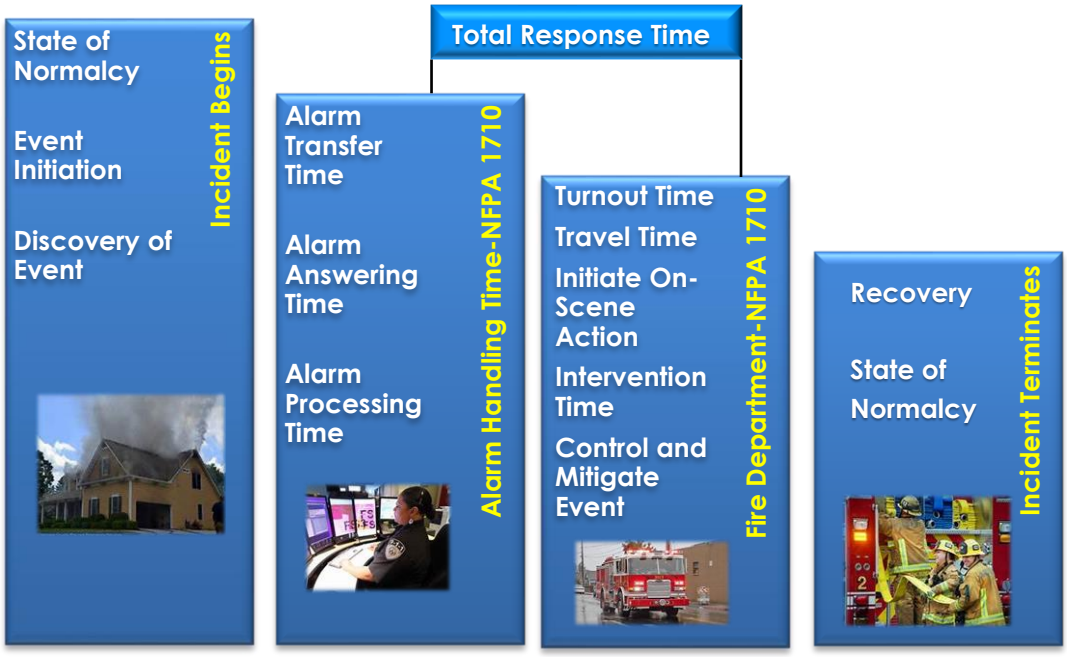
For EMS incidents the standard NFPA 1710 standard establishes a travel time of:

26. *Safe Fire Fighter Staffing: Critical Considerations*, 2nd ed. (Washington, DC: International Association of Fire Fighters, 1995), 5.

- ≤ 240 seconds for the first arriving engine company with automated external defibrillator (AED) or higher level capability.
- ≤ 480 seconds or less travel time of an Advanced Life Support (ALS) unit at an EMS incident where the service is provided by the fire department provided a first responder with an AED or basic life support unit arrived in 240 seconds or less travel time.

The next figure provides an overview of the fire department incident cascade of events and further describes the total cascade of events and their relationship to the total response time of a fire incident.

FIGURE 5-3: Incident Cascade of Events



The next table depicts the PFD's turnout, travel, and total response times as an average and at the 90th percentile as benchmarked against the NFPA 1710 standard.

TABLE 5-10: Fire Average and 90th Percentile Response Times of First Arriving Unit Within Petaluma, by Call Type

Call Type	Average Response Time, Minutes				90th Percentile Response Time, Min.				Number of Calls
	Dispatch	Turnout	Travel	Total	Dispatch	Turnout	Travel	Total	
False alarm	1.2	1.4	4.2	6.8	2.3	2.5	6.8	9.1	168
Good intent	1.6	1.3	3.7	6.6	3.1	2.3	6.0	9.0	78
Hazard	1.5	1.3	4.7	7.5	3.4	2.4	7.8	10.3	69
Outside fire	1.8	1.5	4.7	8.0	3.1	2.9	8.8	12.3	75
Public service	1.4	1.2	4.5	7.0	2.7	2.4	7.0	9.9	226
Structure fire	1.1	1.5	3.6	6.2	1.5	2.7	5.8	8.3	36
Technical rescue	2.2	1.1	4.2	7.5	4.4	2.7	9.1	11.6	5
Fire Total	**1.4**	**1.3**	**4.3**	**7.0**	**2.7**	**2.5**	**6.9**	**9.9**	**657**

A review of the table's 90th percentile response times tells us:

- The overall 90th percentile dispatch time was 2.7 minutes.
  - ***As a benchmark, does not meet the NFPA 1710 benchmark.***
- The overall 90th percentile turnout time was 2.5 minutes.
  - ***As a benchmark, PFD does not meet the NFPA 1710 benchmark.***
- The 90th percentile travel time for structure fires was 6.9 minutes.
  - ***As a benchmark, PFD does not meet the NFPA 1710 benchmark.***

Turnout times at the 90th percentile should be reviewed by PFD leadership to determine if there are any physical issues contributing to the overage in this response time element. This is an element the fire department has the greatest control over.

EMS response times are measured differently than fire service response times. Where the fire service uses NFPA 1710 as a response time benchmarking document, the focus for EMS is and should be directed to the evidence-based research relationship between clinical outcomes and response times. Much of the current research suggests response times have reduced impact on clinical outcomes outside of a small segment of call types. These include cerebrovascular accidents (stroke); injury or illness compromising the respiratory system; injury or illness compromising the cardiovascular system to include S-T segment elevation emergencies; high-acuity medical and pediatric emergencies; cardiac and respiratory arrest; and certain high-risk obstetrical emergencies to name a few. Each requires rapid response times, rapid on-scene treatment and packaging for transport, and rapid transport to the hospital.

As with fire response times, CPSM uses two response time measures to evaluate EMS response times, average and fractile. The average time represents the response time interval at which half of the responses are LESS than that interval, and half are LONGER than that interval. It is a level of performance, but not necessarily a level of reliability. The 90th percentile measure is a measure of reliability. A 90th percentile analysis determines the response interval in which 90 percent of the EMS response times fall under that interval. In other words, the response time interval in which only 10 percent of the EMS response time was longer than that 90th percent interval.

In the EMS analysis, all calls within Petaluma and EMS calls that occurred in the extended Petaluma EMS district outside the city to which at least one PFD's ambulance arrived are included. Also, calls with a total response time exceeding 30 minutes and non-emergency calls were excluded. Only units that had *complete time stamps*, that is, units with all response time components recorded are included.

In all, 3,688 calls were included in the EMS response time analysis. There were 3,331 EMS calls responded to by all types of PFD's units inside the Petaluma fire district and 357 EMS calls responded to in the extended Petaluma EMS district, and which PFD's ambulances responded to.

The next tables depict the PFD's EMS turnout, travel, and total response times as an average and at the 90th percentile.

TABLE 5-11: EMS Average and 90th Percentile Response Times of First Arriving Unit in Petaluma

Call Type	Average Response Time, Minutes				90th Percentile Response Time, Min.				Number of Calls
	Dispatch	Turnout	Travel	Total	Dispatch	Turnout	Travel	Total	
EMS Response	1.2	1.2	3.9	6.2	2.4	2.3	6.0	8.5	3,144
MVA	1.3	1.2	3.6	6.2	2.5	2.6	6.2	9.4	187
EMS Total	**1.2**	**1.2**	**3.9**	**6.2**	**2.4**	**2.3**	**6.0**	**8.6**	**3,331**

TABLE 5-12: Average and 90th Percentile Response Times of First Arriving Unit Within the Extended Petaluma EMS District

Call Type	Average Response Time				90th Percentile Response Time				Number of Calls
	Dispatch	Turnout	Travel	Total	Dispatch	Turnout	Travel	Total	
EMS response	1.2	1.3	8.1	10.6	2.0	2.4	13.2	15.8	307
MVA	1.1	1.6	8.0	10.8	1.7	2.8	12.0	14.9	50
Total	**1.2**	**1.3**	**8.1**	**10.6**	**2.0**	**2.5**	**13.2**	**15.5**	**357**

A review of the tables' 90th percentile response times tells us:

- The average travel time to EMS inside the city calls was 3.9 minutes, and the 90th percentile travel time was 6.0 minutes.
- In the aggregate, these are reasonable response times for PFD's response area given the demand and the size of the extended EMS response zone. We note that the dispatch time, the difference between the time a call is received and the earliest time an agency resource is dispatched of 1.2 minutes on average and 2.4 minutes at the 90th percentile for in-city calls and 1.2 minutes on average and 2.0 minutes at the 90th percentile for out-of-city calls provide an opportunity for improvement. PFD should explore opportunities for its dispatch agency to implement a 'pre-alert' process that notifies ambulance units of incoming calls in their district, even before a final determination regarding the type or severity of the medical response. This is common in many high performing EMS systems.
- The NFPA standard for EMS turnout times is 60 seconds,[27] and while the average of 1.2 minutes for EMS response is close to meeting this standard for in-city calls, the 90th percent reliability turnout time of 2.3 minutes for in-city and 2.5 minutes for out-of-city EMS calls is more than two times the NFPA goal. We recommend that PFD initiate a process review to try and shorten the 90th percentile activation time.

A crucial factor in the whole response time question is what we term "**detection time**." This is the time it takes to detect a fire or a medical situation and notify 911 to initiate the response. In many instances, particularly at night or when automatic detection systems (fire sprinklers and smoke detectors) are not present or inoperable, the fire detection process can be extended. The same holds true for EMS incidents. Many medical emergencies are often thought to be something minor by the patient, treated with home remedies, and the true emergency goes undetected until signs and symptoms are more severe. When the fire-EMS department responds, they often find these patients in acute states. Fires that go undetected and are allowed to

27. https://www.nfpa.org/Assets/files/AboutTheCodes/1720/FAD-AAA_PreFDagenda_10-11_Part3.pdf

expand in size become more destructive, are difficult to extinguish, and require more resources for longer periods of time.

Travel time is key to understanding how fire and EMS station location influences a community's aggregate response time performance. Travel time can be mapped when existing and proposed station locations are known. The location of responding units is one key factor in response time; reducing response times, which is typically a key performance measure in determining the efficiency of department operations, often depends on this factor. The goal of placement of a single fire station or creating a network of responding fire stations in a single community is to optimize coverage with short travel distances, when possible, while giving special attention to natural and manmade barriers, and response routes that can create response-time problems.[28] This goal is generally budget-driven and based on demand intensity of fire and EMS incidents, travel times, and identified risks.

As already discussed, the PFD responds to fire suppression units (engine, ladder, medic units) from three stations and receives automatic and mutual aid from surrounding jurisdictions. This section expands on the earlier discussion on travel times and depicts how travel times of 240, 360, and 480 seconds look when mapped from the current fire station locations. Illustrating response time is important when considering the location from which assets should be deployed. When historic demand is coupled with risk analysis, a more informed decision can be made.

The following figures use GIS mapping to illustrate travel time bleeds using the existing street network from the current PFD stations.

The GIS data for streets includes speed limits for each street segment and allows for "U-turns" for dead-end streets and intersections, as well as other travel obstacles.

It is important to understand that measuring and analyzing response times and response time coverage are measurements of performance. When we discussed community risk above, we identified that the PFD, like most other fire departments in the nation, is an all-hazards response agency. While different regions of the country respond to different environmental risks, the remaining hazards that fire departments confront remain the same. Linking response data to community risks lays the foundation for future fire department planning in terms of fire station location, the need for additional fire stations, and staffing levels whether supplied by the fire department or a combination of a city's fire department and automatic aid. Managing fire department response capabilities to the identified community's risk focuses on three components which are:

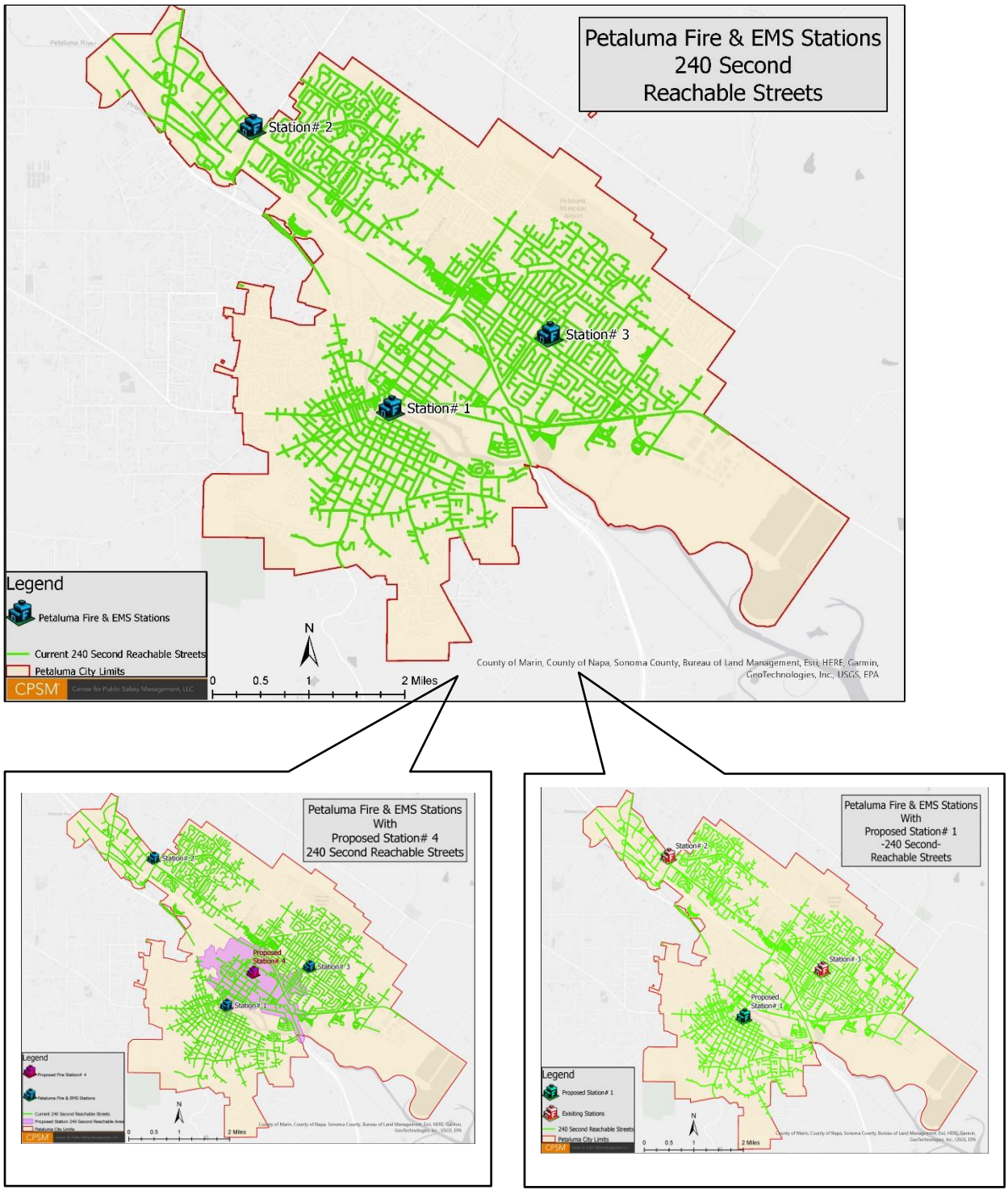
- Having a full understanding of the total risk in the community and how each risk impacts the fire department in terms of resiliency, what the consequences are to the community and fire department should a specific risk or combination of two or more occur.
- Linking risk to the deployment of resources to effectively manage every incident. This includes assembling an Effective Response Force for the response risk in measurable times benchmarked against NFPA standards and deploying appropriate resources.
- Understanding that each element of response times plays a role in the management of community risk.

The next figure reviews the travel time projection at 240 seconds from PFD stations. This was discussed previously in the facility section and is reviewed again here since additional figures

28. NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Departments, 2020 Edition*.

discuss the 360 seconds travel coverage of the second arriving fire suppression unit, and the 480 seconds travel coverage for the assembling of the initial alarm on a residential structural fire.

FIGURE 5-4: Travel Time of 240 Seconds from PFD Stations

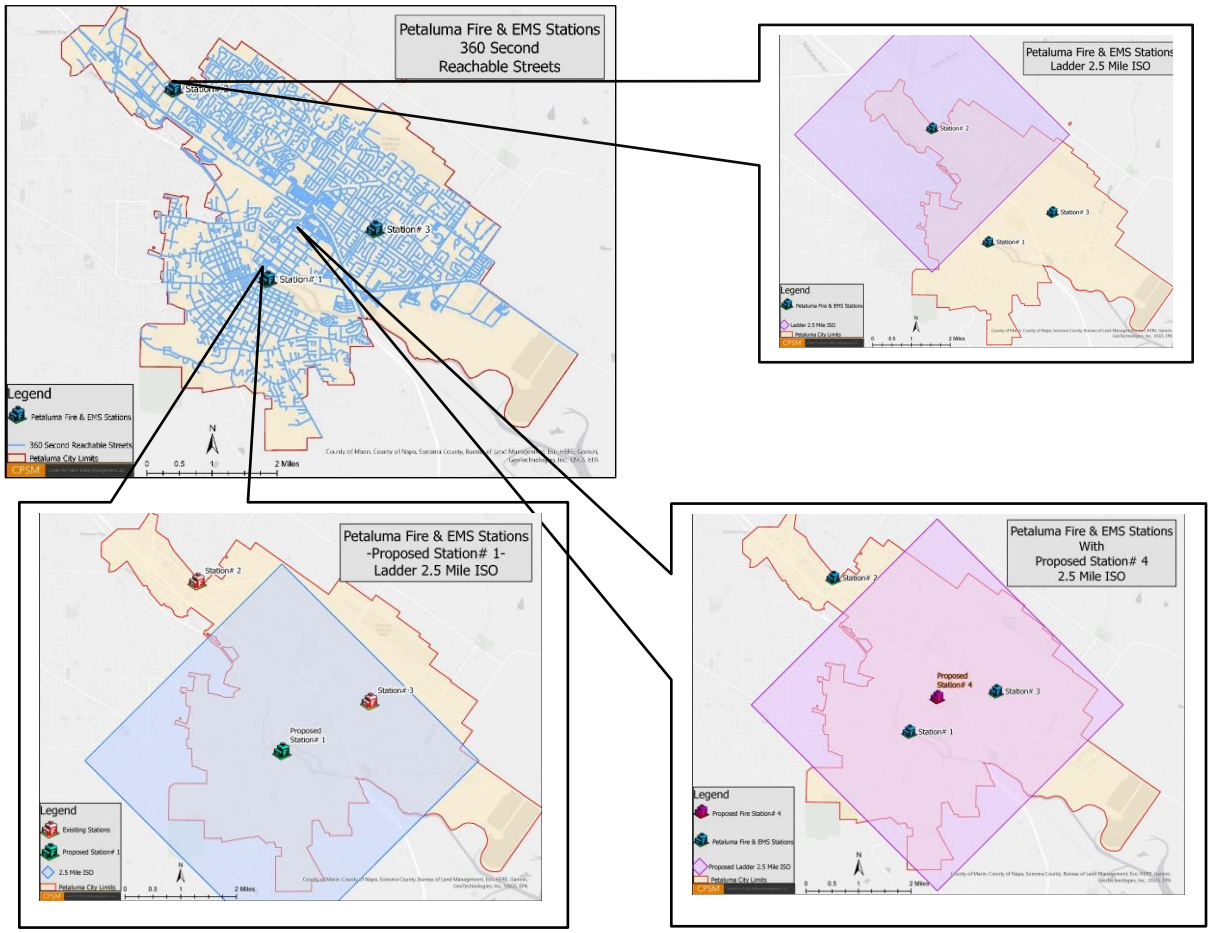


Measuring 240 seconds of travel time in Petaluma in the figure above, which is the travel time for the first arriving engine company to a fire suppression incident and EMS incident with an automatic external defibrillator, illustrates there are gaps north, west, and south of Station 1, and gaps in coverage southeast and north of station 3. There is a shared gap between Stations 2 and 3. Neither Station 4 nor a relocated Station 1 to 307 Petaluma Blvd. South will have an impact on those gaps; however, these stations are being considered for more specific reasons as discussed previously. It is important to keep in mind that many things impact travel time such as weather, traffic, access to certain connector and local streets, and inland waterways to name the most common. Additionally, the NFPA 1720 benchmark is at the 90th percentile.

The next figure shows travel time projections at 360 seconds, which is the NFPA 1710 benchmark for the second fire company, which is to arrive on the scene in less than or equal to 360 seconds 90 percent of the time. This standard links to the two-in/two-out regulation from OSHA and NFPA 1500 standards, as well as the initial critical tasking and the early assembly of an Effective Response Force for the incident.

From the PFD stations, nearly 100 percent of the city is covered as benchmarked against the NFPA standard. A relevant discussion here is the consideration of a new Station 4 or relocating Station 1 to 307 Petaluma Blvd. South. In both scenarios the ladder truck at Station 2 can be relocated to either one of these stations with a marked improvement in centralized response for ladder coverage, along with a positive impact on the ISO-FSRS credit points.

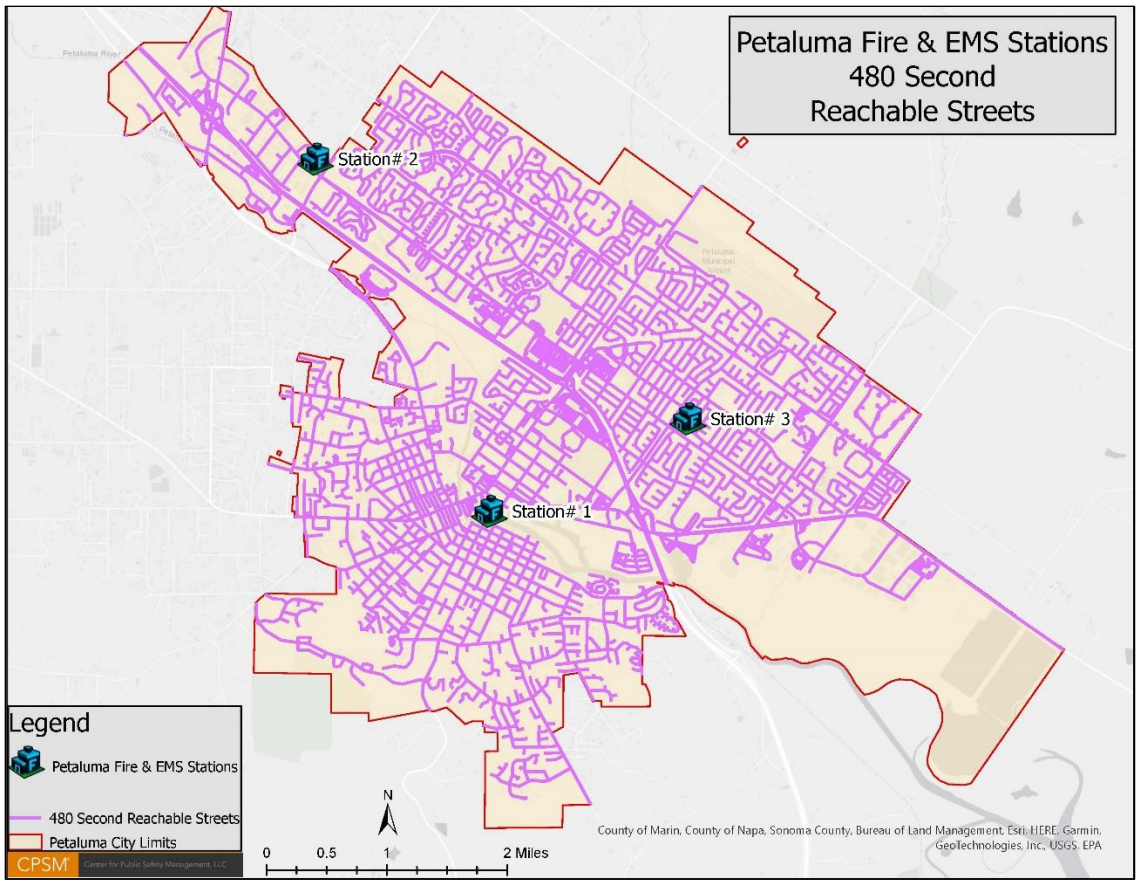
FIGURE 5-5: Travel Time of 360 Seconds from PFD Stations



The next figure looks at the travel time bleeds of 480 seconds, which in the NFPA 1710 standard is the time benchmark for the assembly of the initial first alarm assignment on scene in 480 seconds or less 90 percent of the time for low/medium hazards. This standard links to the incident critical tasking and the assembly of an Effective Response Force for the incident. This figure shows the 480-second response bleed from the PFD stations.

These maps show us that the PFD covers 100 percent of the city under this standard. As the city is covered at 480 seconds, the city is covered as well at the 610-seconds mark for special risk/high-rise incidents under the response standard. However, the response plan does not meet the ERF for a special risk/high-rise incident. As a note, vertical density, particularly involving vulnerable populations, and any building with a vulnerable population, should be treated as a special risk.

FIGURE 5-6: Travel Time of 480 Seconds from PFD Stations



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SECTION 6. EMS OPERATIONS DEPLOYMENT AND PERFORMANCE

CURRENT STAFFING AND DEPLOYMENT OF EMS RESOURCES

Emergency medical services (EMS) in Petaluma, both first response and ambulance, are provided by Petaluma Fire Department (PFD). PFD provides Advanced Life Support (ALS) medical first response and ALS and Basic Life Support (BLS) ambulance service within the City of Petaluma, and areas outside of the City of Petaluma through service agreements in Southern Sonoma County, and a portion of Marin County, for a total ambulance service area of 184 square miles.

PFD operates three primary ALS ambulances 24 hours per day, 365 days a year, staffed with providers who are dual-role personnel, certified as EMS personnel and firefighters. PFD also operates a BLS ambulance staffed 10 hours per day, 365 days per year with single-role EMS providers, who are not cross-trained as firefighters. This deployment results in the staffing production of 26,280 primary ALS unit hours and 3,650 BLS ambulance unit hours (a unit hour is defined as one hour of a staffed and response-capable ambulance).

The BLS ambulance self-dispatches to EMS calls as a secondary ambulance to potentially low-acuity calls and waits a few blocks from an EMS scene to await determination from the primary ambulance if the patient can be managed using BLS care. If so, the ALS ambulance summons the BLS ambulance to the scene to take over patient care and transport the patient to a hospital. This is not the best use of this resource. The most appropriate use of this resource is to be dispatched to BLS call types as a single response unit.

Nearly every EMS response in Petaluma receives at least two responding units, an ALS engine, an ALS ambulance, and occasionally, a BLS ambulance, based on the self-dispatch of the BLS unit. An analysis of EMS responses for 2021 shown in the following table reveals that 99.8 percent of the EMS calls in Petaluma received both an ALS engine and an ALS ambulance.

TABLE 6-1: Fire and Ambulance Tandem Response

Unit	EMS Responses	% First Response
Ambulance - MED991	1,832	79.2%
Engine - 9301	1,614	88.1%
Ambulance - MED992	1,258	83.3%
Engine - 9382	867	68.9%
Aerial - 9351	745	59.2%
Ambulance - MED993	1,815	81.0%
Engine - 9383	1,668	91.9%
Overall EMS Responses-Ambulance	**5,222**	**80.9%**
First Response	**4,894**	**99.8%**

This response configuration may not be an optimal use of first response resources since it commits crucial first response resources to EMS responses that may not be time critical or may not require ALS care. By committing these resources to low acuity calls in which an ALS first response would likely not be necessary to affect the patient's outcome, it potentially delays a rapid first response to medical calls that may be time sensitive. For example, the patient outcome for an EMS response for a twisted ankle will generally not be changed by the presence of a first response unit. However, if the first response resource is committed to the twisted ankle response, and a call for a person not breathing is received in the same response district, a first response resource from out of that response district would normally need to respond. The response from a district further away could delay the response to the high-acuity call, which could have a detrimental impact on the patient's outcome.

ALS first response resources should be preserved for the responses in which the rapid response of an ALS unit may have an impact on patient outcomes.

CPSM understands that the current dispatch agency for PFD does not fully utilize the benefits of a formal Emergency Medical Dispatch (EMD) program, which may partially be the reason for this current response configuration. This will be discussed further in this report; however, we believe there may be other ways to determine response levels in the absence of the adoption of a formal EMD system. This could include the determination of response mode and level of the response by PFD units, based on the response determinant derived through the EMD process and communicated to the dispatched PFD units for the response.

EMS WORKLOAD

In 2021, PFD's ambulances responded to 6,337 calls. Of these, 73 percent were EMS calls and 11 percent were fire calls.

The workload of PFD units is measured in two ways: *runs* and *deployed time*. The deployed time of a run is measured from the time a unit is dispatched through the time the unit has completed a response and is available for another response. Because multiple ambulances respond to some calls, there are more EMS runs (7,777) than EMS calls (6,337) and the average deployed time per run varies from the average duration per call.

One method for measuring workload is *Unit Hour Utilization (UHU)*. UHU is a measure of *activity*, essentially measuring the frequency per hour that an ambulance is *dispatched* to a response.

A Unit Hour is defined as one unit, fully staffed, equipped and available for a response for one hour. For example, one unit on-duty 24 hours per day, 365 days per year equates to 8,760 unit hours (1 x 24 x 365). The UHU is then derived by dividing the number of *responses* by the total number of *unit hours*.

For the period of our analysis, PFD staffed three primary ambulance units 24 hours per day, 7 days per week, plus one BLS ambulance 10 hours per day, 7 days per week. This staffing resulted in **29,930** staffed unit hours (3 [ambulances] x 8,760 [hours each per year]) + (1 [ambulance] x 10 [hours per day] x 365 [days])).

In 2021, there were 7,777 runs that ambulances responded to, yielding a *response UHU* of **0.260**. This essentially means that a PFD ambulance is *dispatched* to an *ambulance response* 26.0 percent of the time they are on duty.

The challenge with only looking at this analysis, however, is that it presumes an ambulance call takes an average of one hour to complete. However, Table 7-11 in the accompanying data

analysis report shows that the total deployed time for PFD's ambulances on the 7,777 ambulance *runs* was 4,279 hours, an average of *0.550 hours, or 33.0 minutes, per ambulance run* (0.550 x 60 minutes).

Dividing the *total deployed time* into the total number of *Unit Hours* for 2021 we derive that a PFD ambulance was deployed on ambulance runs **14.3 percent** of their total on-duty time (4,279 deployed hours ÷ 29,930 on duty Unit Hours).

TABLE 6-2: EMS Unit Hour Utilization

Station	Unit	Unit Type	Staffed Unit Hours	Total Runs	UHU	Deployed Minutes per Run	Total Deployed Hours	UHU - Deployed Time
9301	MED991	ALS Ambulance	8,760	2,470	0.282	34.3	1,412.0	0.161
9302	MED992	ALS Ambulance	8,760	2,127	0.243	33.9	1,202.7	0.137
9302	BLS994	BLS Ambulance	3,650	738	0.202	17.9	219.6	0.060
9303	MED993	ALS Ambulance	8,760	2,442	0.279	35.5	1,444.2	0.165
Total			**29,930**	**7,777**	**0.260**	**30.4**	**4,278.5**	**0.143**

To balance workload for ambulance deployment, the desirable response and deployed ambulance UHU is 0.300. Based on this analysis, and from an EMS only perspective it appears that not only does PFD have ample ambulance capacity to meet the needs of its service area, but that based on the goal of an ambulance UHU of 0.300, PFD could reduce ambulance deployment of the current 29,930 annual hours by 3,650 annual hours by eliminating the BLS ambulance. Based on 2021 response volume, this change would result in a system-wide response UHU of 0.296, and a deployed time UHU of 0.163. The annual savings attributable to this reduction in unit hours are analyzed later in this report. In Petaluma however, and because of the added UHU capacity, ambulance crews are also utilized for pre-fire plans, fire prevention inspections, and as discussed earlier in this report, ambulances are widely utilized to complete the Effective Response Force of fire calls.

TABLE 6-3: EMS Unit Hour Utilization w/o BLS Unit

Station	Unit	Unit Type	Staffed Unit Hours	Total Runs	UHU	Deployed Minutes per Run	Total Deployed Hours	UHU - Deployed Time
9301	MED991	ALS Ambulance	8,760	2,470	0.282	34.3	1,412.0	0.161
9302	MED992	ALS Ambulance	8,760	2,865	0.327	33.9	1,422.3	0.162
9303	MED993	ALS Ambulance	8,760	2,442	0.279	35.5	1,444.2	0.165
Total			**26,280**	**7,777**	**0.296**	**34.6**	**4,278.5**	**0.163**

Projected EMS responses for PFD in 2022 are anticipated to be 8,010, a 3 percent increase from 2021, which is relatively consistent with EMS agencies across the country. This response volume is very manageable with a unit hour production of 26,280. Further, we note that in 2021, 682 (10.8

percent) of the calls that PFD ambulances responded to were *not related to a primary medical response*. PFD leadership should evaluate the value of PFD ambulances being dispatched on these responses as opposed to being available to respond to medical calls. Reducing non-medical responses for PFD's ambulances would increase the efficiency of the ambulance deployment plan, and potentially further reduce the number of on-duty ambulance unit hours necessary to provide effective coverage for the community.

In reviewing PFD's ambulance responses, CPSM noted that the average time on-scene per EMS run seems to be unusually short. Based on the experience of the agencies we have studied; we would typically expect that on-scene patient assessment and stabilization would take about 20 minutes. The clinical leadership of PFD should conduct further analysis of ambulance scene times to determine if they feel the medical care provided during this average scene duration is consistent with EMS clinical protocol expectations.

TABLE 6-4: EMS Ground Transport Unit Time on Task Analysis

Call Type	Average Time Spent per Run, Minutes				Number of Runs
	On Scene	Traveling to Hospital	At Hospital	Deployed	
Cardiac and stroke	11.7	11.4	21.7	51.0	490
Fall and injury	11.3	13.5	23.5	54.9	666
Illness and other	11.1	11.3	21.5	50.5	2,002
MVA	12.1	16.1	27.0	62.9	185
Overdose and psychiatric	11.4	10.2	17.6	46.0	65
Seizure and unconsciousness	11.3	11.2	20.8	49.8	361
EMS Total	**11.3**	**11.9**	**22.0**	**51.8**	**3,769**

AMBULANCE STAFFING SHIFT LENGTH

The typical shift length for PFD personnel is 48 hours. We understand that shift lengths of 48 hours are a growing trend in fire service delivery; however, based on recent studies, we are very concerned about the impact that this extended shift length has on the fatigue and clinical effectiveness of personnel assigned to primarily ambulance operations.

Ambulance responses generally have a higher response volume and longer task times than those for fire suppression units, including first medical response. Numerous studies[29,30,31] have proven that extended duration shift length can cause fatigue-related risks to emergency services personnel, including occupational injuries, impaired clinical judgement, and diminishment of skills proficiency.

We recommend that PFD eliminate the 48-hour shift pattern for personnel assigned to primary ambulance duty, or at the very least, rotate personnel off ambulance assignment during a 48-hour shift to allow them adequate time for rest and recovery. The latter option is not ideal, but it would be a mitigation measure to help assure the safety of personnel and patients.

29. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4686303/
30. https://www.tandfonline.com/doi/full/10.1080/10903127.2017.1376135
31. https://www.safetyandhealthmagazine.com/articles/13035-long-shifts-double-injury-illness-risk-for-ems-workers-study

EXPENSES RELATED TO AMBULANCE SERVICE DELIVERY

The City of Petaluma is fortunate to have established a separate accounting process for ambulance operations. Although not as effective as operating an ambulance service under an established Enterprise Fund as Petaluma had done in the past, the identified accounting helps detail the revenues and expenses related to ambulance service delivery. Using financial data supplied by the city for fiscal years (FY) 2019–2022, CPSM conducted the following financial analysis of PFD's ambulance operations.

We note that the capital expenditure line item does not consider depreciation of capital assets. This may be in a separate fund for the city, but replacing capital equipment such as ambulances, cardiac monitors, and other equipment is a significant expense, which should be accounted for within the ambulance financial documents. For this expense analysis, we will use values with, and without, funded capital refresh for illustrative purposes.

TABLE 6-5: Ambulance Service Delivery Expenses

Expense Classification	Actuals 2020-21	Projected [2021-22]
Salaries	$2,188,967	$2,405,570
Benefits	$1,950,796	$1,977,376
Supplies	$191,026	$190,271
Professional Services	$357,502	$345,234
Utilities, Rent & Training	$14,558	$22,000
Advertising, Promotion, Debt	$3,113	$2,394
Capital Expenditures	$10,100	$886
Total	**$4,716,062**	**$4,943,731**
Capital Adjustment/Depreciation (See next table)	$431,333	$431,333
Total w/Capital Refresh	**$5,147,396**	**$5,375,064**

TABLE 6-6: EMS Depreciation Analysis

Funded Capital Plan	Cost Basis	Useful Life (Years)	Annual Depreciation
Ambulances (6 @ $310,000)	$1,860,000	5	$372,000
Monitors (4 @ $35,000)	$140,000	5	$28,000
MCDs (4 @ $20,000)	$80,000	4	$20,000
Tablets (4 @ $1,500)	$6,000	3	$2,000
Radios (8 @ $3,500)	$28,000	3	$9,333
Totals	**$2,114,000**		**$431,333**

Using this data, we can calculate the Expense per **Unit Hour**, Expense per **Response**, and Expense per **Transport** for PFD's ambulance operations, as shown in the following tables.

TABLE 6-7: EMS Expense Analysis With No Capital Refresh

	Actuals	Projected
Expense Analysis w/No Capital Refresh	**2020-21**	**2021-22**
Responses	7,777	8,010
Expense Per Response	$606.41	$617.17
Transports	3,759	4,011
Expense Per Transport	$1,254.61	$1,232.46
Unit Hours	29,930	29,930
Expense Per Unit Hour	$157.57	$165.18

TABLE 6-8: EMS Expense Analysis With Capital Refresh

	Actuals	Projected
Expense Analysis w/Capital Refresh	**2020-21**	**2021-22**
Responses	7,777	8,010
Expense Per Response	$661.87	$671.02
Transports	3,759	4,011
Expense Per Transport	$1,369.35	$1,339.99
Unit Hours	29,930	29,930
Expense Per Unit Hour	$171.98	$179.59

Expenses for FY 2020–21 is derived from the end-of-year actual expenditures provided by the city. Projections for FY 2021–22 is derived from the FY 2021–22 financials provided by the city, through February 2022 (the eighth fiscal month). These actuals were projected fiscal year end, based on the current run rate as of February 2022.

Based on these categories and expenditures in each category for FY 2020–21 and FY 2021–22, we project the following expenditures through 2025 as shown in the next table.

TABLE 6-9: EMS Projected Expenditures Through FY 2025

Expense Classification	[2022–23]	[2023–24]	[2024–25]
Salaries	$2,643,721	$2,905,450	$3,193,089
Benefits	$2,004,268	$2,031,526	$2,059,155
Supplies	$199,784	$209,773	$220,262
Professional Services	$348,686	$352,173	$355,695
Utilities, Rent, and Training	$26,400	$31,680	$38,016
Advertising, Promotion, Debt	$2,633	$2,897	$3,186
Capital Expenditures	$5,000	$5,000	$5,500
Total	**$5,230,494**	**$5,538,499**	**$5,874,904**
Capital Adjustment/Depreciation	$431,333	$431,333	$431,333
Total w/Capital Refresh	**$5,661,827**	**$5,969,833**	**$6,306,237**

Notes:
Salary expense growth rate projected at 9.9% (the difference between FY 2020-21 and FY 2021-22).
Benefits expense growth rate projected at 1.4% (the difference between FY 2020-21 and FY 2021-22).
Supplies expense growth rate projected at 5% (current industry trend).
Professional Services expense growth rate projected at 1.0% (the difference between FY 2020-21 and FY 2021-22).

Utilities, Rent, and Training expense growth rate projected at 20.0% (the difference between FY 2020-21 and FY 2021-22). Advertising, Promotion, Debt expense growth rate projected at 10.0% (the difference between FY 2020-21 and FY 2021-22).

Using these projections, we can project the Expense per Unit Hour, Expense per Response, and Expense per Transport for PFD's ambulance operations as depicted in the next tables.

TABLE 6-10: EMS Expense Analysis With No Capital Refresh Through FY 2025

Expense Analysis w/No Capital Refresh	[2022–23]	[2023–24]	[2024–25]
Responses	8,251	8,498	8,753
Expense Per Response	$633.95	$651.73	$671.18
Transports	4,132	4,256	4,383
Expense Per Transport	$1,265.97	$1,301.47	$1,340.32
Unit Hours	29,930	29,930	29,930
Expense Per Unit Hour	$174.76	$185.05	$196.29

TABLE 6-11: EMS Expense Analysis With Capital Refresh Through FY 2025

Expense Analysis w/Capital Refresh	2022–23	2023–24	2024–25
Responses	8,251	8,498	8,753
Expense Per Response	$686.23	$702.49	$720.46
Transports	4,132	4,256	4,383
Expense Per Transport	$1,370.37	$1,402.83	$1,438.72
Unit Hours	29,930	29,930	29,930
Expense Per Unit Hour	$189.17	$199.46	$210.70

REVENUE FROM AMBULANCE SERVICE DELIVERY

Revenue for PFD's ambulance operations is essentially generated from two sources; revenue collected from fees charged for ambulance service and Intergovernmental Revenue. It is the stated goal of the city and PFD that the revenue generated from ambulance operations offset EMS fund expenses for the service delivery. Ambulance revenue for public ambulance agencies is enhanced through the Ground Emergency Medical Transport (GEMT) program, administered by the State of California, which is designed to provide a supplemental payment to public ambulance agencies to help offset the low reimbursement provided by MediCal. PFD also participates in a second supplemental revenue provided by the state. The Quality Assurance Fee (QAF) is a program in which ambulance providers pay a supplemental fee to the state for each ambulance transport. In the aggregate, these funds are used by the state to draw federal matching funds, a portion of which is paid to ambulance agencies as a supplemental payment for each MediCal patient transported.

Based on a review of the billing revenue reports provided by PFD from its ambulance billing contractor, it appears the QAF revenue received is included in the MediCal revenue reported by the billing contractor.

The Intergovernmental Revenue for the GEMT program is accounted for in Petaluma revenue account #13600.44000. GEMT revenue for FY 2019–20, and 2020–21 has been nominal, with amounts less than $10,000.

PFD has been allocated CARES Act funding for FY 2020–21 and 2021–22. Funding levels are $686,268 and $363,540, respectively. ***It is important to note that although these amounts are included in the fiscal analysis, they are not recurring funds, so the funding should not be relied on as a future revenue source.***

Using this data, we have articulated the revenue associated with ambulance operations in the next tables.

TABLE 6-12: EMS FY 2020–2021 Revenue Analysis

Financial Class	Number of Accounts	Gross Charges	Average Patient Charge	Payments	$ Collected per Service
Medicare	1,053	$3,156,709	$2,998	$502,404	$477.12
Medicare HMO	222	$667,410	$3,006	$102,540	$461.89
Medi-Cal	83	$252,574	$3,043	$28,656	$345.25
Medi-Cal HMO	552	$1,656,692	$3,001	$193,744	$350.99
Insurance	306	$961,330	$3,142	$644,563	$2,106.42
Private Pay	227	$686,391	$3,024	$51,464	$226.71
Kaiser	328	$1,079,440	$3,291	$1,019,207	$3,107.34
Kaiser MCAL	70	$219,105	$3,130	$25,167	$359.53
Kaiser MCARE	899	$2,873,439	$3,196	$456,606	$507.90
Other	19	$61,379	$3,230	$14,883	$783.32
Sub Total	**3,759**	**$11,614,468**	**$3,090**	**$3,039,234**	**$780.93**

TABLE 6-13: EMS FY 2021–22 Revenue Analysis, Projected

Financial Class	Projected Accounts	Projected Gross Charges	Projected Average Patient Charge	Projected Payments	$ Collected per Service
Medicare	1,122	$3,365,052	$2,998	$535,563	$477.12
Medicare HMO	237	$711,459	$3,006	$109,308	$461.89
Medi-Cal	88	$269,244	$3,043	$30,547	$345.25
Medi-Cal HMO	588	$1,766,034	$3,001	$206,531	$350.99
Insurance	326	$1,024,778	$3,142	$687,104	$2,106.42
Private Pay	242	$731,693	$3,024	$54,861	$226.71
Kaiser	350	$1,150,683	$3,291	$1,086,475	$3,107.34
Kaiser MCAL	75	$233,566	$3,130	$26,828	$359.53
Kaiser MCARE	958	$3,063,085	$3,196	$486,742	$507.90
Other	20	$65,430	$3,230	$15,865	$783.32
Sub Total	**4,007**	**$12,381,023**	**$3,090**	**$3,239,823**	**$792.32**

We are pleased to see that PFD is charging a reasonable regional market rate for ambulance services, since this practice maximizes fee for service revenue, thereby reducing the amount of funds necessary from public sources.

Billing services for PFD's ambulance operations are provided by Wittman Enterprises, a well-respected ambulance billing agency. CPSM has worked with Wittman on other projects and has

found them to be very responsive and providing excellent services to their clients. Based on our review of three years of billing and revenue data, it appears that Wittman is doing an excellent job with revenue cycle management for PFD.

We note that the overall gross collection rate for PFD's ambulance operations in FY 2020–21 is 26.1 percent ($3,039,234 collected for $11,614,468 in gross charges). This is not unusual, based on the payer mix, and the fixed amounts paid by Medicare and Medicaid for ambulance services.

Reviewing the payer mix for PFD, we note a relatively stable and favorable payer mix. The percentage of uninsured/self-pay accounts are relatively low, compared to other self-pay accounts CPSM has found in other communities in California. This is likely not only due to the demographics in PFD's service area, but also the result of a very diligent process used by Wittman to identify insurance sources for PFD's patients.

TABLE 6-14: EMS Revenue Payer Mix: FY 2020-21

Financial Class	Number of Accounts	Percent of Total
Medicare	1,053	28.0%
Medicare HMO	222	5.9%
Medi-Cal	83	2.2%
Medi-Cal HMO	552	14.7%
Insurance	306	8.1%
Private Pay	227	6.0%
Kaiser	328	8.7%
Kaiser MCAL	70	1.9%
Kaiser MCARE	899	23.9%
Other	19	0.5%
Sub Total	**3,759**	**100.0%**

TABLE 6-15: EMS Payer Mix: FY 2021–22 (through May 2022)

Financial Class	Number of Accounts	Percent of Total
Medicare	1,054	28.7%
Medicare HMO	275	7.5%
Medi-Cal	54	1.5%
Medi-Cal HMO	505	13.7%
Insurance	314	8.5%
Private Pay	251	6.8%
Kaiser	321	8.7%
Kaiser MCAL	816	22.2%
Kaiser MCARE	57	1.6%
Other	30	0.8%
Sub Total	**3,677**	**100.0%**

OVERALL AMBULANCE SERVICE ECONOMIC ANALYSIS

Based on the revenue and expenses reported in the PFD reports, we can summarize the fiscal performance of the ambulance service delivery model in the next table.

TABLE 6-16: EMS Fiscal Performance

	From Petaluma Fiscal Reports		CPSM Estimate w/Capital Refresh	
	2020–21	**2021–22**	**2020–21**	**2021–22**
Ambulance Fees Collected	$3,181,672	$3,383,500	$3,181,672	$3,383,500
Intergovernmental Revenue (1)	($10,380)	$451	($10,380)	$451
Intergovernmental Revenue (2)	$686,268	$363,540	$686,268	$363,540
Total Revenue	**$3,857,560**	**$3,383,951**	**$3,857,560**	**$3,747,491**
Ambulance Service Expenses	$4,716,062	$4,739,836	$5,140,396	$5,368,064
Retained Earnings	**($858,503)**	**($1,355,885)**	**($1,282,836)**	**($1,620,573)**

Notes:
1. Account # 13600.44220 (GEMT)
2. Account # 13600.44320 (Intergovernmental Transfer Voluntary Rate Range Program)

Again, the expenses shown in PFD's expense reports do not include the costs related to capital. Including those expenses adds $431,333 in annual expenses. Although PFD's ambulance revenue is comparable to other providers in the region, their expenses are greater than the revenue generated for the services provided.

Broken down by functional metrics, an operational fiscal analysis can be articulated in the next table.

TABLE 6-17: EMS Fiscal Performance Itemization

	From Petaluma Fiscal Reports		CPSM Estimate w/Capital Refresh	
	2020-21	**2021-22**	**2020-21**	**2021-22**
Responses	6,337	6,527	6,337	6,527
Retained Earnings Per Response	($135.47)	($207.73)	($202.44)	($248.28)
Transports	3,759	3,834	3,759	3,834
Retained Earnings Per Transport	($228.39)	($353.63)	($341.27)	($422.66)
Unit Hours	29,930	29,930	29,930	29,930
Retained Earnings Per Unit Hour	($28.68)	($45.30)	($42.86)	($54.15)

As previously noted, it appears that PFD's staffed ambulance unit hours appear to be greater than what is required, based on the current ambulance response and transport volume, and deployed time. Using projections for FY 2023 as an example, reducing staffed ambulance hours by ***3,650*** staffed unit hours would achieve the desired UHU of 0.300. This would reduce annual ambulance expenditures by $689,631 ($188.94 expense per ambulance unit hour, x 3,650 unit hours).

This staffing level could reduce the financial losses from ambulance operations.

TABLE 6-18: Population and Ambulance Response Projections with UHU of 0.300

	2021	2022	2023	2024	2025	2026
Population Served	70,000	71,750	73,544	75,382	77,267	79,199
EMS Responses	7,777	8,010	8,251	8,498	8,753	9,016
Ambulance Response UHU	0.300	0.300	0.300	0.300	0.300	0.300
Ambulance Unit Hours Needed Per Year	25,923	26,701	27,502	28,327	29,177	30,052
Ambulances	3	3	3	3	3	3
Ambulance Personnel (@7.3 FTEs/Ambulance)	21	21	22	23	23	24

PFD's ambulance service delivery operates at a financial loss and expense to the taxpayers of Petaluma. CPSM recognizes however that the city operates with three ambulances as it cannot rely on immediate aid from EMS providers outside of the city and designated EMS zone. The city is an island so to speak as an EMS provider. It may be prudent for the community and the department to consider other options for ambulance service delivery, such as single role positions on 1 to 2 or all of the ambulances (adjustments to how an Effective Response Force should be considered under this alternative), elimination of the BLS unit, or converting one ambulance to a light squad to run low-acuity EMS calls and serve to bolster the Effective Response Force on fire incidents.

EMERGENCY CALL TAKING

EMS 911 call taking, and dispatch of PFD units, is managed by Redwood Empire Dispatch Communications (REDCOM), a Joint Powers Authority (JPA) that handles call taking and dispatch for Sonoma County.

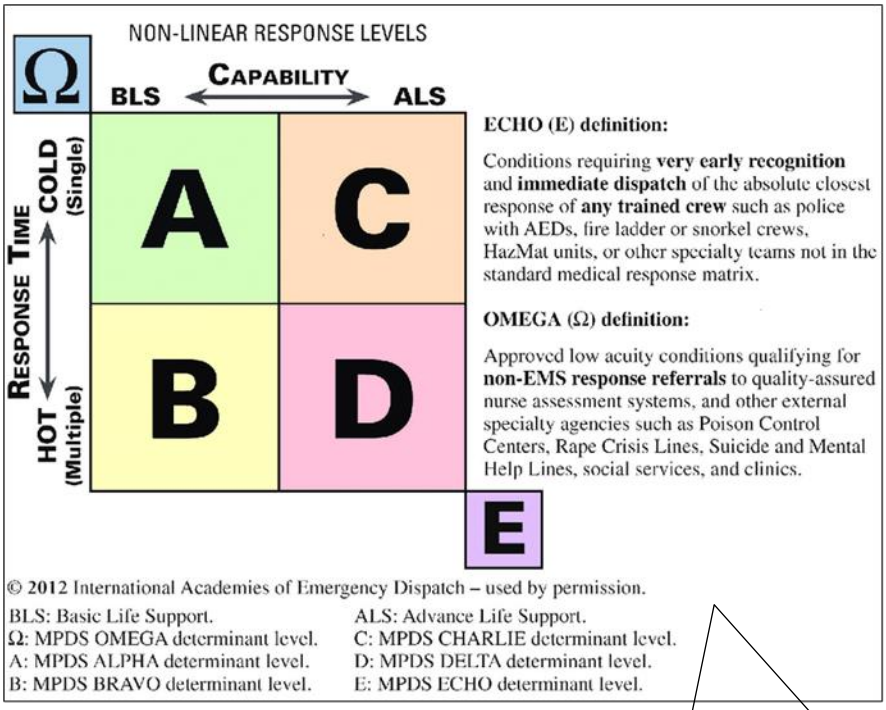
Based on computer-aided dispatch data provided by PFD from REDCOM, it appears that REDCOM uses the Priority Solutions® Medical Priority Dispatch System® (MPDS)[32] for Emergency Medical Dispatch (EMD). This system is a highly respected EMD system and is used most by progressive EMS dispatch agencies.

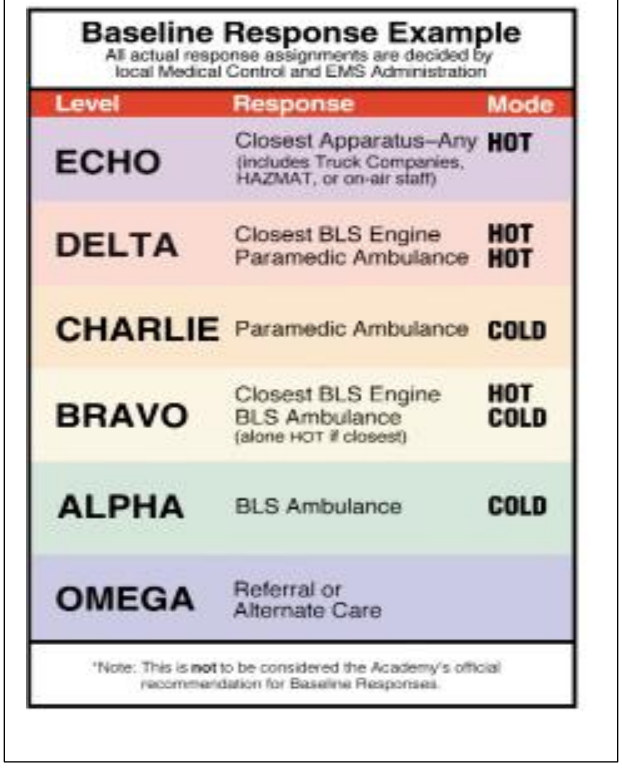
The MPDS system is an evidence-based system that uses clinical protocols and call taking processes to assign a response determinant to the EMS request. These response determinants are alpha-numeric codes that can be used in EMS systems to determine the priority of a response, and the appropriate level of care likely necessary to meet the patient's clinical needs. The response determinants also aid in informing the responding units specifically what type of medical call to which they are responding. If approved by local protocol, the MPDS system can also be used to assign *response priorities* and *modes of response*, as well as make determinations regarding the response configuration for the EMS response.

An example of a response matrix based on MPDS EMD response determinants is outlined in the next figure.

32. https://www.emergencydispatch.org/what-we-do/emergency-priority-dispatch-system/medical-protocol

FIGURE 6-1: Priority Solutions® Medical Priority Dispatch System® Response Matrix





The MPDS system enables the use of an evidence-based process for dispatchers to provide pre-arrival medical instructions during the time EMS units are responding to the call.

Appropriate use of the MPDS system typically includes the active engagement of a physician Medical Director, and a robust quality assurance (QA) process, which helps assure that EMD call taking, EMD determinant assignments, and pre-arrival instructions are being conducted appropriately and reliably.

Many EMS systems across the country are using EMD, and MPDS in particular, to reduce the incidence of HOT responses so as to make providers and the public safer, as well as preserve crucial first medical response resources for 911 medical calls that are time-sensitive (cardiac arrest, choking, heart attack, etc.). Lights and siren (HOT) responses dramatically increase the risk of crashes and injuries to responding personnel and the public. In February 2022, 14 national EMS associations, including the International Association of Fire Chiefs, and the National Association of EMS Physicians, published a joint position statement[33] ***encouraging EMS systems to reduce HOT responses to less than 30 percent of EMS calls, and less than 5 percent of ambulance transports***.

In Petaluma, a first response unit is dispatched to nearly all 911 medical calls within the city. In most communities, time-sensitive medical responses represent a small percentage of EMS responses, typically 10 percent to 30 percent of medical responses. Committing medical first response units to calls in which a timely response will likely not impact the patient's outcome, and not having that resource available for a critical response, could result in a delayed response for a patient with time-sensitive medical emergencies.

The MPDS system can be used effectively to determine which EMS responses are time-sensitive and if the presence of a medical first response unit could make an impact on patient outcomes. The effective use of this system would preserve crucial first response medical units for those responses that are time-sensitive

Due to the growing EMS worker shortage, specifically paramedics, high-performance EMS systems, such as MedStar in Fort Worth, Texas, REMSA in Reno, Nev., and EMSA in Tulsa and Oklahoma City, Okla., have also recently used the MPDS system as the backbone of a tiered ambulance deployment system. Specifically, the systems are using BLS ambulances staffed with EMTs to respond to low-acuity medical complaints, thereby preserving scarce ALS capacity for higher acuity medical responses. This process has enabled those systems to dramatically enhance response capability, while improving job satisfaction for the ambulance personnel.

During interviews with PFD leadership, it was shared that although the MPDS system is used for call taking and pre-arrival instructions, it has not been adopted by the county for use in determining appropriate response levels (ALS vs. BLS), response modes (*HOT vs. non-Lights and siren, or COLD*), or assignment of first medical response units.

We strongly recommend that PFD and the other agencies that are part of the REDCOM JPA work with the leadership at REDCOM and Sonoma County to take full clinical and safety advantage of using the MPDS system for response prioritization, mode, and clinical level of response.

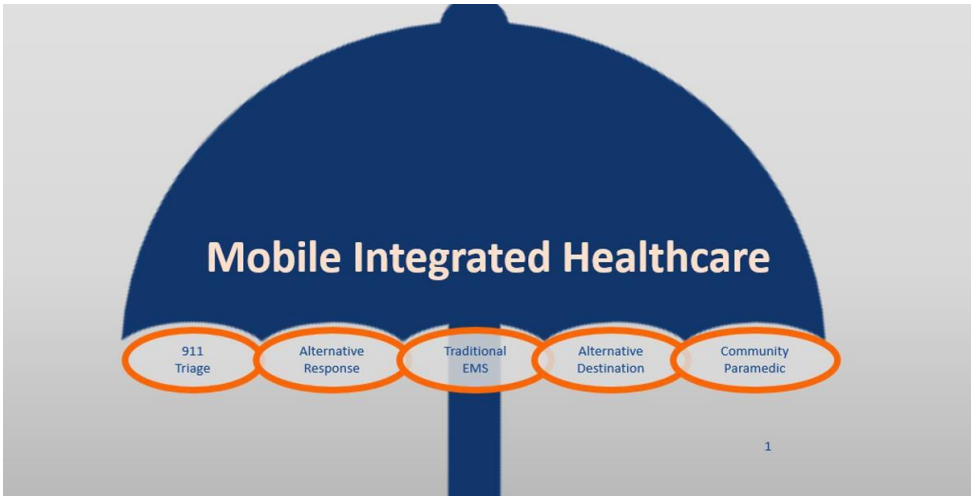
33. https://www.hmpgloballearningnetwork.com/site/emsworld/news/top-ems-groups-issue-joint-statement-ls-responses

COMMUNITY PARAMEDIC PROGRAM

One of the fastest growing value-added service enhancements in EMS is what is known as a Mobile Integrated Healthcare / Community Paramedicine (MIH/CP) program. MIH/CP is comprised of a suite of potential services that EMS can provide to fill gaps in the local healthcare delivery system. In essence, MIH/CP is intended to better manage the increasing EMS call volume and better align the types of care being provided with the needs of the patient. To be effective, MIH/CP is commonly accomplished through a collaborative approach with healthcare and social service agencies within the community.

In 2009 there were four programs like this in the country, but a recent survey by the National Association of EMTs identified more than 250 active MIH/CP programs now operating across the U.S.[34]

FIGURE 6-2: Mobile Integrated Healthcare



During interviews with PFD leadership, they identified an increasing volume of 'high utilizers' requesting EMS services. This response volume places a burden on local resources, and repeated transports of 'high utilizer' patients often does not improve the patient's health status, nor improve their experience of care.

In California, the implementation of MIH/CP services by EMS providers has been challenging, since prior state legislation limits the role of EMS providers to only services provided after an emergency call or during an inter-facility medical transport. However, due to the evidence-based research regarding the efficacy of MIH/CP programs, in June 2022 the State of California passed Assembly Bill 1544[35], authorizing EMS agencies to implement MIH/CP programs.

A consideration for a potential role of the PFD in an MIH/CP program in Petaluma could be an expansion of the currently operated specialized response unit for behavioral health emergencies, in partnership with the Petaluma Police Department and community mental health resources. Sometimes referred to as a Crisis Intervention Team (CIT), specialized units such

34. http://www.naemt.org/docs/default-source/2017-publication-docs/mih-cp-survey-2018-04-12-2018-web-links-1.pdf?Status=Temp&sfvrsn=a741cb92_2
35. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201920200AB1544

as these have been effective in other communities across the country in reducing the risks associated with behavioral health-related responses[36].

We recommend that PFD collaborate with its Medical Director, the Coastal Valleys EMS Agency (CVEMSA), and other community stakeholders to determine the role that an MIH/CP program could play in working with high utilizers and other patients within Petaluma who would benefit from this type of service model.

EMS PERFORMANCE MEASURES & QUALITY

Most communities evaluate the effectiveness of an EMS system based on response times. However, for the majority of EMS responses, time is not a critical factor in the patient's outcome.

A position statement developed by the 2007 consortium of U.S. Metropolitan Municipality EMS Medical Directors[37] cited that in many jurisdictions, response-time intervals for advanced life support units and resuscitation rates for victims of cardiac arrest are the primary measures of EMS system performance. However, the association of the former with patient outcomes is not supported explicitly by the medical literature, while the latter focuses on a very small proportion of the EMS patient population and thus does not represent a sufficiently broad selection of performance measures.

As a result, progressive and transformative EMS systems have adopted a more robust process for properly evaluating EMS system performance with measures based on clinical bundles and patient experience.

Currently, PFD uses a single person, through an outside contract, to provide clinical quality improvement. The use of clinical dashboards for key clinical performance indicators could significantly augment the QA process by identifying opportunities for improvement and tying these opportunities to continuing medical education.

For example, the Metropolitan Area EMS Authority (MedStar Mobile Healthcare) system in Fort Worth, Texas, publishes clinical performance dashboards for specific high-acuity medical interventions such as airway management and mechanical chest compression use, as well as clinical conditions such as cardiac arrest, STEMI, and trauma care.

Examples of clinical performance dashboards follow.

§ § §

36. https://www.nami.org/Advocacy/Crisis-Intervention/Crisis-Intervention-Team-(CIT)-Programs
37. https://pubmed.ncbi.nlm.nih.gov/18379908/

FIGURE 6-3: Clinical Performance Dashboard Examples (1)

MAEMSA Clinical Bundle Performance Dashboard - OHCA

Agency:

Cardiac Arrest	Goal	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Current Avg.
% of recognizable Out-of-Hospital Cardiac Arrests (OHCA) cases correctly identified by Dispatch							
Median time between 9-1-1 call and OHCA recognition							
% of recognized 2nd party OHCA cases that received tCPR							
Median time between 9-1-1 Access to tCPR hands on chest time for OHCA cases							
% of cases with time to tCPR < 180 sec from first key stroke							
System response time < 5 mins for Dispatch-presumed cardiac arrest							
% of cases with CCF ≥ 90%							
% of cases with compression rate 100-120 cpm 90% of the time							
% of cases with compression depth that meet appropriate depth benchmark 90% of the time							
% of cases with mechanical CPR device placement with < 10 sec pause in chest compression							
% of cases with Pre-shock pause < 10 sec							
% arrive at E/D with ROSC							
% discharged alive							
% neuro intact at discharge (Good or Moderate Cognition)							
% of cases with bystander CPR							
% of cases with bystander AED use							
# of people trained in CCR							

MAEMSA Clinical Bundle Performance Dashboard - STEMI

Agency:

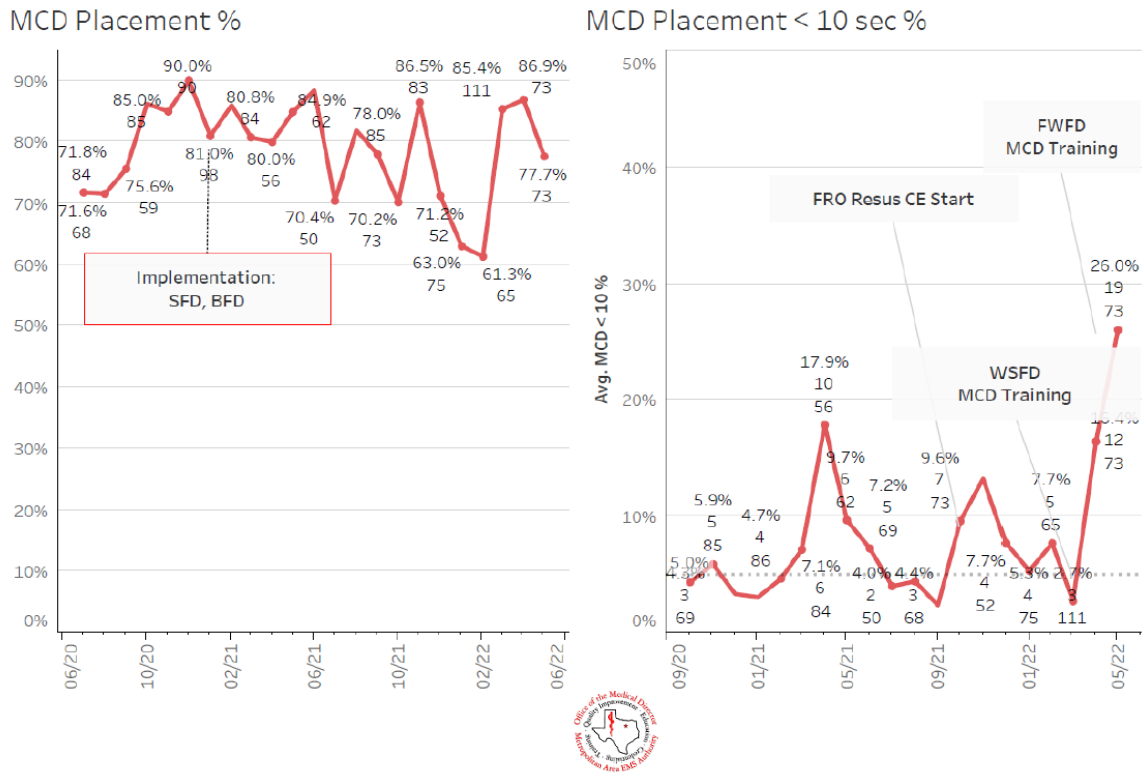
STEMI	Goal	Jan-22	Feb-22	Mar-22	Current Avg.
% of suspected STEMI patients correctly identified by EMS and Confirmed at the Hospital					
% STEMI identified at the Hospital, but not by EMS					
% STEMI identified by EMS, without hospital outcomes					
% of suspected STEMI patients w/ASA admin (*in the absence of contraindications)*					
% of suspected STEMI patients w/NTG admin (*in the absence of contraindications)*					
% of suspected STEMI patients with 12L acquisition within 10 minutes of ambulance patient contact					
% of suspected STEMI patients with 12L transmitted within 5 minutes of ambulance transport initiation					
% of suspected STEMI patients with PCI facility notified of suspected STEMI within 10 minutes of ambulance patient contact					
% of patients with Suspected STEMI Transported to PCI Center					
% of suspected STEMI patients with MedStar PSAP time to Cath Lab intervention time < 90 minutes					

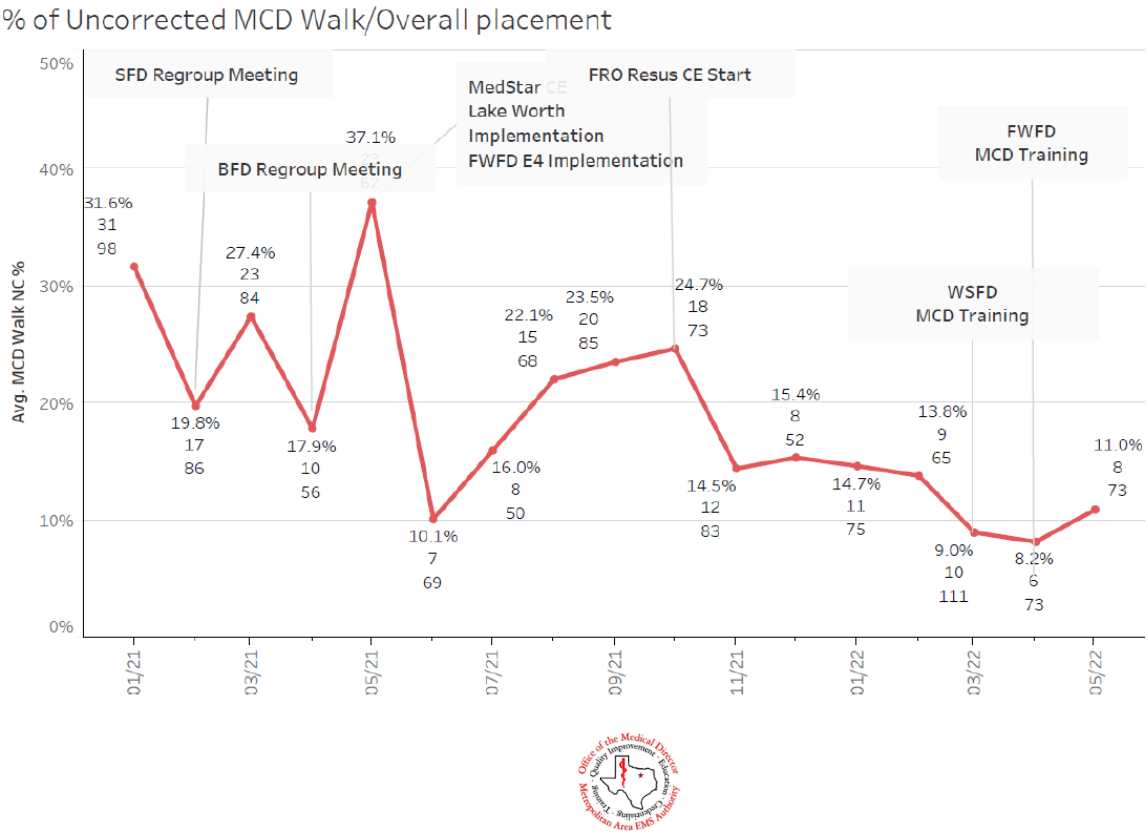
MAEMSA Clinical Bundle Performance Dashboard

Agency:

Ventilation Management	Goal	Jan-22	Feb-22	Mar-22	Current Avg.
% of cases with etCO2 use for non-invasive ventilation management (CPAP, BVM) when equipped	96.0%				
% of cases with etCO2 use for invasive ventilation management (KA, ETT, Cric)	96.0%				
% of successful ventilation management as evidenced by etCO2 waveform throughout the case	96.0%				
% of successful King Airway placement	96.0%				
% of successful endotracheal tube placement	96.0%				
System response time < 5 mins for Dispatch-presumed compromised airway	90.0%				

FIGURE 6-4: Clinical Performance Dashboard Examples (2)

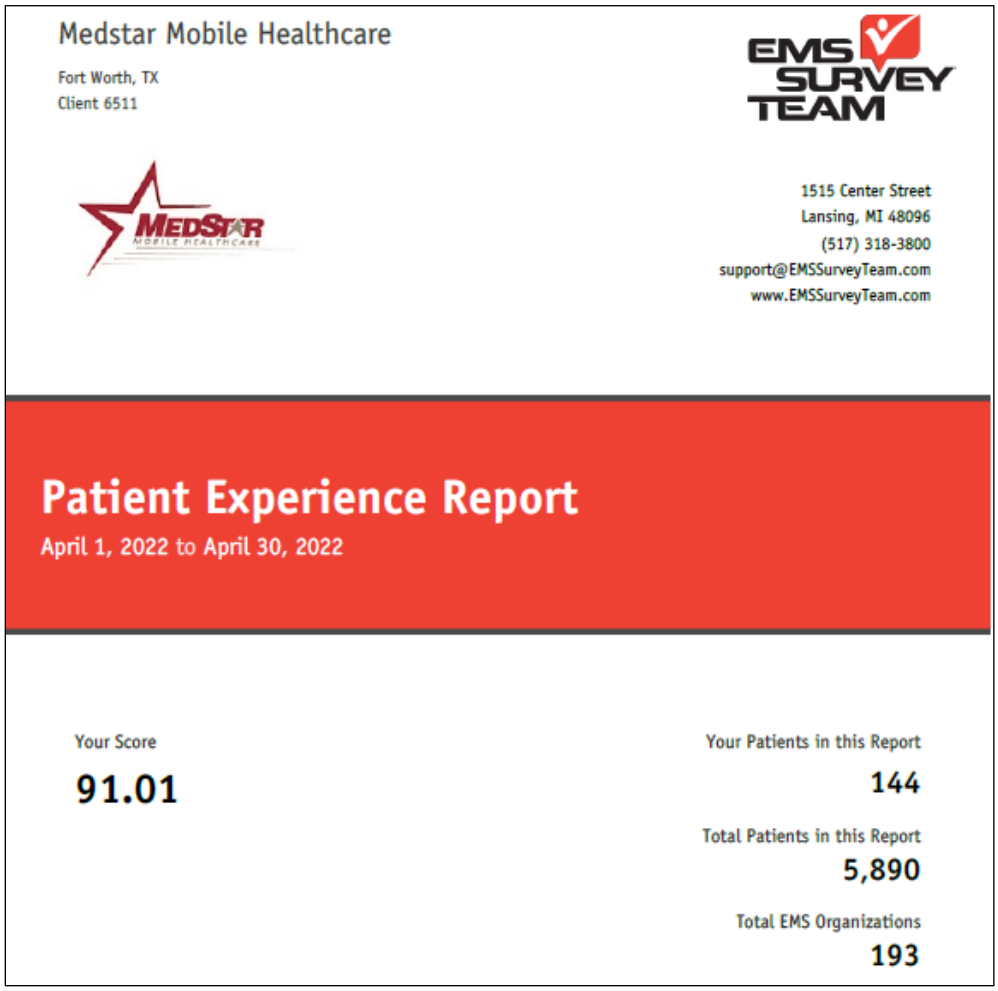




We recommend that PFD, working with its Medical Director and the LEMSA, develop clinical dashboards to evaluate and improve the clinical measures for PFD. If these metrics are not able to be developed and published by the current clinical quality improvement processes available through the LEMSA, PFD should consider adding a quality improvement position to focus on quality improvement, including continuing medical education based on quality improvement findings.

Similarly, Medicare and other healthcare payers have placed significant importance on the role of patient experience in healthcare delivery. EMS is healthcare delivery. A growing number of progressive and transformative EMS agencies have begun evaluating patient experience scores, using an outside agency to assure the assessment is objective and non-biased. An example of this type of patient experience report is shown in the following figure.

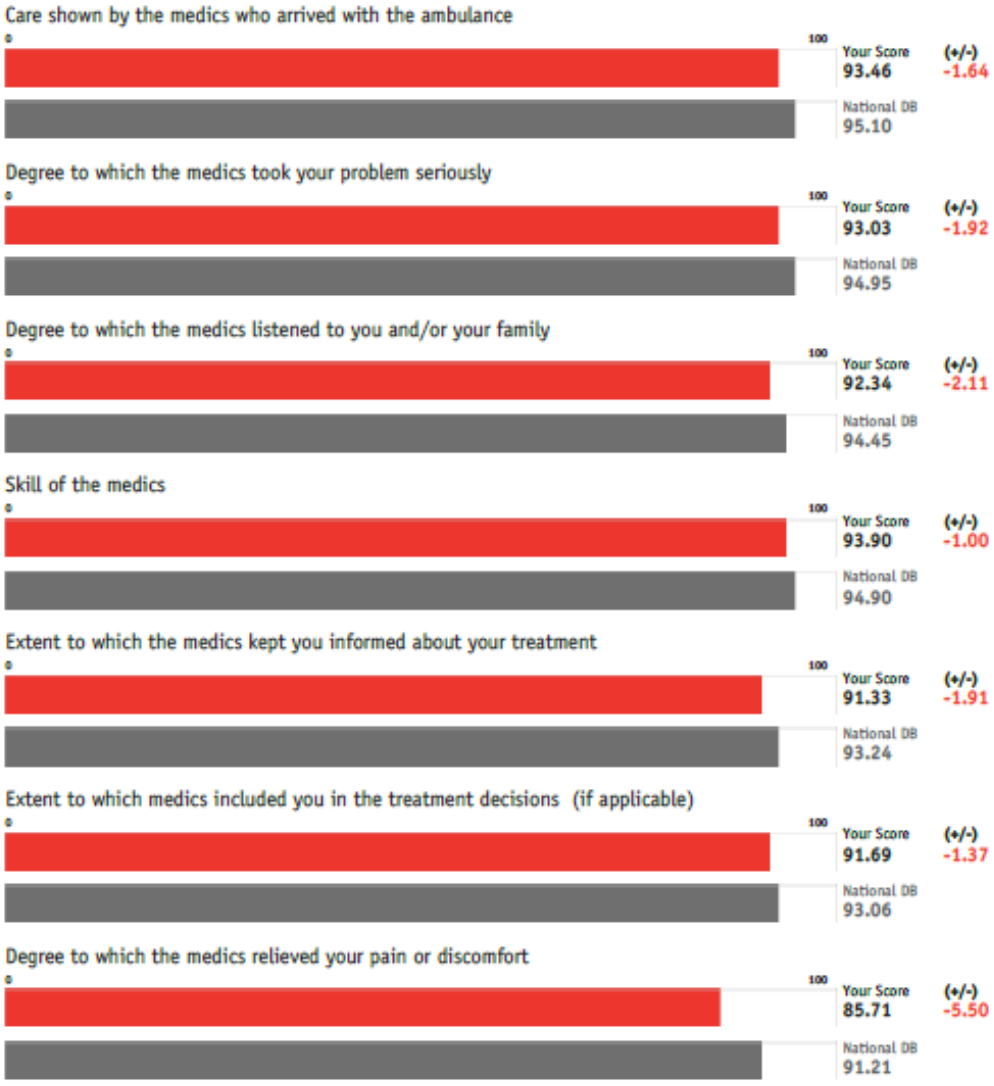
FIGURE 6-5: EMS Survey Example

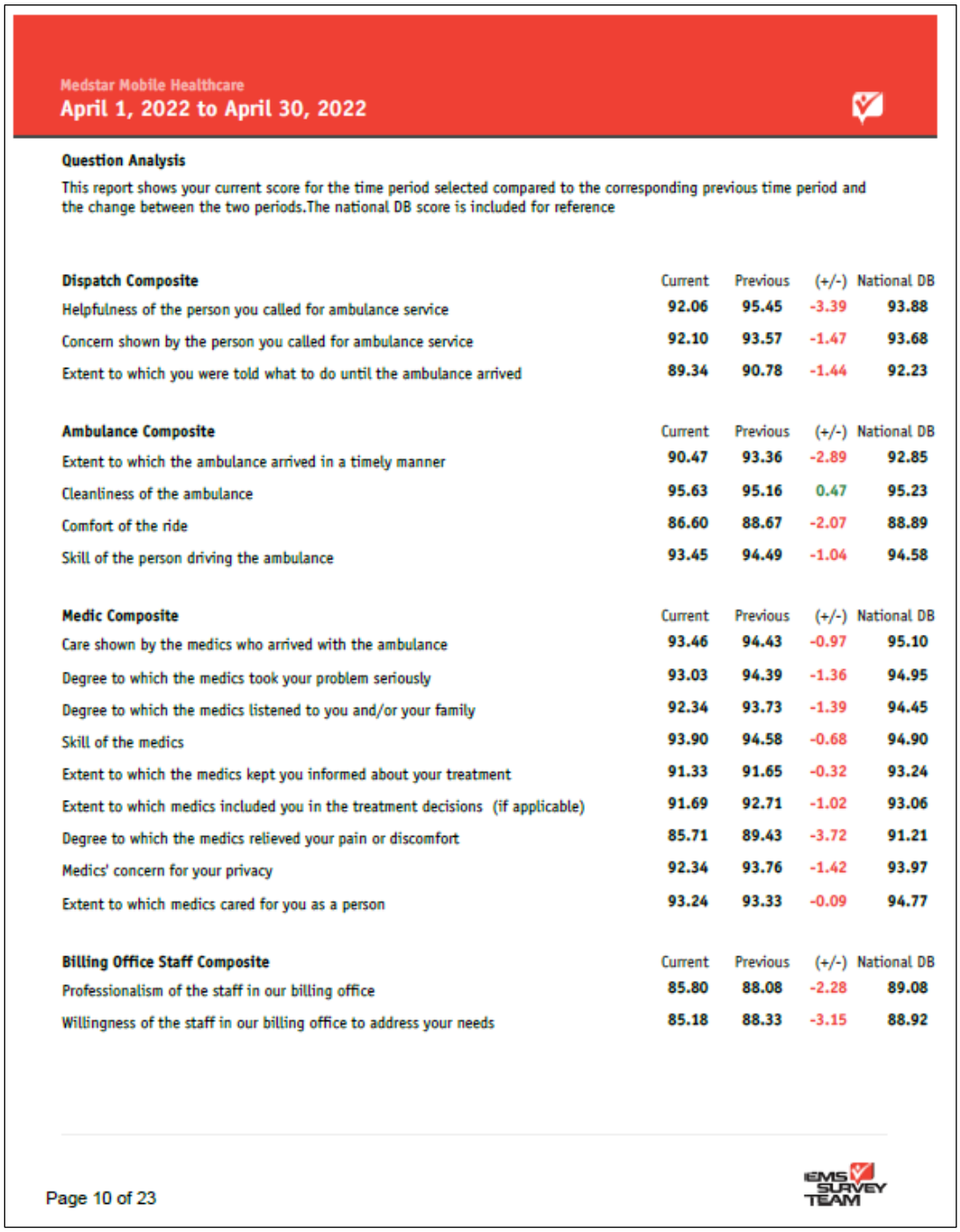


Medstar Mobile Healthcare
April 01, 2022 to April 30, 2022

Medic Composite

This report shows mean scores for each Medic survey item and the overall composite score. The first column shows your organization score with the national database score below it. The second column is the difference between your score and the database mean.





Medstar Mobile Healthcare
April 1, 2022 to April 30, 2022

Question Analysis

This report shows your current score for the time period selected compared to the corresponding previous time period and the change between the two periods.The national DB score is included for reference

Dispatch Composite	Current	Previous	(+/-)	National DB
Helpfulness of the person you called for ambulance service	92.06	95.45	-3.39	93.88
Concern shown by the person you called for ambulance service	92.10	93.57	-1.47	93.68
Extent to which you were told what to do until the ambulance arrived	89.34	90.78	-1.44	92.23

Ambulance Composite	Current	Previous	(+/-)	National DB
Extent to which the ambulance arrived in a timely manner	90.47	93.36	-2.89	92.85
Cleanliness of the ambulance	95.63	95.16	0.47	95.23
Comfort of the ride	86.60	88.67	-2.07	88.89
Skill of the person driving the ambulance	93.45	94.49	-1.04	94.58

Medic Composite	Current	Previous	(+/-)	National DB
Care shown by the medics who arrived with the ambulance	93.46	94.43	-0.97	95.10
Degree to which the medics took your problem seriously	93.03	94.39	-1.36	94.95
Degree to which the medics listened to you and/or your family	92.34	93.73	-1.39	94.45
Skill of the medics	93.90	94.58	-0.68	94.90
Extent to which the medics kept you informed about your treatment	91.33	91.65	-0.32	93.24
Extent to which medics included you in the treatment decisions (if applicable)	91.69	92.71	-1.02	93.06
Degree to which the medics relieved your pain or discomfort	85.71	89.43	-3.72	91.21
Medics' concern for your privacy	92.34	93.76	-1.42	93.97
Extent to which medics cared for you as a person	93.24	93.33	-0.09	94.77

Billing Office Staff Composite	Current	Previous	(+/-)	National DB
Professionalism of the staff in our billing office	85.80	88.08	-2.28	89.08
Willingness of the staff in our billing office to address your needs	85.18	88.33	-3.15	88.92

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EMS SURVEY TEAM

We recommend that PFD consider and implement a process to independently evaluate and publish patient experience scores as a key metric in evaluating overall service delivery quality.

Conclusion and Recommendations: EMS

Overall, EMS and ambulance operations for PFD appear to be effective for the communities they serve. CPSM makes the following recommendations regarding ambulance service delivery; these recommendations are intended to help make the system more efficient and effective.

- PFD should eliminate the 48-hour shift pattern for personnel assigned to primary ambulance duty, or at the very least, rotate personnel off ambulance assignment during a 48-hour shift to allow for adequate time for rest and recovery. (Recommendation No. 9.)
- PFD and the other agencies that are part of the REDCOM JPA should work with the leadership at REDCOM and Sonoma County to take full clinical and safety advantage of using the Medical Priority Dispatch System (MPDS) system for EMS response prioritization, mode of response, and clinical level of response. (Recommendation No. 10.)
- PFD leadership should evaluate the total fire and EMS emergency response system staffing value of PFD ambulances being dispatched on calls which are not primary medical responses, thereby enhancing the availability of ambulances for response to medical calls. (Recommendation No. 11.)
- PFD should collaborate with its Medical Director and the LEMSA to develop and publish clinical dashboards to evaluate and improve key clinical measures for PFD. If these metrics are not able to be developed and published by the current clinical quality improvement processes available through the LEMSA, PFD should consider adding a quality improvement position to focus on quality improvement, including continuing medical education based on quality improvement findings. (Recommendation No. 12.)
- The clinical leadership of PFD should conduct an analysis of ambulance on-scene times to determine if they feel this average on-scene duration of 11 minutes is consistent with EMS clinical protocol expectations. (Recommendation No. 13.)
- To enhance efficiency and cost effectiveness of ambulance deployment, and due to financial losses derived for ambulance operations, the community and PFD should consider other options for ambulance service delivery such as single-role paramedics (paramedic-certified only) in lieu of dual role (fire and paramedic certified) personnel to reduce associated staffing and benefit costs for the dual role position on 1 to 2 or all ALS ambulances; the conversion of one ALS ambulance to a light duty Squad capable of EMS response to low-acuity EMS and fire incidents, as well as higher acuity fire response to bolster the Effective Response Force. Coupled with the Squad concept, elimination of the BLS transport unit, or a more effective approach of adjusting the hours of the BLS unit that matches higher demand times. *It is noted here that on a national level, private EMS agencies as well as local governments have greater success recruiting Emergency Medical Technician (EMT) certified staff than advanced EMT and/or Paramedic staff.* (Recommendation No. 14.)
- PFD should initiate a process review to try and shorten the 90th percentile activation time for ambulance responses, such as by using a 'pre-alert' process to notify ambulance units of incoming calls in their district even before a final determination regarding the type or severity of the medical response. (Recommendation No. 15.)
- PFD should expand their participation in the existing Specialized Assistance for Everyone (SAFE) program, a specialized response unit for behavioral health emergencies and work with its Medical Director, LEMSA, and the Coastal Valleys EMS Agency (CVEMSA) to determine additional roles that an expanded MIH/CP program could play in working with high utilizers

and other patients within Petaluma who would benefit from this type of service model. (Recommendation No. 16.)

- PFD should immediately initiate a process to replace at least two ambulances, with another two replaced within the next 18 months. (Recommendation No. 17.)
- PFD should consider and implement a process to independently evaluate and publish patient experience scores as a key metric in evaluating overall service delivery quality. (Recommendation No. 18.)

§ § §

SECTION 7. DATA ANALYSIS

This data analysis is a key component of the study of the Petaluma Fire Department (PFD), which provides fire protection service to the City of Petaluma and surrounding communities. This analysis examines all calls for service between January 1, 2021, and December 31, 2021, as recorded in the Sonoma County Computer-Aided Dispatch (CAD) system, and from National Fire Incident Reporting System (NFIRS) data obtained from the PFD.

This analysis is made up of three parts. The first part summarizes the annual call volume and workload. The second part focuses on the fire protection service provided by PFD's fire protection and rescue apparatus. The third part explores the emergency medical services provided by the medical response apparatus (ambulances) of PFD.

The PFD is a full-service fire department. It serves an area of approximately 14.4 square miles and 70,000 residents. It provides fire, rescue, and emergency medical services within the Petaluma city limits, Southern Sonoma County, and a portion of Marin County. The fire department ambulance service area covers 184 square miles.

The department operates out of a Fire Prevention Bureau at city hall and three strategically located fire stations. The department utilizes three type 1 engines, one OES type 1 engine, one type 1 aerial truck, one type 6 brush truck, three dual-role ALS ambulances, a part-time single-role BLS ambulance, and a 24-hour Battalion Chief. Daily operations staffing consists of 17 paid personnel working 48-hour rotating shifts.

In 2021, the PFD responded to 7,536 calls. The PFD's fire response apparatus responded to 6,400 calls and had a total of 1,983.2 hours combined workload (deployed time). The PFD's ambulances responded to 6,337 calls and had a total of 4,278.5 hours combined workload. In responding to calls that occurred within the Petaluma Fire District, the PFD's average response time was 6.3 minutes and the 90th percentile response time was 8.8 minutes. In responding to calls that occurred within the extended Petaluma EMS District outside the city limit, the PFD's average response time was 10.6 minutes and the 90th percentile response time was 15.5 minutes.

METHODOLOGY

In this report, CPSM analyzes calls and runs. A call is an emergency service request or incident. A run is a dispatch of a unit (i.e., a unit responding to a call). Thus, a call may include multiple runs.

We linked the CAD and NFIRS data sets. Then, we classified the calls in a series of steps. We first used the NFIRS incident type to identify canceled calls, motor vehicle accidents (MVA), and fire category call types. Calls identified by NFIRS as EMS calls along with any calls that lacked a matching NFIRS record were categorized using the CAD system's incident descriptions. We describe the method of call categorization in Attachment I.

The analysis focuses on calls that involved a responding PFD unit. The mutual aid provided by external agencies within Petaluma is documented in each part of the analysis.

We received records for a total of 8,485 calls in 2021. We removed 747 testing calls and 200 calls that had no responding PFD units. Finally, we excluded seven incidents to which the PFD's administrative unit was the sole responder; however, the workload of administrative units is documented in the analysis.

The CAD data included the information of fire and EMS districts for each call location. In the analysis, we identified aid-given calls for fire if a PFD's fire unit (aerial truck, Battalion Chief, brush, engine, and fire boat) responded to a non-Petaluma fire district. We identified aid-given calls for EMS if a PFD's ambulance responded to a non-Petaluma EMS district.

SUMMARY OF CALLS AND WORKLOAD

In this part, we summarize the total number of calls that PFD responded to, and the corresponding workload measured by the total number of runs and the total work hours in 2021.

Here we separate PFD's service into two types. The first type that we identify as "fire" service was provided by fire response apparatus including an aerial truck, a battalion chief vehicle, a brush truck, engines, and a fire boat. The second type that we identify as "EMS" service was provided by the department's ambulances. In addition, we divide the PFD's service area into three parts: the fire/EMS district within Petaluma, the extended EMS district outside the city of Petaluma, and areas beyond the Petaluma EMS district.

The following figure shows the boundaries of the Petaluma fire (thick brown line) and ambulance (thick blue line) service areas.

The subsequent table summarizes the volume of calls responded by PFD and the PFD's total workload in 2021, broken down by service type and district. In 2021, PFD responded to 7,536 calls, of which, 5,201 calls were responded to by both fire and medical response apparatus.

FIGURE 7-1: Petaluma Fire and Ambulance Districts

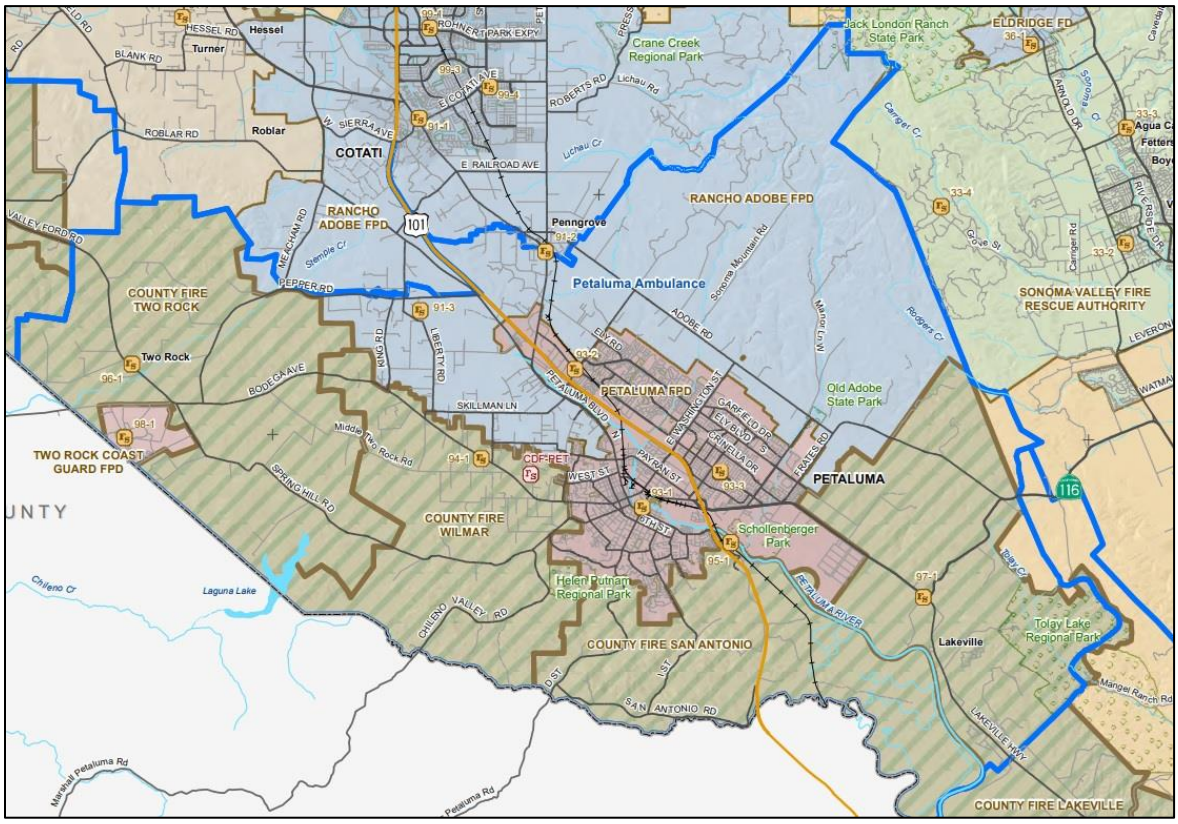


TABLE 7-1: Calls and Workload by Service Type and District

Service	District	Total Calls	Total Runs	Total Hours
Fire	Petaluma Fire	5,653	6,765	1708.6
	Extended Petaluma EMS*	599	751	250.0
	Outside Petaluma EMS	148	166	24.7
	Total	**6,400**	**7,682**	**1,983.2**
EMS	Petaluma Fire	5,060	6,305	3411.0
	Extended Petaluma EMS*	720	873	607.7
	Outside Petaluma EMS	557	599	259.7
	Total	**6,337**	**7,777**	**4,278.5**
Total		**7,536****	**15,459**	**6,261.7**

Note: *Extended Petaluma EMS=Petaluma EMS district outside the city of Petaluma; **PFD provided combined fire and EMS services to 5,201 calls. The total number of calls the PFD responded to was 6,400 + 6,337 - 5,201 = 7,536.

Observations:

- The PFD responded to 7,536 calls in 2021. The fire and EMS services responded to 85 and 84 percent of total calls, respectively.
- The total runs for the year were 15,459. The daily average was 42.4 runs, of which the PFD's fire and EMS services each made 50 percent of total runs, respectively.
- Total deployed time for the year was 6,261.7 hours. The daily average was 17.2 hours for all units combined, of which the PFD's fire and EMS services accounted for 32 and 68 percent of the total deployed time, respectively.

PART 1. FIRE PROTECTION AND RESCUE

In this part, we examine the response and workload of PFD's fire service provided by its fire response apparatus. All calls responded to by these units outside Petaluma's fire district were identified as mutual aid. This part of the analysis includes four sections. The first section focuses on call types and dispatches. The second section explores the time spent and the workload of individual units. The third section presents an analysis of the busiest hours in the year studied. The fourth section provides a response time analysis of the studied units.

AGGREGATE FIRE SERVICE CALL TOTALS AND RUNS

In 2021, the PFD's fire units responded to 6,400 calls. Of these, 69 were structure fire calls and 109 were outside fire calls within the Petaluma Fire District.

Fire Service Calls by Type

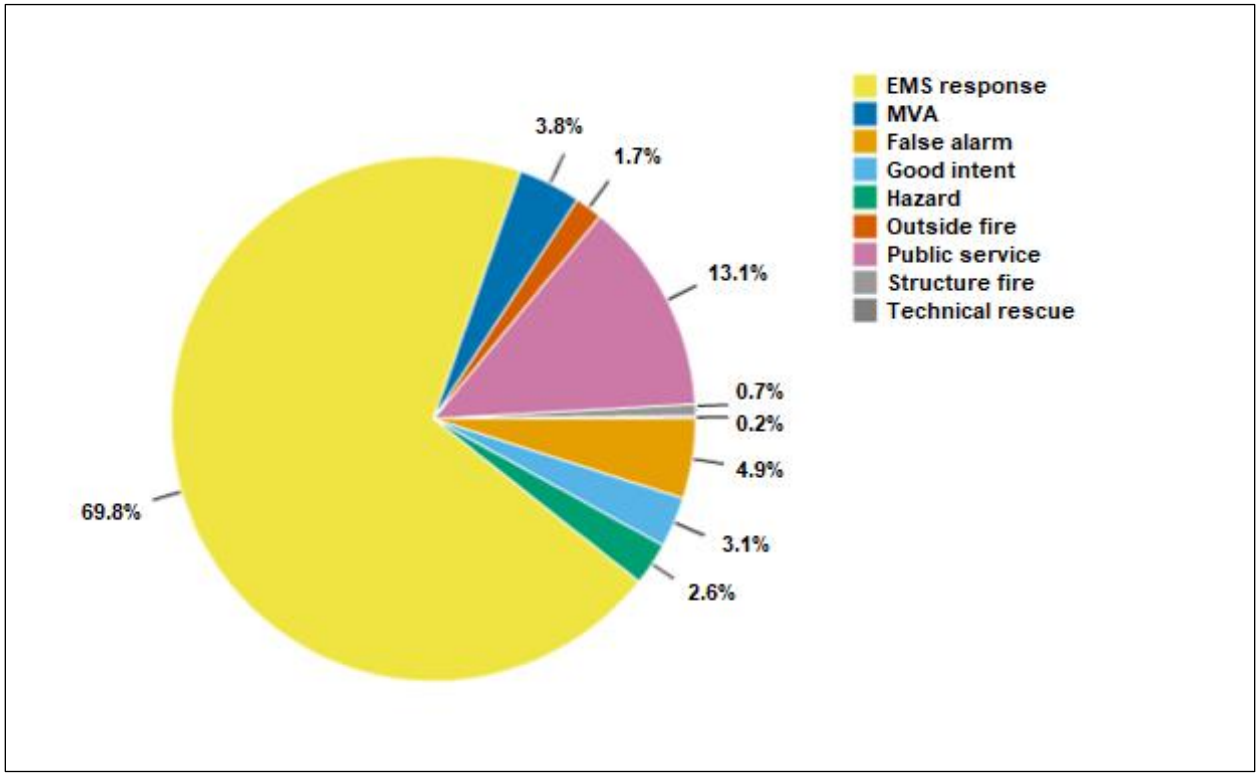
The following table shows the number of calls responded by fire response units by call type, average calls per day, and the percentage of calls that fall into each call type category. The subsequent figure shows the percentage of calls that fall into each fire type category.

TABLE 7-2: Fire Service Calls by Type

Call Type	Total Calls	Calls per Day	Call Percentage
EMS response	3,770	10.3	59.0
MVA	208	0.6	3.2
EMS Total	**3,978**	**10.9**	**62.2**
False alarm	265	0.7	4.1
Good intent	168	0.5	2.6
Hazard	142	0.4	2.2
Outside fire	93	0.3	1.5
Public service	710	1.9	11.1
Structure fire	39	0.1	0.6
Technical rescue	9	0.0	0.1
Fire Total	**1,426**	**3.9**	**22.3**
Canceled	470	1.3	7.3
Mutual aid	526	1.4	8.2
Total	**6,400**	**17.5**	**100.0**

Note: 159 calls that were labeled as mutual aid were also canceled; See Attachment 2.1 for call type identification.

FIGURE 7-2: Calls Responded by Fire Units by Type



Observations:

- PFD's fire response apparatus responded to an average of 17.5 calls per day, including 1.3 canceled (7 percent) calls and 1.4 mutual aid (8 percent) calls per day.
- EMS calls totaled 3,978 (62 percent of all calls), an average of 10.9 calls per day.
  - Motor vehicle accidents (MVA) made up 3 percent of total calls (5 percent of EMS calls).
- Fire calls totaled 1,426 (22 percent of all calls), or an average of 3.9 calls per day.
  - False alarm calls made up 4 percent of total calls (19 percent of fire calls).
  - Structure and outside fire calls combined made up 2 percent of total calls (9 percent of fire calls), or an average of 0.4 calls per day, or about one call every three days.

Fire Service Calls by Call Type and Duration

The following table shows the duration of calls by type using four duration categories: less than 30 minutes, 30 minutes to one hour, one to two hours, and two or more hours. The duration of a call is measured from the time that the first unit is dispatched until the last unit is cleared. The table focuses only on fire service units and does not include EMS units.

TABLE 7-3: Fire Service Calls by Type and Duration

Call Type	Less than 30 Minutes	30 Minutes to One Hour	One to Two Hours	Two or More Hours	Total
EMS response	3,589	173	8	0	3,770
MVA	180	24	4	0	208
EMS Total	**3,769**	**197**	**12**	**0**	**3,978**
False alarm	260	4	1	0	265
Good intent	164	4	0	0	168
Hazard	109	27	6	0	142
Outside fire	55	25	10	3	93
Public service	669	31	5	5	710
Structure fire	17	9	7	6	39
Technical rescue	5	3	0	1	9
Fire Total	**1,279**	**103**	**29**	**15**	**1,426**
Canceled	467	3	0	0	470
Mutual aid	464	44	11	7	526
Total	**5,979**	**347**	**52**	**22**	**6,400**

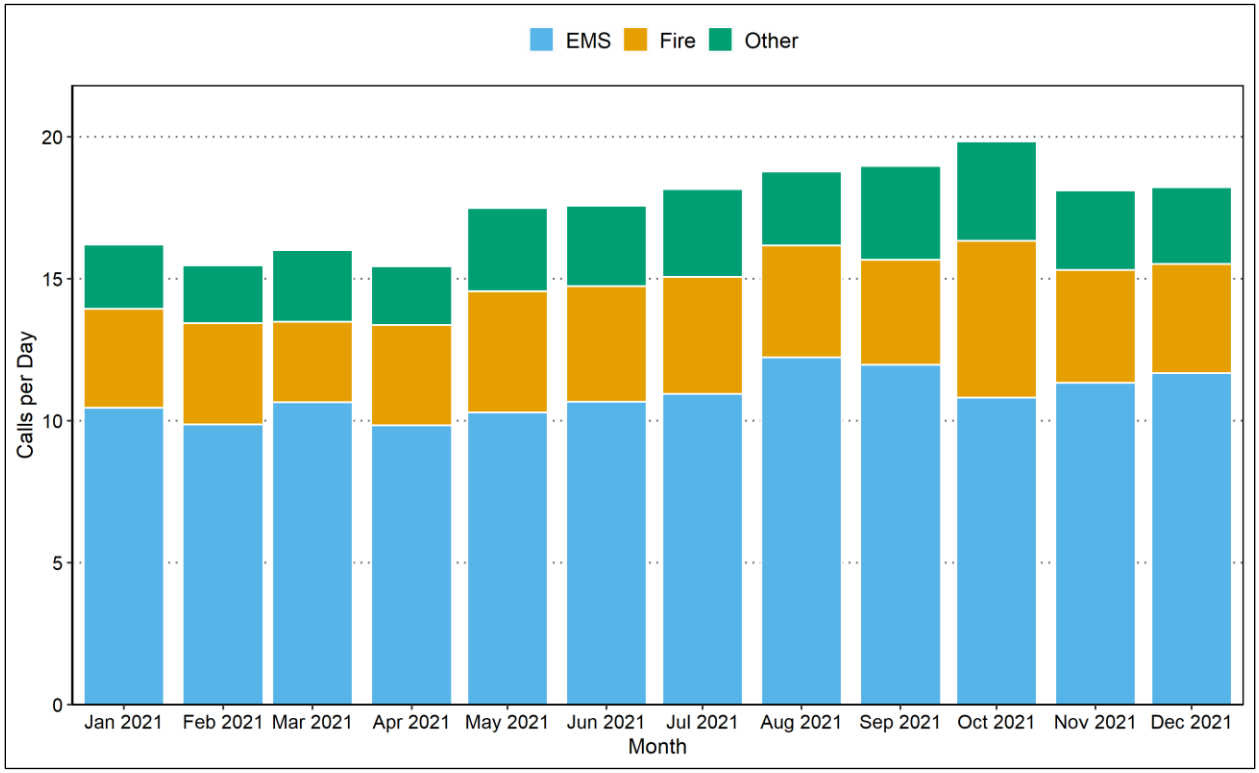
Observations:

- On average, PFD's fire units responded to 0.1 fire calls per day that lasted more than one hour.
- A total of 3,966 EMS calls (99.7 percent) lasted less than one hour, and 12 EMS calls (0.3 percent) lasted one to two hours. 95 percent of EMS calls lasted less than 30 minutes.
- A total of 1,382 fire calls (97 percent) lasted less than one hour, 29 fire calls (2 percent) lasted one to two hours, and 15 fire calls (1 percent) lasted two or more hours. 90 percent of fire calls lasted less than 30 minutes
- A total of 80 outside fire calls (86 percent) lasted less than one hour, 10 outside fire calls (11 percent) lasted one to two hours, and three outside fire calls (3 percent) lasted two or more hours.
- A total of 26 structure fire calls (67 percent) lasted less than one hour, seven structure fire calls (18 percent) lasted one to two hours, and six structure fire calls (15 percent) lasted two or more hours.

Average Fire Service Calls by Month and Hour of Day

The next figure shows the monthly variation in the average daily number of calls handled by PFD's fire response units in 2021. Similarly, the subsequent figure illustrates the average number of calls received each hour of the day.

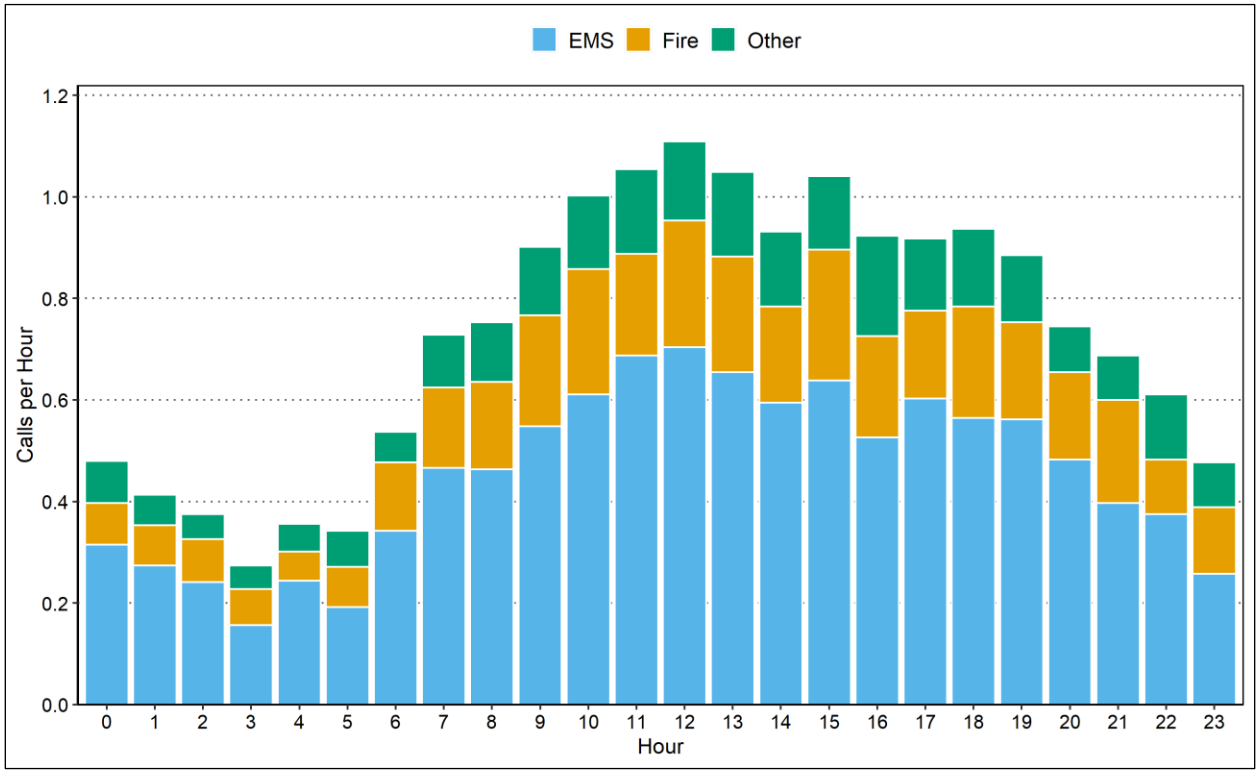
FIGURE 7-3: Calls Responded by Fire Units per Day by Month



Observations:

- EMS calls responded by fire units per day ranged from 9.8 in April 2021 to 12.2 in August 2021.
- Fire calls responded by fire units per day ranged from 2.8 in March 2021 to 5.5 in October 2021.
- Other calls responded by fire units per day ranged from 2.0 in February 2021 to 3.5 in October 2021.
- Total calls responded by fire units per day ranged from 15.4 in April 2021 to 19.8 in October 2021.

FIGURE 7-4: Average Calls Responded by Fire Units by Hour of Day



Observations:

- EMS calls responded to by fire units per hour ranged from 0.16 between 3:00 a.m. and 4:00 a.m. to 0.70 between noon and 1:00 p.m.
- Fire calls responded to by fire units per hour ranged from 0.06 between 4:00 a.m. and 5:00 a.m. to 0.26 between 3:00 p.m. and 4:00 p.m.
- Other calls responded to by fire units per hour ranged from 0.05 between 3:00 a.m. and 4:00 a.m. to 0.20 between 4:00 p.m. and 5:00 p.m.
- Total calls responded to by fire units per hour ranged from 0.27 between 3:00 a.m. and 4:00 a.m. to 1.11 between noon and 1:00 p.m.

Fire Response Units Arriving at Calls

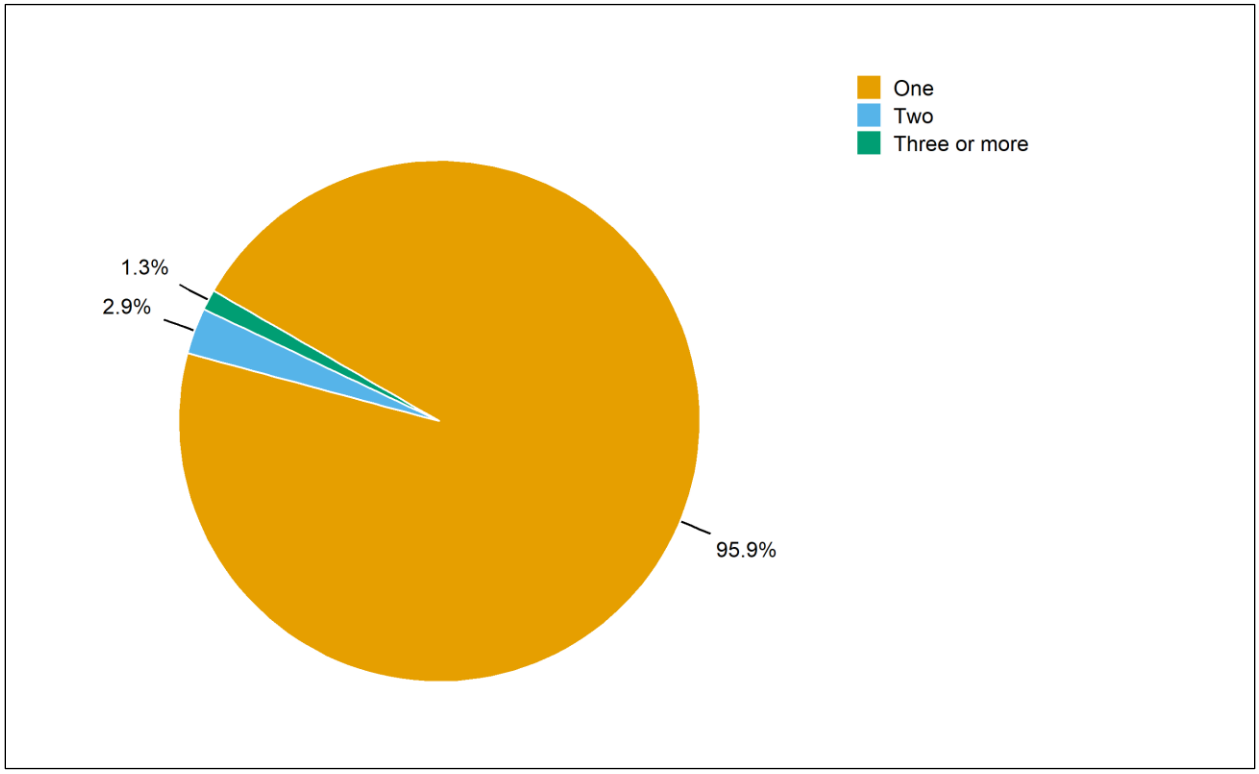
The following table and figure detail the number of calls with one, two, and three or more fire response units arriving at a call, broken down by call type. Here we limit ourselves to calls where a fire unit arrives. For this reason, there are fewer calls in the following table than in Table 7-2.

TABLE 7-4: Fire Service Calls by Type and Number of Arriving Fire Units

Call Type	Number of Units			Total Calls
	One	Two	Three or More	
EMS response	3,514	11	1	3,526
MVA	151	34	8	193
EMS Total	**3,665**	**45**	**9**	**3,719**
False alarm	220	26	4	250
Good intent	140	6	3	149
Hazard	116	17	6	139
Outside fire	64	13	14	91
Public service	627	13	6	646
Structure fire	9	9	20	38
Technical rescue	5	1	2	8
Fire Total	**1,181**	**85**	**55**	**1,321**
Canceled	163	4	1	168
Mutual aid	251	23	5	279
Total	**5,260**	**157**	**70**	**5,487**
Percentage	**95.9**	**2.9**	**1.3**	**100.0**

Note: 168 out of the 470 canceled calls (36 percent) had at least one unit arrived.

FIGURE 7-5: Average Number of Arriving Fire Units for Calls



Observations:

Overall

- On average, 1.1 fire response units arrived at all calls; for 96 percent of calls, only one unit arrived.
- Overall, three or more fire response units arrived at 1 percent of calls.

EMS

- On average, 1.0 fire units arrived per EMS call.
- One fire unit arrived 99 percent of the time, and two or more fire units arrived 1 percent of the time.

Fire

- On average, 1.2 fire units arrived per fire call.
- One fire unit arrived 89 percent of the time, two fire units arrived 6 percent of the time, and three or more fire units arrived 4 percent of the time.
- For outside fire calls, three or more fire units arrived 15 percent of the time.
- For structure fire calls, three or more fire units arrived 53 percent of the time.

Workload of Fire Response Units: Runs and Deployed Time

The workload of PFD's fire response units is measured in two ways: runs and deployed time. The deployed time of a run is measured from the time a unit is dispatched through the time the unit is cleared. Because multiple units respond to some calls, there are more runs (7,682) than calls (6,400) and the average deployed time per run varies from the average duration per call.

Fire Service Runs and Deployed Time

Deployed time, also referred to as deployed hours, is the total deployment time of the fire response units deployed on all runs. The following table shows the total deployed time, both overall and broken down by type of run, for all PFD's fire response units. Table 7-6 and Figure 7-6 present the average deployed minutes by hour of day.

TABLE 7-5: Annual Fire Service Runs and Deployed Time by Run Type

Run Type	Minutes per Run	Total Hours	Percent of Hours	Minutes per Day	Total Runs	Runs per Day
EMS response	16.1	1083.6	54.6	178.1	4,048	11.1
MVA	16.1	88.9	4.5	14.6	332	0.9
EMS Total	**16.1**	**1,172.5**	**59.1**	**192.7**	**4,380**	**12.0**
False alarm	9.4	75.9	3.8	12.5	484	1.3
Good intent	10.2	34.9	1.8	5.7	206	0.6
Hazard	18.1	61.1	3.1	10.0	202	0.6
Outside fire	32.6	90.7	4.6	14.9	167	0.5
Public service	14.8	201.7	10.2	33.2	819	2.2
Structure fire	42.3	93.0	4.7	15.3	132	0.4
Technical rescue	30.7	8.2	0.4	1.3	16	0.0
Fire Total	**16.7**	**565.5**	**28.5**	**93.0**	**2,026**	**5.6**
Canceled	5.7	58.2	2.9	9.6	618	1.7
Mutual aid	17.1	187.0	9.4	30.7	658	1.8
Other total	**11.5**	**245.2**	**12.4**	**40.3**	**1,276**	**3.5**
Total	**15.5**	**1,983.2**	**100.0**	**326.0**	**7,682**	**21.0**

Observations:

Overall

- The total deployed time of PFD's fire units was 1,983.2 hours. The daily average was 5.4 hours for all fire response units combined.
- There were 7,682 runs, including 812 runs dispatched for canceled calls and 464 runs dispatched for mutual aid calls. The daily average was 21.0 runs.

EMS

- EMS runs accounted for 59 percent of the total workload of fire units.
- The average deployed time for EMS runs was 16.1 minutes. The deployed time for all EMS runs averaged 3.2 hours per day.

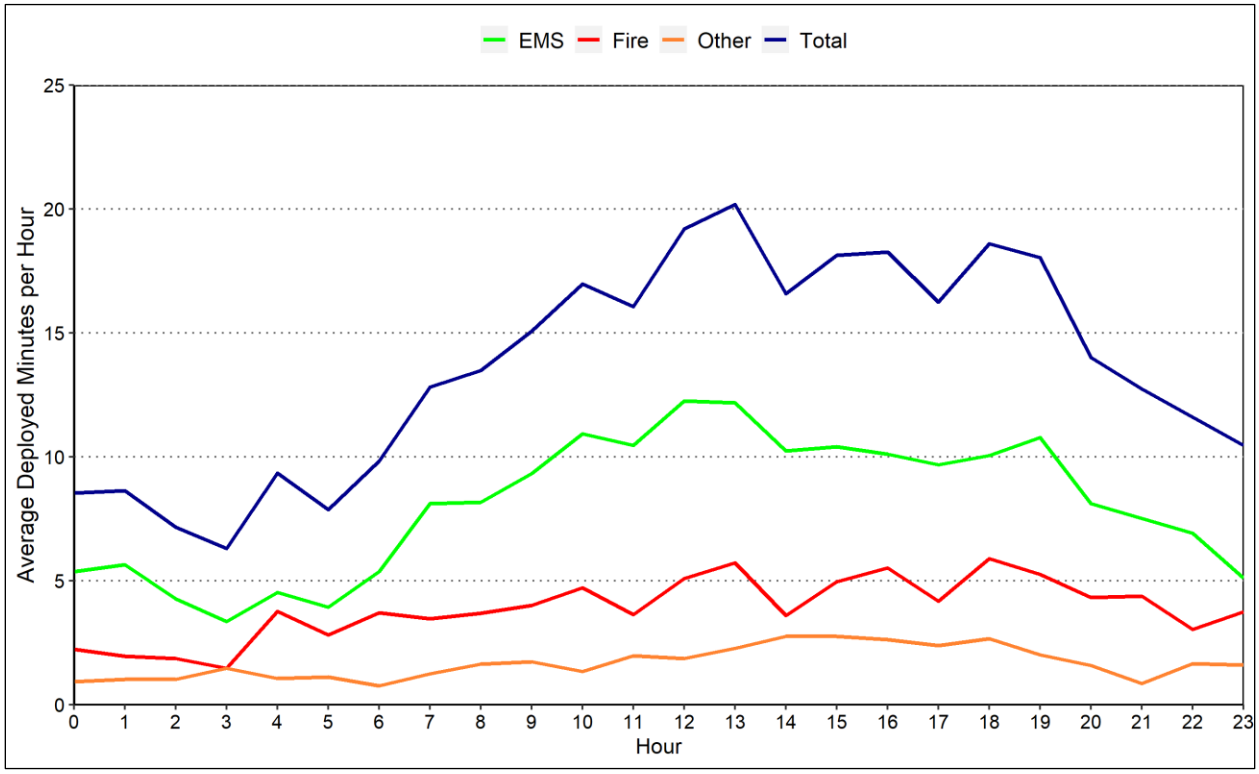
Fire

- Fire runs accounted for 29 percent of the total workload of fire units.
- The average deployed time for fire runs was 16.7 minutes. The deployed time for all fire runs averaged 1.5 hours per day.
- There were 299 runs for structure and outside fire calls combined, with a total workload of 183.7 hours. This accounted for 9 percent of the total workload.
- The average deployed time for outside fire runs was 32.6 minutes per run, and the average deployed time for structure fire runs was 42.3 minutes per run.

TABLE 7-6: Deployed Minutes of Fire Units by Hour of Day

Hour	EMS	Fire	Other	Total
0	5.4	2.2	0.9	8.5
1	5.6	2.0	1.0	8.6
2	4.3	1.9	1.0	7.2
3	3.4	1.5	1.5	6.3
4	4.5	3.8	1.1	9.3
5	3.9	2.8	1.1	7.9
6	5.4	3.7	0.8	9.8
7	8.1	3.5	1.2	12.8
8	8.2	3.7	1.6	13.5
9	9.3	4.0	1.7	15.1
10	10.9	4.7	1.3	17.0
11	10.5	3.6	2.0	16.1
12	12.3	5.1	1.9	19.2
13	12.2	5.7	2.3	20.2
14	10.2	3.6	2.8	16.6
15	10.4	5.0	2.8	18.1
16	10.1	5.5	2.6	18.3
17	9.7	4.2	2.4	16.2
18	10.1	5.9	2.7	18.6
19	10.8	5.3	2.0	18.0
20	8.1	4.3	1.6	14.0
21	7.5	4.4	0.8	12.7
22	6.9	3.0	1.7	11.6
23	5.1	3.8	1.6	10.5
Daily Avg.	**192.7**	**93.0**	**40.3**	**326.0**

FIGURE 7-6: Average Deployed Minutes of Fire Units by Hour of Day



Observations:

- Hourly deployed time of fire units was highest during the day from 10:00 a.m. to 8:00 p.m., averaging above 16.0 minutes per hour.
- Average deployed time peaked between 1:00 p.m. and 2:00 p.m. at 20.2 minutes.
- Average deployed time was lowest between 3:00 a.m. and 4:00 a.m. at 6.3 minutes.

Workload by Fire Unit

Table 7-7 summarizes each fire unit's workload. Tables 7-8 and 7-9 detail each fire unit's runs (Table 7-8) and its daily average deployed time, broken out by run type (Table 7-9).

TABLE 7-7: Workload by Station and Fire Response Unit

Station	Unit	Unit Type	Minutes per Run	Total Hours	Total Percent	Minutes per Day	Total Runs	Runs per Day
9301	9341	Type 6 Engine	11.3	0.2	0.0	0.0	1	0.0
	9342	Boat	8.5	0.4	0.0	0.1	3	0.0
	9357	Brush Truck	43.4	18.8	0.9	3.1	26	0.1
	9381	Type 1 Engine	15.8	680.4	34.3	111.9	2,585	7.1
	BC9	BC	15.1	112.0	5.6	18.4	444	1.2
	OES400	Type 1 Engine	14.7	1.5	0.1	0.2	6	0.0
	Total		**15.9**	**813.4**	**41.0**	**133.7**	**3,065**	**8.4**
9302	9351	Aerial Truck	14.3	319.7	16.1	52.6	1,341	3.7
	9382	Type 1 Engine	12.8	141.1	7.1	23.2	659	1.8
	Total		**13.8**	**460.8**	**23.2**	**75.8**	**2,000**	**5.5**
9303	9383	Type 1 Engine	**16.3**	**709.1**	**35.8**	**116.6**	**2,617**	**7.2**
Total			**15.5**	**1,983.2**	**100.0**	**326.0**	**7,682**	**21.0**

TABLE 7-8: Total Runs by Run Type and Fire Unit

Station	Unit	EMS	False Alarm	Good Intent	Hazard	Outside Fire	Public Service	Structure Fire	Technical Rescue	Cancel	Mutual Aid	Total
9301	9341	0	0	0	0	0	0	0	0	0	1	1
	9342	0	0	0	0	0	0	0	0	2	1	3
	9357	0	0	0	0	16	4	0	0	1	5	26
	9381	1,615	115	83	76	50	257	35	6	210	138	2,585
	BC9	79	90	14	29	25	20	33	3	61	90	444
	OES400	1	0	0	0	2	1	0	0	1	1	6
	Total	**1,695**	**205**	**97**	**105**	**93**	**282**	**68**	**9**	**275**	**236**	**3,065**
9302	9351	730	150	26	33	10	126	29	2	119	116	1,341
	9382	289	15	14	10	25	56	3	0	54	193	659
	Total	**1,019**	**165**	**40**	**43**	**35**	**182**	**32**	**2**	**173**	**309**	**2,000**
9303	9383	**1,666**	**114**	**69**	**54**	**39**	**355**	**32**	**5**	**170**	**113**	**2,617**
Total		**4,380**	**484**	**206**	**202**	**167**	**819**	**132**	**16**	**618**	**658**	**7,682**

TABLE 7-9: Deployed Minutes per Day by Run Type and Fire Unit

Station	Unit	EMS	False Alarm	Good Intent	Hazard	Outside Fire	Public Service	Structure Fire	Technical Rescue	Cancel	Mutual Aid	Total
9301	9341	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	9342	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	9357	0.0	0.0	0.0	0.0	2.1	0.3	0.0	0.0	0.0	0.7	3.1
	9381	71.0	3.8	2.2	4.3	4.2	10.1	4.5	0.5	3.5	7.8	111.9
	BC9	2.9	1.7	0.3	1.0	2.9	1.0	4.0	0.5	0.6	3.4	18.4
	OES400	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.2
	Total	**73.9**	**5.5**	**2.6**	**5.3**	**9.3**	**11.4**	**8.5**	**1.0**	**4.2**	**12.0**	**133.7**
9302	9351	31.3	3.6	0.6	1.6	0.2	5.2	3.3	0.1	1.5	5.3	52.6
	9382	9.6	0.4	0.5	0.6	2.3	1.4	0.4	0.0	1.0	7.1	23.2
	Total	**40.8**	**3.9**	**1.1**	**2.1**	**2.5**	**6.6**	**3.7**	**0.1**	**2.5**	**12.4**	**75.8**
9303	9383	**78.0**	**3.0**	**2.1**	**2.6**	**3.1**	**15.1**	**3.2**	**0.2**	**2.9**	**6.4**	**116.6**
Total		**192.7**	**12.5**	**5.7**	**10.0**	**14.9**	**33.2**	**15.3**	**1.3**	**9.6**	**30.7**	**326.0**

Observations:

- The fire response units of Station 9301 made the most runs (3,065 or an average of 8.4 runs per day) and had the highest total annual deployed time (813.4 or an average of 2.2 hours per day).
  - EMS calls accounted for 55 percent of runs and 55 percent of total deployed time.
  - Outside and structure fire calls accounted for five percent of runs and 13 percent of total deployed time.
- Among all engines, unit 9383 made the most runs (2,617 or an average of 7.2 runs per day) and had the highest total annual deployed time (709.1 or an average of 1.9 hours per day).
  - EMS calls accounted for 64 percent of runs and 67 percent of total deployed time.
  - Outside and structure fire calls accounted for 3 percent of runs and 5 percent of total deployed time.

Workload of Fire Response Units by District

The PFD's fire units primarily provide fire and rescue services within the Petaluma Fire District and give aid to adjacent communities. Table 7-10 examines the PFD's fire units' calls by grand call type and fire district. Table 7-11 breaks down the annual workload of fire units by district. Table 7-12 provides further detail for the workload of fire units associated with structure and outside fire calls, broken out by district. In all Tables, the fire units' responses to the areas outside the Petaluma Fire District are mutual aid.

TABLE 7-10: Calls Responded by Fire Units by Type and District

District	Number of Calls				Percent Calls
	EMS	Fire	Canceled	Total	
Petaluma FD	3,978	1,426	470	5,874	91.8
Graton FPD	0	0	1	1	0.0
Lakeville VFC	20	5	20	45	0.7
North Sonoma Coast FPD	0	0	1	1	0.0
Rancho Adobe FPD	181	92	99	372	5.8
San Antonio VFC	41	8	22	71	1.1
Santa Rosa FD	1	0	1	2	0.0
Schell-Vista FPD	1	0	0	1	0.0
Sebastopol FD	0	0	2	2	0.0
Sonoma Life Support	0	0	2	2	0.0
Sonoma Valley FRA	0	1	1	2	0.0
Timber Cove FPD	0	0	1	1	0.0
Two Rock VFC	0	5	3	8	0.1
Wilmar VFC	7	3	3	13	0.2
Windsor FPD	0	0	2	2	0.0
XSN Team	0	2	1	3	0.0
Total	**4,229**	**1,542**	**629**	**6,400**	**100.0**

Note: All calls that occurred outside Petaluma FD's district are aid given.

TABLE 7-11: Annual Workload of Fire Units by District

District	Runs	Runs Per Day	Minutes Per Run	Annual Hours	Percent Work	Minutes Per Day
Petaluma FD	7,024	19.2	15.3	1,796.3	90.6	295.3
Graton FPD	1	0.0	0.5	0.0	0.0	0.0
Lakeville VFC	65	0.2	15.1	16.4	0.8	2.7
North Sonoma Coast FPD	1	0.0	0.4	0.0	0.0	0.0
Rancho Adobe FPD	452	1.2	16.0	120.6	6.1	19.8
San Antonio VFC	90	0.2	21.3	32.0	1.6	5.3
Santa Rosa FD	2	0.0	0.3	0.0	0.0	0.0
Schell-Vista FPD	1	0.0	2.2	0.0	0.0	0.0
Sebastopol FD	2	0.0	0.1	0.0	0.0	0.0
Sonoma Life Support	2	0.0	0.1	0.0	0.0	0.0
Sonoma Valley FRA	2	0.0	1.1	0.0	0.0	0.0
Timber Cove FPD	1	0.0	0.1	0.0	0.0	0.0
Two Rock VFC	14	0.0	55.2	12.9	0.6	2.1
Wilmar VFC	20	0.1	14.0	4.7	0.2	0.8
Windsor FPD	2	0.0	0.1	0.0	0.0	0.0
XSN Team	3	0.0	7.7	0.4	0.0	0.1
Total	**7,682**	**21.0**	**15.5**	**1,983.2**	**100.0**	**326.0**

TABLE 7-12: Structure and Outside Fire Runs by District

Fire District	Structure Fire Runs	Structure Fires Minutes per Run	Outside Fire Runs	Outside Fires Minutes per Run	Total Hours	Percent Workload
Petaluma FD	132	42.3	167	32.6	183.7	76.3
Lakeville VFC	0	NA	5	40.4	3.4	1.4
Rancho Adobe FPD	19	96.8	12	35.3	37.6	15.6
San Antonio VFC	0	NA	1	76.4	1.3	0.5
Two Rock VFC	0	NA	10	70.8	11.8	4.9
Wilmar VFC	6	21.9	3	18.9	3.1	1.3
Total	**157**	**48.1**	**198**	**34.9**	**240.9**	**100.0**

Note: The number of runs for structure (132) and outside (167) fires inside Petaluma fire district agree with Table 7-5.

Observations:

Petaluma Fire District

- 92 percent of total calls responded to by fire units occurred inside Petaluma.
- Total deployed time was 1,796.3 hours or 91 percent of the total annual workload. The daily average was 4.9 hours for all units combined.
- There were 7,024 runs, including 618 runs dispatched for canceled calls. The daily average was 19.2 runs.

Rancho Adobe Fire Protection District

- Six percent of total calls responded to by fire units occurred inside the Rancho Adobe FPD.
- Total deployed time was 120.6 hours or 6 percent of the total annual workload. The daily average was 20.3 minutes for all units combined.
- There were 452 runs, including 122 runs dispatched for canceled calls. The daily average was 1.3 runs.

Other Districts

- Two percent of total calls responded to by fire units occurred inside other fire districts.
- Total deployed time was 66.4 hours or 3 percent of the total annual workload. The daily average was 10.9 minutes for all units combined.
- There were 206 runs, including 72 runs dispatched for canceled calls. The daily average was 0.6 runs.

Workload of External Fire Response Apparatus

In 2021, some fire response units from external fire agencies in adjacent municipalities provided mutual aid to PFD for incidents that occurred within PFD's fire district. The following table details the annual workload of the fire response units from the external agencies.

TABLE 7-13: Annual Workload by External Fire Agencies

Agency	Runs				Runs Per Day	Minutes Per Run	Annual Hours	Percent Work
	EMS	Fire	Cancel	Total				
Bodega Bay FD	0	1	0	1	0.0	168.4	2.8	0.7
Cal Fire	7	17	1	25	0.1	54.8	22.8	6.0
Calistoga FD	0	1	0	1	0.0	38.5	0.6	0.2
Coast Guard Training Petaluma FD	6	1	6	13	0.0	38.8	8.4	2.2
Geyserville FD	0	2	0	2	0.0	64.5	2.2	0.6
Gold Ridge FD	1	5	0	6	0.0	112.4	11.2	2.9
Graton FD	2	2	0	4	0.0	116.9	7.8	2.0
Guerneville FD (Sonoma Fire)	0	1	1	2	0.0	64.0	2.1	0.6
Healdsburg FD	1	1	0	2	0.0	61.0	2.0	0.5
Kenwood FD	0	1	0	1	0.0	273.3	4.6	1.2
Lakeville FD (North Bay Fire)	13	7	14	34	0.1	50.0	28.3	7.4
Occidental FD	1	1	0	2	0.0	130.3	4.3	1.1
Rancho Adobe FD	239	226	97	562	1.5	20.6	192.7	50.6
Rohnert Park FD	0	2	0	2	0.0	104.6	3.5	0.9
Santa Rosa FD	4	2	1	7	0.0	62.9	7.3	1.9
Schell Vista FD	0	3	0	3	0.0	211.1	10.6	2.8
Sonoma County FD	1	7	0	8	0.0	93.7	12.5	3.3
Sonoma Valley Fire Authority	2	7	1	10	0.0	120.0	20.0	5.2
Two Rock FD (North Bay Fire)	1	3	0	4	0.0	76.5	5.1	1.3
Valley Ford	0	1	0	1	0.0	333.2	5.6	1.5
Wilmar FD (North Bay Fire)	22	21	6	49	0.1	32.8	26.8	7.0
Total	**300**	**312**	**127**	**739**	**2.0**	**30.9**	**381.2**	**100.0**

Analysis of Busiest Hours for Fire Response Units

For the 6,400 calls responded by the PFD's fire units, there is significant variability in the number of calls from hour to hour. One special concern relates to the resources available for hours with the heaviest workload. We tabulated the data for each of the 8,760 hours between January 1, 2021, and December 31, 2021. Table 7-14 shows the number of hours in which there were zero to five or more calls during the hour. Table 7-15 shows the ten one-hour intervals which had the most calls during the studied period. Table 7-16 examines the number of times a call overlapped with another call in each station area and focuses only on the work for fire units.

TABLE 7-14: Frequency Distribution of the Number of Calls Responded by Fire Units

Calls in an Hour	Frequency	Percentage
0	4,358	49.7
1	2,897	33.1
2	1,115	12.7
3	303	3.5
4	74	0.8
5+	13	0.1
Total	**8,760**	**100.0**

TABLE 7-15: Top Ten Hours with the Most Calls Responded by Fire Units

Hour	Number of Calls	Number of Runs	Total Deployed Hours
11/8/2021, noon to 1:00 p.m.	6	6	1.9
9/9/2021, 6:00 p.m. to 7:00 p.m.	6	6	1.5
4/30/2021, 11:00 a.m. to noon	6	6	1.3
3/27/2021, 4:00 p.m. to 5:00 p.m.	5	9	2.4
11/22/2021, 10:00 a.m. to 11:00 a.m.	5	7	1.4
1/30/2021, 3:00 p.m. to 4:00 p.m.	5	7	1.0
8/3/2021, 10:00 a.m. to 11:00 a.m.	5	7	0.7
8/13/2021, noon to 1:00 p.m.	5	6	7.8
10/24/2021, 9:00 a.m. to 10:00 a.m.	5	6	1.4
1/23/2021, 7:00 a.m. to 8:00 a.m.	5	6	1.1

Note: Total deployed hours are a measure of the total time spent responding to calls received in the hour. The deployed time from these calls may extend into the next hour or hours.

TABLE 7-16: Frequency of Overlapping Fire Service Calls

Station	Scenario	Number of Calls	Percent of All Calls	Total Hours
9301	No overlapped call	2,188	93.3	610.2
	Overlapped with one call	150	6.4	20.4
	Overlapped with two calls	8	0.3	0.6
9302	No overlapped call	1,232	96.6	315.8
	Overlapped with one call	43	3.4	6.4
9303	No overlapped call	2,099	93.2	603.0
	Overlapped with one call	148	6.6	21.4
	Overlapped with two calls	6	0.3	0.3
Outside Petaluma	No overlapped call	516	98.1	153.9
	Overlapped with one call	10	1.9	1.2

The following table examines each PFD station's availability to respond to calls within its first due area. At the same time, it focuses on calls where at least one fire response unit eventually arrived and ignores calls where no unit arrived. While there were 5,874 fire service calls within Petaluma's fire district (See Table 7-10), there were 666 calls without an arriving fire unit.

TABLE 7-17: Station Availability to Respond to Calls

Station	Calls in Area	First Due Responded	First Due Arrived	First Due First	Percent Responded	Percent Arrived	Percent First
9301	2,060	1,889	1,859	1,847	91.7	90.2	89.7
9302	1,089	1,013	991	983	93.0	91.0	90.3
9303	2,059	1,865	1,834	1,815	90.6	89.1	88.1
Total	**5,208**	**4,767**	**4,684**	**4,645**	**91.5**	**89.9**	**89.2**

Note: For each station, we count the number of calls occurring within its first due area. Then, we count the number of calls to where at least one fire unit arrived. Next, we focus on fire units from the first due station to see if any of its fire units responded, arrived, or arrived first. The response of reserve engines within the first due area of a station was included in the response of that station.

Observations:

- During 13 hours (0.1 percent of all hours), five or more calls occurred; in other words, the fire units responded to five or more calls in an hour roughly once every 28 days.
  - The highest number of calls to occur in an hour was 6, which happened three times.
- The hour with the most calls was noon to 1:00 p.m. on November 8, 2021. The hour's 6 calls involved 6 individual dispatches resulting in 1.9 hours of deployed time. These 6 calls included five EMS response calls and one public service call.
- Another hour with the most calls was 6:00 p.m. to 7:00 p.m. on September 9, 2021. The hour's 6 calls involved 6 individual dispatches resulting in 1.5 hours of deployed time. These 6 calls included three mutual aid calls and three public service calls.
- Another hour with the most calls was 11:00 a.m. to noon on April 30, 2021. The hour's 6 calls involved 6 individual dispatches resulting in 1.3 hours of deployed time. These 6 calls included three EMS response calls, two public service calls, and one mutual aid call.
- On August 13, 2021, between noon and 1:00 p.m. there were 5 calls with 6 individual dispatches resulting in 7.8 hours of deployed time. These calls included 3 EMS response calls and two mutual aid calls. One mutual aid call was a brush fire that resulted in 6.1 hours of deployed time.

ATTACHMENT 1.1: ADDITIONAL PERSONNEL

The following table illustrates the workload of PFD's administrative fire units in 2021.

TABLE 7-18: Workload of Administrative Fire Units

Unit ID	Type	Annual Hours	Annual Runs
9301	Assist Fire Chief	6.3	14
9305	Fire Marshal	14.1	9
9310	BC	783.9*	8
9311	BC	0.1	3
9312	BC	248.3*	1
9320	Fire Inspector	7.7	2
9321	Fire Inspector	2.4	3
9322	Staff Utility/ Reserve Command	364.4*	1
PR93	Fire Prevention	5.8	11

Note: *Multiple week deployments in the Dixie incident (a wildland fire).

ATTACHMENT 1.2: ACTIONS TAKEN

TABLE 7-19: Actions Taken Analysis for Structure and Outside Fire Calls

Action Taken	Number of Calls	
	Outside Fire	Structure Fire
Confine fire (wildland)	1	0
Contain fire (wildland)	2	0
Control crowd	1	0
Control fire (wildland)	4	0
Enforce codes	1	0
Establish fire lines (wildfire)	3	0
Extinguishment by fire service personnel	65	19
Fire control or extinguishment, other	5	4
Incident command	0	1
Information, investigation & enforcement, other	1	0
Investigate	20	15
Investigate fire out on arrival	4	1
Notify other agencies.	0	1
Provide equipment	1	0
Provide workforce	0	1
Rescue, remove from harm	0	1
Restore sprinkler or fire protection system	0	1
Salvage & overhaul	7	5
Shut down system	0	1
Ventilate	1	0

Note: Totals are higher than the total number of structure and outside fire calls because some calls recorded multiple actions taken.

Observations:

- Out of 93 outside fires, 65 were extinguished by fire service personnel, which accounted for 70 percent of outside fires.
- Out of 39 structure fires, 19 were extinguished by fire service personnel, which accounted for 49 percent of structure fires.

ATTACHMENT 1.3: FIRE LOSS

Table 7-20 presents the number of outside and structure fires, broken out by levels of fire loss. Table 7-21 shows the amount of property and content loss for outside and structure fires inside Petaluma Fire District in 2021.

TABLE 7-20: Total Fire Loss Above and Below $25,000

Call Type	No Loss	Under $25,000	$25,000 plus	Total
Outside fire	80	11	2	93
Structure fire	17	12	10	39
Total	**97**	**23**	**12**	**132**

TABLE 7-21: Content and Property Loss – Structure and Outside Fires

Call Type	Property Loss		Content Loss	
	Loss Value	Number of Calls	Loss Value	Number of Calls
Outside fire	$512,525	10	$55,100	7
Structure fire	$2,396,550	21	$800,250	19
Total	**$2,909,075**	**31**	**$855,350**	**26**

Note: The table includes only fire calls with a recorded loss greater than 0.

Observations:

- 80 outside fires and 17 structure fires had no recorded loss.
- 2 outside fires and 10 structure fires had $25,000 or more in losses.
- Structure fires:
  - The highest total loss for a structure fire was $2,000,000.
  - The average recorded total loss for all structure fires was $145,309.
  - 19 structure fires had content losses with a combined $800,250 in losses.
  - Out of 39 structure fires, 21 recorded property losses, with a combined $2,396,550 in losses.
- Outside fires:
  - The highest total loss for an outside fire was $500,000.
  - The average recorded total loss for outside fires was $43,663.
  - Seven outside fires had content losses with a combined $55,100 in losses.
  - Out of 93 outside fires, 10 recorded property losses, with a combined $512,525 in losses.

PART 2. MEDICAL RESPONSE

In this part, we examine the response and workload of PFD's medical response apparatus, i.e., ambulances. All calls responded to by the PFD's ambulances outside Petaluma's EMS district were identified as mutual aid. The analysis is made up of four sections. The first section focuses on call types and dispatches. The second section explores the time spent and the workload of individual ambulances. The third section presents an analysis of the busiest hours in the year studied. The fourth and final part analyzes the workload of medical transport.

AGGREGATE MEDICAL RESPONSE CALL TOTALS AND RUNS

In 2021, the PFD's ambulances responded to 6,337 calls. Of these, 73 percent were EMS calls and 11 percent were fire calls.

Medical Response Calls by Type

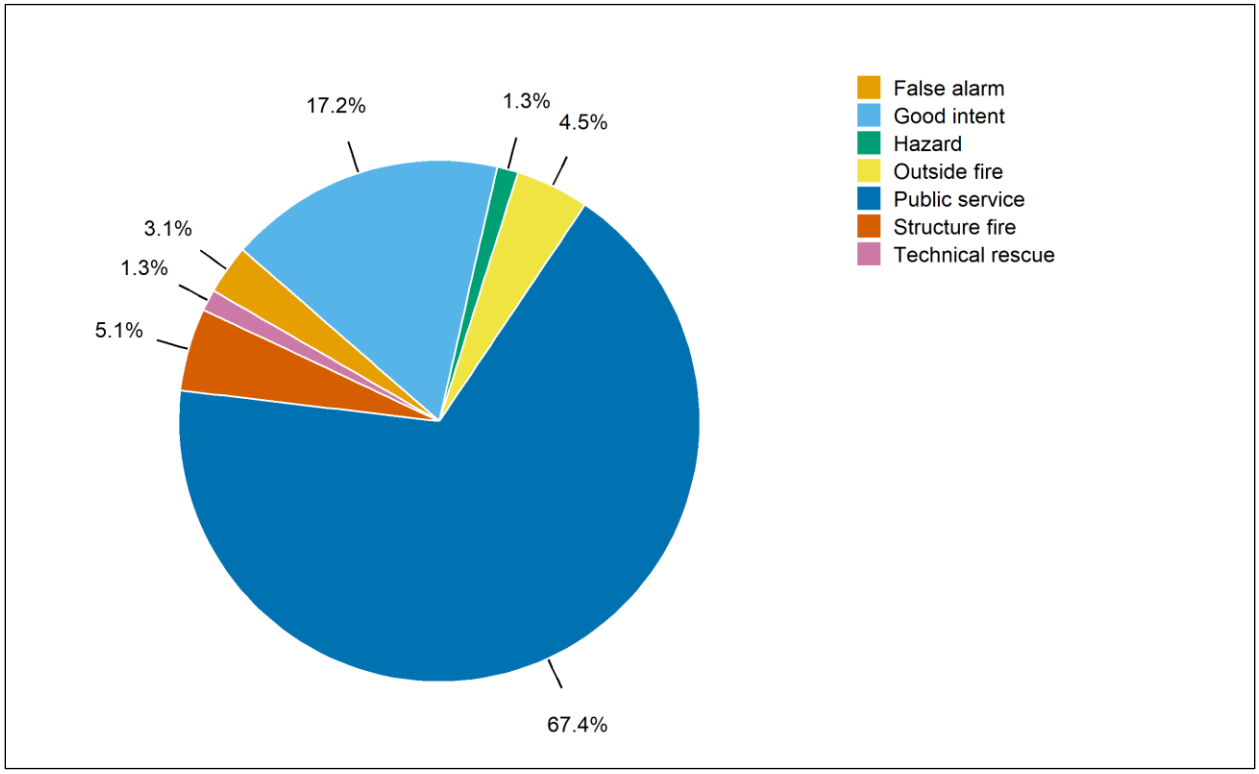
The following table shows the number of calls responded by the PFD's ambulances by call type, average calls per day, and the percentage of calls that fall into each call type category. The subsequent figure shows the percentage of calls that fall into each fire type category. All calls responded by the ambulances outside Petaluma's EMS district were identified as mutual aid.

TABLE 7-22: Medical Response Calls by Type

Call Type	Total Calls	Calls per Day	Call Percentage
EMS response	4,338	11.9	68.5
MVA	298	0.8	4.7
EMS total	**4,636**	**12.7**	**73.2**
False alarm	21	0.1	0.3
Good intent	117	0.3	1.8
Hazard	9	0.0	0.1
Outside fire	31	0.1	0.5
Public service	460	1.3	7.3
Structure fire	35	0.1	0.6
Technical rescue	9	0.0	0.1
Fire total	**682**	**1.9**	**10.8**
Canceled	462	1.3	7.3
Mutual aid	557	1.5	8.8
Total	**6,337**	**17.4**	**100.0**

Note: 320 mutual aid calls were canceled; See Attachment 2.1 for call type identification.

FIGURE 7-7: Fire Calls Responded by Ambulance by Type



Observations:

- Ambulances responded to an average of 17.4 calls per day, including 1.3 canceled (7 percent) and 1.5 mutual aid (9 percent) calls per day.
- EMS calls totaled 4,636 (73 percent of all calls), an average of 12.7 calls per day.
  - Motor vehicle accidents (MVA) made up 5 percent of total calls (6 percent of EMS calls).
- Fire calls totaled 682 (11 percent of all calls), or an average of 1.9 calls per day.

Medical Response Calls by Type and Duration

The following table shows the duration of calls responded to by ambulances by type, using four duration categories: less than 30 minutes, 30 minutes to one hour, one to two hours, and two or more hours. The duration of a call is measured from the time that the first unit is dispatched until the last unit is cleared. The table focuses only on medical units and does not include fire response units.

TABLE 7-23: Medical Response Calls by Type and Duration

Call Type	Less than 30 Minutes	30 Minutes to One Hour	One to Two Hours	Two or More Hours	Total
EMS response	944	2402	953	39	4,338
MVA	132	76	88	2	298
EMS Total	**1,076**	**2,478**	**1,041**	**41**	**4,636**
False alarm	20	1	0	0	21
Good intent	109	7	1	0	117
Hazard	8	1	0	0	9
Outside fire	23	5	2	1	31
Public service	432	24	2	2	460
Structure fire	19	6	6	4	35
Technical rescue	3	2	2	2	9
Fire Total	**614**	**46**	**13**	**9**	**682**
Canceled	437	14	10	1	462
Mutual aid	366	67	112	12	557
Total	**2,493**	**2,605**	**1,176**	**63**	**6,337**

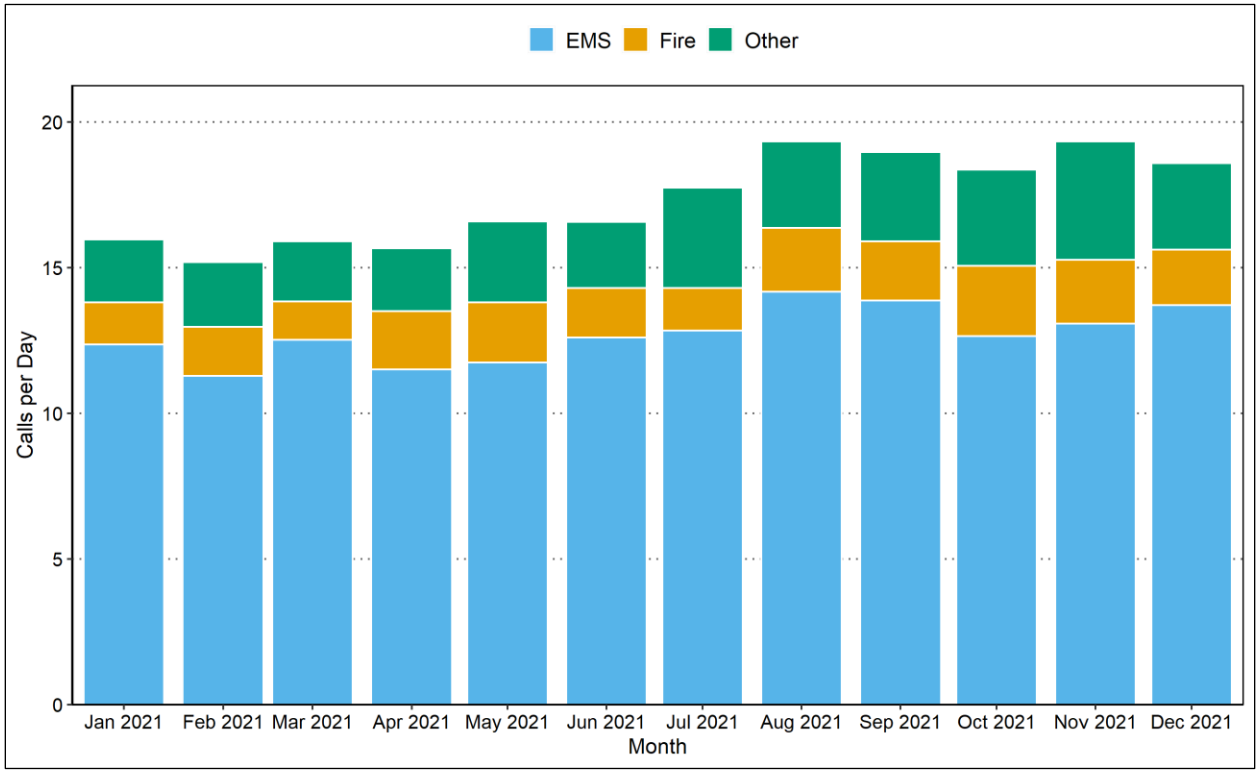
Observations:

- On average, the PFD's ambulances responded to 3.0 EMS calls per day that lasted more than one hour.
- On average, the PFD's ambulances responded to 0.1 fire calls per day that lasted more than one hour.
- A total of 3,554 EMS calls (77 percent) lasted less than one hour, 1,041 EMS calls (22 percent) lasted one to two hours, and 41 EMS calls (1 percent) lasted two or more hours.
- A total of 660 fire calls (97 percent) lasted less than one hour, 13 fire calls (2 percent) lasted one to two hours, and nine fire calls (1 percent) lasted two or more hours.

Average Medical Response Calls by Month and Hour of Day

Figure 7-8 shows the monthly variation in the average daily number of calls responded by ambulances between January 1, 2021, and December 31, 2021. Similarly, Figure 7-9 illustrates the average number of calls received each hour of the day.

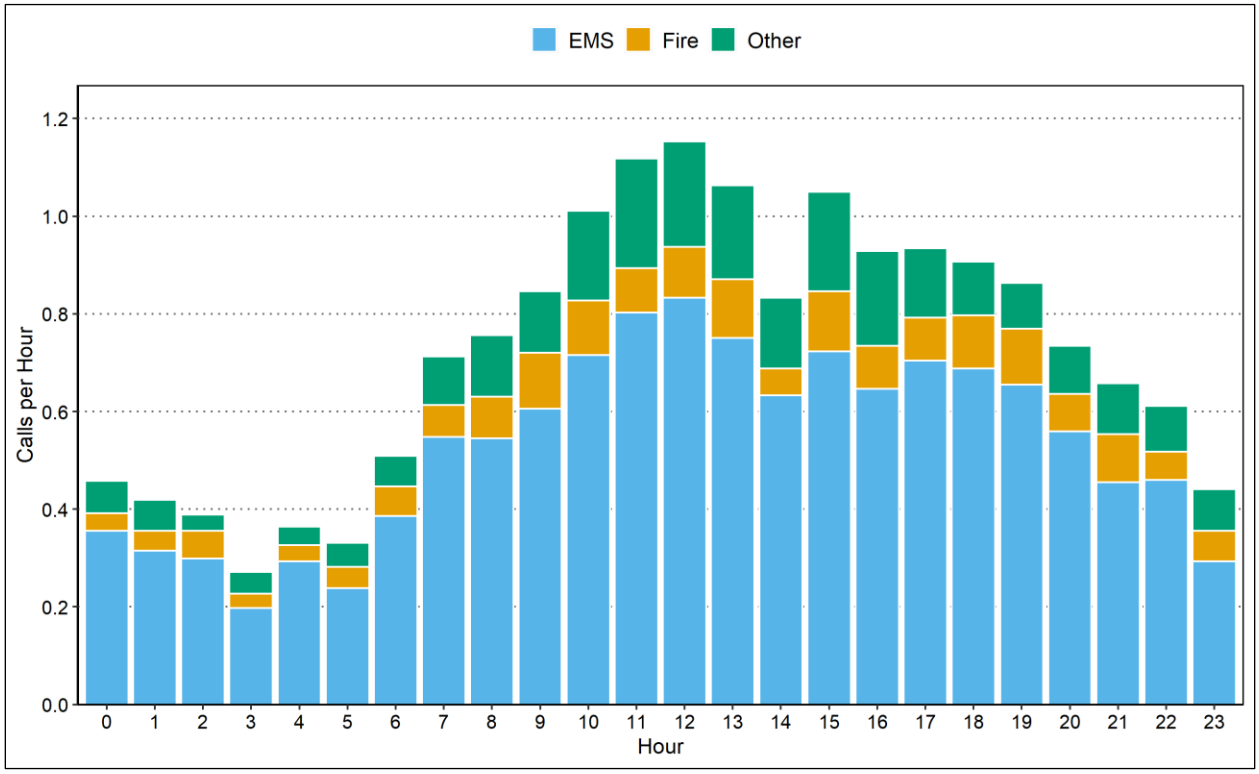
FIGURE 7-8: Medical Response Calls per Day by Month



Observations:

- EMS calls responded by ambulances per day ranged from 11.3 in February 2021 to 14.2 in August 2021.
- Fire calls responded by ambulances per day ranged from 1.3 in March 2021 to 2.4 in October 2021.
- Other calls responded by ambulances per day ranged from 2.1 in March 2021 to 4.1 in November 2021.
- Total calls responded by medical units per day ranged from 15.2 in February 2021 to 19.3 in November 2021.

FIGURE 7-9: Average Medical Response Calls by Hour of Day



Observations:

- Average EMS calls responded by ambulances per hour ranged from 0.20 between 3:00 a.m. and 4:00 a.m. to 0.83 between noon and 1:00 p.m.
- Average fire calls responded by ambulances per hour ranged from 0.03 between 3:00 a.m. and 4:00 a.m. to 0.12 between 3:00 p.m. and 4:00 p.m.
- Average other calls responded by ambulances per hour ranged from 0.03 between 2:00 a.m. and 3:00 a.m. to 0.22 between 11:00 a.m. and noon.
- Average total calls responded by ambulances per hour ranged from 0.27 between 3:00 a.m. and 4:00 a.m. to 1.15 between noon and 1:00 p.m.

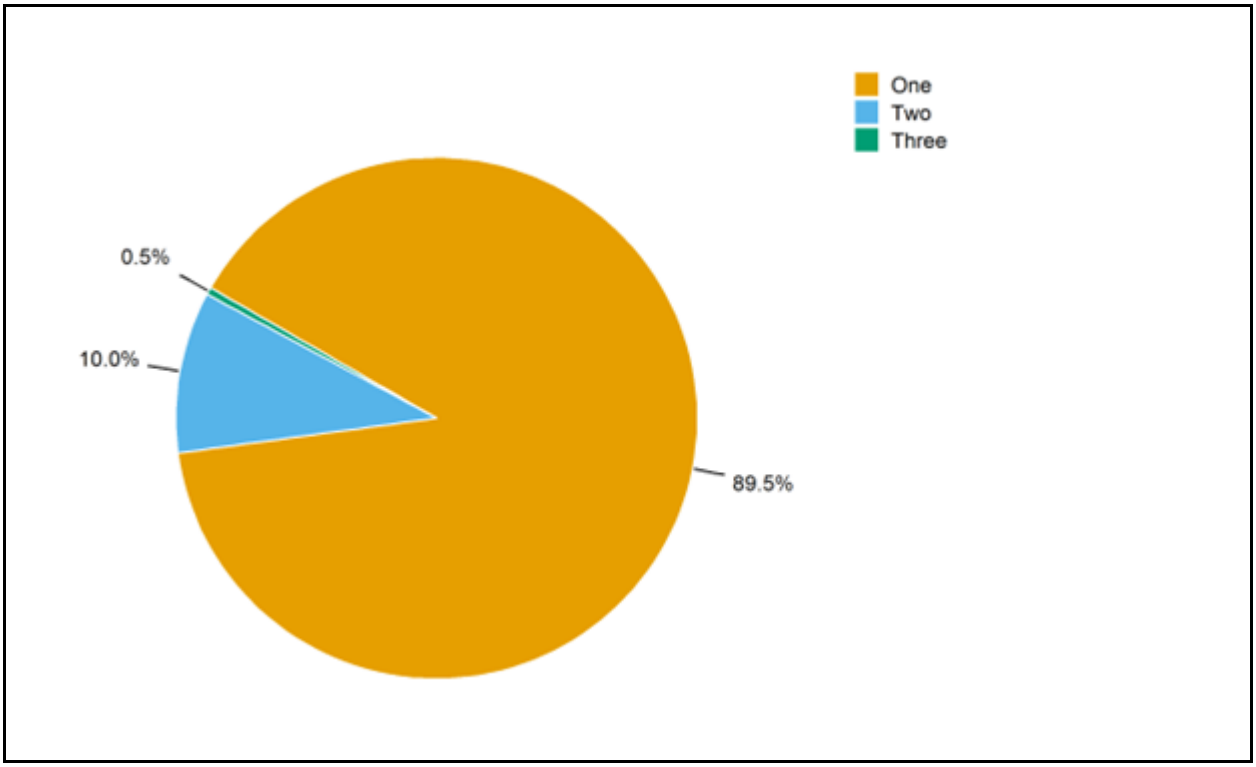
Ambulances Arriving at Calls

Table 7-24 and Figure 7-10 detail the number of calls with one and two or more ambulances arriving at a call, broken down by call type. Here we limit ourselves to calls where an ambulance arrives. For this reason, there are fewer calls in Table 7-24 than in Table 7-22.

TABLE 7-24: Medical Response Calls by Type and Number of Arriving Ambulances

Call Type	Number of Units			Total Calls
	One	Two	Three	
EMS response	3,821	448	5	4,274
MVA	228	39	4	271
EMS Total	**4,049**	**487**	**9**	**4,545**
False alarm	12	2	0	14
Good intent	89	8	1	98
Hazard	3	1	1	5
Outside fire	19	2	0	21
Public service	303	25	1	329
Structure fire	14	5	10	29
Technical rescue	6	2	1	9
Fire Total	**446**	**45**	**14**	**505**
Canceled	160	10	2	172
Mutual aid	219	3	0	222
Total	**4,874**	**545**	**25**	**5,444**
Percentage	**89.5**	**10.0**	**0.5**	**100.0**

FIGURE 7-10: Average Number of Arriving Ambulances for Calls



Observations:

- For 89.5 percent of calls, only one ambulance arrived.
- For 10.0 percent of calls, two ambulances arrived.
- For 0.5 percent of calls, three ambulances arrived.
- For EMS calls, one ambulance arrived 89.1 percent of the time, two ambulances arrived 10.7 percent of the time, and three ambulances arrived 0.2 percent of the time.
- For fire calls, one ambulance arrived 88.3 percent of the time, two ambulances arrived 8.9 percent of the time, and three ambulances arrived 2.8 percent of the time.

WORKLOAD: AMBULANCE RUNS AND DEPLOYED TIME

The workload of the PFD's ambulances is measured in two ways: runs and deployed time. The deployed time of a run is measured from the time an ambulance is dispatched through the time it is cleared. Because multiple units respond to some calls, there are more runs (7,777) than calls (6,337) and the average deployed time per run varies from the average duration per call.

Ambulance Runs and Deployed Time

Deployed time, also referred to as deployed hours, is the total deployment time of an ambulance deployed on all runs. Table 7-25 shows the total deployed time, both overall and broken down by type of run, for all ambulances. Table 7-26 and Figure 7-11 present the average deployed minutes by hour of day.

TABLE 7-25: Ambulance Runs and Deployed Time by Run Type

Run Type	Minutes per Run	Total Hours	Percent of Hours	Minutes per Day	Total Runs	Runs per Day
EMS response	38.9	3,461.4	80.9	569.0	5,335	14.6
MVA	36.4	240.8	5.6	39.6	397	1.1
EMS Total	**38.8**	**3,702.1**	**86.5**	**608.6**	**5,732**	**15.7**
False alarm	8.4	3.6	0.1	0.6	26	0.1
Good intent	10.8	28.0	0.7	4.6	155	0.4
Hazard	8.5	3.1	0.1	0.5	22	0.1
Outside fire	21.0	16.1	0.4	2.7	46	0.1
Public service	12.0	110.5	2.6	18.2	554	1.5
Structure fire	37.5	50.6	1.2	8.3	81	0.2
Technical rescue	40.7	12.9	0.3	2.1	19	0.1
Fire Total	**14.9**	**224.8**	**5.3**	**37.0**	**903**	**2.5**
Canceled	10.1	91.8	2.1	15.1	543	1.5
Mutual aid	26.0	259.8	6.1	42.7	599	1.6
Other Total	**18.5**	**351.6**	**8.2**	**57.8**	**1,142**	**3.1**
Total	**33.0**	**4,278.5**	**100.0**	**703.3**	**7,777**	**21.3**

Observations:

Overall

- The total deployed time of ambulances for the year was 4,278.5 hours. The daily average was 11.7 hours for all ambulances combined.
- There were 7,777 runs, including 543 runs dispatched for canceled calls and 599 runs dispatched for mutual aid calls. The daily average was 21.3 runs.

EMS

- EMS runs accounted for 87 percent of the total ambulance workload.
- The average deployed time for EMS runs was 38.8 minutes. The deployed time for all EMS runs averaged 10.1 hours per day.

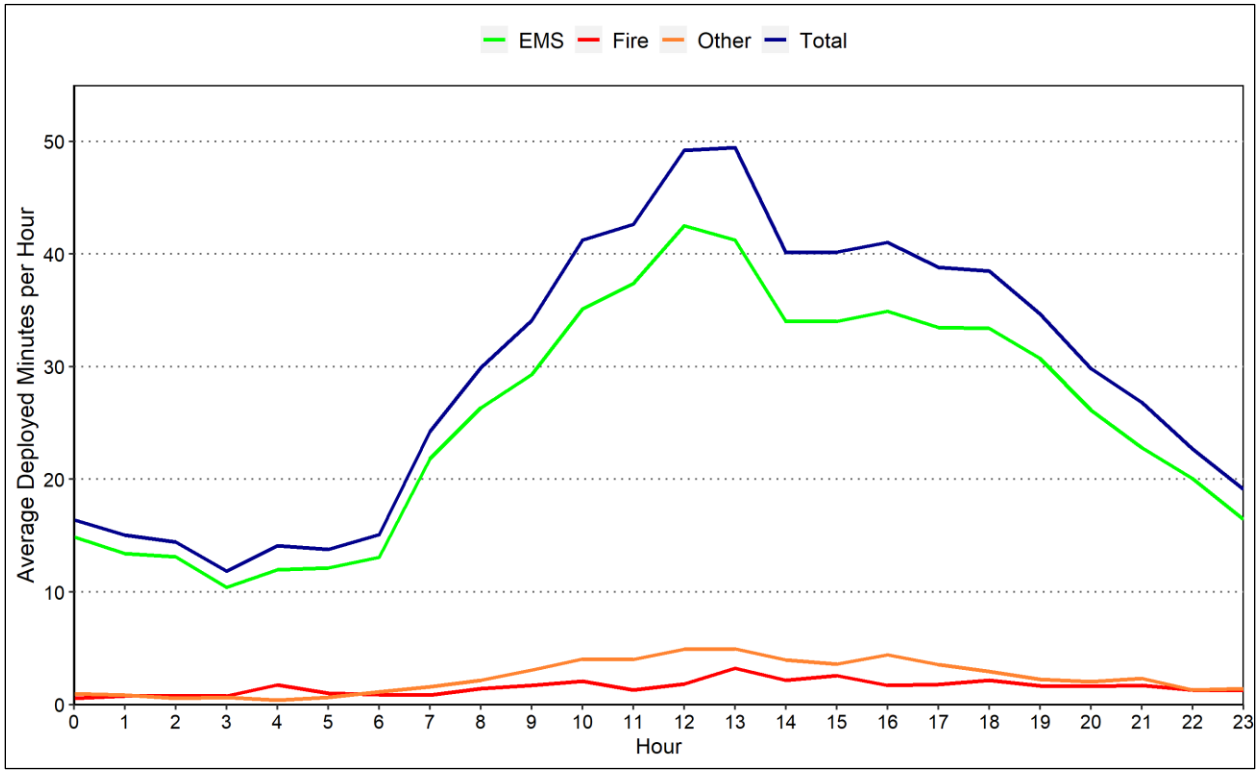
Fire

- Fire runs accounted for 5 percent of the total ambulance workload.
- The average deployed time for fire runs was 14.9 minutes. The deployed time for all fire runs averaged 37.0 minutes per day.

TABLE 7-26: Deployed Minutes of Ambulance by Hour of Day

Hour	EMS	Fire	Other	Total
0	14.9	0.6	1.0	16.4
1	13.4	0.8	0.8	15.0
2	13.1	0.8	0.6	14.5
3	10.4	0.8	0.7	11.8
4	12.0	1.7	0.4	14.1
5	12.1	1.0	0.6	13.8
6	13.1	0.9	1.2	15.1
7	21.8	0.9	1.6	24.2
8	26.3	1.4	2.2	29.9
9	29.3	1.7	3.1	34.1
10	35.1	2.1	4.1	41.2
11	37.4	1.3	4.0	42.6
12	42.5	1.8	4.9	49.2
13	41.2	3.2	5.0	49.4
14	34.0	2.2	4.0	40.1
15	34.0	2.6	3.6	40.2
16	34.9	1.7	4.4	41.1
17	33.5	1.8	3.6	38.8
18	33.4	2.2	2.9	38.5
19	30.7	1.7	2.2	34.7
20	26.2	1.6	2.0	29.8
21	22.8	1.7	2.3	26.8
22	20.1	1.3	1.3	22.7
23	16.4	1.3	1.4	19.1
Daily Avg.	**608.6**	**37.0**	**57.8**	**703.3**

FIGURE 7-11: Average Deployed Minutes of Ambulance by Hour of Day



Observations:

- The hourly deployed time was highest during the day from 10:00 a.m. to 6:00 p.m., averaging more than 42.3 minutes.
- Average deployed time peaked between 1:00 p.m. and 2:00 p.m., averaging 49.4 minutes.
- Average deployed time was lowest between 3:00 a.m. and 4:00 a.m., averaging 11.8 minutes.

Workload by Ambulance

Table 7-27 summarizes the workload of each ambulance. Tables 7-28 and 7-29 detail each ambulance's runs broken out by run type (Table 7-28) and its daily average deployed time by run type (Table 7-29).

TABLE 7-27: Workload by Ambulance

Station	Unit	Deployed Minutes per Run	Total Hours	Total Pct.	Deployed Minutes per Day	Total Runs	Runs per Day
9301	BLS994	17.9	219.6	5.1	36.1	738	2.0
	MED991	34.3	1,412.0	33.0	232.1	2,470	6.8
	Total	**30.5**	**1,631.6**	**38.1**	**268.2**	**3,208**	**8.8**
9302	MED992	33.9	1,202.7	28.1	197.7	2,127	5.8
9303	MED993	35.5	1,444.2	33.8	237.4	2,442	6.7
Total		**33.0**	**4,278.5**	**100.0**	**703.3**	**7,777**	**21.3**

TABLE 7-28: Total Runs by Run Type and Ambulance

Station	Unit	EMS Response	MVA	Fire	Canceled	Mutual Aid	Total
9301	BLS994	580	46	65	37	10	738
	MED991	1,769	132	278	225	66	2,470
	Total	**2,349**	**178**	**343**	**262**	**76**	**3,208**
9302	MED992	1,259	96	234	143	395	2,127
9303	MED993	1,727	123	326	138	128	2,442
Total		**5,335**	**397**	**903**	**543**	**599**	**7,777**

TABLE 7-29: Deployed Minutes per Day by Run Type and Ambulance

Station	Unit	EMS Response	MVA	Fire	Canceled	Mutual Aid	Total
9301	BLS994	31.7	1.7	1.5	0.9	0.3	36.1
	MED991	197.7	13.1	11.3	6.6	3.3	232.1
	Total	**229.5**	**14.7**	**12.9**	**7.5**	**3.6**	**268.2**
9302	MED992	143.4	11.1	9.8	3.9	29.4	197.7
9303	MED993	196.1	13.7	14.3	3.6	9.7	237.4
	Total	**569.0**	**39.6**	**37.0**	**15.1**	**42.7**	**703.3**

Note: Another BLS unit, BLS915, was assigned to the Rancho Adobe FPD, see Table 32.

Observations:

- MED991 made 2,470 runs and had 1,412.0 deployed hours or an average of 6.8 runs and 3.9 hours per day.
  - EMS calls accounted for 77 percent of runs and 91 percent of total deployed time.
  - Fire calls accounted for 11 percent of runs and five percent of total deployed time.
- MED992 made 2,127 runs and had 1,202.7 deployed hours or an average of 5.8 runs and 3.3 hours per day.
  - EMS calls accounted for 64 percent of runs and 78 percent of total deployed time.
  - Fire calls accounted for 11 percent of runs and 5 percent of total deployed time.
  - MED992 made the most runs for mutual aid. The mutual aid runs and deployed hours for the year totaled 179 and 27.2 hours, respectively.
- MED993 made 2,442 runs and had 1,444.2 deployed hours or an average of 6.7 runs and 4.0 hours per day.
  - EMS calls accounted for 76 percent of runs and 88 percent of total deployed time.
  - Fire calls accounted for 13 percent of runs and 6 percent of total deployed time.
- BLS994 made 738 runs and had 219.6 deployed hours or an average of 2.0 runs and 36.1 minutes per day.
  - EMS calls accounted for 85 percent of runs and 93 percent of total deployed time.
  - Fire calls accounted for 9 percent of runs and 4 percent of total deployed time

Workload of Ambulances by District

The PFD's ambulances primarily provide medical service within the Petaluma EMS District and give aid to adjacent communities. The Petaluma EMS district includes both the area inside Petaluma and an extended area outside Petaluma. Table 10 examines the number of ambulance calls by grand call type and district. Table 11 breaks down the annual workload of the ambulances by district. In all tables, the ambulance responses to the areas outside the Petaluma EMS District are considered mutual aid.

TABLE 7-30: Medical Response Calls by Type and District

District		Number of Calls				Percent Calls
		EMS	Fire	Canceled	Total	
Petaluma EMS	Inside Petaluma	4,079	638	343	5,060	79.8
	Outside Petaluma	557	44	119	720	11.4
	Total	**4,636**	**682**	**462**	**5,780**	**91.2**
Bells EMS		0	0	3	3	0.0
Bodega Bay EMS		0	0	1	1	0.0
Closest ALS		22	2	14	38	0.6
Sonoma Life Support		191	11	285	487	7.7
Sonoma Valley FRA		10	0	17	27	0.4
Verihealth South		1	0	0	1	0.0
Total		**4,860**	**695**	**782**	**6,337**	**100.0**

Note: All calls that occurred outside Petaluma EMS are aid given.

TABLE 7-31: Annual Workload of Ambulances by EMS District

District		Runs	Runs Per Day	Minutes Per Run	Total Hours	Percent of Work	Minutes Per Day
Petaluma EMS	Inside Petaluma	6,305	17.3	32.5	3,411.0	79.7	560.7
	Outside Petaluma	873	2.4	41.8	607.7	14.2	99.9
	Total	**7,178**	**19.7**	**33.6**	**4,018.7**	**93.9**	**660.6**
Bells EMS		3	0.0	0.9	0.0	0.0	0.0
Bodega Bay EMS		1	0.0	26.8	0.4	0.0	0.1
Closest ALS		44	0.1	41.4	30.4	0.7	5.0
Sonoma Life Support		519	1.4	24.6	212.8	5.0	35.0
Sonoma Valley FRA		31	0.1	28.1	14.5	0.3	2.4
Verihealth South		1	0.0	95.7	1.6	0.0	0.3
Total		**7,777**	**21.3**	**33.0**	**4,278.5**	**100.0**	**703.3**

Observations:

Petaluma EMS

- 91 percent of medical response calls occurred within Petaluma's EMS district, with 80 percent of calls inside Petaluma and 11 percent outside the city.
- The total deployed time was 4,018.7 hours or 94 percent of the annual workload. The daily average was 11.0 hours for all ambulances combined.
- There were 7,178 runs, including 543 runs dispatched for canceled calls. There were 19.7 runs per day.

Sonoma Life Support

- Eight percent of the total medical response calls occurred inside Sonoma Life Support's EMS district.
- The total deployed time was 212.8 hours or 5 percent of the annual workload. The daily average was 35.3 minutes for all ambulances combined.
- There were 519 runs, including 296 runs dispatched for canceled calls. There were 1.4 runs per day.

Other Districts

- One percent of the total medical response calls occurred in other EMS districts.
- The total deployed time was 46.9 hours or 1 percent of the total annual workload. The daily average was 7.7 minutes for all ambulances combined.
- There were 80 runs, including 37 runs dispatched for canceled calls. There were 0.2 runs per day.

Workload of External Ambulance Services

In 2021, ambulances from external agencies provided mutual aid to PFD for incidents that occurred within PFD's EMS district. The following table details the annual workload of the ambulances from these external agencies.

TABLE 7-32: Annual Workload of Ambulance by External Agency

Agency	Runs				Runs Per Day	Minutes Per Run	Annual Hours
	EMS	Fire	Cancel	Total			
AMR	120	10	10	140	0.4	23.6	55.0
Rancho Adobe FPD*	399	41	17	457	1.3	17.8	135.9
Sonoma Valley Fire Authority	11	3	0	14	0.0	20.8	4.9
Total	**530**	**54**	**27**	**611**	**1.7**	**20.7**	**195.8**

Note: *The Rancho Adobe FPD unit is BLS915.

ANALYSIS OF BUSIEST HOURS FOR AMBULANCES

In this analysis, we included all 6,337 medical response calls given in Table 7-22. For these calls, there is significant variability in the number of calls from hour to hour. One special concern relates to the resources available for hours with the heaviest workload. We tabulated the data for each of the 8,760 hours between January 1, 2021, and December 31, 2021. Table 7-33 shows the number of hours in which there were zero to five or more calls during the hour. Table 7-34 shows the ten one-hour intervals which had the most calls during the studied period. Table 7-35 examines the number of times a call overlapped with another call in each PFD station area.

TABLE 7-33: Frequency Distribution of the Number of Calls Responded by Ambulance

Calls in an Hour	Frequency	Percentage
0	4,412	50.4
1	2,872	32.8
2	1,080	12.3
3	303	3.5
4	74	0.8
5+	19	0.2
Total	**8,760**	**100.0**

TABLE 7-34: Top Ten Hours with the Most Calls Responded by Ambulance

Hour	Number of Calls	Number of Runs	Total Deployed Hours
11/15/2021, noon to 1:00 p.m.	7	9	2.9
3/27/2021, 4:00 p.m. to 5:00 p.m.	6	10	3.4
11/22/2021, 10:00 a.m. to 11:00 a.m.	6	8	2.4
11/8/2021, noon to 1:00 p.m.	6	7	2.5
2/19/2021, 11:00 a.m. to noon	5	10	1.9
7/14/2021, 1:00 p.m. to 2:00 p.m.	5	8	2.3
9/5/2021, 9:00 p.m. to 10:00 p.m.	5	7	2.9
12/9/2021, 9:00 a.m. to 10:00 a.m.	5	7	2.0
8/26/2021, noon to 1:00 p.m.	5	6	3.2
12/30/2021, 11:00 a.m. to noon	5	6	2.6

Note: Total deployed hours are a measure of the total time spent responding to calls received in the hour. The deployed time from these calls may extend into the next hour or hours.

TABLE 7-35: Frequency of Overlapping Calls Responded by Medical Units

Station	Scenario	Number of Calls	Percent of All Calls	Total Hours
9301	No overlapped call	1,940	85.2	1,267.5
	Overlapped with one call	305	13.4	104.6
	Overlapped with two calls	31	1.4	7.4
	Overlapped with three calls	1	0.0	0.1
9302	No overlapped call	1,335	91.0	889.1
	Overlapped with one call	128	8.7	41.5
	Overlapped with two calls	4	0.3	0.9
9303	No overlapped call	1,763	86.6	1,173.6
	Overlapped with one call	257	12.6	79.4
	Overlapped with two calls	16	0.8	3.8
Outside Petaluma EMS	No overlapped call	495	88.9	236.6
	Overlapped with one call	57	10.2	9.4
	Overlapped with two calls	5	0.9	0.5

Table 7-36 examines the availability of each PFD station's ambulance to respond to calls within its first due area. At the same time, it focuses on calls where at least one ambulance eventually arrived and ignores calls where no ambulance arrived. While there were 5,780 medical response calls within the Petaluma EMS district (See Table 7-30), there were 558 calls without an arriving ambulance.

TABLE 7-36: Station Availability to Respond to Medical Response Calls

Station	Calls in Area	First Due Responded	First Due Arrived	First Due First	Percent Responded	Percent Arrived	Percent First
9301	2,030	1,692	1,652	1,608	83.3	81.4	79.2
9302	1,321	1,159	1,131	1,100	87.7	85.6	83.3
9303	1,871	1,567	1,540	1,515	83.8	82.3	81.0
Total	**5,222**	**4,418**	**4,323**	**4,223**	**84.6**	**82.8**	**80.9**

Note: For each station, we counted the number of calls occurring within its first due area. Then, we counted the number of calls to where at least one ambulance arrived. Next, we focus on the ambulance from the first due station to see if it responded, arrived, or arrived first.

Observations:

- During 19 hours (0.2 percent of all hours), five or more calls occurred; in other words, the PFD's ambulances responded to five or more calls in an hour roughly once every 19 days.
  - The highest number of calls responded by ambulances in an hour was seven, which happened once.
- The hour with the most calls was noon to 1:00 p.m. on November 15, 2021. The hour's seven calls involved nine individual dispatches resulting in 2.9 hours of deployed time. These seven calls included two EMS response calls and five mutual aid calls.

TRANSPORT CALL ANALYSIS

In this section, we present an analysis of ambulance activity that involved transporting patients, the variations by hour of day, and the average time for each stage of transport service. We identified transport calls by requiring that at least one ambulance had recorded both a "beginning to transport" time and an "arriving at the hospital" time. Based on these criteria, we note that 197 non-EMS (fire & other) calls that resulted in transport are included in this analysis.

Transport Calls by Type

The following table shows the number of medical response calls by call type broken out by transport and non-transport calls.

TABLE 7-37: Transport Calls by Call Type

Call Type	Number of Calls			Conversion Rate
	Non-transport	Transport	Total	
EMS response	756	3,582	4,338	82.6
MVA	131	167	298	56.0
EMS Total	**887**	**3,749**	**4,636**	**80.9**
Fire & Other Total	**1,504**	**197**	**1,701**	**11.6**
Total	**2,391**	**3,946**	**6,337**	**62.3**

Observations:

- 81 percent of EMS calls involved transporting one or more patients.
- On average, 10.3 EMS calls per day involved transporting one or more patients.

Average Transport Calls per Hour

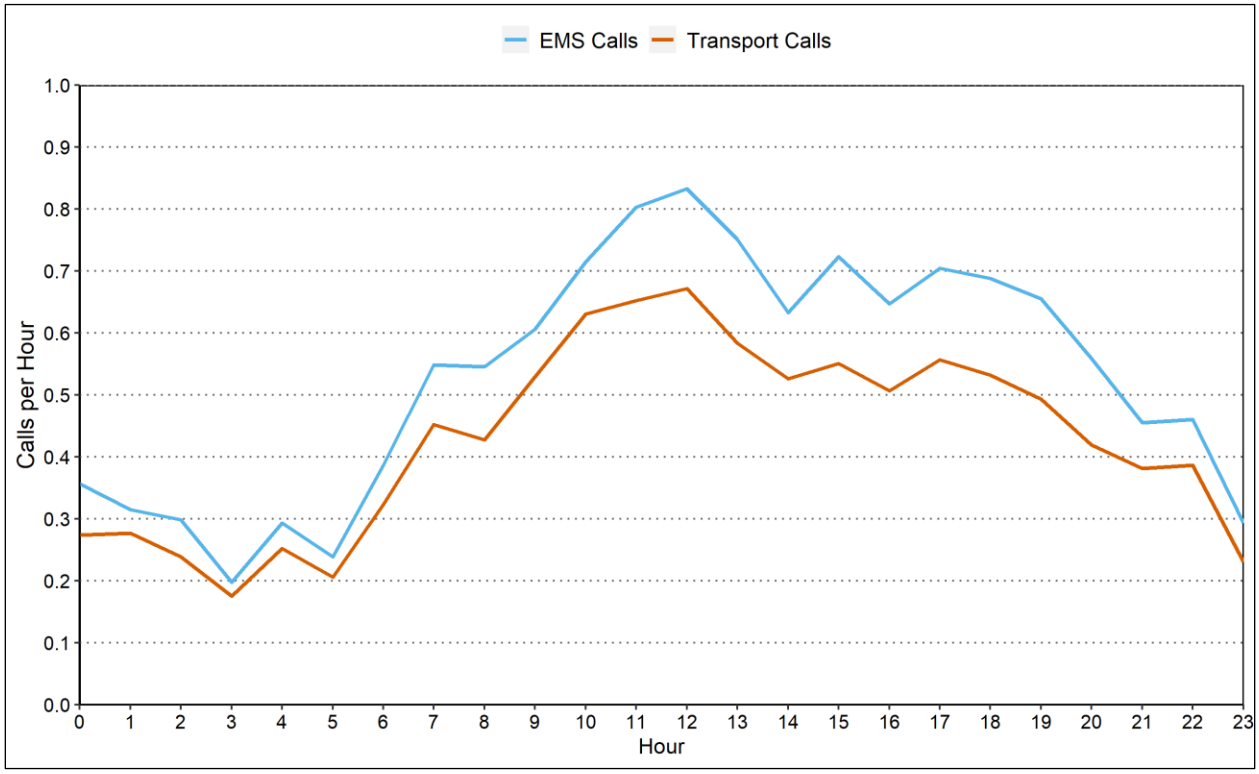
Table 7-38 and Figure 7-12 show the average number of EMS calls received each hour of the day over 2021. In Table 7-38, the conversion rate measures the percentage of EMS calls that transported one or more patients.

TABLE 7-38: EMS Transport Calls per Hour, by Time of Day

Hour	EMS Calls	Transport	EMS Calls per Day	Transport per Day	Conversion Rate
0	130	100	0.4	0.3	76.9
1	115	101	0.3	0.3	87.8
2	109	87	0.3	0.2	79.8
3	72	64	0.2	0.2	88.9
4	107	92	0.3	0.3	86.0
5	87	75	0.2	0.2	86.2
6	141	118	0.4	0.3	83.7
7	200	165	0.5	0.5	82.5
8	199	156	0.5	0.4	78.4
9	221	193	0.6	0.5	87.3
10	261	230	0.7	0.6	88.1
11	293	238	0.8	0.7	81.2
12	304	245	0.8	0.7	80.6
13	274	213	0.8	0.6	77.7
14	231	192	0.6	0.5	83.1
15	264	201	0.7	0.6	76.1
16	236	185	0.6	0.5	78.4
17	257	203	0.7	0.6	79.0
18	251	194	0.7	0.5	77.3
19	239	180	0.7	0.5	75.3
20	204	153	0.6	0.4	75.0
21	166	139	0.5	0.4	83.7
22	168	141	0.5	0.4	83.9
23	107	84	0.3	0.2	78.5
Total	**4,636**	**3,749**	**12.7**	**10.3**	**80.9**

Note: The conversion rate is measured by dividing the number of EMS transports by the number of EMS calls. For example, between midnight and 1:00 a.m., there were 100 EMS transports out of 130 EMS calls. This gives a conversion rate of 100 / 130 = 0. 769, or 76.9 percent.

FIGURE 7-12: Average Transport Calls by Hour



Observations:

- EMS calls per hour were highest during the day from 10:00 a.m. to 8:00 p.m., averaging between 0.6 calls per day and 0.8 calls per day.
- EMS calls per hour peaked between noon and 1:00 p.m., averaging 0.8 calls per day.
- EMS calls per hour were lowest between 3:00 a.m. and 4:00 a.m., averaging 0.2 calls per day.
- Hourly transport calls per day were highest during the day from 9:00 a.m. to 8:00 p.m., averaging between 0.5 calls per day and 0.7 calls per day.
- Average hourly transport calls per day peaked between noon and 1:00 p.m., averaging 0.7 calls per day.
- Average hourly transport calls per day was lowest between 3:00 a.m. and 4:00 a.m., averaging 0.2 calls per day.
- Average hourly transport conversion rates per day peaked between 3:00 a.m. and 4:00 a.m., averaging 89 percent per day.
- Average hourly transport conversion rates per day was lowest between 8:00 p.m. and 9:00 p.m., averaging 75 percent per day.

Transport Calls by Type and Duration

The following table shows the average duration of transport and non-transport EMS calls by call type.

TABLE 7-39: Transport Call Duration by Call Type (in Minutes)

Call Type	Non-transport		Transport	
	Average Duration	Number of Calls	Average Duration	Number of Calls
EMS response	20.7	756	51.5	3,582
MVA	15.3	131	63.4	167
EMS Total	**19.9**	**887**	**52.0**	**3,749**
Fire & Other Total	**11.7**	**1,504**	**72.3**	**197**
Total	**14.7**	**2,391**	**53.0**	**3,946**

Note: The duration of a call is defined as the longest deployed time of any of the units responding to the same call.

Observations:

- The average duration was 19.9 minutes for non-transport EMS calls.
- The average duration was 52.0 minutes for EMS calls where one or more patients were transported to a hospital.

Transport Time Components

The next table shows the average deployed time for an ambulance on a transport call, along with three major components of the deployed time: on-scene time, travel to hospital time, and at-hospital time.

The on-scene time is the interval from the unit arriving on-scene time through the time the unit departs the scene for the hospital. Travel to hospital time is the interval from the time the unit departs the scene to travel to the hospital through the time the unit arrives at the hospital. At-hospital time is the time it takes for patient turnover at the hospital.

This table analyzes times by run. Normally, the number of runs will exceed the number of calls as a call may have multiple runs. In addition, average times may differ slightly from similar averages measured per call.

TABLE 7-40: Time Component Analysis for Ambulance Transport Runs by Call Type

Call Type	Average Time Spent per Run, Minutes				Number of Runs
	On Scene	Traveling to Hospital	At Hospital	Deployed	
EMS response	11.2	11.7	21.8	51.3	3,584
MVA	12.1	16.1	27.0	62.9	185
EMS Total	**11.3**	**11.9**	**22.0**	**51.8**	**3,769**
Fire & Other Total	**12.4**	**18.1**	**29.5**	**71.7**	**201**
Total	**11.3**	**12.2**	**22.4**	**52.8**	**3,970**

Note: Average unit deployed time per run is lower than average call duration for some call types because call duration is based on the longest deployed time of any of the units responding to the same call, which may include an engine or ladder. Total deployed time is greater than the combination of on-scene, transport, and hospital wait times as it includes turnout, initial travel, and hospital return times.

Observations:

- The average time spent on-scene for a transport EMS call was 11.3 minutes.
- The average travel time from the scene of the EMS call to the hospital was 11.9 minutes.
- The average deployed time spent on transport EMS calls was 51.8 minutes.
- The average deployed time at the hospital was 22.0 minutes, which accounts for approximately 42 percent of the average total deployed time for a transport EMS call.

Transport Destination

Table 7-41 shows the number of transports (runs) that PFD's ambulances made in 2021, broken out by destination. Table 7-42 provides the same information for transport made by ambulances from external agencies (mutual aid to PFD).

TABLE 7-41: Transport Runs by Destination

Destination	Transport	Percentage
Petaluma Valley Hospital	3,147	79.3
Santa Rosa Memorial Hospital	365	9.2
Kaiser Permanente Santa Rosa Medical Center	235	5.9
Kaiser Permanente San Rafael Medical Center	189	4.8
Sutter Santa Rosa Regional Hospital	24	0.6
Marin General Hospital	3	0.1
Sonoma Valley Hospital	3	0.1
Queen of the Valley Medical Center	2	0.1
Sutter Novato Community Hospital	2	0.1
Total	**3,970**	**100.0**

TABLE 7-42: External Ambulance Transport Runs by Destination

Destination	Transport	Percentage
Petaluma Valley Hospital	51	60.9
Kaiser Permanente Santa Rosa Medical Center	18	21.4
Kaiser Permanente San Rafael Medical Center	7	8.3
Santa Rosa Memorial Hospital	7	8.3
Sutter Santa Rosa Regional Hospital	1	1.2
Total	**84**	**100.0**

PART 3. RESPONSE TIME ANALYSIS

In this part of the analysis, we present response time statistics for different call types. We separate response time into its identifiable components. Dispatch time is the difference between the time a call is received and the time a unit is dispatched. Dispatch time includes call processing time, which is the time required to determine the nature of the emergency and the types of resources to dispatch. Turnout time is the difference between dispatch time and the time a unit is en route to a call's location. Travel time is the difference between the time en route and arrival on scene. Response time is the total time elapsed between receiving a call to arriving on scene.

In this analysis, we included all calls within Petaluma and EMS calls that occurred in the extended Petaluma EMS district outside the city to which at least one PFD ambulance arrived. Also, calls with a total response time exceeding 30 minutes were excluded. In addition, non-emergency calls were excluded. Finally, we focused on units that had complete time stamps, that is, units with all components recorded, so that we could calculate each segment of response time.

Based on the methodology above, for all 7,536 calls responded by PFD in 2021, a total of 3,988 calls involving any PFD unit responding inside Petaluma and 357 EMS calls involving a PFD ambulance that occurred in the extended Petaluma EMS district are included in the analysis. Calls within Petaluma and those in the extended EMS district are analyzed separately.

Response Time by Type of Call

Table 7-43 breaks down the average and 90th percentile dispatch, turnout, travel, and total response times by call type. Table 7-44 presents the same information for PFD's ambulances in responding to calls that occurred within the extended Petaluma EMS district outside the city. The result shown in Table 7-43 includes calls within Petaluma, while Table 7-44 includes calls in the extended EMS district. A 90th percentile means that 90 percent of calls had response times at or below that number. For example, Table 7-43 shows an overall 90th percentile response time of 8.8 minutes, which means that 90 percent of the time a call had a response time of no more than 8.8 minutes. Figure 7-13 illustrates the average response time for calls broken out by call type.

TABLE 7-43: Average and 90th Percentile Response Times of First Arriving Unit Within Petaluma, by Call Type

Call Type	Average Response Time, Minutes				90th Percentile Response Time, Min.				Number of Calls
	Dispatch	Turnout	Travel	Total	Dispatch	Turnout	Travel	Total	
EMS response	1.2	1.2	3.9	6.2	2.4	2.3	6.0	8.5	3,144
MVA	1.3	1.2	3.6	6.2	2.5	2.6	6.2	9.4	187
EMS Total	**1.2**	**1.2**	**3.9**	**6.2**	**2.4**	**2.3**	**6.0**	**8.6**	**3,331**
False alarm	1.2	1.4	4.2	6.8	2.3	2.5	6.8	9.1	168
Good intent	1.6	1.3	3.7	6.6	3.1	2.3	6.0	9.0	78
Hazard	1.5	1.3	4.7	7.5	3.4	2.4	7.8	10.3	69
Outside fire	1.8	1.5	4.7	8.0	3.1	2.9	8.8	12.3	75
Public service	1.4	1.2	4.5	7.0	2.7	2.4	7.0	9.9	226
Structure fire	1.1	1.5	3.6	6.2	1.5	2.7	5.8	8.3	36
Technical rescue	2.2	1.1	4.2	7.5	4.4	2.7	9.1	11.6	5
Fire Total	**1.4**	**1.3**	**4.3**	**7.0**	**2.7**	**2.5**	**6.9**	**9.9**	**657**
Total	**1.2**	**1.2**	**3.9**	**6.3**	**2.5**	**2.4**	**6.1**	**8.8**	**3,988**

FIGURE 7-13: Average Response Time of First Arriving Unit, by Call Type

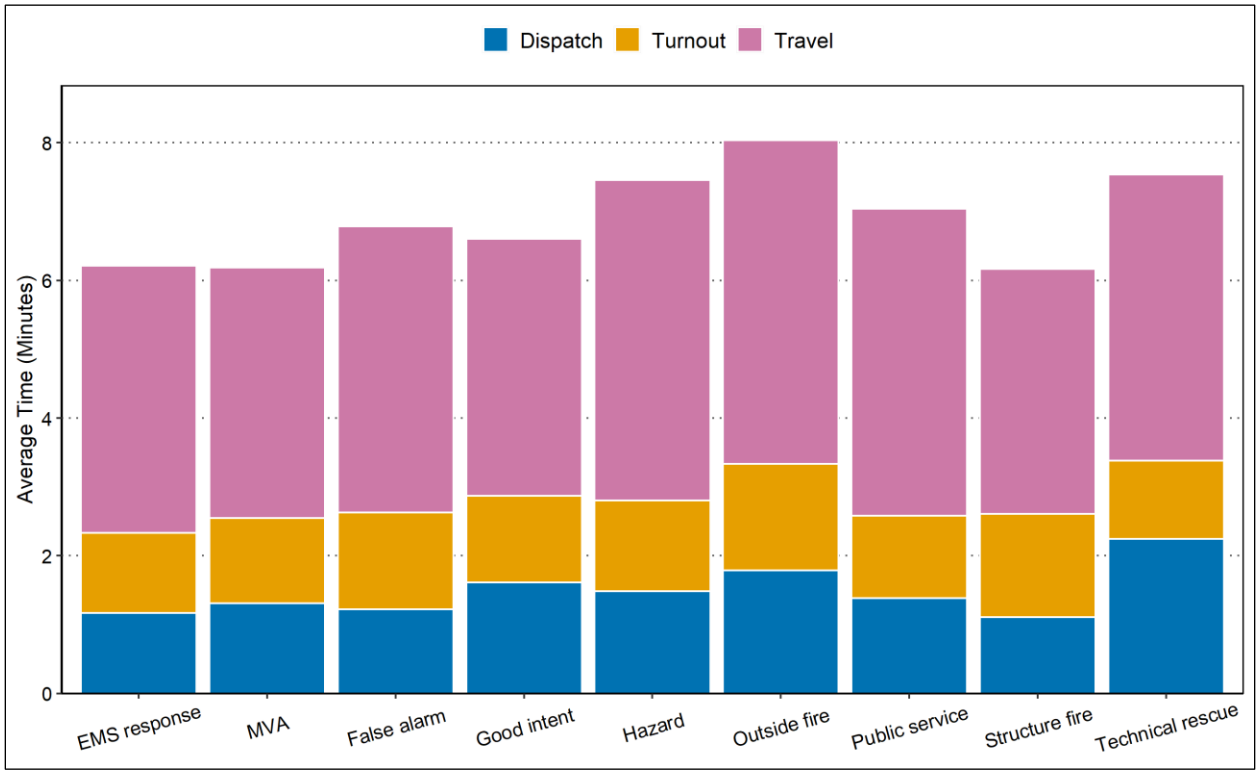


TABLE 7-44: Average and 90th Percentile Response Times of First Arriving Unit Within the Extended Petaluma EMS District, by Call Type

Call Type	Average Response Time, Minutes				90th Percentile Response Time, Min.				Number of Calls
	Dispatch	Turnout	Travel	Total	Dispatch	Turnout	Travel	Total	
EMS Response	1.2	1.3	8.1	10.6	2.0	2.4	13.2	15.8	307
MVA	1.1	1.6	8.0	10.8	1.7	2.8	12.0	14.9	50
Total	**1.2**	**1.3**	**8.1**	**10.6**	**2.0**	**2.5**	**13.2**	**15.5**	**357**

Observations:

Petaluma

- The average dispatch time was 1.2 minutes.
- The average turnout time was 1.2 minutes.
- The average travel time was 3.9 minutes.
- The average total response time was 6.3 minutes.
- The average response time was 6.2 minutes for EMS calls and 7.0 minutes for fire calls.
- The 90th percentile dispatch time was 2.5 minutes.
- The 90th percentile turnout time was 2.4 minutes.
- The 90th percentile travel time was 6.1 minutes.
- The 90th percentile total response time was 8.8 minutes.
- The 90th percentile response time was 8.6 minutes for EMS calls and 9.9 minutes for fire calls.

Extended Petaluma EMS District

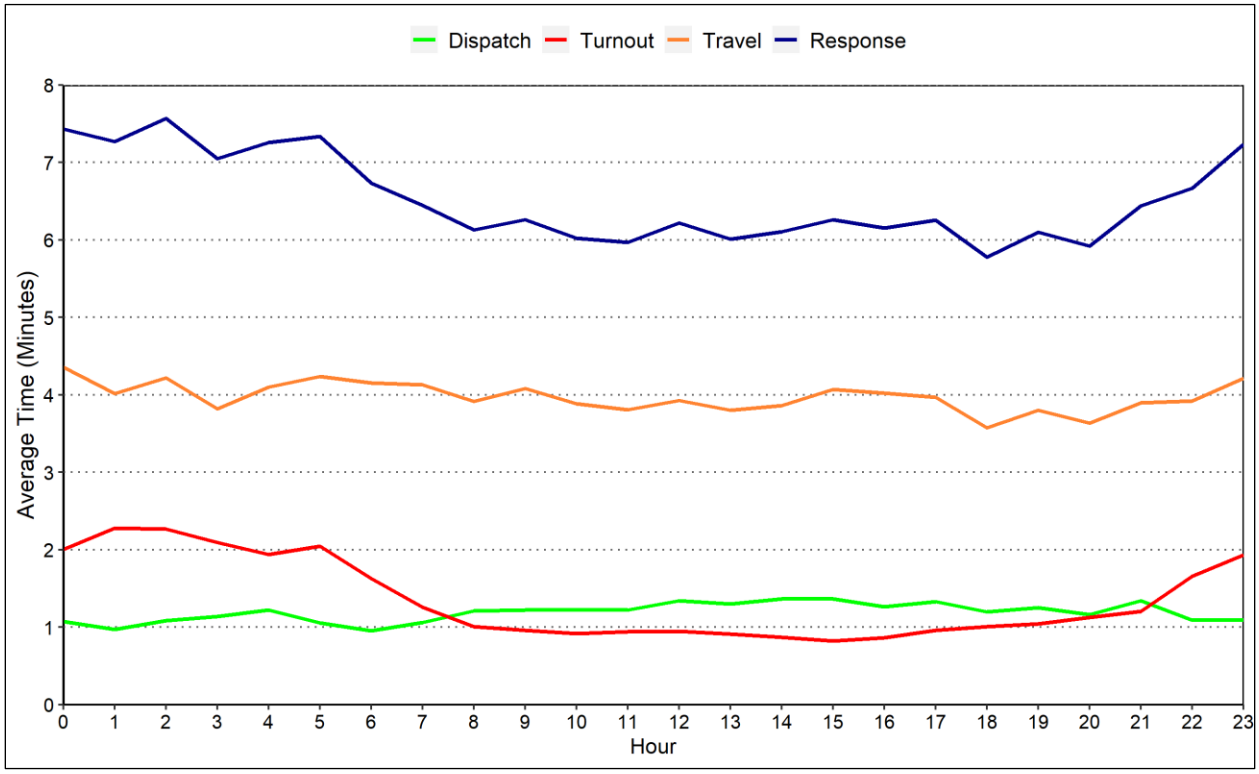
- The average dispatch time was 1.2 minutes.
- The average turnout time was 1.3 minutes.
- The average travel time was 8.1 minutes.
- The average total response time was 10.6 minutes.
- The 90th percentile dispatch time was 2.0 minutes.
- The 90th percentile turnout time was 2.5 minutes.
- The 90th percentile travel time was 13.2 minutes.
- The 90th percentile total response time was 15.5 minutes.

Table 7-45 shows the average response time by the time of day. The table also shows 90th percentile response times. Figure 7-14 shows the average response time by the time of day.

TABLE 7-45: Average and 90th Percentile Response Time of First Arriving Unit Within Petaluma, by Hour of Day

Hour	Time in Minutes					Number of Calls
	Dispatch	Turnout	Travel	Response Time	90th Percentile Response Time	
0	1.1	2.0	4.4	7.4	8.9	116
1	1.0	2.3	4.0	7.3	9.0	100
2	1.1	2.3	4.2	7.6	9.6	84
3	1.1	2.1	3.8	7.1	9.3	65
4	1.2	1.9	4.1	7.3	8.9	82
5	1.1	2.0	4.2	7.3	9.2	78
6	1.0	1.6	4.2	6.7	8.8	119
7	1.1	1.3	4.1	6.4	8.8	178
8	1.2	1.0	3.9	6.1	8.4	162
9	1.2	1.0	4.1	6.3	8.7	209
10	1.2	0.9	3.9	6.0	8.7	225
11	1.2	0.9	3.8	6.0	8.5	255
12	1.3	0.9	3.9	6.2	9.2	268
13	1.3	0.9	3.8	6.0	8.3	240
14	1.4	0.9	3.9	6.1	8.6	205
15	1.4	0.8	4.1	6.3	9.0	232
16	1.3	0.9	4.0	6.2	8.9	187
17	1.3	1.0	4.0	6.3	8.7	216
18	1.2	1.0	3.6	5.8	8.1	219
19	1.3	1.0	3.8	6.1	8.7	193
20	1.2	1.1	3.6	5.9	8.4	178
21	1.3	1.2	3.9	6.4	8.7	155
22	1.1	1.7	3.9	6.7	8.4	126
23	1.1	1.9	4.2	7.2	9.2	96
Total	**1.2**	**1.2**	**3.9**	**6.3**	**8.8**	**3,988**

FIGURE 7-14: Average Response Time of First Arriving Unit, by Hour of Day



Observations:

- Average dispatch time was between 1.0 minutes (6:00 a.m. to 7:00 a.m.) and 1.4 minutes (2:00 p.m. to 3:00 p.m.).
- Average turnout time was between 0.8 minutes (3:00 p.m. to 4:00 p.m.) and 2.3 minutes (1:00 a.m. to 2:00 a.m.).
- Average travel time was between 3.6 minutes (6:00 p.m. to 7:00 p.m.) and 4.4 minutes (midnight to 1:00 a.m.).
- Average response time was between 5.8 minutes (6:00 p.m. to 7:00 p.m.) and 7.6 minutes (2:00 a.m. to 3:00 a.m.).
- The 90th percentile response time was between 8.1 minutes (6:00 p.m. to 7:00 p.m.) and 9.7 minutes (2:00 a.m. to 3:00 a.m.).

Response Time Distribution

Here, we present a more detailed look at how response times to calls within Petaluma are distributed. The cumulative distribution of total response time for the first arriving unit to EMS calls is shown in Figure 7-15 and Table 7-46. Figure 7-15 shows response times for the first arriving unit to EMS calls as a frequency distribution in whole-minute increments, and Figure 7-16 shows the same for the first arriving unit to outside and structure fire calls.

The cumulative percentages here are read in the same way as a percentile. In Figure 7-15, the 90th percentile of 8.6 minutes means that 90 percent of EMS calls within the Petaluma fire district had a response time of 8.6 minutes or less. In Table 7-46, the cumulative percentage of 85.7, for example, means that 85.7 percent of EMS calls had a response time under 8 minutes.

FIGURE 7-15: Cumulative Distribution of Response Time Within Petaluma, First Arriving Unit, EMS

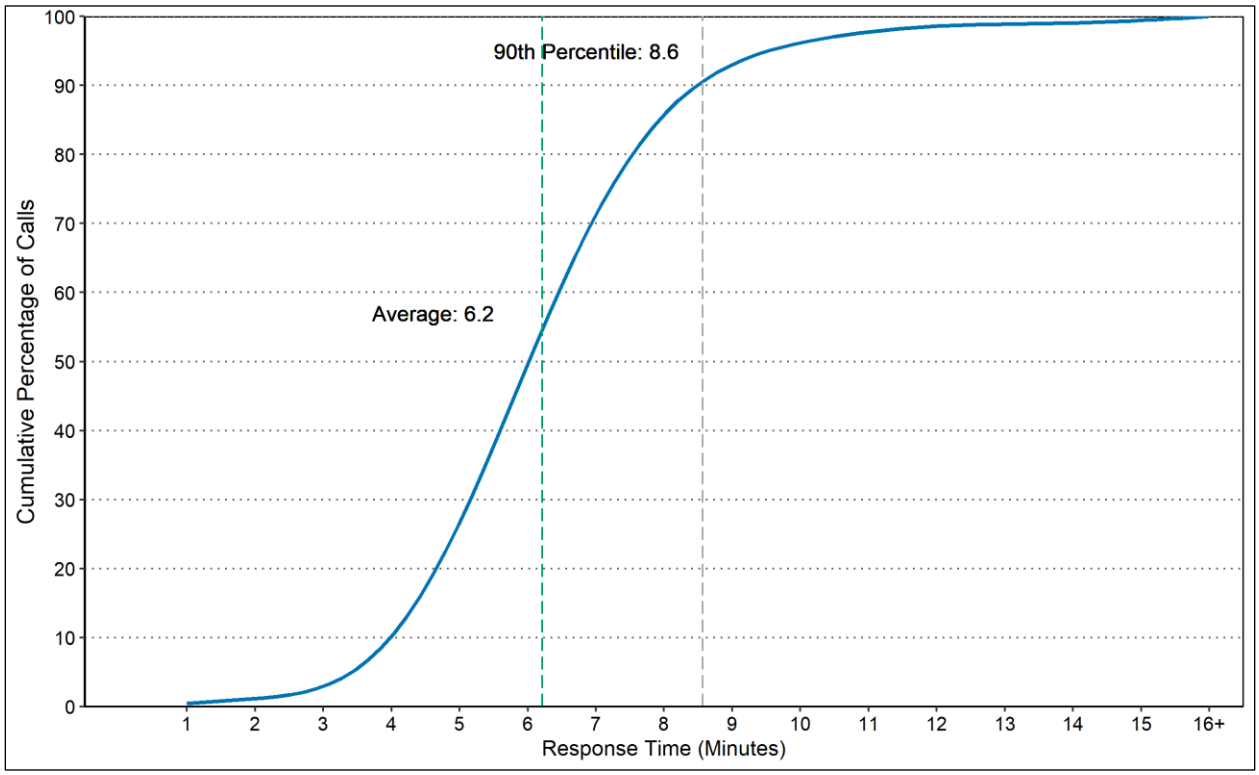


TABLE 7-46: Cumulative Distribution of Response Time Within Petaluma, First Arriving Unit, EMS

Response Time (minute)	Frequency	Cumulative Percentage
1	16	0.5
2	20	1.1
3	67	3.1
4	228	9.9
5	563	26.8
6	753	49.4
7	736	71.5
8	473	85.7
9	240	92.9
10	110	96.2
11	50	97.7
12	27	98.6
13	11	98.9
14	9	99.2
15	5	99.3
16+	23	100.0

FIGURE 7-16: Cumulative Distribution of Response Time Within Petaluma, First Arriving Unit, Outside and Structure Fires

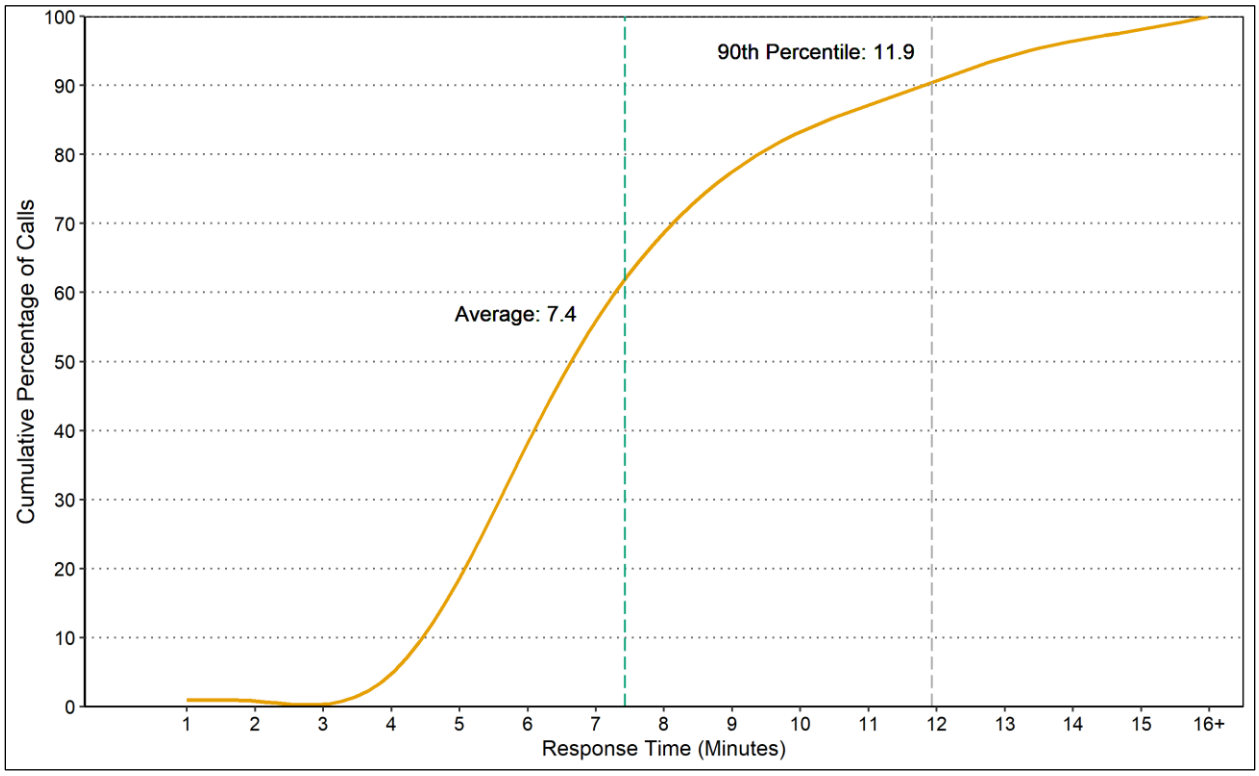


TABLE 7-47: Cumulative Distribution of Response Time Within Petaluma, First Arriving Unit, Outside and Structure Fires

Outside Fire			Structure Fire		
Response Time, Minutes	Frequency	Cumulative Percentage	Response Time, Minutes	Frequency	Cumulative Percentage
1	1	1.3	1	0	0.0
2	0	1.3	2	0	0.0
3	0	1.3	3	0	0.0
4	2	4.0	4	2	5.6
5	7	13.3	5	6	22.2
6	16	34.7	6	11	52.8
7	10	48.0	7	7	72.2
8	9	60.0	8	5	86.1
9	7	69.3	9	3	94.4
10	5	76.0	10+	2	100.0
11	3	80.0			
12	5	86.7			
13	3	90.7			
14	4	96.0			
15	0	96.0			
16+	3	100.0			

Observations:

- For 86 percent of EMS calls, the response time of the first arriving unit was less than 8 minutes.
- For 60 percent of outside fire calls, the response time of the first arriving unit was less than 8 minutes.
- For 86 percent of structure fire calls, the response time of the first arriving unit was less than 8 minutes

ATTACHMENT 2.1: CALL TYPE IDENTIFICATION

When available, NFIRS data serves as our primary source for assigning call categories. For 2,949 of the 7,536 calls that PFD responded to in 2021, NFIRS incident type codes were used to assign call types for fire, MVA, and canceled calls. For 4,587 calls including EMS, fire, and MVA calls that do not have specific NFIRS incident types, we instead used the problem description from the computer-aided dispatch (CAD) data to assign a call category.

Tables 7-48 and 7-49 illustrate the method used to identify the category of all 7,536 calls that PFD responded to. The count of each type of call is different from the corresponding results presented in Tables 7-2 or 7-22 because Tables 7-48 and 7-49 include the original call types of mutual aid calls here. Some of them are mutual aid calls based on the call location and type of PFD's response apparatus.

TABLE 7-48: Fire Call Type by NFIRS Incident Type Code and Description

Call Type	Incident Type Code	Incident Type Description	Frequency
Canceled	141[1]	Forest, woods, or wildland fire	1
	143[2]	Grass fire	1
	150[3]	Outside rubbish fire, other	1
	150[4]	Outside rubbish fire, other	1
	611	Dispatched and cancelled en route	886
	621	Wrong location	6
	622	No incident found on arrival at dispatch address	140
False Alarm	700	False alarm or false call, other	57
	710	Malicious, mischievous false call, other	1
	711	Municipal alarm system, malicious false alarm	4
	715	Local alarm system, malicious false alarm	1
	730	System malfunction, other	4
	733	Smoke detector activation due to malfunction	18
	735	Alarm system sounded due to malfunction	44
	736	CO detector activation due to malfunction	7
	740	Unintentional transmission of alarm, other	9
	741	Sprinkler activation, no fire - unintentional	1
	743	Smoke detector activation, no fire - unintentional	24
	744	Detector activation, no fire - unintentional	13
	745	Alarm system activation, no fire - unintentional	84
	746	Carbon monoxide detector activation, no CO	20
Good Intent	100[5]	Fire, other	2
	600	Good intent call, other	134
	631	Authorized controlled burning	1
	650	Steam, other gas mistaken for smoke, other	4
	651	Smoke scare, odor of smoke	43
	652	Steam, vapor, fog, or dust thought to be smoke	6
	653	Smoke from barbecue, tar kettle	6
	661	EMS call, party transported by non-fire agency	2

Call Type	Incident Type Code	Incident Type Description	Frequency
	671	HazMat release investigation w/no HazMat	2
Hazard	200	Overpressure rupture, explosion, overheat, other	1
	251	Excessive heat, scorch burns with no ignition	2
	400	Hazardous condition, other	11
	411	Gasoline or other flammable liquid spill	12
	412	Gas leak (natural gas or LPG)	23
	413	Oil or other combustible liquid spill	11
	422	Chemical spill or leak	2
	423	Refrigeration leak	2
	424	Carbon monoxide incident	8
	440	Electrical wiring/equipment problem, other	25
	441	Heat from short circuit (wiring), defective/worn	2
	442	Overheated motor	2
	444	Power line down	26
	445	Arcing, shorted electrical equipment	18
	451	Biological hazard, confirmed or suspected	1
	461	Building or structure weakened or collapsed	1
	462	Aircraft standby	2
	463	Vehicle accident, general cleanup	2
	480	Attempted burning, illegal action, other	1
	481	Attempt to burn	1
Motor Vehicle Accident	322	Motor vehicle accident with injuries	247
	323	Motor vehicle/pedestrian accident (MV Ped)	18
	325	Motor vehicle accident with no injuries.	74
Outside Fire	100[6]	Fire, other	2
	130	Mobile property (vehicle) fire, other	2
	131	Passenger vehicle fire	9
	132	Road freight or transport vehicle fire	2
	134	Water vehicle fire	1
	137	Camper or recreational vehicle (RV) fire	1
	138	Off-road vehicle or heavy equipment fire	1
	140	Natural vegetation fire, other	6
	141	Forest, woods, or wildland fire	1
	142	Brush or brush-and-grass mixture fire	11
	143	Grass fire	15
	150	Outside rubbish fire, other	15
	151	Outside rubbish, trash, or waste fire	32
	153	Construction or demolition landfill fire	1
	154	Dumpster or other outside trash receptacle fire	4
	160	Special outside fire, other	4
	161	Outside storage fire	2
	162	Outside equipment fire	2

Call Type	Incident Type Code	Incident Type Description	Frequency
Public Service	331	Lock-in (if lock out, use 511)	9
	500	Service call, other	45
	510	Person in distress, other	2
	511	Lock-out	7
	520	Water problem, other	7
	521	Water evacuation	1
	522	Water or steam leak	39
	531	Smoke or odor removal	27
	541	Animal problem	2
	542	Animal rescue	1
	550	Public service assistance, other	28
	551	Assist police or another governmental agency	20
	552	Police matter	79
	553	Public service	56
	554	Assist invalid	413
	561	Unauthorized burning	5
	571	Cover assignment, standby, move up	2
	800	Severe weather or natural disaster, other	8
	815	Severe weather or natural disaster standby	1
	900	Special type of incident, other	2
Structure Fire	100[7]	Fire, other	2
	111	Building fire	31
	112	Fires in structure other than in a building	2
	113	Cooking fire, confined to container	11
	114	Chimney or flue fire, confined to chimney or flue	3
	115	Incinerator overload or malfunction, fire confined	2
	118	Trash or rubbish fire, contained	2
	120	Fire in mobile prop. used as a fixed struc., other	1
Technical Rescue	352	Extrication of victim(s) from vehicle	4
	353	Removal of victim(s) from stalled elevator	2
	365	Watercraft rescue	2
	371	Electrocution or potential electrocution	1
	381	Rescue or EMS standby	6
Total			**2,949**

Note: 1 to 4 were assigned as "canceled." There were no arriving units for these calls. 1 had a short call duration of 9.5 minutes, 2 had a call duration of 0.2 minutes, 3 had a call duration of 6.2 minutes, and 4 had a call duration of 4.3 minutes; 5-7 Three generic fire calls (incident type 100) were classified by their CAD description: 3=Smoke/Fire investigation; 4=Debris fire; 5=Structure fire.

TABLE 7-49: Call Type by CAD Descriptions

Call Type	Subtype Description	Subtype Code	Calls
False alarm	FIRE ALARM RESIDENTIAL	default	1
EMS Response	BACK PAIN	5	1
	CHOKING	11	19
	CHEST PAIN / CHEST DISCOMFORT	10	285
	CONVULSIONS / SEIZURES	12	120
	DIABETIC PROBLEMS	13	51
	EYE PROBLEMS / EYE INJURIES	16	2
	FALLS	17	611
	HEADACHE	18	28
	HEART PROBLEMS	19	87
	HEAT / COLD EXPOSURES	20	4
	HEMORRHAGE / LACERATIONS	21	165
	ILL SUBJECT	26	18
	INACCESSIBLE INCIDENT / ENTRAPMENTS	22	2
	LAW, FIRE AND AMBULANCE RELATED EVENT	default	2
	MEDICAL AID	default	2
	NFIRS incident type code 300	default	7
	NFIRS incident type code 311	default	10
	NFIRS incident type code 320	default	108
	NFIRS incident type code 321	default	1,722
	OVERDOSE (COMBINED EVENT)	default	20
	OVERDOSE/POISONING (INGESTION)	23	31
	OUT OF COUNTY MEDICAL REQUEST	default	1
	PSYCHIATRIC/ABNORMAL BEHAVIOR/SUICIDE ATTEMPT	25	24
	PREGNANCY/CHILDBIRTH/MISCARRIAGE	24	6
	SICK PERSON	26	624
	STAB/GUNSHOT/PENETRATING TRAUMA	27	4
	STROKE / TRANSIENT ISCHEMIC ATTACK	28	185
	SUICIDE ATTEMPT (COMBINED EVENT)	default	17
	TRAFFIC ACCIDENT	29	2
	TRAUMATIC INJURIES	30	63
	UNCONSCIOUS / FAINTING	31	302
	UNKNOWN / MAN DOWN	32	56
Motor Vehicle Accident	TRAFF ACC AMB ENROUTE (COMBINED EVENT)	default	1
	VEHICLE ACCIDENT (TRAFFIC COLLISION)	default	2
Public Service	COUNTY / CITY ORDINANCE	default	1
	MUTUAL AID	default	1
	TASK FORCE	default	1
Tech. Rescue	VEHICLE ACCIDENT EXTRICATION	default	1
Total			**4,587**